IPmux-1E

TDMoIP Gateway

TDMoIP Driven®

FEATURES

- TDMoIP gateway enabling E1, T1, ISDN, and analog phone communication over asynchronous IP and Ethernet networks

- Framed (full or fractional) and unframed E1/T1 user traffic

- Four FXS/E&M/FXO voice ports for standard analog telephones and key system connections

- Four standard S0 NT or TE interfaces for ISDN basic rate service

- QoS includes:
  - Labeling IP level priority Type of Service (ToS)
  - VLAN tagging and priority labeling according to IEEE 802.1p&Q

- Optional Ethernet user port offering:
  - Transparent LAN bridging
  - User data bandwidth and access control through rate limiting and VLAN filtering

- Ethernet network port with either copper UTP or fiber optic interfaces

- Minimal processing delay (under 3 msec)

- Configurable jitter buffer to compensate for network packet delay

- Manageable via ASCII terminals, Telnet hosts or RADview-Service Center, Java-based network management system

- Compact, 1U-high enclosure

IPmux-1E

TDMoIP Gateway

DESCRIPTION

- IPmux-1E is a TDMoIP gateway for transporting E1/T1, ISDN BRI, and FXS/FXO/E&M services over IP and Ethernet-based networks. IPmux-1E converts the data stream from the user ports to packets for transmission over the packet-switched network. The addressing scheme of these packets is IP. These packets are transmitted via the IPmux-1E Ethernet port to the network. A remote TDMoIP device converts the IP packets back to TDM traffic.

- A powerful internal Layer-2 Ethernet switch provides a user Ethernet port with rate limiting and port-based VLAN tagging capabilities.

- The device supports standard IP features, such as ICMP (ping), ARP, next hop and default gateway.

- *Figure 1* shows a point-to-point application extending analog phone service to a remote PBX, and providing LAN-to-LAN communication over a shared fiber optic or UTP cable.

- *Figure 2* shows a multi-tenant office building where a variety of legacy TDM services (ISDN, E1/T1, and analog phones) are provided by IPmux-1E units connected to IPmux-16 and Megaplex-2100 with ML-IP via the packet-switched network.

PERFORMANCE

- IPmux-1E achieves end-to-end processing delay as low as 3 msec, using high-performance buffering and forwarding techniques.

- Configurable packet size allows to achieve proper balance between PSN throughput and delay.

- An enhanced buffering mechanism compensates for network packet delay variation (jitter) of up to 300 msec.

- An optional internal echo canceller improves voice quality when a large end-to-end delay exists on the TDMoIP link.

QoS SUPPORT

- VLAN tagging and priority labeling are supported according to 802.1p&Q. TDMoIP frames are assigned (tagged) a dedicated VLAN ID.

- VLAN membership allows:
  - Management traffic to be run over a dedicated VLAN
  - User data traffic to be filtered according to a set of up to 15 VLANs.

- The user can configure the ToS or Diffserv of the outgoing TDMoIP packets. This allows the TDMoIP packets to be given a higher priority by network switches and routers.

- Assigned, IANA-registered UDP socket number for TDMoIP simplifies flow classification through switches and routers.

- Rate limiting can be applied on the Ethernet user port to control the maximum rate of the traffic transmitted towards the IP/Ethernet network.

TIMING

- Synchronization between TDM devices is maintained by using advanced clock distribution mechanisms. The clocking options are:
  - **Internal** – the master clock source for the TDM circuit is provided by the IPmux-1E internal clock oscillator
  - **Loopback** – the transmit clock is derived from the E1/T1 port receive clock
  - **Adaptive** – the clock is recovered from the Ethernet network interface
  - **External** – an external clock source is used to synchronize the units with E1 or T1 user interfaces via their station clock ports.

