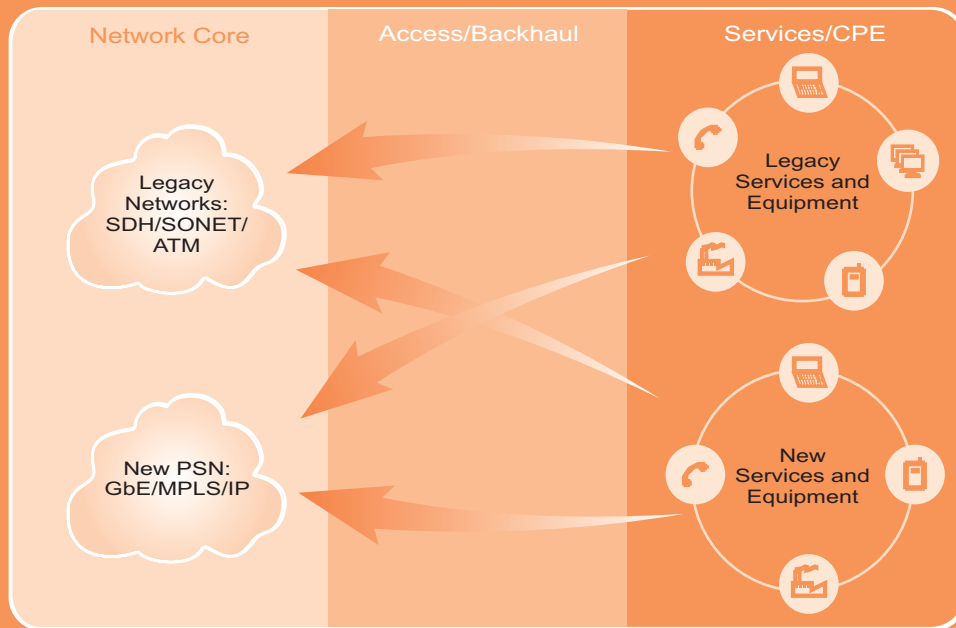# RAD's Selected Customer Applications

The transition to packet-based networks for IP-based content is moving rapidly forward with Carrier Ethernet becoming the access and transport technology of choice for most service providers and operators. Nonetheless, the move to NGN will also leave islands of legacy networks and user communities whose mission-critical applications need to be addressed.

RAD Data Communications offers carriers, mobile operators, service providers, and enterprise users a wide range of access products and network system solutions to enable the fast and easy deployment of multiple services while controlling OpEx and CapEx and minimizing end-user outlays for new and existing communications requirements.

Network Core | Access/Backhaul | Services/CPE

Legacy Networks: SDH/SONET/ATM

New PSN: GbE/MPLS/IP

Legacy Services and Equipment

New Services and Equipment

Facilitating migration to NGN with support for both new services and legacy applications

Carrier Ethernet Access

Support REAL Carrier Ethernet for Reliable, Economical, Accountable and Limitless services over any access or transport infrastructure. Enable TDM and ATM backhaul over Ethernet networks using standards-based pseudowire technology.

Cellular Backhaul

Reduce backhaul costs of 2G and 3G radio access network traffic by deploying cell-site and hub-site gateways with statistical multiplexing, pseudowire, and advanced clock recovery and synchronization. Facilitate step-by-step migration to an all-IP mobile access network through a hybrid approach to data offload, and enable a smooth transition to a data-centric RAN.

Voice Optimization, Compression and VoIP

Reduce the cost of voice connectivity, for inter-MSC trunking and bandwidth-constrained enterprise and satellite applications. Benefit from low cost, low risk entry into the lucrative VoIP service delivery market.

Utilities and Transportation

Support diverse applications ranging from mission-critical control data, video surveillance and voice traffic to Internet access, LAN and industrial Ethernet over various network topologies across their own communications grid or facilities leased from service providers. Manage the transition from existing access and transport infrastructure to new packet-based networks.

Multiservice Access

Allow a seamless mix of a broad range of traditional voice, data and video services along with support for packet-based applications over PDH, SDH/SONET, SHDSL, and new packet access networks.

Government and Enterprise

Support disaster recovery, public safety and homeland security applications with tailored access and backhaul solutions for TETRA, video surveillance, secure fiber, and encrypted wireless networks.

Carrier Ethernet Access

Through the joint efforts of various standards bodies and as a result of close vendor-operator cooperation, Carrier Ethernet has become a widely accepted technology for Layer 2 transport and service deployment. This transformation means that users can now benefit from cost-effectiveness and flexibility that Ethernet affords while receiving the deterministic performance, reliability and management capabilities of traditional TDM and ATM services that they have come to rely upon.

An essential part of Ethernet's transformation to carrier-class technology has been the establishment of Ethernet OAM (operations, administration and maintenance) standards by the IEEE and ITU, designed to monitor network operation in order to detect network faults and measure its performance. These days, a standard Ethernet OAM suite typically includes OAM capabilities such as connectivity verification, fault detection, performance monitoring, and alarm indication.

Another important factor in carrier adoption of Etherent transport is the technology's ability to ensure service resiliency. Service providers have a number of tools at their disposal which serve that purpose, most notably Ethernet Rings Protection Switching (ERPS), which uses ring topology to ensure service restoration in the event of failures.

When referring to Carrier Ethernet access, however, one must consider different service attributes, network topology and infrastructure, as well as user access requirements. The Carrier Ethernet service provider must have a range of manageable product solutions that can deliver various service rates, support multiple physical media and incorporate QoS mechanisms for reducing OpEx, while guaranteeing service level agreements. RAD's EtherAccess solutions portfolio offers a rich feature-set of REAL Ethernet access options – Reliable, Economical, Accountable, Limitless – including Ethernet over fiber, Ethernet over xDSL, Ethernet over PDH/SDH/SONET, Ethernet over ATM, and Ethernet over wireless.

Intelligent Ethernet Demarcation for PSN Networks
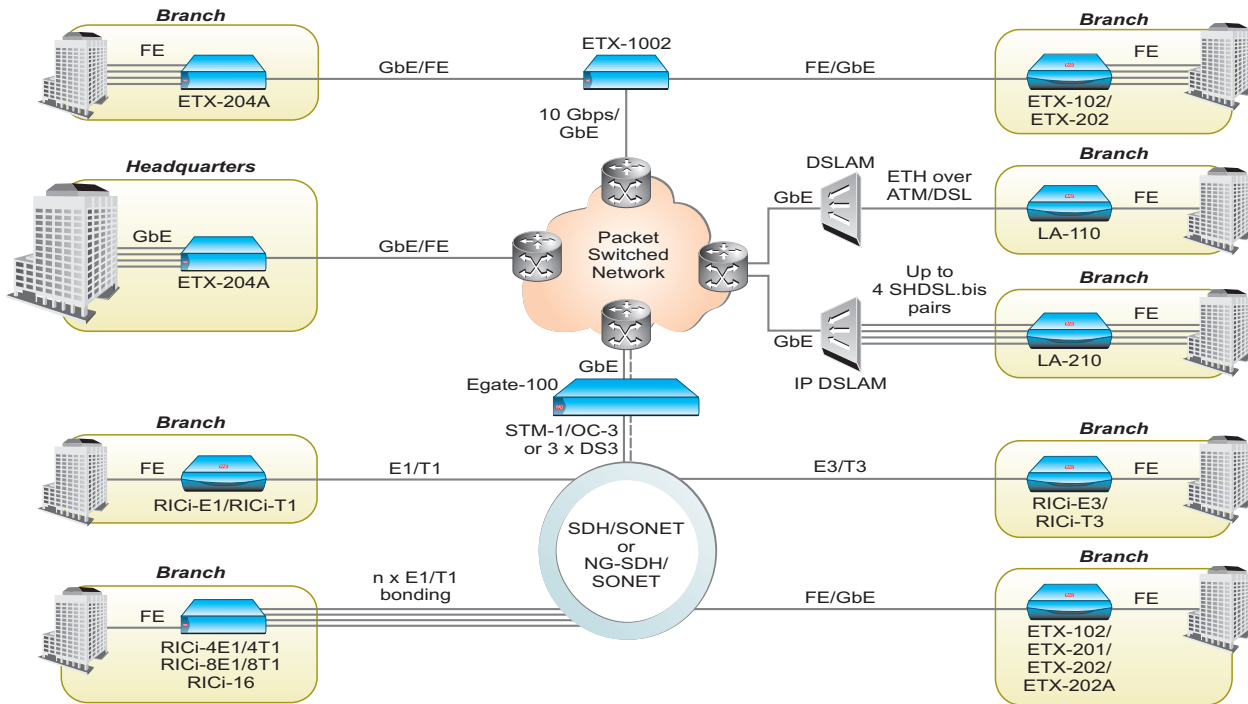
Description

Provide Ethernet transport and services with SLA assurance over a variety of access technologies, including fiber, bonded copper, SDH/SONET, and DSL.

Benefits & Features

- Variety of access technologies extends service providers' customer reach and matches access technology to customer needs
- Consistent Ethernet service attributes across different access technologies with MEF-9 and MEF-14 certified products
- Generates revenues from SLA-based CIR and EIR services while selling excess bandwidth with intelligent oversubscription and without compromising quality of premium services
- End-to-end service control minimizes operational expenses by employing Ethernet OAM mechanisms, such as IEEE 802.1ag and Y.1731

Product Finder

Ethernet Demarcation in a Multi-Carrier Environment
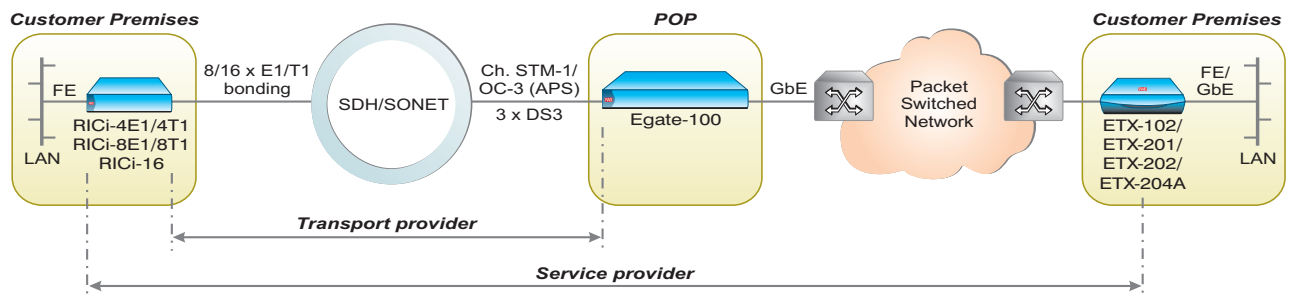

Product Finder

Description

Deploy Ethernet services where the customer is out of the provider's network by leasing lines from a transport provider, and ensure end-to-end SLA control across different networks and provider domains.

Benefits & Features

- Allows service providers to offer extensive Ethernet services with coverage similar to TDM
- End-to-end service control and performance measurements using Ethernet service OAM allow SLA verification across the access provider's network
- Provides same SLA to on-net and off-net customers
- Higher bandwidth rates with Ethernet over NG-PDH encapsulation and bonding standards (GFP, VCAT, LCAS), ensures service quality with hitless restoration, flexible access rate granularity and multi-vendor interoperability

IP DSLAM and WiMAX Backhauling over SDH/SONET
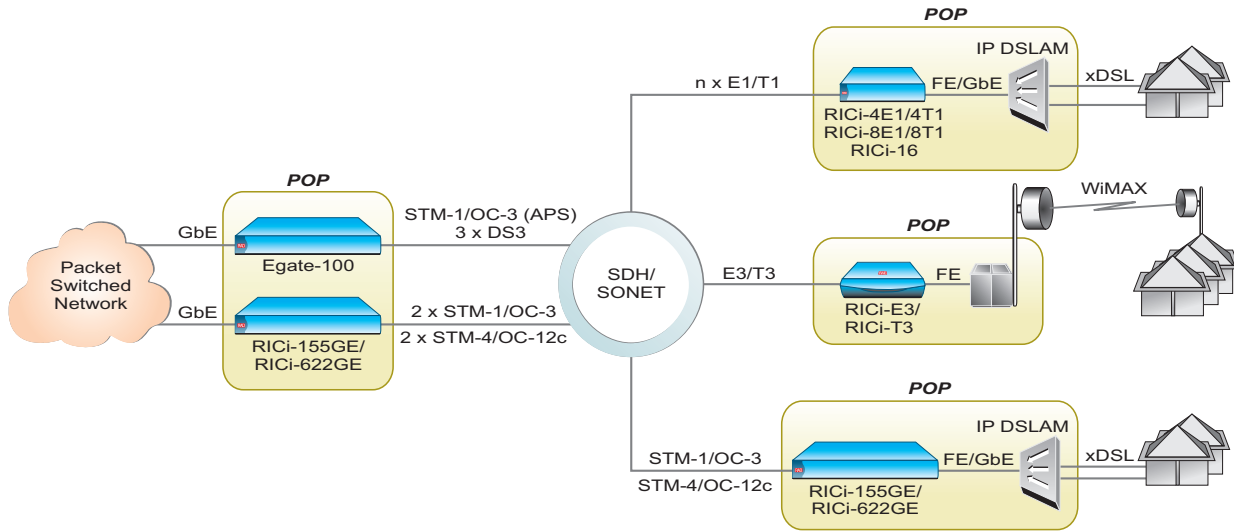
Description

Backhauling IP DSLAMs and WiMAX/BTS over SDH/SONET transport with a seamless hand-off to a packet switched network.

