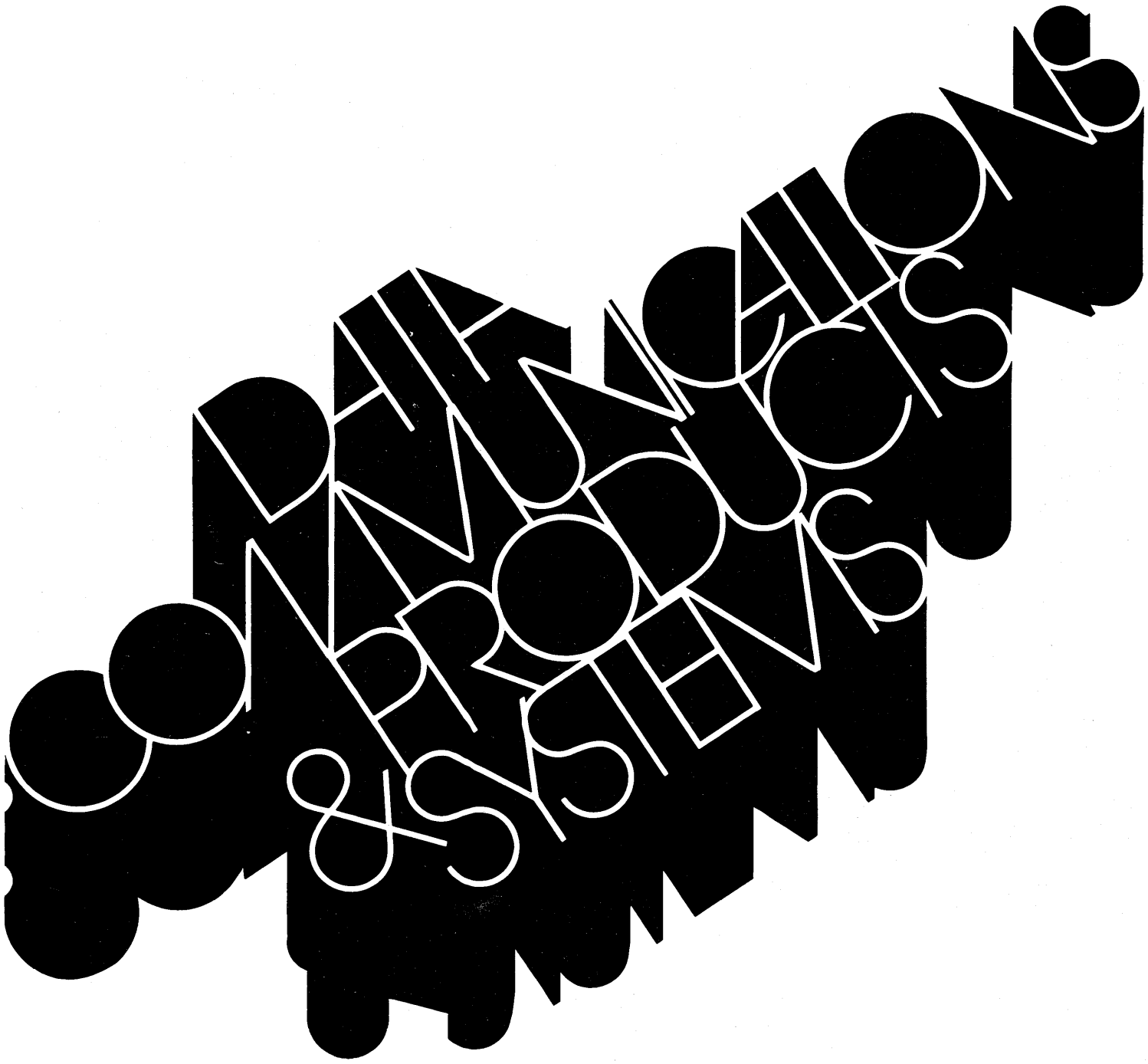

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Control Data Corporation Data Communications Products and Systems can MOVE your data. CDC has the solution to your data transportation and network requirements with the following products and systems:

- The INQUIRY MESSAGE EXCHANGE for high-throughput data transport.
- The PROTECTED MESSAGE EXCHANGE for fully-protected, store-and-forward data transport; optionally providing high throughput inquiry/response service.
- The NETWORK PROCESSING UNIT with efficient front-end capability for Control Data 3000L, 6000 and CYBER 70/170 Mainframes.
- The MICROPROGRAMMABLE COMMUNICATIONS CONTROLLER for high-throughput front-end capability for non-Control Data mainframes.

You can MOVE IT with these products and systems. Make the MOVE now! Call your local Control Data office for assistance in selecting the right combination for you.

CONTROL DATA® CYBER 1000 INQUIRY/MESSAGE EXCHANGE (IMX) SYSTEM

1.0 INTRODUCTION

The CONTROL DATA® CYBER 1000 Inquiry/Message Exchange (IMX) is a highly reliable and efficient switching system for fast routing of messages or computer data. In a dual configuration or larger, the fundamental design of CYBER 1000 hardware and software provides for almost 100% availability: statistics on installed systems show that 99% is readily achieved; and well-managed systems exceed 99.9+% month after month.

The CYBER 1000 IMX is a complete, self-contained, preprogrammed data-switching system. No other equipment or programs are required to perform its various communications tasks. Transmissions are received, edited, routed, translated to other codes as required, and delivered, intercepted or terminated entirely within the confines of the IMX system.

2.0 TYPES OF IMX SYSTEM ORGANIZATIONS

Two different system organizations can be derived with CYBER 1000 IMX System components: a centralized system or a distributed system.

The selection of a particular system organization depends primarily upon 1) the geographical distribution of the communications network and related line costs, 2) bulk-data transmission requirements, and 3) intercommunications requirements for high-speed terminals and data processor(s).

2.1 Centralized System

The centralized IMX System consists of a single Exchange terminating all of the lines in the communications network and providing for communications beween all terminals in the network. The Exchange may also connect to data-processors, providing on-line input to the processor(s) from the communications network.

2.2 Distributed System

A distributed IMX System consists of two or more geographically separated Exchanges, each of which terminates a portion of the lines in the total network. All Exchanges in the system have, within their own portions of the total network, the same general communications capability as the Exchange does in a centralized system. Terminals on lines connected at any Exchange can communicate with terminals connected at any other Exchange through interExchange trunks.

2.3 Applications

The IMX may be employed in any of three basic applications: standalone message switching, data-processor front ending, remote data concentration, or combinations of these.

