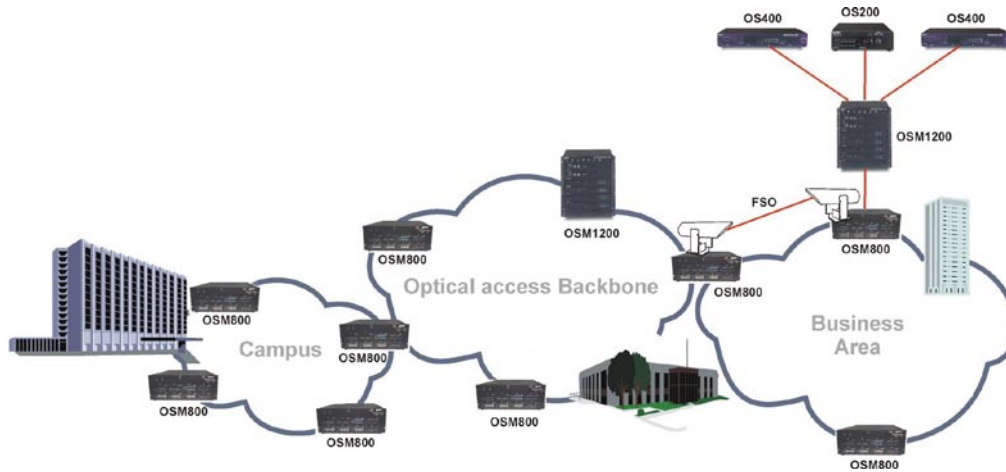# Layer 2 VPNs using Tag Encapsulation and MPLS

The Required Application

The primary requirements of a Broadband Access solution is to be price-sensitive regarding the commodity services, and support the next-generation bundle of services expected from a service driven networking environment.
MRV's broadband access solutions, the OptiSwitch™ family, provide commodity Internet access services as well as voice and high bandwidth video services based on 802.1Q tag encapsulation and Multiple Protocol Label Switching (MPLS) solutions.
MRV's MPLS-based implementation is designed to meet the provider's needs for resiliency, service-delivery mechanism and services support.

The building blocks required to achieve this goal are:
- MPLS in addition to traffic engineer for dynamic QoS transmission.
- Classification (CoS) – MRV's Ethernet Circuit technology,
- Redundant topology implementation for optimal fail-over behavior using advanced protocols such as Rapid Spanning Tree Protocol (RSTP)
  All using the OptiSwitch™ platform!

Relevant Links:
OptiSwitch Master And OptiSwitch Family
For more info about OptiSwitch Master and OptiSwitch:
http://www.mrv.com/products/switches_routers/os.php

The network provider can offer point-to-point and point-to-multipoint connections using Virtual MAN and Transparent LAN Services (TLS) with guaranteed QoS.
These services are based on sophisticated integration of 802.1Q VLANs, DiffServ and traffic engineer technologies together with multipoint MPLS-VPNs.
Implementing MRV's OptiSwitch™ also allows another critical scaling function: the original VLAN tag is kept all along the path (using VLAN encapsulation). This frees the provider from having to repeat the same tags across the entire backbone. Since there are no limits on Layer 2 VPNs tunnels, VLAN tags can be reused in different locations.
As the number of subscribers increases, the 802.1Q VLAN tag model faced several scalability problems. In a typical LAN cloud thousands of Virtual MAN services are needed while the maximum number of VLANs supported is 4096. MRV's access technologies offer a standard-based method to scale these VLAN-based services, using a multipoint MPLS based solution.
MRV's technology allows the mapping of 802.1q VLANs to be mapped to MPLS tunnels or Label Switched Paths (LSPs) in the service provider's access backbone
It allows the multi-service infrastructure to re-use the 4096-802.1Q tag-Id range on each OptiSwitch Master port for different customers, saving many IP address and increasing the network security. This feature practically eliminates this 4K-tag and learning tables limitation in layer2 networks.
This advanced secure Subscriber mechanism ensures that customers are separated from each other even though they have the same 802.1Q Tag-Id, without the need to define a special IP interface per customer, this way many IP address are saved.

The technology includes:
– MRV's Networks MPLS with label distribution protocol (LDP) and RSVP-TE
– Layer2 (Martini draft) and Layer 3 MPLS VPNs – enabling maximum tunneling capabilities
– Multipoint MPLS MAC base Forwarding, connecting organizations via Martini MPLS mesh to one L2 network
– Layer2 and Layer 3 Subscribers provisioning technology enabling maximum control and security
– Advanced Ethernet Circuit: non-blocking, wire-speed policy based on QoS and traffic engineering.
– Advanced rate limitation and bandwidth management
– 4096 tags can be served per port – full layer 2 domains can be terminated on one port without losing performance

– High Availability via Gigabit Ethernet Redundancy (GER) signal redundancy module and backup label switched paths (LSPs) for fast fall over and load balancing - less than 50 ms
– Management
   - MegaVision Web support for network management and accounting
   - Preserving minimum downtime (very low MTTR) by off-line configuration tools

Advantages:
– Built-in, full wire-speed, MPLS technology - No additional cost
– Tag encapsulation option makes IEEE 802.1Q tags locally significant (customer .1Q tags don't have to be the same on both sides of the metro network).
– Transparency: the ability to handle non IP traffic, or private IP addresses, option that does not exist in a pure routing environment
– IP routing protocols can reroute Layer 2 traffic
– MPLS coexists with existing native IP routing
   - Metro network can deliver both native IP for Internet access and private IP services, as well as Layer 2 virtual LAN services
   - MPLS supports IP routing over LSPs and reduces need for BGP tables in core
   - MPLS can traffic-engineer IP traffic
– MPLS coexists with native Layer 2 switching
– MPLS delivers new services to traditional Ethernet network
   - MPLS adds traffic engineering for control over user traffic
   - There is advanced IP routing support (IP traffic engineering)
   - MPLS can scale to provide services between metro networks
   - MPLS can exceed by far the limits of traditional Ethernet broadcast domains

- Multi Point MPLS enables organizations to be remotely connected in one L2 network over MPLS.
– Efficient use of core metro bandwidth using MPLS traffic engineering
– Better margin for resellers and distributors with minimum stock and preserving minimum downtime (very low MTTR)
– Security scheme - both for the management (SSH2, SNMPV3, Radius, ACL for management) and for the subscriber (L2/L3 access list, classification, VLANs)

Drawbacks:
- MPLS adds complexity to traditional Ethernet networks
- New protocol requires additional training for network management staff

Economics and Time:
- Networking infrastructure: Using the OptiSwitch Master™ diferent chassis size, "grow along modular solution" the cost is minimal and the installation time is low
- MPLS is built in in MRV's OptiSwitch Master thus it does not require additional cost. The time for MPLS implementation is low though sometimes it takes time to educate the technician with MPLS new technologies
- Management system: low cost and installations time

Services:
- Scalable Multi Point Layer 2 VPN Ethernet connectivity
- Internet access and private Office-to-Office services.
- Tiered service model using various levels of over subscription

Target Customers:
- Metro Area Network providers
- Enterprises or other customers supporting multiple sites within a metropolitan region
- Utilities and city carriers

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