Vmux-2120

Universal Voice Compression Gateway

- Unique TDMoIP multiplexing, with various voice compression algorithms, provides up to 16:1 compression for effective bandwidth utilization
- Supports Voice Trunking or 3G media gateway services
- Two channelized uplink ports for point-to-multipoint voice trunking applications
- Fully transparent to signaling and telephony features
- Full redundancy

Efficiently transmitting up to 16 E1/T1 voice trunks over TDM, packet-switched and/or 3G networks

Vmux-2120 is a universal voice compression platform with E1/T1 voice ports, designed for two types of applications:
- Voice trunking applications
- 3G media gateway applications.

The application mode of Vmux-2120 is determined by the software downloaded to the unit. By default, Vmux-2120 is supplied loaded with the voice trunking application software.

Only 1U-high, Vmux-2120 is a compact unit that can be installed in 19-inch racks.

TDM₀IP® Driven

RAD
data communications
The Access Company

Vmux-2120
Universal Voice Compression Gateway

VOICE TRUNKING APPLICATION

Vmux-2120 as a Voice Trunking Gateway compresses and transports up to 16 E1/T1 voice trunks over E1, T1 or IP links.

Vmux-2120 employs G.723.1, G.729 Annex A, AMR 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-2120 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.

Voice Activity Detection (VAD) and silence suppression allow Vmux-2120 units to dynamically allocate bandwidth for voice traffic. This results in very efficient bandwidth usage, allowing more bandwidth for data transport.

Vmux-2120 supports relay of Group III fax. Alternative modem and fax can be transmitted transparently (voice band data).

Data Stream Transfer

Vmux-2120 transfers the following data streams that are not processed as voice:

Multiple HDLC channels – Vmux-2120 supports 8 HDLC data streams per E1/T1. The data stream may occupy one or more timeslots. All CCS protocols, such as SS7, ISDN and QSIG, are supported.

SS7 channels – Vmux-2120 supports up to two independent SS7 data streams per E1/T1. Each data stream may occupy one or more timeslots.

Transparent channels – Vmux-2120 features transparent connection between n x 64 channels over IP and TDM networks, either between two Vmux-2120 units or between Vmux-2120 and other Vmux units. Up to 8 timeslots per E1/T1 link can carry transparent data.
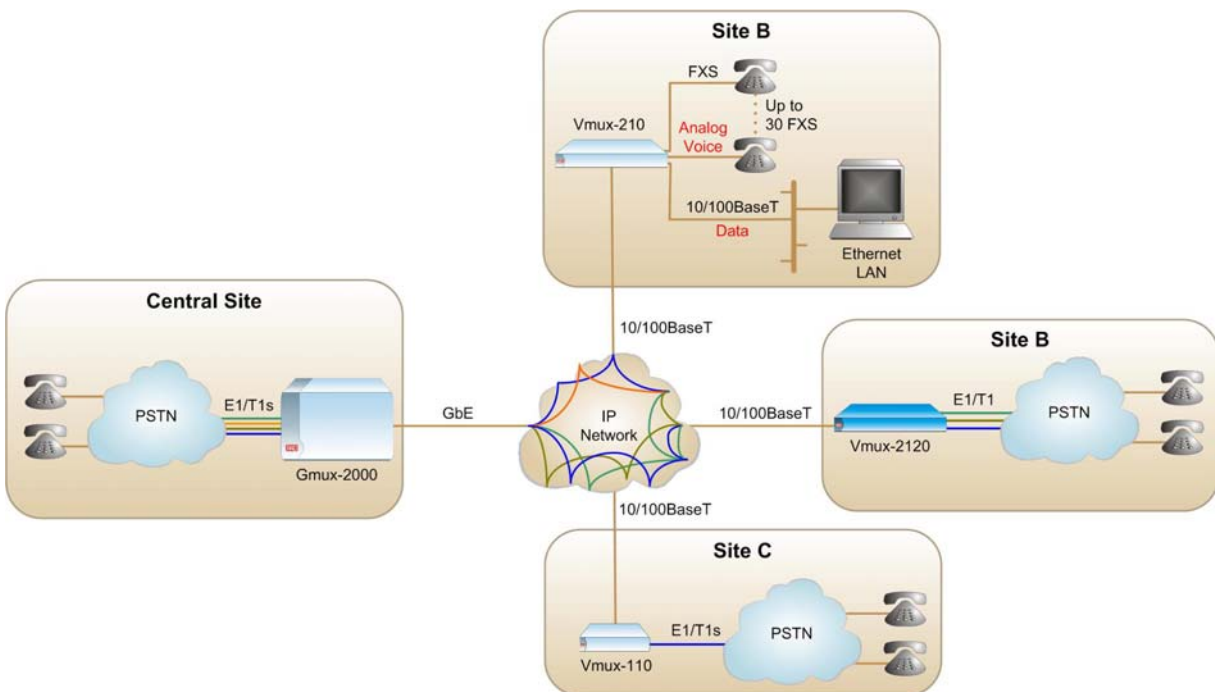

