

# IPmux-4

## TDMoIP Gateway



### FEATURES

- IPmux-4 is a TDMoIP gateway enabling E1/T1 extension over IP networks
- Supports synchronous TDM-based services over IP and Ethernet networks
- Multiplexes up to 4 E1/T1 circuits
- Supports CAS signaling and is totally transparent to all other signaling protocols running over E1/T1
- Extends either framed (full or fractional) or unframed E1/T1 circuits
- E1/T1 frames, or bundles of timeslots, are transported over the network, based on IP addressing
- Integrated DS0 level grooming and cross connect between E1 or T1 ports
- 10/100BaseT uplink to the network
- QoS support:
  - Labeling IP level priority (ToS)
  - VLAN tagging and priority labeling according to IEEE 802.1 p&q
- Low processing delay (under 2 msec)
- Enables synchronous clock distribution across IP-based networks
- Compensates for packet delay variation of up to 32 msec for E1 or 24 msec for T1 circuits
- Redundant power supplies
- Management interfaces: SNMP, Telnet, TFTP and XMODEM with enhanced management tools and features
- RADview Service Center application enables provisioning and monitoring of TDMoIP services
- Compact platform, 1U high, 19-inch enclosure

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### DESCRIPTION

- IPmux-4 provides a compact, simple to configure, and easily scalable solution for transporting TDM E1/T1 services over IP and Ethernet-based networks. IPmux-4 takes data streams from up to 4 E1/T1 ports and converts them into packets (with an IP addressing scheme) for transmission over the network. These packets are transmitted via IPmux-4's 10/100BaseT port to the network. A second IPmux-4 at the remote location converts the IP packets back into TDM traffic.
- The primary benefit of IPmux-4 is that it allows transparent E1/T1 connectivity over the new generation of switch-based packet networks, both in carrier and enterprise environments.
- IPmux-4 is a standard IP device, supporting ICMP (ping), ARP, next hop and default gateway capabilities.
- IPmux-4 features a dry contact alarm port (DB-9), which allows the device to send/receive alarms by opening/closing the contact between the connector's pins.

### PERFORMANCE

- IPmux-4 can achieve an end-to-end processing delay as low as 1.7 msec, using high-performance buffering and forwarding techniques.
- The IP packet size is configurable: greater packet length results in smaller bandwidth overhead yet greater processing delay.
- An enhanced buffering mechanism compensates for packet delay variation (jitter) of up to 32 msec for E1 or up to 24 msec for T1.

### QoS SUPPORT

- IPmux-4 supports VLAN tagging and priority labeling according to 802.1 p&q.
- The user can configure the ToS (Type of Service) of the outgoing IP frames. This allows an en-route Layer-3 router or switch, which supports ToS (or Diffserve), to give higher priority to IPmux-4 traffic for delay-sensitive applications.
- Assigned, IANA-registered UDP socket number for TDMoIP simplifies flow classification through switches and routers.

### OPERATION MODES

- Two types of service are offered:
  - **Unframed:** IPmux-4 extends full E1/T1 circuits transparently across the IP network, regardless of framing structure.
  - **Structured:** IPmux-4 can be configured on a per timeslot basis for fractional E1/T1 services over IP networks. CAS can be enabled.
- Multibundling (grouping timeslots originating from a specific E1 or T1 port) can be performed for up to 31 bundles per E1 port and 24 bundles per T1 port for transport over the network. Both mesh and star topologies are supported.
- IPmux-4 allows an internal cross connect of bundles between its E1 or T1 ports.

### POWER SUPPLY

- IPmux-4 power supplies support carrier environments with -36 to -72 VDC, or 100 to 240 VAC.
- IPmux-4 features optional dual power supplies for redundancy.

