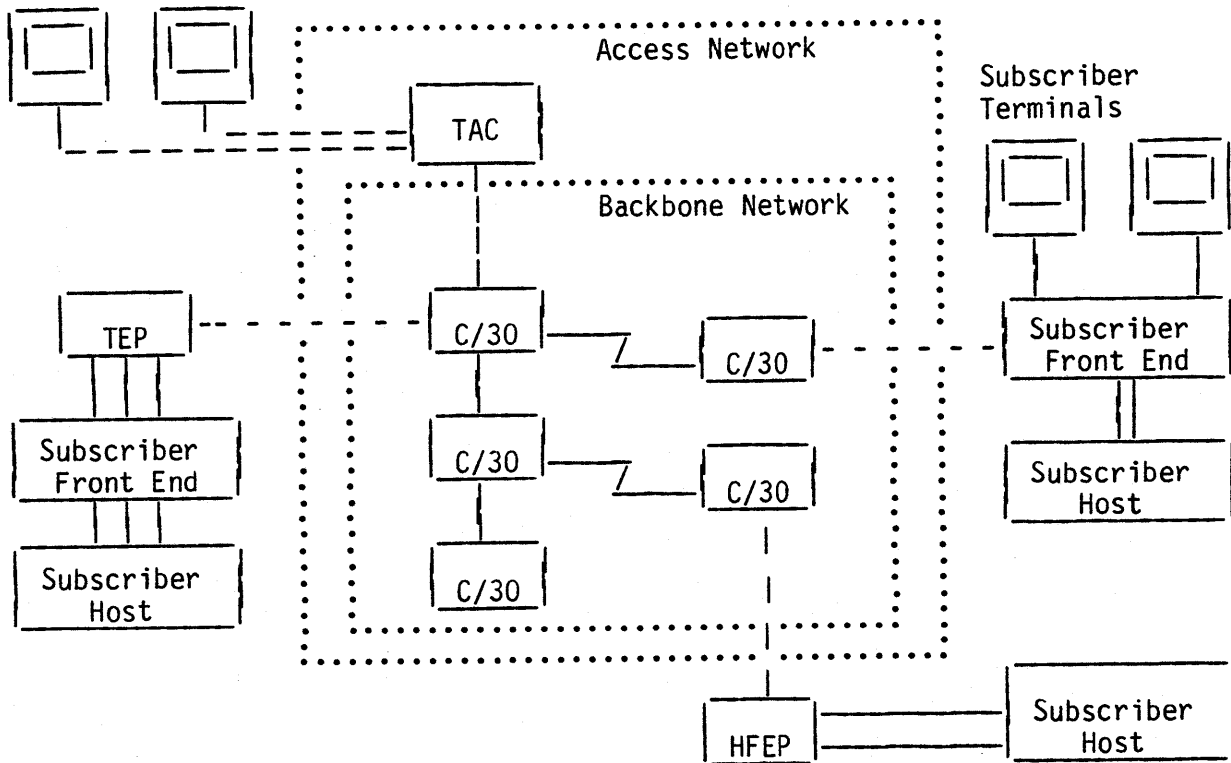


JOHN & DEAN SHOW

---

DDN / CDNET OVERVIEW  
CLASS

Network Terminals



- C/30 Packet-Switching Node (i.e. IMP - Interface Message Processor)
- HFEP Host Front End Processor
- TAC Terminal Access Controller
- TEP Terminal Emulation Processor

Defense Data Network Components

Network Layer Model  
Open Systems Interconnect

1 Physical Layer

- Actual Connection between Network Nodes
- Defines Electrical Characteristics of Wire
- Defines Signals and Number of Wires
- E.g. RS232, RS449

2 Data Link Layer

- Synchronizes Sending and Receiving Data Stream
- Breaks Bit Stream into Frames
- Bit Level Error Detection and Recovery
- E.g. HDLC, SDLC (IBM)

3 Network Layer

- Routes Messages from Source to Destination Node
- May Route over Several Network Nodes
- May Route over Several Different Kinds of Networks
- Messages May be Discarded, Out-of-Order, Duplicated, Damaged
- Defines the Addressing Scheme(s)
- E.g. X.25, ARPANET

4 Transport Layer

- Provides End-to-End Control of Data
- Connection Oriented
  - Open - Send/Receive - Close
- Data is Ordered and Reliable
- Unaware of Routes Used to Deliver Data
- E.g. Network Access Method (NAM)

Network Layer Model  
Open Systems Interconnect

5 Session Layer

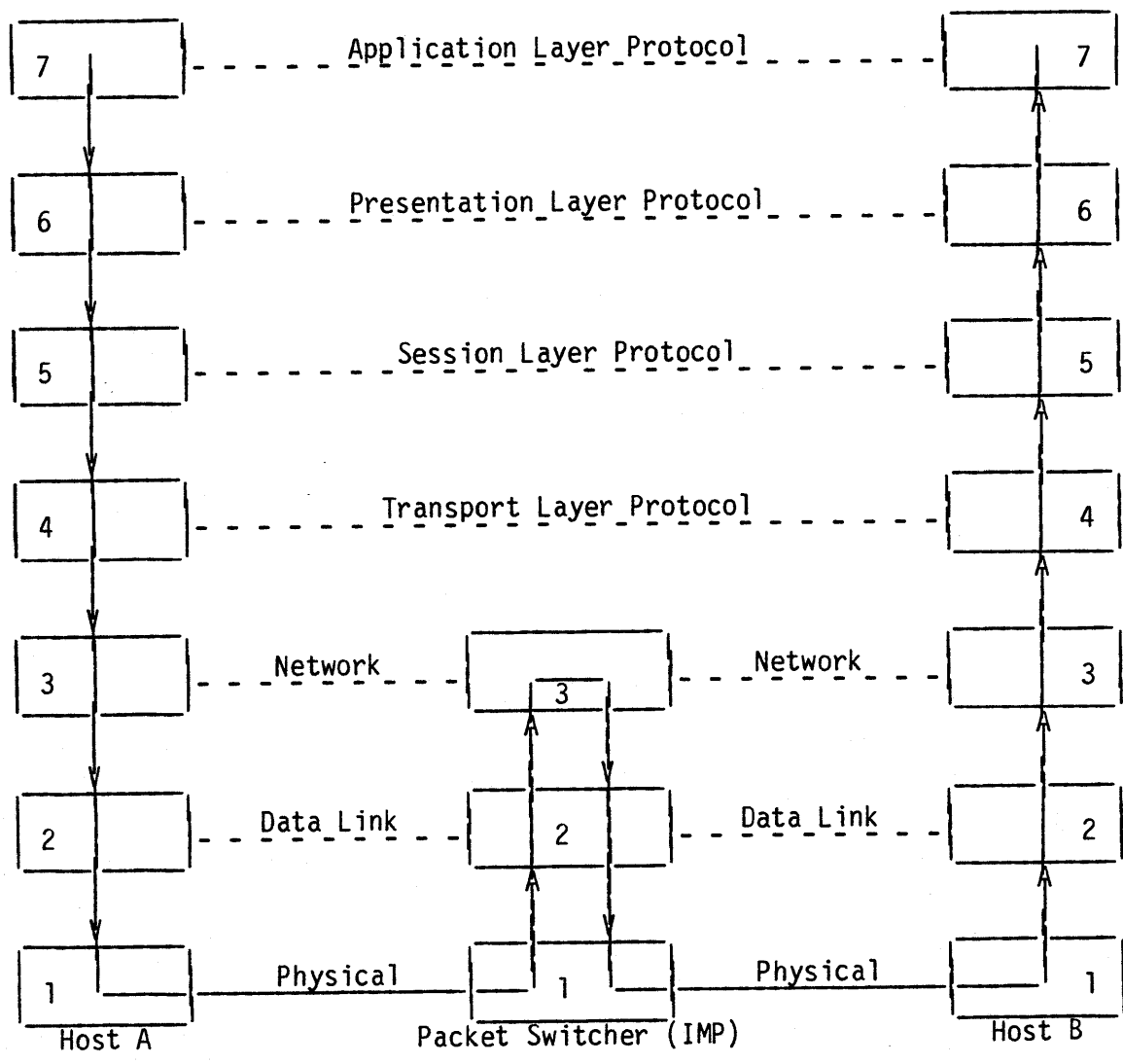
Network Independent Dialogue Between Users/Applications  
Performs Name/Address Translation  
Provides Session Synchronization and Recovery  
Frequently Combined with Presentation  
E.g. IAF, MFLINK (PTF)

