Bell Communications Research

PACKET SWITCH ASSIGNMENT GUIDELINES LOCAL AREA DATA TRANSPORT NETWORK ADMINISTRATION

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1. GENERAL

1.01 This section provides Network Administration with assignment techniques and considerations to be used during the service provisioning of user access lines and trunks to the No. 1 Packet Switching System (No. 1 PSS) packet switch. In conjunction with the assignment process, this section also provides a general description of the packet switching technology and its implementation in the Local Area Data Transport (LADT) network.

1.02 Whenever this section is reissued, the reason(s) for reissue will be listed in this paragraph.

1.03 The title for each figure includes a number(s) in parentheses which identifies the paragraph(s) in which the figure is referenced.

1.04 The terms and specifications provided in this document are relative to LADT Generic 1, Release 1A. Any references to the No. 1 PSS packet switch relate to Version 2.0, Release 2.0.

1.05 It should be noted that the components for service offerings similar to LADT may have different names but perform like functions. This document is generally based on the LADT service offering implemented in the Florida area, which employs AT&T Technologies, Inc. products.

1.06 This section also provides a brief overview of the LADT system, and general information on virtual circuit service and logical channels (LCs). These facilities are negotiated with the user and used as part of call processing through the packet switch. A brief description of the recent change data base is also provided to better acquaint the reader with the fundamental service provisioning process.

2. PHYSICAL DESCRIPTION

2.01 The No. 1 PSS packet switch consists of a 3B20D processor, standard peripherals, and facility interface processors (FIPs).

3B20D PROCESSOR

2.02 The 3B20D processor consists of duplicated 3B control units (CUs). Each CU consists of a central processing unit, its memory, a direct memory access controller, and input/output (I/O) channels. During normal operation, only one CU is active while the other is in the standby mode.

2.03 The standard peripherals of the packet switch include moving head disks to provide mass storage for program text and data, and a magnetic tape for the output of traffic and usage data as well as for field updates. The 3B20D processor also supports the interface to the display terminals, printers, and alarm devices.

2.04 A sample configuration of the packet switch hardware is provided in Fig. 1. The packet switch software configuration is based on the Duplex Multi-Environment Real Time (DMERT) generic software package for the 3B20D processor. The DMERT is a general manager of the processor, memory, and I/O processes.

FACILITY INTERFACE PROCESSOR

2.05 The FIP is a processor that has been custom designed for specific use as the front-end processor for the packet switch. The purpose of the FIP is to provide access for the data service vendor lines, trunk terminations if more than one packet switch is used within the network, and the Data Subscriber Interface (DSI) and Administrative Processor (AP) to packet switch data links.

2.06 The major components of the FIP are:

- central processor unit
- memory

- 3B20D interface
- Digital Data System (DDS) facility interface.

2.07 Each FIP is housed in a FIP frame. Each frame has a maximum equipage of 12 FIPs. The FIPs are numbered uniquely, beginning with zero, but for the entire packet switch. A maximum of five FIP frames may be employed by a packet switch, for a total of 60 FIPs, numbered 0-59. Figure 2 provides the layout of two FIP frames, beginning with Frame 0, FIP0.

ACCESS CONFIGURATION

A. Equipment Layout

2.08 The physical interface between the packet switch user and the FIP is provided by the DDS Channel Service Unit (CSU). The CSU provides access to the synchronous DDS channel local loop and provides the maintenance forces with loop-around testing capabilities. Each CSU is apparatus-coded with respect to the data transmission speed. A separate model is used for each of the 56 kb/s or 9.6 kb/s access lines. A sample CSU frame is provided in Fig. 3. When fully equipped, a CSU frame contains 32 CSUs. The CSUs are grouped in blocks of eight with each group containing only those CSUs with matching transmission rates.

2.09 To interface with the CSU, the access apparatus must provide such functions as timing recovery, proper coding and decoding of signals, and must be capable of generating and detecting DDS network control codes. For the packet switch, these functions are provided by the Data Service Unit (DSU).

2.10 There are different DSU types for different data rates (56 kb/s or 9.6 kp/s). The DSUs are grouped by type so that each of the two patch panels within the DSU frame is associated with a specific type of DSU. **This is mandatory to meet the electrical requirements for the patch panel.** A patch panel is a passive device inserted in the communications path between the DSUs and the FIPs to facilitate reassignment of a DSU (and the associated DDS channel) to a given FIP port. The patch panel also provides access to this path for monitoring and testing. A fully equipped DSU frame contains a maximum of 16 DSUs, with each group containing 8 DSUs. Figure 4 depicts a DSU frame and associated DSUs.

B. CSU to FIP Association

2.11 The DSU provides functions to interface the FIPs with the CSUs. Each FIP has two ports (ports 0 and 1) available for access line terminations. Each port is connected, via the patch panel, to a DSU of the corresponding data transmission speed. Each DSU is, cross-connected to a CSU of a matching transmission rate.

2.12 Figure 5 depicts the association between the CSUs, the DSUs, and the FIP ports. A fully equipped CSU frame with 32 CSUs is directly connected to 32 DSUs (2 fully equipped DSU frames). The cords from the DSUs terminate at the rear of the patch panel for the appropriate data transmission rate. Each port on the FIP has a cord that terminates at the rear of the patch panel, associating each DSU with a single FIP port.

3. PACKET SWITCH COMMUNICATIONS

3.01 Packet switching routes data packets to various destinations. Packet switching store the outgoing packets until there is a confirmation of satisfactory reception, prior to forwarding and subsequent discarding of the packets. Packet switching minimizes the idle periods where no useful information is being passed by interleaving the packets from one user with other packets, as they are received. These packets are then routed over the network. This type of statistical multiplexing allows for the efficient use of shared resources.

PACKET DEFINITION

3.02 A data packet is a fixed maximum length unit of data and control information that is sent from the source to the destination. In the case of LADT, the source is initially the call originator (the dial-up or direct access subscriber) via connection to the DSI (user to the packet switch). The destination is the service vendor. With Generic 1, Release 1A of LADT, service vendors cannot initiate calls. Packets of information can be transmitted back to the subscriber, based on the communication inquiry received.

3.03 The configuration of a single data packet is based on a standard set of communication rules defined as the X.25 communications protocol. Because of the size limitation and the required control information, a data packet may be one of a series or may be self-contained. These data packets are transported over preestablished logical paths called virtual circuits.

VIRTUAL CIRCUIT SERVICES

3.04 Virtual circuit service is the provisioning of an end-to-end communication path through the logical allocation rather than the physical allocation of the packet switch resources. The two types of virtual circuits supported are:

- Virtual Call (VC)
- Permanent Virtual Circuit (PVC).

3.05 The logical path for a VC is a temporary one. The path is established only when a request for the service has been made. The logical path for a PVC is a permanent one. This type of circuit is allocated at the time of service provisioning for a user, and is readily available for user access.

3.06 The multiplexing technique enables multiple virtual circuits (either VCs or PVCs) to be set up over a single access line. This is accomplished by allocating a number of LCs over each access line. A virtual circuit can be established on each LC. Each data packet is then associated with an LC which is mapped with the appropriate destination of the virtual circuit.

3.07 For LADT service, the use of VCs is preferred over the provisioning of PVCs circuits. Because the VC approach provides a varied selection of the X.25 facilities. It allows for better congestion controls in the packet switch due to more frequent opportunities to block new call setup requests, if needed. A VC also provides opportunities for more frequent negotiation of the throughput class, or rate of transmission (another possible congestion control).

