

# Applications of the Loop-V 4200 Router Interface Card

## Introduction

Loop Telecom's Router Interface card combines the function of an edge router and a DTE. With this card, access from LAN to WAN is accomplished within one box, resulting in savings in cost and space.

## LAN and WAN Basics

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

A LAN (local area network), also commonly known by its technology, Ethernet, is an invention of DEC (Digital Equipment Corporation) about 1955. Each device attached to a LAN will broadcast messages to all other attached equipment. Each device also listens to all messages broadcast on the LAN. Messages have sender's and intended receiver's addresses. When its own address is detected as receiver, that device will process the received message. All other messages will be ignored. That no central message handling facility is needed is the principle advantage of this scheme. Traditional networks always needed such central facilities, such as the post office, the telephone central office, or even the lowly office mailroom.

To handle increasing traffic, the speed of the LAN has been upgraded over the years. Common speeds are 10 BaseT (10 Megabits per second) and 100 BaseT (100 Megabits per second). Starting to arrive is Giga BaseT (Gigabits per second).

Two LAN systems can be combined to act as a single LAN, for which a LAN Bridge is used to interconnect two LANs. The Bridge just sends traffic from one side to the other. Most Bridges do filtering. By monitoring messages from two sides, the Bridge can determine if traffic from A side is intended for a device on the B side. If not, then there is no need to forward the message from A to B. In this way, unnecessary message congestion on both sides can be avoided. To allow people to move devices from the A side to the B side, the Bridge will periodically forget the past and re-learn the locations of devices.

Many LANs, geographically separated, can be combined into a WAN (wide area network). Routers are used to interconnect many LANs to make up a WAN. Unlike a Bridge, a Router is a switch. From the address field of messages, a Router must determine which WAN and which Router on the selected WAN should receive the message. Thus each Router must have an IP address. Because traffic within a LAN is much larger than traffic from one LAN to another, a Router allows the WAN facility to have a much smaller capacity than the LANs it is interconnecting. Common capacities used for Routers are 64 Kbps and multiples thereof up to hundreds of megabits.

## Product Description

The Loop Telecom Router Plug-In card is designed for the Loop-V 4200 series products. This card combines the function of a router and a CSU/DSU. With this card, access from LAN to WAN or another LAN is accomplished in one step. Up to 32 WAN channels can be addressed by this Router card.

This card can also be used as a LAN Bridge, which allows direct connection between two or more LAN networks.

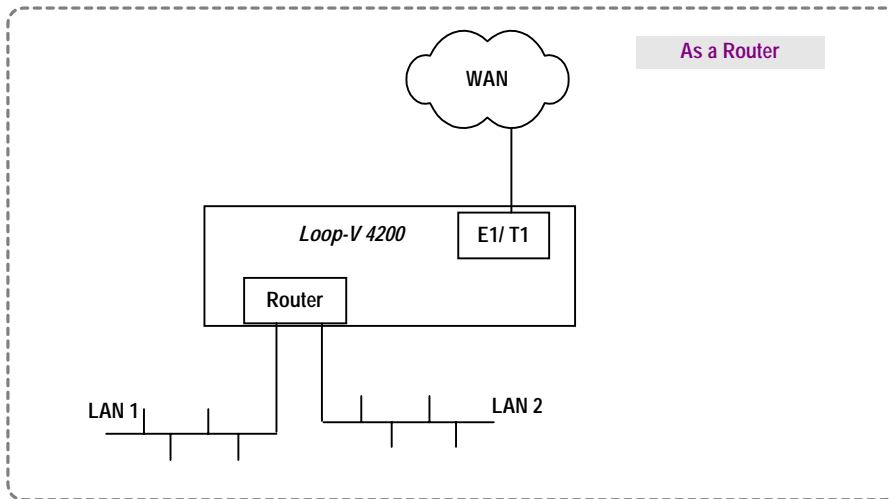
One important application of the Router Card is inband management. The same path used by customer data can be used for remote management. In this way, remote management can traverse multiple private and national networks using the same network for customer data. With this technology, the expense of a separate network dedicated to network management is saved.

The three typical applications are illustrated below.

