



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.

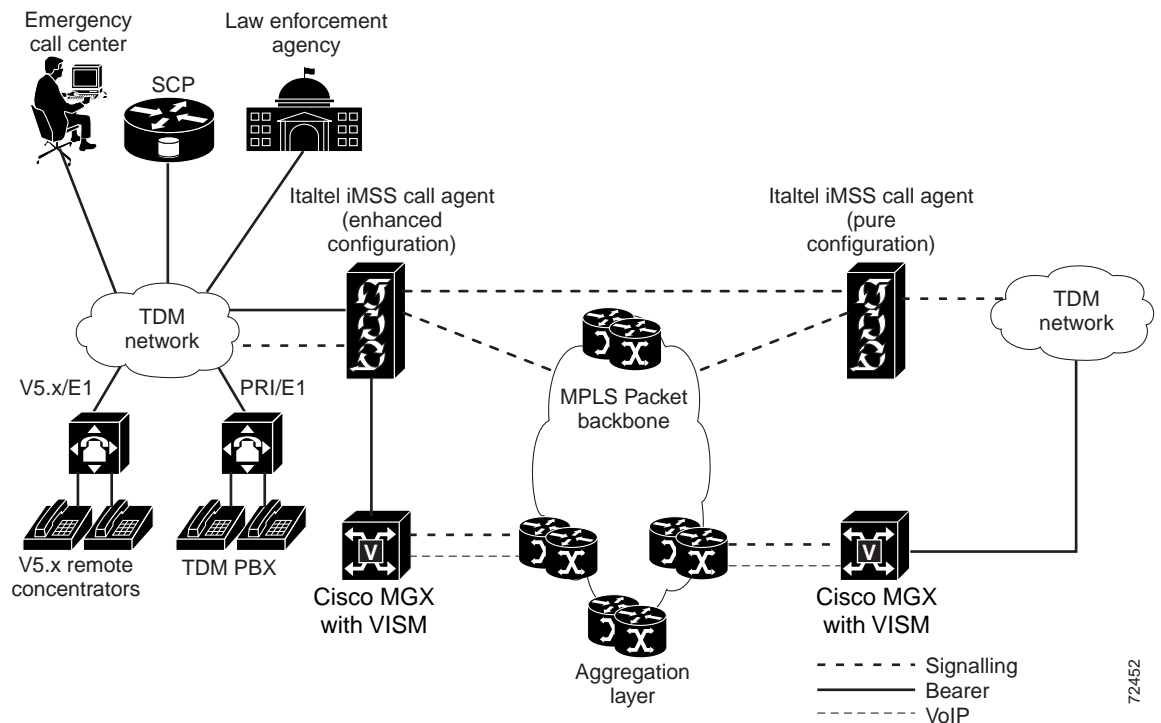
As a call agent, both the iMSS-4040 and iMSS-4050 interpret the signalling messages and route the calls through the packet backbone. The iMSS is the Media Gateway Controller (MGC) and Signalling Gateway (SG), controlling the voice traffic through well-defined standard protocols. The MGC uses the Media 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

