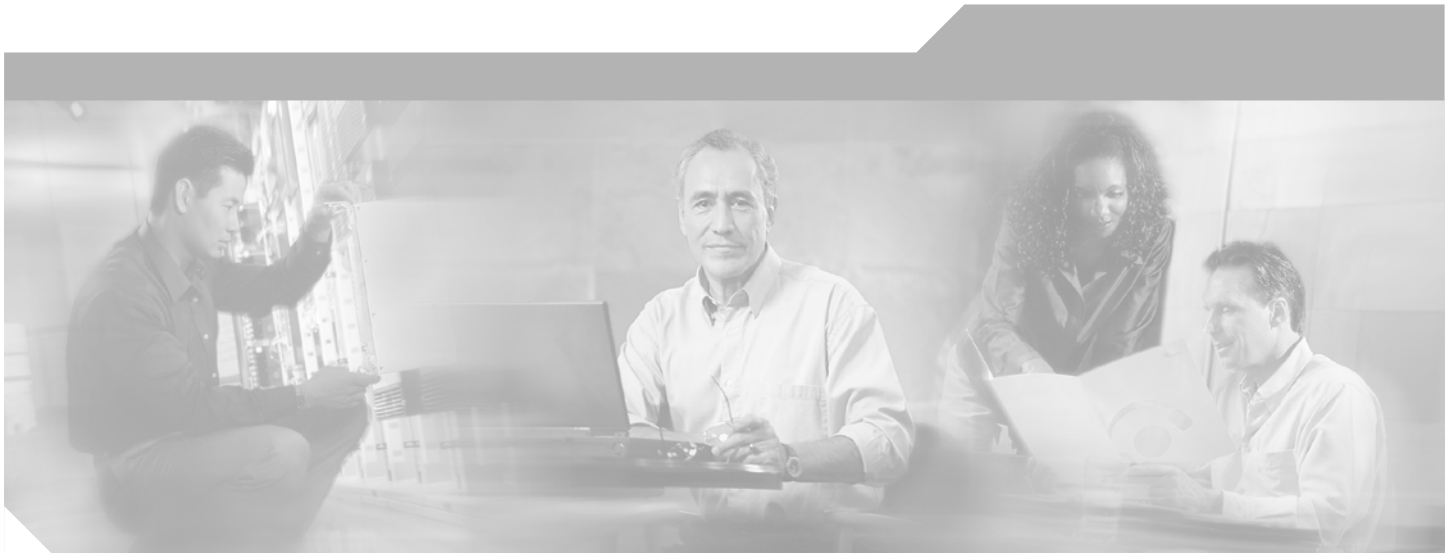

Cisco Multiservice Packet Network Solution Overview

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Corporate Headquarters
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
http://www.cisco.com
Tel: 408 526-4000
800 553-NETS (6387)
Fax: 408 526-4100

Customer Order Number:
Text Part Number: OL-3025-01

Cisco Multiservice Packet Network Solution Overview

CONTENTS

Preface

The Cisco Multiservice Packet Network Solution provides a multiservice architecture for the delivery of voice, Multiprotocol Label Switching (MPLS) Virtual Private Networks (VPNs), and Internet services for Public Telephone and Telegraph (PTT) operators and new service providers.

The solution is a collaboration between Cisco Systems, Inc. and Italtel S.p.A., with Cisco providing the media gateways and Italtel providing the call agents. The solution allows PTT operators and new service providers to offer voice and data services over a single, packet-based, MPLS-enabled IP network, and provides the scalability and features required by a broad range of fixed and wireless service providers.

This preface contains the following sections:

Document and Solution Release

This is the first release of this document, which covers Releases 2.0 and 2.1 of the Cisco Multiservice Packet Network Solution.

Audience

The audiences for this overview and the other related documents for the Cisco Multiservice Packet Network Solution are those responsible for fault diagnosis and second-level maintenance (for example, network management, operations, provisioning, and troubleshooting) for the voice capabilities of the media gateways and call agents.

Contents

The *Cisco Multiservice Packet Network Solution Overview* provides an overview of the general architecture and solutions, an introduction to the components of the solution, and an overview of the network and element management systems used by the solution.

This document does not provide detailed information on how to install and implement a given solution. Rather, it provides the background needed to understand the components, their interconnections, and key issues related to that solution.

The major sections of this document are as follows:

Section	Title
Chapter 1	Solution Architecture
Chapter 2	Solution Components
Chapter 3	Solution Management

For definitions of terms and acronyms associated with the Cisco Multiservice Packet Network Solution, refer to the glossary at the end of this document. For an online listing of internetworking terms and acronyms, refer to the following URL:

http://www.cisco.com/univercd/cc/td/doc/cisintwk/ita/index.htm

Related Documents

Refer to the following documents for further information:

- *Cisco Multiservice Packet Network Solution Documentation Guide*
- *Release Notes for Cisco Multiservice Packet Network Solution, Release 2.0*
- *Release Notes for Cisco Multiservice Packet Network Solution, Release 2.1*

Obtaining Documentation

These sections explain how to obtain documentation from Cisco Systems.

World Wide Web

You can access the most current Cisco documentation on the World Wide Web at this URL:

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Translated documentation is available at this URL:

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Obtaining Technical Assistance

For information on how to obtain technical assistance for the Cisco Multiservice Packet Network Solution, refer to the most current *Release Notes for Cisco Multiservice Packet Network Solution*.

For information on how to obtain technical assistance for a Cisco product, refer to the Release Notes for the relevant product.

CHAPTER 1

Solution Architecture

The Cisco Multiservice Packet Network Solution

The Cisco Multiservice Packet Network Solution defines a multiservice point of presence (POP) architecture that allows Public Telephone and Telegraph (PTT) operators and new service providers to offer voice and data services over a single, packet-based, IP network connecting the POPs. The Cisco Multiservice Packet Network Solution provides the scalability and features required by a broad range of fixed and wireless service providers; multiple reference architectures and solutions accommodate small to large POPs, Internet access, and IP Virtual Private Networks (VPNs).

The solution consists of voice handling media gateways based on the Cisco MGX range with an associated Voice Interworking Service Module (VISM), universal services based on the Cisco AS5400 series gateways, and voice control services supported by the Italtel Multiservice Switching System (iMSS) call agent platform. The AS5400 series can also operate simultaneously as a network access server (NAS) and a voice gateway to deliver universal services—analog modem, digital modem, fax and Voice over IP (VoIP)—on any port at any time.

Additional support is provided for remote time-division multiplex (TDM) private automatic branch exchange (PABX) services, as well as remote concentrators and access equipment using V5.1 or V5.2 protocols.

Multiprotocol Label Switching (MPLS) operates in the core network (based on Cisco 12000 series Internet routers) as a means of encapsulating and label switching the VoIP, IP VPN, and Internet access traffic. In addition, service differentiation or class of service (CoS) is provided by applying Internet Engineering Task Force (IETF)-based Differentiated Services (DiffServ) traffic management processing on a per-class basis for packets traversing the network.

Components

The key components of the Cisco Multiservice Packet Network Solution are the Cisco media gateways and the Italtel call agent. The media gateways interface to the MPLS network, formatting the voice traffic into packets for transmission across the network under the control of the call agent.

See the following sections for further information on these components:

- Media Gateways
- Call Agent

Media Gateways

The Cisco MGX 8230, 8250, and 8850, together with the Cisco VISM, and the Cisco AS5400 and AS5400HPX are the recommended platforms for the media gateways.

The MGX 8230 with VISM, AS5400, and AS5400HPX are suitable for smaller end offices, whereas the MGX 8250 and 8850 with VISM are recommended for larger applications and to allow for future capacity upgrades. Either the Cisco AS5400 or AS5400HPX media gateway is the preferred solution where universal port capability is required.

Call Agent

At the heart of the solution is the iMSS call agent. Two platforms are available:

- iMSS-4050—a versatile call agent. This platform provides the control functions for the voice traffic over the IP network, with the media gateways interconnecting the IP and TDM networks. This setup is running the iMSS in a pure configuration, and the platform is deployed where the POP traffic is predominantly transit and the pure call agent features are required.
- iMSS-4040—a versatile call agent and TDM switch. This platform also provides the control functions for the voice traffic over the IP network, but in addition provides the TDM switching capability, linking the TDM network to the media gateways. This setup is running the iMSS in an enhanced configuration, and the platform is deployed where either a significant amount of TDM traffic is switched at the local POP, or where ISDN and V5.1 and V5.2 terminations are required.

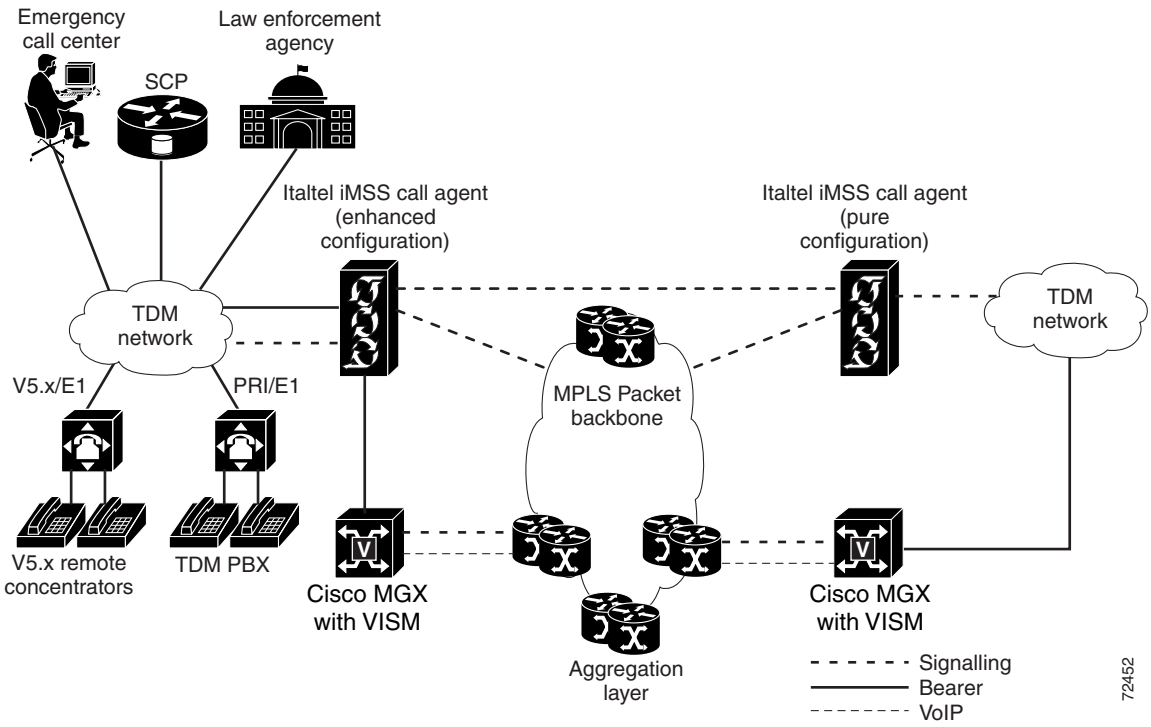
As a call agent, both the iMSS-4040 and iMSS-4050 interpret the signalling messages and route the calls through the packet backbone. The iMSS is the Media Gateway Controller (MGC) and Signalling Gateway (SG), controlling the voice traffic through well-defined standard protocols. The MGC uses the Media Gateway Control Protocol (MGCP) to control the Cisco media gateways and thus control the voice calls over the MPLS network. The SG handles the dialogue between all the various Telecom signalling protocols based on the Signalling System 7 (SS7) suite.

As a TDM switch, the iMSS-4040 incorporates all the features of a Class 4 switch, such as the powerful and scalable circuit switching fabric and call-control functions. In addition, the iMSS-4040 can operate as a Class 5 switch, accepting ISDN primary rate access (PRA) coming from business customers (for example, PABXs) as well as plain old telephone service (POTS) and ISDN basic rate access (BRA) subscribers via V5.1 and V5.2 interfaces.

General Architecture

Figure 1-1 shows a simplified configuration that offloads the voice traffic onto the MPLS network between two POP locations. The right-hand side of the figure shows an Italtel call agent (iMSS-4050 in a pure configuration) controlling an MGX with VISM as a media gateway interconnecting the IP and TDM networks. The left-hand side of the figure shows an Italtel call agent (iMSS-4040 in an enhanced configuration) providing the TDM switching capability and controlling the MGX with VISM that provides the connection to the IP network. The iMSS-4040 call agent also provides ISDN Primary Rate Interface (PRI) and V5.1 and V5.2 connections for remotely connected legacy TDM PABXs and concentrators.

Figure 1-1 Cisco Multiservice Packet Network Solution Architecture



The iMSS call agent supports Intelligent Network (IN) services such as number portability, carrier selection, call screening, and basic number transactions (such as toll free numbers) using either an iMSS integrated database or via an external Service Control Point (SCP) database. For support through an external SCP, the iMSS call agent uses the Intelligent Network Application Part Capability Set 1 (INAP-CS1) based on ETS 300 374-1, September 1994 (ITU-Q1600).

The iMSS call agent also supports Lawful Intercept, allowing government agencies to monitor calls originated by or terminated to a specific Calling Line Identification (CLI). The iMSS call agent maintains a Black List database that only government-authorized operators can change.

Applications

Three key applications are supported in this release of the Cisco Multiservice Packet Network Solution:

- Voice Transit for PSTNs and Mobile Networks—This application offloads voice traffic from the traditional voice circuits onto the MPLS backbone, reducing the capital and operational expenses of their circuit-switched tandem voice networks while enabling revenue-generating data services. This application can also offload voice traffic for mobile voice environments where the interface towards the legacy network is through mobile switch centres (MSCs) in a public land mobile network (PLMN).
- Universal Port—This application delivers universal services (analog modem, digital modem, fax, and VoIP) on any port at any time using the AS5400 or AS5400HPX media gateway operating simultaneously as a NAS and a voice gateway.
- Remote User Access—This application provides ISDN PRI and V5.x connections for remotely connected legacy TDM PABXs and V5.1 and V5.2 concentrators.

Voice Transit for PSTNs and Mobile Networks

Voice Transit Architecture

In a pure call agent configuration, the MGXs with VISMs terminate the bearer circuits from the TDM networks and packetize and route the IP traffic through the MPLS network, under the supervision of the iMSS call agents. The iMSS-4050 call agent receives the SS7 signalling traffic from the TDM network, and provides the facilities to set up, tear down, and manage calls for the voice services on the media gateways using MGCP.

Figure 1-2 illustrates the voice transit application utilizing two iMSS-4050 call agents.

