Introducing the Cisco Mainframe Channel Connection

The Cisco Mainframe Channel Connection (CMCC) family of products includes the Channel Interface Processor (CIP) for the Cisco 7000 and 7500 Series routers and the Channel Port Adapter (CPA) line for the Cisco 7200 Series routers. This chapter helps you understand the CMCC solution for today's data centers. The CMCC products support high-performance mainframe access. CMCCs are part of the Cisco Systems solutions to integrate your mainframe with the rest of your network as it evolves to support higher-bandwidth Internet and intranet solutions.

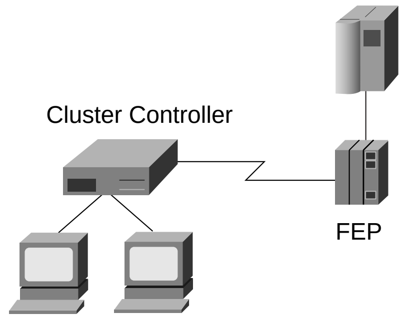
To set the stage for the CMCC family of products, this chapter describes the evolution that is occurring in enterprise networks and data centers. A description of Cisco's history and expertise in mainframe channel technologies and then an overview of the CMCC family follow this. The chapter concludes with a detailed description of the CIP and the CPA line and a summary of product capabilities and differences. For more information about CMCCs, see www.cisco.com/warp/public/779/largeent/sna/edc/mcc.html.

Evolution of the Enterprise Network

In the 1980s, the term SNA network was synonymous with enterprise network. Developed by IBM to support the computing and networking needs of large enterprises, SNA dominated as the networking architecture of choice for most large enterprises. SNA delivered high levels of scalability and availability to enterprises that were unsurpassed by any other networking architecture of the time. SNA was a hierarchical architecture with the mainframe at the pinnacle, which reflected computing realities of the 1970s and 1980s. Mainframes, residing in data centers, were the repository of the majority of mission-critical applications. End users accessed mainframe applications from teletype machines or display terminals (known as 3270 devices). IBM developed SNA to define how display terminals could access applications and information in IBM S/390 mainframes. It should be noted that, throughout the remainder of this document, the term *IBM S/390* refers to both the traditional System/390 mainframe and the new IBM z900 processors. Similarly, the term *OS/390* refers both OS/390 and its successor, zOS.

Figure 1-1 shows a simple SNA network and some of its key components.

