



Cisco AS5350XM and Cisco AS5400XM Universal Gateways Software Configuration Guide

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Preface

This preface discusses how this guide is organized, explains how to use the guide, describes how to get the latest version of the guide, the conventions used in the guide, related documentation, and how to obtain documentation and technical assistance.

Objective

Whether you are a corporate end user or a competitive Internet service provider (ISP), you have purchased a Cisco AS5350XM or Cisco AS5400XM universal gateway to provide dial-up services that facilitate accessibility for remote or roaming personnel, or Internet admission to consumers for e-mail, e-commerce, and web browsing. This guide assists you in configuring basic features to get you started.

Organization and Use

This software configuration guide is organized into the following chapters and appendixes:

Table 1 **Document Organization**

Chapter	Title	Description
Chapter 1	Understanding Basic Hardware Architecture and Cisco IOS Software	Provides a brief overview of the Cisco AS5350XM and Cisco AS5400XM universal gateway architecture, and describes how to upgrade Cisco IOS software.
Chapter 2	Verifying Basic Setup	Describes how to analyze your system, execute basic tasks, and configure your system to set up the universal gateway using the CLI.
Chapter 3	Basic Configuration Using the Command-Line Interface	Describes how to configure additional basic system features.
Chapter 4	Continuing Configuration Using the Command-Line Interface	Describes how to use the Cisco IOS software command-line interface (CLI) to commission your gateway.

Table 1 Document Organization (continued)

Chapter	Title	Description
Chapter 5	Managing and Troubleshooting the Universal Port and Dial-Only Feature Cards	Describes how to manage your universal port cards using the CLI.
Chapter 6	Managing and Troubleshooting the Voice Feature Card	Describes how to manage your voice feature cards using the CLI.
Chapter 7	Configuring Voice over IP	Provides a brief overview of the VoIP call process and explains how to configure VoIP on your gateway.
Appendix A	Using the Setup Script	Describes how to power up the gateway and configure it using the prompt-driven setup script.
Appendix B	ROM Monitor	Describes how to use the ROM monitor to isolate or rule out hardware problems encountered when you install the gateway.
Appendix C	Comprehensive Configuration Examples	Provides basic and advanced configuration examples for reference.

For more information about the Cisco AS5350XM and Cisco AS5400XM universal gateways, see the following resources:

- For platform-specific documentation, such as hardware installation and regulatory compliance information, see the Cisco AS5350XM universal gateway technical support and documentation website at this URL:
http://www.cisco.com/en/US/products/hw/univgate/ps501/tsd_products_support_series_home.html
- For platform-specific documentation, such as hardware installation and regulatory compliance information, see the Cisco AS5400XM universal gateway technical support and documentation website at this URL:
http://www.cisco.com/en/US/products/hw/univgate/ps505/tsd_products_support_series_home.html
- For advanced feature configuration information, see the Cisco IOS documentation set, which includes:
 - *Cisco IOS Command Summary*
 - *Cisco IOS System Error Messages*
 - *Cisco IOS Debug Command Reference*
 - *Cisco IOS Dial Services Quick Configuration Guide*
 - New feature module documentation and release notes
 - Configuration guides and command references (see [Figure 1](#))

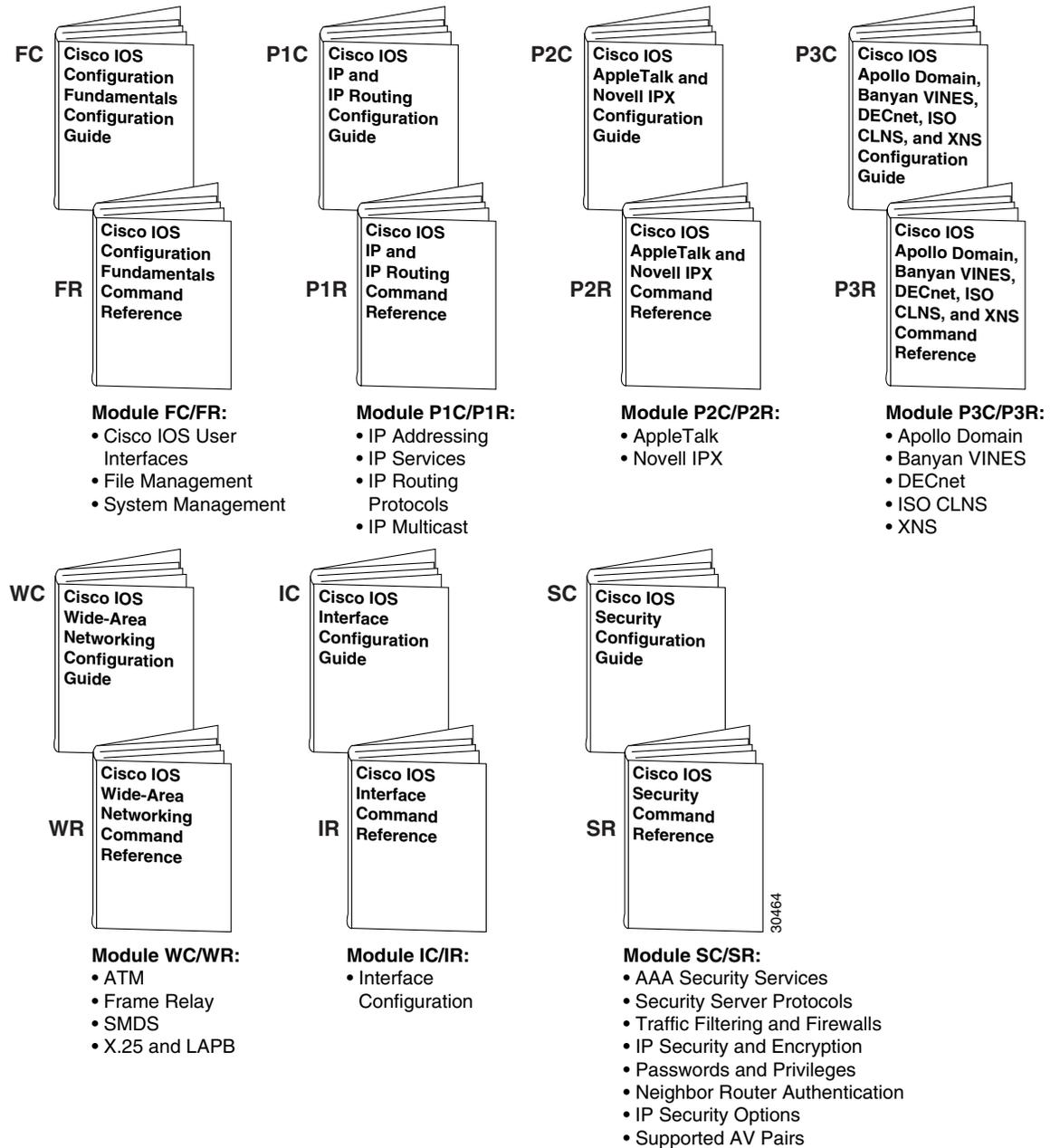
The Cisco IOS documentation set for your release is available online at this URL:

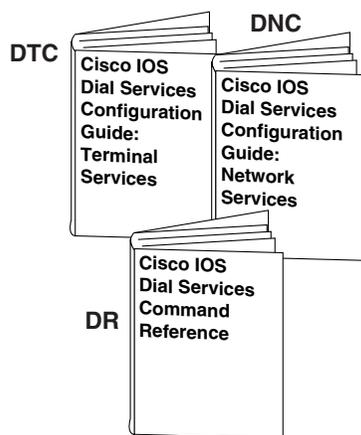
<http://www.cisco.com/univercd/cc/td/doc/product/software/>

**Note**

The abbreviations next to the book icons are page designators (for example, FC, FR, and so on), which are defined in a key in the index of each document to help with navigation. The bulleted lists under each module describe the major technology areas discussed in their corresponding books.

Figure 1 Cisco IOS Software Documentation Modules



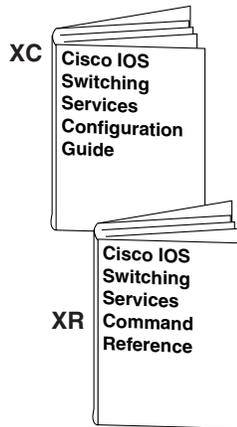


Module DTC/DR:

- Dial Access
- Modem Management
- ISDN BRI Services
- Point-to-Point Protocols
- Dial-on-Demand Routing
- Dial Backup
- Terminal Services

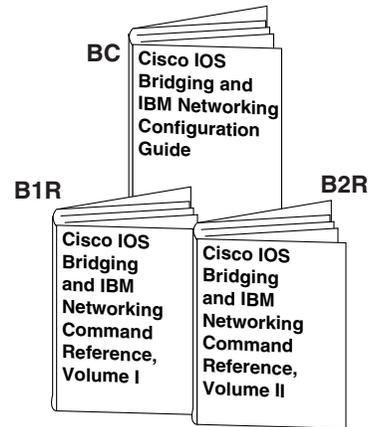
Module DNC/DR:

- Large-Scale Dial Solutions
- Cost-Control Solutions
- Virtual Private Networks
- X.25 on ISDN Solutions
- Telco Solutions
- Dial-Related Addressing Services
- Internetworking Dial Access Scenarios



Module XC/XR:

- Cisco IOS Switching Paths
- Cisco Express Forwarding
- NetFlow Switching
- Multiprotocol Label Switching
- Multilayer Switching
- Multicast Distributed Switching
- Virtual LANs
- LAN Emulation

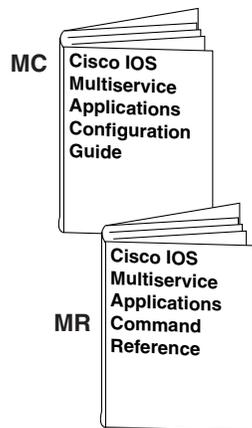


Module BC/B1R:

- Transparent Bridging
- Source-Route Bridging
- Token Ring Inter-Switch Link
- Token Ring Route Switch Module
- Remote Source-Route Bridging
- Data-Link Switching Plus
- Serial Tunnel and Block Serial Tunnel
- LLC2 and SDLC
- IBM Network Media Translation
- SNA Frame Relay Access
- NCIA Client/Server
- Airline Product Set

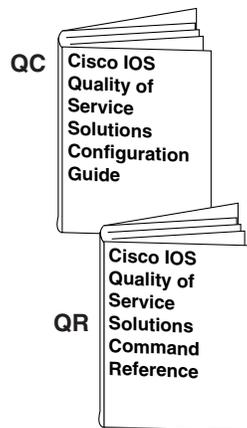
Module BC/B2R:

- DSPU and SNA Service Point
- SNA Switching Services
- Cisco Transaction Connection
- Cisco Mainframe Channel Connection
- CLAW and TCP/IP Offload
- CSNA, CMPC, and CMPC+
- TN3270 Server



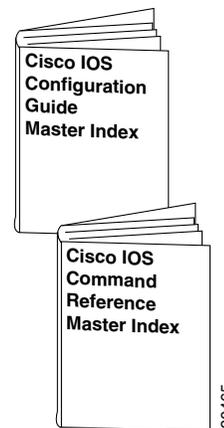
Module MC/MR:

- Voice over IP
- Voice over Frame Relay
- Voice over ATM
- Voice over HDLC
- Video Support
- Universal Broadband Features



Module QC/QR:

- Packet Classification
- Congestion Management
- Congestion Avoidance
- Policing and Shaping
- Signalling
- Link Efficiency Mechanisms



30465

Where to Get the Latest Version of This Guide

This guide is available online and is updated continuously to integrate the latest enhancements to the product. You can access the current online copy of this guide on the World Wide Web at <http://www.cisco.com>, <http://www-china.cisco.com>, or <http://www-europe.cisco.com>. See also the “Obtaining Documentation” section on page xix.

Document Conventions

This publication uses the following conventions to convey instructions and information.

Table 2 Document Conventions

Convention	Description
boldface font	Commands and keywords.
<i>italic font</i>	Variables for which you supply values.
[]	Keywords or arguments that appear within square brackets are optional.
{x y z}	A choice of required keywords appears in braces separated by vertical bars. You must select one.
screen font	Examples of information displayed on the screen.
boldface screen font	Examples of information you must enter.
< >	Nonprinting characters, for example passwords, appear in angle brackets in contexts where italic font is not available.
[]	Default responses to system prompts appear in square brackets.



Note

Means *reader take note*. Notes contain helpful suggestions or references to additional information and material.



Timesaver

This symbol means *the described action saves time*. You can save time by performing the action described in the paragraph.



Caution

This symbol means *reader be careful*. In this situation, you might do something that could result in equipment damage or loss of data.



Tip

This symbol means *the following information will help you solve a problem*. The tips information might not be troubleshooting or even an action, but could be useful information, similar to a Timesaver.



Warning

IMPORTANT SAFETY INSTRUCTIONS

This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device.

SAVE THESE INSTRUCTIONS

Waarschuwing

BELANGRIJKE VEILIGHEIDSINSTRUCTIES

Dit waarschuwingssymbool betekent gevaar. U verkeert in een situatie die lichamelijk letsel kan veroorzaken. Voordat u aan enige apparatuur gaat werken, dient u zich bewust te zijn van de bij elektrische schakelingen betrokken risico's en dient u op de hoogte te zijn van de standaard praktijken om ongelukken te voorkomen. Gebruik het nummer van de verklaring onderaan de waarschuwing als u een vertaling van de waarschuwing die bij het apparaat wordt geleverd, wilt raadplegen.

BEWAAR DEZE INSTRUCTIES

Varoitus

TÄRKEITÄ TURVALLISUUSOHJEITA

Tämä varoitusmerkki merkitsee vaaraa. Tilanne voi aiheuttaa ruumiillisia vammoja. Ennen kuin käsittelet laitteistoa, huomioi sähköpiirien käsittelemiseen liittyvät riskit ja tutustu onnettomuuksien yleisiin ehkäisytapoihin. Turvallisuusvaroitusten käännökset löytyvät laitteen mukana toimitettujen käännettujen turvallisuusvaroitusten joukosta varoitusten lopussa näkyvien lausuntonumeroiden avulla.

SÄILYTÄ NÄMÄ OHJEET

Attention

IMPORTANTES INFORMATIONS DE SÉCURITÉ

Ce symbole d'avertissement indique un danger. Vous vous trouvez dans une situation pouvant entraîner des blessures ou des dommages corporels. Avant de travailler sur un équipement, soyez conscient des dangers liés aux circuits électriques et familiarisez-vous avec les procédures couramment utilisées pour éviter les accidents. Pour prendre connaissance des traductions des avertissements figurant dans les consignes de sécurité traduites qui accompagnent cet appareil, référez-vous au numéro de l'instruction situé à la fin de chaque avertissement.

CONSERVEZ CES INFORMATIONS

Warnung

WICHTIGE SICHERHEITSHINWEISE

Dieses Warnsymbol bedeutet Gefahr. Sie befinden sich in einer Situation, die zu Verletzungen führen kann. Machen Sie sich vor der Arbeit mit Geräten mit den Gefahren elektrischer Schaltungen und den üblichen Verfahren zur Vorbeugung vor Unfällen vertraut. Suchen Sie mit der am Ende jeder Warnung angegebenen Anweisungsnummer nach der jeweiligen Übersetzung in den übersetzten Sicherheitshinweisen, die zusammen mit diesem Gerät ausgeliefert wurden.

BEWAHREN SIE DIESE HINWEISE GUT AUF.

Avvertenza IMPORTANTI ISTRUZIONI SULLA SICUREZZA

Questo simbolo di avvertenza indica un pericolo. La situazione potrebbe causare infortuni alle persone. Prima di intervenire su qualsiasi apparecchiatura, occorre essere al corrente dei pericoli relativi ai circuiti elettrici e conoscere le procedure standard per la prevenzione di incidenti. Utilizzare il numero di istruzione presente alla fine di ciascuna avvertenza per individuare le traduzioni delle avvertenze riportate in questo documento.

CONSERVARE QUESTE ISTRUZIONI**Advarsel VIKTIGE SIKKERHETSINSTRUKSJONER**

Dette advarselssymbolet betyr fare. Du er i en situasjon som kan føre til skade på person. Før du begynner å arbeide med noe av utstyret, må du være oppmerksom på farene forbundet med elektriske kretser, og kjenne til standardprosedyrer for å forhindre ulykker. Bruk nummeret i slutten av hver advarsel for å finne oversettelsen i de oversatte sikkerhetsadvarslene som fulgte med denne enheten.

TA VARE PÅ DISSE INSTRUKSJONENE**Aviso INSTRUÇÕES IMPORTANTES DE SEGURANÇA**

Este símbolo de aviso significa perigo. Você está em uma situação que poderá ser causadora de lesões corporais. Antes de iniciar a utilização de qualquer equipamento, tenha conhecimento dos perigos envolvidos no manuseio de circuitos elétricos e familiarize-se com as práticas habituais de prevenção de acidentes. Utilize o número da instrução fornecido ao final de cada aviso para localizar sua tradução nos avisos de segurança traduzidos que acompanham este dispositivo.

GUARDE ESTAS INSTRUÇÕES**¡Advertencia! INSTRUCCIONES IMPORTANTES DE SEGURIDAD**

Este símbolo de aviso indica peligro. Existe riesgo para su integridad física. Antes de manipular cualquier equipo, considere los riesgos de la corriente eléctrica y familiarícese con los procedimientos estándar de prevención de accidentes. Al final de cada advertencia encontrará el número que le ayudará a encontrar el texto traducido en el apartado de traducciones que acompaña a este dispositivo.

GUARDE ESTAS INSTRUCCIONES**Varning! VIKTIGA SÄKERHETSANVISNINGAR**

Denna varningssignal signalerar fara. Du befinner dig i en situation som kan leda till personskada. Innan du utför arbete på någon utrustning måste du vara medveten om farorna med elkretsar och känna till vanliga förfaranden för att förebygga olyckor. Använd det nummer som finns i slutet av varje varning för att hitta dess översättning i de översatta säkerhetsvarningar som medföljer denna anordning.

SPARA DESSA ANVISNINGAR

Figyelem FONTOS BIZTONSÁGI ELOÍRÁSOK

Ez a figyelmeztető jel veszélyre utal. Sérülésveszélyt rejtő helyzetben van. Mielott bármely berendezésen munkát végezte, legyen figyelemmel az elektromos áramkörök okozta kockázatokra, és ismerkedjen meg a szokásos balesetvédelmi eljárásokkal. A kiadványban szereplő figyelmeztetések fordítása a készülékhez mellékelte biztonsági figyelmeztetések között található; a fordítás az egyes figyelmeztetések végén látható szám alapján kereshető meg.

ORIZZE MEG EZEKET AZ UTASÍTÁSOKAT!**Предупреждение ВАЖНЫЕ ИНСТРУКЦИИ ПО СОБЛЮДЕНИЮ ТЕХНИКИ БЕЗОПАСНОСТИ**

Этот символ предупреждения обозначает опасность. То есть имеет место ситуация, в которой следует опасаться телесных повреждений. Перед эксплуатацией оборудования выясните, каким опасностям может подвергаться пользователь при использовании электрических цепей, и ознакомьтесь с правилами техники безопасности для предотвращения возможных несчастных случаев. Воспользуйтесь номером заявления, приведенным в конце каждого предупреждения, чтобы найти его переведенный вариант в переводе предупреждений по безопасности, прилагаемом к данному устройству.

СОХРАНИТЕ ЭТИ ИНСТРУКЦИИ**警告 重要的安全性说明**

此警告符号代表危险。您正处于可能受到严重伤害的工作环境中。在您使用设备开始工作之前，必须充分意识到触电的危险，并熟练掌握防止事故发生的标准工作程序。请根据每项警告结尾提供的声明号码来找到此设备的安全性警告说明的翻译文本。

请保存这些安全性说明

警告 安全上の重要な注意事項

「危険」の意味です。人身事故を予防するための注意事項が記述されています。装置の取り扱い作業を行うときは、電気回路の危険性に注意し、一般的な事故防止策に留意してください。警告の各国語版は、各注意事項の番号を基に、装置に付属の「Translated Safety Warnings」を参照してください。

これらの注意事項を保管しておいてください。

주의 중요 안전 지침

이 경고 기호는 위험을 나타냅니다. 작업자가 신체 부상을 일으킬 수 있는 위험한 환경에 있습니다. 장비에 작업을 수행하기 전에 전기 회로와 관련된 위험을 숙지하고 표준 작업 관례를 숙지하여 사고를 방지하십시오. 각 경고의 마지막 부분에 있는 경고문 번호를 참조하여 이 장치와 함께 제공되는 번역된 안전 경고문에서 해당 번역문을 찾으십시오.

이 지시 사항을 보관하십시오.

Aviso INSTRUÇÕES IMPORTANTES DE SEGURANÇA

Este símbolo de aviso significa perigo. Você se encontra em uma situação em que há risco de lesões corporais. Antes de trabalhar com qualquer equipamento, esteja ciente dos riscos que envolvem os circuitos elétricos e familiarize-se com as práticas padrão de prevenção de acidentes. Use o número da declaração fornecido ao final de cada aviso para localizar sua tradução nos avisos de segurança traduzidos que acompanham o dispositivo.

GUARDE ESTAS INSTRUÇÕES**Advarsel VIGTIGE SIKKERHEDSANVISNINGER**

Dette advarselssymbol betyder fare. Du befinder dig i en situation med risiko for legemeskadedigelse. Før du begynder arbejde på udstyr, skal du være opmærksom på de involverede risici, der er ved elektriske kredsløb, og du skal sætte dig ind i standardprocedurer til undgåelse af ulykker. Brug erklæringsnummeret efter hver advarsel for at finde oversættelsen i de oversatte advarsler, der fulgte med denne enhed.

GEM DISSE ANVISNINGER

تحذير

إرشادات الأمان الهامة

يوضح رمز التحذير هذا وجود خطر. وهذا يعني أنك متواجد في مكان قد ينتج عنه التعرض للإصابات. قبل بدء العمل، احذر مخاطر التعرض للصدمات الكهربائية وكن على علم بالاجراءات القياسية للحيلولة دون وقوع أي حوادث. استخدم رقم البيان الموجود في آخر كل تحذير لتحديد مكان ترجمته داخل تحذيرات الأمان المترجمة التي تأتي مع الجهاز. قم بحفظ هذه الإرشادات

Upozorenje VAŽNE SIGURNOSNE NAPOMENE

Ovaj simbol upozorenja predstavlja opasnost. Nalazite se u situaciji koja može prouzročiti tjelesne ozljede. Prije rada s bilo kojim uređajem, morate razumjeti opasnosti vezane uz električne sklopove, te biti upoznati sa standardnim načinima izbjegavanja nesreća. U prevedenim sigurnosnim upozorenjima, priloženima uz uređaj, možete prema broju koji se nalazi uz pojedino upozorenje pronaći i njegov prijevod.

SAČUVAJTE OVE UPUTE**Upozornění DŮLEŽITÉ BEZPEČNOSTNÍ POKYNY**

Tento upozorňující symbol označuje nebezpečí. Jste v situaci, která by mohla způsobit nebezpečí úrazu. Před prací na jakémkoliv vybavení si uvědomte nebezpečí související s elektrickými obvody a seznamte se se standardními opatřeními pro předcházení úrazům. Podle čísla na konci každého upozornění vyhledejte jeho překlad v přeložených bezpečnostních upozorněních, která jsou přiložena k zařízení.

USCHOVEJTE TYTO POKYNY

Προειδοποίηση ΣΗΜΑΝΤΙΚΕΣ ΟΔΗΓΙΕΣ ΑΣΦΑΛΕΙΑΣ

Αυτό το προειδοποιητικό σύμβολο σημαίνει κίνδυνο. Βρίσκεστε σε κατάσταση που μπορεί να προκαλέσει τραυματισμό. Πριν εργαστείτε σε οποιοδήποτε εξοπλισμό, να έχετε υπόψη σας τους κινδύνους που σχετίζονται με τα ηλεκτρικά κυκλώματα και να έχετε εξοικειωθεί με τις συνηθισμένες πρακτικές για την αποφυγή ατυχημάτων. Χρησιμοποιήστε τον αριθμό δήλωσης που παρέχεται στο τέλος κάθε προειδοποίησης, για να εντοπίσετε τη μετάφρασή της στις μεταφρασμένες προειδοποιήσεις ασφαλείας που συνοδεύουν τη συσκευή.

ΦΥΛΑΞΤΕ ΑΥΤΕΣ ΤΙΣ ΟΔΗΓΙΕΣ

הרהרה

הוראות בטיחות חשובות

סימן אזהרה זה מסמל סכנה. אתה נמצא במצב העלול לגרום לפציעה. לפני שתעבוד עם ציוד כלשהו, עליך להיות מודע לסכנות הכרוכות במעגלים חשמליים ולהכיר את הנהלים המקובלים למניעת תאונות. השתמש במספר ההוראה המסופק בסופה של כל אזהרה כדי לאתר את התרגום באזהרות הבטיחות המתורגמות שמצורפות להתקן.

שמור הוראות אלה

Opomena

ВАЖНИ БЕЗБЕДНОСНИ НАПАТСТВИЈА

Симболот за предупредување значи опасност. Се наоѓате во ситуација што може да предизвика телесни повреди. Пред да работите со опремата, бидете свесни за ризикот што постои кај електричните кола и треба да ги познавате стандардните постапки за спречување на несреќни случаи. Искористете го бројот на изјавата што се наоѓа на крајот на секое предупредување за да го најдете неговиот период во преведените безбедносни предупредувања што се испорачани со уредот.

ЧУВАЈТЕ ГИ ОБИЕ НАПАТСТВИЈА

Ostrzeżenie

WAŻNE INSTRUKCJE DOTYCZĄCE BEZPIECZEŃSTWA

Ten symbol ostrzeżenia oznacza niebezpieczeństwo. Zachodzi sytuacja, która może powodować obrażenia ciała. Przed przystąpieniem do prac przy urządzeniach należy zapoznać się z zagrożeniami związanymi z układami elektrycznymi oraz ze standardowymi środkami zapobiegania wypadkom. Na końcu każdego ostrzeżenia podano numer, na podstawie którego można odszukać tłumaczenie tego ostrzeżenia w dołączonym do urządzenia dokumencie z tłumaczeniami ostrzeżeń.

NINIEJSZE INSTRUKCJE NALEŻY ZACHOWAĆ

Upozornenie

DÔLEŽITÉ BEZPEČNOSTNÉ POKYNY

Tento varovný symbol označuje nebezpečenstvo. Nachádzate sa v situácii s nebezpečenstvom úrazu. Pred prácou na akomkoľvek vybavení si uvedomte nebezpečenstvo súvisiace s elektrickými obvodmi a oboznámte sa so štandardnými opatreniami na predchádzanie úrazom. Podľa čísla na konci každého upozornenia vyhľadajte jeho preklad v preložených bezpečnostných upozorneniach, ktoré sú priložené k zariadeniu.

USCHOVAJTE SI TENTO NÁVOD

Obtaining Documentation

Cisco documentation and additional literature are available on Cisco.com. Cisco also provides several ways to obtain technical assistance and other technical resources. These sections explain how to obtain technical information from Cisco Systems.

Cisco.com

You can access the most current Cisco documentation at this URL:

<http://www.cisco.com/techsupport>

You can access the Cisco website at this URL:

<http://www.cisco.com>

You can access international Cisco websites at this URL:

http://www.cisco.com/public/countries_languages.shtml

Product Documentation DVD

Cisco documentation and additional literature are available in the Product Documentation DVD package, which may have shipped with your product. The Product Documentation DVD is updated regularly and may be more current than printed documentation.

The Product Documentation DVD is a comprehensive library of technical product documentation on portable media. The DVD enables you to access multiple versions of hardware and software installation, configuration, and command guides for Cisco products and to view technical documentation in HTML. With the DVD, you have access to the same documentation that is found on the Cisco website without being connected to the Internet. Certain products also have .pdf versions of the documentation available.

The Product Documentation DVD is available as a single unit or as a subscription. Registered Cisco.com users (Cisco direct customers) can order a Product Documentation DVD (product number DOC-DOCDVD=) from Cisco Marketplace at this URL:

<http://www.cisco.com/go/marketplace/>

Ordering Documentation

Beginning June 30, 2005, registered Cisco.com users may order Cisco documentation at the Product Documentation Store in the Cisco Marketplace at this URL:

<http://www.cisco.com/go/marketplace/>

Nonregistered Cisco.com users can order technical documentation from 8:00 a.m. to 5:00 p.m. (0800 to 1700) PDT by calling 1 866 463-3487 in the United States and Canada, or elsewhere by calling 011 408 519-5055. You can also order documentation by e-mail at tech-doc-store-mkpl@external.cisco.com or by fax at 1 408 519-5001 in the United States and Canada, or elsewhere at 011 408 519-5001.

Documentation Feedback

You can rate and provide feedback about Cisco technical documents by completing the online feedback form that appears with the technical documents on Cisco.com.

You can send comments about Cisco documentation to bug-doc@cisco.com.

You can submit comments by using the response card (if present) behind the front cover of your document or by writing to the following address:

Cisco Systems
Attn: Customer Document Ordering
170 West Tasman Drive
San Jose, CA 95134-9883

We appreciate your comments.

Cisco Product Security Overview

Cisco provides a free online Security Vulnerability Policy portal at this URL:

http://www.cisco.com/en/US/products/products_security_vulnerability_policy.html

From this site, you can perform these tasks:

- Report security vulnerabilities in Cisco products.
- Obtain assistance with security incidents that involve Cisco products.
- Register to receive security information from Cisco.

A current list of security advisories and notices for Cisco products is available at this URL:

<http://www.cisco.com/go/psirt>

If you prefer to see advisories and notices as they are updated in real time, you can access a Product Security Incident Response Team Really Simple Syndication (PSIRT RSS) feed from this URL:

http://www.cisco.com/en/US/products/products_psirt_rss_feed.html

Reporting Security Problems in Cisco Products

Cisco is committed to delivering secure products. We test our products internally before we release them, and we strive to correct all vulnerabilities quickly. If you think that you might have identified a vulnerability in a Cisco product, contact PSIRT:

- Emergencies — security-alert@cisco.com

An emergency is either a condition in which a system is under active attack or a condition for which a severe and urgent security vulnerability should be reported. All other conditions are considered nonemergencies.

- Nonemergencies — psirt@cisco.com

In an emergency, you can also reach PSIRT by telephone:

- 1 877 228-7302
- 1 408 525-6532

**Tip**

We encourage you to use Pretty Good Privacy (PGP) or a compatible product to encrypt any sensitive information that you send to Cisco. PSIRT can work from encrypted information that is compatible with PGP versions 2.x through 8.x.

Never use a revoked or an expired encryption key. The correct public key to use in your correspondence with PSIRT is the one linked in the Contact Summary section of the Security Vulnerability Policy page at this URL:

http://www.cisco.com/en/US/products/products_security_vulnerability_policy.html

The link on this page has the current PGP key ID in use.

Obtaining Technical Assistance

Cisco Technical Support provides 24-hour-a-day award-winning technical assistance. The Cisco Technical Support & Documentation website on Cisco.com features extensive online support resources. In addition, if you have a valid Cisco service contract, Cisco Technical Assistance Center (TAC) engineers provide telephone support. If you do not have a valid Cisco service contract, contact your reseller.

Cisco Technical Support & Documentation Website

The Cisco Technical Support & Documentation website provides online documents and tools for troubleshooting and resolving technical issues with Cisco products and technologies. The website is available 24 hours a day, at this URL:

<http://www.cisco.com/techsupport>

Access to all tools on the Cisco Technical Support & Documentation website requires a Cisco.com user ID and password. If you have a valid service contract but do not have a user ID or password, you can register at this URL:

<http://tools.cisco.com/RPF/register/register.do>

**Note**

Use the Cisco Product Identification (CPI) tool to locate your product serial number before submitting a web or phone request for service. You can access the CPI tool from the Cisco Technical Support & Documentation website by clicking the **Tools & Resources** link under Documentation & Tools. Choose **Cisco Product Identification Tool** from the Alphabetical Index drop-down list, or click the **Cisco Product Identification Tool** link under Alerts & RMAs. The CPI tool offers three search options: by product ID or model name; by tree view; or for certain products, by copying and pasting **show** command output. Search results show an illustration of your product with the serial number label location highlighted. Locate the serial number label on your product and record the information before placing a service call.

Submitting a Service Request

Using the online TAC Service Request Tool is the fastest way to open S3 and S4 service requests. (S3 and S4 service requests are those in which your network is minimally impaired or for which you require product information.) After you describe your situation, the TAC Service Request Tool provides recommended solutions. If your issue is not resolved using the recommended resources, your service request is assigned to a Cisco engineer. The TAC Service Request Tool is located at this URL:

<http://www.cisco.com/techsupport/servicerequest>

For S1 or S2 service requests or if you do not have Internet access, contact the Cisco TAC by telephone. (S1 or S2 service requests are those in which your production network is down or severely degraded.) Cisco engineers are assigned immediately to S1 and S2 service requests to help keep your business operations running smoothly.

To open a service request by telephone, use one of the following numbers:

Asia-Pacific: +61 2 8446 7411 (Australia: 1 800 805 227)

EMEA: +32 2 704 55 55

USA: 1 800 553-2447

For a complete list of Cisco TAC contacts, go to this URL:

<http://www.cisco.com/techsupport/contacts>

Definitions of Service Request Severity

To ensure that all service requests are reported in a standard format, Cisco has established severity definitions.

Severity 1 (S1)—Your network is “down,” or there is a critical impact to your business operations. You and Cisco will commit all necessary resources around the clock to resolve the situation.

Severity 2 (S2)—Operation of an existing network is severely degraded, or significant aspects of your business operation are negatively affected by inadequate performance of Cisco products. You and Cisco will commit full-time resources during normal business hours to resolve the situation.

Severity 3 (S3)—Operational performance of your network is impaired, but most business operations remain functional. You and Cisco will commit resources during normal business hours to restore service to satisfactory levels.

Severity 4 (S4)—You require information or assistance with Cisco product capabilities, installation, or configuration. There is little or no effect on your business operations.

Obtaining Additional Publications and Information

Information about Cisco products, technologies, and network solutions is available from various online and printed sources.

- Cisco Marketplace provides a variety of Cisco books, reference guides, documentation, and logo merchandise. Visit Cisco Marketplace, the company store, at this URL:

<http://www.cisco.com/go/marketplace/>

- *Cisco Press* publishes a wide range of general networking, training and certification titles. Both new and experienced users will benefit from these publications. For current Cisco Press titles and other information, go to Cisco Press at this URL:

<http://www.ciscopress.com>

- *Packet* magazine is the Cisco Systems technical user magazine for maximizing Internet and networking investments. Each quarter, Packet delivers coverage of the latest industry trends, technology breakthroughs, and Cisco products and solutions, as well as network deployment and troubleshooting tips, configuration examples, customer case studies, certification and training information, and links to scores of in-depth online resources. You can access Packet magazine at this URL:

<http://www.cisco.com/packet>

- *iQ Magazine* is the quarterly publication from Cisco Systems designed to help growing companies learn how they can use technology to increase revenue, streamline their business, and expand services. The publication identifies the challenges facing these companies and the technologies to help solve them, using real-world case studies and business strategies to help readers make sound technology investment decisions. You can access iQ Magazine at this URL:

<http://www.cisco.com/go/iqmagazine>

or view the digital edition at this URL:

<http://ciscoiq.texterity.com/ciscoiq/sample/>

- *Internet Protocol Journal* is a quarterly journal published by Cisco Systems for engineering professionals involved in designing, developing, and operating public and private internets and intranets. You can access the Internet Protocol Journal at this URL:

<http://www.cisco.com/ipj>

- Networking products offered by Cisco Systems, as well as customer support services, can be obtained at this URL:

<http://www.cisco.com/en/US/products/index.html>

- Networking Professionals Connection is an interactive website for networking professionals to share questions, suggestions, and information about networking products and technologies with Cisco experts and other networking professionals. Join a discussion at this URL:

<http://www.cisco.com/discuss/networking>

- World-class networking training is available from Cisco. You can view current offerings at this URL:

<http://www.cisco.com/en/US/learning/index.html>



Understanding Basic Hardware Architecture and Cisco IOS Software

The information in this chapter applies to the Cisco AS5350XM and Cisco AS5400XM universal gateways. This chapter provides a brief profile of the Cisco AS5350XM and Cisco AS5400XM universal gateway hardware components and functionality, explains how to use the Cisco IOS command-line interface (CLI), and describes how to upgrade your Cisco IOS software:

- [Basic Hardware Architecture, page 1-1](#)
- [Exploring the Cisco IOS File System, page 1-3](#)
- [Exploring Cisco IOS Software, page 1-5](#)
- [Upgrading to a New Cisco IOS Release, page 1-9](#)
- [Upgrade the ROM Monitor Image, page 1-12](#)
- [Where to Go Next, page 1-14](#)

The Cisco AS5350XM and Cisco AS5400XM universal gateways are versatile data and voice communications platforms that provide the functions of a gateway, router, and digital modems in a single modular chassis.

The gateways are intended for Internet service providers (ISPs), telecommunications carriers, and other service providers that offer managed Internet connections, and also medium to large sites that provide both digital and analog access to users on an enterprise network.

Basic Hardware Architecture



Note

The cards that reside in the Cisco AS5350XM and Cisco AS5400XM chassis are of two types: trunk feature cards, which provide an T1, E1, or channelized T3 interface, and universal port, dial-only, and voice feature cards, which host the universal digital signal processors (DSPs) that dynamically handle voice, dial, or fax calls.

[Figure 1-1](#) shows the logical and physical system architecture for the Cisco AS5350XM and Cisco AS5400XM universal gateways, and illustrates the components used to process a call.

Figure 1-1 Cisco AS5350XM and Cisco AS5400XM Basic System Architecture

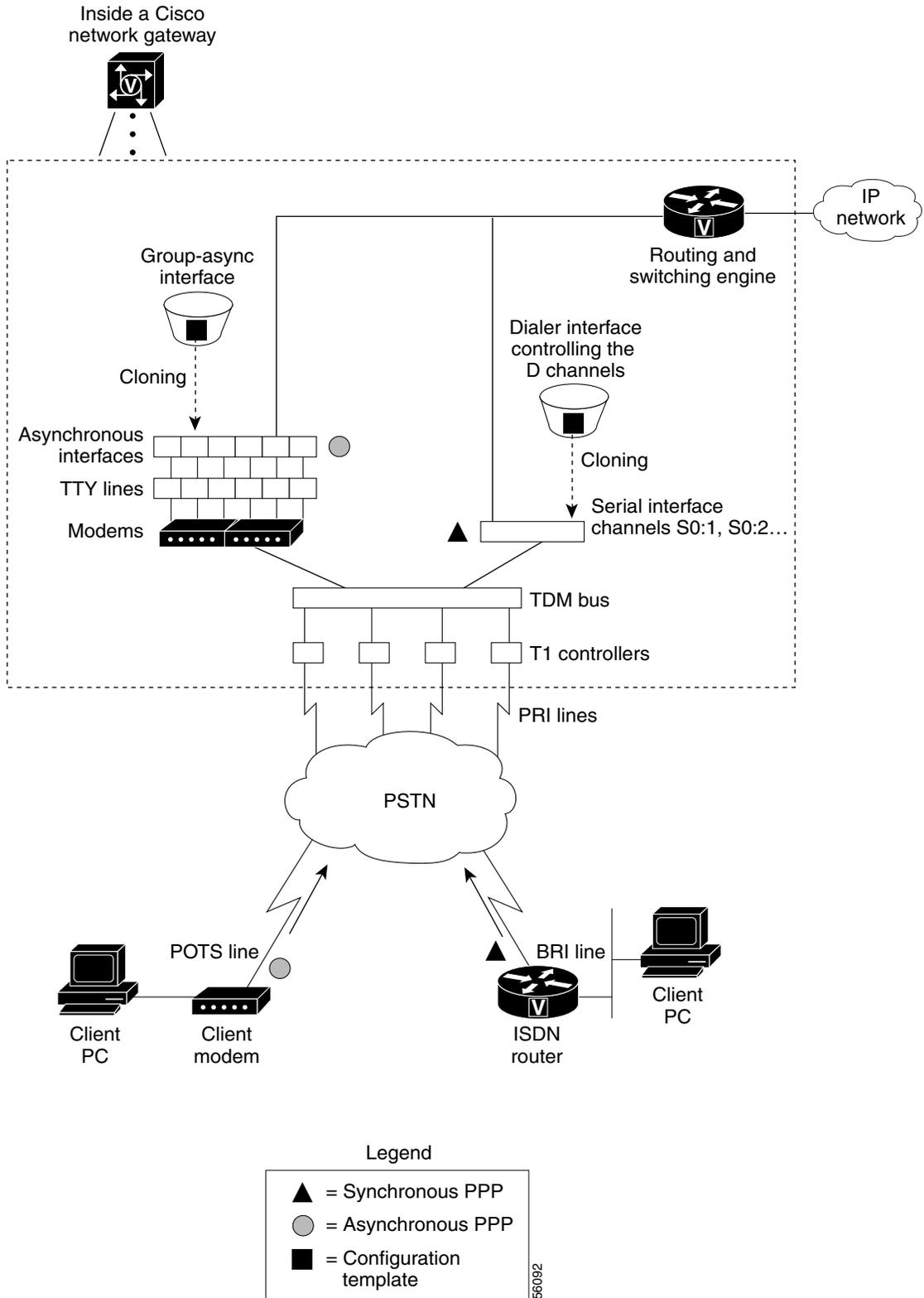


Figure 1-1 shows the following:

- Client modems and Integrated Services Digital Network (ISDN) routers dial into the gateway through the public switched telephone network (PSTN).
- Analog Point-to-Point Protocol (PPP) calls connect to modems inside the gateway.
- Each modem inside the gateway provides a corresponding TTY line and asynchronous interface for terminating character and packet mode services.
- Asynchronous interfaces clone their configurations from a group-async interface.
- Synchronous PPP calls connect to serial interface channels (for example, Se2/0:1 and Se2/0:2).
- Synchronous interfaces clone their configurations from a dialer interface.

One analog PPP call uses the following resources:

- One T1 DS0 channel
- One channel in a time-division multiplexing (TDM) bus
- One integrated modem
- One TTY line
- One asynchronous interface

One synchronous PPP call uses the following resources:

- One T1 DS0 channel
- One serial interface channel

Exploring the Cisco IOS File System

The Cisco IOS File System (IFS) feature provides a single interface to the following:

- Flash memory file system
- Network file system (TFTP, rcp, and FTP)
- Any other endpoint for reading or writing data (such as NVRAM, modem firmware, the running configuration, ROM, raw system memory and flash load helper log)



Note The Cisco AS5350XM and Cisco AS5400XM universal gateways use a Class C Flash File System.

IFS first appeared in Cisco IOS Releases 11.3 AA and 12.0. For more information about IFS, see the chapter “Using the Cisco IOS File System” in the *Cisco IOS Configuration Fundamentals Configuration Guide* for your software release.

Table 1-1 describes the memory locations.

Table 1-1 Memory Location Descriptions

Component	Description
CPU	750 MHz (Cisco AS5350XM and Cisco AS5400XM)
Processor memory	Stores the Cisco IOS image after it is initially read out of flash memory and decompressed (also known as main memory or DRAM). Also stores routing tables, call control blocks, and other data structures.
Packet I/O memory	Temporarily stores packets in transit.
System flash and flash memory	Stores Cisco IOS images, modem firmware/portware, and custom web pages.
NVRAM memory	Stores configurations in nonvolatile memory, which retains its contents when a unit is powered off.

To inspect the file system, enter the **show file systems** command and the **dir** command as shown in the following procedure.

Step 1 View the different file storage areas and file management functions:

```
Router# show file systems
File Systems:

      Size(b)      Free(b)      Type  Flags  Prefixes
      -----      -
      520184        520184      nvr   rw     nvr   :
      -             -           opaque rw     null:
      -             -           opaque rw     system:
      -             -           network rw     tftp:
      -             -           opaque wo     vfc:
* 32768000        22992256     flash rw     flash:
  7602176         4634364     flash rw     flash:
      -             -           opaque wo     lex:
      -             -           network rw     rcp:
      -             -           network rw     ftp:
```

In addition, verify that you have everything that you ordered (for example, 32 megabytes of flash memory). The asterisk (*) indicates the current directory.

Step 2 Display the objects in the system memory directory:

```
Router# dir system:
Directory of system:/

 4  dr-x          0          <no date>  memory
 1  -rw-         5026          <no date>  running-config
 2  dr-x          0          <no date>  ucode
14  dr-x          0          <no date>  vfiles
```



Note Remember to include the trailing colon (:) in **dir** commands.

Step 3 Inspect the contents of flash memory:

```
Router# dir flash:
Directory of flash:/
 1 -rw- 18442404 Oct 11 2004 16:52:54 +00:00 c5400-js-mz
 2 -rw- 11978 Sep 13 2004 13:27:22 +00:00 tb3-2-nemo-sip-stress.conf
 3 -rw- 18373376 Oct 05 2004 14:34:42 +00:00 c5400-js-mz-nm51520ef
 4 -rw- 18446620 Oct 06 2004 13:47:46 +00:00 c5400-js-mz.nemo.Sep30
```

In the example, the flash image is c5350-js-mz. The compressed file size is 1962796 bytes. The total flash memory size is 7602176 bytes. The number of free bytes is 4634364. The crashinfo file is a collection of useful information related to the current crash stored in system flash or flash memory.



Note For more information on crashinfo files, see the *Retrieving Information from the Crashinfo File* document, available online at <http://www.cisco.com/warp/public/63/crashinfo.html>.

Step 4 Display the contents of flash memory:

```
Router# pwd
flash:
Router# dir
 1 -rw- 9950528 Jan 01 2000 00:48:59 c5350-js-mz.121-1.XD1.bin

32768000 bytes total (22817344 bytes free)
```

The Cisco IOS image named c5350-js-mz.121-1.XD1.bin is present.

Step 5 Inspect the NVRAM directory:

```
Router# dir nvram:
Directory of nvram:/

 1 -rw- 0 <no date> startup-config
 2 ---- 0 <no date> private-config

520184 bytes total (520184 bytes free)
```

In the example, the startup-config and private-config are present. The private-config file is a secure file that is part of the startup configuration. It supports encryption technologies, but it is not user accessible.

Exploring Cisco IOS Software

This section describes what you need to know about the Cisco IOS software (the software that runs the gateway) before you configure the gateway using the CLI.

Understanding these concepts saves you time if you have no or minimal experience using the Cisco IOS software.

Getting Help

Use the question mark (?) and arrow keys to help you enter commands, where `Router>` is the prompt for the top level of the Cisco IOS software for the Cisco AS5350XM or Cisco AS5400XM universal gateway.

**Note**

The examples in this guide show prompts for either a Cisco AS5350XM or a Cisco AS5400XM universal gateway. However, regardless of the prompt or output shown, all examples apply to either type of gateway.

- For a list of available commands, enter a question mark:
Router> ?
- To complete a command, enter a few known characters followed by a question mark (with no space):
Router> s?
- For a list of command variables, enter the **show** command followed by a space and a question mark:
Router> show ?
- To redisplay a command you previously entered, press the Up Arrow key. You can continue to press the Up Arrow key for more commands.

Understanding Command Modes

You need to use many different command modes to configure the gateway. Each command mode restricts you to a subset of commands.

**Tip**

If you are having trouble entering a command, check the prompt, and then enter the question mark (?) for a list of available commands. You might be in the wrong command mode or using the wrong syntax.

In the following example, notice how the prompt changes after each command to indicate a new command mode:

```
Router> enable
Router> password
Router# configure terminal
Router(config)# interface gigabitethernet 0/0
Router(config-if)# ip address 172.16.254.250
Router(config-if)# exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
```

The last message is normal and does not indicate an error. Press **Return** to get the Router> prompt.

**Note**

You can press **Ctrl-Z** at any time to immediately return to enable mode (Router#), instead of entering **exit**, which returns you to the previous mode.

Finding Command Options

This section explains how to display options for a command. To display options for a command, enter a ? at the configuration prompt, or after entering part of a command followed by a space. The configuration parser displays options available with the command. For example, if you were in global configuration mode, typed the command **arap**, and wanted to see all the keywords and arguments for that command, you would type **arap ?**

	Command	Purpose
Step 1	Router> enable Password: <i>password</i> Router#	Enters enable mode. Enters the password. You are in enable mode when the prompt changes to Router#.
Step 2	Router# config terminal Enter configuration commands, one per line. End with CNTL/Z. Router(config)#	Enters global configuration mode. You are in global configuration mode when the prompt changes to Router(config)#.
Step 3	Router(config)# controller t1 1/? <0-1> Controller port number Router(config)# controller t1 1/0	Specifies the T1 controller that you want to configure using the controller T1 number global configuration command.
Step 4	Router(config-controller)# ? Controller configuration commands: cablelength Specify cable length for a DS1 link channel-group Specify timeslots to channel-group mapping for an interface default Set a command to its defaults description Controller specific description ds0 ds0 commands ds0-group Replacement of cas-group Configure group of timeslots to a particular signaling type exit Exit from controller configuration mode fdl Specify the FDL standard for a DS1 data link framing Specify the type of Framing on a DS1 link help Description of the interactive help system linecode Specify the line encoding method for a DS1 link loopback Put the entire T1 line into loopback no Negate a command or set its defaults pri-group Configure the specified timeslots for PRI shutdown Shut down a DS1 link (send Blue Alarm)	Displays controller configuration commands.
Step 5	Router(config-controller)# ds0-group ? <0-23> Channel number	Displays the options for the ds0-group controller configuration command. This command is used to configure the channel-associated signaling on a T1 controller.
Step 6	Router(config-controller)# ds0-group 1 ? timeslots List of timeslots in the ds0-group	Displays the only command (timeslots) available in ds0-group 1 .

It might take a minute or two to save the configuration to NVRAM. After the configuration has been saved, the following appears:

```
[OK]
Router#
```



Timesaver

You can use the question mark (?) and arrow keys to help you enter commands.



Timesaver

Each command mode restricts you to a set of commands. If you are having difficulty entering a command, check the prompt and then enter the question mark (?) for a list of available commands. You might be in the wrong command mode or using the wrong syntax.



Timesaver

If you want to disable a feature, enter the keyword **no** before the command; for example, **no ip routing**.



Timesaver

You need to save your configuration changes to NVRAM so that they are not lost if there is a system reload or power outage.

Upgrading to a New Cisco IOS Release

Obtain new Cisco IOS features and more stable code by upgrading to a new Cisco IOS release.

Step 1 Display the contents of flash memory:

```
Router# cd flash:
Router# dir
Directory of flash:/

1  -rw-      9950528   Jan 01 2000 00:48:59  c5350-js-mz.121-1.XD1.bin

32768000 bytes total (13041600 bytes free)
```

Step 2 Copy the new image from the remote TFTP server into flash memory. Make sure that you specify your own TFTP server's IP address and Cisco IOS filename. If you encounter issues with upgrading the image, be sure that you can ping the TFTP server and that appropriate directory permissions are configured on the TFTP server. To see the bangs (!) during the download operation, enable line wrap in your terminal emulation software.



Note

If you have available space for two images, leave both images in flash memory. If necessary, you can easily revert back to the previous image. Enter the **boot system flash newiosname.bin** command to point to the new image filename. By default, the first image in flash memory is loaded.

If you do not have available space, during the copy operation the system displays a message telling you to delete the current file and squeeze the flash memory to make room for the new image. Enter the **delete flash:version** command, followed by the **squeeze flash** command, to perform this delete-and-squeeze operation. Then proceed with the copy operation.

- Step 5** Reload the Cisco AS5350XM or Cisco AS5400XM universal gateway to run the new image. If you erased the old Cisco IOS image, make sure that the **boot system flash** *oldiosname.bin* command is not enabled and pointing to the old image filename; otherwise, the gateway becomes stuck trying to reload the old image over and over again.

```
Router# reload
Proceed with reload? [confirm]

System Bootstrap, Version 12.0(20000106:234457) [tombnyg-rommon_1_6 106],
SOFTWARE REV 1.6
Copyright (c) 1994-2000 by cisco Systems, Inc.
AS5400XM platform with 524288 Kbytes of main memory

Self decompressing the image : #####
##### [OK]
Self decompressing the image : #####
#####
#####
#####
#####
##### [OK]
Press RETURN to get started!
```



Note Most sections of the boot sequence have been omitted from the example.

For more information about TFTP, see the *Loading and Maintaining System Images and Microcode* document, available online at http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/12cgcr/fun_c/fcprt2/fcimages.htm



Tip

On system reload, if the console session freezes or displays unusual characters on the screen, you may have a console session mismatch between the Cisco IOS console line speed and the terminal server speed. This mismatch may occur because of the program settings of your console or your terminal server speed.



Note

Before you proceed to correct session mismatch, verify that your problem is not due to a defective cable or improper cable connection. Check your cable connection or replace the cable and reload the system again.

To correct a console session mismatch, do one of the following:

- Change your console line speed.
- Change your terminal server speed.
- If the above two solutions do not correct the console session, install the console jumper on the motherboard to set your default console port speed to 9600 bps.

Changing Console Line Speed



Caution

Changing your console line speed on an active Cisco AS5350XM or Cisco AS5400XM universal gateway results in a temporary loss of synchronization between the console line and terminal port speeds. At this point, the gateway may recognize a false **send break** command that may result in your system crashing.

To avoid this problem, you can do one of the following:

- If the configuration register on your Cisco AS5350XM or Cisco AS5400XM already has the Break Abort Effect bit set (mask is 0x0100), then you are protected and the false send break event does not occur. (You can change the configuration register to have this bit set, but the change does not take effect until your gateway is rebooted.)
- If the configuration register does not have the Break Abort Effect bit set (mask 0x0100), then disconnect the cable on the console port and either log in to the Cisco AS5350XM or Cisco AS5400XM universal gateway through the AUX port or telnet in through a VTY session. Change the console line speed and the related terminal server speed, and then reconnect the console cable.

Log in to your Cisco AS5350XM or Cisco AS5400XM universal gateway through the AUX port or Telnet VTY session. Enter the **show running-config** command and determine the speed your line console is set for. Possible console speeds are 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200. The default setting is 9600.

If your gateway is in ROM monitor mode, then the AUX port is not functioning. You must then change the terminal server port speed through your console port connection until the `rommon>` prompt is displayed. See [Appendix B, “ROM Monitor.”](#)

Changing Gateway Line Speed

The following example shows how to configure line speed on a Cisco AS5350XM or Cisco AS5400XM universal gateway, beginning in global configuration mode:

```
Router(config)# line 3
Router(config-line)# speed speed_value
```

Upgrade the ROM Monitor Image

Use the **upgrade rom-monitor** command to upgrade the ROM monitor to a new version. The Cisco AS5350XM and Cisco AS5400XM universal gateways have two ROM monitor images. The original image shipped with your system is a read-only image that cannot be erased or altered in the field; the second image is read-and-write upgradable by the field. This eliminates or reduces the need to physically replace the hardware in order to get a new image.

The **upgrade rom-monitor** commands allow you to:

- Load the upgrade ROM monitor image.
- Configure your system to point to the upgrade ROM monitor image at the next reboot of your router.
- Select the read-only ROM monitor image for execution on the next reboot.
- Display both ROM monitor image versions and which ROM monitor image is currently selected.

**Note**

If the upgrade ROM monitor image fails to boot, the router will mark this ROM monitor image as invalid and revert to the read-only image.

The first time a new ROM monitor image is loaded, you must allow the system to boot ROM monitor before doing any additional resets or power cycling. If the ROM monitor-loading process is interrupted, the system interprets this as a bootup failure of the new ROMmon image and reverts to the read-only image.

