RAD's Mobile Backhaul Product Portfolio

RAD
data communications

Intelligent Packet Backhaul for High Capacity Applications

Smart phones, bandwidth hungry apps, road warriors, and everyone's predilection for visual communications on-the-go have recently pushed the volume of mobile data traffic in mobile networks past that of voice traffic – even though industry analysts estimate that the number of 3G cell sites will only surpass the 2G installed-base in 2013. Mobile operators have responded to their customer's seemingly insatiable demand for data by ramping up their 3G networks to support 40 Mbps HSPA+ services, while initial commercial LTE deployments have demonstrated 100 Mbps downloads.

For mobile transport providers and wholesale operators, the explosion of data traffic requires a dramatic rethinking of their backhaul and transport network. According to *Heavy Reading*, only 3% of all cell sites today are served by Ethernet backhaul. This number is expected to jump to 33% in 2013. The migration to Ethernet is inevitable: the physical hand-off from 3G IP base stations and 4G LTE base stations is Ethernet, and Ethernet offers the industry's lowest-cost-per-bit economics. With the efforts of industry standards bodies such as the ITU, IETF and IEEE as well as the Metro Ethernet Forum and its members, Carrier Ethernet has become a reliable, resilient and high performance technology for transporting voice, real-time video and mobile broadband data with measurable SLAs.

RAD offers an incomparable mix of field-proven experience, technological leadership and best-of-breed product offerings to backhaul and aggregate multi-generation mobile voice and data services over converged packet-based networks or to connect remote bases stations to transport networks over bonded TDM, DSL, fiber, and wireless infrastructure.

RAD's Mobile Backhaul Value Proposition

RAD Data Communications is a prime contractor of mobile backhaul product solutions for Tier 1 fixed-mobile carriers and mobile operators, as well as for leading wholesale transport providers.

Field-Proven Experience

With nearly 100,000 cell-site gateways, mobile demarcation devices, aggregation hubs, wireless radios, fiber extenders, and DSL modems deployed around the globe, RAD offers incomparable know-how to backhaul 2G, 3G and 4G mobile traffic cost-effectively. RAD counts among its customer base leading cellular operators and mobile transport providers, such as CenturyLink, France Telecom/ Orange, Deutsche Telekom/T-Mobile, KDDI, KPN, Reliance, Softbank, TeliaSonera, and many others.

Technological Leadership

RAD's technological leadership in mobile backhaul began in 1999 when the company invented TDMoIP, the industry's first TDM pseudowire technology, and implemented a sophisticated clock recovery mechanism to ensure synchronization in a packet network. Since then RAD's engineers have authored and edited many of the industry standards for timing, synchronization and clock recovery. RAD is also a pioneer in system miniaturization, developing the industry's only System on an SFP, supporting both Ethernet over TDM and TDM pseudowire technologies, for insertion in popular routers and switches. An extension of this technological prowess is RAD's ASIC development capabilities, which includes TDM pseudowire and Carrier Ethernet. These chips are embedded in the company's own equipment and give RAD a technological and commercial advantage over other manufacturers dependent on third-party components or software-based processes.

Best-of-Breed Products

Specializing in innovative product solutions tailored to the backhaul and aggregation segment of the network, RAD established several firsts in the deployment of Timing over Packet technologies:

1st

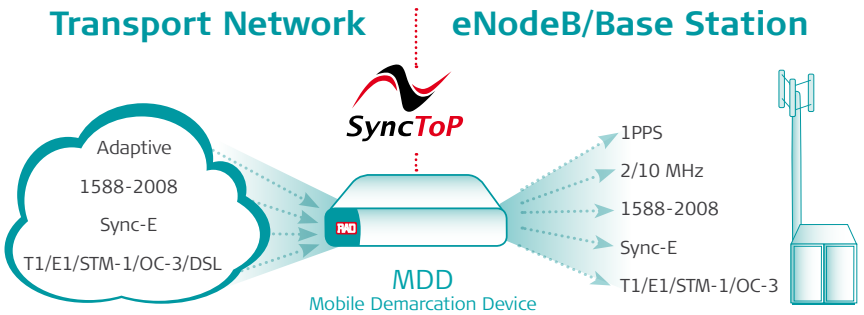
- **1st** vendor to begin mass deployment of mobile demarcation devices supporting Sync-E in a Tier 1 operator's network
- **1st** to demonstrate 1588v2 over live carrier traffic
- **1st** to demonstrate 1588-TC support