2.3.1 Stand-Alone Message Switching

In this configuration the IMX terminates a network of communications lines, each of which services one or more terminals. Communications are from terminal to terminal(s), with no alteration or processing of the information being transferred. The types of applications thus supported include the following when protection of messages on disk is not required.

- Intracompany communications
- Administrative message switching
- General person-to-person communications

2.3.2 Data-Processor Front Ending

In this configuration the IMX terminates a network as in the previous case, but also connects to one or more data processors. Communications are between a terminal and a data processor. There are no terminal-to-terminal communications. The information received from a terminal is processed by a data processor and the results returned to a terminal. The types of applications thus supported include:

- Inquiry-response
- Inventory and supply
- File update
- Remote job entry
- Data collection
- Data acquisition
- Data dissemination
- Order entry
- Command and control
- Timesharing

2.3.3 Remote Data Concentration

In this configuration the IMX terminates a local network and connects to one or more data processors via high-speed lines. Communications are between a terminal and a data

types of applications thus supported include:

- Inquiry-response
- Inventory and supply
- File update
- Remote job entry
- Data collection
- Data acquisition
- Data dissemination
- Order entry
- Command and control
- Timesharing

2.3.3 Remote Data Concentration

In this configuration the IMX terminates a local network and connects to one or more data processors via high-speed lines. Communications are between a terminal and a data processor. There are no terminal-to-terminal communications. The information received from a terminal is sent to a data processor for action, and the results are returned to a terminal. The types of applications supported include those listed in 2.3.2.

2.3.4 Combined Message Switching and Front Ending or Remote Data Concentration

In this configuration the IMX terminates a network and connects to one or more data processors. Communications may be either from terminal to terminal or between terminal and data processor. This configuration supports any combination of the applications listed in 2.3.1 and 2.3.2 above.

3.0 SYSTEM FEATURES

- Modular and Expandable
- Load-Sharing Processor
- Automatic Switchover and Restart
- Central Monitor and Control
- High System Availability
- Flexible Interface Capability
- Network Configuration
- Data Integrity
- Line Monitoring and Controls
- Supervisory Commands, Alarms and Reports
- Operational Simplicity
- Continuous Operation
- On-Line Configuration of Terminals and Lines
- Code Conversion
- Speed Conversion
- Implied and Explicit Routing
- Header Analysis
- Header/Ender Stripping
- Header/Ender Build
- Alternate Routing
- Terminal/Lines/Channel Connect Status Reporting
- Power Isolation Points
- On-Line Terminal Diagnostics

SUPPORT SOFTWARE

- Utility Routines
- Test Aids
- Program Production System (PPS)
- Assembler
- Library Maintenance
- Link Editor
- Load Tape Generator
- FORTRAN Compiler
- Source Module Control System
- Diagnostics
- Measurements Package
- System Stimulator

4.0 INTERFACES

Line interfaces available with the IMX include:

- Binary Synchronous Point-to-Point
- Binary Synchronous Multipoint
- ISO Recommendation 1745
- ATA/IATA Point-to-Point
- Freewheeling Asynchronous ASCII

Channel Interfaces available with the IMX are:

- 2701 Emulation

5.0 DEVELOPMENT

Planned enhancements for the CYBER 1000 IMX include:

- Ability to terminate 256 lines in one CYBER 1000 IMX and 512 in a dual CYBER 1000 IMX.
- Rotating Mass Storage with up to 800 million bytes of storage.

6.0 BASIC SYSTEM COMPONENTS & CONCEPTS

The CYBER 1000 IMX System is composed of one or more data communications centers called Exchanges. Each Exchange provides communications service for the lines and devices which it terminates. When a system consists of more than one Exchange, the Exchanges are interconnected by communications lines or trunks of speeds appropriate to the system requirements.

An Exchange is a complex of one or more identical CYBER 1000 Exchange Units (EUs). In a Multi-EU Exchange, each EU terminates a portion of the lines, shares the total traffic load and provides redundancy for protection against equipment failures. Communication between EUs is provided by use of high-speed lines.

Each EU in a CYBER 1000 Exchange will normally control the lines connected to it. It will issue polls and calls as required, receive and evaluate responses, and monitor the lines for error conditions. Proper handling and routing of all transmissions is accomplished within specific system parameters entered at the console.

Transmissions received from any line can be routed to any terminal(s) in the network if properly addressed. If all of a terminal's transmissions are intended for one fixed destination, they can be directed by implied routing without being addressed.

Transmissions with improperly formatted addresses will be intercepted by the IMX and delivered for handling to the intercept station designated for the terminal generating them. The texts of all transmissions are delivered to their designated or implied addressees without change, except for code translations where required.

Modularity of memory permits tailoring of throughput capability to user requirements. A shared-load concept inherent in the design of Exchanges provides extremely high system efficiency, since each EU performs useful work at all times, assuming its backup function only upon failure of an associated processor. This feature also permits expansion with minimal system interruption.

An EU consists of a special-purpose communications processor, semiconductor memory, line termination equipment, and other input/output devices. The EU is modular with respect to these components (except the processor, which is a fixed component of each EU), and the kinds and amounts employed are dependent on the application.

Control of input/output operations to and from data processors and terminals is performed by Terminal Interface Packages (TIPs). TIPs consist of hardware and software modules which allocate functional responsibilities between the hardware and software. Some TIPs have special-hardware, control-character decoding; others perform this function as software.

Remote TIPs (RTIPs) are used to support terminals and data processors when communications line connection is used. A Local TIP (LTIP) is used when a direct channel connection is required for the interface between the CYBER 1000 and a data processor. The Microprogrammable Communications Controller (MPCC) may be installed directly on the I/O channel of the data processor. The MPCC may be programmed to emulate a standard telecommunications control unit of the data processor.

7.0 SPECIFICATIONS

BASIC EXCHANGE UNIT

- Memory: includes 65K words of 27-bit (8-bit bytes plus parity) semiconductor memory per EU, operated at 1200-nanosecond cycle time.
- Medium-Speed Multiplexer: Line scan capability for up to 128 lines (primary) and up to 128 lines (secondary) per EU, at speeds to 9600 bps.
- Line termination: capability for 32 full-duplex lines is provided when suitable line module interface equipment is installed (see EXPANSION).
- I/O Channels: 12 maximum.
- Control Display: Control Display group with individual EU control and display capability with M35 Exchange Console.
- Magnetic Tape: 800/1600 bpi, dual-mode, 50 ips.

