

## **ANEXOS**

Se anexan a este informe, las hojas de especificaciones de los equipos “*Ethernet Service Uni 1850*” y “*Metro Ethernet Routing Switch 8600*” del fabricante NORTEL, designados para la implantación de la red MetroLAN NetUno.

# >THIS IS THE WAY

SERVICE PROVIDERS CAN DELIVER CARRIER  
ETHERNET TO THE MASSES

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## Product Brief

### Nortel Metro Ethernet Services Unit

*Infrastructure for aggregating the next-generation IP services*

#### Metro Ethernet Services Unit benefits

- > As the delivery point for Ethernet and IP-based services at the edge of the service provider network, the Ethernet Services Unit effectively supports Internet access, video transport, Ethernet Virtual Private Network service and other applications for multiple customers on one physical device
- > Enables an Ethernet-over-dark-fiber access ring topology that achieves 50ms recovery, supporting up to 14 units per ring to maximize bandwidth utilization and network reliability
- > Compact and cost-effective platform delivers multiple classes of service, prioritization, rate enforcement and statistics collection features that are critical for the delivery of profitable Ethernet VPN and residential "triple play" services and meeting Service Level Agreements (SLAs)
- > Integrated end-to-end VPN Continuity Check ensures service is up and running at all times and that SLAs are met, while SNMP and other Metro Ethernet management applications simplify operations and reduce expenses

As service providers strive to generate revenues, the promise of delivering services on a converged Ethernet infrastructure is enticing. Offering IP-based services, such as triple play, is even more compelling given the interest from service providers and end users alike. With the higher levels of bandwidth that can be supported at more granular service rates, implementing Ethernet and IP-based services across a shared infrastructure allows service providers to drive revenues while distributing costs across many more customers. Additionally, the operational simplicity that Ethernet affords simultaneously helps reduce ongoing expenses.

What is still required is an element for the network edge that can economically provide several key service attributes.

These include: a point of demarcation between provider and customer; the rate enforcement, classification and prioritization features to support differentiated service levels; and complete management capabilities that simplify network operations. Additionally, the means to assure service integrity and availability is necessary for service providers to build and support strict SLAs.

Because so much of the service provider's capital equipment investment is incurred at the edge — often 60 percent or more — features need to be delivered in a cost-effective, yet flexible, platform located at the customer premises.

Nortel's Metro Ethernet Services Units are Ethernet switches designed for use as Customer Located Equipment (CLE) at the edge of the service provider network as part of a service-oriented Ethernet infrastructure. The Metro Ethernet Services Unit provides a compact and cost-effective solution that is easy to deploy and use. It delivers wire-speed performance along with the rate enforcement, classification, QoS/prioritization and statistics collection features that are critical for the delivery of profitable Ethernet services. It also helps providers meet the SLAs required by their end customers for all manner of services, including the all-important triple play.

The Metro Ethernet Services Unit 1800 has 24 10/100Base-T Ethernet customer facing ports and two Gigabit Ethernet

network facing ports (SFP GBIC-based or fixed LX), which combine to provide flexible Ethernet service delivery in a 1U-high solution. The non-blocking architecture provides wire-speed switching for uncompromising performance.

The Metro Ethernet Services Unit 1850 has up to 12 10/100/1000Base-T or SFP GBIC ports. The base unit has four ports shared by 10/100/1000Base-T and by SFP GBICs. Two of these four ports act as Network-Network interface (NNI) ports for connection into the service provider network via a GE access ring. The base unit is expandable with two MDA slots — for four-port 10/100/1000Base-T MDAs and/or four-port SFP MDAs.

Packet classification based on 802.1p and DiffServ Code Points allows service providers to offer tiered services with QoS to end customers profitably. Rings allow the cost of the aggregation switch's port to be shared by multiple sites and customers. However, the Metro Ethernet Services Units can be connected one to a ring to provide unshared bandwidth to a single site while keeping the 50ms resiliency.

The Metro Ethernet Services Unit, in combination with the Nortel Metro Ethernet Services Module 8668 in a Metro Ethernet Routing Switch 8600, allows service providers to deliver an Ethernet access ring solution that delivers sub-50ms resiliency and highly-efficient bandwidth aggregation in a

switched Ethernet-over-fiber infrastructure. Additionally, the Metro Ethernet Services Unit supports:

- › Multiple services (e.g., Internet access, Ethernet VPN, VoIP, etc.) per physical access interface for maximum revenue generation
- › Multiple classes of services for prioritization and traffic management required to offer and meet strict SLAs
- › End-to-end service management including tools to support performance monitoring, service assurance and SLA measurement

## Ethernet Access Ring Resiliency

Ethernet Access Ring Resiliency delivers industry-leading reliability and highly efficient aggregation for an Ethernet-over-fiber solution. With the ability to be configured in an access ring topology (supporting up to 14 Metro Ethernet Services Units per access ring), sub-50ms recovery can be achieved.

The Nortel Metro Ethernet Services Module 8668 for the Ethernet Routing Switch 8600 acts as the “headend” node. In the event of a link or node failure in the ring, traffic will be directed to the alternate path and recover in 50ms. This capability, previously available only in SONET or WDM implementations, allows service providers to protect the most vulnerable part of the network with a cost-effective solution.



Enterprise customers are demanding flexible service rates, at intervals lower than the full rate of the interface (e.g., 25 Mbps on a 100-Mbps port). If the access infrastructure is constructed in a point-to-point fashion, there is a greater likelihood that the Gigabit Ethernet uplink from the CLE device to the central office device will be severely under-utilized. The Ethernet access ring capability enabled by the Metro Ethernet Services Unit and the Metro Ethernet Services Module 8668 provides an aggregation network that efficiently utilizes the infrastructure investment.

### Multiple services per access port

Service providers today seek top-line growth and must maximize revenue generation. The ability to deliver multiple services to each customer while leveraging the same infrastructure helps do just that. Additionally, the cost efficiency of delivering triple play services using a single, multi-service port extends beyond revenue generation and limits capital expenditures as well as operational costs that often comprise 80 percent of the network's total cost of ownership.

The Nortel solution allows service providers to deliver more than just Ethernet connectivity service over the Metro Ethernet infrastructure. It enables providers to offer value-added services that enterprise customers are demanding. End customers can maintain the VLAN schemes used in their own networks, yet still access different services offered by the service provider — all enabled by the same Ethernet interface of the Metro Ethernet Services Unit. Simply put, service providers are able to leverage a lower-cost, shared network infrastructure across multiple customers and offer consistent services and SLAs.

## Key features and benefits

*Table 1 defines Metro Ethernet Services Unit key features and associated benefits.*

**Table 1. Metro Ethernet Services Unit 18xx features and benefits**

Feature	Benefits
<b>Ethernet Access Ring Resiliency</b>	Enables ring-based deployment of Metro Ethernet Services Unit, achieving 50ms recovery in an Ethernet-over-fiber implementation; supports up to 14 nodes per access ring for efficient access aggregation.
<b>IEEE 802.1Q/p and IETF DiffServ</b>	Enables the service provider to offer multiple classes of services, e.g., gold, silver and best effort, etc. and tiered services with appropriate prioritization.
<b>VPN Continuity Check</b>	Couples with Metro Ethernet Services Module 8668 to provide tools for performance monitoring, service assurance, SLA measurement and troubleshooting.
<b>Packet classification</b>	Flexible classification based on: port, port + VLAN, port + VLAN + 802.1p bit, port + DSCP, and port + 802.1p combinations. Also support filtering based on source/destination IP address, TCP/UDP source/destination port and destination MAC address.
<b>Granular rate enforcement</b>	Supports rate enforcement of Customer Information Rates (CIRs) and burst window sizes, where packets can be policed in user configurable 1-Mbps increments from 1 Mbps to line rate. Policing parameters can be set on various combinations, including: per port, per port per VLAN, per port per VLAN per 802.1p bit, per port per DSCP, and per port per 802.1p basis.
<b>Network management</b>	Command Line Interface, RADIUS authentication and accounting (1800 only), SNMPv1/v2 and management applications including: Java Device Manager, Product Service Provisioning, Multiservice Data Manager and Optivity* Network Management System provide ease of management and flexibility to adapt to multiple operational environments and provide comprehensive Ethernet service provisioning, fault management and performance monitoring capabilities.
<b>RMON</b>	Supports four groups of RMON including Statistics, History, Alarms, Events from remote monitoring and operational simplicity.
<b>IGMP v1/v2</b>	IP multicast support by examining (snooping) all IGMP traffic in hardware at line rate and pruning unwanted data stream from affecting network or end-station performance.