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> Enter your password if prompted.
Step 2	upgrade rom-monitor file {archive: [file-path] cns: [file-path] flash: [file-path] ftp: [file-path] http: [file-path] null: [file-path] nvram: [file-path] pram: [file-path] rcp: [file-path] system: [file-path] tftp: [file-path]} Example: Router# upgrade rom-monitor file tftp: //00.0.00.0/biff/AS5350_RMFUR.srec	Loads the upgrade ROM monitor image from a specified source directory filename. In the example, you are loading the ROM monitor image from a TFTP server using a TFTP path name.

Selecting a ROM Monitor Image for Execution

This section contains the procedure to select a ROM monitor image for execution on the next reboot. Use this procedure if you want to replace the upgrade ROM monitor image, which has been selected, with the read-only ROM monitor image. The read-only ROM monitor image will then be booted on the next reload of the gateway.

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables Privileged EXEC mode. <ul style="list-style-type: none"> Enter your password if prompted.
Step 2	upgrade rom-monitor preference [readonly upgrade] Example: Router# upgrade rom-monitor preference readonly	When in Cisco IOS, this command in Privileged EXEC mode selects either the read-only or upgrade ROM monitor image as the image to be booted on the next reload. <ul style="list-style-type: none"> In this example, you are selecting the read-only ROM monitor image. One reason could be that the upgrade image has features or side effects you do not like.

Verifying the ROM Monitor Image

To verify whether the upgrade ROM monitor or the read-only ROM monitor image has been installed, perform the following steps.

Step 1 enable

Enables privileged EXEC mode. Enter your password if prompted.

```
Router> enable
```

Step 2 show rom-monitor

When in Cisco IOS, this command in privileged EXEC mode shows both the read-only and the upgrade ROM monitor image versions, as well as which ROM monitor image is running.

```
Router# show rom-monitor
```

```
ReadOnly ROMMON version is:
System Bootstrap, Version 12.3(12r)PI6, RELEASE SOFTWARE (fc1)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 2004 by cisco Systems, Inc.
```

```
Upgrade ROMMON version is:
System Bootstrap, Version 12.3(12r)PI6, RELEASE SOFTWARE (fc1)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 2004 by cisco Systems, Inc.
```

```
Currently running ROMMON from ReadOnly region
ROMMON from ReadOnly region is selected for next boot
```

Where to Go Next

At this point you should go to these references:

- [Chapter 2, “Verifying Basic Setup,”](#) to analyze your system and execute basic tasks and system configuration before configuring the Cisco AS5350XM or Cisco AS5400XM universal gateway using the CLI to prepare your system for data call processing.



Tip

The following publications are available on the Documentation DVD, or on the World Wide Web from the Cisco home page.

- Cisco IOS publications *Dial Solutions Configuration Guide* and *Dial Solutions Command Reference* provide additional basic configuration information. For more advanced configuration topics, see the Cisco IOS software configuration guide, feature modules, and command reference publications that pertain to your Cisco IOS software release.
- For troubleshooting information, see the *System Error Messages* and *Debug Command Reference* publications.



Verifying Basic Setup

The information in this chapter applies to the Cisco AS5350XM and Cisco AS5400XM universal gateways. This chapter details the tasks required to verify that your basic system components are functioning normally:

- [Gigabit Ethernet Configuration, page 2-1](#)
- [Analyzing the System Boot Dialog, page 2-1](#)
- [Checking the Initial Running Configuration, page 2-5](#)
- [Investigating Memory Usage, page 2-7](#)
- [Inspecting CPU Utilization, page 2-8](#)
- [Displaying Component Status Using the Health Monitor, page 2-10](#)
- [Using the Interface Queue Wedge Monitor, page 2-11](#)
- [Where to Go Next, page 2-14](#)

Gigabit Ethernet Configuration

The Cisco AS5350XM and AS5400XM universal gateway Ethernet ports are Gigabit Ethernet ports (labeled GE0 and GE1 on the chassis). The Cisco IOS firmware and software is designed so that configurations for Fast Ethernet will work on the Cisco AS5350XM and AS5400XM universal gateways without requiring any modification by the user.

If the Cisco IOS commands, **write** or **copy running-config startup-config** have been used to save the configuration to NVRAM, then all references to Ethernet interfaces will now be GigabitEthernet, and the IOS commands, **write terminal** and **show running configuration** will always show GigabitEthernet.

If you must have FastEther available as a searchable word for any scripts you are using, you can use the ROMMON command, **ethertype fe** to change GigabitEthernet to FastEther. Once you enter **ethertype fe**, the IOS image will only recognize FastEther. It will *not* recognize GigabitEthernet.

Analyzing the System Boot Dialog

The Cisco AS5350XM and Cisco AS5400XM universal gateways have a specific boot sequence. To view the boot sequence through a terminal session, you must have a console connection to the gateway before it powers up.

**Note**

If you observe no messages on the console port, verify that the baud rate is configured correctly. The Cisco AS5350XM and Cisco AS5400XM console port can support a baud rate up to 115200.

The following boot sequence occurs. Step numbers and comments are inserted in the example to describe the boot sequence.

- Step 1** In the following segment, the gateway decompresses the system boot image, tests the NVRAM for validity, and decompresses the Cisco IOS image.

```
System Bootstrap, Version 12.3(12r)PI6, RELEASE SOFTWARE (fc1)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 2004 by cisco Systems, Inc.
AS5400XM platform with 524288 Kbytes of main memory
```

```
Self decompressing the image :
```

```
#####
#####
##### [OK]
```

- Step 2** Cisco IOS release, available memory, hardware interfaces, and modem lines are displayed.

**Note**

If a feature card type is not recognized, verify that you are running the optimum version of Cisco IOS software. Refer to the hardware-software compatibility matrix, available online at <http://cco-sj-1.cisco.com/cgi-bin/front.x/Support/HWSWmatrix/hswmatrix.cgi>

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```
cisco Systems, Inc.
170 West Tasman Drive
San Jose, California 95134-1706
```

```
Cisco IOS Software, 5400 Software (C5400-JS-M), Version 12.3(14)T, RELEASE SOFTWARE (fc1)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2005 by Cisco Systems, Inc.
Compiled Sat 29-Jan-05 02:10 by yiyan
Image text-base: 0x60011068, data-base: 0x61F80000
```

```
Cisco AS5400XM (BCM) processor (revision 0x21) with 393215K/131072K bytes of memory.
Processor board ID JAB082904P4
SB-1 CPU at 750MHZ, Implementation 1025, Rev 0.3, 256KB L2 Cache
Last reset from IOS reload
Manufacture Cookie Info:
  EEPROM Version 0x4, Board ID 0x4BD,
  Board Hardware Version 1.11, Item Number 800-6572289-01,
  Board Revision 02, Serial Number JAB082904P4.
Processor 0x0, MAC Address badb.adba.d044
2 Gigabit Ethernet interfaces
6 Serial interfaces
648 terminal lines
1 Channelized T3 port
```

```
512K bytes of NVRAM.
125184K bytes of ATA External CompactFlash (Read/Write)
```

Step 3 Because the gateway has never been configured, it cannot find a startup configuration file. Therefore, the software asks, “Would you like to enter the initial configuration dialog? [yes/no]”

Enter **no**. In this example, the Cisco IOS software is configured manually. The automatic setup script is not used. Configuring the Cisco IOS software manually develops your expertise.

Enter **yes** to terminate autoinstall.

```
--- System Configuration Dialog ---

Would you like to enter the initial configuration dialog? [yes/no]: no

Would you like to terminate autoinstall? [yes]: yes
```

Step 4 This example shows the LAN interfaces and the slots in which feature cards are not inserted. The universal port feature card (formerly called Nextport module) firmware version is displayed (version 1.1.6.81). The gateway attempts to switch to a better clock source but does not find a suitable source because the T1 trunks are not yet configured.

```
00:00:03: %NP_MD-6-SLOT_INSERTED: Slot 1 (108 ports max) inserted
00:00:16: %CARRIER-3-NO_DFC: DFC is not present - DFC 3
00:00:16: %CARRIER-3-NO_DFC: DFC is not present - DFC 4
00:00:16: %CARRIER-3-NO_DFC: DFC is not present - DFC 5
00:00:16: %CARRIER-3-NO_DFC: DFC is not present - DFC 6
00:00:16: %CARRIER-3-NO_DFC: DFC is not present - DFC 7
00:00:19: %LINK-3-UPDOWN: Interface GigabitEthernet0/0, changed state to up
00:00:19: %LINK-3-UPDOWN: Interface GigabitEthernet0/1, changed state to up
00:00:19: %LINK-3-UPDOWN: Interface Serial0/0, changed state to down
00:00:19: %LINK-3-UPDOWN: Interface Serial0/1, changed state to down
00:00:20: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed
state to up
00:00:20: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed
state to down
00:00:20: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0, changed state to down
00:00:20: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1, changed state to down
00:00:23: %NP_BS-6-MODULE_STARTED: NextPort module 1/0/0 Started - 1.1.6.81
00:00:26: %NP_BS-6-MODULE_STARTED: NextPort module 1/0/1 Started - 1.1.6.81
00:00:30: %NP_MD-6-MODULE_UP: NextPort module 1/0/0 up
00:00:30: %NP_BS-6-MODULE_STARTED: NextPort module 1/0/2 Started - 1.1.6.81
00:00:33: %NP_MD-6-MODULE_UP: NextPort module 1/0/1 up
00:00:37: %NP_MD-6-MODULE_UP: NextPort module 1/0/2 up
00:01:05: %LINK-5-CHANGED: Interface Serial0/0, changed state to administratively down
00:01:05: %LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to administratively
down
00:01:05: %LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to administratively
down
00:01:05: %LINK-5-CHANGED: Interface Serial0/1, changed state to administratively down
00:01:06: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed
state to down
00:01:10: %SYS-5-RESTART: System restarted --
Cisco Internetwork Operating System Software
IOS (tm) 5400 Software (C5400-JS-M), Version 12.3(14)T, RELEASE SOFTWARE (fc1)
TAC:Home:SW:IOS:Specials for info
Copyright (c) 2004 by cisco Systems, Inc.
Compiled Sun 09-Jul-00 07:06 by beliu
00:01:10: %TRUNK_CLOCK-6-SWITCH: Switching to the clock on slot 2 port 1 priority 205 as
the current primary has gone bad
00:01:10: %TRUNK_CLOCK-6-SWITCH: Switching to the clock on slot 2 port 2 priority 204 as
the current primary has gone bad
00:01:10: %TRUNK_CLOCK-6-SWITCH: Switching to the clock on slot 2 port 3 priority 205 as
the current primary has gone bad
```

```

00:01:10: %TRUNK_CLOCK-6-SWITCH: Switching to the clock on slot 2 port 4 priority 204 as
the current primary has gone bad
00:01:10: %TRUNK_CLOCK-6-SWITCH: Switching to the clock on slot 2 port 5 priority 205 as
the current primary has gone bad
00:01:10: %TRUNK_CLOCK-6-SWITCH: Switching to the clock on slot 2 port 6 priority 204 as
the current primary has gone bad
00:01:10: %TRUNK_CLOCK-6-SWITCH: Switching to the clock on slot 2 port 7 priority 205 as
the current primary has gone bad
00:01:10: %TRUNK_CLOCK-6-BAD_CLOCKS: There are no good clocks in the system. Remain in
HOLDOVER mode
00:01:10: %TRUNK_CLOCK-6-BAD_CLOCKS: There are no good clocks in the system. Remain in
HOLDOVER mode
00:01:10: %TRUNK_CLOCK-6-BAD_CLOCKS: There are no good clocks in the system. Remain in
HOLDOVER mode
00:01:10: %TRUNK_CLOCK-6-BAD_CLOCKS: There are no good clocks in the system. Remain in
HOLDOVER mode
00:01:10: %TRUNK_CLOCK-6-BAD_CLOCKS: There are no good clocks in the system. Remain in
HOLDOVER mode

```

Step 5 Enter the **show version** command to check the system hardware, Cisco IOS image name, uptime, and restart reason:

```
Router> show version
```

```

Cisco Internetwork Operating System Software
IOS (tm) 5400 Software (C5400-JS-M), Version 12.3(14)T, RELEASE SOFTWARE (fc1)
Copyright (c) 2004 by cisco Systems, Inc.
Compiled Mon 19-Feb-04 04:10 by
Image text-base: 0x60008968, data-base: 0x61180000

```

```

ROM: System Bootstrap, Version 12.0(19991122:230447)
BOOTFLASH: 5350 Software (C5350-BOOT-M), Version 12.0(19991112:1311)

```

```

AS5400 uptime is 1 day, 4 hours, 29 minutes
System returned to ROM by reload at 12:34:33 UTC Tue Nov 30 1999
System image file is "flash:c5350-js-mz.xml.Feb19"

```

```

cisco AS5400 (R7K) processor (revision L) with 131072K/65536K bytes of memory.
Processor board ID 99290068
R7000 CPU at 250Mhz, Implementation 39, Rev 1.0, 256KB L2, 2048KB L3 Cache
Last reset from warm-reset
Bridging software.
X.25 software, Version 3.0.0.
SuperLAT software (copyright 1990 by Meridian Technology Corp).
TN3270 Emulation software.
Primary Rate ISDN software, Version 1.1.
Manufacture Cookie Info:
  EEPROM Type 0x0001, EEPROM Version 0x01, Board ID 0x31,
  Board Hardware Version 1.21, Item Number 800-5171-01,
  Board Revision 011, Serial Number 99290068,
  PLD/ISP Version 0.0, Manufacture Date 2-Aug-1999.
Processor 0xFF, MAC Address 0x0503E5F5F4C
Backplane HW Revision FF.FF, Flash Type 5V
2 GigabitEthernet/IEEE 802.3 interface(s)
2 Serial network interface(s)
108 terminal line(s)
8 Channelized T1/PRI port(s)
512K bytes of non-volatile configuration memory.
16384K bytes of processor board System flash (Read/Write)
8192K bytes of processor board Boot flash (Read/Write)

```

```
Configuration register is 0x2102
```

Table 2-1 describes the significant output fields in the previous example.

Table 2-1 *show version Command Field Descriptions*

Field	Description
AS5400 uptime is....	Watch for unscheduled reloads by inspecting this field.
System returned to ROM by reload at....	This line tells you why the gateway last reloaded. If the field displays “power-on,” a power interruption caused the reload.
System image file is....	The gateway booted from this image location.

Checking the Initial Running Configuration

The Cisco IOS software creates an initial running configuration. Inspect the configuration to get familiar with the default settings. User input is shown in boldface type.

```

Router> enable
Password:
Router# show running-config

Building configuration...

Current configuration : 7653 bytes
!
version 12.1
no service single-slot-reload-enable
no service pad
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname Router
!
no boot startup-test
logging rate-limit console 10 except errors
!
!
resource-pool disable
!
!
voice-fastpath enable
ip subnet-zero
no ip routing
no ip finger
ip name-server 172.16.11.48
ip name-server 172.16.2.132
ip name-server 172.16.2.133
!
call rsvp-sync
!
!
fax interface-type modem
mta receive maximum-recipients 0

```

```

!
!
controller T1 1/0
!
controller T1 1/1
!
controller T1 1/2
!
controller T1 1/3
!
controller T1 1/4
!
controller T1 1/5
!
controller T1 1/6
!
controller T1 1/7
!
!
interface GigabitEthernet0/0
 ip address 172.21.101.21 255.255.255.0
 no ip route-cache
 no ip mroute-cache
 duplex auto
 speed 100
 no mop enabled
!
interface GigabitEthernet0/1
 no ip address
 no ip route-cache
 no ip mroute-cache
 shutdown
 duplex auto
 speed auto
!
interface Serial0/0
 no ip address
 no ip route-cache
 no ip mroute-cache
 shutdown
 fair-queue
 clockrate 2000000
!
interface Serial0/1
 no ip address
 no ip route-cache
 no ip mroute-cache
 shutdown
 clockrate 2000000
!
interface Async4/00
 no ip address
 no ip route-cache
!
interface Async4/01
 no ip address
 no ip route-cache
!
interface Async4/02
 no ip address
 no ip route-cache
.
.
.

```

```

interface Async4/107
  no ip address
  no ip route-cache
!
interface Group-Async0
  no ip address
  no ip route-cache
  no group-range
!
ip kerberos source-interface any
ip classless
no ip http server
!
!
line con 0
  logging synchronous
  transport input none
line aux 0
  logging synchronous
line vty 0 4
  password cisco
  login
line 4/00 4/107
  no flush-at-activation
  modem InOut
!
scheduler allocate 10000 400
end

```

The Cisco AS5350XM or Cisco AS5400XM universal gateway displays every asynchronous interface it recognizes. Therefore, if your system has a large number of asynchronous interfaces, the running configuration will be very long. To aggregate the asynchronous interfaces, you must assign them to a group-async interface using the command **group-range**. See the “[Configuring the Asynchronous Group Interface](#)” section on page 3-6.

Group-async interfaces are templates used to control the configuration of multiple asynchronous interfaces on the gateway. Each asynchronous interface corresponds to one of the modem lines and uses the same number as its corresponding line. Configuring the asynchronous interfaces as a group-async interface saves you time and configuration file size.

Investigating Memory Usage

Use the **show memory summary** command to perform these tasks:

- Understand how memory is used for different processor and I/O memory processes.
- Identify memory fragmentation and memory leaks.
 - Memory leak—Memory that is not released back to the processor. Memory leaks are indicated by steady decreases of free memory. However, the preferred way to track memory leaks is to monitor the FreeMem variable in the OID MIB (object-identifier Management Information Base).
 - Memory fragmentation—Memory that is indicated by the largest block of memory not being equal to the lowest block. Fragmentation increases as the numbers grow further apart.

Router# **show memory summary**

	Head	Total (b)	Used (b)	Free (b)	Lowest (b)	Largest (b)
Processor	61952B00	107664640	24210716	83453924	82827184	82866768

```
I/O 4000000 67108880 28952352 38156528 38156528 38156412
```

The sum of the used and free memory equals the total memory. Most of the **show memory summary** command output has been removed for brevity.

**Note**

Do not enter the **show memory summary** command with the **terminal length 0** command enabled. If you do, many screens of output might interrupt your session.

**Note**

To learn more about management information bases (MIBs), see the online references at <http://www.cisco.com/univercd/cc/td/doc/product/software/>. Select your Cisco IOS release and search under new feature documentation.

Inspecting CPU Utilization

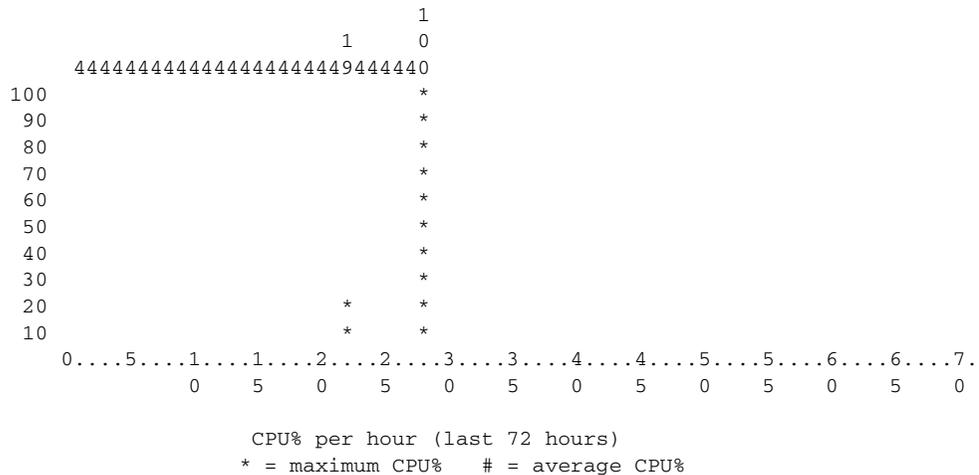
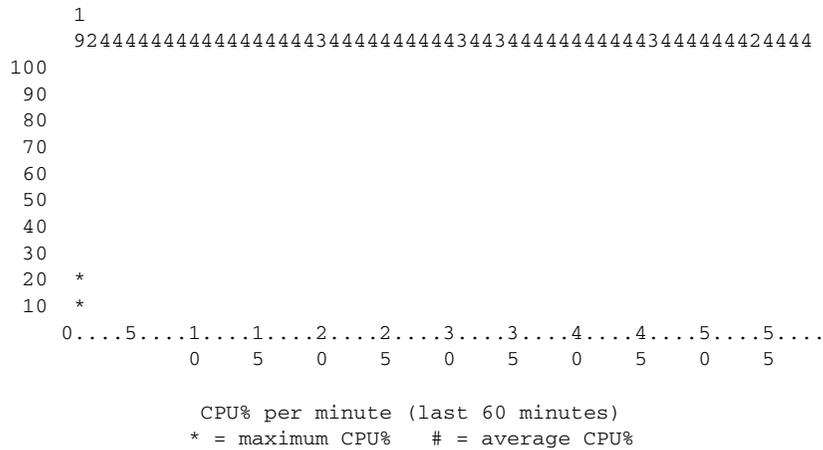
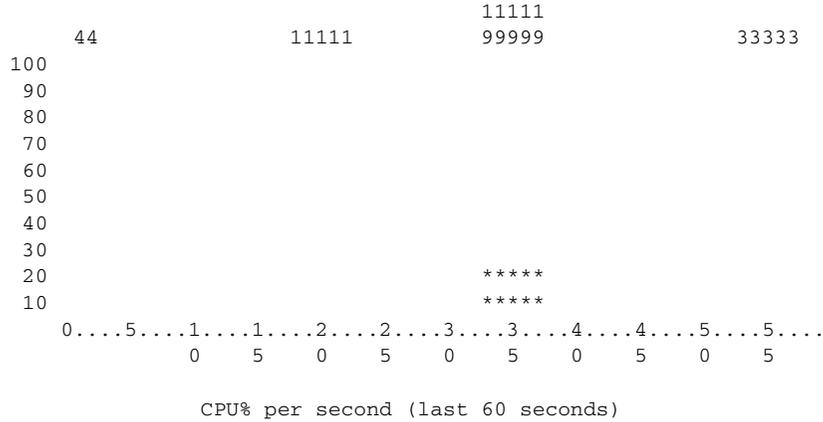
Enter the **show process cpu** command and then the **show process cpu history** command to investigate high CPU utilization. High utilization causes network performance problems. For example, knowing when the router is running at over 50 percent utilization is critical. The router might start dropping packets if an unexpected traffic burst comes through or if Open Shortest Path First (OSPF) is recalculated. Fast switching can also be used to reduce CPU utilization.

```
Router# show process cpu
```

```
CPU utilization for five seconds: 0%/0%; one minute: 1%; five minutes: 1%
PID Runtime(ms) Invoked uSecs 5Sec 1Min 5Min TTY Process
 1          0    20232      0 0.00% 0.00% 0.00% 0 Load Meter
 2          0      12      0 0.00% 0.00% 0.00% 0 EST msg processing
 3    305688    23808 12839 0.00% 0.39% 0.29% 0 Check heaps
 4          0      1      0 0.00% 0.00% 0.00% 0 Chunk Manager
 5          4     10    400 0.00% 0.00% 0.00% 0 Pool Manager
 6          0      2      0 0.00% 0.00% 0.00% 0 Timers
 7        112    20205      5 0.00% 0.00% 0.00% 0 ALARM_TRIGGER_SC
 8          0      2      0 0.00% 0.00% 0.00% 0 Serial Background
 9          0      1      0 0.00% 0.00% 0.00% 0 RM PROCESS
10          0      1      0 0.00% 0.00% 0.00% 0 RM PROCESS
11          0      1      0 0.00% 0.00% 0.00% 0 RM PROCESS
12          0      1      0 0.00% 0.00% 0.00% 0 RM PROCESS
13          0      2      0 0.00% 0.00% 0.00% 0 CAS Process
14        220    2803    78 0.00% 0.00% 0.00% 0 ARP Input
15          0    5058      0 0.00% 0.00% 0.00% 0 HC Counter Timer
16          0      2      0 0.00% 0.00% 0.00% 0 DDR Timers
17          0      2      0 0.00% 0.00% 0.00% 0 Dialer event
18          4      2 2000 0.00% 0.00% 0.00% 0 Entity MIB API
19          0      1      0 0.00% 0.00% 0.00% 0 SERIAL A'detect
20          0      1      0 0.00% 0.00% 0.00% 0 Critical Background
21          72    13826      5 0.00% 0.00% 0.00% 0 Net Background
PID Runtime(ms) Invoked uSecs 5Sec 1Min 5Min TTY Process
43          0      3      0 0.00% 0.00% 0.00% 0 AAA Accounting
.
.
.
```

The **show processes cpu history** command displays in ASCII graphical form the total CPU usage on the router over a period of time: one minute, one hour, and 72 hours, displayed in increments of one second, one minute, and one hour, respectively. Maximum usage is measured and recorded every second; average usage is calculated on periods over one second.

Router# **show process cpu history**



If you see high utilization numbers in the top line of the output, for example over 50 percent, inspect the columns 5Sec, 1Min, and 5Min. Find the process that uses the most CPU power.

Displaying Component Status Using the Health Monitor

The health monitor allows you to see the status of different components of your universal gateway.

The **show health-monitor summary** command shows the status of the following components:

- Chassis: Power supply, temperature, fans
- Memory: Processor, I/O memory
- Feature cards

The **show health-monitor summary** command provides high-level component status.

The **show health-monitor** command shows more details, such as the status of subcomponents.

The following example shows the display output of the **show health-monitor** command:

```
AS5400# show health-monitor
Chassis:
  Power Supply                               Failure
  Redundant Power System is present.
  PS Input Voltage status:                   failure
  PS Output Voltage status:                  failure
  PS Fan status:                             normal
  PS Thermal status:                         normal
  PS OverVoltage status:                     normal
  Temperature                               OK
  Fans                                       OK

Memory:
  Free Memory processor                       OK
  Memory Fragmentation Processor             OK
  Free Memory I/O                           OK
  Memory Fragmentation I/O                   OK
  Detailed summary:
    Head   Total(b)   Used(b)   Free(b)   Lowest(b)   Largest(b)
Processor 62EC07E0 219412512 67221920 152190592 142181548 139874020
  I/O    40000000    67110380 46387964 20722416 20722416 20706928

DFC's:
  Slot 1 (NP108 DFC)                         OK
  Slot 2 (NP108 DFC)                         OK
  Slot 3 (NP108 DFC)                         OK
  Slot 4 (NP60 DFC)                          OK
  Slot 5 (NP108 DFC)                         OK, 1 SPE's BAD
  Slot 7 (CT3 DFC)                           OK

AS5400#
AS5400#
AS5400#
AS5400#
AS5400#show health-monitor summ
AS5400#show health-monitor summary ?
  | Output modifiers
  <cr>
```

The following example shows the display output of the **show health-monitor summary** command:

```
AS5400# show health-monitor summary
Chassis:
```

```

Power Supply                               Failure
Temperature                                 OK
Fans                                         OK

Memory:
Free Memory processor                       OK
Memory Fragmentation Processor             OK
Free Memory I/O                             OK
Memory Fragmentation I/O                   OK

DFC's:
Slot 1 (NP108 DFC)                         OK
Slot 2 (NP108 DFC)                         OK
Slot 3 (NP108 DFC)                         OK
Slot 4 (NP60 DFC)                          OK
Slot 5 (NP108 DFC)                         OK
Slot 7 (CT3 DFC)                           OK

```

Using the Interface Queue Wedge Monitor

The Interface Queue Wedge Monitor displays information about interface queue wedges and the times that they occur. An interface queue is wedged when the packet count that is being transmitted (output queue) or received (input queue) is equal to or greater than the maximum packet count size of the queue, and consequently, no more packets are transmitted or received.

The Interface Queue Wedge Monitor is enabled or disabled using following commands.

- **interface-monitor enable**
- **[no] interface-monitor enable**

The Interface Queue Wedge Monitor is disabled by default.

When the Interface Queue Wedge Monitor is enabled, it monitors all the input and output queue wedge interfaces. The **show wedged-interfaces [output/input]** command displays the queue wedged interfaces.

The **show wedged-interfaces output** command displays the output queue wedge interfaces and their respective time-since-wedges.

The **show wedged-interfaces input** command displays the input queue wedge interfaces and their respective time-since-wedges.

Interface Queue Wedge Output Procedure

When the Interface Queue Wedge Monitor is enabled, and an interface (such as a GigabitEthernet0/0 output queue is already wedged, the following message is displayed on the console, syslog, and buffer:

```
Eg: 00:39:15: %HHM-3-INTFWEDGE: GigabitEthernet0/0 Output Queue Wedged
```

The following procedure shows an example of how to enable, disable, and show the results of a wedged interface output:

Step 1 Enable the Interface Queue Wedge Monitor.

```

AS5400# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
AS5400#(config)# interface-monitor enable
AS5400#(config)# ^Z
AS5400#

```

Step 2 Show interfaces. (In this case, some interfaces are already wedged.)

```
AS5400# show wedged-interfaces output
Interface Name          Time Since Wedge
Async4/00                00:23:33
Async4/01                00:23:26
Async4/02                00:23:21
Async4/03                00:23:15
GigabitEthernet0/0      00:24:35
GigabitEthernet0/1      00:24:50
Virtual-Access2         00:38:19
Virtual-Access3         00:38:19
AS5400#
```

Step 3 Show the interface wedge process running.

```
AS5400# show proc cpu | i Intf
   39          0       341          0  0.00%  0.00%  0.00%   0 Intf Wedge Monit
AS5400#
```

Step 4 Disable the interface monitor.

```
AS5400# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
AS5400#(config)# no interface-monitor enable
AS5400#(config)# ^Z
AS5400#
AS5400#
```

Step 5 Show the interface wedge process running again. (No process is running now.)

```
AS5400# show proc cpu | i Intf
AS5400#
```

Step 6 Show the wedged interface output. (No output.)

```
AS5400# show wedged-interfaces output
Interface Name          Time Since Wedge
AS5400#
AS5400#
```

Step 7 Enable the Interface Queue Wedge Monitor again.

```
AS5400# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
AS5400#(config)# interface-monitor enable
AS5400#(config)# ^Z

AS5400#
00:39:03: %HMM-3-INTFWEDGE: Async4/00 Output Queue Wedged
00:39:04: %SYS-5-CONFIG_I: Configured from console by console
00:39:06: %HMM-3-INTFWEDGE: Async4/01 Output Queue Wedged
00:39:09: %HMM-3-INTFWEDGE: Async4/02 Output Queue Wedged
00:39:12: %HMM-3-INTFWEDGE: Async4/03 Output Queue Wedged
00:39:15: %HMM-3-INTFWEDGE: GigabitEthernet0/0 Output Queue Wedged
00:39:18: %HMM-3-INTFWEDGE: GigabitEthernet0/1 Output Queue Wedged
00:39:39: %HMM-3-INTFWEDGE: Virtual-Access2 Output Queue Wedged
00:39:42: %HMM-3-INTFWEDGE: Virtual-Access3 Output Queue Wedged
AS5400#
AS5400#
AS5400#
```

Step 8 Show wedge output.

```
AS5400# show wedge output
Interface Name          Time Since Wedge
```

```

Async4/00          00:25:26
Async4/01          00:25:20
Async4/02          00:25:15
Async4/03          00:25:08
GigabitEthernet0/0 00:26:29
GigabitEthernet0/1 00:26:44
Virtual-Access2    00:40:12
Virtual-Access3    00:40:12
AS5400#

```

Step 9 Show the interface wedge process running again. (Process is running now.)

```

AS5400# show proc cpu | i Intf
   39          0          25          0  0.00%  0.00%  0.00%  0 Intf Wedge Monit

```

Wedge Interface Input Procedure

The following procedure shows an example of how to enable, disable, and show the results of wedged interface input:

Step 1 Show wedged interfaces. (Interfaces are already wedged.)

```

AS5400# show wedged-interfaces input
Interface          Time Since Wedge
Async4/00          00:21:58
Async4/01          00:21:51
Async4/02          00:21:26
Async4/03          00:21:21
GigabitEthernet0/0 11:58:28
GigabitEthernet0/1 11:58:46
Virtual-Access2    00:08:46
Virtual-Access3    00:08:46
AS5400#
AS5400#

```

Step 2 Show the interface wedge process running.

```

AS5400# show proc cpu | i Intf
   39          0          21          0  0.00%  0.00%  0.00%  0 Intf Wedge Monit
AS5400#
AS5400#
AS5400#

```

Step 3 Disable the interface monitor.

```

AS5400# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
AS5400#(config)# no interface-monitor enable
AS5400#(config)# ^Z
AS5400#
AS5400#
AS5400#

```

Step 4 Show the interface wedge process running again. (No process is running now.)

```

AS5400# show proc cpu | i Intf
AS5400#
AS5400#

```

Step 5 Show the wedged interface input. (No input.)

```

AS5400# show wedged-interfaces output

```

```

Interface                               Time Since Wedge
AS5400#
AS5400#

```

Step 6 Enable the Interface Queue Wedge Monitor again.

```

AS5400# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
AS5400#(config)# interface-monitor enable
AS5400#(config)# ^Z
AS5400#
AS5400#
AS5400#
12:00:50: %HMM-3-INTFWEDGE: Async4/00 Input Queue Wedge
12:00:53: %HMM-3-INTFWEDGE: Async4/01 Input Queue Wedge
12:00:56: %HMM-3-INTFWEDGE: Async4/02 Input Queue Wedge
12:00:59: %HMM-3-INTFWEDGE: Async4/03 Input Queue Wedge
12:01:02: %HMM-3-INTFWEDGE: GigabitEthernet0/0 Input Queue Wedge
12:01:05: %HMM-3-INTFWEDGE: GigabitEthernet0/1 Input Queue Wedge
12:01:26: %HMM-3-INTFWEDGE: Virtual-Access2 Input Queue Wedge
12:01:29: %HMM-3-INTFWEDGE: Virtual-Access3 Input Queue Wedge
AS5400#
AS5400#

```

Step 7 Show the interface wedge process running again. (The process is running now.)

```

AS5400# show proc cpu | i Intf
   39          8        110          72  0.00%  0.00%  0.00%   0 Intf Wedge Monit
AS5400#

```

Step 8 Show the wedge input.

```

AS5400# show wedged-interfaces input
Interface                               Time Since Wedge
Async4/00                                00:24:14
Async4/01                                00:24:06
Async4/02                                00:23:42
Async4/03                                00:23:37
GigabitEthernet0/0                       12:00:44
GigabitEthernet0/1                       12:01:01
Virtual-Access2                           00:11:02
Virtual-Access3                           00:11:02

```

Where to Go Next

At this point you should go to these references:

- [Chapter 3, “Basic Configuration Using the Command-Line Interface,”](#) to commission your Cisco AS5350XM or Cisco AS5400XM universal gateway.
- For additional basic configuration information, see the *Cisco IOS Dial Technologies Configuration Guide* and *Cisco IOS Dial Technologies Command Reference* publications for your Cisco IOS software release, available online at Cisco.com. For more advanced configuration topics, see the Cisco IOS software configuration guide, feature modules, and command reference publications that pertain to your Cisco IOS software release.
- For troubleshooting information, see the *System Error Messages* and *Debug Command Reference* publications for your Cisco IOS software release.



Basic Configuration Using the Command-Line Interface

The information in this chapter applies to the Cisco AS5350XM and Cisco AS5400XM universal gateways. After you have verified your basic setup, you are ready to begin performing basic tasks that prepare your system for data call processing.

This chapter describes how to use the Cisco IOS software command-line interface (CLI) to commission your Cisco AS5350XM or Cisco AS5400XM universal gateway and includes the following tasks:

- [Configuring the Hostname, Password, and Time Stamps, page 3-2](#)
- [Configuring Local AAA Security, page 3-3](#)
- [Creating a Login Banner, page 3-5](#)
- [Configuring Loopback Interfaces, Gigabit Ethernet Interfaces, and IP Route, page 3-5](#)
- [Configuring the Asynchronous Group Interface, page 3-6](#)
- [Configuring T1 and E1 Feature Cards, page 3-8](#)
- [Configuring a Channelized T3 Feature Card, page 3-11](#)
- [Configuring ISDN PRI, page 3-12](#)
- [Configuring DS0 Trunk Group Dial Out, page 3-19](#)
- [Configuring the D Channels for ISDN Signaling, page 3-22](#)
- [Configuring the Universal Port and Dial-Only Feature Cards, page 3-24](#)
- [Configuring the Voice Feature Card, page 3-29](#)
- [Configuring Clocking, page 3-30](#)
- [Enabling IP Basic Setup, page 3-34](#)
- [Testing Asynchronous Shell Connections, page 3-35](#)
- [Verifying the Final Running Configuration, page 3-38](#)
- [Saving Configuration Changes, page 3-40](#)
- [Where to Go Next, page 3-40](#)



Tip

If you are experienced using the Cisco IOS software, you might find the “[Where to Go Next](#)” section on [page 3-40](#) a useful reference for configuration.

Configuring the Hostname, Password, and Time Stamps

The first configuration tasks you might want to execute are assign a hostname to your Cisco AS5350XM or Cisco AS5400XM, set an encrypted password, and turn on time stamps for these reasons:

- Assigning a hostname allows you to distinguish between different network devices.
- Setting an encrypted password in the configuration file adds greater security on your gateway.
- Time stamps help you trace debug output for testing connections. Not knowing exactly when an event occurs hinders you from examining background processes.

Configure

	Command	Purpose
Step 1	Router> enable Password: <i>password</i> Router#	Enters enable mode (also called privileged EXEC mode). Enters the password. You are in enable mode when the prompt changes to Router#.
Step 2	Router# configure terminal Enter configuration commands, one per line. End with CNTL/Z. Router(config)#	Enters global configuration mode. You are in global configuration mode when the prompt changes to Router (config)#.
Step 3	Router(config)# hostname AS5400 AS5400(config)#	Changes the name of the gateway to a meaningful name. Substitute your hostname for <i>AS5400</i> .
Step 4	AS5400(config)# enable secret guessme	Enters an enable secret password. This password provides access to privileged EXEC mode. When you type enable at the EXEC prompt (AS5350> or AS5400>), you must enter the enable secret password to gain access to configuration mode. Substitute your enable secret password for <i>guessme</i> .
Step 5	AS5400(config)# service password-encryption	Applies password encryption. When password encryption is enabled, the encrypted form of the password is displayed when a show configuration command is entered. Note You cannot recover a lost encrypted password.
Step 6	AS5400(config)# service timestamps debug datetime msec	Enters time-stamp debugging messages to include milliseconds in the date and time stamp.
Step 7	AS5400(config)# service timestamps log datetime msec	Enters time-stamp logging messages to include milliseconds in the date and time stamp.
Step 8	AS5400(config)# line con 0	Enters line configuration mode to configure the console port. You are in configuration mode when the prompt changes to AS5350 (config-line)# or AS5400 (config-line)#.

	Command	Purpose
Step 9	AS5400(config-line)# exec-timeout 0 0	Prevents the gateway's EXEC facility from timing out if you do not type any information on the console screen for an extended period.
Step 10	AS5400(config-line)# exit AS5400(config)#	Exits global configuration mode.



Note The **enable password** command is obsolete. Do not use it.

Verify

To verify that you configured the right hostname and passwords, use these commands:

- Enter the **show configuration** command:

```
AS5400(config)# show configuration
Using 1888 out of 512000 bytes
!
version XX.X
.
.
!
hostname AS5400
!
enable secret 5 $1$60L4$X2JY0woDc0.kqallo0/w8/
.
```

Check the hostname and encrypted password displayed near the top of the command output.

- Exit global configuration mode and attempt to log in using the new enable secret password. The **show privilege** command shows the current security privilege level.

```
AS5400# exit

AS5400 con0 is now available
Press RETURN to get started.
AS5400> enable
Password:
AS5400# show privilege
Current privilege level is 15
AS5400#
```

Configuring Local AAA Security

Configure authentication, authorization, and accounting (AAA) to perform login authentication by using the local username database. The **login** keyword authenticates EXEC shell users. Additionally, configure PPP authentication to use the local database if the session was not already authenticated by the **login** keyword.

AAA (called triple A) is the Cisco IOS security model used on all Cisco devices. AAA provides the primary framework through which you set up access control on the Cisco AS5350XM or Cisco AS5400XM universal gateway.

The same authentication method is used on all interfaces. AAA is set up to use the local database configured on the gateway. This local database is created with the **username** configuration commands.

- Step 1** Create a local login username database in global configuration mode. In this example, the administrator's username is *admin*. The remote client's login username is *Harry*.

```
AS5400(config)# username admin password adminpasshere
AS5400(config)# username Harry password Harrypasshere
```



Caution

This step also prevents you from getting locked out of the gateway. If you get locked out, you must reboot the device and perform password recovery.

- Step 2** Configure local AAA security in global configuration mode. You *must* enter the **aaa new-model** command before the other two authentication commands.

```
AS5400(config)# aaa new-model
AS5400(config)# aaa authentication login default local
AS5400(config)# aaa authentication ppp default if-needed local
```

Table 3-1 explains the preceding configuration example.

Table 3-1 Local AAA Commands

Command	Purpose
AS5400(config)# aaa new-model	Initiates the AAA access control system. This command immediately locks down login and PPP authentication.
AS5400(config)# aaa authentication login default local	Configures AAA to perform login authentication by using the local username database. The login keyword authenticates EXEC shell users.
AS5400(config)# aaa authentication ppp default if-needed local	Configures PPP authentication to use the local database if the session was not already authenticated by the login keyword.

- Step 3** Log in with your username and password:

```
AS5400# login
```

```
User Access Verification
```

```
Username: admin
```

```
Password:
```

```
AS5400#
```

A successful login means that your local username works on any TTY or VTY line. Do not disconnect your session until you can log in.

**Note**

For comprehensive information about how to implement a Cisco AAA-based security environment for dial-based and router environments, see the *Cisco AAA Implementation Case Study* document, available online at <http://www.cisco.com/univercd/cc/td/doc/cisintwk/intsolns/aaaisg/index.htm>

Creating a Login Banner

A banner shows you which unit you are connected to (or are connecting through, in the case of a console server).

Step 1 Create the banner:

```
AS5400(config)# banner login |
Enter TEXT message. End with the character '|'.
This is a secured device.
Unauthorized use is prohibited by law.
|
AS5400(config)# ^Z
AS5400#
```

Step 2 Test the banner:

```
AS5400# login

This is a secured device.
Unauthorized use is prohibited by law.

User Access Verification

Username: admin
Password:

AS5400#
```

Configuring Loopback Interfaces, Gigabit Ethernet Interfaces, and IP Route

To commission a basic dial access service, perform the following tasks:

- Create two loopback interfaces.
- Bring up the Gigabit Ethernet interface.
- Add an IP route to the default gateway.

Step 1 Assign the IP addresses as in the following example, and create an IP route to the default gateway:

```
AS5400(config)# interface loopback 0
AS5400(config-if)# ip address 172.22.99.1 255.255.255.255
AS5400(config-if)# exit
AS5400(config)# interface loopback 1
```

```

AS5400(config-if)# ip address 172.22.90.1 255.255.255.0
AS5400(config-if)# exit
AS5400(config)# interface GigabitEthernet 0/0
AS5400(config-if)# ip address 172.28.186.55 255.255.255.240
AS5400(config-if)# no shutdown
AS5400(config-if)# exit
AS5400(config)# ip route 0.0.0.0 0.0.0.0 172.28.186.49

```

In this example:

- Interface loopback 0—Identifies the universal gateway with a unique and stable IP address. One unique IP address from a common block of addresses is assigned to each device in the IP network. This technique makes security-filtering easy for the Network Operations Center (NOC). One Class C subnet used for device identification can support 254 distinct devices with unique loopback addresses.
- Interface loopback 1—Hosts a pool of IP addresses for the remote nodes. In this way, 1 route, instead of 254 routes, is summarized and propagated to the backbone. Pick the IP address for loopback 1 from the range of addresses that you will assign to the local address pool.

Step 2 Verify that the Gigabit Ethernet interface is up. Ping the default gateway to verify this.

```
AS5400# ping 172.28.186.49
```

```

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.28.186.49, timeout is 2 seconds:
.!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 1/1/4 ms

```

This step verifies that you have IP connectivity with another device on the subnet. If the ping to the default gateway succeeds, try pinging the DNS server in your backbone. Make sure that the backbone routers are configured to get to the gateway; otherwise, the ping does not work. Configure the backbone routers to support the routes to the networks you are using.



Note

An 80 percent ping-success rate is normal for the first time you ping an external device. The Cisco AS5350XM and Cisco AS5400XM universal gateways do not have an Address Resolution Protocol (ARP) entry for the external device. A 100 percent success rate is achieved the next time you ping the device.

Configuring the Asynchronous Group Interface

Asynchronous group interfaces allow administrators to easily configure a large number of asynchronous interfaces by allowing them to clone from one managed copy. This can also reduce the number of lines in the configuration, because each individual asynchronous interface configuration can be replaced by at least one group-async interface. To assign the asynchronous interfaces to a group-async interface, first determine the number of asynchronous lines that need to be aggregated. This can be determined from the running configuration.

Notice that in the [“Checking the Initial Running Configuration”](#) section on page 2-5, the asynchronous lines are numbered from 0 to 107.

Configure

	Command	Purpose
Step 1	AS5400> enable Password: <i>password</i> AS5400#	Enters the enable command. Enters your password. You are in privileged EXEC mode when the prompt changes to AS5350# or AS5400#.
Step 2	AS5400# configure terminal Enter configuration commands, one per line. End with CNTL/Z. AS5400(config)#	Enters global configuration mode. You are in global configuration mode when the prompt changes to AS5540(config)# or AS5350(config)#.
Step 3	AS5400(config)# interface group-async 1 AS5400(config-if)#	Enters interface configuration mode, and places all asynchronous interfaces in a single group, so that you configure the same parameters quickly on all interfaces at one time.
Step 4	AS5400(config-if)# group-range slot/port slot/port Building configuration... AS5400(config-if)#	Defines the slot/port group range of the interface. The range that you specify depends on the number of asynchronous interfaces you have on your gateway. If your gateway has 108 asynchronous interfaces, you can specify group-range 1/1 1/107 .
Step 5	AS5400(config-if)# Ctrl-Z AS5400#	Returns to enable mode.

Verify

To verify your group interface configuration enter the **show interface async** command to check whether the protocol is up:

```
AS5400# show interface async 4/0
```

```
Async4/00 is down, line protocol is down
  modem(slot/port)=4/0, state=IDLE
  dsx1(slot/unit/channel)=NONE, status=VDEV_STATUS_UNLOCKED
  Hardware is Async Serial
  MTU 1500 bytes, BW 115 Kbit, DLY 100000 usec,
    reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation SLIP, loopback not set
  DTR is pulsed for 5 seconds on reset
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/10/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: weighted fair
  Output queue: 0/1000/64/0 (size/max total/threshold/drops)
    Conversations 0/1/32 (active/max active/max total)
    Reserved Conversations 0/0 (allocated/max allocated)
    Available Bandwidth 86 kilobits/sec
  5 minute input rate 0 bits/sec, 0 packets/sec
```

```

5 minute output rate 0 bits/sec, 0 packets/sec
  0 packets input, 0 bytes, 0 no buffer
  Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
  0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
  0 packets output, 0 bytes, 0 underruns
  0 output errors, 0 collisions, 0 interface resets
  0 output buffer failures, 0 output buffers swapped out
  0 carrier transitions

```

If you are having trouble, enter the **show async status** command to check for errors and local and remote addresses:

```
AS5400# show async status
```

```
Async protocol statistics:
```

Int	Local	Remote	Qd	InPack	OutPac	Inerr	Drops	MTU
1/00	42.1.1.1	None	0	0	0	0	0	1500
1/01	192.168.10.100	None	0	0	0	0	0	1500
1/02	192.168.10.100	None	0	0	0	0	0	1500
1/03	192.168.10.100	None	0	0	0	0	0	1500
1/04	192.168.10.100	None	0	0	0	0	0	1500
1/05	192.168.10.100	None	0	0	0	0	0	1500
4/52	192.168.10.100	None	0	0	0	0	0	1500
.								
.								
.								
*6/00	192.168.10.100	34.6.42.1	0	130	50	5	0	1500
*6/01	192.168.10.100	34.6.92.1	0	131	53	5	0	1500
*6/02	192.168.10.100	34.5.92.1	0	130	50	5	0	1500
*6/03	192.168.10.100	34.4.14.1	0	116	40	4	0	1500
.								
.								
.								
*7/102	192.168.10.100	34.1.89.1	0	119	40	4	0	1500
*7/103	192.168.10.100	34.4.34.1	0	118	40	4	0	1500
*7/104	192.168.10.100	34.1.67.1	0	105	40	4	0	1500
7/105	192.168.10.100	None	0	0	0	0	0	1500
*7/106	192.168.10.100	34.4.90.1	0	119	40	4	0	1500
*7/107	192.168.10.100	34.1.42.1	0	119	40	4	0	1500

```

Rcvd: 25762 packets, 1052214 bytes
  0 format errors, 891 checksum errors, 0 overrun
Sent: 8891 packets, 222264 bytes, 0 dropped

```

Configuring T1 and E1 Feature Cards

On a Cisco AS5350XM or Cisco AS5400XM universal gateway, you can allocate the available channels for channelized T1 and E1 lines in the following ways:

- Configure all channels to support ISDN PRI.
- If you are not running ISDN PRI, configure all channels to support robbed-bit signaling (also known as channel-associated signaling).
- Configure all channels in a single channel group.
- Mix and match channels supporting ISDN PRI, channel grouping, and channel-associated signaling (CAS).

- Mix and match channels supporting ISDN PRI, channel grouping, and robbed-bit signaling across the same T1 line. For example, on the same channelized T1 you can configure the **pri-group timeslots 1-10,24** command, **channel-group 11 timeslots 11-16** command, and **ds0-group 17 timeslots 17-23 type e&m-fgb** command. This is an unusual configuration because it requires you to align the correct range of timeslots on both ends of the connection.

**Note**

For configuration information about leased-line or nondial use, see the *Cisco IOS Configuration Fundamentals Configuration Guide* for your software release.

**Note**

You can install a maximum of two T1 feature cards, two E1 feature cards, or one channelized T3 (CT3) feature card in a single Cisco AS5350XM or Cisco AS5400XM chassis.

Controller Numbering

The T1 and E1 controller numbering convention is *slot/port* in CLI commands. Feature card slot numbering starts from the motherboard and works up from left to right. Slot 0 is reserved for the motherboard. T1 or E1 feature card slots are numbered sequentially from 1 to 7. Port numbering is from 0 to 7.

Configure

	Command	Purpose
Step 1	AS5400> enable Password: <i>password</i> AS5400#	Enters enable mode. Enters the password. You have entered enable mode when the prompt changes to AS5350# or AS5400#.
Step 2	AS5400# configure terminal Enter configuration commands, one per line. End with CNTL/Z. AS5400(config)#	Enters global configuration mode. You are in global configuration mode when the prompt changes to AS5350(config)# or AS5400(config)#.
Step 3	AS5400(config)# controller [t1 e1] <i>slot/port</i> AS5400(config-controller)#	Enters controller configuration mode to configure your controller slot and port. Slot values range from 1 to 7. Port values range from 0 to 7 for T1 and E1.
Step 4	AS5400(config-controller)# framing esf	Enters the telco framing type: esf or sf .
Step 5	AS5400(config-controller)# linecode b8zs	Enters the telco line code type: ami or b8zs .
Step 6	AS5400(config-controller)# Ctrl-Z AS5400#	Returns to enable mode.

Verify

To verify that your controller is up and running and no alarms have been reported, enter the **show controller** command and specify the controller type, slot, and port numbers:

```
AS5400# show controller t1 1/7

T1 1/7 is up.
No alarms detected.
Framing is ESF, Line Code is B8ZS, Clock Source is Line Primary.
Version info of slot 2: HW: 2, Firmware: 14, NEAT PLD: 13, NR Bus PLD: 19
Data in current interval (476 seconds elapsed):
  0 Line Code Violations, 0 Path Code Violations
  0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
  0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
Total Data (last 24 hours)
  0 Line Code Violations, 0 Path Code Violations,
  0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
  0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
```

Note the following:

- The controller must report being up.
- No errors should be reported.

The TDM subsystem troubleshooting commands are not used during normal system operation. Instead, the Cisco IOS commands show the current status and settings of the TDM backplane, enable debug output for display to the user when TDM programming occurs, and provide a set of test commands to test the functionality of the TDM path. TDM commands are generally used only by a Cisco technical support representative during troubleshooting of data continuity problems.



Note For details on the TDM feature, see the Cisco IOS software configuration guide and command reference publications. These publications are available on the Documentation DVD and on the World Wide Web from the Cisco home page, or you can order printed copies. See [“Obtaining Documentation” section on page xix](#).

If you are having trouble:

- First decide if the problem is due to the T1 or E1 line or with a particular channel group. If the problem is with a single channel group, you have a potential interface problem. If the problem is with the T1 or E1 line, or with all channel groups, you have a potential controller problem. (See the [“Configuring ISDN PRI” section on page 3-12](#).)
- To troubleshoot your E1 or T1 controllers, first check that the configuration is correct. The framing type and line code should match to what the service provider has specified. Then check channel group and PRI-group configurations, especially to verify that the timeslots and speeds are what the service provider has specified. At this point, the **show controller t1** or **show controller e1** commands should be used to check for T1 or E1 errors. Use the command several times to determine if error counters are increasing, or if the line status is continually changing. If this is occurring, you need to work with the service provider.
- Another common reason for failure is the **dial-tdm-clock priority** setting. The default setting is a free-running clock that causes clock slip problems if not set properly. (See the [“Configuring Clocking” section on page 3-30](#).)

Configuring a Channelized T3 Feature Card

The channelized T3 (CT3) feature card offers 28 individual T1 channels (bundled in the T3 line) for serial transmission of data. The channelized T3 link supports the maintenance data link channel in C-Bit parity mode and also payload and network loopbacks. The T1 channels multiplexed in the channelized T3 link support facilities data link (FDL) in extended super frame (ESF) framing.

Additionally, you can allocate your T1 channels as described in the [“Configuring T1 and E1 Feature Cards”](#) section on page 3-8.

Controller Numbering

The channelized T3 controller numbering convention is *slot/port* in CLI commands. Feature card slot numbering starts from the motherboard and works up from left to right. Slot 0 is reserved for the motherboard. Feature card slots are numbered sequentially from 1 to 7. Port number value is always 0.

Under the channelized T3, the T1 controller numbering convention is *slot/port:channel* in CLI commands. Port numbering values range from 1 to 28.

Configure

	Command	Purpose
Step 1	AS5400> enable Password: <i>password</i> AS5400#	Enters enable mode. Enters the password. You are in enable mode when the prompt changes to AS5350# or AS5400#.
Step 2	AS5400# configure terminal Enter configuration commands, one per line. End with CNTL/Z. AS5400(config)#	Enters global configuration mode. You are in global configuration mode when the prompt changes to AS5350(config)# or AS5400(config)#.
Step 3	AS5400(config)# controller t3 1/0 AS5400(config-controller)#	Enters controller configuration mode to configure your T3 controller for slot 1 port 0. Slot values range from 1 to 7. Port number is always 0.
Step 4	AS5400(config-controller)# framing c-bit	Enters the telco framing type: c-bit or m23 .
Step 5	AS5400(config-controller)# clock source line	Enters line clock source: internal or line .
Step 6	AS5400(config-controller)# cablelength 450	Enters your cable length: values range from 0 to 450 feet.

	Command	Purpose
Step 7	<pre>AS5400(config-controller)# t1 1-28 controller</pre> <p>or</p> <pre>AS5400(config-controller)# t1 1-10,15-20,23 controller</pre>	<p>Configures your T1 controllers. Values range from 1 to 28. In this instance, all 28 T1 channels are configured at once.</p> <p>or</p> <p>Omits specified T1 controllers while provisioning others. In this instance, T1 controllers 11–14, 21, 22, and 24–28 are unprovisioned.</p> <p>Note This CLI command is backward compatible only.</p>
Step 8	<pre>AS5400(config-controller)# Ctrl-Z AS5400#</pre>	Returns to enable mode.

Verify

To verify that your controller is up and running and no alarms have been reported, enter the **show controller** command and specify the controller type, slot, and port numbers:

```
AS5400# show controller t3 1/0

T3 1/0 is down.
  Applique type is Channelized T3
  Transmitter is sending remote alarm.
  Receiver has loss of signal.
  FEAC code received: No code is being received
  Framing is M23, Line Code is B3ZS, Clock Source is Line
  Data in current interval (330 seconds elapsed):
    0 Line Code Violations, 0 P-bit Coding Violation
    0 C-bit Coding Violation, 0 P-bit Err Secs
    0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
    0 Unavailable Secs, 0 Line Errored Secs
    0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
  Total Data (last 24 hours)
    9944 Line Code Violations, 0 P-bit Coding Violation,
    0 C-bit Coding Violation, 0 P-bit Err Secs,
    0 P-bit Severely Err Secs, 0 Severely Err Framing Secs,
    86400 Unavailable Secs, 0 Line Errored Secs,
    0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
```



Tip

If you are having trouble, make sure that the **show controller** command output is not reporting alarms or violations. Also, see the [“Configuring T1 and E1 Feature Cards”](#) section on page 3-8.

Configuring ISDN PRI

ISDN PRI interfaces can be configured on the 8-port T1 or E1 feature cards, or the CT3 feature card. ISDN provides out-of-band signaling using the D channel for signaling and the B channels for user data.

Channelized T1 ISDN PRI offers 23 B channels and 1 D channel. Channelized E1 ISDN PRI offers 30 B channels and 1 D channel. Channel 24 is the D channel for T1, and channel 16 is the D channel for E1.

For a complete description of the commands mentioned in this section, refer to the *Cisco IOS Dial Technologies Command Reference* for your software release.

Request PRI Line and Switch Configuration from a Telco Service Provider

Before configuring ISDN PRI on your Cisco router, you need to order a correctly provisioned ISDN PRI line from your telecommunications service provider.

This process varies from provider to provider on a national and international basis. However, some general guidelines follow:

- Determine if the outgoing B channel calls are made in ascending or descending order. The Cisco IOS software default is descending order; however, if the switch from the service providers is configured for outgoing calls made in ascending order, the router can be configured to match the switch configuration of the service provider.
- Ask for delivery of calling line identification. Providers sometimes call this CLI, or automatic number identification (ANI).
- If the gateway will be attached to an ISDN bus (to which other ISDN devices might be attached), ask for point-to-multipoint service (subaddressing is required) and a voice-and-data line.

Table 3-2 provides a sample of the channelized T1 configuration attributes you might request for a PRI switch.

Table 3-2 Channelized T1 Configuration Attributes

Attribute	Value
Line format	Extended super frame (ESF) format
Line coding	Binary 8-zero substitution (B8ZS)
Call type	23 incoming channels and 23 outgoing channels
Speed	64 kbps
Call-by-call capability	Enabled
Channels	23 B + D
Trunk selection sequence	Either ascending order (from 1 to 23) or descending order (from 23 to 1)
B + D glare	Yield
Directory numbers	Only 1 directory number assigned by service provider
SPIDs required?	None

Controller Numbering

The T1 or E1 controller numbering convention is *slot/port* in CLI commands. Feature card slot numbering starts from the motherboard and works up from left to right. Slot 0 is reserved for the motherboard. T1 or E1 feature card slots are numbered sequentially from 1 to 7. Port numbering is from 0 to 7.

The channelized T3 controller numbering convention is *slot/port* in CLI commands. Feature card slot numbering starts from the motherboard and works up from left to right. Slot 0 is reserved for the motherboard. Feature card slots are numbered sequentially from 1 to 7. Port number value is always 0.

Under the channelized T3 controller, the T1 controller numbering convention is *slot/port:channel* in CLI commands. Port numbering values range from 1 to 28.

Configure

	Command	Purpose
Step 1	AS5400> enable Password: <i>password</i> AS5400#	Enters enable mode. Enters the password. You are in enable mode when the prompt changes to AS5350# or AS5400#.
Step 2	AS5400# configure terminal Enter configuration commands, one per line. End with CNTL/Z. AS5400(config)#	Enters global configuration mode. You are in global configuration mode when the prompt changes to AS5350(config)# or AS5400(config)#.
Step 3	AS5400(config)# isdn switch-type <i>switch-type</i>	Selects a service provider switch type that accommodates PRI. (See Table 3-3 for a list of supported switch type keywords.)
Step 4	AS5400(config)# controller t1 1/0 or AS5400(config)# controller e1 1/0	Specifies T1 feature card slot, port number, and channel. On the CT3 feature card, port-number values range from 1 to 28 . On the T1 feature card, port-number values range from 0 to 7 . or Specifies E1 feature card slot, port number, and channel. On the E1 feature card, port number values range from 0 to 7 . Note After you configure the T1 or E1 controller, a corresponding D-channel serial interface is created instantly. See the “Configuring the D Channels for ISDN Signaling” section on page 3-22 to learn how to configure your D channel.
Step 5	AS5400(config-controller)# framing esf or AS5400(config-controller)# framing crc4	Enters framing type for the T1 or CT3 feature card. or Enters framing type for the E1 feature card.
Step 6	AS5400(config-controller)# linecode b8zs or AS5400(config-controller)# linecode hdb3	Defines the line code as binary 8 zero substitution (B8ZS) for the T1 or CT3 feature card. or Defines the line code as high-density bipolar 3 (HDB3) for the E1 feature card.

	Command	Purpose
Step 7	AS5400 (config-controller) # pri-group [timeslots range] ¹	Configures ISDN PRI. If you do not specify the timeslots, the controller is configured for 23 B channels and 1 D channel.
Step 8	AS5400 (config-controller) # Ctrl-Z AS5400#	Returns to enable mode.

1. For T1, timeslots range 1 to 24. You can specify a range of timeslots (for example, **pri-group timeslots 12-24**) if other timeslots are used for non-PRI channel groups.

For channelized T1 ISDN PRI—If you do not specify the timeslots, the specified controller is configured for 23 B channels and 1 D channel. B channel numbers range **1** to **23**; channel 24 is the D channel for T1. Corresponding serial interface numbers range **0** to **23**. In commands, the D channel is **interface serial slot/port:23**—for example, **interface serial 1/0:23**.

For channelized E1 ISDN PRI—If you do not specify the timeslots, the specified controller is configured for 30 B channels and 1 D channel. B channel numbers range **1** to **31**; channel 16 is the D channel for E1. Corresponding serial interface numbers range **0** to **30**. In commands, the D channel is **interface serial slot/port:15**—for example, **interface serial 1/0:15**.

Table 3-3 ISDN Service Provider PRI Switch Types

Area	Keyword	Switch Type
none	none	No switch defined
Australia	primary-ts014	Australia PRI switches
Europe	primary-net5	European, New Zealand, and Asia ISDN PRI switches (covers the Euro-ISDN E-DSS1 signaling system and is European Telecommunication Standards Institute or ETSI-compliant)
Japan	primary-ntt	Japanese ISDN PRI switches
North America	primary-4ess	AT&T 4ESS switch type for the United States
	primary-5ess	AT&T 5ESS switch type for the United States
	primary-dms100	NT DMS-100 switch type for the United States
	primary-ni	National ISDN switch type

Verify

To verify that you have configured the interfaces correctly, use the following commands:

- Enter the **show controller t3** command and specify the slot and port numbers. Verify that the controller is up and that you do not have excessive errors; otherwise your controller might go down frequently. This could indicate switch problems.

