Vmux-2100

Modular Voice Trunking Gateway

- Unique TDMoIP multiplexing allows transmission of the compressed voice over Packet Switched Networks and/or TDM Networks
- Fully transparent to signaling and telephony features
- Automatic link backup mechanism between TDM and Ethernet links ensures system survivability
- HDLC channel compression for CCS protocols
- Compact 1U-high platform, compatible with 19-inch racks

Efficiently transmitting up to 16 E1 or T1 voice trunks over a single E1/T1 or Ethernet/IP link

TDMoIP® Driven

Vmux-2100 is a modular Voice Trunking Gateway that compresses and transports up to 16 E1 or T1 voice trunks over E1, T1 or IP links.

Vmux-2100 employs G.723.1, G.729 Annex A and G.711 compression algorithms, together with RAD's unique TDMoIP multiplexing, to transmit up to 496/384 voice channels, including transparent CAS and CCS, over a single E1/T1 or IP link.

Vmux-2100 is unique in that it is a single device able to transmit compressed voice over both TDM and IP networks. It can easily switch between the networks whenever this may be necessary or convenient.

Switching transmission between TDM and IP links does not require additional investments in equipment. It can be performed automatically upon link failure.

Voice Activity Detection (VAD) and silence suppression allow Vmux units to dynamically allocate bandwidth for voice traffic. This results in very efficient bandwidth usage, allowing more bandwidth for data transport. The gateway detects, generates and relays DTMF/MFR2/MFC signaling.

CAS is transparently transmitted end-to-end (see *Figure 1*). When transmitting over non-IP networks (E1, T1 or n x 64 kbps), the A2oMPLS multiplexing format can be used instead of TDMoIP.

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The A2oMPLS header is smaller than the TDMoIP header, saving a further 5% in bandwidth. This technique is compliant with the MPLS/Frame Relay Alliance 5.0 Implementation Agreement: I.366.2 Voice Trunking Format over MPLS.

Vmux-2100 supports relay of Group III fax, as well as all common modem rates and standards. Other modem and fax rates can be transmitted transparently (voice band data).

Only 1U-high, Vmux-2100 is a compact modular unit that can be installed in 19-inch racks. The unit consists of up to four Voice Compression modules, a single Main module, and up to two power supply modules. All modules are plug-in and field-replaceable. Power supply and Voice Compression modules are hot-swappable.

DATA STREAM TRANSFER

Vmux-2100 transfers the following data streams that are not processed as voice:

Multiple HDLC channels – Vmux-2100 supports up to four independent HDLC data streams per E1/T1. Each data stream may occupy one or more timeslots. All CCS protocols, such as SS7, ISDN and QSIG, are supported.

SS7 channels – Vmux-2100 supports up to two independent SS7 data streams per E1/T1. Each data stream may occupy one or more timeslots.

Transparent channels – Vmux-2100 supports transparent connection between n x 64 channels over IP and TDM networks. This feature operates between two Vmux-2100 units as well as between Vmux-2100 and Vmux-110. Up to eight timeslots per E1/T1 can carry transparent data.

MAIN MODULE

The Main module features a single 10/100BaseT UTP Ethernet ports (Network and User) with optional autonegotiation support. The Ethernet port operates at 10/100 Mbps speed, half and full duplex.

The Ethernet interfaces comply with the IEEE 802.3 standard. They support full autonegotiation according to 802.3x flow control for full duplex, and backpressure option for half duplex.

In addition to the standard Ethernet port, the Main module can also be ordered with a redundant pair of E1/T1 or n x 64 kbps serial links.

ENHANCED LINK BACKUP

Vmux-2100 features automatic link backup between the TDM ports and the Ethernet ports on the Main module (in point-to-point applications only). Primary, secondary and tertiary links are configured so that if the primary link fails, Vmux-2100 automatically switches to the next link. Once a failed higher link has been restored, the voice traffic is automatically switched back.