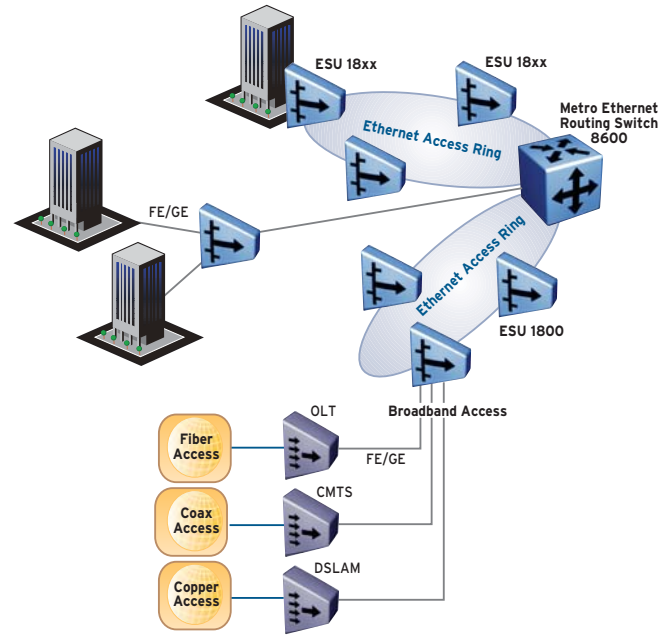
The Metro Ethernet Services Unit 1800 is recommended for Ethernet services to the Multiple Tenant Unit (MTU) and for aggregation of lower-speed, low-density broadband access. The Metro Ethernet Services Unit 1850 can be used for aggregation of Gigabit Ethernet from the customer premises as well as denser IP-DSLAMs. Both models can co-exist on the same ring in any order.

### Multiple Classes of Service

VoIP and video traffic are sensitive to both network delay and jitter — the variation experienced in that delay. The ability to classify traffic as early as possible helps ensure that mission-critical applications are given the level of performance dictated by their service contracts on an end-to-end basis.

By assigning different service class levels to traffic flows, applications can be given the bandwidth and network priority required where and when they need it. The Metro Ethernet Services Unit provides the performance and QoS features to support the requirements of delay-sensitive applications. Four priority egress queues form the

**Figure 1. Ethernet Access Ring – highly scalable and resilient**



basis of Metro Ethernet Services Unit 1800 traffic management functionality, while the 1850 supports eight egress queues. With the ability to classify traffic based on IEEE 802.1Q/p and DiffServ markings and prioritize accordingly, delay-sensitive applications can be given priority across the access ring.

### Service continuity and management

A key differentiator of Nortel's Ethernet VPN management solution, VPN Continuity Check is a powerful service assurance and debugging tool critical to measuring and validating customers' SLAs. It may be used to validate all VPN end-points, test connectivity and determine roundtrip delay measurements per VPN. The tool may be

## Metro Ethernet Services Unit platform

Available models:

1800: 24 10/100Base-T + 2 SFP GBIC slots, AC powered

1800: 24 10/100Base-T + 2 Fixed 1000Base-LX ports, DC powered

1850: 12 10/100/1000Base-T or SFP GBIC ports configured as a 4-port (10/100/1000Base-T and SFP combo) base unit + 2 Media Dependent Adapter (MDA) slots, each of which can utilize a 4-port 10/100/1000Base-T MDA or a 4-port SFP GBIC MDA, AC or DC powered

Both models are available with either a single 110/220V AC power supply or a single 48V DC power supply.



Metro Ethernet Services Unit 1850



Metro Ethernet Services Unit 1800





invoked from the network operations center using the command line interface, from the craft interface Java Device Management, or from Nortel Product and Service Provisioning, thus removing the need for costly customer site trips.

VPN Continuity Check test results are stored and can be polled by any SNMP performance application to provide customers with SLA reports. In addition, the Metro Ethernet Services Module 8668 maintains a table of recent VPN Continuity Checks, which can be configured to run periodically. This information is used by network management to verify that SLA parameters are being achieved and generate a trend of the service over time.

This tool allows service providers to detect problems before customers notice any service degradation, isolating problems quickly and methodically. By verifying not only the integrity of the path all the way to the customer-facing port, but the total delay incurred, this capability allows for a true end-to-end SLA verification.

## Network management

The Metro Ethernet Services Unit is easy to set up and use, simplifying network operations. The Metro Ethernet Services Unit can be configured quickly with fewer errors, decreasing implementation times and troubleshooting activities.

The Metro Ethernet Services Unit is fully manageable in or out of band with SNMP applications such as Nortel's Product Services Provisioning, Optivity Network Management System and Multiservice Data Manager. For smaller networks, the Metro Ethernet Services Unit can be managed using Nortel's Java Device Manager or Command Line Interface.

Product Services Provisioning helps automate the provisioning and configuration process for quicker service activation and service adjustments. Optivity NMS provides a comprehensive set of discovery, fault and diagnostic capabilities for identifying problems before they impact network services. Multiservice Data Manager provides a centralized discovery, fault and performance monitoring tool for service provider and carrier networks.

## Summary

As a cost-effective device purpose-built for the edge of service provider networks, the Metro Ethernet Services Unit enables maximum revenue generation through its ability to support multiple services and multiple VPNs per port, all in a compact 1U-high unit. Achieving sub-50ms recovery and highly-effective bandwidth aggregation in an Ethernet access ring topology, the Metro Ethernet Services Unit provides key capabilities for profitable Ethernet services, including robust classification, rate enforcement and traffic management features. Also, VPN Continuity Check makes it quick and easy to assure service uptime from end to end, allowing service providers to offer stringent SLAs with confidence.

Service providers require edge devices that deliver the high performance necessary for today's multimedia application traffic, and the Metro Ethernet Services Unit fulfills the promise of carrier-class Ethernet services.