X.25 COMMUNICATIONS PROTOCOL

3.08 Users of the packet switch are provided access via 9.6 or 56 kb/s access lines using a specifically designed set of rules. This protocol, is an international standard that supports the virtual circuit services (VC and PVC) of the packet switch.

3.09 The X.25 protocol is structured into several independent levels. Three identifiable levels are:

- Packet level (level 3)
- Link level (level 2)
- Physical level (level 1).

3.10 The level 3 protocol, or the packet level, is the most complex of the three levels identified. This level associates and connects the logical channels on access lines to support either VCs or PVCs. A maximum of 511 LCs are provided for the set up of both types of virtual circuits on each 56 kb/s access line, while a maximum of 127 logical channels are supported for all virtual circuits (VCs and PVCs) on each 9.6 kb/s access line. The number of LCs provided to a user are negotiated at service provisioning. This protocol transfers user data from access lines to and from the level 2 protocol in the blocks of data called packets, and provides the flow and control functions specified by the X.25 protocol parameters.

3.11 The level 2 protocol is the link level protocol used in packet switch communications. This protocol controls the data interchange across the physical line between the packet switch and the user. It also converts the information into transmission units called frames. The conversion of the data packet into a frame is done by level 2 software. During this conversion process, the address and control field are attached above the data packet. The address field identifies whether the frame of information (data packet and control fields) is a command or a response. Once the link level completes its main function of ensuring the transference of an error-free frame, the frame is then passed to the level 1 protocol for actual transmission.

3.12 The physical level (level 1) of the communications protocol is the simplest level. The basic functions of the level 1 protocol are to activate, maintain, and deactivate the physical link between the user and the packet switch.

3.13 The following user subscription options are available through the X.25 communications protocol for the No. 1 PSS Release 2.0 packet switch:

- Closed User Group
- Throughput Class Negotiation
- Flow Control Parameters
- Nonstandard Default Window Sizes
- Nonstandard Default Packet Sizes
- Flow Control Parameter Negotiations
- Permanent Virtual Circuits

- Two-way Logical Circuits
- One-way Outgoing Logical Circuits
- Incoming Calls Barred
- Outgoing Calls Barred
- Fast Select
- Fast Select Acceptance.

3.14 *Closed User Group:* A closed user group (CUG) facility is established for VCs at the time of service provisioning. This option allows a number of Data Terminal Equipments (DTEs) belonging to the group to communicate exclusively with each other. Unless the CUG is provided with an outgoing access feature, any communication with other DTEs outside of the group is precluded. (The term DTE refers to any user equipment which is joined to a data communications network. It could be anything from a simple terminal to a large computer system, e.g., a data service vendor on the LADT network.)

3.15 ***Throughput Class Negotiation:*** This facility is established at service provisioning for VCs. It permits negotiation on a per call basis of the throughput classes for each direction of transmission. The throughput class is the rate of transmission, and includes from 75 to 9600 bits per second (bps) on 56 kb/s and 9.6 kb/s access lines.

3.16 *Flow Control Parameters:* This facility refers to the flow control procedures that are provided separately for each direction of data transmission. These procedures include the size of the transmission window and the actual size of the data packet. The standard window size for a VC is two packets for each direction of transmission. This means that only the two data packets in the window may be transmitted. Each time a packet is transmitted, the next data packet in line for transmission will move into the window. The packet sizes that are supported are 128 and 256 bytes.

3.17 *Nonstandard Default Window Sizes:* This facility is established at the time of service provisioning for PVCs. It provides for the selection of a window size from the range of window sizes supported by the network (2 or 3) for each direction of transmission. The default value is 2 for both directions of transmission.

3.18 ***Nonstandard Default Packet Sizes:*** This facility is established at the time of service provisioning for PVCs. It provides for the selection of a packet size (128 or 256 bytes) for each direction of transmission for each PVC. The default value for both directions of transmission is 128 bytes.

3.19 ***Flow Control Parameter Negotiation:*** This facility permits negotiation of the flow control parameters (window and packet sizes) on a per call basis. It applies to VCs, and is negotiated for each direction of transmission.

3.20 *PVCs:* This facility is established at service provisioning. It allows for the establishment of permanent logical paths, readily available for user access, rather than paths established only on an as needed or per call basis.

3.21 *Two-Way LCs:* This facility is established at the time of service provisioning. In the case of 2-way LCs, the channel may be used for either incoming or outgoing calls. One direction of transmission does not take priority over the other.

3.22 *One-Way Outgoing LC:* This facility is established at service provisioning. It restricts the LC use to originating outgoing VCs only. Use of this facility ensures that at least one LC will be available for outgoing VCs, regardless of the amount of incoming traffic.

3.23 ***Incoming Calls Barred:*** This facility, established at service provisioning, denies incoming VCs to the DTE. This option is the equivalent of specifying that all LCs for VCs be established as 1-way outgoing channels.

3.24 ***Outgoing Calls Barred:*** This facility prevents the network from accepting outgoing VCs from the DTE. It is established at service provisioning, and is the equivalent to specifying all LCs for VCs as 1-way incoming channels.

3.25 ***Fast Select:*** This per VC facility allows the calling DTE to send up to 128 bytes of data in the call request packet, and receive the same amount in the call connected or clear indication packet. This applies only if the latter two packets are issued in direct response to the call request packet.

3.26 ***Fast Select Acceptance:*** This facility, established at service provisioning, prevents fast select incoming calls packets from being delivered to a

DTE which does not support fast select.

4. PACKET SWITCH APPLICATION IN LADT

4.01 The LADT service uses packet switching technology to provide the access and routing of communications from local subscribers and data base service vendors. The significant distinction between LADT users and specific users as acknowledged by the packet switch is:

(a) The LADT users are those local residence and business subscribers who access a service vendor's data base via connection to a DSI. Service vendors, who provide the data bases for inquiry, are also LADT users, as they are on the receiving end of the call. A service vendor's access to LADT is via a direct connection to the packet switch, using 9.6 or 56 kb/s DDS facilities.

(b) The packet switch users are only those customers whose access lines interface directly with the packet switch. Although local LADT subscribers use the packet switch for the transport of data packets, the actual direct linkage is only from a DSI to the packet switch. Therefore, the DSI is considered a user to the packet switch. Likewise, the Generic 1, Release 1A LADT AP and the service vendor access line(s) are established via direct linkage to the packet switch and are also considered users.

4.02 Figure 6 depicts a basic configuration of the overall LADT network. From this figure it can be seen that the packet switch is the center of the communications between the local subscribers (via the DSIs), the service vendors, and the AP.

4.03 The local subscribers to the LADT network access the DSI(s) via dial-up or direct facilities. Dial-up subscribers have shared access to the DSI through a dial-up multiline hunt group (MLHG). Direct access subscribers are provided access to the DSI by use of data SLC* carrier system facilities.

4.04 The DSI to packet switch data link is provided via a 56 kb/s access line. The virtual circuit service used for this data link is, by definition, a VC. Multiple VCs to the packet switch are established on a request basis, as local dial-up or direct access subscribers place attempts to the service vendor(s) via the LADT network.

4.05 Access lines from the service vendor(s) to the packet switch are provided based on service vendor requirements. There are many arrangements available to the service vendor, ranging from one or more individual access lines to a hunt group arrangement. (Refer to Section 255-025-022 for a description of the variable service arrangements.) The service vendor access lines may be either 9.6 or 56 kb/s facilities. Service vendor communications to the LADT network (via the packet switch) may be on a VC or on a PVC basis. By use of a virtual circuit service and the LC allocations provided by the packet switch, a service vendor can use a single access line, and yet still be capable of interacting with several local subscribers simultaneously.