## Router Application

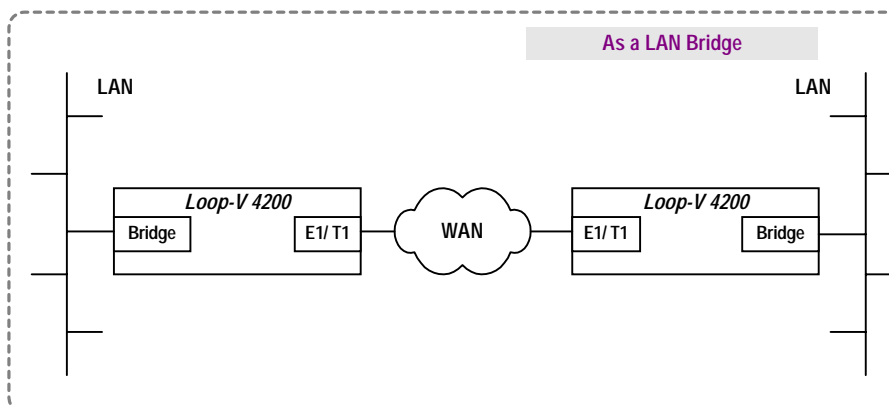
In this application, the Router is used for one or two LANs to access one or more WANs. It also acts as a bridge between the two physical LAN ports. In addition, remote LANs can be connected using the Bridge function. In the illustration below, although a single WAN is shown, connections can be made to multiple WANs.

Multiple logical WANs may also exist on the same or separate physical network. The maximum number of WANs is 32, up to an aggregate maximum of 2 Megabits total data rate.



## Bridge Application

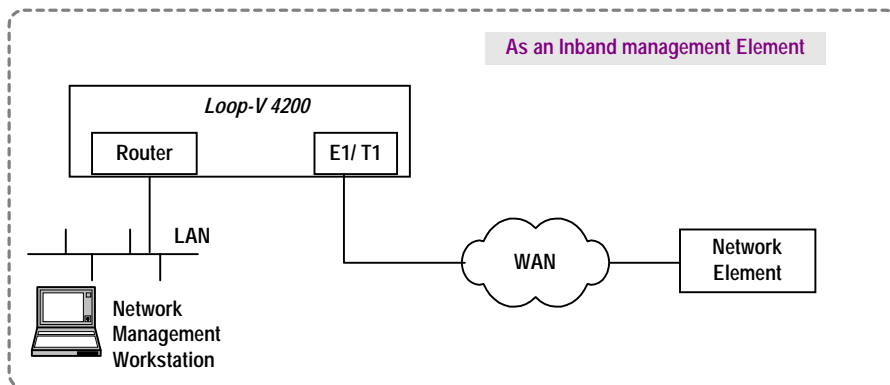
This is a simple connection between two or more LANs. All the LANs so connected will behave as a single LAN to the user.



## In-Band Management Application

Many of Loop Products have “In-Band Management” capability. This means that these devices can extract, from the same network used for customer data, management information. In this way, a separate network for management would not be needed, resulting in considerable savings in many cases.

The Router Plug-In card allows a network management center (NMC) computer to manage remote devices that are in-band capable, as illustrated below.



## Detailed Plug-In Card Setup

Follow the manual for the Router Plug-In for mechanical installation. This section will provide additional details for software configuration. From the main menu, first go to the port where the Router is plugged in. This is the “U” command to select a port.

