# Service Provider Business Case Study: Operating Expenditures

## Executive Summary

### Introduction

The Metro Ethernet Forum worked with 36 service providers to identify actual OpEx savings for Metro Ethernet services compared to legacy Private Line, Frame Relay and ATM services. The results provided an impressive detailed picture of the actual individual steps required to deliver a single data service to an enterprise customer and then monitor that service. The results provided not only a model for accurately tracking OpEx cost, but clearly identified cost savings for Metro Ethernet that continue to grow over time.

Using actual live data, a real-world forecast model was constructed for a typical metro area, with a population of 1 – 2 million people and 50,000 – 80,000 businesses. The model compared the OpEx savings over a three-year period for Ethernet Line and Ethernet LAN services versus legacy[1] private line and Frame Relay/ATM virtual circuit services. As defined by the Metro Ethernet Forum, Ethernet Line (E-Line) services are point-to-point services, while Ethernet LAN (E-LAN) services are multipoint services. The following results of this study are compelling:

1. Metro Ethernet services can reduce OpEx by 23% for service providers, which can represent millions of dollars per metro area and tens-of-millions of dollars within a service provider's total territory[2]

2. These Metro Ethernet OpEx savings grow each year, and will increase as the technology and services mature

**Chart 1: Metro Ethernet Savings for a Singe Metro Area**

| Year 1 OpEx savings | Year 2 OpEx savings | Year 3 OpEx savings | 3-year OpEx cumulative |
|---|---|---|---|
| 18% | 20% | 24% | 23% |

These savings were driven by Service Providers' ability to automate Ethernet operating processes and significantly reduce the number of truck rolls that service providers require. The management systems of Ethernet networks can simplify the configuration of services, reducing the time to deliver services to customers. Once these services are in place, customer requests for greater bandwidth or additional services are accomplished via a quick software adjustment, versus a time-consuming and costly truck roll.

The full details and methodology of this scenario model follow in this executive summary. This summary also introduces the OpEx study which tracked the processes required to deliver and monitor enterprise data services.

Additional work to be released in the near future will cover Asian service providers, as well as emerging service providers from each of these three regions. These upcoming reports will focus on the differences between the regions as well as the service providers that are fully leveraging Ethernet capabilities to achieve greater OpEx savings than shown with this report.

[1] Legacy private line services are T1/E1, T3/E3 and higher OC-n/STM-n services.
[2] Cumulative Metro Ethernet OpEx savings amounted to $1.8 million over three year for a single metro area.

## Overview

The following presents an executive summary of the Metro Ethernet Forum's OpEx study, covering North American and European service providers. This study was conducted between April and September, 2003, and included participation from 36 service providers with real Metro Ethernet networks in place today. The scope of the study was the comparison and analysis of service provider OpEx for E-Line and E-LAN services versus Private Line and Frame Relay or ATM services.

These results have been compiled and integrated within a real-world scenario model to forecast 3-year total cost savings. This scenario model tracks the deployment of enterprise data services by a service provider within a single medium-sized city over a three-year period. Such a medium-sized city would be represented by:

- Approximately 50,000 – 80,000 business establishments
- Approximately 1 – 2 million people living in the metro area
- Approximately 45,000 buildings, ranging from single-story to high-rise
    - Approximately 40,000 one- and two-story buildings
    - Approximately 3,000 three-story buildings
    - The remainder being four-story and higher buildings

Tracked within this scenario model is the initial provisioning of services, service bandwidth upgrades, new services additions, new customer site additions and service monitoring requirements. Based on this real-world scenario model, the results indicate that E-Line and E-LAN services deliver a material level of operations savings to service providers. During the three-year period, the scenario model tracked the following results which represents a typical network implementation:

- The delivery of 13,800 services, each to a single business location
- These businesses are located within 2,156 buildings of three floors and higher
- Fiber access was required for 517 buildings

This executive summary contains the discussion and results of the scenario model and the operating expenditures study used to conduct the scenario analysis. Specifically included are:

- The scenario analysis, including the methodology, the results and its implications
- A discussion of operating expenditures related to Initial Provisioning of services, service Bandwidth Upgrades, Site Additions, Service Additions and NOC functions, including network monitoring and alarm resolution
- How the industry could leverage these savings, and what needs to be done to increase the magnitude of these savings

# Scenario Model

The scenario model tracks the deployment of services from an existing network by a single service provider within a single medium-sized city over a real-life three-year period. For the purposes of this analysis, a mix of E-Line and E-LAN services was compared with an equal amount of traditional SONET/SDH Private Line and Frame Relay or ATM services. Based on the defined number of services, the scenario analysis tracked:

- The initial provisioning of these services
- Service bandwidth upgrades
- Customer site additions
- Customer service additions, and
- Service monitoring requirements.

## The Results

The results of the scenario model show that Metro Ethernet services provide material savings for service providers operations. Based on a real-world analysis over a 3-year time frame, these savings are 23 percent versus legacy data services.