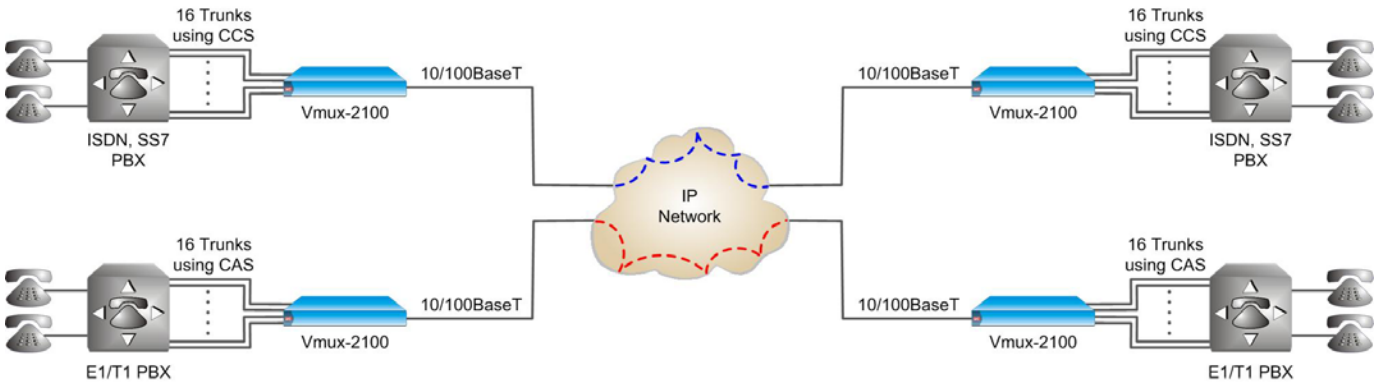

Figure 1. Compressed Voice over IP, Including Transparent Transmission of CCS and CAS

VOICE COMPRESSION MODULES

Each Vmux-2100 Voice Compression module features two or four E1/T1 ports. The modules compress the timeslots received from the PBX E1/T1 trunks, using standard algorithms and silence suppression. The compressed payload bytes are then encapsulated into a TDMoIP packet and forwarded to the main link.

BUNDLE CONNECTIVITY CHECK

Vmux-2100 checks voice bundle connectivity using either TDMoIP Layer-4 messages or traditional ICMP (pings). (Layer-4 method is recommended when using routers or firewalls to ensure the Vmux-2100's ability to establish bundle connectivity and also to avoid the flooding the network with pings).

Q.50 & BANDWIDTH MANAGEMENT

Vmux-2100 employs two types of bandwidth management methods. The Q.50 protocol can be used with PBXs that support it. The proprietary Vmux-2100 bandwidth control can be used when the Q.50 protocol is not supported. Bandwidth management is available only when using link ports on the Main module.

SUPER TANDEM

In super tandem applications (see *Figure 2*), where calls are routed through several Vmux-2100 gateways, the intermediate Vmux-2100 gateways sense that the voice has already been compressed by another Vmux, and thus do not uncompress and then recompress the data as it passes through them. This feature ensures that voice is compressed and decompressed only once (at the terminating Vmux-2100 gateways) avoiding voice degradation or delay.

QoS SUPPORT

The Vmux-2100 IP port complies with all the relevant Ethernet LAN standards, such as IEEE 802.3 and 802.3u. It provides reliable, high Quality of Service (QoS), by optional VLAN tagging and priority labeling according to IEEE 802.1D&Q.

Figure 2. Super Tandem Application with no Voice Degradation or Delay between Hops: Calls between Site B and Site C are Compressed/Decompressed only Once

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MANAGEMENT

All Vmux-2100 operating parameters are configured using simple, menu-based software. Upgrade or backup software can be uploaded and downloaded via TFTP.

Vmux-2100 can be configured and monitored via a local ASCII terminal, Telnet or via RADview, RAD's network management system. Vmux-2100 features a DB-9 Control port for direct connection of a local terminal for monitoring and control.

The user can configure the Type of Service (ToS) of the outgoing IP packets. This allows an en-route Layer 3 router or switch that supports ToS (or Diffserv), to give higher priority to Vmux-2100 IP traffic for delay-sensitive applications.

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

Since Vmux-2100 internal control unit has its own IP address, the Ethernet port can also be used for connecting to management systems running over Ethernet networks. Management systems connected to one unit's Ethernet port can also manage a remote unit, inband (see *Figure 3*).

The LAN traffic connected to the Ethernet port can be inhibited to prevent LAN data bursts from monopolizing the TDM link bandwidth and disrupting voice traffic. This ensures that the link bandwidth will be utilized for voice (and optionally management) traffic only.

For system security, Vmux-2100 provides four different levels of users: Monitor, Technician, Operator and Administrator. Up to 20 different usernames with passwords can be defined.

DIAGNOSTICS

Vmux-2100 supports local (internal) and remote (external) loopback activation on E1/T1 links. The user can also perform tone injection towards the local PBX. In addition, a ping utility is included to confirm IP connectivity to remote units.