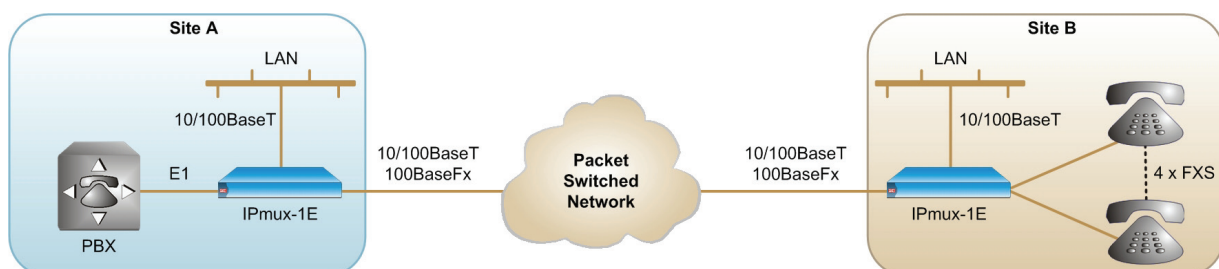- The external clock port provides out-of-band synchronization.

APPLICATIONS

Figure 1. Voice and Data Integration over an Ethernet Link

ETHERNET PORTS

- IPmux-1E supports the following Ethernet ports:
  - One network port (copper or fiber optic)
  - One user port (copper).

E1 OR T1 PORT

- One E1 or T1 port for connectivity to any standard E1 or T1 device.
- E1 and T1 interfaces support the following:
  - Integral LTU/CSU for line protection and long haul applications
  - G.703 unframed and G.704 framed modes
  - CAS
  - CRC-4 bit generation (E1).
- An internal 16-msec echo canceller for the E1 and T1 ports is available.

ISDN BRI S0 PORTS

- Four standard ISDN basic rate S0 ports provide connectivity to any Network Termination (NT) or Terminal Equipment (TE) ISDN device.
- The phantom feeding function enables IPmux-1E to power the remote user equipment (NT mode).
- Each S0 port supports remote and local digital loopback test modes.

ANALOG PORTS

- IPmux-1E offers four FXS, FXO, or E&M analog ports.
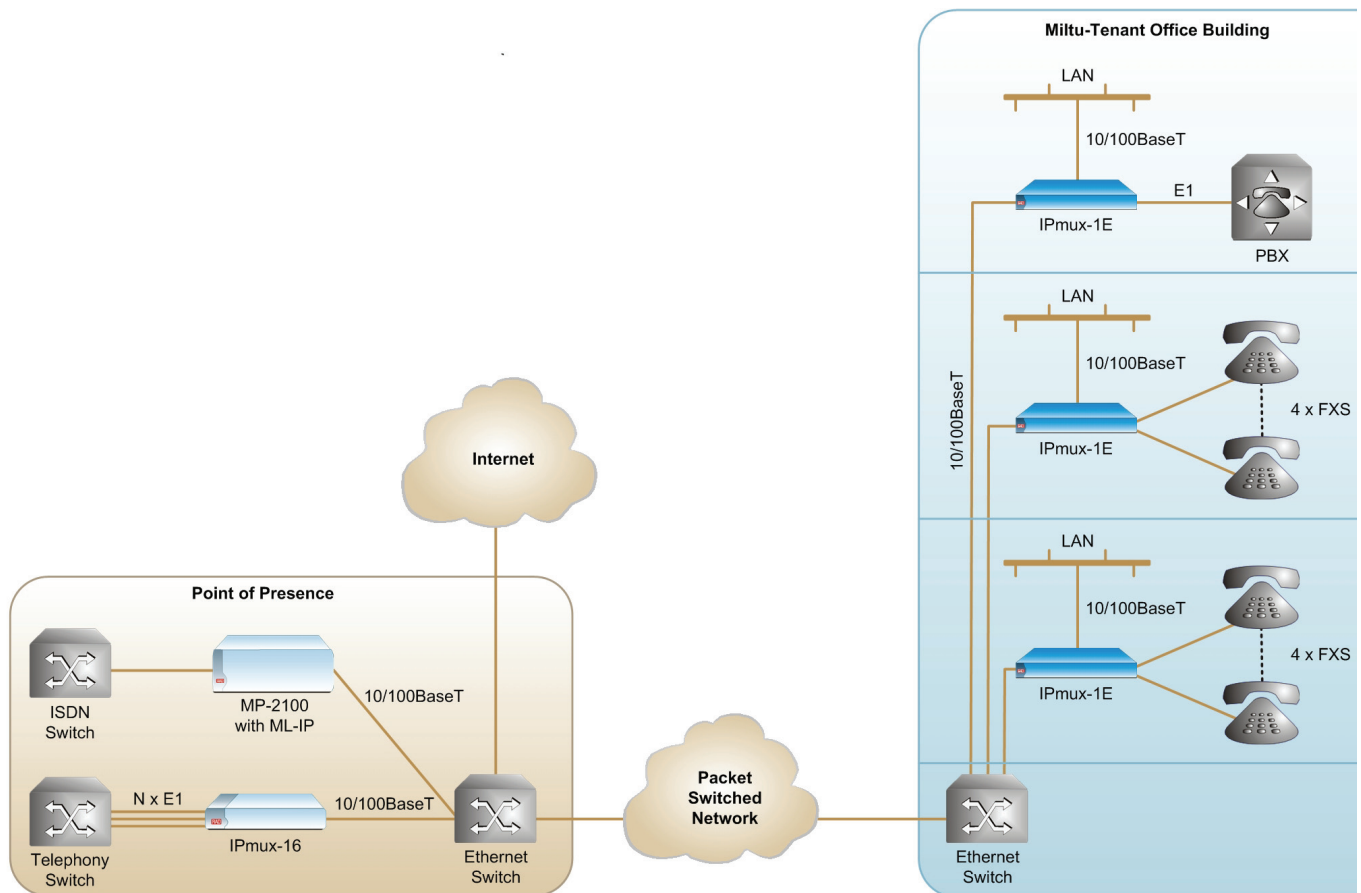- An internal 16-msec echo canceller for the analog ports is available.

