



White Paper **Is Your Network Ready for The Broadband Revolution?**

INTRODUCTION

The broadband revolution has been talked about for some time. Now, with broadband multimedia services finally starting to roll out, the reality of what this revolution means for service providers is rapidly becoming apparent.

The impact of broadband multimedia services on the network will be enormous, with the greatest impact being felt by the metro optical transport network. The sheer volume of users and services and huge increases in bandwidth dictate a whole new approach to network planning. Support for emerging consumer broadband services, combined with high speed business interconnection services, will require an incredibly flexible infrastructure – particularly since the rate of service penetration and market adoption is unpredictable. Service providers will need an optical infrastructure that enables them to adapt to demand as it emerges, to add new services and increase bandwidth to existing services, all without impacting the ongoing operations of the network. They must be able to add nodes, or modify services and technologies on existing nodes, so they can reach new customers and roll out new services quickly – again, all without impacting ongoing network services.

Even the nature of the traffic will be changing over time. Initially, it is expected that the bulk of traffic will be generated by broadcast and multicast services (such as IPTV or pay per view). Increasingly, this will be overshadowed by interactive services, such as video on demand (VoD), gaming, and high definition personal video conferencing. At the same time, legacy services must be accommodated on the new infrastructure, to maintain existing customers and revenues.

Service providers need to have in place an extremely flexible infrastructure. There won't be time to undertake major reconfigurations of the network – the solution lies in implementing an infrastructure now that will continue to serve the broadband market needs over the next ten to fifteen years. This infrastructure shouldn't force the service provider to commit to a single technology or single topology. The market is far too dynamic for that. The ideal infrastructure is one that has been designed from day 1 for maximum flexibility, growth and reliability, and for that you need an agile, service transparent infrastructure that can be fully managed end to end. For that, you need wavelength networking.

As reported in Network World, Verizon is planning network upgrades that will support new services such as optical VPNs and high-speed home networking as well as reduce data replication among multiple services. On its national optical network, Verizon is installing reconfigurable optical add/drop multiplexers (ROADMs) and plans to migrate to wavelength switching to support automated operations and provisioning, according to Mark Wegleitner, Verizon senior vice president and CTO.

Source: Verizon CTO lays out next-gen network plans, Jim Duffy, NetworkWorld.com, September 29, 2005

THE NEW ARCHITECTURE: PLANNING FOR UNCERTAINTY

The future is uncertain, but it is possible to plan for it. The new infrastructure must enable service providers to:

- Flexibly add bandwidth to existing services and add new services, without impacting existing services
- Rapidly and flexibly add new service distribution elements without impacting existing services
- Scale the networks in all directions: the number of customers and services, as well as the bandwidth required per customer or service
- Deliver all services reliably and extremely quickly, day in and day out, so customers have no reason to look elsewhere
- Manage the network end to end, to ensure all resources are being used to maximum efficiency

To satisfy all these requirements, service providers need a wavelength transport infrastructure, such as the one shown in Figure 1.

