

# IPmux-1/IPmux-1E



## TDMoIP Gateways



### FEATURES

- IPmux-1 and IPmux-1E are TDMoIP gateways enabling E1/T1, ISDN-BRI, and FXS communication over asynchronous IP and Ethernet networks
- Ethernet network port supports either copper UTP or fiber options
- Optional Ethernet user port offers:
  - Transparent LAN bridging
  - User data bandwidth management through rate limiting
- Both structured (full or fractional) and unframed E1/T1 are supported
- Two-wire FXS voice ports support standard analog telephones and key systems
- ISDN basic rate supports standard S0 NT or TE
- QoS support:
  - Labeling IP level priority (ToS)
  - VLAN tagging and priority labeling according to IEEE 802.1(p&q)
- Minimal processing delay (under 3 msec)
- Network Packet Delay Variation is absorbed using a configurable jitter buffer
- 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, 1U high enclosure

# IPmux-1/IPmux-1E

## TDMoIP Gateways

### DESCRIPTION

- IPmux-1/IPmux-1E provide a compact, minimal configuration solution for transporting E1/T1, ISDN-BRI, and FXS services over IP and Ethernet based networks. IPmux-1/IPmux-1E take the data stream from its user ports and converts it to packets for transmission over the network. The addressing scheme of these packets is IP. These packets are transmitted via the IPmux-1/IPmux-1E Ethernet network port to the network. A second IPmux at the remote location converts the IP packets back to TDM traffic.
- IPmux-1/IPmux-1E can function as an Ethernet IAD (Integrated Access Device) that offers access of both native TDM and bridged data over shared media, via its optional Ethernet user port.
- IPmux-1/IPmux-1E are standard IP devices, supporting ICMP (ping), ARP, next hop and default gateway capabilities.

### PERFORMANCE

- IPmux-1/IPmux-1E can achieve end-to-end processing delay as low as 3 msec, using high-performance buffering and forwarding techniques.
- IP packet size is configurable. Greater packet length results in greater processing delay, yet smaller bandwidth overhead.
- An enhanced buffering mechanism compensates for packet delay variation (jitter) of up to 300 msec in the network.

### QoS SUPPORT

- IPmux-1/IPmux-1E support 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 Diffserv), to give higher priority to IPmux-1/IPmux-1E traffic for delay-sensitive applications.

- Assigned, IANA registered UDP socket number for TDMoIP simplifies flow classification through switches and routers.
- Rate limiting can be applied to control the maximum traffic rate transmitted towards the IP/Ethernet network.

### TIMING

- IPmux-1/IPmux-1E maintain synchronization between TDM devices, by deploying advanced clock distribution mechanisms. The clocking options are:
  - **Internal** – the master clock source for the TDM circuit is provided by the IPmux-1/IPmux-1E internal clock oscillator
  - **Loopback** – the transmit clock is derived from the E1/T1 port's receive clock.
  - **Adaptive** – the clock is recovered from the Ethernet network interface.
  - **External** – IPmux-1 offers an external clock port option that synchronizes the device from an external clock.

### APPLICATIONS

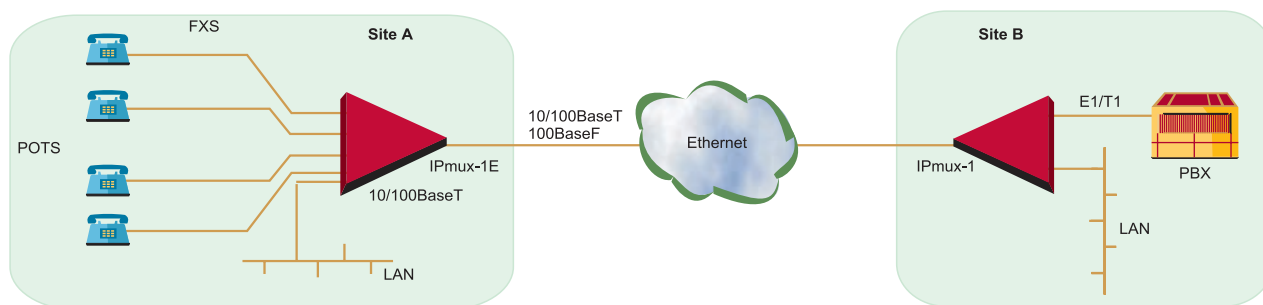


Figure 1. Voice and Data Integration over an Ethernet Link

## ETHERNET PORTS

- IPmux-1/IPmux-1E offer an Ethernet Network port.
  - **UTP option** – standard 10/100BaseT half/full duplex port with auto-negotiation support. If auto-negotiation is disabled, IPmux-1 capabilities can be configured to any of the following:
    - 100BaseT – full duplex
    - 100BaseT – half duplex
    - 10BaseT – full duplex
    - 10BaseT – half duplex.
  - **Fiber option** – standard 100BaseF full duplex port (see Table 1).
- An optional Ethernet user port is UTP only.

## E1 OR T1 PORT (IPmux-1 only)

- One standard E1 or T1 port provides connectivity to any standard E1 or T1 device.
- Integral LTU/CSU can be enabled for line protection and long haul applications.

