IPmux-8

TDM Pseudowire Access Gateway

TDMoIP Driven®

FEATURES

- Modular TDM pseudowire access gateway extending up to eight framed/unframed E1/T1 circuits over packet-switched networks (PSNs)

- Built on TDMoIP technology, implementing the emerging IETF, MFA Forum, and ITU-T standards for Pseudowire Emulation Edge-to-Edge (PWE3)

- Simple transport solution for voice, video and data over PSNs

- Point-to-point and point-to-multipoint applications

- Transparent to protocols and signaling that run over E1/T1

- Transports E1/T1 frames or DS0 bundles over the network according to 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 packet delay variation of up to 32 msec

- Optional redundant power supply

- Management capabilities: SNMP, Telnet, TFTP and XMODEM with enhanced management tools and features

- Provisioning and monitoring of TDMoIP services using the RADview Service Center application

- Compact, 1U high, 19-inch rack mountable enclosure with two TDM service slots and two PSN slots

IPmux-8

TDM Pseudowire Access Gateway

DESCRIPTION

- IPmux-8 provides a compact, simple to configure, easily scalable solution for transporting TDM E1/T1 services over IP and Ethernet-based networks.

- The primary benefit of IPmux-8 is transparent E1/T1 connectivity over Layer 2/3 packet networks, both in carrier and enterprise environments.

- Data streams of up to eight E1/T1 ports are converted into packets for transmission over the network. The addressing scheme of these packets is IP-based. The packets are transmitted via the Ethernet modules to the network. A remote TDMoIP gateway converts the IP packets back to TDM traffic.

- IPmux-8 is a standard IP device, supporting ICMP (ping), ARP, next hop, and default gateway capabilities.

- The operation complies with the IETF TDMoIP protocol. It works in conjunction with Gmux-2000, IPmux-1E, IPmux-11, IPmux-14, IPmux-16 and Megaplex ML-IP.

- A dry contact alarm port also serves 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 an NMS.

PERFORMANCE

- IPmux-8 achieves minimal end-to-end processing delay, 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.
    - An enhanced buffering mechanism compensates for packet delay variation (jitter) of up to 32 msec.

QoS SUPPORT

- VLAN tagging and priority labeling are implemented according to 802.1p&Q.

- VLAN-based separation of user traffic is supported by attaching 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.

OPERATION MODES

- Two types of service are offered:
    - Unframed: Full E1/T1 circuits are transparently extended across the IP network, regardless of framing structure.
    - Framed: IPmux-8 can be configured on a per-timeslot basis for fractional E1/T1 services over the packet network. CAS is supported.

- 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 DS0 cross-connect between its E1/T1 ports.

- 1:1 bundle redundancy is used to back up TDMoIP traffic in case of a bundle connection or TDM interface failure.
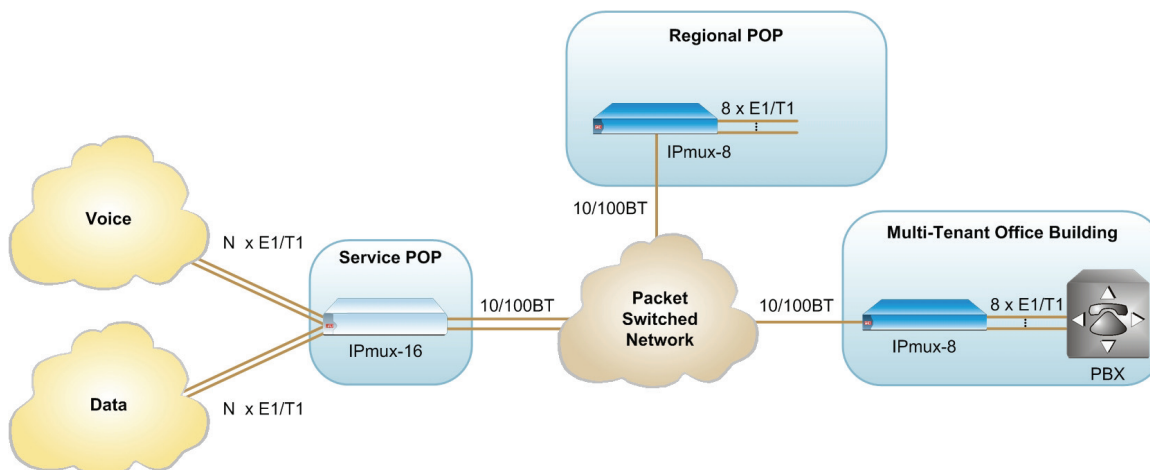
APPLICATIONS

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

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 MODULES

- One or two 1- or 4-port Ethernet modules can be installed in the IPmux-8 chassis, providing links to the packet network.

- Each module supports the following combinations of the 10/100BaseT or 100BaseFx ports:
  - 1-port Ethernet module, one network port per module
  - 4-port Ethernet module, four ports per module (one network and three user ports).

- The 4-port Ethernet modules use hot-swappable fiber optic SFP transceivers (up to two fiber optic ports per module).

- The Ethernet modules re-order packets that arrive from the network to ensure an uninterruptible TDM service.

