IPmux-8

TDMoIP Gateway

TDMoIP Driven™

FEATURES

- Modular TDMoIP gateway extending up to eight framed/unframed E1/T1 circuits over IP and Ethernet networks
- Fully supports TDM-based services by maintaining synchronization over any packet-switched network (Ethernet, IP and MPLS)
- Simple transport solution for voice, video and data over IP
- Point-to-point and point-to-multipoint applications
- Transparent to protocols and signaling running over E1/T1
- E1/T1 frames or DS0 bundles are transported over the network based on IP addressing
- Integrated DS0 level grooming and cross-connect between E1/T1 ports
- Single or dual 10/100BaseT or 100BaseFx uplink to the network with redundancy support on the Ethernet link
- 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)
- Compensates for the packet network delay variation of up to 32 msec for E1 or 24 msec for T1
- Optional redundant power supply
- Management interfaces: SNMP, Telnet, TFTP and XMODEM with enhanced management tools and features
- Provisioning and monitoring of TDMoIP services is easily performed using the RADview Service Center application
- Compact platform, 1U high, 19-inch rack compatible enclosure

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DESCRIPTION

- IPmux-8 provides a compact, simple to configure and easily scalable solution for transporting TDM E1/T1 services over IP and Ethernet-based networks.
- IPmux-8 takes data streams from up to eight E1/T1 ports and converts them into packets for transmission over the network. The addressing scheme of these packets is IP. The packets are transmitted via IPmux-8's Ethernet ports to the network. A second TDMoIP gateway at the remote location converts the IP packets back to TDM traffic.
- The primary benefit of IPmux-8 is to allow transparent E1/T1 connectivity over layer 2/3 packet switched networks, both in carrier and enterprise environments.
- IPmux-8 is a standard IP device, supporting ICMP (ping), ARP, next hop, and default gateway capabilities.
- IPmux-8 complies with the TDMoIP protocol. It works in conjunction with RAD's IPmux-1, IPmux-1E, IPmux-16, Megaplex ML-IP, Kilomux KML.11, and other third-party products that implement the TDMoIP protocol.
- IPmux-8 features a dry contact alarm port that can serve as a general-purpose input port. The alarms are classified into three categories, stored in the Event Log, and can generate a system trap that is sent to the NMS.

PERFORMANCE

- IPmux-8 achieves end-to-end processing delay as low as 1.7 msec, using high-performance buffering and forwarding techniques.
- IP packet size is configurable. Greater packet length results in greater processing delay, yet a smaller bandwidth overhead.
- 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-8 supports VLAN tagging and priority labeling according to 802.1 p&Q.
- VLAN-based separation of user traffic is supported by applying a dedicated VLAN tag to every TDMoIP circuit.
- The Type of Service (ToS) of outgoing IP packets is user-configurable. This allows an en-route Layer-3 router or switch, which supports ToS (or Diffserv), to give higher priority to IPmux-8 traffic for delay-sensitive applications.
- Assigned, IANA-registered UDP socket number for TDMoIP simplifies flow classification through switches and routers.

APPLICATIONS

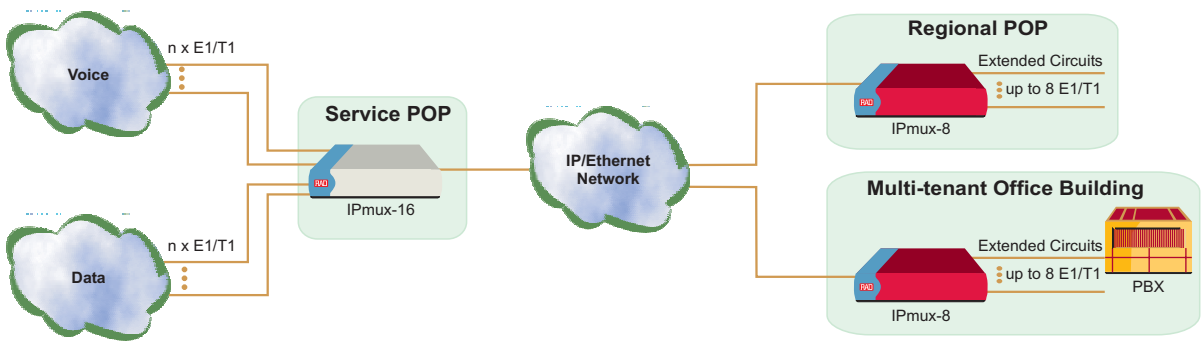

Figure 1. Extending E1/T1-based Services over IP

OPERATION MODES

- Two types of service are offered:
  - Unframed: Full E1/T1 circuits are transparently extended across the IP network, regardless of framing structure.
  - Structured: A bundle of timeslots can be configured for fractional E1/T1 services over IP networks. CAS can be enabled.
- Multibundling (grouping timeslots originating from a specific E1/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-8 allows internal cross-connect of bundles between its E1/T1 ports.