The scenario model tracked four network operations functions, Planning Engineering, Field Technicians, CO / POP Technicians and NOC operations. These four categories track the labor functions necessary to deliver a service to a customer and monitor that service during usage. Therefore, delivering real OpEx savings from these functions will improve a service provider's financial results.

**Table 1: Metro Ethernet OpEx Savings over Three Years**

| | Year 1 | Year 2 | Year 3 | Cumulative |
|---|---|---|---|---|
| **OpEx Savings** | **18%** | **20%** | **24%** | **23%** |
| E-Line | $306,304 | $1,427,694 | $2,688,542 | $4,422,540 |
| E-LAN | $55,865 | $431,062 | $1,197,521 | $1,684,448 |
| **Total Ethernet** | **$362,169** | **$1,858,756** | **$3,886,063** | **$6,106,988** |
| | | | | |
| Private Line | $373,613 | $1,784,658 | $3,555,853 | $5,714,124 |
| FR / ATM | $70,542 | $550,378 | $1,583,967 | $2,204,887 |
| **Total Legacy** | **$444,155** | **$2,335,036** | **$5,139,820** | **$7,919,011** |
| | | | | |
| **OpEx Savings** | **$81,986** | **$476,280** | **$1,253,757** | **$1,812,023** |

Source: PointEast Research

As these results show, there is a material OpEx savings associated with delivering E-Line and E-LAN services. These OpEx savings are cumulative and grow over time, as there are different levels of savings associated with different types of operating functions. The overriding consideration is that these savings are associated with a young technology. Many standards and operating methods are still under development and being improved upon. Also, most service providers have not yet fully leveraged all the functionalities of Ethernet and are still on a "learning curve". As their familiarity with Ethernet grows and as standards are developed and implemented, these OpEx savings have the potential to become even greater.

# Operating Expenditures Study

The objective of this economic study is to compare the operating expenditures of delivering a single Metro Ethernet service versus a single legacy data service. Based on this comparison, a business case for a medium-sized city over a 3-year time frame was produced. This business case shows 23 percent OpEx savings delivered from Metro Ethernet services.

The comparison was made between Metro Ethernet services delivered via an Ethernet-based network versus legacy data services delivered via a legacy network infrastructure. For this study, two Metro Ethernet services were evaluated against two legacy data services.

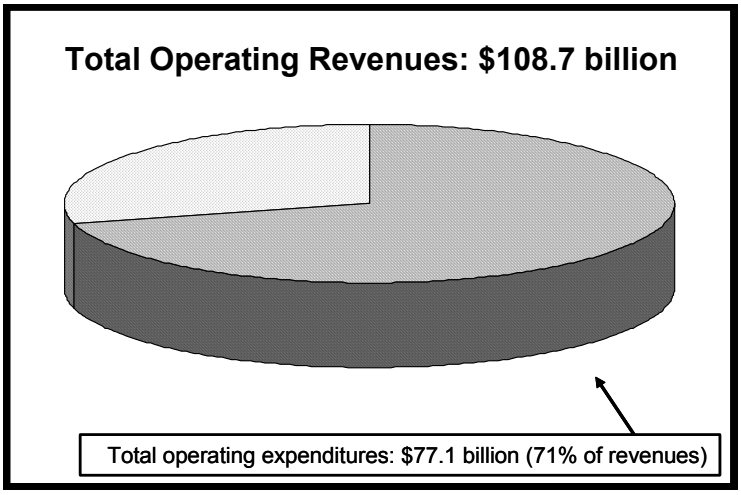
The study examined and compared North American and European service providers' key operating expenditures of delivering these metro data services to existing end-user business customers. Service providers targeted for the study included incumbent Bell Operating Companies, European PTTs, facilities-based CLECs, facilities-based city service providers, and wholesale service providers.

## What are operating expenditures?

Network operations comprise all the processes and functions needed to operate a network and deliver services to customers. They include the sales and marketing processes, the various support functions, all the technicians and engineers for provisioning and monitoring, and the corporate processes in general. By far, labor costs associated with all of these items account for the majority of a service provider's annual operating expenditures budget.

The significance that a reduction in OpEx can have cannot be downplayed. OpEx accounts for a significant portion of overall expenditures as well as total revenue, and a reduction in OpEx will improve the service provider's bottom line. Data from the Federal Communication Commission for 2001 show the size of total operating expenditures as a portion of total operating revenues.

**Chart 1: Total U.S. Incumbent Financial Data**




Source: Federal Communications Commission, 2001

For the purposes of this study, comparisons and analyses are focused on labor expenses related to delivering and supporting customer services. Not all of the FCC defined OpEx categories are therefore related to these various functions. However, the selection and implementation of network technology directly impacts approximately $^1/_3$ of OpEx functions and can influence an additional 6 percent. With U.S. incumbent total operational expenditures at $77 billion, this amount to approximately $30 billion. At this level, service providers should carefully select the technology used to build their networks and how these networks will be monitored and maintained.