6 Presentation Layer

Provides Useful Transformations on Data  
Character Set Conversion  
Text Compression  
Encryption  
Representation Differences (e.g. floating point)  
Frequently Combined with Session  
E.g. IAF, MFLINK

7 Application Layer

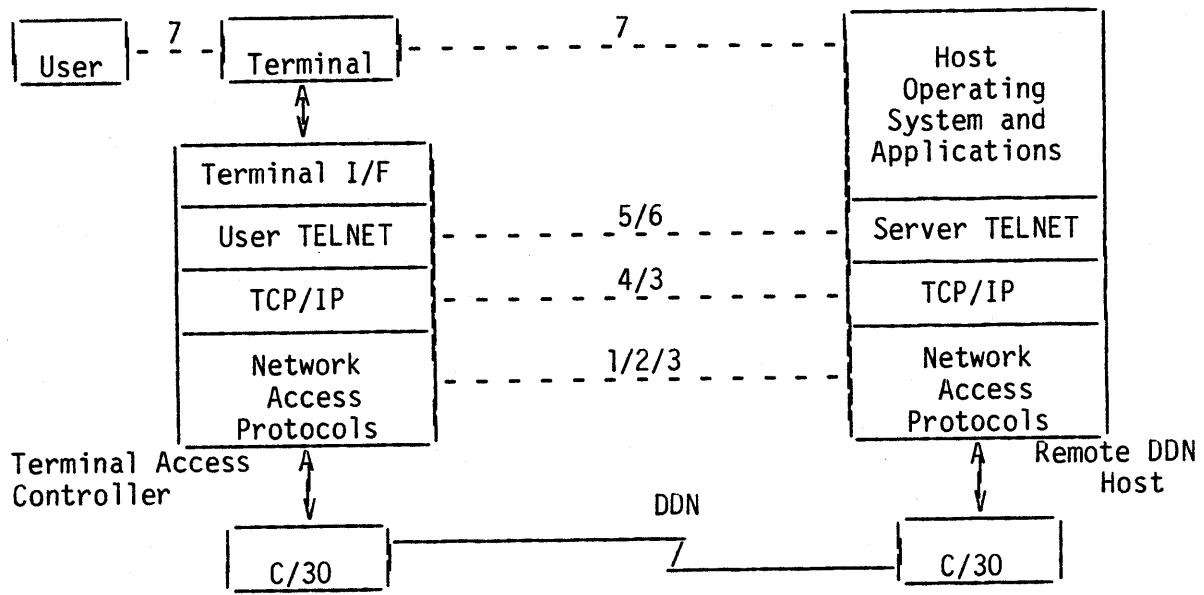
Actual User or Application that Accesses Network Services  
E.g. Terminal User, NOS Control Statement



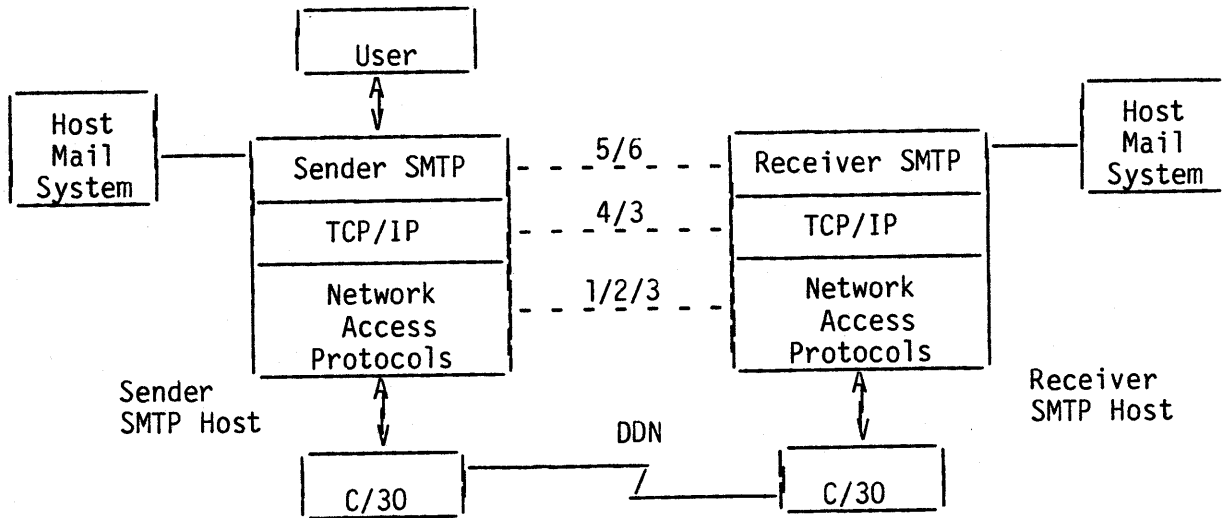
ISO Reference Model

## DDN Protocols

1 Physical	ARPANET 1822, RS232, RS449
2 Data Link	ARPANET 1822, HDLC/LAPB (X.25)
3a Network	ARPANET 1822, X.25
3b Network	Internet Protocol (IP)
4 Transport	Transmission Control Protocol (TCP)
5 Session	Three Required Protocols
6 Presentation	File Transfer Protocol (FTP) Simple Mail Transfer Protocol (SMTP) Terminal Interface (TELNET)