EXPANSION

- Memory: Up to 262K words maximum per EU (in increments of 32 words).
- High-Speed Multiplexer: Line scan capability for up to 32 lines (primary) and up to 32 lines (secondary) per EU, at speeds to 230K bps. Line termination capability for up to 32 full-duplex lines when suitable line module interface equipment is installed.
- Line Termination: Up to 160 full-duplex connections per EU when Medium and High-Speed Multiplexer installed (two increments of 48 and one increment of 32).
- Exchange: Up to eight EUs.

OPTIONAL PERIPHERALS

- Magnetic Tape Transports: Up to six different configurations of dual and single transports and combinations per Exchange; one configuration per Exchange Unit
- Peripheral Controller: Controlling card punch, card reader and line printer or any combination thereof
- Interface equipment for data processor front-ending via communications line, direct channel connection, or a combination of these.

POWER REQUIREMENTS PER EU

- 120v ±10 percent
  60 Hz ±1/2 Hz
  Single phase
  2.8 kva

HEAT DISSIPATION PER EU

- 4640 Btu/hr

PHYSICAL CHARACTERISTICS

- Exchange Unit:
  Width: 54.0 in.
  Depth: 30.0 in.
  Height: 73.0 in.
  Weight: 1200 lbs.
- Control Display Group: (Desk, Chair and Displays)
  Width: 54.0 in.
  Depth: 24.0 in.
  Height: 53.5 in. (maximum)
  Weight: 100 lbs.
- Typical Magnetic Tape Transport Cabinet:
  Width: 28.0 in.
  Depth: 30.0 in.
  Height: 73.0 in.
  Weight: 500 lbs.

CONTROL DATA CYBER 1000 PROTECTED MESSAGE EXCHANGE (PMX) SYSTEM

1.0 INTRODUCTION

To the efficiency, throughput and reliability of CDC's Inquiry/Message Exchange, the CDC® CYBER 1000 Protected Message Exchange adds the ultimate security of store-and-forward switching. Here, again, the user can enjoy availability in the 99% range, with well-managed systems regularly providing 99.9+% month after month.

Here, too, is a complete, self-contained and pre-programmed data-communication system. No other systems, equipment or programs are required in order to perform its various communications tasks. Transmissions are received, edited, routed, translated to other codes as required, delivered or intercepted, and stored for later retrieval or processing entirely within the confines of the PMX system.

Present customers have chosen the CYBER 1000 for a number of different reasons. Banks need the security that the system offers, as well as a safeguard against the loss of a message or transaction. Automobile manufacturers use it for scheduling and parts distribution, and they like the backup features that reduce the possibility of downtime. Airline customers like the very high-throughput capabilities which allow them to handle the wild peaks that

occur during holidays. A common carrier chose the system because of its huge file capacity.

2.0 TYPES OF PMX SYSTEM ORGANIZATIONS

Two different system organizations can be derived using the CYBER 1000 PMX System components, a centralized system or a distributed system. The selection of a particular system organization depends primarily upon (1) the geographical distribution of the communications network and related line costs, (2) bulk data transmission requirements, and (3) intercommunications requirements for high-speed terminals and data processor(s).

2.1 Centralized System

The centralized PMX System consists of a single Exchange terminating all of the lines in the communications network. Capability is provided for data communications between all terminals in the network. Additionally, the Exchange may connect to a data processor(s) providing on-line inputs to the data processor(s) from the communications network.

2.2 Distributed System

A distributed PMX System consists of two or more geographically separated Exchanges, each of which terminates a portion of the lines in the total network. Each Exchange in the distributed system has the same general communications capability as previously described for the centralized system. Additionally, terminals on lines connected at one of the Exchanges can now communicate, through the interExchange trunks, with terminals on lines which connect at another Exchange.

2.3 Applications

The PMX may be employed in any of three basic applications: stand-alone message switching, data processor front-ending, or a combination of these.

2.3.1 Stand-Alone Message Switching

In this configuration the PMX terminates a network of communications lines, each of which services one or more terminals. Communications are from terminal to terminal(s), with no alteration or processing of the information being transferred. The types of applications thus supported include:

- intracompany communications,
- administrative message switching,
- general person-to-person communications.

2.3.2 Data-Processor Front Ending

In this configuration the PMX terminates a network as in the previous case, but also connects to one or more data processors. Communications are between a terminal and a data processor. There are no terminal-to-terminal communications. The information received from a terminal is processed by a data processor and the results returned to a terminal. The types of applications thus supported include:

- inquiry-response
- inventory and supply
- file update
- remote job entry
- data collection
- data acquisition
- data dissemination
- order entry
- command and control
- timesharing

2.3.3 Combined Message Switching and Front Ending

In this configuration the PMX terminates a network and connects to one or more data processors. Communications may be either from terminal-to-terminal or between terminal and data processor. This configuration supports any combination of the applications listed in 2.3.1 and 2.3.2 above.

3.0 PMX SYSTEM FEATURES

GENERAL

- Reliability with data integrity
- File-protected software system
- Load-sharing processor
- Modular expansion — software and hardware
- High throughput
- Selection of I/O devices

OPERATIONS AND SUPERVISION

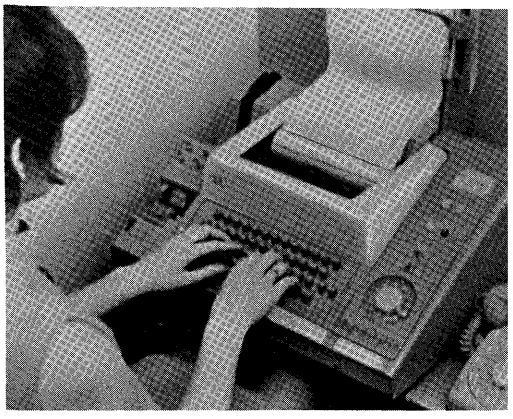
- Central monitor and control
- Automatic restart from point of failure
- On-line configuration of terminals/lines
- Terminal/line/channel-connect status reporting and analysis
- Full complement of supervisory commands, alarms and reports

ROUTING

- Implied, explicit and exception routing
- Header/ender analysis
- Single address/multiple address/group-code addressing
- Inverted address routing
- Very large routing directory capability
- Alternate routing
- Priority designator routing

MESSAGE PROCESSING

- Protected message switching and/or inquiry/response message switching



- Header/ender stripping
- Header/ender build
- Intercept of erroneous messages
- On-line message correction
- Input/output message numbering
- Multiple priority output queuing by line (up to four levels)
- Multiple priority output queuing by station (one or two levels on selected dial-out service)
- Code conversion (up to 15 different code sets per EU)
- Time-scheduled dial-out to specified terminals