The industry as a whole recognized RAD's product excellence by awarding the company the GSM Association's 2008 Global Mobile Award for "Best Network Quality Initiative" for its cell-site gateways.

Solutions for Mobile Backhaul and Aggregation

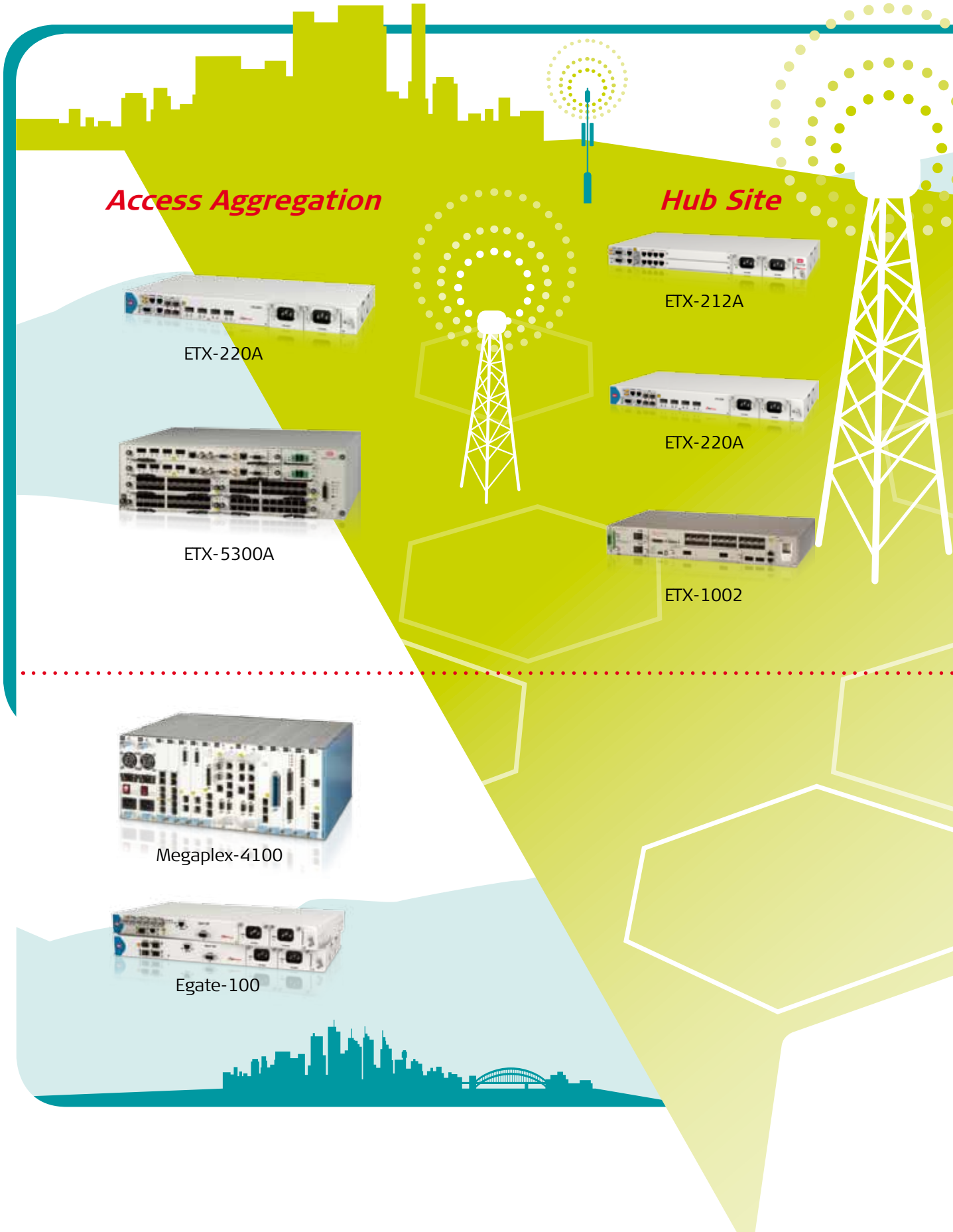
- Mobile Demarcation
- Cell-site Connectivity
- Hub-site Connectivity
- Copper/DSL Extension
- Fiber Extension
- Unlicensed Microwave Extension
- Ethernet over Bonded PDH/SDH/SONET