4.06 The AP is also provided with a direct data link to the packet switch. This 9.6 kb/s facility provides communications between the AP and the packet switch for the support of the LADT network control functions. The AP contains the programs responsible for the network integrity, network management, network service, such as billing and traffic measurements, and network maintenance of the DSIs.

5. NETWORK ASSIGNMENTS

CONSIDERATIONS

A. Facility Interface Processors

5.01 Each FIP has two ports available for assignment to either access lines or trunks. These ports are numbered 0 and 1 on each FIP. This provides terminations for up to 24 lines and/or trunks per each FIP frame, which must be assigned during the service provisioning of the DDS facilities to the packet switch.

5.02 The two ports on a single FIP should be assigned to either two access lines or two trunks of the same transmission rate. This guideline is provided for ease in the overall administration of the FIP ports.

5.03 Since the Generic 1, Release 1A LADT network currently maintains one No. 1 PSS packet switch, there are no trunks provided that currently require assignment. Should trunks be provided for communications between two or more packet switches, current administrative procedures dictate that a single FIP should be assigned either lines or trunks to its two ports; a combination of a line and a trunk is not suggested.

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5.04 An additional consideration pertaining to FIPs is the FIP to DSU association. The DSUs are clustered in groups of eight, and all eight must be of the same transmission rate. The cabling between the FIPs and the DSUs must be taken into consideration at the time a FIP port is assigned. It is recommended that either the equipment engineer or the maintenance J drawing be consulted to identify any cabling considerations.

B. Logical Channels

5.05 The FIP allocates LCs for user access lines; trunks do not require LCs. The channels are allocate by the FIP in blocks of 256. The number of channels required by a specific service vendor for each access lines is negotiated at the time of service provisioning. If an access line requires any number up to 256 LCs, the FIP will allocate the full 256 channel block. If the access line requires between 257 LCs and the maximum of 511, the FIP will allocate two full channel blocks of 256 in each. (Note that LC zero is not available for assignment to an access line or trunk.) The total number of LCs required per access line is a consideration when determining the FIP assignment for the access line.

5.06 A FIP can be equipped with 1 or 2 memory boards. One memory board is equipped with a buffer capacity to handle 511 channels. This capacity could be allocated to a single access line using all 511 LCs, or 2 access lines using up to 256 LCs each. If additional LCs are required, a second memory board may be added to the FIP to provide extra buffer capacity. However, since a 56 kb/s access line can probably only support approximately 100 logical channels before exhausting capacity on a bit per second throughput basis, the likelihood of extra memory being required is low.

FIP ASSIGNMENT RULES

A. Scope

5.07 There are three basic issues which govern the rules for the assignment of an access line or trunk to a FIP port:

- Diversity
- Maintenance and Load Balance
- Memory Board Conservation.

5.08 The purpose of diversification is to minimize the impact on customers in the event of the failure of a particular FIP. It would be reasonable to spread the following access arrangement over at least two FIPs:

- Service vendors with two or more access lines
- A wire center that has two DSIs or for one DSI serving dial-up overflow traffic from another.

5.09 **For maintenance and load balance purposes, it is preferable to spread assignments over a single port in each FIP prior to completely loading both ports in a single FIP.** If a single port in each equipped FIP is assigned first, then all FIPs in the office will be equally loaded and there would be no need for further load balancing based on the traffic characteristics. This method exercises all FIPs so that potential problems can readily be identified in the early stages of service provisioning.

5.10 The conservation of memory boards is a basic consideration during the access line assignment process. The number of LCs required for a specific access line impacts whether or not and when an additional memory board needs to be added to the FIP.

B. Access Line Assignments

5.11 The conservation of memory boards, along with diversification, maintenance, and load balance considerations cause the access line assignment rules to be segregated into two categories:

- Access lines requiring less than 256 LCs
- Access lines requiring 256 or more LCs.

The number of LCs requested by the customer will be detailed on the service order at the time of service provisioning.

5.12 If the number of LCs requested for an access lines is **less** than 256, then the assignment should be made in the following sequence:

(1) Assign the line to a FIP on which another customer has a line assigned, and the number of LCs on the already assigned line is **less** than 256.

(2) Assign the line to a FIP that has no other assignments to it.

(3) Assign the line to a FIP on which another line for the same customer is already assigned, and the number of LCs on the already assigned (or working) line is **less** than 256.

(4) Assign the line to a FIP on which a different customer already has a line assigned, and the number of LCs for the other line is **equal to** or **greater than** 256. If this process is used for the new assignment, another memory board must be added to the FIP.

(5) Assign the line to a FIP on which another line for the same customer is already assigned, and the number of LCs on the already assigned (or working) line is **equal to** or **greater than** 256. If this process is used for the new assignment, another memory board must be added to the FIP.

5.13 If the number of LCs requested for the access line being assigned is **equal to** or **greater than** 256, then the assignment should be made in the following sequence:

(1) Assign the line to a FIP that has no other lines assigned to it.

(2) Assign the line to a FIP on which a different customer has a line already assigned, and the number of LCs on the already assigned (or working) line is **equal to** or **greater than** 256. If this process is used for the new assignment, another memory board must be added to the FIP.

(3) Assign the line to a FIP on which another line for the same customer is already assigned, and the number of LCs on the already assigned (or working) line is **equal to** or **greater than** 256. If this process is used for the new assignment, another memory board must be added to the FIP.

(4) Assign the line to a FIP on which a different customer has a line already assigned, and the number of LCs on the already assigned (or working) line is **less than** 256. If this process is used for the new assignment, another memory board must be added to the FIP.

(5) Assign the line to a FIP on which another line for the same customer is already assigned, and the number of LCs on the already assigned (or working) line is **less than** 256. If this process is used for the new assignment, another memory board must be added to the FIP.

LC ASSIGNMENT RULES

5.14 The LCs are assigned to each access line, with a maximum of 11 available assignments (127 maximum for 9.6 kb/s access lines and 511 for 56 kb/s access lines). These channels are numbered starting with 1 through 511. The LC 0 does exist, but is used by the X.25 communications protocol for restart and diagnostics. Logical channel 0 is not available for assignment to an access line.

5.15 The LC assignments are segregated into those channels allocated for PVCs, those allocated for 2-way service, and 1-way outgoing LCs. The sum of these three types of channels is the total number of LCs requested by the user. These channels may be numbered sequentially, or, a gap of more than one number can be left in between the channel types for growth. If a gap is left for growth and administrative purposes, the total number of LCs allocated (from 1 to the last number of the last 1-way outgoing channel) cannot be greater than the maximum number of LCs allocated in the channel block(s). These rules are explained in the following paragraphs, and are also provided in a schematic form in Fig. 7.

5.16 The LC assignments are made in the following order:

- PVCs
- 2-way LCs
- 1-way outgoing LCs.

5.17 The PVCs are automatically reserved by the No. 1 PSS packet switch by virtue of not assigning the channel numbers. The LC number 1 is always the first channel reserved, with all other channels for PVCs reserved in numerical order.

5.18 Two-way LC numbers start at "X" (refer to Fig. 7). The "X" can be calculated by taking the number of the last PVC LC, and adding a 1 to it. The rule is that "X" must be either greater than or equal to the last PVC LC number plus 1. If a larger gap is desired between the last PVC channel and the first 2-way channel number, the value of "plus 1" may be increased. However, paragraph 5.21 provides a rule regarding the last number of the last LC for the channel block(s), which must also be considered.

