Introducing TCP/IP on the CMCC

The role of the mainframe has shifted as businesses increasingly embrace network-centric computing and the architecture of the Web. This computing paradigm is giving mainframes new opportunities. Front-end processes are separated from back-end processes, and content is separated from infrastructure, giving any type of client transparent access to resources on any type of server, as long as both support the Web interface.

According to IDC, more than 87 percent of S/390s were using TCP/IP to access at least some of the data on the mainframe in 2000. Customers are implementing mainframe TCP/IP and evolving toward integrated network infrastructures for end users to access SNA and TCP/IP host applications.

This chapter introduces you to using the CMCC in a mainframe TCP/IP environment. The information in this chapter can help you determine when and where to use the TCP/IP features of the CMCC, as well as the best design for your data center to optimize performance and availability.

This chapter includes the following information:

- The forces driving enterprises to adopt TCP/IP on the mainframe
- An overview of the three TCP/IP features available on the CMCC: IP Datagram, TCP/IP Offload, and the TN3270 Server

Why Customers Require TCP/IP on the Mainframe

Industry prognosticators in the late 1980s were fond of predicting the imminent demise of the mainframe in favor of less-expensive, microprocessor-based alternatives utilizing client/server technologies. The mainframe has shown considerable resilience. Businesses today are processing more mainframe instructions per second (measured in MIPS) than ever before. In short, a huge installed base of applications and an extremely robust, secure operating environment have ensured the survival of the mainframe.

The following requirements are the key reasons why support for TCP/IP on the mainframe is increasing:

- TCP/IP is the basis for all Internet and intranet applications.
- TCP/IP has become the de-facto standard network architecture; interoperability with partners, suppliers, and customers requires a TCP/IP infrastructure.
- The mainframe remains a vital piece in the overall enterprise computing environment.
- The communications software for the mainframe, IBM's CS/390, includes TCP/IP at no additional charge.
- Standards exist to allow TCP/IP-based end systems and SNA devices to access legacy SNA applications over a TCP/IP infrastructure (TN3270 and HPR/IP, respectively).

Virtually every enterprise is faced with the task of implementing new applications that offer Internet and intranet access to customers, suppliers, and partners. TCP/IP, the language of the Internet, is the basis for all these applications. In addition, the enterprise intranet requires a sophisticated set of network appliances and network servers to support security, management, and directory services for these applications. These network-based services are all built using TCP/IP.

As a result of the incredible growth in Internet and intranet applications, TCP/IP has become the standard for interoperability between systems. Electronic data interchange (EDI) used to occur over SNA or other proprietary protocols. Now, Web-oriented protocols like Extended Markup Language (XML) are used to electronically exchange information between applications. Customers, suppliers, and employees all expect to be able to interact with the enterprise using the new, standard user interface—the Web browser.

The mainframe has evolved into an applications and Internet/intranet superserver on an open, standards-based network. The continuing success of the mainframe depends on its ability to reinvent itself as a key platform in the next-generation corporate intranets. This reinvention means attracting new application development and providing active TCP/IP support while maintaining the same level of security and other services afforded by SNA.

IBM has played an active role in ensuring the continued vitality of the mainframe. TCP/IP support, which used to be a separately licensed and priced item, is now included in the mainframe communications subsystem, CS/390. In fact, IBM offers a complete line of TCP/IP applications for the mainframe, including a Web server and an application server. Enterprises automatically have TCP/IP support on the mainframe; they simply have to "turn it on" to leverage the growing set of TCP/IP applications.

Fortunately, enterprises can implement new, TCP/IP-based applications on the mainframe without having to completely rewrite their legacy SNA applications. Standards exist and are supported by a variety of vendors that provide access to SNA applications by both TCP/IP and SNA devices. TN3270 is a standard that permits TCP/IP-based end users to access SNA applications using either standard terminal emulator software or a Web browser. HPR/IP (EE, described in the chapter Introducing SNA on the CMCC) permits SNA devices to access SNA applications over a TCP/IP network.

Enterprises must implement TCP/IP in order to support the applications of the 21st Century. The mainframe, a linchpin of most enterprises, must support TCP/IP in order to maintain its vitality and secure its spot as an Internet/intranet superserver.

Overview of the CMCC IP Datagram Feature

The most common approach to provide CMCC attachment to a TCP/IP mainframe is using the CMCC IP Datagram feature. The CIP and the CPA support both the IP Datagram feature.

Both the host and Cisco router, such as the Cisco 7000, 7200, and 7500 Series, transmit Internet traffic in the form of IP datagrams. When the IP routing software in a host or router needs to transmit a datagram, it consults the routing table on the host or router to determine where to send the datagram. Using the destination IP address, the software looks up the address in the table and selects the next hop to which to send the datagram. The datagram travels from one router to another router until the datagram can be delivered directly across one physical network. The CMCC provides the last hop across the channel to the host.