Figure 1. Voice Trunking over IP in an Any-to-Any Point Topology

Vmux-2120 features two 10/100BaseT UTP Ethernet ports (Network and User) with optional autonegotiation support. The Ethernet ports operate at 10/100 Mbps speed, half- and full-duplex. The Ethernet interfaces comply with the IEEE 802.3 standard, supporting full autonegotiation according to 802.3x flow control for full-duplex, and backpressure option for half-duplex.

The Ethernet ports can also be used as two redundant uplink ports.

In addition to the default Ethernet ports (one uplink, one user), the device supports two E1/T1 uplinks that may be configured as redundant to each other and can both function as channelized uplinks. This enables the traffic from 16 user ports to be compressed to two TDM uplink ports in any flexible configuration, with a compression rate of 16:1.

Channelized E1 Main Link
Vmux-2120 has a two-port channelized E1/T1 main link. With this option, Vmux-2120 supports up to two E1/T1 ports for point-to-multipoint TDM applications (see *Figure 2*).

Bundle Connectivity Check
Vmux-2120 checks voice bundle connectivity using TDMoIP OAM messages.

Q.50 & Bandwidth Management
Vmux-2120 employs two types of bandwidth management methods. The Q.50 protocol can be used with PBXs that support it. The proprietary Vmux-2120 bandwidth control can be used when the Q.50 protocol is not supported. Bandwidth management is available only when using link ports.
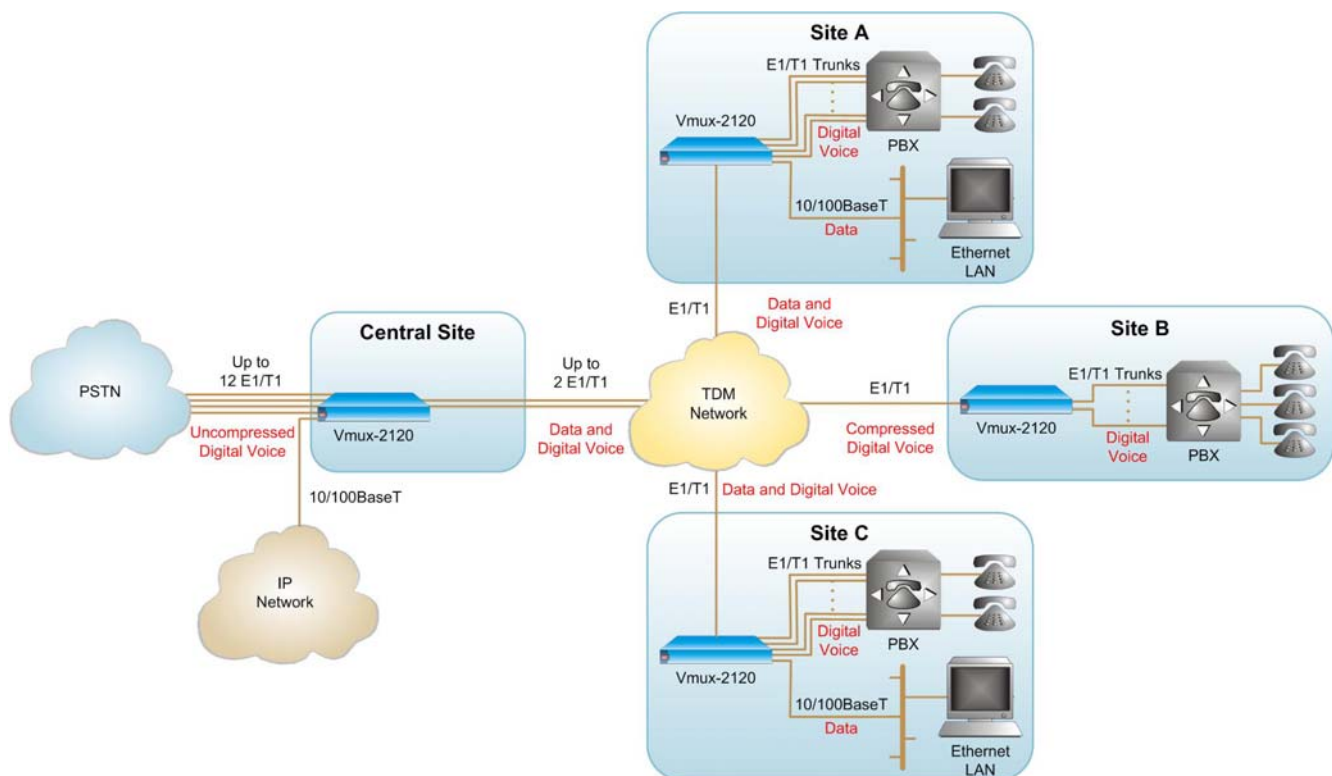