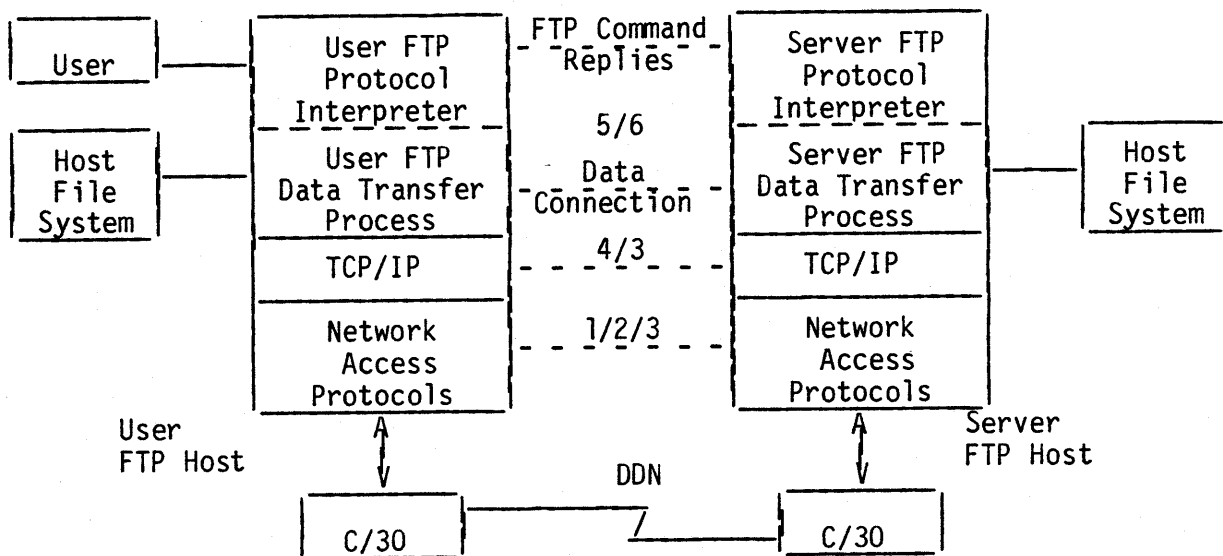


DDN TELNET Protocol Function



DDN Simple Mail Transfer Protocol (SMTP) Function





DDN File Transfer Protocol (FTP) Function

## CDCNET Components

- DI Basic Device Interface  
Cabinet  
Power Supply and Cooling  
Slots for 8 Large Boards  
Slots for 8 Small Boards
- MPB Main Processor Board  
Primary CPU for a DI  
Random-Access Memory, some Battery-Backed.  
Read-Only Memory (for bootstrap and diagnostics).
- SMM System Memory Module  
Primary DI Memory Resources  
Accessible by all Boards
- PMM Private Memory Module  
Fast-Access Memory  
Accessible only by MPB
- ESCI Ethernet Serial Channel Interface  
Provides interface to Ethernet Transceiver  
MC68000 Processor, plus special Ethernet chips
- MCI Mainframe Channel Interface  
Provides interface to CYBER I/O Channel  
MC68000 Processor, plus channel interface circuits
- LIM Line Interface Module  
Small Boards  
Provides interface to terminals and other standard lines  
E.g. RS232, RS449, V21.
- CIM Communications Interface Module  
Controls up to 8 Line Interface Modules

## Device Interface Types

### MDI Mainfram Device Interface

Provides CYBER Mainframe Connection to CDCNET.

MPB Main Processor Board  
SMM System Memory Module  
PMM Private Memory Module  
ESCI Ethernet Serial Channel Interface  
MCI Mainfram Channel Interface

### TDI Terminal Device Interface

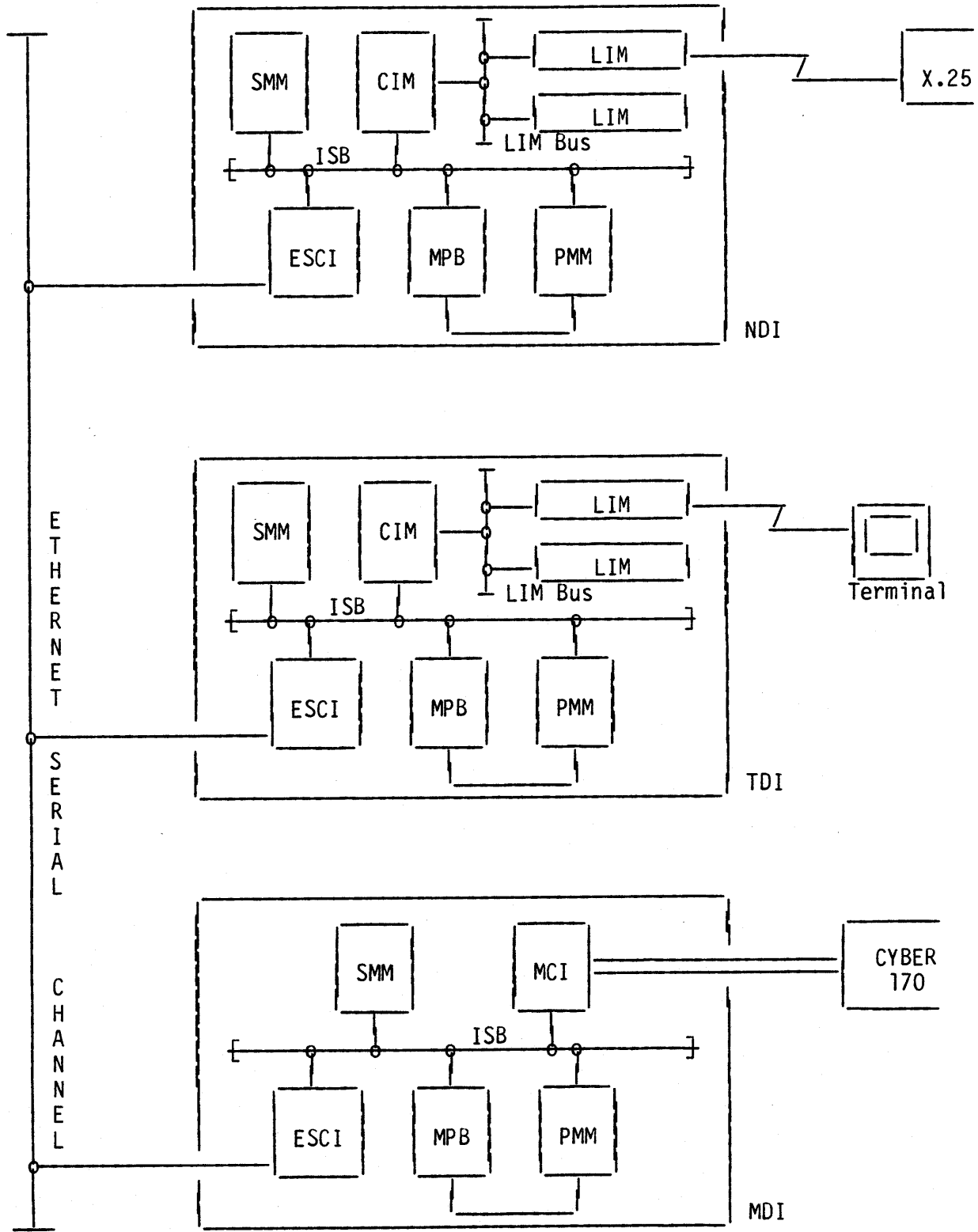
Provides Terminal connections to CDCNET

MPB Main Processor Board  
SMM System Memory Module  
ESCI Ethernet Serial Channel Interface  
CIM Communications Interface Module  
LIM Line Interface Module(s)

### NDI Network Device Interface

Provides External Network Connections to CDCNET

MPB Main Processor Board  
SMM System Memory Module  
ESCI Ethernet Serial Channel Interface  
CIM Communications Interface Module  
LIM Line Interface Module(s)



Generic CDCNET Hardware Configuration

CDCNET Software Components  
Interface Components

ASync TIP

Asynchronous Terminal Interface Program  
Provides Terminal Control and Interface  
(e.g. character conversion, page wait)

IVT Gateway

Interactive Virtual Terminal Gateway  
Provides Interface to CYBER Interactive Services  
Transformation between CDCNET and CYBER Formats

X.25 Gateway

Provides Interface to X.25 Packet Networks  
(e.g. TELENET, TYMNET)

CDCNET Software Components  
Upper/Core Layer Components

CDNA Session Layer

Implements OSI Layer 5  
Based upon NBS Session Standard  
Provides Named, Network-Independent Services

Generic Transport

Not Technically an OSI Layer  
Provides Standard Transport Interface for Multiple Protocols  
Resides Between Session and any Real Transport Layer

Xerox Transport

Implements OSI Layer 4  
Xerox Ethernet Transport  
Provides reliable, ordered data connections

CDNA Internet 3B

Implements part of OSI Layer 3  
Routes Messages between Concatenated Networks

CDNA Generic Intranet

Not Technically a Layer, resides between 3A and 3B  
Provides Standard Interface for Multiple Network Solutions

CDCNET Software Components  
Network Solution Layer Components

Ethernet Network Solution

ESCI 3A

Implements part of OSI Layer 3  
Xerox Ethernet Protocol  
Provides Packet Delivery to Directly-Connected Nodes

ESCI SSR

Implements OSI Layer 2  
Xerox Ethernet Protocol  
Ethernet Stream Service Routine

ESCI Driver

Implements OSI Layers 2/1  
Firmware to Control ESCI Board

X.25 Network Solution

X.25 Packet Level

Implements part of OSI Layer 3  
CCITT X.25 Packet Layer Standard  
Provides Packet Delivery to Directly-Connected Nodes

HDLC SSR

Implements OSI Layer 2  
CCITT High-Level Data Link Control Protocol Standard  
HDLC Stream Service Routine

CDCNET Software Components  
Network Management-Entities (M-Es)