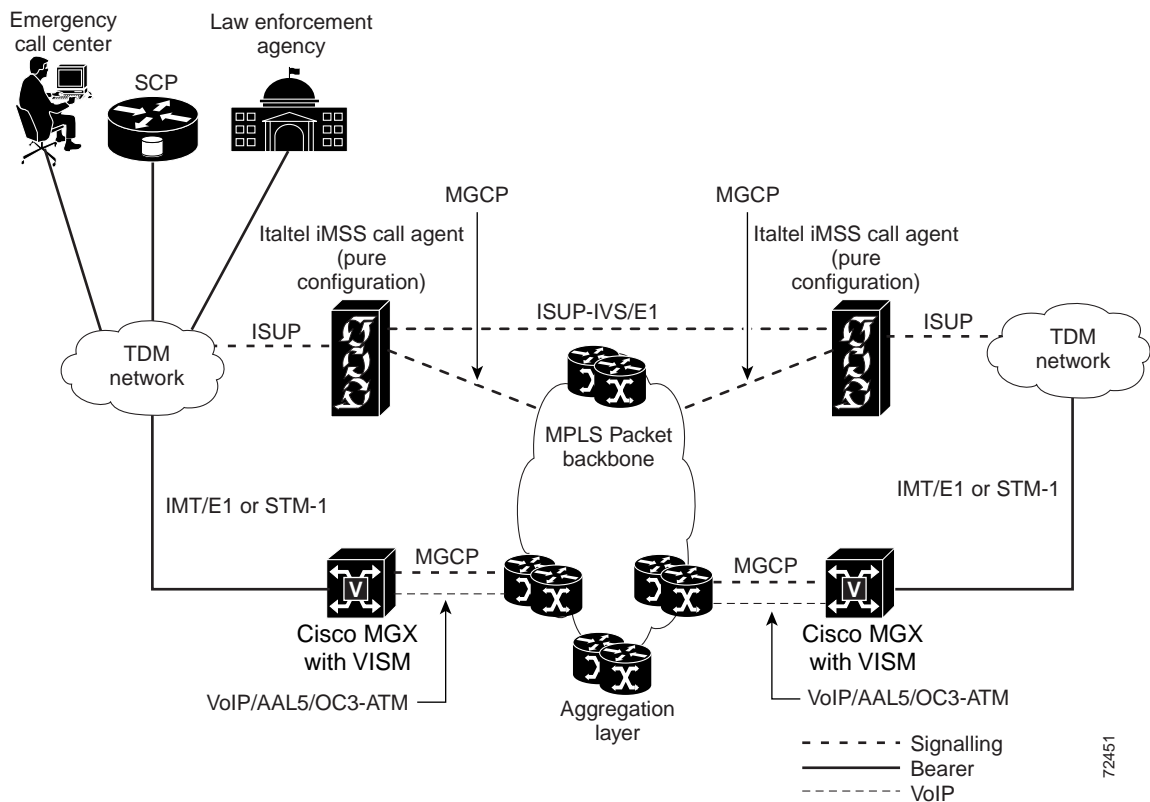
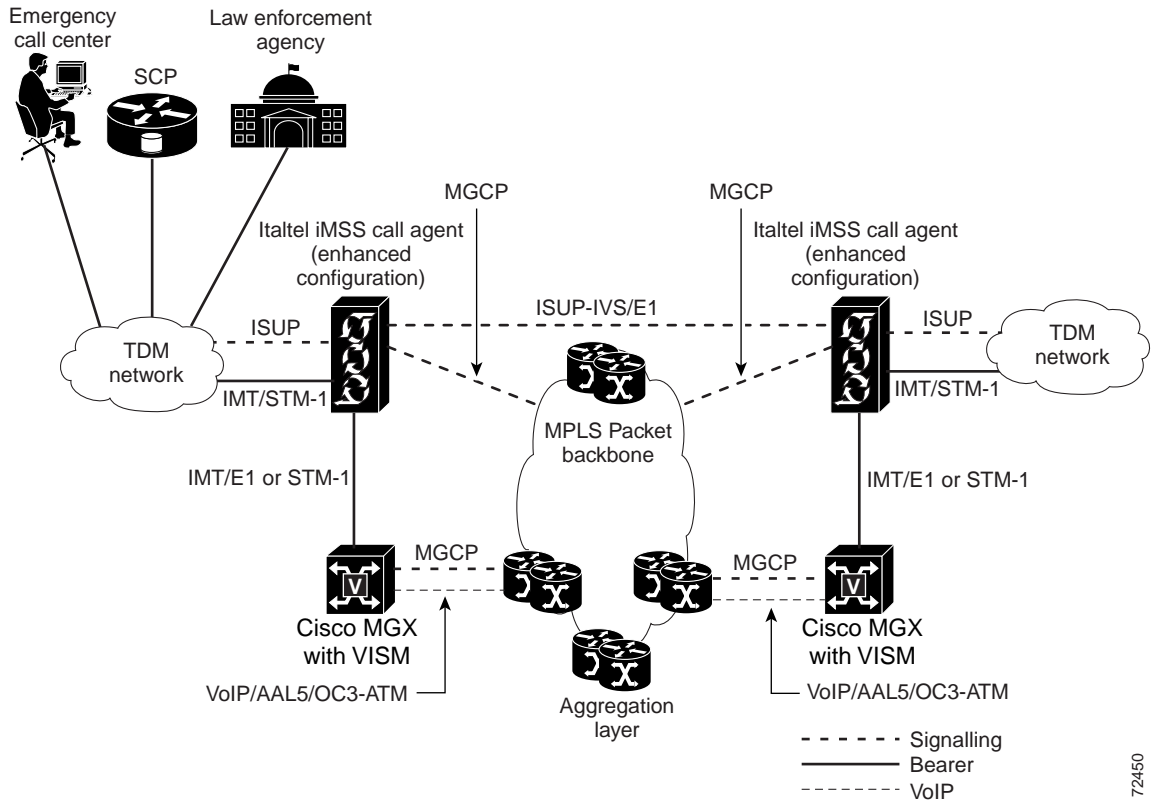


Figure 1-3 illustrates the voice transit application utilizing two iMSS-4040 call agents. The MGXs with VISMs packetize and route the traffic to the MPLS network, but the iMSS-4040 call agents terminate the bearer circuits from the TDM networks.