Figure 2. Vmux-2120 with a Channelized E1/T1 uplink at the Central Site in Point-to-Multipoint Topology Transporting Data and Compressed Voice over a TDM Network

Super Tandem

In super tandem applications (see *Figure 4*), where calls are routed through several Vmux-2120 gateways, the intermediate Vmux-2120 gateways sense that the voice has already been compressed by another Vmux-2120, 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-2120 gateways), avoiding voice degradation or delay.

3G MEDIA GATEWAY APPLICATIONS

The fully redundant Vmux-2120 supplies 3G media gateways services, thus enables the operator to avoid 2G MSC forklifts to support 3G services. The platform is interoperable with the NG-MSC and softswitches.

Network operators that already use Vmux-2120 for voice trunking applications (typical of 2G mobile networks) can easily upgrade their equipment to meet the requirements of 3G mobile networks by downloading, on site, the 3G media gateway (MG) application software. *Figure 3* shows the integration of Vmux-2120 in a 3G mobile operator network.

Vmux-2120 with the 3G MG application software is a complete media gateway for voice over IP applications with a processing capacity of 4, 8, 12 or 16 E1/T1.
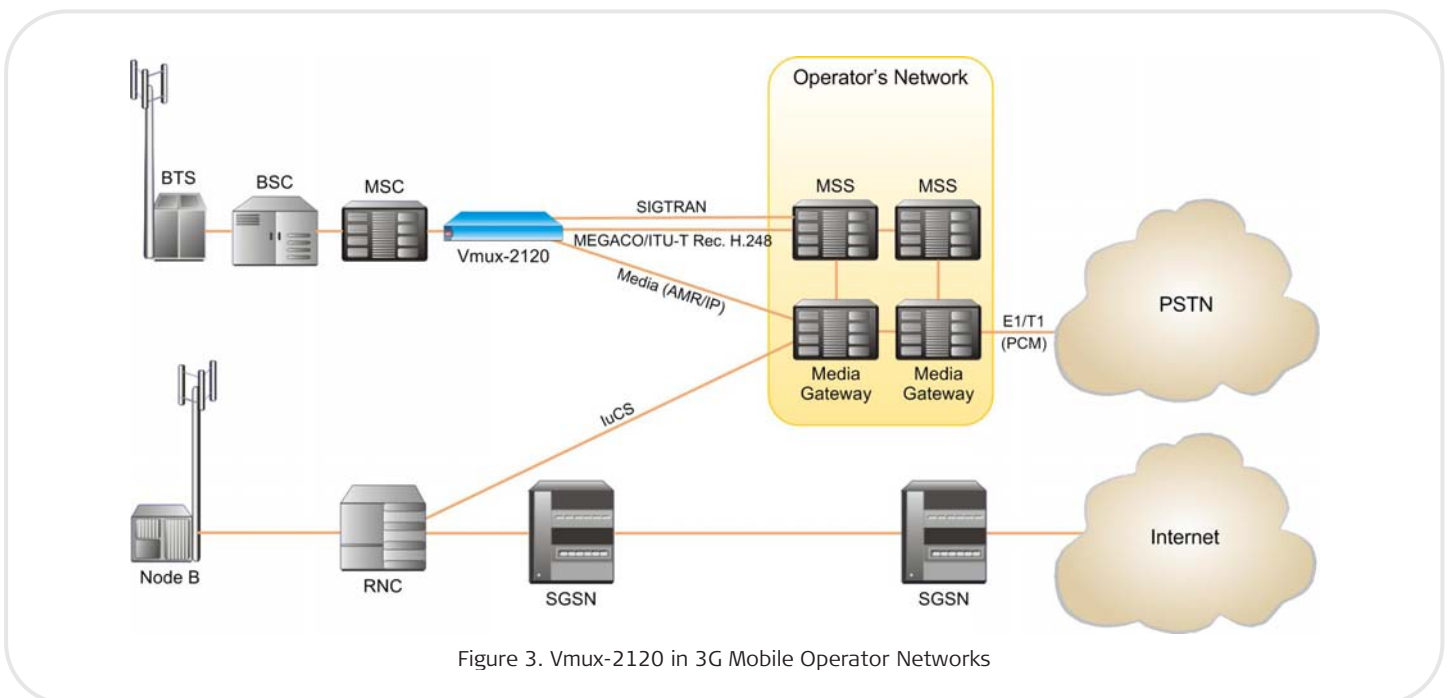