Benefits & Features

- A variety of access bandwidth rates up to 1 Gbps using GFP, VCAT and LCAS bonding and encapsulation protocols
- Seamless extension and aggregation of Ethernet/IP-based broadband services over a TDM infrastructure
- Fast deployment of broadband services
- Reduces OpEx and CapEx by leveraging existing transport infrastructure

Product Finder

Ethernet Services over Wireline and Wireless Access Links
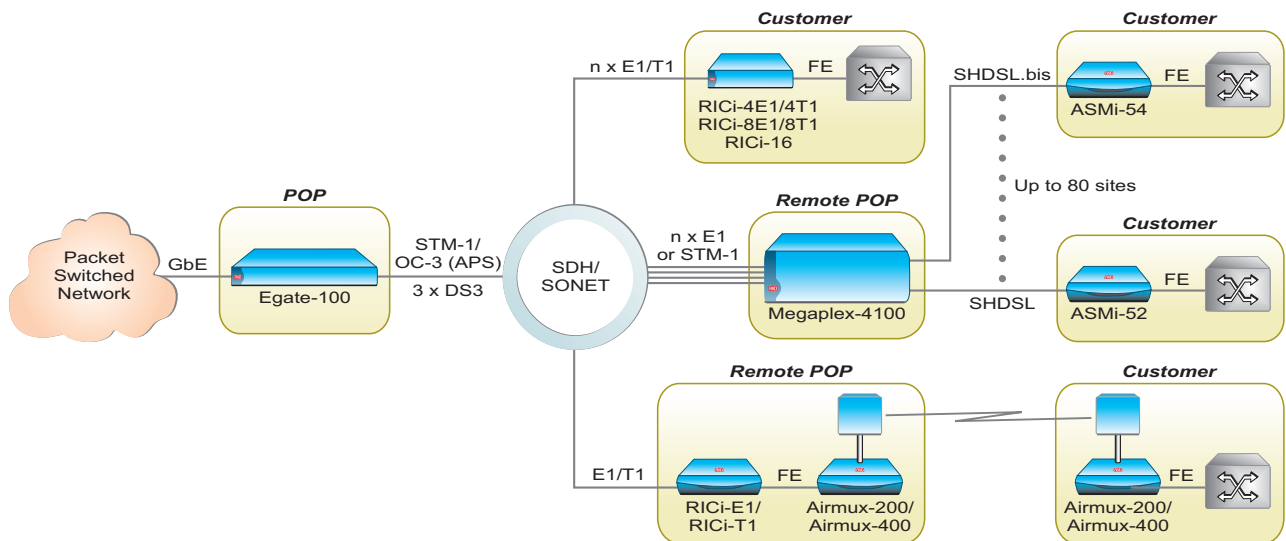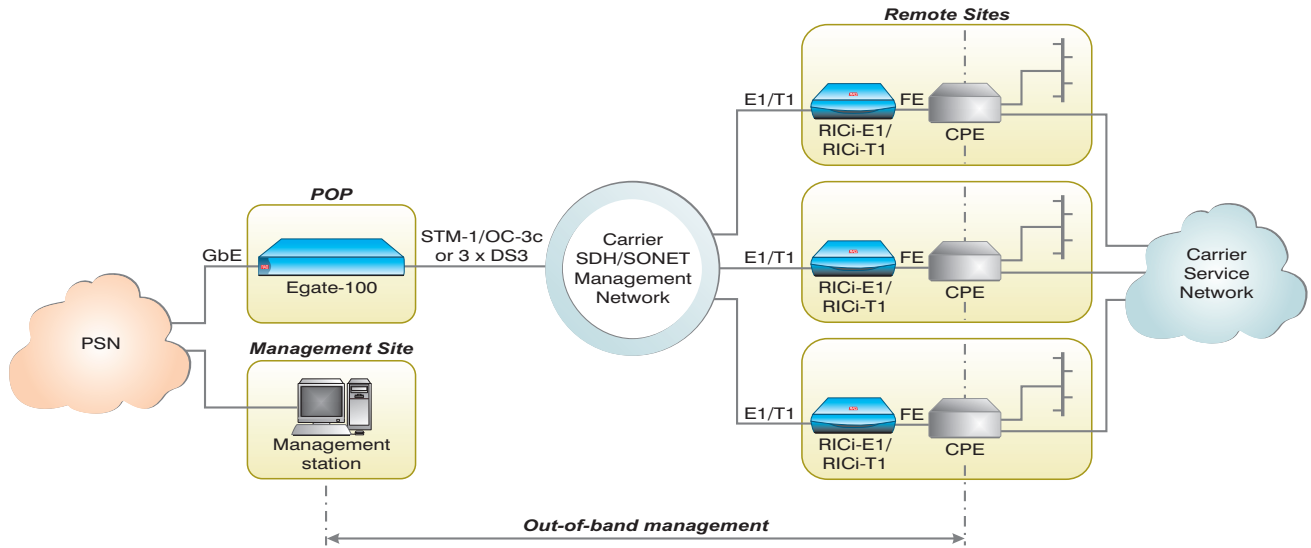

Product Finder

Description

Aggregation of Ethernet services over TDM, SHDSL and wireless infrastructure, so that service providers can extend their Ethernet offerings to areas beyond their metro reach using legacy infrastructure and point-to-point wireless.

Benefits & Features

- Extends Ethernet service reach to any customer
- Fast deployment of Ethernet services
- Complete solution for Ethernet services over PDH/SDH/SONET, SHDSL and wireless links provides operational cost savings
- Flexible aggregation: from a single timeslot to n x E1/T1

Out-of-Band Remote Management

Description

Use PDH for out-of-band management traffic.

Benefits & Features

• Offers managed services where inband management traffic is not available

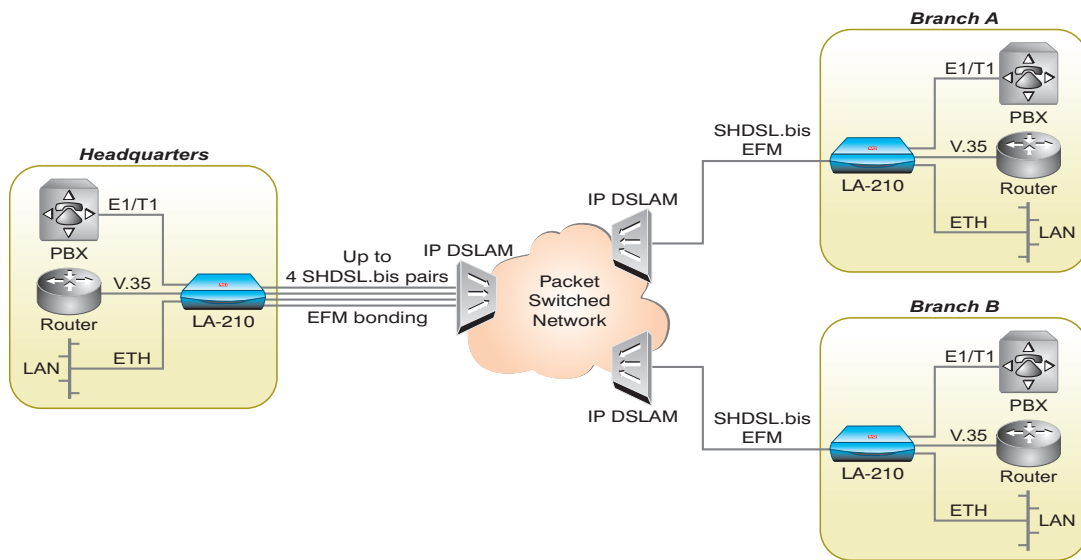• Uses widely available PDH infrastructure to provide managed services

Product Finder

Egate-100	– p.	58
RICi-E1	– p.	53
RICi-T1	– p.	53

Emulated Legacy Services and Ethernet over Bonded Copper Using DSL Infrastructure

Product Finder

LA-210 – p. 66

Description

EFM standards-based SHDSL.bis supports Ethernet, E1/T1 or serial services up to 22 Mbps (over four bonded pairs of copper). Service providers can take advantage of their new IP DSLAM infrastructure to deploy additional business services.

Benefits & Features

• Ethernet "all-the-way" over DSL allows for end-to-end Ethernet-based OAM

• Eliminates ATM "cell tax" for better utilization of network resources

• Single access link for both Ethernet and legacy E1/T1/serial services

• End-to-end service control minimizes operational expenses by employing Ethernet OAM mechanisms, such as IEEE 802.1ag and Y.1731

Mid-Band Ethernet and High Speed Ethernet Using Fiber and DSL
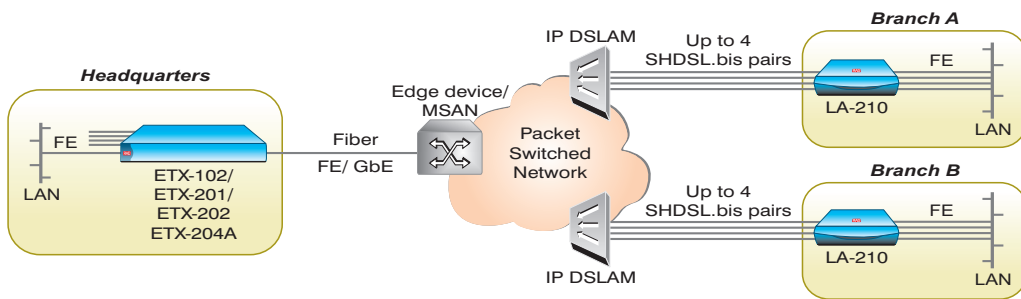
Description

Provide VPN services using Ethernet over SHDSL (EFM) for speeds up to 22 Mbps and fiber access for higher speeds (up to 1 Gbps).

Benefits & Features

• Same service attributes over DSL and fiber access
• Provides Ethernet Private Line (EPL) and Ethernet Virtual Private Line (EVPL) services
• End-to-end service monitoring using Ethernet OAM over both fiber and DSL access

Product Finder

ETX-102	– p. 64
ETX-201	– p. 64
ETX-202	– p. 64
ETX-204A	– p. 62
LA-210	– p. 66

SyncToP

RAD's Synchronization and Timing over Packet (ToP) Solutions

While clocking data has been transmitted natively in TDM networks, new packet switched networks (PSNs) are asynchronous by nature and introduce inaccuracies, such as packet delay variation (PDV) and packet loss – making synchronization the biggest challenge in the migration to Ethernet, IP and MPLS transport.

PSNs therefore require robust clock distribution to all network elements, including precise phase (time of day) transfer and frequency accuracy. This ensures efficient bandwidth utilization and optimal service quality for real-time voice and video services, as well as for data applications.

Popular Synchronization Methods

Adaptive Clock Recovery (ACR)

ACR is a frequency synchronization method in which the clock is distributed over the PSN as a Constant Bit Rate (CBR) TDM pseudowire stream and regenerated at the receiving end using the packet's time-of-arrival information, independently of the physical layer. The clock stream format is a standard TDM pseudowire (SAToP/CESoPSN) flow, delivered in either unicast or multicast modes.

IEEE 1588-2008 (1588v2)

IEEE standard 1588, also known as Precision Time Protocol (PTP), is a frequency and phase (TOD – time of day) distribution protocol in packet networks, offering high accuracy with nanosecond precision. It is based on time stamp information exchange in a master-slave hierarchy, whereby the timing information is originated at a Grandmaster clock function that is usually traceable to a Primary Reference Clock (PRC) and/or Coordinated Universal Time (UTC). Although it can be implemented end-to-end, support of 1588 by intermediate network elements ("boundary clocks" and "transparent clocks") ensures better performance.

Synchronous Ethernet (Sync-E)

Synchronous Ethernet, defined in ITU-T standards G.8261, G.8262 and G.8264, uses the Ethernet physical layer to accurately distribute frequency, using clock mechanisms similar to those of SDH/SONET. Unlike higher-layer timing distribution, where clocking information is carried as a flow of packets, Synchronous Ethernet locks the clock of the Ethernet physical layer to a PRC, independently of the data transmission protocols used at higher layers. As Sync-E is a link-by-link frequency distribution scheme, it requires the entire clock distribution path (i.e., all the network nodes involved) to be Sync-E compliant.

Network Timing Reference (NTR)

NTR is a highly accurate standardized method for frequency distribution in DSL-based Last Mile segments. A network reference clock (i.e., a service clock) is distributed from an NTR-enabled DSLAM to the CPE by mapping its frequency information to the DSL modem transmission. The advantages of NTR lie in its high level of accuracy and in the fact that it eliminates the need for an expensive synchronization apparatus in the DSL modem/IAD, thereby reducing the overall cost of the solution.

RAD's SyncToP™ Platform

The contributing author of major standards for timing and synchronization over packet transport, RAD has created the **SyncToP** platform of high performance clock recovery and distribution techniques with powerful frequency, phase and TOD alignment capabilities. These are incorporated into a variety of PSN access gateways and demarcation devices to ensure reliable transmission of real-time traffic without the need for costly external synchronization devices.

The **SyncToP** suite includes such technologies as IEEE 1588-2008, Synchronous Ethernet, adaptive clock recovery, and NTR. The latter is implemented in a manner that enables its use even with IP DSLAMs which are not equipped with NTR support. Furthermore, the **SyncToP** platform provides unique flexibility in supporting the simultaneous use of different clock transfer methodologies, for example, employing Sync-E to receive the clock from the network then distributing it to the cell-site using PTP.

RAD's **SyncToP** platform enables highly accurate, seamless delivery of 2G, 3G and 4G traffic over packet backhaul, ensuring QoS priorities for clock traffic and meeting mobile backhaul's strenuous requirements, including definite frequency accuracy of 50 ppb for GSM and 16 ppb for 2G CDMA and 3G UMTS.

RAD's Contribution to Industry Standards

RAD is the contributing author of the following packet timing and synchronization standards:

- IEEE 1588-2008
- ITU-T G.8261
- ITU-T G.8262
- ITU-T G.8263
- ITU-T G.8264
- ITU-T G.8265
- ITU-T G.8266 (G.8261bis)
- IETF TICTOC WG

SyncToP's Value Proposition

- Ensure service quality at SDH/SONET levels for real-time voice and video over packet
- Avoid impaired cell hand-offs and excessive dropped calls in IP RANs
- Allow high flexibility by bridging different timing and synchronization technologies and eliminate the need for complete network upgrades
- Reduce CapEx by incorporating synchronization functionalities in the demarcation device/RAN gateway without the need for dedicated clocking hardware
- Lower OpEx by optimizing bandwidth utilization for efficient clock transfer
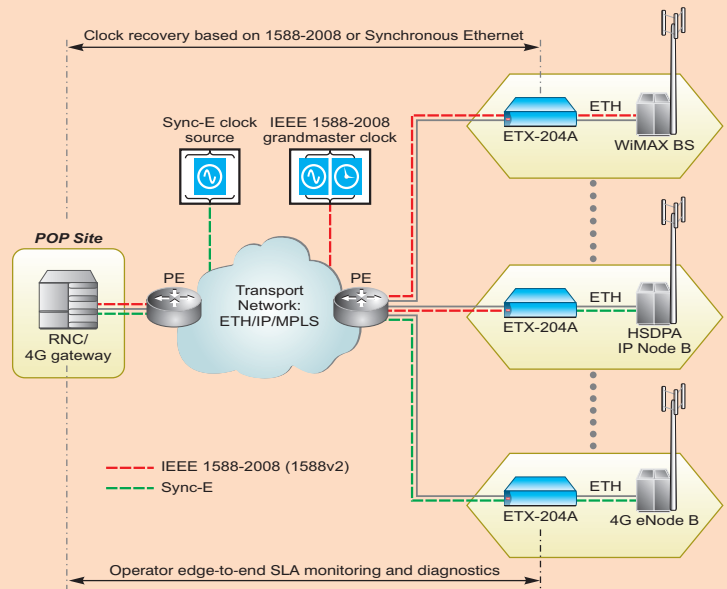
SLA assurance for IP Node Bs, LTE eNode Bs, and WiMAX base stations
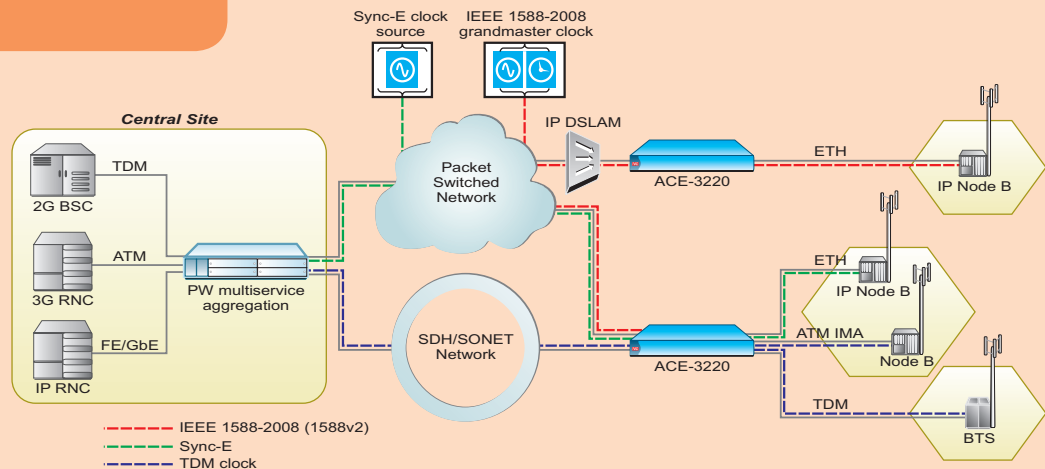
Ensuring accurate synchronization for multi-generation traffic with multiple clocking standards

Cellular Backhaul

Cellular backhaul – the part of the radio network connecting base stations to their controllers – has always been a major contributor to the high costs of building out and running a mobile network. Now it is recognized as the crucial segment that can make or break mobile service delivery and significantly impact operators' profitability.