TIMING

- IPmux-8 maintains synchronization between TDM devices by deploying advanced clock distribution mechanisms. The clocking options are:
  - Internal: The device's internal oscillator provides the master clock source for the TDM circuit.
  - Loopback: The transmit clock is derived from the respective port's receive clock.
  - Adaptive: The clock is recovered from the Ethernet network interface.

ETHERNET MODULE

- Two Ethernet modules can be installed in the IPmux-8 chassis, providing the uplink to the packet network.
- Each module supports a single 10/100BaseT or 100BaseFx port.
- IPmux-M/ETH/UTP, IPmux-M/ETH/MM-LC, and IPmux-M/ETH/SM-LC modules support re-ordering when packets arrive from the network in the wrong order, without considering them as lost packets.
- Ethernet link redundancy to the network is supported when IPmux-8 is equipped with two Ethernet modules.

E1 AND T1 MODULES

- Each E1/T1 module provides four standard E1/T1 interfaces, which enable connectivity to any standard E1/T1 device (see *Ordering*).
- Integral LTU/CSU can be enabled for line protection and long haul applications.
- 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. Standard E1/T1 alarms are supported end-to-end.

POWER SUPPLY

- Power supply is available for AC or DC.
- IPmux-8 features optional redundant power supplies.

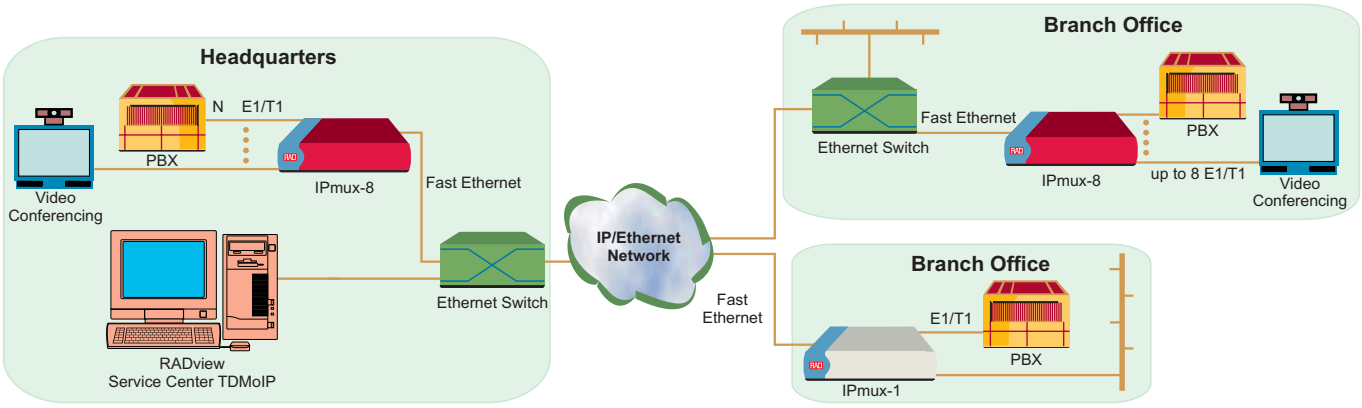

Figure 2. Enterprise Connectivity over Campus or Metro Area Networks

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DIAGNOSTICS & MANAGEMENT

- IPmux-8 supports E1/T1 remote loop and local loop testing. End-to-end alarm generation and end-to-end AIS indication are also provided. If a local E1/T1 port receives AIS, it is passed to the remote port via the Ethernet/IP network. If a local Ethernet port is not connected, AIS indication will be generated both in the local and the remote devices.
- SES and UAS statistics are collected in 15-minute intervals on the E1/T1 ports, and are stored for 24 hours (96 intervals). E1/T1 physical layer alarms (LOS, AIS, LOF, LCV) are also supported.
- IPmux-8 monitors Ethernet 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-8 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 version of software, IPmux-8 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-8 can be configured and monitored locally via an ASCII terminal, or remotely via Telnet or RADview.
- RADview-HPOV, RAD's SNMP-based network management system, with its user-friendly GUI, allows monitoring and configuring multiple IPmux devices. Fault isolation, statistics and events gathering are available. RADview-HPOV can hold a complete predefined IPmux-8 configuration to shorten and simplify field installation.
- The RADview Service Center and Element Manager package supplies and monitors TDMoIP devices and circuits. The Service Center's intuitive GUI "point-and-click" functionality and easy-to-follow wizards increase the efficiency and accuracy of the service provisioning process.