SUPPORT SOFTWARE

- Utility Routines — Disk, Tape, Card, Printer
- Test Aids
- Program Production System (PPS)
- Assembler
- Library Maintenance
- Link Editor
- Load Tape Generator
- FORTRAN Compiler
- Source Module Control System
- Diagnostics
- Measurements Package
- System Stimulator

MISCELLANEOUS

- On-line retrieval (disk and magnetic tape)
- Terminal (data processor) speed transformation
- Power isolation points

4.0 INTERFACES

ASYNCHRONOUS

- AT&T 83B
- Freewheeling Baudot TTY
- Freewheeling ASCII TTY
- AT&T 81D1
- AT&T 8A1
- AT&T 85A
- Dial-In Domestic Telex
- Dial-In/Out TWX
- Dial-In/Out TTY
- ATA/IATA Low-Speed

SYNCHRONOUS

- Point-to-Point Binary Synchronous (ASCII, EBCDIC, Transparent)
- Dial-In/Out Binary Synchronous (ASCII, EBCDIC, Transparent)
- ATA/IATA Medium-Speed

CHANNEL

- 270X Emulation

5.0 BASIC SYSTEM COMPONENTS & CONCEPTS

The CYBER 1000 PMX System is composed of one or more data communications centers called Exchanges. Each Exchange provides communications service for the lines and devices which it terminates. When a system consists of more than one Exchange, the Exchanges are interconnected by communications lines or trunks of speeds appropriate to the system requirements.

An Exchange is a complex of one or more identical CYBER 1000 Exchange Units (EUs). In a Multi-EU Exchange, each EU terminates a portion of the lines, shares the total traffic load and provides redundancy for protection against equipment failures. Communication between EUs is provided by a disk-trunking process which optimizes intra-exchange communications, while maintaining complete message protection.

Complete message protection is provided by the recording of all message traffic and system status information on secondary storage, consisting of a sealed, fixed-head disk unit. This information, recorded redundantly, is accessed to provide recovery data in case of failure.

Modularity of memory and secondary storage permits tailoring of throughput capability to user requirements. A shared-load concept inherent in the design of Exchanges provides extremely high system efficiency, since each EU performs useful work at all times, assuming its backup function only upon failure of an associated processor. This feature also permits expansion with minimal system interruption.

An EU consists of a special-purpose communications processor, semiconductor memory, fast access disk storage, line termination equipment, and other input/output devices. The EU is modular with respect to these components (except the processor, which is a fixed component of each EU); and the kinds and amounts employed are dependent on the application.

Control of input/output operations to and from data processors and terminals is performed by Terminal Interface Packages (TIPs). TIPs consist of hardware and software modules which allocate functional responsibilities between the hardware and software. Some TIPs have special-hardware, control-character decoding; others perform this function as software.

Remote TIPs (RTIPs) are used to support terminals and data processors when a communications line connection is used. A Local TIP (LTIP) is used when direct channel connection is required for the interface between the CYBER 1000 and a data processor. The Microprogrammable Communications Controller (MPCC) may be installed directly on the I/O channel of the data processor. The MPCC may be programmed to emulate a standard telecommunications control unit of the data processor.

Each EU in a CYBER 1000 PMX Exchange will normally control the lines connected to it. It will issue polls and calls as required, receive and evaluate responses, and monitor the lines for error conditions. Proper handling and routing of all messages is accomplished within specific systems parameters entered via the console. The PMX can also terminate uncontrolled inputs.

Transmissions received from any line can be routed (switched) to any station(s) in the network if properly addressed. If any station or stations direct messages to only one fixed destination, the incoming messages from each station can be directed via implied routing, i.e., the input station implies the message destination and the messages need not be addressed. Switched messages with improperly formatted addresses will be intercepted by the PMX and delivered to the intercept station designated for the input station generating the message. The texts of all messages received are delivered to the designated for implied) outstation(s) without change, except for code translation where required. Normally, all received messages are stored on disk. However, an optional capability for fast processing of messages, without protection on disk, is available.

A record of all protected messages through each EU is maintained on the EU's disk system(s), and the disk system(s) of the neighbor EU, to the limit of their available capacity. Messages so stored may be automatically retrieved by request from any of the outstations to which they were originally directed, or from the Exchange Console(s). If desired, this retrieval capabiliy is expanded by the use of extended storage on disk packs and journal records on magnetic tapes.

6.0 SPECIFICATIONS

BASIC EXCHANGE UNIT

- Memory: includes 65K words of 27-bit (8-bit bytes plus parity) semiconductor memory per EU, operated at 1200-nanosecond cycle time.
- Fast Access Disk Storage: 12 or 24-million-bit, fixed-head disk per EU.
- Medium-Speed Multiplexer: Line scan capability for up to 128 lines (primary) and up to 128 lines (secondary) per EU, a speeds to 9600 bps.
- Line termination: capability for 32 full-duplex lines is provided when suitable line module interface equipment is installed (see Expansion).
- I/O Channels: 12 maximum.
- Control Display: Control display group with individual EU control and display capability with M35 Exchange Console.
- Magnetic Tape: 800/1600 bpi, dual-mode, 50 ips.

EXPANSION

- Memory: Up to 262K words maximum per EU (in increments of 32K words).
- Line Termination: Up to 128 full-duplex connections per EU (two increments of 48 each).
- High-Speed Multiplexer: Line scan capability for up to 32 lines (primary) and up to 32 lines (secondary) per EU, at speeds to 230K bps. Line termination capability for up to 32 full-duplex lines when suitable line module interface equipment is installed. Note: Combined total of lines serviced by medium-speed multiplexer and high-speed multiplexer does not exceed 128.
- Exchange: Up to eight EUs.

OPTIONAL PERIPHERALS

- Magnetic Tape Transports: Up to six different configurations of dual and single transports and combinations per Exchange; one configuration per EU.
- Rotating Mass Storage: Disk Pack Storage — 40 million bytes each (up to eight units per EU).
- Peripheral Controller: Controlling card punch, card reader and line printer or any combination thereof.
- Interface equipment for data processor front-ending via communications line, direct channel connection, or a combination of these.
- Teletype Corporation Model 40 as Exchange Console.