- IPmux-8 units equipped with two Ethernet modules provide Ethernet network link redundancy.

- 4-port Ethernet modules support switching, rate limiting and VLAN stacking.

E1 AND T1 MODULES

- Each E1/T1 module features four standard E1/T1 interfaces, for connecting IPmux-8 to any standard E1/T1 device.

- 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 local/remote loopback tests. Standard E1/T1 alarms are supported end-to-end.
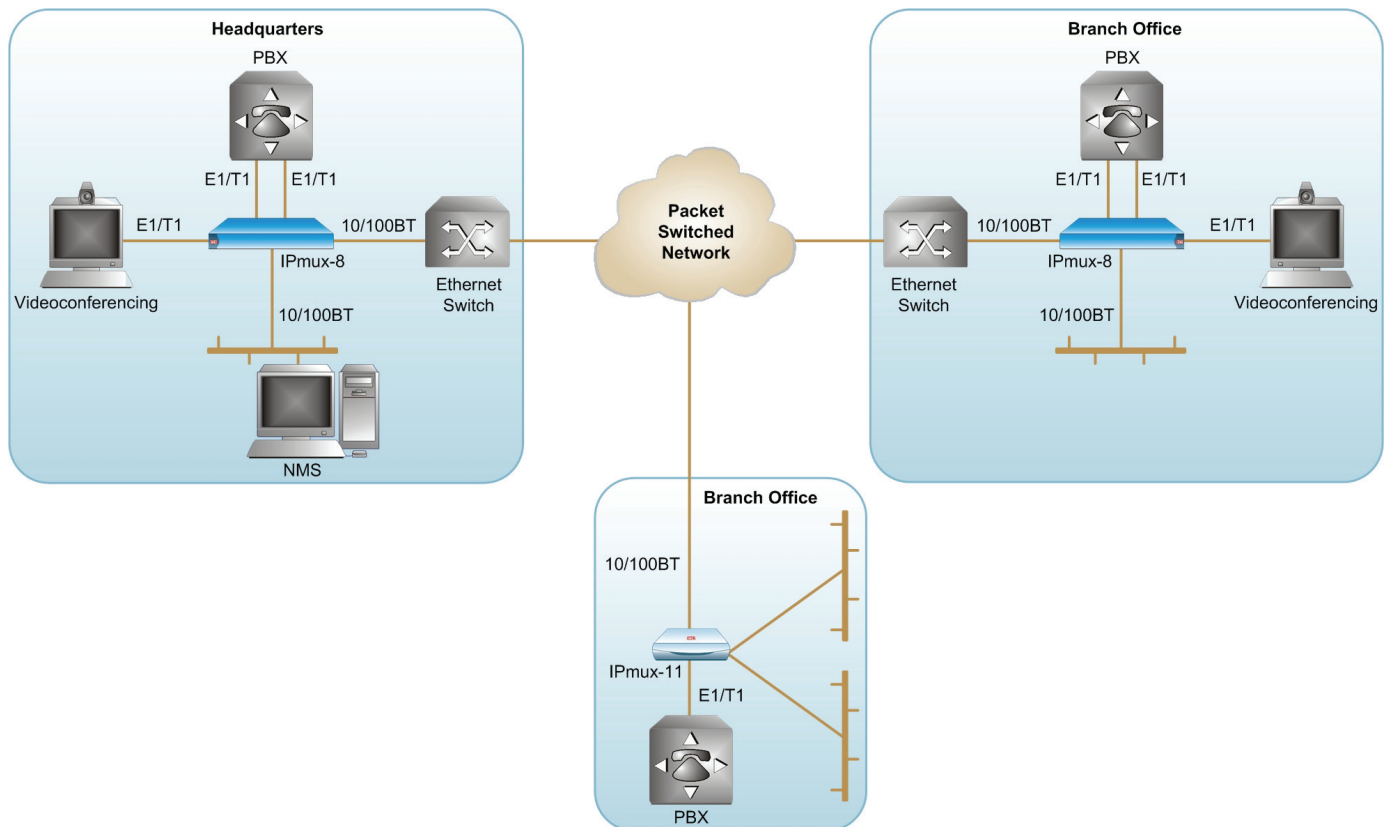

Figure 2. Enterprise Connectivity over Campus or Metro Area Networks

IPmux-8

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POWER SUPPLY

- Power supply is available for AC or DC.

- IPmux-8 features optional redundant power supplies. The power supplies are not hot-swappable.

DIAGNOSTICS & MANAGEMENT

- IPmux-8 supports E1/T1 local and remote loopback tests. 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.

- An internal built-in test (BIT) is performed after power-up. The results of the test are displayed at the local terminal.

- Software can be downloaded locally, using XMODEM protocol, 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
  - Remotely, via Telnet or SNMP-based management software (RADview-SC/TDMoIP).

- The RADview Service Center TDMoIP network management application provides TDMoIP service and manages the TDMoIP devices via a user-friendly graphical interface that allows monitoring and configuring multiple IPmux devices. Fault isolation, statistics and events gathering are available. The intuitive GUI with its "point-and-click" functionality and easy-to-follow wizards increases the efficiency and accuracy of the service provisioning process.