The first step is to set up DS0 assignments for each WAN, the “M” command. Each of the 32 time slots, TS1 to TS32, can be assigned a WAN, WAN1 to WAN32. If multiple time slots are assigned to a single entity, LAN or WAN, the selected time slots should be contiguous. In the example below, WAN1 is assigned TS1, totaling 64 Kbps and WAN14 is assigned TS6 and TS7 totaling 128 Kbps.

```

PORT H RTR          === Port DS0 MAP Setup ===          11:51:46 03/07/2001
ARROW KEYS: CURSOR MOVE, TAB: ROLL OPTIONS

TimeSlot WANPort      TimeSlot WANPort
TS1  :   WAN1         TS17 :   Idle
TS2  :   Idle         TS18 :   Idle
TS3  :   Idle         TS19 :   Idle
TS4  :   Idle         TS20 :   Idle
TS5  :   Idle         TS21 :   Idle
TS6  :   WAN14        TS22 :   Idle
TS7  :   WAN14        TS23 :   Idle
TS8  :   Idle         TS24 :   Idle
TS9  :   Idle         TS25 :   Idle
TS10 :   Idle         TS26 :   Idle
TS11 :   Idle         TS27 :   Idle
TS12 :   Idle         TS28 :   Idle
TS13 :   Idle         TS29 :   Idle
TS14 :   Idle         TS30 :   Idle
TS15 :   Idle         TS31 :   Idle
TS16 :   Idle         TS32 :   Idle

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

Next, each of two LANs, and each of 32 WANs, those that have time slots assigned, must be configured.

Use the "S" command for LAN1 to WAN16, the "A" command for WAN17 to 32.

```

PORT H RTR      === Port System(LAN1-WAN16) Setup ===      11:51:12 03/07/2001
ARROW KEYS: CURSOR MOVE, Please Input: nnn.nnn.nnn.nnn, BACKSPACE to edit

NI      IPAddress      SubnetMask      Frame      RIP_I      RIP_II      Mode
LAN1    001.001.001.001  255.255.000.000  ETHERNET    DISABLE    DISABLE    ROUTER
LAN2    000.000.000.000  000.000.000.000  ETHERNET    DISABLE    DISABLE    BRIDGE
WAN1    003.003.003.003  255.000.000.000  HDLC        ENABLE     ENABLE     ROUTER
WAN2    000.000.000.000  000.000.000.000  HDLC        DISABLE    DISABLE    ROUTER
WAN3    000.000.000.000  000.000.000.000  HDLC        DISABLE    DISABLE    ROUTER
WAN4    000.000.000.000  000.000.000.000  HDLC        DISABLE    DISABLE    ROUTER
WAN5    000.000.000.000  000.000.000.000  HDLC        DISABLE    DISABLE    ROUTER
WAN6    000.000.000.000  000.000.000.000  HDLC        DISABLE    DISABLE    ROUTER
WAN7    000.000.000.000  000.000.000.000  HDLC        DISABLE    DISABLE    ROUTER
WAN8    000.000.000.000  000.000.000.000  HDLC        DISABLE    DISABLE    ROUTER
WAN9    000.000.000.000  000.000.000.000  HDLC        DISABLE    DISABLE    ROUTER
WAN10   000.000.000.000  000.000.000.000  HDLC        DISABLE    DISABLE    ROUTER
WAN11   000.000.000.000  000.000.000.000  HDLC        DISABLE    DISABLE    ROUTER
WAN12   000.000.000.000  000.000.000.000  HDLC        DISABLE    DISABLE    ROUTER
WAN13   000.000.000.000  000.000.000.000  HDLC        DISABLE    DISABLE    ROUTER
WAN14   032.032.032.032  255.255.255.000  HDLC        ENABLE     ENABLE     BRIDGE
WAN15   000.000.000.000  000.000.000.000  HDLC        DISABLE    DISABLE    ROUTER
WAN16   000.000.000.000  000.000.000.000  HDLC        DISABLE    DISABLE    ROUTER

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If a port, LAN or WAN is configured with "Mode" BRIDGE, then the IPAddress and Mask are ignored. If configured as ROUTER, then user must fill in the IPAddress and SubnetMask. In addition, the Frame type and whether RIP-I and RIP-II are disabled or enabled must be set. All configurations for vacant WANs are ignored. It is common to enter all 0's for these fields.