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



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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.

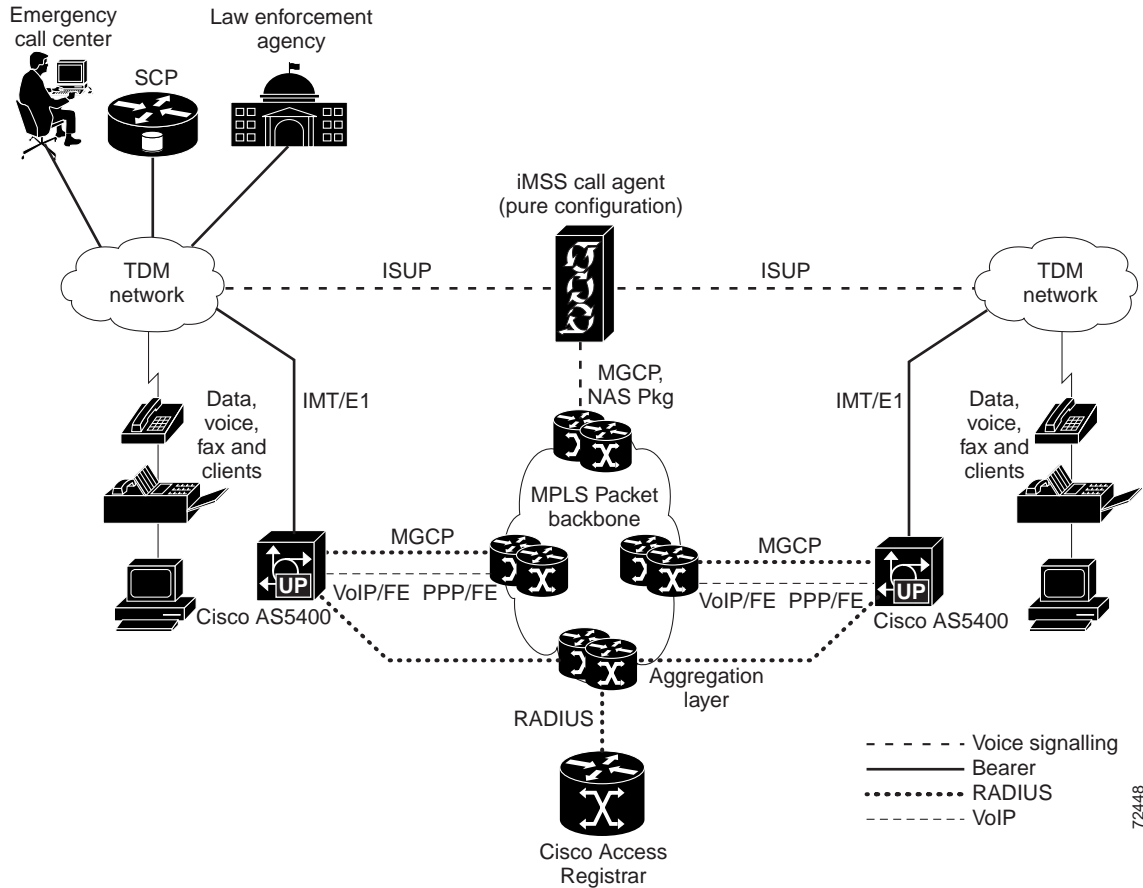
The section does not describe use of the AS5400 or AS5400HPX as a voice or dial only platform.

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.