```
AS5400# show controller t3 1/0
```

```
T3 1/0 is up.
  Applique type is Channelized T3
  No alarms detected.
  MDL transmission is disabled
```

```

FEAC code received:No code is being received
Framing is C-BIT Parity, Line Code is B3ZS, Clock Source is Internal
Data in current interval (270 seconds elapsed):
  0 Line Code Violations, 0 P-bit Coding Violation
  0 C-bit Coding Violation, 0 P-bit Err Secs
  0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
  0 Unavailable Secs, 0 Line Errored Secs
  0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
Total Data (last 32 15 minute intervals):
  0 Line Code Violations, 0 P-bit Coding Violation,
  0 C-bit Coding Violation, 0 P-bit Err Secs,
  0 P-bit Severely Err Secs, 0 Severely Err Framing Secs,
  0 Unavailable Secs, 0 Line Errored Secs,
  0 C-bit Errored Secs, 0 C-bit Severely Errored Secs

```

- Enter the **show controller t1** command and specify the slot and port numbers.

```
AS5400# show controller t1 1/0
```

```

T1 1/0 is up.
  Applique type is Channelized T1
  Cablelength is long gain36 0db
  No alarms detected.
  alarm-trigger is not set
  Version info of slot 1: HW:768, PLD Rev:4
  Framers Version:0x8

Manufacture Cookie Info:
  EEPROM Type 0x0001, EEPROM Version 0x01, Board ID 0x041,
  Board Hardware Version 3.0, Item Number 73-4089-03,
  Board Revision 05, Serial Number JAB99432626,
  PLD/ISP Version 0.1, Manufacture Date 11-Nov-1999.

Framing is ESF, Line Code is B8ZS, Clock Source is Line.
Data in current interval (264 seconds elapsed):
  3 Line Code Violations, 1 Path Code Violations
  5 Slip Secs, 0 Fr Loss Secs, 1 Line Err Secs, 1 Degraded Mins
  5 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
.
.
.

```

- Enter the **show isdn status** command to view layer status information.

```
AS5400# show isdn status
```

```

Global ISDN Switchtype = primary-5ess
ISDN Serial1/0:1:23 interface
  dsl 0, interface ISDN Switchtype = primary-5ess
  Layer 1 Status:
    ACTIVE
  Layer 2 Status:
    TEI = 0, Ces = 1, SAPI = 0, State = MULTIPLE_FRAME_ESTABLISHED
  Layer 3 Status:
    0 Active Layer 3 Call(s)
  Activated dsl 0 CCBs = 0
  The Free Channel Mask: 0x807FFFFF
.
.
.
ISDN Serial1/0:28:23 interface
  dsl 27, interface ISDN Switchtype = primary-5ess
  Layer 1 Status:
    ACTIVE
  Layer 2 Status:

```

```

TEI = 0, Ces = 1, SAPI = 0, State = MULTIPLE_FRAME_ESTABLISHED
Layer 3 Status:
  0 Active Layer 3 Call(s)
Activated dsl 27 CCBs = 0
The Free Channel Mask: 0x807FFFFF
Total Allocated ISDN CCBs = 0

```

Note the following information for Serial 1/0:1:23 (the first half of the messages):

- Layer 1 Status should be “Active.”
 - Layer 2 Status should be “Multiple_Frame_Established.” (It might take several seconds for Layer 2 status to appear.)
 - Layer 3 Status should be “0 Active Layer 3 Call(s).”
 - The second half of the messages displays information for Serial 1/0:28:23.
- Monitor ISDN channels and service by entering the **show isdn service** command:

```

AS5400# show isdn service

PRI Channel Statistics:
ISDN Se0:23, Channel (1-31)
  Activated dsl 0
  State (0=Idle 1=Propose 2=Busy 3=Reserved 4=Restart 5=Maint)
  2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 0 0 0 0 3 3 3 3 3 3 3 3
  Channel (1-31) Service (0=Inservice 1=Maint 2=Outofservice)
  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 2 2 2 2 2 2 2 2
ISDN Se1:23, Channel (1-31)
  Activated dsl 1
  State (0=Idle 1=Propose 2=Busy 3=Reserved 4=Restart 5=Maint)
  2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 0 3 3 3 3 3 3 3 3 3
  Channel (1-31) Service (0=Inservice 1=Maint 2=Outofservice)
  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 2 2 2 2 2 2 2 2
ISDN Se2:23, Channel (1-31)
  Activated dsl 2
  State (0=Idle 1=Propose 2=Busy 3=Reserved 4=Restart 5=Maint)
  2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 0 0 0 0 3 3 3 3 3 3 3 3
  Channel (1-31) Service (0=Inservice 1=Maint 2=Outofservice)
  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 2 2 2 2 2 2 2 2
ISDN Se3:23, Channel (1-31)
  Activated dsl 3
  State (0=Idle 1=Propose 2=Busy 3=Reserved 4=Restart 5=Maint)
  2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 3 3 3 3 3 3 3 3 3
  Channel (1-31) Service (0=Inservice 1=Maint 2=Outofservice)
  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 2 2 2 2 2 2 2 2
ISDN Se4:23, Channel (1-31)
  Activated dsl 4
  State (0=Idle 1=Propose 2=Busy 3=Reserved 4=Restart 5=Maint)
  2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 3 3 3 3 3 3 3 3 3
  Channel (1-31) Service (0=Inservice 1=Maint 2=Outofservice)
  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 2 2 2 2 2 2 2 2
ISDN Se5:23, Channel (1-31)
  Activated dsl 5
  State (0=Idle 1=Propose 2=Busy 3=Reserved 4=Restart 5=Maint)
  2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 0 0 0 0 0 0 0 0 3 3 3 3 3 3 3 3
  Channel (1-31) Service (0=Inservice 1=Maint 2=Outofservice)
  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 2 2 2 2 2 2 2 2
ISDN Se6:23, Channel (1-31)
  Activated dsl 6
  State (0=Idle 1=Propose 2=Busy 3=Reserved 4=Restart 5=Maint)
  2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 0 3 3 3 3 3 3 3 3 3
  Channel (1-31) Service (0=Inservice 1=Maint 2=Outofservice)
  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 2 2 2 2 2 2 2 2

```


If you are having trouble:

- Make sure the cable connection is not loose or disconnected if the Layer 1 Status is “Deactivated.” This status message indicates a problem at the physical layer.
- There may be a problem with your telco, or the framing and line code types you entered may not match those of your telco. A Layer 2 error indicates that the gateway cannot communicate with the telco. There is a problem at the data link layer.

Configuring DS0 Trunk Group Dial Out

The DS0 Trunk Group Dial Out feature adds functionality that enhances outbound call routing by giving the user control over individual DS0 lines for outbound calls. Previous to this feature, outbound DS0 lines could not be configured separately from DS1 lines. The dial out capabilities of a DS1 line applied to all DS0 lines under that DS1 line.

Currently, the aggregation of DS1 lines into trunk groups is done through the Trunk Group Resource Manager (TGRM). The DS0 Trunk Group Dial Out feature enables the TGRM subsystem to aggregate DS0 lines into trunk groups also. The dial out capabilities of these DS0 trunk groups can then be configured directly at the DS0 level through the TGRM CLI and by setting the authentication authorization and accounting (AAA) attributes.

The configuration of DS0 lines for outbound calls enables the Dial on Demand feature to initiate outbound calls over a set of B channels.

DS0 dial out trunk groups are configured on a Network Access Server (NAS). They support both digital and asynchronous calls and can be configured for ISDN PRI and Non-Facility Associated Signaling (NFAS) circuits.

A trunk group is a logical grouping of multiple T1 or E1 interfaces with the same signaling characteristics. A single trunk group can contain up to 64 trunks. Each trunk group can consist of DS0 lines from different circuits, but each individual DS0 line can belong to only one trunk group.

**Note**

DS0 dial out trunk groups can be provisioned for dial out only at present and should not be provisioned as targets of dial peers.

**Note**

DS0 dial out trunk groups do not support voice interfaces.

Trunk Group Resource Manager

The Trunk Group Resource Manager (TGRM) supports the logical grouping, configuration, and joint management of one or more interfaces. The TGRM is used to store configuration information and to accept or select an interface from a trunk group when requested.

A trunk group is provisioned as the target of a dial peer or a dial out profile on an AAA server, and the TGRM transparently selects the specific interface and channels to use for incoming or outgoing calls. Trunks are selected based on the trunk that is least used (default configuration) or the hunt scheme configured.

Using trunk groups simplifies the task of configuring dial peers and interfaces, and also enables the dynamic selection of interfaces as needed in the access server.

A trunk group can include any number of interfaces, but all the interfaces in a trunk group must use the same type of signaling.

The TGRM subsystem has been enhanced to add fractional trunks to a trunk group. A fractional trunk is a single DS0 line or a group of DS0 lines from a trunk.

Configure

The **trunk-group** command assigns a trunk to a trunk group by specifying the trunk group *label* parameter and optionally setting the *preference* parameter.

The DS0 Dial Out Trunk Group feature adds two new optional keywords:

- **timeslots** *list of timeslots*
- **preference** *preference*

The **timeslots** keyword allows you to selectively add DS0 lines from a signaling circuit. Fractional trunk groups are configured from the controller configuration mode only (because a PRI serial interface may represent multiple member interfaces, including NFAS). If the **timeslots** option is not specified, all the DS0s in the signaling circuit are assigned to the trunk group.

The **preference** keyword is configured after the **timeslots** option and is visible only when the **timeslots** option is used. This helps to differentiate between the *list of timeslots* number and the *preference* number.

The following example shows the syntax for configuring selected DS0 lines using the **timeslots** keyword and the **preference** keyword.

trunk-group *label* **timeslot** *list of timeslots* **preference** *preference*

The following example shows the syntax for configuring all the DS0 lines in the signaling circuit:

trunk-group *label* *preference*

Syntax Parameter Descriptions

<i>label</i>	Trunk group label. Maximum length of the trunk group label is 127 alphanumeric characters.
<i>list of timeslots</i>	List of the interfaces from the signaling circuit to be added to the trunk group. The range is 1 to 64.
<i>preference</i>	Priority of the trunk group member in a trunk group. The range is from 1 (highest priority) to 64 (lowest priority). The <i>preference</i> variable can be used to sort a list of trunks in order. A trunk with no <i>preference</i> variable is given the highest preference.

The following examples show the configuration steps for PRI signaling. Controller T1 3 is a trunk configured for PRI.

PRI Trunk Configuration

Step 1 Configure framing, clock source, DS0 group, and so forth.

```
AS5400(config)# controller T1 3
AS5400(config-controller)# framing esf
AS5400(config-controller)# clock source line secondary 3
AS5400(config-controller)# linecode b8zs
AS5400(config-controller)# pri-group timeslots 1-24
AS5400(config-controller)# !
```

Step 2 Configure the trunk group label.

```
AS5400(config)# interface Serial3:23
AS5400(config-if)# no ip address
AS5400(config-if)# trunk-group PRI-TRUNK-GROUP
```



Note The **timeslots** option is *not* available in the serial interface configuration mode, because a serial interface may represent an NFAS serial interface.

Step 3 Configure timeslots and preference.

```
AS5400(config)# controller T1 3
AS5400(config-controller)# framing esf
AS5400(config-controller)# clock source line secondary 3
AS5400(config-controller)# linecode b8zs
AS5400(config-controller)# pri-group timeslots 1-24
AS5400(config-controller)# trunk-group PRI-TRUNK-GROUP-1 timeslots 1-10
AS5400(config-controller)# trunk-group PRI-TRUNK-GROUP-2 timeslots 11-15
AS5400(config-controller)# trunk-group PRI-TRUNK-GROUP-3 timeslots 20-22 preference 10
```



Note When a PRI or NFAS trunk is fractionally added to a trunk group, the **timeslots** keyword is compulsory.

Verify

Use the **show trunk group** command to display the DS0 lines that belong to a particular trunk group. A trunk group can be a group of DS0 lines from various signaling channels.

```
AS5400#show trunk group pri-tg
Trunk group: pri-tg
  Description:
  trunk group label: pri-tg

  Translation profile (Incoming):
  Translation profile (Outgoing):

  Hunt Scheme is least-used
  Max Calls (Incoming):   NOT-SET (Any)   NOT-SET (Voice) NOT-SET (Data)
  Max Calls (Outgoing):   NOT-SET (Any)   NOT-SET (Voice) NOT-SET (Data)
  Retries: 0

  Trunk 2/1:23      Preference 10
    Channels : 1-23
    Total channels available : 23
    Data = 0, Voice = 0, Modem = 0, Pending = 0, Free = 23
  Total calls for trunk group: Data = 0, Voice = 0, Modem = 0
                                Pend = 0, Free = 23

  advertise_flag 0x00000040, capacity timer 25 sec tripl_config_mask 0x00000000
  AC_curr 24, FD_curr 0, SD_curr 0

  succ_curr 0 tot_curr 0
  succ_report 0 tot_report 0
  changed 0 replacement position 0
```

Configuring the D Channels for ISDN Signaling

The ISDN D channels carry the control and signaling information for your ISDN calls—for both circuit-switched data calls, and analog modem calls.

The D channel notifies the central office switch to send the incoming call to particular time slots on the Cisco gateway or router. Each one of the B channels carries data or voice. The D channel carries signaling for the B channels. The D channel identifies whether the call is a circuit-switched digital call or an analog modem call. Analog modem calls are decoded and then sent off to the onboard modems. Circuit-switched digital calls are directly relayed to the ISDN processor in the gateway.

When you configured ISDN PRI on the T1 or E1 controller, you automatically created a serial interface that corresponds to the PRI group time slots. This interface is a logical entity that is associated with the specific controller. After the serial interface is created, you must configure the D channel serial interface that carries signaling. The configuration applies to all the PRI B channels (time slots) for that PRI group.

Figure 3-1 shows the logical contents of an ISDN PRI interface used in a T1 network configuration. The logical contents include 23 B channels, 1 D channel, 24 time slots, and 24 virtual serial interfaces (total number of B + D channels).

Figure 3-1 Logical Relationship of ISDN PRI Components for T1

Channel type	Time slot number	Virtual serial interface number
B (data channel)	1	S0:0
B (data channel)	2	S0:1
B (data channel)	3	S0:2
B (data channel)	4	S0:3
•	•	•
•	•	•
•	•	•
•	•	•
•	•	•
B (data channel)	21	S0:20
B (data channel)	22	S0:21
B (data channel)	23	S0:22
Ⓚ (signaling channel)	24	S0:23

Logical contents of a PRI interface

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Note

When you configure your T1 controller for an NFAS backup D channel, a serial interface is automatically created only when your primary D channel fails.

Configure

	Command	Purpose
Step 1	AS5400> enable Password: <i>password</i> AS5400#	Enters enable mode. Enters the password. You are in enable mode when the prompt changes to AS5350# or AS5400#.
Step 2	AS5400# configure terminal Enter configuration commands, one per line. End with CNTL/Z. AS5400(config)#	Enters global configuration mode. You are in global configuration mode when the prompt changes to AS5350(config)# or AS5400(config)#.
Step 3	AS5400(config)# interface serial 1/0:23 AS5400(config-if)#	Enters serial interface configuration mode. After you configure the T1 controller, a corresponding D channel serial interface is automatically created. For example, serial interface 1/0:23 is the D channel for T1 controller 1. You must configure each serial interface to receive incoming and send outgoing signaling. Note On a channelized E1 PRI line, the serial interface is 1/0:15.
Step 4	AS5400(config-if)# ip address 172.16.254.254 255.255.255.0	Assigns an IP address and subnet mask to the interface.
Step 5	AS5400(config-if)# isdn incoming-voice modem	Configures all incoming voice calls. Note This command has two possible keywords: data and modem . You must use the modem keyword to enable both modem and voice calls. The modem keyword represents bearer capabilities of speech.
Step 6	AS5400(config-if)# exit	Exits interface configuration mode.

Verify

To verify your D channel configuration, enter the **show interface serial** command and make sure the line protocol is up and you are using the correct IP interface. Also, make sure that excessive errors are not being reported.

```
AS5400# show interface serial 1/0:23

Serial1/0:23 is up, line protocol is up (spoofing)
  Hardware is DSX1
  Internet address is 172.16.254.254/16
  MTU 1500 bytes, BW 64 Kbit, DLY 20000 usec,
    reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation PPP, loopback not set
  Last input 00:00:03, output never, output hang never
  Last clearing of "show interface" counters 00:00:01
  Queueing strategy:fifo
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  1 minute input rate 0 bits/sec, 0 packets/sec
  1 minute output rate 0 bits/sec, 0 packets/sec
    0 packets input, 0 bytes, 0 no buffer
```

```

Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
0 packets output, 0 bytes, 0 underruns
0 output errors, 0 collisions, 0 interface resets
0 output buffer failures, 0 output buffers swapped out
0 carrier transitions
Timeslot(s) Used:24, Transmitter delay is 0 flags
AS5400#

```

If you are having trouble:

- Make sure the serial interface and protocol are up by entering the **show interface serial** command.
- Check the IP address.

```

AS5400# show interface serial 1/0:23

Serial1/0:23 is up, line protocol is up (spoofing)
Hardware is DSX1
Internet address is 172.16.254.254/16
MTU 1500 bytes, BW 64 Kbit, DLY 20000 usec,
    reliability 255/255, txload 1/255, rxload 1/255
Encapsulation PPP, loopback not set
Last input 00:00:07, output never, output hang never
Last clearing of "show interface" counters 00:00:06
Queueing strategy:fifo
Output queue 0/40, 0 drops; input queue 0/75, 0 drops
1 minute input rate 0 bits/sec, 0 packets/sec
1 minute output rate 0 bits/sec, 0 packets/sec
    0 packets input, 0 bytes, 0 no buffer
    Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
    0 packets output, 0 bytes, 0 underruns
    0 output errors, 0 collisions, 0 interface resets
    0 output buffer failures, 0 output buffers swapped out
    0 carrier transitions
Timeslot(s) Used:24, Transmitter delay is 0 flags
AS5400#

```

Configuring the Universal Port and Dial-Only Feature Cards

The universal port and dial-only feature cards support all modem standards and features. Rather than the more traditional line-to-modem mapping, lines are mapped to a system processing engine (SPE) that resides on the universal port and dial-only feature cards. Associated SPE firmware serves a function similar to modem code on a modem ISDN channel aggregation (MICA) technologies modem.



Note

The dial-only feature card only supports dial services. Dial services include modem calls (all modulations), ISDN digital calls, V.110 data calls, and V.120 data calls. Modem pass-through calls are not included in dial services.

One SPE provides services for six ports, with additional ports per SPE. Busyout and shutdown can be configured at the SPE or port level.

The universal port and dial-only feature cards perform the following functions:

- Converts pulse code modulation (PCM) bitstreams to digital packet data.
- Forwards converted and packetized data to the main processor, which examines the data and forwards it to the backhaul egress interface.
- Supports all modem standards (such as V.34 and V.42*bis*) and features, including dial-in and dial-out.

**Note**

For further information, see [Chapter 5, “Managing and Troubleshooting the Universal Port and Dial-Only Feature Cards.”](#)

For detailed information about CLI commands supported on the universal port and dial-only feature cards, see the *Monitoring Voice and Fax Services on the Cisco AS5350 and Cisco AS5400 Universal Gateways* publication, available online at http://www.cisco.com/en/US/products/sw/iosswrel/ps1839/products_feature_guide09186a0080080e60.html.

SPE Firmware

SPE firmware is automatically downloaded to a universal port or dial-only feature card from the Cisco AS5350XM or Cisco AS5400XM universal gateway when you boot the system for the first time or when you insert a universal port or dial-only feature card while the system is operating. When you insert feature cards while the system is operating, the Cisco IOS image recognizes the feature cards and downloads the required firmware to the feature cards.

The SPE firmware image is bundled with the gateway Cisco IOS image. The SPE firmware image uses an *autodetect* mechanism, which enables the universal port feature card to service multiple call types. An SPE detects the call type and automatically configures itself for that operation. The firmware is upgradable independently of Cisco IOS upgrades, and different firmware versions can be configured to run on SPEs in the same feature card.

The universal port and dial-only feature cards support the modem standards and features listed in [Table 3-4](#).

Table 3-4 Modem Standards and Supported Features

Feature	Description
Carrier protocols	ITU V.23 at 75/1200 bps Telcordia Technologies 103 at 300 bps ITU V.21 at 300 bps ITU V.22 at 1200 bps Telcordia 212A at 1200 bps ITU V.22 <i>bis</i> at 2400 bps ITU V.32 up to 9600 bps ITU V.32 <i>bis</i> up to 14,400 bps V.32 turbo up to 19,200 bps V.FC up to 28,800 bps V.34 up to 28,800 bps V.34+ up to 33,600 bps TIA/ITU V.90 K56flex
Error-correcting link-access protocols	V.42 LAPM, MNP 2-4
Compression protocols	V.42 <i>bis</i> (includes MNP 5)
Command interface	Superset of the AT command set
In-band signaling or tone generation and detection	DTMF generation DTMF detection MF generation MF detection
Other	Out-of-band access for management PPP and SLIP framing

Configure

Configure the lines and ports to allow users to dial in to your network.

	Command	Purpose
Step 1	AS5400> enable Password: <i>password</i> AS5400#	Enters the enable command. Enters your password. You are in privileged EXEC mode when the prompt changes to AS5350# or AS5400#.
Step 2	AS5400# configure terminal Enter configuration commands, one per line. End with CNTRL/Z. AS5400 (config)#	Enters global configuration mode. You are in global configuration mode when the prompt changes to AS5350 (config)# or AS5400 (config)#.

	Command	Purpose
Step 3	AS5400(config)# spe country <i>country name</i>	Specifies the country for the feature card parameters (including country code and encoding). This setting is applied at the system level. All universal port or dial-only feature cards use the same country code. The default is usa if the gateway is configured with T1 interfaces and e1-default if the gateway is configured with E1 interfaces. Use the no form of this command to set the country code to the default of usa . Note All sessions on all universal port or dial-only feature cards in all slots must be idle for this command to execute.
Step 4	AS5400(config)# line <i>slot/port slot/port</i> AS5400(config-line)#	Enters the numbers of the ports to configure. If you wish to configure 108 ports on slot 3, enter line 3/00 3/107 . If you wish to configure 324 ports on slots 3–5, enter line 3/00 5/107 . 108 ports will be configured on each slot.
Step 5	AS5400(config-line)# transport input all	Allows all protocols to be used when connecting to the line.
Step 6	AS5400(config-line)# autoselect ppp	Enables remote IP users running a PPP application to dial in, bypass the EXEC facility, and connect directly to the network.
Step 7	AS5400(config-line)# modem inout	Enables incoming and outgoing calls.
Step 8	AS5400(config-line)# Ctrl-Z AS5400#	Returns to enable mode.

Modems and lines are configured after the ISDN channels are operational and POTS telephone calls have been successfully routed to the modems

Each modem is mapped to a dedicated asynchronous line inside the gateway. After the **modem inout** command is applied to the lines, the gateway is ready to accept modem calls.

AAA security is applied to the lines using the **aaa new-model** command and **aaa authentication login default local** command. AAA performs login authentication by using the local username database. The **login** keyword authenticates EXEC shell users. For more information about the AAA commands, see the “[Configuring Local AAA Security](#)” section on page 3-3.

**Note**

The modem speed 115200 bps and hardware flow control are the default settings for integrated modems.

Resetting to Default Values for Country Codes

To reset the modem to default settings for country codes, enter the **no spe country** command in global configuration mode.

Verify

To verify your SPE configuration, use these commands.

- Enter the **show spe** command to display a summary for all the lines:

```
AS5400# show spe

SPE settings:
=====
Country code configuration: default T1 (u Law)
Polling interval: 8 secs.
History log events: 50(per port)
Port legends:
=====
Port state: (s)shutdown (t)test (r)recovery (d)download
            (b)busiedout (p)busyout pending, (B)bad (a)active call
Call type: (m)modem (d)digital (f)fax-relay (v)voice (_)not in use
System resources summary:
=====
Total ports: 108, in use ports: 0, disabled ports: 0, free ports: 108
Total active calls: modem 0, voice 0, digital 0, fax-relay 0

SPE#      Port #      SPE      SPE      SPE  SPE  Port      Call
State     Busyout Shut Crash State  Type
4/00     0000-0005  ACTIVE   0       0     0  _____
4/01     0006-0011  ACTIVE   0       0     0  _____
4/02     0012-0017  ACTIVE   0       0     0  _____
4/03     0018-0023  ACTIVE   0       0     0  _____
4/04     0024-0029  ACTIVE   0       0     0  _____
.
.
.
```

- Enter the **show line number** command to display a summary for a single line:

```
AS5400# show line 1

  Tty Typ      Tx/Rx    A Modem  Roty Acc0 AccI   Uses   Noise  Overruns  Int
    1 AUX    9600/9600  - -      - - -     0       0     0/0      -
Ready

Line 1, Location: "", Type: ""
Length: 24 lines, Width: 80 columns
Baud rate (TX/RX) is 9600/9600, no parity, 2 stopbits, 8 databits
Status: Ready
Capabilities: none
Modem state: Ready
Group codes: 0
Modem hardware state: noCTS noDSR DTR RTS
  TTY NUMBER 1
Parity Error = 0 Framing Error = 0 Receive Error = 0 Overrun = 0
Outcount = 0 totalout = 39 incount = 0 totalin = 0

Special Chars: Escape Hold Stop Start Disconnect Activation
                ^x none - - none
Timeouts:      Idle EXEC Idle Session Modem Answer Session Dispatch
                00:10:00 never never none not set
                Idle Session Disconnect Warning
                never
                Login-sequence User Response
```

If you are having trouble, make sure you turned on the protocols for connecting to the lines (**transport input all**) and configured the lines for incoming and outgoing calls (**modem inout**).

Configuring the Voice Feature Card

A voice feature card with one to six PVDM2-64 modules supports different port densities depending on codec complexity.



Note

For detailed information about the voice feature card CLI commands, see the *High-Density Packet Voice Feature Card for Cisco AS5350XM and AS5400XM Universal Gateways* document, available online at the following URL:

http://www.cisco.com/en/US/products/ps6706/products_feature_guide09186a008060df15.html

Configure

The voice feature card should work without specific modifications to the software configuration on these platforms. However, you might need to upgrade the firmware on the voice feature card, depending on the software release you are using.

To upgrade the firmware of the voice feature card, follow these steps:

	Command or Action	Purpose
Step 1	AS5400> enable Password: <i>password</i> AS5400#	Enters the enable command. Enters your password. You are in privileged EXEC mode when the prompt changes to AS5350# or AS5400#.
Step 2	AS5400# configure terminal Enter configuration commands, one per line. End with CNTL/Z. AS5400(config)#	Enters global configuration mode. You are in global configuration mode when the prompt changes to AS5350(config)# or AS5400(config)#.
Step 3	AS5400(config)# voice dsp slot [/dsp] [slot [/dsp]]	Enters voice dsp config mode and specifies the slot/dsp location or a range of slots/dsps. <ul style="list-style-type: none"> For the <i>slot</i> argument, specify a value from 1 to 7 to specify the location of the VFC. For the <i>dsp</i> argument, specify a value from 1 to 24 to specify the location of the DSP. To specify a range, the first two arguments specify the first slot/dsp in the range. The second two arguments specify the last slot/dsp in the range. Where slash marks appear in the command syntax, they are required.
Step 4	AS5400(config-voice-dsp)# firmware location flash: filename	Specifies that the firmware is in flash memory and identifies the file name.

	Command or Action	Purpose
Step 5	AS5400(config-voice-dsp)# end	Exits config-voicedsp mode and returns to global configuration mode.
Step 6	AS5400(config-voice-dsp)# Ctrl-Z AS5400#	Returns to enable mode.

Verifying

To verify your firmware upgrade, use the **show voice dsp version** command.

```
AS5400#show voice dsp version ?
```

```
IOS-Bundled Default          Version      Firmware-Type
=====
system:/bundled_fw_image    4.4.5      c5510
```

```
On-Flash Dspware-Filename   Version      Firmware-Type
=====
flash:dsp_c5510_flex.rbf    4.5.9051   c5510
flash:new_flex.rbf         4.4.5      c5510
flash:big.rbf              4.5.985x   c5510
```

```
DSP#      Type      Version      Filename
3/1       C5510     4.5.9051    flash:dsp_c5510_flex.rbf
3/2       C5510     4.4.5       system:/bundled_fw_image
3/3       C5510     4.4.5       system:/bundled_fw_image
3/4       C5510     4.4.5       system:/bundled_fw_image
3/5       C5510     4.4.5       system:/bundled_fw_image
3/6       C5510     4.4.5       system:/bundled_fw_image
3/7       C5510     4.4.5       system:/bundled_fw_image
3/8       C5510     4.4.5       system:/bundled_fw_image
3/9       C5510     4.4.5       system:/bundled_fw_image
3/10      C5510     4.4.5       system:/bundled_fw_image
3/11      C5510     4.4.5       system:/bundled_fw_image
```

Configuring Clocking

The time-division multiplexing (TDM) bus on the Cisco AS5350XM and Cisco AS5400XM universal gateway backplane can receive an input clock from one of these basic sources on the gateway:

- T1, E1, and CT3 feature cards
- An external T1 or E1 clock source feed directly through the Building Integrated Timing Supply (BITS) interface port on the motherboard
- Free-running clock providing clock from an oscillator



Note

BITS is a single building master timing supply. BITS generally supplies DS1 and DS0 level timing throughout an office. In North America, BITS is the clock that provides and distributes timing to a wireline network's lower levels.

Trunk Feature Card Ports

The TDM bus can be synchronized with any trunk cards. On the T1 or E1 feature card, each port receives the clock from the T1 or E1 line. The CT3 feature card uses an M13 multiplexer to receive the DS1 clock. Each port on each trunk feature card slot has a default clock priority. Also, clock priority is configurable through the **dial-tdm-clock priority** CLI command.

External Clock

The TDM bus can be synchronized with an external clock source that can be used as an additional network reference. If no clocks are configured, the system uses a primary clock through a software-controlled default algorithm. If you want the external T1 or E1 clock (using the BITS interface) as the primary clock source, you must configure it using the **dial-tdm-clock priority** CLI command; the external clock is never selected by default.

The BITS interface requires a T1 line composite clock reference set at 1.544 MHz and an E1 line composite clock reference set at 2.048 MHz.

Free-Running Clock

If there is no good clocking source from a trunk feature card or an external clock source, then choose the free-running clock from the local oscillator through the **dial-tdm-clock priority** CLI command.

The following table lists commands to help you configure the clock source and clock source priority used by the TDM bus:

	Command	Purpose
Step 1	AS5400> enable Password: <i>password</i> AS5400#	Enters enable mode. Enters the password. You are in enable mode when the prompt changes to AS5350# or AS5400#.
Step 2	AS5400# configure terminal Enter configuration commands, one per line. End with CNTL/Z. AS5400(config)#	Enters global configuration mode. The example uses the terminal configuration option. You are in global configuration mode when the prompt changes to AS5350(config)# or AS5400(config)#.
Step 3	<ul style="list-style-type: none"> AS5400(config)# dial-tdm-clock priority priority# {external freerun slot/ds1 port} 	<p>Enter one of the bulleted commands, depending on your configuration.</p> <p>Configures the T1 or E1 feature card clock priority, slot, and port that are providing the clocking source. Priority range is a value between 1 and 99. Feature card slot is a value between 1 and 7. DS1 port number controller is a value between 0 and 7.</p> <p>Note DS1 port specifies T1 port.</p>

	Command	Purpose
•	AS5400(config)# dial-tdm-clock priority priority# {external freerun slot/ds3 port:ds1 port}	Configures the CT3 feature card clock priority, slot, and port that is providing the clocking source. Priority range is a value between 1 and 99. Feature card slot is a value between 1 and 7. DS3 port specifies the T3 port. DS1 port number controller is a value between 1 and 28. Note A clock with priority of 100 cannot drive the TDM clock.
Step 4	AS5400(config)# Ctrl-Z AS5400#	Returns to privileged EXEC mode.
Step 5	AS5400# copy running-config startup-config	Saves your changes when ready.

Configuration Examples

In the following example, the BITS clock is set to priority 1.

```
AS5400(config)# dial-tdm-clock priority 1 external
AS5400(config)# exit
AS5400#
```

In the following example, a trunk clock from a T1 feature card is set at priority 2 and uses slot 4 and ds1 port (controller) 6.

```
AS5400(config)# dial-tdm-clock priority 2 4/6
AS5400(config)# exit
```

In the following example, a trunk clock from a CT3 feature card is set at priority 2 and uses slot 1, ds3 port 0, and ds1 port 19.

```
AS5400(config)# dial-tdm-clock priority 2 1/0:19
AS5400(config)# exit
```

In the following example, free-running clock is set at priority 3.

```
AS5400(config)# dial-tdm-clock priority 3 free
AS5400(config)# exit
```

Verify

You can verify the system primary and backup clocks and the status of all trunk feature card controller clocks. You can also view information about and the history of the last 20 TDM clock changes and the events that caused them.

- Verify your default system clocks and clock history using the **show tdm clocks** command (this example is for T1 or E1):

```
AS5400# show tdm clocks

Primary Clock:
-----
TDM Bus Master Clock Generator State = HOLDOVER

Backup clocks for primary:
Source Slot Port DS3-Port Priority Status State
```

```
-----
Trunk cards controllers clock health information
-----
```

```
Slot  Type  7 6 5 4 3 2 1 0
1      T1  B B B B B B B B
```

```
CLOCK CHANGE HISTORY
-----
```

CLOCK	Event	Time
1/1	Loss Of Signal (LOS)	00:00:22 UTC Tue Nov 30 1999
1/2	Loss Of Signal (LOS)	00:00:22 UTC Tue Nov 30 1999
1/3	Alarm Indication Signal (AIS)	00:00:22 UTC Tue Nov 30 1999
1/4	Alarm Indication Signal (AIS)	00:00:22 UTC Tue Nov 30 1999
1/5	Alarm Indication Signal (AIS)	00:00:22 UTC Tue Nov 30 1999
1/6	Alarm Indication Signal (AIS)	00:00:22 UTC Tue Nov 30 1999
1/7	Alarm Indication Signal (AIS)	00:00:22 UTC Tue Nov 30 1999

AS5400#

- Verify your TDM clock history using the **show tdm clocks** command (this example is for channelized T3):

```
AS5400# show tdm clocks
```

```
Primary Clock:
```

```
-----
System primary is slot 7 ds3_port 0 dsl_port 1 of priority 1
TDM Bus Master Clock Generator State = NORMAL
```

```
Backup clocks for primary:
```

Source	Slot	Port	DS3-Port	Priority	Status	State
Trunk	7	8	YES	214	Good	Default
Trunk	7	9	YES	215	Good	Default

```
Trunk cards controllers clock health information
-----
```

```
CT3          2 2 2 2 2 2 2 2 2 1 1 1 1 1 1 1 1 1 1 1
Slot  Port  Type  8 7 6 5 4 3 2 1 0 9 8 7 6 5 4 3 2 1 0 9 8 7 6 5 4 3 2 1
7      0      T3  G G G G G G G G G G G G G G G G G G G G G G G G G G G G
```

```
CLOCK CHANGE HISTORY
-----
```

CLOCK	Event	Time
7/1	Signal recovered from LOS	00:03:29 UTC Sat Jan 1 2000
7/8	Alarm Indication Signal (AIS)	11:27:48 UTC Fri Feb 25 2000
7/1	Signal recovered from LOS	11:30:22 UTC Fri Feb 25 2000

AS5400#

- Verify your user-configured trunk clock selection using the **show tdm clocks** command:

```
AS5400# show tdm clocks
```

```
Primary Clock:
```

```
System primary is slot 2 port 0 of priority 15
TDM Bus Master Clock Generator State = NORMAL
```

```
Backup clocks for primary:
```

```

Source Slot Port DS3-Port Priority Status State
Trunk 2 1 NO 205 Good Default
Trunk cards controllers clock health information
Slot Type 7 6 5 4 3 2 1 0
2 T1 B B B B G G G G

```

CLOCK CHANGE HISTORY

```

CLOCK Event Time
2/1 Controller shutdown 23:23:06 UTC Tue Nov 30 1999
2/0 Change in CLI configuration 23:27:25 UTC Tue Nov 30 1999
AS5400#

```

- Verify your free-running clock selection using the **show tdm clocks** command:

```
AS5400# show tdm clocks
```

```

Primary Clock:
System primary is FREE RUNNING with priority 2
TDM Bus Master Clock Generator State = FREERUN
Backup clocks for primary:
Source Slot Port DS3-Port Priority Status State
Trunk 2 0 NO 204 Good Default
Trunk 2 1 NO 205 Good Default
Trunk cards controllers clock health information
Slot Type 7 6 5 4 3 2 1 0
2 T1 B B B B G G G G
CLOCK CHANGE HISTORY

```

```

CLOCK Event Time
Freerun Change in CLI configuration 23:27:25 UTC Tue Nov 30 1999
AS5400#

```

- Verify your BITS clock selection using the **show tdm clocks** command:

```
AS5400# show tdm clocks
```

```

Primary Clock:
System primary is external with priority 1
TDM Bus Master Clock Generator State = NORMAL
Backup clocks for primary:
Source Slot Port DS3-Port Priority Status State
Trunk 2 0 NO 204 Good Default
Trunk 2 1 NO 205 Good Default
Trunk cards controllers clock health information
Slot Type 7 6 5 4 3 2 1 0
2 T1 B B B B G G G G
CLOCK CHANGE HISTORY

```

```

CLOCK Event Time
External Change in CLI configuration 23:27:25 UTC Tue Nov 30 1999
AS5400#

```



Tip

The most common reason for clock slip problems is that the **dial-tdm-clock priority** parameter is set improperly. Change the default setting for the **dial-tdm-clock priority** parameter from free-running clock to a setting that matches your system requirements.

Enabling IP Basic Setup

To fine-tune the IP routing functions and domain-name services for EXEC shell users, follow these steps:

Step 1 Optimize IP routing functions in global configuration mode:

```
AS5400(config)# ip subnet-zero
AS5400(config)# no ip source-route
AS5400(config)# ip classless
AS5400(config)# ip domain-lookup
```

Table 3-5 describes the commands in the example.

Table 3-5 IP Routing Commands

Command	Purpose
ip subnet-zero	Specifies that 172.22.0.0 is a legal subnet.
no ip source-route	Tightens security by ensuring that IP-header packets cannot define their own paths through the gateway.
ip classless	Tightens security by ensuring that IP-header packets cannot define their own paths through the gateway.
ip domain-lookup	Enables IP domain-name lookups.

Step 2 In global configuration mode, enter domain-name service commands to support EXEC shell users:

```
AS5400(config)# ip host mymap 172.22.53.101
AS5400(config)# ip domain-name mydomain.com
AS5400(config)# ip name-server 172.22.11.10
AS5400(config)# ip name-server 172.22.11.11
```

Table 3-6 describes the commands in the example.

Table 3-6 Domain-Name Commands

Command	Purpose
ip host mymap 172.22.53.101	Creates a local name-to-address map. When the gateway is not entered in a DNS server, this map is useful.
ip domain-name mydomain.com	Tells the gateway how to qualify DNS lookups. In this example, <i>mydomain.com</i> is appended to the end of each looked-up name.
ip name-server 172.22.11.10 ip name-server 172.22.12.11	Specifies the primary and secondary name servers. The ip name-server command is used for mapping names to IP addresses.

Testing Asynchronous Shell Connections

This task verifies that the following components are working:

- The physical asynchronous data path

- Basic modem links
- Basic IP functionality to support shell sessions

The Cisco IOS software provides a command-line interface (CLI) called the EXEC that can be accessed by dialing in with a modem. The EXEC provides access to terminal-shell services (no PPP) to do the following:

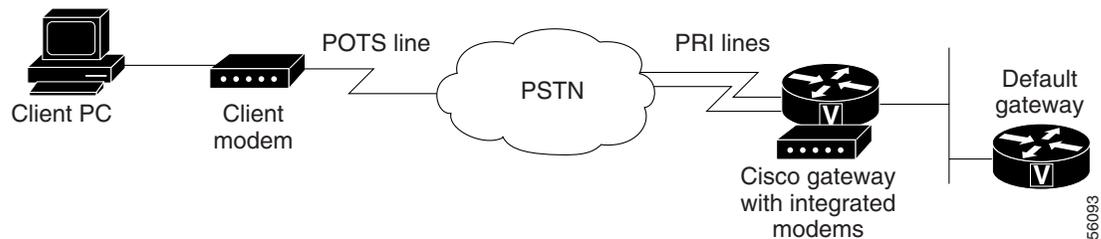
- Modify configuration files
- Change passwords
- Troubleshoot possible problems including modem connections
- Access other network resources by using Telnet

During this task, some administrators try to make complex services function, such as PPP-based web browsing. Do not jump ahead. Many other elements still must be configured (for example, PPP and IPCP). The asynchronous-shell test ensures that the EXEC login prompt can be accessed by a client modem. Taking a layered approach to building a network isolates problems and saves you time.

To test asynchronous-shell connections, perform the following steps:

- Step 1** Locate a client PC, client modem, and analog line. From the client PC, open a terminal emulation program (such as HyperTerminal, not dial-up networking) and connect to the client modem. [Figure 3-2](#) shows the network environment for this test.

Figure 3-2 Test Environment



- Step 2** From a terminal emulation program, test your EIA/TIA-232 connection to the client modem. Enter the **at** command. The modem returns the prompt OK.

```
at
OK
```



Note To learn more about the **at** command set, see the various references available online at the Technical Assistance Center website at http://www.cisco.com/cgi-bin/Support/PSP/psp_view.pl?p=Internetworking:ASYNC&s=Implementation_and_Configuration

- Step 3** Dial the PRI telephone number assigned to the gateway (in this example, the number is 5554100). After the modem successfully connects, a connect message appears.

```
atdt 5554100
CONNECT 33600/REL - LAPM
```



Note Many modems support the **a/** command, which recalls the last **at** command. The **ath** command hangs up a modem call. The **atdl** command dials the last telephone number.

Step 4 Log in to the EXEC session on the gateway (from the client PC):

```
This is a secured device.
Unauthorized use is prohibited by law.
```

```
User Access Verification
```

```
Username: Harry
Password:
```

```
AS5400>
```

Step 5 Identify the line where the call landed. The following example shows that line TTY 216 accepted the call. The call has been up and active for 30 seconds.

```
AS5400# show caller
```

Line	User	Service	Active Time	Idle Time
con 0	admin	TTY	00:39:09	00:00:00
tty 216	Harry	TTY	00:00:30	00:00:07

```
AS5400# show caller user Harry
```

```
User: Harry, line tty 216, service TTY
Active time 00:00:42, Idle time 00:00:19
Timeouts:          Absolute  Idle      Idle
                  Session   Exec
Limits:            -         -         00:10:00
Disconnect in:    -         -         00:09:40
TTY: Line 1/00
DS0: (slot/unit/channel)=2/0/18
Line: Baud rate (TX/RX) is 115200/115200, no parity, 1 stopbits, 8 databits
Status: Ready, Active, No Exit Banner
Capabilities: No Flush-at-Activation, Hardware Flowcontrol In
              Hardware Flowcontrol Out, Modem Callout, Modem RI is CD
              Integrated Modem
Modem State: Ready
```



Note The **show caller** command was added to the Cisco IOS software in Cisco IOS Release 11.3 AA and Release 12.0 T. If your software release does not support this command, use the **show user** command.

Step 6 Test the IP functionality to support shell sessions. From the gateway, use Telnet to access another device in your network.

```
AS5400# telnet 171.68.186.49
Trying 171.68.186.49 ... Open
```

```
access-gw line 2
```

```
access-gw telnet smart
Translating "smart"...domain server (171.68.10.70) [OK]
Trying smart.cisco.com (171.68.191.135)... Open
```

```
UNIX(r) System V Release 4.0 (smart)
```

```

login: Router
Password:
No directory! Logging in with home=/
Last login: Fri Aug 18 13:50:07 from dhcp-aus-163-230
Sun Microsystems Inc. SunOS 5.5.1 Generic May 1996

```

Verifying the Final Running Configuration

The following is an example of a final running configuration:

```

AS5400# show running-config

Building configuration...

Current configuration : 6017 bytes
!
version 12.2
no service single-slot-reload-enable
no service pad
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname AS5400
!
boot system tftp c5350-js-mz.xml.Feb19 171.69.20.20
no boot startup-test
no logging buffered
logging rate-limit console 10 except errors
enable secret 5 $1$ltzj$81GJ1cGmyZRdXdPXncLAo/
!
!
resource-pool disable
!
!
voice-fastpath enable
ip subnet-zero
no ip finger
ip domain-name cisco.com
ip name-server 171.69.11.48
ip name-server 171.69.2.132
ip name-server 171.69.2.133
!
no ip dhcp-client network-discovery
!
!
fax interface-type modem
mta receive maximum-recipients 0
!
!
crypto mib ipsec flowmib history tunnel size 200
crypto mib ipsec flowmib history failure size 200
!
!
controller T1 1/0
    framing sf
    linecode ami
!
controller T1 1/1

```

```
framing sf
linecode ami
!
.
.
.
controller T1 1/7
framing sf
linecode ami
!
!
interface GigabitEthernet0/0
ip address 172.21.101.21 255.255.255.0
no ip route-cache
no ip mroute-cache
duplex auto
speed auto
!
interface GigabitEthernet0/1
no ip address
no ip route-cache
no ip mroute-cache
shutdown
duplex auto
speed auto
!
interface Serial0/0
no ip address
no ip route-cache
no ip mroute-cache
shutdown
clockrate 2000000
!
interface Serial0/1
no ip address
no ip route-cache
no ip mroute-cache
shutdown
clockrate 2000000
!
interface Async4/00
no ip address
!
interface Async4/01
no ip address
!
interface Async4/02
no ip address
!
.
.
.
interface Async4/107
no ip address
!
interface Group-Async0
no ip address
no ip route-cache
no ip mroute-cache
no group-range
!
ip classless
ip route 0.0.0.0 0.0.0.0 172.21.101.1
no ip http server
```

```

!
!
call rsvp-sync
!
!
line con 0
  logging synchronous
  transport input none
line aux 0
  logging synchronous
line vty 0 4
  password #1writer
  login
line 4/00 4/107
  no flush-at-activation
  modem InOut
!
scheduler allocate 10000 400
end

```

Saving Configuration Changes

To prevent the loss of the gateway configuration, save it to NVRAM.

Configure

	Command	Purpose
Step 1	AS5400> enable Password: <i>password</i> AS5400#	Enters enable mode (also called privileged EXEC mode) and enters the password. You are in enable mode when the prompt changes to AS5350# or AS5400#.
Step 2	AS5400# copy running-config startup-config	Saves the configuration changes to NVRAM so that they are not lost during resets, power cycles, or power outages.
Step 3	AS5400(config-if)# Ctrl-Z AS5400#	Returns to enable mode.

Where to Go Next

At this point you can go to these references:

- [Chapter 4, “Continuing Configuration Using the Command-Line Interface,”](#) to continue system configuration of basic features.
- [Chapter 5, “Managing and Troubleshooting the Universal Port and Dial-Only Feature Cards,”](#) to configure, manage, and troubleshoot universal-port and dial-only feature card connections on your gateway.
- [Chapter 6, “Managing and Troubleshooting the Voice Feature Card,”](#) to configure, manage, and troubleshoot voice feature card connections on your gateway.
- [Appendix C, “Comprehensive Configuration Examples.”](#)

- The *Monitoring Voice and Fax Services on the Cisco AS5350 and Cisco AS5400 Universal Gateways* publication, available online at http://www.cisco.com/en/US/products/sw/iosswrel/ps1839/products_feature_guide09186a0080080e60.html.
- The *High-Density Packet Voice Feature Card for Cisco AS5350XM and AS5400XM Universal Gateways* document, available online at: http://www.cisco.com/en/US/products/ps6706/products_feature_guide09186a008060df15.html
- For additional basic configuration information, see the *Cisco IOS Dial Technologies Configuration Guide* and *Cisco IOS Dial Technologies Command Reference* publication. For more advanced configuration topics, see the Cisco IOS software configuration guide, feature modules, and command reference publications that pertain to your Cisco IOS software release.
- For Cisco AAA-based security information, see the *Cisco AAA Implementation Case Study* publication, available online at <http://www.cisco.com/univercd/cc/td/doc/cisintwk/intsolns/secsols/aaasols/>
- For troubleshooting information, see the *System Error Messages* and *Debug Command Reference* publications.



Continuing Configuration Using the Command-Line Interface

The information in this chapter applies to the Cisco AS5350XM and Cisco AS5400XM universal gateways. This chapter continues where the “[Basic Configuration Using the Command-Line Interface](#)” chapter ends. After you have commissioned your Cisco AS5350XM or Cisco AS5400XM universal gateway, you might want to configure other features that include serial interface support, T1 channel groups, and signaling.

Proceed to the following sections:

- [Configuring Synchronous Serial Interfaces for WAN Support, page 4-1](#)
- [Configuring T1 Channel Groups, page 4-3](#)
- [Configuring ISDN NFAS on Channelized T1 PRI Groups, page 4-4](#)
- [Configuring E1 R2 Signaling, page 4-6](#)
- [Configuring Alarms, page 4-9](#)
- [Saving Configuration Changes, page 4-11](#)
- [Where to Go Next, page 4-11](#)



Tip

If you are experienced using the Cisco IOS software, you might find the “[Where to Go Next](#)” section at the end of this chapter a useful reference for configuration.

Configuring Synchronous Serial Interfaces for WAN Support

Configure the synchronous serial interfaces on the motherboard to connect to a WAN through a CSU or DSU.

This section describes how to enable the serial interface, specify IP routing, and set up external clock timing on a DCE or DTE interface. To use a port as a DTE interface, you need only connect a DTE adapter cable to the port. When the system detects the DTE mode cable, it automatically uses the external timing signal. To use a port in DCE mode, you must connect a DCE interface cable and set the clock speed with the **clock rate** configuration command. You must also set the clock rate to perform a loopback test.

Configure

	Command	Purpose
Step 1	AS5350> enable Password: <i>password</i> AS5350#	Enters enable mode (also called privileged EXEC mode) and enters the password. You are in enable mode when the prompt changes to AS5350# or AS5400#.
Step 2	AS5350# configure terminal Enter configuration commands, one per line. End with CNTL/Z. AS5350(config)#	Enters global configuration mode. You are in global configuration mode when the prompt changes to AS5350(config)# or AS5400(config)#.
Step 3	AS5350(config)# interface serial 0/0	Enters interface configuration mode and specifies the first interface to be configured.
Step 4	AS5350(config-int)# ip address 172.22.4.67 255.255.255.0	If IP routing is enabled, assigns an IP address and subnet mask to the interface.
Step 5	AS5350(config-int)# clock rate 2015232	Configures the external clock signal only if you are configuring a DCE interface. The available options include 1200, 2400, 4800, 9600, 14400, 19200, 28800, 38400, 56000, 64000, 128000, and 2015232.
Step 6	AS5350(config-int)# no shutdown	Changes the shutdown state to up and enables the interface.
Step 7	AS5350(config-controller)# Ctrl-Z AS5350#	Returns to enable mode.

Verify

To verify that you have configured the interfaces correctly, use these commands:

- Specify one of the new serial interfaces with the **show interfaces serial port** command and verify that the first line of the display specifies the interface with the correct slot number. Also verify that the interface and line protocol are in the correct state: up or down.