Finally the Port Route is set up. Press "R" from the "Port Menu" screen to enter in the screen of Port Router Setup. This Route table enables the Router Plug-In to find optimal route through the network. All or as many rows of this table can be left all 0's without undue detriment to the operation of the WAN network.

```

PORT H RTR      === Port ROUTE Setup ===                  11:51:37 03/07/2001
ARROW KEYS: CURSOR MOVE, Please Input: nnn.nnn.nnn.nnn, BACKSPACE to edit

Net_Address      Netmask          Gateway_Address  NI_Address      Metric
000.000.000.000  000.000.000.000  210.061.247.120  210.061.247.120  15
000.000.000.000  000.000.000.000  000.000.000.000  000.000.000.000  01
000.000.000.000  000.000.000.000  000.000.000.000  000.000.000.000  01
000.000.000.000  000.000.000.000  000.000.000.000  000.000.000.000  01
000.000.000.000  000.000.000.000  000.000.000.000  000.000.000.000  01
000.000.000.000  000.000.000.000  000.000.000.000  000.000.000.000  01
000.000.000.000  000.000.000.000  000.000.000.000  000.000.000.000  01
000.000.000.000  000.000.000.000  000.000.000.000  000.000.000.000  01
000.000.000.000  000.000.000.000  000.000.000.000  000.000.000.000  01
000.000.000.000  000.000.000.000  000.000.000.000  000.000.000.000  01
000.000.000.000  000.000.000.000  000.000.000.000  000.000.000.000  01
000.000.000.000  000.000.000.000  000.000.000.000  000.000.000.000  01

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

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**NOTE:** After changing any system configuration, perform a reset operation on the Router card to activate the new configuration.

## Loop-V 4200 System Setup

After the Router Card is setup, the Loop-V 4200 system must be setup before the LAN ports will be connected to any WAN. This is because the time slots of the cards, although defined for one or more WANs, need to be cross-connected to a WAN port, which is usually an E1 or T1 facility.

Consult the manuals of Loop-V 4200-9 or Loop-V 4200-28 for the system to set up the cross-connect. In the example below, the Router is plugged into PORT K. Time slots 1, 6, and 7, which are assigned to WAN ports, are interconnected to PORT C, and E1 facility. Time slots 6 and 7 of the Router, both assigned to WAN14, are assigned contiguous time slots at PORT C.

```

LOOP V4200-9      === System Setup ( MAP ) ===      09:25:55 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 FE1   FE1   FE1   FE1   FT1   FXO   FXS   DTE   ROUTER  INBAND
SLOT NONCAS NONCAS CAS   CAS   NONCAS A-LAW  A-LAW  V.35
=====
 1 d J 01 d B 01 d   00 v F 01 d   00 v D 01 v C 03 d A 01 d C 05 d   00
 2 d   00 d B 02 d J 02 v F 02 d   00 v D 02 v C 04 d C 02 d   00 d   00
 3 d K 01 d B 03 v H 01 v F 03 d J 03 v D 03           d E 03 d   00 d   00
 4 d K 02 d B 04 v H 02 v F 04 d   00 v D 04           d   00 d   00 d   00
 5 d   00 d B 05 d K 01 d D 05 d   00           d   00 d   00 d   00
 6 d   00 d B 06 d   00 d D 06 d   00           d   00 d C 08 d   00
 7 d   00 d B 07 d   00 d D 07 d   00           d   00 d C 09 d   00
 8 d   00 d B 08 d K 07 d D 08 d   00           d   00 d   00 d   00
 9 d   00 d B 09 d K 08 d D 09 d   00           d   00 d   00 d   00
10 d   00 d B 10 d   00 d D 10 d   00           d   00 d   00 d   00
11 d   00 d B 11 d   00 d D 11 d   00           d   00 d   00 d   00
12 d   00 d B 12 d   00 d D 12 d   00           d   00 d   00 d   00
13 d   00 d B 13 d   00 d D 13 d   00           d   00 d   00 d   00
14 d   00 d B 14 d   00 d D 14 d   00           d   00 d   00 d   00
15 d   00 d B 15 d   00 d D 15 d   00           d   00 d   00 d   00
16 d   00 d B 16 s   00 s   00 d   00           d   00 d   00 d   00
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## In-Band Management Setup

In the specific case of in-band management, each of the remote network elements that are in-band capable, should be assigned a WAN port. Up to 32 network elements can be assigned this way. Then, the time slots of each of the WAN port so assigned must be cross-connected to reach the remote network element. In this way, the management terminal connected to local LAN will be able to reach the remote elements.

## Conclusion

Applications and setup procedure of the Router Plug-In card for the Loop-V 4200 is given in this paper.