- E1 UTP, E1 CX or T1 options are available.
- 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 or T1 alarms are supported end-to-end.
- **E1/T1 Framing** – two types of service are offered:
  - **Unframed** – IPmux-1 extends full E1/T1 circuits transparently across the IP network, regardless of framing structure.
  - **Structured** – IPmux-1 can be configured for fractional E1/T1 services over IP networks. CAS can be enabled.

## ISDN BRI 'S' PORTS (IPmux-1E only)

- Four standard ISDN basic rate 'S' ports provide connectivity to any Network Termination (NT) or Terminal Equipment (TE) ISDN device.
- Phantom feeding function enables IPmux-1E to power the remote user equipment (NT mode).
- Each 'S' port supports remote and local digital loopback test modes.

## ANALOG FXS PORTS (IPmux-1E only)

- IPmux-1E offers four two-wire FXS voice ports, with RJ-11 connectors.

## EXTERNAL CLOCK PORT

- External clock port is available for station clock input and out-of-band synchronization.

Table 1. Fiber Options

Interface Type	Wavelength (nm)	Optical Power (dBm)		Receive Sensitivity (dBm)	Optical Budget (dB)*	Loss (dB/km)	
		Min	Max			Min	Max
SC Multimode	1300	-20	-14	-31	8*	1	4
SC Single mode	1300	-20	-14	-31	8*	0.5	0.8
LC Multimode	1300	-19	-14	-32	10*	1	4
LC Single mode	1300	-15	-8	-32	14*	0.5	0.8

\* Permitted fiber optic cable length differs according to fiber characteristics, splices, and connectors.

## OPTICAL BUDGET CALCULATION:

$$\text{Optical Budget [dB]} = |\text{Receive Sensitivity}| - |\text{Optical Power}| - 3 \text{ (Aging)} - \text{Connectors \& Patch Panels Loss}$$

## Distance Calculation:

$$\text{Min Distance} = \text{Optical Budget/Maximum Loss}$$

$$\text{Max Distance} = \text{Optical Budget/Minimum Loss}$$

# IPmux-1/IPmux-1E

## TDMoIP Gateways

### POWER SUPPLY

- IPmux-1 is available with either an AC or a DC power supply (IPmux-1E is available only with AC). AC power supply supports 100 to 240 VAC and DC power supply supports –36 to –72 VDC.

### DIAGNOSTICS & MANAGEMENT

- IPmux-1/IPmux-1E support remote loop and local loop testing.
  - IPmux-1 provides end-to-end alarm generation and end-to-end AIS indication. When a local E1 or T1 port receives 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.
  - Physical layer alarms support:
    - IPmux-1 – E1/T1 port LOS, AIS, LOF, LCV
    - IPmux-1E – ISDN 'S' LOF and FXS port status.
- IPmux-1/IPmux-1E perform an internal built-in test (BIT) after power up. The results of the test are visible via the local terminal.
  - IPmux-1/IPmux-1E monitor LAN and IP layer network condition statistics such as packet loss and packet delay variation (jitter). The events are stored in log files.
  - Software download is supported via the local terminal, using XMODEM, or remotely, using TFTP. After downloading a new software version, IPmux-1/IPmux-1E 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-1/IPmux-1E can be configured and monitored locally via an ASCII terminal, or remotely via Telnet or RADview.

### MANAGEMENT APPLICATIONS

- RADview HP OpenView, RAD's SNMP-based network management system, allows monitoring and configuring multiple IPmux devices through a user-friendly graphical display. Fault isolation, statistics and event gathering are available. RADview HP OpenView can hold a complete predefined IPmux 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.