```
AS5350# show interfaces serial 0/0
Serial0/0 is up, line protocol is up
  Hardware is 4T
  Internet address is 172.0.0.1/8
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, crc 16, loopback not set, keepalive set (10 sec)
  Last input 00:00:08, output 00:00:04, output hang never
  Last clearing of "show interface" counters never
  Queueing strategy: fifo
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
    392 packets input, 33312 bytes, 0 no buffer
    Received 392 broadcasts, 0 runts, 0 giants, 0 throttles
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
    358 packets output, 25157 bytes, 0 underruns
    0 output errors, 0 collisions, 1 interface resets
    0 output buffer failures, 0 output buffers swapped out
```

```
0 carrier transitions DCD=up DSR=up DTR=up RTS=up CTS=up
```

- Display the entire system configuration file with the **show configuration** command. Verify that the configuration is accurate for the system and each interface.

**Tip**

If you are having trouble, make sure that the network interface is properly connected and terminated.

**Note**

If you have questions or need assistance, see the [“Obtaining Documentation” section on page xix](#).

Configuring T1 Channel Groups

You can configure up to 24 channel groups for each T1 controller for backup links or serial backhaul connections.

First, you must define the time slots that belong with each channel group. Channel groups are numbered 0 to 23, and time slots are numbered 1 to 24. Defining a channel group creates a serial interface; defining multiple channel groups creates an equal number of serial interfaces that you can configure independently.

**Note**

The channel group numbers for each channelized T1 controller can be arbitrarily assigned.

Configure

To define the channel groups, time slots, and (if needed) circuit speed, enter the following command in controller configuration mode:

```
AS5350(config-controller)# channel-group number timeslots range [speed {48 | 56 | 64}]
```

In the United States, channel-group speeds can be either 56 or 64 kbps. If 64 kbps is used, we recommend that you use the ESF framing type and a linecode of B8ZS. Working with your local service provider, you can create channel groups with from 1 to 24 time slots. These time slots can be in any order, contiguous or noncontiguous.

After you define the T1 channel groups, you can configure each channel group as a serial interface (think of each channel group as a virtual serial interface). Subinterface configuration is also supported on the created serial interface.

To define the serial interface that corresponds to a T1 channel group, enter the following command in global configuration mode to enter interface configuration mode:

```
AS5350(config)# interface serial slot/port:channel-group
```

Verify

The following example shows a T1 controller configured for channel groups and an ISDN PRI group. The **pri-group** command and the **channel-group** command cannot have overlapping time slots; note the correct time slot configuration.

```

AS5350# show running-config

Building configuration...

Current configuration:
!
! Last configuration change at 15:49:30 UTC Mon Apr 3 2000 by admin
! NVRAM config last updated at 01:35:05 UTC Fri Mar 17 2000 by admin
!
version 12.0
service timestamps debug datetime msec localtime show-timezone
service timestamps log datetime msec localtime show-timezone
service password-encryption
!
---text omitted---
!

controller t1 1/0
channel-group 0 timeslot 1-6
channel-group 1 timeslot 7
channel-group 2 timeslot 8
channel-group 3 timeslot 9-11
pri-group timeslot 12-24

```

Configuring ISDN NFAS on Channelized T1 PRI Groups

ISDN Non-Facility Associated Signaling (NFAS) allows a single D channel to control multiple PRI interfaces. A backup D channel can also be configured for use when the primary NFAS D channel fails.

When configuring NFAS for T1 controllers configured for ISDN, you use an extended version of the ISDN **pri-group** command to specify the following:

- Range of PRI time slots to be under the control of the D channel (time slot 24)
- Function to be performed by time slot 24 (primary D channel, backup, or none); the last specifies its use as a B channel
- Group identifier number for the interface under control of this D channel



Note

Your Cisco AS5350XM or Cisco AS5400XM universal gateway must connect to a Primary-4ESS, Primary-DMS 100, or Primary-NI switch (see [Table 3-3 on page 3-15](#)) and must also have a channelized T1 controller and, as a result, be ISDN PRI capable.

Configure

To configure ISDN NFAS, complete the following tasks in controller configuration mode:

Command	Purpose
AS5350(config-controller)# pri-group timeslots 1-24 nfas_d primary nfas_interface number nfas_group number	On one channelized T1 controller, configures the NFAS primary D channel.
AS5350(config-controller)# pri-group timeslots 1-24 nfas_d backup nfas_interface number nfas_group number	On a different channelized T1 controller, configures the NFAS backup D channel to be used if the primary D channel fails.
AS5350(config-controller)# pri-group timeslots 1-24 nfas_d none nfas_interface number nfas_group number	(Optional) On other channelized T1 controllers, configures a 24 B channel interface, if desired.

Take a Channel or Interface Out of Service

You can take a specified channel or an entire PRI interface out of service or put it into one of the other states that is passed on to the switch.

To do so, complete one of the following tasks in interface configuration mode:

Command	Purpose
AS5350(config-controller)# isdn service dsl number b_channel number state state-value	Takes an individual B channel out of service or sets it to a different state.
AS5350(config-controller)# isdn service dsl number b_channel 0 state state-value	Sets the entire PRI interface to the specified state.

These are the supported state values:

- 0—In service
- 1—Maintenance
- 2—Out of service

Verify

Monitor NFAS groups by entering the **show isdn nfas group number** command:

```
AS5350# show isdn nfas group 0
ISDN NFAS GROUP 0x0 ENTRIES:
```

```
The primary D is Serial0:23.
The backup D is Serial1:23.
```

```
There are 2 total nfas members.
There are 24 total available B channels.
The primary D-channel is DSL 0 in state IN SERVICE.
The backup D-channel is DSL 1 in state STANDBY.
The current active layer 2 DSL is 0.
```

Configuring E1 R2 Signaling

R2 signaling is an international signaling standard that is common to channelized E1 networks. You can configure a channelized E1 interface to support different types of R2 signaling, used in older analog telephone networks.



Note

The Cisco implementation of R2 signaling has dialed number identification support (DNIS) turned on by default. If you enable the automatic number identification (ANI) option, the collection of DNIS information is still performed. Specifying the ANI option does not disable DNIS collection. DNIS is the number being called. ANI is the caller's number. For example, if you are configuring gateway A to call gateway B, then the DNIS number is assigned to gateway B, and the ANI number is assigned to gateway A. Also, note that ANI is similar to caller ID.

Configure

To configure E1 R2 signaling, use the following commands, beginning in global configuration mode:

	Command	Purpose
Step 1	AS5350> enable Password: <i>password</i> AS5350#	Enters enable mode (also called privileged EXEC mode) and enters the password. You are in enable mode when the prompt changes to AS5350# or AS5400#.
Step 2	AS5350# configure terminal Enter configuration commands, one per line. End with CNTL/Z. AS5350(config)#	Enters global configuration mode. You are in global configuration mode when the prompt changes to AS5350(config)# or AS5400(config)#.
Step 3	AS5350(config)# controller e1 0/0 AS5350(config-controller)#	Enters controller configuration mode to configure your E1 controller port. Specifies E1 feature card slot, port number, and channel. On the E1 feature card, port number values range from 0 to 1.
Step 4	AS5350(config-controller)# ds0-group 1 timeslots 1-30 type r2-analog r2-compelled ani	Configures the time slots that belong to each E1 circuit for R2 signaling. Sets R2 signaling to R2 ITU Q411, the tone signal to R2 compelled register signaling, and ANI to address information provisioned option. R2 line signaling options include r2-analog , r2-digital , and r2-pulse . Tone signaling options include dtmf (default), r2-compelled , r2-non-compelled , and r2-semi-compelled . You can also set ani (ANI address information provisioned) for any of the above options.
Step 5	AS5350(config-controller-cas)# cas-custom 1	Enters the channel number to customize.

	Command	Purpose
Step 6	<pre>AS5350(config-ctrl-cas)# country <i>country</i> use-default</pre>	<p>Uses defaults for the specified country.</p> <p>Note To view the parameters for the country (if the country defaults are the same as ITU defaults), enter write term.</p> <p>The default setting for all countries is ITU.</p> <p>See the “Country Codes for R2 Signaling” section on page 4-8 for a list of supported countries.</p>
Step 7	<pre>AS5350(config-ctrl-cas)# answer-signal group-b 6</pre> <p>[or]</p> <pre>AS5350(config-ctrl-cas)# default answer-signal group-b 6</pre> <p>[or]</p> <pre>AS5350(config-ctrl-cas)# no answer-signal group-b 6</pre> <pre> controller E1 0 clock source line primary ds0-group 0 timeslots 1-15,17-31 type r2-analog r2-compelled cas-custom 0 country singapore use-defaults category 2 <--- default category for singapore answer-signal group-b 6 <--- default bxfree for singapore AS5350(config-ctrl-cas)# exit AS5350(config)#</pre>	<p>Sets the cas custom command answer signal to group-b 6.</p> <p>CAS custom commands include caller-digits, category, country, unused-abcd, invert-abcd, metering, ka, kd, dnis-digits, answer-signal, and nc-congestion</p> <p>Sets answer-signal group-b to the default ITU value.</p> <p>Resets answer-signal group-b 6 to the default value.</p> <p>Note The parameters you do not set are automatically set to the ITU default by the gateway.</p> <p>After you configure a country with default settings, the gateway displays a write term, similar to the one displayed here.</p> <p>Exits CAS custom mode and returns to global configuration mode.</p>
Step 8	<pre>AS5350(config)# spe country {<i>country</i> e1-default}</pre>	<p>Sets the SPE country code or uses the E1 default (A-law).</p> <p>Note The gateway must be in idle state (no calls are active) to execute the SPE country command.</p> <p>Note On the Cisco AS5350XM and Cisco AS5400XM universal gateway, DS-0 companding law selection is configured for the entire system rather than on individual voice ports.</p>

	Command	Purpose
Step 9	AS5350(config)# voice-port <i>slot/controller-number:DS0 group-number</i>	Enters voice port mode for the port you want to configure.
	AS5350(config-voiceport)#	
Step 10	AS5350(config-voiceport)# cptone <i>contry-code</i>	Enters the 2-digit country code to configure the regional ring tone.
Step 11	AS5350(config-voiceport)# Ctrl-Z	Returns to enable mode.
	AS5350#	

Country Codes for R2 Signaling

Table 4-1 lists the country codes supported for R2 signaling.

Table 4-1 Country Codes for R2 Signaling

argentina	greece	paraguay
australia	guatemala	peru
bolivia	hongkong-china	philippines
brazil	india	saudi Arabia
bulgaria	indonesia	singapore
china	israel	southafrica-panafel
colombia	itu	telmex
costarica	korea	telnor
croatia	laos	thailand
easturope	malaysia	uruguay
equador-itu	malta	venezuela
ecuador-lme	newzealand	vietnam

Verify

To verify your R2 signaling configuration, enter the **show controller e1** command to view the status for all controllers, or enter the **show controller e1 #** command to view the status for a particular controller. Make sure the status indicates the controller is up (line 2 in the following example) and no alarms (line 4 in the following example) or errors (lines 9 and 10 in the following example) have been reported.

```
AS5350# show controller e1 0/0
E1 0/0 is up.
  Applique type is Channelized E1 - balanced
  No alarms detected.
  Version info of Slot 0: HW: 2, Firmware: 4, PLD Rev: 2

Manufacture Cookie is not programmed.

Framing is CRC4, Line Code is HDB3, Clock Source is Line Primary.
Data in current interval (785 seconds elapsed):
  0 Line Code Violations, 0 Path Code Violations
  0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
```

```
0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
Total Data (last 13 15 minute intervals):
0 Line Code Violations, 0 Path Code Violations,
0 Slip Secs, 12 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 12 Unavail Secs
```

If the connection does not come up, check for the following:

- Loose wires, splices, connectors, shorts, bridge taps, and grounds
- Backwards transmit and receive
- Mismatched framing types (for example, CRC-4 and no-CRC-4)
- Transmit and receive pair separation (crosstalk)
- Faulty line cards or repeaters
- Noisy lines (for example, power and crosstalk)

If you see errors on the line or the line is going up and down, check for the following:

- Mismatched line codes (HDB3 versus AMI)
- Receive level
- Frame slips because of poor clocking plan

When the E1 controller comes up, you see the following message:

```
%CONTROLLER-3-UPDOWN: Controller E1 0, changed state to up
```

Configuring Alarms

Facility alarms currently monitor the following failure events:

- Interface down
- T1, E1, or T3 controller down
- Modem board failure
- Redundant power supply (RPS) failure
- Thermal failure
- Fan failure

Cisco IOS software polls every second to detect the failure events that you have configured and turns on an alarm when any one of the failure events is detected. By default, the facility alarm is off. Users have to configure a facility alarm command to enable monitoring of the failure conditions.

Enter **no** before the full command to disable any of the alarm commands.

```
AS5350# no facility-alarm detect rps
```

Configure

	Command	Purpose
Step 1	AS5350> enable Password: <i>password</i> AS5350#	Enters enable mode and enters the password. You are in enable mode when the prompt changes to AS5350# or AS5400#.
Step 2	AS5350# configure terminal Enter configuration commands, one per line. End with CNTL/Z. AS5350(config)#	Enters global configuration mode. You are in global configuration mode when the prompt changes to AS5350(config)# or AS5400(config)#.
Step 3	AS5350(config)# facility-alarm detect interface [<i>interface type</i>] [<i>slot/port</i>]	Turns on the facility alarm when an interface goes down. Enters the interface type and slot/port designation.
Step 4	AS5350(config)# facility-alarm detect controller [<i>t1</i> <i>e1</i> <i>t3</i>] [<i>slot/port</i>]	Turns on an alarm when the controller goes down. The slot values range from 1 to 7. The port values range from 0 to 7 for T1 and E1. The port value is always 0 for T3.
Step 5	AS5350(config)# facility-alarm detect modem-board [<i>slot</i>]	Turns on an alarm when the modem board present in the specified slot fails.
Step 6	AS5350(config)# facility-alarm detect rps	Turns on alarm when RPS failure event is detected. Any of the following failures turns on the alarm: <ul style="list-style-type: none"> • Input power voltage failure • Output power voltage failure • Overvoltage condition • Multiple failures
Step 7	AS5350(config)# facility-alarm detect temperature	Turns on an alarm if a thermal failure event is detected.
Step 8	AS5350(config)# facility-alarm detect fan	Turns on an alarm if a fan failure event is detected.
Step 9	AS5350(config-if)# Ctrl-Z AS5350#	Returns to enable mode.

Verify

To see the status of the alarms, enter the **show facility-alarm** command:

```
AS5350# show facility-alarm

      Device           State
      -----
gigabitethernet 0/0 UP
Modem Card 4         UP

Facility Alarm is ON
```

If you are having trouble:

- Make sure the cable connections are not loose or disconnected.
- Make sure you are using number 12 or 14 AWG copper wires to connect to the alarm port terminal blocks.
- Make sure your alarm is operational.

Saving Configuration Changes

To prevent the loss of the gateway configuration, save it to NVRAM.

Configure

	Command	Purpose
Step 1	AS5350> enable Password: <i>password</i> AS5350#	Enters enable mode (also called privileged EXEC mode) and enters the password. You are in enable mode when the prompt changes to AS5350# or AS5400#.
Step 2	AS5350# copy running-config startup-config	Saves the configuration changes to NVRAM so that they are not lost during resets, power cycles, or power outages.
Step 3	AS5350 (config-if)# Ctrl-Z AS5350#	Returns to enable mode.

Where to Go Next

At this point you can go to these references:

- [Chapter 5, “Managing and Troubleshooting the Universal Port and Dial-Only Feature Cards,”](#) to configure, manage, and troubleshoot universal port and dial-only feature card connections on your gateway.
- [Chapter 6, “Managing and Troubleshooting the Voice Feature Card,”](#) to configure, manage, and troubleshoot voice feature card connections on your gateway.
- [Appendix C, “Comprehensive Configuration Examples.”](#)



Tip

The following publications are available on the Documentation DVD, on the World Wide Web from the Cisco home page, or you can order printed copies.

- For additional basic configuration information, see the *Cisco IOS Dial Technologies Configuration Guide* and *Cisco IOS Dial Technologies Command Reference* publications for your software release. For more advanced configuration topics, see the Cisco IOS software configuration guide, feature modules, and command reference publications that pertain to your Cisco IOS software release.
- For troubleshooting information, see the *System Error Messages* and *Debug Command Reference* publications.



Managing and Troubleshooting the Universal Port and Dial-Only Feature Cards

The information in this chapter applies to the Cisco AS5350XM and Cisco AS5400XM universal gateways, and includes the following sections:

- [Configuring SPE Performance Statistics, page 5-2](#)
- [Managing Ports, page 5-4](#)
- [Managing SPEs, page 5-6](#)
- [Troubleshooting, page 5-8](#)
- [Upgrading SPE Firmware, page 5-11](#)
- [Where to Go Next, page 5-20](#)

Two different types of Nextport digital signal processor (DSP) feature cards are available for Cisco AS5350XM and Cisco AS5400XM universal gateways.

- Universal port feature card—The universal port feature card supports 60 (NP-60) to 108 (NP-108) voice, fax, and dial calls in a Cisco AS5350XM and Cisco AS5400XM universal gateway.
- Dial-only feature card—The dial-only feature card supports 60 (DL-60) to 108 (DL-108) dial calls in a Cisco AS5350XM and Cisco AS5400XM universal gateway. It does not support voice or fax services.



Note

Dial services include modem calls (all modulations), ISDN digital calls, V.110 data calls, and V.120 data calls. Modem pass-through calls are not included in dial services.

You can manage your port connections at the feature card slot level, service processing element (SPE) level, or port level using monitoring and troubleshooting commands. A port is defined as an endpoint on a trunk card through which multiservice tones, voice, and data flow. There are multiple ports on each SPE.

The universal port and dial-only feature cards include SPE and slot software hierarchies. On the Cisco AS5350XM and Cisco AS5400XM universal gateways, the hierarchy designation is *slot/spe* and *slot/port*:

- Slot values range from 1 to 7.
- Port values range from 0 to one less than the total port count available on the card.
- SPEs range from 0 to 17.

For example, universal port card port 2/5 is the sixth port in the second chassis slot on the gateway. Slot 0 is reserved for the motherboard.

You can perform the following functions on an SPE:

- General configuration such as busyout, shutdown, or clear
- View statistics and states
- Configure automatic and manual recovery processes
- Upgrade firmware

Configuring SPE Performance Statistics

By default, an event log is enabled and based on one event queue per SPE port. The log contains raw data in binary form, which must be viewed using the **show** commands listed in the “[Viewing SPE Performance Statistics](#)” section on page 5-3. You may configure some aspects of how the record is kept using the following global configuration mode commands (at the `AS5350(config)#` or `AS5400(config)#` prompt):

- **spe call-record modem *max-userid***—Generates a modem call record after a modem call is terminated. The *max-userid* is the maximum user ID size, in bytes, allowable in the modem. The **call-record** default is 30; the range is 0 to 100. You can display this record on the console or a configured syslog server. This call record is not stored in the port event log. To disable this function, use the **no** form of this command. This replaces the **modem call-record** command.
- **spe log-size *number***—Allows you to configure the size of the history event queue buffer for manageable SPEs in the gateway. The default is 100 events per port. Use the **show port [modem | voice | fax] log** command to view port events. This command is used in the same way as the **modem buffer-size** command is used for MICA modems.
- **show port [modem | voice | fax] log reverse**—Displays port events with the most recent event first.



Note

The dial-only feature card only supports dial services. Dial services include modem calls (all modulations), ISDN digital calls, V.110 data calls, and V.120 data calls. Modem pass-through calls are not included in dial services.

The following privileged EXEC mode commands allow you to clear some or all of the log events relating to the SPEs (at the `AS5350#` or `AS5400#` prompt):

- **clear spe log**—Allows you to clear all event entries in the slot history event log.
- **clear spe counters**—Clears statistical counters for all types of services for the specified SPE, a range of SPE range, or all the SPEs. If you do not specify a range of SPEs or a specific SPE, all SPE statistics are cleared. It is used in the same way the **clear modem counters** command is used for MICA modems.
- **clear port log**—Allows you to clear all event entries in the port level history event log. This command clears the entire port log. You cannot remove individual service events from the port log. You can use **show port modem log** or **show port digital log** to display specific service events, but you must use **clear port log** to clear the entire port log.

Viewing SPE Performance Statistics

You can view SPE statistics using the Cisco IOS software with the gateway. To view performance statistics for the universal port or dial-only feature cards, enter one or more of the following commands in privileged EXEC mode (at the `AS5350#` or `AS5400#` prompt):

show spe voice Commands

- **show spe voice active**—Displays the active statistics of all SPEs, a specified SPE, or a specified SPE range serving voice traffic.
- **show spe voice slot | slot/spe summary**—Displays the history statistics of all SPEs in a particular slot, specified SPE, or specified SPE range serving voice traffic.

**Note**

The dial-only feature card only supports dial services. Dial services include modem calls (all modulations), ISDN digital calls, V.110 data calls, and V.120 data calls. Modem pass-through calls are not included in dial services.

show spe digital Commands

- **show spe digital active**—Displays the active statistics of all SPEs, a specified SPE, or a specified SPE range serving digital traffic.
- **show spe digital csr**—Displays the digital call success rate statistics for a specific SPE, range of SPEs, or all the SPEs.
- **show spe digital disconnect-reason**—Displays the digital disconnect reasons for the specified SPE or SPE range. The disconnect reasons are displayed with Class boundaries.
- **show spe digital slot | slot/spe summary**—Displays the history statistics of all SPEs in a particular slot, specified SPE or the specified SPE range serving digital traffic.

show spe modem Commands

- **show spe modem active**—Displays the active statistics of all SPEs, a specified SPE, or a specified SPE range serving modem traffic. It is used in the same way as the **show modem** command is used for MICA modems. (The **show modem** command is not supported on the Cisco AS5350XM or Cisco AS5400XM universal gateway.)
- **show spe modem csr**—Displays the call success rate statistics for a specific SPE, range of SPEs, or all the SPEs.
- **show spe modem disconnect-reason**—Displays the reason for disconnection for the specified SPE or SPE range. Disconnection reasons are displayed with class boundaries. This command is used in the same way as the **show modem call-stats** command is used for MICA modems. (The **show modem call-stats** command is not supported on the Cisco AS5350XM or Cisco AS5400XM universal gateway.)
- **show spe modem {high | low} speed**—Shows the connection speeds negotiated within each high or low speed modulation or codecs for a specific range of SPEs or all the SPEs.

- **show spe modem slot | slot/spe summary**—Displays the history statistics of all SPEs in a particular slot, specified SPE, or specified SPE range. It is used in the same way as the **show modem** command is used for MICA modems. (The command is not supported on the Cisco AS5350XM or Cisco AS5400XM universal gateway.)

show spe Commands

- **show spe log**—Displays the oldest event first from the slot history event log.
- **show spe log reverse**—Displays the latest event first from the log.
- **show spe version**—Lists all SPEs and the SPE firmware files used. This helps you decide if you need to update your SPE firmware files. This command is used in the same way as the **show modem mapping** command is used for MICA modems. (The **show modem mapping** command is not supported on the Cisco AS5350XM or Cisco AS5400XM universal gateway.)
- **show spe fax active**—Displays the active statistics of all SPEs, a specified SPE, or a specified SPE range serving fax-relay traffic.

show port Commands

- **show port config**—Displays the configuration information for specified ports or the specified port range. The port should have an active session associated with it at the time the command is executed.
- **show port [digital | modem | voice | fax] log**—Displays the event log with oldest event first. For modems, this command is used the same way as the **show modem log** command is used for MICA modems. (The **show modem log** command is not supported on the Cisco AS5350XM or Cisco AS5400XM universal gateway.)
- **show port [digital | modem | voice | fax] log reverse**—Displays the latest event first from the port history event log.
- **show port modem calltracker**—Displays the port level information for an active modem call using the call tracker database. If there is no call on the specified port, the information of the most recent call is displayed. The call tracker feature must be enabled by invoking the **calltracker enable** command. (For detailed information about the call tracker feature, see the *Call Tracker plus ISDN and AAA Enhancements for the Cisco AS5300 and Cisco AS5800* document, available online at http://www.cisco.com/univercd/cc/td/doc/product/software/ios121/121newft/121limit/121x/121xh/121xh_2/dt_cltrk.htm)
- **show port modem test**—Displays the test log for the specified SPE port range or all the SPE ports.
- **show port operational-status**—Displays the operational status of the specified ports or the specified port range. The port should have an active session associated with it at the time the command is executed.

Managing Ports

This section describes how to manage universal-port and dial-only feature card ports. You can clear ports, remove ports from service, and disable ports from dial-up service by using port configuration mode. For details on disabling a port from dial-up service, see the “[Troubleshooting](#)” section on [page 5-8](#).

Clear Ports

To clear a port means to deactivate calls on a port or to clear the *Bad* state on a port and reset it. Ports need to be cleared if communication attempts with the port have failed or if the port is to be removed from operation.

Use the **show spe slot/spe** command to view the active ports on an SPE. To clear ports on an SPE, enter the following command in privileged EXEC mode. You can clear all ports on the gateway, all ports on a slot, or a port. This replaces the **clear modem** command.

- The example below clears port 1 on slot 4.

```
AS5400# clear port 4/1
AS5400# This will clear port 4/01 [confirm] yes
AS5400#
```

- The example below clears all active ports on slot 4.

```
AS5400# clear port 4
AS5400# This will clear port 4/00 - 4/107 [confirm] yes
AS5400#
```

If *slot/port* is specified, the port on that SPE is cleared. If *slot* is specified, all active ports on that particular slot are cleared. If no argument is specified, all ports are cleared.

Additionally, this command clears the *Bad* state on a port and resets it. However, the port is not cleared if the SPE was previously in a *Bad* state because of an SPE firmware download.

Port Configuration Mode

Port configuration mode allows you to enter a mode similar to line configuration mode. This mode allows individual ports or ranges of ports to be shut down or put in busyout mode. Port configuration mode commands replace the **modem range**, **modem busyout**, and **modem shutdown** commands used with MICA modems.

- The example below demonstrates how to enter port configuration mode for a single port.

```
AS5400# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
AS5400(config)# port 3/1
AS5400(config-port)#
```

- The example below demonstrates how to enter port configuration mode for a range of ports.

```
AS5400# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
AS5400(config)# port 3/1 3/18
AS5400(config-port)#
```

Port Configuration Mode Commands

The following commands are available in port configuration mode:

- busyout card/port**—Gracefully disables a port or all ports on a feature card by waiting for the active services on the specified port to terminate. You can busy out all ports or just one port on a card—for example, **busyout 1** specifies all ports on card 1; **busyout 1/4** specifies just port 4 on card 1. Use the **no** form of this command to reenable the ports. This replaces the **modem busyout** command. Maintenance activities such as testing can still be performed while a port is in busyout mode.



Note **port busyout** and **spe busyout** are different commands, and do not affect one another. If you busyout a port or SPE with one command, you can clear it only with the analogous **clear** command.

- **shutdown**—Clears active calls on the port. No more calls can be placed on the port. The state of the SPEs are reflected in the **show spe** command display. Use the **no** form of this command to reenable the ports. This command replaces the **modem shutdown** command.

**Note**

When a port is in busyout mode or shutdown mode, the state of the SPE is changed to the consolidated states of all the underlying ports on that SPE.

Managing SPEs

This section describes how to manage SPEs by setting the SPE country code, entering SPE configuration mode, upgrading the SPE firmware, performing busyout on SPEs, and clearing active calls on the SPEs.

SPE Country

On the Cisco AS5350XM and Cisco AS5400XM universal gateways, DS0 companding law selection is configured for the entire system rather than on individual voice ports.

To configure companding on your T1, E1, or T3 controller lines, you must use the **spe country** command in global configuration mode. (This command replaces the **modem country** command. If you do not specify a country, your controller line uses the default.)

For T1 interfaces, the default is **t1-default** (Mu-law); for E1 interfaces, the default is **e1-default** (A-law). Use the **no** form of this command to set the country code to the default.

Supported countries include, but are not limited to, those shown in [Table 5-1](#):

Table 5-1 Supported Countries and Corresponding Companding Law

Country	Companding Law	Country	Companding Law
Australia	A-law	Netherlands	A-law
Austria	A-law	New Zealand	A-law
Belgium	A-law	Norway	A-law
China	A-law	Poland	A-law
Cyprus	A-law	Portugal	A-law
Czech/Slovak Republic	A-law	Russia	A-law
Denmark	A-law	Singapore	A-law
Finland	A-law	South Africa	A-law
France	A-law	Spain	A-law
Germany	A-law	Sweden	A-law
Hong Kong	Mu-law	Switzerland	A-law

Table 5-1 Supported Countries and Corresponding Companding Law (continued)

Country	Companding Law	Country	Companding Law
India	A-law	Taiwan	Mu-law
Ireland	A-law	Thailand	A-law
Israel	A-law	Turkey	A-law
Italy	A-law	United Kingdom	A-law
Japan	Mu-law	USA	Mu-law
Malaysia	A-law	—	—

**Note**

The gateway must be in idle state (no calls are active) to execute the SPE country command.

- The following example sets the country code to **usa**.

```
AS5400(config)# spe country usa
AS5400(config)#
```

- The following example verifies that DS0 companding was set to **usa** (or Mu-law). It also displays the SPE busyout status.

```
AS5400# show spe
```

```
SPE settings:
=====
Country code configuration usa
Polling interval: 12 secs.
History log events: 50(per port)
Port legends:
=====
Port state: (s)shutdown (t)test (r)recovery (d)download
             (b)busiedout (p)busyout pending, (B)bad (a)active call
Call type: (m)modem (d)digital (v)voice (_)not in use
```

SPE#	Port #	SPE State	SPE Busyout	SPE Shut	SPE Crash	Port State	Call Type
4/00	0000-0005	ACTIVE	0	0	0	_____	_____
4/01	0006-0011	ACTIVE	0	0	0	_____	_____
4/02	0012-0017	ACTIVE	0	0	0	_____	_____
4/03	0018-0023	ACTIVE	0	0	0	_____	_____
4/04	0024-0029	ACTIVE	0	0	0	_____	_____
4/05	0030-0035	ACTIVE	0	0	0	_____	_____
4/06	0036-0041	ACTIVE	0	0	0	_____	_____
4/07	0042-0047	ACTIVE	0	0	0	_____	_____
4/08	0048-0053	ACTIVE	0	0	0	_____	_____
4/09	0054-0059	ACTIVE	0	0	0	_____	_____
4/10	0060-0065	ACTIVE	0	0	0	_____	_____
4/11	0066-0071	ACTIVE	0	0	0	_____	_____
4/12	0072-0077	ACTIVE	0	0	0	_____	_____
4/13	0078-0083	ACTIVE	0	0	0	_____	_____
4/14	0084-0089	ACTIVE	0	0	0	_____	_____
4/15	0090-0095	ACTIVE	0	0	0	_____	_____
4/16	0096-0101	ACTIVE	0	0	0	_____	_____
4/17	0102-0107	ACTIVE	0	0	0	_____	_____

SPE Configuration Mode

SPE configuration mode allows you to configure SPEs, similar to line configuration mode. You can configure an SPE by specifying a slot and an SPE associated with the slot or, you can choose to configure a range of SPEs by specifying the first and last SPE in the range.

The following example demonstrates how to enter SPE configuration mode.

```
AS5400# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
AS5400(config)# spe 1/1 1/17
AS5400(config-SPE)#
```

SPE Configuration Mode Commands

The following commands are available in SPE configuration mode:

- **firmware location**—Allows you to transfer a specified version of SPE firmware from system flash memory to the SPEs named upon entering SPE configuration mode. For further information on firmware upgrades, see the [“Upgrading SPE Firmware” section on page 5-11](#).
- **firmware upgrade** *busyout* | *download-maintenance* | *reboot*—Allows you to specify the upgrade method. Three methods of upgrade are available.
 - *Busyout* (the default) upgrades when all calls are terminated on an SPE.
 - *Download-maintenance* waits to upgrade at the next download maintenance. For further information on firmware upgrades, see the [“Upgrading SPE Firmware” section on page 5-11](#). The default download-maintenance time is 0300.
 - *Reboot* upgrades at the next reboot. Note that for the **firmware upgrade reboot** command to take effect after a reload, you must have saved the running configuration with the **copy running-config startup-config** command.
- **busyout**—Gracefully disables an SPE by waiting for all the active services on the specified SPE to terminate. If there are active ports on the specified SPE, the state of the SPE is changed to *Busiedout*. The SPE is temporarily disabled. Use the **no** form of this command to reenble the SPEs.
- **shutdown**—Clears active calls on all ports on the SPE. Calls can no longer be placed on the SPE because the SPE state is changed to *Out-of-Service*. The state of the SPEs is reflected in the **show spe** command display. Use the **no** form of this command to reenble the ports on the SPE.

Troubleshooting

This section provides troubleshooting information that applies to your modems regardless of service type mode. You learn how to perform diagnostic tests on installed ports or SPEs, configure automatic recovery of ports on an SPE, and configure a scheduled recovery of SPEs.

Configure SPE Diagnostic Tests

You can perform three types of diagnostic tests on your SPE modem:

- SPE startup test
- SPE autotest
- SPE back-to-back test

SPE Startup Test

To perform diagnostic testing on all your installed SPE ports during the initial systemd startup or rebooting process, in global configuration mode with the prompt displayed as `AS5350#` or `AS5400#`, enter the following command:

port modem startup-test—Perform diagnostic testing for all modems.

The results of the SPE port startup test are displayed in the **show port modem test** command output. SPE ports that pass the diagnostic test are *Pass*, *Fail*, and *Unkn*. Ports that fail the diagnostic test are marked as *Bad*. These ports cannot be used for call connections. Depending on how many ports are installed, this diagnostic test may take from 5 to 10 minutes to complete. Perform additional testing on an inoperative SPE port by executing the **test port modem back-to-back** command. The **no port modem startup-test** command disables startup testing.

SPE Autotest

To perform diagnostic testing on all the installed SPE ports during the initial system startup or rebooting process, or during service, in global configuration mode with the prompt displayed as `AS5350(config)#` or `AS5400(config)#`, enter the following command:

port modem autotest—Perform diagnostic testing for all ports.

The results of the SPE port autotest are displayed in the **show port modem test** command output. Ports that pass the diagnostic test are marked as *Idle*, *Busy*, *Downloading*, and *Reset*, and are put into service. Ports that fail the diagnostic test are marked as *Bad*, and are not put into service or tested again until they are no longer marked as *Bad*. If all the ports of an SPE are bad, the corresponding SPE is also marked bad. These ports cannot be used for call connections. Depending on how many ports are present and not marked *Bad*, this diagnostic test may take from 5 to 10 minutes to complete. Perform additional testing on an inoperative port by executing the **test port modem back-to-back** command. The **no port modem autotest** command disables testing.

You can additionally configure the following options:

- **port modem autotest minimum ports**—Defines the minimum number of free ports available for autotest to begin.
- **port modem autotest time hh:mm interval**—Enables the autotesting time and interval.
- **port modem autotest error threshold**—Defines the maximum number of errors detected for autotest to begin.

A sample diagnostic autotest setting the time at 12:45 and at 8-hour intervals looks like the following:

```
AS5400(config)# port modem autotest time 12:45 8
AS5400(config)#
```

SPE Back-to-Back Test

When an SPE port fails testing and is labeled *Bad*, you can perform additional testing by conducting a series of internal back-to-back connections and data transfers between two SPE ports. All port test connections occur inside the gateway. For example, if mobile users cannot dial in to port 2/5 (the sixth port on the card in the second chassis slot), attempt a back-to-back test with port 2/5 and a known-functioning port such as port 2/6.

Enter the following command in privileged EXEC mode (the prompt is displayed as `AS5350#` or `AS5400#`) to perform internal back-to-back port tests between two ports:

test port modem back-to-back *slotport slotport [num-packets]*—Performs internal back-to-back port tests between two ports, sending test packets of the specified size.

You might need to execute this command on several different combinations of ports to determine which one is not functioning properly. A pair of operable ports successfully connects and transmits data in both directions. An operable port and an inoperable port do not successfully connect with each other.

A sample back-to-back test might look like the following:

```
AS5400# test port modem back-to-back 2/10 3/20
```

```
Repetitions (of 10-byte packets) [1]:
*Mar 02 12:13:51.743:%PM_MODEM_MAINT-5-B2BCONNECT:Modems (2/10) and (3/20) connected in
back-to-back test:CONNECT33600/V34/LAP
*Mar 02 12:13:52.783:%PM_MODEM_MAINT-5-B2BMODEMS:Modems (3/20) and (2/10) completed
back-to-back test:success/packets = 2/2
```

A port that has been confirmed to have problems can often be fixed using the **clear spe** command. For more information, see the “Clear an SPE” section on page 5-11.

The results of the **test port modem back-to-back** command are displayed in the **show port modem test** command output:

```
AS5400# show port modem test
```

Date	Time	Modem	Test	Reason	State	Result
3/02	12:00:57 PM	2/01	Back-To-Back	:STARTUP TEST	Idle	PASS
3/02	12:00:57 PM	2/00	Back-To-Back	:STARTUP TEST	Idle	PASS
3/02	12:00:58 PM	2/02	Back-To-Back	:STARTUP TEST	Idle	PASS
3/02	12:00:58 PM	2/03	Back-To-Back	:STARTUP TEST	Idle	PASS
3/02	12:00:58 PM	2/04	Back-To-Back	:STARTUP TEST	Idle	PASS
3/02	12:00:58 PM	2/05	Back-To-Back	:STARTUP TEST	Idle	PASS
...						
3/02	12:01:14 PM	3/95	Back-To-Back	:STARTUP TEST	Idle	PASS
3/02	12:01:14 PM	3/94	Back-To-Back	:STARTUP TEST	Idle	PASS
3/02	12:01:15 PM	3/75	Back-To-Back	:STARTUP TEST	Idle	PASS
3/02	12:01:15 PM	3/74	Back-To-Back	:STARTUP TEST	Idle	PASS
3/02	12:13:52 PM	3/20	Back-To-Back	:USER INITIATED	Idle	PASS
3/02	12:13:52 PM	2/10	Back-To-Back	:USER INITIATED	Idle	PASS
...						
3/02	12:44:00 PM	3/102	No Test (Time)	:MIN IDLE MODEMS	Idle	NOTST
3/02	12:44:00 PM	3/103	No Test (Time)	:MIN IDLE MODEMS	Idle	NOTST
3/02	12:44:00 PM	3/104	No Test (Time)	:MIN IDLE MODEMS	Idle	NOTST
3/02	12:44:00 PM	3/105	No Test (Time)	:MIN IDLE MODEMS	Idle	NOTST
3/02	12:44:00 PM	3/106	No Test (Time)	:MIN IDLE MODEMS	Idle	NOTST
3/02	12:44:00 PM	3/107	No Test (Time)	:MIN IDLE MODEMS	Idle	NOTST
3/02	12:44:21 PM	2/73	Back-To-Back	:TIME INTERVAL	Idle	PASS
3/02	12:44:21 PM	2/72	Back-To-Back	:TIME INTERVAL	Idle	PASS
3/02	12:44:21 PM	2/33	Back-To-Back	:TIME INTERVAL	Idle	PASS
3/02	12:44:21 PM	2/32	Back-To-Back	:TIME INTERVAL	Idle	PASS
3/02	12:44:21 PM	3/37	Back-To-Back	:TIME INTERVAL	Idle	PASS



Note

The *Reason* column indicates why the test was started. The *TIME INTERVAL* is one of the triggers under autotest; the other is the error threshold.

SPE Recovery

You can configure automatic recovery (removal from service and reloading of SPE firmware) of ports on an SPE at any available time from global configuration mode (the prompt is AS5350 (config)# or AS5400 (config)#):

spe recovery {port-action {disable | recover | none} | port-threshold *num-failures*}

When an SPE port fails to connect for a certain number of consecutive times, a problem exists in a specific part or the whole of SPE or firmware. Such SPEs have to be recovered by downloading firmware. Any port failing to connect *num-failures* times is moved to a state based on **port-action**, where you can choose to *disable* (mark the port as *Bad*) or *recover* the port when the SPE is in the idle state and has no active calls. The default for *num-failures* is 30.

You can also schedule recovery using the **spe download maintenance configuration** command.

SPE Download Maintenance

You can configure a scheduled recovery of SPEs from global configuration mode (the prompt is AS5350(config)# or AS5400(config)#):

spe download maintenance time *hh:mm* | **stop-time** *hh:mm* | **max-spes** *num-of-spes* | **window** *time-period* | **expired-window** {*drop-call* | *reschedule*}

Download maintenance starts at **time**, steps through all the SPEs that need recovery and SPEs that need a firmware upgrade, and starts maintenance on **max-spes** at a time. It waits for the **window** delay time for all the ports on the SPE to become inactive before moving the SPE to the *idle* state. It downloads firmware immediately after the SPE moves to idle. If the ports are still in use by the end of **window**, depending on the **expired-window** setting, connections on the SPE ports are shut down and the firmware is downloaded by choosing the *drop-call* option, or the firmware download is rescheduled to the next download maintenance time by choosing the *reschedule* option. This process continues until the number of SPEs under maintenance is below **max-spes**, or until **stop-time** (if set), or until all SPEs marked for recovery or upgrade have had their firmware reloaded. The default download-maintenance time is 0300.

Clear an SPE

The **clear spe** privileged EXEC mode command allows you to manually recover a port that is frozen in a suspended state. This command causes the firmware configured for that SPE to be downloaded to the specified SPE or the range of SPEs and power-on self test (POST) to be executed. This command can be executed regardless of the state of the SPEs. All active ports running on the SPE are prematurely terminated and messages are logged into the appropriate log. This replaces the **clear modem** command.

The following example shows a cold start on SPE 1 on slot 1:

```
AS5400# clear spe 1/1
AS5400# Are you sure you want to clear SPE 1/1(Y/N)? Y
```

Upgrading SPE Firmware

With new systems, Cisco loads a Cisco IOS software-compatible version of SPE firmware into each installed SPE. A map of the version or versions of SPE firmware copied to RAM for each SPE is stored in nonvolatile random-access memory (NVRAM) so that it is retained over power cycles.



Note

You do not have to take any action to use the preinstalled version of SPE firmware with new systems.

You can acquire new SPE firmware from the Cisco Software Center in one of two ways:

- **Bundled** in regular Cisco IOS releases. See the “[Using SPE Firmware Bundled with Cisco IOS Software](#)” section on page 5-19 for details.

- **Unbundled** from Cisco.com. This is a more up-to-date version of SPE firmware released before the next Cisco IOS release, or a special version of SPE firmware shipped with a new board. See the [“Upgrading SPE Firmware from the Cisco.com FTP Server”](#) section on page 5-13 for details.

When you have the new firmware, you can configure different firmware versions onto individual SPEs or ranges of SPEs on a universal port or dial-only feature card. You can also configure different upgrade methods by using the **firmware upgrade** command.

Important Upgrade Commands

There are several commands you use to upgrade SPE firmware. For examples on using the commands, see the [“Upgrading SPE Firmware from the Cisco.com FTP Server”](#) section on page 5-13 and the [“Using SPE Firmware Bundled with Cisco IOS Software”](#) section on page 5-19.

- Use the **copy tftp flash filename** command to copy any version of SPE firmware (no matter how it is obtained) into system flash memory. You can store several versions of the SPE firmware in system flash memory under different filenames.
- Use the **firmware location** SPE configuration command to transfer a specified version of SPE firmware from system flash memory to the SPEs named on entering SPE configuration mode.
- Use the **firmware upgrade busyout | download-maintenance | reboot** SPE configuration command to configure when the file named in the **firmware location** command will be loaded to the SPEs. Three methods of upgrade are available:
 - *Busyout* (the default) upgrades when all calls are terminated on an SPE.
 - *Download-maintenance* waits to upgrade at the next download maintenance (see the [“SPE Download Maintenance”](#) section on page 5-11). The default download-maintenance time is 03:00.
 - *Reboot* upgrades at the next reboot. Note that for the **firmware upgrade reboot** command to take effect after a reload, you must have saved the running configuration with the **copy running-config startup-config** command.



Note

The **copy ios-bundled** command is not necessary with the universal port or dial-only feature card. By default, the version of SPE firmware bundled with the Cisco IOS software release transfers to all SPEs not specifically configured for a different SPE firmware file.

Displaying SPE Firmware Versions

Use the **show spe version** command to list the versions of SPE firmware running on the SPEs, residing in system flash memory, and bundled with Cisco IOS software. This helps you decide if you need to change the version running on the modems.



Note

The version number (version column) may not match the filename (UPG firmware-filename column) for a short period of time while a range of SPEs is in the process of downloading new firmware. The version number is updated at the beginning of the upgrade process, whereas the filename is updated upon completion of the process. This is done intentionally to enable you to recognize the upgrade process from the **show spe version** output.

```
AS5400# show spe version
```

```

IOS-Bundled Default Firmware-Filename
=====
system:/ucode/np_spe_firmware1

Version  Firmware-Type
=====  =====
0.0.6.75  SPE firmware

On-Flash Firmware-Filename
=====
flash:np.spe
flash:np_6_77.spe
flash:np_6_79.spe

Version  Firmware-Type
=====  =====
0.6.4.5  SPE firmware
0.0.6.77  SPE firmware
0.0.6.79  SPE firmware

SPE-#  SPE-Type  SPE-Port-Range  Version  UPG Firmware-Filename
2/00   CSMV6     0000-0005       0.0.6.75  N/A ios-bundled default
2/01   CSMV6     0006-0011       0.0.6.75  N/A ios-bundled default
2/02   CSMV6     0012-0017       0.0.6.75  N/A ios-bundled default
2/03   CSMV6     0018-0023       0.0.6.75  N/A ios-bundled default
2/04   CSMV6     0024-0029       0.0.6.75  N/A ios-bundled default
2/05   CSMV6     0030-0035       0.0.6.75  N/A ios-bundled default
2/06   CSMV6     0036-0041       0.0.6.77  N/A np_6_77.spe
2/07   CSMV6     0042-0047       0.0.6.77  N/A np_6_77.spe
2/08   CSMV6     0048-0053       0.0.6.77  N/A np_6_77.spe
2/09   CSMV6     0054-0059       0.0.6.77  N/A np_6_77.spe
2/10   CSMV6     0060-0065       0.0.6.77  N/A np_6_77.spe
2/11   CSMV6     0066-0071       0.0.6.77  N/A np_6_77.spe
2/12   CSMV6     0072-0077       0.0.6.79  N/A np_6_79.spe
2/13   CSMV6     0078-0083       0.0.6.79  N/A np_6_79.spe
2/14   CSMV6     0084-0089       0.0.6.79  N/A np_6_79.spe
2/15   CSMV6     0090-0095       0.0.6.79  N/A np_6_79.spe
2/16   CSMV6     0096-0101       0.0.6.79  N/A np_6_79.spe
2/17   CSMV6     0102-0107       0.0.6.79  N/A np_6_79.spe

```

Upgrading SPE Firmware from the Cisco.com FTP Server

Upgrading SPE firmware from the Cisco.com FTP server is a three-step process:

- Downloading the SPE firmware from Cisco.com FTP server to a local TFTP server
- Copying the SPE firmware file to the gateway and SPEs (which may also involve removing old firmware)
- Configuring SPEs to use an upgraded firmware file

Download SPE Firmware from the Cisco.com FTP Server to a Local TFTP Server



Note

You must be a registered Cisco user to log in to the Cisco Software Center.

You can download software from the Cisco.com FTP server using an Internet browser or using an FTP application. Both procedures are described.

Using an Internet Browser

- Step 1** Launch an Internet browser.
- Step 2** Bring up the Cisco Software Center home page at the following URL (subject to change without notice): <http://www.cisco.com/kobayashi/sw-center/>
- Step 3** Under Software Products & Downloads, click **Access Software**.

- Step 4** Click **AS5350 Series** or **AS5400 Series**.
- Step 5** Click the SPE firmware you want and download it to your workstation or PC. For example, to download SPE firmware for the universal port feature card, click **Download Nextport SPE Software**.
- Step 6** Click the SPE firmware file you want to download, and then follow the remaining download instructions. If you are downloading the SPE firmware file to a PC, make sure you download it to the **c:/tftpboot** directory; otherwise, the download process does not work.
- Step 7** When the SPE firmware is downloaded to your workstation, transfer the file using a terminal emulation software application to a TFTP server that can be accessed by the universal gateway.

Using an FTP Application



Note

The directory path leading to the SPE firmware files on cco.cisco.com is subject to change without notice. If you cannot access the files using an FTP application, try the Cisco Systems URL <http://www.cisco.com/cgi-bin/ibld/all.pl?i=support&c=3>

- Step 1** Log in to the Cisco.com FTP server, called cco.cisco.com:

```
terminal> ftp cco.cisco.com

Connected to cio-sys.cisco.com.
220-
220- Cisco Connection Online          |          | Cisco Systems, Inc.
220- Email: cco-team@cisco.com        |||          ||| 170 West Tasman Drive
220- Phone: +1.800.553.2447  .:|||||:..:|||||:. San Jose, CA 95134
220-
220- NOTE: As of February 1,1997 ftp.cisco.com will now point to this
220- service. Please be advised. To use the former ftp.cisco.com after
220- February 1, connect to ftpeng.cisco.com
220-
220- You may login with:
220- + Your CCO username and password, or
220- + A special access code followed by your e-mail address, or
220- + "anonymous" followed by your e-mail address for guest access.
220-
220 cio-sys FTP server (CIOESD #103 Sun Dec 15 14:43:43 PST 1996) ready.
```

- Step 2** Enter your CCO registered username and password (for example, **harry** and **letmein**):

```
Name (cco.cisco.com:harry): harry
331 Password required for harry.
Password: letmein
230-#####
230-# Welcome to the Cisco Systems CCO FTP server.
230-# This server has a number of restrictions. If you are not familiar
230-# with these, please first get and read the /README or /README.TXT file.
230-# http://www.cisco.com/acs/info/cioesd.html for more info.
230-#####
230-
230- ***** NOTE: As of February 1, 1997, "cco.cisco.com", *****
230- ***** "www.cisco.com" and "ftp.cisco.com" are now all *****
230- ***** logical names for the same machine. *****
230- *****
230- ***** The old "ftp.cisco.com" is an entirely *****
230- ***** different machine, which is now known as *****
230- ***** "ftpeng.cisco.com" or "ftp-eng.cisco.com". *****
```

```

230- *****
230- ***** In general, "ftpeng.cisco.com" is used only for *****
230- ***** distribution of Cisco Engineering-controlled *****
230- ***** projects, such as beta programs, early field *****
230- ***** trials, developing standards documents, etc. *****
230- *****
230- ***** Be sure to confirm you have connected to *****
230- ***** the machine you need to interact with. *****
230-
230- If you have any odd problems, try logging in with a minus sign (-) as
230- the first character of your password. This will turn off a feature
230- that may be confusing your ftp client program.
230- Please send any questions, comments, or problem reports about this
230- server to cco-team@cisco.com.
230-
230- NOTE:
230- o To download files from CCO, you must be running a *passive-mode*
230- capable FTP client.
230- o To drop files on this system, you must cd to the /drop directory.
230- o Mirrors of this server can be found at
230-
230- + ftp://www-europe.cisco.com European (Amsterdam)
230- + ftp://www-fr.cisco.com France (Paris)
230- + ftp://www-au.cisco.com Australia (Sydney)
230- + ftp://www-jp.cisco.com Japan (Tokyo)
230- + ftp://www-kr.cisco.com Korea (Seoul)
230-
230- Please read the file README
230- it was last modified on Sat Feb 1 12:49:31 1997 - 163 days ago
230 User harry logged in. Access restrictions apply.
Remote system type is UNIX.
Using binary mode to transfer files.

```

Step 3 Specify the directory path that holds the SPE firmware you want to download. For example, the directory path for the universal gateway SPE firmware is **/cisco/access/nextport**:

```
ftp> cd /cisco/access/nextport
```

```

250-Please read the file README
250- it was last modified on Tue May 27 10:07:38 1997 - 48 days ago
250-Please read the file README.txt
250- it was last modified on Tue May 27 10:07:38 1997 - 48 days ago
250 CWD command successful.

```

Step 4 View the contents of the directory with the **ls** command:

```

ftp> ls
227 Entering Passive Mode (192,31,7,130,218,128)
150 Opening ASCII mode data connection for /bin/ls.
total 2688
drwxr-s--T  2 ftpadmin ftpcio   512 Jun 30 18:11 .
drwxr-sr-t  19 ftpadmin ftpcio   512 Jun 23 10:26 ..
lrwxrwxrwx  1 root      3      10 Aug  6 1996  README ->README.txt
-rw-rw-r--  1 root      ftpcio  2304 May 27 10:07 README.txt
-r--r--r--  1 ftpadmin ftpint 377112 Jul 10 18:08 np-spe-upw-1.0.1.2.bin
-r--r--r--  1 ftpadmin ftpint  635 Jul 10 18:08 SPE-firmware.3.1.30.readme
226 Transfer complete.

```

Step 5 Specify a binary image transfer:

```

ftp> binary
200 Type set to I.

```

Step 6 Copy the SPE firmware files from the gateway to your local environment with the **get** command.

Step 7 Quit your terminal session:

```
ftp> quit
Goodbye.
```

Step 8 Verify that you successfully transferred the files to your local directory:

```
server% ls -al
total 596
-r--r--r-- 1 280208 Jul 10 18:08 np-spe-upw-1.0.1.2.bin
server% pwd
/auto/tftboot
```

Step 9 Transfer these files to a local TFTP or RCP server that your gateway or router can access.

Copy the SPE Firmware File from the Local TFTP Server to the SPEs

The procedure for copying the SPE firmware file from your local TFTP server to a universal port or dial-only feature card is a two-step process:

1. Transfer the SPE firmware to the gateway's flash memory.
2. Configure the SPEs to use the upgrade firmware.

The upgrade occurs automatically, either as you leave configuration mode or as specified in the configuration.

These two steps are performed only once. After you copy the SPE firmware file into flash memory for the first time, you should not have to perform these steps again. Because the SPE firmware is configurable for individual SPEs or ranges of SPEs, the Cisco IOS software automatically copies the SPE firmware to each SPE each time the gateway restarts.

Transfer SPE Firmware to Flash Memory

Follow these steps to download the universal SPE firmware to flash memory:

Step 1 Check the image in the gateway flash memory:

```
AS5400# show flash
System flash directory:
File Length Name/status
  1 4530624 c5350-js-mx
[498776 bytes used, 16278440 available, 16777216 total]
16384K bytes of processor board System flash (Read/Write)
```

Step 2 Enter the **copy tftp flash** command to download the code file from the TFTP server into the gateway flash memory. You are prompted for the download destination and the remote host name.

**Note**

The system no longer asks you if you want to erase flash memory before reloading it. SPE firmware code is small; unlike system images, you can sometimes hold more than one version of SPE firmware in flash memory.

If you do not have available space to copy the SPE firmware, during the copy operation the system displays a message telling you to delete the current file and squeeze the flash memory to make room for the new image. Enter the **delete flash:version** command, followed by the **squeeze flash** command, to perform this delete-and-squeeze operation. Then proceed with the copy operation.

