



Carrier Ethernet

A New Era in Business Access



Ethernet Access Drivers

- Every enterprise vertical has highly scalable applications that have unpredictable, bursty bandwidths.
- Business services that converge both real-time voice/video and best-effort data thus requiring specialized traffic management to maintain quality.
- Service providers require the low cost access to fuel high bandwidth applications.
- Multi-site enterprises demand a mix of service sizes which leverage a range of copper, TDM and Fiber facilities.
- Common service and experience for end-users regardless of how or where they are connected to the network.

Drivers for Ethernet Access

Performance. Cost Optimization. Simplicity.

Carrier Ethernet is uncontested as a technology to access business customers. TDM, SONET/SDH and ATM are all giving way to Ethernet due to its performance, cost-optimization and operational simplicity. According to the Metro Ethernet Forum (MEF), Ethernet is the fastest growing service segment projected to generate over US\$ 40B in global revenue by 2015.

A vast array of enterprise verticals are benefiting from Ethernet access due to its ability to deliver flexible bandwidth at the lowest cost per bit delivered. However, it is not simply about flexible bandwidth at a low price point, it is more importantly about executing on IT strategies.

Key market sectors such as education, healthcare, finance, government and media all benefit from improved service scalability, performance and reliability to accelerate new application adoption, while reducing operational cost.



Education



Financial



Government



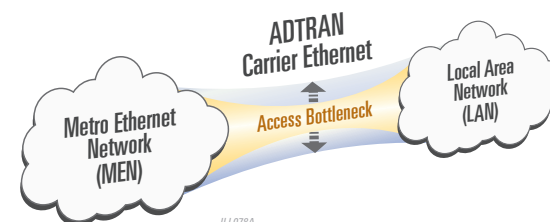
Healthcare



Retail

Evolving the Access Network

Both Enterprise and Small to Medium Enterprise (SME) local networks are growing to Ethernet speeds, as are the metro networks of service providers. The connecting access network must keep pace to avoid an access bottleneck.





Carrier Ethernet is not just about adding flexible bandwidth — it is about executing on new IT strategies:

- Mission-critical/Real-time Services
- Data Center/ Server Consolidation
- Remote Access/LAN Extension
- Video & Web Conferencing/Tele-learning
- Business Continuity/Disaster Recovery
- Mobile Backhaul

Enabling Ethernet in Every Network

As successful as Ethernet services have become, there are several key barriers slowing the adoption.

Ethernet delivery of fiber optic facilities, known as Ethernet over Fiber (EoF), is the deployment model of choice for most service providers. The reason for this high demand is due to the tremendous scale of EoF, which supports large service rates (10 Gbps or more) and can extend that service 80km or more. However, despite all the industry focus, and service provider investment in fiber optic access, its penetration to date is less than 25 percent in many regions. Fiber rollout could take decades to reach all of the customer locations that TDM/Copper access already reaches today. This is often referred to as the Fiber Gap.

100 Mbps and higher rate Ethernet services offer customers a lower cost per bit compared to legacy services such as those delivered over SONET/SDH. Businesses that demand higher speeds benefit from huge operational savings, which explains why 1 Gbps and 10 Gbps are the fastest growing Ethernet service rates. Inversely at lower speeds such as sub-10 Mbps rates, which over 90 percent of all businesses subscribe, Ethernet services are held back due to their higher tariff when compared to incumbent TDM services. 10 Mbps Ethernet still offer an improved cost per bit but overall these next-generation services may demand more monthly tariff compared to a TDM leased line. This is referred to as the Price Gap.

Similar to this price gap, a Small or Medium Enterprise (SME) may require 1 Mbps or less



bandwidth with a future demand for only 3 or 4 Mbps. The truth is many SME IT applications do not demand the high

bandwidth that Ethernet services traditionally deliver. This is called the Bandwidth Gap.

