Total Control Hub

System Overview

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About This Guide

About This Guide provides an overview of this guide, describes guide conventions, tells you where to look for specific information and lists other publications that may be useful.

This guide describes the various components of the 3Com Total Control Enterprise Network Hub and how they work together to build a communications platform for integrating local and wide area networks.

This guide is intended for network administrators or engineers who will be installing and configuring the Total Control system for use with their applications.

If the information in the release notes shipped with your product differs from the information in this guide, follow the instructions in the release notes.

Conventions

The following table lists conventions that are used throughout this guide.

Icon	Notice Type	Description
	Information note	Important features or instructions
	Caution	Information to alert you to potential damage to a program, system, or device
	Warning	Information to alert you to potential personal injury

Related Documentation

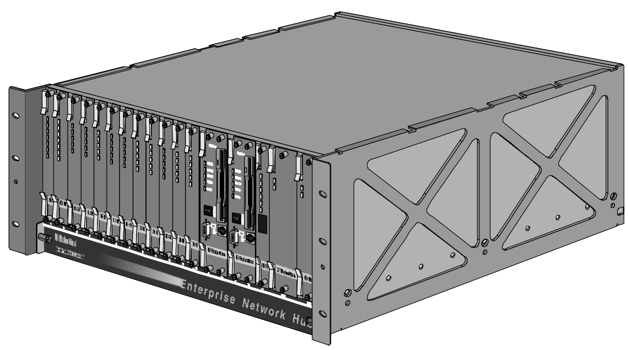
While this guide provides an overview of the Total Control system and its components, more detailed information can be found on the Total Control documentation CD-ROM.

1 TOTAL CONTROL SYSTEM OVERVIEW

This chapter provides a functional overview of the Total Control system, including some of its many features.

Total Control System Functional Overview

The Total Control Enterprise Network Hub is a powerful data communications platform that supports a broad variety of data, voice, and video applications.



Total Control Enterprise Network Hub

The Hub implements a modular architecture to support these applications. Depending on the application, different Network Application Cards (NACs) and Network Interface Cards (NICs) are installed in the Total Control Hub to provide the desired functionality.

NACs combine hardware and firmware to provide the capabilities of channel banks, DSU/CSUs, modems, ISDN equipment, routers, and terminal servers into one compact unit. NACs communicate with each other within the system over a high-speed, multi-layered midplane. Also connected to the midplane are NICs, which provide the physical LAN or WAN interfaces for the NACs.

Total Control System Features

The following are some of the many features the Total Control System offers:

- **Modular Architecture—** Up to 17 front-loaded NACs and their corresponding rear-loaded NICs can be installed. NACs can be added to or removed from the system on the fly without removing power.
- **Software Upgradeable—** NAC firmware can be changed with a simple software upgrade. This provides a cost-effective method of upgrading functionality without having to purchase new hardware.
- **SNMP Management—** The system can be monitored, controlled and maintained from a central location via SNMP using a standard MIB browser or 3Com's Total Control Manager/SNMP or Security Accounting Server software.
- **High Density—** Typical systems can support up to 64 analog POTS, 48 analog calls over T1, 60 analog calls over E1, and a maximum of 235 ISDN calls over T1 or E1 PRI.

  A system which incorporates the new "HiPer" series of products can support up to 336 analog or ISDN calls over T1 or 420 analog or ISDN calls over E1.
- **Redundant Powers Supplies—** Up to two 70 or 130 A AC or DC power supplies are supported for full redundancy and load sharing.
- **Status Indication—** All NACs provide LED status indicators for things such as power, network, alarm, or channel conditions.
- **Cable Management—** All network and power connections are made at the rear-of the system, on the NICs, allowing free access to the NACs at the system's front.
- **Integrated Fan Tray—** Provides system cooling and ventilation.
- **PPP Co-Processing—** Modems in the Total Control system share the responsibility of processing PPP packets within the system. This distribution of PPP processing means enhanced system performance, especially when under high load conditions.

2 SYSTEM COMPONENTS

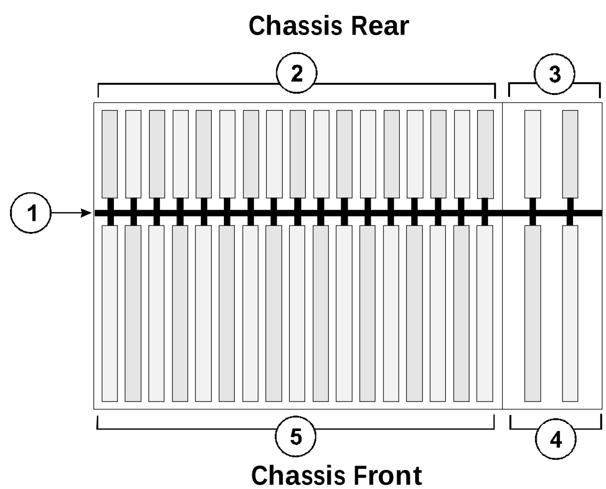
This chapter provides a brief overview of all of the system components for the Total Control Hub at the time of system release 3.1.

