Slash Voice Costs over IP and TDM Networks

Compressed Voice System
Vmux product family

voice

RAD

data communications

Unique Access Solutions

CVS

Compressed Voice over IP and TDM Networks

In today's competitive telecommunications environment, extending capital budgets and lowering operating costs are often the keys to survival. RAD's Compressed Voice System (CVS™) helps utilize existing resources more efficiently – slashing recurring E1/T1 costs by providing a high-density voice compression system designed to work over both TDM and IP-based networks. CVS uses powerful voice processing algorithms **to compress a full E1/T1 down to 128 kbps, or 16 full E1/T1 lines (496/384 concurrent voice channels) and associated signaling down to a single E1/T1 circuit**. CVS lets carriers provide high quality voice services at a small initial investment and low operating costs. CVS is also ideal in multi-site enterprise networks, remote call centers and other voice trunking applications.

TDMoIP Technology Transports Circuits over IP/Ethernet/MPLS

RAD's CVS solution is led by the Vmux™ family of voice trunking gateways, which offers the highest density and compression ratios and the most advanced features and algorithms.

Vmux employs TDMoIP® (Time Division Multiplexing over the Internet Protocol) technology, which transparently extends E1, T1, E3 or T3 circuits across packet-switched IP/Ethernet/MPLS networks. It is transparent to all protocols and signaling, and therefore supports legacy PBXs, including proprietary features. TDMoIP enables service providers to migrate to next-generation networks and continue to provide all their revenue-generating legacy voice and data services while minimizing network maintenance and operating costs.

For applications that require network integration of voice, fax and modem traffic together with HDLC frame forwarding and Ethernet switching, the Vmux excels with highly efficient bandwidth management over IP, Ethernet or TDM networks.

For applications that require a large number of analog ports or a variety of data and voice interfaces, a similar solution can be supplied using the Megaplex™ family.

Vmux Family of Compact Voice Trunking Gateways Minimizes Bandwidth Requirements

Vmux-2100

The Vmux-2100™ voice trunking gateway is a unique device that provides compressed voice transmission over both TDM and IP networks, and can easily switch between them whenever this may be advantageous, ensuring a migration path from TDM to IP networks.
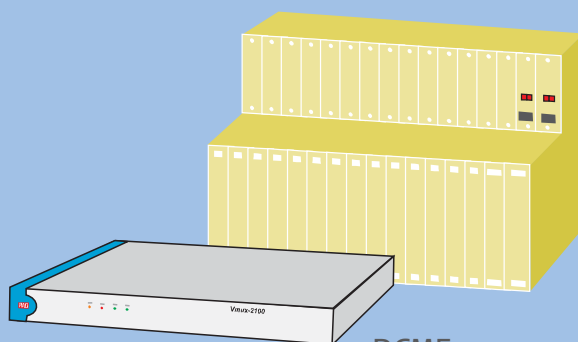
Vmux-110

The compact Vmux-110™ voice trunking gateway complements the Vmux system, fulfilling the need for a low capacity remote voice and data gateway for both IP and leased line TDM networks.