SPECIFICATIONS

ETHERNET INTERFACE

- **Number of Ports**
  - 1-port Ethernet module: 1 per module (network)
  - 4-port Ethernet module: 4 per module (1 network and 3 user ports)

- **Number of Modules**
  Up to 2 per unit

- **Standards**
  IEEE 802.3, 802.3u, 802.1p&Q

- **Maximum Frame Size**
  1536 bytes

- **Data Rate**
  10 or 100 Mbps, full duplex

- **Connector (UTP)**
  RJ-45, 8-pin

- **Fiber Optic**
  1-port Ethernet modules:
  - 1310 nm multimode laser: 2 km (1.2 mi)
  - 1310 nm single mode laser: 15 km (9.3 mi)
  4-port Ethernet module:
  - SFP-1: 1310 nm multimode LED, 2 km (1.2 miles)
  - SFP-2: 1310 nm single mode laser, 15 km (9.3 miles)
  - SFP-3: 1310 nm single mode laser, 40 km (24.8 miles)
  - SFP-4: 1550 nm single mode laser, 80 km (49.7 miles)

Note: *For detailed specifications of the SFP transceivers, see the SFP Transceivers data sheet.*

E1 INTERFACE

- **Ports**
  4 per module, up to 2 modules per unit

- **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**
  ±3V ±10%, balanced
  ±2.3V ±10%, unbalanced

- **Line Impedance**
  120Ω, balanced
  75Ω, unbalanced

- **Jitter Performance**
  Per ITU-T G.823

- **Connector**
  - RJ-45, 8-pin, balanced
  - BNC, unbalanced (via adapter cable)

T1 INTERFACE

- **Ports**
  4 per module, up to 2 modules
  per unit

- **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

TERMINAL CONTROL INTERFACE

- **Type**
  RS-232/V.24 (DTE)

Note: Cross-cable for terminal connection is supplied.

- **Data Rate**
  9.6, 19.2, 38.4, 57.6, or 115.2 kbps

- **Connector**
  9-pin, D-type, male

GENERAL

- **Indicators**
  System:
  RDY (red) – Self-test results
  PS1/PS2 (green) – PS1/PS2 status
  ALM (red) – Alarm status

  Ethernet module:
  LINK (yellow) – LAN link status
  ACT (green) – LAN activity status

  E1/T1 module:
  SYNC 1–4 (green) – Synchronization
    status

- **Power**
  PSUs: Up to 2 redundant AC/AC,
    or DC/DC power supplies
  AC: 100 to 230 VAC, 55W,
  DC: -40 to -57 VDC, 75W

Note: IPmux-8 supports redundant power supplies. The power supplies are not hot-swappable.

- **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)

- **Environment**
  Operating temperature:
    0 to 50°C (32 to 122°F)
  Storage temperature:
    -20 to 70°C (32 to 110°F)
  Humidity: Up to 90%,
          non-condensing

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ORDERING

IPMUX-8/&/*
TDM pseudowire access gateway

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

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

INTERFACE MODULES

Note: At least one E1/T1 module and one Ethernet module must be ordered per IPmux-8 chassis.

IPMUX-8M/#/$
IPmux-8 TDM module

Specify TDM interface type:
   E1 for balanced E1 interface, RJ-45
   E1CX for unbalanced E1 interface,
      RJ-45 (RJ-45 to BNC adapter
      cable is supplied)
   T1 for balanced T1 interface, RJ-45

$ Specify number of ports for E1
   and T1 modules:
   4 for four ports

IPMUX-M/ETH/~
1-port Ethernet module

~ Specify Ethernet network port type:
   UTP for 10/100BaseT interface,
      RJ-45
   MM-LC for 100BaseFx interface,
      multimode fiber, LC
   SM-LC for 100BaseFx interface,
      single mode fiber, LC

IPMUX-M/4ETH/4UTP
4-port Ethernet module with four
copper ports

IPMUX-M/4ETH/@/3UTP
4-port Ethernet module with one SFP
fiber optic and three copper ports

IPMUX-M/4ETH/@/@/2UTP
4-port Ethernet module with two SFP
fiber optic and two copper ports

@ Specify SFP transceiver type:
   SFP-1 for 1310 nm multimode
      LED, 2 km (1.2 miles)
   SFP-2 for 1310 nm single mode
      laser, 15 km (9.3 miles)
   SFP-3 for 1310 nm single mode
      laser, 40 km (24.8 miles)
   SFP-4 for 1550 nm single mode
      laser, 80 km (49.7 miles)
   NULL for empty port slot

SUPPLIED ACCESSORIES

AC power cord for each ordered AC
power supply

DC connection kit for each ordered
DC power supply

CBL-RJ45/2BNC/E1/X
RJ-45-to- BNC adapter cable (if an
unbalanced E1 interface is ordered)

CBL-DB9/DB9/NULL
Control port cross-cable

RM-ACE-202
Hardware kit for mounting one
IPmux-8 unit into a 19-inch rack