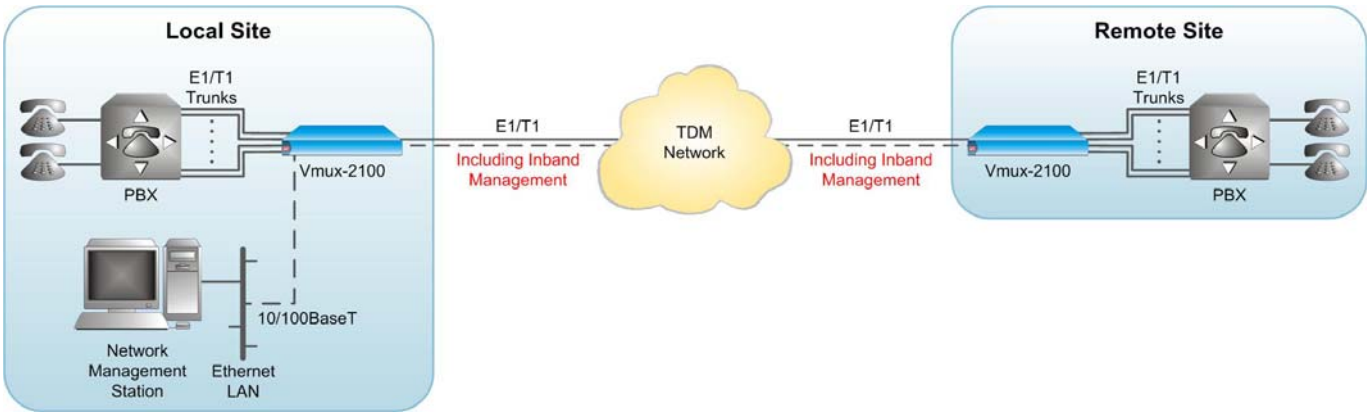

Figure 3. Inband Management of a Remote Vmux-2100 from an Ethernet LAN via a TDM Link

Figure 4. Vmux-2100 Transporting up to 496/384 Voice Channels over a Single TDM Link

Specifications

MAIN MODULE – ETHERNET PORTS

***Note**: The Main module includes a single Ethernet port by default. A redundant pair of E1, T1 or Serial links can be added as an option.*

Number of ports
1

Standards
IEEE 802.3, 802.3u, Ethernet, 802.1D&Q

Data Rate
10 or 100 Mbps, half duplex or full duplex, autonegotiation

Statistics
According to RFC 2819, RMON-MIB

Copper UTP Interface
Range: up to 100m (330 ft) on UTP Cat.5 cable
Connector: RJ-45

Indicators
ACT (green) – blinks when traffic is detected over the Ethernet line

LINK (green) – ON when Ethernet line is OK

MAIN MODULE – E1 LINK

Number of Ports
2 (one active, other for backup or two active)

Connectors (per port)
RJ-45 balanced/unbalanced (automatic detection)

***Note**: CBL-RJ45/2BNC/E1 adapter cable is available for converting each Main module E1 port RJ-45 connector into a pair of BNC connectors for unbalanced coax interface (see Ordering).*

MAIN MODULE – T1 LINK

Number of Ports
2 (one active, other for backup or two active)

Statistics
Full statistical diagnostics capability according to ANSI T1.403-1989
Local support of ESF diagnostics according to AT&T PUB 54016

***Note**: Additional E1/T1 interface specifications that are applicable to main links and voice ports and ports are listed below.*

MAIN MODULE – SERIAL LINK

Number of Ports
2 (one active, other for backup)

Data Rate
n x 64 kbps, up to 2048 kbps

Clock Modes
DCE: Vmux-2100 provides clock to connected equipment
DTE: Vmux-2100 accepts clock from connected equipment

Interface
Selectable for V.35, X.21, RS-530, RS-530A, V.36/RS-449, or RS-232

Connector
Both ports terminate in a single 50-pin SCSI connector

***Note**: A Y-cable can be ordered for splitting the serial links' single 50-pin SCSI connector into two separate channels with standard V.35, X.21 or RS-530 connectors (see Ordering).*