Figure 1-2 iMSS-4050: Pure Call Agent Configuration

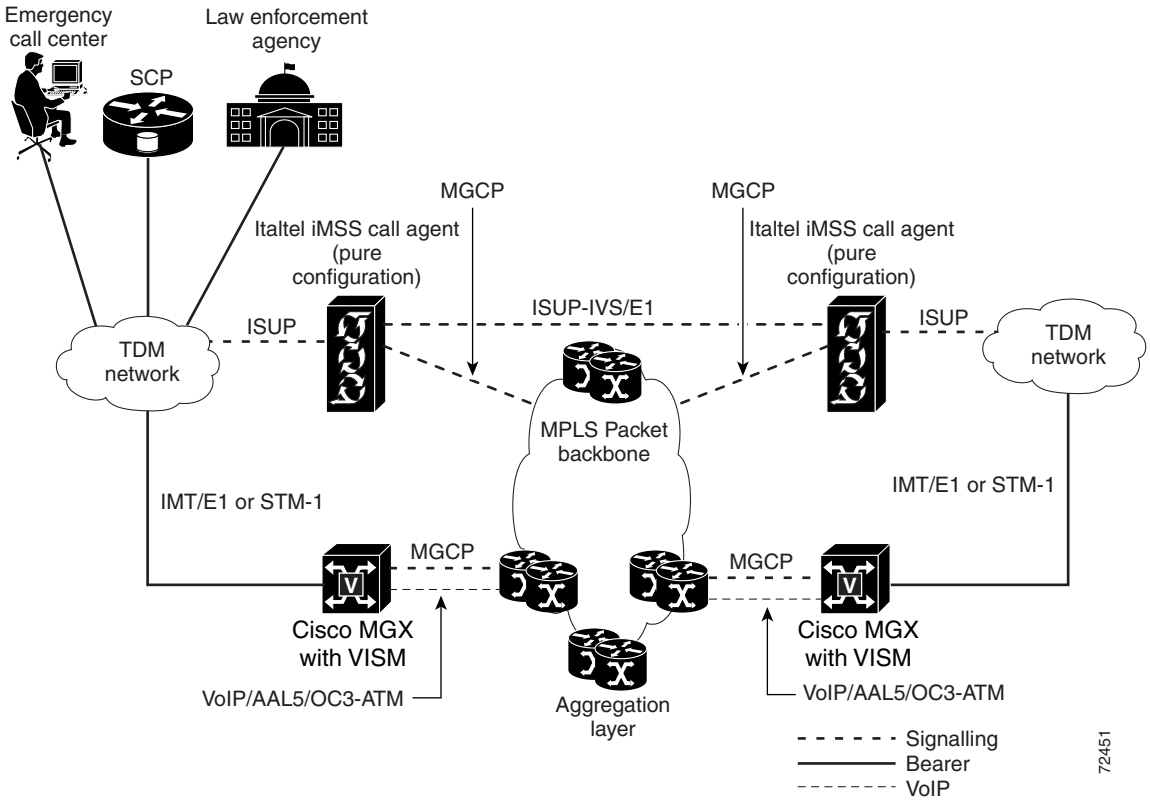
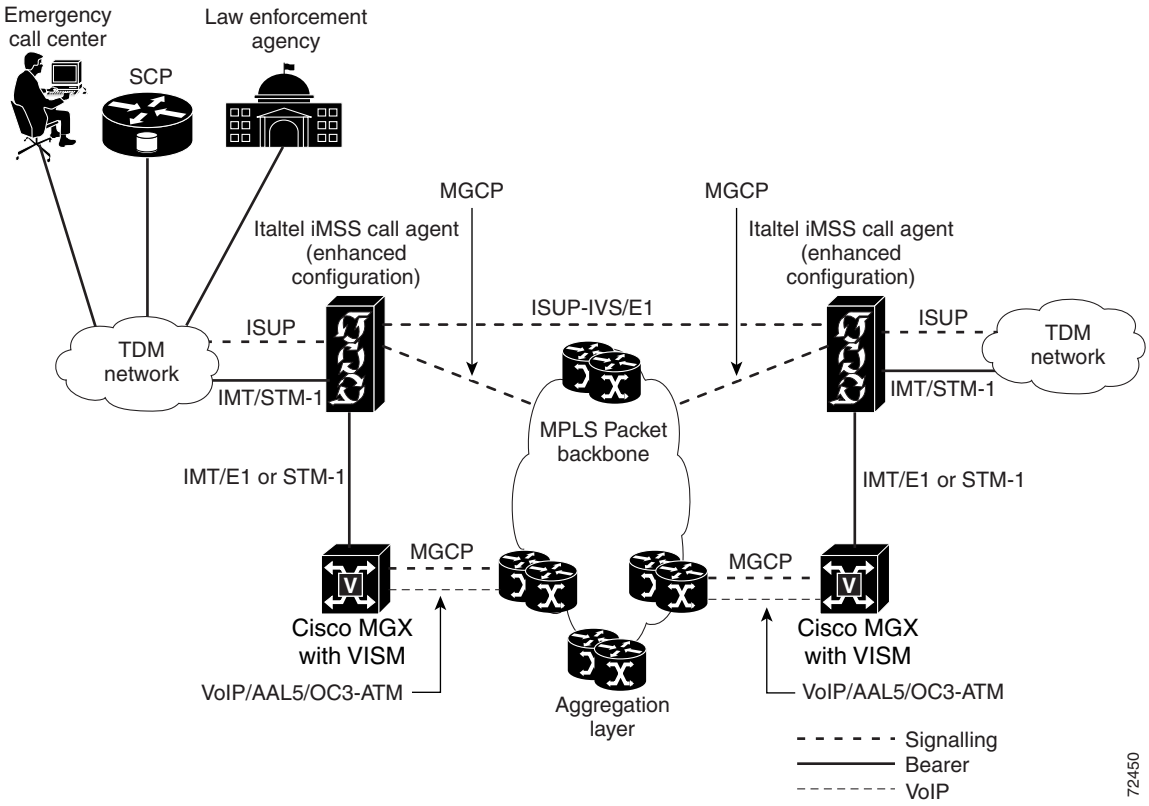


Figure 1-3 illustrates the voice transit application utilizing two iMSS-4040 call agents. The MGXs with VISMs packetize and route the traffic to the MPLS network, but the iMSS-4040 call agents terminate the bearer circuits from the TDM networks.

Figure 1-3 iMSS-4040: Enhanced Call Agent Configuration



A variety of configurations of the iMSS call agent are possible in addition to the multiple call agent configurations in Figure 1-2 and Figure 1-3. It is possible to use a single call agent, either physically located on one site or distributed geographically over multiple sites; refer to Chapter 2, "Solution Components" for information on possible call agent configurations and on the criteria, such as processing capacity and port costs for selecting particular configurations.

Universal Port

The iMSS call agent and AS5400 or AS5400HPX media gateway can be used to provide universal port services. This functionality allows the media gateway to operate simultaneously as a NAS and a voice gateway to deliver universal dial services—analog modem, digital modem, fax, and VoIP—on any port at any time. Selection of the service to be offered on a particular port is done on a call-by-call basis.

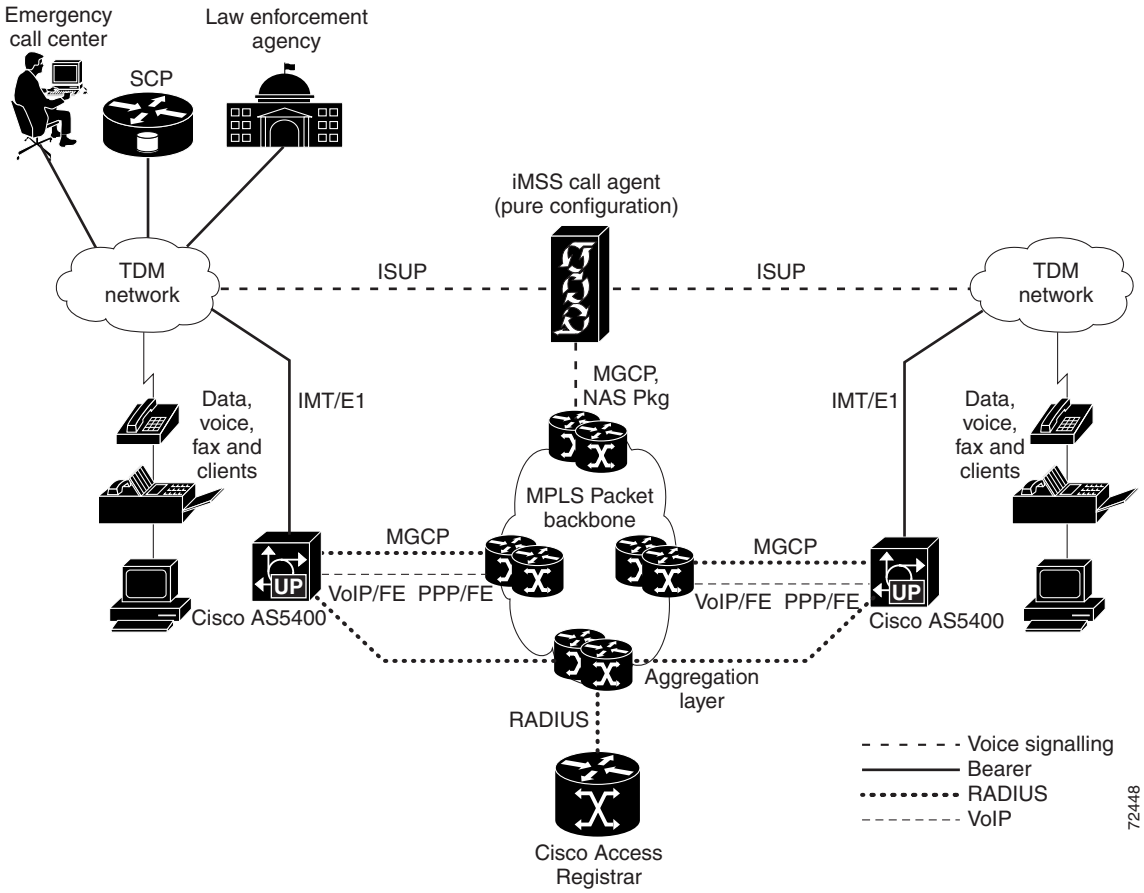
The section does not describe use of the AS5400 or AS5400HPX as a voice or dial only platform.

Universal Port Architecture

In a pure call agent configuration, the AS5400 or AS5400HPX media gateways terminate the bearer circuits from the TDM networks, and packetize and route the traffic to the MPLS network calls under the supervision of the call agent. The media gateways also are responsible for authenticating and maintaining the state information to deliver the dial services. The iMSS-4050 call agent receives the SS7 signalling traffic from the TDM network and provides the facilities to set up, tear down, and manage calls for the voice services on the media gateways through the MGCP.

Figure 1-4 illustrates the universal port architecture for an application with voice transit and dial termination at each POP, utilizing just one iMSS-4050 call agent in a pure configuration. Multiple call agents are not supported in this configuration.

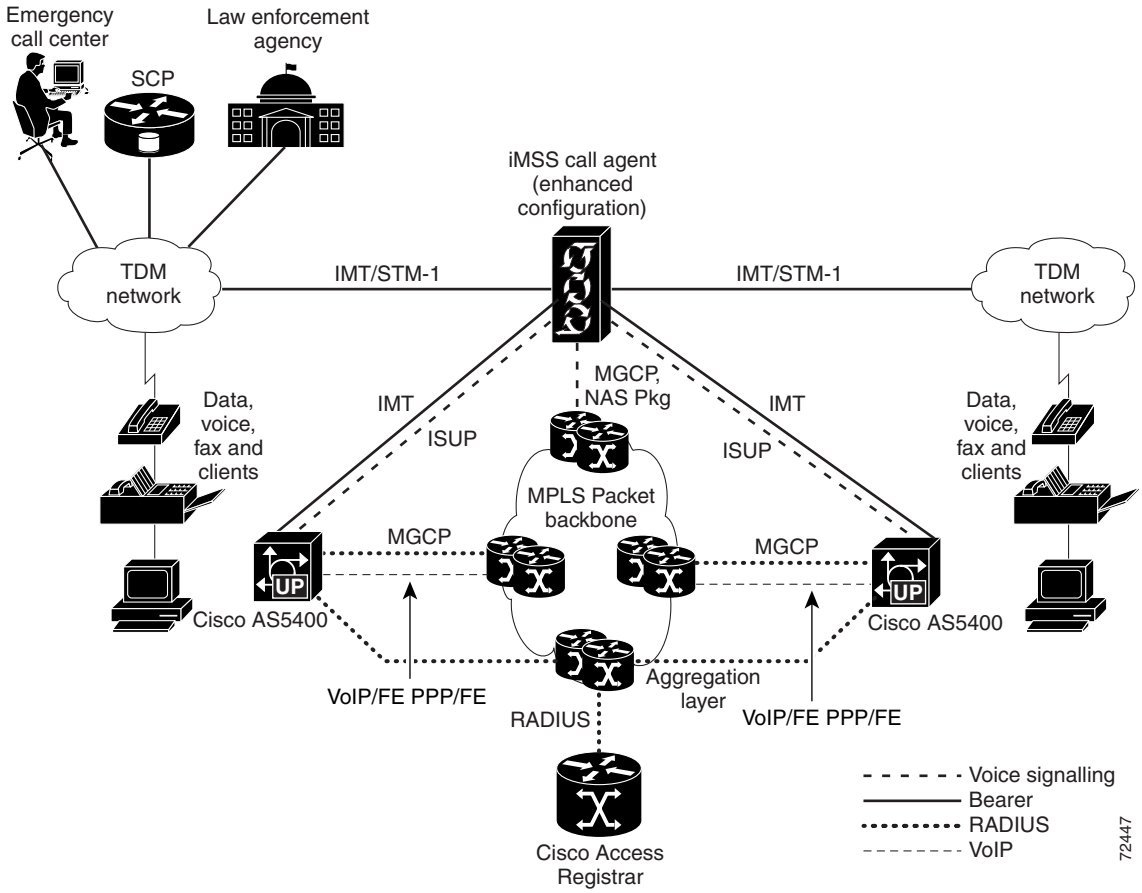
Figure 1-4 Universal Port with Pure Call Agent Configuration



In an enhanced call agent configuration, the iMSS-4050 call agent terminates the bearer circuits from the TDM networks. The AS5400 or AS5400HPX media gateways packetize and route the traffic to the IP network and are responsible for authenticating the dial services.

Figure 1-5 illustrates the universal port architecture for an application with voice transit and dial termination at each POP, utilizing just one iMSS-4040 call agent in an enhanced configuration. Multiple call agents are not supported in this configuration.

Figure 1-5 Universal Port with Enhanced Call Agent Configuration



An MGCP and NAS software package running on both the AS5400 media gateway and iMSS-4050 call agent manages the voice services. The iMSS-4050 call agent also requires SS7 signalling termination.

Authentication, Authorization and Accounting

The Cisco Access Registrar (CAR) is an optional component that can provide the authentication, authorization, and accounting (AAA) features required for the dial services authentication. CAR is a standards-based Remote Authentication Dial-In User Service (RADIUS) server.

CAR is based on a client/server model. The media gateway (client) requests name and password information from the server; the server authenticates this information and determines which dynamic resources the user is authorized for, returning either an acceptance containing the necessary configuration information, a rejection to deny access, or a request for further information.

Any one or all of the authentication, authorization, or accounting functions can be subcontracted to another RADIUS server. In some cases, the CAR could then act as a proxy server. For example, the CAR could proxy to a Lightweight Directory Access Protocol (LDAP) server for access to directory information about users for authentication.

It is important to correctly size the number of CARs required based on the expected load and to distribute these around the network for redundancy.