Figure 3. Vmux-2120 in 3G Mobile Operator Networks

Vmux-2120 can be easily incorporated in 3G networks using the MEGACO/ITU-T Rec. H.248 and SIGTRAN protocols. In such 3G networks, the call control functions are handled by one or more Media Gateway Controllers (MGCs) that manage all the voice traffic processing and flows within the network as well as managing the Vmux-2120.
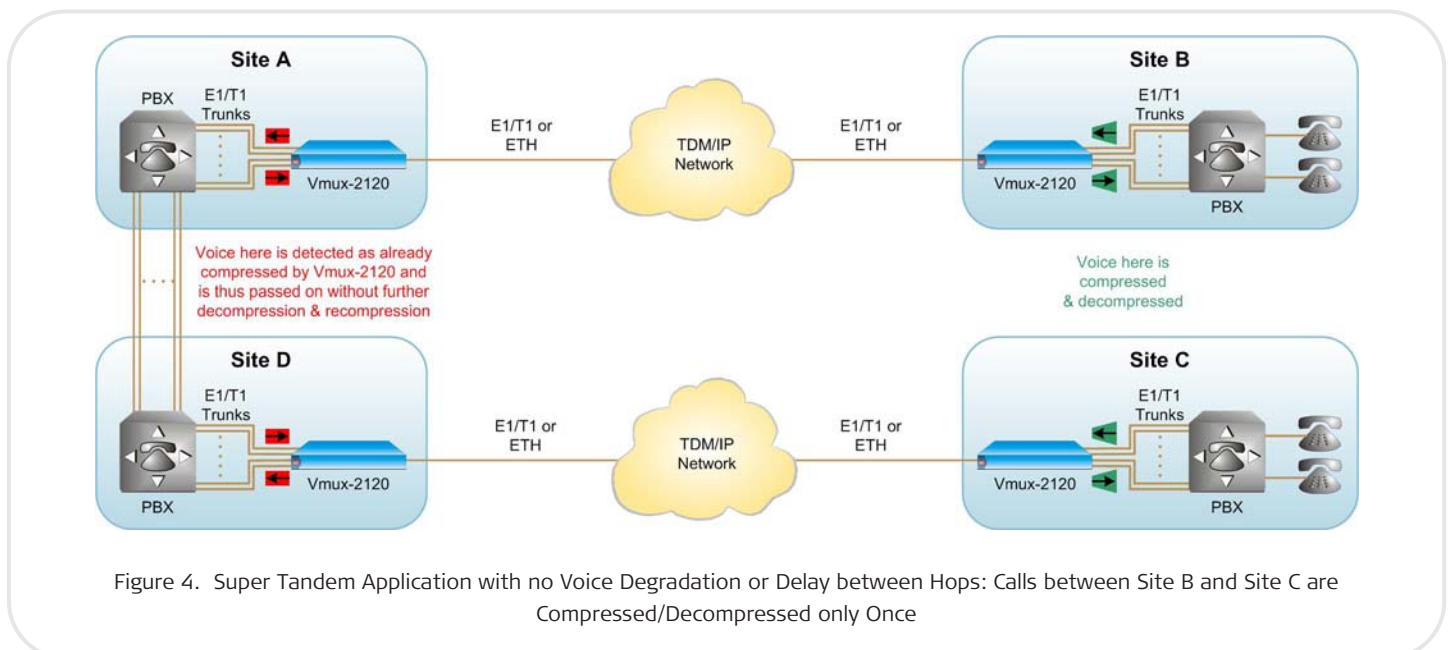
To enhance availability, the Vmux-2120 supports MGC redundancy, where the user can specify up to four secondary MGCs in addition to the primary MGC.