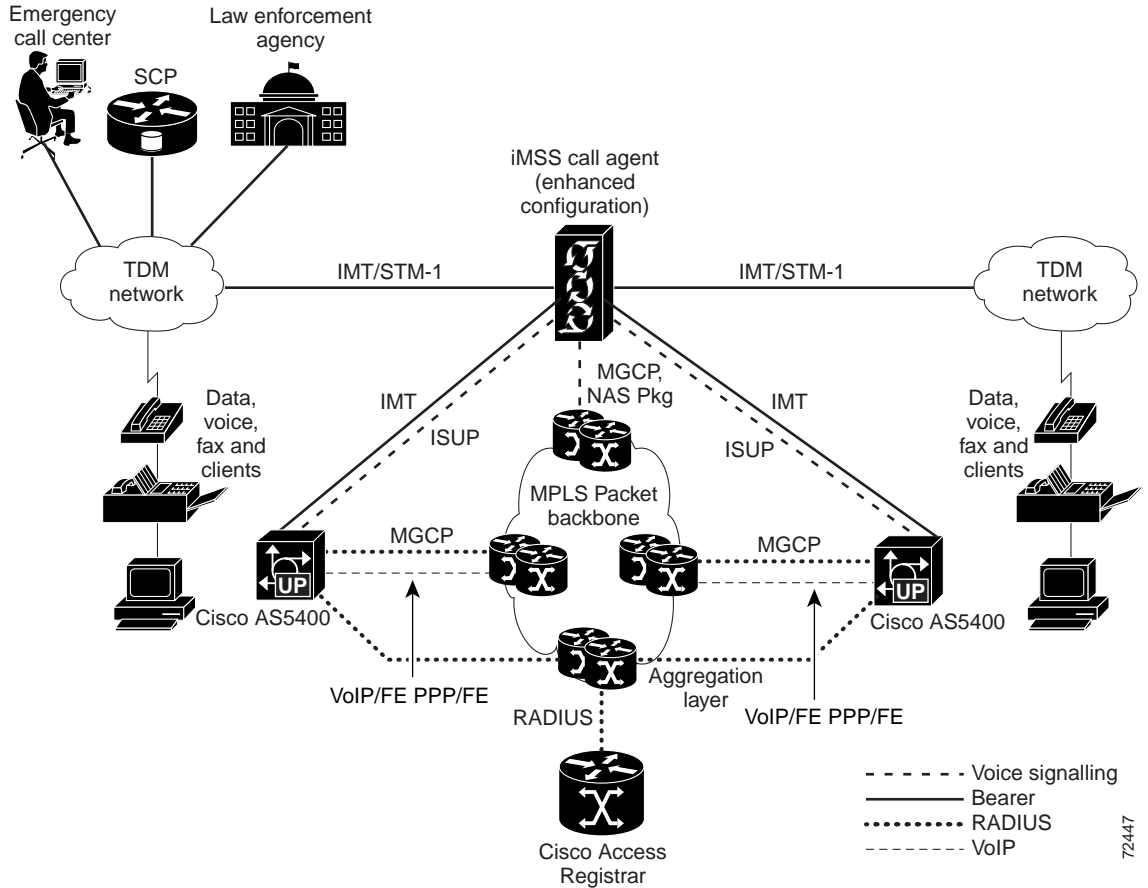
Figure 1-4 Universal Port with Pure Call Agent Configuration



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

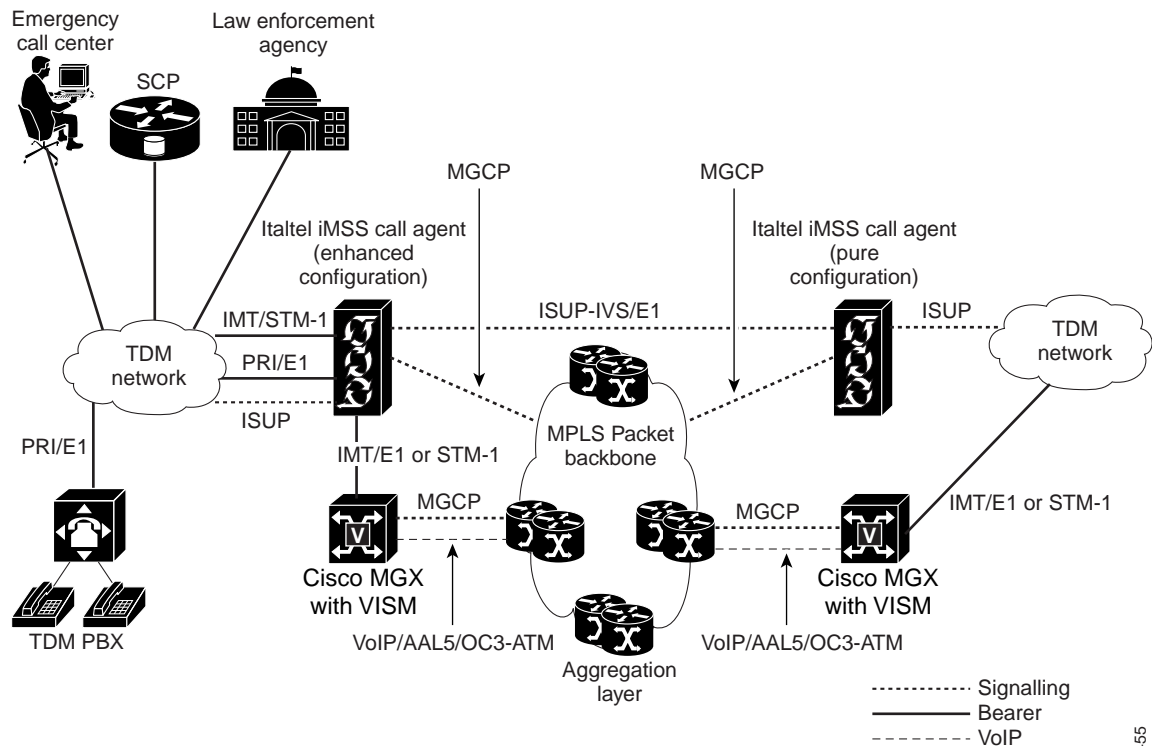
The iMSS call agent and MGX with VISM can be used to provide access for remotely-connected legacy TDM PABXs and access network equipment using V5.1 and V5.2 protocols.