Figure 1-1 Simple SNA Network

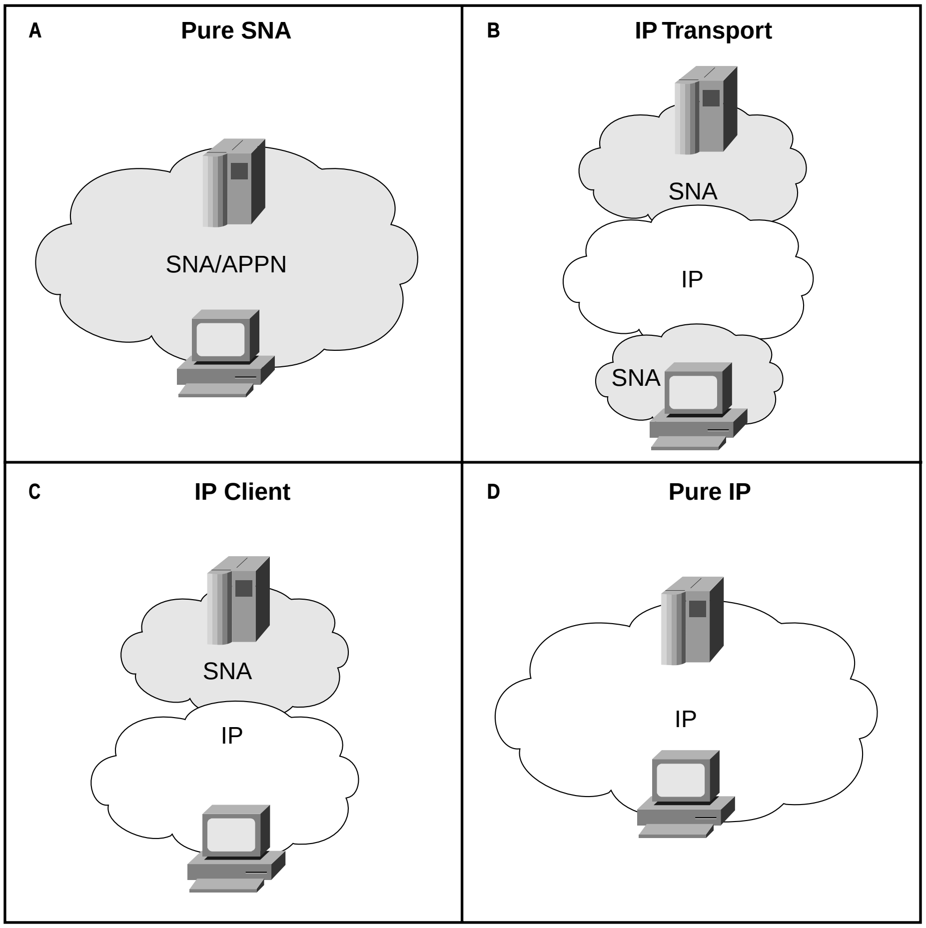


Beginning in the 1980s, many advanced enterprises began to integrate TCP/IP into their networks to accommodate interoperability between a wide variety of systems, including UNIX-based servers. Today, virtually all enterprises have IP in at least some portion of the network to support corporate intranets and Internet access. However, the presence of IP does not mean that SNA has been eliminated. Many enterprises continue to support SNA applications, SNA devices, or SNA networking protocols.

There are a variety of ways that an enterprise can accommodate both SNA and IP in the enterprise. First, it can keep the two environments completely separate. This eliminates any issues of integrating the two environments but can be very costly. Second, it can build a common backbone, usually based on IP protocols, and keep the end systems and applications either native SNA or native IP. This approach helps to eliminate the costs associated with supporting different networks but means that some desktops are supporting two different protocol stacks—SNA and IP. In the third approach, the SNA stacks are eliminated from the desktops and SNA applications are accessed by utilizing a standard that allows IP clients to access SNA applications (TN3270), which can dramatically reduce the costs associated with desktop maintenance and support. In the final approach, the enterprise converts, over time, its SNA applications to IP-based equivalents. Because today's mainframes come equipped with an IP stack, this final step does not mean that an enterprise must eliminate its mainframes.

Figure 1-2 shows the four approaches to SNA-to-IP migration. Cisco offers a wide variety of solutions, including its CMCC solutions, to support an enterprise at each stage in the migration. Many enterprises will find, in fact, that their networks have elements of each of the four phases. Cisco solutions offer the ability to independently migrate portions of the network based on business need.

Figure 1-2 SNA-to-IP Migration



Quadrant A: Pure SNA

Many IBM networks today still access SNA applications on the mainframe from SNA clients. In Figure 1-2, Quadrant A represents a pure SNA network that is fully based on the IBM protocols and architecture. All host and client systems are SNA-based. Cisco supports a Quadrant A environment through the use of the Cisco SNA (CSNA) feature on the CMCC. SNA traffic from one or several serial lines or Token Ring or Ethernet LANs can be aggregated in a single data center router, such as a Cisco 7500 or 7200 Series router. Using CSNA, this SNA traffic can be sent to the mainframe via either Enterprise Systems Connection (ESCON) or parallel bus and tag connections.

Quadrant B: IP Transport

More than 87 percent of enterprise networks have migrated their backbones to TCP/IP. Quadrant B represents the first major step in the migration from SNA to IP. In Quadrants A and B, the branch and data center fundamental network characteristics have not changed. However, the backbone network in Quadrant B has been replaced with IP.

Cisco supports a Quadrant B environment using technologies such as Data-Link Switching Plus (DLSw+), remote source-route bridging (RSRB), and Advanced Peer-to-Peer Networking (APPN). These technologies run in the Cisco router and connect to SNA applications in the mainframe through a CMCC using the CSNA feature. For more information on DLSw+, refer to the *DLSw+ Design and Implementation Guide* at www.cisco.com/warp/public/cc/pd/ibsw/ibdlsw/prodlit/dlswa_rg.pdf. For more information on the SNA Switching Services (SNASw) feature, which provides support for APPN nodes, refer to the *SNA Switching Services Design and Implementation Guide* at www.cisco.com/warp/public/cc/pd/ibsw/snasw/tech/snasw_rg.pdf.

Quadrant C: IP Client

With the proliferation of Internet connections and the fact that TCP/IP is included free with Windows 95/98 and Windows 2000, more organizations are looking at TN3270 as a low-cost means to access some of their SNA applications. TN3270 eliminates the requirement for dual stacks on the desktop and minimizes the cost of specialized desktop software. In Quadrant C, SNA is isolated to the data center, and the desktop has TCP/IP only.

Cisco supports a Quadrant C environment through gateway functions that are provided in the router and CMCC. Two examples are the Cisco Transaction Connection (CTRC), which provides access to S/390-based Customer Information Control System (CICS), Information Management System (IMS), and DB2 data, and the Cisco TN3270 Server application, which runs on a CMCC. For more information on the TN3270 Server, refer to the *TN3270 Design and Implementation Guide* at www.cisco.com/warp/public/cc/pd/ibsw/tn3270sr/tech/tndg_toc.htm.