Because of these barriers to the adoption of Ethernet services, an Ethernet access deployment model that leverages all forms of customer access facilities (fiber, copper and TDM) allows network operators to deploy services to the largest addressable market. Cost-effective delivery of 1 Mbps up to 10 Gbps service rates can be achieved by leveraging the most applicable access facility. This is the key to growing high margin business services. At ADTRAN® we call this unique, universal service delivery model Ethernet over X (EoX).



Ethernet over λ

Accelerating the Adoption of Ethernet services.

Ethernet over λ : λ = Fiber, Copper, TDM and Wavelength λ

ADTRAN affords service providers the ability to remove network bottlenecks regardless of the access method available to the operator whether fiber, copper or TDM. Ethernet over Fiber access provides unmatched bandwidth and service reach while both Ethernet over Copper and TDM utilize improved data transmission standards to offer a similar value proposition as fiber, but with a lower cost of ownership.



“ADTRAN offers the broadest and most comprehensive product line on the market for access network migration”

—Frost & Sullivan.

Both on- and off-network solutions are needed to maximize the value of Ethernet services. The ADTRAN Ethernet solution suite allows for the universal delivery of Ethernet over a variety of physical connections — EoCu, TDM and fiber.

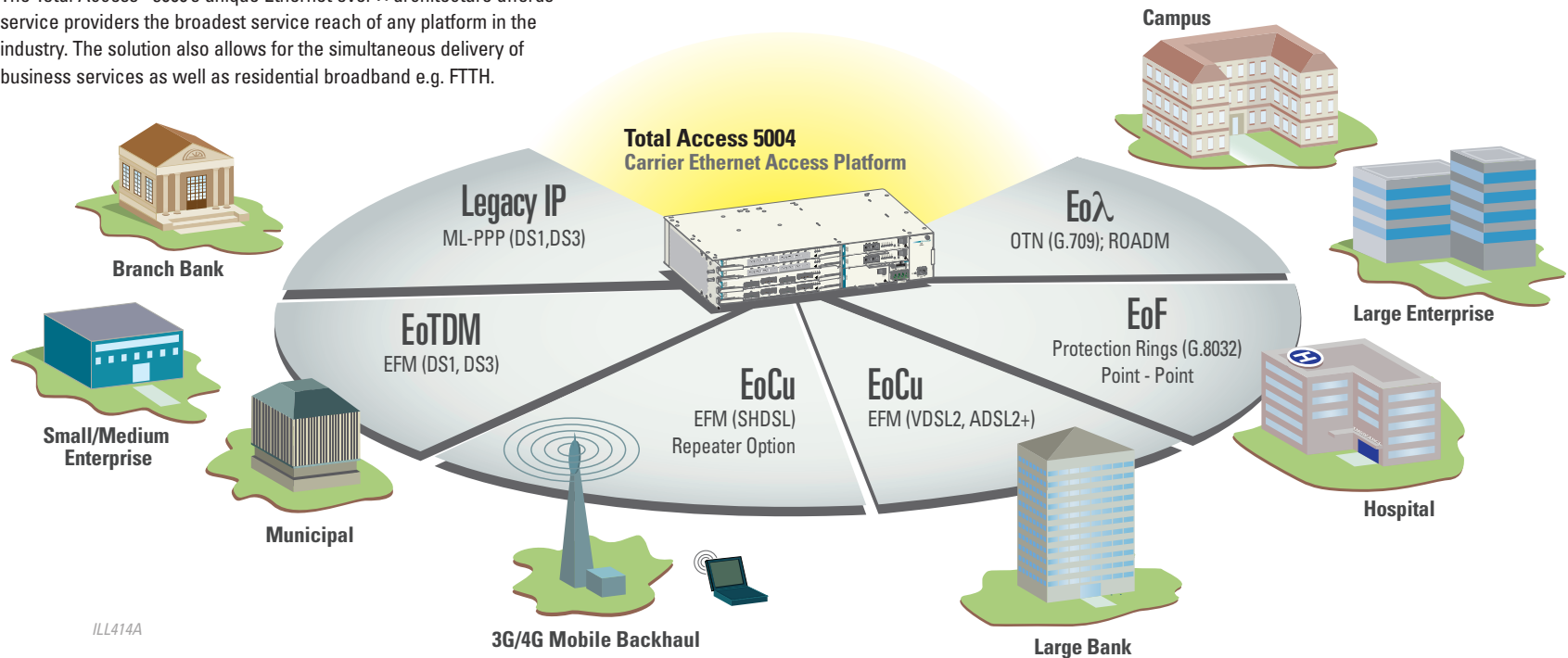
Attributes	Fiber (F)	Copper (Cu)	TDM	Wavelength (λ)
Key Value	Highest scalability	Lowest cost of ownership	Shortest sales cycle, time to market.	Highest scale, greatest reach
Applicable Service Rate	10M to 10 Gbps service delivery	Sub-1M to 100 Mbps service delivery.	Sub-10 Mbps and even 100 Mbps services delivery.	1G—10 Gbps service delivery
Key Vertical Segment	Large Enterprise buildings, campuses, wholesale services to other service providers	Branch offices and off-fiber services delivery	For Off-net locations where TDM leased services must be used	Service aggregation/backhaul and wholesale services
Typical Customer Reach	Up to 80km reach from point of presence (PoP) to customer site.	500m to 15km reach from point of presence (PoP) to customer site.	Any site that TDM services are offered. Hint: All customer sites.	Near unlimited reach using Packet Optical Transport Systems (P-OTS)