Chassis

The chassis, or card-cage, is the main building block of the Total Control system. It is a rack-mountable enclosure with a high-speed, multi-layer midplane. Up to 17 front-loaded Network Application Cards (NACs) and rear-loaded Network Interface Cards (NICs) can be loaded into the chassis. These NACs and NICs interface with the midplane via 180-pin high-density connectors as shown below. In addition to the midplane, the chassis possesses an integrated fan tray which provides cooling for the installed cards.

Cards installed in the chassis receive power through the midplane from two front-loaded power supply units (PSUs) and their corresponding rear-loaded power supply interfaces (PSIs). Two power supplies provide full redundancy and load-sharing.

Callout #	Description
1	Midplane
2	NICs
3	PSIs
4	PSUs
5	NACs



Chassis Midplane

The chassis midplane contains multiple data busses which allow communications between each of the cards in the chassis. The midplane busses are as follows:

- **Management Bus—** The Management bus consists of the NAC Management Bus and the NIC Management Bus. It spans all 17 slots of the chassis.

  The NAC Management bus provides dedicated, full duplex, 512 Kbps serial channels that run from the NMC slot to each of the NAC slots. This bus lets the NMC communicate with installed cards for configuration, status queries, issuing commands, performing tests, and downloading software to the NACs.

  The NIC Management bus provides a common serial channel from the NMC to each NIC, and an individual dedicated serial channel from each NIC to the NMC. This bus operates at 9600 bps and lets the NMC manage the network interface directly.

- **Packet Bus—** The Packet bus, which allows inter-card communications between all NACs in the chassis, It spans all chassis slots except the seventeenth. The NMC, located in this slot, does not have access to the Packet bus. The Packet bus is a 10 MHz, 32-bit wide parallel bus that is used between packet-oriented devices, such as EdgeServer and the chassis modems.

- **TDM Bus—** The TDM (Time Division Multiplexed) bus carries traffic between circuit-switched devices, such as a T1 card and a digital modem. Like the Packet Bus, the TDM Bus spans slots 1 through 16 of the chassis. The TDM bus consists of multiple TDM channels passing synchronous serial data, providing 512 full duplex, 64 Kbps time slots.

  The TDM bus which passes data between the NIC and the NAC consists of 24, 64 Kbps time slots.

- **ISA Bus—** Communication between a some NACs and their corresponding NICs is accomplished through the ISA bus. The ISA bus is an 8 MHz, 16-bit parallel bus that adheres to IEEE PC Bus Standard P996.
- **PCI Bus—** Communication between a some NACs and their corresponding NICs is accomplished through the PCI bus. The PCI bus is a 25 or 33 MHz, 32 bit parallel bus that complies with version 2.0 and 2.1 of the PCI specification.

Chassis Fan Tray

At the bottom of the chassis is an integrated fan tray which contains 15 fans. These fans provide cooling and ventilation for the cards in the chassis. The fan tray receives power internally from the chassis power supplies so there is no additional external cabling associated with it.

The fan tray is monitored by the chassis' Network Management Card (NMC) if one is installed. The system can be configured to set alarms should any fan on the tray fail. This helps protect against the possibility of a system shutdown due to over heating.

Mounting Options

The Total Control chassis can be mounted in industry-standard 19 or 21-inch racks.

The chassis possesses front-mounting flanges for mounting in 19-inch racks. Mounting the chassis in a 21-inch rack requires the use of special brackets. In addition, there are other brackets available for special mounting conditions such as mid or rear-mount. These are most often used to comply with certain safety agency specifications.

Power Supply Units and Interfaces

The Total Control system receives power from two front-loaded Power Supply Units (PSUs) and their corresponding rear-loaded Power Supply Interfaces (PSIs). The PSU/PSI sets are available with ratings of 70 or 130 A in AC or DC versions. With the two PSU/PSI sets installed, automatic redundant switch over and automatic shut-off in over-voltage and short-circuit conditions is supported.

All power connections are made at the rear of the chassis at the PSI. Each PSI has its own cabling interface as well as its own power switch. At the front of the chassis, the PSU has LEDs indicating both PSU and PSI power status.

Power Specifications

Version	Input Voltage
70 or 130A AC	90 to 264 VAC @ 50 to 60 Hz, auto-sensing
70 or 130A DC	-40 to -60 VDC

Network Application Cards (NACs)

NACs are the basic building blocks of the Total Control system. Merging hardware and firmware, they provide functionality for the numerous applications which the Hub can facilitate. Typical NAC functions include:

- Modem
- Digital trunk termination
- Routing
- Server
- Management

A NAC-to-NIC compatibility matrix is provided in Appendix A of this guide. For NAC firmware code compatibility information, please vist the TotalService web site at:

http://totalservice.usr.com

Modem Cards

Currently, there are two types of NACs which perform modem functions. They are the Quad Modem Card and the HiPer DSP.

Quad Modem Card

The Quad Modem NAC contains four modems which comply with a wide variety of protocols and support analog and digital applications.

Analog Applications Analog applications for the Quad Modem NAC require a Quad Analog NIC. The NIC provides four RJ-11 jacks for interfacing to the Public Switched Telephone Network (PSTN), as well as an RS-232 interface.

