Configuration of the Loop-V 4200 T1/E1 ATM Frame Relay Card

Introduction

Loop Telecom's T1/E1 ATM Frame Relay plug-in card combines the function of a Frame Relay to ATM inter-working and the function of a CSU/DSU. With this card, access from a Frame Relay customer's FRAD (Frame Relay Assembler-Dissembler) equipment to an ATM or Frame Relay switch is accomplished within one box, resulting in savings in cost and space. Two types of plug-in cards provide interfaces to E1 and to T1 transmission format.

ATM and Frame Relay Basics

This section is a tutorial discussion for beginners. Experienced network engineers can skip to the next section.

Traditional telephone networks use circuit switching. When a customer requests a connection, a dedicated circuit is assigned to the customer for the duration of the call. During the call, this circuit is unavailable to others whether the customer is actively using the circuit or not. Of course, the customer pays for the entire connection time regardless of the amount of information passed during the call. During busy times, a customer requesting a connection may get a "network busy" signals, meaning that all circuits are already in use. An analogy to circuit switching is travel by rail. A customer buys a ticket for a seat, which then becomes unavailable to others. During peak holiday travel, a customer may find that all seats are sold, regardless of whether all seats have a person sitting.

Developments in data communication resulted in packet transmission technology. Data streams from a customer are "encapsulated" into packets. In each packet, in addition to a segment of customer data, are information about the packet, including but not limited to the following:

address of the destination,

address of the sender,

length of the packet,

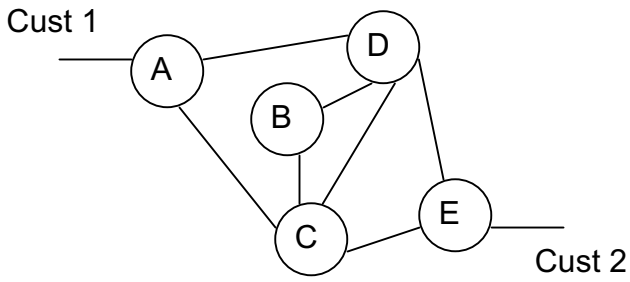
check sum of the packet,

packet sequence number, and

route history that the packet traveled so far.

The main advantage of using packet transmission is efficiency. A packet transmission facility can be shared, with the active and idle periods of many users interleaved. The corresponding analogy is travel by highway. No reservations or tickets are necessary to enter a highway. However, during peak holiday travel, cars are slowed or even stopped due to congestion. For packets, when congestion in a facility occurs, packets are temporary stored, resulting in delay. When package storage facilities are exhausted, packets are discarded. Such delays and loss are acceptable for data transmission because reasonable delays are acceptable and lost data can be re-sent. Not so for voice conversation, where delays result in stutters and losses result in chopped speech. Proponents for the convergence of voice and data claim that by giving voice-traffic priority, the delays and losses of speech packets could be minimized. In travel, this is equivalent to special lanes on the highway reserved for privileged vehicles. Naturally, even these special lanes can be congested. Congestion control is an important feature of any packet transmission system.

When customer data is encapsulated, standards must be followed both for the proper routing through the packet network and for the proper extraction of the data at the destination. Though X.25 was the earliest packet format, standards popular now are the IP (Internet Protocol), the FR (Frame Relay), and the ATM (Asynchronous Transfer Mode). Processes that convert a data stream into packet form are variously termed PAD (packet assembler-dissembler), FRAD (Frame Relay assembler-dissembler), and SAR (segmentation assembly-recovery).