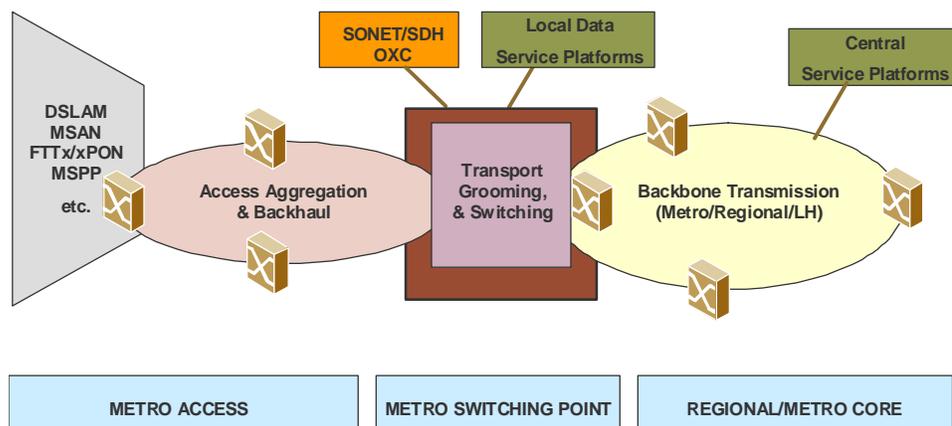


Figure 1 – Optical Layer Evolution

METRO ACCESS

The first thing to consider in terms of the metro access network is the customer end: the network must be “access agnostic”, that is, able to accept input from any source: digital subscriber line access multiplexer (DSLAM); multiservice access node (MSAN); fiber to the user, node or home (FTTx); passive optical network (PON); multiservice provisioning platform (MSPP); or any other type of access device. The customer end is also a key contributor to the scalability issues: the number of end points accessing the network and the bandwidth required to service those end points is going to grow enormously as a result of increasing demand for broadband multimedia services. For example, consider what is required to support broadcast video services. In the past, networks were planned around the assumption that each user experienced a certain amount of downtime within any block of time. With broadcast services, the entire customer population can be plugged in at the same

time, expecting non-stop service. Attempting to deliver this level of service with a traditional network would be cost prohibitive – if it were possible at all. Instead, service providers must look for a solution that has been purpose-built for this environment.

The solution chosen must be open and flexible, supporting all technologies, not just Ethernet. While Ethernet is undoubtedly the main traffic type now, other technologies could easily evolve in response to new and currently unknown requirements. Service providers need to ensure that their new infrastructure has the flexibility to adapt to whatever the future has in store. The new network should also support legacy technologies such as ESCON, FICON, Fibre Channel, SONET and SDH over a unified infrastructure.

Service providers must also have complete flexibility in terms of topology. Support for multiple topologies is essential for deep penetration of fiber into the access network, which in turn enables service delivery close to the subscriber. Not only must the network support all topology options now (mesh, ring, linear), it must be possible to change and adapt topologies, as need dictates.

A wavelength-based infrastructure can meet all the access requirements. It provides the optical layer resiliency necessary to deliver non-stop services, which is essential for any service provider who wants to compete in the multimedia market. By supporting Gigabit Ethernet (GigE) directly on wavelengths, the service provider can avoid unnecessary complexity and overhead. The wavelength infrastructure can handle the scalability requirements, even as growth goes from 1 to 2.5 Gb/s per access point to 10 Gb/s. A carrier-grade wavelength infrastructure enables the service provider to monitor the network end to end, and to quickly deploy new service end points, optically switch and optically replicate wavelengths from a central management point. Ideally, network-planning tools will be available to help the service provider keep one step ahead as new services roll out and new markets develop.

METRO CORE

Initially, due to the uncertainty of where services will be needed and which services will be in demand, service providers will likely opt for a centralized service delivery model in which the metro core acts as the sole service delivery point. This will enable service providers to control costs by limiting capital expenditures while service demand is building. However, the infrastructure must be adaptable and allow service providers to expand from the centralized model into a distributed network of service delivery points as demand grows. Any adaptation of the network including topology changes, additions and deletions of nodes, services, technologies, etc., must be possible without disrupting ongoing services.

The bulk of the traffic handled in the core network will likely be Ethernet. However, like the access network, the core must be able to handle traffic from legacy systems. To enable the service provider to operate a single, unified infrastructure, the metro core network should also support the interconnection of large data centers and SANs.

The ideal metro core network is based on flexible wavelength distribution, and supports:

- 10 Gb/s-based wavelength services today, with a planned migration to 40 Gb/s
- N x 10 Gb/s wavelengths today
- Multiplexing of 1 x GigE channels onto a single 10 Gb/s wavelength

- Deployment of new service points, reconfiguring and addition to existing end points in line with service demand
- Optical resilience, including the ability to manage the entire service delivery architecture end to end, with features such as auto power balancing

METRO SWITCHING

The only cost effective way to get huge amounts of traffic from the access to the core is through switching. A new node, called the metro services switching point, provides switching and grooming of broadband multimedia services. Optical wavelength switching ensures service resiliency: a must for video (and voice) services. The switching point implements switching on an “as required” basis; service processing is only undertaken when it provides value. Otherwise, the traffic simply passes through the switch. The switch also offers CWDM and DWDM termination. Optical media replication supports cost-effective distribution of broadcast multimedia content to multiple simultaneous end points, all with optical resiliency and speed.