```
AS5400# copy tftp flash

Address or name of remote host [192.168.19.91]?
Source filename [c5350-js-mz.xml.Feb16]?
Destination filename [c5350-js-mz.xml.Feb16]?
Accessing tftp://192.168.19.91/c5350-js-mz.xml.Feb16...
Loading c5350-js-mz.xml.Feb16 from 192.168.19.91 (via GigabitEthernet0/0):
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
[OK - 10573848/21147648 bytes]
10573848 bytes copied in 77.356 secs (137322 bytes/sec)
```

Step 3 Verify that the file has been copied into the gateway flash memory:

```
AS5400# show flash

#- ED --type-- --crc--- -seek-- nlen -length- -----date/time----- name
1 .. unknown 12375B0E 92704 6 337539 Feb 21 2001 22:46:51 np.spe
2 .. image 1A58C7EA AA7F9C 20 10573848 Feb 21 2001 23:11:59 c5350-js-mz.xml.Feb16
5079140 bytes available (10911644 bytes used)
```

Configure SPEs to Use an Upgraded Firmware File

Follow these steps to configure the SPEs to use the upgraded firmware:

Step 1 Enter the **enable** command.

```
AS5400> enable
```

Step 2 Enter your password.

```
Password: password
AS5400#
```

You are in privileged EXEC mode when the prompt changes to AS5350# or AS5400#.

Step 3 Display SPE firmware versions to obtain the filename of the firmware on flash memory.

**Note**

As explained previously, the version number and UPG firmware filename may not match until the upgrade is complete.

```
AS5400# show spe version

IOS-Bundled Default Firmware-Filename          Version  Firmware-Type
```

```

=====
system:/ucode/np_spe_firmware1                               0.0.6.75  SPE firmware

On-Flash Firmware-Filename                                Version  Firmware-Type
=====
flash:np.spe                                              0.6.4.5  SPE firmware
flash:np_6_77.spe                                         0.0.6.77 SPE firmware
flash:np_6_79.spe                                         0.0.6.79 SPE firmware
flash:np-spe-upw-1.0.1.2.bin                              1.0.1.2  SPE firmware

SPE-#  SPE-Type  SPE-Port-Range  Version  UPG Firmware-Filename
2/00   CSMV6      0000-0005      0.0.6.75  N/A ios-bundled default
2/01   CSMV6      0006-0011      0.0.6.75  N/A ios-bundled default
2/02   CSMV6      0012-0017      0.0.6.75  N/A ios-bundled default
2/03   CSMV6      0018-0023      0.0.6.75  N/A ios-bundled default
2/04   CSMV6      0024-0029      0.0.6.75  N/A ios-bundled default
2/05   CSMV6      0030-0035      0.0.6.75  N/A ios-bundled default
2/06   CSMV6      0036-0041      0.0.6.77  N/A np_6_77.spe
2/07   CSMV6      0042-0047      0.0.6.77  N/A np_6_77.spe
2/08   CSMV6      0048-0053      0.0.6.77  N/A np_6_77.spe
2/09   CSMV6      0054-0059      0.0.6.77  N/A np_6_77.spe
2/10   CSMV6      0060-0065      0.0.6.77  N/A np_6_77.spe
2/11   CSMV6      0066-0071      0.0.6.77  N/A np_6_77.spe
2/12   CSMV6      0072-0077      0.0.6.79  N/A np_6_79.spe
2/13   CSMV6      0078-0083      0.0.6.79  N/A np_6_79.spe
2/14   CSMV6      0084-0089      0.0.6.79  N/A np_6_79.spe
2/15   CSMV6      0090-0095      0.0.6.79  N/A np_6_79.spe
2/16   CSMV6      0096-0101      0.0.6.79  N/A np_6_79.spe
2/17   CSMV6      0102-0107      0.0.6.79  N/A np_6_79.spe

```

Step 4 Enter global configuration mode by typing the **configure** terminal command.

```

AS5400# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
AS5400(config)#

```

You are in global configuration mode when the prompt changes to AS5350(config)# or AS5400(config)#.

Step 5 Enter SPE configuration mode, which is similar to line configuration mode. You can choose to configure a single SPE or range of SPEs by specifying the first and last SPE in the range.

```

AS5400(config)# spe slot/spe

or

AS5400(config)# spe slot/spe slot/spe

```

You are in SPE configuration mode when the prompt changes to AS5350(config-SPE)# or AS5400(config-SPE)#.

Step 6 Specify the SPE firmware file in flash memory to use for the selected SPEs. This is the firmware filename that you obtained in Step 3.

```

AS5400(config-SPE)# firmware location np-spe-upw-1.0.1.2.bin

```

Step 7 Specify when the SPE firmware upgrade is to occur.

```

AS5400(config-SPE)# firmware upgrade busyout | download-maintenance | reboot

```

Step 8 Type the **exit** command to exit SPE config mode.

```

AS5400(config-SPE)# exit

```

```
AS5400(config)#
```

- Step 9** Press the **Enter** key to make the changes and then type **Ctrl-Z** to return to privileged EXEC mode.

```
AS5400(config)# Ctrl-Z
AS5400#
```

- Step 10** Save your changes when ready.

```
AS5400# copy running-config startup-config
```

Using SPE Firmware Bundled with Cisco IOS Software

Use this procedure to update SPE firmware on the SPEs in your gateway if you decide to use the version of SPE firmware bundled with Cisco IOS software instead of the version already mapped to your ports.

To set the SPE firmware mapping to the SPE firmware version bundled with Cisco IOS software, enter the following commands:

- Step 1** Enter the **enable** command.

```
AS5400> enable
```

- Step 2** Enter your password.

```
Password: password
AS5400#
```

You are in privileged EXEC mode when the prompt changes to AS5350# or AS5400#.

- Step 3** Enter global configuration mode by typing the **configure terminal** command.

```
AS5400# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
AS5400(config)#
```

You are in global configuration mode when the prompt changes to AS5350 (config) # or AS5400 (config) #.

- Step 4** Enter SPE configuration mode, which is similar to line configuration mode. You can choose to delete the configuration for a single SPE or range of SPEs by specifying the first and last SPE in the range. The SPE firmware used by the SPEs automatically reverts to the version bundled with the current Cisco IOS image.

```
AS5400(config)# spe slot/spe
```

or

```
AS5400(config)# spe slot/spe slot/spe
```

You are in SPE configuration mode when the prompt changes to AS5350 (config-SPE) # or AS5400 (config-SPE) #.

- Step 5** If the previous download was unbundled firmware, enter the **no** form of the **firmware location** command to revert to the default Cisco IOS bundled SPE firmware:

```
AS5400(config-SPE)# no firmware location
```

- Step 6** Type the **exit** command to exit SPE configuration mode.

```
AS5400(config-SPE)# exit
```

```
AS5400(config)#
```

- Step 7** Press the **Enter** key to verify your command registers, and then type **Ctrl-Z** to return to privileged EXEC mode.

```
AS5400(config)# Ctrl-Z
AS5400#
```

- Step 8** Save your changes when ready.

```
AS5400# copy running-config startup-config
```

This process does not delete any existing SPE firmware that resides in system flash memory in case you later want to revert to it. If you decide to delete the code from system flash memory, remember that *all* files in system flash memory are deleted; therefore, save and restore any important files (for example, the Cisco IOS software image).



Note

If the new Cisco IOS image contains the same SPE firmware as the old one, no new code is downloaded to the SPEs.

Where to Go Next

At this point you can go to these references:

- [Chapter 7, “Configuring Voice over IP”](#) to learn how to configure voice and fax traffic over an IP network.
- [Appendix C, “Comprehensive Configuration Examples.”](#)



Tip

The following publications are useful for those familiar with the Cisco universal gateway products that use MICA modems.

- *Comparing Universal Port SPE Commands to MICA Modem Commands*, available online at http://www.cisco.com/warp/customer/76/nextport_compare.html.
- *Managing Port Services on the Cisco AS5350 Universal Gateway*, available online at http://www.cisco.com/univercd/cc/td/doc/product/access/acs_serv/as5350/sw_conf/alxnxpt.htm.
- *Managing Port Services on the Cisco AS5400 Universal Gateway*, available online at <http://www.cisco.com/univercd/cc/td/doc/product/software/ios121/121newft/121t/121t3/nextport/index.htm>.
- For more advanced configuration topics, see the Cisco IOS software configuration guide, feature modules, and command reference publications *Dial Solutions Configuration Guide* and *Dial Solutions Command Reference Guide* for your software release.



Managing and Troubleshooting the Voice Feature Card

The information in this chapter applies to the Cisco AS5350XM and Cisco AS5400XM universal gateways, and includes the following sections:

- [Viewing DSP Performance Statistics, page 6-1](#)
- [Managing DSPs, page 6-2](#)
- [Troubleshooting, page 6-3](#)
- [Upgrading DSP Firmware, page 6-4](#)
- [Using the AMR-NB Codec, page 6-8](#)
- [Where to Go Next, page 6-9](#)

The high-density packet voice and fax feature card (AS5X-FC) supports up to six high-density packet voice and fax digital signal processor (DSP) modules (AS5X-PVDM2-64), providing scalability from 64 to 384 channels. The voice feature card converts voice and fax calls into IP packets or frames that can be transmitted as voice over IP (VoIP) over a variety of transport technologies on the Cisco AS5350XM or Cisco AS5400XM universal gateways.

You can manage the voice feature card at the slot level, digital signal processor (DSP) level, or channel level by using monitoring and troubleshooting commands. On the Cisco AS5350XM and Cisco AS5400XM universal gateways, the hierarchy designation is *slot/dsp* and *slot/channel*.

You can perform the following functions on a voice feature card:

- General configuration such as busyout, shutdown, or clear
- View statistics and states
- Configure recovery processes
- Upgrade firmware

Viewing DSP Performance Statistics

You can view DSP statistics by using the Cisco IOS software with the universal gateway. To view performance statistics for the voice feature cards, enter one or more of the following commands in privileged EXEC mode (at the `AS5350XM#` prompt).

show voice dsp Commands

- **show voice dsp active**—Displays the statistics for DSPs with active calls.
- **show voice dsp summary**—Displays summary information about the state, call types, and total calls for all the DSPs in a particular slot, a specified DSP, or a specified range of DSPs.

show voice dsp channel Commands

- **show voice dsp channel operational-status**—Displays operational status of a channel or a range of channels. The channels should have active calls at the time the command is executed.
- **show voice dsp channel statistics**—Displays error statistics for a channel or a range of channels. The channels should have active calls at the time the command is executed.
- **show voice dsp channel traffic**—Displays traffic information for a channel or a range of channels. The channels should have active calls at the time the command is executed.

Managing DSPs

This section describes how to manage DSPs by entering DSP configuration mode, including upgrading the DSP firmware, performing busyout on DSPs, and clearing active calls on the DSPs.

DSP Configuration Mode

DSP configuration mode allows you to configure DSPs. You can configure a DSP by specifying a slot and a DSP associated with the slot or, you can choose to configure a range of DSPs by specifying the first and last DSP in the range.

The following example demonstrates how to enter DSP configuration mode:

```
AS5400# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
AS5400(config)# voice dsp slot/dsp slot/dsp
AS5400(config-voicedsp)#
```

DSP Configuration Mode Commands

Use the following commands in DSP configuration mode:

- **firmware location**—Allows you to transfer a specified version of DSP firmware from system flash memory to the DSPs named upon entering DSP configuration mode. For further information on firmware upgrades, see the [“Upgrading DSP Firmware” section on page 6-4](#).
- **firmware upgrade busyout | reboot**—Allows you to specify the upgrade method. Two methods of upgrade are available.
 - *Busyout* (the default) upgrades when all calls are terminated on an DSP.
 - *Reboot* upgrades at the next DSP reset or system reboot.

- **busyout**—Gracefully disables a DSP by waiting for all the active services on the specified DSP to terminate. If there are active calls on the specified DSP, the state of the DSP is changed to *Busiedout*. The DSP is temporarily disabled. Use the **no** form of this command to reenable the DSP.
- **shutdown**—Clears all active calls on the DSP. Calls can no longer be placed on the DSP because the DSP state is changed to *Out-of-Service*. The state of the DSP is reflected in the **show voice dsp** command display. Use the **no** form of the **shutdown** command to reenable the channels on the DSP.

Troubleshooting

This section provides troubleshooting information for your voice feature card. You can view debug information, set automatic recovery options, and upgrade the DSP firmware.

Debugging Commands

Use the following **debug** commands in privileged EXEC mode:

- **debug voice dsp crash-dump**—Displays debugging information for the crash dump feature details. No debug output is displayed until there is one DSP crash. When the crash dump feature is turned on, the detailed debug messages are displayed.
- **debug dsp-resource-manager flex**—Displays debugging information about errors downloading the DSP firmware to the DSP, and DSP allocation statistics, errors, and functions.
- **debug voice hpi**—Displays debugging information for Host Port Interface (HPI) message events, which are used to communicate with DSPs.

DSP Recovery

Automatic recovery (removal from service and reloading of DSP firmware) is enabled by default for the voice feature card.

You can disable automatic recovery using the **voice dsp recovery disabled** command in configuration mode.

Clear a DSP

Use the **clear voice dsp** command in privileged EXEC mode to manually restart a DSP. This command can be used to reset a DSP. This command causes the firmware that is configured for that DSP to be downloaded to the specified DSP or range of DSPs. This command can be executed regardless of the state of the DSPs. All active channels running on the DSP are prematurely terminated.

The following example shows a cold start on DSP 1 on slot 1:

```
AS5400# clear voice dsp 1/1
AS5400# Are you sure you want to clear voice dsp 1/1 (Y/N)? Y
```

Upgrading DSP Firmware

With new systems, Cisco loads a Cisco IOS software-compatible version of DSP firmware into each DSP. A map of the version or versions of DSP firmware copied to RAM for each DSP is stored in NVRAM so that it is retained over power cycles.



Note

You do not have to take any action to use the bundled version of DSP firmware with new systems.

You can acquire new DSP firmware from the Cisco Software Center in one of two ways:

- **Bundled** in regular Cisco IOS releases. See the [“Using DSP Firmware Bundled with Cisco IOS Software” section on page 6-7](#) for details.
- **Unbundled** from Cisco.com. This is a more up-to-date version of DSP firmware released before the next Cisco IOS release, or a special version of DSP firmware shipped with a new board. See the [“Using Unbundled DSP Firmware” section on page 6-5](#) for details.

When you have the new firmware, you can configure different firmware versions onto individual DSPs or ranges of DSPs on a voice feature card. You can also configure different upgrade methods by using the **firmware upgrade** command.



Note

Do not store more than nine DSP firmware images in system flash memory. If you store more than nine DSP firmware images in system flash memory, the **firmware upgrade** command will fail. You will need to delete at least one firmware image from the system flash memory and reboot the gateway to use one of the remaining unbundled DSP firmware images.

Important Upgrade Commands

There are several commands you use to upgrade DSP firmware. For examples on using the commands, see the [“Using Unbundled DSP Firmware” section on page 6-5](#) and the [“Using DSP Firmware Bundled with Cisco IOS Software” section on page 6-7](#).

- Use the **copy tftp flash filename** command to copy any version of DSP firmware (no matter how it is obtained) into system flash memory. You can store several versions of the DSP firmware in system flash memory under different filenames.
- Use the **firmware location** command in DSP configuration mode to transfer a specified version of DSP firmware from system flash memory to the DSPs specified in DSP configuration mode.
- Use the **firmware upgrade busyout | reboot** command in DSP configuration mode to configure when the file named in the **firmware location** command will be loaded to the DSPs. Two methods of upgrade are available:
 - *Busyout* (the default) upgrades when all calls are terminated on an DSP.
 - *Reboot* upgrades at the next DSP reset or system reboot.



Note

The **copy ios-bundled** command is not necessary with the voice feature card. By default, the version of DSP firmware bundled with the Cisco IOS software release is transferred to all DSPs that are not specifically configured for a different DSP firmware file.

Displaying DSP Firmware Versions

Use the **show voice dsp version** command to list the versions of DSP firmware running on the DSPs, residing in system flash memory, and bundled with Cisco IOS software. This helps you decide whether you need to change the version running on the DSPs.



Note

The version number displayed may not match the filename for a short period of time while a range of DSPs is in the process of downloading new firmware. The version number is updated at the beginning of the upgrade process, whereas the filename is updated upon completion of the process. This is done intentionally to enable you to recognize the upgrade process from the **show voice dsp version** output.

```
AS5400# show voice dsp version
```

```
IOS-Bundled Default          Version      Firmware-Type
=====
system:/bundled_fw_image    7.3.0       c5510

On-Flash Dspware-Filename   Version      Firmware-Type
=====
flash:dsp_c5510_flex.rbf    4.4.5       c5510
flash:big.rbf               4.5.985x    c5510

DSP#      Type      Version      Filename
5/1       C5510    4.4.5        flash:dsp_c5510_flex.rbf
5/2       C5510    7.3.0        system:/bundled_fw_image
5/3       C5510    7.3.0        system:/bundled_fw_image
5/4       C5510    7.3.0        system:/bundled_fw_image
5/5       C5510    7.3.0        system:/bundled_fw_image
```

Using Unbundled DSP Firmware

Use this procedure to configure DSPs to use unbundled DSP firmware. For more information about unbundled DSP firmware releases for the voice feature card, see the [“Using the AMR-NB Codec” section on page 6-8](#).



Note

By default, the version of DSP firmware bundled with the Cisco IOS software release is transferred to all DSPs that are not specifically configured for a different DSP firmware file. This procedure is only necessary if you are using DSP firmware that is not bundled with the Cisco IOS software release.

Step 1 Enter the **enable** command.

```
AS5400> enable
```

Step 2 Enter your password.

```
Password: password
AS5400#
```

You are in privileged EXEC mode when the prompt changes to AS5350# or AS5400#.

Step 3 Display DSP firmware versions to obtain the filename of the firmware on flash memory.



Note The version number and filename may not match until the upgrade is complete.

```
AS5400# show voice dsp version

IOS-Bundled Default          Version      Firmware-Type
=====
system:/bundled_fw_image    7.0.200x   c5510

On-Flash Dspware-Filename   Version      Firmware-Type
=====
No voice dsp in the slot range 1 to 7
```

Step 4 Enter global configuration mode by typing the **configure terminal** command.

```
AS5400# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
AS5400(config)#
```

You are in global configuration mode when the prompt changes to AS5350(config)# or AS5400(config)#.

Step 5 Enter DSP configuration mode. You can choose to configure a single DSP or range of DSPs by specifying the first and last DSP in the range.

```
AS5400(config)# voice dsp slot/dsp
```

or

```
AS5400(config)# voice dsp slot/dsp slot/dsp
```

You are in DSP configuration mode when the prompt changes to AS5350(config-voicedsp)#.

Step 6 Specify the DSP firmware file in flash memory to use for the selected DSPs. This is the firmware filename that you obtained in Step 3.

```
AS5400(config-voicedsp)# firmware location vfc-dsp-upw-7.0.1.2.bin
```

Step 7 Specify when the DSP firmware upgrade is to occur.

```
AS5400(config-voicedsp)# firmware upgrade busyout | reboot
```

Step 8 Type the **exit** command to exit DSP config mode.

```
AS5400(config-voicedsp)# exit
AS5400(config)#
```

Step 9 Press the **Enter** key to make the changes, and then type **Ctrl-Z** to return to privileged EXEC mode.

```
AS5400(config)# Ctrl-Z
AS5400#
```

Step 10 Save your changes.

```
AS5400# copy running-config startup-config
```

Using DSP Firmware Bundled with Cisco IOS Software

Use this procedure to update DSP firmware on the DSPs in your gateway if the DSPs are currently configured with any non-bundled DSP firmware version.



Note

This process does not delete any existing DSP firmware that resides in system flash memory in case you later want to revert to it. If you decide to delete the code from system flash memory, remember that *all* files in system flash memory are deleted; therefore, save and restore any important files (for example, the Cisco IOS software image).



Note

If the new Cisco IOS image contains the same DSP firmware as the old one, no new code is downloaded to the DSPs.

To set the DSP firmware to the DSP firmware version bundled with Cisco IOS software, enter the following commands:

Step 1 Enter the **enable** command.

```
AS5400> enable
```

Step 2 Enter your password.

```
Password: password
AS5400#
```

You are in privileged EXEC mode when the prompt changes to AS5350# or AS5400#.

Step 3 Enter global configuration mode by typing the **configure terminal** command.

```
AS5400# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
AS5400(config)#
```

You are in global configuration mode when the prompt changes to AS5350 (config) # or AS5400 (config) #.

Step 4 Enter DSP configuration mode. You can either delete the configuration for a single DSP, or a range of DSPs by specifying the first and last DSP in the range. The DSP firmware used by the DSPs automatically reverts to the version bundled with the current Cisco IOS image.

```
AS5400(config)# voice dsp slot/dsp
```

or

```
AS5400(config)# voice dsp slot/dsp slot/dsp
```

You are in DSP configuration mode when the prompt changes to AS5400 (config-voicedsp) #.

Step 5 If the previous download was unbundled firmware, enter the **no** form of the **firmware location** command to revert to the default Cisco IOS bundled DSP firmware:

```
AS5400(config-voicedsp)# no firmware location
```

Step 6 Type the **exit** command to exit DSP configuration mode.

```
AS5400(config-voicedsp)# exit
AS5400(config)#
```

- Step 7** Press the **Enter** key to verify your command registers, and then type **Ctrl-Z** to return to privileged EXEC mode.

```
AS5400(config)# Ctrl-Z
AS5400#
```

- Step 8** Save your changes.

```
AS5400# copy running-config startup-config
```

Using the AMR-NB Codec



Note

You must buy a license to access the DSPWare that supports the AMR-NB codec. It is recommended that you purchase a Cisco SMARTnet contract in order to streamline the process of getting the AMR-NB codec DSPWare. When obtaining your license, use the following part numbers:

FR535XM-AMR-LIC for the Cisco AS5350XM

FR54XM-AMR-LIC for the Cisco AS5400XM

For more information, contact your Cisco representative or visit the following Cisco.com website to obtain a Cisco SMARTnet contract:

http://www.cisco.com/en/US/partner/products/svcs/ps3034/ps2827/ps2978/serv_datasheet09186a0080092491.html

The Adaptive Multirate Narrow Band (AMR-NB) codec is a high complexity multimode codec that supports eight narrowband speech encoding modes with bit rates between 4.75 and 12.2 kbps. The sampling frequency used in AMR-NB is 8000 Hz and the speech encoding is performed on 20 ms speech frames. Therefore, each encoded AMR-NB speech frame represents 160 samples of the original speech.

The AMR-NB codec was originally developed and standardized by the European Telecommunications Standards Institute (ETSI) for Groupe Speciale Mobile (GSM) cellular systems, and chosen by the Third Generation Partnership Project (3GPP) as the mandatory codec for third generation (3G) cellular systems.

[Table 1](#) contains codec mode and bit rate information for the AMR codec.

Table 1 AMR Codec Modes and Bit Rates

Codec Mode	Bit Rate (kbps)
0	4.75
1	5.15
2	5.90
3	6.70
4	7.40
5	7.95
6	10.2
7	12.2
8 ¹	1.80

1. Used for Silence Indication Detection(SID) frames.

How the AMR-NB Codec Works

The multirate encoding (or multimode) capability of AMR-NB is designed for preserving high speech quality under a wide range of transmission conditions. Unlike other codecs, the AMR-NB codec can adapt to different bit rates (see [Table 1](#)) based on channel conditions during the call.

To perform mode adaptation, the decoder (speech receiver) sends a signal to the encoder (speech sender) to indicate which new mode it prefers. This mode-change signal is called codec mode request (CMR). Because speech is sent in both directions between the two ends in most sessions, the mode requests from the decoder at one end to the encoder at the other end are sent in a piggyback form over the speech frames in the reverse direction; there is no out-of-band signaling needed for sending CMRs. The Cisco AS5400XM and Cisco AS5350XM cannot initiate CMRs and received CMRs can be processed. For more information about AMR-NB codecs, see RFC3267.

Restrictions for the AMR-NB Codec

The following message is displayed when an upgrade takes place if a version of DSPWare other than the recommended version is uploaded:

```
WARNING: Recommended GSM AMR-NB supported DSPWare for this Cisco IOS image is X.Y.Z Where X.Y.Z changes depending on the Cisco IOS image that is used by the customer.
```

This warning has no impact on the firmware upgrade and calls can be brought up with a version of DSPWare that is not the recommended version.

Where to Go Next

At this point you can go to these references:

- [Chapter 7, “Configuring Voice over IP,”](#) to learn how to configure voice and fax traffic over an IP network.
- [Appendix C, “Comprehensive Configuration Examples”](#)

**Tip**

The following publications are available on the Documentation DVD, or on the World Wide Web from the Cisco home page.

- The *High-Density Packet Voice Feature Card for Cisco AS5350XM and AS5400XM Universal Gateways* document, available online at:
http://www.cisco.com/en/US/products/ps6706/products_feature_guide09186a008060df15.html
- For more advanced configuration topics, see the Cisco IOS software configuration guide, feature modules, and command reference publications *Dial Solutions Configuration Guide* and *Dial Solutions Command Reference Guide* for your Cisco IOS release.



Configuring Voice over IP

The information in this chapter applies to the Cisco AS5350XM and Cisco AS5400XM universal gateways.

Voice over IP (VoIP) technology enables voice-capable routers and switches to transport packetized live voice traffic such as telephone calls over IP data intranetworks or internetworks rather than public switched telephone networks (PSTN) or private TDM (PBX) networks. VoIP thus enables toll bypass, remote PBX presence over WANs, unified voice and data trunking, and plain old telephone service (POTS)-Internet telephony gateways. VoIP enables more efficient and full use of your existing IP data network, both reducing transmission costs and possibly your need to support dual (voice and data) networks.

Routers and switches such as the Cisco AS5350XM and Cisco AS5400XM universal gateways can handle origination, transport, and termination of VoIP traffic. They digitize analog voice signals, compress them, package them into a series of discrete packets, and transport them interleaved with data packets. They can transmit VoIP packets to both VoIP and non-VoIP destinations, and can receive both VoIP and nonVoIP calls. When data lines are busy, they can spill traffic onto the PSTN.

To ensure acceptable quality of service (QoS) for your voice users, it is important that you configure your gateway carefully and monitor its performance vigilantly—to ensure, for voice traffic, priority service with minimal loss and delay. Unlike most other types of data, voice is intolerant of almost any form of loss or delay. Users cannot wait for a destination device to reorder packets and request that the sending device retransmit any that are missing, as it does for most other data types.

To configure basic VoIP, in general you need to do the following:

- Configure signaling on voice ports
- Configure dial peers

You might also need to do the following:

- Configure voice QoS features
- Configure Frame Relay for VoIP
- Configure the gateway to distinguish between voice and modem calls (necessary when the network-access server supports both modem dialup and VoIP users on the same POTS interface)
- Optimize dial-peer and network-interface configurations
- Configure VoIP for Microsoft NetMeeting

This chapter briefly introduces the subject of configuring VoIP and describes the first few configuration tasks. It describes, at a high level, some of the voice QoS features that you can enable. Most important, it points you to other references from which you can gain a broader and deeper look at the subject.

This chapter describes the following topics:

- [VoIP Basics, page 7-2](#)
- [Configuring Basic VoIP, page 7-5](#)
- [Voice QoS Basics, page 7-15](#)
- [Enabling QoS Features for VoIP, page 7-16](#)
- [Additional Resources, page 7-21](#)



Tip

It is critical that you consult the additional references cited throughout and at the end of the chapter before you configure VoIP. These plus additional references throughout the Cisco website (search for *configure voip* to locate the most current references) provide the information that you need to optimize settings. The more information that you have at your disposal, the greater your probability of success, as measured by cost savings and user acceptance.



Note

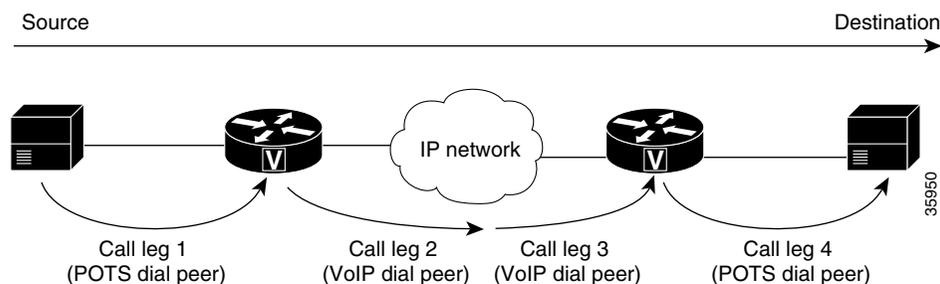
Although VoIP technology is primarily software-based, it requires that you install a universal port or voice feature card into the appropriate slot of your Cisco AS5350XM or Cisco AS5400XM universal gateway. The number of ports or channels available for sending VoIP data depends on the capacity of your card. For more information, see [Chapter 5, “Managing and Troubleshooting the Universal Port and Dial-Only Feature Cards”](#) or [Chapter 6, “Managing and Troubleshooting the Voice Feature Card.”](#)

VoIP Basics

Before you configure VoIP on your gateway, it might help to understand at a high level what happens when you place a VoIP call. Think of each event in a call flow as occurring on one of the several “legs” of a call, as shown in the following typical scenario. (See [Figure 7-1.](#)) Other scenarios are possible, of course, including ones where the call destination is an IP phone and the call never leaves the IP network.

- Call-leg 1: Originating device to originating gateway
- Call-leg 2: Originating gateway into the IP network
- Call-leg 3: IP network to destination gateway
- Call-leg 4: Destination gateway to destination device

Figure 7-1 Call Legs



Legs connecting a local device (typically a phone, fax machine, or PBX) to a gateway are called *POTS* (plain old telephone service) legs. Legs connecting a gateway to the IP network are called *VoIP* legs. A POTS or VoIP leg is either *inbound* or *outbound*, from the perspective of the associated gateway.

Table 7-1 describes the different types of call legs.

Table 7-1 Call Legs

Call Leg Source	Call Leg Destination	Call Leg Type
Originating device	Originating gateway	Inbound POTS
Originating gateway	IP network	Outbound VoIP
IP network	Destination gateway	Inbound VoIP
Destination gateway	Destination device	Outbound POTS

A gateway uses two call legs—an inbound POTS with an outbound VoIP or an inbound VoIP with an outbound POTS—to create an end-to-end call through the gateway. A call that passes through both an originating gateway and a destination gateway has four call legs.

Call Flow

Table 7-2 and Table 7-3 detail the general call flow from the perspective of an originating and destination gateway respectively.

Table 7-2 VoIP Call Flow, Originating Gateway View

Event	Leg Type
User sends dialed digits using public switched telephone network to gateway.	Inbound POTS
Gateway does the following: <ul style="list-style-type: none"> Processes information (maps dialed digits, according to information stored in dial-peer configuration tables, either to an IP host that connects directly to the destination gateway or to a PBX at the destination that can complete the call). Initiates H.323 session across network. Processes voice signals and sends packets over network. As appropriate, sends call-progress and other in-band signals. Ends session. 	Outbound VoIP

Table 7-3 VoIP Call Flow, Destination Gateway View

Event	Leg Type
Gateway receives dialed digits.	Inbound VoIP
Gateway does the following: <ul style="list-style-type: none"> Processes information (maps dialed digits, according to information stored in dial-peer configuration tables, to a destination device). Gateway participates in H.323 session across network. Processes voice signals and sends packets over network. As appropriate, sends call-progress and other in-band signals. Ends session. 	Outbound POTS plus inbound VoIP

Dial Peers

Each kind of call leg into or out of a gateway—inbound POTS, outbound VoIP, inbound VoIP, and outbound POTS—must have assigned to it a set of allowable call scenarios, called dial peers.

- POTS dial peers associate gateway ports with destination endpoints. You need a POTS dial peer for every port-to-endpoint association.
- VoIP dial peers associate destination phone numbers with IP addresses or other means to send packets to that destination. You need a VoIP dial peer for every set of destination endpoints.

A dial peer is, essentially, a single static route within a routing table. A collection of dial peers constitutes a dial plan.

Syntax

A POTS dial peer has the following syntax:

```
dial-peer voice tag pots
  destination-pattern number
  port port#
  other configurable options
```

where *tag* is a numeric value of local significance only, *number* is the full E.164 phone number of the associated endpoint, and *port#* is the voice port in the gateway through which the call is transmitted once a destination pattern is matched.

A VoIP dial peer has the following syntax:

```
dial-peer voip tag voip
  destination-pattern number
  session target data address
  other configurable options
```

where *tag* is a numeric value of local significance only, *number* is the full E.164 phone number of the associated endpoint, and *data address* is the address to which the gateway sends a call whose destination pattern matches the one in the peer.

Matching Rules

A gateway redirects an incoming call along the most appropriate outbound leg. It chooses the most appropriate leg by first finding the POTS or VoIP (depending on call direction) dial peer whose destination pattern matches the call's dialed digits. For outbound VoIP legs, it chooses the longest matching dial peer. If more than one such match exists, it checks whether preferences have been assigned those peers and chooses the peer with the lowest preference level.

Example

Let us say, for a very simple example (your implementation will be far more complex), that a company has offices in San Jose and Newark. Extensions in the San Jose office are in the range 5000 to 5999, those in the Newark office in the range 6000 to 6999. A caller at San Jose extension 5000 wants to call Newark extension 6000. [Table 7-4](#) shows the dial peers needed to make this connection:

Table 7-4 Sample Dial Peers

Dial-Peer (Tag) Number	Dial Peer	Function
San Jose Gateway		
1	dial-peer voice 1 pots destination-pattern 5000 port 1/0:1	Associates San Jose extension 5000 with San Jose gateway port 1/0:1.
2	dial-peer voice 2 voip destination-pattern 6... session target ipv4:172.16.1.1	Transmits San Jose's Newark-bound calls (extensions 6000–6999) to the gateway in Newark whose IP address is 172.16.1.1.
Newark Gateway		
3	dial-peer voice 3 voip destination-pattern 5... session target ipv4:172.19.1.1	Transmits Newark's San Jose-bound calls (extensions 5000–5999) to the gateway in San Jose whose IP address is 172.19.1.1.
4	dial-peer voice 4 pots destination-pattern 6000 port 1/0:3	Associates Newark extension 6000 with Newark gateway port 1/0:3.

When the San Jose caller at extension 5000 dials the digits 6000, the originating gateway in San Jose does the following:

1. Receives, through port 1/0:1 to which extension 5000 connects, the dialed digits 6000.
2. Searches its VoIP dial peers until it finds dial-peer 2, whose destination pattern best matches the dialed digits.
3. Sends the dialed digits through the IP network to the gateway specified by dial-peer 2's session target (172.16.1.1).

The destination gateway in Newark now does the following:

1. Receives the dialed digits through the IP network.
2. Searches its POTS dial peers until it finds dial-peer 4, whose destination pattern matches the dialed digits.
3. Sends the call out the port specified by that dial peer (port 1/0:3, which connects to extension 6000).

In this west-to-east scenario, dial peers 2 and 4 are used, in that order. If Newark extension 6000 were to call San Jose extension 5000, dial peers 3 and 1 would be used, in that order.

Configuring Basic VoIP

Configuring basic VoIP involves the following:

- [Perform Preconfiguration Tasks](#)
- [Configure Signaling on Voice Ports](#)
- [Configure Dial Peers](#)
- [Configuring Echo Cancellation on the Voice Feature Card](#)
- [Configuring Nextport Echo Canceller Control \(optional\)](#)

Perform Preconfiguration Tasks

Before you configure your gateway for VoIP, complete the following tasks. See the earlier chapters in this book and the references at the end of this chapter for the additional information you need to do so.

-
- Step 1** Establish a working IP network in which delay (as measured by ping tests) and jitter are minimized.
- Step 2** Install a universal port or voice feature card into the appropriate slot of your gateway. The number of ports or channels available for sending VoIP data depends on the capacity of the card. For more information, see [Chapter 5, “Managing and Troubleshooting the Universal Port and Dial-Only Feature Cards”](#) or [Chapter 6, “Managing and Troubleshooting the Voice Feature Card.”](#)
- Step 3** Complete basic gateway configuration. For more information, see [Chapter 3, “Basic Configuration Using the Command-Line Interface.”](#)
- Step 4** Formulate the beginning of a dial plan that includes the following:
- Logical network diagram showing voice ports and components to which they connect, including phones, fax machines, PBX or key systems, other voice devices that require connection, and voice-enabled routers
 - Connection details, including physical interfaces (T1, analog, and so forth), relevant LAN and WAN ports, and all voice ports; for each WAN, type (Frame Relay, PPP, and so forth); for Frame Relay, relevant PVCs and link-access rates
 - Phone numbers or extensions for each voice port, logically laid out and consistent with existing private dial plans and external dialing schemes
- Step 5** Establish a working telephony network based on that dial plan.
- Step 6** Integrate the dial plan and telephony network into your existing IP network topology. The following is recommended:
- Make routing or dialing transparent to users by, for example, avoiding such inconveniences as secondary dial tones.
 - Contact your PBX vendor to learn how to reconfigure PBX interfaces.
-

Configure Signaling on Voice Ports

The Cisco AS5350XM and Cisco AS5400XM universal gateways process and manage digital voice calls on the universal port or voice feature card. They support voice configuration on channelized T1, E1, and T3 trunk interfaces.

Your universal gateway supports ISDN PRI, E1 R2, and T1 CAS digital signaling. Configure your voice ports according to signaling type. Set parameters as needed for input gain, output attenuation, echo cancellation, various timeouts, and translation rules. Defaults are generally adequate, but may need to be tweaked for some networks.



Note

For ISDN configurations, voice ports (with serial interfaces acting as D channels) are created automatically when you configure an ISDN PRI group. Before configuring your voice ports, configure both B and D channels as described in [Chapter 3, “Basic Configuration Using the Command-Line Interface.”](#)

**Tip**

For more information, see the following online references:

- *Voice over IP for the Cisco AS5300*, available online at <http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120t/120t3/voip5300/>
- *Voice Over IP for the Cisco 3600 Series Commands*, available online at http://www.cisco.com/univercd/cc/td/doc/product/software/ios113ed/113t/113t_1/voip/commands.htm
- *E1 R2 Signaling Configuration and Troubleshooting*, available online at <http://www.cisco.com/warp/public/788/signalling/e1r2config.html>

ISDN PRI Signaling

Signaling for ISDN PRI VoIP is handled by ISDN PRI group configuration. If you have ISDN PRI voice ports, be sure to complete these tasks:

- “Configuring ISDN PRI” section on page 3-12
- “Configuring the D Channels for ISDN Signaling” section on page 3-22
- “Configuring ISDN NFAS on Channelized T1 PRI Groups” section on page 4-4

Ensure that multiframes are established on the serial interfaces (acting as the D channel). Then set parameters as needed for input gain, output attenuation, echo cancellation, various timeouts, and translation rules.

E1 R2 Signaling

R2 is an international signaling standard for channelized E1 networks used in Europe, Asia, and South America, equivalent to channelized T1 signaling in North America. There are two elements to R2 signaling:

- Line signaling (supervision), including R2 digital, R2 analog, and R2 pulse
- R2 interregister signaling (call-setup control), including compelled, noncompelled, and semi-compelled

If you have ISDN PRI voice ports, be sure to complete the “Configuring E1 R2 Signaling” section on page 4-6. Configure signaling types and, if necessary, set parameters unique to specific countries.

T1 CAS Signaling

Channel-associated signaling (CAS) occurs in-band within the data channel, rather than on a separate signaling channel as is the case (on the D channel) with ISDN PRI. For T1 CAS, specify parameters such as frame type and line code.

Configure Dial Peers

Your next step in preparing to set up dial peers is to determine the configurable options that you want to enable.

Configurable Options

Configurable options are the attributes to be applied to calls handled using that dial peer. These typically include, at a minimum, required quality of service, codec for voice encoding, and whether voice-activity detection is to be enabled. The following attributes, for example, are typical in a VoIP dial peer:

```
req-qos best-effort
codec g711ulaw
vad
```

You have many options and great flexibility in configuring dial peers. [Table 7-5](#) and [Table 7-6](#) show the most common configurable options that you can enable in POTS and VoIP dial peers, respectively, from config or config-dial-peer mode.

Table 7-5 POTS Dial-Peer Configuration Commands

Command	Purpose
answer-address	Sets call destination number.
application	Sets selected application.
calling-number	Sets calling number (for fgd_eana signaling only).
default	Sets a command to its defaults.
destination-pattern	Sets full E.164 telephone number.
digit-strip	Strips digits from the POTS dialed number.
direct-inward-dial	Sets called number as final call destination.
exit	Exits dial-peer configuration mode.
forward-digits	Configures the destination digits ahead of this dial peer.
huntstop	Stops hunting on dial peers.
incoming	Sets incoming called number.
info-digits	Prepends info digits to the calling number.
information-type	Sets information type for dial peer.
max-conn	Sets maximum connections per peer; “no” sets to unlimited.
no	Negates a command or sets its defaults.
numbering-type	Sets calling/called party numbering type.
port	Sets voice port associated with the peer.
preference	Configures preference order of the peer.
prefix	Sets prefix to be dialed before the dialed number.
progress_ind	Indicates call progress.
register	Registers E.164 number of this peer with gatekeeper.
resource	Sets resource allocation policy.
session	Sets session [target protocol transport] for this peer.
shutdown	Changes administrator state of this peer to down.
translate-outgoing	Sets translation rule.

Table 7-6 VoIP Dial-Peer Configuration Commands

Command	Purpose
acc-qos	Sets minimally acceptable quality of service for calls to this peer.
answer-address	Sets call destination number.
application	Sets selected application.
clid_restrict	Restricts display of caller ID.
codec	Sets codec for calls to this peer.
default	Set a command to its defaults.
destination-pattern	Sets full E.164 telephone number.
dtmf-relay	Transports DTMF digits across IP link.
exit	Exits dial-peer configuration mode.
expect-factor	Sets expectation factor for voice quality.
fax	Configures fax service.
fax-relay	Sets fax-relay options.
huntstop	Stops hunting on dial peers.
icpif	Sets calculated planning-impairment factor.
incoming	Sets incoming called number.
information-type	Sets information type for dial peer.
ip	Sets IP packet options.
max-conn	Sets maximum connections per peer; “no” sets to unlimited.
max-redirects	Sets maximum redirects for this peer.
no	Negates a command or sets its defaults.
numbering-type	Sets calling or called party numbering type.
preference	Configures preference order of the peer.
req-qos	Sets required quality of service for calls to this peer.
roaming	Sets use of roaming server.
session	Sets session [target protocol transport] for this peer.
settle-call	Sets use of settlement server.
shutdown	Changes admin state of this peer to down (no->up).
snmp	Modifies SNMP voice-peer parameters.
tech-prefix	Sets H.323 gateway technology prefix.
translate-outgoing	Sets translation rule.
vad	Sets use of Voice Activity Detection.
voice-class	Sets dial-peer voice-class control parameters.

Here are just a few of the things that you can do with these commands (which, as mentioned previously, you set from config or config-dial-peer mode):

- Configure destination patterns with wildcards and other operators.

Example: Use 6... to denote a 4-digit number beginning with 6.

- Define fixed-length or variable-length destination patterns.

Example: Use 6... to denote a 4-digit number beginning with 6; use 9E to denote a variable-length number beginning with 9.

- Specify that a prefix be added to calls on certain outgoing POTS call legs.

Example: Prepend 9 to calls that pass through a PBX requiring 9 to access an outside line; replace prefixes that are stripped by a dial peer because they match the destination pattern.

- Specify that certain dialed digits be expanded.

Example: Expand local 5-digit extensions beginning with 7 to the full E.164 number 1-408-7xxx.

- Create a hunt group to handle inbound calls.

Example: Establish multiple dial peers, each for a different voice port, and each containing the same destination pattern; the gateway directs inbound calls to the voice ports in sequence until it reaches one that is not busy.

- Set up preferences for routing outbound calls.

Example: Assign preference 1 to dial-peer voice 1, which directs outbound calls over the IP network; assign preference 2 to dial-peer voice 2, which directs calls over the PSTN; the gateway, looking for the longest exact match, finds both dial peers and then uses preference as a tie breaker among those matches.



Tip

For more information, see *Voice over IP for the Cisco AS5300*, available online at <http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120t/120t3/voip5300/>

Dial-Peer Configuration Table

The next step in creating dial peers is to create a dial-peer configuration table. Under the following headings, show data for all of your gateways and associated dial peers. [Table 7-7](#) is for the simple gateway-to-gateway scenario described earlier; your own will be far more complex.

Table 7-7 *Dial-Peer Configuration Table*

Dial-Peer Tag	Extension	Destination Pattern	Type	Voice Port	Session Target	Codec	QoS
San Jose Gateway							
1	5000	5000	pots	1/0:1	—	—	—
2	—	6...	voip	—	172.16.1.1	6.711	best effort
Newark Gateway							
3	—	5...	voip	—	172.19.1.1	6.711	best effort
4	6000	6000	pots	1/0:3	—	—	—



Tip

Consult the references at the end of the chapter before you create a dial-peer configuration table. See also *Voice over IP for the Cisco AS5300*, available online at <http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120t/120t3/voip5300/>

Configuring Echo Cancellation on the Voice Feature Card

The **echo-cancel enable** command enables cancellation of voice that is sent out the interface and received back on the same interface; sound that is received back in this manner is perceived by the listener as an echo. Disabling echo cancellation might cause the remote side of a connection to hear an echo. Because echo cancellation is an invasive process that can minimally degrade voice quality, this command should be disabled if it is not needed.

For the voice feature card, software echo cancellation is the default configuration—G.168-compliant echo cancellation is enabled by default with a coverage of 64 milliseconds. Hardware echo cancellation is not available.

Configure

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	voice-port slot/port Example: Router(config)# voice-port 2/1	Enters voice-port configuration mode and identifies a slot and port for configuration parameters.
Step 4	echo-cancel enable Example: Router(config-voiceport)# echo-cancel enable	Enables the cancellation of voice that is sent out the interface and received back on the same interface.
Step 5	echo-cancel coverage {24 32 48 64} Example: Router (config-voiceport)# echo-cancel coverage 24	Adjusts the echo canceller by the specified number of milliseconds. <ul style="list-style-type: none"> The default is 64.
Step 6	exit Example: Router(config-voiceport)# exit	Exits voice-port configuration mode and returns to global configuration mode.

Configuring Nextport Echo Canceller Control (optional)

The AS5350XM and AS5400XM universal gateways can detect 2100Hz tones, received in G.711 encoded VoIP packets. Customers can enable Nextport Voicecap to control the echo canceller when 2100-Hz tones are received in G.711 encoded VoIP packets from either the PSTN or IP side of the network.


Note

Nextport control over the echo canceller is only possible in G.711 codec modes.


Note

We do not recommend that you enable Nextport control over the echo canceller in conjunction with modem-pass-through.

You enable IP tone detection and Nextport control over the echo canceller using CLI commands, but you must first set the following two Voicecap parameters to enable these features:

- `v51 = 32769`
This setting enables IP side tone detection/notification and allows Nextport to disable the nonlinear processor (NLP) or the echo canceller upon reception of 2100-Hz answer tones from the IP side. This setting is required in Cisco IOS Release 12.3T and later.
- `v2 = 512`
This setting enables detection of the 250 millisecond silence. This setting is optional. When this setting is used in conjunction with the `v51 = 32769` setting, Nextport restores the echo canceller to its original state after it detects the 250-millisecond silence.

The following example shows how to enable Nextport control over the echo canceller by creating a Voicecap entry and applying it to the voice port.

1. Create Voicecap entries by entering the following CLI command:

Syntax:

```
router(config)# voicecap entry <name> <parameter list>
```

Example:

```
router(config)# voicecap entry npecho_ctrl v2=512 v51=32769
```

2. Apply the Voicecap entries to the voice port by entering the following CLI command:

Syntax:

```
router(config)# voicecap configure <name>
```

Example:

```
router(config)# voicecap configure npecho_ctrl
```

The following example shows the complete procedure for creating and applying Voicecap:

```
router(config)# voicecap entry npecho_ctrl v2=512 v51=32769
router(config)# voice-port 3/0
router(config-voiceport)# voicecap configure npecho_ctrl
router(config-voiceport)# end
```


Note

The Voicecap must be applied to the voice port.

The Cisco IOS CLI **show** command does not display the current echo state. However, you can display the EST trace messages that show the tone detections and the resultant echo operations if you issue *debug trace module f080 0010 x/y/z*. Nextport enables and disables the nonlinear processor (NLP) and the echo canceller based on reception of 2100-Hz answer tones from the IP side or PSTN side and generates EST trace messages for each tone detected and its echo operation. Nextport also detects the 250 milliseconds of silence and generates EST trace messages to indicate such detection and to indicate that the echo state has been restored.

To display the EST trace messages, issue *debug trace module f080 0010 x/y/z* as follows:

```
router# debug trace module f080 0010 s/d/m
```

where:

- s = slot
- d = dial feature card
- m = module number

When the default configuration values for Index 51 and Index 52 are used, IP tone detection and notification are disabled, and all existing features continue to function as normal.

The following example shows EST trace messages collected from the IOS console:

```
5350-torpedo#
*Apr 26 21:40:51.735: 00:00:14: Port Trace Event:
*Apr 26 21:40:51.735: Port : 3/00
*Apr 26 21:40:51.735: Address : 0x3000000
*Apr 26 21:40:51.735: Trace Event: 0x2
*Apr 26 21:40:51.735: Data Format: ASCII
*Apr 26 21:40:51.735: Data Len : 56
*Apr 26 21:40:51.735: Data : Session 0x0144 Received Early ANS tone 0x01 from
IP side
*Apr 26 21:40:51.735: 00:00:14: Port Trace Event:
*Apr 26 21:40:51.735: Port : 3/00
*Apr 26 21:40:51.735: Address : 0x3000000
5350-torpedo# Address : 0x3000000
*Apr 26 21:40:51.735: Trace Event: 0x2
*Apr 26 21:40:51.735: Data Format: ASCII
*Apr 26 21:40:51.735: Data Len : 63
*Apr 26 21:40:51.735: Data : Session 0x0144 Received Tone Off nt f for code 0x01
from IP side
*Apr 26 21:40:51.735: 00:00:14: Port Trace Event:
*Apr 26 21:40:51.735: Port : 3/00
*Apr 26 21:40:51.735: Address : 0x3000000
*Apr 26 21:40:51.735: Trace Event: 0x2
*Apr 26 21:40:51.735: Data Format: ASCII
5350-torpedo# *Apr 26 21:40:51.735: Data Len : 45
*Apr 26 21:40:51.735: Data : Session 0x0144 Received ANS tone 0x03 from IP
*Apr 26 21:40:51.735: 00:00:14: Port Trace Event:
*Apr 26 21:40:51.735: Port : 3/00
*Apr 26 21:40:51.735: Address : 0x3000000
*Apr 26 21:40:51.735: Trace Event: 0x2
*Apr 26 21:40:51.735: Data Format: ASCII
*Apr 26 21:40:51.735: Data Len : 47
*Apr 26 21:40:51.735: Data : Session 0x0144 Non-linear Processor Is Disabled
*Apr
5350-torpedo# 26 21:40:51.735: 00:00:14: Port Trace Event:
*Apr 26 21:40:51.735: Port : 3/00
*Apr 26 21:40:51.735: Address : 0x3000000
*Apr 26 21:40:51.735: Trace Event: 0x2
*Apr 26 21:40:51.735: Data Format: ASCII
*Apr 26 21:40:51.735: Data Len : 63
```