The challenge to extend Ethernet services in a cost-effective way is met using innovative solutions that bring all access deployment types back through a common aggregation platform.

Universal Service Delivery

The Total Access® 5000's unique Ethernet over X architecture affords service providers the broadest service reach of any platform in the industry. The solution also allows for the simultaneous delivery of business services as well as residential broadband e.g. FTTH.



ILL414A



ADTRAN extends the delivery of Ethernet services beyond copper-based access facilities and allows service providers the option to deliver Gigabit speeds to customers over optical facilities.

Ethernet over Fiber Extending the service reach.

- **Increasing service bandwidth and spanning greater distances**
- **Enabling deployments for next-generation networks**
- **Providing flexible, resilient services with inherent protection**
- **Simplifying the delivery of a universal service by using a common operational method**

ADTRAN extends the delivery of Ethernet services beyond copper-based access facilities and allows service providers the option to deliver Gigabit speeds to customers over optical facilities. Optical Ethernet is a preferred means of deploying Ethernet services to the last mile. This technology spans greater distances with a thinner, lighter, more flexible deployment than other mediums. Also known as Ethernet over Fiber (EoF), this solution offers inherent protection and resiliency while enabling higher bandwidths to reach greater distances. These deployments are commonly supported on bandwidths up to 1 Gbps and for distances up to 80km. Thus making EoF the preferred method for upgrades in the network infrastructure. The Operation, Administration,

Maintenance (OAM) and Fault, Configuration, Accounting, Performance, Security (FCAPS) capabilities and processes will be virtually transparent between ADTRAN Ethernet over Copper (EoCu), Ethernet over Time Division Multiplexing (EoTDM) and EoF solutions. This will significantly reduce the operational impact of upgrading access facilities as customer access requirements change due to bandwidth demand; fiber supply and lease line/fiber costs; or requirements to deliver transparent service between business locations that do not share the same type of access facilities. With the integration of EoF in the Total Access 5000 and NetVanta® 8000 platforms, ADTRAN offers a scalable solution that supports service migration as providers continue to examine the customer demand for greater bandwidth. As wireless needs continue to grow, EoF is an ideal transport method for mobile backhaul networks, as well as enabling long-haul reach to residential and business networks.

NetVanta 8044

Ethernet over Fiber Termination with four 10/100/1000BaseT as well as four Gigabit interfaces via SFPs.



Award-winning NetVanta 8044M

ADTRAN's award-winning NetVanta 8044M, recognized by Frost & Sullivan.



NetVanta 838

Enhanced Protection and NetVanta 838 Outside Plant (OSP) versions allow for EoCu deployments in uncontrolled environmental conditions.