SyncToP Timing Synchronization Platform



- High performance clock recovery and distribution techniques
- Powerful frequency, phase and time of day alignment capabilities
- Timing synchronization technologies:
  - IEEE 1588v2 Precision Time Protocol: slave, master, 1588-TC
  - Synchronous Ethernet
  - NTR (network timing reference) over SHDSL
  - Adaptive clock recovery (ACR)

Mobile Backhaul Portfolio



Mobile Demarcation

ETX-203A

ETX-204A/ETX-205A

Cell-Site Gateways

LA-210

IPmux-24/4L

ACE-3220

Mobile Extension

ASMi-54

Optimux-108L/IPmux-4L

RICi-16

MiRIC MiTOP

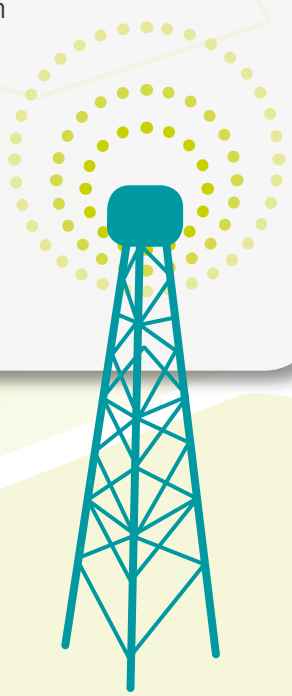
Powerful SLA Assurance and Availability Tools

- End-to-end performance monitoring and Ethernet OAM
  - IEEE 802.3-2005
  - IEEE 802.1ag
  - ITU Y.1731
  - Layer 1,2,3 diagnostic loopbacks
- H-QoS
- Circuit validation and throughput measurement per RFC 2544
- Standardized service protection and redundancy mechanisms: LAG (802.3ad), Ethernet Ring (G.8032), EVC protection (G.8031)