Vmux with 16:1 compression is the most cost-effective solution on the market

High Density in a Compact Unit

With its small footprint, easy installation and low power requirements, the 1U high Vmux-2100 voice trunking gateway offers the same number of ports as traditional 10U high DCME platforms.
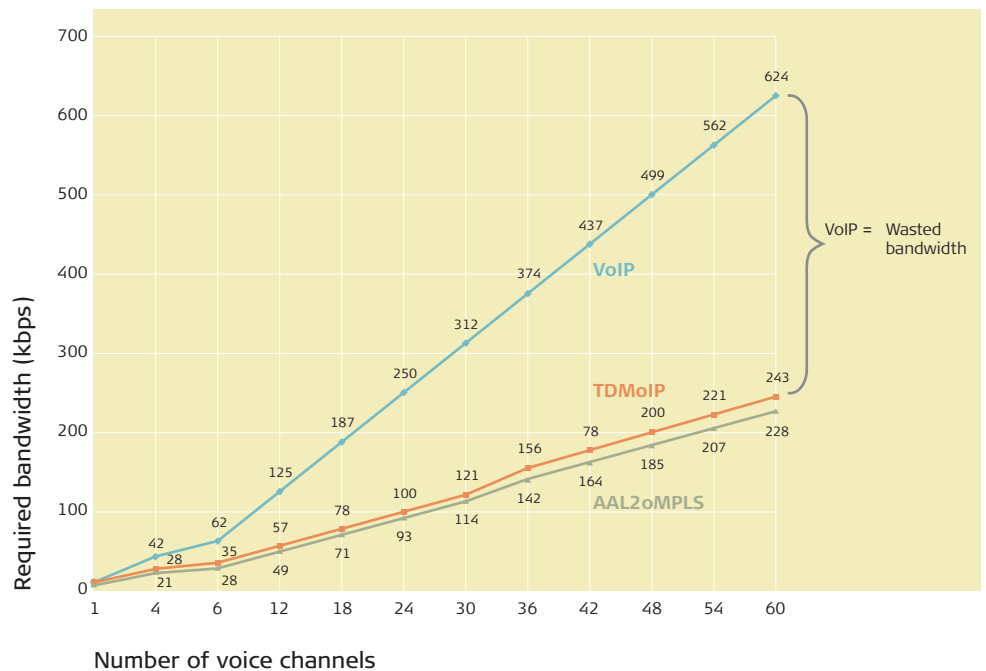
Vmux-2100

DCME equipment

Best Voice Compression on the Market

RAD's Vmux voice trunking gateway achieves 16:1 compression by combining industry standard technologies such as G.723.1, G.729A and G.711 compression algorithms, voice activity detection, silence suppression and comfort noise generation with RAD's unique TDMoIP aggregation and multiplexing protocol, which provides user configurable frame size and packetizing intervals. The graph below shows how **TDMoIP achieves up to 60% better bandwidth utilization than VoIP solutions**. Bandwidth calculations assume G.723.1 compression at 5.3 kbps with 50% silence suppression.

Cost-Effective Voice Trunking over MPLS Networks

RAD's Vmux can further improve bandwidth utilization by compressing voice over the MPLS network. In fact, RAD was the first vendor to comply with the MPLS Forum's implementation agreement (IA) for voice trunking over the MPLS network, which enables the transfer of compressed voice over a converged MPLS backbone using existing ATM Adaptation Layer 2 (AAL2) technology (AAL2oMPLS). Compliance with the MPLS Forum's Voice Trunking Format IA also allows the Vmux to facilitate the migration process from ATM to MPLS.

VoIP = Wasted bandwidth
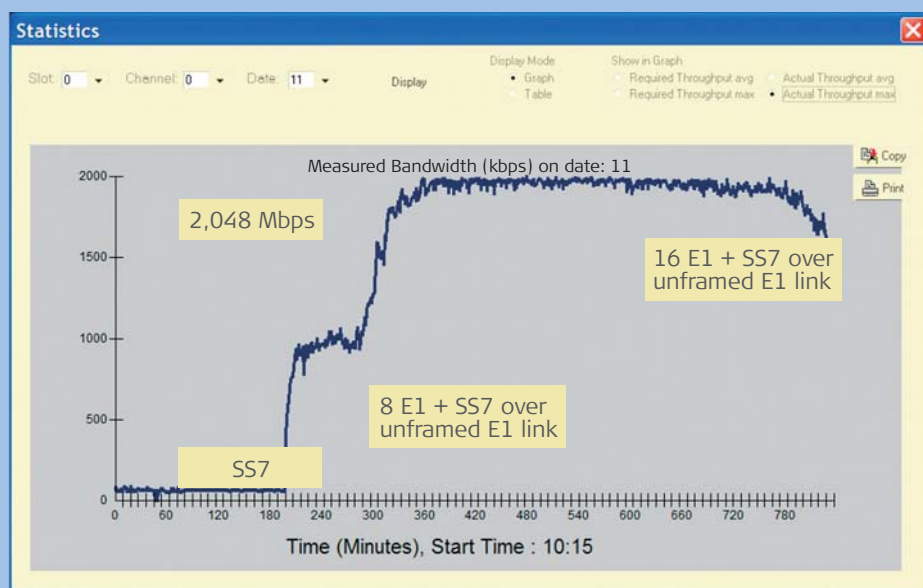
Required bandwidth (kbps)

Number of voice channels

VoIP values: 42, 62, 125, 187, 250, 312, 374, 437, 499, 562, 624

TDMoIP values: 28, 35, 57, 78, 100, 121, 156, 78, 200, 221, 243

AAL2oMPLS values: 21, 28, 49, 71, 93, 114, 142, 164, 185, 207, 228

Optimize Your Bandwidth Usage

cost-effectiv

The RADview™ Service Center application is a powerful tool for provisioning and monitoring the Vmux family of voice trunking gateways using SNMP management. The intuitive GUI interface, "point-and-click" functionality and easy-to-follow wizards increase the efficiency and accuracy of the service provisioning process. The ability to deploy and manage the units from a central

site rather than manual provisioning in the field improves system uptime, reduces technician visits and lowers customer support costs.

