Data Sheet

IPmux-2L

TDM Pseudowire Access Gateway

Legacy over PSN solution for transmitting E1 streams over packet switched networks

TDMoIP Driven®

- Comprehensive support for pseudowire/circuit emulation standards including TDMoIP, CESoPSN, SAToP and HDLCoPSN
- Built on TDMoIP technology, implementing IETF, MFA Forum, ITU-T for Pseudowire Emulation Edge-to-Edge (PWE3)
- E1 and serial traffic emulation over MPLS, IP and Ethernet networks
- Support for both framed (full or fractional) and unframed E1 traffic

IPmux-2L is a TDM pseudowire access gateway extending TDM-based services over packet switched networks. It also serves as an Ethernet-based access device.

PSEUDOWIRE PERFORMANCE

The unit provides a legacy over PSN solution for transmitting E1 streams over packet switched networks (PSNs). The device converts the data stream from its user E1 and high-speed data ports into packets for transmission over the network. The addressing scheme of these packets is IP or MPLS.

These packets are transmitted via the IPmux-2L Ethernet network port to the PSN. A remote pseudowire device converts the packets back to TDM traffic.

The ASIC-based architecture provides a robust and high performance pseudowire solution with minimal processing delay.

The unit supports various legacy over packet transport types, including TDMoIP, CESoPSN, SAToP and HDLCoPSN.

RAD
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IPmux-2L

TDM Pseudowire Access Gateway

High-performance ASIC-based buffering and forwarding techniques achieve minimal end-to-end processing delay. Configurable packet size balances PSN throughput and delay while a jitter buffer compensates for packet delay variation (jitter) of up to 200 msec in the network.

An assigned IANA-registered UDP port number for pseudowire simplifies flow classification through switches and routers.

PSEUDOWIRE TIMING

Synchronization between TDM devices is maintained by deploying advanced clock distribution mechanisms. The clocking options are:

- Internal – The IPmux-2L internal clock oscillator provides the master clock source for the TDM circuit
- Loopback – The transmit clock is derived from the TDM or serial data port receive clock
- Adaptive – The clock is recovered from the PSN
- External – An external clock source synchronizes the device via its two E1 ports to input or output a 2.048 Mbps clock reference.

The system clock ensures a single clock source for all TDM links and uses master and fallback timing sources for clock redundancy. The system also supports two different clock sources from two TDM links at the same time.

PSEUDOWIRE QoS

IPmux-2L supports VLAN tagging and priority labeling according to 802.1p&q. Pseudowire packets are assigned a dedicated VLAN ID and 802.1p bit.

The ToS or Diffserv of the outgoing pseudowire packets are user-configurable. This allows assigning pseudowire packets a higher priority in IP networks.

EXP bits are used for QoS marking of the TDMoMPLS traffic in MPLS networks.

TDM INTERFACE

One or two E1 ports provide connectivity to any standard E1 device.

E1 interfaces feature:

- Integral LTU for long haul applications
- G.703 unframed and G.704 framed modes
- CAS and CRC-4 bit generation (E1).

SERIAL INTERFACE

A data port is available for an N × 64 kbps serial connection to legacy equipment.

Provided via 25-pin D-type connector, the serial port supports the following interfaces:

- X.21
- V.24/RS-232
- RS-530/RS-422
- V.35
- V.36/RS-449.

DCE/DTE modes are selected via adapter cables and IPmux-2L clock configuration.

ETHERNET INTERFACE

IPmux-2L includes the following Ethernet ports:

- One network port (copper or fiber optic)
- Two user ports (both copper, or one copper and one fiber optic).

The network and user ports support autonegotiation, VLAN tagging and rate limiting.