**Table 2. Metro Ethernet Services Unit technical specifications**

Category	Specifications for 1800	Specifications for 1850
<b>Physical specifications</b>		
Weight	2.8 kg (6.2 lbs.)	4.7 kg (10.4 lbs.)
Height	4.4 cm (1.73 in.)	4.4 cm (1.73 in.)
Width	44.1 cm (17.3 in.)	44.1 cm (17.3 in.)
Depth	20.8 cm (8.19 in.)	36.6 cm (14.4 in.)
<b>Performance specifications</b>		
Frame forwarding rate	8.8 Gbps switching fabric capacity	24 Gbps switching fabric capacity
(64-byte packets)	6.6 Mpps packet forwarding rate	17.9 Mpps packet forwarding rate
Port filtering performance (64-byte packets)	Wire speed Address database size: 8K	Wire speed Address database size: 16K
Max MTU size	Up to 1600 bytes	Up to 9K bytes
Data rate	10 or 100 Mbps user-facing	10 or 100 or 1000 Mbps
<b>Interface options</b>		
10Base-T/100Base-TX	RJ-45 (8-pin modular) connectors for MDI-X interface	
10/100/1000Base-T		RJ-45 (8-pin modular) connectors for MDI-X interface
1000Base-X	Small Form factor Pluggable	Small Form factor Pluggable
<b>Metro Ethernet Services Unit supports the following SFP GBICs:</b>		
1000Base-SX SFP	Short wavelength 850 nm MTRJ or LC type fiber optic connectors to connect devices over multimode fiber optic cable (275 m, 62.5 um core or 550 m, 50 um core)	Short wavelength 850 nm MTRJ or LC type fiber optic connectors to connect devices over multimode fiber optic cable (275 m, 62.5 um core or 550 m, 50 um core)
1000Base-LX SFP	Long wavelength 1300 nm duplex LC type fiber optic connector to connect devices over single mode fiber optic cable (5 km, 10 um core)	Long wavelength 1300 nm duplex LC type fiber optic connector to connect devices over single mode fiber optic cable (5 km, 10 um core)
1000Base-BX10 SFP	Bidirectional Small Form Factor Pluggable GBIC (mini-GBIC, connector type: LC) — 1490 nm Wavelength, 70 km	Bidirectional Small Form Factor Pluggable GBIC (mini-GBIC, connector type: LC) — 1490 nm Wavelength, 70 km
CWDM SFP GBICs	8 wavelengths from 1470 nm ~ 1610 nm duplex LC type fiber optic connector to connect devices over single mode fiber optic cable (40 km/70 km, 9 um core)	8 wavelengths from 1470 nm ~ 1610 nm duplex LC type fiber optic connector to connect devices over single mode fiber optic cable (40 km/70 km, 9 um core)
<b>Network protocol and standards compatibility</b>		
Network protocol and standards compatibility	<ul style="list-style-type: none"> <li>• IEEE 802.3 10Base-T Ethernet (twisted-pair copper)</li> <li>• IEEE 802.3u 100Base-TX Fast Ethernet (twisted-pair copper)</li> <li>• ANSI/IEEE802.3 Auto-negotiation</li> <li>• IEEE802.3x Flow Control</li> <li>• IEEE 802.1p (Priority Queues)</li> <li>• IEEE 802.1Q (VLAN Tagging)</li> <li>• IEEE 802.1z (Gigabit Ethernet)</li> </ul>	<ul style="list-style-type: none"> <li>• IEEE 802.3 10Base-T Ethernet (twisted-pair copper)</li> <li>• IEEE 802.3u 100Base-TX Fast Ethernet (twisted-pair copper)</li> <li>• ANSI/IEEE802.3 Auto-negotiation</li> <li>• IEEE802.3x Flow Control</li> <li>• IEEE 802.1p (Priority Queues)</li> <li>• IEEE 802.1Q (VLAN Tagging)</li> <li>• IEEE 802.1z (Gigabit Ethernet)</li> </ul>

**Table 2. Metro Ethernet Services Unit technical specifications — continued**

Category	Specifications for 1800	Specifications for 1850
<b>RFC support</b>	<ul style="list-style-type: none"> <li>• RFC 1213 (MIB II)</li> <li>• RFC 1493 (Bridge MIB)</li> <li>• RFC 1573 (Interface MIB)</li> <li>• RFC 1643 (Ethernet MIB)</li> <li>• RFC 1757 and RFC1271 (RMON): 4 first groups: Alarms, Events, Statistics and History</li> <li>• RFC 768 User Datagram Protocol (UDP)</li> <li>• RFC 783 Trivial File Transfer Protocol (TFTP)</li> <li>• RFC 854 Telnet</li> <li>• RFC 1112 Internet Group Management Protocol (IGMP) version 1</li> <li>• RFC 2236 Internet Group Management Protocol (IGMP) version 2</li> <li>• IGMP MIB (RFC 2833)</li> <li>• RFC 951 BOOTP</li> <li>• RFC 2131 BOOTP/DHCP relay</li> <li>• RFC 1157 (SNMP)</li> <li>• RFC 1907 (SNMPv2)</li> <li>• RFC 2865 (RADIUS)</li> <li>• RFC 2866 (RADIUS accounting)</li> </ul>	<ul style="list-style-type: none"> <li>• RFC 1213 (MIB II)</li> <li>• RFC 1493 (Bridge MIB)</li> <li>• RFC 1573 (Interface MIB)</li> <li>• RFC 1643 (Ethernet MIB)</li> <li>• RFC 1757 and RFC 1271 (RMON): 4 first groups: Alarms, Events, Statistics and History</li> <li>• RFC 768 User Datagram Protocol (UDP)</li> <li>• RFC 783 Trivial File Transfer Protocol (TFTP)</li> <li>• RFC 854 Telnet</li> <li>• RFC 1112 Internet Group Management Protocol (IGMP) version 1</li> <li>• RFC 2236 Internet Group Management Protocol (IGMP) version 2</li> <li>• IGMP MIB (RFC 2833)</li> <li>• RFC 951 BOOTP</li> <li>• RFC 2131 BOOTP/DHCP relay</li> <li>• RFC 1157 (SNMP)</li> <li>• RFC 1907 (SNMPv2)</li> <li>• RFC 2865 (RADIUS)</li> <li>• RFC 2866 (RADIUS accounting)</li> </ul>
<b>Electrical specifications</b>	<ul style="list-style-type: none"> <li>• AC power supply: 100 -240V AC, 47-63 Hz universal</li> <li>• DC power supply: -40 to -60V DC (48V Nominal)</li> </ul>	<ul style="list-style-type: none"> <li>• AC power supply: 100 -240V AC, 47-63 Hz universal</li> <li>• DC dual feed power supply: -40 to -60V DC (48V Nominal)</li> </ul>
<b>Environmental specifications</b>	<ul style="list-style-type: none"> <li>• Operating temperature 0° to 60° C</li> <li>• Storage temperature -25° to - 70° C</li> <li>• Humidity 5% to 95% non-condensing</li> <li>• Altitude 3,024 m (10,000 ft.) maximum</li> </ul>	<ul style="list-style-type: none"> <li>• Operating temperature 0° to 60° C</li> <li>• Storage temperature -25° to - 70° C</li> <li>• Humidity 5% to 95% non-condensing</li> <li>• Altitude 3,024 m (10,000 ft.) maximum</li> </ul>
<b>Safety agency approvals</b>	<ul style="list-style-type: none"> <li>• UL60950-2000</li> <li>• CSA 22.2 #60950-00</li> <li>• IEC 60950/EN 60950</li> <li>• UL 94-V1 flammability requirements for all PC boards</li> <li>• NOM-019</li> </ul>	<ul style="list-style-type: none"> <li>• UL60950-2000</li> <li>• CSA 22.2 #60950-00</li> <li>• IEC 60950/EN 60950</li> <li>• UL 94-V1 flammability requirements for all PC boards</li> <li>• NOM-019</li> </ul>
<b>Electromagnetic emissions summary</b>	<p>Meets the following standards:</p> <ul style="list-style-type: none"> <li>• US: FCC CFR47, Part 15, Subpart B, Class A</li> <li>• Canada: ICES-003, Issue 3, Class A</li> <li>• Australia/New Zealand. AS/NZS 3548: 1995, Class A A1:1997/A2:1997 Class A</li> <li>• Japan: VCCI-V-3/02.04 Class A</li> <li>• Taiwan: CNS 13438, Class A</li> <li>• Europe: EN55022: 1998/A1:2000, EN61000-3-2:2000, EN61000-3-3:1995/A1:2001, CISPR 22-1997/A1:2000 Class A</li> </ul>	<p>Meets the following standards:</p> <ul style="list-style-type: none"> <li>• US: FCC CFR47, Part 15, Subpart B, Class A</li> <li>• Canada: ICES-003, Issue 3, Class A</li> <li>• Australia/New Zealand. AS/NZS 3548: 1995, Class A A1:1997/A2:1997 Class A</li> <li>• Japan: VCCI-V-3/02.04 Class A</li> <li>• Taiwan: CNS 13438, Class A</li> <li>• Europe: EN55022: 1998/A1:2000, EN61000-3-2:2000, EN61000-3-3:1995/A1:2001, CISPR 22-1997/A1:2000 Class A</li> </ul>
<b>Electromagnetic immunity</b>	EN55024 :1998/A1 :2001	EN55024 :1998/A1 :2001



## Ordering information

### Order number Description

DJ1412?06**	Nortel Metro Ethernet Services Unit 1800-24T with 24T 10/100Base-TX ports plus 2 SFP GBIC slots and AC power supply
DJ1412008	Nortel Metro Ethernet Services Unit 1800-01 with 24 10/100Base-TX ports plus 2 built-in 1000Base-LX uplink ports and -48V DC power supply
DJ1412012	Nortel Metro Ethernet Services Unit 1800-24T with 24 10/100Base-TX ports plus 2 SFP GBIC slots and -48V DC power supply
DJ1412?11**	Nortel Metro Ethernet Services Unit 1850, 4 Combo ports, 2 MDA slots and AC power supply
DJ1412013	Nortel Metro Ethernet Services Unit 1850, 4 Combo ports, 2 MDA slots and -48V DC power supply

