



Pseudowires in the Access

Accelerating the adoption of Ethernet-based services

Houman Modarres

MPLScon '06
New York City
25 May 2006

Ethernet / MPLS Business Services Infrastructure

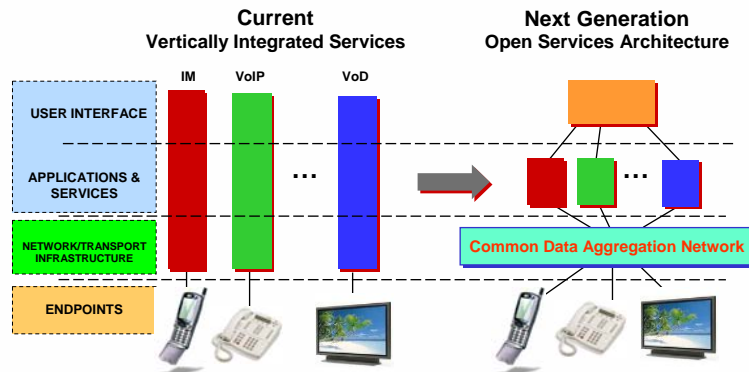
- **Driving towards higher-value services to enterprises**
 - VOIP
 - IP VPNs
 - Storage extension & Disaster recovery
 - Enhanced Services
- **To do so, we must control the performance characteristics of Ethernet infrastructure on a per-application basis**
- **Greenfield approaches that ignore the realities of Service Migration & Interworking will be of limited value in the broader picture**
- **Intelligent Aggregation capabilities exist today to make broad-scale deployment possible**
 - Pseudowires (including PW OAM, PW CAC...)
 - Ethernet OAM
 - QoS & OAM mapping
 - Service interworking with Legacy



Implications

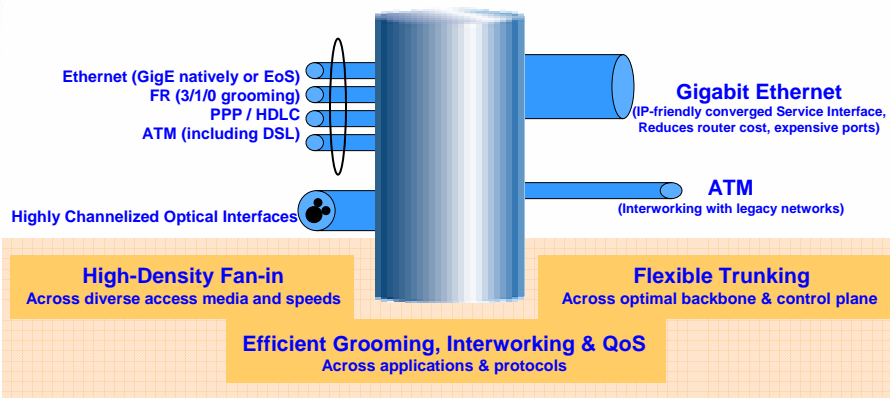
	"Old World"	Business Ethernet
Service Foundation	TDM (Voice/TDM)	IP / MPLS
Nature of Connections	Circuits	Flows
Nature of Applications	Simple	Complex
Nature of Service	Basic	Rich
Nature of Users	Fixed with low expectations	Fixed / Mobile with high expectations
Fundamental Network Element	Switch (C4/C5)	Router
Grooming & Aggregation Function	DCS	?