5.19 The next number to be determined is the number of the last 2-way LC requested by the user. In Fig. 7 this number is represented by "M". In order to calculate M, the total number of 2-way LCs requested must be known.

5.20 The first number of the 1-way outgoing LCs is the next number to be determined. This number, represented by "Y" in Fig. 7, is equal to the number of the last 2-way LC plus at least 1. Again, the "plus 1" may be increased to provide an administrative gap in the numbering sequence, provided it coincides with the rule stipulated in paragraph 5.21.

5.21 The final number to be determined in the assignment of LC numbers is the number of the last 1-way outgoing channel. In Fig. 7 this number is identified as "Z". To determine this number, the total number of 1-way outgoing channels requested must be known. These numbers can be assigned sequentially following the first number of this group of assignments (1-way outgoing channels). However, this number must be less than or equal to the maximum number of channels allocated in the channel block(s).

ASSIGNMENT PROCEDURES

5.22 For DSIs and the AP, FIP port assignments and LC allocations are done at the time of installation. For other users, specifically service vendors, FIP assignments are made as a part of the service order process. The LC allocations must be taken into consideration during the determination of the actual FIP assignment(s).

5.23 In addition to the actual assignment of the FIP and LCs, the translations work group must also assign facility identifiers (IDs) for each of the ports assigned. The facility ID is the software identifier of a specific port on a FIP, and its associated access line (or trunk). The facility ID numbers range from 0 to 239. (It should be noted that the range extends to 239, for a total of 240 numbers, because FIPs were initially designed for four ports instead of two. Thus, 60 FIPs multiplied by four ports per FIP would have resulted in a requirement for 240 numbers. However, with two ports per FIP, it would be feasible to use a range of numbers from 0 to 119, although recent change will allow 0 to 239.)

5.24 A numbering scheme is available which would allow for patterning assignments and provide for anticipated growth in the number of ports available per FIP. This process would require port 0 in all FIPs to be numbered first, and then port 1 in all FIPs. The numbering should be sequential, beginning with FIP 0, port 0 and ending with FIP 59, port 1. In this manner, if a third port, port 2, was added to each FIP, the numbering scheme could continue, beginning with FIP 0, port 2, facility ID 120. This pattern would also provide for a fixed assignment scheme, should a mechanized method of assignment be developed.

5.25 The translation group is also responsible for maintaining an accurate record of the FIP to the data terminal number (DTN) relationship. It would be beneficial to maintain a record of the allocated number of LCs, if not the actual LC assignments. Figure 8 provides a sample series of forms that can be used for this purpose. Use of the Assignment Record form will assist in the complete assignment process related to the packet switch. These assignments can be easily verified in recent change.

6. RECENT CHANGE

6.01 Recent change is the semi-permanent record of logical assignments provided to maintain user service. The packet switch recent change information resides within the packet switch memory, and is administered by the personnel responsible for the local No. 1 PSS data base administration.

6.02 The mode of operation used with the packet switch recent change is via a group of interactive forms handled by a modified version of the On-line Data Integrity (ODIN) system. One such form for reviewing and updating is the Customer Service Form, as provided in Fig. 9. This form is displayed on the cathode ray tube (CRT) in two parts.

6.03 Figure 10 is an example of a completed Customer Service Form. This particular example provides the data base requirements for the DSI to packet switch access line. The DSI has been allocated a full set of 200 end point numbers (EPNs) in the assignment of the DTN or logical network address (LNA). Also, the facility ID number of 63 follows the recommended numbering pattern described in paragraph 5.24. The second screen of the two-part Customer Service Form is not required for the provisioning of the DSI to packet switch access line. It is specifically designed to provide the details relating to MLHG.

6.04 Table A provides brief definitions for the various fields on the Customer Service Form, by field number. For a complete description of each field, refer to the Transport Network (TNET) Input/Output manual.

7. ABBREVIATIONS AND ACRONYMS

7.01 Abbreviations and acronyms used in this section are defined in the following list:

TERM	DEFINITION
AP	Administrative Processor
CRT	Cathode Ray Tube
CU	Control Unit
CUG	Closed User Group
DDS	Digital Data System
DMERT	Duplex Multi-Environment Real Time
DSI	Data Subscriber Interface
DTE	Data Terminal Equipment
DTN	Data Terminal Number
EPN	End Point Number
FIP	Facility Interface Processor
ID	(Facility) Identifier
LADT	Local Area Data Transport
LC	Logical Channel
LNA	Logical Network Address
PSS	Packet Switching System
PVC	Permanent Virtual Circuit
TNET	Transport Network
VC	Virtual Call

8. REFERENCES

8.01 The following sections should be used as references for additional information:

SECTION	TITLE
255-025-005	LADT General Description
255-025-020	LADT System Administration
255-025-021	Data Subscriber Interface
255-025-022	Data Terminal Numbers
255-025-040	Administrative Processor Measurements
255-025-041	Packet Switch Measurements
255-093-010	Feature Document—No. 1 Packet Switching System Description
255-093-510	Feature Document—Data Subscriber Interface LADT Network