### Small Form factor Pluggable GBICs available

AA1419013	1-port 1000Base-SX Small Form Factor Pluggable GBIC (mini-GBIC, connector type: LC)
AA1419014	1-port 1000Base-SX Small Form Factor Pluggable GBIC (mini-GBIC, connector type: MT-RJ)
AA1419015	1-port 1000Base-LX Small Form Factor Pluggable GBIC
AA1419025	1-port 1000BaseCWDM Small Form Factor Pluggable GBIC (mini-GBIC, connector type: LC) - 1470nm Wavelength, 40km
AA1419026	1-port 1000BaseCWDM Small Form Factor Pluggable GBIC (mini-GBIC, connector type: LC) - 1490nm Wavelength, 40km
AA1419027	1-port 1000BaseCWDM Small Form Factor Pluggable GBIC (mini-GBIC, connector type: LC) - 1510nm Wavelength, 40km
AA1419028	1-port 1000BaseCWDM Small Form Factor Pluggable GBIC (mini-GBIC, connector type: LC) - 1530nm Wavelength, 40km
AA1419029	1-port 1000BaseCWDM Small Form Factor Pluggable GBIC (mini-GBIC, connector type: LC) - 1550nm Wavelength, 40km
AA1419030	1-port 1000BaseCWDM Small Form Factor Pluggable GBIC (mini-GBIC, connector type: LC) - 1570nm Wavelength, 40km
AA1419031	1-port 1000BaseCWDM Small Form Factor Pluggable GBIC (mini-GBIC, connector type: LC) - 1590nm Wavelength, 40km
AA1419032	1-port 1000BaseCWDM Small Form Factor Pluggable GBIC (mini-GBIC, connector type: LC) - 1610nm Wavelength, 40km
AA1419033	1-port 1000BaseCWDM Small Form Factor Pluggable GBIC (mini-GBIC, connector type: LC) - 1470nm Wavelength, 70km
AA1419034	1-port 1000BaseCWDM Small Form Factor Pluggable GBIC (mini-GBIC, connector type: LC) - 1490nm Wavelength, 70km
AA1419035	1-port 1000BaseCWDM Small Form Factor Pluggable GBIC (mini-GBIC, connector type: LC) - 1510nm Wavelength, 70km
AA1419036	1-port 1000BaseCWDM Small Form Factor Pluggable GBIC (mini-GBIC, connector type: LC) - 1530nm Wavelength, 70km
AA1419037	1-port 1000BaseCWDM Small Form Factor Pluggable GBIC (mini-GBIC, connector type: LC) - 1550nm Wavelength, 70k
AA1419038	1-port 1000BaseCWDM Small Form Factor Pluggable GBIC (mini-GBIC, connector type: LC) - 1570nm Wavelength, 70km
AA1419039	1-port 1000BaseCWDM Small Form Factor Pluggable GBIC (mini-GBIC, connector type: LC) - 1590nm Wavelength, 70km
AA1419040	1-port 1000BaseCWDM Small Form Factor Pluggable GBIC (mini-GBIC, connector type: LC) - 1610nm Wavelength, 70km
AA1419069	1-port 1000Base-BX10 Bidirectional Small Form Factor Pluggable GBIC (mini-GBIC, connector type: LC) - 1310nm Wavelength, 70km
AA1419040	1-port 1000Base-BX10 Bidirectional Small Form Factor Pluggable GBIC (mini-GBIC, connector type: LC) - 1490nm Wavelength, 70km

The -BX10 requires a pair to function, Tx1310, Rx1490 or vice versa.

\*\* The seventh character (?) of the order number must be replaced with the proper code to indicate desired product nationalization:

"A" – No power cord included

"B" – Includes European "Schuko" power cord common in Austria, Belgium, Finland, France, Germany, The Netherlands, Norway, and Sweden

"C" – Includes power cord commonly used in the United Kingdom and Ireland

"D" – Includes power cord commonly used in Japan

"E" – Includes North American power cord

"F" – Includes Australian power cord, also commonly used in New Zealand and the People's Republic of China

Nortel is a recognized leader in delivering communications capabilities that enhance the human experience, ignite and power global commerce, and secure and protect the world's most critical information. Serving both service provider and enterprise customers, Nortel delivers innovative technology solutions encompassing end-to-end broadband, Voice over IP, multimedia services and applications, and wireless broadband designed to help people solve the world's greatest challenges. Nortel does business in more than 150 countries. For more information, visit Nortel on the Web at [www.nortel.com](http://www.nortel.com).

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## >THIS IS THE WAY

WE BRING OPERATIONAL SIMPLICITY, FLEXIBILITY  
AND ENHANCED SCALABILITY OF ETHERNET  
TO METRO AREA NETWORKS

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### Product Brief

## Nortel Metro Ethernet Routing Switch 8600

Ethernet offers an attractive network option for carriers seeking to deploy a wide range of voice, video and data network services using Ethernet as the user interface as well as the underlying infrastructure.

For enterprises that want to cost-effectively extend LANs at native rates into the MAN and WAN, Ethernet is the answer. For carriers and service providers looking for a fast, reliable and profitable way to eliminate bandwidth bottlenecks from LAN to MAN/WAN, Ethernet is the answer.

Metro Ethernet enables carriers to build next-generation infrastructures across the metro to provide Ethernet-based

services as well as to provide Ethernet-based infrastructures to backhaul IP services and aggregate broadband traffic. Point-to-point, point-to-multipoint and any-to-any connection configurations allow deployment options that meet differing service and application requirements.

Nortel leads the industry in delivering carrier-class Metro Ethernet solutions with the Metro Ethernet Routing Switch 8600 (formerly the Passport 8600 Routing Switch). This proven platform has been a workhorse for enterprises and a reliable profit-maker for service providers. Now, it is leading the way in delivering scalable, feature-

rich, Ethernet-based Virtual Private Networks (VPNs) and next-generation Ethernet MAN infrastructure.

The Metro Ethernet Routing Switch 8600 is a key component of Nortel's Metro Ethernet solution, delivering 1-Gigabit and 10-Gigabit Ethernet performance with Quality of Service (QoS) for business-critical applications and services. The Metro Ethernet Routing Switch 8600 delivers premium performance and availability, QoS-based traffic prioritization, scalability and support for a wide range of interfaces, including 10-Megabit to 10-Gigabit Ethernet, Packet-over-SONET/SDH and ATM.

When equipped with Metro Ethernet Services Module 8668, the Metro Ethernet Routing Switch 8600 delivers important benefits to service providers seeking to increase their Ethernet-based network footprint (Table 1).

**Table 1. Metro Ethernet Routing Switch key benefits**

Feature	Benefit
Multiple services (e.g., Internet access, transparent LAN service, VoIP VPNs, etc.) supported per UNI port	<b>Maximizes revenue generation</b>
Ethernet access ring resiliency (when used with Nortel Metro Ethernet Services Unit 1800 and/or 1850), with 50ms protection on the ring	<b>Ensures high availability to meet strict SLAs</b>
A well-defined Ethernet user-network interface (UNI)	<b>Provides complete end-user separation and service delineation</b>
A robust network-to-network interface (NNI), enabling support of up to 16 million Ethernet VPNs	<b>Delivers extraordinary degrees of network and service scalability, security and operational ease</b>
Efficient IP Multicast and VLAN-to-IP network mapping capabilities	<b>For efficient triple-play service delivery on any port</b>
A flexible suite of traffic policing, QoS and statistics capabilities	<b>Enables multiple levels of service at different price points</b>
OAM&P tools supporting end-to-end, per-VPN performance monitoring and measurement capabilities	<b>Provides enhanced SLA monitoring for service assurance</b>
Support for existing and emerging Ethernet-related industry standards	<b>Meets interworking demands of multi-vendor Ethernet switched and transport networks</b>



## What makes the Metro Ethernet Routing Switch 8600 exceptional?

With the capability to deliver hundreds of millions of packets per second (Mpps) performance, the Metro Ethernet Routing Switch 8600 provides resiliency, intelligence and security in a field-tested and proven solution.