In addition to the Media Gateway function, Vmux-2120 can also serve as signaling gateway for Signaling System 7: the signaling gateway function terminates SS7 Message Transfer Part 2 links and transfers the signaling information over the IP network using Message Transfer Part 2 User Adaptation (M2UA) per RFC3331 and SCTP per RFC2960, a.k.a SIGTRAN. The maximum signaling processing capability is five signaling timeslots per platform.

VOICE COMPRESSION

You can order the Vmux-2120 unit with 4, 8, 12 or 16 E1/T1 ports. The device compresses 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.

Vmux-2120 supports a wide range of voice compression codecs (ITU-T Rec. G.723.1 for 5.3 and 6.4 kbps, and G.729 for 8 kbps), Adaptive Multi-Rate (AMR) narrow-band codecs standardized by the European Telecommunications Standards Institute (ETSI) for GSM cellular systems), as well as 64 kbps PCM codecs per ITU-T Rec. G.711 (A-law and μ-law).

Figure 4. Super Tandem Application with no Voice Degradation or Delay between Hops: Calls between Site B and Site C are Compressed/Decompressed only Once

Vmux-2120

Universal Voice Compression Gateway

Advanced digital signal processing techniques ensure bandwidth-efficient, highly-reliable service, unaffected by the use of voice compression. These techniques include silence suppression, built-in echo cancellation of 128 ms per channel, selectable handling of inband signaling, fax and modems and more.

QOS SUPPORT

The Ethernet ports comply with all the relevant Ethernet LAN standards, such as IEEE 802.3 and 802.3u. They provide reliable, high Quality of Service (QoS), by optional VLAN tagging and priority labeling according to IEEE 802.1D&Q.

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-2120 IP traffic for delay-sensitive applications.

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

To transfer voice as well as 10/100 Mbps Ethernet data over an uplink with limited bandwidth (such as for satellite applications), the ingress data rate on both Ethernet ports is limited to one of several values between 128 kbps and 8 Mbps.

SYSTEM CLOCK

The clock propagation feature gives the user the flexibility to choose between two different clock modes. You can either define a separate clock for each TDM port or synchronize all the connected TDM systems by defining one system clock from one original source.

In addition, a backup source may be configured for the system clock, the Fallback clock. This means that you can configure several links as clock sources on same priority level. Any of the connected links can provide the system clock source. The backup system is used only when there are no functioning links at the master system.

MANAGEMENT

Vmux-2120 can be configured and monitored via a local ASCII terminal, Telnet or RADview (RAD's network management system).

All Vmux-2120 operating parameters are configured using simple, menu-based software. Upgrade or backup software can be uploaded and downloaded via TFTP.

Since Vmux-2120 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 4*).

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-2120 provides three different levels of users: Monitor, Technician and Administrator. Up to 20 different usernames with passwords can be defined.

DIAGNOSTICS

Vmux-2120 features local (internal) and remote (external) loopbacks on E1 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.

FULLY REDUNDANT SYSTEM

Thanks to its redundant main board and redundant power supplies, the 1U high platform complies with the most stringent carrier-grade requirements. The system enables hot-standby, hot-swappable card redundancy mode of work.