Remote User Access

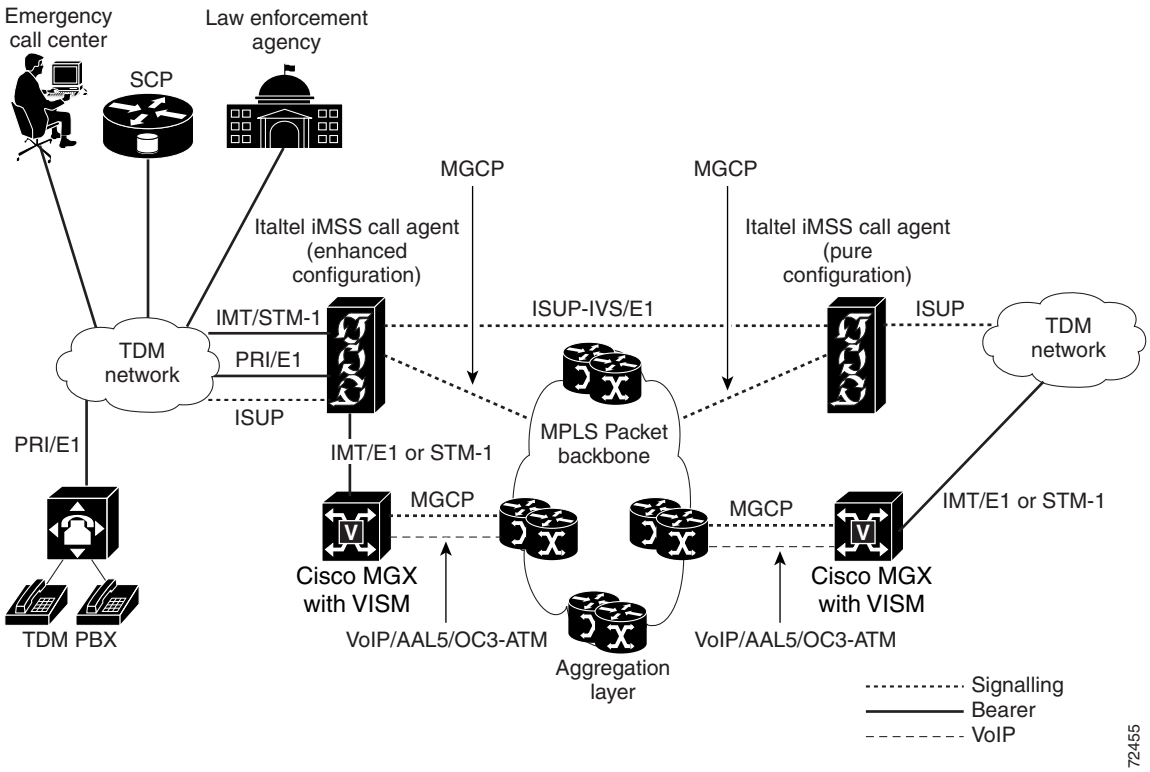
The iMSS call agent and MGX with VISM can be used to provide access for remotely-connected legacy TDM PABXs and access network equipment using V5.1 and V5.2 protocols.

The PRI Interconnect application provides access for customers with existing PABXs, and the V5.x interconnect application provides access for customers with existing remote concentrators, allowing traditional POTS and ISDN subscribers to be hosted on the iMSS call agent.

PRI Interconnect Architecture

The PRI Interconnect solution requires an iMSS-4040 call agent (enhanced configuration) with a PRI interface to terminate the bearer circuits from the TDM network. The solution provides access for remote TDM PABXs with PRI interconnect access to the MPLS packet network.

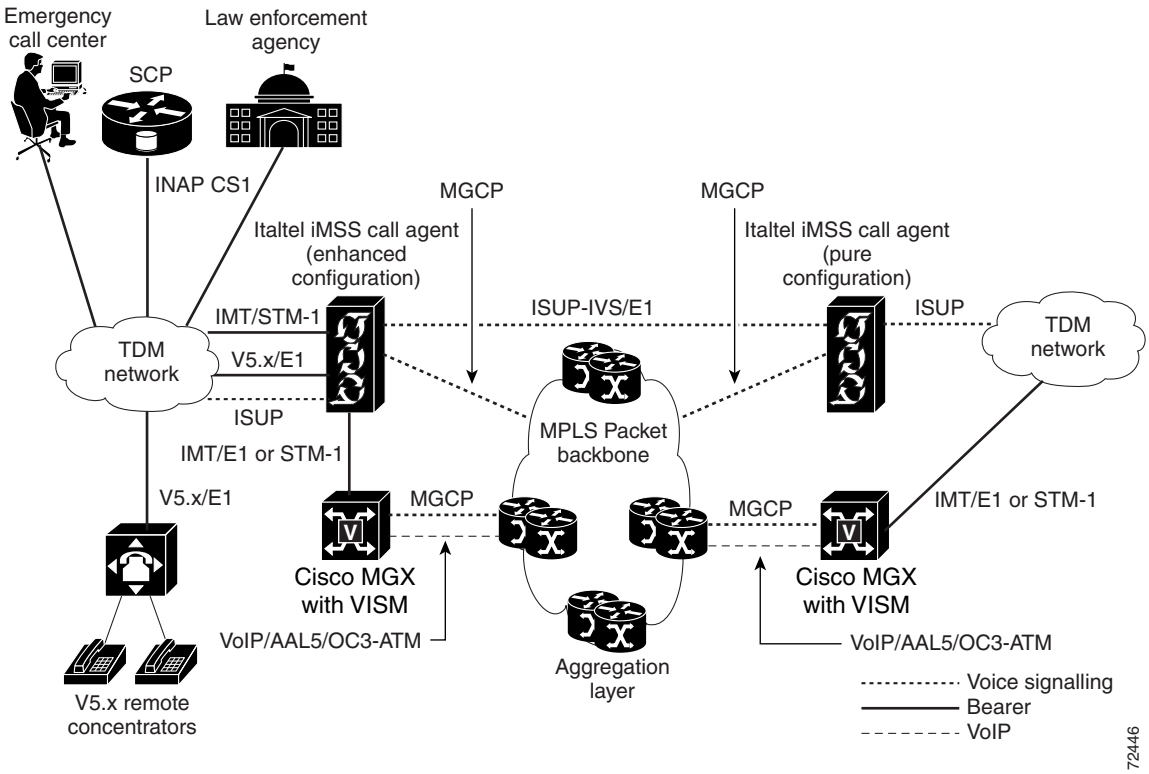
Figure 1-6 PRI Interconnect for Remote TDM PABXs



V5.1 and V5.2 Interconnect Architecture

The V5.1 and V5.2 Interconnect solution requires an iMSS-4040 call agent (enhanced configuration) with V5.x interface to terminate the bearer circuits from the TDM network, supporting traditional services for POTS users and intelligent network services through INAP.

Figure 1-7 V5.1 and V5.2 Interconnect for Remote Access Equipment



Management

For this release of the Cisco Multiservice Packet Network Solution, configuration, fault, performance, and accounting management is provided within the relevant element management systems.

The configuration management functions enable the planning and installation of network elements and their interconnection into a network, and the activation, modification and deletion of customer services that use that network. Management of the Cisco MGX 8230, 8250, and 8850 with VISM is provided by the Cisco WAN Manager (CWM), and management of the AS5400 and AS5400HPX gateways is provided by the Cisco Universal Gateway Manager (UGM). Management of the call agent components is provided by the Italtel-supplied Multiservice Element Manager (MSEM). Management of the data core components can be provided by the Cisco 12000 Manager (C12KM), and management of the access switches and routers can be provided by CiscoWorks 2000 (CW2K) Routed WAN Solution.

The fault management functions enable the detection, isolation, and correction of abnormal operation of the network. Each of the individual element management systems captures fault information, and HP OpenView Network Node Manager (NNM), delivered with CWM, can optionally be used with the media gateways. Fault management for the Cisco IOS devices (for example, the Cisco 7507 and 7513 Routers and Catalyst 4000 and 6000 switches) uses the Cisco CNS Notification Engine (CNOTE) to forward Syslog messages to operations support systems such as the Cisco Info Centre (CIC). HP OpenView NNM, together with the Fault and Trouble Management component of MSEM, provide an overall network-wide view, or can be used to monitor sub-divisions of the Cisco Multiservice Packet Network Solution (for example, core, access, media gateways, and call agent) as required.

The performance management functions evaluate and report on the effectiveness of the network and network elements for the support of services. The focus within performance management is the collection and analysis of statistics for the call agents, media gateways, and routers. The call level statistics, traffic flows for traffic engineering, and measurements at the edge routers generate a series of specialized reports that provide an indication of the core network performance and how this impacts voice traffic.

Within the Cisco Multiservice Packet Network Solution, accounting management, to enable the use of the network services to be measured and the costs for such usage to be determined, falls within the domain of the call agent management system MSEM.

CHAPTER 2

Solution Components

Introduction

This chapter provides a description of the key components—the media gateways and call agents—of the Cisco Multiservice Packet Network Solution. See the following sections for further information on these components:

- Media Gateways
- Call Agent

The focus of each section is to define the particular features used within the solution. Refer to the *Cisco Multiservice Packet Network Solution Documentation Guide* for links to the product documentation sets for further detailed information on each component.

Media Gateways

The Cisco MGX 8230, 8250 and 8850, together with the Cisco Voice Interworking Service Module (VISM), and the Cisco AS5400 and AS5400HPX are the recommended platforms for the media gateways.

The MGX 8230 with VISM, AS5400, and AS5400HPX are suitable for smaller end offices, whereas the MGX 8250 and 8850 with VISM are recommended for larger applications and to allow for future capacity upgrades. Either the Cisco AS5400 or AS5400HPX media gateway is the preferred solution where universal port capability is required.

See the following sections for further information on these media gateways:

- Cisco MGX 8230, 8250, and 8850 with VISM
- Cisco AS5400 and AS5400HPX Gateways

Note Refer to the most current *Release Notes for Cisco Multiservice Packet Network Solution* for the latest information regarding Cisco IOS software versions, other application software, and platform details.

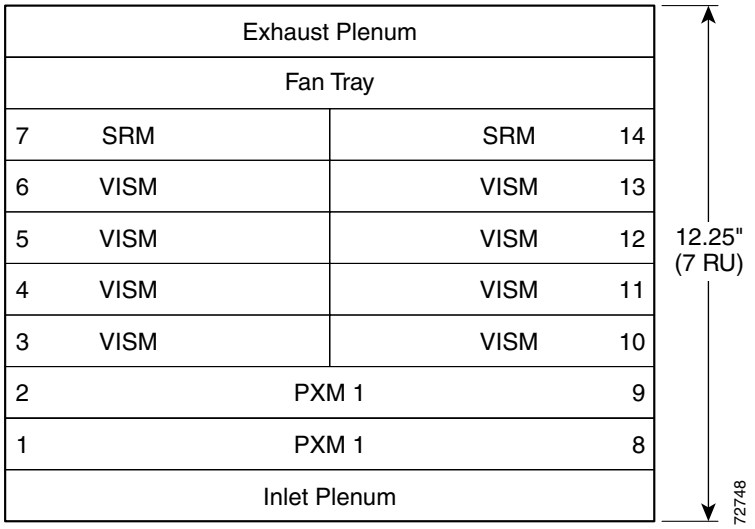
Cisco MGX 8230, 8250, and 8850 with VISM

The Cisco MGX 8230, 8250, and 8850, together with the VISM, are the highly scalable carrier class platforms that deliver the voice services in combination with the Italtel Multiservice Switching System (iMSS) call agent. All components—control processor, IP modules, switching fabric, network interfaces, service interfaces, critical backplane signals, power supplies, power modules, and cooling fans—have 100 percent system redundancy, meeting the demand for high availability.

Platform Components

The MGX 8230 with VISM is suitable for smaller end offices, whereas the MGX 8250 and 8850 with VISM are recommended for larger applications and to allow for future capacity upgrades. The MGX 8230 has a 1.2 Gbps backplane capacity, eight slots for the VISMs, two slots for the Service Resource Modules (SRMs), and two slots for redundant Processor Switch Modules (PXM-1 cards). See Figure 2-1 for the layout of the MGX 8230.

Figure 2-1 MGX 8230 Platform—Front View



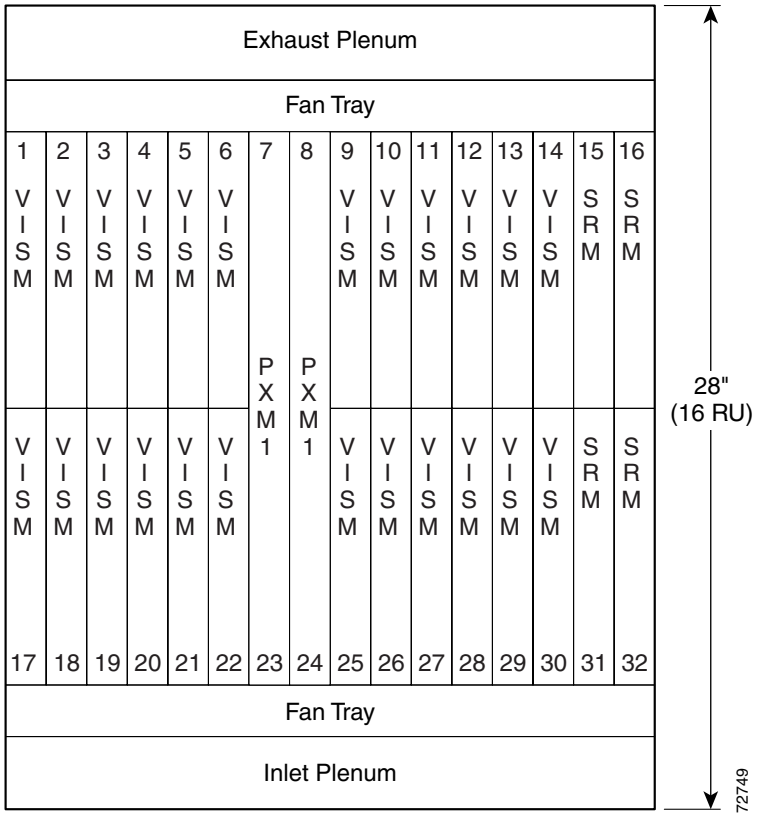
The MGX 8230 supports both SRM and SRM/E (Enhanced SRM) cards. The Cisco Multiservice Packet Network Solution recommends use of the SRM/E one-port STM-1/OC-3 back card; this provides built-in bit error rate tester (BERT) capabilities for the E1 lines, bulk distribution, and loop back and redundancy capabilities.

The PXM-1 combines ATM switching and ATM trunking on one card, with trunking speeds up to OC-12, although OC-3 is recommended for the Cisco Multiservice Packet Network Solution.

The MGX 8250 and 8850 have an identical chassis of two shelves of 16 cards, with 24 slots for the VISMs, four slots for the SRMs or SRM/Es, and two slots for the redundant PXM-1 cards. The MGX 8250 has a 1.2 Gbps backplane capacity whereas the MGX 8850 has a backplane capacity that can range from 1.2 Gbps to 45 Gbps. See Figure 2-2 for the layout of the MGX 8250 and 8850 platforms.