Open Services Framework



- Separation of transport and endpoint layers from session control
- Session management across multiple real-time communication services
- One common packet-based network that can carry all types of application traffic
- Independent of access medium and speed

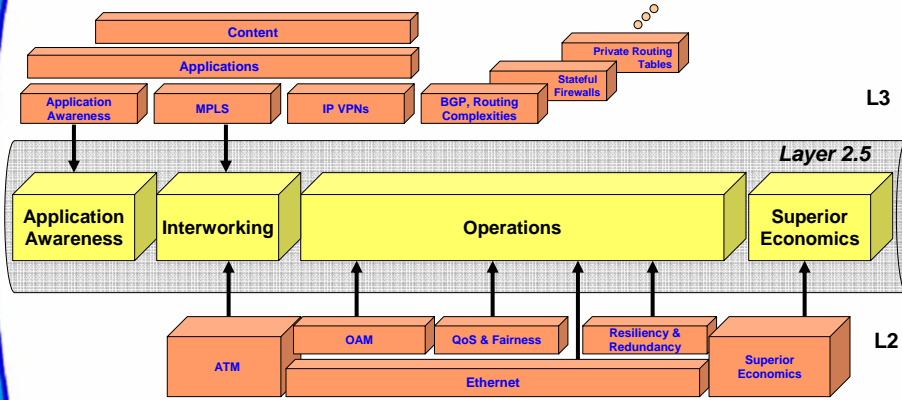
Aggregation: Key Role in Carrier Networks



The Dimensions of Intelligent Aggregation

Dimensions	Business Ethernet	Residential Broadband (IPTV, VoD)	Wireless (FMC/IMS)
1) Infrastructure Shift	<ul style="list-style-type: none"> To Ethernet / MPLS (ATM/FR → EoS/GbE) 	<ul style="list-style-type: none"> To Ethernet / MPLS (ATM DSLAM → IP DSLAM) BPONs → GPONs/EPONs) 	<ul style="list-style-type: none"> To Ethernet / MPLS TDM → Ethernet ATM → MPLS
2) Customer Traffic	<ul style="list-style-type: none"> Pseudowire (PWE3) Encapsulation 	<ul style="list-style-type: none"> Subscriber Flows 	<ul style="list-style-type: none"> Subscriber Sessions
3) QoS	<ul style="list-style-type: none"> Strict SLAs per customer circuit Requirements set based on expectations / SLAs from legacy (FR/ATM/PL) 	<ul style="list-style-type: none"> Per Subscriber Flow Performance Requirements tighten with transition from data only to triple play 	<ul style="list-style-type: none"> Per Subscriber Session Performance Requirements tighten with transition from voice-only to mobile multimedia
4) Flow Scale	<ul style="list-style-type: none"> Volume services are still in sub-Mbps circuits 	<ul style="list-style-type: none"> Transition from static to real-time Hundreds of Thousands of flows 	<ul style="list-style-type: none"> Possibly millions of flows
5) Operations & Management Model	<ul style="list-style-type: none"> Legacy OAM in place, Ethernet work-in-progress Shifting to SOA (XML/SOAP) Bill to Web Portal 	<ul style="list-style-type: none"> OAM ?? Billing: 3 Bills 	<ul style="list-style-type: none"> OAM ?? Billing: Web portal
6) Interworking with legacy	<ul style="list-style-type: none"> Ethernet – FR/ATM Ethernet – EoS ATM - MPLS 	<ul style="list-style-type: none"> Ethernet – ATM 	<ul style="list-style-type: none"> Ethernet – TDM Ethernet - ATM

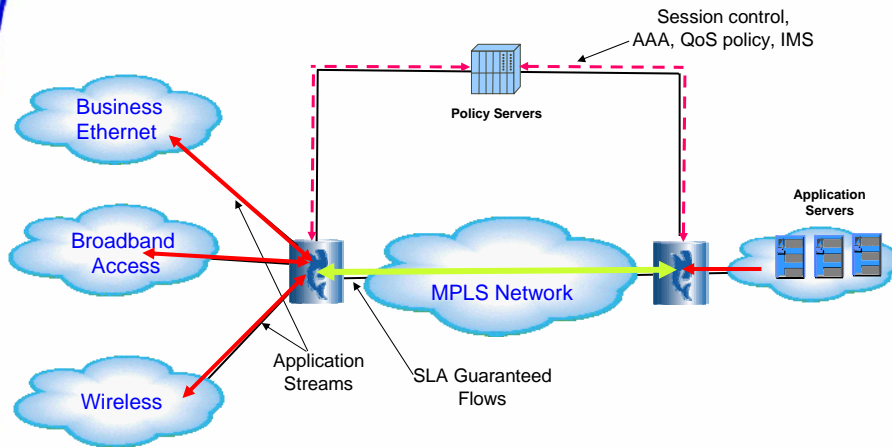
Minimizing the Cost and Complexity of Delivering Business IP Services



