

IPmux-2L

TDM Pseudowire Gateway



- Comprehensive compliance with pseudowire/circuit emulation standards including TDMoIP, CESoPSN, and SAToP
- Built on TDMoIP technology, implementing IETF, MFA Forum, ITU T for Pseudowire Emulation Edge-to-Edge (PWE3)
- E1 traffic emulation over MPLS, IP and Ethernet networks
- Transmission of 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

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 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 employs various legacy over packet protocols, including TDMoIP, CESoPSN, and SAToP.

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.

TDMoIP uses constant-rate AAL1 for circuit emulation as per RFC 5087. AAL1 mode is used for structured transport of unchannelized data and circuits with relatively constant usage. In addition, AAL1 is used when the TDM-bound IWF is required to maintain a high timing accuracy and when high reliability is required.

TDMIP
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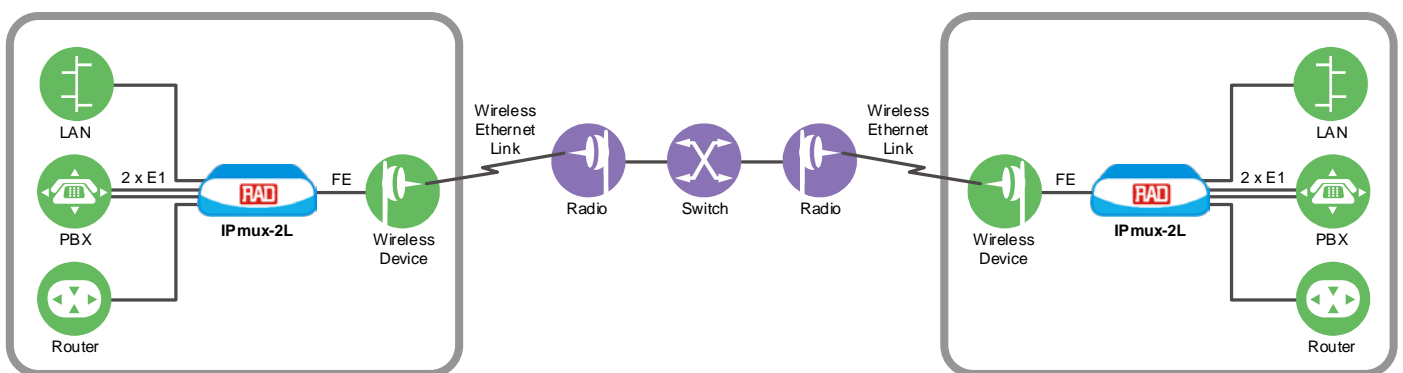


Figure 1. LAN and TDM Services over a Wireless Ethernet Link



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

QoS

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

ETHERNET

IPmux-2L features an internal Layer-2 Ethernet switch with three Ethernet ports. The ports can be configured to operate as network or user interfaces.

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.

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).

TIMING AND SYNCHRONIZATION

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 receive clock
- Adaptive – The clock is recovered from the PSN
- Receive – The system timing is locked to the clock received via one of the TDM ports or the third FE port (Sync-E option).

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

Sync-E

IPmux-2L utilizes standard Synchronous Ethernet (Sync-E) technology to ensure highly accurate clock recovery over PSN (special ordering option). The clock operation conforms to ITU-T G.8261 requirements.

MANAGEMENT AND SECURITY

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.

MONITORING AND DIAGNOSTICS

External and internal loopbacks check TDM connectivity.

A built-in internal and external BERT utility is used to monitor the TDM link quality. Virtual Cable Test (VCT) checks the quality of Ethernet cables, connectors and terminations, identifying a cable break or short.

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.

AC-powered units report power failures to defined network management stations by sending a trap, thus enabling the devices to properly disconnect from the network with notification of the reason for the service problem.

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Specifications

E1 INTERFACE

Number of Ports	1 or 2
Compliance	ITU-T Rec. G.703, G.704, G.706, G.732, G.823
Framing	Framed per G.732: <ul style="list-style-type: none"> with or without CAS with or without CRC-4 Unframed
Data Rate (per port)	2.048 Mbps
Signaling	CAS, CCS (transparent)
Line Code	HDB3, AMI
Signal Level	Receive: <ul style="list-style-type: none"> 0 to -36 dB with LTU (long haul) 0 to -10 dB without LTU (short haul) Transmit: <ul style="list-style-type: none"> Balanced: $\pm 3V (\pm 10\%)$
Jitter and Wander Performance	As per ITU-T G.823
Impedance	Balanced 4-wire: 120Ω Unbalanced coax: 75Ω
Connector	RJ-45

ETHERNET INTERFACE

Number of Ports	3 (1 network, up to 2 user)
Port Combinations	3 UTP or 2 UTP and 1 SFP
Type	Electrical: 10/100BaseT Fiber optic: 100BaseFx, 100BaseLX10, 100BaseBx10
SFP Transceivers	Connector: LC

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/XFP/SFP+ Transceivers data sheet*.