For this type of application, analog calls can be received by one modem and directed to a chassis Gateway card, the RS-232 interface, or to another modem. Conversely, calls can be directed to the modem from each of these.

Digital Applications Digital applications such as cellular and Integrated Services Digital Network (ISDN) require that the Quad Modem NAC work in conjunction with a chassis trunk card.

For applications such as these, data from a channel on a T1 or E1 span terminated by the trunk card is sent to a chassis modem via the TDM Bus on the midplane. Once the modem processes the data, it routes it over the Packet Bus to another modem or a chassis Gateway card.

Supported Protocols Each modem on the Quad Modem card supports the following protocols:

- V.90
- V.34
- V.32
- V.22
- V.25
- x2™
- V.32 Terbo
- V.32 bis
- V.22 bis
- Bell 212A

HiPer DSP

The HiPer DSP is a combination trunk and modem card. Used with a HiPer DSP T1 or HiPer DSP E1 NIC, it can terminate an entire T1 or E1 span and provide modems for each of the span's channels. This equates to 24 modems per card for T1 applications and 30 modems per card for E1.

Span line channels can be permanently assigned to specific modem channels or they can be configured to find an open modem. Either way, the modem processes the data and routes it to a chassis Gateway or to another modem over the Packet Bus.

The HiPer DSP supports a number of different switch types, frame types and line coding for Channelized T1, T1/PRI, and E1/PRI applications. In addition, the span line interface can be configured for long or short-haul applications.

Trunk Cards

The Total Control system can contain a single Dual PRI cards dedicated to processing and passing incoming data from T1 or E1 trunk lines to chassis modems or it can contain a single HiPer DSP card which performs both trunk and modem functions. The Dual PRI card is described below. An overview of the HiPer DSP card can be found in the Modem Card section of this guide.

Dual PRI Card

The Dual PRI NAC is a 386 processor-based trunk card for the Total Control Hub. The Dual PRI acts as a Data Service Unit (DSU) for data pulled from each of the two possible span lines terminated at its corresponding NIC. The NIC acts as a Channel Service Unit (CSU). The data is then passed down the TDM Bus to a chassis modem or to a chassis ISDN Gateway depending on the configuration.

Depending on the firmware that is loaded, the card can support the following T1 and E1 applications:

- Channelized T1
- T1/PRI
- E1/PRI
- E1/CAS
- E1/DASS2

There are several types of NIC that can be used with the trunk card and the type used depends on the application supported. The following NICs are currently available:

- **Dual DSX-1 NIC—** Supports short-haul Channelized T1 and T1/PRI applications when the physical connection between the NIC and the Telco interface is 655 feet or less
- **Dual DS1 NIC—** Supports Channelized T1 and T1/PRI applications when the physical connection between the NIC and the Telco interface is greater than 655 feet
- **Dual E1 NIC—** Supports all E1 applications

As with the HiPer DSP, the Dual Trunk card can be configured to support a number of different switch types, frame types and line coding for applications listed above.

Gateways and Servers

Ethernet, Token Ring, and Frame Relay connections between the Total Control system and a LAN or WAN are made via chassis Gateways and Servers. The following Gateways are currently supported in the Total Control system:

- NETServer and NETServer PRI
- HiPer Access Router Card

- X.25 Packet Assembler/Disassembler (X.25 PAD)

The Total Control system also supports application server/Gateway components called EdgeServer and EdgeServer PRO.

NETServer and NETServer PRI

The NETServer and NETServer PRI are remote access routers which can be integrated in the Total Control Hub. These cards route information pulled from the Packet Bus, or, in the case of the NETServer PRI, from the TDM Bus to the connected network. Data received from the network side is routed to a chassis modem or trunk card for processing and dial-out services. Each card supports a mix of 48 analog and/or 47 ISDN calls for T1 applications or 60 analog or ISDN calls for E1 applications.

There are four basic functions which the NETServer and NETServer PRI perform. They are:

- **IP Terminal Service—** Remote terminals can log into an IP host on the NETServer's local network as if they were physically connected to it. To do this, the NETServer receives TTY terminal output over a dial-up line. It then forwards the terminal output to the host using a virtual terminal protocol like Telnet or Rlogin. Since the connection is bidirectional, the terminal also receives the host's responses.
- **IP Modem Sharing—** Hosts on a local IP network can use a chassis modem to dial out. The NETServer can also create pools of modems that can be used by local hosts on a first come, first serve basis.
- **Network Dial In Access—** Remote IP and IPX users can dial in and attach to the local network as if they were local nodes. IP and/or IPX packets are transmitted over a dial-in connection encapsulated in a serial line networking protocol (PPP, SLIP, or CSLIP). When received by the NETServer, the IP and IPX packets are forwarded from the remote user to the LAN and vice versa.
- **Dial-Up Routing—** The same routing engine that allows network dial-in access allows the NETServer to establish dial up routing sessions with remote networks. Such connections can be maintained continuously or established on an on-demand basis and torn down when not needed.

These NACs include support for virtual private networking as well as IP and IPX packet filtering on both inbound and outbound calls.

