



Planning the Network

This chapter describes the basics of planning a network and identifies some of the resources available to the network planner using Cisco MGM:

- [3.1 Network Planning](#)
- [3.2 What Network Elements Are Available to a Network Planner?](#)

3.1 Network Planning

Network planning is the process of deciding the topology and capacity of a network. Network planning can achieve the business return on investment (ROI) by enabling high-performance networks and communications applications.

It is important to take the time to review and plan your network before you build and configure it. During network planning, remember to keep future needs in mind as well as present requirements, so that the topology and capacity of the networks can be changed, if required.

Adequate network planning is needed for a number of reasons, including to:

- Satisfy key business drivers such as low operating costs or rapid return on investment
- Respond to network growth and traffic distribution changes in the future
- Identify and satisfy the needs of customers
- Anticipate and provide protection in the event of a catastrophe
- Centralize management, resulting in lower administration costs
- Support many and varied company requirements quickly and efficiently
- Identify hardware requirements

The key stages are planning, analyzing, and reviewing a network. Network planning may be required for a new network, or you may be analyzing an existing network before upgrading the existing infrastructure.

3.2 What Network Elements Are Available to a Network Planner?

The following sections detail the switches and cards that are available:

- [3.2.1 Cisco MGX 8880 Media Gateway](#)

- [3.2.2 Cisco MGX 8850 Multiservice Switch](#)
- [3.2.3 Cisco PXM-45 Processor Switch Module](#)
- [3.2.4 Cisco Voice Switch Service Module](#)
- [3.2.5 Cisco Voice Interworking Service Module](#)
- [3.2.6 Cisco Route Processor Module](#)
- [3.2.7 Cisco AXSM Broadband ATM Switch Module](#)
- [3.2.8 Cisco MGX Service Resource Module](#)

3.2.1 Cisco MGX 8880 Media Gateway

The Cisco MGX 8880 Media Gateway hardware has the same slot configuration as the Cisco MGX 8850 Multiservice Switch, but with a smaller chassis. The Cisco MGX 8880 fits in a 19-inch or a 23-inch rack. It is optimized for voice applications, and supports two types of voice service modules; Cisco Voice Switch Service Module (VXSM) and Cisco Voice Interworking Service Module (VISM). It also features the following:

- The DC version of the Cisco MGX 8880, with its low profile cooling system, enables three gateways to fit in a 7-foot rack.
- The MGX 8880 uses the PXM-45/C controller card only.
- The MGX 8880 uses an integrated redundancy connector (RCON).

3.2.2 Cisco MGX 8850 Multiservice Switch

The Cisco MGX 8850 Multiservice Switch is designed for service providers deploying narrowband and/or broadband services. It can be voice enabled with VXSM and VISM modules. The Cisco MGX 8850 scales from DS0 to OC-48c/STM-16 and supports any combination of the following services:

- Frame Relay
- ATM
- Voice over ATM
- Voice over IP
- Circuit emulation
- IP
- Wireless aggregation
- DSL aggregation
- ATM service backbones

3.2.3 Cisco PXM-45 Processor Switch Module

The Cisco PXM-45 Processor Switch Module for the Cisco MGX 8880 and Cisco MGX 8850 IP + ATM Multiservice Switch is a combination ATM switching fabric and processor card. The switching fabric provides 45 Gbps of nonblocking switching capacity, while the processor provides the control plane that delivers IP+ATM networking software, diagnostics, and performance monitoring.

The Cisco PXM-45 provides the following features:

- 45-Gbps nonblocking switching
- Hot card insertion/removal
- 1:1 hot-standby redundancy
- User-selectable primary and secondary clock sources with graceful switchover
- Internal Stratum-3, external building integrated timing supply (BITS), or inband clock sources
- Inband or out-of-band management via EIA/TIA-232 or 10BaseT control ports
- Support for narrowband and broadband service modules scaling from DS0 to OC-48c/STM-16

3.2.4 Cisco Voice Switch Service Module

The Cisco Voice Switch Service Module (VXSM) is a high-density voice module that enables compatibility with the Cisco MGX 8880 Media Gateway and the Cisco MGX 8850 Multiservice Switch. The Cisco VXSM provides high availability, scalable, and robust voice features for wireless, wireline, and cable applications.