### APPLICATIONS

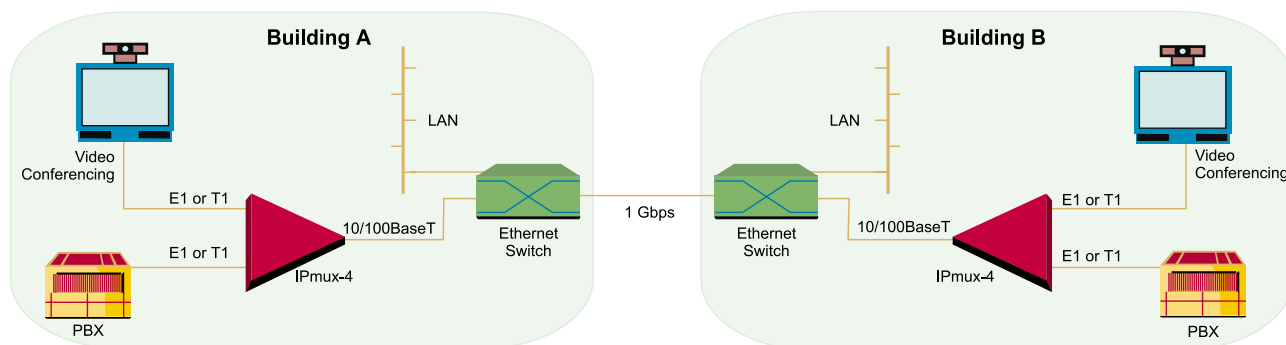


Figure 1. Voice and Video across Campus LAN

## TIMING

- IPmux-4 maintains synchronization between TDM devices by employing advanced clock distribution mechanisms. The clocking options are:
  - **Internal:** The master clock source for the TDM circuit is provided by the internal clock oscillator of IPmux-4.
  - **External:** Port 4 of IPmux-4 can be defined as the clock input port. This enables any of the remaining 3 ports to be configured to work in EXT mode, thus being locked to the receive clock of port 4.
  - **Loopback:** The transmit clock is derived from the respective port's receive clock.
  - **Adaptive:** The clock is recovered from the Ethernet network interface.

## INTERFACE MODULES

- IPmux-4 is ordered with one E1 or T1 module which provides an Ethernet port and either one or four standard E1 or T1 ports enabling connectivity to any standard E1 or T1 device (see *Ordering*).

### E1/T1 PORT

- Integral LTU/CSU can be enabled for line protection and long haul options.
- Alarm detection and insertion are supported together with error statistics. SES/UAS statistics, LOS/AIS physical layer alarms and remote loop/local loop test modes are all supported. Standard E1/T1 alarms are supported end-to-end.

## ETHERNET PORT

- Each E1/T1 module includes a single, standard 10/100BaseT port with auto-negotiation support, which provides the uplink to the network. If auto-negotiation is disabled, IPmux-4 can be configured to any of the following:
  - 100BaseT – full duplex
  - 100BaseT – half duplex
  - 10BaseT – full duplex
  - 10BaseT – half duplex.

## DIAGNOSTICS & MANAGEMENT

- IPmux-4 supports remote and local loop testing. End-to-end alarm generation and end-to-end AIS indication are also provided. In the event that a local E1/T1 port receives an AIS, it is passed to the remote port via the Ethernet/IP network. If a local Ethernet port is not connected, an AIS indication will be generated both in the local and the remote devices.
- On the E1/T1 ports, SES and UAS statistics are collected in 15-minute intervals and are stored for 24 hours (96 intervals). E1/T1 physical layer alarms (LOS, AIS, LOF, LCV) are also supported.