Unlimited iPhone data packages, mobile TV offerings and other bandwidth-guzzling mobile broadband services shift the transport burden to the RAN (radio access network), which was originally designed to handle mainly voice traffic with a small number of E1/T1 links. The need to accommodate mobile broadband bandwidth requirements is further complicated by continuously declining average revenues per user (ARPU), the effect of which can only be mitigated by dropping the cost per Mbps.

HSPA+ upgrades, Ethernet backhaul rollouts and the migration to 4G LTE's all-IP networks are some of the strategies implemented by operators and transport providers to improve the efficiency of their networks and to make room for data-intensive, rich-media traffic. These strategies, however, introduce a new set of hurdles. Ensuring accurate timing and synchronization over clocking-challenged networks; supporting multi-operator colocation with customized Etherent backhaul SLAs; smartly managing RAN traffic in LTE's flat architecture; and enabling backward compatibility to ensure service continuity for legacy 2G and 3G traffic are a few of the issues that need addressing.

RAD's mobile backhaul solutions ensure cost reduction and high quality delivery for GSM, CDMA and UMTS voice and video traffic, as well as for HSPA+ and LTE mobile broadband applications. Featuring best-of-breed cell-site gateways and aggregation hubs, RAD's mobile backhaul products enable operators and transport providers to optimize bandwidth utilization and converge all services over a unified network, using any available access link – whether TDM, copper DSL, fiber, or microwave. In addition, multi-standard pseudowire support, resilient ring functionality and extensive timing over packet capabilities – including 1588v2 and Sync-E – enable a smooth and cost-effective transition to all-IP radio RANs.

Cellular Backhaul Migration to Packet Transport
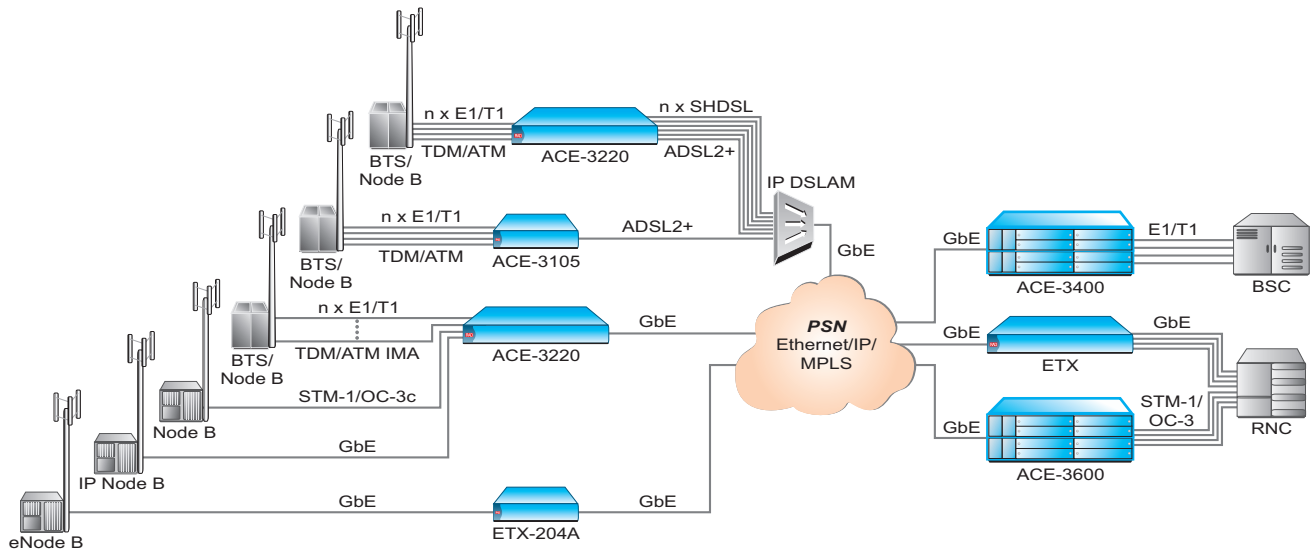
Description

Migration to next-generation packet transport becomes a viable alternative for cellular backhaul. As shown in the application above, several base stations and Node Bs are connected over packet switched networks. Pseudowire technology is implemented for 2G TDM, 3G ATM and IP Node B cellular equipment.

Benefits & Features

- Leverages next-generation packet transport (DSL, fiber) for 2G/2.5G/3G/4G backhaul
- Packet switched networks support higher bandwidth availability while reducing OpEx
- Single platform for multi-generation traffic (TDM, ATM, IP)
- Timing and synchronization over the packet transport network
- Well suited for fixed and mobile convergence (FMC)
- Supports "any-service-any-port"

Product Finder

ACE-3105	– p. 76
ACE-3220	– p. 74
ACE-3400	– p. 82
ACE-3600	– p. 80
ETX-204A	– p. 62

WiMAX/4G Cellular Backhaul over TDM/SDH/SONET for Transport Providers
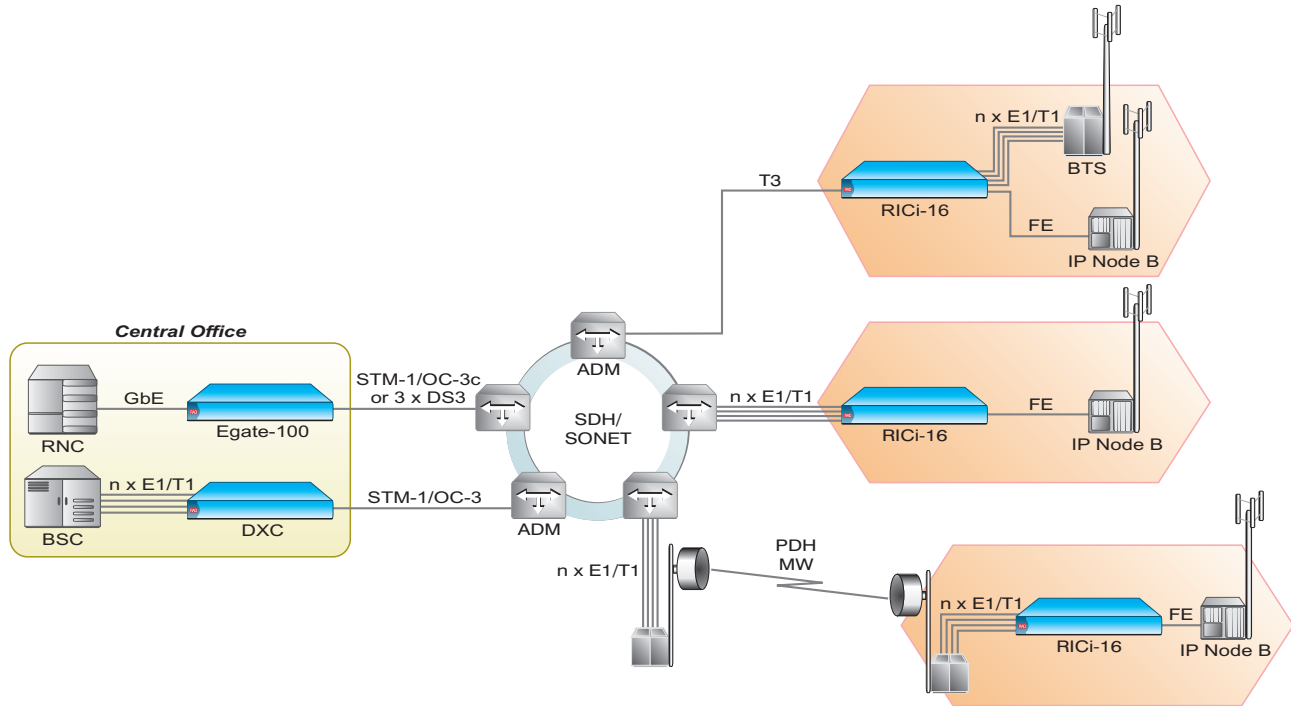

Product Finder

Description

Transport of IP Node B Ethernet traffic over PDH and SDH/SONET infrastructure, together with TDM aggregation over n x E1/T1 or channelized T3. Integrated M13 and SONET ADM functionality for legacy E1/T1 delivery.

Benefits & Features

- Flexible bandwidth allocation with circuit bonding
- CapEx reduction through leverage of the existing SDH/SONET/PDH links
- Complete solution with RAD's CLEs
- Reduces OpEx by using a single management system with flexible service provisioning (64 kbps to n x E1/T1)

Ethernet Demarcation for Cellular Transport Services
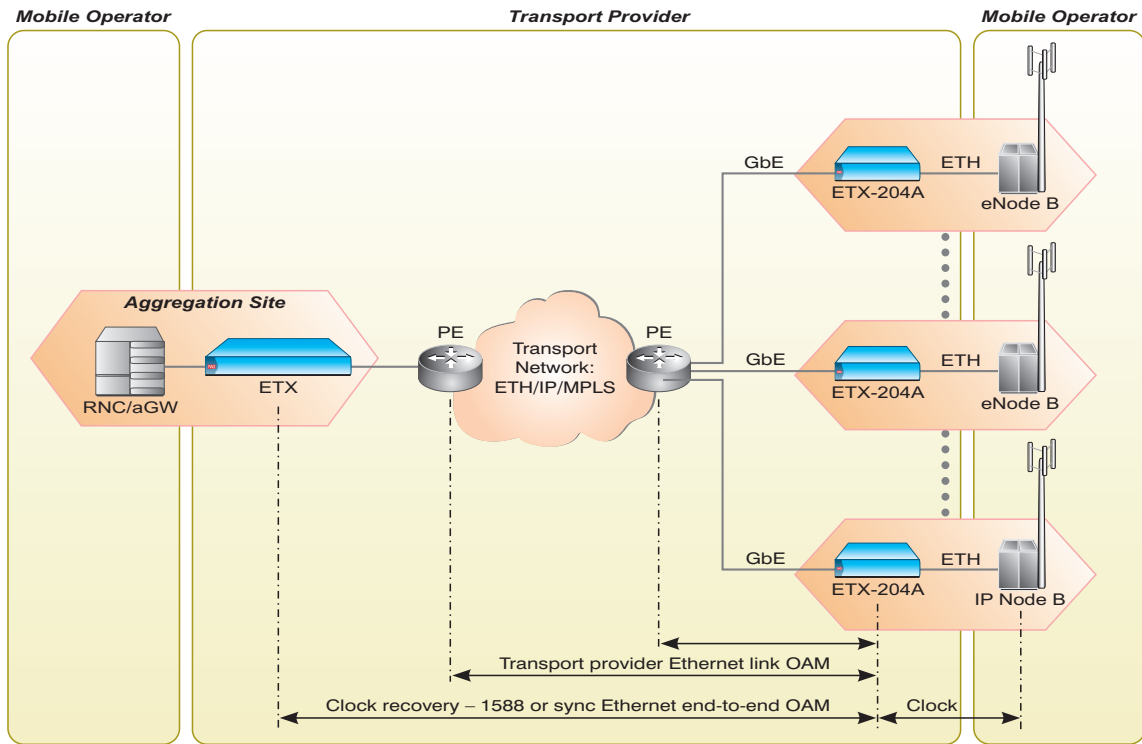
Description

Enable service assurance for Ethernet-based next-generation mobile networks, such as WiMAX, IP Node B and LTE 4G all-IP RANs, by providing a clear demarcation between mobile operator and transport provider domains, including end-to-end services control, performance monitoring and SLA measurement.

Benefits & Features

• End-to-end and link level Ethernet OAM for fault management and performance monitoring

• Powerful synchronization and clock transfer support to ensure service quality over packet transport, including IEEE 1588-2008 and Synchronous Ethernet

• Advanced QoS capabilities per Ethernet virtual connection and/or class of service (EVC, EVC.CoS)

• Physical link protection for increased uptime

Product Finder

ETX-204A – p. 62

HSDPA Hybrid Broadband Transport

Description

The introduction of new mobile services calls for cost-effective transport alternatives. 2G/3G traffic aggregation and separation of the voice to the SDH/SONET, and HSDPA data stream to the DSL and the packet network, presents a viable solution to increase back-haul bandwidth in a controlled manner.

Benefits & Features

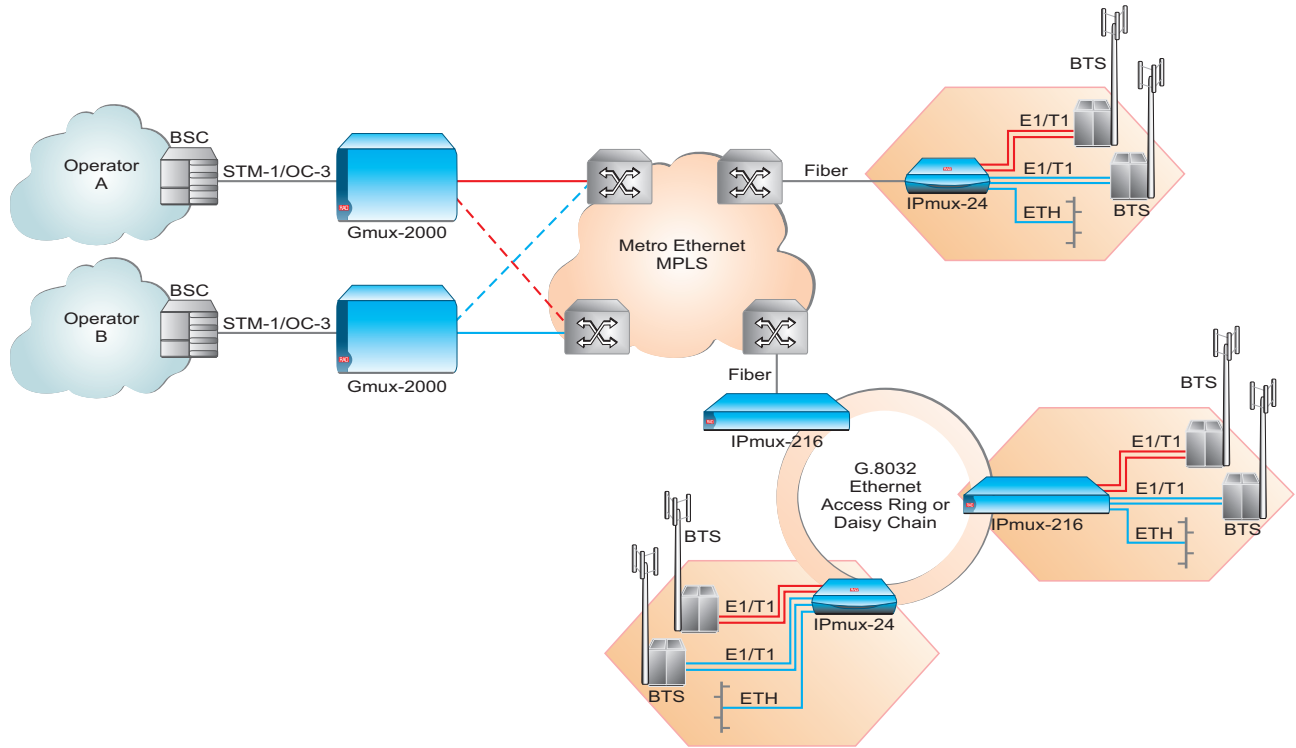• Reduces HSDPA transport costs by using packet switched transport

• Scalable cost-effective broadband access service (DSL)

• Future-proof: supports Ethernet both in the user and network interfaces

• Ensures QoS for voice and real-time traffic

Product Finder

ACE-3220	– p. 74
ACE-3400	– p. 82
ACE-3402	– p. 82

Resilient Ethernet Ring

Product Finder

Description

The IPmux-24 and IPmux-216 support up to 16 nodes in a G.8032 standard ring, with sub-50 ms protection switching time. Where fiber is deployed in the access, it is possible to build an Ethernet ring topology to backhaul 2G base station traffic.