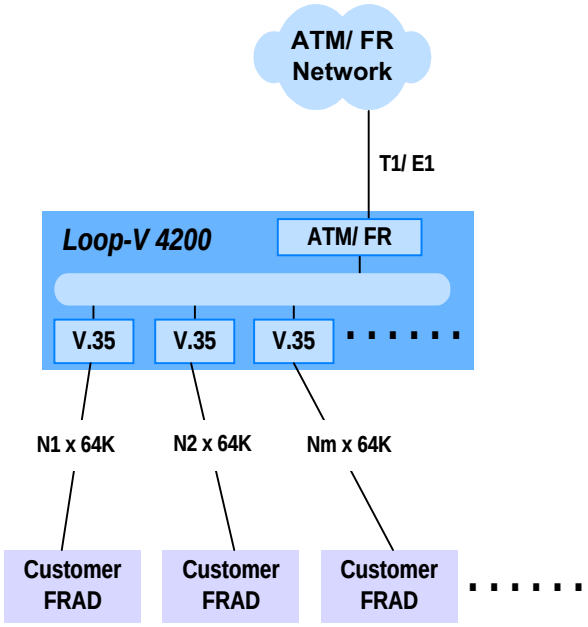
A typical packet network consists of switching nodes (A, B, C, D, and E in the diagram) and transmission facility connecting pairs of nodes. Not all node pairs will have a transmission facility directly connecting them. Packets from customer 1 to customer 2 may travel through several different paths crossing several nodes. For example, the first packet from customer 1 may follow the nodes A-C-E, while the next packet could follow A-D-E. This flexibility allows the most efficient use of the transmission facilities. When one route is congested, another route is attempted.

Each packet arriving at a node must be analyzed for its ultimate destination and for the best route. If all paths are congested, the packet may be temporarily stored until paths are usable. If the storage at a node is already full, further packets will be discarded. Because packets may travel different distances, the arriving packets at customer 2 may not be in the same order as departing from customer 1. Sequence numbers in each packet allow customer 2 to rearrange the packets and also detect missing packets. Route history prevents a packet from being sent in a circular path, as in A-C-B-D-C-B-D-C.

Within a network, the encapsulation standard must be uniform. Inter-working devices are used to convert one format into another for transport over different packet networks.

Product Description

The Loop Telecom ATM Frame Relay Plug-In card is designed for the Loop-V 4200 series products. This card combines the function of an ATM/Frame Relay and CUS/DSU. With this card, access from a Frame Relay customer's FRAD is accomplished within one box, resulting in savings in cost and space.



A typical application is illustrated above. In this example, packets in Frame Relay format from several FRADs are combined into a single outgoing ATM or Frame Relay format.

Detailed Plug-In Card Setup

Follow the manual for the ATM/Frame Relay Plug-In for mechanical installation. This section will provide additional details for software configuration. Also, the DTE cards (V.35) to accept Frame Relay inputs from customer FRAD must be installed.

After all cards are installed, the user must assign logical FR channel numbers to the FR inputs. If there are DTE cards plugged into Loop-V 4200 slots B, C, and D, they could be assigned logical FR channels numbered 1, 2, and 3. These logical channel numbers are used in the setup process. Before the ATM/FR Plug-In card is setup, the TSI (time slot interchange) of the main chassis must be setup.

Loop-V 4200 System TSI Setup

Consult the Loop-V 4200 manual to set up the cross-connect. In the example below, an E1 plug-in card is installed in PORT A. A V.35 plug-in card is installed in each of the three ports PORT B, PORT C, and PORT D, which are in turn fed from customers FRAD (frame relay assembler-dissembler).

```
LOOP V4200-9            === System Setup ( MAP ) ===     10:47:33 07/19/2000
ARROW KEYS: CURSOR MOVE, Please Input: 0~9, BACKSPACE to edit
     PORT A PORT B PORT C PORT D PORT E PORT F PORT H PORT J PORT K PORT Z
TIME ATM/E1 DTE    DTE    DTE                                      INBAND
SLOT CAS    V.35   V.35   V.35
==== ====== ====== ====== ====== ====== ====== ====== ====== ====== ======
  1   d B 01 d A 01 d A 04 d A 09                                   d   00
  2   d B 02 d A 02 d A 05 d A 10                                   d   00
  3   d B 03 d A 03 d A 06 d A 11                                   d   00
  4   d C 01 d   00 d A 07 d A 12                                   d   00
  5   d C 02 d   00 d A 08 d   00                                   d   00
  6   d C 03 d   00 d   00 d   00                                   d   00
  7   d C 04 d   00 d   00 d   00                                   d   00
  8   d C 05 d   00 d   00 d   00                                   d   00
  9   d D 01 d   00 d   00 d   00                                   d   00
 10   d D 02 d   00 d   00 d   00                                   d   00
 11   d D 03 d   00 d   00 d   00                                   d   00
 12   d D 04 d   00 d   00 d   00                                   d   00
 13   d   00 d   00 d   00 d   00                                   d   00
 14   d   00 d   00 d   00 d   00                                   d   00
 15   d   00 d   00 d   00 d   00                                   d   00
 16   d   00 d   00 d   00 d   00                                   d   00

<<ESC key to previous menu, SPACE key to another page >>           PAGE1
```