```

*Apr 26 21:40:51.735:      Data      : Session 0x0144 Received Tone Off ntf for code 0x03
from IP side
*Apr 26 21:40:51.735:      00:00:14: Port Trace Event:
*Apr 26 21:40:51.735:      Port      : 3/00
*Apr 26 21:40:51.735:
5350-torpedo#      Address   : 0x3000000
*Apr 26 21:40:51.735:      Trace Event: 0x2
*Apr 26 21:40:51.735:      Data Format: ASCII
*Apr 26 21:40:51.735:      Data Len   : 47
*Apr 26 21:40:51.735:      Data      : Session 0x0144 Received ANSam tone 0x07 from IP
*Apr 26 21:40:51.735:      00:00:13: Port Trace Event:
*Apr 26 21:40:51.735:      Port      : 3/00
*Apr 26 21:40:51.735:      Address   : 0x3000000
*Apr 26 21:40:51.735:      Trace Event: 0x2
*Apr 26 21:40:51.735:      Data Format: ASCII
*Apr 26 21:40:5
5350-torpedo#1.735:      Data Len   : 63
*Apr 26 21:40:51.735:      Data      : Session 0x0144 Received Tone Off ntf for code 0x07
from IP side
*Apr 26 21:40:51.739:      00:00:13: Port Trace Event:
*Apr 26 21:40:51.739:      Port      : 3/00
*Apr 26 21:40:51.739:      Address   : 0x3000000
*Apr 26 21:40:51.739:      Trace Event: 0x2
*Apr 26 21:40:51.739:      Data Format: ASCII
*Apr 26 21:40:51.739:      Data Len   : 48
*Apr 26 21:40:51.739:      Data      : Session 0x0144 Received /ANSam tone 0x0f from IP
5350-torpedo#*Apr 26 21:40:51.739:      00:00:13: Port Trace Event:
*Apr 26 21:40:51.739:      Port      : 3/00
*Apr 26 21:40:51.739:      Address   : 0x3000000
*Apr 26 21:40:51.739:      Trace Event: 0x2
*Apr 26 21:40:51.739:      Data Format: ASCII
*Apr 26 21:40:51.739:      Data Len   : 31
*Apr 26 21:40:51.739:      Data      : Session 0x0144 ECAN Is Disabled
*Apr 26 21:40:51.739:      00:00:04: Port Trace Event:
*Apr 26 21:40:51.739:      Port      : 3/00
*Apr 26 21:40:51.739:      Address   : 0x3000000
5350-torpedo#*Apr 26 21:40:51.739:      Trace Event: 0x2
*Apr 26 21:40:51.739:      Data Format: ASCII
*Apr 26 21:40:51.739:      Data Len   : 63
*Apr 26 21:40:51.739:      Data      : Session 0x0144 Received Tone Off ntf for code 0x0f
from IP side
*Apr 26 21:46:36.431:      00:00:08: Port Trace Event:
*Apr 26 21:46:36.431:      Port      : 3/00
*Apr 26 21:46:36.431:      Address   : 0x3000000
*Apr 26 21:46:36.431:      Trace Event: 0x2
*Apr 26 21:46:36.431:      Data Format: ASCII
*Apr 26 21:46:36.431:      Data Len   : 43
*Apr 26 21:46:36.431:      Data      : Session 0x0144 detected 250 msec of silence
*Apr 26 21:46:36.431:      00:00:08: Port Trace Event:
*Apr 26 21:46:36.431:      Port      : 3/00
*Apr 26 21:46:36.431:      Address   : 0x3000000
*Apr 26 21:46:36.435:      Trace Event: 0x2
*Apr 26 21:46:36.435:      Data Format: ASCII
*Apr 26 21:46:36.435:      Data Len   : 41
*Apr 26 21:46:36.435:      Data      : Session 0x0144 Ecan State 0x0007 Restored

```

Voice QoS Basics

Quality of service refers to the ability of a network to provide differentiated service to selected network traffic over various underlying technologies. QoS is not inherent in a network infrastructure. Rather, you institute QoS by strategically enabling appropriate QoS features throughout an intranetwork or internetwork.

Voice traffic differs from data traffic in a number of ways:

- Data is often bursty by nature; voice is deterministic (smooth).
- Data applications resend dropped packets; voice applications can only conceal dropped packets.
- Data applications can usually tolerate some delay; voice applications must minimize delay, so that the recipient does not hear clips in the transmission.

All of these mandate use of QoS strategies to give strict priority to voice traffic, ensuring reliable delivery and minimal delay for networks that carry both voice and data.

**Note**

The ITU-T G.114 recommendation specifies, for good voice quality, that no more than 150 ms of one-way, end-to-end delay should occur. In many situations, 200 ms may be acceptable.

QoS features for voice focus on two things—reliability and predictability. Reliability ensures delivery without packet loss. Predictability ensures delivery without excessive delay. Together, they serve to eliminate poor-quality voice transmission, including crackles and missing syllables that render a call unsatisfactory or even incoherent to the recipient.

Voice traffic requires real-time service, with steady and predictable throughput and low delay. In the presence of bursty, delay-tolerant data traffic, you must provide for voice traffic a differentiated—that is, higher-priority—level of service. Because networking equipment and devices that carry both data and voice cannot differentiate traffic that requires high-priority service from traffic that does not, your only means for ensuring that voice traffic is expedited or that it receives constant, predictable transmission across a backbone shared by data traffic is by enabling QoS features.

Effective end-to-end QoS throughout a network must serve disparate users, applications, organizations, and technologies, all at reasonable cost and effort. QoS features enable you to balance service levels for user satisfaction, granting priority service to voice while servicing data transmission to the degree of fairness that you require. In addition, other benefits can accrue: Internet service providers (ISPs), for example, can selectively enable QoS features so as to offer their customers differentiated services with different associated costs, as well as a spectrum of new applications and additional services based on these levels of service.

Cisco IOS software provides many features for optimizing QoS. Fine-tuning your network to adequately support VoIP almost certainly involves enabling some of these features. Be sure to read the cited references as you enable features, because the details of wide-scale QoS deployment are beyond the scope of this document. Also, keep in mind that you must configure QoS throughout your network, not just on the devices running VoIP, to optimize voice performance.

Not all QoS features are appropriate for all network devices and topologies. Edge devices and backbone devices do not necessarily perform the same operations. Briefly, edge devices handle packet classification, fragmentation, queuing, bandwidth management, and policing; backbone devices handle switching and transport, congestion management, and queue management. Thus, the QoS tasks that they perform might differ. Consider the functions of both edge and backbone devices in your network, and enable QoS features for each type as appropriate.

Enabling QoS Features for VoIP

The following text briefly describes some of the most important QoS features that you can enable, and cites references that you need to make informed decisions about the use and optimization of those features. Features discussed include the following:

- [Congestion Management](#)
 - [Weighted Fair Queuing](#)
 - [Low-Latency Queuing](#)
 - [IP RTP Priority and Frame Relay IP RTP Priority](#)
 - [Resource Reservation](#)
- [Fragmentation and Interleaving](#)
- [Traffic Shaping for Frame Relay](#)
- [Other Bandwidth-Reduction Features](#)
 - [Voice Encoding](#)
 - [RTP Packet-Header Compression](#)
 - [Serialization Delay](#)
 - [Voice Activity Detection](#)
 - [Jitter Buffering](#)

References in the [“Additional Resources” section on page 7-21](#) provide more information.



Tip

Should you have problems with QoS, try adding the following commands to your configuration:

- At the top-level configuration level:


```
io-cache enable
voice-fastpath enable
```
- Under the Gigabit Ethernet interface:


```
ip route-cache
```

Congestion Management

Weighted Fair Queuing

You need to avoid congestion on backbone gateways serving high-traffic, high-speed networks. A weighted-fair-queuing methodology called WRED (weighted random early detection) queues traffic according to priority values that you set (you set voice traffic to critical, for example), sets different packet-drop thresholds for each queue, and drops packets in lower-priority queues as necessary so that higher-priority queues can be adequately served. This ensures that low-bandwidth conversations get through, even in the presence of other high-bandwidth applications.

**Tip**

For more information and configuration options, see the *Configuring Weighted Fair Queuing* document, available online at

http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/12cgcr/qos_c/qcpart2/

Low-Latency Queuing

If you need to give voice packets priority but cannot allow them to starve other applications, the recommended queuing methodology is LLQ (low-latency queuing), used in conjunction with IP RTP Priority. LLQ directs voice traffic into a priority queue, but allows you to place limits on the amount of traffic serviced at this and each other priority level before the next-lower priority level is serviced.

**Tip**

For more information and configuration options, see the *Low-Latency Queuing* document, available online at

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120t/120t7/>

IP RTP Priority and Frame Relay IP RTP Priority

IP RTP Priority creates a strict-priority queue for VoIP calls. Only when the priority queue empties does the gateway process the other queues. The feature becomes active only when congestion exists on the interface.

Configure IP RTP Priority when you configure dial peers. Set an IP priority level to specify, in the packet header, that a voice call be accorded class-5 (critical) priority. Other queuing and traffic-management functions such as RSVP detect this information and provide priority service.

If your voice traffic passes through a Frame Relay network, the same argument holds, but the feature is called Frame Relay IP RTP Priority (described in the third reference below).

**Tip**

For more information and configuration options, see the following:

- *VoIP over PPP Links with Quality of Service (LLQ / IP RTP Priority, LFI, cRTP)*, available online at <http://www.cisco.com/warp/public/788/voice-qos/voip-mlppp.html>
- *IP RTP Priority*, available online at <http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120t/120t5/iprtp.htm>
- *Frame Relay IP RTP Priority*, available online at <http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120t/120t7/friprtp.htm>

Resource Reservation

You can set things up so that your and any other similarly-set-up sending or receiving system can reserve bandwidth, on a call-by-call basis, along a router path by enabling RSVP (Resource Reservation Protocol) on all WAN links that transport voice traffic.

Configure RSVP when you configure dial peers. Do not enable RSVP in conjunction with Frame Relay traffic shaping.

**Tip**

For more information and configuration options, see *Voice over IP for the Cisco AS5300*, available online at <http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120t/120t3/voip5300/>

Call-Admission Control

You can gracefully prevent calls from entering your Cisco AS5350XM or Cisco AS5400XM universal gateway from the PSTN when certain resources—such as CPU, memory, and interfaces—are not available to process those calls. Such intervention is called call-admission control.

If your system experiences high CPU usage, large call volumes, or occasional large numbers of simultaneous calls, you need to control two specific aspects of call-admission control: call spikes and call thresholds. Doing so is especially important if you handle transactions involving debit cards, which require AAA and similar types of support.

Configure call spikes to limit the number of incoming calls over a short period of time. Configure call thresholds to define under which circumstances system resources should be enabled.

**Tip**

For more information and configuration options, including how to configure limits on call spikes and call thresholds, refer to the following document:

- *Call Admission Control for H.323 VoIP Gateways*, available online at http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122limit/122x/122xa/122xa_2/ft_pfavb.htm
-

Fragmentation and Interleaving

Transmission of voice packets, usually small (60 to 240 bytes) in size, can be unduly delayed in networks that also transmit large data packets. Fragmenting large data packets into smaller ones and interleaving voice packets among the fragments reduces jitter and delay. Use fragmentation and interleaving in conjunction with a congestion-management technique such as IP RTP Priority, RSVP, or both if you have a low-bandwidth (< 1.5 Mbps) WAN circuit, but not if you have a high-bandwidth (> 1.5 Mbps) WAN circuit. The recommended fragmentation and interleaving methodology is FRF.12 for Voice over Frame Relay, Multilink PPP for VoIP-over-PPP leased lines.

**Tip**

For more information and configuration options, see the following:

- For FRF.12, *Frame Relay Fragmentation for Voice*, available online at http://www.cisco.com/warp/public/788/vofr/fr_frag.html
 - For Multilink PPP, *VoIP over PPP Links with Quality of Service (LLQ / IP RTP Priority, LFI, cRTP)*, available online at <http://www.cisco.com/warp/public/788/voice-qos/voip-mlppp.html>
-

Traffic Shaping for Frame Relay

You must regulate traffic flow so that packets arrive at their destination only as fast as the destination can handle them. You do so by buffering packets that are generated faster than a configured value, and releasing them at that value. It is especially important that you enable traffic shaping in Frame Relay networks, but not in conjunction with RSVP. Do not enable traffic shaping with PPP leased lines.

**Tip**

For more information and configuration options, see the *VoIP over Frame Relay with Quality of Service (Fragmentation, Traffic Shaping, IP RTP Priority)* document, available online at <http://www.cisco.com/warp/public/788/voice-qos/voip-ov-fr-qos.html>

**Note**

Successful traffic shaping on a Frame Relay network requires that you set not just this but many other QoS features. See these references and the “[Additional Resources](#)” section for more information.

Other Bandwidth-Reduction Features

Voice Encoding

The Cisco AS5350XM and Cisco AS5400XM universal gateways offer multiple codec (coders/decoder) methodologies for encoding (digitizing and, optionally, compressing) voice:

- G.711
- G.723.1
- G.726
- G.729
- G.729a
- G.729ab
- G.729b
- GSMAMR-NB
- GSMFR
- G.Clear

**Note**

Tandem switching (also called dual encodings or dual compressions) can cause additional problems. Digital calls routed to a tandem (toll) office are converted there to analog form for processing, and then reconverted to digital form for further transmission. Converting and reconvertng in this way more than about twice distorts signals irreparably. If your calls are subject to significant toll-office processing, choose PCM if you have sufficient bandwidth. We also recommend that you employ a Cisco IOS Multimedia Conference Manager (H.323 gatekeeper) or management application such as Cisco Voice Manager to help manage these types of processes.

Other factors that might enter into your decision, or that you can use to tweak performance, include the likelihood of multiple tandem encodings and how you handle packet fragmentation.

**Tip**

For more information and configuration options, see the *VoIP over PPP Links with Quality of Service (LLQ / IP RTP Priority, LFI, cRTP)* document, available online at <http://www.cisco.com/warp/public/788/voice-qos/voip-mlppp.html>

RTP Packet-Header Compression

Because of the repetitive nature of subsequent IP/UDP/RTP (network/transport/session-layer) headers, you can compress them significantly. A recommended methodology is cRTP (Compressed Real-Time Transfer Protocol), which, by tracking first-order and second-order differences between headers on subsequent packets, compresses the 40-byte header to just 2 or 4 (without or with UDP checksum) bytes. Other methodologies may be preferable if the cRTP high CPU usage causes delay. Use a compression methodology on both ends of low-bandwidth (< 1.5 Mbps) WAN circuits, but not at all on high-speed (> 1.5 Mbps) WANs.

**Tip**

For more information and configuration options, see the *VoIP over PPP Links with Quality of Service (LLQ / IP RTP Priority, LFI, cRTP)* document, available online at <http://www.cisco.com/warp/public/788/voice-qos/voip-mlppp.html>

Serialization Delay

You can control packet (payload) size—which, in turn, controls how long one packet takes to be placed on the system interface. Set this in bytes, ideally equaling no more than 20 ms (typically equivalent to two 10-ms voice samples per packet). Increasing serialization delay increases end-to-end delay. You want to incur no more than 150–200 ms of one-way, end-to-end delay.

**Note**

Take care when you assign a payload size for your chosen codec. To assign a codec and payload size, you use the `codec codec bytes payload_size` command under the **dial-peer voip** command. Although the `codec` command permits a wide range of payload sizes, the universal port and voice feature cards permit a much smaller range of sizes, to help ensure that end-to-end delay for voice signals does not exceed 200 ms. If your network uses a variety of gateway and router types, you may need to ensure that payload sizes are set both optimally (so as not to incur excessive end-to-end delay) and consistently.

**Tip**

For more information and configuration options, see *Voice over IP—Per Call Bandwidth Consumption*, available online at http://www.cisco.com/warp/public/788/pkt-voice-general/bwidth_consume.html

Voice Activity Detection

Because telephone users generally speak in turn, a typical voice conversation contains up to 50 percent silence. A feature called VAD (Voice Activity Detection) causes the gateway to transmit when speech starts and cease transmitting when speech stops. During silences, it generates white noise so that callers do not mistake silence for a disconnected call. By suppressing packets of silence, VAD enables you to handle more calls. For VoIP bandwidth planning, assume that VAD reduces bandwidth by 35 percent. Enable VAD if you wish to allocate more bandwidth to other types of traffic.

A possible problem with VAD is that it tends to clip the start and end of speech. To avoid activation during very short pauses and to compensate for clipping, VAD waits approximately 200 ms after speech stops before stopping transmission. Upon restarting transmission, it includes the previous 5 ms of speech along with the current speech.

VAD disables itself on a call automatically if ambient noise prevents it from distinguishing between speech and background noise.

**Tip**

For more information and configuration options, see the *VoIP over PPP Links with Quality of Service (LLQ / IP RTP Priority, LFI, cRTP)* document, available online at <http://www.cisco.com/warp/public/788/voice-qos/voip-mlppp.html>

Jitter Buffering

Jitter occurs when there is a discrepancy between when a voice packet is expected to arrive and when it actually arrives, causing discontinuity in the voice stream. Cisco devices handle jitter by buffering received data and playing it back smoothly.

Default jitter-buffer settings are sufficient in most networks under normal situations. If you experience choppy voice signals or poor voice quality, increase the size of the buffer. If you experience significant overall network delay, decrease the size. If your network is noisy and you use jitter-prone applications such as unified messaging server or interactive voice response, choose fixed mode and a relatively high nominal value. Note that the trade-off for increasing jitter-buffer size is a corresponding increase in delay.

Cisco jitter buffers are normally sized dynamically, and adaptive mode plus default buffer size should suffice, but you can adjust mode and size as needed.

Additional Resources

In configuring VoIP and setting QoS parameters for your network, you will have to wrestle with a large number of decisions and parameters. This chapter provides a brief overview on this very complex subject. The following sources provide more information:

- Cisco documents on IP telephony solutions:
http://www.cisco.com/univercd/cc/td/doc/product/voice/ip_tele/index.htm
- Cisco feature modules: <http://www.cisco.com/univercd/cc/td/doc/product/software/>, under listings for your Cisco IOS release
- Cisco IOS documents:
 - *Cisco IOS Quality of Service Solutions Configuration Guide*
 - *Cisco IOS Multiservice Applications Command Reference*
 - *Cisco IOS Voice, Video, and Fax Configuration Guide*
 - *Cisco IOS Voice, Video, and Fax Command Reference*

**Note**

Start your search at <http://www.cisco.com/univercd/cc/td/doc/product/software/> and then go to your Cisco IOS release.

- Commercially available books:

- Davidson, J. Peters, J. and Gracely, B. *Voice Over IP Fundamentals*, Indianapolis, Indiana: Cisco Press; 2000.
- Caputo, R. *Cisco Packetized Voice & Data Integration*, New York, New York: McGraw-Hill; 2000.
- VoIP references for Cisco devices:
 - *Voice-over-IP Quick Start Guide*, available online at http://www.cisco.com/univercd/cc/td/doc/product/access/acs_mod/1700/voipqsg.htm
 - Cisco IOS Voice Configuration Library, available online at http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123cgcr/voice_c/vcl.htm
- Other websites:
 - Tutorials on various telecommunications topics: <http://www.iec.org/tutorials/>



Using the Setup Script

This appendix describes how to power up the Cisco AS5350XM and Cisco AS5400XM universal gateways and configure them using the prompt-driven setup script (also called the System Configuration dialog).

If you prefer to configure the gateway manually, go to the [“Exploring Cisco IOS Software”](#) section on [page 1-5](#) to familiarize yourself with the command-line interface (CLI) and then go to [Chapter 3, “Basic Configuration Using the Command-Line Interface,”](#) for step-by-step instructions.

The setup script in this appendix is a typical example using a version of Cisco IOS software that may not exactly match your newly loaded software; however, message prompts are similar.

Getting Started

Before you power up the gateway and begin to use the setup script in the System Configuration dialog, make sure you have already connected the cables to the gateway and configured your PC terminal emulation program for 9600 baud, 8 data bits, no parity, and 2 stop bits. Connect to the gateway through the console port; the AUX port is not active. All configuration must be performed from your PC terminal emulation program window.

The prompts and resulting messages vary depending on your responses. For most configurations, you can press **Enter** to accept the default entries displayed in square brackets ([]).

This section provides the setup scripts for the following hardware configurations:

- [Cisco AS5350XM or Cisco AS5400XM with AS54-DFC-CT3, page A-1](#)
- [Cisco AS5350XM or Cisco AS5400XM with AS54-DFC-8CT1, page A-6](#)
- [Cisco AS5350XM or Cisco AS5400XM with AS54-DFC-8CE1, page A-10](#)



Note

Information that you enter is in **boldface** font. Also note that if you make a mistake during the configuration, exit and run the System Configuration dialog again by pressing **Ctrl-c**, and then type **setup** at the privileged EXEC (also called enable) mode prompt (`AS5350#` or `AS5400#`).

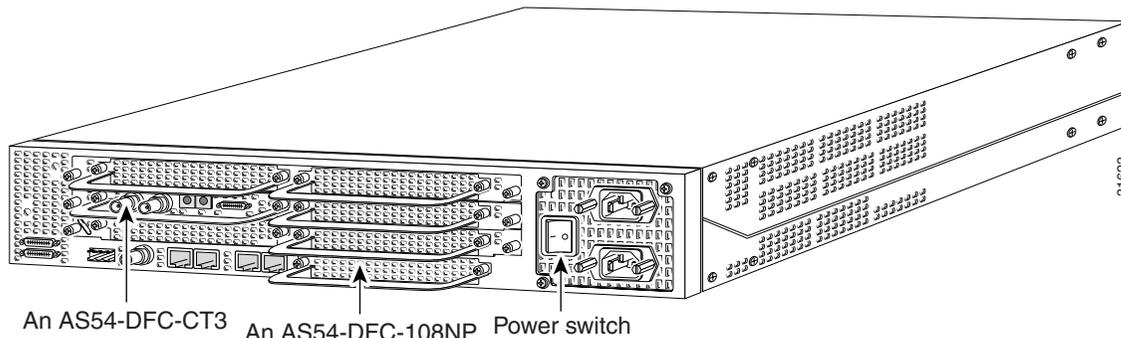
Cisco AS5350XM or Cisco AS5400XM with AS54-DFC-CT3

To use the setup script on the gateway configuring an AS54-DFC-CT3 trunk card and five AS54-DFC-108NP universal port cards, take the following steps.

Step 1 Power up the gateway. The power switch is on the rear panel, at the upper right corner near the power cord, as shown in [Figure A-1](#).

Messages begin to appear in your terminal emulation program window.

Figure A-1 Power Switch Location



Caution

Do not press any keys on the keyboard until the messages stop. Any keys pressed during this time are interpreted as the first command typed when the messages stop, which might cause you to power cycle the gateway and start over. It takes a few minutes for the messages to stop.

The messages look similar to the following display.

Note

The displayed messages depend on the Cisco IOS software release and feature set you selected. The screen displays in this section are for reference only and might not exactly reflect the messages on your console.

```
System Bootstrap, Version 12.3(12r)PI6, RELEASE SOFTWARE (fc1)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 2004 by cisco Systems, Inc.
AS5400XM platform with 524288 Kbytes of main memory
```

```
Self decompressing the image :
#####
#####
##### [OK]
```

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cisco Systems, Inc.
170 West Tasman Drive
San Jose, California 95134-1706

```
Cisco IOS Software, 5400 Software (C5400-JS-M), Version 12.3(14)T, RELEASE SOFTWARE (fc1)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2005 by Cisco Systems, Inc.
Compiled Sat 29-Jan-05 02:10 by yiyan
Image text-base: 0x60011068, data-base: 0x61F80000
```

```
Cisco AS5400XM (BCM) processor (revision 0x21) with 393215K/131072K bytes of memory.
Processor board ID JAB082904P4
SB-1 CPU at 750MHz, Implementation 1025, Rev 0.3, 256KB L2 Cache
Last reset from IOS reload
Manufacture Cookie Info:
  EEPROM Version 0x4, Board ID 0x4BD,
  Board Hardware Version 1.11, Item Number 800-6572289-01,
  Board Revision 02, Serial Number JAB082904P4.
Processor 0x0, MAC Address badb.adba.d044
2 Gigabit Ethernet interfaces
6 Serial interfaces
648 terminal lines
1 Channelized T3 port
512K bytes of NVRAM.
125184K bytes of ATA External CompactFlash (Read/Write)
```

Press RETURN to get started!

Step 2 When the following message appears, enter **yes** to continue:

```
Would you like to enter the initial configuration dialog? [yes/no]: yes
```

At any point you may enter a question mark '?' for help.
Use ctrl-c to abort configuration dialog at any prompt.
Default settings are in square brackets '['].

Step 3 When the following message appears, enter **no** to configure all interfaces. Note that if you enter **yes**, your system will not be configured correctly:

Basic management setup configures only enough connectivity for management of the system, extended setup will ask you to configure each interface on the system

```
Would you like to enter basic management setup? [yes/no]: no
```

Step 4 When the following message appears, enter **yes** to see the current interface summary:

```
First, would you like to see the current interface summary? [yes]: yes
```

Any interface listed with OK? value "NO" does not have a valid configuration

Interface	IP-Address	OK?	Method	Status	Protocol
GigabitEthernet0/0	unassigned	NO	unset	up	up
GigabitEthernet0/1	unassigned	NO	unset	up	down
Serial0/0	unassigned	NO	unset	down	down
Serial0/1	unassigned	NO	unset	down	down
.					
.					
.					

Step 5 Enter a hostname for the gateway.

```
Enter host name [Router]: AS5400
```

- Step 6** Enter an enable secret password. This password is encrypted (more secure) and cannot be seen when you view the configuration.

```
Enter enable secret: lab
```

- Step 7** Enter an enable password. This password is *not* encrypted (less secure) and can be seen when you view the configuration.

```
Enter enable password: guessme
```

- Step 8** Enter the virtual terminal password, which is used for remote console access.

```
Enter virtual terminal password: guessagain
```

- Step 9** Respond to the following prompts as appropriate for your network:

```
Configure SNMP Network Management? [no]: yes
Community string [public]:
Configure IP? [no]:
Configure IGRP routing? [yes]:
Your IGRP autonomous system number [1]: 15
Configure bridging? [no]:
```



Note If you answer **no** to IGRP, you are prompted to configure RIP.

- Step 10** Enter the letter corresponding to the ISDN switch type that matches your telco switch type, or press **Enter** to accept the default.

```
Do you want to configure ISDN switch type? [yes]:
The following ISDN switch types are available:
[a] primary-4ess
[b] primary-5ess
[c] primary-dms100
[d] primary-net5
[e] primary-ntt
[f] primary-ts014
Enter the switch type [b]:
```

- Step 11** Enter **yes** to create T1 controllers, then enter the number of T1 controllers you want to create, or press **Enter** to create all the controllers.

```
Do you want to create t1 controllers? [yes]: yes
Enter # of t1 controllers, you want to create under t3 controller [28]:
```

```
Configuring controller T3 3/0:
Next, you will be prompted to configure controllers.
These controllers enable users to dial in via ISDN or analog modems.
```

- Step 12** Enter **yes** to allow users to dial in using ISDN or analog modems.

```
Do you intend to allow users to dial in? [yes]: yes
```

```
There are 10 controllers on this access server. If you want to use
the full capacity of the access server configure all controllers.
```

```
Controller CT3 0,1...etc in software corresponds to Port 0,1...etc
on the back of the access server.
```

```
PRI configuration can be configured to controllers all at once
based on your PRI controllers selection. Whereas CAS configuration
will be configured individually for each controller.
```

- Step 13** Enter the number of controllers you will be using for the PRI configuration, or press **Enter** to configure all controllers.

Enter # of controllers, you will be using for PRI configuration [28]:

Configuring controller parameters:

- Step 14** Press **Enter** for every slot, port, and channel.

```
Configuring controller t1 3/0:1
  Configuring PRI on this controller.
.
.
.
.
Configuring controller t1 3/0:28
```

- Step 15** Enter **yes** to use robbed bit signaling on the controller.

Will you be using CT1 (robbed-bit signaling) on this controller? [yes]: **yes**

- Step 16** Enter your telco framing type.

The following framing types are available: esf | sf
Enter the framing type [esf]:

- Step 17** Enter your telco line code type.

The following linecode types are available: ami | b8zs
Enter the line code type [b8zs]:

- Step 18** Enter the letter corresponding to the signaling type to support modem pooling over the T1 lines, or press **Enter** to accept the default.

```
The following line signaling types are available
[a] e&m-fgb
[b] e&m-fgd
[c] e&m-immediate-start
[d] fgd-eana
[e] fgd-os
[f] fxs-ground-start
[g] fxs-loop-start
[h] none
[i] r1-itu
[j] r1-modified
[k] r1-turkey
[l] sas-ground-start
[m] sas-loop-start
```



Note Signaling type R1-ITU is not supported on the Cisco AS5400 platform.

- Step 19** Enter the tone signaling type.

The following tone signaling types are available:
dtmf | mf
Enter the tone signal type [dtmf]:

- Step 20** Enter **yes** to configure digital number identification service (DNIS).

Do you want to provision DNIS address information? [yes]: **yes**

- Step 21** Repeat [Step 15](#) to [Step 20](#) to configure the remaining controllers.

- Step 22** Enter **yes** to configure the GigabitEthernet0/0 interface to connect the gateway to a LAN, and then respond to the remaining questions to configure the Gigabit Ethernet port.

```
Do you want to configure GigabitEthernet0/0 interface? [yes]: yes
Use the 100 Base-TX (RJ-45) connector? [yes]:
```



Note Full-duplex mode enables simultaneous data transfer between a sending and a receiving station.

```
Operate in full-duplex mode? [no]:
Operate at 100 Mbps speed? [yes]:
Configure IP on this interface? [yes]:
  IP address for this interface [X.X.X.X]: 172.22.50.10
  Subnet mask for this interface [255.255.0.0] :
  Class B network is 172.22.0.0, 16 subnet bits; mask is /16
```

- Step 23** Repeat [Step 22](#) to configure any other Gigabit Ethernet ports, if necessary.

- Step 24** Configure your serial interfaces by responding to the following prompts:

```
Do you want to configure Serial0/0 interface? [no]: yes
Configure IP on this interface? [no]: yes
Configure IP unnumbered on this interface? [no]:
  Assign to which interface [GigabitEthernet0/0]:
```

- Step 25** Repeat [Step 24](#) to configure any other serial interfaces, if necessary.

After you complete the configuration script, the setup script displays the configuration command script.

- Step 26** Go to the [“Save the Configuration File”](#) section on page A-14.

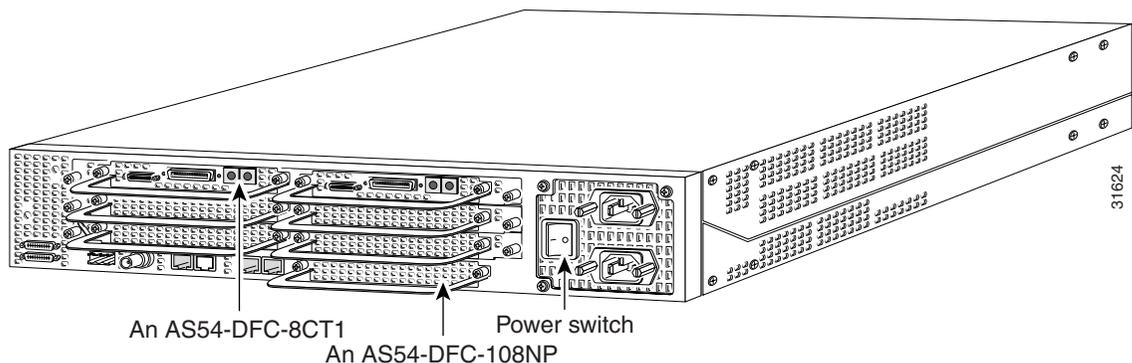
Cisco AS5350XM or Cisco AS5400XM with AS54-DFC-8CT1

To use the setup script on the gateway configuring two AS54-DFC-8CT1 trunk cards and five AS54-DFC-108NP universal port cards, take the following steps.

- Step 1** Power up the gateway. The power switch is on the rear panel, at the upper right corner near the power cord, as shown in [Figure A-2](#).

Messages begin to appear in your terminal emulation program window.

Figure A-2 Power Switch Location



**Caution**

Do not press any keys on the keyboard until the messages stop. Any keys pressed during this time are interpreted as the first command typed when the messages stop, which might cause you to power cycle the gateway and start over. It takes a few minutes for the messages to stop.

The messages look similar to the following display.

**Note**

The displayed messages depend on the Cisco IOS software release and feature set you selected. The screen displays in this section are for reference only and might not exactly reflect the messages on your console.

```
System Bootstrap, Version 12.3(12r)PI6, RELEASE SOFTWARE (fc1)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 2004 by cisco Systems, Inc.
AS5400XM platform with 524288 Kbytes of main memory
```

```
Self decompressing the image :
```

```
#####
#####
##### [OK]
```

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```
cisco Systems, Inc.
170 West Tasman Drive
San Jose, California 95134-1706
```

```
Cisco IOS Software, 5400 Software (C5400-JS-M), Version 12.3(14)T, RELEASE SOFTWARE (fc1)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2005 by Cisco Systems, Inc.
Compiled Sat 29-Jan-05 02:10 by yiyan
Image text-base: 0x60011068, data-base: 0x61F80000
```

```
Cisco AS5400XM (BCM) processor (revision 0x21) with 393215K/131072K bytes of memory.
Processor board ID JAB082904P4
SB-1 CPU at 750MHz, Implementation 1025, Rev 0.3, 256KB L2 Cache
Last reset from IOS reload
Manufacture Cookie Info:
  EEPROM Version 0x4, Board ID 0x4BD,
  Board Hardware Version 1.11, Item Number 800-6572289-01,
  Board Revision 02, Serial Number JAB082904P4.
Processor 0x0, MAC Address badb.adba.d044
2 Gigabit Ethernet interfaces
6 Serial interfaces
648 terminal lines
1 Channelized T3 port
512K bytes of NVRAM.
125184K bytes of ATA External CompactFlash (Read/Write)
```

Press RETURN to get started!

Step 2 When the following message appears, enter **yes** to continue:

Would you like to enter the initial configuration dialog? [yes/no]: **yes**

At any point you may enter a question mark '?' for help.
Use ctrl-c to abort configuration dialog at any prompt.
Default settings are in square brackets '['].

Step 3 When the following message appears, enter **no** to configure all interfaces. Note that if you enter **yes**, your system will not be configured correctly.

Basic management setup configures only enough connectivity for management of the system, extended setup will ask you to configure each interface on the system

Would you like to enter basic management setup? [yes/no]: **no**

Step 4 When the following message appears, enter **no** to bypass the current interface summary:

First, would you like to see the current interface summary? [yes]: **no**

Step 5 Enter a hostname for the gateway.

Configuring global parameters:

Enter host name [Router]: **AS5400**

The enable secret is a password used to protect access to privileged EXEC and configuration modes. This password, after entered, becomes encrypted in the configuration.

Step 6 Enter an enable secret password. This password is encrypted (more secure) and cannot be seen when you view the configuration.

Enter enable secret: **lab**

The enable password is used when you do not specify an enable secret password, with some older software versions, and some boot images.

Step 7 Enter an enable password. This password is *not* encrypted (less secure) and can be seen when you view the configuration.

Enter enable password: **guessme**

The virtual terminal password is used to protect access to the router over a network interface.

Step 8 Enter the virtual terminal password, which is used for remote console access.

Enter virtual terminal password: **guessagain**

Step 9 Respond to the following prompts as appropriate for your network:

Configure SNMP Network Management? [no]: **yes**
Community string [public]:
Configure IP? [no]:
Configure IGRP routing? [yes]:
Your IGRP autonomous system number [1]: **15**
Configure bridging? [no]:



Note If you answer **no** to IGRP, you are prompted to configure RIP.

- Step 10** Enter the letter corresponding to the ISDN switch type that matches your telco switch type, or press **Enter** to accept the default.

```
Do you want to configure ISDN switch type? [yes]:
The following ISDN switch types are available:
[a] primary-4ess
[b] primary-5ess
[c] primary-dms100
[d] primary-net5
[e] primary-ntt
[f] primary-ts014
Enter the switch type [b]:
```

- Step 11** Enter **yes** to allow users to dial in using ISDN or analog modems.

```
Do you intend to allow users to dial in? [yes]: yes
```

There are 16 controllers on this access server. If you want to use the full capacity of the access server configure all controllers.

Controller CT1 0,1,...etc in software corresponds to Port 0,1,..etc on the back of the access server.

PRI configuration can be configured to controllers all at once based on your PRI controllers selection. Where as CAS configuration will be configured individually for each controller.

- Step 12** Enter the number of controllers you will be using for the PRI configuration, or press **Enter** to configure all controllers.

```
Enter # of controllers, you will be using for PRI configuration [16]:
```

```
Configuring controller parameters:
```

- Step 13** Press **Enter** for every slot, port, and channel.

```
Configuring controller T1 1/0:
Configuring PRI on this controller.
```

```
Configuring controller T1 1/1:
Configuring PRI on this controller.
```

```
Configuring controller T1 1/2:
Configuring PRI on this controller.
```

```
Configuring controller T1 1/3:
Configuring PRI on this controller.
```

```
.
.
.
.
```

```
Configuring controller T1 2/6:
Configuring PRI on this controller.
```

```
Configuring controller T1 2/7:
Configuring PRI on this controller.
```

Configuring interface parameters:

- Step 14** Enter **yes** to configure the GigabitEthernet0/0 interface to connect the gateway to a LAN. Then respond to the remaining questions to configure the Gigabit Ethernet port.

Do you want to configure GigabitEthernet0/0 interface? [yes]: **yes**

Use the 100 Base-TX (RJ-45) connector? [yes]:



Note Full-duplex mode enables simultaneous data transfer between a sending and a receiving station.

Operate in full-duplex mode? [no]:

Operate at 100 Mbps speed? [yes]:

Configure IP on this interface? [yes]:

IP address for this interface [X.X.X.X]: **172.22.50.10**

Subnet mask for this interface [255.255.0.0] :

Class B network is 172.22.0.0, 16 subnet bits; mask is /16

- Step 15** Repeat [Step 14](#) to configure any other Gigabit Ethernet ports, if necessary.

- Step 16** Configure your serial interfaces by responding to the following prompts:

Do you want to configure Serial0/0 interface? [no]: **yes**

Configure IP on this interface? [no]: **yes**

Configure IP unnumbered on this interface? [no]:

Assign to which interface [GigabitEthernet0/0]:

- Step 17** Repeat [Step 16](#) to configure any other serial interfaces, if necessary.

After you complete the configuration script, the setup script displays the configuration command script.

- Step 18** Go to the [“Save the Configuration File”](#) section on [page A-14](#).

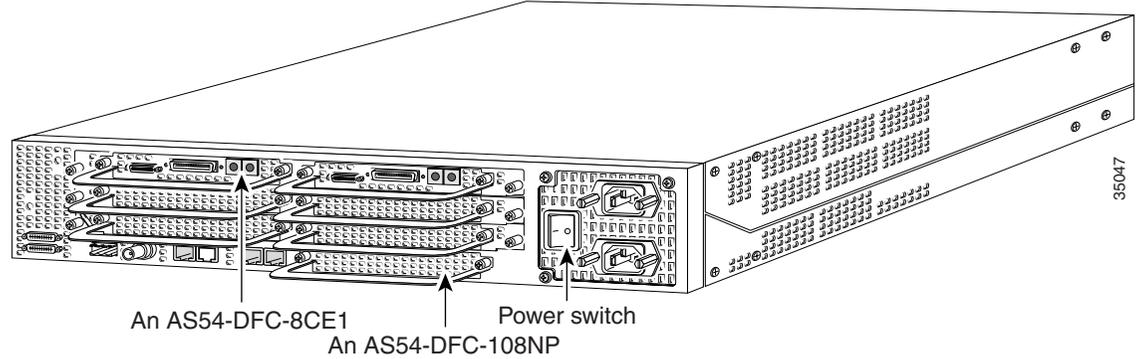
Cisco AS5350XM or Cisco AS5400XM with AS54-DFC-8CE1

To use the setup script on the gateway configuring two AS54-DFC-8CE1 trunk cards and five AS54-DFC-108NP universal port cards, take the following steps.

- Step 1** Power up the gateway. The power switch is on the rear panel, at the upper right corner near the power cord, as shown in [Figure A-3](#).

Messages begin to appear in your terminal emulation program window.

Figure A-3 Power Switch Location

**Caution**

Do not press any keys on the keyboard until the messages stop. Any keys pressed during this time are interpreted as the first command typed when the messages stop, which might cause you to power cycle the gateway and start over. It will take a few minutes for the messages to stop.

The messages look similar to the following display.

**Note**

The displayed messages depend on the Cisco IOS software release and feature set you selected. The screen displays in this section are for reference only and probably will not exactly reflect the messages on your console.

```
System Bootstrap, Version 12.3(12r)PI6, RELEASE SOFTWARE (fc1)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 2004 by cisco Systems, Inc.
AS5400XM platform with 524288 Kbytes of main memory
```

```
Self decompressing the image :
```

```
#####
#####
##### [OK]
```

```
Restricted Rights Legend
```

```
Use, duplication, or disclosure by the Government is
subject to restrictions as set forth in subparagraph
(c) of the Commercial Computer Software - Restricted
Rights clause at FAR sec. 52.227-19 and subparagraph
(c) (1) (ii) of the Rights in Technical Data and Computer
Software clause at DFARS sec. 252.227-7013.
```

```
cisco Systems, Inc.
170 West Tasman Drive
San Jose, California 95134-1706
```

```
Cisco IOS Software, 5400 Software (C5400-JS-M), Version 12.3(14)T, RELEASE SOFTWARE (fc1)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2005 by Cisco Systems, Inc.
Compiled Sat 29-Jan-05 02:10 by yiyang
Image text-base: 0x60011068, data-base: 0x61F80000
```

```

Cisco AS5400XM (BCM) processor (revision 0x21) with 393215K/131072K bytes of memory.
Processor board ID JAB082904P4
SB-1 CPU at 750MHz, Implementation 1025, Rev 0.3, 256KB L2 Cache
Last reset from IOS reload
Manufacture Cookie Info:
  EEPROM Version 0x4, Board ID 0x4BD,
  Board Hardware Version 1.11, Item Number 800-6572289-01,
  Board Revision 02, Serial Number JAB082904P4.
Processor 0x0, MAC Address badb.adba.d044
2 Gigabit Ethernet interfaces
6 Serial interfaces
648 terminal lines
1 Channelized T3 port
512K bytes of NVRAM.
125184K bytes of ATA External CompactFlash (Read/Write)

```

Press RETURN to get started!

Step 2 When the following message appears, enter **yes** to continue:

Would you like to enter the initial configuration dialog? [yes/no]: **yes**

At any point you may enter a question mark '?' for help.
Use ctrl-c to abort configuration dialog at any prompt.
Default settings are in square brackets '['].

Step 3 When the following message appears, enter **no** to configure all interfaces. Note that if you enter **yes**, your system will not be configured correctly.

Basic management setup configures only enough connectivity for management of the system, extended setup will ask you to configure each interface on the system

Would you like to enter basic management setup? [yes/no]: **no**

Step 4 When the following message appears, enter **yes** to see the current interface summary:

First, would you like to see the current interface summary? [yes]: **yes**

Any interface listed with OK? value "NO" does not have a valid configuration

GigabitEthernet0/0	unassigned	NO	unset	up	up
GigabitEthernet0/1	unassigned	NO	unset	up	up
Group-Async0	unassigned	NO	unset	down	down
Serial0/0	unassigned	NO	unset	down	down
Serial0/1	unassigned	NO	unset	down	down

Step 5 Enter a hostname for the gateway.

Configuring global parameters:

Enter host name [Router]: **AS5400**

The enable secret is a password used to protect access to privileged EXEC and configuration modes. This password, after entered, becomes encrypted in the configuration.

Step 6 Enter an enable secret password. This password is encrypted (more secure) and cannot be seen when you view the configuration.

Enter enable secret: **lab**

The enable password is used when you do not specify an enable secret password, with some older software versions, and some boot images.

- Step 7** Enter an enable password. This password is *not* encrypted (less secure) and can be seen when you view the configuration.

Enter enable password: **guessme**

The virtual terminal password is used to protect access to the router over a network interface.

- Step 8** Enter the virtual terminal password, which is used for remote console access.

Enter virtual terminal password: **guessagain**

- Step 9** Respond to the following prompts as appropriate for your network:

```
Configure SNMP Network Management? [no]: yes
Community string [public]:
Configure IP? [no]:
Configure IGRP routing? [yes]:
Your IGRP autonomous system number [1]: 15
Configure bridging? [no]:
```



Note If you answer no to IGRP, you are prompted to configure RIP.

- Step 10** Enter the letter corresponding to the ISDN switch type that matches your telco switch type, or press **Enter** to accept the default.

```
Do you want to configure ISDN switch type? [yes]:
The following ISDN switch types are available:
[a] primary-4ess
[b] primary-5ess
[c] primary-dms100
[d] primary-net5
[e] primary-ntt
[f] primary-ts014
Enter the switch type [d]:
```

- Step 11** Enter **yes** to allow users to dial in using ISDN or analog modems.

Do you intend to allow users to dial in? [yes]: **yes**

There are 16 controllers on this access server. If you want to use the full capacity of the access server configure all controllers.

Controller E1 0,1,..etc in software corresponds to Port 0,1,..etc on the back of the access server.

PRI configuration can be configured to controllers all at once based on your PRI controllers selection. Where as CAS configuration will be configured individually for each controller.

- Step 12** Enter the number of controllers you will be using for the PRI configuration, or press **Enter** to configure all controllers.

Enter # of controllers, you will be using for PRI configuration [16]:

Configuring controller parameters:

- Step 13** Press **Enter** for every slot, port, and channel.

```
Configuring controller E1 1/0:
  Configuring PRI on this controller.
```

```
Configuring controller E1 1/1:
  Configuring PRI on this controller.
```

```
.
.
.
.
```

```
Configuring controller E1 2/6:
  Configuring PRI on this controller.
```

```
Configuring controller E1 2/7:
  Configuring PRI on this controller.
```

- Step 14** Enter **yes** to configure the GigabitEthernet0/0 interface to connect the gateway to a LAN. Then respond to the remaining questions to configure the Gigabit Ethernet port (you can also press **Enter** to accept the default):

```
Do you want to configure GigabitEthernet0/0 interface? [yes]: yes
Use the 100 Base-TX (RJ-45) connector? [yes]:
```



Note Full-duplex mode enables simultaneous data transfer between a sending and a receiving station.

```
Operate in full-duplex mode? [no]:
Operate at 100 Mbps speed? [yes]:
Configure IP on this interface? [yes]:
  IP address for this interface [X.X.X.X]: 172.22.50.10
  Subnet mask for this interface [255.255.0.0] :
  Class B network is 172.22.0.0, 16 subnet bits; mask is /16
```

- Step 15** Repeat [Step 14](#) to configure any other Gigabit Ethernet ports, if necessary.

- Step 16** Configure your serial interfaces by responding to the following prompts:

```
Do you want to configure Serial0/0 interface? [no]: yes
Configure IP on this interface? [no]: yes
Configure IP unnumbered on this interface? [no]:
  Assign to which interface [GigabitEthernet0/0]:
```

- Step 17** Repeat [Step 16](#) to configure any other serial interfaces, if necessary.

After you complete the configuration script, the setup script displays the configuration command script.

- Step 18** Go to the next section, "[Save the Configuration File.](#)"
-

Save the Configuration File

To save the configuration file, follow these steps:

- Step 1** Enter **0**, **1**, or **2** when the following prompt is displayed:

```
[0] Go to the IOS command prompt without saving this config.
[1] Return back to the setup without saving this config.
[2] Save this configuration to nvram and exit.
```

```

Enter your selection [2]:

Use this configuration? [yes/no]: yes
Building configuration...
Use the enabled mode 'configure' command to modify this configuration.

Press RETURN to get started!

%LINK-3-UPDOWN: Interface Ethernet0, changed state to up
%LINK-3-UPDOWN: Interface Serial0, changed state to down
%LINK-3-UPDOWN: Interface Serial1, changed state to down

<Additional messages omitted.>

```

Step 2 When the messages stop appearing on your screen, press **Enter** to access the following prompt:

```

AS5400>
%AT-6-ONLYROUTER: Ethernet0: AppleTalk port enabled; no neighbors found

```



Note If you see this message, it means that no other routers were found on the network attached to the port.

Step 3 The AS5350> or AS5400> prompt indicates that you are now at the command-line interface (CLI) and you have just completed the basic gateway configuration. However, this is not a complete configuration. At this point you have two options:

- Run the setup script in the System Configuration dialog again and create another configuration. Enter the following commands to repeat the setup script:

```

AS5400> enable
Password: password
AS5400# setup

```

- Modify the existing configuration or configure additional features with the CLI as described in the *Dial Solutions Configuration Guide*, the *Dial Solutions Command Reference Guide*, the Cisco IOS software configuration guide, and command reference publications. See the [“Obtaining Documentation” section on page xix](#).

Where to Go Next

At this point you can go to [Chapter 2, “Verifying Basic Setup,”](#) for step-by-step instructions to configure the gateway manually.

You can also refer to the following documents for more advanced configuration topics:

- Cisco IOS software configuration guide
- Command reference publications
- *Dial Solutions Configuration Guide*
- *Dial Solutions Command Reference*

These publications are available on the Documentation DVD, or on the World Wide Web from the Cisco home page.



ROM Monitor

The information in this chapter applies to the Cisco AS5350XM and Cisco AS5400XM universal gateways.

This appendix describes the Cisco AS5350XM and Cisco AS5400XM ROM monitor, the first software to run when the gateway is powered-up or reset. The ROM monitor can help you isolate or rule out hardware problems encountered when installing your gateway. This appendix describes the following:

- [Entering the ROM Monitor Program, page B-1](#)
- [ROM Monitor Command Conventions, page B-2](#)
- [Command Aliasing, page B-2](#)
- [ROM Monitor Commands, page B-2](#)

Entering the ROM Monitor Program

The ROM monitor diagnostics help initialize the processor hardware and boot the main operating system software. If you set the software configuration register (bits 3, 2, 1, and 0) to zero, you can start the gateway in the standalone ROM monitor. An example of the ROM monitor prompt follows:

```
rommon 1 >
```

To enable the Break key, and to default to booting at the ROM monitor while running the system software, reset the configuration register to 0x0 by entering configuration mode, and enter the following configuration command:

```
confreg 0x0
```

The new configuration register value, 0x0, takes effect after the gateway is rebooted with the **reload** command. If you set the configuration to 0x0, you will have to manually boot the system from the console each time you reload the gateway.



Timesaver

Break (system interrupt) is always enabled for 60 seconds after rebooting the system, regardless of whether break is configured to be off by setting the configuration register. During the 60-second window, you can break to the ROM monitor prompt.

ROM Monitor Command Conventions

Following are ROM monitor command conventions:

- Brackets [] denote an optional field. If a minus option is followed by a colon (for example: [-s:]), you must provide an argument for the option.
- A word in italics means that you must fill in the appropriate information.
- All address and size arguments to the memory-related commands are assumed to be hexadecimal (no “0x” prefix or “h” suffix needed).
- The options [-*bw*l] for the memory-related commands provide for byte, word, and longword operations. The default is *word*.
- You can invoke the memory-related commands by entering the command with no arguments. This causes the utility to prompt you for parameters. This option is available for the commands marked as prompting.
- All the built-in commands can be aborted (user interrupt signal) by pressing the Break key at the console.
- You can place more than one command (except the repeat command) on a line by using the semicolon delimiter.

Command Aliasing

The ROM monitor supports command aliasing modeled on the aliasing function built into the Korn shell. The **alias** command is used to set and view aliased names. This allows you to alias command names to a letter or word. Aliasing is often used to shorten command names or automatically invoke command options.

Aliases are stored in NVRAM and remain intact across periods of no power. These are some of the set aliases:

```
b = boot
h = history
i = reset
r = repeat
k = stack
? = help
```

ROM Monitor Commands

At the ROM monitor prompt, enter **?** or **help** at the `rommon n >` prompt to display a list of available commands and options, as follows:

```
rommon 2 > help
alias          set and display aliases command
boot          boot up an external process
confreg       configuration register utility
cont          continue executing a downloaded image
context       display the context of a loaded image
cookie        display contents of cookie PROM in hex
dev           list the device table
dir           list files in file system
dis           disassemble instruction stream
frame         print out a selected stack frame
```

hardware_info	display hardware information
help	monitor builtin command help
history	monitor command history
meminfo	memory information (-spd dumps SDRAM cookie)
reset	system reset
rommon-pref	select ROMMON
set	show all monitor variables
showmon	display currently selected ROM monitor
stack	produce a stack trace
sync	write monitor environment to NVRAM
sysret	print out info from last system return
tftpdnld	tftp image download
unalias	unset an alias
unset	unset a monitor variable

**Note**

You can display additional details for a command by entering the command name with a **-?** option, which prints the command usage message.

The commands are listed and described in alphabetical order. Note that the ROM monitor commands are case sensitive.

- **alias** [*name = value*]—Aliases a name to a value. If the value contains white space or other special (shell) characters, it must be enclosed in quotation marks. If the value has a space as the last character, the next command-line word is also checked for an alias (normally only the first word on the command line is checked). Without an argument, this command prints a list of all aliased names with their values.

For example:

```
rommon 1 > alias
r = repeat
h = history
? = help
b = boot
ls = dir
```

- **boot** or **b**—Boots an image. The **boot** command with no arguments boots the first image in boot flash memory. You can include an argument, *filename*, to specify a file to be booted over the network using the Trivial File Transfer Protocol (TFTP). The local device (see the description of **b device** following) can be specified by entering the device specifier (*devid*). If the specified device name is not recognized by the ROM monitor, the system attempts to boot the image (*imagename*) from a network TFTP server. Do not insert a space between *devid* and *imagename*. Options to the **boot** command are **-x**, load image but do not execute, and **-v**, verbose. The form of the **boot** command follows:

The Cisco AS5350XM and Cisco AS5400XM universal gateways support the following three boot commands at the ROM monitor level:

boot [-xv] [devid] [imagename]

b—load/run the first XM image on flash.

b flash:filename—Load or run the image pointed to by flash:filename.

- **confreg** [*hexnum*]—When executed with the argument *hexnum*, changes the virtual configuration register to match the hex number specified. Without the argument, the **confreg** command dumps the contents of the virtual configuration register in English and allows you to alter the contents. You are

prompted to change or keep the information held in each bit of the virtual configuration register. In either case, the new virtual configuration register value is written into NVRAM and does not take effect until you reset or power cycle the gateway.

The configuration register resides in NVRAM. The configuration register is identical in operation to other Cisco gateways. Enter the **confreg** command for the menu-driven system, or enter the new value of the register in hexadecimal.



Note The value is always interpreted as hex. The **confreg** utility prints a before and after view of the configuration register when used in menu-driven mode.

For example:

```
rommon 2 > confreg

Configuration Summary
(Virtual Configuration Register:0x0)
enabled are:
break/abort has effect
console baud:9600
boot:the ROM Monitor

do you wish to change the configuration? y/n [n]: y
enable "diagnostic mode"? y/n [n]:
enable "use net in IP bcast address"? y/n [n]:
enable "load rom after netboot fails"? y/n [n]:
enable "use all zero broadcast"? y/n [n]:
disable "break/abort has effect"? y/n [n]:
enable "ignore system config info"? y/n [n]:
change console baud rate? y/n [n]: y
enter rate:0 = 9600, 1 = 4800, 2 = 1200, 3 = 2400
4 = 19200, 5 = 38400, 6 = 57600, 7 = 115200 [0]:
change the boot characteristics? y/n [n]:
```

```
Configuration Summary
(Virtual Configuration Register:0x0)
enabled are:
break/abort has effect
console baud:9600
boot:the ROM Monitor

do you wish to change the configuration? y/n [n]:
```

- **cont [-b]**—Continues a loaded image that has stopped. The **-b** option sets the requested break points before continuing.

For example:

```
reboot >
monitor: command "launch" aborted due to user interrupt
diagmon 7 > cont

reboot>
```

- **context**—Displays the CPU context at the time of the fault. The context from kernel mode and process mode of a booted image is displayed, if available.

For example:

```
rommon 6 > context
```

```

CPU Context:
d0 - 0x00000028      a0 - 0x0ff00420
d1 - 0x00000007      a1 - 0x0ff00000
d2 - 0x00000007      a2 - 0x02004088
d3 - 0x00000000      a3 - 0x020039e6
d4 - 0x00000000      a4 - 0x02002a70
d5 - 0x02003e8a      a5 - 0x02003f17
d6 - 0x00000000      a6 - 0x02003938
d7 - 0x00000001      a7 - 0x0200392c
pc  - 0x02004adc      vbr - 0x02000000

```

- **cookie**—Displays the contents of the cookie PROM in hexadecimal format.

For example:

```

rommon 1 > cookie

cookie:
00 01 01 31 03 15 03 20 00 14 33 01 30 11 4a 41
42 30 33 35 31 30 37 38 32 00 00 00 00 00 13 63
0c 1d 00 00 00 00 11 11 22 22 33 33 44 44 55 55
66 66 77 77 88 88 99 99 00 00 11 11 22 22 33 33
ff 00 30 96 f8 00 7a ff ff ff ff ff ff ff ff ff
ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff
ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff
ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff

```

- **dev**—Lists boot device identifications on the gateway.