To support broadband multimedia service delivery, multiservice switching is required for:

- Wavelengths, to provide:
 - Networking of wavelength services
 - Frequency translation (CWDM/DWDM) and 3R
- SONET/SDH, to groom legacy traffic for local service delivery platforms
- GigE, to provide:
 - Grooming for delivery to local service delivery platforms
 - Switching for Ethernet services
- Short haul data services, to provide managed networking for legacy services and eliminate the need for an overlay network

With a unified service delivery infrastructure, service providers can transport services from the access point through the core of the network, aggregating as appropriate to ensure maximum utilization of fiber. They can also plan and manage the network from end to end. Now, with the metro services switching point, they can switch traffic, which enables service providers to put optical services deeper into the network (i.e., closer to the customer).

MERITON AGILE OPTICAL NETWORKING

Meriton Agile Optical Networking (AON) includes all the products and functionality required to implement an efficient, future-proof broadband multimedia service delivery infrastructure:

- **3300 Optical Services Multiplexer (OSM):** A versatile, cost-effective C/DWDM access multiplexer
- **6400 Optical Transport Platform (OTP):** A reconfigurable optical transport solution, incorporating ROADM technology, enabling dynamic allocation of TDM, Ethernet, data or optical services
- **7200 Optical Switching Platform (OSP):** An award-winning networking system that collapses ROADM/CWDM/DWDM transmission and switching of wavelengths. The OSP can support switching & grooming of SONET/SDH Ethernet traffic if required

- **8600 Network Management System (NSM):** An advanced wavelength management system that transforms the transport infrastructure into a service-delivery platform
- **9500 Network Planning Tool (NPT):** A tool that simplifies the design and planning across the entire Agile Optical Networking portfolio.

The Meriton AON enables operators to deploy cost-effective service delivery platforms within a centralized infrastructure, which can then grow to a distributed infrastructure in line with service uptake.

CENTRALIZED SERVICE DELIVERY

The centralized service delivery model allows services providers to use the optical network to deliver services through to the customer service delivery point without requiring it to pass through multiple service layer processing hops (see Figure 2). This reduction in processing preserves the customer experience and increases the efficiency of the network.

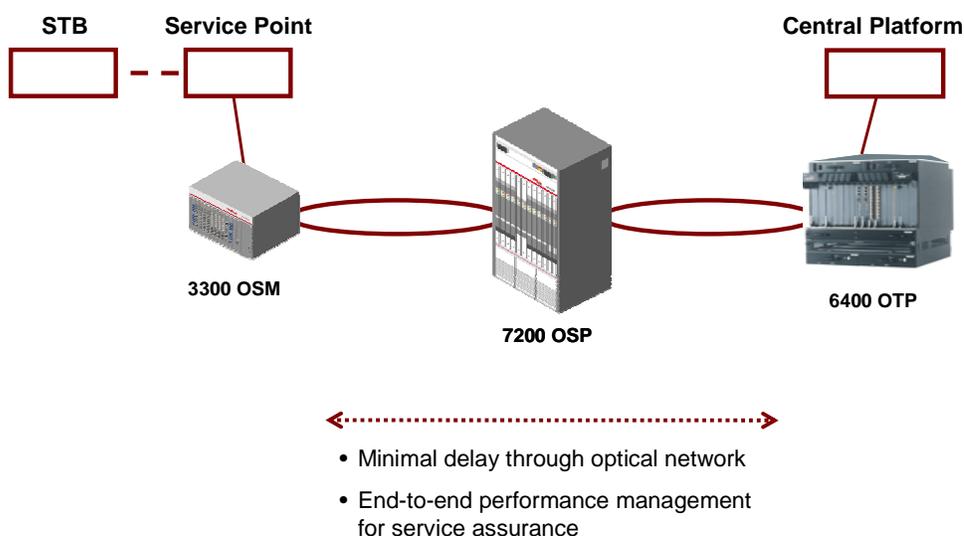


Figure 2 – Centralized Service Delivery Model

DISTRIBUTED SERVICE DELIVERY

A distributed service delivery model enables service providers to replicate multimedia streams at the optical layer. Doing this replication as close to the service delivery point as possible provides significant cost benefits. The Meriton AON enables a single multimedia stream to be switched to multiple core distribution links, or switched to multiple access network distribution links simultaneously.