Routing

Exchanges Routine Information with other DIS

Directory

Exchanges names of available protocols and services with other DIS

File Access

Provides DI access to mainframe-resident disk files

Command

Routes and Executes operator and terminal user commands

Log

Processes and Routes log messages to mainframe and/or operator

Alarm

Processes and Routes alarm messages to mainframe and/or operator

Clock

Synchronizes and maintains DI-resident clocks

Echo

Provides common echo source for diagnostic uses

Error

Processes network errors and generates appropriate log messages



CDCNET Software Components  
Base System Software

Executive

- CPU Scheduling
- Buffer Management
- Inter-task Messages

Device Manager

- Common Software Interface for External Boards (e.g. ESCI, MCI)

Configuration Procurer

- Reads DI configuration from mainframe and obtains necessary software

Online Loader

- Obtains software requested on-line (e.g. by command) from mainframe

System Ancestor

- Common Subroutines
- Initial Loader
- Command Parser
- Command Processors
- Diagnostics

CDCNET Software Components  
CYBER Resident Components

Network Access Method (NAM)

C170-based Network System

Primarily Terminal Oriented

Supports A-A Connections Also

NVF Network Validation Facility

PIP Peripheral Interface Program (2550 Interface)

NS Network Supervisor (2550 load/dump)

CS Communications Supervisor (2550 terminal/line monitor)

Interactive Facility (IAF)

Interactive Job Interface to NOS

NAM Application

Permanent File/Queued File Transfer Facility (PTF/QTF)

Permanent File Transfers

Job and Print File Transfers

Supports inter-CYBER, also VAX and IBM

Network Operations Facility (NOF)

Operator Interface to CDCNET

CDCNET Command Entry

CDCNET Log and Alarm Display

Network File Manager/Server (NETFM/NETFS)

CDCNET File Server for CYBER 170

Manages File Directory (CDCNET designed for NOS/VE World)

NAM Application

INITMDI MDI Initialization

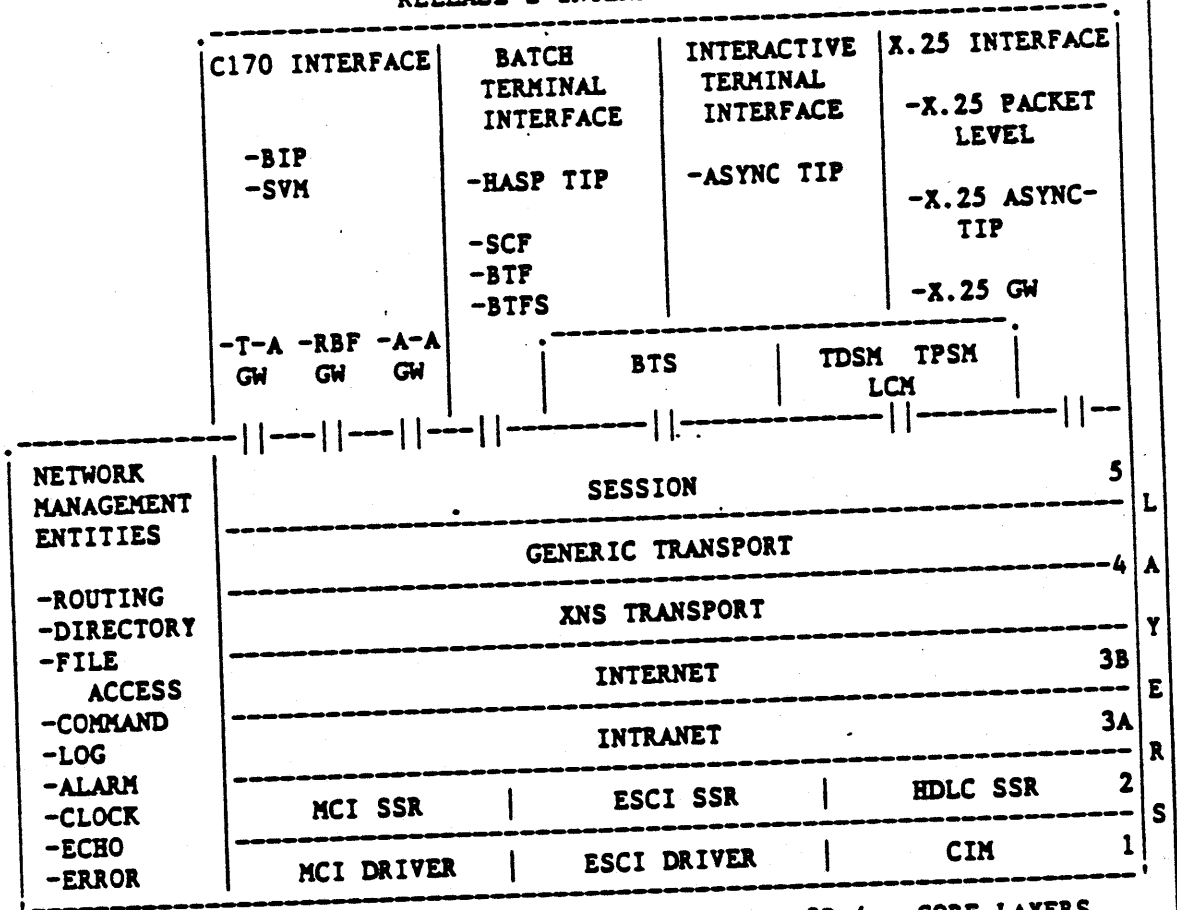
MANCC Manage CDCNET Configuration

DI SOFTWARE MODEL:

-INTERFACE SOFTWARE  
-LAYER SOFTWARE

-NETWORK MANAGEMENT ENTITIES  
-BASE SYSTEM SOFTWARE

RELEASE 2 INTERFACE SOFTWARE



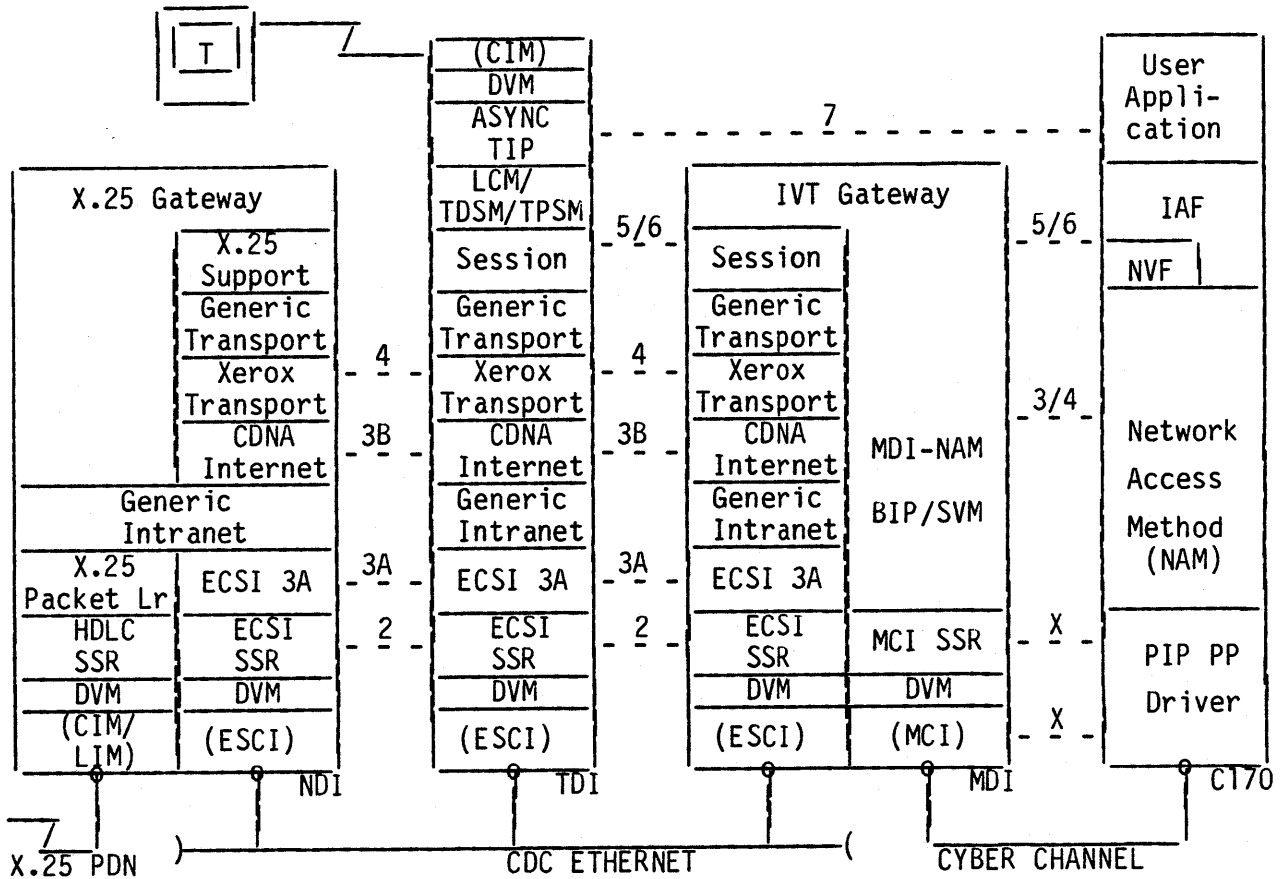
LAYERS: 1-3A = NETWORK SOLUTIONS, 3B-4 = CORE LAYERS

