

***“The Operational Advantages of Ethernet
in a Metro Network”
An MEF Economic Study***

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Outline

- Introduction
- Study objectives & scope
- Service Providers surveyed
- Methodology
- Key challenges
- Initial observations & findings
- Going forward
- Questions & answers

Introduction

- Third MEF economic study since 2001:
 - Metro Ethernet Services for Enterprises (Capex & Opex)
 - The Optical Ethernet MAN (SP Capex study)
- Studies performed by respected industry consultants under the guidance of the MEF Economic Committee:
 - Network Strategy Partners (Michael Kennedy)
 - Point East Research (Scott Clavenna / Brian Van Steen)
 - Information gathered in strict confidence
- A key component of MEF's evangelization efforts to “accelerate the adoption of optical Ethernet as the technology of choice in metro networks worldwide”

Study Objectives & Scope

- Compare the OPEX of Ethernet service delivery when a carrier deploys a new metro Ethernet service to the OPEX of delivering legacy data services using providers existing legacy overlay network infrastructure.
- The 2 Ethernet services that are proposed for this study and that are consistent with the MEF's priorities are:
 - Ethernet Private Line (E-Line) service
 - Ethernet Virtual LAN (E-LAN) analogous to an Ethernet Transparent LAN service.
- These would serve as the basis of comparing the OPEX cost versus a comparable private point-to-point, frame relay or ATM service.

MEF E-Line Service (and Legacy Analogue)

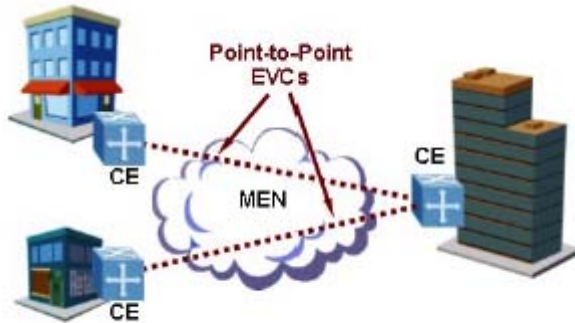


Figure 3: E-Line Service using Point-to-Point EVCs

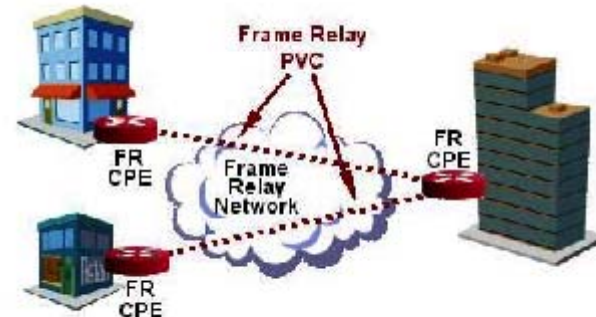


Figure 4: Frame Relay analogy of E-Line Service

MEF E-Line Service

Frame Relay Service

- Provides a pt-pt Ethernet Virtual Connection (EVC) between two UNIs.
- Typically provides symmetrical bandwidth and performance for data sent in either direction.
- May define a CIR, PIR and associated burst sizes
- May be used to construct services analogous to Frame Relay, Ethernet and private Leased Lines. However, the range of Ethernet bandwidth and connectivity options is much greater.

MEF E-LAN Service (and Legacy Analogue)

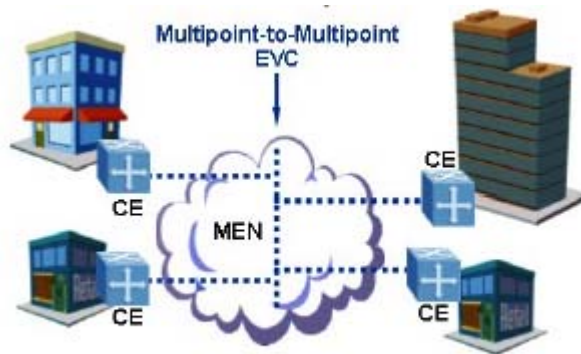


Figure 5: E-LAN Service using Multipoint EVC

MEF E-LAN Service

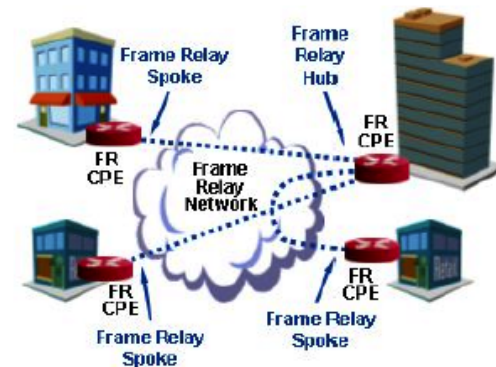


Figure 6: Frame Relay analogy to E-LAN Service

Frame Relay Service

- Provides multi-point connectivity via a multi-point EVC.
 - Data sent from one UNI can be received at one or more of the other UNIs
- As new sites are added, they are connected to the same multi-point EVC
 - Reduces provisioning complexity, time and cost
- Similar to E-Line, may define a CIR, PIR and associated burst sizes.
- Makes the Metro Ethernet Network (MEN) look like a LAN.
 - Less complex than legacy hub and spoke or mesh network configurations