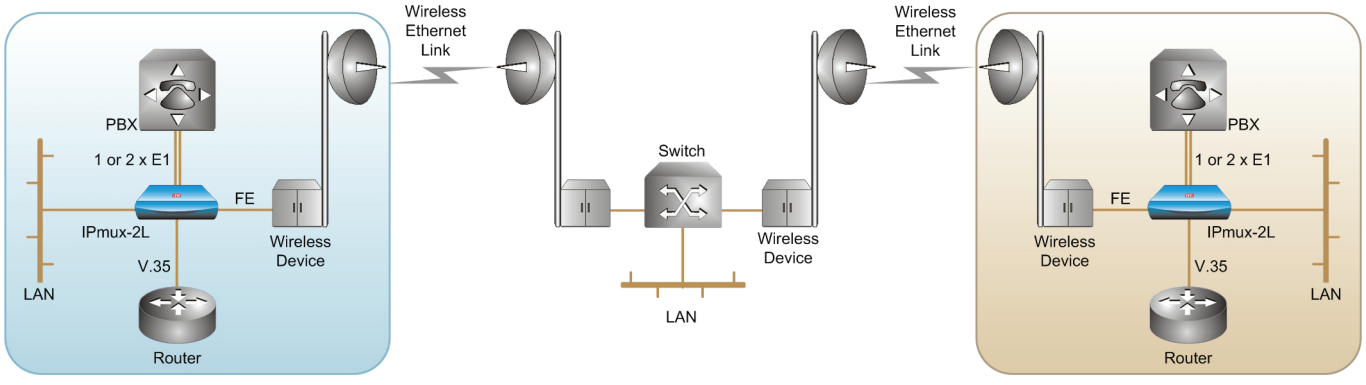

Figure 1. LAN and TDM Services over a Wireless Ethernet Link

ETHERNET CAPABILITIES

An internal Layer-2 Ethernet switch of IPmux-2L includes three Ethernet ports. One port serves as a network interface and the other two serve for user Ethernet traffic.

Each Ethernet port features:

- Port-based rate limiting for bandwidth control
- Four priority queues (strict or weighted) for handling traffic with different service demands. Traffic is classified according to IP Precedence, 802.1P, DSCP or port default priority.
- Port-based VLAN membership for ingress traffic restriction
- Port-based VLAN tagging
- Double VLAN tagging (VLAN stacking)
- Bridging and filtering.

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

MANAGEMENT

IPmux-2L can be configured and monitored locally via an ASCII terminal, or remotely via Telnet or Web browser.

Management traffic can run over a dedicated VLAN.

Software can be downloaded via a local terminal using XMODEM/YMODEM, or remotely, using TFTP. After downloading a new software version, IPmux-2L automatically saves the previous version in non-volatile memory for backup purposes.

Also, copies of the configuration file may be downloaded and uploaded to a remote workstation for backup and restore purposes.

Current date and time are retrieved from a dedicated server, using SNTP.

DIAGNOSTICS

External and internal loopbacks check TDM and serial link connectivity.

A built-in internal and external BERT utility is used to monitor the TDM link quality.

The following E1 physical layer performance statistics are available: LOS, LOF, LCV, RAI, AIS, FEBE, BES, DM, ES, SES, UAS and LOMF.

LAN and IP layer network condition statistics, such as packet loss and packet delay variation (jitter), are monitored and stored by the device.

Fault isolation, statistics and event logging are also available.

RAD's TDM PW OAM verifies connectivity and prevents pseudowire configuration mismatch.

Specifications

E1 INTERFACE

Number of Ports
1 or 2

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

Data Rate
2.048 Mbps

Line Code
HDB3, AMI

Framing
Unframed, framed, multiframe; with or without CRC-4

Signaling
CAS, CCS (transparent)

Line Impedance
120Ω, balanced
75Ω, unbalanced

Signal Levels
Receive:
0 to -36 dB with LTU (long haul)
0 to -10 dB without LTU (short haul)
Transmit balanced: ±3V ±10%
Transmit unbalanced: ±2.37V ±10%