HiPer Access Router Card (HiPer ARC)

The HiPer ARC is a high-performance version of the NETServer card. Faster and more robust processing allows the HiPer ARC to route up to 336 analog or ISDN calls for T1 applications and up to 420 for E1 applications.

The HiPer ARC interfaces with the chassis midplane's Packet Bus to process calls from both the HiPer DSP and Quad Modem NACs.

The HiPer ARC provides LAN protocol support including IP with RIP I, RIP II, CIDR, IP RIP spoofing and DHCP address assignment. It also provides WAN protocol support for the Point-to-Point Protocol (PPP), Serial Line IP (SLIP), compression over PPP and SLIP, and PAP and CHAP authentication.

Distributed security services allow dial-in user authentication across multiple HiPer ARCs within HiPer Access network. In addition, the HiPer ARC utilizes the Remote Access Dial-In User Protocol (RADIUS) for password encryption, dial-back and other security measures to protect network services. In order to this it must work with a RADIUS server. Per-user firewalls provide additional security once a user is granted access to a network.

X.25 Packet Assembler/Disassembler (X.25 PAD)

This card integrates an X.25 PAD into the Total Control Hub, providing it with digital access to chassis modems. This incorporation of the PAD into the Hub eliminates external equipment and RS-232 cables to increase performance and reduce cabling.

The X.25 PAD works in the packet-switched environment to establish, maintain, and disconnect end-to-end logical calls or connections. The X.25 PAD also handles network addressing, call routing, and multiplexing.

Additionally, the product supports several features that dramatically increase the number of calls it can handle. Call setup time is reduced by receiving call information over the Packet Bus and automatically routing incoming calls to their destination via ANI (Automatic Number Identification), DNIS (Dialed Number Identification Service) or Modem Profile information. Automatic channel configuration allows dynamic configuration of all asynchronous channels based on ANI, DNIS or subscriber ID.

The X.25 PAD is used with the Dual V.35/RS-232 NIC. The NIC has two V.35/RS-232 interfaces for connecting to Packet Switched Networks via EIA RS-232 or V.35. The option of using EIA RS-232 or V.35 at the interface is software programmable on the NAC.

EdgeServer and EdgeServer PRO

The EdgeServer and EdgeServer PRO provide powerful information access by integrating Windows NT servers within the Total Control system. They each combine the functionality of a server, communication interface, and operating system with the high-performance capabilities of Microsoft Windows NT Remote Access Service (RAS) in a self-contained platform that eliminates the need to purchase a separate access server, third-party software, stand-alone PC, and corresponding support contracts.

Both the EdgeServer and EdgeServer PRO communicate with chassis modems over the Packet Bus. With the proper configuration and software loaded, some typical applications that these NACs support are:

- **Web hosting and caching—** Running web hosting services or web caching software on the EdgeServer moves this high bandwidth traffic to the edge of the network, reducing back-end traffic and improving response time to dial-in users.
- **COM port emulation—** In addition to RAS ports and services, EdgeServer controlled modems in the Total Control Enterprise Network Hub can be defined as COM ports. This allows serial-port-based applications (such as modem pooling and fax pooling) to run on the EdgeServer and share the hub modems as if they were attached to COM ports on the EdgeServer.
- **Token-based authentication and firewall—** Security-conscious organizations are moving to token-based authentication mechanisms requiring more than simple password schemes to prevent unauthorized remote access. EdgeServer supports the leading token-based authentication products and firewall software thus ensuring the highest level of remote access security.

EdgeServer The EdgeServer runs on a 486 DX4-100 MHz processor with 64 MB of RAM. It has a 1 GB hard drive. The operating system is Microsoft Windows NT Server 4.0 with Service Pack 3. The EdgeServer NAC is unique in that it requires two slots in the chassis.

The EdgeServer can use either a 10 Mbps Ethernet or 4/16 Mbps Token Ring NIC for interfacing to a network. A SCSI NIC is also needed for attaching SCSI peripherals such as CD-ROM drives.

At the front of the EdgeServer NAC is a floppy disk drive, interfaces for monitor, keyboard and mouse, and LED status indicators for power, hard drive, SCSI, and LAN conditions.

EdgeServer PRO The EdgeServer PRO is a more powerful and robust version of the EdgeServer. It supports up to two Intel Pentium Pro processors, up to 1 GB of RAM, and up to two hard drives. The operating system is Microsoft Windows NT Server 4.0 with Service Pack 3. This NAC requires three slots in the chassis.

The EdgeServer PRO currently interfaces to an Ethernet network using a Dual PCI 10/100 Mbps Ethernet NIC. A second NIC called the EdgeServer PRO Peripheral NIC provides all of the interfaces for connecting a mouse, keyboard, and monitor. In addition, an Ultra-wide SCSI 3 interface is provided for attaching SCSI peripherals such as CD-ROM drives.

At the front of the EdgeServer PRO NAC is a floppy disk drive and status-indicating LEDs for power, hard drive, LAN and SCSI conditions. An eight-character system display is also provided for performance monitoring or user defined information.

Management Cards

A Network Management Card (NMC) can be installed in the Total Control Hub to provide a single point of management for performing configuration, status queries, issuing commands, performing tests, and downloading software to the NACs within the system.