The VISM service modules can operate in a 1:N redundancy mode; that is, one module on each shelf is designated as a backup. For example, for a fully loaded 8250 or 8850 chassis with 1:N redundancy, two of the 24 VISM cards would be used as backup, and 22 cards would carry traffic. With 1:1 redundancy, each shelf can support six redundant pairs. Note that the individual redundancy groups must offer backup on the upper and lower shelves independently, and the SRM cards must be in redundant pairs.

Figure 2-2 MGX 8250 and 8850 Platforms—Front View



Voice Interworking Service Module (VISM)

The VISM is front and back card set. Each VISM supports up to eight E1 lines (using RJ48 or SMB connectors) through ports located on the back card of the two-card set. Each line is configured either for binary 8-zero substitution (B8ZS) or alternate mask inversion (AMI) coding, with voice compression to G.711, G.726 (32K), and G.729ab coder-decoder (codec) standards. Line failures that are detected cause the VISM to generate E1 facility alarms, and lines can be tested using continuity tests and line loopbacks. The VISM can connect directly to the time-division multiplexing (TDM) E1 lines through ports located on the back card, or optionally via the bulk distribution capability of the SRM/E card.

The VISM communicates with the packet network for transmitting and receiving the voice payload by using the STM-1 port on the PXM-1 card. Permanent virtual circuits (PVCs) are setup between the MGX and the edge router, and all packets are sent across these PVCs regardless of their destination. The router is responsible for extracting the IP address and correctly routing the cells. For reliability, VISM supports two independent STM-1 interfaces each connected to a separate router, and each with its own PVC—one is designated the primary and one the secondary.

The Cisco Multiservice Packet Network Solution also supports the VISM-PR, a new generation VISM with an additional G.723.1 codec, and a higher density daughter card that provides increased DSP capacity for full support of eight E1s with codecs G.726 and G.729ab.

See Table 2-1 for configuration rules for the VISM, VISM-PR, and PXM cards supported in the Cisco Multiservice Packet Network Solution.

Table 2-1 VISM Module and MGX Platform/PXM Card Configuration Rules

VISM Module	MGX 8230 (with PXM-1)	MGX 8250 (with PXM-1)	MGX 8850 (with PXM-1)	MGX 8850 (with PXM-1E)	MGX 8850 (with PXM-45)
MGX-VISM-8E1	Yes	Yes	Yes	No	No
MGX-VISM-PR-8E1	Yes	Yes	Yes	Yes	Yes

Note Within the Cisco Multiservice Packet Network Solution, the VISM hardware supports either VISM Software Release 2.1 (MGX-VISM-SW2100) or Release 3.0 (MGX-VISM-SW3000), and the VISM-PR hardware supports only VISM Software Release 3.0 (MGX-VISM-SW3000).

Table 2-2 lists the codecs supported by each VISM module within the Cisco Multiservice Packet Network Solution.

Table 2-2 VISM Module Codec Support

Codec	VISM	VISM-PR
G.711	Yes	Yes
G.723.1	No	Yes
G.726 (32K)	Yes	Yes
G.729a	Yes	Yes

Configurations

Platform components are dependent on the size of the application. For small applications, the MGX 8230 Edge Concentrator is recommended. See Table 2-3 for a configuration that supports up to 32 E1 lines using one SRM/E card. See Table 2-4 for a configuration that supports up to 64 E1 lines using two SRM/E cards, one on each shelf.

Table 2-3 MGX 8230 Line Card Components (up to 32 E1 lines)

Product	Description	Quantity
MGX8230	MGX 8230, 8 I/O+2 SRM slots, PXM-1, PXM-UI, cooling, 19”	1
PXM1-4-155-R	Redundant PXM1-4-155, PXM1-UI (including upgrade of the first PXM-1	1
MGX-MMF-4-155/B=	PXM-1 4-port 155 Mbps back card, multimode fibre (MMF), SC connectors	2
MGX-SRME	Enhanced Service Redundancy Module	2
MGX-SMFIR-1-155	SRME 1-port 155 Mbps back card, single mode fibre intermediate range (SMFIR), SC connector	2

Table 2-3 MGX 8230 Line Card Components (up to 32 E1 lines) (continued)

Product	Description	Quantity
MGX-STM1-EL-1	STM1 Elec. Interface back card for SRME-155-1, SMB connector	1
MGX-VISM-8E1	Voice Interworking Service Module, eight E1 ports	1 to 4
MGX-VISM-PR-8E1	Voice Interworking Service Module-PR, eight E1 ports	1 to 4
AX-RJ48-8E1	8-port E1 back card with RJ48 connectors	1 to 4

Table 2-4 MGX 8230 Line Card Components (33 to 64 E1 lines)

Product	Description	Quantity
MGX8230	MGX 8230, 8 I/O+2 SRM slots, PXM-1, PXM-UI, cooling, 19”	1
PXM1-4-155-R	Redundant PXM1-4-155, PXM1-UI (including upgrade of the first PXM-1	1
MGX-MMF-4-155/B=	PXM-1 4-port 155 Mbps back card, multimode fibre (MMF), SC connectors	2
MGX-SRME	Enhanced Service Redundancy Module	2
MGX-SMFIR-1-155	SRME 1-port 155 Mbps back card, single mode fibre intermediate range (SMFIR), SC connector	2
MGX-STM1-EL-1	STM1 Elec. Interface back card for SRME-155-1, SMB connector	2
MGX-VISM-8E1	Voice Interworking Service Module, eight E1 ports	5 to 8
MGX-VISM-PR-8E1	Voice Interworking Service Module-PR, eight E1 ports	5 to 8
AX-RJ48-8E1	8-port E1 back card with RJ48 connectors	5 to 8

For medium configurations, the MGX 8250 or 8850 with VISM is recommended. See Table 2-5 for an MGX 8850 configuration that supports up to 96 E1 lines using two SRM/E cards. See Table 2-6 for a configuration that supports up to 192 E1 lines using four SRM/E cards.

Table 2-5 MGX 8850 Line Card Components (up to 96 E1 lines)

Product	Description	Quantity
MGX8850	MGX 8850, 24 I/O+4 SRM slots, PXM-1, PXM-UI, cooling, 19”	1
PXM1-4-155-R	Redundant PXM1-4-155, PXM1-UI (including upgrade of the first PXM-1	1
MGX-MMF-4-155/B=	PXM-1 4-port 155 Mbps back card, multimode fibre (MMF), SC connectors	2
MGX-SRME	Enhanced Service Redundancy Module	2

Table 2-5 MGX 8850 Line Card Components (up to 96 E1 lines) (continued)

Product	Description	Quantity
MGX-SMFIR-1-155	SRME 1-port 155 Mbps back card, single mode fibre intermediate range (SMFIR), SC connector	2
MGX-STM1-EL-1	STM1 Elec. Interface back card for SRME-155-1, SMB connector	2
MGX-VISM-8E1	Voice Interworking Service Module, eight E1 ports	9 to 12
MGX-VISM-PR-8E1	Voice Interworking Service Module-PR, eight E1 ports	9 to 12
AX-RJ48-8E1	8-port E1 back card with RJ48 connectors	9 to 12

Table 2-6 MGX 8850 Line Card Components (up to 192 E1 lines)

Product	Description	Quantity
MGX8850	MGX 8850, 24 I/O+4 SRM slots, PXM-1, PXM-UI, cooling, 19”	1
PXM1-4-155-R	Redundant PXM1-4-155, PXM1-UI (including upgrade of the first PXM-1	1
MGX-MMF-4-155/B=	PXM-1 4-port 155 Mbps back card, multimode fibre (MMF), SC connectors	2
MGX-SRME	Enhanced Service Redundancy Module	2
MGX-SMFIR-1-155	SRME 1-port 155 Mbps back card, single mode fibre intermediate range (SMFIR), SC connector	4
MGX-STM1-EL-1	STM1 Elec. Interface back card for SRME-155-1, SMB connector	4
MGX-VISM-8E1	Voice Interworking Service Module, eight E1 ports	13 to 24
MGX-VISM-PR-8E1	Voice Interworking Service Module-PR, eight E1 ports	13 to 24
AX-RJ48-8E1	8-port E1 back card with RJ48 connectors	13 to 24

Configurations requiring more than 192 E1 lines require more than one MGX platform.

Refer to the most current *Release Notes for Cisco Multiservice Packet Network Solution* for details of the required Cisco IOS software release.

Protocol Support

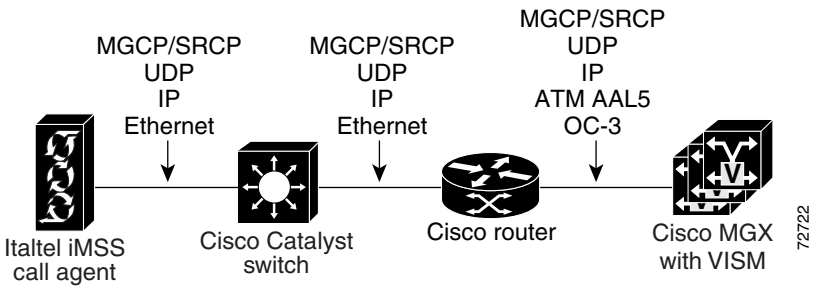
Control Traffic

Special gateway controller protocols are used between the call agent and the VISM. These protocols are transmitted as User Datagram Protocol/Internet Protocol (UDP/IP) datagrams to the edge router on the same PVC as the voice traffic.

The Media Gateway Control Protocol (MGCP) provides the call control for the setup and teardown of calls. The VISM Software Release 2.1 supports MGCP Version 0.1, and the VISM Software Release 3.0 supports MGCP Version 1.0.

The Simple Gateway Control Protocol (SGCP) and Simple Resource Control Protocol (SRCP) are used by the call agent to verify that the VISM is operational, and for auditing the status of the lines. Both the VISM classic and VISM-PR cards support SGCP Version 1.1 and SRCP Version 1.0. Figure 2-3 shows the control traffic protocols in a sample configuration with all components in the same location.

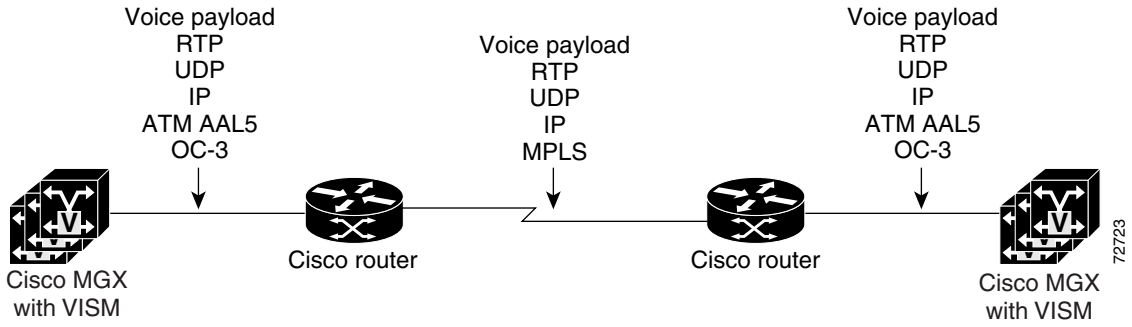
Figure 2-3 Control Traffic between the VISM and iMSS Call Agent



Voice Bearer Traffic

The voice traffic is first formatted into a Real-Time Transport Protocol (RTP) packet, then encapsulated in a UDP and then an IP packet, and then converted to AAL-5 ATM cells (that comply to RFC 1483) for transmission to the network. RTP is used to allow time-stamping of the voice samples to permit dejittering of samples transmitted to the destination TDM line. Figure 2-4 shows the voice bearer protocols in a sample configuration with VISMs connected to edge routers dedicated to voice traffic.

Figure 2-4 Voice Bearer Traffic



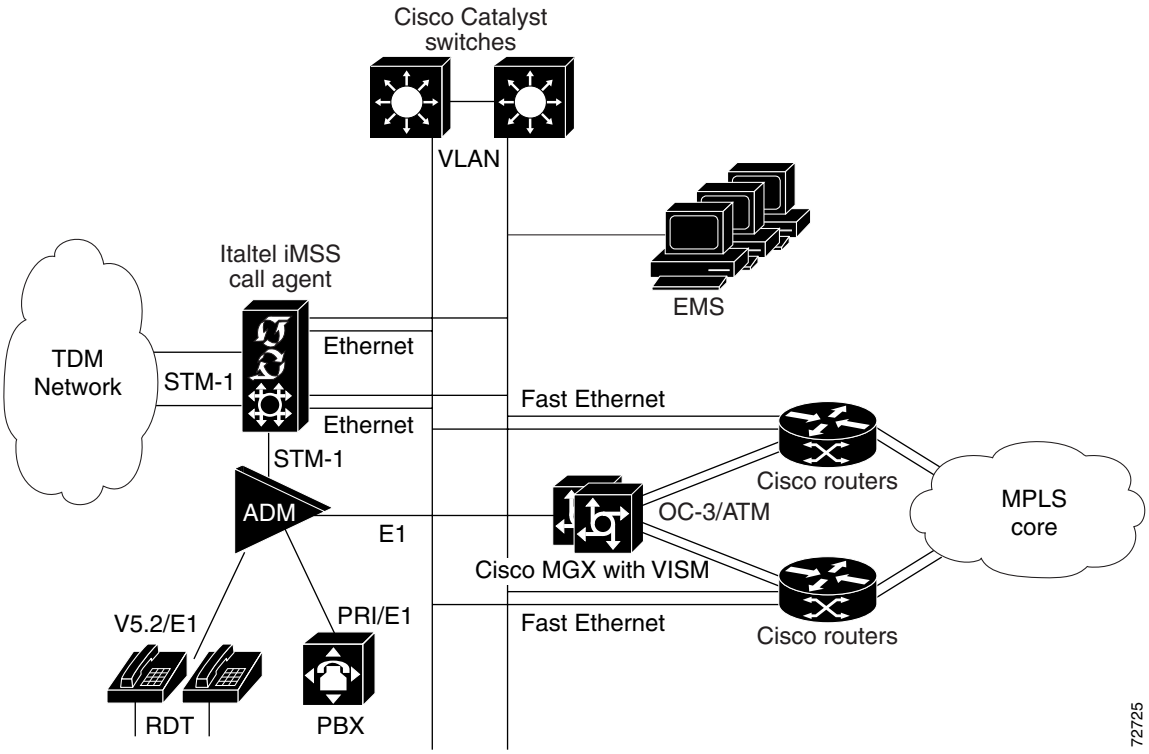
Physical Layout

See Figure 2-5 for a sample physical configuration for a voice-only deployment of MGXs with VISMs as the media gateways. The call agent for this configuration is the iMSS-4040 providing TDM PRI and V5.2 connectivity, running in an enhanced configuration. The line cards require a TDM Switching matrix card on the Optical Peripheral Module (OPM) of the iMSS call agent, and an Add/Drop Multiplexer (ADM)—either third party or Italtel—to handle the E1 lines for the iMSS-4040, and to handle the PRI and V5.2 connections. In this sample configuration, the ADM is also required to handle the communication with the VISM over the E1 rather than STM-1 connection.