The Vmux-2100 network management system includes the VmuxStat application, which collects bandwidth utilization data

from the TDM uplink. With up to four days' worth of data stored on file, VmuxStat can help you monitor your statistics performance and provide valuable information that will help you provision the right bandwidth on your expensive leased lines.

Statistics

Slot: 0 ▾ Channel: 0 ▾ Date: 11 ▾   Display

Display Mode: ● Graph ○ Table

Show in Graph: Required Throughput avg, Required Throughput max, Actual Throughput avg, ● Actual Throughput max

Measured Bandwidth (kbps) on date: 11

2,048 Mbps

16 E1 + SS7 over unframed E1 link

8 E1 + SS7 over unframed E1 link

SS7

Time (Minutes), Start Time : 10:15

Example showing actual 16:1 compression in an international voice trunking application

The graph shows actual throughput on a live network where 16 E1 trunks and SS7 signaling is carried on an unframed E1 link. Voice was configured for G.723.1 at 5.3 kbps, fax at 14.4 kbps and measured silence suppression was between 48 and 54%. 2 kHz COT, Q.50 Annex A and bandwidth control mechanisms were also deployed in this application.
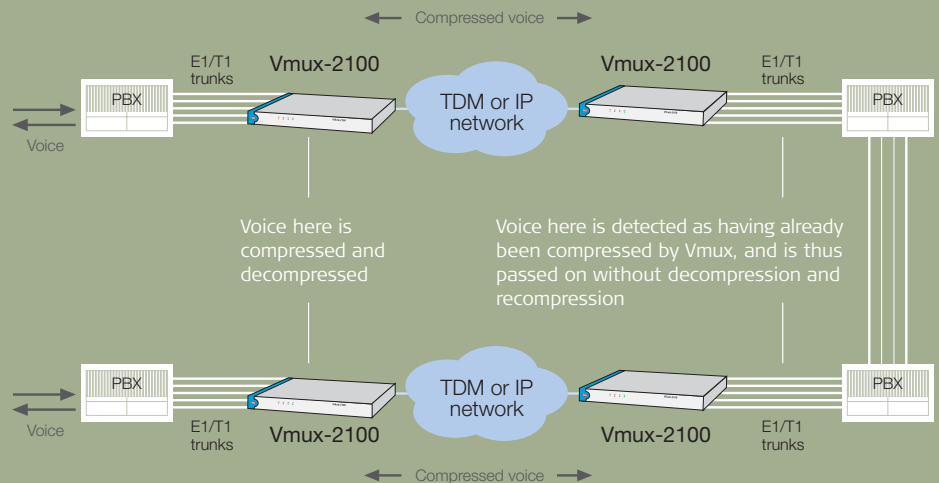
Fast payback – in 40 days to one year*

*depending on your configuration and line costs

Single Voice Compression Cycle over Multiple Hops Ensures High Quality Voice

Voice loses some of its quality as it undergoes cycles of compression and decompression through multiple voice compression systems and telephone switches. RAD's Super Tandem feature ensures that voice quality is not compromised when calls are routed through several Vmux-2100 gateways. Intermediate Vmux-2100 units sense when a voice channel has already been compressed and do not recompress the data as it moves through the phone network.