RADview EMS Management for Mobile Backhaul

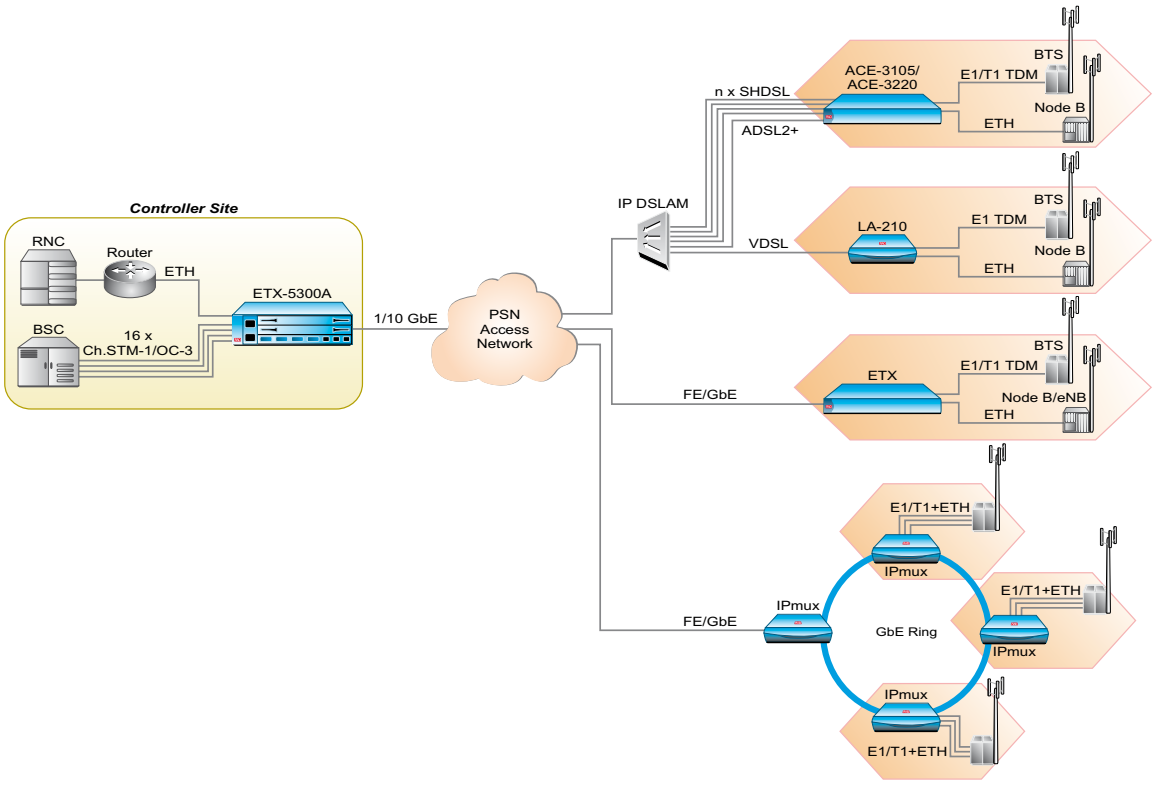
- Topology map
- Real-time device status
- Troubleshooting tools
- Interoperable with third-party NMS and leading OSS/umbrella systems
- Business Continuity (Hot Standby)