Service Providers Surveyed

	North America	Europe	Total
Incumbents	6	4	10
Established Alternates	6	6	12
New Entrants	5	5	10
Total	17	15	32

- Extremely broad, well-balanced study:
 - NA vs Europe, New Entrants vs Incumbents, EoS vs Switch overlay
 - CEO, CTO, Marketing, PLM, Operations & Planning
- Strong participation from non MEF members
- Additional Service Provider interviews to come

Ethernet Adoptions Found in the Market

- Metro Ethernet networking (widespread):
 - Ethernet-over-SONET/SDH point-to-point
 - Ethernet-over-SONET/SDH ring/multipoint
 - Ethernet-over-fiber point-to-point
 - Ethernet-over-fiber switched/multipoint
 - *Single or multi-wavelength fiber*
- Metro Ethernet networking (emerging):
 - Ethernet-over-MPLS multipoint
 - Ethernet-over-RPR-over SONET/SDH ring/multipoint
 - *Not enough data to permit inclusion in the quantitative portion of the study at this time. Will be included in the qualitative portion of the study.*

Mapping MEF Services to the Real World

- MEF E-Line Service:
 - Ethernet over SONET/SDH point-to-point
 - Ethernet over Fiber point-to-point
- MEF E-LAN Service:
 - Ethernet over SONET/SDH ring/multipoint
 - Ethernet over Fiber switched / multipoint
- Legacy Services:
 - F/R, ATM, Leased Lines (n*DS1/E1, DS3/E3, OCn)

Study Methodology

- Cross-disciplinary engagements with Service Providers:
 - Marketing:
 - Scope of Ethernet deployments, service definitions, pricing, rate of adoption.
 - Network Operations:
 - Typical operations process (functions, process, time, cost) for Ethernet, ATM, F/R and P/L services
 - Network Planning:
 - Planning and deployment challenges

Methodology - Marketing

- Understanding the Service Provider's Metro Ethernet business:
 - Commitment to marketing and selling Ethernet services
 - Is Ethernet aggressively positioned in the market (with a desire to exploit Ethernet advantages) or is it an “add-on” to existing data services
- Understanding the sales environment:
 - How is Ethernet selling,
 - What are customers using it for,
 - What is the market for follow-on orders,
 - Is there cannibalization,
 - What capacities are customers demanding
- Understanding the pricing structure:
 - Especially versus legacy services
 - *if Ethernet is priced “20%” lower, and opex is “20%” lower, where is the benefit to the service provider?*

Methodology: Network Operations

- “Time & Motion” data gathering for circuit provisioning, and ongoing circuit monitoring & management:
 - ATM, Private Line, Ethernet.
 - Time requirements based on monthly averages.
- Cost information was captured for each step and function:
 - Approximated based on average salaries for each employee and the average amount of time devoted to each step or function.
- At this point, the approximate time and cost devoted to each type of circuit (ATM, TDM PL and Ethernet) can be tabulated in a straightforward manner.

Methodology: Network Engineering

- Qualitative assessment:
 - Exploration of the operations challenges experienced in building and maintaining an Ethernet-based network compared with legacy networks.
 - Objective was to understand the challenges encountered, how they were overcome and where more work was needed from equipment vendors.

Key Challenges Identified So Far

- Contributions to Opex costs arising from organizational structures:
 - Service providers with separate division for circuit and packet services, versus
 - Service providers with single divisions for these different services
- Impacts of different regulatory environments:
 - Different operating procedures arising from regulatory regimes
 - where possible these differences will be analyzed and compared, otherwise the differences will be highlighted qualitatively
- Dealing with different currencies (C\$, US\$, £ and €)
 - To be dealt with by using percentages

Initial Observations & Findings /1

- Majority of the individual Ethernet circuit demand in the market today is between 10 and 100 Mbps:
 - Granularity of b/w jumps is larger than first expected.
 - Probably driven by S/P need to keep service definitions simple.
- Metro Ethernet complements F/R: it does not cannibalize it.
 - Major Frame Relay demand is between 56 and 768 Kbps:
 - Ethernet service revenues are largely accretive not substitutions.
- Service demand above (n*)T1/E1 is largely met with ATM and Private Line services and is the strongest candidate to migrate to metro Ethernet:
 - Opex comparisons against ATM, P/L and SONET/SDH (service provisioning, turn-up, trouble shooting, etc) are required.

Initial Observations & Findings /2

- Ethernet bandwidth changes can be completed overnight versus in most cases a completely new circuit for TDM, ATM or FR
 - Significant scope for Opex savings
- For wholesale providers, there is ~20% savings in initial provisioning of Ethernet circuits
- Some network monitoring and management functions and features still have to be addressed by equipment vendors and/or standards bodies
 - “Ethernet OAM” (‘ping’ ‘traceroute’ etc)

Going Forward

- Data gathering phase largely completed.
 - Data analysis getting underway now:
 - Expected to take 6-8 weeks
- White Paper for MEF members expected to be available by early August.
- MEF and PointEast will share the results of the study with the industry more extensively beginning in Q3.
 - MEF collateral committee to develop external collaterals during Q3
 - Analyst briefings, Industry symposiums, etc
- Potential to expand the analysis to consider the Opex advantages for APAC service providers in a future phase.

Questions ???