Outfitted with the Metro Ethernet Services Module 8668 blade, the Metro Ethernet Routing Switch 8600 employs state-of-the-art network processor technology to implement Ethernet VPN functions in a programmable format, while retaining the high-speed processing capabilities previously associated with fixed silicon implementations. The ability to program the network processor means that fast-moving changes in the standards defining how VPNs are implemented can be captured and brought to market quickly, and with reduced cost.

Ethernet VPN service topologies supported by the Ethernet Services Module 8668 include point-to-point, point-to-multipoint, and any-to-any models. Implementation of these specific topologies gives service providers and enterprises additional flexibility while improving overall resource utilization and network efficiency. Unknown unicast, multicast and broadcast traffic are constrained within their respective VPNs, effectively limiting unnecessary broadcasting. For example, an enterprise customer with a headquarters site and many branch offices would benefit from an Ethernet VPN service implemented in a point-to-multipoint or hub-and-spoke fashion. Leveraging a point-to-multipoint service topology, service providers can restrict the spokes to only communicate through the hub, thereby maximizing the efficiencies of their Ethernet infrastructure and optimizing resource utilization and enhancing data security.

Metro Ethernet Services Module 8668 supported access deployment models are:

- > Single enterprise service access via a dedicated link
- > Multiple enterprise service access via an Ethernet access link
- > Multiple enterprise service access via an Ethernet access ring

This flexibility makes it appropriate for both greenfield buildouts as well as demand-based add-ons to existing infrastructures. Once the network is up and running, these same capabilities limit the number of truck-rolls required to add users and adjust service levels across the network.

### Delineation

The primary responsibility of the Ethernet UNI is service demarcation. Metro Ethernet Services Module 8668 goes beyond simple demarcation by allowing service providers and enterprises to deliver multiple services and service types per port. Economics are driving administrators today to deliver more than one service to a particular end user while leveraging the same infrastructure. For example, multi-service operators (MSOs) are looking to deliver voice, video, VPN and Internet access while leveraging the hybrid fiber/coax plant. This is now possible with the Metro Ethernet Routing Switch 8600 equipped with the Metro Ethernet Services Module 8668 (Figure 1).

Separation of end-user traffic is achieved through support for IEEE 802.1Q, pre-standard IEEE 802.1ad Stacked VLANs (Provider Bridge or Q-in-Q), and Stacked Tags used by Nortel Metro Ethernet Services Units. Delineation continues on the network side of the Metro Ethernet Services Module 8668 with support for Nortel's pre-standard 802.1ah MAC-in-MAC on the NNI link (see Figure 1).

### Scalability and efficiency

Nortel's Ethernet NNI, as implemented on Metro Ethernet Services Module 8668, essentially takes the encapsulated customer data and adds a service label that can support and distinguish up to 16 million Ethernet VPNs. Service providers no longer have to worry about overlapping VLAN-IDs or partitioning the network to avoid this issue, significantly simplifying operations. The Metro Ethernet Services Module 8668 supports up to 4,000 customer "VLAN ID-to-provider service ID" mappings per port. Up to 20,000 service end-point mappings per Metro Ethernet Services Module 8668 can be achieved when using the Metro Ethernet Services Unit 1800/1850 to collect customer traffic. Each network processor (eight per module) supports up to 128 mapped UNIs and up to 336 transparent UNIs. A transparent UNI is defined when all traffic on a physical port is assigned to a single service, while a mapped UNI provides multiple services per physical port to one or more customers.

The Metro Ethernet Services Module 8668 improves bandwidth efficiency by tunneling enterprise broadcast traffic inside provider unicast packets. Additionally, Metro Ethernet Services Module 8668's pre-standard 802.1ah MAC-in-MAC implementation uses the MAC addresses of the Ethernet UNIs (ingress ports), rather than customer MACs in the switch forwarding tables. This eliminates the "MAC address explosion" issue by greatly reducing the number of MAC addresses that must be learned and maintained by switches in the service provider's core infrastructure. Keeping the number of MAC addresses to a minimum reduces the aging out and relearning of MAC addresses, thus enhancing end-to-end performance and making network forwarding far more stable.

The Metro Ethernet Routing Switch 8600 delivers high performance, carrier-class Ethernet switching functions for key service provider applications:

- > Broadband managed services to apartments, condominiums, office parks, campuses and more
- > Carrier-class Ethernet VPNs for seamless LAN/MAN/WAN connectivity
- > Point-of-presence (PoP) edge-to-core traffic aggregation





Figure 2 shows Metro Ethernet Routing Switch 8600 deployed in support of triple play services including video (broadcast TV, video on demand), voice over IP, and high-speed Internet access over a common network. Residential subscribers are connected to the network via various access technologies (xDSL, cable, direct fiber, Ethernet access ring, etc.) while enterprise subscribers are connected via direct Ethernet VPNs. A mix of residential and enterprise services are supported on every port, creating a truly shared Ethernet-based infrastructure that serves both consumers and business customers with uncompromising performance. A video headend, voice gateway and BRAS all deliver the respective services to a given end customer. Metro Ethernet Routing Switch 8600 leverages existing industry-recognized multicast features, along with innovative new implementations in order to efficiently support triple play services. For broadcast TV in particular, a number of special features have been developed to support efficient delivery of multi-cast traffic.

Triple play services can be implemented on an Ethernet access ring topology using Nortel Metro Ethernet Services Units or directly on the Metro Ethernet Routing Switch via the Metro Ethernet Services Module 8668. In either case, a customer can be directly connected to the UNI, or there may be an access device such as a Layer 2 switch or DSLAM connected to the UNI (see Figure 3).

Metro Ethernet Services Module 8668 supports up to 98,000 customer MAC addresses per Ethernet UNI port (ingress port) with an ability to set hard and soft limits, per VPN service, for customer MAC address usage.

**Reliability**

The Metro Ethernet Routing Switch 8600 architecture is designed to provide protection strategies at multiple levels: to deliver “five nines” reliability.

At the device level, the Metro Ethernet Routing Switch 8600 is equipped with redundant, hot-swappable components — switch fabrics, power supplies and fan trays. Temperature sensors constantly monitor the components and cooling systems to maintain acceptable system conditions.

At the trunk level, Distributed Multi-Link Trunking (DMLT) provides redundancy by enabling trunk groups to be configured across different slots in the same chassis. In the event of a failure, links would remain active, because other modules in the trunk group could take over.

Network- and link-level redundancy is provided by several key features:

- > 50ms failover when using ring-based access with Metro Ethernet Services Unit 1800/1850
- > 50ms failover based on LACP MLT (requires Metro Ethernet 8600 CPU Expansion Mezzanine card on the CPU) between Metro Ethernet Routing Switch 8600s
- > Multi-Link Trunking
- > Sub-second failover based on RSTP/MSTP protocols (IEEE 802.1w and 802.1s respectively) on NNI trunk ports

Nortel’s innovative Split Multi-Link Trunking (SMLT) on the Metro Ethernet Routing Switch 8600 improves the scalability and reliability of Layer 2 networks by removing