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Reference Architecture



Requirements:

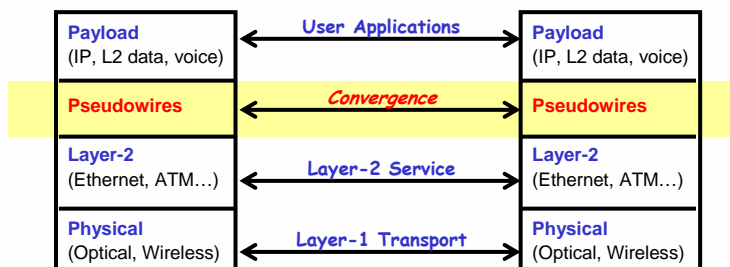
- Aggregate lots of user flows independent of access medium and speed
- Focus on application-awareness, subscriber traffic management, QoS / SLA and efficient backbone interface
- Interface with policy & application servers for personalized services

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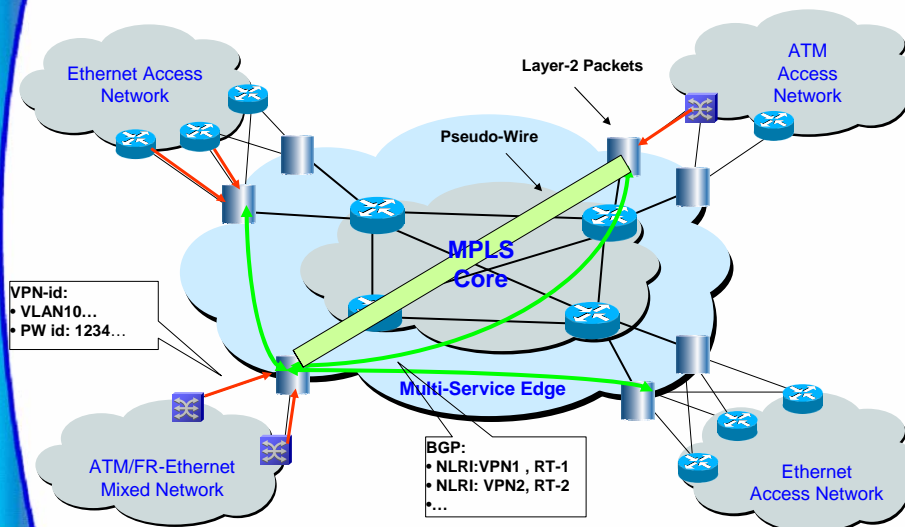
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Pseudowires...

- A type of “*virtual circuit*”: on top of all Layer-2, below Layer-3 (IP)
- A **point-to-point connection** that carries packets, cells or bit streams
- Uses **MPLS control plane** to provision data flows
- Works over legacy as well as low-cost Metro **Ethernet**
- **Future-proofed** against ‘next big thing’ in access
 - ➔ Suitable for Service Convergence
 - ➔ Utilizes current access assets