SPECIFICATIONS

ETHERNET INTERFACE

- **Ports**
  1 per module, up to two modules
- **Standards**
  IEEE 802.3, 802.3u
- **Data Rate**
  10 or 100 Mbps, full duplex
- **Range**
  Up to 100m on UTP Cat.5
- **Connector**
  RJ-45, 8-pin
- **Fiber Optic**
  - Range: See *Table 2*
  - Connector: LC

E1 INTERFACE

- **Ports**
  4 ports per module, up to two modules (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 -20 dB with LTU
  0 to -10 dB without LTU
- **Transmit Level**
  Balanced: ±3V ±10%
  Unbalanced: ±2.3V ±10%
- **Connector**
  Balanced: RJ-45, 8-pin
  Unbalanced: RJ-45, 75Ω (adapter cables from RJ-45 to BNC are supplied)
- **Line Impedance**
  Balanced: 120Ω
  Unbalanced: 75Ω
- **Jitter Performance**
  Per ITU-T G.823

T1 INTERFACE

- **Ports**
  4 per module
  (see *Ordering*)
- **Standards**
  AT&T TR-62411,
  ITU-T Rec. G.703, G.704,
  ANSI T1.403, G.824
- **Data Rate**
  1.544 Mbps
- **Line Code**
  AMI, B8ZS, B7ZS
- **Framing**
  Unframed, SF, ESF
- **Receive Level**
  0 to -30 dB
- **Transmit Level**
  ±2.75V ±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**
  100Ω, balanced
- **Jitter Performance**
  Per AT&T TR-62411

DTE CONTROL INTERFACE

- **Standards**
  RS-232/V.24 (DTE)
- **Data Rate**
  9.6, 19.2, 38.4, 57.6, or 115.2 kbps
- **Connector**
  DB-9

GENERAL

- **Environment**
  Temperature:
  Operating
  0–50°C/32–122°F
  Storage
  -20–70°C/-4–158°F
  Humidity: Up to 90%,
  non-condensing
- **Power**
  55W, 100 to 230 VAC
  75W, -40 to -57 VDC

Note: *Supports power supply redundancy.*

- **Physical**
  Height: 44 mm / 1.7 in
  Width: 432 mm / 17 in
  Depth: 350 mm / 13.8 in
  Weight: 7.0 kg / 15.5 lb

Table 2. Fiber Optic Interface Characteristics

Type	Connector	Optical Power [dBm]		Receive Sensitivity [dBm]		Loss [dB/km]		Typical Range [km/miles]
		Min	Max	Min	Max	Min	Max	
Multimode	LC	-19	-14	-32	-8	1.0	4.0	2.0/1.2
Single mode	LC	-15	-8	-28	-8	0.5	0.8	15.0/9.3

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ORDERING

BASIC UNIT

IPMUX-8/&/*
TDMoIP gateway

& Specify power supply:
AC for 100 to 230 VAC
-48 for -40 to -57 VDC

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

INTERFACE MODULES

Note: *At least one E1/T1 module and one Ethernet module must be ordered in conjunction with the IPmux-8 basic unit.*

IPMUX-8M/#/&
IPmux-8 E1/T1 port modules

Specify supported service:
E1CX for unbalanced E1 interface with RJ-45 connectors (75Ω)
E1 for balanced E1 interface, with RJ-45 connector
T1 for T1 interface, with RJ-45 connector

& Specify **4** for 4 ports

IPMUX-M/ETH/*
Ethernet network module, packet re-order support, RJ-45 connector

***** Specify Ethernet module:
UTP for for 10/100BaseT module, packet re-order support, RJ-45 connector
MM-LC for 100BaseFx multimode module with fiber LC connector, packet re-order support, RJ-45 connector
SM-LC for 100BaseFx single mode module with fiber LC connector, packet re-order support, RJ-45 connector

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