RAD’s EtherAccess Carrier Ethernet Product Portfolio
for Business, Wholesale and Mobile Backhaul Applications
Your Single Source for Carrier Ethernet Solutions

Take advantage of RAD’s full end-to-edge platform:

- Complete Carrier Ethernet access ecosystem from a single source, including a choice of 1 Mbps to 10 GbE NTUs and high capacity aggregation
- Best-of-breed Carrier Ethernet capabilities to enable multi-CoS value added services with performance reporting
- Drive down OpEx with fault management and testing
- Reduce carrier TCO with cost-optimized design, multi-functional devices and service lifecycle management tools
- End-to-end visibility across wholesale and service provider networks
- Support network convergence with a common platform and management system
- Built-in pseudowire emulation capabilities allow continued support for TDM services
- Modular CPEs can be deployed for fiber, PDH and DSL access
- Timing synchronization expertise for LTE backhaul

**Market Segments**

**Retail Business Services**
- Inter-office connectivity, VPN, Internet access, storage, data centers
- Cloud connectivity

**Wholesale Services**
- Transport services for service providers
- E-NNI carrier-to-carrier services

**Mobile Backhaul**
- 2G, 3G, LTE backhaul
- CES, Timing over Packet synchronization
Addressing Carrier Ethernet Service Challenges

* Service Reach
RAD’s solutions enable the connection of in- and out-of-region customer sites over fiber, DSL, PDH, SDH/SONET, and wireless with uniform service characteristics and end-to-end SLA assurance.

* Robust Service Management
RAD’s EtherAccess product suite features built-in test-head functionalities with the full composite of service lifecycle management tools, including RFC 2544 testing, hardware-based Ethernet OAM, fault management, and L2 and L3 loopbacks, to cut down OpEx and minimize service turn up and performance monitoring challenges.

* End-to-End SLAs/QoS
RAD’s Carrier Ethernet solutions enable operators to reap the most benefits from Carrier Ethernet’s lowest cost-per-Megabit economics, by offering powerful traffic management capabilities as well as a full complement of performance monitoring and Ethernet OAM tools.

* Migration of Legacy Services
RAD’s Carrier Ethernet devices support TDM pseudowire tunneling, facilitating a smooth transition from PDH, SDH/SONET and ATM to new networks while preserving equipment and infrastructure investments for as long as it is economically feasible.

* Timing over Packet
RAD’s Carrier Ethernet access solutions are equipped with the SyncToP platform of high performance clock recovery and distribution techniques, to enable highly accurate delivery of real-time traffic over packet networks by eliminating built-in delay and delay variation impairments. Supported capabilities include Synchronous Ethernet, IEEE 1588v2 PTP TC, BC and Grand Master functionalities, as well as NTR over SHDSL and adaptive clock recovery (ACR).

* Service Resiliency
RAD’s demarcation and aggregation devices enable SDH/SONET-like performance with 802.3ad link aggregation protection, G.8031 Ethernet Linear Protection (EVC protection) and G.8032 Ethernet Ring Protection Switching for under 50 ms detection and recovery of physical and virtual circuit disruptions.

Managing the Service Lifecycle
Variety of Ethernet Access Solutions

**Ethernet Over PDH/SDH/SONET**

- **Branch**
  - FE/GbE
  - RICi
  - EoPDH

- **Branch**
  - ETX & MiiRIC
  - EoPDH E1/T1
  - E3/DS3 Ch.DS3

- **Branch**
  - RICI/ETX
  - n x EoPDH Bonding

- **Branch**
  - FE/GbE
  - RICi
  - STM-1/OC-3

- **Branch**
  - STM-1/OC-3
  - STM-4/OC-12
  - STM-16/OC-48
  - 3 x DS3

- **Egate**
  - SDH/SONET

**Ethernet Over DSL**

- **Branch**
  - 10/100BT
  - E1
  - n x SHDSL Bonding

- **Branch**
  - 10/100BT
  - SHDSL

- **Branch**
  - LA

- **Branch**
  - DSLAM

- **LA**
  - GbE

**Service Provider Packet Switched Network**

- **GbE/10G**

**Variety of Ethernet Access Solutions**
Ethernet Over Fiber

Network Operations Center

**RADview-EMS Management**
- Topology Map
- Network Inventory
- Real-Time Device Status
- Software and Configuration Management
- Troubleshooting Tools
- Business Continuity (Hot Standby)