Figure 2. Integrated Ethernet-Based Voice and Data Access for Multi-Tenant Building

DIAGNOSTICS

- External and internal loopbacks can be used to check the TDM links connectivity.

- The following physical layer alarms are supported:
  - E1/T1 LOS, AIS, LOF, LCV
  - ISDN S0 LOF
  - FXS/FXO/E&M port status.

- IPmux-1E 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, AIS indication is generated both in the local and the remote devices.

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

- IPmux-1E monitors LAN and IP layer network condition statistics, such as packet loss and packet delay variation (jitter). The events are stored in log files.

MANAGEMENT

- Configuration and monitoring are performed locally via an ASCII terminal, or remotely via Telnet, or RADview.

- Software download is supported via the local terminal, using XMODEM, or remotely, using TFTP. After downloading a new software version, IPmux-1E automatically saves the previous version in non-volatile memory for backup. Similarly, copies of the configuration file can be downloaded and uploaded to a remote workstation for backup and restore purposes.

- 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 event gathering are available. The intuitive GUI, "point-and-click" functionality and easy-to-follow wizards increase the efficiency and accuracy of the service provisioning process.

Table 1. Fiber Optic Interface Characteristics

Interface Type	Wavelength [nm]	Optical Power Min [dBm]	Max	Receive Sensitivity [dBm]	Optical Budget [dB]*	Loss Min [dB/km]	Max
Multimode	1310	-19	-14	-32	10*	1	4
Single mode	1310	-15	-8	-32	14*	0.5	0.8

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

SPECIFICATIONS

E1 INTERFACE

- **Standards**
  ITU-T Rec. G.703, G.704, G.706, G.732, G.823

- **Framing**
  - Unframed
  - CRC-4 with or without MF
  - CAS with or without 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**
  ±3V ±10%, balanced
  ±2.37V ±10%, unbalanced

- **Connector**
  - Balanced: RJ-45
  - Unbalanced: RJ-45 (RJ-45 to BNC adapter cable is supplied)

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

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

T1 INTERFACE

- **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 dB 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

- **Line Impedance**
  100Ω, balanced

- **Jitter Performance**
  Per AT&T TR-62411, ITU-T G.824

ETHERNET INTERFACE

- **UTP**
  - Standards: IEEE 802.3, 802.3u, 802.1p&Q
  - Data rate: 10 or 100 Mbps, half/full-duplex
  - Range: up to 100m (328 ft) on UTP Cat.5 cable
  - Connector: RJ-45

- **Fiber Optic (network port only)**
  - Characteristics: see *Table 1*
  - Connector: SC or LC

CONTROL INTERFACE

- **Interface**
  RS-232/V.24 (DCE)