PSEUDOWIRE

Standard Compliance	IETF: RFC 4553 (SAToP), RFC 5087 (TDMoIP), RFC 5086 (CESoPSN) ITU-T: Y.1413 MFA: IA 4.1, IA 8.0.0
Number of PW Connections	63
Jitter Buffer Size	0.5–200 msec (unframed) with 0.1 msec 1.5–200 msec (framed) with 0.5 msec

MANAGEMENT

Control Port	RS-232 interface, DB-9 connector
Tools	SNMPv1v2c, Telnet
Options	ASCII terminal via V.24 (RS-232) DCE port Web browser Entity MIB (RFC 4133)

TIMING

Clock Sources	Internal Receive Loopback Adaptive
Sync-E	Per G.8261 (no ESSM/CSM), via Ethernet port 3 (ordering option)
Adaptive Clock	According to G.823 traffic interface

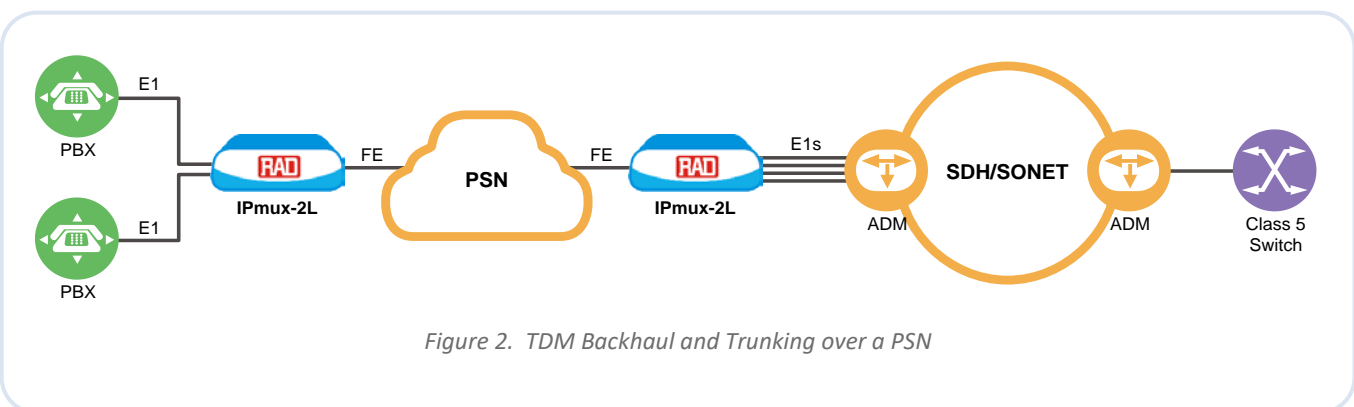


Figure 2. TDM Backhaul and Trunking over a PSN

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DIAGNOSTICS

LED Indicators	PWR (green): Power status
	TST (yellow): Test status
	ALM (red): Alarm status
	LOC/REM (red/red): E1 local/remote sync loss
	INK/ACT (green/yellow): Ethernet link/activity status on RJ-45 or SFP
Loopbacks	Local and remote loopbacks on E1 port
	BERT: E1 port internal/external
	VCT : Ethernet ports
Statistics	E1 (per G.826 and RFC 2495)
	Ethernet (per RFC 2819)
	Jitter buffer indication (overflow, underflow, sequence error, max/min jitter buffer levels)
Dying Gasp	When working with AC-powered units only

GENERAL

Power

Power Supply	AC/DC: 100–240 VAC or 48/60 VDC nominal (40 to 72 VDC)
Power Consumption	38W (max.)

Physical

Height	43 mm (1.7 in)
Width	220 mm (8.6 in)
Depth	170 mm (6.7 in)
Weight	0.5 kg (1.1 lb)

Environment

Operating Temperature	0° to 50°C (32° to 122°F)
Humidity	up to 90%, non-condensing

Ordering

The information below represents examples of supported configurations. For additional configuration options, please contact your local RAD partner.

IPMUX-2L/1E1

IPMUX-2L/1E1/N

IPMUX-2L/2E1

IPMUX-2L/2E1/N

ORDERING OPTIONS

Some options are not supported by all models. Some option combinations are invalid or may require a minimum order. To determine the BOM for your application, please contact your local RAD partner.

E1 links	1E1	Single E1 link
	2E1	Dual E1 links
SFP-ready slot	N	SFP-ready slot

SUPPLIED ACCESSORIES

Power cord
AC/DC adapter plug

OPTIONAL ACCESSORIES

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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