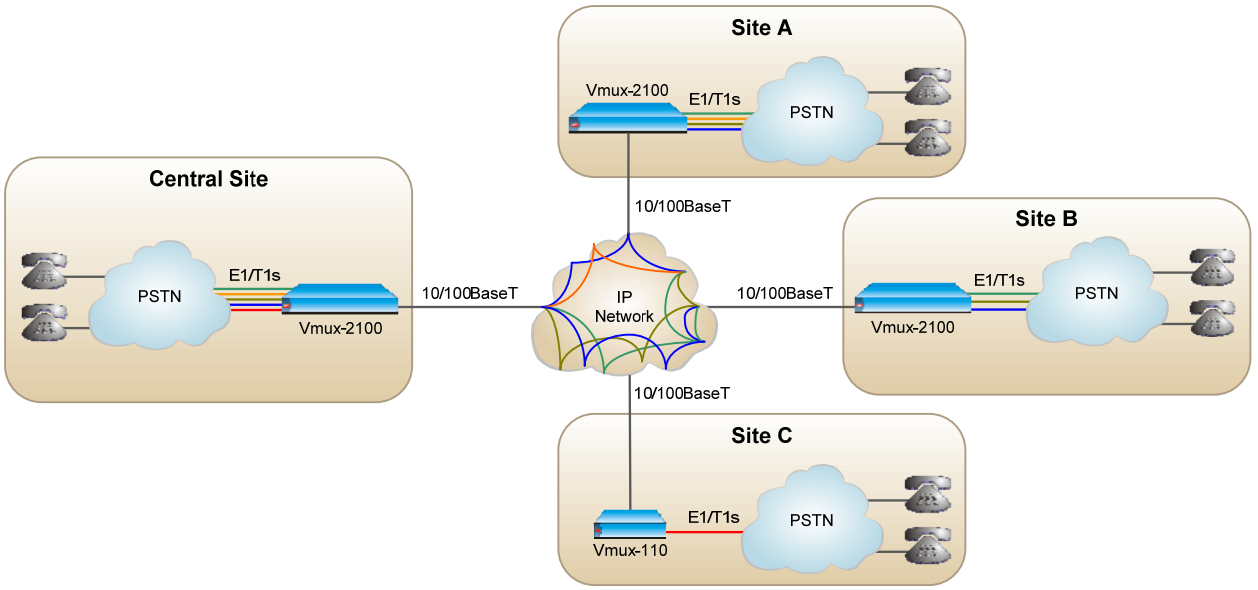

Figure 5. Voice Trunking over IP in an Anv-to-Anv Point Topology

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VOICE COMPRESSION MODULES

Compression Algorithms
G.723.1 (5.3 or 6.4 kbps)
G.729A (8 kbps)
G.711 (A-law or μ-law)

Silence Suppression
G.723.1A, G.729B

Echo Cancellation
32 msec per channel as per G.168

Fax Relay
Group III, 4.8, 9.6, 14.4 kbps

Modem Relay
V.22/V.22 bis
V.32/V.32 bis
V.34 up to 21.6 kbps

Voice Band Data
Transparent support for modems and faxes

Signaling Support
Transparent CAS, including R2 and E&M
Transparent CCS, including ISDN, QSIG and SS7
Clear channel

MF Signaling Support
DTMF, MFR2, MFC detection, generation and relay

Ports per Module
(according to ordering)

E1 Port Modules:
2 (62 channels max) or
4 (124 channels max)
T1 Port Modules:
2 (48 channels max) or
4 (96 channels max)

E1 INTERFACES

Data Rate
2.048 Mbps (per port)

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

Framing
G.732N
G.732N with CRC-4
G.732S
G.732S with CRC-4

Line Code
HDB3

Receive Signal Level
With LTU: 0 to -43 dB
Without LTU: 0 to -12 dB

Transmit Signal Level
Balanced: ±3V (±10%)
Unbalanced: ±2.37V (±10%)

Timing
Internal or loopback

Jitter Performance
Per ITU-T G.823

Line Type
Balanced 4-wire, 120Ω

Indicators (per port)
LOC (red): Local Sync Loss on port
REM (red): Remote Sync Loss on port

Connectors (per port)
RJ-45 for balanced interface

T1 INTERFACES

Data Rate
1.544 Mbps (per port)

Standards
ANSI T1.403, AT&T TR-62411, ITU-T Rec. G.703

Framing
SF, ESF

Line Code
AMI

Zero Suppression
B8ZS

Receive Signal Level
With CSU: 0 to -36 dB
Without CSU: 0 to -30 dB

Transmit Signal Level
With CSU: 0, -7.5, -15, or -22.5 dB
Without CSU: ±2.7V (±10%) at 0-655 ft

Timing
Internal or loopback

Jitter Performance
Per AT&T TR-62411

Line Type
Balanced 4-wire, 100Ω

Indicators (per port)
RED (red): Local Sync Loss (Red Alarm) on port
YEL (yellow): Remote Sync Loss (Yellow Alarm) on port

Connectors (per port)
RJ-45

CONTROL PORT

Located on the Main module, for direct connection to terminal.