Furthermore the redundant main board enables hitless software upgrade.
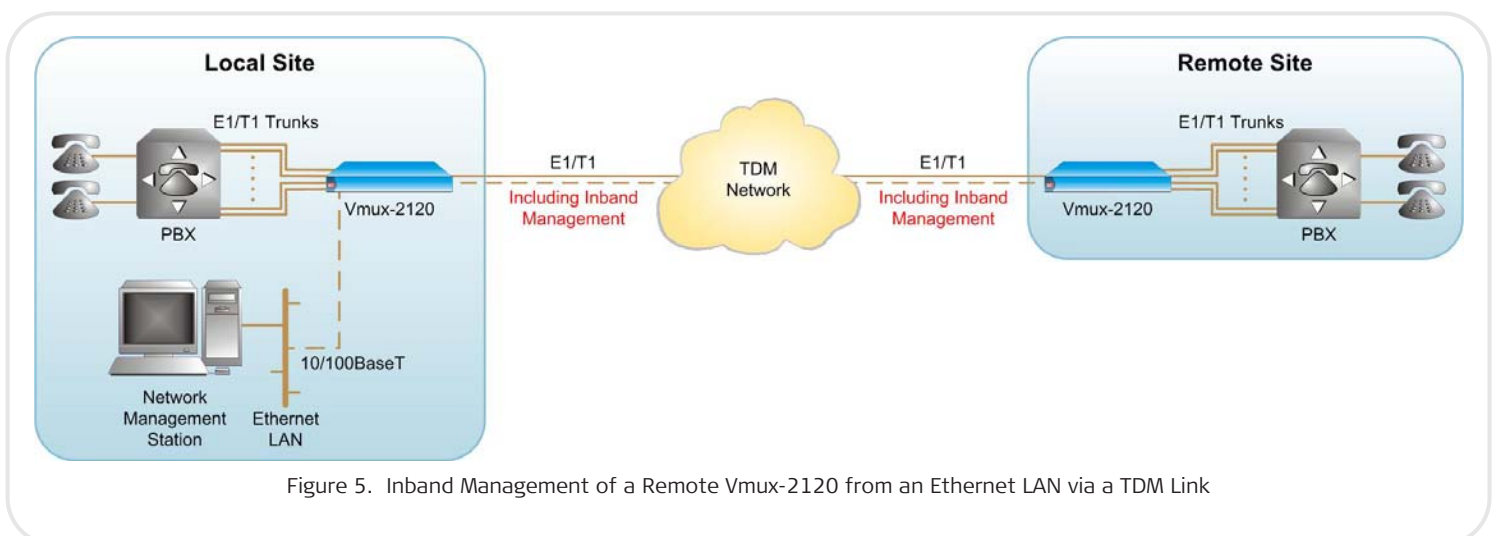

Figure 5. Inband Management of a Remote Vmux-2120 from an Ethernet LAN via a TDM Link

UPLINK REDUNDANCY

The Uplink Redundancy feature enables you to configure the two TDM and the two Ethernet uplinks in any pattern of redundancy to ensure extended backup for the uplink channels.

Uplink Redundancy is reached by applying BFD (Bi-directional Forwarding Detection), a mechanism that provides low overhead, short – duration, detection of failures in the path between two engines.

INVEST-AS-YOU-GROW

Vmux-2120 can be ordered with only some of the voice ports activated. Licenses may be added to open unused ports at any given time, enabling easy future expansion.

Figure 6. Vmux-2120 Transporting up to 496/384 Voice Channels over a Single TDM Link

Specifications

ETHERNET PORTS

Number of ports
2 (Network and User or both redundant uplink ports)

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

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

Ingress Data Rate Limit
Can be independently set for each Ethernet port: 128 kbps, 256 kbps, 512 kbps, 1 Mbps, 2 Mbps, 4 Mbps, 8 Mbps, or unlimited

Statistics
According to RFC 2819, RMON-MIB

OR

According to RFC 3638 or RFC 3635:

• Received frames – Correct Frames, Correct Octets, Alignment Errors, FCS Errors

• Transmitted frames – Correct Frames, Correct Octets, Single Collision, Multiple Collision, Deferred Transmission, Late Collision, Carrier Sense Error

Range
Up to 100m (328 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

E1 UPLINK - TRUNKING

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

Data Rate
2.048 Mbps (per port)