Compressed voice

| E1/T1 trunks | Vmux-2100 | | | TDM or IP network | | Vmux-2100 | E1/T1 trunks |

PBX

Voice

Voice here is compressed and decompressed

Voice here is detected as having already been compressed by Vmux, and is thus passed on without decompression and recompression

PBX

PBX

Voice

E1/T1 trunks — Vmux-2100 — TDM or IP network — Vmux-2100 — E1/T1 trunks

PBX

Compressed voice

Benefits of Vmux with TDMoIP Technology

- High quality voice compression using G.711, G.723.1 and G.729A algorithms

- 16:1 compression reduces bandwidth and leased line costs

- Converges voice, fax, modem, HDLC and LAN services, reducing infrastructure costs

- Compact 1U high unit saves space with up to 16 E1 or T1 trunks on E1, T1 or Ethernet bearer

- Group III fax relay at rates of 4.8 to 14.4 kbps

- Dynamic bandwidth allocation according to voice activity

- Transparently supports CAS and CCS signaling protocols including SS7, ISDN, Q.Sig and DPNSS

- Single compression cycle on multi-hop trunks

- Simultaneous transmission over IP and TDM networks

Typical Users of Compressed Voice Solutions

- **General:** PBX and LAN extension over wireless, satellite, E1/T1 or IP links (voice compression and improved voice communications between locations)

- **International telecom providers:** Wholesale and calling card services

- **Large enterprises:** Simple implementation of remote call centers

- **Government and large enterprises:** Disaster recovery and mobile contact centers

- **Mobile operators:** Inter-MSC trunking

- **Cable MSOs:** E1/T1 voice circuits over cable modems

- **Wireless operators:** Voice/LAN services over Wireless Local Loop (WLL)

- **National carriers:** Rural telephony services over satellite

TDMoIP®
Driven

Wide Range of Applications

High Capacity Voice Trunking over Leased Lines, Satellite, IP or MPLS

RAD's Vmux-2100 is a compact product that is simple to deploy and ideal for international and domestic toll-bypass, call centers and inter-MSC connectivity for mobile networks. It reduces transmission costs significantly and improves utilization of expensive satellite, leased line and IP links. It can be configured to compress up to 16 E1/T1 voice circuits and associated signaling (e.g., SS7) into a single E1/T1 or IP link. The Vmux-2100 also transparently supports all telephony switch/PBX/ACD features to ensure that functionality is not compromised. Redundant link capability ensures voice calls are not dropped if the primary E1/T1 link fails. RAD's Megaplex acts as a channel bank (e.g., at a remote call center) to simply convert E1/T1 circuits to analog voice for direct connection to telephones.
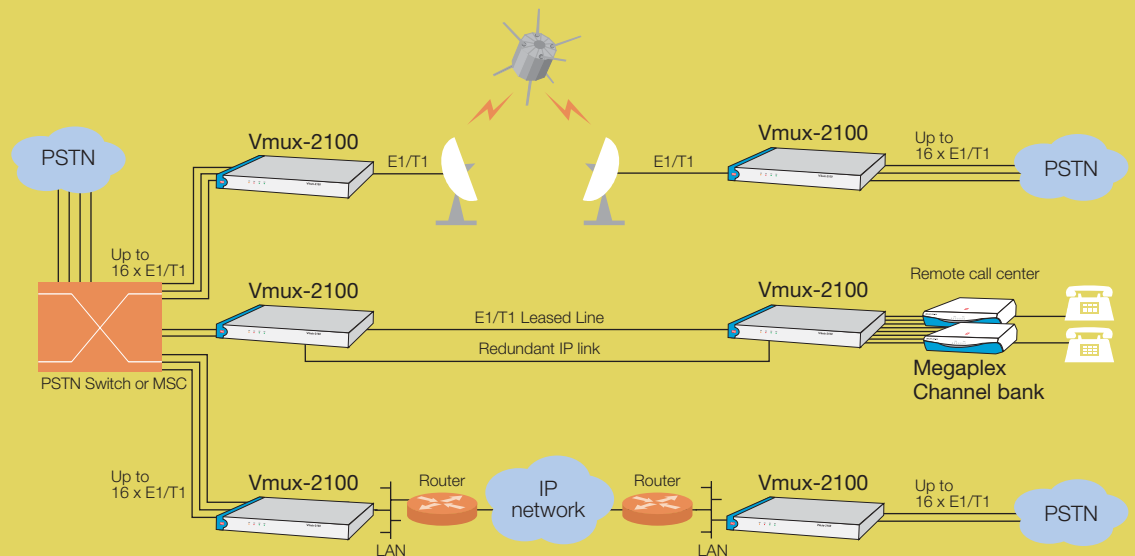
Voice Trunking over IP in a Multipoint-to-Multipoint Application