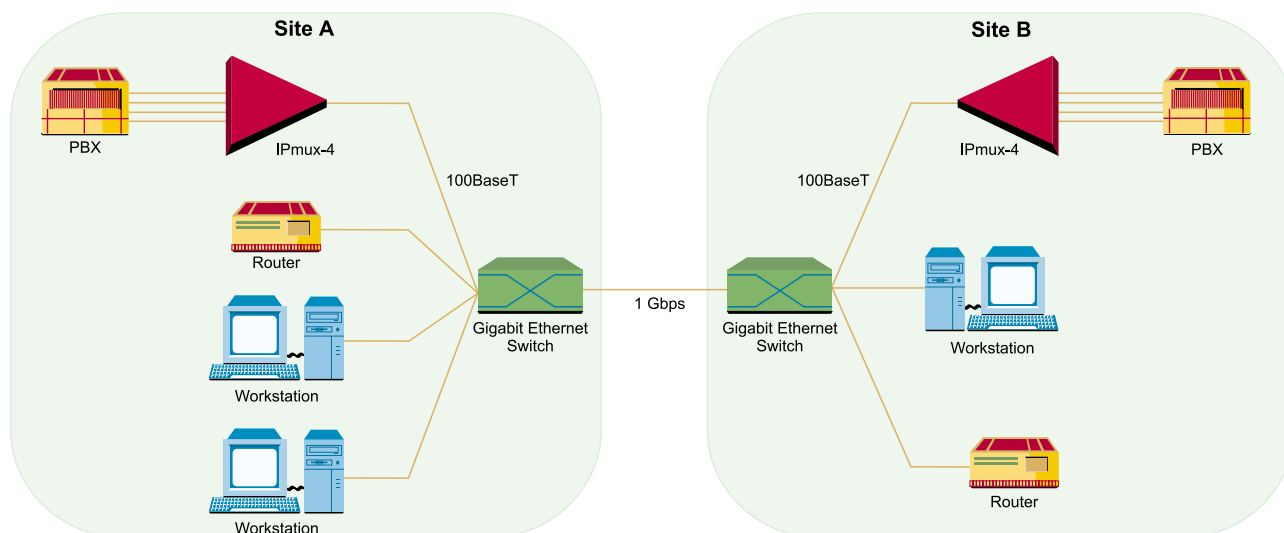


Figure 2. Multiplexing Voice and Data over Fast/Giga Ethernet Trunk

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## TDMoIP Gateway

- IPmux-4 monitors LAN and IP layer network condition statistics, such as packet loss and packet delay variation (jitter). The events are stored in log files and SNMP traps are generated.
- IPmux-4 performs an internal built-in test (BIT) after power up. The results of the test are visible via the local terminal.
- Software download is supported via the local terminal using XMODEM or remotely, using TFTP. After downloading a new software version, IPmux-4 automatically saves the previous version in non-volatile memory for backup purposes. Similarly, copies of the configuration file may be downloaded and uploaded to a remote workstation for backup and restore purposes.
- IPmux-4 can be configured and monitored locally via an ASCII terminal, or remotely via Telnet or RADview.

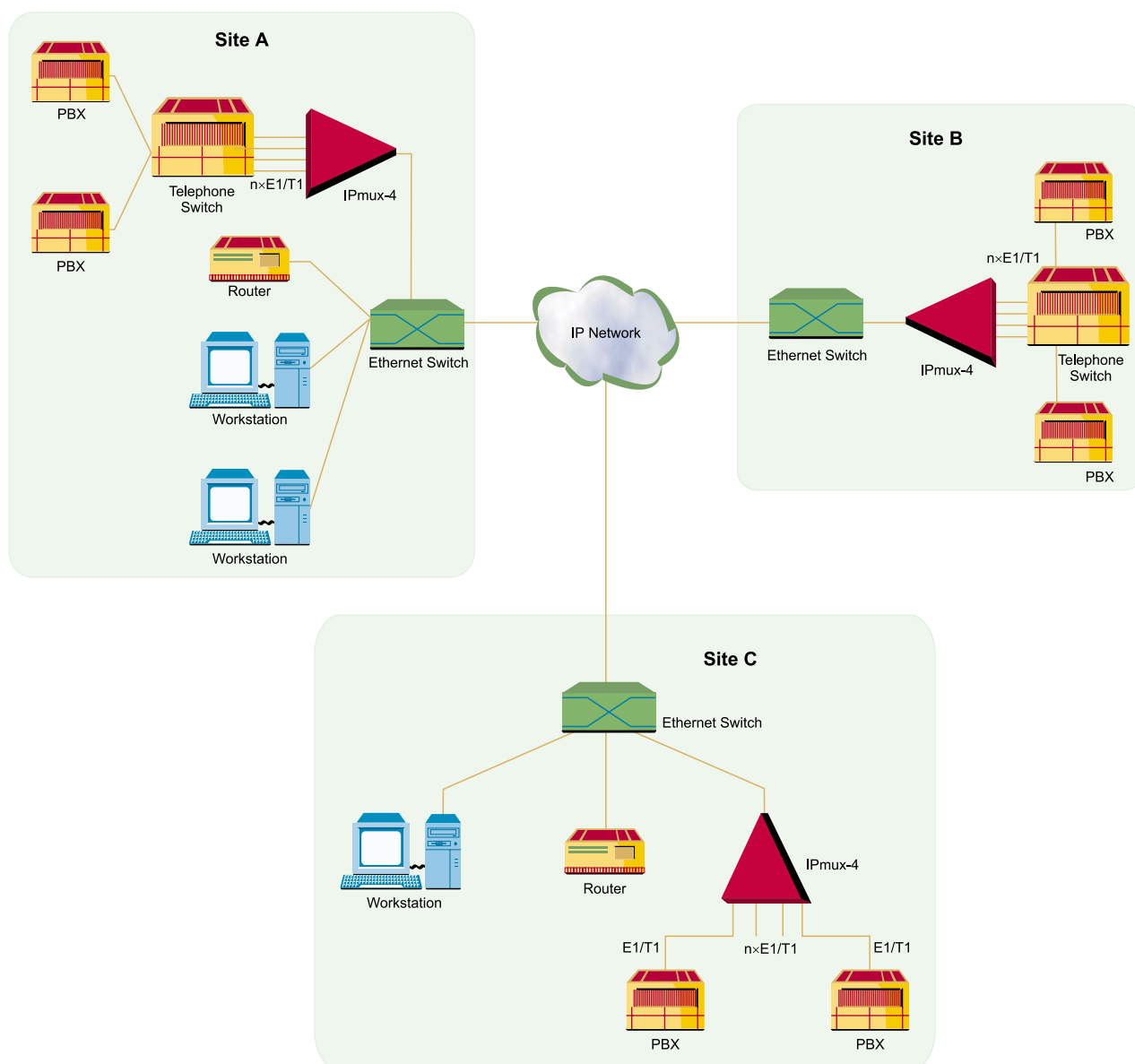


Figure 3. IP-based Metropolitan Area Network (MAN)