POWER REQUIREMENTS PER EU

- 120v ±10 percent
  60 Hz ±1/2 Hz
  Single phase
  4.2 kva (2.5 kva nominal)

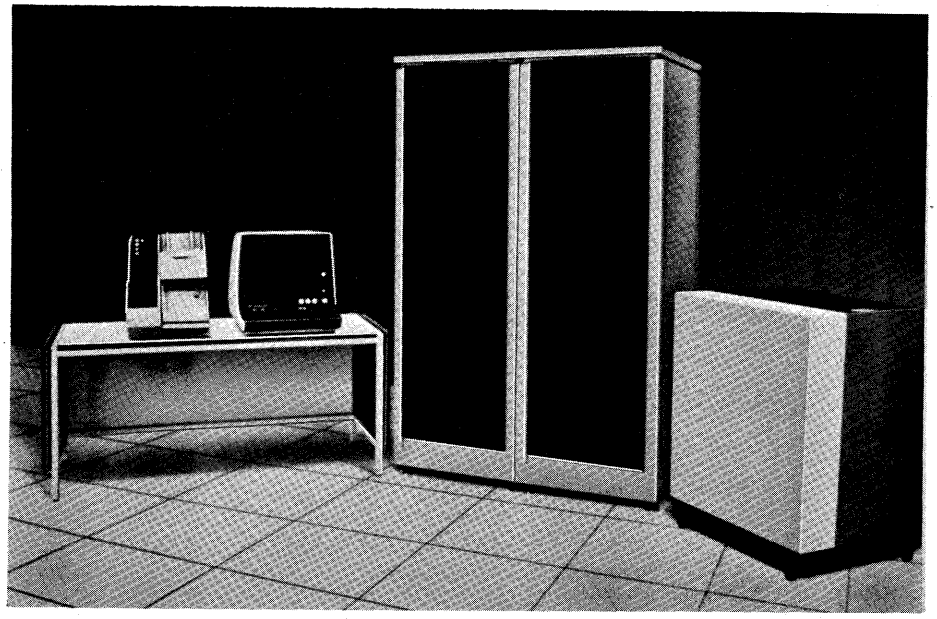
HEAT DISSIPATION PER EU

- 14,200 Btu/hr

PHYSICAL CHARACTERISTICS

- Exchange Unit:
  Width: 80.3 in.
  Depth: 30.0 in.
  Height: 73.0 in.
  Weight: 1800 lbs.
- Control Display Group: (Desk, Chair and Displays)
  Width: 54.0 in.
  Depth: 24.0 in.
  Height: 53.5 in. (maximum)
  Weight: 100 lbs.
- Typical Magnetic Tape Transport Cabinet:
  Width: 28.0 in.
  Depth: 30.0 in.
  Height: 73.0 in.
  Weight: 500 lbs.
- Disk Pack Storage (per Drive):
  Width: 27.5 in.
  Depth: 37.5 in.
  Height: 28.0 in.
  Weight: 600 lbs.

CONTROL DATA 225X NETWORK PROCESSING UNIT



1.0 INTRODUCTION

The CONTROL DATA® 255X Network Processing Unit (NPU) is a combination of hardware modules designed to meet varying customer requirements — from the very small to the very large. The NPU interfaces to CONTROL DATA® CYBER 170, CYBER 70, 6000, or 3000 Lower Series Computer Systems. The Communications Control Program (CCP), resident in the NPU, includes variants that allow intercommunications with either Network Operating System (NOS) or Network Operating System/Batch Environment (NOS/BE). In addition, the 2550-100 Emulation Module is available to replace 6671/6676 Data Set Controllers.

A primary element of each NPU system is a Communications Processor (CP). It provides buffer storage for input and output data, and includes hardware interfaces to both the host processor and the multiplex subsystem. The NPU also performs, under the control of software and firmware, many of the functions which are dependent upon the characteristics of terminal devices and of other network elements. This, in turn, reduces the cost and variation of hardware line adapters, and facilitates the incorporation of new terminal types into the network.

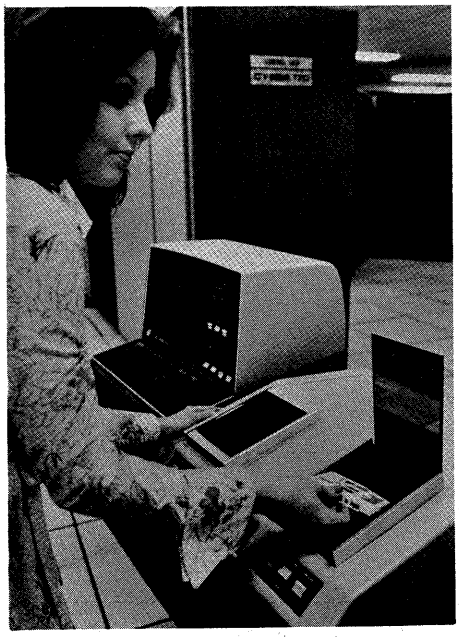
The basic element of the multiplex subsystem consists of two very high-speed, digital-data, multiplex-loop circuits: one dedicated to the handling of input from terminals to the communications processor, the other to output from processor to terminals.

This basic element is combined with other elements, such as processor interface, circuit interface and control, to form the total communications system.

The design of most multiplexing subsystems is based on a scanning technique, in which each line interface is periodically interrogated to determine whether action is required, such as removal of an input character from a buffer, or providing another character for output. This scan function must be performed for each circuit at a rate which cannot be less than once during each character-time of the fastest line. Since this operation consumes time, the number of connected circuits and their speed have a direct bearing upon system capacity, regardless of the amount of traffic handled.

By contrast, the CDC multiplex subsystem is demand-driven. When acion is required by a circuit interface, it will generate a demand-service request to the communications processor. Circuit connectability becomes a factor only in the specification of numbers of circuits that can be physically terminated and addressed. Consequently, system configuration is greatly simplified by the fact that it is largely governed by throughput volume.

Associated with the NPU is a software package identified as the Communications Control Program (CCP). This software accomplishes the overall functions of interfacing to the host computer and to a variety of terminals. The CCP is modularly structured to provide the capacity to meet future network implementations. It also takes maximum advantage of the hardware features of the NPU. The software and hardware are designed as an integrated, modular, expandable communications system.



The 255X NPU has been selected by universities, corporations, government and military installations, research institutes, and hospitals for a variety of reasons. The major reason for selection has been the versatility of the unit due to the modular structure of its hardware and software. This modularity has permitted implementation for the needs of today with ease of expansion to handle the requirements of tomorrow.

2.0 BASIC SYSTEM COMPONENTS & CONCEPTS

The NPU is a new communications product to serve the data communications handling functions for the CDC® CYBER 170, CYBER 70, 6000, and 3000 Lower Series Computer Systems. The NPU design integrates state-of-the-art hardware with new software concepts to provide a cost-effective, modular and highly flexible solution to data communications requirements. The NPU is composed of a series of common hardware and software elements.