RAD's Vmux product line uses TDMoIP technology to extend voice circuits (including signaling) transparently over IP networks and therefore eliminates the need for expensive E1/T1 voice circuits. In this application, each Vmux-2100 unit compresses voice channels into IP bundles that are routed to remote locations over the IP infrastructure in a hub-and-spoke, full-mesh or partial-mesh topology.
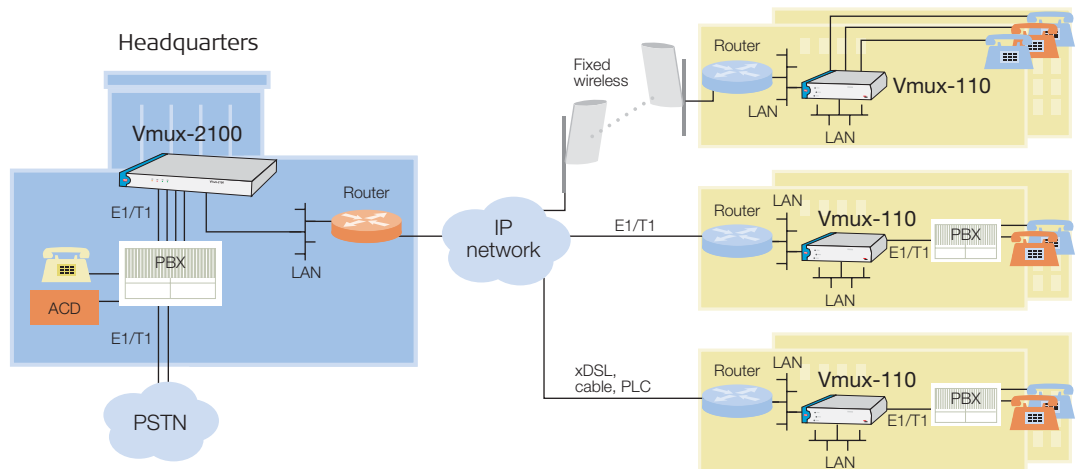
Voice Trunking over TDM in a Point-to-Multipoint Application

In this application, the Vmux-2100 at the central site compresses E1/T1 voice trunks into channelized E1/T1 links for distribution to remote locations over a TDM network.

In addition, the Vmux-2100 integrates Ethernet traffic over those same E1/T1 links to further reduce network costs.
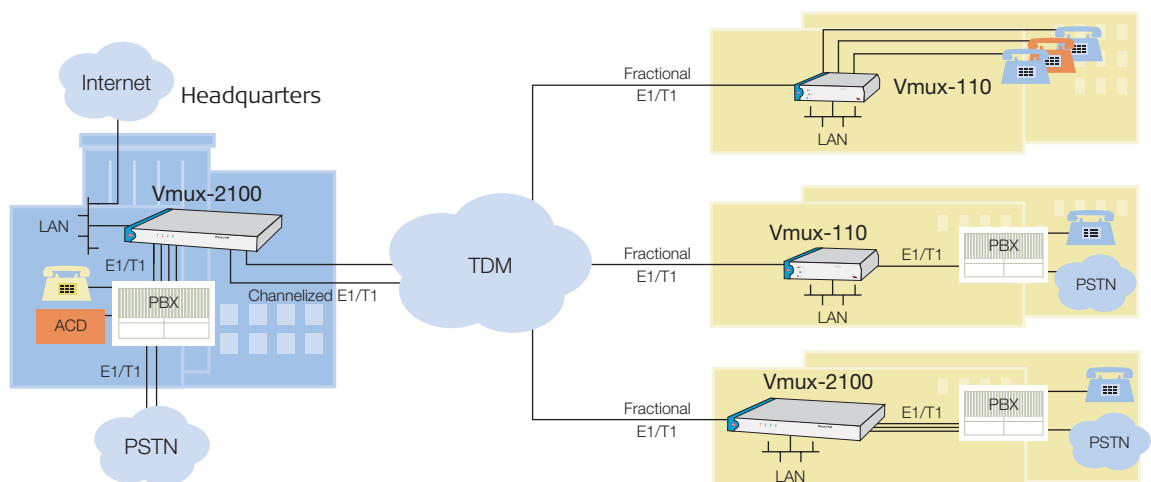
Minimizing Access Costs: Multi-Tenant Unit (MTU) and Rural Telephony over TDM or IP Links