Jitter and Wander Performance
Per ITU-T G.823

Connector
Balanced: RJ-45
Unbalanced: coax BNC

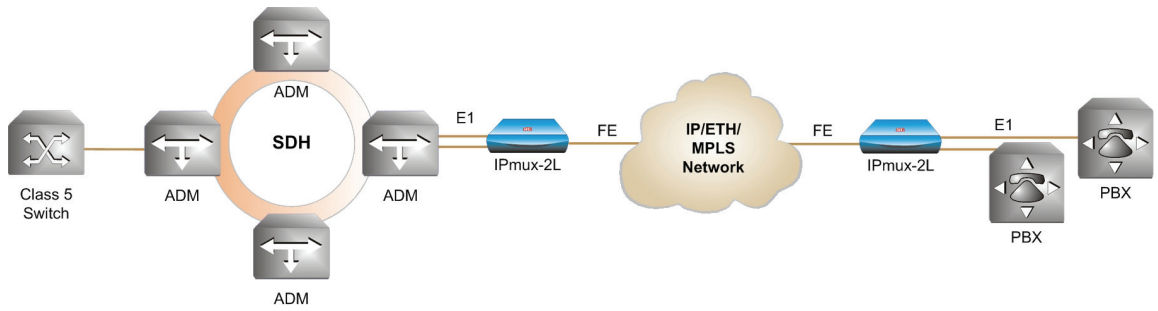

Figure 2. TDM Backhaul and Trunking over a PSN

SERIAL INTERFACE

Number of Ports
1

Interface Type
X.21, V.24/RS-232, RS-530/RS 422, V.35, V.36/RS 449

Timing
DCE – IPmux-2L provides both Tx and Rx clock to the user equipment. Optionally the incoming data can be sampled with an inverted clock.

DTE1 –IPmux-2L provides the Rx clock. The attached user equipment provides the Tx clock.

DTE2 – The attached user equipment provides both Tx and Rx clocks.

Control Signals
CTS – constantly ON or follows RTS, user-selectable

DCD – constantly ON, unless a fault in the PSN network is detected

Data Rate
N × 64 kbps (N = 1, 2, ... 32)

Connector
25-pin, D-type, female

ETHERNET INTERFACE

Number of Ports
3 (1 network, up to 2 user)

Port Combination
1 SFP-based, 2 built-in UTP

Type
Electrical: 10/100BaseT

Fiber optic: 100BaseFx, 100BaseLX10, 100BaseBx10

Fast Ethernet SFPs
For full details, see the SFP Transceivers data sheet at www.rad.com

Connector
LC

PSEUDOWIRE CONNECTIONS

Standards Compliance
IETF: RFC 4553 (SAToP), RFC 5087 (TDMoIP), RFC 5086 (CESoPSN) and RFC 4618 (HDLCoPSN)

ITU-T: Y.1413

MFA: IA 4.1, IA 8.0.0

Number of PW Connections
63 (31 PWs per E1 port, 1 PW per serial port)

Jitter Buffer Size
0.5–200 msec (unframed) with 0.1 msec granularity
1.5–200 msec (framed) with 0.5 msec granularity

GENERAL

Timing
Internal
External input or output via an E1 or serial port
Loopback
Adaptive

Adaptive Clock Characteristics
According to G.823 traffic interface

Management
SNMPv1v2c
Telnet
ASCII terminal via V.24 (RS-232) DCE port
Web browser

Diagnostics
Loopbacks: E1 port local/remote, serial port local/remote

BERT: E1 port internal/external

Statistics
E1 (per G.826 and RFC 2495)

Ethernet (per RFC 2819)

Jitter buffer indication (overflow, underflow, sequence error, max/min jitter buffer levels)

Indicators
PWR (green) – Power status
TST (yellow) – Test status
ALM (red) – Alarm status
LOC/REM (red/red) – E1 local/remote sync loss
LINK/ACT (green/yellow) – Ethernet link/activity status on RJ-45 or SFP