BASE SYSTEM SOFTWARE:  
-EXECUTIVE  
-DVM  
-COMMON SUBROUTINES  
-FAILURE MANAGERS

-INITIAL LOADER  
-CONFIGURATION PROCURER  
-SYSTEM ANCESTOR  
-ONLINE LOADER

-COMMAND PARSER  
-COMMAND PROCESSORS  
-DIAGNOSTICS

KEY: - - - n - - - Peer Protocol Interface at Network Layer n  
 \_\_\_\_\_ Direct Interface  
 (vertical line) No Interface



CDCNET Software Components

## CYBER Host Implementation of DDN

### X.25 Network Solution

- 1 Physical           RS-449, Connecting to DCE, 56000 Bits-per-second  
                      Connected to Modem  
                      Link via Phone Line to C/30 at TYMSHARE in Cupertino  
                      Implemented in LIM (NDI)  
                      Standard CDCNET
  
- 2 Data Link         HDLC/LAPB  
                      Implemented in CIM (NDI)  
                      Standard CDCNET
  
- 3a Network         X.25 Packet Level  
                      Only Used Point-to-Point Between NDI and C/30  
                      Implemented in NDI  
                      Standard CDCNET with Enhancements  
                      Special DDN 'Facility' called DDN Basic X.25

CYBER Host Implementation of DDN

List of CPCIs

DCNS	Standard CDCNET
NOS	Standard NOS 2.4.3
X.25	X.25 Modifications
IP	Internet Protocol
IPSR	IP Static Routing
TCP	Transmission Control Protocol
EGP	Exterior Gateway Protocol
TELNET	Terminal Interface
	TELNET Interface
	Server TELNET Gateway
	User TELNET Gateway
DOD G/W	<i>DOD/170 Gateway</i>
	DOD Network Products Gateway
	DOD CYBER 170 Interface
FTP	File Transfer Protocol
SMTP	Simple Mail Transfer Protocol
NOS Mods	NOS Modifications

DDN CYBER Host Implementation  
CPCI Summaries

X.25 Modifications

Small Enhancements to Support 'DDN Standard X.25'  
No Work Done

Internet Protocol

Implements DDN IP  
Resides in Both NDI and MDI  
Uses CDNA Generic Intranet for Interface to Network Solution  
Supports both Ethernet and X.25 Network Solutions  
Complete through Detailed Design

Internet Protocol Static Routing

Supplies Host and Network Routing Information for IP  
Table Initialized by CDCNET Configuration Commands  
Complete through Detailed Design

Exterior Gateway Protocol

Keeps IP Routing Tables Up-to-Date  
Exchanges Network (not host) Routing Information with DDN  
Resides in NDI  
No Work Done

Transmission Control Protocol

Computes and Maintains Checksums on Data Blocks  
Maintains Acknowledgement Windows  
Provides End-to-End Flow Control  
Re-orders Packets into Original Order  
Header Includes checksum, window information, packet number  
Data is Byte-Stream Oriented (not message oriented)  
Resides in NDI and MDI  
Complete through Detailed Design

DDN CYBER Host Implementation  
CPCI Summaries

TELNET Interface

Provides Subroutine Interface for TELNET Protocol

Functions include

Interrupt Process

Erase Character

Erase Line

Abort Output

Are You There

Binary Mode

Go Ahead/Suppress Go Ahead

Resides in NDI and MDI

Complete through Detailed Design

Server TELNET Gateway

Provides DDN Terminal Access to CYBER

Transformations between TELNET and VTP/IVT Protocols

VTP (Virtual Terminal Protocol) - CDCNET Terminal Protocol

IVT (Interactive Virtual Terminal Protocol) - NP Protocol

Resides in MDI

User TELNET Gateway

Provides CDCNET Terminal Access to DDN

Transformations between TELNET and VTP/IVT Protocols

VTP (Virtual Terminal Protocol) - CDCNET Terminal Protocol

IVT (Interactive Virtual Terminal Protocol) - NP Protocol

Resides in NDI



DDN CYBER Host Implementation  
CPCI Summaries

DOD Network Products Gateway

Provides 170 Access to DDN TCP, IP, and TELNET  
Resides in MDI  
Communicates with DOD 170 Interface using NAM

DOD CYBER 170 Interface

Subroutines to provide 170 applications with DDN services  
Resides in 170, in each application  
Communicates with DOD NP G/W in MDI using NAM

File Transfer Protocol

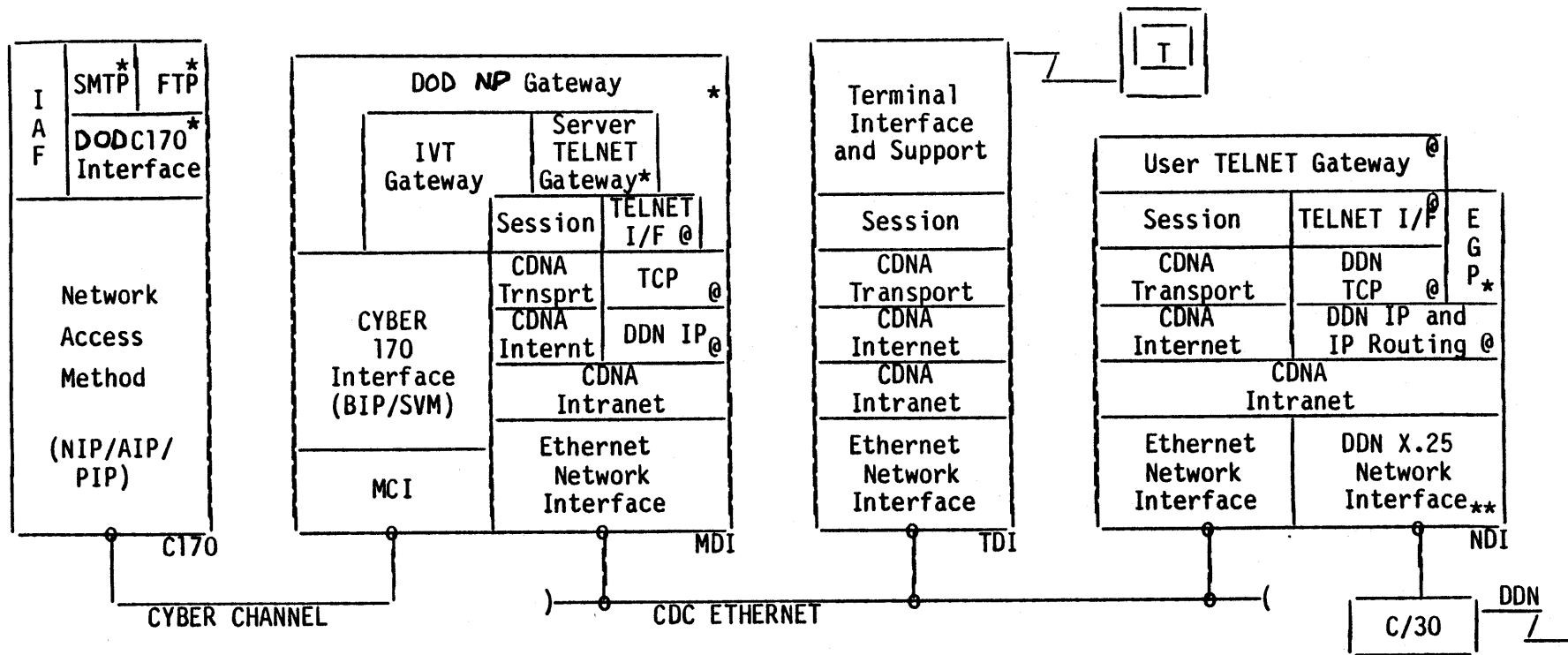
Transfers Files Between Computers  
Support ASCII and Binary Files  
Supports Restart if Failure mid-stream  
Text Compression  
Accesses DDN via DOD Gateway  
Resides in CYBER