RAD's Vmux is ideal for delivering voice services to remote buildings, strip malls or even rural villages because it is easy to deploy and efficiently delivers high quality voice with 16:1 voice compression. The Vmux also transparently supports all PBX or 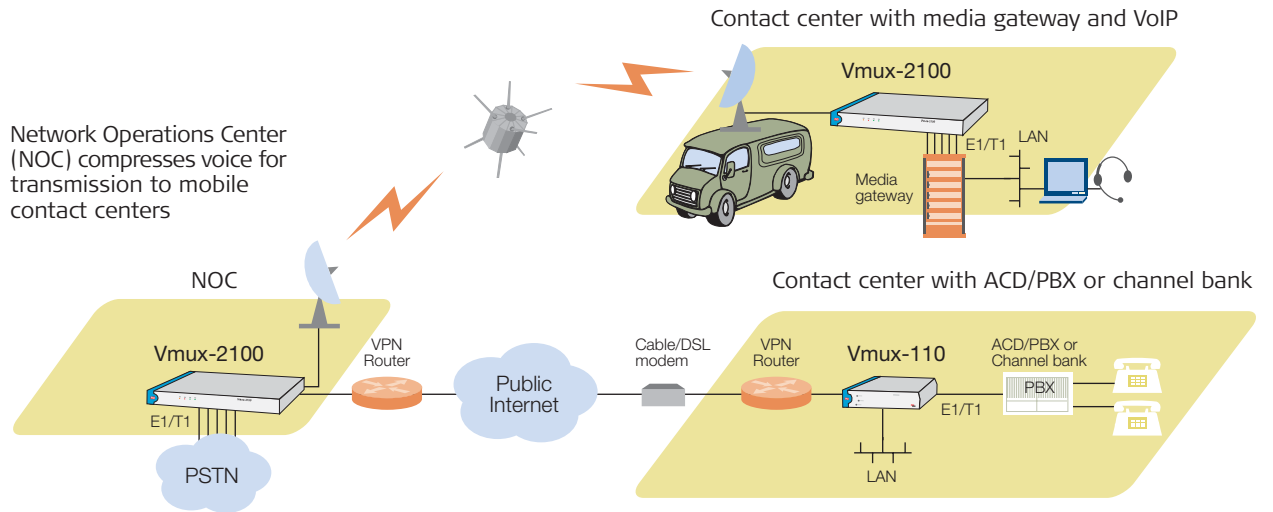telephony features to ensure that voice quality and functionality are not compromised. In applications where the remote location also requires connection to a router, the Vmux E1/T1 ports can be configured to tunnel HDLC-based protocols, such as PPP and Frame Relay, over the same link together with the voice traffic.
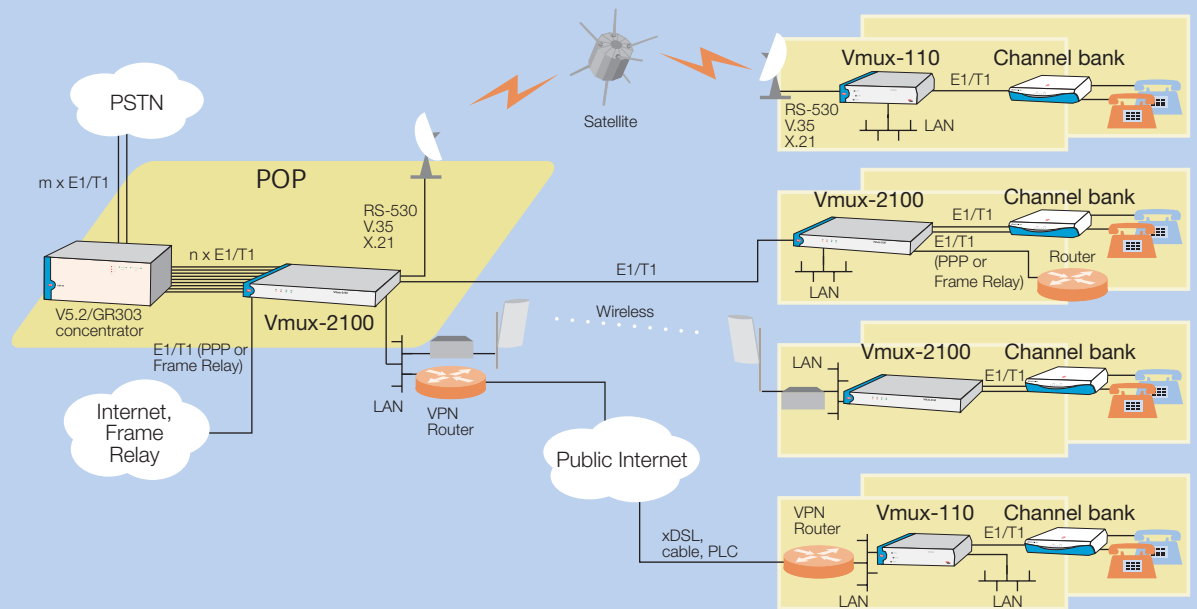
Voice Trunking from Mobile Contact Center to PSTN