RADVIEW
Complex Networks Managed Smartly



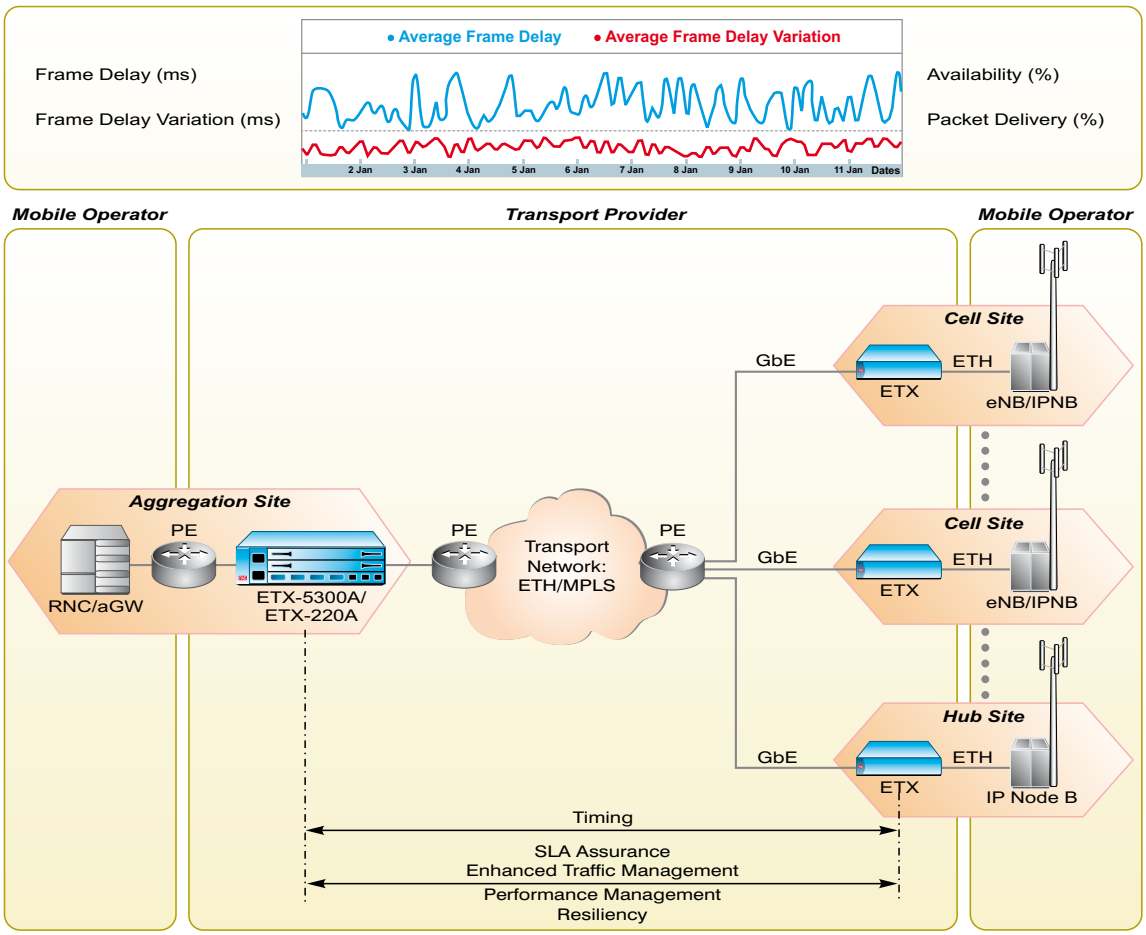
Applications

2G, 3G, 4G Backhaul



- Leverage low cost-per-bit next-generation packet transport (DSL, fiber) for 2G, 3G, 4G backhaul to support higher bandwidth availability while reducing OpEx
- Single platform for multi-generation traffic (TDM, ATM, IP) to allow a gradual migration to all-IP backhaul networks
- Robust timing and synchronization over packet with Sync-E and 1588v2 support
- Ethernet SLA-based quality of service and traffic prioritization per service
- Extensive TDM and ATM pseudowire capabilities for seamless 2G and 3G circuit emulation over packet