In IP datagram mode, the mainframe TCP/IP stack performs all the required IP datagram processing. Cisco CMCC routers pass IP datagrams to the CS/390 using the Common Link Access for Workstation (CLAW) or Cisco MultiPath Channel Plus (CMPC+) protocol.

Supporting IP Datagram Using the CLAW Protocol

The CMCC can be configured to use the CLAW protocol for TCP/IP communication across the channel. The CLAW protocol uses two host subchannels (read and write). To minimize host CPU overhead when the system is busy, CLAW uses the full capacity of the channel and provides efficient routing to external adapters. CLAW is a continuously running channel program that polls the CPU for channel program processes, uses two subchannels (one read and one write), and uses 32 logical links to route to a specific application. Logical link 0 is used for the control path, and the other 31 are used for applications. An indicator shows that multiple frames represent one data block. IP packets are encapsulated in CLAW frames with a maximum frame size of 4096 bytes and are transmitted to the channel.

CLAW writes last as long as there is data to send. CLAW reads never end. As mentioned in the previous paragraph, two subchannels are used, one for writing and one for reading. One subchannel is used for all outbound data from the mainframe, while the second subchannel is used for all inbound data to the mainframe.

Supporting IP Datagram Using the Cisco CMPC+ Protocol

You can also configure the CMCC to use the CMPC+ channel protocol for TCP/IP communications across the channel. CMPC+ is the Cisco implementation of IBM's MPC+ feature. The CMPC+ feature (in Cisco IOS Release 12.0(3)T and later) supports the MPC+ features and protocol necessary to support IP. CMPC+ enables High Performance Data Transfer (HPDT). It allows TCP/IP connections to the host through CMCC adapters, using either the TCP/IP stack or the High Speed Access Services (HSAS) IP stack. CMPC+:

- Runs on the CMCC
- Supports TCP/IP and HSAS transmission group
- Supports one IP start per CMPC+ group
- Supports one read subchannel and one write subchannel per CMPC+ group. The read subchannel and the write subchannel in an CMPC+ group can be on different physical channels.
- Supports up to 64 KB per I/O block

Up to 64 CMPC+ groups can be configured on a CMCC, depending on memory configuration. CMPC+ can coexist with CMPC, TCP/IP Offload, CLAW, TN3270, and CSNA features.

Overview of the CMCC TCP/IP Offload Feature

TCP/IP Offload was developed as a way to offload CPU-intensive TCP/IP processing from the mainframe to the CMCC to free mainframe CPU cycles for application processing. TCP/IP Offload provides substantial savings in host CPU cycles by reducing mainframe cycles when servicing TCP clients in older version of MVS TCP/IP (before OS/390 Version 2, Release 5) and VM.

Note: The TCP/IP Offload feature is relevant prior to CS/390 Version 2, Release 5.

In the TCP/IP Offload implementation, all TCP/IP processing is performed on the CMCC rather than on the mainframe. The CMCC is channel-attached to the mainframe host. Data for the host arrives at the CMCC. The CMCC processes the IP and TCP packet headers and then passes the data to the host. The offload server passes the data to the API at the host so that the data can be delivered to the TCP/IP application. The only TCP/IP processing performed on the host is that of passing data between TCP/IP and the CLAW interface to the CMCC. The TCP/IP Offload feature uses the CLAW protocol for communicating between the CMCC and the TCP/IP address space.

CMCC Offload with IBM's Transaction Processing Facility

Transaction Processing Facility (TPF) is IBM's high-speed, transaction-oriented operating system that is widely used in airline and hotel reservation systems. Using Cisco CMCC with the TCP/IP Offload feature, TCP/IP users can access today's TPF applications and future applications, leveraging high-speed Web servers on TPF. Today, using Cisco CMCCs with the TCP/IP Offload feature is a high-performance, router-based, channel-attached device that supports TCP/IP applications on a host running TPF.

Overview of the CMCC TN3270 Server

As already described, TN3270 is a standard protocol that allows TCP/IP-based end systems to access mainframe SNA applications. TN3270 is a client/server protocol; the client portion is implemented on the end system and the server is implemented either on the destination system (that is, the mainframe) or in an intermediate gateway device. The TN3270 Server converts the TN3270 traffic into traditional SNA traffic for delivery to VTAM.

TN3270 Server software is provided at no additional charge with IBM's CS/390. However, because the server function entails protocol conversion for each and every data packet headed to or from the mainframe, this operation can quickly consume a large portion of the mainframe CPU cycles if the base of users is large. For this reason, the CMCC offers an optional TN3270 Server. All of the TN3270 Server processing is performed on the CMCC, and the SNA data is passed to the mainframe using the CMCC CSNA feature. For more information on the Cisco TN3270 Server, refer to the *TN3270 Design and Implementation Guide* at www.cisco.com/warp/public/cc/pd/ibsw/tn3270sr/tech/tndg_toc.htm.