Benefits & Features

• High accuracy clock recovery to synchronize base stations to one clock source

• Provides resiliency in case of fiber cut between the nodes in the ring

• Enables easy replacement of obsolete SDH access ring, without expensive fiber re-layout

• Supports multi-generation/multi-operator colocation at the same tower

• Enhances service reliability through network resiliency and redundancy

IP RAN Backhaul over DSL
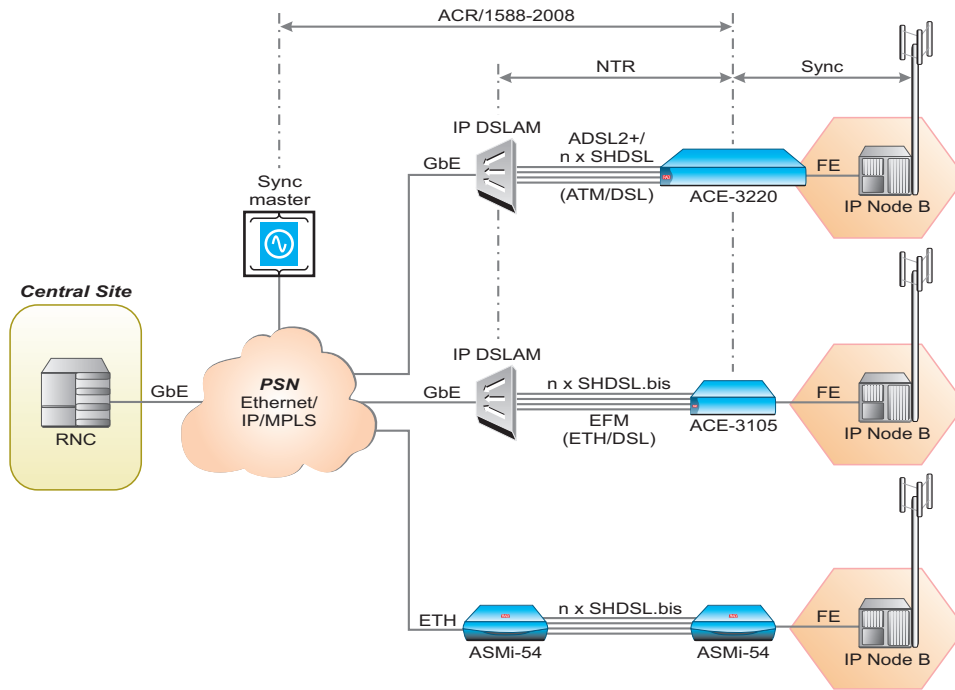
Description

With the introduction of IP RAN, DSL becomes a viable means for connecting base stations over DSL/ATM or over DSL/EFM. Direct point-to-point connections can also be used for extending service coverage in rural areas.

Benefits & Features

• Backhaul service over copper

• QoS capabilities for service differentiation

• EFM bonding for high data rates over multiple copper pairs

• EFM bonding ensures traffic delivery, even when individual links are added or dropped to/ from the bonded group
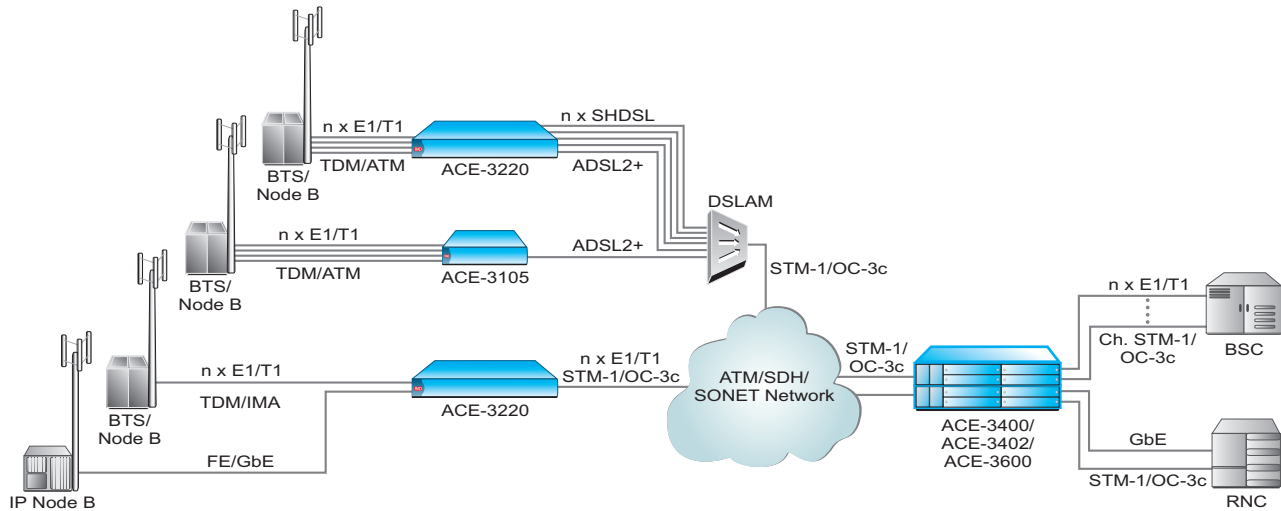
Product Finder

ACE-3105	– p. 76
ACE-3220	– p. 74
ASMi-54	– p. 136

2G/3G/4G Cellular Backhaul over ATM/SDH/SONET/PDH

Product Finder

Description

Aggregation of multiple generations of mobile traffic over the same transport infrastructure is one way to reduce operational costs. As shown in the application above, several base stations and Node Bs are connected over shared access lines, improving the efficiency of the transmission lines.

Benefits & Features

- Flexible port configuration to support 2G, 3G and future generations simultaneously
- Reduces OpEx by using less total bandwidth (ATM statistical multiplexing), requiring fewer E1/T1 links
- Reduces CapEx through utilization of lower cost STM-1/OC-3c ports in the backbone and on the RNC
- Leverages DSLAM infrastructure for cell-site backhaul
- Supports "any-service-any-port"

Inter-MSC and 3G Media Gateway Solutions
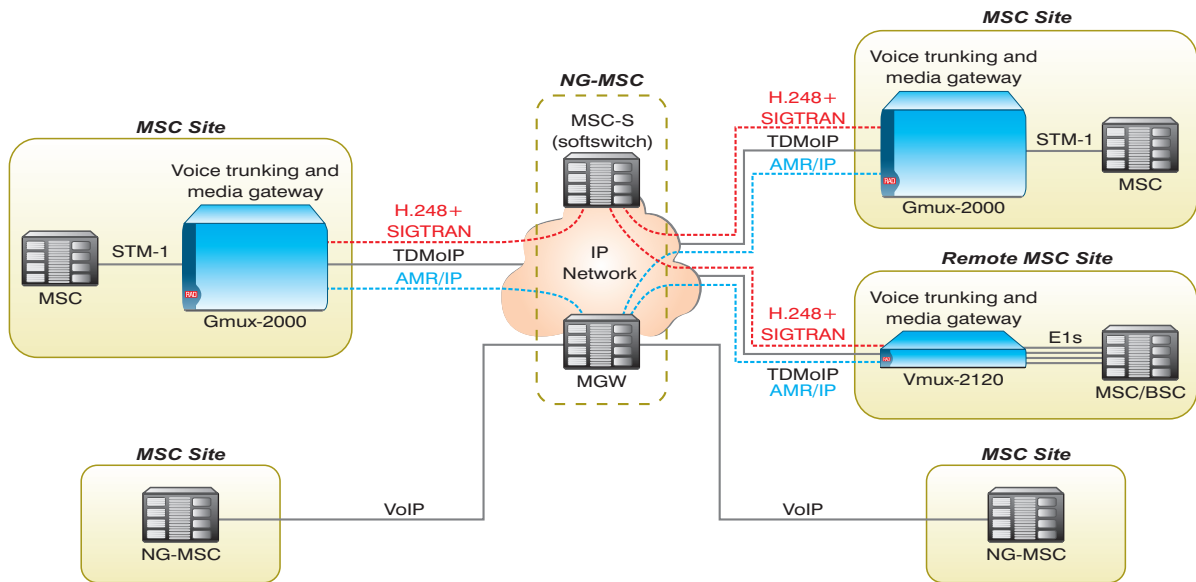
Description

Typically, hundreds of long haul links are used to connect MSCs (E-channel) in meshed, star or mixed network topologies. Limiting the number of links translates into immediate cost savings. RAD's Vmux/Gmux voice trunking gateways use advanced voice compression technologies to significantly reduce the number of required leased lines. In addition to Inter-MSC compression, the Vmux family also supports 3G media gateway services on the legacy MSC network.

Benefits & Features

- Fast payback
- Up to 16:1 voice compression for higher bandwidth utilization and OpEx savings
- Supports and optimizes all types of signaling channels
- Seamless migration from TDM to IP networks
- Small, scalable and easy to install
- Future-ready for interoperability with next-generation mobile core (softswitch-based)

Product Finder

Gmux-2000	– p. 156
Vmux-2120	– p. 152

Voice Optimization, Compression and VoIP

With the explosion in the volume of Web and video traffic, it is easy to forget that real-time voice conversations continue to be the gold standard of communications. Voice traffic still accounts for a large share of overall global communications volume. Any efficiencies that can be applied to voice can have a significant impact on overall cost of service delivery.

RAD leads the industry with advanced voice compression and optimization solutions. These include voice compression gateways using the same codecs as are used for VoIP (G.723.1 and G.729a, for example), but go one step further by optimizing the traffic for voice trunking applications. Offshore call centers are a good illustration of where RAD's

voice compression products offer dramatic cost savings for transporting large volumes of calls across expensive facilities.

The rising popularity of VoIP is partly due to its inherent efficiency vis-à-vis traditional TDM technologies, as well as its synergy with other packet-based services and transports. RAD has a complete end-to-end service provider offering for the delivery and management of VoIP services. The RAD VoIP System provides a turnkey suite of VoIP capabilities that enable low cost and low risk entry into the VoIP market.

Offshore Call Centers
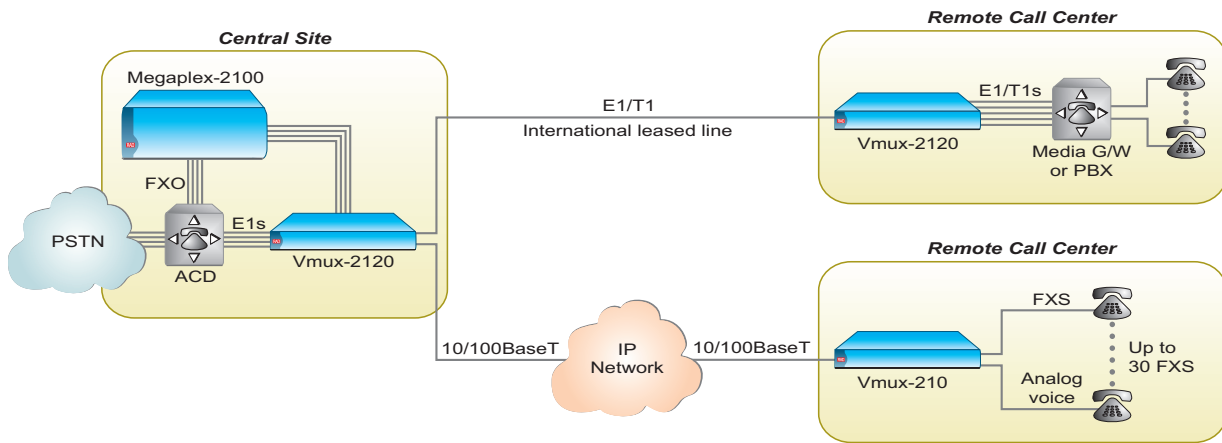
Description

The cost of international leased lines is still a large contributor to the overall OpEx involved in operating an offshore call center, especially one with thousands of seats. Using RAD's Vmux voice trunking gateways, providers of offshore call center services can significantly reduce their operational costs, without degrading the level of service they provide.