The redundancy in the topology is achieved using dual virtual LANs and multiple components—MGXs with VISMs, Catalyst switches, and Cisco routers—with multiple connections to the MPLS network. A recommended configuration is to use multiple Cisco 7500 series routers as edge routers to aggregate the voice traffic because they make a clear separation between traffic aggregation and the core network routers, and provide a high level of redundancy. Any data traffic should be handled by additional Cisco routers. The voice-based Cisco routers can route local traffic within the point of presence (POP) without any load on the core, handle MPLS label imposition and disposition, and determine traffic classifications. The routers run the Hot Standby Router Protocol (HSRP) so that the iMSS call agent detects a virtual router rather than active and standby routers.

Each VLAN is connected to one side of the OPM of the iMSS call agent.

Figure 2-5 MGX with VISM Physical Connections—Enhanced Call Agent Configuration



PVCs are setup between the MGX and the edge router, and all packets are sent across these PVCs regardless of their destination. For reliability, VISM supports two independent STM-1 interfaces each with its own PVC—one is designated the primary and one the secondary. Loopback cells are sent every 200 ms on each PVC as the heartbeat mechanism.

Cisco AS5400 and AS5400HPX Gateways

The Cisco AS5400 or AS5400HPX media gateway together with the Italtel iMSS call agent can be used to provide universal port services. This universal port functionality allows the media gateway to operate simultaneously as a network access server (NAS) and a voice gateway to deliver universal dial services—analog modem, digital modem, fax, and Voice over IP (VoIP)—on any port at any time.

Platform Components

The Cisco AS5400 and AS5400HPX media gateways support two 10/100 Mbps Ethernet LAN ports and have seven slots for Dial Feature Cards (DFCs). One or two DFC slots can be used for trunk feature cards, and the remaining slots can be used for Digital Signal Processor (DSP) cards. All cards are hot swappable.

Both media gateways support the 8-port E1/PRI termination trunk feature card and the 60- and 108-Universal Port Feature cards. The 8-port E1/PRI card provides physical termination for E1, PRI, or intermachine trunks (IMTs). The universal port feature cards support the modem, wireless, voice, and fax calls. Modem-management features are available for troubleshooting, including modem status, real-time call-in-progress statistics, modem activity log, hard/soft busy out, and modem firmware upgrade.

The maximum configuration is 16 E1 lines (two E1/PRI DFCs) and five 108-Universal Port DSPs in the seven slots. This configuration provides a total of 496 calls (determined by 31 calls on each E1 line). An alternative option would be to use four 108-Universal Port Feature cards and one 60-Universal Port Feature card to better match the maximum number of calls, but this is a balance between requirements for redundancy (DSP cards are pooled), inventory management issues due to a mix of cards, and cost of the cards. See Table 2-7 and Table 2-8 for sample AS5400 and AS5400HPX bundles.

Table 2-7 AS5400 Bundles

Product	Description	Quantity
AS54-8E1-240-AC	AS5400; 8E1, 276 ports, dual AC, IP+ IOS, 240 data licenses	1
AS54-16E1-480-AC	AS5400;16E1, 492 ports, dual AC, IP+ IOS, 480 data licenses	1

Table 2-8 AS5400HPX Bundles

Product	Description	Quantity
AS54HPX-8E1-240AC	AS5400HPX; 8E1, 276 ports, dual AC, IP+IOS, 240 voice licenses	1
AS54HPX-16E1-480AC	AS5400HPX; 16E1, 492 ports, dual AC, IP+IOS, 480 voice licenses	1

The AS5400 and AS5400HPX share the same architecture and the same adaptors, and run the same Cisco IOS code. The AS5400HPX has a slightly higher performance on E1 lines due to differences in the motherboard and better memory management, and is thus able to sustain more calls.

The AS5400 and AS5400HPX require the MGCP + NAS Package that is part of Cisco IOS IP PLUS. Refer to the most current *Release Notes for Cisco Multiservice Packet Network Solution* for details of the required Cisco IOS release.

Cisco Access Registrar

The Cisco Access Registrar (CAR) is an optional component that can provide the authentication, authorization, and accounting (AAA) features required for the dial services authentication. CAR is a standards-based Remote Authentication Dial-In User Service (RADIUS) server.

CAR is based on a client/server model. The media gateway (client) requests name and password information from the server; the server authenticates this information and determines which dynamic resources the user is authorized for, returning either an acceptance containing the necessary configuration information, a rejection to deny access, or a request for further information.

Any one or all of the authentication, authorization, or accounting functions can be subcontracted to another RADIUS server. In some cases, the CAR could then act as a proxy server. For example, the CAR could proxy to a Lightweight Directory Access Protocol (LDAP) server for access to directory information about users for authentication.

Based on a Sun Solaris, CAR helps deploy access services by centralizing AAA information while simplifying provisioning and management. However, it is important to correctly size the number of CARs required based on the expected load, and to distribute these around the network for redundancy.

See Table 2-9 for a list of CAR components.

Table 2-9 CAR Components

Product	Description	Quantity
AR 1.7R2 for Solaris 7/8 release	Cisco Access Registrar v1.7r2, January 29, 2002	1

Protocol Support

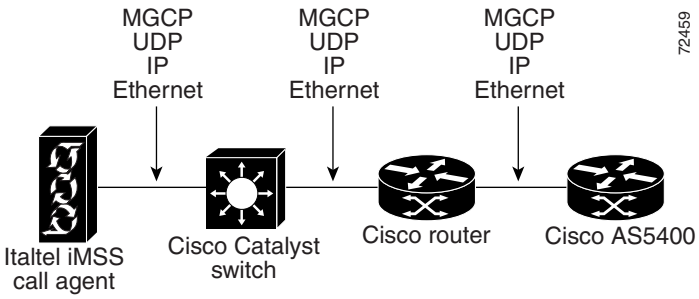
Control Traffic

Special gateway controller protocols are used between the call agent and the AS5400 or AS5400HPX. These protocols are transmitted as UDP/IP datagrams to the edge router on the same PVC as the voice traffic.

MGCP provides the call control for the setup and teardown of calls. The AS5400 and AS5400HPX support MGCP Version 1.0.

SGCP and SRCP are used by the call agent to verify that the AS5400 and AS5400HPX are operational, and for auditing the status of the lines. Both the AS5400 and AS5400HPX support SGCP Version 1.1 and SRCP Version 1.0. Figure 2-6 shows the control traffic protocols in a sample configuration with all components in the same location.

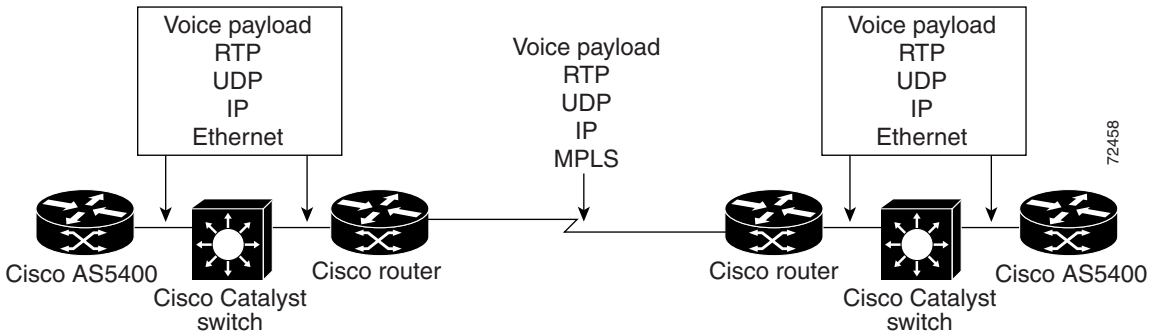
Figure 2-6 Control Traffic



Voice Bearer Traffic

The voice traffic is first formatted into an RTP packet, then encapsulated in a UDP and then an IP packet, for transmission over Fast Ethernet to the Cisco router and thus the network. RTP is used to allow time-stamping of the voice samples to permit dejittering of samples transmitted to the destination TDM line. Figure 2-7 shows the voice bearer protocols in a sample configuration with AS5400s connected to edge routers dedicated to voice traffic.

Figure 2-7 Voice Bearer Traffic

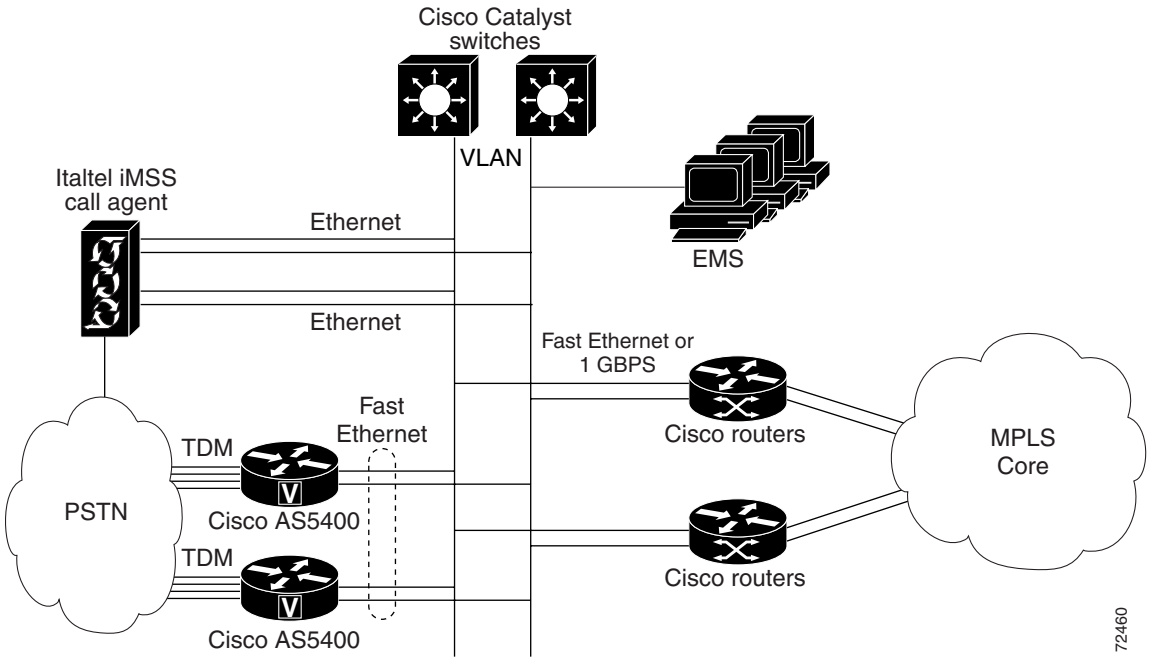


Physical Layout

See Figure 2-8 for a sample physical configuration for a voice-only deployment of AS5400s as the media gateways. The AS5400s support the TDM links to the Public Switched Telephone Network (PSTN) and are connected to edge routers dedicated to voice traffic. The call agent for this configuration is the iMSS-4050 running in a pure configuration.

The redundancy in the topology is achieved using dual VLANs and multiple components—AS5400s, Catalyst switches, and Cisco routers—with multiple connections to the MPLS core. The AS5400 accepts a dual power supply, although it is not a fully redundant system. Because a failure of the media gateway would disable the communication, it is recommended to use a minimum of two gateways with the trunk group split between them.

Figure 2-8 AS5400 Physical Connections—Pure Call Agent Configuration



A recommended configuration is to use multiple Cisco 7500 series routers as edge routers to aggregate the voice traffic as they make a clear separation between traffic aggregation and the core network routers, and provide a high level of redundancy. Any data traffic should be handled by additional Cisco routers. The voice-based Cisco routers can route local traffic within the POP without any load on the core, handle MPLS label imposition and disposition, and determine traffic classifications. The routers run the Hot Standby Router Protocol (HSRP) so that the iMSS call agent detects a virtual router rather than active and standby routers.

Call Agent

Two platforms of the Italtel Multiservice Switching System (iMSS) are available, as follows:

- iMSS-4050—a versatile call agent. This platform provides the control functions for the voice traffic over the IP network, with the media gateways interconnecting the IP and TDM networks. This setup is running the iMSS in a pure configuration, and the platform is deployed where the POP traffic is predominantly transit and the pure call agent features are required.
- iMSS-4040—a versatile call agent and TDM switch. This platform also provides the control functions for the voice traffic over the IP network, but in addition provides the TDM switching capability, linking the TDM network to the media gateways. This setup is running the iMSS in an enhanced configuration, and the platform is deployed where either a significant amount of TDM traffic is switched at the local POP, or where ISDN and V5.1 and V5.2 terminations are required.

As a call agent, both the iMSS-4040 and iMSS-4050 interpret the signalling messages and route the calls through the packet backbone. The iMSS is the Media Gateway Controller (MGC) and Signalling Gateway (SG), controlling the voice traffic through well-defined standard protocols. The MGC uses MGCP to control the Cisco media gateways and thus control the voice calls over the MPLS network. The SG handles the dialogue between all the various Telecom signalling protocols based on the Signalling System 7 (SS7) suite.

As a TDM switch, iMSS-4040 incorporates all the features of a Class 4 switch, such as the powerful and scalable circuit switching fabric and call-control functions. In addition, the iMSS-4040 can operate as a Class 5 switch, accepting ISDN primary rate access (PRA) coming from business customers (for example, private automatic branch exchange [PABXs]) as well as plain old telephone service (POTS) and ISDN basic rate access (BRA) subscribers via V5.1 and V5.2 interfaces.

Platform Components

The iMSS consists of the following main components or telephony modules: Optical Peripheral Module (OPM), Interconnection Structure Module (ISM), Basic Service Handler (BSH), Virtual Termination Call Handler (VTCH), and Operation and Maintenance Server (OMS). Each iMSS can include up to 100 of these modules.

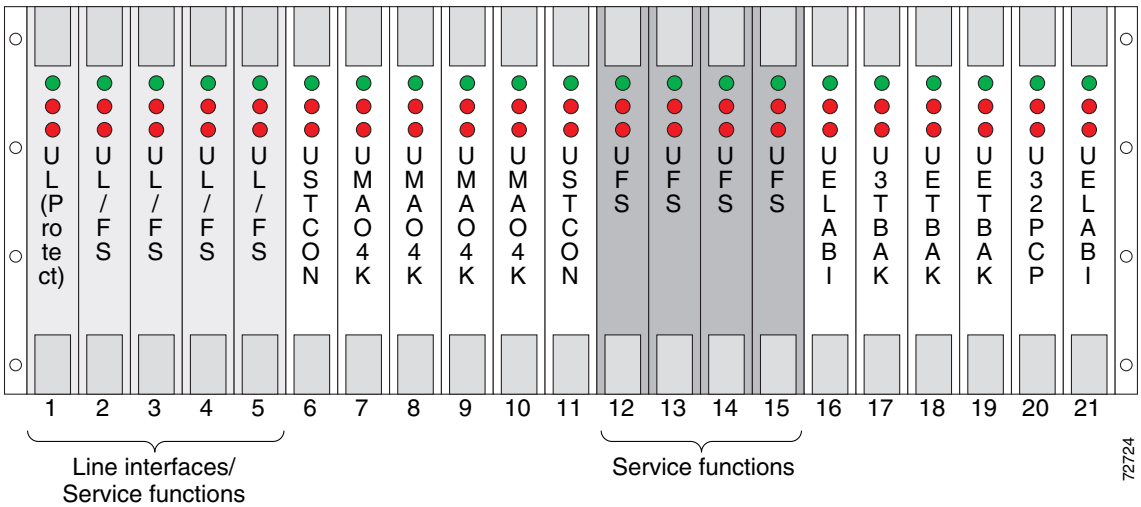
Note The Protocol Handling Server (PHS) is not supported in releases 2.0 and 2.1 of the Cisco Multiservice Packet Network Solution.