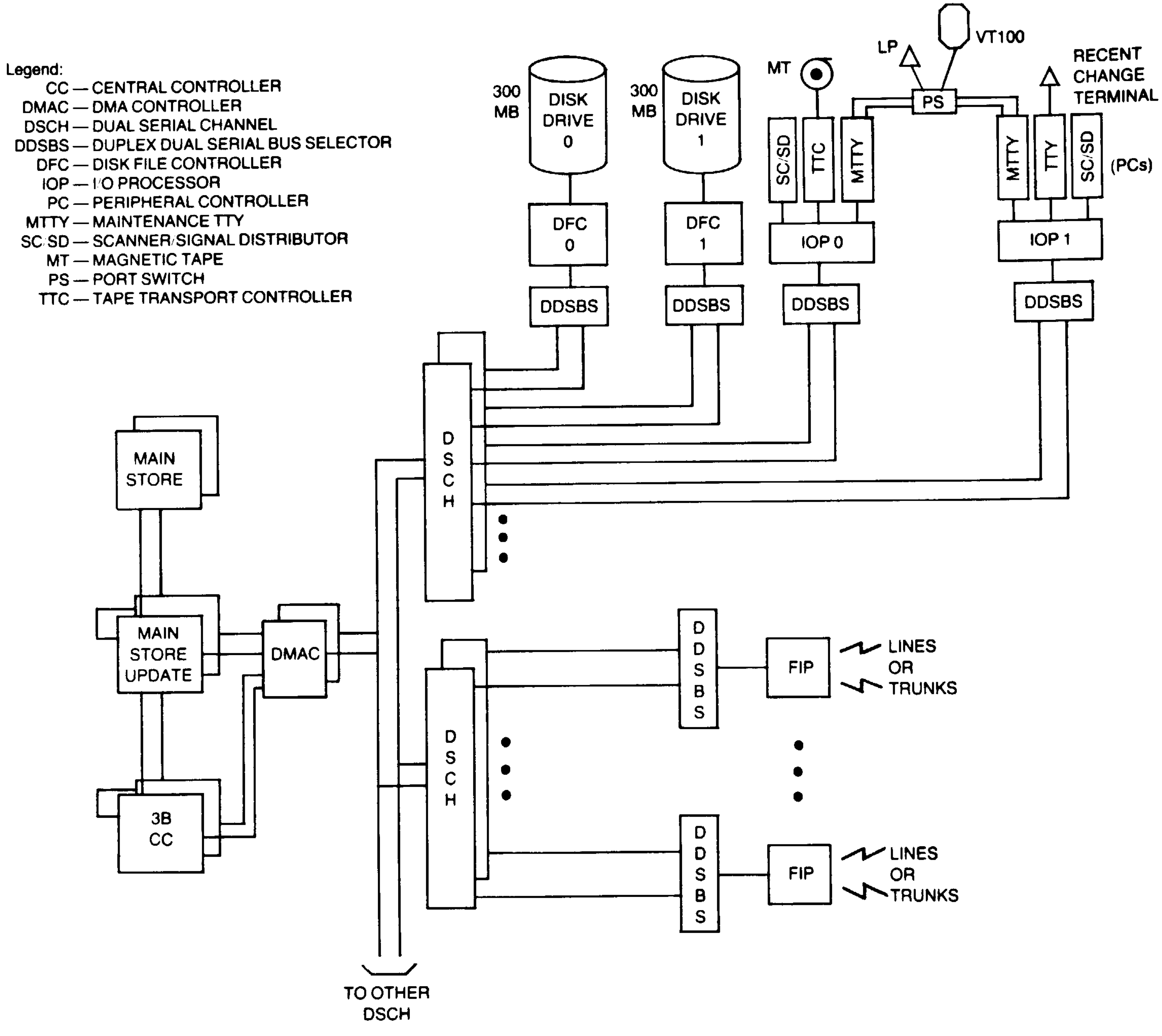

Fig. 1—Packet Switch Hardware Configuration (2.04)

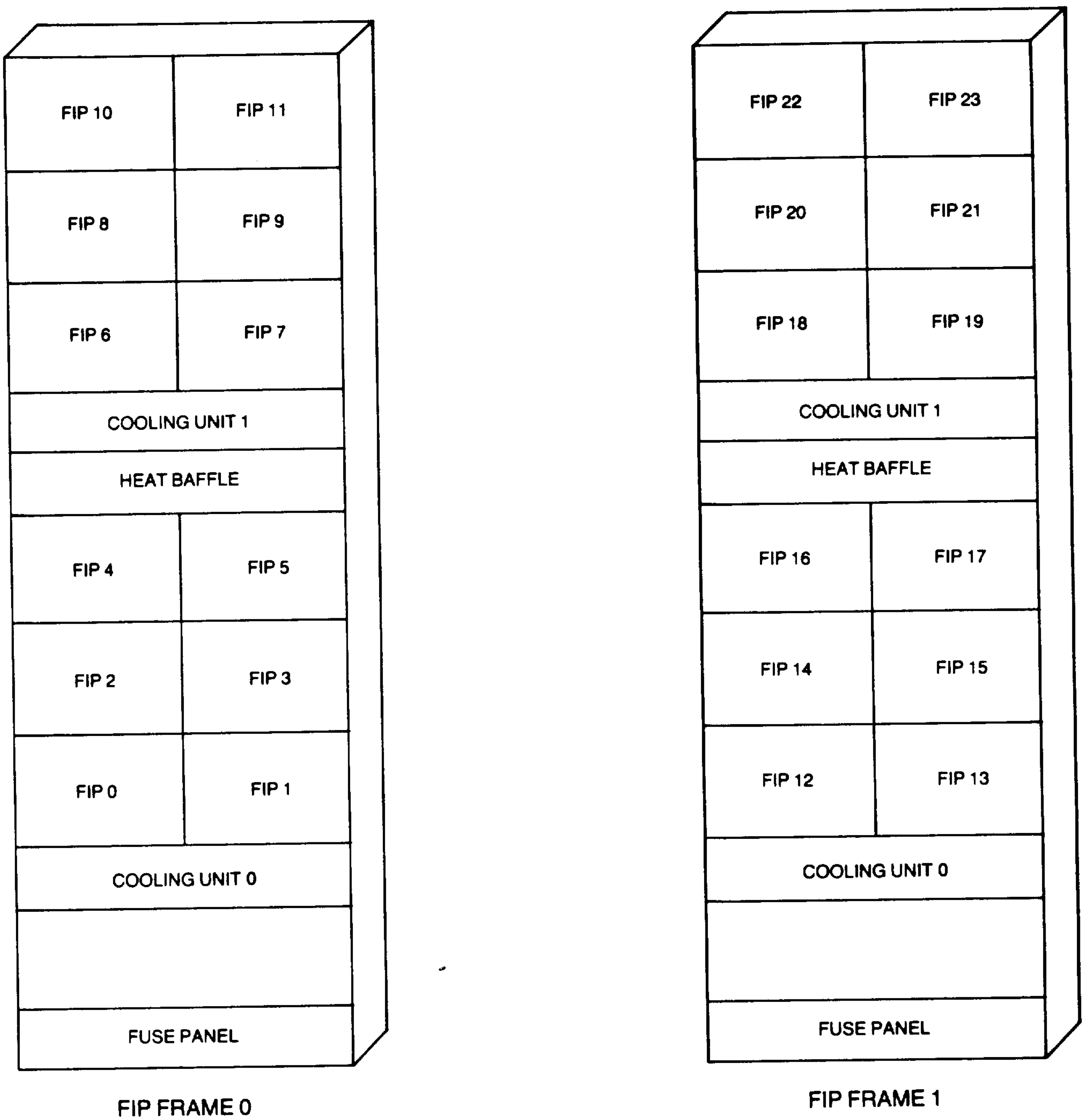

Fig. 2—FIP Frames with FIPs (2.07)

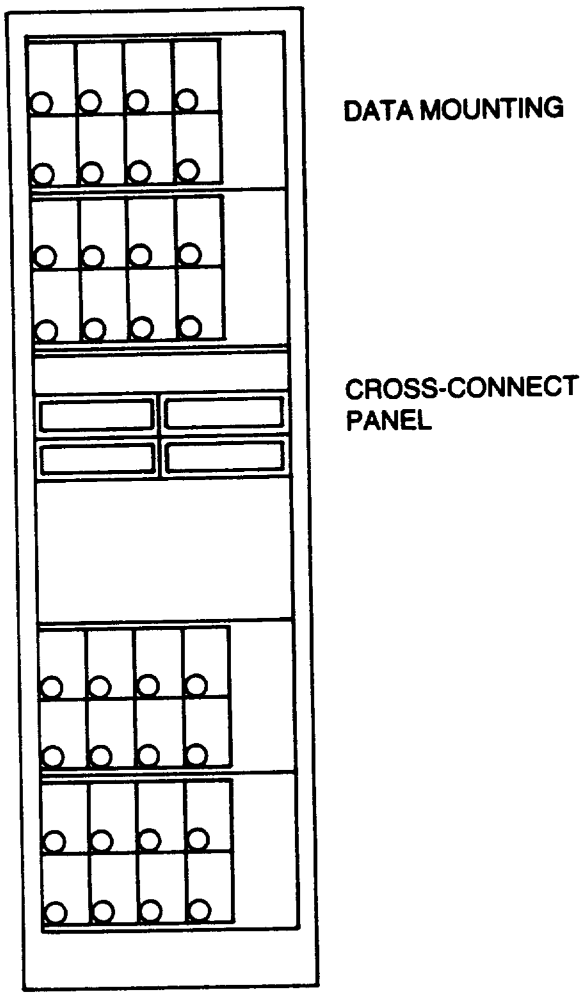

Fig. 3—CSU Frame (2.08)