Benefits & Features

• Significant bandwidth reduction (up to 16:1) translates to significant cost savings

• Simultaneous transmission over TDM and IP networks

• Transparent to all telephony features

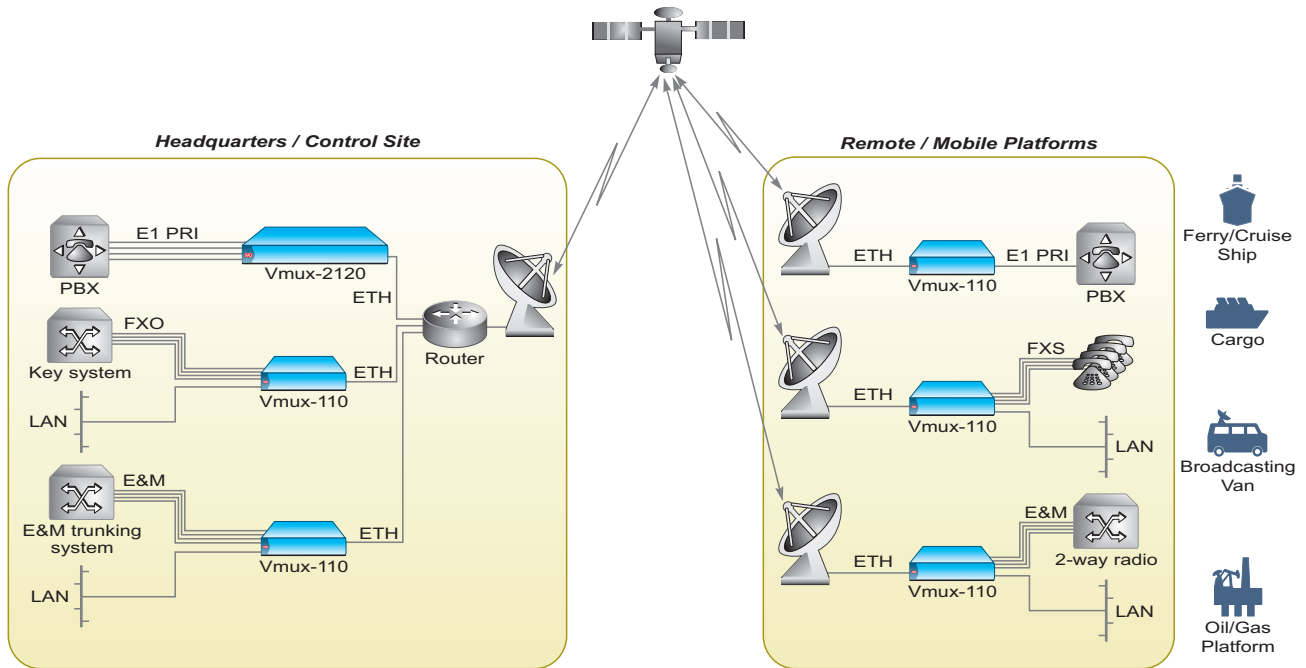• Compact, scalable and simple to deploy

Product Finder

Megaplex-2100	– p. 92
Vmux-210	– p. 154
Vmux-2120	– p. 152

Efficient Voice Transmission over Satellite

Headquarters / Control Site — *Remote / Mobile Platforms*

Product Finder

Description

Providing voice services to remote/mobile platforms usually involves satellite communications, which significantly increase OpEx. RAD's Vmux voice trunking gateways reduce the costs and increase the capacities involved in extending voice services over satellite.

Benefits & Features

- Significant bandwidth reduction (up to 16:1) translates to significant cost savings
- Transparent to all telephony features
- Compact, scalable and simple to deploy
- Ideal for oil/gas, maritime, broadcasting, emergency response, and government/military communications

Business-Grade IP Telephony System for Alternative Carriers and ISPs
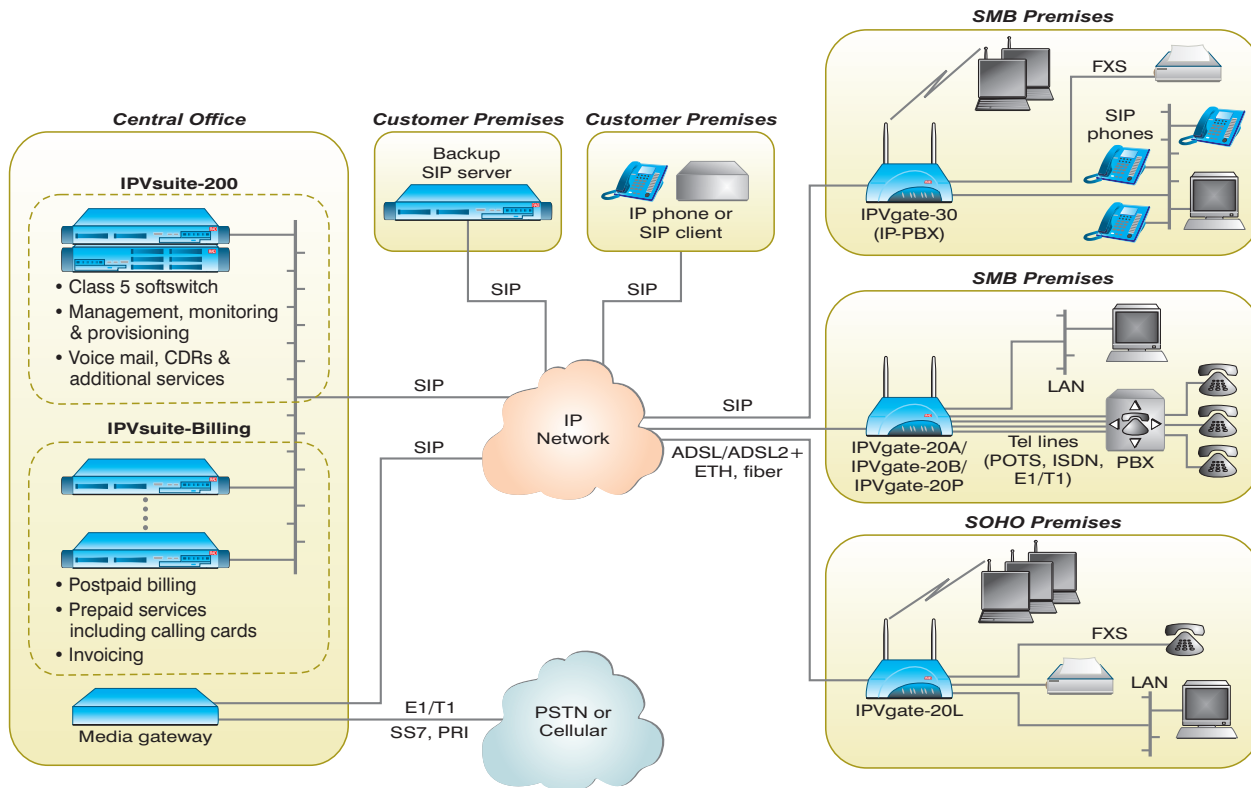
Description

Competition in the telephony market is driving new carriers and ISPs to add telephony access to their service offering, while utilizing existing IP networks. RAD's fully integrated VoIP system allows these service providers to offer business customers a fully integrated Class 5 solution that can be deployed quickly, requires minimal time to service, and ensures rapid ROI.

Benefits & Features

• Allows data service providers to add voice and PSTN access to this service offering

• Fully integrated solution minimizes time to service

• Advanced management system minimizes deployment time and on-site visits

• Single box CPE includes: DSL modem, router, Wi-Fi access point and VoIP gateway (analog and ISDN), as well as IP-PBX

Product Finder

IPVgate-20A	– p. 161
IPVgate-20B	– p. 161
IPVgate-20L	– p .162
IPVgate-20P	– p. 161
IPVgate-30	– p. 163
IPVsuite-200	– p. 159
IPVsuite-Billing	– p. 160

Utilities and Transportation

Utilities and transportation environments present several unique challenges to any network designer. They typically must support a wide variety of communications applications. These range from analog control circuits, low speed data, TDM circuits, digital and analog voice (including Omnibus) and mobile, to video surveillance, LAN traffic, broadband Internet access, and Wi-Fi. Network topologies can vary from daisy-chain to star or ring designs. Additionally, utility and transportation networks must be highly reliable and resilient due to the critical nature of the traffic they carry and the enhanced security environment in which they operate.

Utilities

Power
Provide reliable transmission of mission-critical Teleprotection data and real-time video between power plant control centers and remote sites.

Gas and Oil
Enable connectivity to remote gas and oil platforms and distribution facilities. Support a wide variety of voice, data and video surveillance applications across links with limited and/or expensive bandwidth such as satellite.

Water
Provide reliable communications to distributed locations, such as pumping stations, treatment plants and control rooms.

Pipelines
Enable add/drop communications in a daisy-chain configuration across long distances. Support voice, data and video surveillance applications with high reliability over limited bandwidth and resiliency.

Transportation

Rail
Provide reliable and efficient communications for a wide variety of applications, ranging from Omnibus voice, track signaling and control, to train schedule display panels and ticketing terminals in stations.

Motorways
Enable efficient communications between digital message boards along the highway and centralized control facilities.
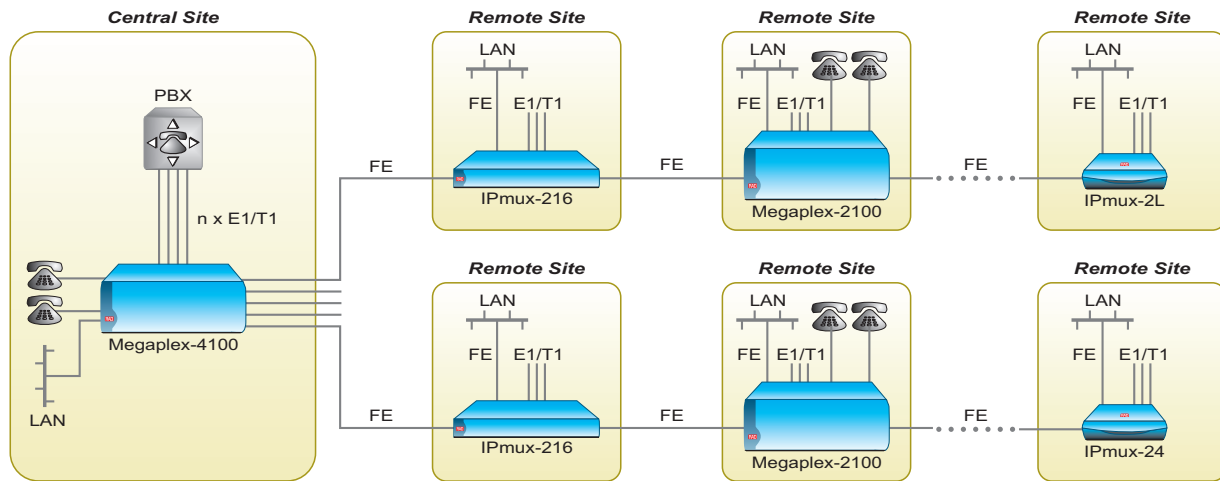
Air
Ensure highly reliable and resilient communications for all aspects of airline, airport and air traffic control operations.

Maritime
Provide reliable and efficient ship-to-shore communications for applications, including navigation data, voice, Ethernet, and GSM connectivity, as well as maritime traffic control operations.

Ethernet Daisy-Chain over Fiber

Central Site

PBX

n x E1/T1

Megaplex-4100

LAN

Remote Site

LAN

FE   E1/T1

FE

IPmux-216

FE

Remote Site

LAN

FE   E1/T1

FE

Megaplex-2100

FE

Remote Site

LAN

FE   E1/T1

FE

IPmux-2L

Remote Site

LAN

FE   E1/T1

FE

IPmux-216

FE

Remote Site

LAN

FE   E1/T1

FE

Megaplex-2100

FE

Remote Site

LAN

FE   E1/T1

FE

IPmux-24

Description

Ethernet provides high bandwidth at low cost and therefore is particularly well suited for extension of various services over fiber to remote facilities in distributed linear networks, such as are common in utilities and railway applications.

Benefits & Features

- Shared LAN capabilities save timeslots for each node
- Hardened IPmux-24 for deployment in extreme temperature environments (-30°C/65°C)
- Megaplex-2100 with ML-IP enables three-port 10/100BaseT Ethernet uplink module with up to 8 Mbps capacity
- Megaplex-4100 with pseudowire module acts as a central site solution

Product Finder

IPmux-2L	– p. 178
IPmux-24	– p. 174
IPmux-216	– p. 176
Megaplex-2100	– p. 92
Megaplex-4100	– p. 88

# Next-Generation Multiservice Access and Aggregation
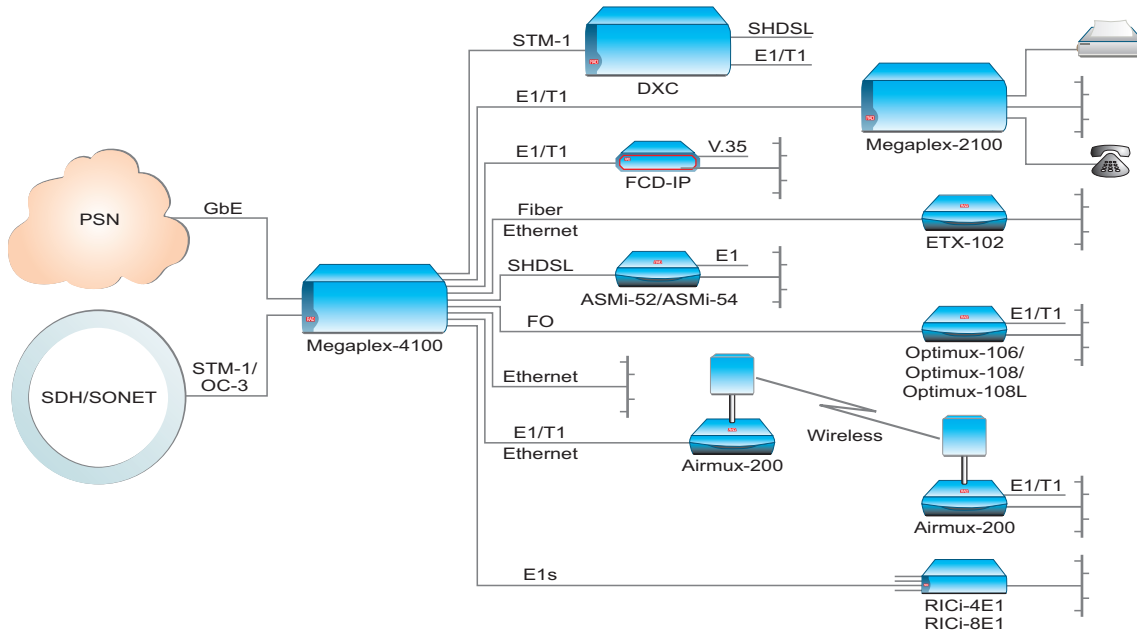
Product Finder

Description

Provides a versatile and coherent multiservice access solution, supporting any Ethernet and legacy service over any media to next-generation SDH/SONET or PSN transmission networks.