Standards
RS-232/V.24 (DCE)

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

Connector
DB-9, female

DIAGNOSTICS

Main Links
IP Diagnostics:
- Performance monitoring
- LAN statistics
- Pings

E1/T1 Diagnostics: local and remote loopbacks

Voice Compression Ports
Local and remote loopback per E1/T1 channel
Tone injection towards local side:
- Per timeslot
- Per entire E1/T1 channel
- On all E1/T1 channels simultaneously

INDICATORS

E1/T1 Alarms (per port)
LOS – Loss of Signal
LOF – Loss of Frame
AIS – Alarm Indication Signal
RAI – Remote Alarm Indication
LOMF (E1 only) – Loss of Multiframe
LCV – Line Code Violation

Front Panel Indicators
TST (yellow):
- On when test is running
- Flashes when Sync loss is detected on the TDM uplink (if TDM Line Check feature is enabled)

ALM (red): alarm is present in system
PWR 1 (green): On when Power Supply Module 1 is providing power
PWR 2 (green): On when Power Supply Module 2 is providing power

Rear Panel Indicators
LINK (green): On when the link is active
ACT (yellow): Blinks during LAN traffic activity

GENERAL

Power
Input (*according to ordering*):
AC: 100 to 240 VAC, 50/60 Hz
48: -48 (-36 to -72) VDC
24: 24 (20 to 36) VDC
Output (per PS module):
3.3 VDC: up to 15A
5 VDC: up to 5A
Total: 60W

***Note**: Two hot-swappable power supply modules can be installed for redundancy*

Physical
Height: 4.3 cm (1.7 in)
Width: 43.5 cm (17.1 in)
Depth: 24.0 cm (9.5 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 (-4 to 158°F)
Humidity: Up to 90%, non-condensing

Table 1. Vmux/Gmux Family Comparison

Feature	Vmux-2100 (Ver. 4.1)	Vmux-110 (Ver. 4.1)	Vmux-210 (Ver. 1.1)	Vmux-2120 (Ver. 1.0)	Gmux-2000 (Ver. 3.6)
					
Maximum compression ratio	16:1	16:1	16:1	16:1	16:1
Maximum number of compressed voice channels	496/384	30	30	496/384	3,472
Voice Interface	E1/T1	E1/T1/FXS/FXO/E&M	FXS	E1/T1	E1/T1/STM-1/OC-3
Network Interface	E1/T1, Fast Ethernet	E1/T1, Serial, Fast Ethernet	E1/T1, Serial, Fast Ethernet	E1/T1, Fast Ethernet	E1/T1/STM-1/OC-3, GbE, GbE/2
Signaling	Any	Any	CAS only	Any	Any
Fax/Modem/DTMF Relay	✓	✓	✓	✓	✓
Management	ASCII terminal, Telnet, RADview-SC/Vmux	ASCII terminal, Telnet, RADview-SC/Vmux	ASCII terminal, Telnet, RADview-SC/Vmux	ASCII terminal, Telnet, RADview-SC/Vmux	ASCII terminal, Telnet, RADview-SC/Vmux

Data Sheet

Vmux-2100

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Ordering

Vmux-2100/*/$

***Note**: System includes chassis, power supplies and power supply cables only. A Main module and at least one Voice Compression module must be ordered for every Vmux-2100 system. All modules can be ordered separately.*

Legend

* Power supply type:
- **AC** 100 to 240 VAC
- **48** -36 to -72 VDC

$ Redundant power supply:
- **R** Redundant power supply (of same type)

MODULES

VMUX-M/M-ETH-#
Main Module with a single Ethernet port by default, and optional redundant E1, T1 or serial links.

Legend

\# Optional redundant TDM link type:
- **E1** E1
- **T1** T1

VMUX-M/VCA-&/%
Enhanced Voice Compression Module

Legend

& TDM interface type:
- **E1** E1
- **T1** T1

% Number of E1/T1 ports:
- **2** 2
- **4** 4

VMUX-2100-PS/*
Power Supply Module

SUPPLIED ACCESSORIES

AC power cord (when AC power supply is ordered)

DC adapter plug (when DC power supply is ordered)

VMUX/RM
Hardware kit for mounting one Vmux-2100 unit into both 19-inch and ETSI racks

OPTIONAL ACCESSORIES

CBL-DB9F-DB9M-STR
Control port cable

CBL-RJ45/2BNC/E1
Interface adapter cable for converting one Main module E1 port RJ-45 connector into a pair of BNC connectors for unbalanced coax interface

***Note**: For E1 Voice Modules conversion to unbalanced 75Ω interfaces must be performed externally (e.g., using RAD's BE-1 converter).*

RM-VMUX-2100/23
Hardware kit for mounting one Vmux-2100 unit into a 23-inch rack

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