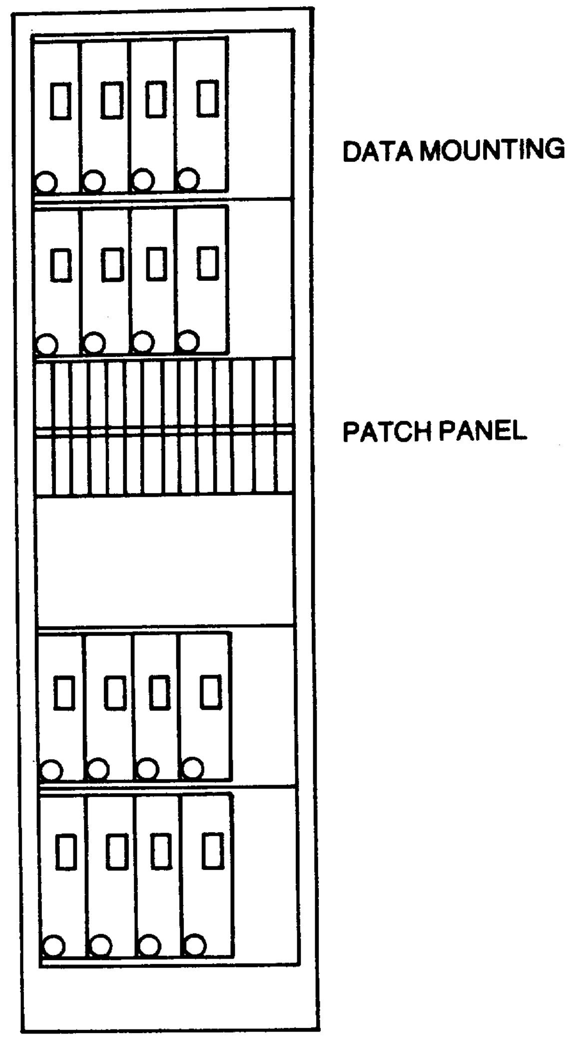

Fig. 4—DSU Frame (2.10)

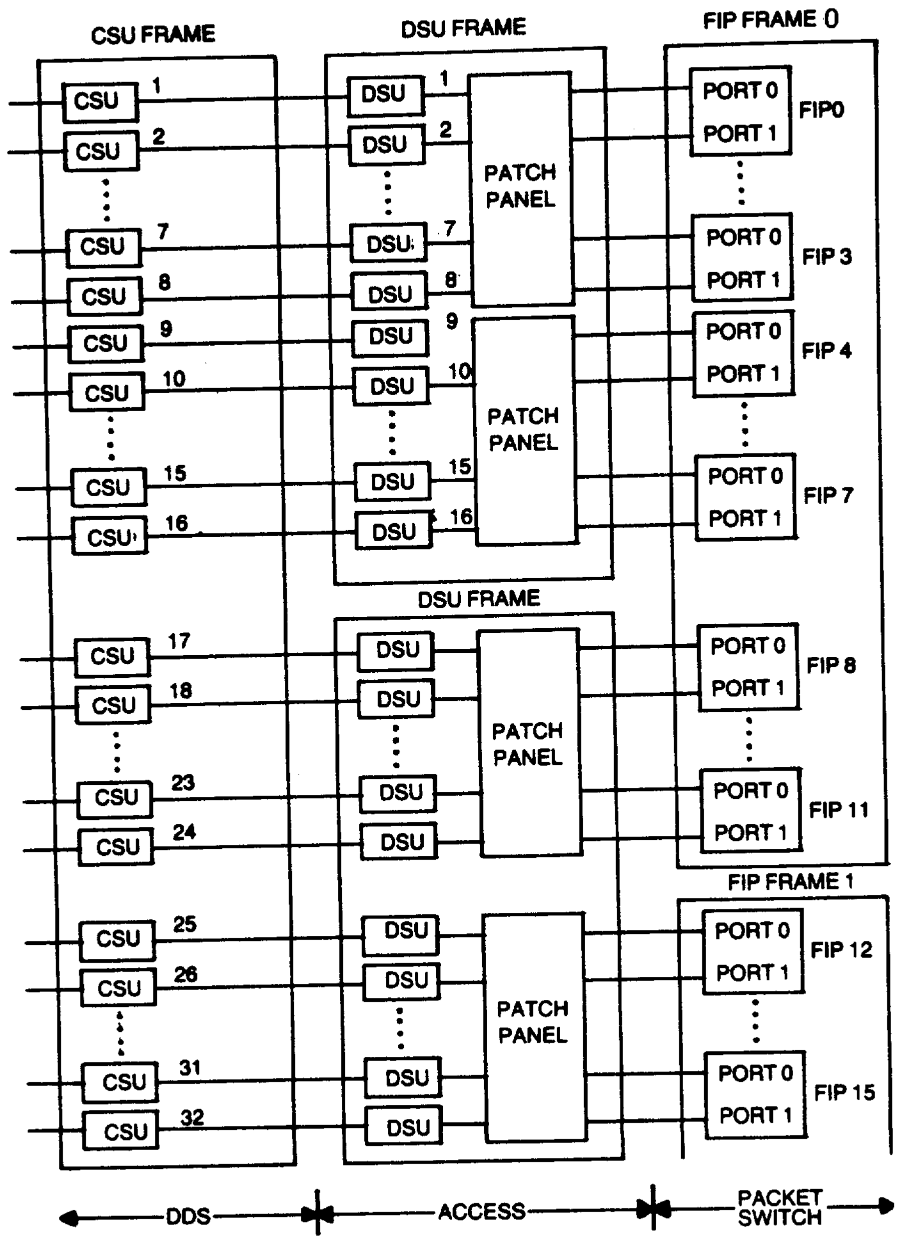

Fig. 5—CSU to FIP Association (2.12)