Benefits & Features

- Single aggregation unit for TDM and Ethernet services
- Supports both SDH/SONET and PSN transmission networks
- Extends useful life of deployed equipment by enabling migration to PSN or next-generation SDH/SONET
- Solution for both core utility and Utelco requirements
- Cost-effective E1, T1 and SHDSL ring capability for protected low bandwidth application

SCADA Connectivity for the Utility Market
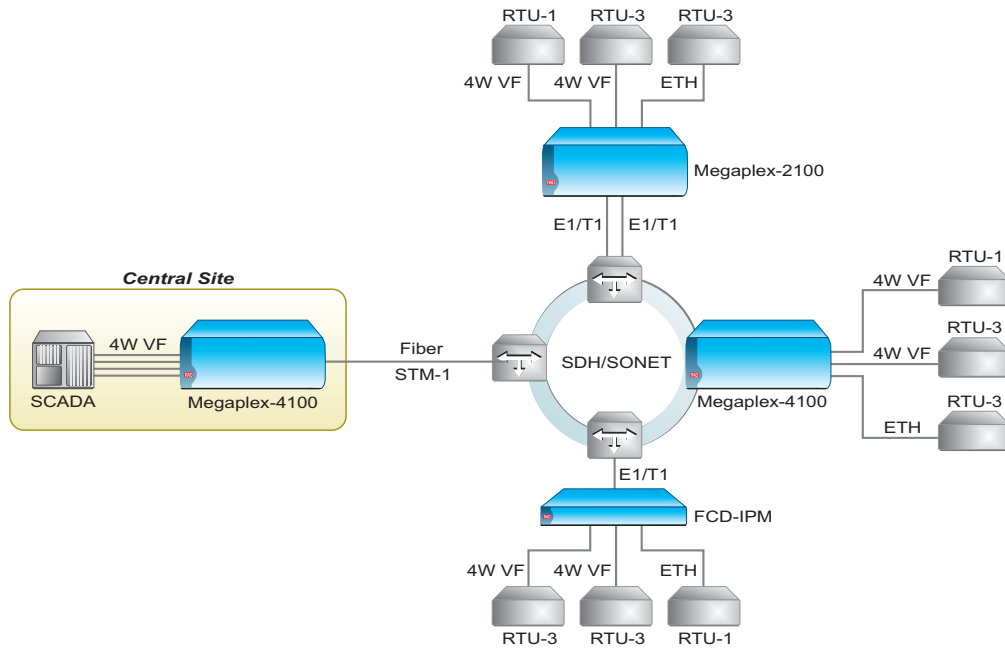
Description

Utilities networks are typified by a mix of equipment, including voice switches, video surveillance apparatus and newer Ethernet-enabled data devices alongside traditional equipment with low speed data interfaces. By using RAD's product solutions, these services can be supported on a single platform, ensuring user flexibility and migration to PSN.
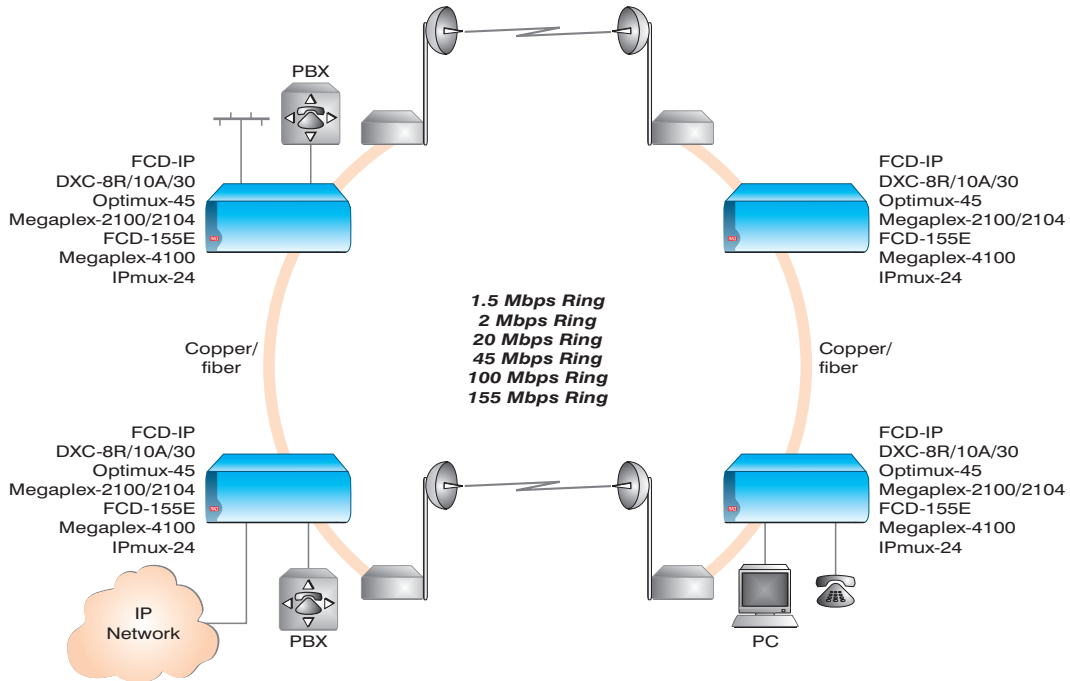
Benefits & Features

• Supports high and low speed data, Ethernet and voice services on one platform

• Compatible with the new C37.94 Teleprotection standard

• Supports high level of redundancy for all service levels

Product Finder

FCD-IPM – p. 112

Megaplex-2100 – p. 92

Megaplex-4100 – p. 88

Protected Ring Solutions over Any Media

FCD-IP
DXC-8R/10A/30
Optimux-45
Megaplex-2100/2104
FCD-155E
Megaplex-4100
IPmux-24

PBX

FCD-IP
DXC-8R/10A/30
Optimux-45
Megaplex-2100/2104
FCD-155E
Megaplex-4100
IPmux-24

1.5 Mbps Ring
2 Mbps Ring
20 Mbps Ring
45 Mbps Ring
100 Mbps Ring
155 Mbps Ring

Copper/
fiber

Copper/
fiber

FCD-IP
DXC-8R/10A/30
Optimux-45
Megaplex-2100/2104
FCD-155E
Megaplex-4100
IPmux-24

FCD-IP
DXC-8R/10A/30
Optimux-45
Megaplex-2100/2104
FCD-155E
Megaplex-4100
IPmux-24

IP
Network

PBX

PC

Product Finder

Description

RAD enables users to deploy protected rings of various capacities without impacting traffic. These include a 1.5 Mbps ring, 2 Mbps ring, 20 Mbps ring, 45 Mbps ring, 100 Mbps ring, and a 155 Mbps ring. Some of the solutions are standard SDH/SONET and therefore can be added to an SDH/SONET existing ring. No other vendor offers such a wide range of protected TDM ring solutions.

Benefits & Features

• Compact
• Wide range of services
• SDH/SONET or SDH/SONET-like protection
• Good price/performance

Multi-Party Voice (Omnibus) for Railways
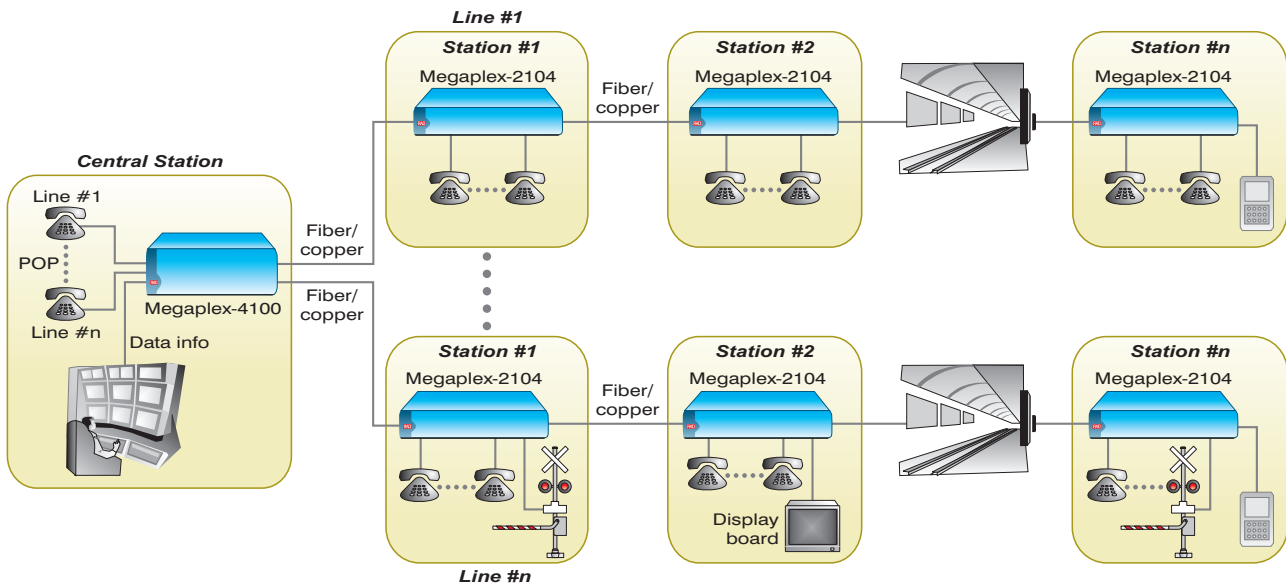
Description

Communications between railway network elements are vital for uninterrupted and safe operation of railways. The Megaplex flexible modular multiplexers enable integration of voice, ISDN, video, data, and LAN services over multiple E1/T1, Ethernet uplinks or n x 64 kbps links. Omnibus support provides instant multi-party voice communications between distant operators.

Benefits & Features

- Enables immediate multi-party voice transmission
- Saves additional E1 PBX or any other network infrastructure for immediate broadcast voice transmission
- Saves bandwidth on the link with E&M interface
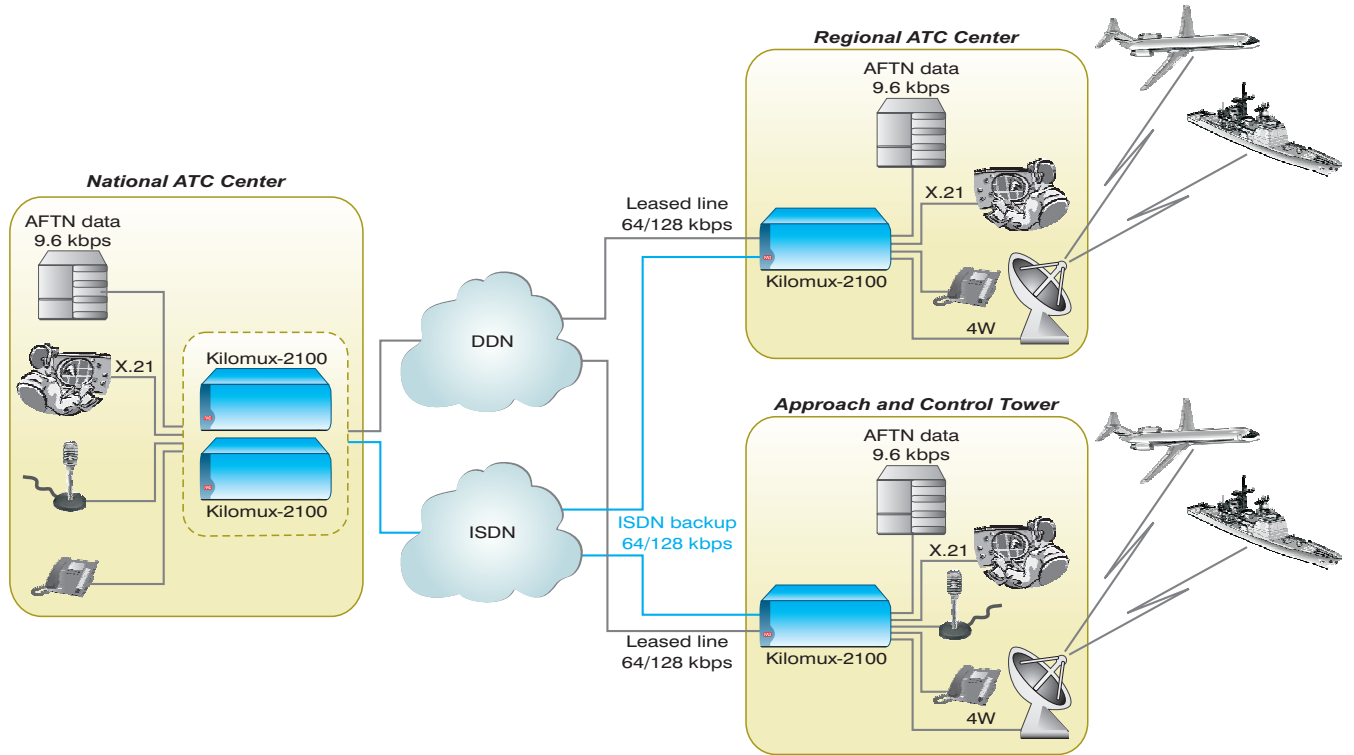
Product Finder

Megaplex-2104   – p. 92

Megaplex-4100   – p. 88

Air Traffic Control and Maritime Solutions

National ATC Center

AFTN data
9.6 kbps

X.21

Kilomux-2100

Kilomux-2100

DDN

ISDN

Regional ATC Center

AFTN data
9.6 kbps

Leased line
64/128 kbps

X.21

Kilomux-2100

4W

Approach and Control Tower

AFTN data
9.6 kbps

ISDN backup
64/128 kbps

X.21

Leased line
64/128 kbps

Kilomux-2100

4W

Product Finder

**Kilomux-2100** – p. 99

Description

Air route and maritime traffic control facilities are becoming increasingly integrated, even across national borders, making reliable voice and data transmission over public networks paramount for the safe provisioning of ATC services. RAD's Kilomux has a track record of fail-safe operations, supporting industry standard interfaces and optimizing OpEx via reliable and effective dialed backup mechanisms.

Benefits & Features

• High reliability and availability solution for uninterrupted mission-critical applications

• Optimized for low speed leased line transmission and dialed backup for lowered OpEx

• Support of VHF trunking and PTT applications

• Ruggedized platforms withstand the rigors of field operations

Ethernet Connectivity for Smart Grid Applications
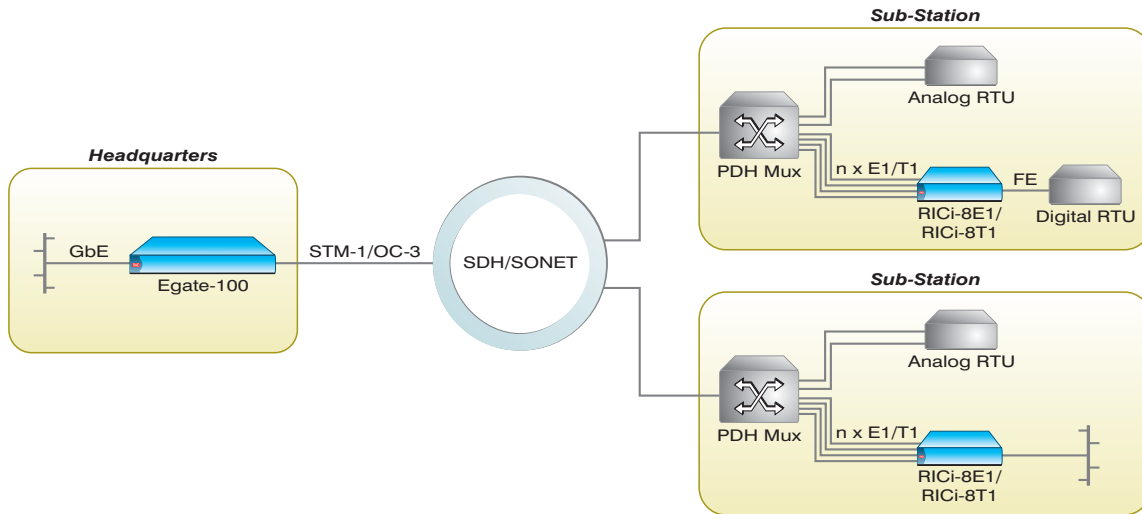
Description

Backhaul smart meter data from utility companies' sub-stations to NOCs over SDH/SONET or Metro Ethernet networks.

Benefits & Features

- Fully managed Layer 2 backhaul solution to meet smart-grid automation requirements over private or third-party networks
- Easy to install and maintain, cost-effective devices
- Eliminate the need for on-site inspections to collect utilities data

Product Finder

Multiservice Access

The transformation of virtually all communications into a digital, packetized format has brought great change to the networking industry. Even so, there remains an enormous installed base of all types of devices that use TDM, analog or low speed data devices, which depend on PDH/SDH/SONET transport of their analog lines and control circuit information. Common examples include the key building blocks of traditional utilities and transportation networks as well as public safety TETRA installations, to name a few.