An effective disaster recovery plan should include a contact center that provides voice and data communications to critical personnel when their normal place of operation is unusable. In this application, RAD's Vmux-2100 is ideal becaus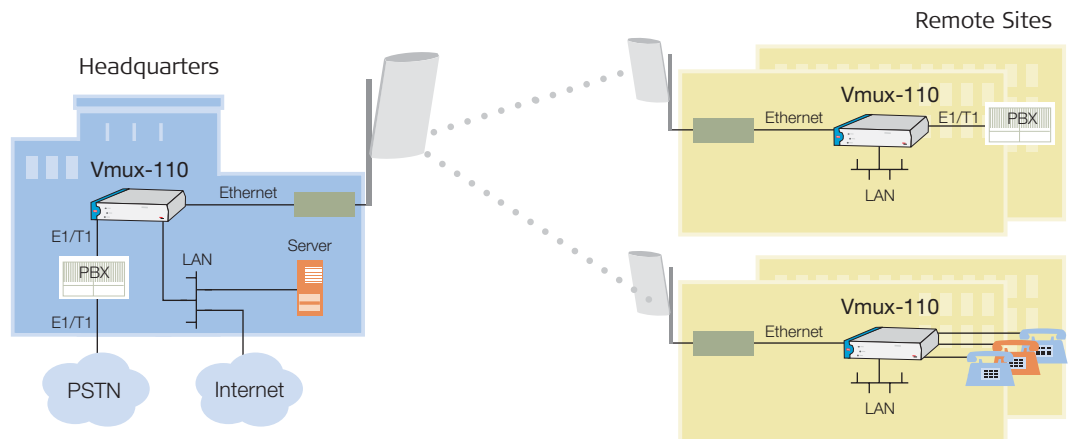e it is compact, simple to deploy and provides transparent voice and data facilities. Its 16:1 compression and high tolerance to packet loss, latency and jitter make it an ideal solution for mobile contact centers that are accessible over satellite or IP VPNs (e.g., cable modems).

Contact center with media gateway and VoIP

Vmux-2100

E1/T1 LAN

Media gateway

Network Operations Center (NOC) compresses voice for transmission to mobile contact centers

NOC

Contact center with ACD/PBX or channel bank

Vmux-2100

E1/T1

PSTN

VPN Router

Public Internet

Cable/DSL modem

VPN Router

Vmux-110

ACD/PBX or Channel bank

PBX

E1/T1

LAN

Voice, Data and Internet Services over Wireless (WLL/LMDS)

RAD's Vmux-110 is a compact, 1U high product that is ideal for wireless links because it delivers LAN and high quality voice to remote locations over IP or Ethernet. The Vmux-110 uses voice compression, rate-configurable fax relay and dynamic bandwidth allocation to minimize bandwidth requirements. A single Vmux-110 with E1/T1 can provide 30 or 24 voice channels, respectively, to as many as 12 remote locations using the TDMoIP bundling mechanism, making it ideal not only for point-to-point, but also point-to-multipoint applications. Remote Vmux-110 units can be ordered with either E1/T1 voice interfaces for connecting to remote PBXs or with FXS interfaces for connecting to analog telephones or key systems.

Remote Sites

Headquarters

Vmux-110

Ethernet

E1/T1 LAN E1/T1 PBX

LAN

Vmux-110

E1/T1

Ethernet

PBX LAN Server

E1/T1

PSTN Internet

Vmux-110

Ethernet

LAN

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