The NMC manages all of the devices in the chassis under the direction of a PC running console software such as 3Coms Total Control Manager/SNMP software or a standard MIB browser. This PC is referred to as the management station (MS) and connects to the NMC's NIC remotely via a SLIP connection, or locally via a LAN connection. Management of the chassis is performed via Simple Network Management Protocol (SNMP). The NMC receives requests from the MS which are communicated by the Management Information Bases (MIBs) defined for each device and then executes the request.

There are two varieties of NMC:

- NMC (386 or 486 processor-based)

- HiPer NMC (Pentium processor)

Both varieties perform the same management function by communicating with the other NACs and NICs in the system via the midplane's NAC Management Bus and NIC Management Bus respectively. The HiPer NMC, however, provides a more powerful engine for increased processing power for the "HiPer" series of cards.

The 386 and 486-based NMCs can use a 10 Mbps Ethernet, or 4/16 Mbps Token Ring NIC for communicating with the Network. Currently, the HIPer NMC supports interfacing to an Ethernet network via the 10/100 Ethernet AUX I/O NIC.

Network Interface Cards (NICs)

NICs allow the NACs to interface with a network for transmitting or receiving data. The following network interfaces are supported by the Total Control system:

- **PSTN/WAN**
  - **T1—** DS-1 and DSX-1 interfaces supporting Channelized T1 and T1/PRI applications
  - **E1—** Supports E1/PRI, E1/CAS, and E1/DASS2 applications
  - **V.35—** Supports V.35 Frame Relay or RS-232
  - **Analog—** Supports analog connections to the POTS
- **LAN**
  - **Ethernet—** Supports standard 10Base-T, 10Base-5, 10Base-2, or auto-negotiating 10Base-T/100Base-Tx interfaces
  - **Token Ring—** Supports 4/16 Mbps IBM Type 1 (STP) and IBM Type 3 (UTP) interfaces
- **Serial**
  - **RS-232—** EIA/TIA-232-E configured as DTE
  - **SLIP—** EIA/TIA-232-E configured as DTE

For NIC and NAC compatibility information, please see Appendix A of this guide.

Management Software

3Com produces two software packages for managing the Total Control system. They are:

- Total Control Manager/SNMP (TCM)
- Security/Accounting Server

Total Control Manager/SNMP (TCM)

TCM is a GUI-based, central site management system which can connect to the NMC over a LAN or dial-up connection to manage a chassis.

A personal computer, also called a management station, running Total Control Manager/SNMP software sends commands to the NMC. The NMC manages all the cards in the Total Control hub. Two protocols govern these management functions: Simple Network Management Protocol (SNMP) between the NMC and the management station, and a proprietary 3Com protocol between the NMC and the managed cards.

TCM is compatible with the following Operating Systems:

- Windows NT® 4.0
- Windows® 95
- HP Open View™ 4.1 for HP-UX 10.20
- SUN Solaris® 2.5.1

Security/Accounting Server (S/A Server)

S/A Server software performs security (authenticating and authorizing users) and accounting (logging call-related events) functions.

S/A Server can be used with compatible versions of the NMC, NETServer, HiPer ARC or any other RADIUS™ -compliant Network Access Server (NAS) client.

S/A Server software is installed on a management station that is connected to NAS clients via a LAN. S/A Server monitor’s UDP port 1645 for security requests and UDP port 1646 for accounting requests.

The client/server relationship in the Total Control chassis depends on the point-of-entry for communication. If the point-of-entry for communication is a modem card in the Total Control chassis, the modem is the client, and the NMC acts as a client proxy. If the point-of-entry for communication is a NETServer card in the Total Control chassis, the NETServer card is the client.

S/A Server is compatible with the following Operating Systems:

- Windows NT® 4.0
- Windows® 95
- HP Open View™ 4.1 for HP-UX 10.20
- SUN Solaris® 2.5.1

3 APPLICATIONS

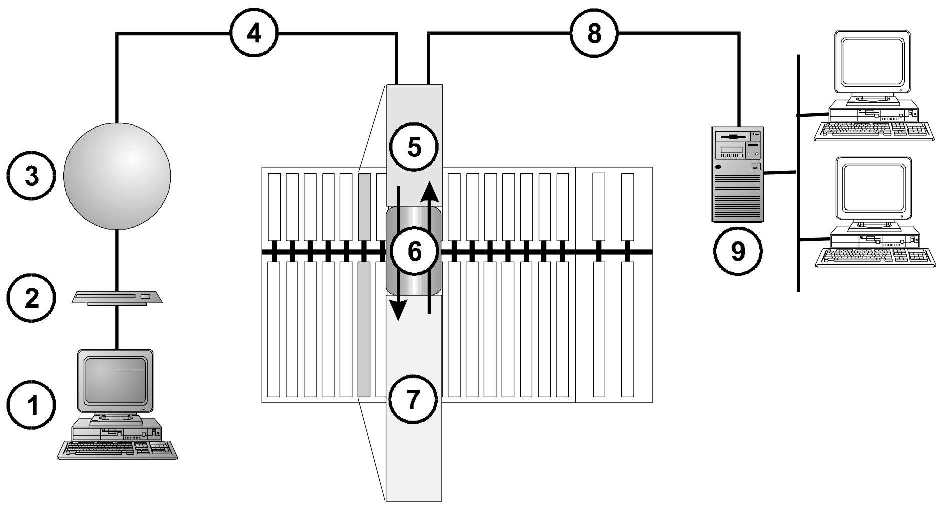
This chapter discusses four basic applications the Total Control Hub can be configured as well as how they are processed. They are:

- Analog modem-to-PC/Host
- Analog modem-to-LAN
- T1-to-LAN
- ISDN-to-LAN

Two different implementations of the last application are provided. The first assumes the Total Control Hub is comprised of typical NACs and NICs. The second assumes the Hub is comprised of the new “HiPer” series of cards.

Analog Modem-to-PC/Host

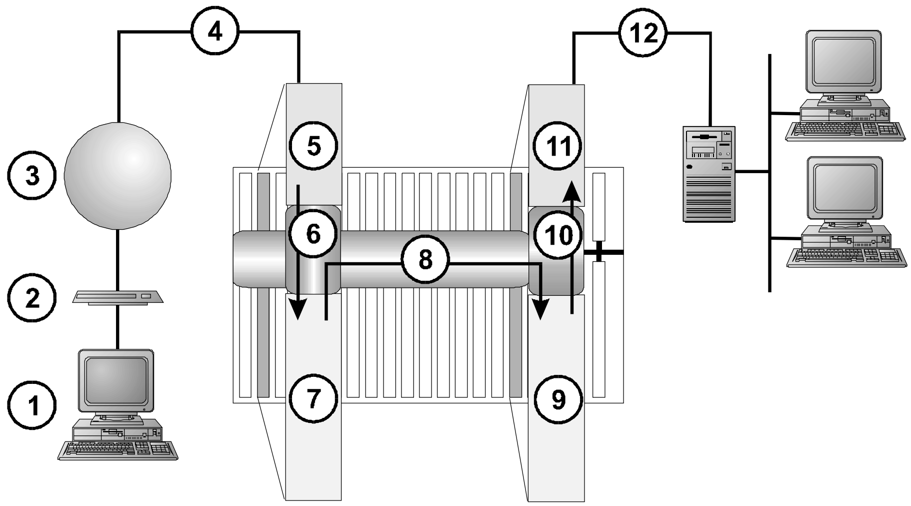
In this application, a user is connecting to remote PC or Host through the Total Control Hub.



Callout	Description
1	User's PC— DTE sending digital signals to modem
2	User's modem— DCE modulating digital signals to analog and sending them over the PSTN
3	PSTN
4	Analog signal sent to Total Control system
5	Quad Analog NIC receives call
6	Data is passed from NIC to the NAC through the chassis midplane
7	Quad Modem NAC receives the signal, demodulates it and passes it back through the midplane to the NIC's RS-232 port
8	RS-232 signal is sent to the PC or host
9	PC or host receives and processes the signal

Analog Modem-to-LAN

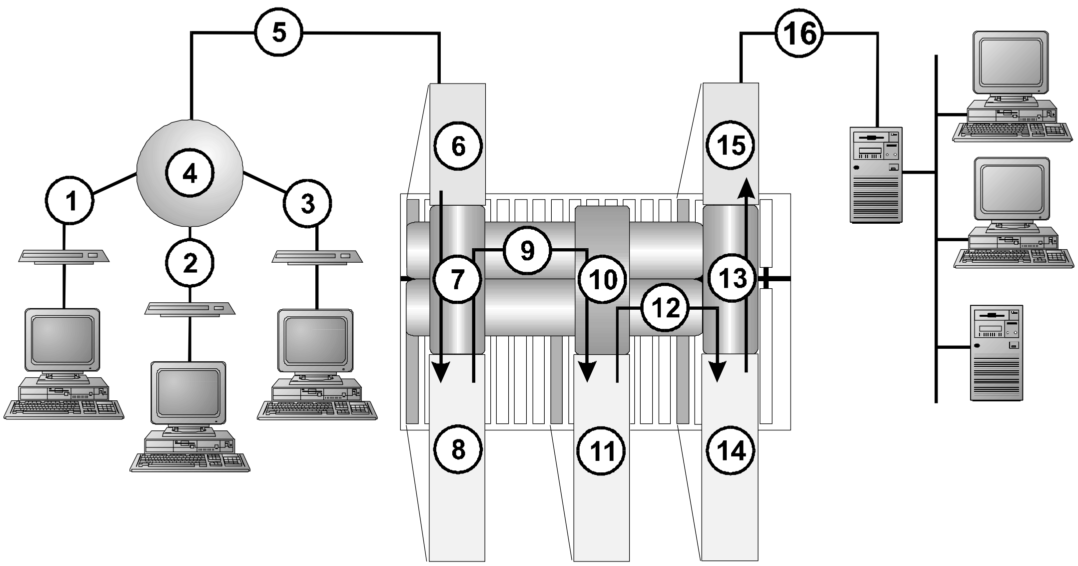
In this application a user is trying to access a LAN from a remote location.