For example:

```

rommon 10 > dev

Devices in device table:
      id name
flash: flash
flash: flash

```

- **dir *dev***—Lists the files on the named device.

For example:

```

rommon 11 > dir flash:

File size          Checksum   File name
9474676 bytes (0x909274) 0x54322421  c5350-js-mz.Jan6

```

- **ethertype [fe | ge]**—The Cisco AS5350XM and AS5400XM universal gateway Ethernet ports are Gigabit Ethernet ports (labeled GE0 and GE1 on the chassis). The Cisco IOS firmware and software is designed so that configurations for Fast Ethernet will work on the Cisco AS5350XM and AS5400XM universal gateways without requiring any modification by the user.

If the Cisco IOS commands, **write** or **copy running-config startup-config** have been used to save the configuration to NVRAM, then all references to Ethernet interfaces will now be GigabitEther, and the IOS commands, **write terminal** and **show running configuration** will always show GigabitEther.

If you must have FastEther available as a searchable word for any scripts you are using, you can use the ROMMON command, **ethertype fe** to change GigabitEther to FastEther. Once you enter **ethertype fe**, the IOS image will only recognize FastEther. It will *not* recognize GigabitEther.

For example:

```

rommon 6 > ethertype fe

```

- **frame** [*number*]**—**Displays an entire individual stack frame. Enter a number to indicate which frame to display. You can also specify a number to indicate which stack frame to display. Note that the default is 0 (zero), which is the youngest frame.

For example:

```
rommon 6 > frame 2

Frame 02: FP = 0x02003960    RA = 0x020050ee
at 0x02003968 (fp + 0x08) = 0x02004f8d
at 0x0200396c (fp + 0x0c) = 0x0200f390
at 0x02003970 (fp + 0x10) = 0x02006afc
at 0x02003974 (fp + 0x14) = 0xc0a82983
at 0x02003978 (fp + 0x18) = 0x02003a7e
at 0x0200397c (fp + 0x1c) = 0x02002630
at 0x02003980 (fp + 0x20) = 0x00000000
at 0x02003984 (fp + 0x24) = 0x02000000
at 0x02003988 (fp + 0x28) = 0x0200c4a4
at 0x0200398c (fp + 0x2c) = 0x0200f448
```

- **help****—**Prints a summary of the ROM monitor commands to the console screen. This is the same output as entering **?**

For example:

```
rommon 11 > help

alias                set and display aliases command
boot                 boot up an external process
confreg              configuration register utility
cont                  continue executing a downloaded image
context              display the context of a loaded image
cookie               display contents of cookie PROM in hex
dev                  list the device table
dir                  list files in file system
dis                  disassemble instruction stream
frame                print out a selected stack frame
hardware_info        display hardware information
help                 monitor builtin command help
history              monitor command history
meminfo              memory information (-spd dumps SDRAM cookie)
reset                system reset
rommon-pref          Select ROMMON
set                  show all monitor variables
showmon              display currently selected ROM monitor
stack                produce a stack trace
sync                 write monitor environment to NVRAM
sysret               print out info from last system return
tftpdnld             tftp image download
unalias              unset an alias
unset                unset a monitor variable
```

- **history** or **h****—**Displays the command history, that is, the last 16 commands executed in the ROM monitor environment.
- **meminfo****—**Displays the size (in bytes), the starting address, the available range of the main memory, the starting point and size of packet memory, and the size of nonvolatile memory (NVRAM).

For example:

```
rommon 9 > meminfo

Main memory size:128 MB. Packet memory size:64 MB
Available main memory starts at 0xa000e000, size 0x7ff2000
Packet memory starts at 0xa8000000
```

```
NVRAM size:0x80000
Main memory control register:0xbe9022f4
Shared memory control register:0x00000202
```

- **reset** or **i**—Resets and initializes the system, similar to power up.
- **rommon-pref [readonly | upgrade]**—Selects the ROM monitor image to be booted on the next reload.
- **set**—Displays all the monitor variables and their values.
- **showmon**—Displays both ROM monitor images and verifies which image is running.

For example:

```
rommon 1 > showmon
```

```
ReadOnly ROMMON version is:
System Bootstrap, Version 12.3(12r)PI6, RELEASE SOFTWARE (fc1)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 2004 by cisco Systems, Inc.
```

```
Upgrade ROMMON version is:
System Bootstrap, Version 12.3(12r)PI6, RELEASE SOFTWARE (fc1)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 2004 by cisco Systems, Inc.
```

```
Upgrade ROMMON currently running
Upgrade ROMMON is selected for next boot
```

- **stack [num]**—Produces a stack trace of the number of frames, specified by *num*. The default is 5. The command dumps from the kernel stack and the process stack (if one is available) of a booted image.

For example:

```
rommon 5 > stack 8
```

```
Stack trace:
PC = 0x02004adc
Frame 00: FP = 0x02003938    RA = 0x02005f2a
Frame 01: FP = 0x02003948    RA = 0x02005df0
Frame 02: FP = 0x02003960    RA = 0x020050ee
Frame 03: FP = 0x02003994    RA = 0x02004034
Frame 04: FP = 0x02003b00    RA = 0x00012ca6
```

- **sync**—Writes the working in-core copy of the environment variables and aliases them to NVRAM so that they are read on the next reset.
- **sysret**—Displays the return information from the last booted system image. This includes the reason for terminating the image, a stack dump of up to eight frames, and if an exception is involved, the address where the exception occurred.

For example:

```
rommon 8 > sysret
```

```
System Return Info:
count: 19, reason: user break
pc:0x60043754, error address: 0x0
Stack Trace:
FP: 0x80007e78, PC: 0x60043754
FP: 0x80007ed8, PC: 0x6001540c
FP: 0x80007ef8, PC: 0x600087f0
FP: 0x80007f18, PC: 0x80008734
```

- **tftpdnld -r**—Loads the image from the TFTP server pointed to by TFTP_FILE as shown below:

```
rommon 1 > set
TFTP_SERVER=1.6.1.2
IP_SUBNET_MASK=255.0.0.0
DEFAULT_GATEWAY=1.2.0.1
IP_ADDRESS=1.2.65.10
TFTP_FILE=hyeh/c5400-js-mz.nemo.Sep20
```

The user must set up the preceding five environmental variables (*variable = new.value*) above to boot from the TFTP server as follows:

```
rommon 2> TFTP_FILE=user/newimage.ios
```

- **unalias name**—Removes *name* and its associated value from the alias list.
- **unset varname**—Removes the variable name from the variable list.
- **xmodem [- yc] destination_file_name**—Downloads a system image to flash memory over the console port. The *-y* option performs the download. The *-c* option performs the download using 16-bit CRC error checking. The Xmodem transfer protocol supports a 128-byte block size, and the transfer begins with a block number starting at 1, which contains file data. This is the default transfer protocol.



Comprehensive Configuration Examples

The information in this appendix applies to the Cisco AS5350XM and Cisco AS5400XM universal gateways.

This appendix includes sample outputs of the **show config** command after you have completed the procedures in [Chapter 2, “Verifying Basic Setup,”](#) and have configured various advanced features.

The following examples are useful references for you only if you are experienced with the Cisco IOS software:

- [CT3 CAS/ISDN with RADIUS, page C-1](#)
- [CT3 CAS/ISDN Without RADIUS, page C-10](#)
- [CT3 Without Resource Pooling, page C-19](#)
- [CT3 CAS with Resource Pooling, page C-24](#)
- [Two 8 T1/PRI ISDN with Modems, page C-30](#)
- [Two 8 E1/PRI ISDN with Modems, page C-41](#)
- [Two 8 T1/PRI CAS with Modems, page C-46](#)
- [Two 8 T1/PRI CAS with RADIUS \(AAA\) and Resource Pooling, page C-50](#)
- [Two 8 T1/PRI ISDN with RADIUS \(AAA\) and Resource Pooling, page C-55](#)
- [Two 8 E1/PRI ISDN with RADIUS \(AAA\) and Resource Pooling, page C-67](#)
- [CT3 with Resource Pooling, AAA, and Modem, page C-70](#)

CT3 CAS/ISDN with RADIUS

```
AS5400# show config

Building configuration ...

Current configuration:
!
version 12.1
no service pad
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
service internal
!
hostname CT3-Mixed-UUT
!
```

```

no boot startup-test
logging buffered 32000 debugging
aaa new-model
aaa group server radius aaa.router
  server 192.168.1.137 auth-port 1645 acct-port 1646
  server 192.168.1.138 auth-port 1645 acct-port 1646
!
aaa authentication ppp default group aaa.router local
aaa authorization network default group aaa.router local
aaa authorization network no-author none
aaa accounting update newinfo periodic 30
aaa accounting network default start-stop group aaa.router
enable password lab
!
username cisco password password
!
!
resource-pool disable
!
!
!
dial-tdm-clock priority 1 1/0:1
!
!
!
ip subnet-zero
no ip domain-lookup
ip host tftpboot 172.22.254.253
!
mgcp package-capability trunk-package
mgcp default-package trunk-package
isdn switch-type primary-5ess
isdn voice-call-failure 0
modemcap entry factory:MSC=&f
modemcap entry test:MSC=s30=28800
cns event-service server
mta receive maximum-recipients 0
!
!
controller T3 1/0
  framing m23
  clock source line
  t1 1 controller
  t1 2 controller
  t1 3 controller
  t1 4 controller
  t1 5 controller
  t1 6 controller
  t1 7 controller
  t1 8 controller
  t1 9 controller
  t1 10 controller
  t1 11 controller
  t1 12 controller
  t1 13 controller
  t1 14 controller
  t1 15 controller
  t1 16 controller
  t1 17 controller
  t1 18 controller
  t1 19 controller
  t1 20 controller

```

```
t1 21 controller
t1 22 controller
t1 23 controller
t1 24 controller
t1 25 controller
t1 26 controller
t1 27 controller
t1 28 controller
!
controller T1 1/0:1
  framing esf
  pri-group timeslots 1-24
!
controller T1 1/0:2
  framing esf
  pri-group timeslots 1-24
!
controller T1 1/0:3
  framing esf
  pri-group timeslots 1-24
!
controller T1 1/0:4
  framing esf
  pri-group timeslots 1-24
!
controller T1 1/0:5
  framing esf
  pri-group timeslots 1-24
!
controller T1 1/0:6
  framing esf
  pri-group timeslots 1-24
!
controller T1 1/0:7
  framing esf
  pri-group timeslots 1-24
!
controller T1 1/0:8
  framing esf
  pri-group timeslots 1-24
!
controller T1 1/0:9
  framing esf
  pri-group timeslots 1-24
!
controller T1 1/0:10
  framing esf
  pri-group timeslots 1-24
!
controller T1 1/0:11
  framing esf
  pri-group timeslots 1-24
!
controller T1 1/0:12
  framing esf
  pri-group timeslots 1-24
!
controller T1 1/0:13
  framing esf
  pri-group timeslots 1-24
!
controller T1 1/0:14
  framing esf
  pri-group timeslots 1-24
```

```

!
controller T1 1/0:15
  framing esf
  pri-group timeslots 1-24
!
controller T1 1/0:16
  framing esf
  pri-group timeslots 1-24
!
controller T1 1/0:17
  framing esf
  ds0-group 0 timeslots 1-24 type e&m-fgb
  cas-custom 0
!
controller T1 1/0:18
  framing esf
  ds0-group 0 timeslots 1-24 type e&m-fgb
  cas-custom 0
!
controller T1 1/0:19
  framing esf
  ds0-group 0 timeslots 1-24 type e&m-fgb
  cas-custom 0
!
controller T1 1/0:20
  framing esf
  ds0-group 0 timeslots 1-24 type e&m-fgb
  cas-custom 0
!
controller T1 1/0:21
  framing esf
  ds0-group 0 timeslots 1-24 type e&m-fgb
  cas-custom 0
!
controller T1 1/0:22
  framing esf
  ds0-group 0 timeslots 1-24 type e&m-fgb
  cas-custom 0
!
controller T1 1/0:23
  framing esf
  ds0-group 0 timeslots 1-24 type e&m-fgb
  cas-custom 0
!
controller T1 1/0:24
  framing esf
  ds0-group 0 timeslots 1-24 type e&m-fgb
  cas-custom 0
!
controller T1 1/0:25
  framing esf
  ds0-group 0 timeslots 1-24 type e&m-fgb
  cas-custom 0
!
controller T1 1/0:26
  framing esf
  ds0-group 0 timeslots 1-24 type e&m-fgb
  cas-custom 0
!
controller T1 1/0:27
  framing esf
  ds0-group 0 timeslots 1-24 type e&m-fgb
  cas-custom 0
!

```

```
controller T1 1/0:28
  framing esf
  ds0-group 0 timeslots 1-24 type e&m-fgb
  cas-custom 0
!
!
!
!
!
interface GigabitEthernet0/0
  description VLAN 6
  ip address 192.168.6.100 255.255.255.0
  no ip directed-broadcast
  no ip mroute-cache
  duplex auto
  speed auto
!
interface GigabitEthernet0/1
  description VLAN 7
  ip address 172.22.36.36 255.255.254.0
  no ip directed-broadcast
  no ip mroute-cache
  duplex auto
  speed auto
!
interface Serial0/0
  ip address 172.22.123.2 255.255.255.0
  no ip directed-broadcast
  clockrate 8000000
!
interface Serial0/1
  ip address 172.22.124.2 255.255.255.0
  no ip directed-broadcast
  encapsulation ppp
  ppp authorization no-author
!
interface Serial1/0:1:23
  ip address 10.1.0.2 255.255.255.0
  no ip directed-broadcast
  encapsulation ppp
  ip mroute-cache
  logging event link-status
  no keepalive
  dialer idle-timeout 72000 either
  dialer-group 1
  isdn switch-type primary-5ess
  isdn incoming-voice data
  no fair-queue
  no cdp enable
  ppp authentication chap
!
interface Serial1/0:2:23
  ip address 10.1.1.2 255.255.255.0
  no ip directed-broadcast
  encapsulation ppp
  ip mroute-cache
  logging event link-status
  no keepalive
  dialer idle-timeout 72000 either
  dialer-group 1
  isdn switch-type primary-5ess
  isdn incoming-voice data
  isdn T203 10000
  no fair-queue
```

```
no cdp enable
ppp authentication chap
!
interface Serial1/0:3:23
ip address 10.1.2.2 255.255.255.0
no ip directed-broadcast
encapsulation ppp
ip mroute-cache
logging event link-status
no keepalive
dialer idle-timeout 72000 either
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice data
no fair-queue
no cdp enable
ppp authentication chap
!
interface Serial1/0:4:23
ip address 10.1.3.2 255.255.255.0
no ip directed-broadcast
encapsulation ppp
ip mroute-cache
logging event link-status
no keepalive
dialer idle-timeout 72000 either
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice data
no fair-queue
no cdp enable
ppp authentication chap
!
interface Serial1/0:5:23
ip address 10.1.4.2 255.255.255.0
no ip directed-broadcast
encapsulation ppp
ip mroute-cache
logging event link-status
no keepalive
dialer idle-timeout 72000 either
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice data
no fair-queue
no cdp enable
ppp authentication chap
!
interface Serial1/0:6:23
ip address 10.1.5.2 255.255.255.0
no ip directed-broadcast
encapsulation ppp
ip mroute-cache
logging event link-status
no keepalive
dialer idle-timeout 72000 either
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice data
no fair-queue
no cdp enable
ppp authentication chap
!
interface Serial1/0:7:23
```

```
ip address 10.1.6.2 255.255.255.0
no ip directed-broadcast
encapsulation ppp
ip mroute-cache
logging event link-status
no keepalive
dialer idle-timeout 72000 either
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice data
no fair-queue
no cdp enable
ppp authentication chap
!
interface Serial1/0:8:23
ip address 10.1.7.2 255.255.255.0
no ip directed-broadcast
encapsulation ppp
ip mroute-cache
logging event link-status
no keepalive
dialer idle-timeout 72000 either
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice data
no fair-queue
no cdp enable
ppp authentication chap
!
interface Serial1/0:9:23
ip address 10.1.8.2 255.255.255.0
no ip directed-broadcast
encapsulation ppp
ip mroute-cache
logging event link-status
no keepalive
dialer idle-timeout 72000 either
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice data
no fair-queue
no cdp enable
ppp authentication chap
!
interface Serial1/0:10:23
ip address 10.1.9.2 255.255.255.0
no ip directed-broadcast
encapsulation ppp
ip mroute-cache
logging event link-status
no keepalive
dialer idle-timeout 72000 either
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice data
no fair-queue
no cdp enable
ppp authentication chap
!
interface Serial1/0:11:23
ip address 10.1.10.2 255.255.255.0
no ip directed-broadcast
encapsulation ppp
ip mroute-cache
```

```

logging event link-status
no keepalive
dialer idle-timeout 72000 either
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice modem
no fair-queue
no cdp enable
ppp authentication chap
!
interface Serial1/0:12:23
ip address 10.1.11.2 255.255.255.0
no ip directed-broadcast
encapsulation ppp
ip mroute-cache
logging event link-status
no keepalive
dialer idle-timeout 72000 either
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice modem
no fair-queue
no cdp enable
ppp authentication chap
!
interface Serial1/0:13:23
ip address 10.1.12.2 255.255.255.0
no ip directed-broadcast
encapsulation ppp
ip mroute-cache
logging event link-status
no keepalive
dialer idle-timeout 72000 either
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice modem
no fair-queue
no cdp enable
ppp authentication chap
!
interface Serial1/0:14:23
ip address 10.1.13.2 255.255.255.0
no ip directed-broadcast
encapsulation ppp
ip mroute-cache
logging event link-status
no keepalive
dialer idle-timeout 72000 either
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice modem
fair-queue 64 256 0
no cdp enable
ppp authentication chap
!
interface Serial1/0:15:23
ip address 10.1.14.2 255.255.255.0
no ip directed-broadcast
encapsulation ppp
ip mroute-cache
logging event link-status
no keepalive
dialer idle-timeout 72000 either
dialer-group 1

```

```
isdn switch-type primary-5ess
isdn incoming-voice modem
fair-queue 64 256 0
no cdp enable
ppp authentication chap
!
interface Serial1/0:16:23
ip address 10.1.15.2 255.255.255.0
no ip directed-broadcast
encapsulation ppp
ip mroute-cache
logging event link-status
no keepalive
dialer idle-timeout 72000 either
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice modem
fair-queue 64 256 0
no cdp enable
ppp authentication chap
!
interface Group-Async0
ip address 192.168.253.1 255.255.255.0
no ip directed-broadcast
encapsulation ppp
async default routing
async mode interactive
peer default ip address pool one
no fair-queue
ppp authentication chap
group-range 2/00 7/107
!
router eigrp 100
network 192.168.6.0
network 192.168.7.0
!
ip local pool one 192.168.253.2 192.168.253.254
ip nat translation timeout never
ip nat translation tcp-timeout never
ip nat translation udp-timeout never
ip nat translation finrst-timeout never
ip nat translation syn-timeout never
ip nat translation dns-timeout never
ip nat translation icmp-timeout never
ip classless
ip route 172.16.14.0 255.255.255.0 192.168.21.10
ip route 172.17.14.0 255.255.255.0 192.168.21.10
ip route 172.18.14.0 255.255.255.0 192.168.21.10
ip route 172.19.1.0 255.255.255.0 192.168.21.10
ip route 172.20.1.0 255.255.255.0 192.168.21.10
ip route 172.16.0.0 255.0.0.0 172.22.36.1
ip route 172.16.0.0 255.0.0.0 172.22.36.1
ip route 192.168.173.0 255.255.255.0 172.22.36.1
ip route 192.168.243.0 255.255.255.0 172.22.36.1
no ip http server
!
logging facility local5
logging 192.168.1.137
dialer-list 1 protocol ip permit
!
snmp-server engineID local 00000009020000E01E6B2FBE
snmp-server view public-view internet included
snmp-server community public RO
snmp-server community Public RO
```

```

snmp-server community junk RW
snmp-server community v2c view vldefault RO
snmp-server community v3c view vldefault RO
snmp-server contact Test123456
snmp-server chassis-id 'router for AS5400 ct3'
!
radius-server host 192.168.1.137 auth-port 1645 acct-port 1646
radius-server host 192.168.1.138 auth-port 1645 acct-port 1646
radius-server retransmit 2
radius-server timeout 9
radius-server deadtime 30
radius-server key lab
!
line con 0
  exec-timeout 0 0
  logging synchronous
  transport input none
line aux 0
  exec-timeout 0 0
  password password
  logging synchronous
line vty 0 4
  no exec
  no logging synchronous
line 2/00 7/107
  autoselect ppp
  autoselect timeout 10
  logging synchronous
  modem InOut
  transport input all
!
ntp clock-period 17179742
ntp server 192.168.6.1
scheduler allocate 10000 400
end

```

CT3 CAS/ISDN Without RADIUS

```

AS5400# show config

Building configuration ...

Current configuration:
!
version 12.1
no service pad
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
service internal
!
hostname CT3-Mixed-UUT
!
no boot startup-test
logging buffered 32000 debugging
!
enable password password
!
username cisco password password
!
!

```

```
resource-pool disable
!
!
!
!
dial-tdm-clock priority 1 1/0:1
!
!
!
!
ip subnet-zero
no ip domain-lookup
ip host tftpboot 172.22.254.253
!
mgcp package-capability trunk-package
mgcp default-package trunk-package
isdn switch-type primary-5ess
isdn voice-call-failure 0
modemcap entry factory:MSC=&f
modemcap entry test:MSC=s30=28800
cns event-service server
mta receive maximum-recipients 0
!
!
controller T3 1/0
 framing m23
 clock source line
 t1 1 controller
 t1 2 controller
 t1 3 controller
 t1 4 controller
 t1 5 controller
 t1 6 controller
 t1 7 controller
 t1 8 controller
 t1 9 controller
 t1 10 controller
 t1 11 controller
 t1 12 controller
 t1 13 controller
 t1 14 controller
 t1 15 controller
 t1 16 controller
 t1 17 controller
 t1 18 controller
 t1 19 controller
 t1 20 controller
 t1 21 controller
 t1 22 controller
 t1 23 controller
 t1 24 controller
 t1 25 controller
 t1 26 controller
 t1 27 controller
 t1 28 controller
!
controller T1 1/0:1
 framing esf
 pri-group timeslots 1-24
!
controller T1 1/0:2
 framing esf
 pri-group timeslots 1-24
!
```

```
controller T1 1/0:3
  framing esf
  pri-group timeslots 1-24
!
controller T1 1/0:4
  framing esf
  pri-group timeslots 1-24
!
controller T1 1/0:5
  framing esf
  pri-group timeslots 1-24
!
controller T1 1/0:6
  framing esf
  pri-group timeslots 1-24
!
controller T1 1/0:7
  framing esf
  pri-group timeslots 1-24
!
controller T1 1/0:8
  framing esf
  pri-group timeslots 1-24
!
controller T1 1/0:9
  framing esf
  pri-group timeslots 1-24
!
controller T1 1/0:10
  framing esf
  pri-group timeslots 1-24
!
controller T1 1/0:11
  framing esf
  pri-group timeslots 1-24
!
controller T1 1/0:12
  framing esf
  pri-group timeslots 1-24
!
controller T1 1/0:13
  framing esf
  pri-group timeslots 1-24
!
controller T1 1/0:14
  framing esf
  pri-group timeslots 1-24
!
controller T1 1/0:15
  framing esf
  pri-group timeslots 1-24
!
controller T1 1/0:16
  framing esf
  pri-group timeslots 1-24
!
controller T1 1/0:17
  framing esf
  ds0-group 0 timeslots 1-24 type e&m-fgb
  cas-custom 0
!
controller T1 1/0:18
  framing esf
  ds0-group 0 timeslots 1-24 type e&m-fgb
```

```
cas-custom 0
!
controller T1 1/0:19
 framing esf
 ds0-group 0 timeslots 1-24 type e&m-fgb
 cas-custom 0
!
controller T1 1/0:20
 framing esf
 ds0-group 0 timeslots 1-24 type e&m-fgb
 cas-custom 0
!
controller T1 1/0:21
 framing esf
 ds0-group 0 timeslots 1-24 type e&m-fgb
 cas-custom 0
!
controller T1 1/0:22
 framing esf
 ds0-group 0 timeslots 1-24 type e&m-fgb
 cas-custom 0
!
controller T1 1/0:23
 framing esf
 ds0-group 0 timeslots 1-24 type e&m-fgb
 cas-custom 0
!
controller T1 1/0:24
 framing esf
 ds0-group 0 timeslots 1-24 type e&m-fgb
 cas-custom 0
!
controller T1 1/0:25
 framing esf
 ds0-group 0 timeslots 1-24 type e&m-fgb
 cas-custom 0
!
controller T1 1/0:26
 framing esf
 ds0-group 0 timeslots 1-24 type e&m-fgb
 cas-custom 0
!
controller T1 1/0:27
 framing esf
 ds0-group 0 timeslots 1-24 type e&m-fgb
 cas-custom 0
!
controller T1 1/0:28
 framing esf
 ds0-group 0 timeslots 1-24 type e&m-fgb
 cas-custom 0
!
!
!
!
!
interface GigabitEthernet0/0
 description VLAN 6
 ip address 192.168.6.100 255.255.255.0
 no ip directed-broadcast
 no ip mroute-cache
 duplex auto
 speed auto
!
```

```

interface GigabitEthernet0/1
  description VLAN 7
  ip address 172.22.36.36 255.255.254.0
  no ip directed-broadcast
  no ip mroute-cache
  duplex auto
  speed auto
!
interface Serial0/0
  ip address 172.22.123.2 255.255.255.0
  no ip directed-broadcast
  clockrate 8000000
!
interface Serial0/1
  ip address 172.22.124.2 255.255.255.0
  no ip directed-broadcast
  encapsulation ppp
  ppp authorization no-author
!
interface Serial1/0:1:23
  ip address 10.1.0.2 255.255.255.0
  no ip directed-broadcast
  encapsulation ppp
  ip mroute-cache
  logging event link-status
  no keepalive
  dialer idle-timeout 72000 either
  dialer-group 1
  isdn switch-type primary-5ess
  isdn incoming-voice data
  no fair-queue
  no cdp enable
  ppp authentication chap
!
interface Serial1/0:2:23
  ip address 10.1.1.2 255.255.255.0
  no ip directed-broadcast
  encapsulation ppp
  ip mroute-cache
  logging event link-status
  no keepalive
  dialer idle-timeout 72000 either
  dialer-group 1
  isdn switch-type primary-5ess
  isdn incoming-voice data
  isdn T203 10000
  no fair-queue
  no cdp enable
  ppp authentication chap
!
interface Serial1/0:3:23
  ip address 10.1.2.2 255.255.255.0
  no ip directed-broadcast
  encapsulation ppp
  ip mroute-cache
  logging event link-status
  no keepalive
  dialer idle-timeout 72000 either
  dialer-group 1
  isdn switch-type primary-5ess
  isdn incoming-voice data
  no fair-queue
  no cdp enable
  ppp authentication chap

```

```
!  
interface Serial1/0:4:23  
  ip address 10.1.3.2 255.255.255.0  
  no ip directed-broadcast  
  encapsulation ppp  
  ip mroute-cache  
  logging event link-status  
  no keepalive  
  dialer idle-timeout 72000 either  
  dialer-group 1  
  isdn switch-type primary-5ess  
  isdn incoming-voice data  
  no fair-queue  
  no cdp enable  
  ppp authentication chap  
!  
interface Serial1/0:5:23  
  ip address 10.1.4.2 255.255.255.0  
  no ip directed-broadcast  
  encapsulation ppp  
  ip mroute-cache  
  logging event link-status  
  no keepalive  
  dialer idle-timeout 72000 either  
  dialer-group 1  
  isdn switch-type primary-5ess  
  isdn incoming-voice data  
  no fair-queue  
  no cdp enable  
  ppp authentication chap  
!  
interface Serial1/0:6:23  
  ip address 10.1.5.2 255.255.255.0  
  no ip directed-broadcast  
  encapsulation ppp  
  ip mroute-cache  
  logging event link-status  
  no keepalive  
  dialer idle-timeout 72000 either  
  dialer-group 1  
  isdn switch-type primary-5ess  
  isdn incoming-voice data  
  no fair-queue  
  no cdp enable  
  ppp authentication chap  
!  
interface Serial1/0:7:23  
  ip address 10.1.6.2 255.255.255.0  
  no ip directed-broadcast  
  encapsulation ppp  
  ip mroute-cache  
  logging event link-status  
  no keepalive  
  dialer idle-timeout 72000 either  
  dialer-group 1  
  isdn switch-type primary-5ess  
  isdn incoming-voice data  
  no fair-queue  
  no cdp enable  
  ppp authentication chap  
!  
interface Serial1/0:8:23  
  ip address 10.1.7.2 255.255.255.0  
  no ip directed-broadcast
```

```

encapsulation ppp
ip mroute-cache
logging event link-status
no keepalive
dialer idle-timeout 72000 either
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice data
no fair-queue
no cdp enable
ppp authentication chap
!
interface Serial1/0:9:23
ip address 10.1.8.2 255.255.255.0
no ip directed-broadcast
encapsulation ppp
ip mroute-cache
logging event link-status
no keepalive
dialer idle-timeout 72000 either
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice data
no fair-queue
no cdp enable
ppp authentication chap
!
interface Serial1/0:10:23
ip address 10.1.9.2 255.255.255.0
no ip directed-broadcast
encapsulation ppp
ip mroute-cache
logging event link-status
no keepalive
dialer idle-timeout 72000 either
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice data
no fair-queue
no cdp enable
ppp authentication chap
!
interface Serial1/0:11:23
ip address 10.1.10.2 255.255.255.0
no ip directed-broadcast
encapsulation ppp
ip mroute-cache
logging event link-status
no keepalive
dialer idle-timeout 72000 either
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice modem
no fair-queue
no cdp enable
ppp authentication chap
!
interface Serial1/0:12:23
ip address 10.1.11.2 255.255.255.0
no ip directed-broadcast
encapsulation ppp
ip mroute-cache
logging event link-status
no keepalive

```

```
dialer idle-timeout 72000 either
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice modem
no fair-queue
no cdp enable
ppp authentication chap
!
interface Serial1/0:13:23
ip address 10.1.12.2 255.255.255.0
no ip directed-broadcast
encapsulation ppp
ip mroute-cache
logging event link-status
no keepalive
dialer idle-timeout 72000 either
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice modem
no fair-queue
no cdp enable
ppp authentication chap
!
interface Serial1/0:14:23
ip address 10.1.13.2 255.255.255.0
no ip directed-broadcast
encapsulation ppp
ip mroute-cache
logging event link-status
no keepalive
dialer idle-timeout 72000 either
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice modem
fair-queue 64 256 0
no cdp enable
ppp authentication chap
!
interface Serial1/0:15:23
ip address 10.1.14.2 255.255.255.0
no ip directed-broadcast
encapsulation ppp
ip mroute-cache
logging event link-status
no keepalive
dialer idle-timeout 72000 either
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice modem
fair-queue 64 256 0
no cdp enable
ppp authentication chap
!
interface Serial1/0:16:23
ip address 10.1.15.2 255.255.255.0
no ip directed-broadcast
encapsulation ppp
ip mroute-cache
logging event link-status
no keepalive
dialer idle-timeout 72000 either
dialer-group 1
isdn switch-type primary-5ess
isdn incoming-voice modem
```

```

fair-queue 64 256 0
no cdp enable
ppp authentication chap
!
interface Group-Async0
ip address 192.168.253.1 255.255.255.0
no ip directed-broadcast
encapsulation ppp
async default routing
async mode interactive
peer default ip address pool one
no fair-queue
ppp authentication chap
group-range 2/00 7/107
!
router eigrp 100
network 192.168.6.0
network 192.168.7.0
!
ip local pool one 192.168.253.2 192.168.253.254
ip nat translation timeout never
ip nat translation tcp-timeout never
ip nat translation udp-timeout never
ip nat translation finrst-timeout never
ip nat translation syn-timeout never
ip nat translation dns-timeout never
ip nat translation icmp-timeout never
ip classless
ip route 172.16.14.0 255.255.255.0 192.168.21.10
ip route 172.17.14.0 255.255.255.0 192.168.21.10
ip route 172.18.14.0 255.255.255.0 192.168.21.10
ip route 172.19.1.0 255.255.255.0 192.168.21.10
ip route 172.20.1.0 255.255.255.0 192.168.21.10
ip route 172.16.0.0 255.0.0.0 172.22.36.1
ip route 172.16.0.0 255.0.0.0 172.22.36.1
ip route 192.168.173.0 255.255.255.0 172.22.36.1
ip route 192.168.243.0 255.255.255.0 172.22.36.1
no ip http server
!
logging facility local5
logging 192.168.1.137
dialer-list 1 protocol ip permit
!
snmp-server engineID local 00000009020000E01E6B2FBFE
snmp-server view public-view internet included
snmp-server community public RO
snmp-server community Public RO
snmp-server community junk RW
snmp-server community v2c view vldefault RO
snmp-server community v3c view vldefault RO
snmp-server contact Test123456
snmp-server chassis-id 'router for AS5400 ct3'
!
line con 0
exec-timeout 0 0
logging synchronous
transport input none
line aux 0
exec-timeout 0 0
password lab
logging synchronous
line vty 0 4
no exec
no logging synchronous

```

```

line 2/00 7/107
  autoselect ppp
  autoselect timeout 10
  logging synchronous
  modem InOut
  transport input all
!
ntp clock-period 17179742
ntp server 192.168.6.1
scheduler allocate 10000 400
end

```

CT3 Without Resource Pooling

```

AS5400# show config

Building configuration ...

Current configuration:
!!
version 12.1
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname CT3-CAS-UUT
!
no boot startup-test
no logging console
!
<text omitted>
!
resource-pool enable
resource-pool call treatment resource busy
resource-pool call treatment profile no-answer
!
resource-pool group resource 4700
  range port 1/0 1/107
  range port 2/0 2/1
!
resource-pool group resource 5300
  range port 2/2 2/107
  range port 3/0 3/107
  range port 4/0 4/107
  range port 5/0 5/107
  range port 6/0 6/107
!
resource-pool profile customer 4700
  limit base-size 110
  limit overflow-size 18
  resource 4700 speech
  dnis group default
!
resource-pool profile customer 5300
  limit base-size 538
  limit overflow-size 18
  resource 5300 speech
  dnis group elnino
!
resource-pool profile service gold
  modem min-speed 33200 max-speed 56000

```

```

resource-pool aaa protocol local
!
!
!
!
dial-tdm-clock priority 1 7/0:1
!
!
!
ip subnet-zero
no ip domain-lookup
ip host jurai 172.23.254.253
!
mgcp package-capability trunk-package
mgcp default-package trunk-package
isdn voice-call-failure 0
cns event-service server
mta receive maximum-recipients 0
!
!
controller T3 7/0
  clock source line
  t1 1 controller
  t1 2 controller
  t1 3 controller
  t1 4 controller
  t1 5 controller
  t1 6 controller
  t1 7 controller
  t1 8 controller
  t1 9 controller
  t1 10 controller
  t1 11 controller
  t1 12 controller
  t1 13 controller
  t1 14 controller
  t1 15 controller
  t1 16 controller
  t1 17 controller
  t1 18 controller
  t1 19 controller
  t1 20 controller
  t1 21 controller
  t1 22 controller
  t1 23 controller
  t1 24 controller
  t1 25 controller
  t1 26 controller
  t1 27 controller
  t1 28 controller
!
controller T1 7/0:1
  framing esf
  ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
  cas-custom 1
!
controller T1 7/0:2
  framing esf
  ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
  cas-custom 1
!
controller T1 7/0:3
  framing esf

```

```
    ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
    cas-custom 1
!
controller T1 7/0:4
    framing esf
    ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
    cas-custom 1
!
controller T1 7/0:5
    framing esf
    ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
    cas-custom 1
!
controller T1 7/0:6
    framing esf
    ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
    cas-custom 1
!
controller T1 7/0:7
    framing esf
    ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
    cas-custom 1
!
controller T1 7/0:8
    framing esf
    ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
    cas-custom 1
!
controller T1 7/0:9
    framing esf
    ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
    cas-custom 1
!
controller T1 7/0:10
    framing esf
    ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
    cas-custom 1
!
controller T1 7/0:11
    framing esf
    ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
    cas-custom 1
!
controller T1 7/0:12
    framing esf
    ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
    cas-custom 1
!
controller T1 7/0:13
    framing esf
    ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
    cas-custom 1
!
controller T1 7/0:14
    framing esf
    ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
    cas-custom 1
!
controller T1 7/0:15
    framing esf
    ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
    cas-custom 1
!
controller T1 7/0:16
```

```

framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!
controller T1 7/0:17
framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!
controller T1 7/0:18
framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!
controller T1 7/0:19
framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!
controller T1 7/0:20
framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!
controller T1 7/0:21
framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!
controller T1 7/0:22
framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!
controller T1 7/0:23
framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!
controller T1 7/0:24
framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!
controller T1 7/0:25
framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!
controller T1 7/0:26
framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!
controller T1 7/0:27
framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!
controller T1 7/0:28
framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!

```

```
!  
!  
!  
interface GigabitEthernet0/0  
 ip address 192.168.18.100 255.255.255.0  
 no ip directed-broadcast  
 no ip mroute-cache  
 no keepalive  
 duplex auto  
 speed auto  
!  
interface GigabitEthernet0/1  
 ip address 192.168.19.100 255.255.255.0  
 no ip directed-broadcast  
 no ip mroute-cache  
 duplex auto  
 speed auto  
!  
interface Serial0/0  
 no ip address  
 no ip directed-broadcast  
 clockrate 2000000  
!  
interface Serial0/1  
 no ip address  
 no ip directed-broadcast  
 shutdown  
 clockrate 2000000  
!  
interface Group-Async0  
 no ip address  
 no ip directed-broadcast  
 no group-range  
!  
interface Group-Async1  
 ip unnumbered GigabitEthernet0/0  
 no ip directed-broadcast  
 encapsulation ppp  
 async default routing  
 async mode interactive  
 no peer default ip address  
 no fair-queue  
 ppp authentication chap  
 group-range 1/00 6/107  
!  
router eigrp 100  
 network 192.168.18.0  
 network 192.168.19.0  
!  
ip nat translation timeout never  
ip nat translation tcp-timeout never  
ip nat translation udp-timeout never  
ip nat translation finrst-timeout never  
ip nat translation syn-timeout never  
ip nat translation dns-timeout never  
ip nat translation icmp-timeout never  
ip classless  
ip route 172.16.14.0 255.255.255.0 192.168.21.10  
ip route 172.17.14.0 255.255.255.0 192.168.21.10  
ip route 172.18.14.0 255.255.255.0 192.168.21.10  
ip route 172.19.1.0 255.255.255.0 192.168.21.10  
ip route 172.20.1.0 255.255.255.0 192.168.21.10  
ip route 172.21.1.0 255.255.255.0 192.168.21.10  
ip route 172.22.1.0 255.255.255.0 192.168.21.10
```

```

ip route 172.22.254.253 255.255.255.255 GigabitEthernet0/0
no ip http server
!
snmp-server engineID local 000000090200003096F80084
!
line con 0
  exec-timeout 0 0
  logging synchronous
  transport input none
line aux 0
  exec-timeout 0 0
  logging synchronous
  transport input all
line vty 0 4
  password password
  no logging synchronous
line 1/00 6/107
  autoselect ppp
  autoselect timeout 10
  logging synchronous
  modem InOut
  transport input all
!
ntp clock-period 17179843
ntp server 192.168.18.1
scheduler allocate 40000 200
end

```

CT3 CAS with Resource Pooling

```

AS5400# show config

Building configuration ...

Current configuration:
!
version 12.1
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname CT3-CAS-UUT
!
no boot startup-test
no logging console
aaa new-model
aaa group server radius aaa.router
  server 192.168.1.137 auth-port 1645 acct-port 1646
  server 192.168.1.138 auth-port 1645 acct-port 1646
!
aaa authentication ppp default group aaa.router local
aaa authorization network default group aaa.router local
aaa accounting update newinfo periodic 30
aaa accounting network default start-stop group aaa.router
enable password password
!
<text omitted>
!
resource-pool enable
resource-pool call treatment resource busy
resource-pool call treatment profile no-answer

```

```
!
resource-pool group resource 4700
  range port 1/0 1/107
  range port 2/0 2/1
!
resource-pool group resource 5300
  range port 2/2 2/107
  range port 3/0 3/107
  range port 4/0 4/107
  range port 5/0 5/107
  range port 6/0 6/107
!
resource-pool profile customer 4700
  limit base-size 110
  limit overflow-size 18
  resource 4700 speech
  dnis group default
!
resource-pool profile customer 5300
  limit base-size 538
  limit overflow-size 18
  resource 5300 speech
  dnis group elnino
!
resource-pool profile service gold
  modem min-speed 33200 max-speed 56000
resource-pool aaa protocol local
!
!
!
!
dial-tdm-clock priority 1 7/0:1
!
!
!
!
ip subnet-zero
no ip domain-lookup
ip host jurai 172.23.254.253
!
mgcp package-capability trunk-package
mgcp default-package trunk-package
isdn voice-call-failure 0
cns event-service server
mta receive maximum-recipients 0
!
!
controller T3 7/0
  clock source line
  t1 1 controller
  t1 2 controller
  t1 3 controller
  t1 4 controller
  t1 5 controller
  t1 6 controller
  t1 7 controller
  t1 8 controller
  t1 9 controller
  t1 10 controller
  t1 11 controller
  t1 12 controller
  t1 13 controller
  t1 14 controller
  t1 15 controller
```

```

t1 16 controller
t1 17 controller
t1 18 controller
t1 19 controller
t1 20 controller
t1 21 controller
t1 22 controller
t1 23 controller
t1 24 controller
t1 25 controller
t1 26 controller
t1 27 controller
t1 28 controller
!
controller T1 7/0:1
  framing esf
  ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
  cas-custom 1
!
controller T1 7/0:2
  framing esf
  ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
  cas-custom 1
!
controller T1 7/0:3
  framing esf
  ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
  cas-custom 1
!
controller T1 7/0:4
  framing esf
  ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
  cas-custom 1
!
controller T1 7/0:5
  framing esf
  ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
  cas-custom 1
!
controller T1 7/0:6
  framing esf
  ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
  cas-custom 1
!
controller T1 7/0:7
  framing esf
  ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
  cas-custom 1
!
controller T1 7/0:8
  framing esf
  ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
  cas-custom 1
!
controller T1 7/0:9
  framing esf
  ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
  cas-custom 1
!
controller T1 7/0:10
  framing esf
  ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
  cas-custom 1
!

```

```
controller T1 7/0:11
  framing esf
  ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
  cas-custom 1
!
controller T1 7/0:12
  framing esf
  ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
  cas-custom 1
!
controller T1 7/0:13
  framing esf
  ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
  cas-custom 1
!
controller T1 7/0:14
  framing esf
  ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
  cas-custom 1
!
controller T1 7/0:15
  framing esf
  ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis cas-custom 1
!
controller T1 7/0:16
  framing esf
  ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
  cas-custom 1
!
controller T1 7/0:17
  framing esf
  ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
  cas-custom 1
!
controller T1 7/0:18
  framing esf
  ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
  cas-custom 1
!
controller T1 7/0:19
  framing esf
  ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
  cas-custom 1
!
controller T1 7/0:20
  framing esf
  ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
  cas-custom 1
!
controller T1 7/0:21
  framing esf
  ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
  cas-custom 1
!
controller T1 7/0:22
  framing esf
  ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
  cas-custom 1
!
controller T1 7/0:23
  framing esf
  ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
  cas-custom 1
!
```

```

controller T1 7/0:24
  framing esf
  ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
  cas-custom 1
!
controller T1 7/0:25
  framing esf
  ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
  cas-custom 1
!
controller T1 7/0:26
  framing esf
  ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
  cas-custom 1
!
controller T1 7/0:27
  framing esf
  ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
  cas-custom 1
!
controller T1 7/0:28
  framing esf
  ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
  cas-custom 1
!
!
!
!
interface GigabitEthernet0/0
  ip address 192.168.18.100 255.255.255.0
  no ip directed-broadcast
  no ip mroute-cache
  no keepalive
  duplex auto
  speed auto
!
interface GigabitEthernet0/1
  ip address 192.168.19.100 255.255.255.0
  no ip directed-broadcast
  no ip mroute-cache
  duplex auto
  speed auto
!
interface Serial0/0
  no ip address
  no ip directed-broadcast
  clockrate 2000000
!
interface Serial0/1
  no ip address
  no ip directed-broadcast
  shutdown
  clockrate 2000000
!
interface Group-Async0
  no ip address
  no ip directed-broadcast
  no group-range
!
interface Group-Async1
  ip unnumbered GigabitEthernet0/0
  no ip directed-broadcast
  encapsulation ppp
  async default routing

```

```
async mode interactive
no peer default ip address
no fair-queue
ppp authentication chap
group-range 1/00 6/107
!
router eigrp 100
 network 192.168.18.0
 network 192.168.19.0
!
ip nat translation timeout never
ip nat translation tcp-timeout never
ip nat translation udp-timeout never
ip nat translation finrst-timeout never
ip nat translation syn-timeout never
ip nat translation dns-timeout never
ip nat translation icmp-timeout never
ip classless
ip route 172.16.14.0 255.255.255.0 192.168.21.10
ip route 172.17.14.0 255.255.255.0 192.168.21.10
ip route 172.18.14.0 255.255.255.0 192.168.21.10
ip route 172.19.1.0 255.255.255.0 192.168.21.10
ip route 172.20.1.0 255.255.255.0 192.168.21.10
ip route 172.21.1.0 255.255.255.0 192.168.21.10
ip route 172.22.1.0 255.255.255.0 192.168.21.10
ip route 172.22.254.253 255.255.255.255 GigabitEthernet0/0
no ip http server
!
!
dialer dnis group callblock
 number 5555
!
dialer dnis group v90
 number 815.....
!
dialer dnis group elnino
 number 915....
!
snmp-server engineID local 000000090200003096F80084
!
radius-server host 192.168.1.137 auth-port 1645 acct-port 1646
radius-server host 192.168.1.138 auth-port 1645 acct-port 1646
radius-server retransmit 2
radius-server timeout 9
radius-server deadtime 30
radius-server key lab
!
line con 0
 exec-timeout 0 0
 logging synchronous
 transport input none
line aux 0
 exec-timeout 0 0
 logging synchronous
 transport input all
line vty 0 4
 password password
 no logging synchronous
line 1/00 6/107
 autoselect ppp
 autoselect timeout 10
 logging synchronous
 modem InOut
 transport input all
```

```

!
ntp clock-period 17179843
ntp server 192.168.18.1
scheduler allocate 40000 200
end

```

Two 8 T1/PRI ISDN with Modems

```

AS5400# show config

Building configuration ...

Current configuration:
!
version 12.1
no service pad
service timestamps debug uptime
service timestamps log uptime
service password-encryption
!
hostname AS5400-T1-PRI-UUT
!
no boot startup-test
logging rate-limit 5
no logging console
enable password password
!
resource-pool disable
!
!dial-tdm-clock priority 1 2/4
!
!ip subnet-zero
ip ftp source-interface GigabitEthernet0/0
ip ftp username frank
ip ftp password 7 06F022C4D1D0
no ip domain-lookup
ip host greenbug 172.22.43.28
ip host jurai 172.23.254.253
!
mgcp package-capability trunk-package
mgcp default-package trunk-package
isdn switch-type primary-5ess
isdn voice-call-failure 0
cns event-service server
mta receive maximum-recipients 0
!
!
controller T1 2/0
 framing esf
 linecode b8zs
 cablelength short 133
 pri-group timeslots 1-24
!
controller T1 2/1
 framing esf
 linecode b8zs
 cablelength short 133
 pri-group timeslots 1-24
!
controller T1 2/2
 framing esf

```

```
linecode b8zs
cablelength short 133
pri-group timeslots 1-24
!
controller T1 2/3
framing esf
linecode b8zs
cablelength short 133
pri-group timeslots 1-24
!
controller T1 2/4
framing esf
linecode b8zs
cablelength short 133
pri-group timeslots 1-24
!
controller T1 2/5
framing esf
linecode b8zs
cablelength short 133
pri-group timeslots 1-24
!
controller T1 2/6
framing esf
linecode b8zs
cablelength short 133
pri-group timeslots 1-24
!
controller T1 2/7
framing esf
linecode b8zs
cablelength short 133
pri-group timeslots 1-24
!
controller T1 5/0
framing esf
linecode b8zs
cablelength short 133
pri-group timeslots 1-24
!
controller T1 5/1
framing esf
linecode b8zs
cablelength short 133
pri-group timeslots 1-24
!
controller T1 5/2
framing esf
linecode b8zs
cablelength short 133
pri-group timeslots 1-24
!
controller T1 5/3
framing esf
linecode b8zs
cablelength short 133
pri-group timeslots 1-24
!
controller T1 5/4
framing esf
linecode b8zs
cablelength short 133
pri-group timeslots 1-24
!
```

```

controller T1 5/5
  framing esf
  linecode b8zs
  cablelength short 133
  pri-group timeslots 1-24
!
controller T1 5/6
  framing esf
  linecode b8zs
  cablelength short 133
  pri-group timeslots 1-24
!
controller T1 5/7
  framing esf
  linecode b8zs
  cablelength short 133
  pri-group timeslots 1-24
!
!
!
!
!
interface GigabitEthernet0/0
  ip address 192.168.10.102 255.255.255.0
  no ip directed-broadcast
  no ip route-cache
  no ip mroute-cache
  no keepalive
  duplex auto
  speed auto
!
interface GigabitEthernet0/1
  no ip address
  no ip directed-broadcast
  no ip route-cache
  no ip mroute-cache
  shutdown
  duplex auto
  speed auto
!
interface Serial0/0
  no ip address
  no ip directed-broadcast
  no ip route-cache
  no ip mroute-cache
  shutdown
  fair-queue 64 256 0
  clockrate 2000000
!
interface Serial0/1
  no ip address
  no ip directed-broadcast
  no ip route-cache
  no ip mroute-cache
  shutdown
  clockrate 2000000
!
interface Serial2/0:23
  no ip address
  no ip directed-broadcast
  isdn switch-type primary-5ess
  isdn incoming-voice modem
  fair-queue 64 256 0
  no cdp enable

```

```
!  
interface Serial2/1:23  
  no ip address  
  no ip directed-broadcast  
  isdn switch-type primary-5ess  
  isdn incoming-voice modem  
  fair-queue 64 256 0  
  no cdp enable  
!  
interface Serial2/2:23  
  no ip address  
  no ip directed-broadcast  
  isdn switch-type primary-5ess  
  isdn incoming-voice modem  
  fair-queue 64 256 0  
  no cdp enable  
!  
interface Serial2/3:23  
  no ip address  
  no ip directed-broadcast  
  isdn switch-type primary-5ess  
  isdn incoming-voice modem  
  fair-queue 64 256 0  
  no cdp enable  
!  
interface Serial2/4:23  
  no ip address  
  no ip directed-broadcast  
  isdn switch-type primary-5ess  
  isdn incoming-voice modem  
  fair-queue 64 256 0  
  no cdp enable  
!  
interface Serial2/5:23  
  no ip address  
  no ip directed-broadcast  
  isdn switch-type primary-5ess  
  isdn incoming-voice modem  
  fair-queue 64 256 0  
  no cdp enable  
!  
interface Serial2/6:23  
  no ip address  
  no ip directed-broadcast  
  isdn switch-type primary-5ess  
  isdn incoming-voice modem  
  fair-queue 64 256 0  
  no cdp enable  
!  
interface Serial2/7:23  
  no ip address  
  no ip directed-broadcast  
  isdn switch-type primary-5ess  
  isdn incoming-voice modem  
  fair-queue 64 256 0  
  no cdp enable  
!  
interface Serial5/0:23  
  no ip address  
  no ip directed-broadcast  
  isdn switch-type primary-5ess  
  isdn incoming-voice modem  
  fair-queue 64 256 0  
  no cdp enable
```

```

!
interface Serial5/1:23
  no ip address
  no ip directed-broadcast
  isdn switch-type primary-5ess
  isdn incoming-voice modem
  fair-queue 64 256 0
  no cdp enable
!
interface Serial5/2:23
  no ip address
  no ip directed-broadcast
  isdn switch-type primary-5ess
  isdn incoming-voice modem
  fair-queue 64 256 0
  no cdp enable
!
interface Serial5/3:23
  no ip address
  no ip directed-broadcast
  isdn switch-type primary-5ess
  isdn incoming-voice modem
  fair-queue 64 256 0
  no cdp enable
!
interface Serial5/4:23
  no ip address
  no ip directed-broadcast
  isdn switch-type primary-5ess
  isdn incoming-voice modem
  fair-queue 64 256 0
  no cdp enable
!
interface Serial5/5:23
  no ip address
  no ip directed-broadcast
  isdn switch-type primary-5ess
  isdn incoming-voice modem
  fair-queue 64 256 0
  no cdp enable
!
interface Serial5/6:23
  no ip address
  no ip directed-broadcast
  isdn switch-type primary-5ess
  isdn incoming-voice modem
  fair-queue 64 256 0
  no cdp enable
!
interface Serial5/7:23
  no ip address
  no ip directed-broadcast
  isdn switch-type primary-5ess
  isdn incoming-voice modem
  fair-queue 64 256 0
  no cdp enable
!
interface Async1/00
  ip address 172.16.97.1 255.255.255.0
  no ip directed-broadcast
  encapsulation ppp
  no ip route-cache
  no ip mroute-cache
  dialer in-band

```

```
dialer idle-timeout 2000000
dialer string 6151300001
dialer-group 1
async default routing
async mode interactive
no peer default ip address
no fair-queue
ppp authentication chap
hold-queue 1000 in
hold-queue 1000 out
!
interface Async1/01
ip address 172.16.98.1 255.255.255.0
no ip directed-broadcast
encapsulation ppp
no ip route-cache
no ip mroute-cache
dialer in-band
dialer idle-timeout 2000000
dialer string 7150100001
dialer-group 1
async default routing
async mode interactive
no peer default ip address
no fair-queue
ppp authentication chap
hold-queue 1000 in
hold-queue 1000 out
!
interface Async1/02
ip address 172.16.99.1 255.255.255.0
no ip directed-broadcast
encapsulation ppp
no ip route-cache
no ip mroute-cache
dialer in-band
dialer idle-timeout 2000000
dialer string 7150100002
dialer-group 1
async default routing
async mode interactive
no peer default ip address
no fair-queue
ppp authentication chap
hold-queue 1000 in
hold-queue 1000 out
!
interface Async1/03
ip address 172.16.100.1 255.255.255.0
no ip directed-broadcast
encapsulation ppp
no ip route-cache
no ip mroute-cache
dialer in-band
dialer idle-timeout 2000000
dialer string 7150100003
dialer-group 1
async default routing
async mode interactive
no peer default ip address
no fair-queue
ppp authentication chap
hold-queue 1000 in
hold-queue 1000 out
```

```

!
interface Async1/04
 ip address 172.16.101.1 255.255.255.0
 no ip directed-broadcast
 encapsulation ppp
 no ip route-cache
 no ip mroute-cache
 dialer in-band
 dialer idle-timeout 2000000
 dialer string 7150100004
 dialer-group 1
 async default routing
 async mode interactive
 no peer default ip address
 no fair-queue
 ppp authentication chap
 hold-queue 1000 in
 hold-queue 1000 out
!
interface Async1/05
 ip address 172.16.102.1 255.255.255.0
 no ip directed-broadcast
 encapsulation ppp
 no ip route-cache
 no ip mroute-cache
 dialer in-band
 dialer idle-timeout 2000000
 dialer string 7150100005
 dialer-group 1
 async default routing
 async mode interactive
 no peer default ip address
 no fair-queue
 ppp authentication chap
 hold-queue 1000 in
 hold-queue 1000 out
!
interface Async1/06
 ip address 172.16.103.1 255.255.255.0
 no ip directed-broadcast
 encapsulation ppp
 no ip route-cache
 no ip mroute-cache
 dialer in-band
 dialer idle-timeout AS5400
 dialer string 7150100006
 dialer-group 1
 async mode interactive
 ppp authentication chap
!
interface Async1/07
 ip address 172.16.104.1 255.255.255.0
 no ip directed-broadcast
 encapsulation ppp
 no ip route-cache
 no ip mroute-cache
 dialer in-band
 dialer idle-timeout AS5400
 dialer string 7150100007
 dialer-group 1
 async mode interactive
 ppp authentication chap
!
interface Async1/08

```

```
ip address 172.16.105.1 255.255.255.0
no ip directed-broadcast
encapsulation ppp
no ip route-cache
no ip mroute-cache
dialer in-band
dialer idle-timeout AS5400
dialer string 7150100008
dialer-group 1
async mode interactive
ppp authentication chap
!
interface Async1/09
ip address 172.16.106.1 255.255.255.0
no ip directed-broadcast
encapsulation ppp
no ip route-cache
no ip mroute-cache
dialer in-band
dialer idle-timeout AS5400
dialer string 7150100009
dialer-group 1
async mode interactive
ppp authentication chap
!
interface Async1/10
ip address 172.16.107.1 255.255.255.0
no ip directed-broadcast
encapsulation ppp
no ip route-cache
no ip mroute-cache
dialer in-band
dialer idle-timeout AS5400
dialer string 7150100010
dialer-group 1
async mode interactive
ppp authentication chap
!
interface Async1/11
ip address 172.16.108.1 255.255.255.0
no ip directed-broadcast
encapsulation ppp
no ip route-cache
no ip mroute-cache
dialer in-band
dialer idle-timeout AS5400
dialer string 7150100011
dialer-group 1
async mode interactive
no peer default ip address
no cdp enable
ppp authentication chap
!
interface Async1/12
ip address 172.16.109.1 255.255.255.0
no ip directed-broadcast
encapsulation ppp
no ip route-cache
no ip mroute-cache
dialer in-band
dialer idle-timeout AS5400
dialer string 7150100012
dialer-group 1
async mode interactive
```

```

no peer default ip address
no cdp enable
ppp authentication chap
!
interface Async1/13
ip address 172.16.110.1 255.255.255.0
no ip directed-broadcast
encapsulation ppp
no ip route-cache
no ip mroute-cache
dialer in-band
dialer idle-timeout AS5400
dialer string 7150100013
dialer-group 1
async mode interactive
no peer default ip address
no cdp enable
ppp authentication chap
!
interface Async1/14
ip address 172.16.111.1 255.255.255.0
no ip directed-broadcast
encapsulation ppp
no ip route-cache
no ip mroute-cache
dialer in-band
dialer idle-timeout AS5400
dialer string 7150100014
dialer-group 1
async mode interactive
no peer default ip address
no cdp enable
ppp authentication chap
!
interface Async1/15
ip address 172.16.112.1 255.255.255.0
no ip directed-broadcast
encapsulation ppp
no ip route-cache
no ip mroute-cache
dialer in-band
dialer idle-timeout AS5400
dialer string 7150100015
dialer-group 1
async mode interactive
no peer default ip address
no cdp enable
ppp authentication chap
!
interface Async1/16
ip address 172.16.113.1 255.255.255.0
no ip directed-broadcast
encapsulation ppp
no ip route-cache
no ip mroute-cache
dialer in-band
dialer idle-timeout AS5400
dialer string 7150100016
dialer-group 1
async mode interactive
no peer default ip address
no cdp enable
ppp authentication chap
!