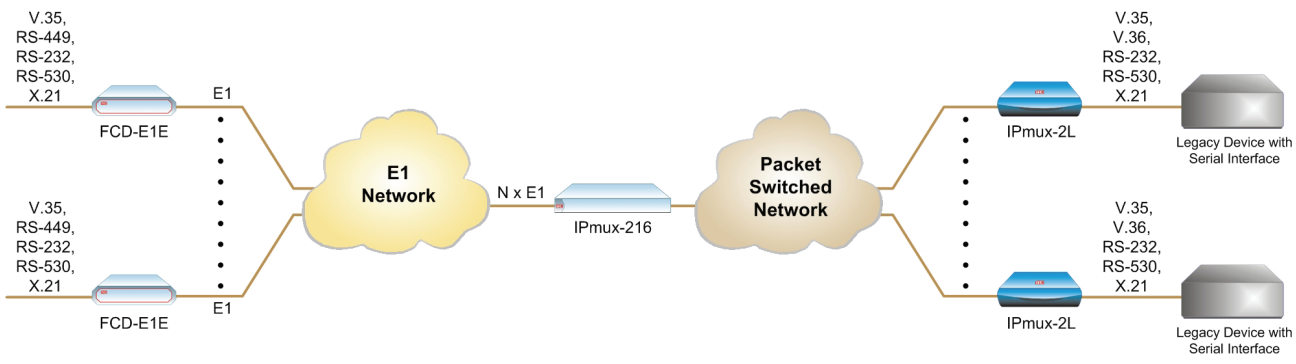

Figure 3. Gradual Migration from Serial Data Services to a PSN

IPmux-2L

TDM Pseudowire Access Gateway

Power
AC/DC: 100–240 VAC or 48/60 VDC nominal (40 to 72 VDC)

Power Consumption
8W max

Physical
Height: 43 mm (1.7 in)
Width: 217 mm (8.5 in)
Depth: 170 mm (6.7 in)
Weight: 0.5 kg (1.1 lb)

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

Table 1. IPmux Family Product Comparison

Feature	IPmux-2L (Ver. 1.0)	IPmux-14 (Ver. 2.0)	IPmux-24 (Ver. 1.0)	IPmux-216 (Ver. 1.0)
TDM service ports	1, 2 (E1 only)	2, 4	1, 2, 4	8, 16
Ethernet network ports	1 × FE	1 × FE network, 1 × FE network/user	1 × GbE/FE network, 1 × GbE/FE network/user	1 × GbE/FE network, 1 × GbE/FE network/user
Ethernet subscriber ports	1 or 2 × FE	1 × FE	1 × GbE/FE	1 × GbE/FE
Number of PWs	63	64	64	256
Multi-pseudowire	✓	✓	✓	✓
Advanced clock recovery	–	✓	✓	✓
Redundant power supply	–	–	–	✓
External clock port	–	Optional	Optional	✓
Serial data port	Optional	Optional	–	–
SSH, SSL, RADIUS	–	–	✓	✓
Network management system	RV-EMS/NGN	RV-SC/TDMoIP	RV-SC/TDMoIP	RV-SC/TDMoIP