The Communications Processor (CP) is a 16-bit processor which operates in parallel mode. The program is stored in main memory (a high-speed solid state medium) while the microcode which specifies how the program instructions are to be executed is stored in micromemory. The microcode available with the CP implements an instruction set offering an expanded repertoire of instructions. The microcode also provides additional power for character and field manipulation, indexing and other communications-oriented processes.

The NPU firmware emulates the 16 levels of vectored interrupt featured by CDC 1700 Series Computers. This system consists of 16 levels of external interrupt, 16 levels of internal interrupt, and 16 levels of interrupt used by the multiplex subsystem. Certain conditions (such as demand for an output character or receipt of data) will generate an internal interrupt. External interrupts occur when a computer peripheral device has finished an I/O operation or requires attention.

The strength of the interrupt scheme is its ability to handle a significant number of interrupts in a flexible and efficient manner. Comparatively few computers provide as many discrete interrupts as does the CP.

The re-loading of programs is provided by an autoload, implemented in microcode sequence. The operator can downline load the CP from the associated host computer. Alternatively, any readable device could be used as a loading medium with the appropriate firmware control sequence. The system will support auto-load via two schemes.

- Downline via Channel Coupler
- Local via Cassette Tape (maintenance)

The CP features a maintenance console panel which is also usable by programmers and provides for:

- Display of Register Contents
- Display of Memory Locations
- Operating Switches
- Indicators

The above functions can also be implemented via the communications console.

The CP features both a direct memory access (DMA) interface to peripherals and a program interface to peripherals. Using the interrupt data channel (IDC) interface, the program controls the data transfer, employing one register to address the desired peripheral and another register to transfer data, commands, or status between CP and the peripheral.

The DMA channel permits direct transfer of data between the peripherals and main memory, bypassing the CP main registers. The DMA channel can handle far more data than the IDC with less CP supervision.

The Channel Coupler provides a low-cost communications link between a CDC CYBER Host Computer and the CP in an NPU.

The primary function of the coupler is to pass 8-bit data characters directly between the computer memories with minimum software supervision.

The coupler provides the means for transfers between Peripheral Processor Unit (PPU) and CP at PPU-channel transfer rate. Supervision is via both PPU and CP software

commands, and control words in the CP buffer. Buffer chaining in the CP memory is provided.

All coupler operations are initiated by PPU function commands and/or CP I/O commands. The transfer of data between computers also requires additional PPU I/O instructions and control words in CP memory.

The optional addition of a second channel coupler to the configuration allows various interconnection options, such as two connections with one host.

The feature setting the NPU apart from traditional communications processors is its use of demand-driven multiplexing instead of scanning. Processor intervention is required only when data blocks require servicing. The hardware and firmware associated with this concept, within the NPU, are known as the multiplex subsystem.

The component units which make up the multiplex subsystem are:

- Multiplex Loop Interface Adapter (MLIA)
- Loop Multiplexer (LM)
- Communications Line Adapters (CLAs)
- Programmable Cyclic Encoder

The MLIA is an integral part of the multiplex subsystem. It interconnects the CP and the LMs providing serial-to-parallel, and parallel-to-serial data conversions, loop control and error monitoring plus buffering of communications demand peaks in both directions.

The LM provides the electrical and mechanical interface between the multiplex loop and CLAs which reside within the LM.

The LM consists of one loop interface logic card and a wired-card enclosure with connectors suitable for rack mounting.

FUNCTIONAL FEATURES

- CLA demand-driven information flow
- 20 x 10^6 bps loop speed
- 8 LMs per multiplex loop
- 32 lines maximum serviced per LM (maximum of 254 lines serviced by all LMs combined)
- Cyclic check — character generation on high-frequency input loop
- Cyclic check — character verification on high-frequency output loop
- Transparent data handling
- Error response on input loop
- Error response on output loop

The LM connects to other LMs and the MLIA via two coaxial cables (the I/O loops).

CLAs are used to interface the NPU to the communications facilities and provide level conversion and isolation, control, and interim character buffering.

Detailed configuration information for CLAs in a specific system may be obtained from local CDC offices.

There are two classes of CLAs. They are for:

- Asynchronous Transmission
- Synchronous Transmission

Asynchronous CLA

- *Half-duplex operation
- *Full-duplex operation
- *Echoplex operation
- *Variable baud rate (45 to 9600 baud — all standard speeds)
- *Input and output speeds may be different
- *1, 1.5, or 2 stop bits
- *Even, odd, or not parity check on input
- *Even, odd, or no parity generation on output
- *Loopback self-test mode
- *Break detection and generation
- *Reverse channel detection and control
- *Data transfer overrun detection
- Variable 8-bit CLA address
- Full EIA RS232C/CCITT V.24 Interface
- 2 asynchronous CLAs per card
- Modem interface connector on the front of the card
- Modem indicator lamps on the front of the card
- State-of-the-art technology (MSI and LSI)
- Card size = 11" x 14"

*Program-controlled

Synchronous CLA

- *Half-duplex operation
- *Full-duplex operation
- *Variable code length (5 to 8 bits plus parity per character)
- *Variable baud rate to 9600 bps (determined by modem)
- Transparent data handling
- *Variable synchronization character
- *Loopback self-test mode
- Provision for external modem clock source
- Variable 8-bit CLA address
- EIA RS232/CCITT V.24 interface
- AT&T 301/303 interface
- CCITT V.35 interface
- 2 synchronous CLAs per card
- Modem interface connector on the front of the card
- State-of-the-art technology (MSI and LSI)
- Modem indicator lamps on the front of the card
- Card size = 11" x 14"
- Local terminal connection optional

*Program Controlled

3.0 SPECIFICATIONS

Detailed configuration information may be obtained from local CDC offices.

BASIC NETWORK PROCESSING UNIT

- Memory: Includes 32K or 16-bit semiconductor memory, operated at 550 nanoseconds cycle time.
- Line Termination: Up to 32 full-duplex lines when appropriate CLAs are installed.
- CYBER Coupler: Connects to CYBER 70/170 Peripheral Processing Unit.

EXPANSION

- Memory: Up to 131K words maximum (in increments of 16K words or 32K words)
- Line Terminations: Up to 128 full-duplex lines (in increments of 32 lines), when appropriate CLAs are installed
- Second CYBER Coupler: To a second CYBER 70/170 Peripheral Processing Unit.