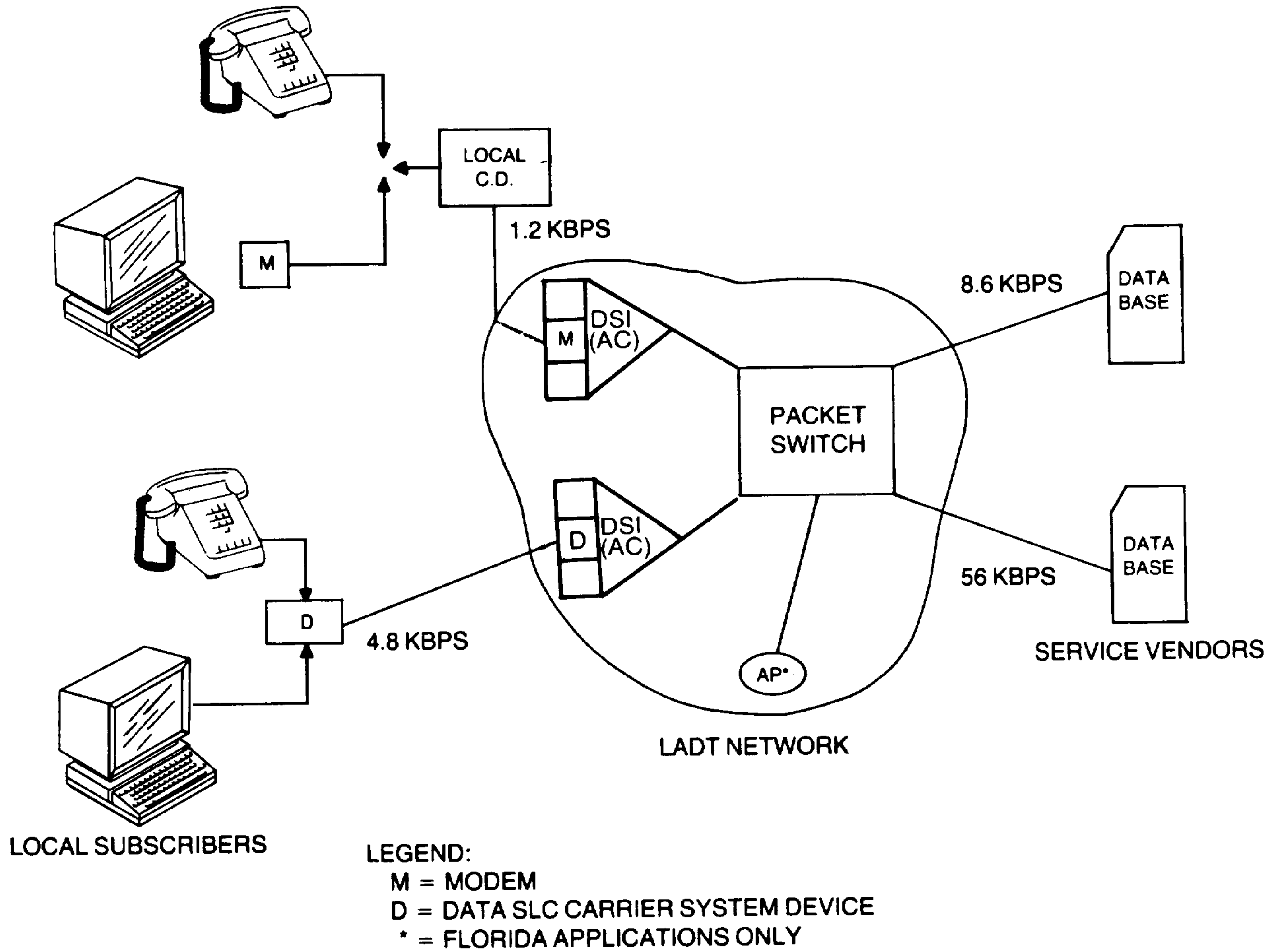

Fig. 6—LADT Network (4.02)

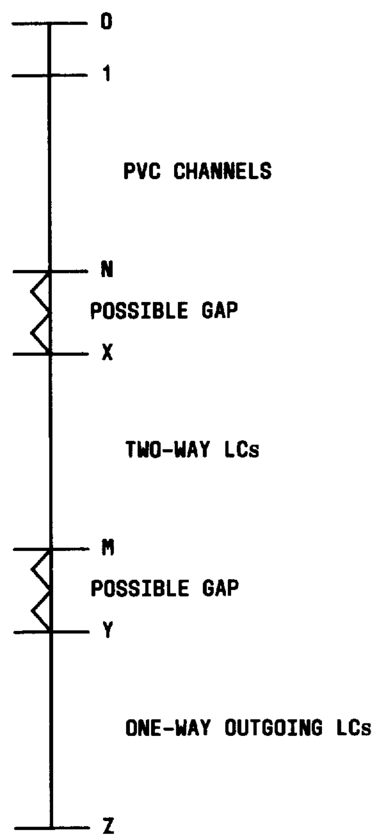

Fig. 7—Schematic of Logical Channel Rules (5.15)

PG______OF______

DATE____________

ASSIGNMENT RECORD

FIP/DTN/LC ASSOCIATION

DTN	FIP ASSIGNMENTS				LC ASSIGNMENTS			MEMORY BOARDS	SPEED
	FRAME	NO.	PORT	FAC. ID	PVC	2-WAY	1-WAY OUT		
		0	0						
		0	1						
		1	0						
		1	1						
		2	0						
		2	1						
		3	0						
		3	1						
		4	0						
		4	1						
		5	0						
		5	1						
		6	0						
		6	1						
		7	0						
		7	1						
		8	0						
		8	1						
		9	0						
		9	1						
		10	0						
		10	1						
		11	0						
		11	1						
		12	0						
		12	1						

Fig. 8—Assignment Record (Sheet 1 of 5) (5.25)

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ASSIGNMENT RECORD (Contd)

FIP/DTN/LC ASSOCIATION

DTN	FIP ASSIGNMENTS				LC ASSIGNMENTS			MEMORY BOARDS	SPEED
	FRAME	NO.	PORT	FAC. ID	PVC	2-WAY	1-WAY OUT		
		13	0						
		13	1						
		14	0						
		14	1						
		15	0						
		15	1						
		16	0						
		16	1						
		17	0						
		17	1						
		18	0						
		18	1						
		19	0						
		19	1						
		20	0						
		20	1						
		21	0						
		21	1						
		22	0						
		22	1						
		23	0						
		23	1						
		24	0						
		24	1						
		25	0						
		25	1						

Fig. 8—Assignment Record (Sheet 2 of 5) (5.25)

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DATE____________

ASSIGNMENT RECORD (Contd)

FIP/DTN/LC ASSOCIATION

DTN	FIP ASSIGNMENTS				LC ASSIGNMENTS			MEMORY BOARDS	SPEED
	FRAME	NO.	PORT	FAC. ID	PVC	2-WAY	1-WAY OUT		
		26	0						
		26	1						
		27	1						
		28	0						
		28	1						
		29	0						
		29	1						
		30	0						
		30	1						
		31	0						
		31	1						
		32	0						
		32	1						
		33	0						
		33	1						
		34	0						
		34	1						
		35	0						
		35	1						
		36	0						
		36	1						
		37	0						
		37	1						
		38	0						
		38	1						

Fig. 8—Assignment Record (Sheet 3 of 5) (5.25)

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DATE__________

ASSIGNMENT RECORD (Contd)

FIP/DTN/LC ASSOCIATION

DTN	FIP ASSIGNMENTS				LC ASSIGNMENTS			MEMORY BOARDS	SPEED
	FRAME	NO.	PORT	FAC. ID	PVC	2-WAY	1-WAY OUT		
		39	0						
		39	1						
		40	0						
		40	1						
		41	0						
		41	1						
		42	0						
		42	1						
		43	0						
		43	1						
		44	0						
		44	1						
		45	0						
		45	1						
		46	0						
		46	1						
		47	0						
		47	1						
		48	0						
		48	1						
		49	0						
		49	1						
		50	0						
		50	1						
		51	0						
		51	1						

Fig. 8—Assignment Record (Sheet 4 of 5) (5.25)

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DATE__________

ASSIGNMENT RECORD (Contd)

FIP/DTN/LC ASSOCIATION

DTN	FIP ASSIGNMENTS				LC ASSIGNMENTS			MEMORY BOARDS	SPEED
	FRAME	NO.	PORT	FAC. ID	PVC	2-WAY	1-WAY OUT		
		52	0						
		52	1						
		53	0						
		53	1						
		54	0						
		54	1						
		55	0						
		55	1						
		56	0						
		56	1						
		57	0						
		57	1						
		58	0						
		58	1						
		59	0						
		59	1						

Fig. 8—Assignment Record (Sheet 5 of 5) (5.25)

A. FIRST SCREEN

```
                       Customer Service Form
(1)LNA:(2)SRSA Group:305-768(3)EPN:3000  (4)Last EPN:3199 (5)Facility Id:63
(6)Spec Addr:b̸                          (7)FIP Number:2  (8) FIP Slot:1
(9)Access Line State:     b̸              (10)Line Speed: 56
(11)Flow Control Nego:Y   (12)Throughput Nego:Y  (13)Fast Select Accept: Y
(14)Level 2 Window Size:7                (15)Subnetwork ID 0
(16)Outgoing Calls Barred: N             (17)Incoming Calls Barred: N
(18)Maximum Number of Channels:(130to256)(19)Max PVC Channels:0
(20)Two Way Channel Range: 1  To 129     (23)One Way Channel Range: b̸ To b̸
              (26)Closed User Group List
              (27)International Closed User Group Number ID
                  b̸
```