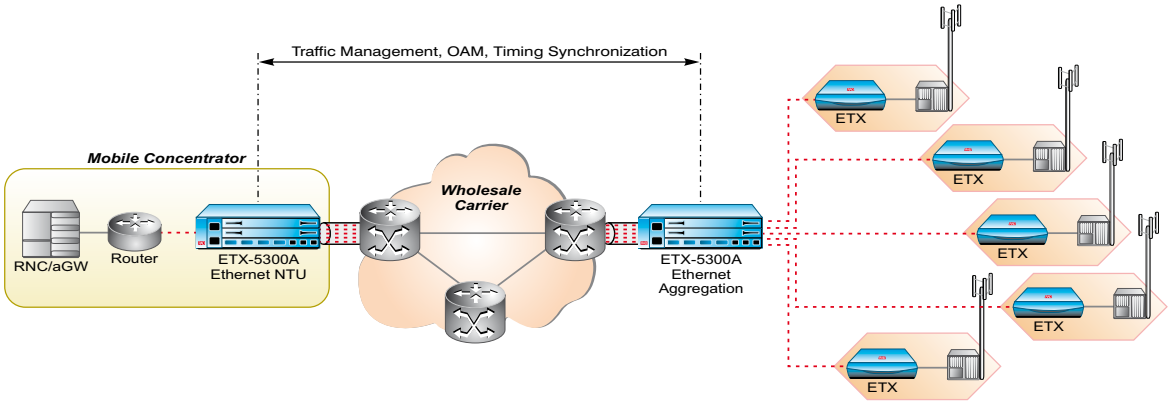
Mobile Demarcation



- Backhaul IP Node B and eNode B traffic over Ethernet, MPLS networks with end-to-end SLA assurance
- Powerful wire speed performance monitoring and fault localization capabilities
- MEF-defined Ethernet service features with hierarchical traffic management tools per flow
- SDH/SONET-like availability and resiliency with standards-based Ethernet linear and ring protection switching
- Extensive 1588v2 and Synchronous Ethernet support for frequency, phase and TOD (time of day) synchronization

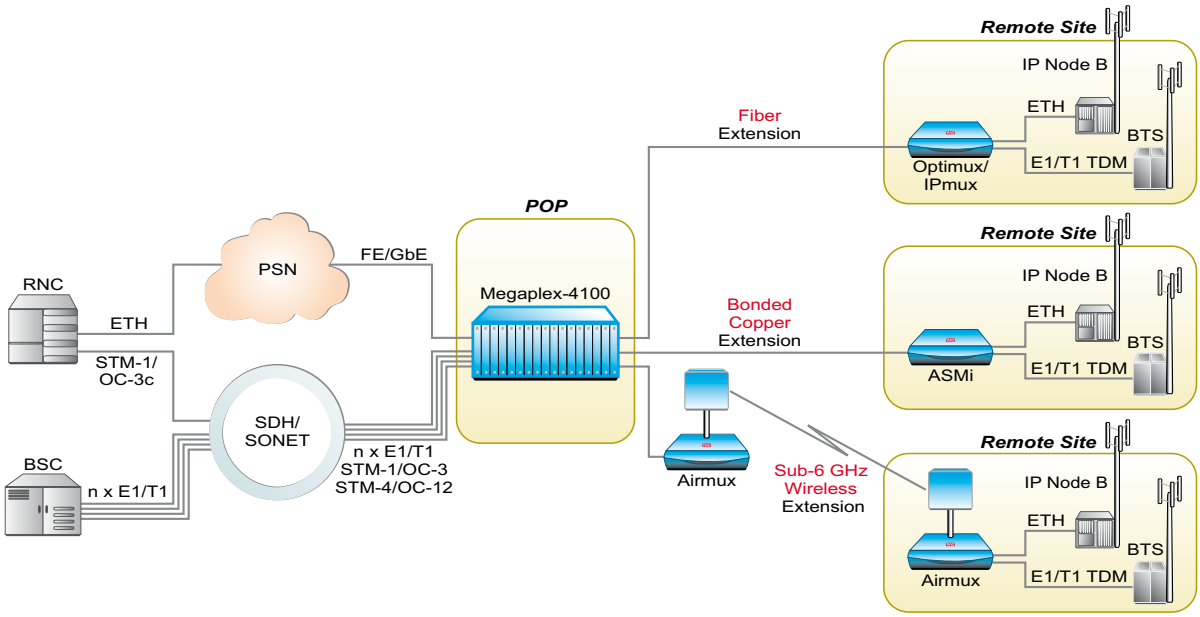
Applications

Mobile Aggregation



- Powerful 10G aggregation and demarcation platforms
- Carrier Ethernet MEF-compliant for:
  - MEF-9, MEF-14 E-Line, E-LAN, E-TREE services
  - MEF-8 PDH emulation
  - MEF-22 mobile backhaul
  - MEF-26 E-NNI
- SDH/SONET-like availability and resiliency with LAG and Ethernet Linear and Ring Protection Switching (G.8031, G.8032)
- Extensive Synchronous Ethernet and 1588v2 master and slave support
- TDM pseudowire support: CESoPSN, SAToP, UDP/IP encapsulation
- Comprehensive Ethernet OAM suite: 802.1ag and Y.1731
- Sophisticated traffic management for simultaneous processing of 1000s of multi-priority service flows