NetVanta 832 and NetVanta 838

Used for EoCu network termination, bonding together up to two or eight e.SHDSL pair respectively (four-pair option also available).



NetVanta 832T, 834T and NetVanta 838T Cost-effective EoCu network termination, bonding together up to two, four or eight e.SHDSL pair respectively. AC local powered.

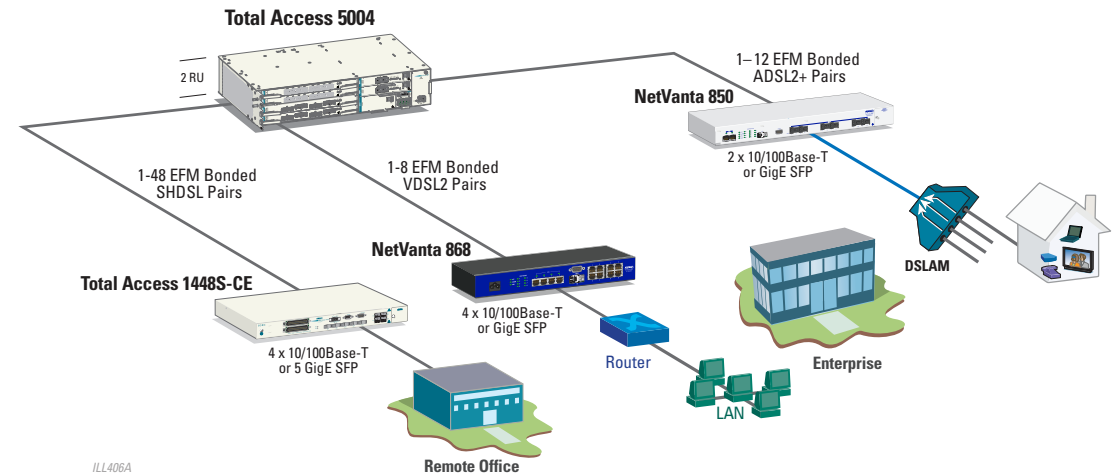


NetVanta 868 and 850 Network termination element for 100 Mbps service deliver using innovative EFM VDSL2 bonding. Device bonds up to eight access pairs and is AC local powered, providing both electrical and optical Ethernet interfaces.



Ethernet Service over Copper Access Delivering 100 Mbps+ services at the lowest cost.

Ethernet over Copper and TDM utilize improved data transmission standards to offer a similar value proposition as fiber. These advanced standards include ITU-T G.998.2 and IEEE 802.3ah, known as Ethernet in the First Mile (EFM), which defines a universal way to effectively bond together lower bandwidth TDM circuits or dry copper loops (pairs of wires), creating a higher speed Carrier Ethernet access connection. The ADTRAN Ethernet solution suite fully leverages these standards as well as other unique Carrier-class innovations to allow service providers to deliver better services to more customers—sooner.



The solution allows service providers to extend Gigabit Metro LAN and Ethernet Private Line services to enterprises that previously could only offer basic, lower rate Business DSL and VoIP service.

ADTRAN EoCu delivers rates 6x higher than typical EFM services and 4x more than Business DSL. Enterprises of all verticals may benefit from Gigabit Ethernet service levels to accelerate next generation applications and services, regardless of their proximity to fiber access.



A photograph of two stacked QSC QSR12 power amplifiers. The top unit is clearly visible, showing its front panel with two large blue cooling fans, a digital display, and various control buttons and ports. The bottom unit is partially visible behind it. The amplifiers are silver-colored with black accents.

Total Access 5000

Metro Ethernet & IP Core

Total Access 1448S-CE

Total Access 1424S-CE

Total Access 1448S-CE

Total Access 1424S-CE

NetVanta 83xT

NetVanta 83xT

DSLAM

DSLAM Backhaul

Enterprise

Remote Offices

Labels in diagram include: GigE, Up to 4 subtended GigE uplinks, 1-48 EFM Bonded SHDSL Pairs, 1-24 EFM Bonded SHDSL Pairs, 4 x 10/100Base-T or 5 GigE SFP, Up to 48 EFM Bonded SHDSL pairs, 4 x 10/100Base-T, and 4 x 10/100Base-T.