- RADview-HPOV, RAD's SNMP-based network management system, provides a user-friendly graphical display that allows monitoring and configuring of multiple IPmux-4 devices. Fault isolation, statistics and events gathering are available. RADview-HPOV can hold a complete predefined IPmux-4 configuration to shorten and simplify field installation.
- The RADview Service Center and element manager package supplies and monitors TDM over IP (TDMoIP) devices and circuits. The Service Center's intuitive GUI interface, "point-and-click" functionality and easy-to-follow wizards increase the efficiency and accuracy of the service provisioning process.

## SPECIFICATIONS

### E1 INTERFACE

- **Ports**  
1 or 4 (see *Ordering*)
- **Standards**  
ITU-T Rec. G.703, G.704, G.706, G.732, G.823
- **Framing**  
Unframed, CRC4 MF, CAS MF
- **Data Rate**  
2.048 Mbps
- **Line Code**  
HDB3
- **Receive Level**  
0 to -27 dB with LTU  
0 to -10 dB without LTU
- **Transmit Level**  
Balanced:  $\pm 3V$  ( $\pm 10\%$ )  
Unbalanced:  $\pm 2.3V$  ( $\pm 10\%$ )
- **Line Impedance**  
Balanced: 120 $\Omega$   
Unbalanced: 75 $\Omega$
- **Jitter Performance**  
Per ITU-T G.823
- **Connectors**  
Balanced: RJ-45, 8-pin  
Unbalanced: pair of mini BNC, 75 $\Omega$  (adapter cables from mini BNC to BNC are supplied)

### T1 INTERFACE

- **Ports**  
1 or 4 (see *Ordering*)
- **Standards**  
AT&T TR-62411,  
ITU-T Rec. G.703, G.704,  
ANSI T1.403
- **Data Rate**  
1.544 Mbps
- **Line Code**  
AMI, B8ZS, B7ZS
- **Framing**  
Unframed, SF, ESF
- **Receive Level**  
0 dB to -27 dB

- **Transmit Level**  
 $\pm 2.75V \pm 10\%$  at 0-655 ft  
with DSU  
0 dB, -7.5 dB, -15 dB, -22.5 dB  
with CSU
- **Line Impedance**  
100 $\Omega$ , balanced
- **Jitter Performance**  
Per AT&T TR-62411
- **Connector**  
RJ-45, 8 pin

### ETHERNET INTERFACE

- **Ports**  
1
- **Standards**  
IEEE 802.3, 802.3u
- **Data Rate**  
10 or 100 Mbps, half duplex or full duplex
- **Range**  
Up to 100m on UTP Cat.5
- **Connector**  
RJ-45, 8-pin

### DTE CONTROL INTERFACE

- **Standards**  
RS-232/V.24 (DTE)
- **Data Rate**  
9,600, 19,200, 38,400 or 57,600 bps
- **Connector**  
DB-9

### GENERAL

- **Power**  
100 to 240 VAC, 47 to 63 Hz, 30W  
-36 to -72 VDC

**Note:** Supports power supply redundancy

- **Physical**  
Height 4.4 cm/1.7 in (1U)  
Width 43.2 cm/17.0 in  
Depth 35.0 cm/13.8 in  
Weight 2.8 kg/6.2 lb
- **Environment**  
Temperature:  
Operating:  
0 to 50°C/32 to 122°F  
Storage:  
-20 to 70°C/32 to 110°F  
Humidity: Up to 90%,  
non-condensing

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## TDMoIP Gateway



### ORDERING

#### BASIC UNIT

##### IPmux-4/&/\*

TDMoIP Gateway for IP networks

& Specify power supply:

AC for 100 to 240 VAC

48 for -36 to -72 VDC

\* Specify **R** for redundant identical power supply

#### INTERFACE MODULE

##### IPmux-4M/#/+ /ETH

E1/T1 Optional Modules

**Note:** A single module must be ordered in conjunction with the IPmux-4 basic unit.

# Specify supported service:

**E1** for E1 interface, with RJ-45 connector

**T1** for T1 interface, with RJ-45 connector

**E1CX** for E1 interface, with mini BNC connectors

+ Specify number of ports:

1 for 1 port

4 for 4 ports

#### RM-11

Hardware for mounting IPmux-4 units in a 19-inch rack



data communications

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