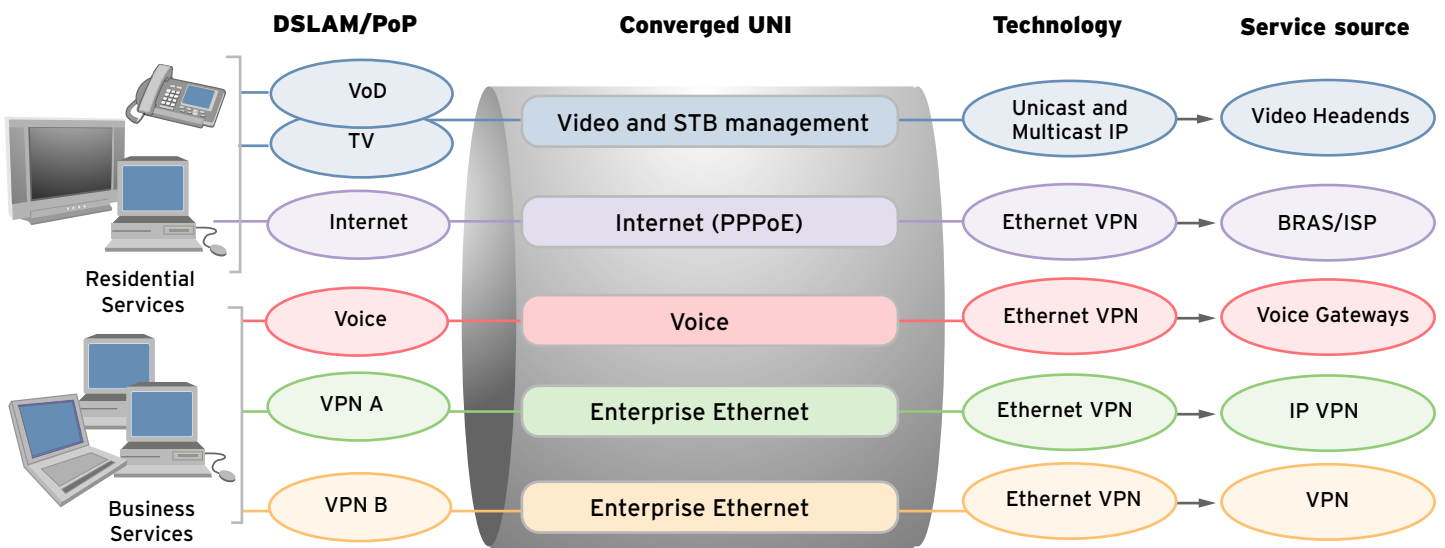


Figure 1. Metro Ethernet UNI allows triple play plus business services.



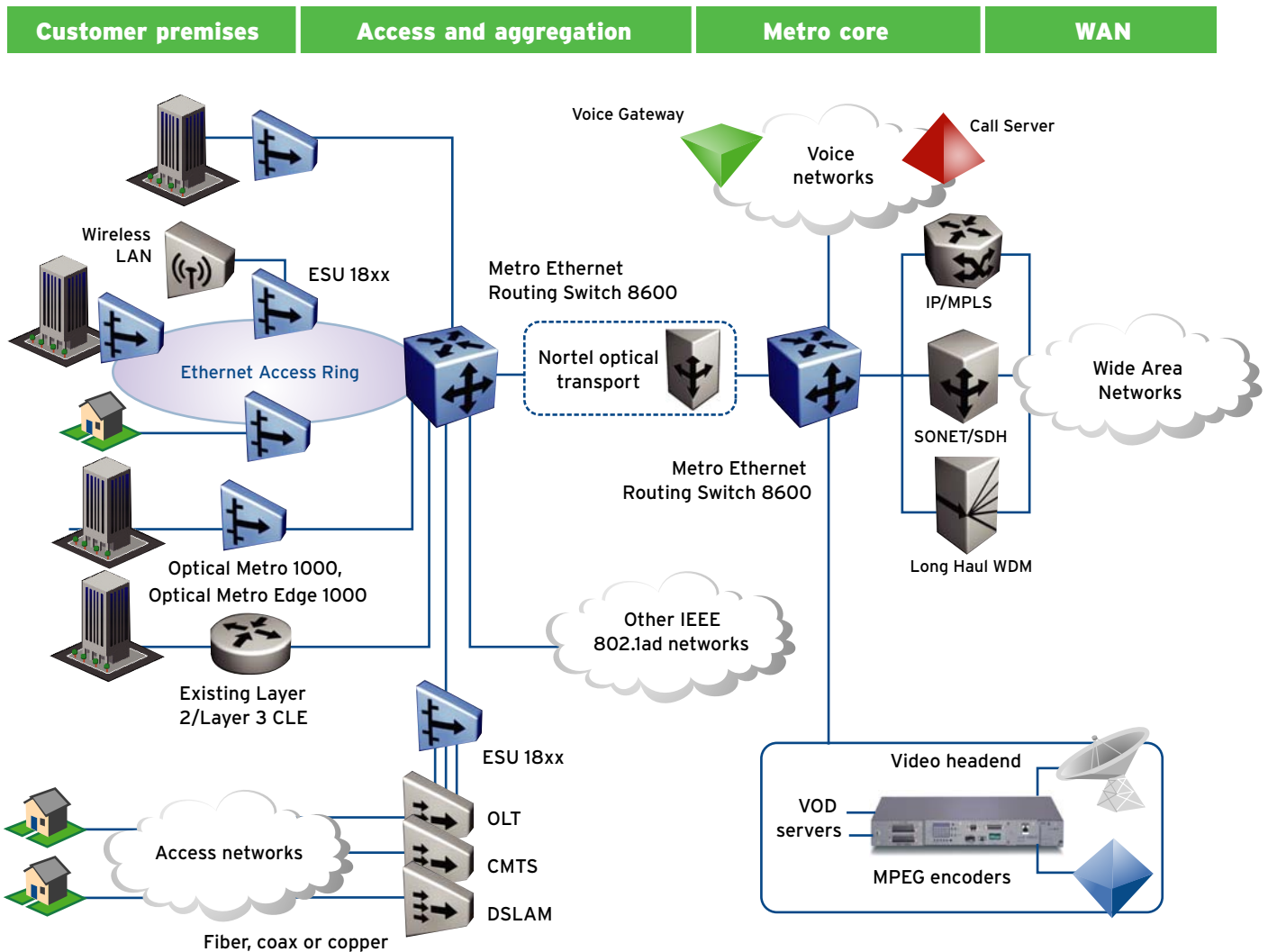


Figure 2. Metro Ethernet Routing Switch 8600 supports triple play services over a common network.

spanning tree convergence issues in the access network and providing faster recovery in the event of link failures.

**Service continuity and management**

Metro Ethernet Services Module 8668 provides extensive capabilities for performance monitoring, service assurance, SLA measurement and troubleshooting. An advanced SNMP-based network management toolkit allows scheduling of periodic tests and generation of a history of the test results can validate VPN end-points, test connectivity (uptime), perform performance monitoring (e.g., round-trip delay) and debug failures. These are critical to measuring and validating customers’

SLAs. This capability allows service providers to detect problems with the service before the customer notices the service degradation.

These tools also allow the service provider to troubleshoot and isolate the problem quickly and methodically. This operational simplicity at the service level enables significant operational savings.

Statistics are kept per-port and per-customer VPN. This is key to allowing the service provider to provide flexible tiered services and appropriately bill for each service.

**Quality of Service**

For enterprises and service providers alike, the network must be able to maintain quality of service profiles and differential treatment from end to end. Traffic classification occurs at ingress, per service endpoint, and is done using customer 802.1p or trusted customer TOS/DSCP markings.

Metro Ethernet Services Module 8668 implementation is based on RFC 2698, Two Rate Three Color Marker. This algorithm meters an IP/Ethernet packet stream and marks its packets based on two rates — Peak Information Rate (PIR) and Committed Information Rate (CIR) — and their associated

burst sizes, to be green, yellow or red. A packet is marked red if it exceeds the PIR.

Otherwise it is marked either yellow or green depending on whether it exceeds or doesn't exceed the CIR.

Metro Ethernet Services Module 8668 supports four classes of service, with four distinctive queues. Applications are prioritized across the network using intelligent agents in the interface modules to support IEEE 802.1p Class of Service (CoS) and IETF Differentiated Service (DiffServ).

All frames egressing a Nortel pre-standard 802.1ah MAC-in-MAC network are marked with proper 802.1p CoS markings, enabling end-to-end QoS and multivendor interoperability. Operators can set policing parameters per port for transparent ports and per port per VPN for mapped ports.