**RADview-PM Performance Monitoring Portal**
- Actual Performance Metrics based on ITU-T Y.1731:
  - Frame delay (Latency)
  - Frame delay variation (Jitter)
  - Packet delivery ratio
  - Availability
- Threshold Management
- Report Generation
- Immediate Detection of Service Degradation
Applications
Mid-Band and High Speed Ethernet Services Using Fiber, DSL and Wireless

- Provide Layer 2 VPN (virtual private network) services to business users with consistent service attributes over fiber, SHDSL.bis and Wireless
- Up to 22.8 Mbps over EFM-bonded SHDSL.bis pairs and 10 Gbps over Ethernet fiber
- Deliver SLA-based Ethernet Private Line (EPL), Ethernet Virtual Private Line (EVPL) and Ethernet LAN (E-LAN) services
- Provision differentiated services across diverse access links with Ethernet OAM, performance monitoring and advanced traffic management capabilities
- Extend reach of Ethernet-based access to end users with cost-effective Ethernet radio
**IP DSLAM and WiMAX Backhaul over SDH/SONET**

- Provide broadband access by backhauling traffic from IP DSLAMs and WiMAX base stations over PDH and SDH/SONET transport with seamless hand-off to a packet switched network
- Seamless extension and aggregation of Ethernet/IP-based broadband services over TDM infrastructure

- Fast deployment of broadband services
- Reduce OpEx and CapEx by leveraging existing transport Infrastructure

**Ethernet Access over TDM Leased Lines**

- Utilize leased TDM lines to reach out-of-footprint customers for Ethernet services, while ensuring consistent service attributes and end-to-end SLA control across different networks and provider domains
- Extend Ethernet service reach over third-party networks without affecting user experience or service quality
- End-to-end service control and performance measurements using Ethernet service OAM to allow SLA verification across the access provider’s network

- Provide same service definition for on-net and off-net customers
- Higher bandwidth rates with Ethernet over NG-PDH/SDH encapsulation and bonding standards (GFP, VCAT, LCAS) ensures service quality with hitless restoration, flexible access, rate granularity, and multi-vendor interoperability
Applications

Ethernet Access Aggregation

- Aggregate SLA-backed, QoS-differentiated Carrier Ethernet services in access and metro networks, while ensuring high level of resiliency and reliability for effective network and service control
- Intelligent Ethernet demarcation and aggregation devices in hub-and-spoke or ring deployments
- Scalable 1-Gigabit and 10-Gigabit Carrier Ethernet fiber rings with sub-50 ms switchover protection for high availability and service continuity
- End-to-end management of EPL, EVPL, E-LAN, and E-Tree services
- True SDH/SONET replacement with hard QoS, Ethernet OAM and performance monitoring
Mobile Demarcation

- Backhaul eNode B traffic over Ethernet/IP/MPLS networks with end-to-end SLA assurance, performance monitoring and easy fault localization – right off the base station.
- Combine Ethernet demarcation functionalities with powerful clock transfer support to ensure service quality over packet transport
- MEF-defined Ethernet service features with hierarchical QoS per flow/service
- Five Nines (99.999%) availability and resiliency with Ethernet linear and ring protection switching

- Fast and reliable diagnostics with hardware-based OAM
- Extensive 1588v2, Synchronous Ethernet support for frequency, phase and ToD synchronization
- Terminate thousands of EVC flows using powerful high capacity aggregation device
- TDM capabilities for 2G support over the same network connection
**RAD's Carrier Ethernet Ecosystem: Products & Capabilities**