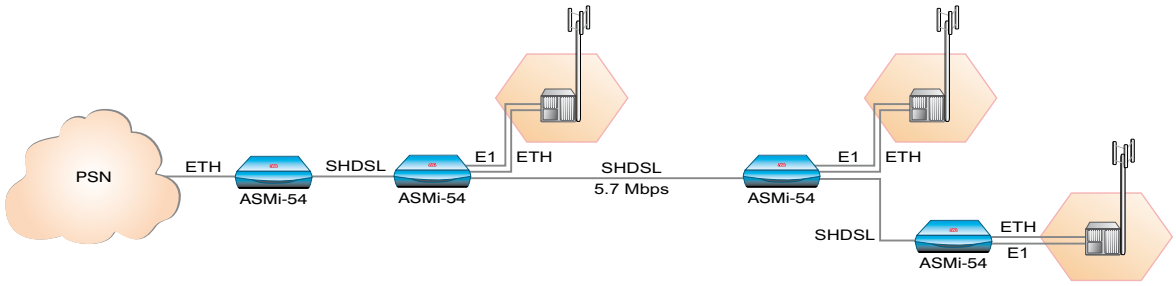
Mobile Extension over Fiber, Copper, Wireless



- Extend coverage to remote or underserved areas with affordable backhaul solutions over copper, fiber or wireless
- Connect multi-generation base stations over a single access link to reduce OpEx and Capex
- Point-to-point or point-to-multipoint service extension over fiber, SHDSL.bis and sub-6 GHz wireless links
- 100 Mbps over wireless and fiber or 22 Mbps over EFM bonded copper
- Service coverage assurance across difficult terrains and geographic barriers

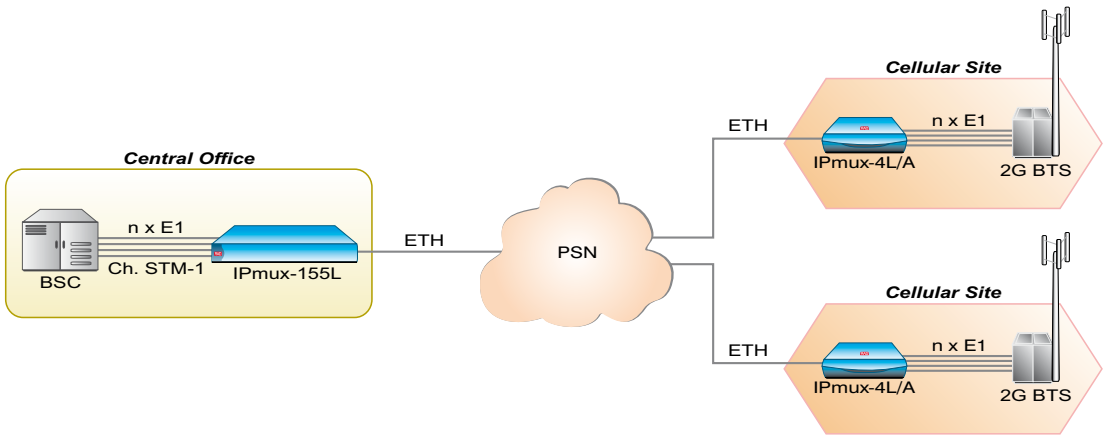
Applications

Mobile Extension over DSL



- Point-to-point TDM and Fast Ethernet extension over multiple SHDSL.bis lines
- 11.4 Mbps over 2-wire and up to 30 Mbps over 4-wire
- EFM bonding per 802.3-2005
- Ethernet bridging and routing
- VLAN prioritization and Ethernet QoS support
- Daisy chain or ring topology

Backhaul 2G/3G Traffic over PSN



- Economical service extension and low-cost aggregation over fiber and packet-switched networks
- Pseudowire technology allows TDM-served base stations to quickly and cost effectively connect over Ethernet
- Save on external synchronization sources by using built-in sync capabilities

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