This distributed service delivery model can be implemented reliably and cost effectively over an optical wavelength infrastructure.

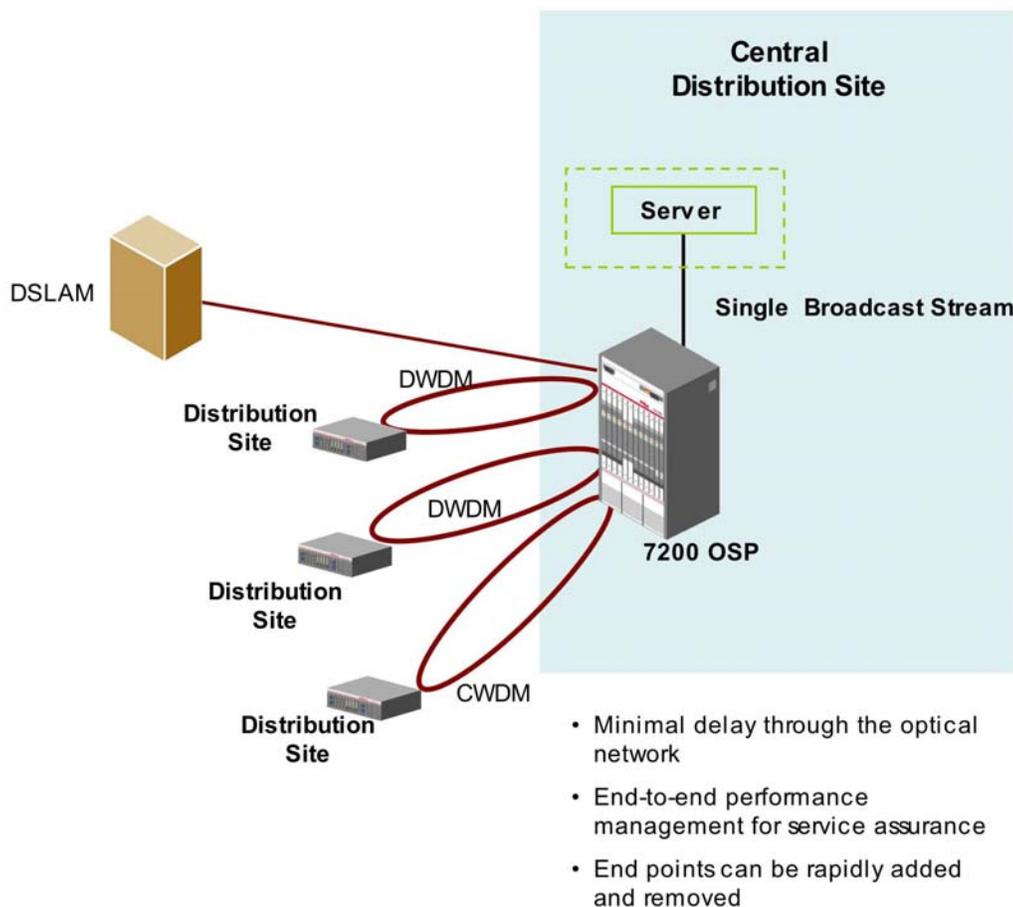


Figure 3 – Distributed Service Delivery Model

FLEXIBLE ACCESS OPTIONS COVER ALL POSSIBILITIES

The Meriton AON supports both CWDM and DWDM in the access network, ensuring service providers have complete flexibility to implement the appropriate solution for their needs, and that they have the ability to adapt the network as those needs change. Each node within the network supports CWDM and DWDM from the onset, so the decision to migrate from one to the other can be based purely on need. In addition, the network supports traffic at 1 and 2.5 Gb/s with planned evolution to 10 Gb/s.