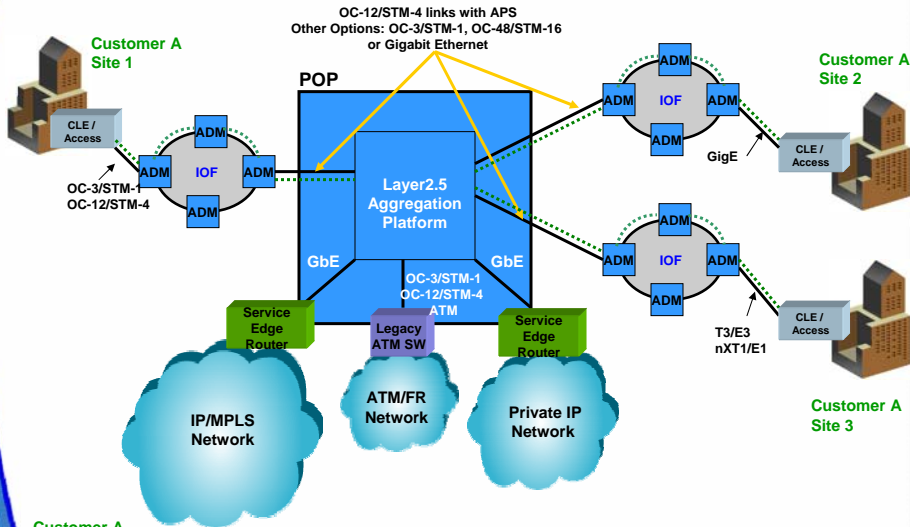


Pseudowires and L2oMPLS

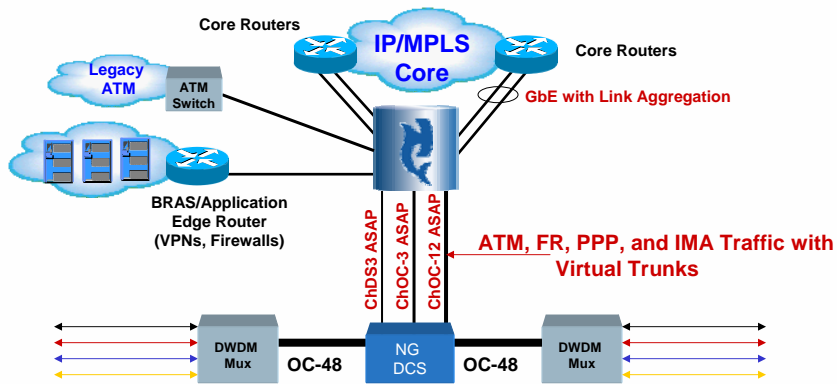


Metro Aggregation

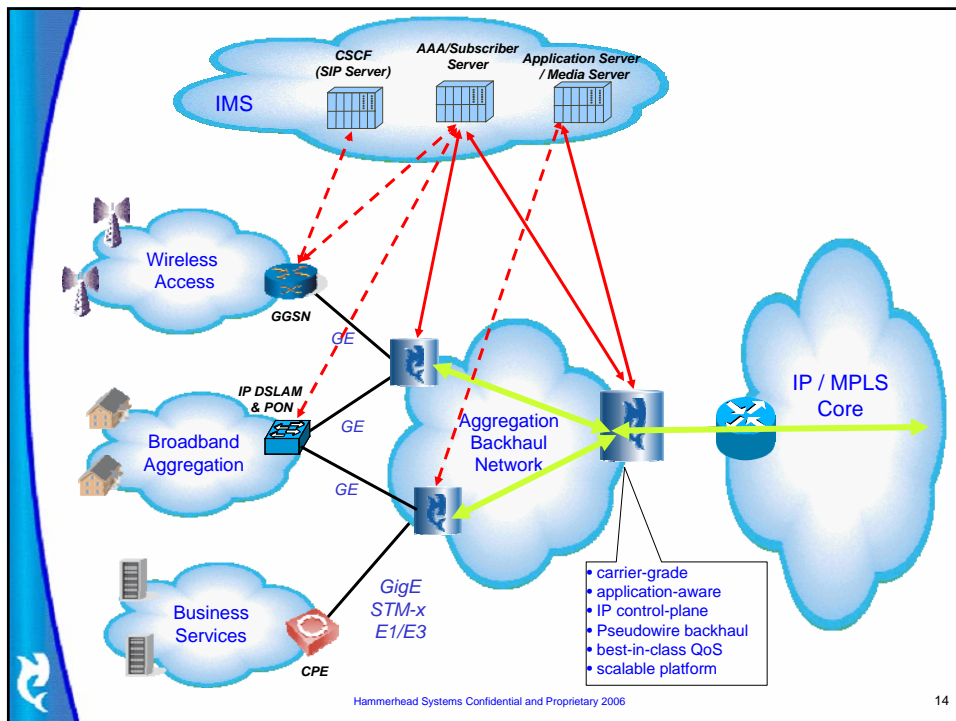