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

Line Type
G.732N
G.732N with CRC-4
G.732S
G.732S with CRC-4
Unframed

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

Interface Type
Balanced 4-wire, 120Ω
Unbalanced 4-wire, 75Ω

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

Connectors (per port)
RJ-45 balanced

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

T1 UPLINK - TRUNKING

Number of Ports
2 (one active, one 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

Data Rate
1.544 Mbps (per port)

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

Line Type
SF, ESF, Transparent

Line Code
AMI, 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

Interface Type
Balanced 4-wire, 100Ω

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

Connectors (per port)
RJ-45

VOICE PROCESSING

Compression Algorithms
G.723.1 (5.3 or 6.4 kbps)
G.729A (8 kbps)
AMR (4.75 kbps, 5.15 kbps, 5.90 kbps,
    6.70 kbps, 7.40 kbps, 7.95 kbps,
    10.20 kbps and 12.20 kbps)
G.711 (A-law or μ-law)

Silence Suppression
G.723.1A, G.729B

Echo Cancellation
128 ms per channel as per G.165 and
G.168

Fax Relay
Group III, 4.8, 9.6, 14.4 kbps

Voice Band Data
Transparent support for modems and faxes

E1 VOICE PORTS

Number of Ports
(according to ordering)
4 (124 channels max)
8 (248 channels max)
12 (372 channels max)
16 (496 channels max)

Data Rate
2.048 Mbps (per port)

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

Line Type
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%)

Jitter Performance
Per ITU-T G.823

Interface Type
Balanced 4-wire, 120Ω
Unbalanced 4-wire, 75Ω

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

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

Connectors (per port)
RJ-45 balanced

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

T1 VOICE PORTS

Number of Ports
(according to ordering)
4 (96 channels max)
8 (192 channels max)
12 (288 channels max)
16 (384 channels max)

Data Rate
1.544 Mbps (per port)

Standards
ANSI T1.403, ITU-T Rec. G.703

Line Type
D4, ESF

Line Code
AMI, 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

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

Interface Type
Balanced 4-wire, 100Ω

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

Connectors (per port)
RJ-45 balanced

3G MEDIA GATEWAY

Media Handling
Media Control Protocol:
MEGACO/ITU-T Rec. H.248 V2

Protocol Message Encoding:
    Binary
    Text (pretty or compact)

Media Transport Protocols:
    RTP per RFC3550
    RTCP per RFC3551

Signaling Transport
Signaling Protocol:
SS7 per ITU-T Rec. Q.703, termination of up to five MTP 2 signaling links per unit

Signaling Transport Protocols
SIGTRAN compliant:

- SCTP per RFC2960

- SS7 MTP 2 User Adaptation (M2UA) per RFC3331

CONTROL PORT

Standards
RS-232/V.24 (DCE)

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

Connector
DB-9, female

ALARM RELAY PORT

Dry Contacts
1A, 60 VDC max.
30VSC, 60W max.

Connector
DB-9, female

DIAGNOSTICS

Uplinks
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
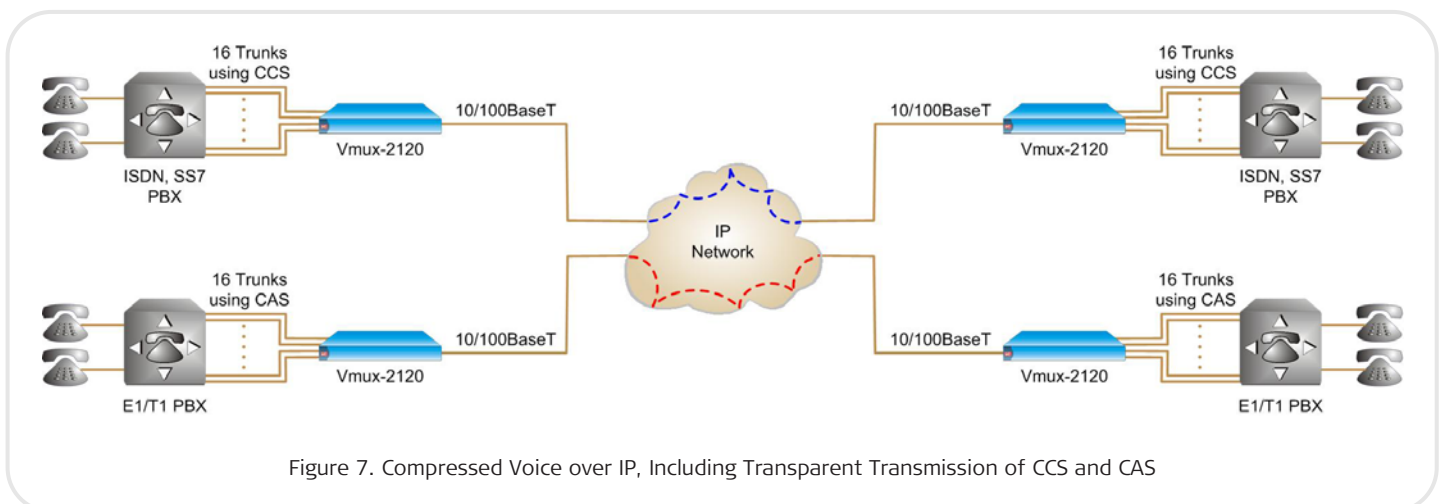- Per entire E1/T1 channel or
- On all E1/T1 channels simultaneously