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ADTRAN's management solution provides decision support system functionality to complement or provide OSS functionality.

Automating and Enhancing Service Management

Reducing Operating Expense

ADTRAN Advanced Operational Environment (AOE) allows network operators to save time and money. AOE services management solutions transform the traditional operational environment from an equipment configuration and provisioning paradigm to a service-oriented one that supports the service providers' everyday business operations. Hardware tasks have been automated within ADTRAN's services management solutions, greatly reducing the training and equipment knowledge required of customer service representatives and technicians.

Simplify OSS integration

From service activation and troubleshooting to network planning, AOE simplifies operational tasks. ADTRAN's advanced management applications simplify these tasks through either an intuitive web interface or a flexible machine interface to existing billing, provisioning, equipment and cable records systems, enabling automated provisioning and records maintenance. Web access is secure and requires only an Internet browser with Java; no client is required.

Simplify OSS integration

Service activation and diagnostics operate at a variety of operational levels to provide improved network and service visibility. AOE operates throughout multiple layers of the service including the physical and logical layers, ensuring the greatest possible visibility regarding the health and performance of the service. Whether it is Carrier Ethernet, IPTV, VoIP, Internet, Circuit Emulation or any service deployed from the ADTRAN access system, ADTRAN's services management solutions will verify the correct provisioning and performance of the circuit as well as prescribe corrective actions if problems arise.

ADTRAN's services management solutions incorporate expert-based system logic resulting from our years of field experience and technology development. By integrating this high level logic into the management system, ADTRAN offers the service provider an integrated way to capture and retain network knowledge and put it to use in the decision and diagnostic elements within the system.



With the click of a button, easily provision and troubleshoot the network with integrated dashboard functionality.



ADTRAN's customers rely on our ability to address operational challenges associated with business-class service delivery and to utilize existing assets, including equipment, OSS, technician expertise, and established processes and procedures.

A Carrier-class Solution

The Ethernet service essentials.

Service Assurance—Quality and Resiliency

ADTRAN incorporates the Ethernet resiliency and redundancy features necessary to support high-availability business services. ADTRAN's Ethernet solutions offer redundant common control with standards-based uplink redundancy mechanisms to the Metro Ethernet network. Additionally, ADTRAN's AnyPort™ bonding feature allows Carriers to bond pairs/circuits across multiple card slots. Using standard EFM protection mechanisms, both facility and card level protection is supported, providing maximum resiliency for high-availability business circuits. ADTRAN products also provide specialized service protection in uncontrolled environmental conditions.

The NetVanta 800 Series delivers packet flow capabilities certified compliant per the MEF. These packet flow capabilities offer traffic classification and bandwidth profiling that is required to offer customers a flexible, tiered service offering. In addition to this highly configurable QoS toolset, the solution supports standards-based measurement and monitoring capabilities required to maintain a Carrier-grade, SLA-based Ethernet service. ServiceMonitor is a non-service affecting tool which provides proactive reporting of customer bandwidth SLA compliance and Y.1731 OAM PM statistics. CapacityManager is an early warning tool, which reports the percent utilization on the Ethernet aggregator uplinks.