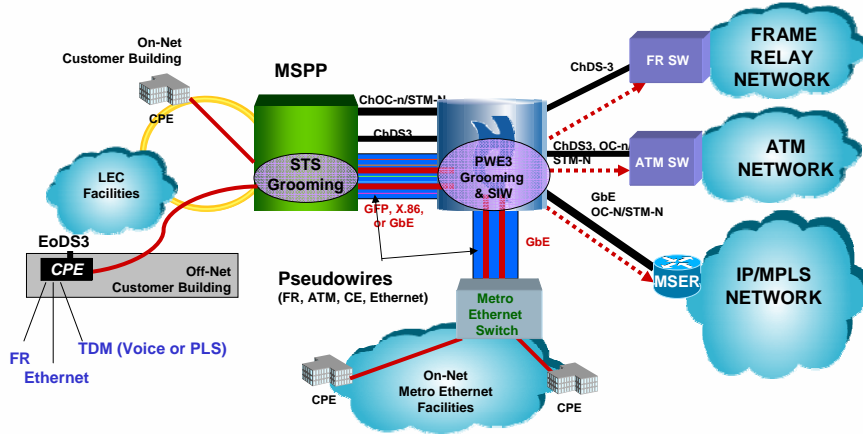
New & Existing Services, Delivered to Multiple Customers, Leveraging Investment in Existing SONET/SDH Infrastructure