The Cisco VXSM has time-division multiplexing (TDM) interfaces ranging from T1/E1 to channelized OC-3/STM-1. It provides service providers with carrier-class capabilities for high capacity and reliability for Voice over IP (VoIP) services. The Cisco VXSM supports up to 8064 DS-0s and can protect active voice calls if scheduled or unscheduled outages occur.

The Cisco VXSM architecture combines a high-performance voice services engine with onboard digital signal processors (DSPs) to provide advanced voice processing and features that allow quick development and deployment of VoIP services. The Cisco VXSM offers carrier-grade voice quality with voice, modem, and fax features. Together with a softswitch, it provides deployment flexibility for various packet voice networks based on the MGCP, PacketCable Trunking Gateway Control Protocol (TGCP), H.248, H.323, and the session initiation protocol (SIP). Cisco VXSM architecture allows new functions and services to be easily added through software upgrades.

- The VXSM provides the following high density features:
 - Scales up to 8064 VoIP DS-0s per service module
 - Reduces costs by maximizing density per platform
 - Allows 40,320 VoIP DS-0s per chassis and 120,960 VoIP DS-0s per rack, with echo cancellation
- TDM interfaces provide:
 - Scalable optical interfaces; available with 2- or 4-port OC-3/STM-1 interfaces per service module
 - Scalable electrical interfaces; up to 48 T1/E1 interfaces per service module
- VXSM high availability—Ensures carrier-class reliability by providing active call preservation
- VXSM integrated nonblocking architecture—Lowers costs by integrating TDM, network processing, and DSP technology onto a single module

3.2.5 Cisco Voice Interworking Service Module

The Cisco Voice Interworking Service Module (VISM-PR) is a packet voice module for the Cisco MGX 8880 Media Gateway and the Cisco MGX 8000 Series multiservice switches. The Cisco VISM-PR offers robust packet voice functions for service providers and enterprise customers, and supports full 8 T-1s/E-1s capacity for G.711, G.726 and G.729ab codecs.

The VISM-PR provides high quality voice, fax, and modem services. The VISM-PR can be deployed in standalone configurations or with softswitches to enable a variety of packet voice services in network architectures using MGCP, PacketCable TGCP, H.323, and SIP.

The VISM-PR allows you to easily add packet voice services to existing Cisco MGX 8000 Series multiservice networks.

The VISM-PR provides the following features:

- High density voice aggregation:
 - Up to 20 VISM-PR per MGX 8880 MG chassis
 - 1: N redundancy
 - Channelized T3/OC-3/STM-1 via SRME Module
- Distributed card architecture:
 - Dedicated high-performance DSP resources
 - Dual control processors to eliminate processing bottlenecks
 - No loss of DS0 Density under any configuration (ECAN, codec)
- Dynamic DSP allocation:
 - G.711, G.726, G.729ab, G.723.1, T.38 Fax, clear channel
 - VAD and comfort noise generation
 - Programmable 24, 32, 64, 128 ms echo cancellation
 - DTMF / MF detection / generation

3.2.6 Cisco Route Processor Module

The Cisco Route Processor Module-Premium (RPM-PR) is a high-performance route processor module for the Cisco MGX 8000 Series of multiservice switches, which allows service providers to quickly enable new, high-margin IP services using Cisco IOS Software. The Cisco RPM-PR provides high-quality, scalable, IP and ATM integration using Multiprotocol Label Switching (MPLS) technology to create scalable Internet solutions. The Cisco RPM-PR allows the addition of an MPLS control plane for use by the Cisco Virtual Switch Architecture. The MPLS control plane can be used concurrently with the PNNI and Media Gateway Control Protocol (MGCP) control planes on the Cisco MGX 8000 series of multiservice switches.

The Cisco RPM-PR brings enhanced performance and functionality to the RPM module's router blades for the Cisco MGX 8880 and Cisco MGX 8850. Improvements include a high-performance, NPE-400 processor capable of processing more than 350,000 packets per second (pps), greater DRAM and Flash capacity, and hardware-based error checking and correction (ECC).

The Cisco RPM-PR enables functionality such as Point-to-Point Protocol (PPP) aggregation, IP VPNs, IP QoS, and IP routing.