Quadrant D: Pure IP

Finally, in Quadrant D, many organizations are building new mainframe applications or rewriting existing applications to use TCP/IP.

Cisco supports a Quadrant D environment through the use of IP Datagram support and the support of SNA traffic through APPN over IP (APPN/High Performance Routing [HPR] over IP) using the SNASw Enterprise Extender (EE) feature. Connectivity to the S/390 can be through an ESCON or parallel channel, through the use of a CMCC, or through an Open Systems Adapter (OSA). For more information on the SNASw feature, which provides support for APPN nodes, refer to the *SNA Switching Services Design and Implementation Guide* at www.cisco.com/warp/public/cc/pd/ibsw/snasw/tech/snasw_rg.pdf.

Evolution of the Data Center

The previous section discussed trends that have been impacting enterprise networks over the last two decades. These larger trends, and the migration from SNA to IP, have impacted the entire network, from the data center to the remote campus and even to the smallest branch office. There are, however, trends that are specific to the evolving nature of the typical enterprise data center that are relevant to the discussion of the Cisco CMCC product family, such as:

- Changing role of the mainframe
- Centralization of servers
- Increased sophistication and bandwidth of the data center backbone

Changing Role of the Mainframe

In the 1970s and early 1980s, the mainframe was the linchpin of the enterprise, running the majority of all applications, particularly mission-critical applications. With the advent of the client/server revolution beginning in the mid-1980s, some industry experts predicted the decline and eventual replacement of the mainframe by UNIX and PC servers that would run new applications based on the client/server paradigm. That prediction turned out to be highly optimistic.

Although it is true that UNIX and PC servers offered, at the time, an attractive price/performance ratio, these servers did not offer the same level of fault tolerance and disaster recovery capabilities of the mainframe. Many IT organizations could not justify rewriting their mission-critical applications on client/server platforms. And in the last decade, dramatic and rapid improvements have been made to mainframe technology. Today's mainframe offers an exceptional price/performance ratio. As a result, the mainframe remains a staple in most large enterprises.

The role of the mainframe, however, has changed. It is still accessed directly by end users via software that emulates a traditional terminal display, although to a lesser extent than in the past. Now, to an increasing extent, the mainframe acts as a repository of enterprise data to a growing and sophisticated set of servers such as Web servers, Web application servers, and host integration servers. Another shift is the pervasive use of TCP/IP on the mainframe to support new applications. These shifts require that today's mainframe have very efficient and high-speed access to the enterprise network.

Centralization of Servers

At the beginning of the client/server revolution, most servers were placed out in the network, near the department that the application on the server was supporting. Eventually, most large enterprises discovered that supporting a large base of far-flung servers, each potentially running a different type or level of operating system, was a very expensive proposition. As a result, most large enterprises today have centralized at least some types of servers back into the data center. Server farms, created with a large number of high-end servers rack-mounted and resident in the data center, are now the norm.

The implication of the server centralization to the mainframe and the data center is profound. In the 1980s, the data center contained few LANs and many serial lines that connected the data center to the remote enterprise locations. With the reconcentration of computing power and traffic back into the data center, the data center network is now extremely sophisticated and supports very high bandwidth. There is a very large amount of traffic that flows between the different servers in the server farm, as well as between the server farm and the mainframes.

Increased Sophistication and Bandwidth of the Data Center Network

The modern data center network is built with a high-speed, switched LAN infrastructure. Often running at speeds of 1 Gbps or faster, the data center backbone has the bandwidth in place to support huge amounts of traffic. The servers in the data center often have dedicated, high-speed LAN connections. This is in direct contrast with the traditional SNA environment, in which a "high-speed link" was a serial line running at 56 KBps and Token Ring LANs started at a paltry 4 Mbps. The mainframe, an integral part of the data center computing environment, must be able to participate in this high-speed environment. The connectivity choices of a decade ago, such as the front-end processor (FEP) and the IBM 3172 Interconnect Controller, are not able to address these requirements.

In addition to the high bandwidth supported, the data center network is a very sophisticated blend of technologies. With the prevalence of corporate intranets and Internet connectivity, the data center supports a wide variety of security devices, directory services, policy servers, load balancing devices, and so on. The mainframe does not necessarily participate directly with these networking appliances and devices, but the devices that connect the mainframe to the network must support these emerging network services.

Cisco Mainframe Channel Connectivity

IBM channel-attachment support is provided on the Cisco 7000 and 7500 Series routers by the CIP and on the Cisco 7200 Series routers by the CPA. With a CMCC, the Cisco router can directly connect the mainframe to the internetwork in the data center. Cisco was a pioneer in directly connecting the modern router to the mainframe and has been offering direct mainframe channel connectivity since 1996. Its customer base is worldwide, with thousands of enterprises using the CMCC family.