- Designed as MEF machines to deliver standardized E-Line, E-LAN and E-Tree services per MEF-9 and MEF-14 specifications, as well as MEF-22-based mobile backhaul applications and E-NNI support per MEF-26 for carrier to carrier connectivity; conforms to emerging CE 2.0 specifications
- The most sophisticated traffic management capabilities available, including multi-level hierarchical scheduling with policers and shapers per UNI, EVC and EVC.CoS to optimize bandwidth utilization while providing differentiated QoS to meet committed SLAs and predictable performance for multi-priority traffic
- Comprehensive set of hardware-based Ethernet OAM, fault management and performance monitoring tools per IEEE 802.3-2005, 802.1aq and ITU-T Y.1731. Built-in RFC-2544 tester capabilities and L2/L3 diagnostic loopbacks
- Full suite of standards-based timing and synchronization over packet attributes, including:
  - Synchronous Ethernet (Sync-E)
  - 1588v2 Precision Time Protocol master, transparent and slave clock with hardware-based timestamping as well as ToD (time of day, 1PPS) synchronization
- Extensive TDM pseudowire support: CESoPSN, SAToP, CESoETH (MEF-8), UDP/ IP encapsulation
- Carrier-grade service resiliency with LAG, Ethernet Linear and Ring Protection Switching: ITU-T G.8031, G.8032

**Ethernet over Fiber**

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<th>CPEs</th>
<th>ETX-203AX/AM</th>
<th>ETX-205A, ETX-204A</th>
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<tbody>
<tr>
<td>Fixed/ Modular Carrier Ethernet Demarcation Devices</td>
<td>Supports business, wholesale and mobile backhaul applications, incorporating Timing over Packet technologies and TDM pseudowire</td>
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- Cost-optimized for today’s business Ethernet services over fiber. Modular version fits any media for greater flexibility
- ETX-220A 10G Carrier Ethernet Demarcation Device
- High capacity demarcation device with carrier grade redundancy for 10 GbE services
- MiTOP-E1/T1/E3/T3 SFP TDM Pseudowire Gateways
- System on an SFP providing TDM connectivity for ANY Ethernet switch

**Aggregation**

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<th>ETX-1002</th>
<th>ETX-5300A</th>
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<td>10 Gigabit Carrier Ethernet Aggregation Switch</td>
<td>Ethernet Service Aggregation Platform</td>
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- Grooms up to 24 GbE connections into four 10 GbE links
- ETX-5300A Highest capacity-to-size ratio. Aggregates GbE and 10 GbE traffic plus TDM pseudowire for business, wholesale and mobile backhaul services
**Ethernet over TDM**

**CPEs**
- **ETX-203AX/AM**
  - Fixed/Modular Carrier Ethernet Demarcation Devices
  - Cost-optimized for today’s business Ethernet services over fiber. Modular version fits any media for greater flexibility
- **RICI-16/8/4**
  - Ethernet over Bonded PDH NTUs
  - For carrier-grade business services, backhaul and out-of-region connectivity over legacy infrastructure
- **RICI-E1/T1/E3/T3**
  - Fast Ethernet over PDH NTUs
  - Managed Fast Ethernet over TDM converters with QoS and diagnostics
- **MiRICi-E1/T1/E3/T3**
  - Miniature Ethernet to PDH Remote Bridges
  - Managed SFP Ethernet bridges with QoS, OAM, VLAN stacking

**Aggregation**
- **Egate-100**
  - Gigabit Ethernet over TDM Aggregation Gateway
  - Aggregation of Ethernet services over channelized STM-1/OC-3 or 3 x DS3
- **Egate-2000**
  - Gigabit Ethernet Aggregator over PDH, SDH/SONET
  - High capacity Ethernet over TDM aggregation up to STM-16/OC-48 for MEF-certified services

**Ethernet over DSL**
- **ETX-203AX/AM**
  - Fixed/Modular Carrier Ethernet Demarcation Devices
  - Cost-optimized for today’s business Ethernet services over fiber. Modular version fits any media for greater flexibility
- **LA-210**
  - EFM DSL Network Termination Unit
  - For business Ethernet services over bonded DSL copper

**Management and Performance Monitoring**
- **RADview-EMS Management**
- **RADview-PM Performance Monitoring Portal**

**RADview**
- Complex Networks Managed Smartly