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

- **Connector**
  DB-9, female

ISDN S0 INTERFACE

- **Compliance**
  ETS 300012, I.430, NTT, 5ESS, DMS-100, NI1

- **Bit Rate**
  192 kbps

- **Line Coding**
  Pseudo-ternary

- **Line Termination**
  100Ω ±5%

- **Connector**
  RJ-45

ANALOG INTERFACES

- **Type**
  FXS, FXO, and E&M

- **Modulation Method**
  PCM (per ITU-T G.711 and AT&T PUB-43801), µ-Law or A-Law

- **Interface**
  Loop start for direct connection to a 2-wire telephone

- **Diagnostics**
  - Remote analog loopback
  - 1-kHz tone injection
  - Activity status

- **Connectors**
  - FXS and FXO: RJ-11
  - E&M: RJ-45

GENERAL

- **Timing**
  E1/T1:
  - Internal (from internal oscillator)
  - External (E1 or T1, via dedicated port)
  - Loopback (derived from the E1/T1 receive line)
  - Adaptive (regenerated from Ethernet link)

  PCM:
  - Internal (from internal oscillator)
  - Loopback (derived from Channel 1 for the unit with ISDN/TE, FXS, FXO and E&M interfaces)
  - Adaptive (regenerated from the Ethernet link)

- **Power**
  AC: 100 to 240 VAC, 50/60 Hz
  DC: -48 VDC only

- **Power Consumption**
  25W or 32W (with Ethernet switch)

- **Physical**
  Height: 44 mm (1.7 in)
  Width: 432 mm (17.0 in)
  Depth: 246 mm (9.7 in)
  Weight: 2.3 kg (5.1 lb)

- **Environment**
  Temperature: 0–50°C (32–122°F)
  Humidity: Up to 90%, non-condensing

IPmux-1E

TDMoIP Gateway

▌ ORDERING

IPmux-1E/#/+/&/*
TDMoIP gateway

Specify power supply:
  AC for 100 to 240 VAC
  DC for -48 VDC

+ Specify TDM user port type:
  4BRI for 4 ISDN S0 interfaces
  4FXS for 4 analog FXS interfaces
  4FXO for 4 analog FXO interfaces
  4E&M for 4 analog E&M
    interfaces
  4FXS-EC for 4 analog FXS
    interfaces and echo canceller
  4FXO-EC for 4 analog FXO
    interfaces and echo canceller
  4E&M-EC for 4 analog E&M
    interfaces and echo canceller
  E1-EC for balanced E1 interface
    and echo canceller
  E1CX-EC for unbalanced E1
    interface, RJ-45 and echo
    canceller (RJ-45 to BNC adapter
    cable is supplied)
  T1-EC for balanced T1 interface,
    RJ-45 and echo canceller

& Specify Ethernet port type:
  UTP for 10/100BaseT network
    port, RJ-45
  MM-SC for 100BaseFx network
    port, 850 nm, multimode, SC
  SM-SC for 100BaseFx network
    port, 1310 nm, single mode, SC
  UTP/UTP for 10/100BaseT
    network port, RJ-45 and
    10/100BaseT user port, RJ-45
  MM-LC/UTP for 100BaseFx
    network port, 850 nm,
    multimode, LC and
    10/100BaseT user port, RJ-45
  SM-LC/UTP for 100BaseFx
    network port, 1310 nm, single
    mode, LC and 10/100BaseT user
    port, RJ-45

* Specify station clock port type
  (optional, default is none):
  STC-E1 for 2.048-Mbps balanced,
    RJ-45
  STC-E1CX for 2.048-Mbps,
    unbalanced, mini BNC
    (mini BNC to BNC adapter cable
    is supplied)
  STC-T1 for 1.544-Mbps balanced,
    RJ-45

Note: Station clock port is available for the units with E1 or T1 TDM user ports only.

SUPPLIED ACCESSORIES

Power cord

DC power supply connector kit (if a DC-powered unit is ordered)

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

CBL-MINIBNC-BNC
Mini BNC to BNC adapter cable (if a station clock module with unbalanced E1 interface is ordered)

RM-34
Hardware kit for mounting one IPmux-1E unit into a 19-inch rack

OPTIONAL ACCESSORIES

CBL-DB9F-DB9M-STR
Control port cable

AIRLINX Communications, Inc.
Box 253
Greenville, NH 03048
E-mail: sales@airlinx.com
Tel: (888) 224-6814
Fax: (603) 878-0530