**Policing**

- > Ingress policing on a per-port basis for Transparent UNI
- > Ingress policing on per-service basis for Mapped UNI

- > User-tunable bandwidth in increments of 64 kbps up to 1 Mbps, then to line rate in increments of 1 Mbps

- > Committed and Peak Information Rate, CIR and PIR, policing parameters

**Ingress packet classification**

- > Per-port basis
- > Configurable mapping of customer 802.1p to service provider priority level per service
- > Configurable mapping of customer DSCP to service provider priority level per service

**Interoperability**

With its network processor-enabled flexibility, Metro Ethernet Services Module 8668 interworks with a comprehensive range of Ethernet technologies on the user side, including:

- > IEEE 802.1Q Ethernet VLANs
- > Pre-standard IEEE 802.1ad Ethernet Stacked VLANs (Provider Bridge)
- > HVPLS U-PE

**Security**

The Ethernet UNI on the Metro Ethernet Services Module 8668 neither uses nor processes any Layer 3 address information from the end-user's network. Network address translation is unnecessary, because the entire end-customer packet is encapsulated so that the customer's Layer 3 header is kept intact across the provider network. The Metro Ethernet Services Module pre-standard 8668's pre-standard 802.1ah MAC-in-MAC style encapsulation prevents a 'MAC-explosion' scenario in the provider metro core that could lead to flooding of customer packets across the provider network. This encapsulation also makes the provider infrastructure transparent to the customer's Ethernet control protocol packets. Metro Ethernet Services Module 8668 provides a simple option to tunnel enterprise control frames without complex provisioning.

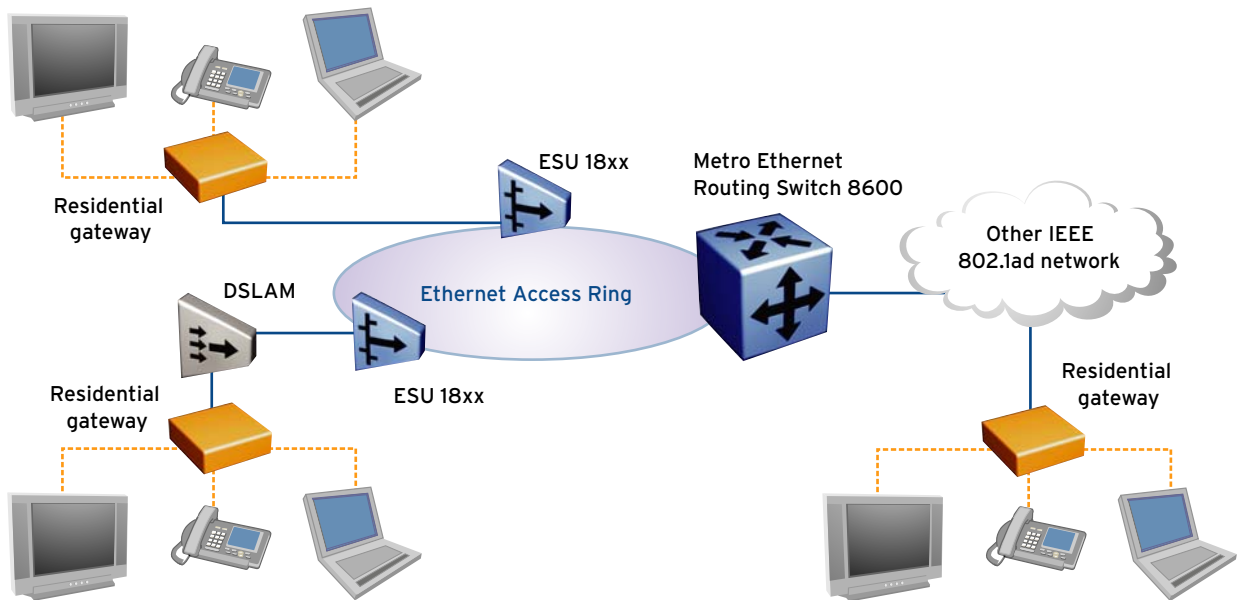


Figure 3. Triple Play services implementation

## Simple operations

The Metro Ethernet Routing Switch 8600 and all modules can be managed through Nortel's integrated Product Service Provisioning, Multiservice Data Manager and Optivity network management tools. Product Services Provisioning automates the provisioning and configuration process for quicker service activation and service adjustments. Optivity NMS provides a comprehensive set of discovery, fault and diagnostic capabilities for identifying problems before they impact network services. Multiservice Data Manager provides a centralized discovery, fault and performance monitoring tool for service provider and carrier networks. These capabilities are shared across the entire Metro Ethernet Routing Switch Series, dramatically reducing network administration associated with configuring individual devices.

Metro Ethernet Services Module 8668 supports single endpoint service activation at the Ethernet UNI. Activation can be followed immediately by a VPN continuity verification test to ensure that the activation was carried out correctly.

From the physical to the logical, all aspects of the Metro Ethernet Routing Switch 8600 were designed to be easy to install, operate and maintain for maximum ease and minimum cost of ownership.

Metro Ethernet Routing Switch 8600  
(8010CO Chassis)



### True modularity for maximum flexibility

With a range of fault-tolerant models to choose from, Metro Ethernet Routing Switch 8600 offers cost-effective Ethernet switching solutions with superior flexibility for enterprises and service providers.

### Chassis choices

Three redundant chassis models are available:

- > For service provider central offices, Nortel offers a NEBS3-compliant 10-slot chassis designed for the most demanding environments, with enhanced cooling and electro-magnetic interference (EMI) protection features.

- > Where high density, availability and scalability are essential, Nortel offers a 10-slot chassis — one or two slots for a load-sharing CPU/switching fabric module, with the remaining slots available for input/output modules.
- > Where space is at a premium and lower density is desired, a 6-slot chassis is available.

### Module choices

A choice of switch modules for access and trunking makes the Metro Ethernet Routing Switch 8600 ideal. For the evolving network, input/output modules can be mixed and matched to offer Ethernet interfaces from 10 Mbps to 10 Gbps, using the Metro Ethernet Services Module 8668 as a server module for Ethernet services.

The range of module options means the network can grow as business needs grow. The platform can support scalable switching bandwidth up to 512 Gbps — wire-speed routing of hundreds of millions of packets per second.

This unparalleled flexibility protects the network investment by accommodating evolving Ethernet standards and hard-to-forecast business growth.

## Ordering information

Order Number	Description
<b>Chassis</b>	
DS1402001	8010 10-slot chassis. Includes chassis, dual backplane, two fan trays, RS232 cable for management console, rack mount kit, and cable guide kit. Requires at least one power supply, up to three power supplies supported.
DS1402002	8006 6-slot chassis. Includes chassis, dual backplane, fan tray, RS232 cable for management console, rack mount kit, and cable guide kit. Requires at least one power supply, up to three power supplies supported.
DS1402004	8010co 10-slot NEBS chassis. Includes chassis, fan trays, RS232 cable for management console, rack mount kit and cable management. Requires at least two 8004 power supplies, up to three power supplies supported.
<b>Software</b>	
DS1410019-3.6	Metro Ethernet Routing Switch 8600 Software Kit: Includes v3.6 Metro Ethernet Switching SW license, Device Manager, and complete documentation set. One license kit required per chassis. Support contracts must be purchased separately.
<b>CPU/Switch Fabrics</b>	
DS1404026	Metro Ethernet Routing Switch 8691omSF Switch Fabric/CPU Module. One required per 8600 chassis. Supports 8006, 8010 or 8010CO chassis. Includes PCMCIA flash memory card.
DS1404027	Metro Ethernet Routing Switch 8600 CPU Expansion Mezzanine card. Field Installable for 8691omSF Switch Fabric module. Supports 50ms failover in Metro Ethernet configuration.
DS1404096	Metro Ethernet Routing Switch 8691ommez Switch Fabric/CPU Module. Combined DS1404026 and DS1404027. Implement only in Metro Ethernet ring configurations for 50ms ring resiliency.
DS1404103	Metro Ethernet Routing Switch 8692omSF Switch Fabric/CPU. One required with R Modules. Interoperable with all pre-R modules. Includes 256MB SDRAM and 64MB PCMCIA. For use in Metro Ethernet Routing Switch 8600 configuration.
DS1404066	Metro Ethernet Routing Switch 8692ommez Switch Fabric/CPU 8692 with Expansion Mezzanine card. Supports 50ms failover in Metro Ethernet configuration and 50ms ring resiliency in ring configurations.
<b>Interface Modules</b>	
DS1404068	8668ESM. Metro Ethernet Services Module. 8-port Gigabit Ethernet interface module, SFP-based* for use in Metro Ethernet configurations.
DS1304009	8672ATMM. ATM baseboard w/MDA slots. Accepts two MDAs*, supports up to 8 OC-3 or 2 OC-12 ports.
DS1404055	8632TXM. 32 ports autosensing 10/100BASE-TX plus 2 GBIC* ports interface module.
DS1404056	8648TXM 48 port autosensing 10BASE-T/100BASE-TX Ethernet interface module.
DS1404059	8608GBM 8-port 1000BASE Gigabit Ethernet GBIC-based* interface module.
DS1404060	8683POSM POS baseboard w/3 MDA Slots. Accepts three MDAs*, supports up to 6 OC-3 or 3 OC-12 ports.
DS1404061	8608GTM 8 port 1000BASE-T Gigabit Ethernet interface module.