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

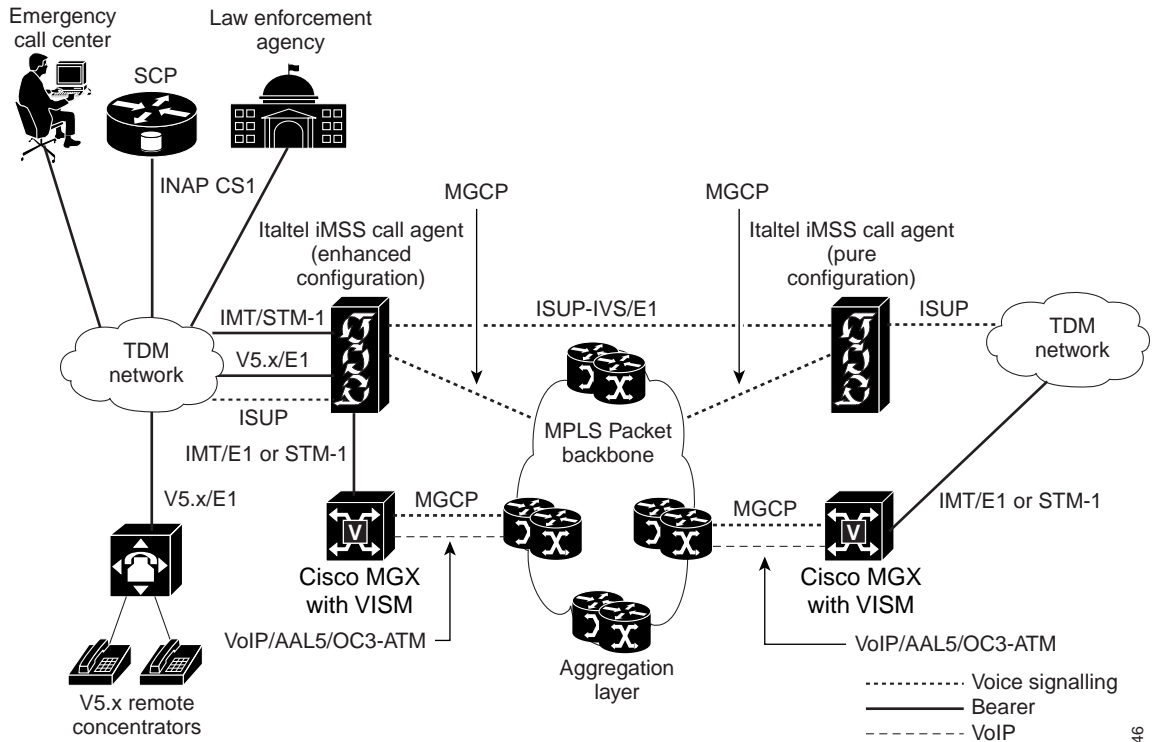


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V5.1 and V5.2 Interconnect Architecture

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



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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.