Although these TDM services are not likely to be totally replaced anytime soon, network operators are aggressively leveraging the lower cost and more scalable bandwidth offered by packet-based technology for their metro transport and core networks. Recognizing that both older and newer communications

technologies will co-exist for some time to come, service providers are looking to maximize their investments in existing veteran systems – even as they slowly decommission them – while benefiting from the cost efficiencies and flexibility of packet-based technologies.

The multiservice access platform product line from RAD is designed to support a variety of narrowband and broadband data rates, digital and analog voice services, and video surveillance for utilities, transportation networks, carriers, and service providers. These products include multiservice provisioning platforms (MSPP), compact add/drop multiplexers (ADM), digital cross connects, M13 multiplexers, access node multiplexers, multiservice network termination units (NTU, CSU/DSU), SHDSL and SHDSL.bis modems, and TDM pseudowire gateways.

Multiservice and Ethernet Aggregation over Any Access Infrastructure
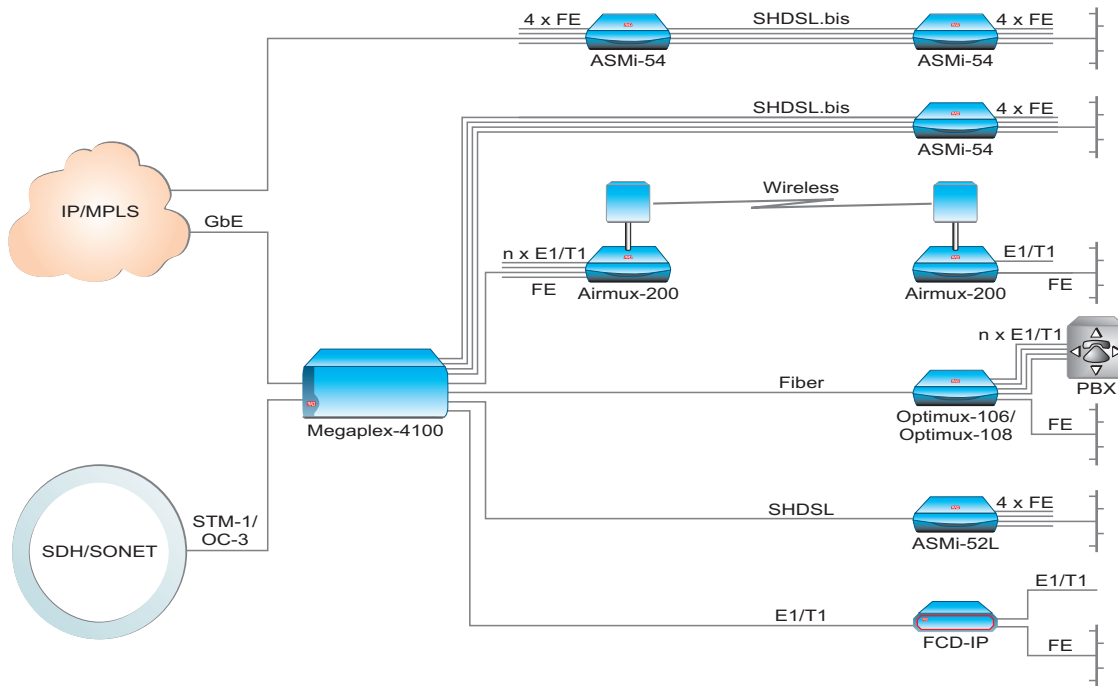
Description

TDM and Ethernet aggregation over the Last Mile via fiber, E1, T1, wireless, SHDSL, and SHDSL.bis.
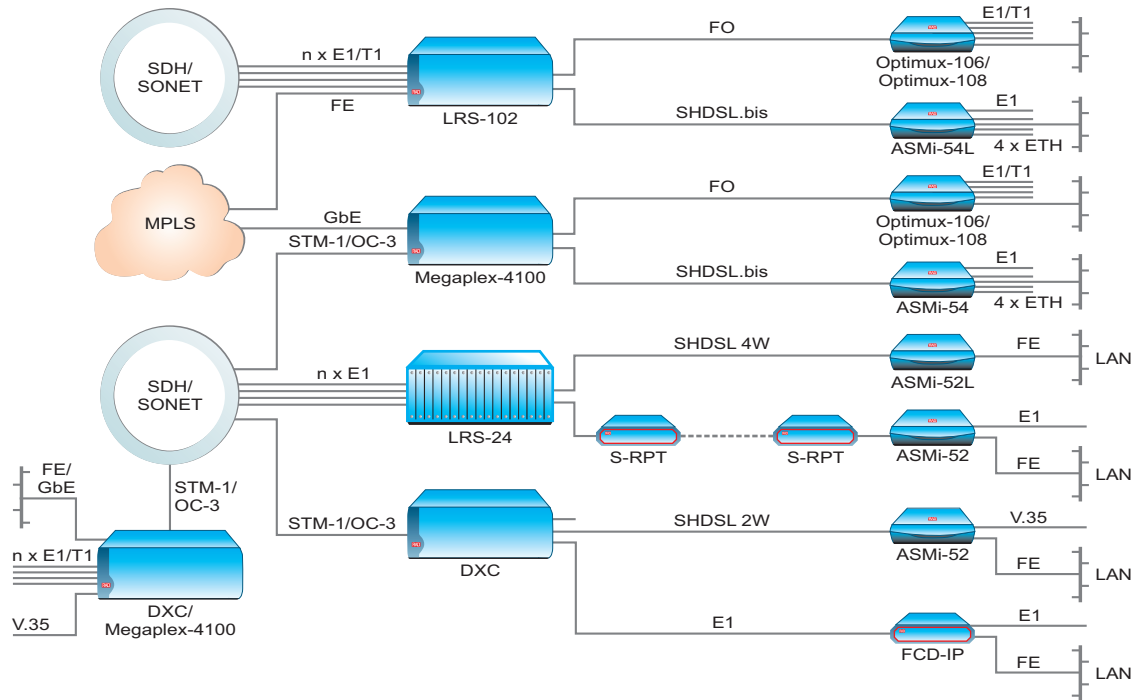
Benefits & Features

- SDH/SONET and Ethernet aggregation over any infrastructure
- Optimized use of SDH/SONET using VCAT
- Complete solution for Ethernet and E1/T1 in multiple locations and ranges
- Various units support both TDM and IP traffic

Product Finder

Airmux-200	– p. 149
ASMi-52L	– p. 135
ASMi-54	– p. 136
FCD-IP	– p. 114
Megaplex-4100	– p. 88
Optimux-106	– p. 118
Optimux-108	– p. 118

Multiservice Access over DSL and Fiber


Product Finder

Description

RAD's SHDSL TDM solution achieves significant cost savings and maximizes the use of existing infrastructure, adding new revenue opportunities and increasing service footprint, thereby expanding the carrier or provider service-offering portfolio.

Benefits & Features

- High port density for greater efficiency and profitability
- Saves expensive colocation costs
- Direct grooming for simpler single-unit solution
- Supports 2-wire or 4-wire SHDSL
- Supports 2-wire, 4-wire, 8-wire SHDSL.bis up to 22 Mbps

Cost-Effective Service Extension over Packet Access
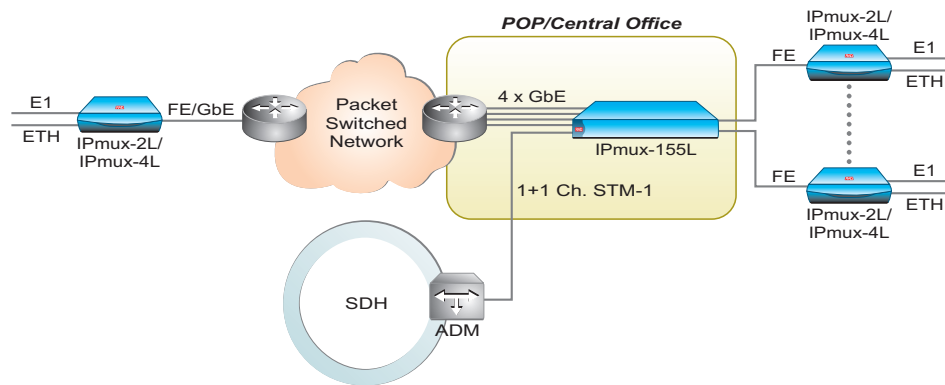
Description

Reduce the costs of traditional voice and Ethernet services for small and mid-sized enterprises, or multi-tenant units (MTUs), over packet switched access networks.

Benefits & Features

- Supports legacy TDM user equipment and services while reducing transport costs
- Economical aggregation in small POPs with high port density, small footprint and low power consumption
- Eliminates the need for additional Ethernet switches

Product Finder

IPmux-2L	– p. 178
IPmux-4L	– p.178
IPmux-155L	– p. 181

Government and Enterprise

Government and Public Safety

Governments are upgrading their networks and systems to enable, among other things, Web-based access to resources, real-time collaboration, video conferencing, video surveillance, and improved inter-agency communications. With a wide assortment of devices and systems in place – some dozens of years old – the communications network needs to be able to support both legacy interfaces as well as leading-edge communications technologies, for example, migrating TETRA networks to packet-based infrastructures.

Education

Educational institutions are very focused on cost-effective solutions with rapid ROI. RAD Data Communications offers versatile solutions via fiber, copper or wireless to support virtually any type of communications protocol or network topology, enabling the creation of an integrated communications network.

Financial Services

With solutions such as TDM-based trader turret connectivity across IP networks, efficient "hoot-and-holler" circuits using voice compression, and inter-PBX voice trunking to international locations that use 1/16 the bandwidth of a "normal" TDM connection, RAD's experience in the financial service industry is unmatched.

Broadcasting

RAD has a broad portfolio of solutions well suited to the needs of broadcasters. These range from voice compression gateways, which are ideal for economically transmitting voice across limited and/or expensive satellite bandwidth, to multiservice access multiplexers, which are frequently employed to terminate the disparate types of communications used by broadcasters.

Healthcare

Medical imaging, telemedicine, regulatory compliance, pharmaceuticals management, and administrative requirements are placing a huge burden on existing communications and data networking systems. These activities necessitate high performance, real-time connectivity across multiple locations.

Manufacturing

Real-time collaboration with suppliers, videoconferencing, migration of shop floor control networks to Ethernet, and online linkages with parts manufacturers, are just a few examples forcing manufacturers to deploy the latest communication technologies.

Mining

Frequently situated in remote locations, ill-served by existing communications infrastructure, natural resource extractors need to build highly efficient communications network uplinks via satellite and/or wireless connections.

Corporate Connectivity over PSN Network
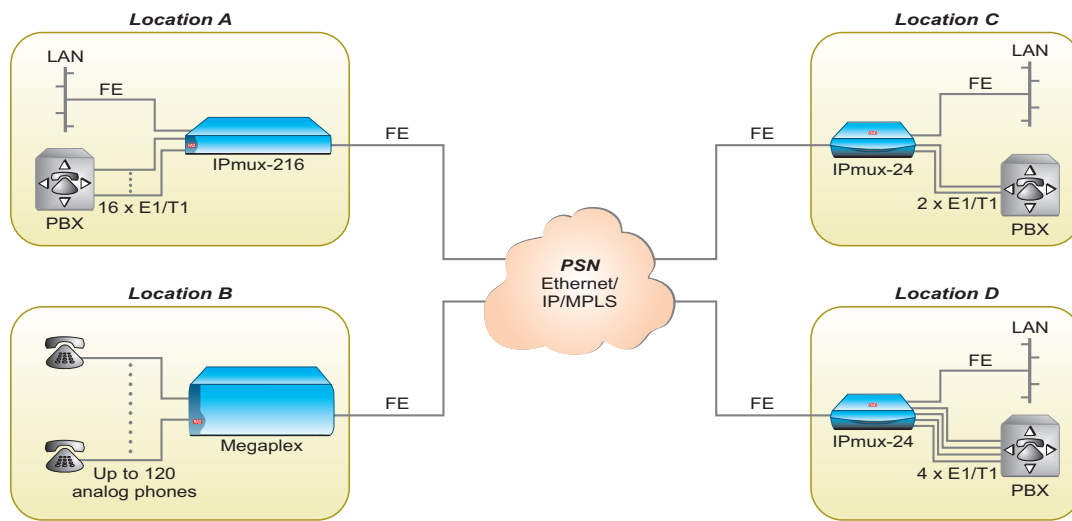
Description

Provides corporate connectivity for data and voice (analog and digital) over a leased Ethernet service.

Benefits & Features

• Uses low cost Ethernet service instead of PDH/SDH/SONET leased lines

• Same Ethernet service hand-off is used for both voice and data services

• Transparent voice connectivity maintains all PBX features seamlessly
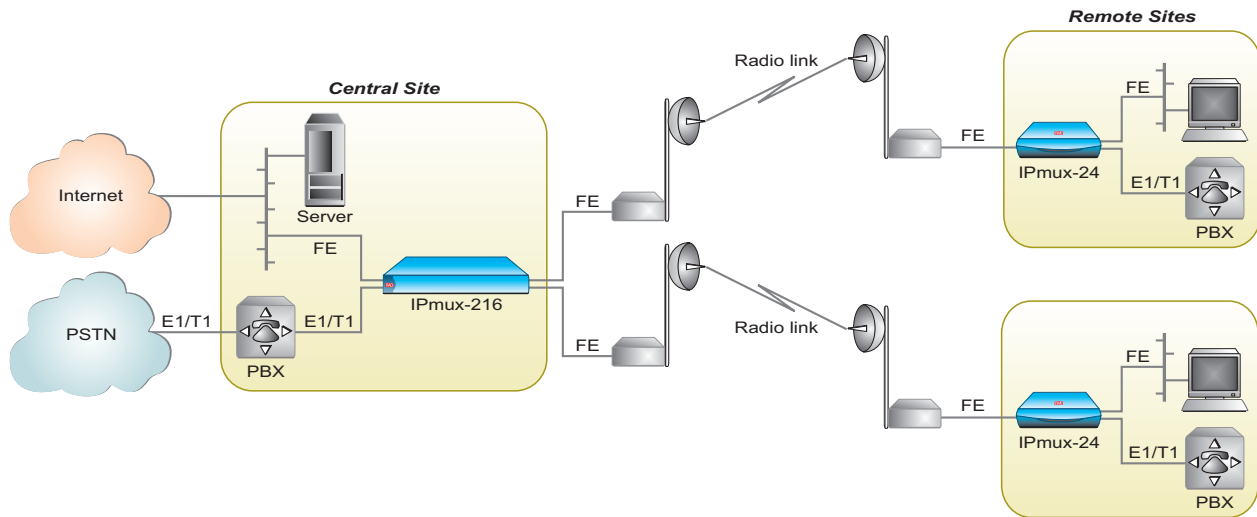
Product Finder

GOVERNMENT AND ENTERPRISE APPLICATIONS

E1/T1 Circuit Emulation and LAN Access over Fixed Wireless Links

Product Finder

**IPmux-24** — p. 174

IPmux-216 — p. 176

Description

Ethernet radios are simple, low cost communications alternatives to fixed lines or microwave for transporting LAN traffic. By deploying RAD's IPmux TDM pseudowire gateways, the Ethernet radio device can also be used to quickly deliver multiple E1 and T1 circuits along with Ethernet, resulting in fast payback.