From the system main menu, press “S” for the System Setup screen. Then select the option MAP for the TSI map, shown above. Time slots are then assigned.

Logical Frame Relay channels 1, 2, and 3 will be assigned to the V.35 cards plugged into ports B, C, and D respectively. These logical channels will be assigned contiguous blocks of time slots in PORT A. The number of time slots assigned to each logical channel determines the bandwidth allocated to each of these channels, with each time slot providing 64 Kbps capacity. In the example above, channel 1 is assigned 3 time slots or 192 Kbps, channel 2 will have 5 time slots or 320 Kbps, and channel 3 will have 4 time slots or 256 Kbps. Note the corresponding reciprocal assignments for each of the PORTs. Once assigned, the logical channel numbers will be used in the setup of the ATM/Frame Relay Plug-In card. A total of 31 time slots are available.

ATM Frame Relay Plug-In Card Configuration

From the main system menu, press “U” to select the PORT, in this case, PORT A. Then from the PORT menu, press “S” for Unit System Setup. The following screen is shown. At the bottom, four setup choices are given. For initial setup, each of these four setup screens should be filled in. An asterisk will highlight the current selection (*). Use arrow keys to change selection. Press ENTER to activate.

```
PORT A ATM/FR              === Port System Setup ===          17:25:44 07/21/2000




>> Select ATM_setup  Type ?     *T1/E1     CH_MAP     FR_MAN     CONN_TAB
```

When the setup choice T1/E1 is entered. The following screen is shown.

The Interface setting displays the egress port type (E1 or T1).

The Protocol setting allows the user to specify the protocol on the line (ATM or Frame Relay).

The Channel Map, with 31 time slot positions, specifies the type of traffic. A “1” specifies presence of layer 2 traffic in that time slot, and an “i” indicates an idle time slot . For ATM traffic, this setting cannot be modified.

All of the E1 line settings, Frame, Code, CRC, and others, must match that of the ATM network settings.

NOTE: Although the following illustrations are for the E1 interface the procedure for the T1 interface are similar except for the 24 available time slots for T1 compared to 30 for E1.

```
PORT A ATM/FR              === Port System Setup ===          10:16:40 12/26/2000
ARROW KEYS: CURSOR MOVE, TAB: ROLL OPTIONS

     FRAME      = ON                    Interface  : E1
     CODE       = HDB3                  Protocol   : ATM
     CRC        = ON                    Channel Map:
     RAI        = ON                    [1111111111111111i111111111111111]
     AIS        = FRAMED
     CAS        = OFF
     FDL        = OFF
     Sa_bit     = Sa4
     INTF       = 120 Ohm



<< Press ESC key to return to previous menu >>
```

Setup Specific to ATM Protocol

In the following, further setup will be for the ATM protocol. For Frame Relay protocol, see later sections.