OPTIONAL PERIPHERALS

- CONTROL DATA 2572-1 Card Reader: 300 cpm
- CONTROL DATA 2570-1 Line Printer: 300 lpm

POWER REQUIREMENTS PER BASIC NPU

- 120v ±10%
- 60 Hz Nominal
- Three-Phase
- 4.8 kva

HEAT DISSIPATION PER BASIC NPU

- 11,500 Btu/hour (Basic unit with 32 line terminations)

PHYSICAL CHARACTERISTICS

- Network Processing Unit:
  Width: 48.0 in.
  Depth: 34.0 in.
  Height: 75.0 in.
  Weight: 950 lbs.

- Communications Console: (CDC 713-10)
  Width: 18.0 in.
  Depth: 29.0 in.
  Height: 18.0 in.
  Weight: 75 lbs.
- Line Printer (CDC 2570-1)
  Width: 37.5 in.
  Depth: 27.0 in.
  Height: 39.5 in.
  Weight: 75 lbs.
- Card Reader (CDC 2572-1)
  Width: 14.0 in.
  Depth: 21.0 in.
  Height: 17.0 in.
  Weight: 55 lbs.

4.0 DEVELOPMENTS

The NPU will be significantly enhanced over the next few years as part of CDCs Network Products Development Plan. Specific planned enhancements include:

- Termination of High-Speed Communications Lines, up to 56 kbps
- Support of Remote NPU, including Downline Load by a CYBER 70/170 Host Computer
- Connection of one NPU to two CYBER 70/170 Host Computers
- Higher Capacity
- CONTROL DATA Communications Control Procedure (CDCCP) with Synchronous Data Link Control (SDLC) as a subset

MICROPROGRAMMABLE COMMUNICATIONS CONTROLLER (MPCC)

1.0 INTRODUCTION

The CONTROL DATA® Microprogrammable Communications Controller (MPCC) is available to provide direct channel connection of a non-CDC host computer to:

- one or more CYBER 1000 Computers, or
- other computers or terminals.

The MPCC attaches to the I/O Channel of the host computer as a replacement for the communications controller supplied by the host computer vendor. The MPCC provides a low-cost, high-throughput, very flexible means of interfacing computers or terminals to the host computer. Two MPCCs may be arranged in a dual configuration.

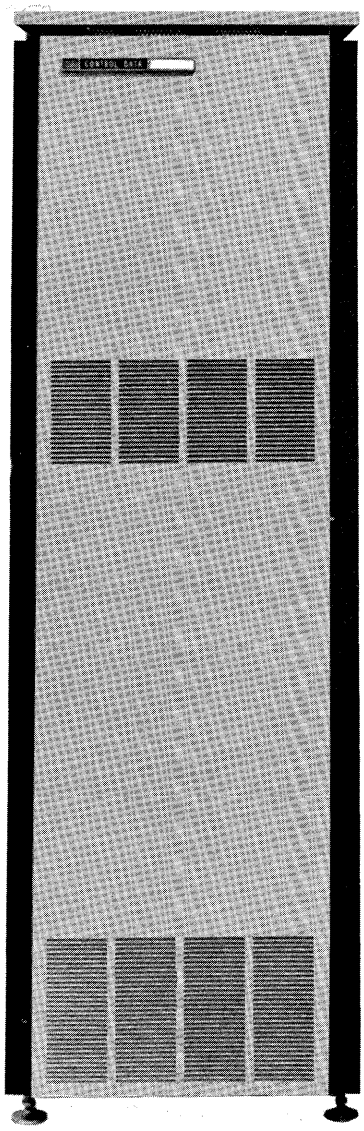
2.0 BASIC SYSTEM COMPONENTS & CONCEPTS

The Microprogrammable Communications Controller directly connects to up to two host I/O Channels, thereby replacing any existing communications controllers, such as UNIVAC CTMCs and CSPs or IBM 270X TCUs and 3704/3705 Controllers. Connection to each host channel is accomplished by a Microprogrammable Control Board supplied with appropriate driver/receiver electronics consistent with the host electrical interface characteristics.

MPCC connection to the CYBER 1000 is accomplished in two ways: (1) direct connection via the CYBER 1000 Memory Access Controller (MAC) through a MAC Interface Unit (MIU) with data transfer rates at CYBER 1000 Memory speeds; or (2) remote connection via communications lines (i.e., Modem Interface). Up to 32 medium- and high-speed communications lines may be attached to a MPCC via its Communications Line Adapters (CLAs), with data transfer rates up to 56 kbps per line, subject to overall system capacity limitations. Flexibility, provided by the programmable capabilities of the MPCC, allows the CYBER 1000 to adapt easily to a reasonable host interface requirement, while retaining its own network communications capabilities.

The IBM interface presently available provides for connection to the byte or block multiplexer channels or the selector channel. Up to 256 subchannel addresses are detectable on the multiplexer channels with no grouping restrictions. The MPCC is plug-compatible with an IBM 3705 and can coexist on a multiplexer channel with other devices. The interface also accommodates the Emergency Power Off (EPO) function.

The Microprogrammable Communications Controller is a highly-flexible, multipurpose, stored-program, controller and converter that employs the latest technology. Instructions are 16 binary bits in length, data paths are 8 bits parallel and fast solid-state memory (55 nanoseconds) is used.



Direct addressing of up to 65,536 sixteen-bit words is provided.

Two levels of microprogramming are provided. The first level provides standard microprogramming features to control and manipulate data. The second level allows the user to construct his own instruction repertoire for special requirements. Both levels of microprogramming are controlled by Read Only Memory (ROM). Random Access Memory (RAM) is also used.

The high speed of instruction execution (125 nanoseconds for a one-cycle instruction) makes it ideal as a communications controller.

Input/output functions are provided by a parallel 8-bit bidirectional external data bus. In order to enhance control functions, a flexible, masked, priority interrupt scheme has been implemented. Both active and programmed interrupts are available.

A Control Console is available as an option, but is not required for normal operation. A Monitor Control Panel is provided for speedy troubleshooting in the event of a malfunction.

The large number of parallel data paths between all of the operating registers allows great flexibility. The ability to construct a unique instruction repertoire, at the microcode level, allows almost any solution to be custom-tailored for the task at hand. Thus, the MPCC provides a readily-available tool for the emulation of other existing controllers.