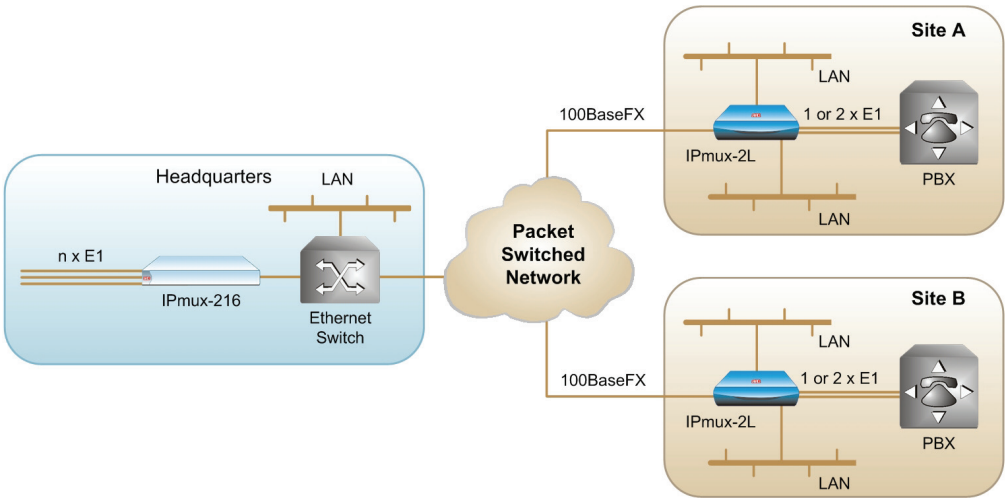

Figure 4. Corporate Multisite Communication over a PSN

IPmux-2L

TDM Pseudowire Access Gateway

Ordering

IPmux-2L/+/&/#

Legend

+ TDM interface type:
- **1E1** 1 balanced E1
- **1E1CX** 1 unbalanced E1
- **2E1** 2 balanced E1
- **2E1CX** 2 unbalanced E1

& Serial interface type (Default=no serial interface):
- **V35** V.35 interface
- **V36** V.36/RS-449 interface
- **RS530** RS-530 interface
- **X21** X.21 interface
- **RS232** RS-232 interface

Fiber optic Ethernet interface type (Default=two 10/100BaseT ports)
- **N** SFP-ready slot
- **1** Fast Ethernet/STM-1, 1310 nm, multimode, LED, 2 km (1.2 mi)
- **2** Fast Ethernet/STM-1, 1310 nm, single mode, laser, 15 km (9.3 mi)
- **3** Fast Ethernet/STM-1, 1310 nm, single mode, laser, 40 km (24.8 mi)
- **4** Fast Ethernet/STM-1, 1310 nm, single mode, laser, 80 km (49.7 mi)
- **10A** Fast Ethernet/STM-1, Tx - 1310 nm, Rx - 1550 nm, single mode (single fiber), laser (WDM) , 20 km (12.4 mi)
- **10B** Fast Ethernet/STM-1, Tx - 1550 nm, Rx - 1310 nm, single mode (single fiber), laser (WDM) , 20 km (12.4 mi)

Note: *For single-fiber applications, a device with the SFP-10A interface should always be used opposite a device with the SFP-10B interface, and vice versa.*

Note: *It is strongly recommended to order this device with **original** RAD SFPs **installed**. This will ensure that prior to shipping, RAD has performed comprehensive functional quality tests on the entire assembled unit, including the SFP devices. RAD cannot guarantee full compliance to product specifications for units using non-RAD SFPs. For detailed specifications of the SFP transceivers, refer to the SFP Transceivers data sheet.*

SUPPLIED ACCESSORIES

Power cord

AC/DC adapter plug

OPTIONAL ACCESSORIES

The following cables convert the IPmux-2L 25-pin serial data port connector into the respective interface. Cable length is 2m (6 ft).

CBL-HS2/V/1/$
Adapter cable for connecting a data port in DCE timing mode to V.35 equipment

CBL-HS2/V/2/$
Adapter cable for connecting a data port in DTE1 timing mode to V.35 equipment

CBL-HS2/V/3/$
Adapter cable for connecting a data port in DTE2 timing mode to V.35 equipment

CBL-HS2/R/1/$
Adapter cable for connecting a data port in DCE timing mode to V.36/RS 449 equipment

CBL-HS2/R/2/$
Adapter cable for connecting a data port in DTE1 timing mode to V.36/RS-449 equipment

CBL-HS2/R/3/$
Adapter cable for connecting a data port in DTE2 timing mode to V.36/RS-449 equipment

CBL-HS2/X/1/$
Adapter cable for connecting a data port in DCE timing mode to X.21 equipment

$ Cable connector type:
- **F** Female
- **M** Male

CBL-DB9F-DB9M-STR
Control port cable

RM-33-2
Hardware kit for mounting one or two IPmux-2L units into a 19-inch rack

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