Channel Map Setup

Select the CH_MAP item on the Port System Setup menu. Use this channel map to tell the ATM/FR card what time slots are combined to be a logical frame relay channel. The logical channel number can be 1 to 31. A 0 will indicate an idle time slot. For our example, the time slots assigned for logical channels 1, 2, and 3 should match that in the Loop-V 4200 TSI map for PORT A.

```
PORT A ATM/FR           === Port Channel Map Setup ===      17:25:53 07/21/2000
ARROW KEYS: CURSOR MOVE, Please Input: 0~9, BACKSPACE to edit



  Time Slot  :  01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16
  FR Channel : [01 01 01 02 02 02 02 02 03 03 03 03 00 00 00 00]

  Time Slot  :  17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
  FR Channel : [00 00 00 00 00 00 00 00 00 00 00 00 00 00 00]









<< Press ESC key to return to previous menu >>
```

Frame Relay Management Setup – FR to ATM

Select the FR_MAN item on the Port System Setup menu. Use this management setup to tell the protocol details of the ATM network. The logical channel number can be 1 to 31. The meanings of the parameters are as follows:

Column Heading	Options	Meaning
CH	1 to 31	Logical channel number
Active	YES NO	Activated by user An idle frame relay channel
Protocol	ITU	Using Q.933 Annex A protocol
Direction	User Network Bidirection	Acts as user side device (periodically issues polling messages to network side) Acts as network side device (waits for polling messages from user side) This channel can issue polling messages and respond to polling messages
T391 Polling Interval	5-30 seconds	The interval between Status Inquiry message from user to network, else error counted.
T392 Response time	5-30 seconds	The max allowed interval between Status Inquiry and network response, else error counted.
N391 PVC Polling Interval	1-255 seconds	The interval between PVC Status Inquiry message from user to network, else error counted.
N392 Error count	1-10	Determine service affecting condition by detecting N392 errors in the last N393 events.
N393 Error count	1-10	See N392

These parameters must be coordinated with the ATM network parameters.

```
PORT A ATM/FR          === Port FR Management Setup ===     17:26:13 07/21/2000
ARROW KEYS: CURSOR MOVE, TAB: ROLL OPTIONS


[CH] [Active]  [Protocol] [Direction]  [T391] [T392] [N391] [N392] [N393]
-------------------------------------------------------------------------
  1    YES        ITU        User         10     15     001    3      4
  2    YES        ITU        User         10     15     001    3      4
  3    YES        ITU        User         10     15     001    3      4
  4    NO         ITU        Network      10     15     001    3      4
  5    NO         ITU        Network      10     15     001    3      4
  6    NO         ITU        Network      10     15     001    3      4
  7    NO         ITU        Network      10     15     001    3      4
  8    NO         ITU        Network      10     15     001    3      4
  9    NO         ITU        Network      10     15     001    3      4
 10    NO         ITU        Network      10     15     001    3      4
 11    NO         ITU        Network      10     15     001    3      4
 12    NO         ITU        Network      10     15     001    3      4
 13    NO         ITU        Network      10     15     001    3      4
 14    NO         ITU        Network      10     15     001    3      4
 15    NO         ITU        Network      10     15     001    3      4
 16    NO         ITU        Network      10     15     001    3      4

<< Press ESC key to return to previous menu >> << Space bar for CH 17-31   >>
```

Connection Table Setup – FR to ATM

Select the CONN_TAB item on the Port System Setup menu. Use this management setup to link the connection table to that of the ATM network. The channel number can be 1 to 31. All the numerical entries must be coordinated with the ATM network. The meanings of the table columns are as follows:

Column Heading	Options	Meaning
[Blank]	1-128	Line number for reference
CH	1-31	Logical channel number
DLCI	16-991	Data Link Connection Identifier within the channel
VPI	1-199	Virtual Path Identifier, from ATM
VCI	1-199	Virtual Channel Identifier, from ATM
BR	1-1920	Bit Rate requested in Kilobits/sec for this VC
[Blank]	1-1920	Actual Bit Rate allocated I Kilobits/sec
IWK & Translation	Network	Network inter-working, FRF.5
	SVC-Mode1	Service inter-working, FRF.8, Map FECN field in Frame Relay to ATM EFCI field
	SVC-Mode 2	Service inter-working, FRF.8, ATM EFCI is always set to “congestion net experienced”
	SVC-YES	Translation column appears in table, see Translation below.
	SVC-NO	Translation column appears in table, see Translation below.
	SVC-YES	Do translation between Frame Relay (FRF-3) and ATM (RFC1483)
	SVC-NO	Forward encapsulations unaltered
DE-CLP	MAP	Maps content of DE (discard eligibility) in Frame Relay or CLP (cell loss probability) in ATM to CLP in ATM, DE in Frame Relay
	0	Regardless of contend of DE and CLP, set outgoing DE and CLP to constant 0.
	1	Regardless of contend of DE and CLP, set outgoing DE and CLP to constant 1.

```
PORT A ATM/FR          === Port Connection Table Setup ===     17:26:29 07/21/2000
```

```
ARROW KEYS: CURSOR MOVE, Please Input: 0~9, BACKSPACE to edit


                  [CH] [DLCI] [VPI] [VCI] [BR]  [IWK & Translation] [DE-CLP]

 index : 1         01   100    012  00101 0001    Network              MAP
             ------------------------------------------------------------------
              1     1    100    12    101    1    Network              MAP
              2     0    101    12    101   11    Network              MAP
              3     0    102    12    102   11    Network              MAP
              4     0    103    12    103   11    Network              MAP
              5     0    104    12    104   11    Network              MAP
              6     1    105    12    105   11    Network              MAP
              7     1    106    12    106   11    Network              MAP
              8     1    107    12    107   11    Network              MAP
              9     1    108    12    108   11    Network              MAP
             10     1    109    12    109   11    Network              MAP
             11     1    110    12    110   11    Network              MAP
             12     1    111    12    111   11    Network              MAP
             13     1    112    12    112   11    Network              MAP


<< Press ESC key to return to previous menu >>
```

The entire connection table can be viewed by paging through the line numbers using the space bar. Each of the line numbers (line index) can be edited. The procedure is as follows.

(1) Move the cursor to the “index” number. Type in the line number followed by ENTER.

(2) Edit any of the entry by moving the cursor to that entry. For numbers, enter the new number followed by ENTER. For option choices, use TAB key to cycle through the availabe choices.

Setup Specific to FR-FR Protocol

In the following, setup will be for the FR-FR protocol. From the E1/T1 menu, select Frame Relay for the Protocol. Screen below illustrates that for the T1 interface.

```
PORT A ATM/FR              === Port System Setup ===          10:16:30 12/26/2000
ARROW KEYS: CURSOR MOVE, TAB: ROLL OPTIONS

     FRAME      = ESF                    Interface  : T1
     CODE       = B8ZS                   Protocol   : Frame Relay
     YEL        = ON                     Channel Map:
     AIS        = FRAMED                 [111111111111111111111111]
     INBAND     = OFF
     INTF       = LONG HAUL
     LBO        = 0 dB




<< Press ESC key to return to previous menu >>
```

Channel Map Setup

Select the CH_MAP item on the Port System Setup menu. Use this channel map to tell the ATM/FR card what time slots are combined to be a logical frame relay channel. The logical channel number can be 1 to 31. A 0 will indicate an idle time slot. For our example, the time slots assigned for logical channels 1, 2, and 3 should match that in the Loop-V 4200 TSI map for PORT A.

```
PORT A ATM/FR            === Port Channel Map Setup ===      17:25:53 07/21/2000
ARROW KEYS: CURSOR MOVE, Please Input: 0~9, BACKSPACE to edit



  Time Slot  :  01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16
  FR Channel : [01 01 01 02 02 02 02 02 03 03 03 03 00 00 00 00]

  Time Slot  :  17 18 19 20 21 22 23 24
  FR Channel : [00 00 00 00 00 00 00 00]









<< Press ESC key to return to previous menu >>
```

Frame Relay Management Setup – FR to FR

Select the FR_MAN item on the Port System Setup menu. Use this management setup to tell the protocol details of the ATM network. The logical channel number can be 1 to 31. The meanings of the parameters are the same as for FR to ATM.