Optical Peripheral Module

The OPM is the key element of the iMSS call agent, providing the switch control and call handling, and the synchronization and timing for the TDM line interfaces. The OPM consists of control processors, a synchronization and timing unit (card identifier USTCON), a time slot switching matrix, four slots for multiservice cards, and five slots for interface cards. See Figure 2-9 for the layout of the OPM.

The OPM is a fully redundant system with dual power supplies, fans, and switching matrix, and multiple slots for hot-swappable cards.

Figure 2-9 OPM Front View



Two Main Control Processors (UELABI) work in hot-standby mode to control the internal OPM elements and external communication devices and channels, although only one is in control at any one time. Each processor card has a dual 10BaseT Ethernet card (UETBAK) for intermodule communication and communication with the OMS. Similarly two Peripheral Control Processors (U32PCP) that work in hot-standby mode handle the control channels.

These dual processors and dual Ethernet cards (providing four Ethernet interfaces) allow the OPM to be divided into two independent sides, providing full redundancy.

The multiservice cards provide the telephony and signalling functions (UFSDSP) and recorded announcements and signalling functions (UFSGAV).

Note The UETDSP card, a hardware evolution of the UFSDSP telephony and signalling card is not supported in releases 2.0 and 2.1 of the Cisco Multiservice Packet Network Solution.

Each line card (USTM1N) provides one Synchronous Digital Hierarchy (SDH) STM-1 interface (155 Mbps supporting 63 trunks at 2 Mbps), with either optical or electrical interfaces. Optical STM-1 SDH interfaces (TOSTM1) have line protection using automatic path selection (APS) according to ITU-T G.783; electrical STM-1 SDH interfaces (TESTM1) have Equipment Protection Switching.

The switching matrix (UMAPER) and enhanced switching matrix (UMA04K) cards support 2000 and 4000 DS0s respectively. These two cards are mutually exclusive within one OPM.

For releases 2.0 and 2.1 of the Cisco Multiservice Packet Network Solution, the line cards require an ADM (either third party or Italtel) to handle the E1 lines for both the iMSS-4040 and iMSS-4050, and to handle PRI and V5.x connections for the iMSS-4040. The ADM is also required to handle the communication with the VISM if there is no STM-1 connection on the VISM.

Table 2-10 OPM Cards

Product	Description	Quantity
UELABI	Main Control Processor	2
UETBAK	Dual 10BaseT Ethernet card	2
U32PCP	Peripheral Control Processor	2
USTCON	Synchronization and Timing Unit	2
UFSDSP	Multiservice card—telephony and signalling functions	up to 4
UFSGAV	Multiservice card—recorded announcements and signalling functions	up to 4
USTM1N	STM-1 SDH Interface card	up to 5
UL2M16	16 x E1 Interface card	up to 5
TESTM1	Electrical STM-1 Interface back card	up to 5
TOSTM1	Optical STM-1 Interface back card	up to 5
UMAPER	Switching Matrix (2000 DS0s) card	up to 4
UMA04K	Enhanced Switching Matrix (4000 DS0s)card	up to 4
AD2M155	ADM card	1

Interconnection Structure Module

The ISM allows TDM switching to be extended over multiple OPMs. The ISM can be used only in distributed and multi-module iMSS-4040 configurations. See the “Configurations” section for sample configurations.

Virtual Termination Call Handler

The VTCH software module supports the communication with the Cisco media gateways using MGCP and SRCP, as well as manage the signalling requirements with the SS7 network. The VTCH is implemented on the Centralized Processing Server (CPS). The CPS is based on the same control processor and communication components as the OPM. However, because the CPS's only requirement is to provide processing capacity, it does not require the synchronization and timing unit, time slot switching matrix, or line cards.

The CPS is also a fully redundant system with dual power supplies and fans, and multiple slots for hot-swappable cards.

Basic Service Handler

The BSH software module provides Intelligent Network (IN) services such as call screening, number portability features, and basic number transactions such as toll free numbers. The BSH is implemented on the CPS, and as with the VTCH module, the only requirement of the CPS is to provide processing capacity, thus not requiring the synchronization and timing unit, time slot switching matrix, or line cards.

The BSH module uses an integrated Service Control Point (SCP) database for the IN services, with the internal call handling based on the Intelligent Network Application Part Capability Set 1 (INAP-CS1). The integrated database can be within one BSH module, and thus physically located in a central POP, or distributed over multiple BSH modules, and thus multiple POPs. The Service Switching Point (SSP) functionality that queries the SCP database to provide the IN services is implemented in either an OPM or VTCH module or modules. Each OPM or VTCH module requires an associated BSH module, up to a maximum of five BSH modules correlated to the same subsystem number.

An external SCP database can used instead of the one integrated in the BSH module(s). For support through an external SCP, the iMSS call agent uses INAP-CS1 based on ETS 300 374-1, September 1994 (ITU-Q1600). In this case, communication with the external SCP databases is handled by the OPM modules.

Operation and Maintenance Server

The OMS is a centralized unit that manages the physical and logical configuration of the whole system, collecting billing data, monitoring traffic measurements and alarms, and providing the interface to the local operator and to the MultiService Element Manager (MSEM). See Chapter 3, "Solution Management" for further information.

The OMS is a fully redundant system with master and slave units dually connected over two Ethernet links, with an additional backup serial line in case of faults on all Ethernet interfaces. The dual Ethernets allow redundant interfaces to both the other iMSS modules, as well as to operator consoles and the MSEM.

Protocol Support

The iMSS-4040 and iMSS-4050 use the ISDN User Part - Inter Virtual Switch (ISUP-IVS) proprietary protocol for interexchange signalling. An exchange is defined to be an iMSS, single or distributed, with its own dial plan (resident on OMS). The proprietary Intra Module Control Protocol (iMCP) is used for intraexchange communication between the OPMs and between the OPMs and OMS.

The iMSS-4040 and iMSS-4050 use SS7 signalling protocols to handle the dialogue between the various Telecom components, and uses MGCP to control the Cisco media gateways and thus the voice calls over the IP network. For releases 2.0 and 2.1 of the Cisco Multiservice Packet Network Solution, it is necessary to backhaul the SS7 signal from remote POPs to the central main POP using the existing SS7 signalling network. The iMSS call agent provides full services for the SS7 network.

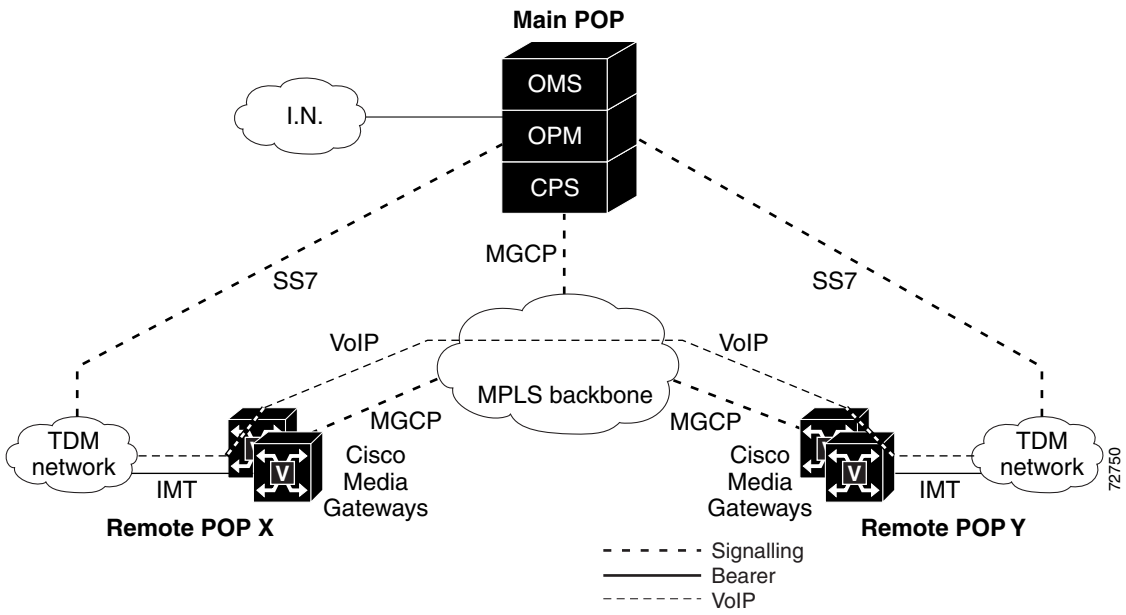
The iMSS-4040 supports access to ISDN using Digital Subscriber Signalling System Number 1 (DSS1) according to ITU-T S 300 347-1 for V5.2.

Configurations

It is possible to have a single-site (centralized) or a multisite (distributed) iMSS call agent depending on whether the central office (CO) is located in one site or geographically distributed in several locations (POPs) linked together. The interconnection network, carrying signalling links and bearer channels among the POPs, can be either a pre-existing or a new circuit-based or packet-based installation.

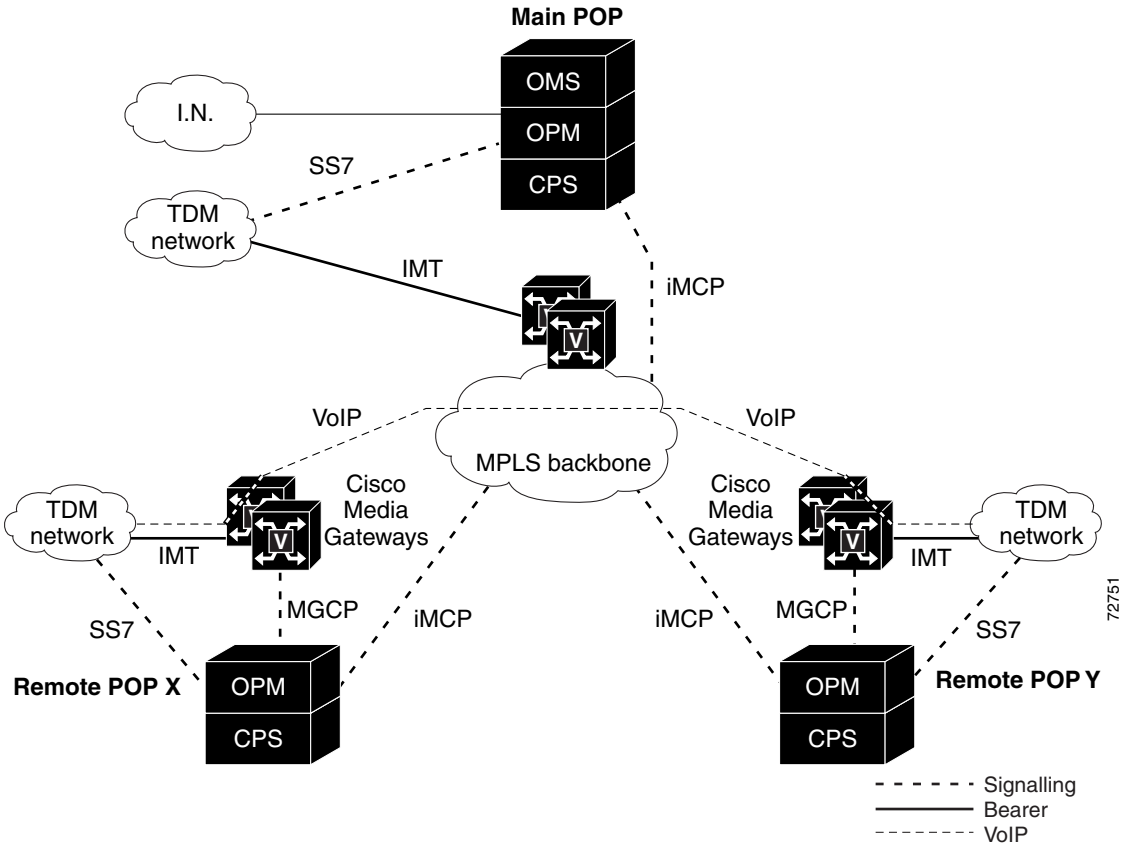
See Figure 2-10 for an example of the iMSS-4050 call agent in a centralized configuration with the OPM and CPS in one location (the main POP). SS7 is being carried over the existing SS7 signalling network.

Figure 2-10 Single iMSS-4050 Call Agent—Centralized Configuration



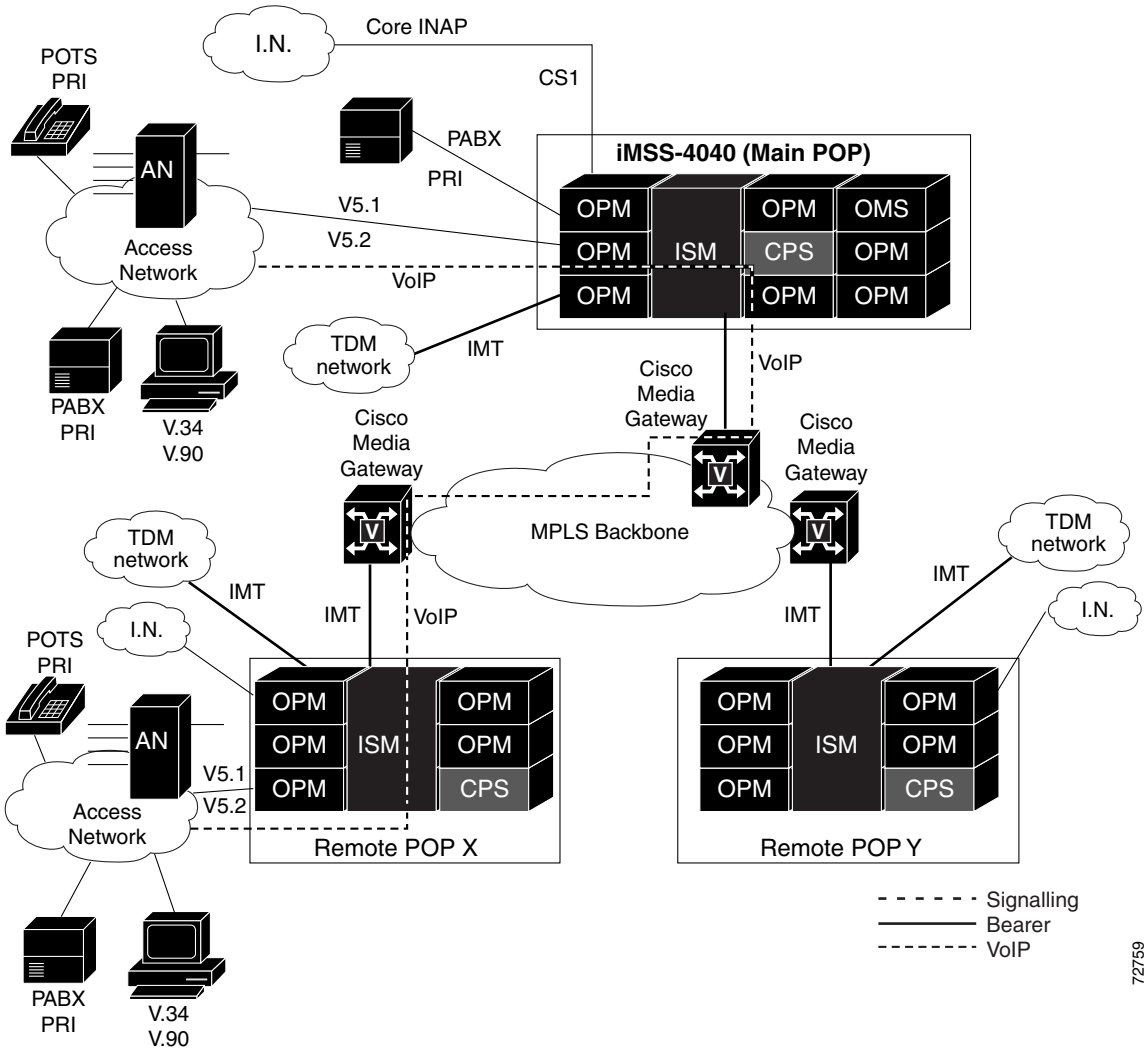
See Figure 2-11 for an example of the iMSS-4050 call agent in a distributed configuration. This configuration has additional OPMs and CPSs in the remote locations (remote POPs), distributing the SG and MGC functions to the remote POPs. iMCP is used for intraexchange communication between the OPMs and between the OPMs and OMS.