Benefits & Features

- Delivers E1/T1 circuits using low cost Ethernet radios
- Supports up to four E1/T1 links
- High clock accuracy across the Ethernet links
- Small footprint
- Quick ROI

Connectivity for Municipalities and Government Institutions

Central Education Facility ... **Remote Schools**
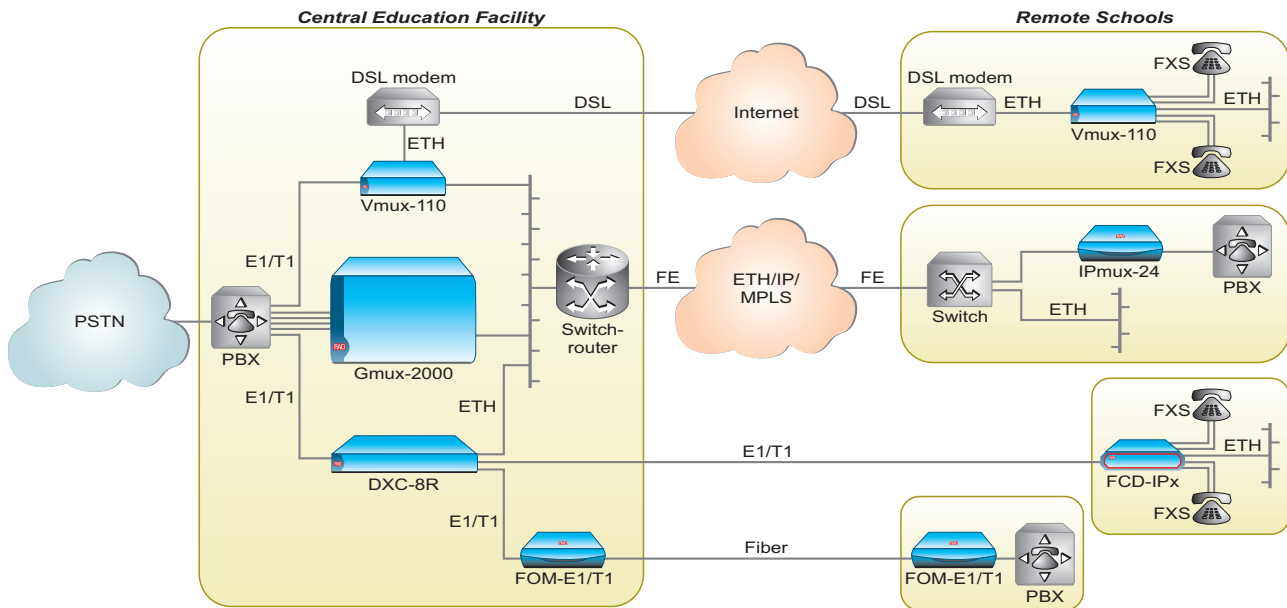
Description

TDM circuit emulation and compressed voice solutions enable municipalities and government institutions, such as school districts or public health authorities, to sensibly migrate their legacy voice and Ethernet services to more cost-effective packet switched networks (PSN), maintaining voice quality and optimizing bandwidth requirements on expensive segments.
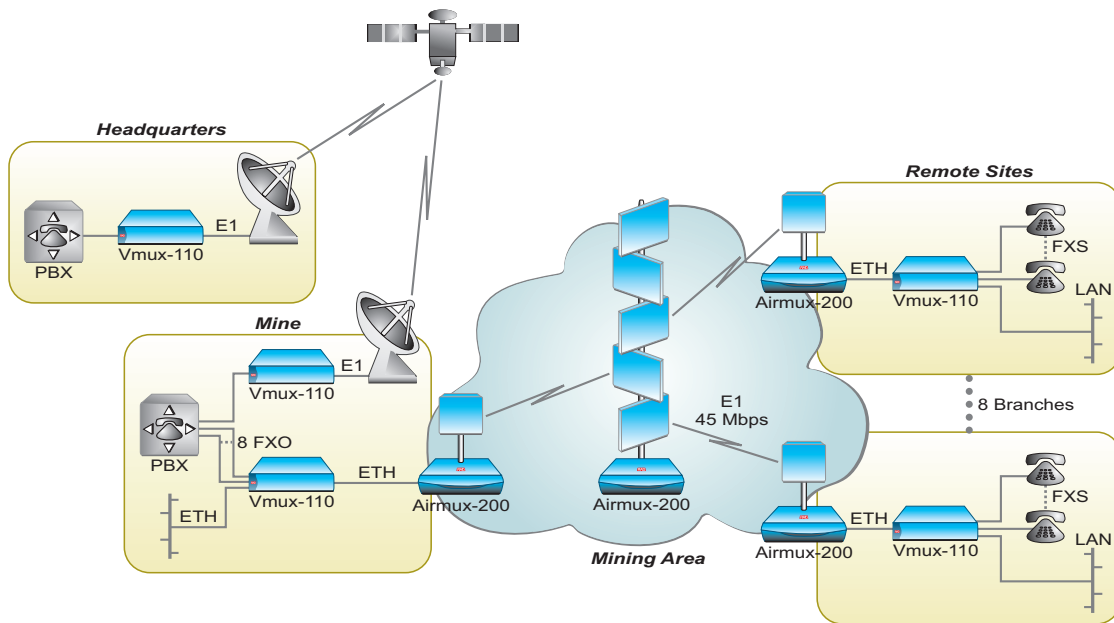
Benefits & Features

- Preserves investment in legacy equipment
- Sensible migration path to PSN
- Reduces leased line costs
- Transparent to all signaling protocols
- Toll-quality voice
- No staff retraining

Product Finder

DXC-8R	– p. 102
FCD-IP	– p. 114
FOM-E1/T1	– p. 133
Gmux-2000	– p. 182
IPmux-24	– p. 174
Vmux-110	– p. 155

Industrial Multi-Site Connectivity over Satellite and WLL

Product Finder

Airmux-200 — p. 149

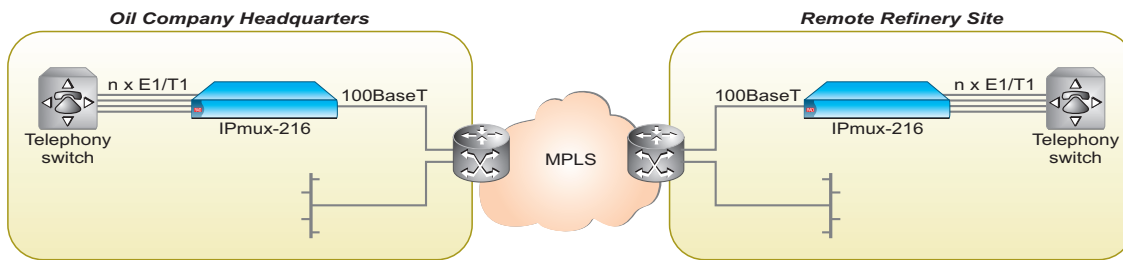**Vmux-110** — p. 155

Description

Providing voice services to remote or mobile platforms usually involves satellite and wireless Local Loop communications, which significantly increases OpEx. RAD's Vmux voice trunking gateways reduce the cost and increase the capacity involved in extending voice services over satellite.

Benefits & Features

- Significant bandwidth reduction (up to 16:1) translates to significant cost savings
- Preserves investment in legacy equipment
- Reduces leased line costs
- Transparent to all signaling protocols and telephony features
- Ideal for oil/gas, maritime, broadcasting, emergency response, and government/military communications

Enterprise Multi-Site Voice and Data Convergence

Oil Company Headquarters | Remote Refinery Site

n x E1/T1 — IPmux-216 — 100BaseT — MPLS — 100BaseT — IPmux-216 — n x E1/T1

Telephony switch | Telephony switch

Description

Multinational multi-site enterprises are increasingly using PSN infrastructures to carry their corporate data while still using legacy PSTN services to support inter-site voice connectivity at considerable expense. TDM circuit emulation services enable them to migrate voice traffic in a seamless fashion to their corporate data network, enjoying considerable net OpEx savings.

Benefits & Features

• Uses low cost Ethernet service instead of PDH/SDH/SONET leased lines

• Same Ethernet service hand-off is used for both voice and data services

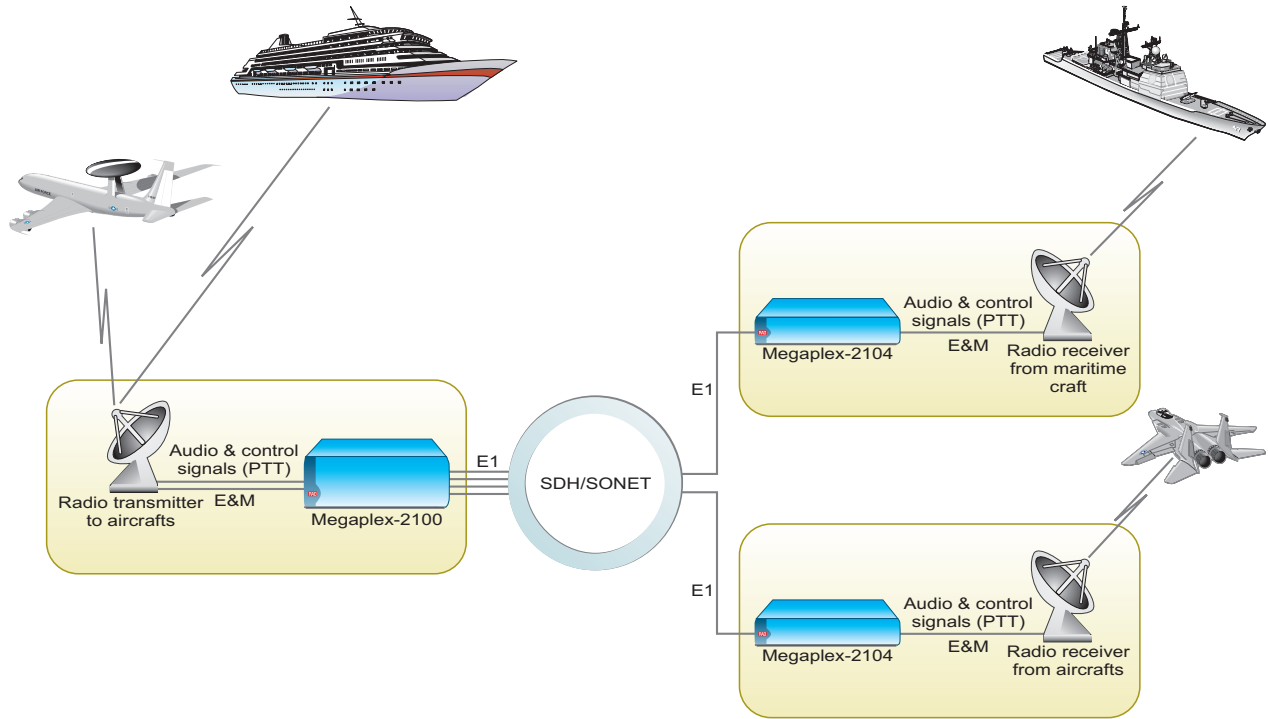• Transparent voice connectivity maintains all PBX features seamlessly

Product Finder

IPmux-216 – p. 176

Effective Radio Relays over Digital Networks

Product Finder

**Megaplex-2100** — p. 92

Megaplex-2104 — p. 92

Description

RAD's Megaplex multiservice multiplexers effectively support traditional VHF radio, as well as a multitude of data interfaces to bridge any geographical gap and relay critical radio and data transmission over digital transmission infrastructures.

Benefits & Features

• Supports VHF trunking and PTT applications

• Voice compression significantly reduces bandwidth utilization over expensive satellite links

• Ruggedized platforms withstand the rigors of field operations

Transporting TETRA Traffic over Any Media
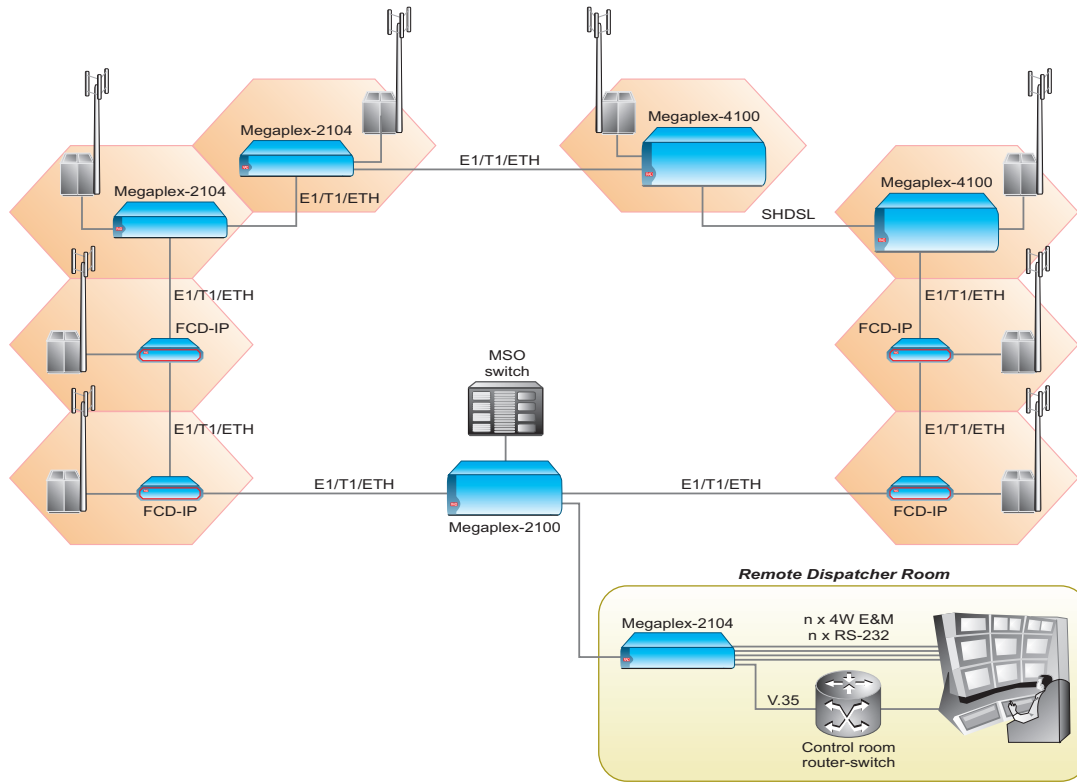
Description

Public safety and emergency organizations, as well as transportation and utility companies, can efficiently deploy resilient backhaul infrastructure for their TETRA applications over any media (wireless/fiber/copper). Where Ethernet or IP is used as the backhaul network, the above application can be implemented with TDMoIP gateways such as the IPmux family.

Benefits & Features

- Single-box solution for voice, low speed data and Ethernet services
- E1/T1 ring and Resilient Fast Ethernet Ring (RFER)* for quick self-healing transport layer
- Compact, easy to manage
- Different form factors for different node needs
- Covers TDM and packet-based solution

*With IPmux-24/IPmux-216

Product Finder

GOVERNMENT AND ENTERPRISE APPLICATIONS