Connection Table Setup – FR to FR

Select the CONN_TAB item on the Port System Setup menu. Use this management setup to link the connection table to that of the Frame Relay network. The channel number can be 1 to 31. All the numerical entries must be coordinated with the Frame Relay network. The meanings of the table columns are as follows:

Column Heading	Options	Meaning
[Blank]	1-128	Line number for reference
CH	1-31	Logical channel number
DLCI	16-991	Data Link Connection Identifier within the egress E1/T1 port
CIR	1-1920	Committed Information Rate
[Blank]	(…)	Actual allocated bandwidth
Bc	1-1920	Committed Burst Size
Be	1-1920	Excess Burst Size

```
PORT A ATM/FR        === Port Connection Table Setup ===    10:17:59 12/26/2000
ARROW KEYS: CURSOR MOVE, Please Input: 0~9, BACKSPACE to edit


                 [CH  DLCI] <=> [DLCI   CIR         Bc    Be]

 index : 4        00   104        104  0200       0500  0000
            ------------------------------------------------
             1     1   101        101   500( 500)  500     0
             2     2   102        102   500( 500)  500     0
             3     1   103        103   500( 500) 1000     0
             4     0   104        104   200(   0)  500     0
             5     0     0          0     0(   0)    0     0
             6     0     0          0     0(   0)    0     0
             7     0     0          0     0(   0)    0     0
             8     0     0          0     0(   0)    0     0
             9     0     0          0     0(   0)    0     0
            10     0     0          0     0(   0)    0     0
            11     0     0          0     0(   0)    0     0
            12     0     0          0     0(   0)    0     0
            13     0     0          0     0(   0)    0     0


<< Press ESC key to return to previous menu >>
```

The procedure for modifying this table is the same as for the FR-ATM protocol.

Glossary of Acronyms

The following acronyms are listed for the user's convenience.

AAL	Asynchronous-Transfer-Mode Adaptation Layer
ATM	Asynchronous Transfer Mode
Bc	Committed Burst Size
Be	Excess Burst Size
BECN	Backward Explicit Congestion Notification
BGP	Border Gateway Protocol
BOOTP	Boot Protocol
BPDU	Bridge Protocol Data Units
CBO	Continuous Bit Stream Orientation
CIDR	Classless Inter-Domain Routing
CIR	Committed Information Rate
CLLM	Consolidated Link Layer Management Message
CLP	Cell Loss Probability
CPU	Central Processing Unit
DCE	Data Communications Equipment
DE	Discard Eligibility
DLCI	Data Link Connection Identifier
ECN	Explicit Congestion Notification
FDDI	Fiber Distributed Data Protocol
FECN	Forward Explicit Congestion Notification
FR	Frame Relay
FRAD	Frame Relay Assembler-Dissembler
FTP	File Transfer Protocol
HEC	Header Error Control
ICMP	Internet Control Message Protocol
IP	Internet Protocol
ISP	Internet Service Provider
IWF	Inter-Working Function
IWK	Inter-Working
LAN	Local Area Network
LOC	Loss of Continuity
MAC	Media Access Control
NNI	Network to Network Interface
OSI	Open System Interconnection
OSPF	Open Shortest Path First
PC	Personal Computer
PNNI	Private Network to Network Interface
PVC	Permanent Virtual Circuit
QoS	Quality of Service
RDI	Reverse Defect Indicator
RIP	Routing Information Protocol
SAR	Segmentation Assembler-Recovery
SNMP	Simple Network Management Protocol
SVC	
TCP	Transport Control Protocol
TFTP	Trial File Transfer Protocol
UDP	User Data-gram Protocol
UNI	User Network Interface
VBR	Variable Bit Rate
VC	Virtual Connection
VCI	Virtual Channel Identifier
VLAN	Virtual Local Area Network
VPI	Virtual Path Identifier
WAN	Wide Area Network
XNS	Xerox Network Systems