Figure 2-11 Single iMSS-4050 Call Agent—Distributed Configuration



See Figure 2-12 for an example of the iMSS-4040 call agent in a distributed configuration. This configuration has additional OPMs and CPSs in the remote locations, using iMCP for intraexchange communication between the OPMs and between the OPMs and OMS. Additional ISMs are also required to allow the TDM switching to be extended over the multiple OPMs.

Figure 2-12 Single iMSS-4040 Call Agent—Distributed Configuration



CHAPTER 3

Solution Management

Introduction

The following sections describe the management architecture, the element management systems (EMSs), and the management tools for the Cisco Multiservice Packet Network Solution:

- Management Architecture
- Element Management Systems
- Management Tools

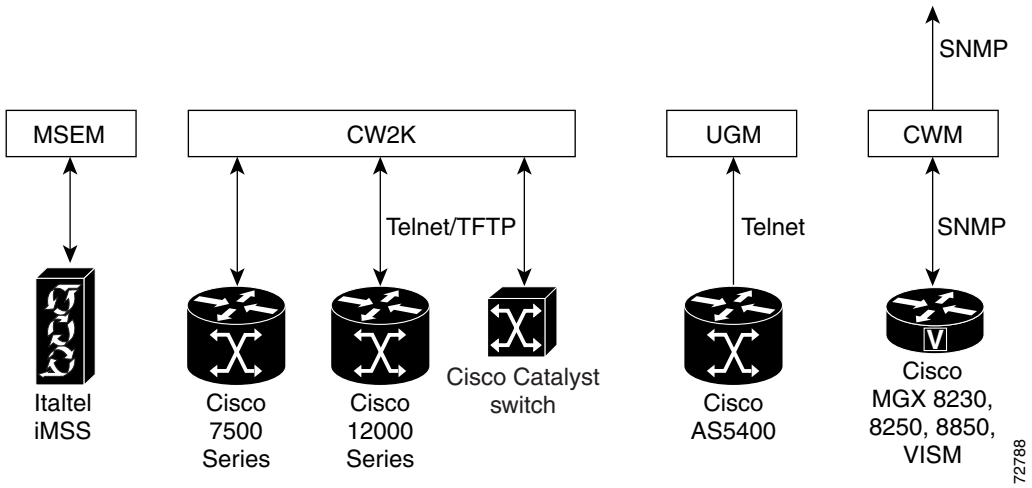
Management Architecture

For releases 2.0 and 2.1 of the Cisco Multiservice Packet Network Solution, configuration, performance, fault, and accounting management is provided within the relevant EMSs.

The configuration management functions enable the planning and installation of network elements and their interconnection into a network, and the activation, modification and deletion of customer services that use that network.

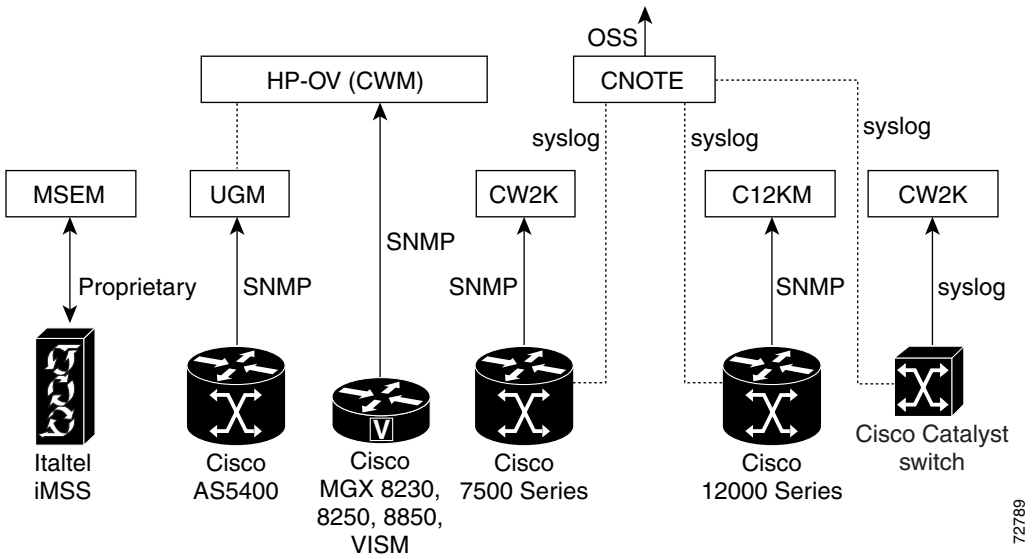
The performance management functions evaluate and report on the effectiveness of the network and network elements for the support of services. The focus within performance management is the collection and analysis of statistics for the call agents, media gateways, and routers. The call level statistics, traffic flows for traffic engineering, and measurements at the edge routers generate a series of specialized reports that provide an indication of the core network performance and how this impacts voice traffic.

Figure 3-1 Configuration and Performance Management—Element View



The fault management functions enable the detection, isolation, and correction of abnormal operation of the network. Each of the individual EMSs captures fault information, and HP OpenView Network Node Manager (NNM), delivered with Cisco WAN Manager (CWM), can optionally be used with the media gateways. Fault management for the Cisco IOS devices (for example, the Cisco 7500 and 12000 series Internet routers and Catalyst switches) uses the Cisco CNS Notification Engine (CNOTE) to forward Syslog messages to operations support systems (for example, Cisco Info Centre). These routers and switches can also optionally use the HP OpenView NNM for fault management. The HP OpenView NNM, together with the Fault and Trouble Management component of the Italtel Multiservice Element Manager (MSEM), provide an overall network-wide view, or can be used to monitor subdivisions of the Cisco Multiservice Packet Network Solution (for example, core, access, media gateways, and call agent) as required.

Figure 3-2 Fault Management—Element View



Within the Cisco Multiservice Packet Network Solution, accounting management, to enable the use of the network services to be measured and the costs for such usage to be determined, falls within the domain of the call agent management system MSEM.

See Table 3-1 for a summary of the EMSs for the media gateways and call agents supported as part of the Cisco Multiservice Packet Network Solution.

Table 3-1 Media Gateway and Call Agent Element Management Systems

Solution Component	Configuration Management	Fault Management	Performance Management
Cisco MGX 8230, 8250, and 8850 with VISM	Cisco WAN Manager	Cisco WAN Manager (optional: HP OpenView NNM)	Cisco WAN Manager
Cisco AS5400 and AS5400HPX Universal Gateways	Cisco Universal Gateway Manager	Cisco Universal Gateway Manager (optional: HP OpenView NNM)	Cisco Universal Gateway Manager
Italtel iMSS-4040 and iMSS-4050 call agents	Multiservice Element Manager: Service Configuration Management	Multiservice Element Manager: Fault and Trouble Management	Multiservice Element Manager: Traffic and Performance Management

See Table 3-2 for a summary of the EMSs that could be used with the core and access routers and switches.

Table 3-2 Media Gateway and Call Agent Element Management Systems

Solution Component	Configuration Management	Fault Management	Performance Management
Cisco 12000 series Internet routers	Cisco 12000 Manager	CNS Notification Engine (optional: HP OpenView NNM)	Cisco 12000 Manager
Cisco 7500 series routers	CiscoWorks 2000 Routed WAN Management Solution	CNS Notification Engine (optional: HP OpenView NNM)	CiscoWorks 2000 Routed WAN Management Solution
Catalyst 3500 series switch, Catalyst 4000 series branch office switch, and Catalyst 6000 multilayer switch	CiscoWorks 2000 Routed WAN Management Solution	CNS Notification Engine (optional: HP OpenView NNM)	CiscoWorks 2000 Routed WAN Management Solution

Element Management Systems

Element management systems are available for each of the components of the solution. See Table 3-3 for a summary of these systems.

Management of the Cisco MGX 8230, 8250, and 8850 platforms with the Voice Interworking Service Module (VISM) is provided by CWM, with HP OpenView NNM as an optional component.

Management of the AS5400 and AS5400HPX gateways is provided by the Cisco Universal Gateway Manager (UGM).

Management of the call agent components is provided by the Italtel-supplied MSEM applications: Service Configuration Manager (SCM), Fault and Trouble Manager (FTM), Traffic and Performance Manager (T/PM), and Billing Manager.

Management of the data core components can be provided by the Cisco 12000 Manager (C12KM), and management of the access switches and routers can be provided by CiscoWorks 2000 (CW2K) Routed WAN Management Solution, with the Resource Manager Essentials (RME) application. Note that configuration management for the switches is optional within the Cisco Multiservice Packet Network Solution because the switches have static configurations.

Table 3-3 Element Management Systems

Element Management System	Manages	Linked Management Components
Cisco WAN Manager	Cisco MGX 8230, 8250, and 8850 with VISM	HP OpenView Network Node Manager (optional) CiscoView
Cisco Universal Gateway Manager	Cisco AS5400 and AS5400HPX Universal Gateways	Cisco Element Management Framework
Italtel Multiservice Element Manager	Italtel iMSS-4040 and iMSS-4050 call agents	Service Configuration Manager Fault and Trouble Manager Traffic and Performance Manager Billing Manager
Cisco 12000 Manager	Cisco 12000 series Internet routers	Cisco Element Management Framework
CiscoWorks 2000: Routed WAN Management Solution	Cisco 7500 series routers and Catalyst switches	CiscoView Resource Manager Essentials

The C12KM and UGM are integrated within the Cisco Element Management Framework (CEMF)—the foundation element management layer of the Cisco Service Management (CSM) system. CEMF provides common interfaces and management services for the element management applications, including an easy-to-use graphical user interface that isolates the end operator from the complexities of Cisco IOS software and the Simple Network Management Protocol (SNMPS. In addition, CEMF provides a standard set of external interfaces that enable higher-level network and service management applications to be integrated and enabled.

Refer to the *Cisco Multiservice Packet Network Solution Documentation Guide* for a list of the relevant product documents for CEMF.

The rest of this section provides further information for the following EMSs:

- Cisco WAN Manager
- Cisco Universal Gateway Manager
- Multiservice Element Manager

- Cisco 12000 Manager
- CiscoWorks 2000: Routed WAN Management Solution

Cisco WAN Manager

The CWM is a suite of WAN multiservice management applications that provides configuration, performance, and fault management for the Cisco MGX 8230, 8250, and 8850 platforms with the VISM.

The CWM is shipped with WAN CiscoView. This GUI-based device management software application allows you to display a graphical representation of the Cisco MGX 8230, 8250, and 8850 platforms, display configuration and performance information, and perform minor configuration and troubleshooting tasks.

- Configuration Management: The Connection Manager allows you to add, modify, and delete end-to-end connections; you can establish connections automatically by selecting the desired connection end-points and configuring the connection type and class of service. The Service Class Template Manager allows you to configure the VISM cards used in the Cisco Multiservice Packet Network Solution. The Network Configurator allows you to add new nodes, or modify or delete existing nodes. It also provides descriptor information, node name, and IP address information for the nodes in your network.
- Performance Management: The Statistics Collection Manager allows you to control and manage statistics collection; a forms-based interface establishes and modifies statistic collection policies, such as which statistics to collect, and collection interval periods for a node, port, or private virtual circuit. Wide ranges of statistics are available at the port and virtual channel level to support operations and maintenance, customer network management and usage-based billing. Although VISM does not yet forward historical statistical information, access to the real time counters on the VISM is provided through CiscoView.
- Fault Management: CWM can optionally operate with HP OpenView NNM to provide fault management for the switch (refer to the "HP OpenView Network Node Manager" section). The Event Manager in CWM and the HP OpenView Event Browser filter events (by a combination of event type, source, message string, time received, and severity), group events into categories based on severity, and act on events based on custom-defined operator actions.

The Network Browser provides a hierarchical representation of network information in a table format, based on either a physical or logical relationship among the various network elements, and the Security Manager provides controlled access to multiple users of CWM, based on the unique user ID and password.

Refer to the *Cisco Multiservice Packet Network Solution Documentation Guide* for a list of the relevant product documents for CWM.

HP OpenView Network Node Manager

HP OpenView NNM provides network views in an intuitive graphical format. It discovers network devices and provides a map to illustrate the structure of the network and the status of devices and segments. When a major device fails, the event correlation engine evaluates the event stream to pinpoint the root cause of the failure. Other capabilities help you prevent problems by identifying potential trouble spots before a failure occurs, allowing you to manage the network more intelligently, thus leading to increased network up-time and lower costs.

The OpenView Event Management System provides a framework for the display of alarms. OpenView identifies problems fast through an advanced event correlation engine, immediately pinpointing the root cause of network problems, while also displaying all of the contributing events for each of the alarms. Out-of-the-box correlation circuits are included for some of the most common network management problems.

The HP OpenView Web Launcher allows access from anywhere; a login facility with password authentication ensures the security of management data.

Out-of-the-box reports present trends on performance, availability, inventory, and exceptions. Analysis of this historical data provides a clear picture about the devices in the network and allows you to become more proactive in managing faults.

The OpenView Alarm Browser provides a convenient central location for monitoring critical events on your network. The Alarm Browser sorts the alarms into categories and dynamically filters the alarm list (for example, by node) to make the information more useful. Alarm categories used are as follows: Error, Threshold, Status, Configuration, Application Alerts, and All. The Alarm Browser can also manage the alarm process by acknowledging that the problem causing an alarm is being addressed, deleting alarms from the list after they are resolved, and specifying additional actions that can be executed upon selected alarms.

Refer to the *Cisco Multiservice Packet Network Solution Documentation Guide* for a list of the relevant product documents for HP OpenView NNM.

Cisco Universal Gateway Manager

The UGM, within the CEMF, provides configuration, performance, and fault management for the Cisco AS5400 and AS5400HPX Universal Gateways.

- Configuration Management: UGM provides various configuration services for the gateways and their components. As objects are configured or modified, the database is updated automatically to reflect the current configuration of the network.
- Performance Management: UGM allows you to collect performance information from each gateway and its components. The Performance Manager allows you to monitor the network by creating graphical views of this performance data.
- Fault Management: UGM provides device- and port-specific alarm frequency and severity information. The Event Browser supports point-and-click alarm acknowledgement and clearing functions, and also enables trap forwarding.