Simple Mail Transfer Protocol

Transfers Mail Messages Between Computers  
ASCII Text Files  
Rudimentary User Interface  
Supports Mail Servers (e.g. SSDF MAIL)  
Accesses DDN via DOD Gateway  
Resides in CYBER

NOS Mods

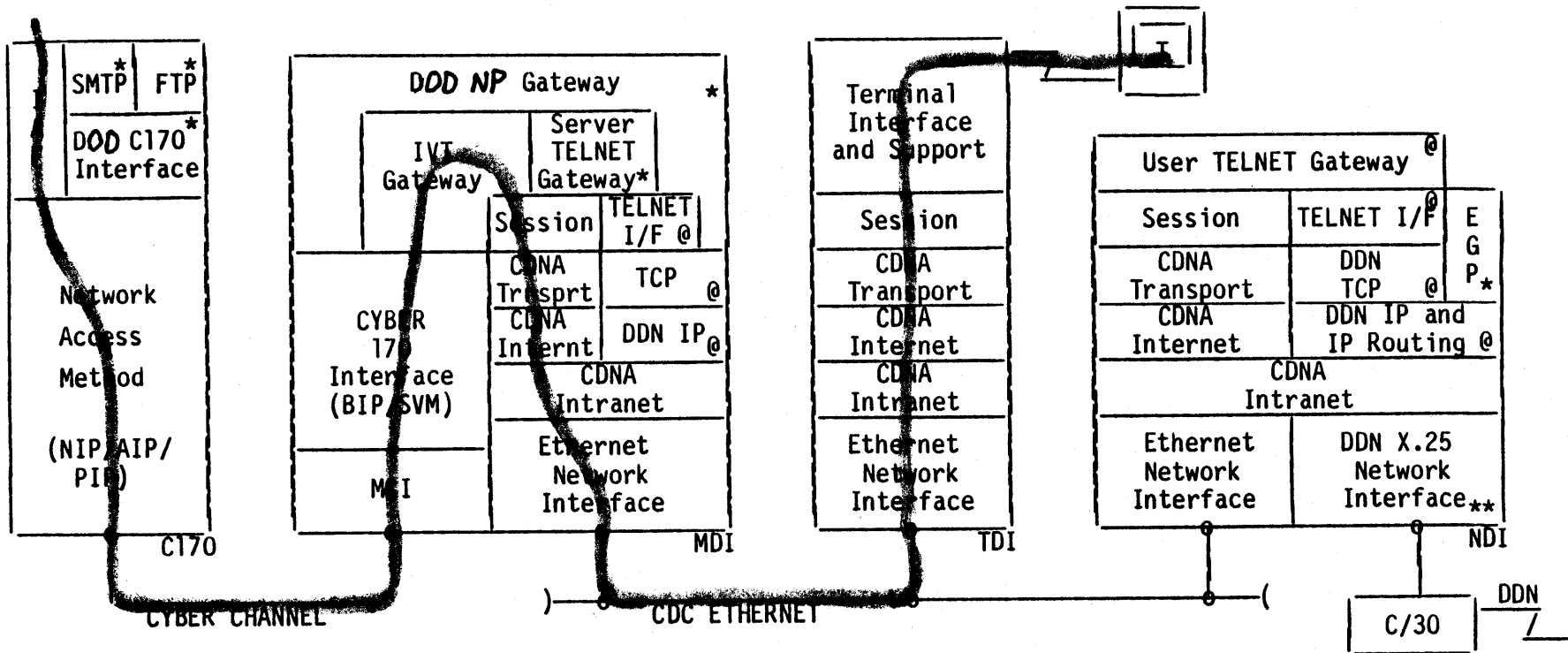
Changes to NOS Tables to Support FTP/SMTP/170 Interface  
Changes to QTRM to Support CYBER Applications  
Small Changes



- @ Developed by CSU and
- \* Developed by ISD
- \*\* Standard DCNS Modified by ISD
- none Standard DCNS or NOS

DDN CYBER Host Interface Components

CDCNET Terminal Access to NOS (Standard CDCNET)

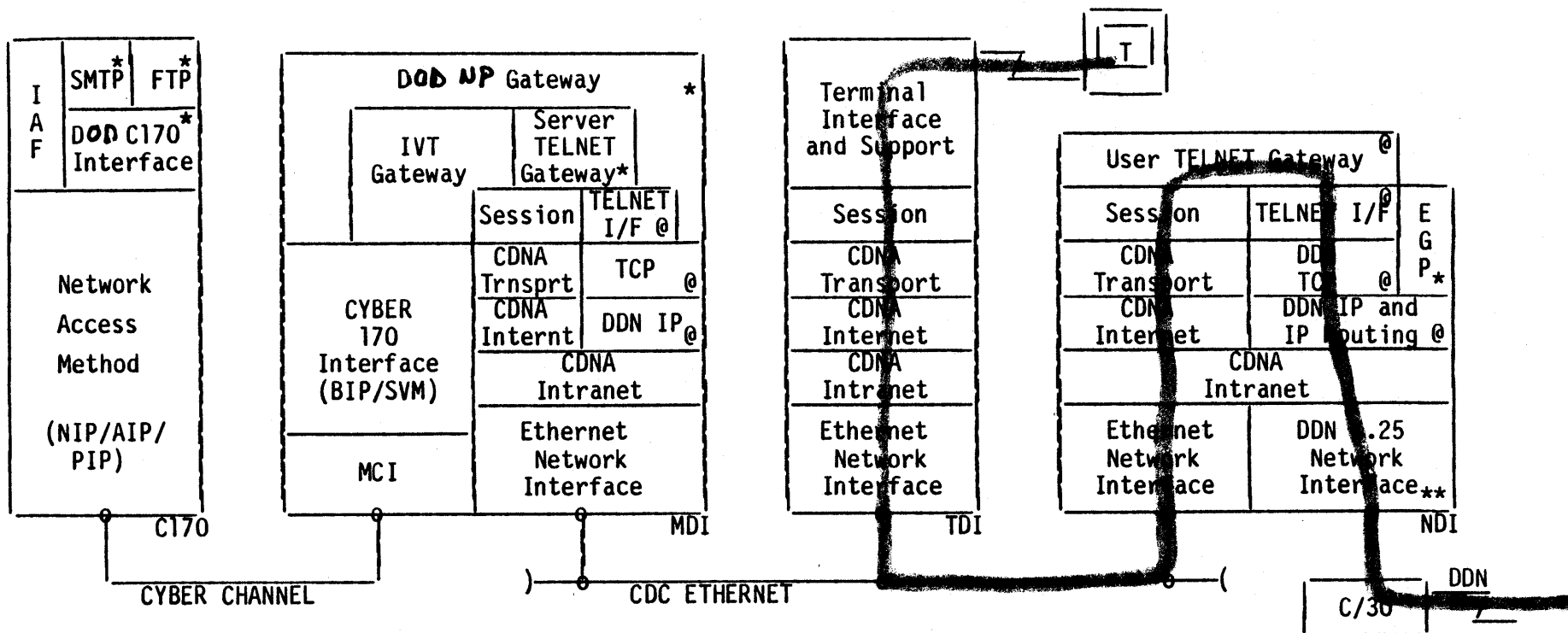


- @ Developed by CSU
- \* Developed by ISD
- \*\* Standard DCNS Modified by ISD
- none Standard DCNS or NOS