Callout	Description
1	User's PC— DTE sending digital signals to modem
2	User's modem— DCE modulating digital signals to analog and sending them over the PSTN
3	PSTN
4	Analog signal sent to Total Control system
5	Quad Analog NIC receives call
6	Data is passed from NIC to the NAC through the chassis midplane
7	Quad Modem NAC receives the signal, demodulates it and passes it chassis midplane's Packet Bus to the NETServer or NETServer PRI NAC
8	Chassis midplane's Packet Bus
9	NETServer or NETServer PRI NAC processes packets
10	Processed packets are sent through the midplane to the NIC
11	Packets sent from the NIC onto the network
12	Packets are sent over the network to their destination on the LAN

T1-to-LAN

In this application, users are dialing into the Total Control Hub over analog lines in order to access a remote LAN. At the PSTN their signals are multiplexed onto a T1 line going to the Hub.



Callout	Description
1	User 1's analog connection to PSTN
2	User 2's analog connection to PSTN
3	User 3's analog connection to PSTN
4	PSTN where User 1, 2, and 3's analog signals are multiplexed onto a digital T1 line
5	Digital T1 line to Total Control system
6	T1 NIC terminates the T1 Line
7	Timing and data signals recovered from the Line are passed to the T1 NAC through the chassis midplane
8	T1 NAC processes data, maps the T1's DS0s to modems, and places the data on the chassis midplane's TDM Bus
9	TDM Bus passes the data down to the appropriate modem
10	Modem NAC pulls data from the TDM Bus
11	Modem NAC demultiplexes the signal, puts it into packet format, and places it on the chassis midplane's Packet Bus to go to the router
12	Packet Bus passes the packets down to the NETServer or for routing

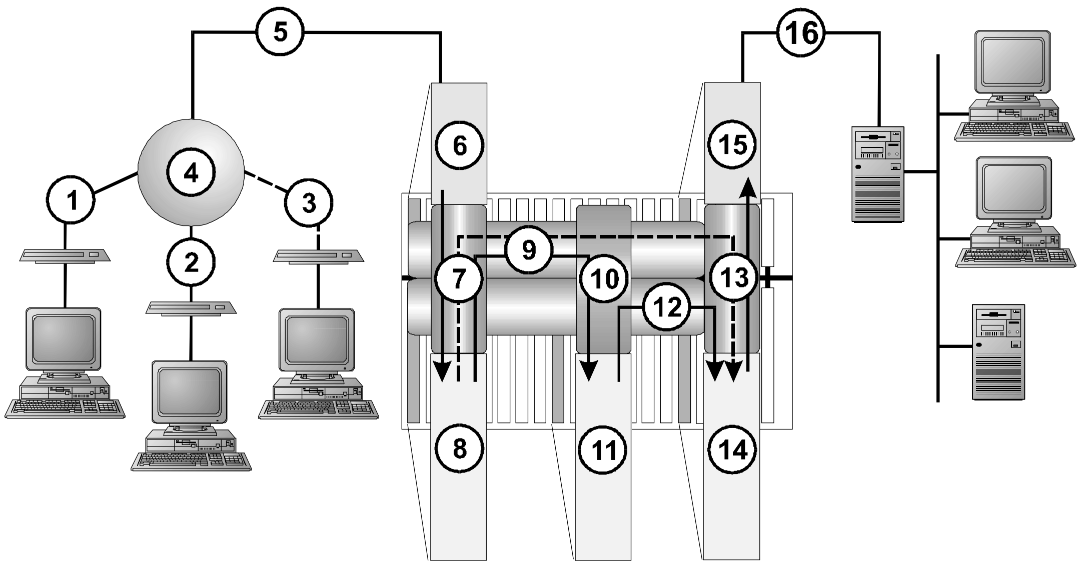
Callout	Description
13	NETServer receives the data from the Packet Bus
14	NETServer processes the data and determines its destination and passes it to its NIC
15	Packets sent from the NIC to the network
16	Packets are sent over the network to their destination on the LAN

ISDN-to-LAN

In this application, remote users are connecting to a LAN through the Total Control Hub over a mixture of analog and ISDN connections.

Typical System Configuration

This implementation of the application assumes the Total Control Hub is based upon a typical configuration using T1/PRI, Quad Modem, and NETServer PRI cards.