The Cisco RPM-PR is a double-height line card, which connects to the MGX midplane through an internal OC-6 ATM cell bus. The Cisco RPM-PR supports up to two single-height back cards: four-port Ethernet and one-port Fast Ethernet.

The RPM-PR provides the following features:

- High performance
 - Over 350,000 pps forwarding
 - Up to 512 MB DRAM
 - 32 MB Flash memory
 - Support for 2000 virtual interfaces
 - Single bit repair and double/triple bit detection ECC support for DRAM
 - 1:N redundancy
- Robust IP support
 - Border Gateway Protocol Version 4 (BGP4)
 - Open Shortest Path First (OSPF) Protocol
 - Routing Information Protocol (RIP) Versions 1 and 2
 - Interior Gateway Routing Protocol (IGRP)
 - Enhanced IGRP (EIGRP)
 - Intermediate System-to-Intermediate System (IS-IS)
 - Static routes

3.2.7 Cisco AXSM Broadband ATM Switch Module

The Cisco AXSM Broadband ATM Switch Module in combination with the high-capacity PXM-45 processor and XM-60 switching module delivers connectivity from T3/E3 to OC-48c/STM-16. The Cisco MGX 8880 and Cisco MGX 8850 Multiservice Switch can accommodate a total of 12 AXSM modules to provide the high broadband densities required by service providers.

The AXSM architecture, combined with PXM-45 and RPM, provides ATM networking features such as such as Private Network-Network Interface (PNNI), switched virtual circuit/path (SVC/SVP), soft permanent virtual circuit/path (SPVC/SPVP), and MPLS.

The AXSM module gives carrier-class availability by providing hot-standby 1:1 card redundancy with Y-cable as well as redundancy with SONET/SDH automatic protection switching (APS). The AXSM module with its large connection count is highly scalable for aggregation applications.

The AXSM Broadband ATM Switching Module provides the following features:

- ATM capability up to OC-48c/STM-16.
- High scalability in interface speeds with T3/E3 ports, OC-3c/STM-1, OC-12c/STM-4, and OC-48c/STM-16 AXSM modules. Each port on the AXSM can be configured for either trunk or access applications.
- Module port densities of 16 T3/E3 ports, 16 OC-3c/STM-1 ports, 4 OC-12c/STM-4 ports, and 1 OC-48c/STM-16 port that can scale up to 12 OC-48c/STM-16 modules in each Cisco MGX 8880 and Cisco MGX 8850 Multiservice Switch. Each OC-48c/STM-16 provides nonblocking, full duplex throughput, in which a connection can occupy the entire line rate.

- Support for all ATM service classes, with up to 16 classes of service (CoS). Supports carrier-class implementation of standards-based PNNI, SVC/SVP, SPVC/SPVP, and MPLS services.
- Large cell buffers (one million cells), which help to maximize performance during congestion, reducing the number of retransmits; the buffers are allocated dynamically, depending on connection resource needs, thereby optimizing use of system resources.
- High reliability with hot-standby 1:1 AXSM card redundancy, and 1:1 and 1+1 line redundancy using APS.

3.2.8 Cisco MGX Service Resource Module

The Cisco MGX Service Resource Module (SRM) provides three major functions for service modules:

- Bulk distribution of T1 and E1 traffic
- Bit error rate testing of T1 and E1 lines and ports
- 1:N redundancy

The Cisco MGX-SRM operates at line speeds of OC-3 rather than DS3. The Cisco MGX SRM provides the existing functionality of the SRM-3T3, such as bulk distribution, 1:N redundancy, and bit error rate tester (BERT). It supports one SONET or Synchronous Digital Hierarchy (SDH) interface using SMFIR-155 (optical) and SMB-155 (electrical) back cards.

The Cisco MGX SRM architecture is similar to that of the current SRM-3T3/C, with the following additional features:

- Bulk distribution of T1 or E1 traffic to all 12 service module slots using one SONET or SDH OC3/STM1 interface
- 1:1 SRM Hot-Standby Router Protocol (HSRP) redundancy
- Card-to-card linear (1+1) APS support for optical interfaces
- No back card requirement for SRM operation when bulk distribution is not required