**—————** Data Flow, CDCNET Terminal Access to NOS

DDN CYBER Host Interface Components

CDCNET Terminal Access to DDN (User TELNET)

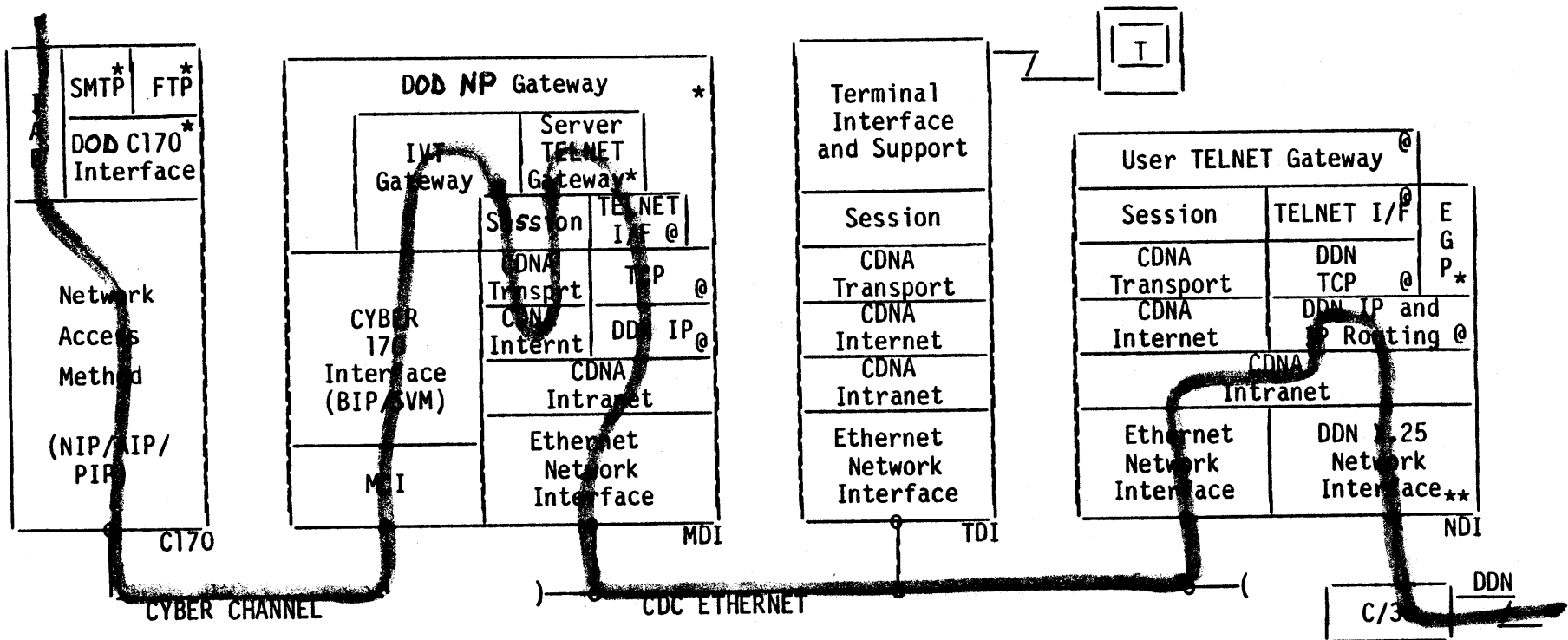


- @ Developed by CSU
- \* Developed by ISD
- \*\* Standard DCNS Modified by ISD
- none Standard DCNS or NOS

**—** Data Flow, CDCNET Terminal Access to DDN

DDN CYBER Host Interface Components

DDN Terminal Access to NOS (User TELNET)

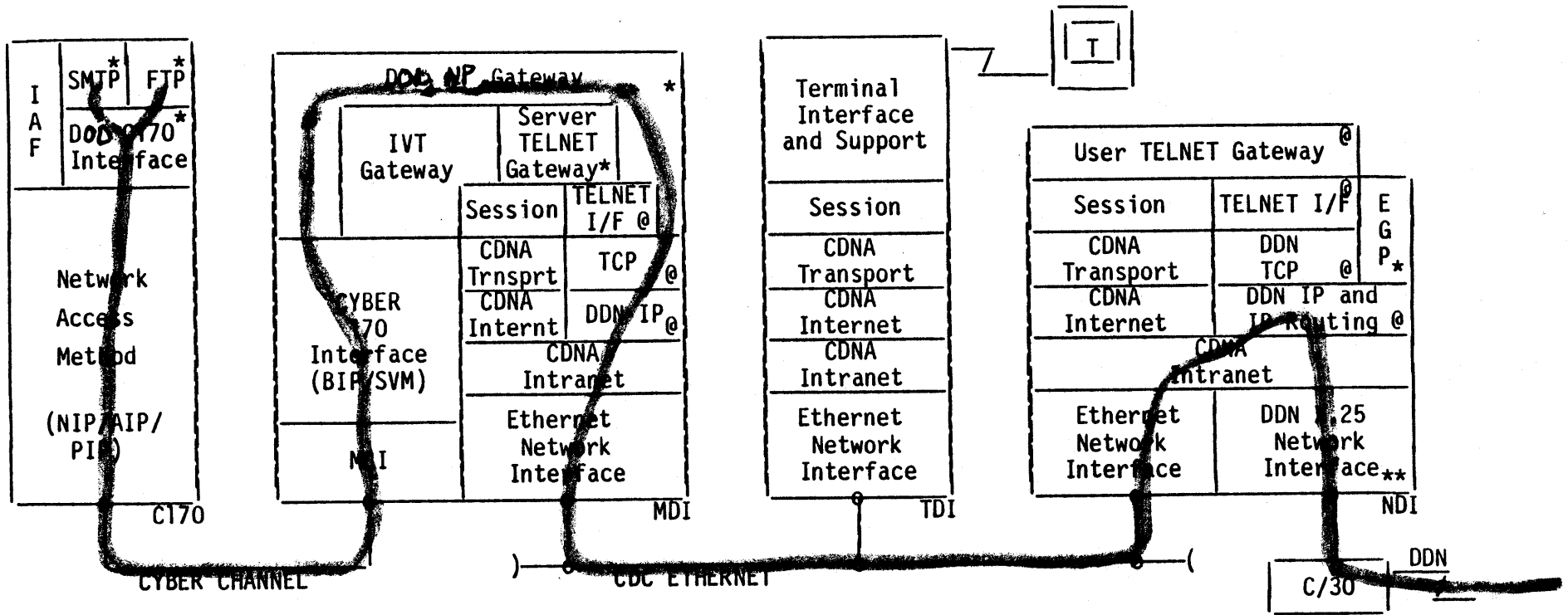


- @ Developed by CSU
- \* Developed by ISD
- \*\* Standard DCNS Modified by ISD
- none Standard DCNS or NOS

**—————** Data Flow, DDN Terminal Access to NOS

DDN CYBER Host Interface Components

Mail and File Access Between NOS and DDN (FTP, SMTP)



- @ Developed by CSU
- \* Developed by ISD
- \*\* Standard DCNS Modified by ISD
- none Standard DCNS or NOS