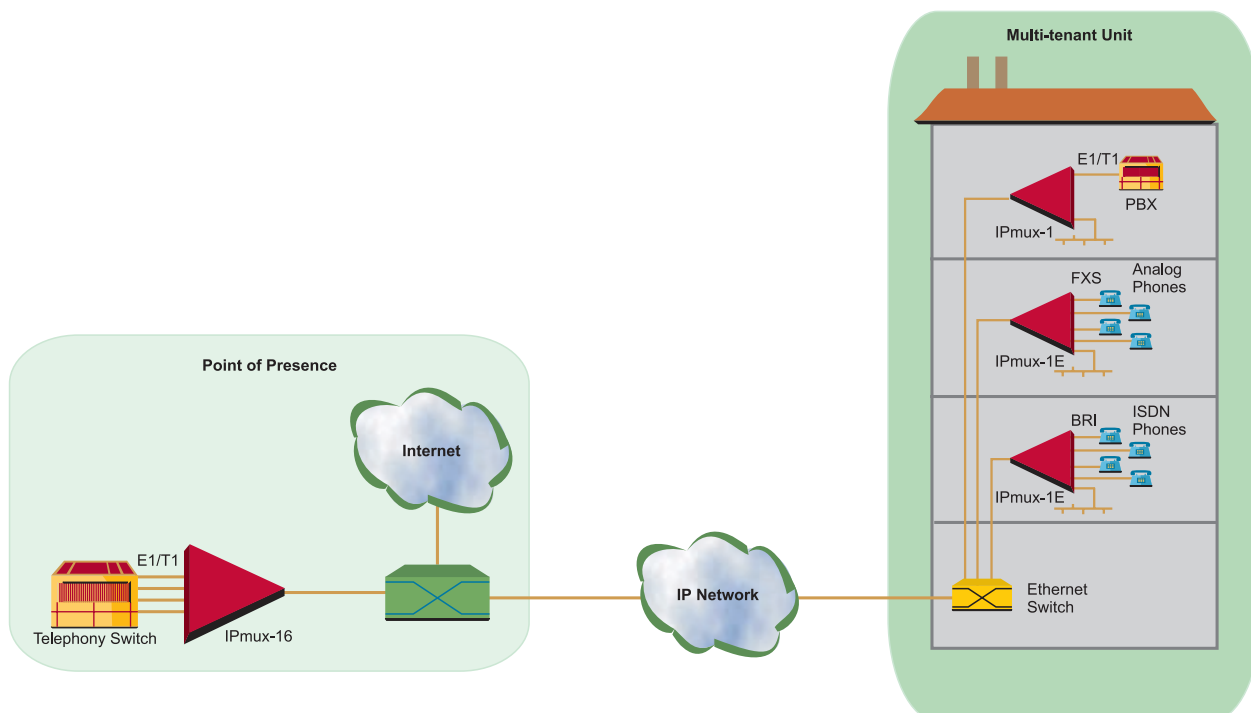


Figure 2. Ethernet-based Multi-tenant Application with Voice and Data Integrated Access

### SPECIFICATIONS

#### E1 INTERFACE

- **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 -28 dB with LTU  
0 to -9 dB without LTU
- **Transmit Level**  
Balanced:  $\pm 3V \pm 10\%$
- **Unbalanced:  $\pm 2.37V \pm 10\%$**
- **Connector**  
Balanced: RJ-45, 8-pin  
Unbalanced: pair of mini BNC, 75 $\Omega$  (adapter cables from mini BNC to BNC are supplied)
- **Line Impedance**  
Balanced: 120 $\Omega$   
Unbalanced: 75 $\Omega$

#### E1 EXTERNAL CLOCK

- **Standards**  
G.703
- **Data Rate**  
2.048 Mbps
- **Line Code**  
HDB3
- **Receive Level**  
0 dB to -9 dB
- **Transmit Level**  
Balanced:  $\pm 3V \pm 10\%$   
Unbalanced:  $\pm 2.37V \pm 10\%$
- **Connector**  
Balanced: RJ-45, 8-pin  
Unbalanced: pair of mini BNC, 75 $\Omega$  (adapter cables from mini BNC to BNC are supplied)

- **Line Impedance**  
Balanced: 120 $\Omega$   
Unbalanced: 75 $\Omega$
- **Jitter Performance**  
Per ITU-T G.823

#### T1 EXTERNAL CLOCK

- **Standards**  
ANSI T1.403
- **Data Rate**  
1.544 Mbps
- **Line Code**  
AMI, B8ZS, B7ZS
- **Framing**  
Unframed, SF, ESF
- **Receive Level**  
0 dB to -30 dB
- **Transmit Level**  
 $\pm 2.75V \pm 10\%$  at 0 to 655 ft with DSU  
0 dB, -7.5 dB, -15 dB, -22.5 dB with CSU

#### T1 INTERFACE

- **Standards**  
AT&T TR-62411, ITU-T Rec. G.703, G.704, ANSI T1.403, G.824 standards
- **Data Rate**  
1.544 Mbps
- **Line Code**  
AMI, B8ZS, B7ZS
- **Framing**  
Unframed, SF, ESF
- **Receive Level**  
0 dB to -30 dB
- **Transmit Level**  
 $\pm 2.75V \pm 10\%$  at 0 to 655 ft with DSU  
0 dB, -7.5 dB, -15 dB, -22.5 dB with CSU
- **Connector**  
RJ-45, 8 pin
- **Line Impedance**  
100 $\Omega$ , balanced
- **Jitter Performance**  
Per AT&T TR-62411, ITU-T G.824

#### ETHERNET INTERFACE

- **UTP option**
  - **Standards**  
IEEE 802.3, 802.3u, Ethernet, 802.1p&q
  - **Data Rate**  
10 or 100 Mbps, half/full duplex
  - **Range**  
Up to 100m on UTP Cat.5
  - **Connector**  
RJ-45, 8-pin
- **Fiber options**
  - **Range**  
See Table 1
  - **Connector**  
SC (no user port)  
LC (user and network ports)  
See *Ordering Options*.

#### CONTROL INTERFACE

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

#### ISDN S0 INTERFACE

- **Compliance**  
ETS 300012, I.430, NTT, 5ESS, DMS-100, NI1
- **Bit Rate**  
192 kbps
- **Line Coding**  
Pseudo-ternary
- **Line Termination**  
100 $\Omega \pm 5\%$
- **Connector**  
RJ-45

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**data communications**

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