Intelligent Aggregation for Business Services

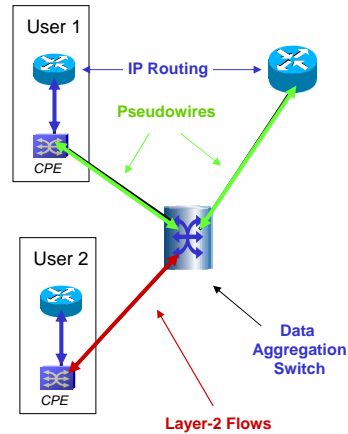


Intelligent Aggregation for Business Ethernet Services: Sample Deployment Scenario

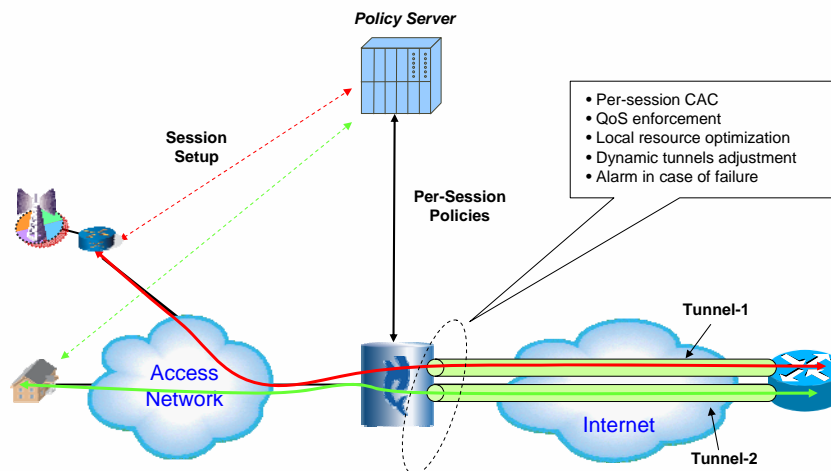


Pseudowires in the Access

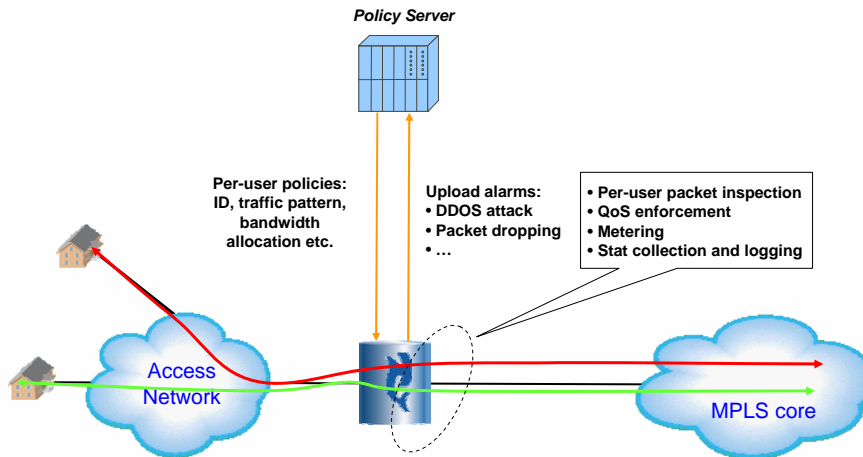
- **Flexibility**
 - Multiplex traffic from all access infrastructure
- **QoS guarantees at fine granularity**
 - Sustain per-flow QoS after aggregation
 - Support delay-sensitive traffic
- **Edge-to-edge OAM**
 - Support MPLS-Ethernet/ATM OAM Mapping
- **Rapid Protection & Restoration**
 - Recovery from failures in msec's
- **Support Multiple Control-Planes**
 - MPLS, Ethernet, ATM...
- **Easy to Manage**
 - Compatible with backbone's MPLS control-plane
- **Cost Effective**
 - Remove unnecessary IP functions



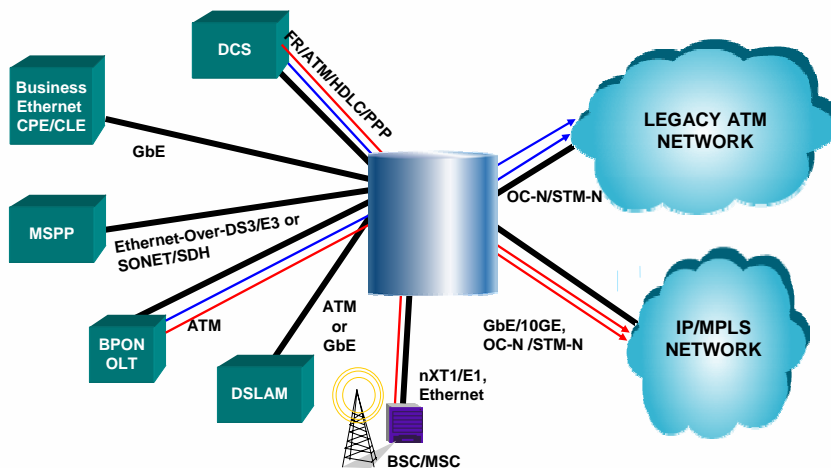
Session Admission Control



Session Awareness



Broader Scope of Services Migration



- High density Ethernet fan in, for Native GigE as well as EoS
- Diverse Access media and speeds
- Granular QoS, with policing & OAM mapping on a per flow level
- Flexible trunking and handoff to IP and legacy networks
- Any-to-any service interworking

Summary: The Value of Intelligent Aggregation

- **Driving towards higher-value services across business and residential subscribers**
- **To do so, we must control the performance characteristics of Ethernet infrastructure on a per-application basis**
- **Greenfield approaches that ignore the realities of Service Migration & Interworking will be of limited value in the broader picture**
- **Intelligent Aggregation capabilities exist today to make broad-scale deployment possible**
 - Pseudowires (including PW OAM, PW CAC...)
 - Ethernet OAM
 - QoS & OAM mapping
 - Service interworking with Legacy
- **Key Requirements are:**
 - Ability to support lots of flows,
 - With granular QoS and OAM,
 - Including service interworking with legacy services & transport.