\* All SFPs, GBICs, MDAs, and XFPs sold separately.

## Technical specification information

<b>Capacity and performance</b>	<ul style="list-style-type: none"><li>• Full duplex switching capacity of 512 Gbps, with redundant switch fabrics</li><li>• Performance for 64-byte packets: aggregate throughput maximum of 384 Mpps, 10 microseconds latency</li><li>• Chassis options: 8006, 6-slot chassis for backbones of lower density or higher space premium; 8010, 10-slot chassis for high availability/high scalability; 8010CO, 10-slot NEBS-compliant chassis. 2 slots reserved for switch fabric, balance for I/O modules.</li></ul>
Switch fabric/CPU modules:	One switch fabric required, second optional fabric doubles capacity and provides load sharing <ul style="list-style-type: none"><li>• 8691omSF Switch Fabric/CPU Module</li><li>• 8600 CPU Expansion Mezzanine card for 8691omSF. Field Installable. Supports 50ms failover in Metro Ethernet configuration.</li><li>• 8692omSF switch fabric/CPU. One required with R Modules. Interoperable with all pre-R modules.</li><li>• 8692ommez switch fabric/CPU 8692 with Expansion Mezzanine card. Supports 50ms failover on NNI trunks with Multi-Link Trunking</li></ul>
Interface modules:	<ul style="list-style-type: none"><li>• 8668ESM. 8-port Ethernet Services Module. SFP-based, Gigabit Ethernet</li><li>• 8672ATMM. ATM baseboard supports up to 8 OC-3 or 2 OC-12 ports</li><li>• 8632TXM. 32 ports 10/100 plus 2 GBIC ports</li><li>• 8648TXM. 48 10/100TX ports</li><li>• 8608GBM. 8-port Gigabit Ethernet, GBIC-based</li><li>• 8683POSM. POS Baseboard supports up to 6 OC-3 or 3 OC-12 ports.</li><li>• 8608GTM. 8 ports 1000BASE-T, fixed Gigabit Ethernet.</li></ul>
<b>IP layer protocols</b>	<ul style="list-style-type: none"><li>• IPv4</li><li>• Routing protocols: RIP, RIP2, BGP4, OSPFv2,</li><li>• IP Multicast: PIM-SM, PIM-SSM, IGAP, IGMPv1, v2, and v3, DVMRP, PGM</li></ul>
<b>Address database size</b>	<ul style="list-style-type: none"><li>• M Modules: 128,000 table entries per system (when configured for M mode)</li><li>• Addressing: 48-bit MAC address, 32-bit IP address</li><li>• Gigabit Ethernet port MTU: 1950 bytes</li><li>• Jumbo frames up to 9600 bytes supported on specific modules</li></ul>
<b>Ethernet network protocols and standards compatibility</b>	<ul style="list-style-type: none"><li>• IEEE 802.3 Ethernet</li><li>• IEEE 802.3z 1000BASE-SX and 1000BASE-LX</li><li>• IEEE 802.3ab</li><li>• IEEE 802.3ad</li><li>• IEEE 802.3ae</li><li>• IEEE 802.3x (Flow control)</li><li>• IEEE 802.1D Bridging</li><li>• IEEE 802.1Q (VLAN tagging)</li><li>• IEEE 802.1p (Prioritizing)</li><li>• Pre-IEEE 802.1ad (Provider Bridge)</li><li>• Pre-IEEE 802.1ah (Provider Backbone Bridge)</li><li>• IEEE 802.1x (EAP)</li><li>• IEEE 802.1w (RSTP)</li></ul>
<b>Resiliency features</b>	<ul style="list-style-type: none"><li>• Redundant switch fabrics and fans, hot swappable I/O modules, N+1 power supply redundancy</li><li>• High Availability Mode = hitless Layer 2 failover; sub-second Layer 3 failover</li><li>• Virtual Router Redundancy Protocol (VRRP)</li><li>• Load balancing via ECMP for RIP, OSPF, and BGP</li></ul>
<b>Link aggregation</b>	<ul style="list-style-type: none"><li>• IEEE 802.3 ad</li><li>• Multi-Link Trunking (MLT) for port level redundancy</li><li>• Distributed MLT for trunk level redundancy</li><li>• Split MLT for device level redundancy</li></ul>
<b>Quality of Service traffic management</b>	<ul style="list-style-type: none"><li>• DiffServ (RFC 2474), IP ToS precedence</li><li>• IEEE 802.1Q VLAN Tagging, IEEE 802.1p User Priority settings</li><li>• Queues: 4 hardware queues per port; strict priority and WRR configurable</li></ul>
<b>Management and administration</b>	<ul style="list-style-type: none"><li>• CLI</li><li>• SNMP (v1, v2, v3) compliant management</li><li>• PSP for provisioning</li><li>• Java Device Manager for configuration</li></ul>



## Technical specification information (continued)

### Security

- RADIUS accounting
- Filtering: 4096 source/destination or global filter sets, filter actions include forward, drop, mirror, default, reset priority bit
- Internal DOS protection
- SSH & SNMPv3 support
- CLI access protocols; multiple access levels RO/RW password protection; up to six authentication levels supported

### Physical

#### 8010 10-slot chassis:

- Rack space: 13RU, rack-mountable, up to 3 per standard 19", 23", or 600mm wide 7' high frame
- Dimensions: 22.9"/58.2 cm high X 18.5"/47.0 cm wide X 19.9"/50.5 cm deep
- Weight: 85 lb. (39 kg) empty, 225 lb. (102 kg) fully configured
- Power: 100/240 VAC, -48/-60 VDC,

#### 8010CO 10-slot chassis:

- Rack space: 20 RU, rack-mountable, up to 2 per standard 19", 23", or 600mm wide 7' high frame
- Dimensions: 35.0"/88.9 cm high X 17.4"/44.2 cm wide X 23.7"/60.2 cm deep
- Weight: 184 lb (83.46 kg) empty, 315 lb (142.88 kg) fully configured
- Power: 100/240 VAC, -48/-60 VDC

#### 8006 6-slot chassis:

- Rack space: 9RU, rack-mountable, up to 5 per standard 19", 23", or 600mm wide 7' high frame
- Dimensions: (H) 15.8"/40.1 cm high X 17.5"/44.5 cm wide X 19.9"/50.5 cm deep
- Weight: 49 lb. (22 kg) empty, 140 lb. (63 kg) fully configured
- Power: 100/240 VAC, -48/-60 VDC

### Environmental

- Operating temperature: 0° C to 40° C (32° F to 104° F)
- 85% - 95% maximum relative humidity, noncondensing
- Operating altitude: 3000 m (10,000 ft) maximum
- Free fall/drop: ISO 4180-s, NATA 1A
- Vibration: IEC 68-2-6/34
- Shock/bump: IEC 68-2-27/29

### Electromagnetic emissions

- US: FCC CFR47 Part 15, Subpart B, Class A
- Canada: ICES-003, Issue-2, Class A
- Australia/New Zealand: AS/NZS 3548:1995, Class A
- Japan: VCCI-V3/97.04, Class A

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