Multi-topology support is also inherent in the network components, and the AON has the ability to manage the reconfiguration of traffic as required. Wavelengths can be added or dropped as necessary to support multimedia broadcasts.

Cost benefits can be achieved by terminating multiple WDM chains on one metro node. Driving WDM deeper into the network also means that service providers can use WDM to support services from other network layers, including multiservice access networks, IP-based DSLAMs, FTTx and cable head ends.

THE BENEFITS OF A UNIFIED INFRASTRUCTURE

Regardless of the traffic type, technology, topology or service, the Meriton AON provides a multimedia service delivery architecture that service providers can manage end to end, ensuring the lowest possible OPEX and CAPEX.

The Meriton AON can be used to implement a unified service delivery architecture that leverages optical wavelength transparency and switching to enable a range of services. Reconfigurable ingress ports provide an evolutionary path for services on a common infrastructure. The network supports service processing, which service providers can choose to implement according to network requirements. SONET/SDH aggregation and switching capabilities make it possible to fully support legacy traffic on the new infrastructure. The network also supports Ethernet aggregation and switching, so service providers can aggregate traffic as close as possible to local service delivery platforms. Ethernet traffic is carried directly on the wavelength, without the additional overhead added by Layer 2 processing. The unified architecture also integrates short-haul data services, such as FICON and ESCON, to help reduce deployment and operation costs.

The Meriton Agile Optical Network provides the ideal infrastructure for implementing broadband multimedia services, as shown in Figure 4.

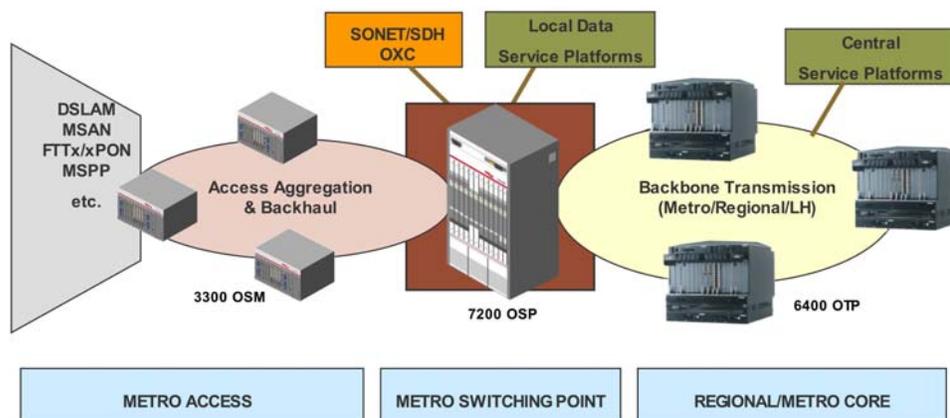


Figure 4 – AON Supporting Broadband Multimedia Services

AON: READY TO SERVE IN THE REVOLUTION

With the AON supporting broadband multimedia services, the provider can be ready for anything the broadband revolution has in store. It's clear: maintaining status quo is not an option. Service providers need an infrastructure that enables them to leverage optical scalability, resilience and service assurance. They need to deploy optical wavelength networking deep into the access network, and only undertake service layer processing when it adds value. Above all they need to be able to manage the network from end to end.

The Meriton AON was specifically designed to meet all these requirements. The AON uses managed wavelength transparency to enable operators to build a unified network infrastructure that is ideal for supporting consumer broadband services.



About Meriton Networks Inc.

Meriton Networks Inc., provider of the optical networking foundation for 21st century networks, has developed the industry's first unified end-to-end Agile Optical Networking architecture. Meriton customers that include incumbent and competitive carriers, as well as world-class enterprises, deploy a single, cost-effective solution that addresses the issues of fiber relief and network cost reduction, while also enabling the delivery of all high-speed metro and regional services. The Meriton solution includes metro access, metro core and regional extension products, which are fully managed by a best-in-class suite of network and service management and network planning tools.

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