Figure 7. Compressed Voice over IP, Including Transparent Transmission of CCS and CAS

Vmux-2120
Universal Voice Compression Gateway

GENERAL

Panel Indicators
TST (yellow):
- On: test is running
- Flashes: system is booting

ALM (red): alarm is present in system
PS 1 (green): On when Power Supply 1 is providing power
PS 2 (green): On when Power Supply 2 is providing power
MM1 (green): card in slot 1 is active
MM2 (green): card in slot 2 is active

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

Power Consumption
One Power Supply: Max. 50W
Dual Power Supply: Max. 65W

Physical
Height:4.4 cm (1.7 in)
Width:　44 cm (17.3 in)
Depth:　31.2 cm (12.2 in)
Weight:　5.5 kg (12.1 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. 4.09)	Vmux-110 (Ver. 4.09)	Vmux-210 (Ver. 4.09)	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
Scalability	✓				✓
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 (trunking only)	ASCII terminal, Telnet, Web, RADview-SC/Vmux

Vmux-2120

Universal Voice Compression Gateway

Ordering

Note: *The Vmux-2120 system includes the chassis, redundant PS and one voice card for voice compression or 3G media gateway services.*
For a redundant voice card system (two voice cards), order an additional voice card.

Vmux-2120/*/?/@/$
Vmux-2120 Voice Trunking Gateway
See Note above.

Vmux-2120-M/?/@/$
Voice cards for Vmux-2120. See Note above.

Vmux-2120-LIC/#/!
Vmux-2120 upgrade license to activate additional voice ports.

Note: *To order upgrade licenses you need to specify your voice module's serial number.*

Legend

*	Power supply type:	
	ACR	Redundant, 100 to 240 VAC, 50/60 Hz
	DCR	Redundant, -48 (-36 to -72) VDC
?	Voice cards:	
	VC	Voice Compression module
	VCMG	3G Media Gateway Voice Compression module
@	Number of voice ports	
	4E1	4 E1 ports
	8E1	8 E1 ports
	12E1	12 E1 ports
	16E1	16 E1 ports
	4T1	4 T1 ports
	8T1	8 T1 ports
	12T1	12 T1 ports
	16T1	16 T1 ports
#	TDM interface type	
	E1	E1
	T1	T1
$	For 16 port devices only:	

Optional partial activation by software key
(Default=all ports are activated):

2SK	2 activated ports
4SK	4 activated ports
8SK	8 activated ports
12SK	12 activated ports

! Software key for activating additional voice ports on an existing voice module:

2SK	Activate 2 additional voice ports
4SK	Activate 4 additional voice ports
8SK	Activate 8 additional voice ports

Note: *You can order combinations of the above.*
For example, to upgrade from 4 to 10 active ports, order license for activating additional 4 and another license for additional 2 voice ports.

SUPPLIED ACCESSORIES

AC power cord (when AC power supply is ordered)

DC adapter plug (when DC power supply is ordered)

RM-VMUX-2100/19
Hardware kit for mounting one Vmux-2120 unit into a 19-inch rack

OPTIONAL ACCESSORIES

CBL-DB9F-DB9M-STR
Control port cable

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

RM-VMUX-2100/23
Hardware kit for mounting one Vmux-2120 unit into a 23-inch rack

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