The CMCC adapters are based on IBM technology and support ESCON, ESCON Director, and bus and tag block multiplexor channel connections. The CMCC supports both SNA and TCP/IP traffic to and from the mainframe and can replace or augment traditional mainframe connectivity devices such as the FEP and the IBM 3172 Interconnect Controller.

An ESCON Director greatly reduces the number of channel adapters and physical cable connections required to share devices among multiple systems. One control unit connection to the ESCON Director can provide all of the required connectivity for a multi-image configuration. It also can handle multiple concurrent data transfers. If the ESCON Director is configured with 60 ports, 30 pairs of ports can transfer data at channel speeds. A router with a CMCC can connect to multiple hosts, using the ESCON Director with a single ESCON interface.

The CIP and the CPA support the same CMCC software applications. The differences between the CIP and CPA are of performance and capacity. The difference in performance is based on the internal bus architecture of the CIP and the CPA. The difference in capacity is based on maximum memory configurations (128 MB for the CIP and 32 to 128 MB for the CPA).

Channel Interface Processor

The CIP is a channel-attached interface for the Cisco 7000 and 7500 Series routers. The CIP connects a host mainframe to a control unit and, in many cases, eliminates the need for a FEP or interconnect controller for channel-attachment support. The CIP is designed for high-end network environments that demand high-performance, high-port density, and high-capacity solutions. The CIP supports the IBM ESCON Channel Adapter (ECA) and bus and tag Parallel Channel Adapter (PCA) channel-attached interfaces from the Cisco 7000 and 7500 Series routers to IBM mainframes.

The CIP offers the following benefits:

- Maximum throughput for every application
- Maximum port density
- High-speed processing engines

A single CIP can support up to two physical channel interfaces of either PCA or ECA in any combination. The CIP parallel channel interface is provided by the PCA, while the ESCON channel interface is provided by the ECA. Each CIP is configured with the appropriate channel adapters at the time of manufacturing.

The Cisco 7000 and 7500 Series routers support online insertion and removal (OIR), which allows you to install or remove CIPs while the system is operating.

Channel Port Adapter

The CPA is available for the Cisco 7200 Series routers. The CPA expands the value of the Cisco IBM channel solution by providing channel connectivity to midrange mainframe configurations. The CPA is a standard single-width port adapter supporting ESCON or parallel channel interfaces to IBM mainframes and IBM-compatible mainframes.

The CPA offers the following benefits:

- Support for all major LAN and WAN interfaces
- Superior performance in the midrange market segment

Each CPA provides a single channel interface for the Cisco 7200 Series routers. In some cases, the CPA eliminates the need for a separate FEP or interconnect controller. The CPA contains a single input/output (I/O) connector.

The Cisco 7200 Series router supports OIR, which allows you to install or remove port adapters while the system is operating.

The CPA is available in three forms: the ESCON CPA (ECPA), the high-performance ESCON CPA Version 4 (ECPA4), and the Parallel CPA (PCPA), described in the following sections.

The ECPA is a high-speed port adapter. A single Cisco 7200 VXR Series router can support up to five high-speed port adapters. Each ECPA model is available with 32 MB of system memory and is capable of supporting one ESCON port.

The ECPA4 is a high-performance version of the ECPA. The ECPA4 system processor's performance is more than twice that of the ECPA processor and comes with four times the memory (128 MB). The ECPA4 includes an updated ESCON chip set.

The PCPA provides support for a single parallel channel physical interface, with both 3.0 and 4.5 MBps data transfer rates. The PCPA uses the same processing engine as the ECPA and supports 32 MB of system memory.

Table 1-1 shows the differences among the different types of CMCC adapters.

Table 1-1 Product Differences among the CIP, ECPA, ECPA4, and the PCPA

Feature	CIP	ECPA	ECPA4	PCPA
Router Platform	Cisco 7500 and Cisco 7000 with RSP7000	Cisco 7200	Cisco 7200	Cisco 7200
Channel Interfaces	ESCON, Parallel	ESCON	ESCON	Parallel
Maximum Number of Interfaces	2	1	1	1
Maximum Memory	128 MB	32 MB	128 MB	32 MB
Cisco IOS® Release Support	Cisco IOS Release 10.2 and later	Cisco IOS Release 11.3(3)T and later	Cisco IOS Release 12.1(5)T and later	Cisco IOS Release 11.3(3)T and later
Virtual Port Adapter	2	0	0	0
Channel Interface State Tracking (HSRP, SNMP Alerts)	Yes	*Disabled*—Use the **state-tracks-signal** command to enable	*Disabled*—Use the **state-tracks-signal** command to enable	*Disabled*—Use the **state-tracks-signal** command to enable