Service Delivery Simplification

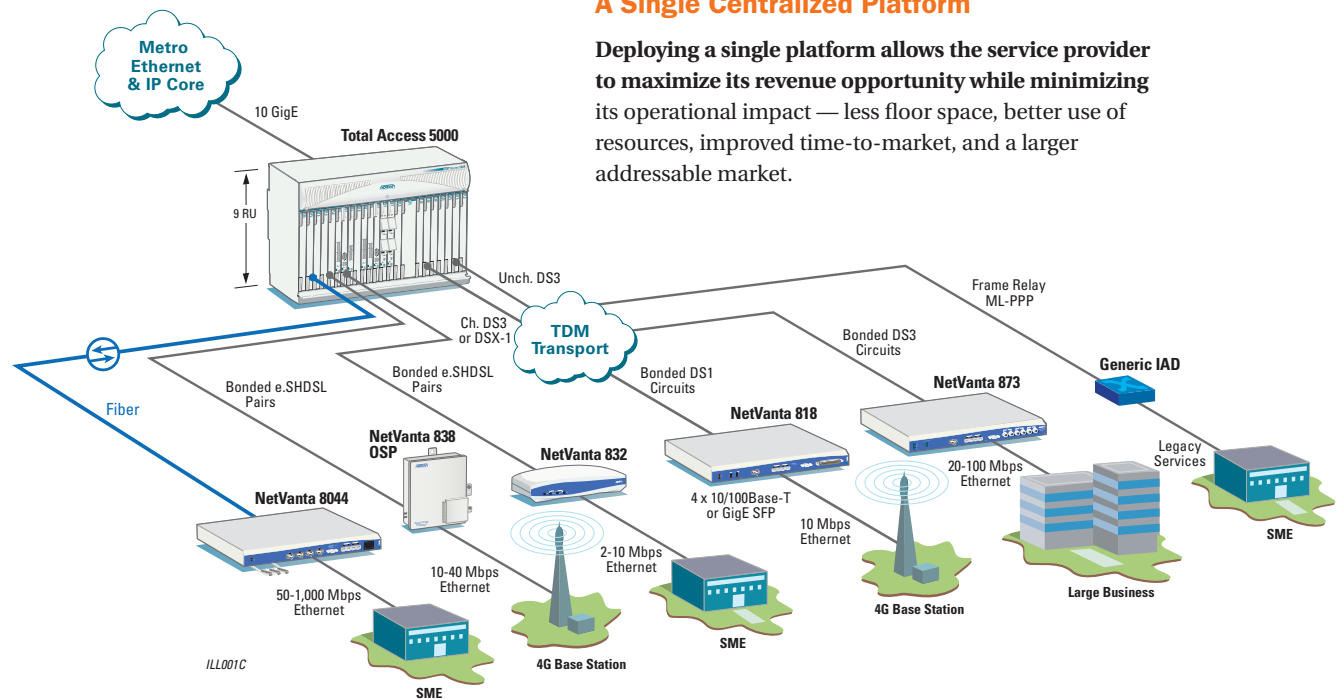
ADTRAN, as a key player in the successful deployment of Carrier Ethernet services, supports more than just a full-featured and cost-effective hardware solution set. Carriers must deploy service delivery solutions which minimize the operational costs associated with end to end service activation, assurance and diagnostics. ADTRAN solutions do this. ADTRAN is known for innovative Carrier Ethernet operational tools like TScan™ loop diagnostics and EZ service provisioning which minimize operational expenses. These same tools have now been incorporated in the innovative ADTRAN Advanced Operational Environment (AOE), Services Management Platform as value added software products. ServiceActivator is a simplified service turn-up tool which leverages service templates created in ServiceDesigner to minimize the interaction and time required for service activation. Automated provisioning functions are supported via the AOE OSS GW, which supports TL1 and XML interfaces. ServiceCheck makes use of ADTRAN's extensive real-world knowledge and experience in outside plant architectures and issues to provide comprehensive physical and logical layer diagnostics up through the service or application layer with the option to run TScan on trouble loops. These operational tools enable carriers to confidently deploy ADTRAN solutions in large scale, providing carriers with best-in-class OPEX and CAPEX solutions for business Ethernet services.



ADTRAN solutions extend LAN applications, voice, video, data, and Internet access across an all-Ethernet, end-to-end network.



ADTRAN offers both ANSI- and ETSI-based chassis options designed for Ethernet deployments delivering to dozens or even hundreds of customers.



A Single Centralized Platform

Deploying a single platform allows the service provider to maximize its revenue opportunity while minimizing its operational impact — less floor space, better use of resources, improved time-to-market, and a larger addressable market.



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