**—————** Data Flow, Mail and File Application Access to/from DDN

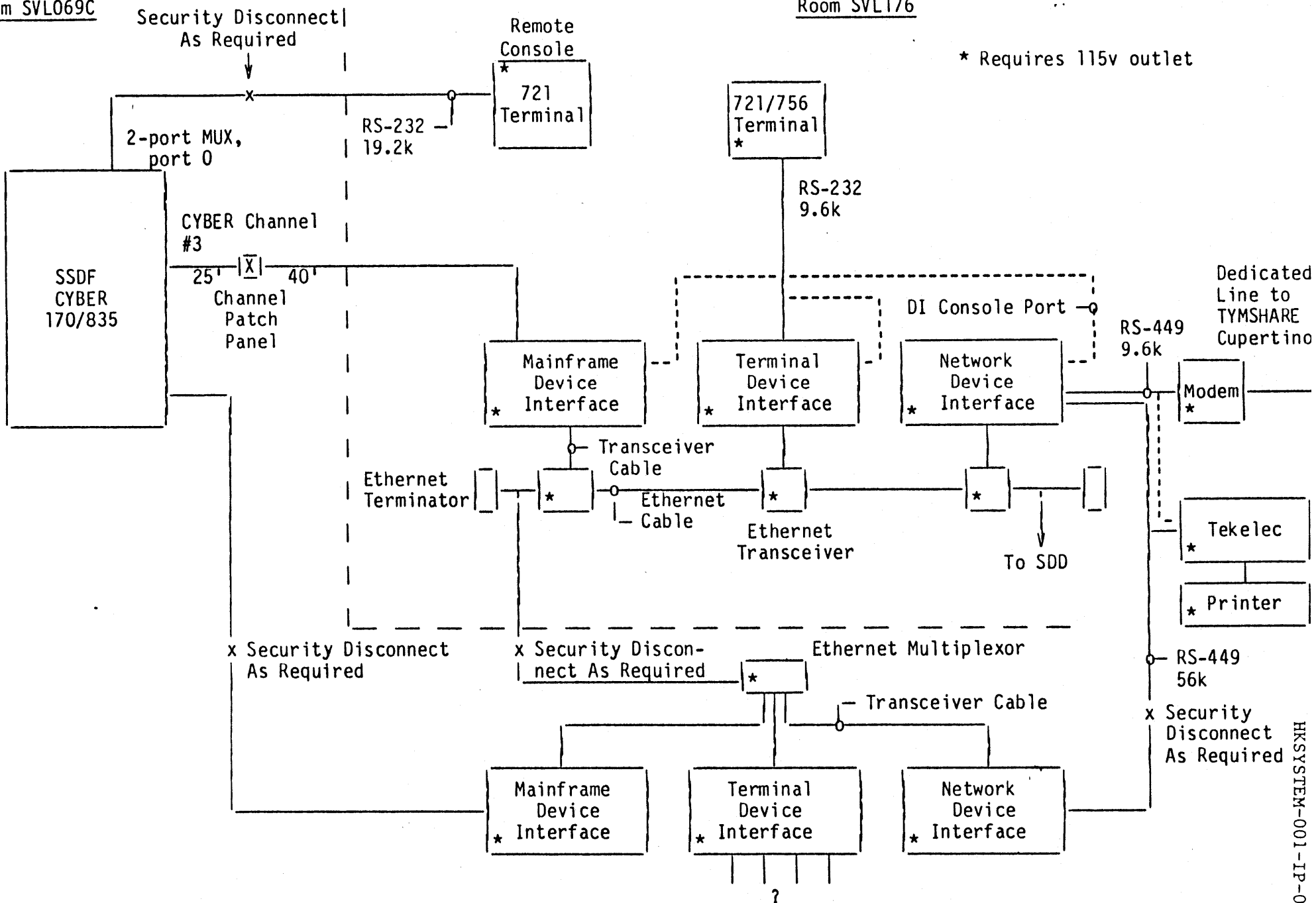
DDN CYBER Host Interface Components

Room SVL069C

Room SVL176

\* Requires 115v outlet

D-5



Ultimate DDN Configuration, ISD Sunnyvale

HKSYSTEM-001-IP-00-A

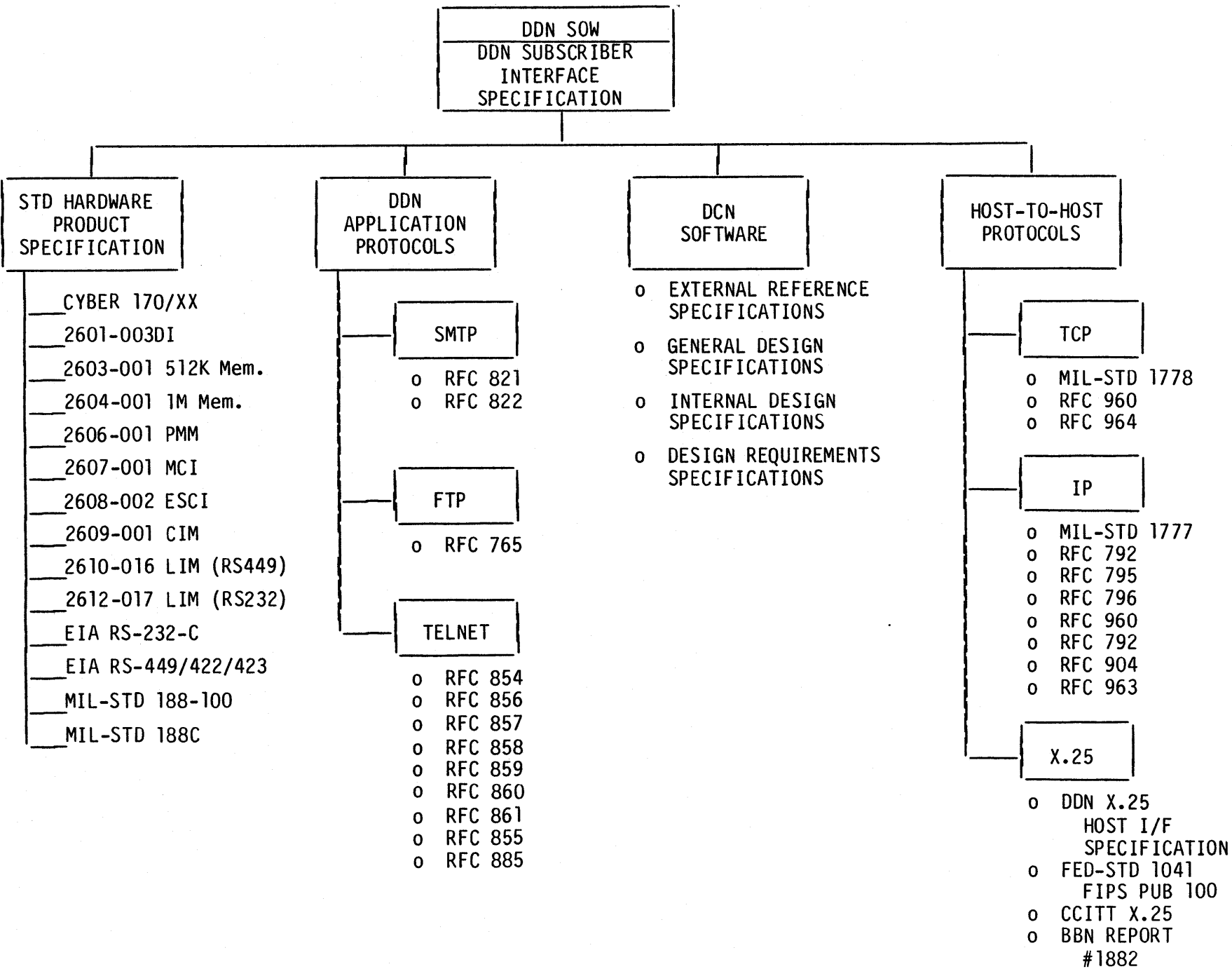


Figure 2.1-1. DDN Specification Tree