```

```
interface Async1/17
 ip address 172.16.114.1 255.255.255.0
 no ip directed-broadcast
 encapsulation ppp
 no ip route-cache
 no ip mroute-cache
 dialer in-band
 dialer idle-timeout AS5400
 dialer string 7150100017
 dialer-group 1
 async mode interactive
 no peer default ip address
 ppp authentication chap
!
interface Async1/18
 ip address 172.16.115.1 255.255.255.0
 no ip directed-broadcast
 encapsulation ppp
 no ip route-cache
 no ip mroute-cache
 dialer in-band
 dialer idle-timeout AS5400
 dialer string 7150100018
 dialer-group 1
 async mode interactive
 no peer default ip address
 ppp authentication chap
!
interface Async1/19
 ip address 172.16.116.1 255.255.255.0
 no ip directed-broadcast
 encapsulation ppp
 no ip route-cache
 no ip mroute-cache
 dialer in-band
 dialer idle-timeout AS5400
 dialer string 7150100019
 dialer-group 1
 async mode interactive
 no peer default ip address
 ppp authentication chap
!
interface Async1/20
 ip address 172.16.117.1 255.255.255.0
 no ip directed-broadcast
 encapsulation ppp
 no ip route-cache
 no ip mroute-cache
 dialer in-band
 dialer idle-timeout AS5400
 dialer string 7150100020
 dialer-group 1
 async mode interactive
 no peer default ip address
 ppp authentication chap
!
interface Group-Async0
 ip unnumbered GigabitEthernet0/0
 no ip directed-broadcast
 encapsulation ppp
 no ip route-cache
 no ip mroute-cache
 async mode interactive
 no peer default ip address
```

```

ppp authentication chap
group-range 1/21 7/107
!
router eigrp 100
 network 192.168.10.0
!
ip local pool ip-pool 10.4.1.1 10.4.1.250
ip default-gateway 192.168.10.1
ip nat translation timeout never
ip nat translation tcp-timeout never
ip nat translation udp-timeout never
ip nat translation finrst-timeout never
ip nat translation syn-timeout never
ip nat translation dns-timeout never
ip nat translation icmp-timeout never
ip classless
ip route 172.16.1.97 255.255.255.255 Async1/00
ip route 172.16.1.98 255.255.255.255 Async1/01
ip route 172.16.1.99 255.255.255.255 Async1/02
ip route 172.16.1.100 255.255.255.255 Async1/03
ip route 172.16.1.101 255.255.255.255 Async1/04
ip route 172.16.1.102 255.255.255.255 Async1/05
ip route 172.16.1.103 255.255.255.255 Async1/06
ip route 172.16.1.104 255.255.255.255 Async1/07
ip route 172.16.1.105 255.255.255.255 Async1/08
ip route 172.16.1.106 255.255.255.255 Async1/09
ip route 172.16.1.107 255.255.255.255 Async1/10
ip route 172.16.1.108 255.255.255.255 Async1/11
ip route 172.16.1.109 255.255.255.255 Async1/12
ip route 172.16.1.110 255.255.255.255 Async1/13
ip route 172.16.1.111 255.255.255.255 Async1/14
ip route 172.16.1.112 255.255.255.255 Async1/15
ip route 172.16.1.113 255.255.255.255 Async1/16
ip route 172.16.1.114 255.255.255.255 Async1/17
ip route 172.16.1.115 255.255.255.255 Async1/18
ip route 172.16.1.116 255.255.255.255 Async1/19
ip route 172.16.1.117 255.255.255.255 Async1/20
no ip http server
!
dialer-list 1 protocol ip permit
!
!
!
line con 0
 exec-timeout 0 0
 logging synchronous
 transport input none
line aux 0
 logging synchronous
line vty 0 4
 password 7 1042081B
 no logging synchronous
 login
line 1/00 1/107
 autoselect ppp
 script dialer dial
 logging synchronous
 modem InOut
 transport input all
line 3/00 4/107
 autoselect ppp
 script dialer dial
 logging synchronous
 modem InOut

```

```
transport input all
line 6/00 7/107
  autoselect ppp
  script dialer dial
  logging synchronous
  modem InOut
transport input all
!
exception core-file coredump
exception protocol ftp
exception dump 172.23.254.253
ntp clock-period 17179873
ntp server 192.168.10.1
scheduler allocate 4000 200
end
```

Two 8 E1/PRI ISDN with Modems

```
AS5400# show config

Building configuration ...

Current configuration:
!
version 12.1
no service pad
service timestamps debug datetime msec
service timestamps log uptime
no service password-encryption
service internal
!
hostname AS5400-E1-PRI-UUT
!
enable password password
!
<test omitted>
!
!
resource-pool disable
!
!
spe country united-kingdom
!
!
ntp server 192.168.10.1
!
!
!
ip subnet-zero
no ip domain-lookup
ip host jurai 172.23.254.253
!
isdn switch-type primary-net5
isdn voice-call-failure 0
cns event-service server
mta receive maximum-recipients 0
!
xgcp snmp sgcp
!
controller E1 6/0
pri-group timeslots 1-31
```

```

!
controller E1 6/1
pri-group timeslots 1-31
!
controller E1 6/2
pri-group timeslots 1-31
!
controller E1 6/3
pri-group timeslots 1-31
!
controller E1 6/4
pri-group timeslots 1-31
!
controller E1 6/5
pri-group timeslots 1-31
!
controller E1 6/6
pri-group timeslots 1-31
!
controller E1 6/7
pri-group timeslots 1-31
!
controller E1 7/0
pri-group timeslots 1-31
!
controller E1 7/1
pri-group timeslots 1-31
!
controller E1 7/2
pri-group timeslots 1-31
!
controller E1 7/3
pri-group timeslots 1-31
!
controller E1 7/4
pri-group timeslots 1-31
!
controller E1 7/5
pri-group timeslots 1-31
!
controller E1 7/6
pri-group timeslots 1-31
!
controller E1 7/7
pri-group timeslots 1-31
!
!
!
!
interface GigabitEthernet0/0
 ip address 192.168.10.103 255.255.255.0
 no ip directed-broadcast
 no ip route-cache
 no ip mroute-cache
!
interface GigabitEthernet0/1
 no ip address
 no ip directed-broadcast
 no ip route-cache
 no ip mroute-cache
 shutdown
!
interface Serial0/0
 no ip address

```

```
no ip directed-broadcast
no ip route-cache
no ip mroute-cache
shutdown
fair-queue 64 256 0
clockrate 2000000
!
interface Serial0/1
no ip address
no ip directed-broadcast
no ip route-cache
no ip mroute-cache
shutdown
clockrate 2000000
!
interface Serial6/0:15
no ip address
no ip directed-broadcast
isdn switch-type primary-net5
isdn incoming-voice modem
fair-queue 64 256 0
no cdp enable
!
interface Serial6/1:15
no ip address
no ip directed-broadcast
isdn switch-type primary-net5
isdn incoming-voice modem
fair-queue 64 256 0
no cdp enable
!
interface Serial6/2:15
no ip address
no ip directed-broadcast
isdn switch-type primary-net5
isdn incoming-voice modem
fair-queue 64 256 0
no cdp enable
!
interface Serial6/3:15
no ip address
no ip directed-broadcast
isdn switch-type primary-net5
isdn incoming-voice modem
fair-queue 64 256 0
no cdp enable
!
interface Serial6/4:15
no ip address
no ip directed-broadcast
isdn switch-type primary-net5
isdn incoming-voice modem
fair-queue 64 256 0
no cdp enable
!
interface Serial6/5:15
no ip address
no ip directed-broadcast
isdn switch-type primary-net5
isdn incoming-voice modem
fair-queue 64 256 0
no cdp enable
!
interface Serial6/6:15
```

```

no ip address
no ip directed-broadcast
isdn switch-type primary-net5
isdn incoming-voice modem
fair-queue 64 256 0
no cdp enable
!
interface Serial6/7:15
no ip address
no ip directed-broadcast
isdn switch-type primary-net5
isdn incoming-voice modem
fair-queue 64 256 0
no cdp enable
!
interface Serial7/0:15
no ip address
no ip directed-broadcast
isdn switch-type primary-net5
isdn incoming-voice modem
fair-queue 64 256 0
no cdp enable
!
interface Serial7/1:15
no ip address
no ip directed-broadcast
isdn switch-type primary-net5
isdn incoming-voice modem
fair-queue 64 256 0
no cdp enable
!
interface Serial7/2:15
no ip address
no ip directed-broadcast
isdn switch-type primary-net5
isdn incoming-voice modem
fair-queue 64 256 0
no cdp enable
!
interface Serial7/3:15
no ip address
no ip directed-broadcast
isdn switch-type primary-net5
isdn incoming-voice modem
fair-queue 64 256 0
no cdp enable
!
interface Serial7/4:15
no ip address
no ip directed-broadcast
isdn switch-type primary-net5
isdn incoming-voice modem
fair-queue 64 256 0
no cdp enable
!
interface Serial7/5:15
no ip address
no ip directed-broadcast
isdn switch-type primary-net5
isdn incoming-voice modem
fair-queue 64 256 0
no cdp enable
!
interface Serial7/6:15

```

```
no ip address
no ip directed-broadcast
isdn switch-type primary-net5
isdn incoming-voice modem
fair-queue 64 256 0
no cdp enable
!
interface Serial7/7:15
no ip address
no ip directed-broadcast
isdn switch-type primary-net5
isdn incoming-voice modem
fair-queue 64 256 0
no cdp enable
!
interface Async1/00
ip unnumbered GigabitEthernet0/0
no ip directed-broadcast
encapsulation ppp
async mode interactive
ppp authentication chap
!
interface Async1/01
ip unnumbered GigabitEthernet0/0
no ip directed-broadcast
encapsulation ppp
async mode interactive
ppp authentication chap
!
interface Async1/02
ip unnumbered GigabitEthernet0/0
no ip directed-broadcast
encapsulation ppp
async mode interactive
ppp authentication chap
!
.
.
<information deleted>
.
.
!

interface Async5/106
ip unnumbered GigabitEthernet0/0
no ip directed-broadcast
encapsulation ppp
async mode interactive
ppp authentication chap
!
interface Async5/107
ip unnumbered GigabitEthernet0/0
no ip directed-broadcast
encapsulation ppp
async mode interactive
ppp authentication chap
!
interface Group-Async0
no ip address
no ip directed-broadcast
no group-range
!
router eigrp 100
network 192.168.13.0
```

```

!
ip default-gateway 192.168.13.1
ip classless
no ip http server
!
!
!
line con 0
  exec-timeout 0 0

```

Two 8 T1/PRI CAS with Modems

```

AS5400# show config

Building configuration ...

Current configuration:
!
version 12.1
no service pad
service timestamps debug uptime
service timestamps log uptime
service password-encryption
!
hostname AS5400-T1-CAS-UUT
!
no boot startup-test
enable password password
!
<text omitted>
!
!
resource-pool disable
!
!
dial-tdm-clock priority 1 2/0
!
!
ip subnet-zero
ip ftp source-interface GigabitEthernet0/0
ip ftp username frank
ip ftp password 7 000D1E0B0508
no ip domain-lookup
ip host jurai 172.23.254.253
!
mgcp package-capability trunk-package
mgcp default-package trunk-package
isdn voice-call-failure 0
chat-script dial ABORT ERROR ABORT BUSY ABORT "NO CARRIER" TIMEOUT 120 "" at OK
"\datd,,\T" CONNECT
cns event-service server
mta receive maximum-recipients 0
!
!
controller T1 2/0
  framing esf
  linecode b8zs
  cablelength short 133
  ds0-group 0 timeslots 1-24 type e&m-fgb
  cas-custom 0
!

```

```
controller T1 2/1
  framing esf
  linecode b8zs
  cablelength short 133
  ds0-group 0 timeslots 1-24 type e&m-fgb
  cas-custom 0
!
controller T1 2/2
  framing esf
  linecode b8zs
  cablelength short 133
  ds0-group 0 timeslots 1-24 type e&m-fgb
  cas-custom 0
!
controller T1 2/3
  framing esf
  linecode b8zs
  cablelength short 133
  ds0-group 0 timeslots 1-24 type e&m-fgb
  cas-custom 0
!
controller T1 2/4
  framing esf
  linecode b8zs
  cablelength short 133
  ds0-group 0 timeslots 1-24 type e&m-fgb
  cas-custom 0
!
controller T1 2/5
  framing esf
  linecode b8zs
  cablelength short 133
  ds0-group 0 timeslots 1-24 type e&m-fgb
  cas-custom 0
!
controller T1 2/6
  framing esf
  linecode b8zs
  cablelength short 133
  ds0-group 0 timeslots 1-24 type e&m-fgb
  cas-custom 0
!
controller T1 2/7
  framing esf
  linecode b8zs
  cablelength short 133
  ds0-group 0 timeslots 1-24 type e&m-fgb
  cas-custom 0
!
controller T1 3/0
  framing esf
  linecode b8zs
  cablelength short 133
  ds0-group 0 timeslots 1-24 type e&m-fgb
  cas-custom 0
!
controller T1 3/1
  framing esf
  linecode b8zs
  cablelength short 133
  ds0-group 0 timeslots 1-24 type e&m-fgb
  cas-custom 0
!
controller T1 3/2
```

```

framing esf
linecode b8zs
cablelength short 133
ds0-group 0 timeslots 1-24 type e&m-fgb
cas-custom 0
!
controller T1 3/3
framing esf
linecode b8zs
cablelength short 133
ds0-group 0 timeslots 1-24 type e&m-fgb
cas-custom 0
!
controller T1 3/4
framing esf
linecode b8zs
cablelength short 133
ds0-group 0 timeslots 1-24 type e&m-fgb
cas-custom 0
!
controller T1 3/5
framing esf
linecode b8zs
cablelength short 133
ds0-group 0 timeslots 1-24 type e&m-fgb
cas-custom 0
!
controller T1 3/6
framing esf
linecode b8zs
cablelength short 133
ds0-group 0 timeslots 1-24 type e&m-fgb
cas-custom 0
!
controller T1 3/7
framing esf
linecode b8zs
cablelength short 133
ds0-group 0 timeslots 1-24 type e&m-fgb
cas-custom 0
!
!
interface GigabitEthernet0/0
mac-address 000b.7264.9173
ip address 192.168.10.100 255.255.255.0
no ip directed-broadcast
duplex auto
speed auto
!
interface GigabitEthernet0/1
no ip address
no ip directed-broadcast
no ip route-cache
no ip mroute-cache
shutdown
duplex auto
speed auto
!
interface Serial0/0
no ip address
no ip directed-broadcast
no ip route-cache
no ip mroute-cache
shutdown

```

```
    fair-queue
    clockrate 2000000
  !
interface Serial0/1
  no ip address
  no ip directed-broadcast
  no ip route-cache
  no ip mroute-cache
  shutdown
  clockrate 2000000
  !
interface Async1/00
  ip address 10.1.1.1 255.255.255.0
  no ip directed-broadcast
  encapsulation ppp
  dialer in-band
  dialer idle-timeout 30 either
  dialer string 10000
  dialer-group 1
  async mode interactive
  ppp authentication chap
  !
interface Group-Async0
  ip unnumbered GigabitEthernet0/0
  no ip directed-broadcast
  encapsulation ppp
  async mode interactive
  ppp authentication chap
  group-range 1/01 7/107
  !
router eigrp 100
  network 192.168.10.0
  !
ip default-gateway 192.168.10.1
ip nat translation timeout never
ip nat translation tcp-timeout never
ip nat translation udp-timeout never
ip nat translation finrst-timeout never
ip nat translation syn-timeout never
ip nat translation dns-timeout never
ip nat translation icmp-timeout never
ip classless
ip route 192.168.21.1 255.255.255.255 Async1/00
ip route 172.16.14.0 255.255.255.0 192.168.21.10
ip route 172.17.14.0 255.255.255.0 192.168.21.10
ip route 172.18.14.0 255.255.255.0 192.168.21.10
ip route 172.19.1.0 255.255.255.0 192.168.21.10
ip route 172.20.1.0 255.255.255.0 192.168.21.10
ip route 172.21.1.0 255.255.255.0 192.168.21.10
ip route 172.22.1.0 255.255.255.0 192.168.21.10
no ip http server
  !
dialer-list 1 protocol ip permit
  !
  !
line con 0
  exec-timeout 0 0
  logging synchronous
  transport input none
line aux 0
  logging synchronous
line vty 0 4
  password 7 13091610
  no logging synchronous
```

```

login
line 1/00 1/107
  exec-timeout 0 0
  autoselect ppp
  script dialer dial
  logging synchronous
  modem InOut
  transport input all
line 4/00 7/107
  exec-timeout 0 0
  autoselect ppp
  script dialer dial
  logging synchronous
  modem InOut
  transport input all
!
exception core-file coredump
exception protocol ftp
exception dump 223.255.254.253
ntp clock-period 17179726
ntp server 192.168.10.1
scheduler allocate 40000 400
end

```

Two 8 T1/PRI CAS with RADIUS (AAA) and Resource Pooling

```

AS5400# show config

Building configuration ...

Current configuration:
!
version 12.1
no service pad
service timestamps debug uptime
service timestamps log uptime
service password-encryption
!
hostname AS5400-T1-CAS-UUT
!
no boot startup-test
enable password password
!
<text omitted>
!
!
resource-pool enable
resource-pool call treatment resource channel-not-available
resource-pool call treatment profile no-answer
!
resource-pool group resource group1
  range port 1/0 1/107
!
resource-pool group resource group2
  range port 4/0 4/107
  range port 5/0 5/107
!
resource-pool group resource group3
  range port 6/0 6/107
  range port 7/0 7/107
!

```

```

resource-pool profile customer telco1
  limit base-size all
  limit overflow-size 0
  resource group2 speech
  dnis group group2
!
resource-pool profile customer telco2
  limit base-size 60
  limit overflow-size 100
  resource group1 speech
  dnis group group1
!
resource-pool profile customer all
  limit base-size all
  limit overflow-size 0
  resource group3 speech
  dnis group default
!
resource-pool profile discriminator not_allowed
  call-type speech
  dnis group not_allowed
!
!
!dial-tdm-clock priority 1 2/0
!
!ip subnet-zero
ip ftp source-interface GigabitEthernet0/0
ip ftp username frank
ip ftp password 7 000D1E0B0508
no ip domain-lookup
ip host jurai 172.23.254.253
!
mgcp package-capability trunk-package
mgcp default-package trunk-package
isdn voice-call-failure 0
chat-script dial ABORT ERROR ABORT BUSY ABORT "NO CARRIER" TIMEOUT 120 "" at OK
"\datd,,\T" CONNECT
cns event-service server
mta receive maximum-recipients 0
!
!
controller T1 2/0
  framing esf
  linecode b8zs
  cablelength short 133
  ds0-group 0 timeslots 1-24 type e&m-fgb
  cas-custom 0
!
controller T1 2/1
  framing esf
  linecode b8zs
  cablelength short 133
  ds0-group 0 timeslots 1-24 type e&m-fgb
  cas-custom 0
!
controller T1 2/2
  framing esf
  linecode b8zs
  cablelength short 133
  ds0-group 0 timeslots 1-24 type e&m-fgb
  cas-custom 0
!
controller T1 2/3
  framing esf

```

```

linecode b8zs
cablelength short 133
ds0-group 0 timeslots 1-24 type e&m-fgb
cas-custom 0
!
controller T1 2/4
framing esf
linecode b8zs
cablelength short 133
ds0-group 0 timeslots 1-24 type e&m-fgb
cas-custom 0
!
controller T1 2/5
framing esf
linecode b8zs
cablelength short 133
ds0-group 0 timeslots 1-24 type e&m-fgb
cas-custom 0
!
controller T1 2/6
framing esf
linecode b8zs
cablelength short 133
ds0-group 0 timeslots 1-24 type e&m-fgb
cas-custom 0
!
controller T1 2/7
framing esf
linecode b8zs
cablelength short 133
ds0-group 0 timeslots 1-24 type e&m-fgb
cas-custom 0
!
controller T1 3/0
framing esf
linecode b8zs
cablelength short 133
ds0-group 0 timeslots 1-24 type e&m-fgb
cas-custom 0
!
controller T1 3/1
framing esf
linecode b8zs
cablelength short 133
ds0-group 0 timeslots 1-24 type e&m-fgb
cas-custom 0
!
controller T1 3/2
framing esf
linecode b8zs
cablelength short 133
ds0-group 0 timeslots 1-24 type e&m-fgb
cas-custom 0
!
controller T1 3/3
framing esf
linecode b8zs
cablelength short 133
ds0-group 0 timeslots 1-24 type e&m-fgb
cas-custom 0
!
controller T1 3/4
framing esf
linecode b8zs

```

```
cablelength short 133
ds0-group 0 timeslots 1-24 type e&m-fgb
cas-custom 0
!
controller T1 3/5
framing esf
linecode b8zs
cablelength short 133
ds0-group 0 timeslots 1-24 type e&m-fgb
cas-custom 0
!
controller T1 3/6
framing esf
linecode b8zs
cablelength short 133
ds0-group 0 timeslots 1-24 type e&m-fgb
cas-custom 0
!
controller T1 3/7
framing esf
linecode b8zs
cablelength short 133
ds0-group 0 timeslots 1-24 type e&m-fgb
cas-custom 0
!
!
interface GigabitEthernet0/0
mac-address 000b.7264.9173
ip address 192.168.10.100 255.255.255.0
no ip directed-broadcast
duplex auto
speed auto
!
interface GigabitEthernet0/1
no ip address
no ip directed-broadcast
no ip route-cache
no ip mroute-cache
shutdown
duplex auto
speed auto
!
interface Serial0/0
no ip address
no ip directed-broadcast
no ip route-cache
no ip mroute-cache
shutdown
fair-queue
clockrate 2000000
!
interface Serial0/1
no ip address
no ip directed-broadcast
no ip route-cache
no ip mroute-cache
shutdown
clockrate 2000000
!
interface Async1/00
ip address 10.1.1.1 255.255.255.0
no ip directed-broadcast
encapsulation ppp
dialer in-band
```

```

dialer idle-timeout 30 either
dialer string 10000
dialer-group 1
async mode interactive
ppp authentication chap
!
interface Group-Async0
ip unnumbered GigabitEthernet0/0
no ip directed-broadcast
encapsulation ppp
async mode interactive
ppp authentication chap
group-range 1/01 7/107
!
router eigrp 100
network 192.168.10.0
!
ip default-gateway 192.168.10.1
ip nat translation timeout never
ip nat translation tcp-timeout never
ip nat translation udp-timeout never
ip nat translation finrst-timeout never
ip nat translation syn-timeout never
ip nat translation dns-timeout never
ip nat translation icmp-timeout never
ip classless
ip route 192.168.1.1 255.255.255.255 Async1/00
ip route 172.16.14.0 255.255.255.0 192.168.21.10
ip route 172.17.14.0 255.255.255.0 192.168.21.10
ip route 172.18.14.0 255.255.255.0 192.168.21.10
ip route 172.19.1.0 255.255.255.0 192.168.21.10
ip route 172.20.1.0 255.255.255.0 192.168.21.10
no ip http server
!
dialer dnis group group1
number 10000
call-type cas speech
!
dialer dnis group group2
number 10001
call-type cas speech
!
dialer dnis group not_allowed
number 66666
dialer-list 1 protocol ip permit
!
!
!
line con 0
exec-timeout 0 0
logging synchronous
transport input none
line aux 0
logging synchronous
line vty 0 4
password 7 13091610
no logging synchronous
login
line 1/00 1/107
exec-timeout 0 0
autoselect ppp
script dialer dial
logging synchronous
modem InOut

```

```

transport input all
line 4/00 7/107
exec-timeout 0 0
autoselect ppp
script dialer dial
logging synchronous
modem InOut
transport input all
!
exception core-file coredump
exception protocol ftp
exception dump 172.23.254.253
ntp clock-period 17179726
ntp server 192.168.10.1
scheduler allocate 40000 400
end

```

Two 8 T1/PRI ISDN with RADIUS (AAA) and Resource Pooling

```

AS5400# show config

Building configuration ...

Current configuration:
!
version 12.1
no service pad
service timestamps debug uptime
service timestamps log uptime
service password-encryption
!
hostname AS5400-T1-PRI-UUT
!
no boot startup-test
logging rate-limit 5
no logging console
enable password password
!
<text omitted>
!
resource-pool enable
resource-pool call treatment resource channel-not-available
resource-pool call treatment profile no-answer
!
resource-pool group resource group1
  range port 1/0 1/107
!
resource-pool group resource group2
  range port 4/0 4/107
  range port 5/0 5/107
!
resource-pool group resource group3
  range port 6/0 6/107
  range port 7/0 7/107
!
resource-pool profile customer bell_atlantic
  limit base-size all
  limit overflow-size 0
  resource group2 speech
  dnis group group2
!

```

```

resource-pool profile customer us_west
  limit base-size 60
  limit overflow-size 100
  resource group1 speech
  dnis group group1
!
resource-pool profile customer all
  limit base-size all
  limit overflow-size 0
  resource group3 speech
  dnis group default
!
resource-pool profile discriminator not_allowed
  call-type speech
  dnis group not_allowed
!
! dial-tdm-clock priority 1 2/4
!
! ip subnet-zero
ip ftp source-interface GigabitEthernet0/0
ip ftp username frank
ip ftp password password
no ip domain-lookup
ip host greenbug 172.22.43.28
ip host jurai 172.23.254.253
!
mgcp package-capability trunk-package
mgcp default-package trunk-package
isdn switch-type primary-5ess
isdn voice-call-failure 0
cns event-service server
mta receive maximum-recipients 0
!
!
controller T1 2/0
  framing esf
  linecode b8zs
  cablelength short 133
  pri-group timeslots 1-24
!
controller T1 2/1
  framing esf
  linecode b8zs
  cablelength short 133
  pri-group timeslots 1-24
!
controller T1 2/2
  framing esf
  linecode b8zs
  cablelength short 133
  pri-group timeslots 1-24
!
controller T1 2/3
  framing esf
  linecode b8zs
  cablelength short 133
  pri-group timeslots 1-24
!
controller T1 2/4
  framing esf
  linecode b8zs
  cablelength short 133
  pri-group timeslots 1-24
!

```

```
controller T1 2/5
  framing esf
  linecode b8zs
  cablelength short 133
  pri-group timeslots 1-24
!
controller T1 2/6
  framing esf
  linecode b8zs
  cablelength short 133
  pri-group timeslots 1-24
!
controller T1 2/7
  framing esf
  linecode b8zs
  cablelength short 133
  pri-group timeslots 1-24
!
controller T1 5/0
  framing esf
  linecode b8zs
  cablelength short 133
  pri-group timeslots 1-24
!
controller T1 5/1
  framing esf
  linecode b8zs
  cablelength short 133
  pri-group timeslots 1-24
!
controller T1 5/2
  framing esf
  linecode b8zs
  cablelength short 133
  pri-group timeslots 1-24
!
controller T1 5/3
  framing esf
  linecode b8zs
  cablelength short 133
  pri-group timeslots 1-24
!
controller T1 5/4
  framing esf
  linecode b8zs
  cablelength short 133
  pri-group timeslots 1-24
!
controller T1 5/5
  framing esf
  linecode b8zs
  cablelength short 133
  pri-group timeslots 1-24
!
controller T1 5/6
  framing esf
  linecode b8zs
  cablelength short 133
  pri-group timeslots 1-24
!
controller T1 5/7
  framing esf
  linecode b8zs
  cablelength short 133
```

```

    pri-group timeslots 1-24
    !
    !
interface GigabitEthernet0/0
 ip address 192.168.10.102 255.255.255.0
 no ip directed-broadcast
 no ip route-cache
 no ip mroute-cache
 no keepalive
 duplex auto
 speed auto
 !
interface GigabitEthernet0/1
 no ip address
 no ip directed-broadcast
 no ip route-cache
 no ip mroute-cache
 shutdown
 duplex auto
 speed auto
 !
interface Serial0/0
 no ip address
 no ip directed-broadcast
 no ip route-cache
 no ip mroute-cache
 shutdown
 fair-queue 64 256 0
 clockrate 2000000
 !
interface Serial0/1
 no ip address
 no ip directed-broadcast
 no ip route-cache
 no ip mroute-cache
 shutdown
 clockrate 2000000
 !
interface Serial2/0:23
 no ip address
 no ip directed-broadcast
 isdn switch-type primary-5ess
 isdn incoming-voice modem
 fair-queue 64 256 0
 no cdp enable
 !
interface Serial2/1:23
 no ip address
 no ip directed-broadcast
 isdn switch-type primary-5ess
 isdn incoming-voice modem
 fair-queue 64 256 0
 no cdp enable
 !
interface Serial2/2:23
 no ip address
 no ip directed-broadcast
 isdn switch-type primary-5ess
 isdn incoming-voice modem
 fair-queue 64 256 0
 no cdp enable
 !
interface Serial2/3:23
 no ip address

```

```
no ip directed-broadcast
isdn switch-type primary-5ess
isdn incoming-voice modem
fair-queue 64 256 0
no cdp enable
!
interface Serial2/4:23
no ip address
no ip directed-broadcast
isdn switch-type primary-5ess
isdn incoming-voice modem
fair-queue 64 256 0
no cdp enable
!
interface Serial2/5:23
no ip address
no ip directed-broadcast
isdn switch-type primary-5ess
isdn incoming-voice modem
fair-queue 64 256 0
no cdp enable
!
interface Serial2/6:23
no ip address
no ip directed-broadcast
isdn switch-type primary-5ess
isdn incoming-voice modem
fair-queue 64 256 0
no cdp enable
!
interface Serial2/7:23
no ip address
no ip directed-broadcast
isdn switch-type primary-5ess
isdn incoming-voice modem
fair-queue 64 256 0
no cdp enable
!
interface Serial5/0:23
no ip address
no ip directed-broadcast
isdn switch-type primary-5ess
isdn incoming-voice modem
fair-queue 64 256 0
no cdp enable
!
interface Serial5/1:23
no ip address
no ip directed-broadcast
isdn switch-type primary-5ess
isdn incoming-voice modem
fair-queue 64 256 0
no cdp enable
!
interface Serial5/2:23
no ip address
no ip directed-broadcast
isdn switch-type primary-5ess
isdn incoming-voice modem
fair-queue 64 256 0
no cdp enable
!
interface Serial5/3:23
no ip address
```

```

no ip directed-broadcast
isdn switch-type primary-5ess
isdn incoming-voice modem
fair-queue 64 256 0
no cdp enable
!
interface Serial5/4:23
no ip address
no ip directed-broadcast
isdn switch-type primary-5ess
isdn incoming-voice modem
fair-queue 64 256 0
no cdp enable
!
interface Serial5/5:23
no ip address
no ip directed-broadcast
isdn switch-type primary-5ess
isdn incoming-voice modem
fair-queue 64 256 0
no cdp enable
!
interface Serial5/6:23
no ip address
no ip directed-broadcast
isdn switch-type primary-5ess
isdn incoming-voice modem
fair-queue 64 256 0
no cdp enable
!
interface Serial5/7:23
no ip address
no ip directed-broadcast
isdn switch-type primary-5ess
isdn incoming-voice modem
fair-queue 64 256 0
no cdp enable
!
interface Async1/00
ip address 172.16.97.1 255.255.255.0
no ip directed-broadcast
encapsulation ppp
no ip route-cache
no ip mroute-cache
dialer in-band
dialer idle-timeout 2000000
dialer string 6151300001
dialer-group 1
async default routing
async mode interactive
no peer default ip address
no fair-queue
ppp authentication chap
hold-queue 1000 in
hold-queue 1000 out
!
interface Async1/01
ip address 172.16.98.1 255.255.255.0
no ip directed-broadcast
encapsulation ppp
no ip route-cache
no ip mroute-cache
dialer in-band
dialer idle-timeout 2000000

```

```
dialer string 7150100001
dialer-group 1
async default routing
async mode interactive
no peer default ip address
no fair-queue
ppp authentication chap
hold-queue 1000 in
hold-queue 1000 out
!
interface Async1/02
ip address 172.16.99.1 255.255.255.0
no ip directed-broadcast
encapsulation ppp
no ip route-cache
no ip mroute-cache
dialer in-band
dialer idle-timeout 2000000
dialer string 7150100002
dialer-group 1
async default routing
async mode interactive
no peer default ip address
no fair-queue
ppp authentication chap
hold-queue 1000 in
hold-queue 1000 out
!
interface Async1/03
ip address 172.16.100.1 255.255.255.0
no ip directed-broadcast
encapsulation ppp
no ip route-cache
no ip mroute-cache
dialer in-band
dialer idle-timeout 2000000
dialer string 7150100003
dialer-group 1
async default routing
async mode interactive
no peer default ip address
no fair-queue
ppp authentication chap
hold-queue 1000 in
hold-queue 1000 out
!
interface Async1/04
ip address 172.16.101.1 255.255.255.0
no ip directed-broadcast
encapsulation ppp
no ip route-cache
no ip mroute-cache
dialer in-band
dialer idle-timeout 2000000
dialer string 7150100004
dialer-group 1
async default routing
async mode interactive
no peer default ip address
no fair-queue
ppp authentication chap
hold-queue 1000 in
hold-queue 1000 out
!
```

```
interface Async1/05
 ip address 172.16.102.1 255.255.255.0
 no ip directed-broadcast
 encapsulation ppp
 no ip route-cache
 no ip mroute-cache
 dialer in-band
 dialer idle-timeout 2000000
 dialer string 7150100005
 dialer-group 1
 async default routing
 async mode interactive
 no peer default ip address
 no fair-queue
 ppp authentication chap
 hold-queue 1000 in
 hold-queue 1000 out
!
interface Async1/06
 ip address 172.16.103.1 255.255.255.0
 no ip directed-broadcast
 encapsulation ppp
 no ip route-cache
 no ip mroute-cache
 dialer in-band
 dialer idle-timeout AS5400
 dialer string 7150100006
 dialer-group 1
 async mode interactive
 ppp authentication chap
!
interface Async1/07
 ip address 172.16.104.1 255.255.255.0
 no ip directed-broadcast
 encapsulation ppp
 no ip route-cache
 no ip mroute-cache
 dialer in-band
 dialer idle-timeout AS5400
 dialer string 7150100007
 dialer-group 1
 async mode interactive
 ppp authentication chap
!
interface Async1/08
 ip address 172.16.105.1 255.255.255.0
 no ip directed-broadcast
 encapsulation ppp
 no ip route-cache
 no ip mroute-cache
 dialer in-band
 dialer idle-timeout AS5400
 dialer string 7150100008
 dialer-group 1
 async mode interactive
 ppp authentication chap
!
interface Async1/09
 ip address 172.16.106.1 255.255.255.0
 no ip directed-broadcast
 encapsulation ppp
 no ip route-cache
 no ip mroute-cache
 dialer in-band
```

```
dialer idle-timeout AS5400
dialer string 7150100009
dialer-group 1
async mode interactive
ppp authentication chap
!
interface Async1/10
 ip address 172.16.107.1 255.255.255.0
 no ip directed-broadcast
 encapsulation ppp
 no ip route-cache
 no ip mroute-cache
 dialer in-band
 dialer idle-timeout AS5400
 dialer string 7150100010
 dialer-group 1
 async mode interactive
 ppp authentication chap
!
interface Async1/11
 ip address 172.16.108.1 255.255.255.0
 no ip directed-broadcast
 encapsulation ppp
 no ip route-cache
 no ip mroute-cache
 dialer in-band
 dialer idle-timeout AS5400
 dialer string 7150100011
 dialer-group 1
 async mode interactive
 no peer default ip address
 no cdp enable
 ppp authentication chap
!
interface Async1/12
 ip address 172.16.109.1 255.255.255.0
 no ip directed-broadcast
 encapsulation ppp
 no ip route-cache
 no ip mroute-cache
 dialer in-band
 dialer idle-timeout AS5400
 dialer string 7150100012
 dialer-group 1
 async mode interactive
 no peer default ip address
 no cdp enable
 ppp authentication chap
!
interface Async1/13
 ip address 172.16.110.1 255.255.255.0
 no ip directed-broadcast
 encapsulation ppp
 no ip route-cache
 no ip mroute-cache
 dialer in-band
 dialer idle-timeout AS5400
 dialer string 7150100013
 dialer-group 1
 async mode interactive
 no peer default ip address
 no cdp enable
 ppp authentication chap
!
```

```
interface Async1/14
 ip address 172.16.111.1 255.255.255.0
 no ip directed-broadcast
 encapsulation ppp
 no ip route-cache
 no ip mroute-cache
 dialer in-band
 dialer idle-timeout AS5400
 dialer string 7150100014
 dialer-group 1
 async mode interactive
 no peer default ip address
 no cdp enable
 ppp authentication chap
!
interface Async1/15
 ip address 172.16.112.1 255.255.255.0
 no ip directed-broadcast
 encapsulation ppp
 no ip route-cache
 no ip mroute-cache
 dialer in-band
 dialer idle-timeout AS5400
 dialer string 7150100015
 dialer-group 1
 async mode interactive
 no peer default ip address
 no cdp enable
 ppp authentication chap
!
interface Async1/16
 ip address 172.16.113.1 255.255.255.0
 no ip directed-broadcast
 encapsulation ppp
 no ip route-cache
 no ip mroute-cache
 dialer in-band
 dialer idle-timeout AS5400
 dialer string 7150100016
 dialer-group 1
 async mode interactive
 no peer default ip address
 no cdp enable
 ppp authentication chap
!
interface Async1/17
 ip address 172.16.114.1 255.255.255.0
 no ip directed-broadcast
 encapsulation ppp
 no ip route-cache
 no ip mroute-cache
 dialer in-band
 dialer idle-timeout AS5400
 dialer string 7150100017
 dialer-group 1
 async mode interactive
 no peer default ip address
 ppp authentication chap
!
interface Async1/18
 ip address 172.16.115.1 255.255.255.0
 no ip directed-broadcast
 encapsulation ppp
 no ip route-cache
```

```
no ip mroute-cache
dialer in-band
dialer idle-timeout AS5400
dialer string 7150100018
dialer-group 1
async mode interactive
no peer default ip address
ppp authentication chap
!
interface Async1/19
ip address 172.16.116.1 255.255.255.0
no ip directed-broadcast
encapsulation ppp
no ip route-cache
no ip mroute-cache
dialer in-band
dialer idle-timeout AS5400
dialer string 7150100019
dialer-group 1
async mode interactive
no peer default ip address
ppp authentication chap
!
interface Async1/20
ip address 172.16.117.1 255.255.255.0
no ip directed-broadcast
encapsulation ppp
no ip route-cache
no ip mroute-cache
dialer in-band
dialer idle-timeout AS5400
dialer string 7150100020
dialer-group 1
async mode interactive
no peer default ip address
ppp authentication chap
!
interface Group-Async0
ip unnumbered GigabitEthernet0/0
no ip directed-broadcast
encapsulation ppp
no ip route-cache
no ip mroute-cache
async mode interactive
no peer default ip address
ppp authentication chap
group-range 1/21 7/107
!
router eigrp 100
network 192.168.10.0
!
ip local pool ip-pool 10.4.1.1 10.4.1.250
ip default-gateway 192.168.10.1
ip nat translation timeout never
ip nat translation tcp-timeout never
ip nat translation udp-timeout never
ip nat translation finrst-timeout never
ip nat translation syn-timeout never
ip nat translation dns-timeout never
ip nat translation icmp-timeout never
ip classless
ip route 172.16.1.97 255.255.255.255 Async1/00
ip route 172.16.1.98 255.255.255.255 Async1/01
ip route 172.16.1.99 255.255.255.255 Async1/02
```

```

ip route 172.16.1.100 255.255.255.255 Async1/03
ip route 172.16.1.101 255.255.255.255 Async1/04
ip route 172.16.1.102 255.255.255.255 Async1/05
ip route 172.16.1.103 255.255.255.255 Async1/06
ip route 172.16.1.104 255.255.255.255 Async1/07
ip route 172.16.1.105 255.255.255.255 Async1/08
ip route 172.16.1.106 255.255.255.255 Async1/09
ip route 172.16.1.107 255.255.255.255 Async1/10
ip route 172.16.1.108 255.255.255.255 Async1/11
ip route 172.16.1.109 255.255.255.255 Async1/12
ip route 172.16.1.110 255.255.255.255 Async1/13
ip route 172.16.1.111 255.255.255.255 Async1/14
ip route 172.16.1.112 255.255.255.255 Async1/15
ip route 172.16.1.113 255.255.255.255 Async1/16
ip route 172.16.1.114 255.255.255.255 Async1/17
ip route 172.16.1.115 255.255.255.255 Async1/18
ip route 172.16.1.116 255.255.255.255 Async1/19
ip route 172.16.1.117 255.255.255.255 Async1/20
no ip http server
!
dialer dnis group group1
  number 10000
  call-type cas speech
!
dialer dnis group group2
  number 10001
  call-type cas speech
!
dialer dnis group not_allowed
  number 66666
dialer-list 1 protocol ip permit
!
dialer-list 1 protocol ip permit
!
!
line con 0
  exec-timeout 0 0
  logging synchronous
  transport input none
line aux 0
  logging synchronous
line vty 0 4
  password password
  no logging synchronous
  login
line 1/00 1/107
  autoselect ppp
  script dialer dial
  logging synchronous
  modem InOut
  transport input all
line 3/00 4/107
  autoselect ppp
  script dialer dial
  logging synchronous
  modem InOut
  transport input all
line 6/00 7/107
  autoselect ppp
  script dialer dial
  logging synchronous
  modem InOut
  transport input all
!

```

```
exception core-file coredump
exception protocol ftp
exception dump 223.255.254.253
ntp clock-period 17179873
ntp server 192.168.10.1
scheduler allocate 4000 200
end
```

Two 8 E1/PRI ISDN with RADIUS (AAA) and Resource Pooling

```
AS5400# show config
```

```
Building configuration ...
```

```
Current configuration:
```

```
!
version 12.1
no service pad
service timestamps debug datetime msec
service timestamps log uptime
no service password-encryption
service internal
!
hostname AS5400-E1-PRI-UUT
!
enable password password
!

username AS5400-E1-PRI-UUT password password
!
<text omitted>
!
resource-pool enable
resource-pool call treatment resource channel-not-available
resource-pool call treatment profile no-answer
!
resource-pool group resource group1
  range port 1/0 1/107
!
resource-pool group resource group2
  range port 4/0 4/107
  range port 5/0 5/107
!
resource-pool group resource group3
  range port 2/0 2/107
  range port 3/0 3/107
!
resource-pool profile customer bell_atlantic
  limit base-size all
  limit overflow-size 0
  resource group2 speech
  dn timer group2
!
resource-pool profile customer us_west
  limit base-size 60
  limit overflow-size 100
  resource group1 speech
  dn timer group1
!
resource-pool profile customer all
  limit base-size all
```

```

limit overflow-size 0
resource group3 speech
dnis group default
!
resource-pool profile discriminator not_allowed
call-type speech
dnis group not_allowed
!
!
spe country united-kingdom
!
!
ntp server 192.168.10.1
!
!
!
ip subnet-zero
no ip domain-lookup
ip host jurai 172.23.254.253
!
isdn switch-type primary-net5
isdn voice-call-failure 0
cns event-service server
mta receive maximum-recipients 0
!
xgcp snmp sgcp
!
controller E1 6/0
pri-group timeslots 1-31
!
controller E1 6/1
pri-group timeslots 1-31
!
controller E1 6/2
pri-group timeslots 1-31
!
controller E1 6/3
pri-group timeslots 1-31
!
controller E1 6/4
pri-group timeslots 1-31
!
controller E1 6/5
pri-group timeslots 1-31
!
controller E1 6/6
pri-group timeslots 1-31
!
controller E1 6/7
pri-group timeslots 1-31
!
controller E1 7/0
pri-group timeslots 1-31
!
controller E1 7/1
pri-group timeslots 1-31
!
controller E1 7/2
pri-group timeslots 1-31
!
controller E1 7/3
pri-group timeslots 1-31
!
controller E1 7/4

```

```
pri-group timeslots 1-31
!
controller E1 7/5
pri-group timeslots 1-31
!
controller E1 7/6
pri-group timeslots 1-31
!
controller E1 7/7
pri-group timeslots 1-31
!
!
!
interface GigabitEthernet0/0
 ip address 192.168.10.103 255.255.255.0
 no ip directed-broadcast
 no ip route-cache
 no ip mroute-cache
!
interface GigabitEthernet0/1
 no ip address
 no ip directed-broadcast
 no ip route-cache
 no ip mroute-cache
 shutdown
!
interface Serial0/0
 no ip address
 no ip directed-broadcast
 no ip route-cache
 no ip mroute-cache
 shutdown
 fair-queue 64 256 0
 clockrate 2000000
!
interface Serial0/1
 no ip address
 no ip directed-broadcast
 no ip route-cache
 no ip mroute-cache
 shutdown
 clockrate 2000000
!
<text omitted>
!
interface Serial7/7:15
 no ip address
 no ip directed-broadcast
 isdn switch-type primary-net5
 isdn incoming-voice modem
 fair-queue 64 256 0
 no cdp enable
!
interface Async1/00
 ip unnumbered GigabitEthernet0/0
 no ip directed-broadcast
 encapsulation ppp
 async mode interactive
 ppp authentication chap
!
interface Async1/01
 ip unnumbered GigabitEthernet0/0
 no ip directed-broadcast
 encapsulation ppp
```

```

async mode interactive
ppp authentication chap
!
<text omitted>
!
interface Async5/106
ip unnumbered GigabitEthernet0/0
no ip directed-broadcast
encapsulation ppp
async mode interactive
ppp authentication chap
!
interface Async5/107
ip unnumbered GigabitEthernet0/0
no ip directed-broadcast
encapsulation ppp
async mode interactive
ppp authentication chap
!
interface Group-Async0
no ip address
no ip directed-broadcast
no group-range
!
router eigrp 100
network 192.168.13.0
!
ip default-gateway 192.168.13.1
ip classless
no ip http server
!
dialer dnis group group1
number 10000
call-type cas speech
!
dialer dnis group group2
number 10001
call-type cas speech
!
dialer dnis group not_allowed
number 66666
dialer-list 1 protocol ip permit
!
!
line con 0
exec-timeout 0 0
transport input none
speed 9600
line aux 0
line vty 0 4
login

```

CT3 with Resource Pooling, AAA, and Modem

```

AS5400# show config

Building configuration . . .
Current configuration:
!
version 12.1
service timestamps debug datetime msec

```

```
service timestamps log datetime msec
no service password-encryption
!
hostname CT3-CAS-UUT
!
no boot startup-test
logging buffered 10000000 debugging
no logging console
aaa new-model
aaa group server radius aaa.router
server 192.168.1.137 auth-port 1645 acct-port 1646
server 192.168.1.138 auth-port 1645 acct-port 1646
!
aaa authentication ppp default group aaa.router local
aaa authorization network default group aaa.router local
aaa accounting update newinfo periodic 30
aaa accounting network default start-stop group aaa.router
enable password lab
!
username cisco password 0 lab
username 4700-F8 password 0 lab
username 4700-F13 password 0 lab
username 4700-I4 password 0 lab
username ELNINO-N3 password 0 lab
username ELNINO-N4 password 0 lab
username ELNINO-N5 password 0 lab
username NAS password 0 lab
username HGW password 0 lab
username all
!
!
resource-pool enable
resource-pool call treatment resource busy
!
resource-pool group resource 4700
range port 1/0 1/107
!
resource-pool group resource 5300
range port 2/0 2/107
range port 4/0 4/107
range port 5/0 5/107
range port 6/0 6/107
!
resource-pool profile customer 4700
limit base-size 110
limit overflow-size 18
resource 4700 speech
!
resource-pool profile customer 5300
limit base-size 538
limit overflow-size 18
resource 5300 speech
dnis group elnino
!
resource-pool profile service gold
modem min-speed 33200 max-speed 56000
!
!
!
!
dial-tdm-clock priority 1 freerun
calltracker enable
!
!
```

```

!
!
ip subnet-zero
ip ftp source-interface GigabitEthernet0/0
ip ftp username router
ip ftp password lab
no ip domain-lookup
ip host jurai 223.255.254.253
!
isdn voice-call-failure 0
cns event-service server
!
!
!
mta receive maximum-recipients 0
!
!
controller T3 7/0
clock source line
t1 1-28 controller
!
controller T1 7/0:1
framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!
controller T1 7/0:2
framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!
controller T1 7/0:3
framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!
controller T1 7/0:4
framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!
controller T1 7/0:5
framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!
controller T1 7/0:6
framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!
controller T1 7/0:7
framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!
controller T1 7/0:8
framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!
controller T1 7/0:9
framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis

```

```
cas-custom 1
!
controller T1 7/0:10
framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!
controller T1 7/0:11
framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!
controller T1 7/0:12
framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!
controller T1 7/0:13
framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!
controller T1 7/0:14
framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!
controller T1 7/0:15
framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!
controller T1 7/0:16
framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!
controller T1 7/0:17
framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!
controller T1 7/0:18
framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!
controller T1 7/0:19
framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!
controller T1 7/0:20
framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!
controller T1 7/0:21
framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!
controller T1 7/0:22
framing esf
```

```

ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!
controller T1 7/0:23
framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!
controller T1 7/0:24
framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!
controller T1 7/0:25
framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!
controller T1 7/0:26
framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!
controller T1 7/0:27
framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!
controller T1 7/0:28
framing esf
ds0-group 1 timeslots 1-24 type e&m-fgb dtmf dnis
cas-custom 1
!
!
!
interface Loopback0
no ip address
!
interface GigabitEthernet0/0
ip address 192.168.18.100 255.255.255.0
no keepalive
duplex auto
speed auto
hold-queue 4000 out
!
interface GigabitEthernet0/1
ip address 172.22.35.71 255.255.0.0
shutdown
duplex auto
speed auto
!
interface Serial0/0
no ip address
shutdown
clockrate 2000000
!
interface Serial0/1
no ip address
shutdown
clockrate 2000000
!
interface Group-Async0
no ip address
no group-range

```

```
!
interface Group-Async1
ip unnumbered GigabitEthernet0/0
encapsulation ppp
async default routing
async mode interactive
no peer default ip address
fair-queue
ppp authentication chap
group-range 1/00 6/107
!
router eigrp 100
network 192.168.18.0
network 192.168.19.0
!
ip nat translation timeout never
ip nat translation tcp-timeout never
ip nat translation udp-timeout never
ip nat translation finrst-timeout never
ip nat translation syn-timeout never
ip nat translation dns-timeout never
ip nat translation icmp-timeout never
ip classless
ip route 172.16.14.0 255.255.255.0 192.168.21.10
ip route 172.17.14.0 255.255.255.0 192.168.21.10
ip route 172.18.14.0 255.255.255.0 192.168.21.10
ip route 172.19.1.0 255.255.255.0 192.168.21.10
ip route 172.20.1.0 255.255.255.0 192.168.21.10
ip route 192.168.0.0 255.0.0.0 GigabitEthernet0/1
ip route 192.168.173.18 255.255.255.255 GigabitEthernet0/1
ip route 223.255.254.253 255.255.255.255 GigabitEthernet0/0
no ip http server
!
logging facility local2
logging 192.168.1.131
!
dialer dnis group callblock
number 5555
!
dialer dnis group v90
number 815.....
!
dialer dnis group elnino
number 915....
!
snmp-server engineID local 000000090200003096F80084
snmp-server community public RW
!
radius-server host 192.168.1.137 auth-port 1645 acct-port 1646
radius-server host 192.168.1.138 auth-port 1645 acct-port 1646
radius-server retransmit 2
radius-server timeout 9
radius-server deadtime 30
radius-server key lab
!
!
line con 0
exec-timeout 0 0
logging synchronous
transport input none
line aux 0
exec-timeout 0 0
logging synchronous
transport input all
```

```
line vty 0 4
password lab
no logging synchronous
line 1/00 6/107
autoselect ppp
autoselect timeout 10
logging synchronous
modem InOut
transport input all
!
```



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