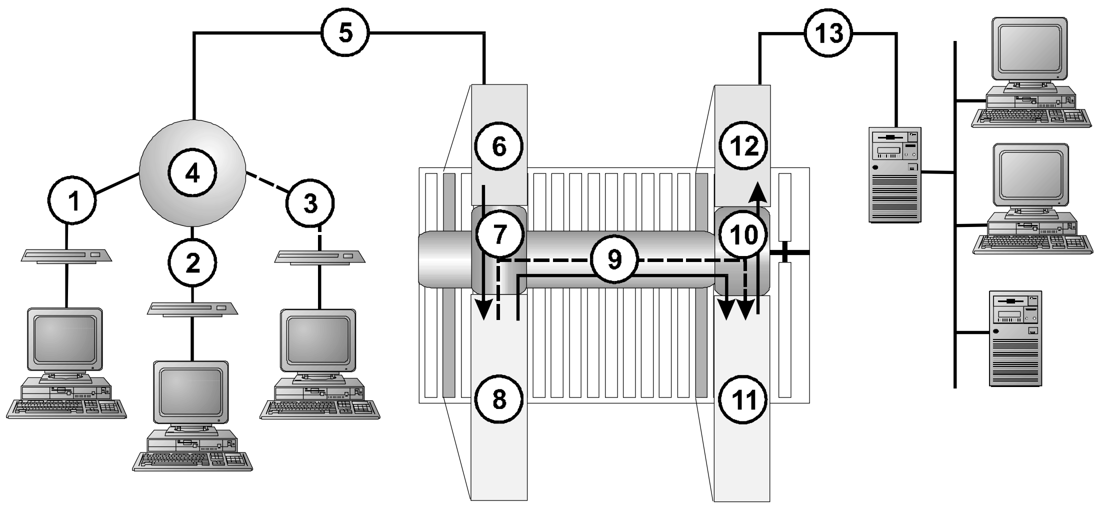


Callout	Description
1	User 1's analog connection to PSTN
2	User 2's analog connection to PSTN
3	User 3's digital ISDN connection to PSTN
4	PSTN where User 1, 2, and 3's analog and digital signals are multiplexed onto a digital T1/PRI line
5	Digital T1/PRI line to Total Control system
6	T1 NIC terminates the T1/PRI Line
7	Timing and data signals recovered from the Line are passed to the T1 NAC through the chassis midplane
8	T1 NAC processes data. For analog data, it maps the T1/PRI's DS0s to modems. Digital calls are to be sent directly to the NETServer PRI. The T1/PRI NAC places the data on the chassis midplane's TDM Bus
9	TDM Bus passes the analog call's data down to the appropriate modem and the digital call's data to the NETServer PRI

Callout	Description
10	Modem NAC pulls analog call's data from the TDM Bus
11	Modem NAC demultiplexes the signals, puts them into packet format, and places it on the chassis midplane's Packet Bus to go to the router
12	Packet Bus passes the packets down to the NETServer PRI for routing
13	NETServer PRI receives the data from the TDM Bus and from the Packet Bus
14	NETServer processes the data and determines its destination and passes it to its NIC
15	Packets sent from the NIC to the network
16	Packets are sent over the network to their destination on the LAN

"HiPer" System Configuration

This implementation of the application assumes the Total Control Hub is based upon a "HiPer" configuration using HiPer DSP and HiPer ARC cards.



Callout	Description
1	User 1's analog connection to PSTN
2	User 2's analog connection to PSTN
3	User 3's digital ISDN connection to PSTN
4	PSTN where User 1, 2, and 3's analog and digital signals are multiplexed onto a digital T1/PRI line
5	Digital T1/PRI line to Total Control system
6	HiPer DSP T1 NIC terminates the T1/PRI Line
7	Timing and data signals recovered from the Line are passed to the HiPer DSP NAC through the chassis midplane
8	HiPer DSP NAC processes data and places the data from both the analog and digital calls on the chassis midplane's Packet Bus
9	Packet Bus passes the data down to the HiPer ARC NAC
10	HiPer ARC NAC pulls data from the Packet Bus
11	HiPer ARC processes the data and determines its destination and passes it to its NIC
12	Packets sent from the NIC to the network
13	Packets are sent over the network to their destination on the LAN

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NAC-TO-NIC COMPATIBILITY MATRIX

The following table shows which NICs are compatible with each NAC within the Total Control system.

NACs \ NICs	Ethernet (10 Mbps)	PCI Dual 10/100Base-T Ethernet	10/100 Ethernet AUX I/O	Token Ring (4/16 Mbps)	Quad Modem Analog	Dual DS-1	Dual DSX-1	Dual E1	HiPer DSP T1/E1	V.35	V.35/Ethernet Combo	SCSI-2	EdgeServer Pro Peripheral
NMC (486)	X			X									
HiPer NMC			X										
Quad Modem (DS/SS)[1]					X								
HiPer DSP (T1 or E1)									X				
Dual T1/E1 (186)						X	X						
Dual PRI[2]						X	X	X					
NETServer (4 MB RAM & NO Daughter Card)	X			X									
NETServer PRI (8, 16, or 20 MB RAM & Munich Daughter Card)[3]				X							X		
HiPer ARC		X											
EdgeServer				X							X	X	
EdgeServer PRO		X											X
X.25 PAD										X			

NOTES:

1. Quad Modem NIC needed for analog applications only

2. Corresponding NIC determined by firmware loaded on NAC as shown in the following table:

Firmware Loaded	NIC Used
Channelized T1	Configured for Long Haul Applications: Dual DS-1 Configured for Short Haul Applications: Dual DSX-1
T/PRI	Configured for Long Haul Applications: Dual DS-1 Configured for Short Haul Applications: Dual DSX-1
E1/PRI	Dual E1
E1/CAS	Dual E1
E1/DASS2	Dual E1

3. Corresponding NIC determined by the firmware type (Ethernet, Token Ring, or CCA) loaded on NAC

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