UGM supports role-based access to its management functions, with the Access Manager allowing you to define user groups and assign users to these groups, and also support control of administrative state variables for UGM resources.

Cisco UGM runs on a Sun Solaris platform and accesses standards-based information through SNMP, Telnet, and FTP/TFTP.

Refer to the *Cisco Multiservice Packet Network Solution Documentation Guide* for a list of the relevant product documents for UGM.

Multiservice Element Manager

MSEM provides configuration, performance, and fault management for the Italtel iMSS-4040 and iMSS-4050 call agents, with the capability to manage up to 50 Italtel Multiservice Switching System (iMSS) call agents. MSEM interacts with the Operation and Maintenance Server (OMS) to manage the Optical Peripheral Module (OPM) and Protocol Handling Server (PHS) components of the iMSS and to perform its element and network management functions.

OMS is the operator interface to the OPM and PHS components of the exchange, allowing local and remote management through a linked Windows NT console. OMS functions include software download and start-up management, exchange upgrade management for maintenance activities such as switchover, and built-in alarm collection and troubleshooting diagnostics (checking faults for consistency and translating into diagnostic reports). OMS provides an interface to MSEM.

MSEM is the centralized system for the operation, administration, and maintenance of the iMSS call agent, providing automatic collection of billing and traffic data, alarm management (collection, filtering, correlation, and user alerting), and transmission of service provisioning and configuration data. MSEM supports exchange operations such as remote transfer and remote activation of software patches and voice announcements, date-time monitoring and synchronizing between MSEM and iMSS, transparent access to the iMSS to allow data queries and modification, and scheduling of iMSS command batch broadcasting.

MSEM provides management in four key areas, as follows:

- Service Configuration Management (SCM)
- Fault and Trouble Management (FTM)
- Traffic and Performance Management (T/PM)
- Billing Management

MSEM also provides proprietary interfaces to external Operations Support Systems (OSSs) and other external billing systems.

Refer to the *Cisco Multiservice Packet Network Solution Documentation Guide* for a list of the relevant product documents for MSEM.

Cisco 12000 Manager

The C12KM, within the CEMF, delivers a range of provisioning, configuration, fault isolation/analysis, inventory, and capacity management tools for the Cisco 12016 and 12416 Internet routers in the core of the Cisco Multiservice Packet Network Solution.

- Provisioning: The C12KM provides auto discovery and auto synchronization of the physical devices with the CEMF object model and repository, provisioning the Cisco 12000 series Internet routers prior to installation, and then automatically detecting and beginning management upon physical installation and configuration.
- Configuration Management: The C12KM provides save, restore, and configuration editor functions (for setting the node, card, and port parameters), manages the Cisco IOS Software, and controls image downloads. The system allows concurrent operations to multiple Cisco 12000 series Internet routers and bulk application of profiles for common POS interface set-ups. The system contains a browser for MIBs, and provides an application programming interface (API) for integration through the CEMF Common Object Request Broker Architecture (CORBA) gateway.

- Fault Management: The C12KM provides comprehensive fault management at the chassis, card, and port levels, through a set of event management filtering, grouping, thresholding, and notification escalation tools. The event/alarm browser tracks all events and alarms related to the Cisco 12000 series Internet routers, displaying the status of the core network via color-coded icons. Dialog screens show availability details, including uptime and last change time of chassis and cards, with a color-coded LED status for the chassis, cards, and ports.
- Performance and Accounting Management: The C12KM collects and stores performance and traffic information from the Cisco 12000 series Internet routers, and can view the performance statistics of a selected interface by attribute within a specific time period. The system can archive performance data in comma-separated value (CSV) format, and forward information through a northbound interface to higher-level applications (such as applications for billing).

Refer to the *Cisco Multiservice Packet Network Solution Documentation Guide* for a list of the relevant product documents for C12KM.

CiscoWorks 2000: Routed WAN Management Solution

The CW2K: Routed WAN Management Solution provides applications for configuring, administering, monitoring, and troubleshooting the Cisco 7507 and 7513 routers, and the Catalyst switches in the Cisco Multiservice Packet Network Solution. The application provides visibility into network behavior, identifies performance bottlenecks and long-term performance trends, provides configuration tools to optimize bandwidth and link utilization, and receives and analyzes information collected by remote monitoring (RMON) devices.

The Cisco Multiservice Packet Network Solution uses CiscoWorks 2000 CD One, 4th Edition. This includes CiscoView, a graphical SNMP-based device management tool that provides real-time views of networked Cisco Systems devices. These views deliver a continuously updated physical picture of device configuration and performance conditions, with simultaneous views available for multiple device sessions.

Refer to the *Cisco Multiservice Packet Network Solution Documentation Guide* for a list of the relevant product documents for CiscoWorks 2000 CD One, 4th Edition.

Configuration management of the routers and switches in the Cisco Multiservice Packet Network Solution uses the Resource Manager Essentials (RME) application within CW2K.

Note The CW2K Internetwork Performance Monitor (IPM), Access Control List (ACL) and NetScout nGenius Real-Time Monitor (RTM) applications are not used in releases 2.0 and 2.1 of the Cisco Multiservice Packet Network Solution.

Resource Manager Essentials

The RME application provides configuration, inventory management, syslog and change reporting, and software image management for the routers and switches in the Cisco Multiservice Packet Network Solution.

RME allows you to collect the monitoring, fault, and availability information needed to track devices critical to the network uptime and application availability. RME also provides tools that you can use to rapidly and reliably deploy Cisco software images and view configurations of the routers and switches, and, together with Cisco.com service and support, automate software maintenance.

RME is based on a client/server architecture that connects multiple web-based clients to a server on the network. As the number of network devices increases, additional servers or collection points can be added to manage network growth with little impact on the client browser application. By taking advantage of the scalability inherent in the intranet architecture, RME supports multiple users anywhere on the network.

Refer to the *Cisco Multiservice Packet Network Solution Documentation Guide* for a list of the relevant product documents for RME.

Management Tools

For releases 2.0 and 2.1 of the Cisco Multiservice Packet Network Solution, the key network management tool is CNOTE.

CNS Notification Engine

CNOTE is a high-performance fault management gateway that receives Syslog messages from IOS devices and converts them into SNMP v1 or v2c traps, which are forwarded to OSSs (for example, Cisco Info Centre) that have registered with CNOTE. During trap conversion, the CNOTE adds additional information to the traps, such as slot number and port number thus enriching the information contained in the network event messages. This added information makes it easier for OSS fault management applications to perform event deduplication and fault correlation operations.

In addition, the CNOTE gateway improves network monitoring by delivering a robust trap stream to recover nonreliable User Datagram Protocol (UDP) traps when they get lost in the network. Multiple OSS clients can register themselves with a single CNOTE gateway using category trap filters to receive different streams of events, and the gateway provides a set of user-defined trap suppression and severity overwrite rules to manage the network.

Using the CNOTE gateway as an event source, fault management systems can manage the Cisco 12000 series Internet routers, Cisco 7500 series routers, and Catalyst switches in the Cisco Multiservice Packet Network Solution. In addition, CNOTE can receive events from Route Processor Modules (RPMs).

Refer to the *Cisco Multiservice Packet Network Solution Documentation Guide* for a list of the relevant product documents for CNOTE.

A

AAA authentication, authorization and accounting

ACL Access Control List

ADM Add/Drop Multiplexer (typically used to interconnect slow links with fast links on an SDH link)

AIS Alarm Indication Signal

AMI alternate mask inversion

ATM Asynchronous Transfer Mode

AUSM ATM User Service Module (Narrowband)

AXSM ATM Switch Service Module (Broadband)

B

B8ZS binary 8-zero substitution

BCA Basic Cabinet

BERT bit error rate tester

BGP Border Gateway Protocol

BRA Basic Rate Access

BRI Basic Rate Interface

BSH Basic Service Handler (component of the iMSS Call Agent)

C

C12KM Cisco 12000 Manager

CAC Call Admission Control

CAR Cisco Access Registrar

CAS Communicating Applications Specification

CCD	Clear Channel Data
CCS	Channel Associated Signalling
CDR	Call Detail Record
CEMF	Cisco Element Management Framework
CIF	Cisco Info Center
Cisco IOS	Cisco Internetwork Operating System
CLASS	Custom Local Area Signalling Services
CLASS 4	Telephone switch offering only long distance services
CLASS 5	Telephone switch offering advanced call features and local access
CLEC	Competitive Local Exchange Carrier. Also called Other Local Operator
CLI	Calling Line Identification
CNOTE	Cisco CNS Notification Engine
CNS	Cisco Networking Services
CO	Central Office
codec	coder-decoder
CORBA	Common Object Request Broker Architecture
CoS	class of service
CPE	Customer Premise Equipment
CPS	Centralized Processing Server (component of the iMSS Call Agent)
CS1	Capability Set 1
CSM	Cisco Service Management
CW2K	CiscoWorks 2000
CWM	Cisco WAN Manager

D

DFC	Dial Feature Card
DiffServ	Differentiated Services. The use of ToS bits in the IP header to indicate traffic importance and drop preference
DNIS	Dial Number Identification Service

DNS Domain Name System

DPC Destination Point Code

DS0 digital service zero (0). 64 Kbps POTS telephone line, encoded using PCM

DSCP DiffServ Code Point

DSP Digital Signal Processor

DSS1 Digital Subscriber Signalling System Number 1

E

egress Traffic leaving the network

EMS element management system

ETSI European Telecommunications Standards Institute

F

FTM Fault and Trouble Manager

FTP File Transfer Protocol

G

GK Gatekeeper

GW Gateway

H

HSRP Hot Standby Router Protocol

I

IAD Integrated Access Device

IAM Initial Address Message

IFAM Initial Forward and/or Final Address Message

IGP Interior Gateway Protocol

ILEC Incumbent Local Exchange Carrier

iMCP Intra Module Control Protocol

iMSS Italtel Multiservice Switching System

IMT intermachine trunk (trunk used between CLASS 4 switches)

IN Intelligent Network

INAP Intelligent Network Application Part

ingress Traffic entering the network

IOS See Cisco IOS

IP Internet Protocol

IPM Internetwork Performance Monitor

ISDN Integrated Services Digital Network

IS-IS Intermediate System-to-Intermediate System

ISM Interconnection Structure Module (component of the iMSS Call Agent)

ISUP ISDN User Part

ITP IP Transfer Point

ITU-T International Telecommunications Union Telecommunications Standardization Sector

IVR Interactive Voice Response

IVS Inter Virtual Switch

L

LDAP Lightweight Directory Access Protocol

LDP Label Distribution Protocol

LDS Local Digital Switch (typically a Class 5 switch)

LE Local Exchange

LER Label Edge Router

LNP Local Number Portability

LSR Label Switch Router

M

MGC Media Gateway Controller

MGCP Media Gateway Control Protocol, RFC2705. Version 0.1 is the November 1998 version of this RFC, which is available as an (expired) Internet Draft

MMF multimode fibre

MPLS Multiprotocol Label Switching

MSC Mobile Switching Center

MSEM Multiservice Element Manager

N

NAS network access server

NB Narrow Band

NMS Network Management System

NOC Network Operations Center

NRDB Network Resource Database

NSE Named Signaling Events. Used within Voice over IP RTP streams to indicate in-band signaling. Functionally equivalent to AAL2 type 3 packets in AAL2

NTS Number Translation Service

O

O&M Operations and Maintenance

OLO Other Local Operator. Also called Competitive Local Exchange Carrier

OMS Operation and Maintenance Server (component of the iMSS Call Agent)

OPC Originating Point Code

OPM Optical Peripheral Module (component of the iMSS Call Agent)

OPT Open Packet Telephony

OSPF Open Shortest Path First

OSS Operations Support System

P

P	Provider Router
PABX	private automatic branch exchange (Europe)
PBX	private branch exchange (U.S.)
PC	Point Code
PE	Provider Edge Router
PEB	Pan European Backbone
PHS	Protocol Handling Server (component of the iMSS Call Agent)
PLMN	public land mobile network
PoI	Point of Interconnection
POP	point of presence
POS	Packet Over SONET
POTS	plain old telephone service (typically considered an analog phone connected with an RJ11 jack with normal telephone service)
PRA	Primary Rate Access
PRI	Primary Rate Interface
PSTN	Public Switched Telephone Network
PTT	Public Telephone and Telegraph (typically the major government-owned incumbent telephone company in a country)
PVC	permanent virtual circuit
PXM	Processor Switch Module

Q

QoS	Quality of Service

R

RADIUS	Remote Authentication Dial-In User Service
RAI	Remote Alarm Indication
RME	Resource Manager Essentials

RPM Route Processor Module

RSVP Resource Reservation Protocol

RTCP Real Time Control Protocol

RTM Real-Time Monitor

RTP Real-Time Transport Protocol. Used by Voice over IP to send voice bearer traffic and can also carry CAS traffic using Named Signaling Events (see NSE)

S

SASE Stand Alone Synchronization Equipment

SCM Service Configuration Manager

SCP Service Control Point

SDF Service Data Function

SDH Synchronous Digital Hierarchy (approximately equivalent to SONET used in US and Japan)

SG Signalling Gateway

SGCP Simple Gateway Control Protocol

SIP Session Initiation Protocol

SLA Service Level Agreement

SLR Service Location Register

SLT Signalling Link Terminal

SMFIR single mode fibre intermediate range

SMS Short Message Service

SN Service Node

SNMP Simple Network Management Protocol

SONET Synchronous Optical NETwork

SRCP Simple Resource Control Protocol

SRI Send Routing Information

SRM Service Resource Module

SRM/E Enhanced Service Resource Module

SS7 Signalling System 7

SSP Service Switching Point

STM-1 Synchronous Transport Module, level 1 (2,016 DS0s, 155.52 Mb data rate—equivalent to OC-3 used in U.S. and Japan)

STM-4 Synchronous Transport Module, level 4 (8,064 DS0s, 622.080 Mb data rate—equivalent to OC-12 used in U.S. and Japan)

STP Signal Transfer Point

T

TCAP Transaction Capabilities Application Part

TCP Transmission Control Protocol

TDM time-division multiplexing

TDP Tag Distribution Protocol

TFTP Trivial File Transfer Protocol

TGW Trunking Gateway

TMN Telecommunications Managed Networks

ToS Type of Service

T/PM Traffic and Performance Manager

TSC Transit Switching Center

U

UDP User Datagram Protocol

UGM Universal Gateway Manager

V

V5 ETSI family of interface specifications for connections between Local Exchanges and Access Networks. V5.1 is the specification for multiplex type access networks. V5.2 is the specification for concentrator type networks.

VAD Voice Activity Detection. Also called “silence suppression”

VC virtual circuit (virtual channel)

VCI virtual circuit identifier (virtual channel identifier)

VISM Voice Interworking Service Module

VLAN Virtual LAN (local area network)

VoIP Voice over IP

VP virtual path

VPI virtual path identifier

VPN Virtual Private Network

VPS Voice Processing System

VTCH Virtual Termination Call Handler (component of the iMSS Call Agent)

VTN Virtual Transit Network

W

WAN wide-area network