3.0 SPECIFICATIONS

BASIC MPCC

- Memory: includes 4K words of 16-bit semiconductor memory, operated at 55-nanosecond cycle time.
- Maintenance panel
- Line Termination/CYBER 1000 access: either
  (a) up to four full-duplex connections (to 56K BPS), or
  (b) direct access to CYBER 1000 memory
- Host Computer Channel Interface: interface to the I/O channel of one host computer. If IBM multiplexer channel, up to 256 subchannel addresses are detectable. Emergency Power Off is supported.
- Magnetic Tape Cartridge: for loading of the basic MPCC (and also a second MPCC, if present)

EXPANSION

- Memory: Up to 65K words maximum (in increments of 4K)
- Line Terminations: Up to 32 full-duplex connections (to 56K bps), if direct access to CYBER 1000 memory not used.
- Host Computer Channel Interface: interface to the I/O Channel of a second host computer.
- Second MPCC: may be installed in the same cabinet as the basic MPCC.

POWER REQUIREMENTS for BASIC MPCC

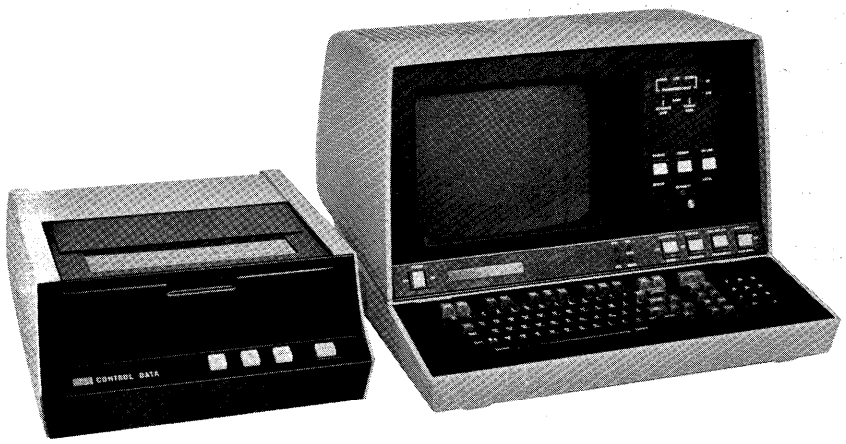
- 120v ±10 percent
- 60 Hz nominal
- Single-phase, 30a service

HEAT DISSIPATION for BASIC MPCC

- 3,300 Btu/hr

PHYSICAL CHARACTERISTICS

- Single or dual MPCC with up to 32 line terminations is contained in one standard Control Data cabinet.
  Width: 24.0 in.
  Depth: 34.0 in.
  Height: 75.0 in.
  Weight: 475 lbs.



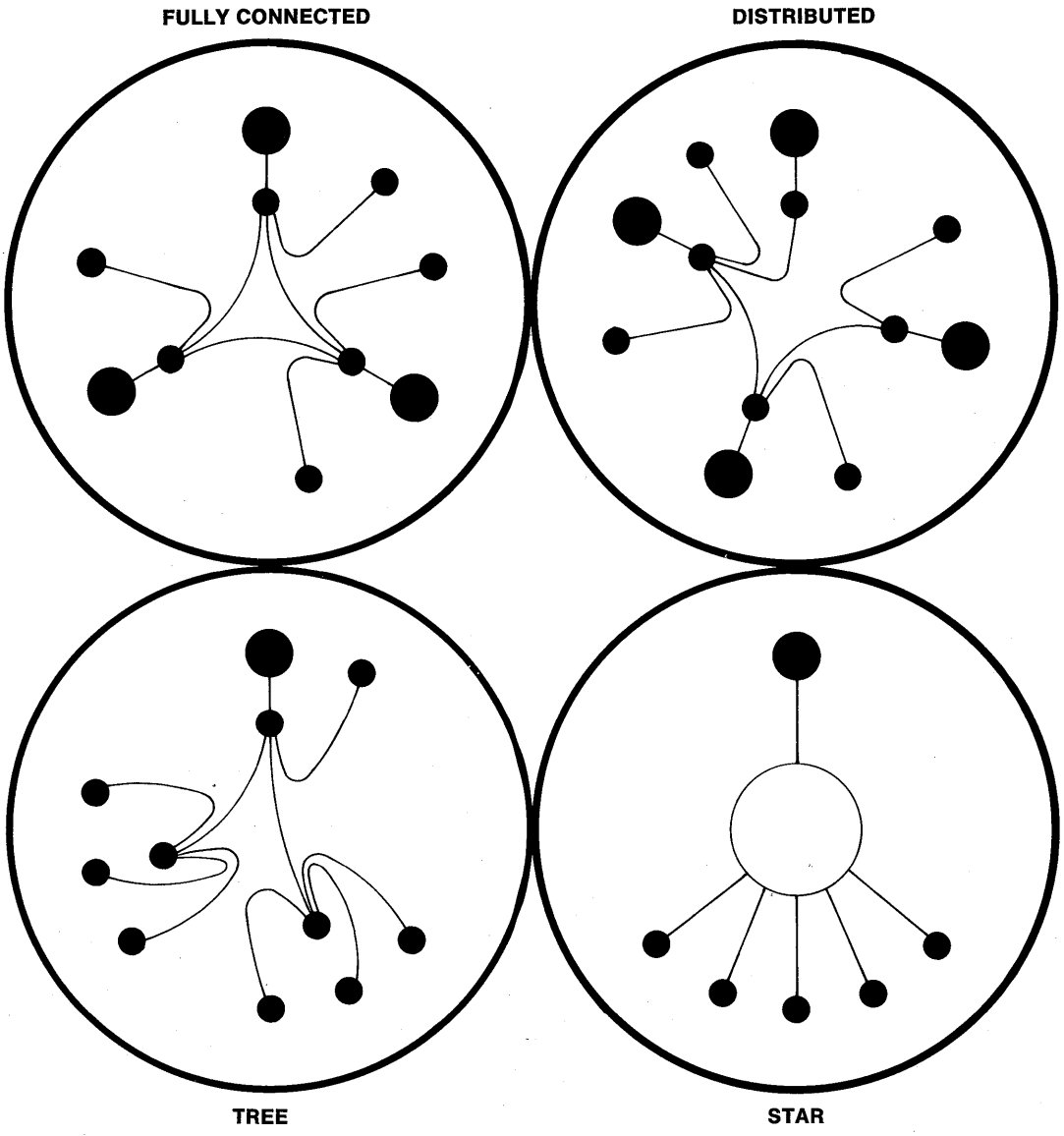
OPTIONAL EQUIPMENT

- Control Console

4.0 DEVELOPMENT

Planned enhancements for the MPCC include:

- Increase data paths to 16 bits and 32 bits
- Increase speed to 10 mHz (100 nanoseconds/instruction)



Control Data Corporation has the products, systems, services, expertise and resources to plan, design, implement, install, and provide on-going support for your data communications needs from the smallest to the largest in any type of network.

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