B. SECOND SCREEN

(29)EPN	(30)FID	(31)FIP	(32)FIP Slot	(33)Window	(34)Line State
b̸	b̸	b̸	b̸	b̸	b̸

Note: b̸ = field left blank

Fig. 9—Customer Service Form (6.02)

A. FIRST SCREEN

```
                          Customer Service Form
(1)LNA:(2)SRSA Group:_______(3)EPN:___   (4)Last EPN:____  (5)Facility Id:__
(6)Spec Addr:_                           (7)FIP Number:_   (8) FIP Slot:_
(9)Access Line State:____________        (10)Line Speed: __
(11)Flow Control Nego:__    (12)Throughput Nego:__    (13)Fast Select Accept: __
(14)Level 2 Window Size:__               (15)Subnetwork ID __
(16)Outgoing Calls Barred: __            (17)Incoming Calls Barred: __
(18)Maximum Number of Channels:__________(19)Max PVC Channels:__
(20)Two Way Channel Range:___  To ___    (23)One Way Channel Range:___  To ___
              (26)Closed User Group List
              (27)International Closed User Group Number ID

                  ____
                  ____
                  ____
                  ____
                  ____
                  ____
                  ____
                  ____
                  ____
                  ____
```

B. SECOND SCREEN

```
(29)EPN (30)FID (31)FIP (32)FIP Slot (33)Window (34)Line State

   ____    ___     __         _           _         __________
   ____    ___     __         _           _         __________
   ____    ___     __         _           _         __________
   ____    ___     __         _           _         __________
   ____    ___     __         _           _         __________
   ____    ___     __         _           _         __________
   ____    ___     __         _           _         __________
   ____    ___     __         _           _         __________
   ____    ___     __         _           _         __________
   ____    ___     __         _           _         __________
   ____    ___     __         _           _         __________
   ____    ___     __         _           _         __________
   ____    ___     __         _           _         __________
   ____    ___     __         _           _         __________
   ____    ___     __         _           _         __________
   ____    ___     __         _           _         __________
   ____    ___     __         _           _         __________
   ____    ___     __         _           _         __________
   ____    ___     __         _           _         __________
```

Fig. 10—Sample Completed Customer Service Form (6.03)

TABLE A

CUSTOMER SERVICE FORM FIELD DEFINITIONS

FIELD NO	FIELD NAME	DEFINITIONS
1	LNA	The LNA (DTN) consists of three subfields which make up the 10-digit number (fields 2, 3, and 4).
2	SRSA	The service region/service area (SRSA) is the first six-digits of the DTN, which are the Data numbering Plan Area (DNPA) and the Data Central Office (DCO) code.
3	EPN	This is the EPN for the access line, or the first EPN for the group of assigned DTNs.
4	Last EPN	This is the last EPN for a group of or multiple access lines. If the line or hunt group has a single EPN, this field is left blank.
5	Facility ID	This field is an arbitrary number, from a range of 0 to 239, that is a software identification of a port on a FIP. Once a number has been assigned, it cannot be duplicated on another assignment.
6	Spec Addr	The specific addressing option is used with hunt groups to send information over specific lines of a hunt group. This field is left blank for single lines, including the DSI access line.
7	FIP Number	This number, from 0 to 59, represents the specific FIP the access line is on. This field is left blank for hunt groups.
8	FIP Slot	The FIP slot is the number of the port on the FIP. Valid port numbers are 0 or 1. This field will be left blank for hunt groups.
9	Access Line State	This field is a read-only field, and is unused for hunt groups.
10	Line Speed	This field specifies the transmission rate of an access line or lines in a hunt group. Valid entries are 56 kb/s or 9.6 kb/s.
11	Flow Control Nego	Valid entries for the Flow Control Negotiation field are either "yes" or "no". This option permits negotiation on a per call basis of some X.25 facilities, e.g., packet size. This facility is needed by the DSI so that a terminal and service vendor can communicate using 256 octet data packets. It also allows the DSI and service vendor to negotiate the X.25 level 3 window size. The default value is "yes."

TABLE A (Contd)

CUSTOMER SERVICE FORM FIELD DEFINITIONS

FIELD NO	FIELD NAME	DEFINITIONS
12	Throughput Nego	For the Throughput Negotiation field, valid entries are either "yes" or "no." This option permits negotiation on a per call basis of the throughput classes for each direction of data transmission. Throughput classes up to and including 9600 bps are supported (i.e., 75, 150, 300, 600, 1200, 2400, 4800, and 9600 bps). The default throughput class associated with each call is 9600 bps. The default value for this field is "yes."
13	Fast Select Accept	Specified with either "yes" or "no". This option authorizes the network to transmit to the DTE incoming call packets which select the fast select facility. The default value is yes.
14	Level 2 Window Size	The window size for the X.25 level 2. This field is left blank for hunt groups.
15	Subnetwork ID	The subnetwork identification of the line being assigned.
16	Outgoing Calls Barred	Specified as either "yes" or "no". It must be "no" for the DSI access line, as this field, when specified "yes", prevents calls from being originated on the line. The default value is no.
17	Incoming Calls Barred	This field is specified as either "yes" or "no". Incoming calls barred prevent calls from being received by the line assigned. The default value is "no."
18	Maximum Number of Channels	This field specifies the maximum number of LCs allocated to the access line. The DSI access line requires a minimum of 130 LCs. There is a limit of 512 channels per memory board on a FIP.
19	Max PVC Channels	All of the LCs between 1 and the maximum number of PVC Channels, inclusive, are reserved for PVCs. If this is a hunt group, the same number of channels is reserved for each line in the hunt group.
20	Two Way Channel Range	This field is the "from/to" range of 2-way channels that the customer has contracted to use. The number in the first field must be less than or equal to the number in the second field. The number in the second field must be less than the maximum number of channels specified for this access line in field 18. These fields are not specified if incoming or outgoing access is barred.
23	One Way Channel Range	This field specifies the "from/to" range of 1-way outgoing channels the customer has contracted to use. The number in the first field must be less than or equal to the number in the second field. The number in the second field must be less than the maximum number of channels specified for this access line in field 18. These fields are not specified if incoming or outgoing access is barred.

TABLE A (Contd)

CUSTOMER SERVICE FORM FIELD DEFINITIONS

FIELD NO	FIELD NAME	DEFINITIONS
24	Closed User Group List	This is the list of a maximum of 10 CUGs that a customer can belong to. A CUG is one in which only the group members can communicate with each other.
27	International Closed User Group Number ID	The CUGs for each customer are numbered 0 through 9, from the first (top) entry to the last (bottom) entry.
28	Hunt Group List	The hunt group list is on the second screen of the Customer Service Form. The hunt group can consist of up to 20 lines. This list is not used for single lines. No blank rows are allowed between members in the list, but the order of lines in the list is insignificant.
29	EPN	The EPN for members of the hunt group.
30	Facility ID	The facility ID number for members of the hunt group.
31	FIP	FIP number for the access line.
32	FIP Slot	FIP port number for the access line (same number as field 8).
33	Window Size	Level 2 window Size
34	Line State	The current line state for the member of the hunt group. This is read-only field.