# Initial Provisioning Results

The Initial Provisioning of a service is the time and steps needed between when the customer orders a service and when that service is delivered to the customer. These steps involve:

- Planning Engineering (verifying customer order and credit check, capacity availability, equipment availability and technician scheduling)
- Field Technicians (truck roll, equipment set-up, circuit provision and test)
- CO / NOC Technicians (occasional truck roll, circuit cross connects and jumper cables, and occasional test assistance)

Based on the OpEx study results, Metro Ethernet services provide OpEx savings related to initial provisioning of:

- 13 to 19 percent for E-Line services, and
- 17 to 22 percent for E-LAN services.

These savings are mostly due to reduced times needed by Field Technicians to provision and test Metro Ethernet services versus legacy services. There are also occasional savings with Planning Engineers, leveraging more automated Ethernet-based provisioning systems.

# Bandwidth Upgrade Results

As customers use their services, there is a certain amount of "service churn" that service providers experience. One of the reasons for this churn is customers needing to upgrade the amount of bandwidth that is used. Once again, the steps necessary for a Bandwidth Upgrade involve Planning Engineering, Field Technicians and CO / NOC Technicians.

Based on the OpEx study results, Metro Ethernet services provide OpEx savings related to bandwidth upgrades of:

- 66 to 82 percent for E-Line services, and
- 69 to 83 percent for E-LAN services.

These savings are entirely due to the fact that the bandwidth of Metro Ethernet services can be adjusted via a software adjustment in the NOC. In comparison, legacy services require a truck roll to the customer site to change the connection at the customer demarcation point. Given the large amount of travel time and cost associated with truck rolls for Field Technicians, this saving is significant. There were also additional savings associated with CO / POP Technicians. Once again, the cross-connects associated with Ethernet bandwidth changes are changed via a software adjustment, while for legacy services, the work must be done at the central office.

## Service Additions

Ethernet Service additions can be as simple as physically connecting another port, without making any hardware equipment changes, and provisioning the circuit remotely. Legacy equipment used to deliver Private Line services would typically require additional line cards and end-to-end timeslot provisioning to accommodate a new high bandwidth service. Ethernet also has the potential of being the "single-port" for multiple services. With its scalability and flexibility, a customer can order a single 100Mbps port to deliver Internet access, transparent LAN, voice and video services, simply via different VLAN tags. With legacy services, this is much more difficult and expensive, and given the 45Mbps limit of Frame Relay, may require multiple connections.

Customer Service Additions are similar to Bandwidth Upgrades. Once again, Ethernet allows most service additions to be completed via a software adjustment as opposed to a truck roll, as required with legacy services. With Metro Ethernet services, a truck roll may be required to assist the customer with the connection to the demarcation point and new VLAN tagging. If the customer is sophisticated and maintains an internal IT department, this truck roll may not be required. For the purposes of this scenario model, it was assumed that for 10 percent of Service Additions, a truck roll would be required.

# Site Addition Results

Customers also grow their business over time, setting up new locations. These new corporate locations must then be brought on-line, to communicate with the customers head office and with other corporate locations. For the service provider, this is a Site Addition. Basically, a Site Addition is similar to Initial Provisioning, and the steps necessary for a Site Addition require Planning Engineering, Field Technicians and CO / NOC Technicians.

Based on the OpEx study results, Metro Ethernet services provide OpEx savings of approximately 30 percent. These savings were mostly due to reduced times needed by Field Technicians to provision and test Metro Ethernet services versus legacy services. There were also occasional savings with Planning Engineers, leveraging more automated Ethernet-based provisioning systems.

# NOC Function Results

The technicians and engineers working in the Network Operations Center (NOC) perform functions related to monitoring of the network, resolving alarms, and occasionally supporting the provisioning of services. Every service provider will have a NOC; some service providers will have both a primary and back-up NOC, and some service providers separate data NOCs and transport NOCs.

The NOC technicians that specifically monitor the network deal with faults that trigger alarms. These alarms are categorized according to severity, with the alarms requiring attention designated as Minor, Major and Critical. These

technicians will typically work shifts, with 12 hours working followed by 36 hours off. The average NOC technician will thus work 182.5 hours in the average month.

Other than 12 percent operational savings from simplified circuit provisioning and upgrades, there are no material OAM&P savings realized as of yet. This is an area to look to for future potential savings as Ethernet Service OAM&P techniques are refined and standardized.

# Summary and Future Issues

Metro Ethernet services do provide material OpEx savings to service providers today, and these savings increase over time. At a 23 percent savings level, these savings can amount to tens-of-millions of dollars across multiple cities within a service provider's territory.

The future benefits are based on the fact that today's savings come from a technology that is still viewed by service providers as "new". Most service providers are still in the process of fully understanding Ethernet and how to leverage its capabilities. It will still be a couple of years before Ethernet will be fully understood by all the engineers and technicians supporting these services. Many of these engineers and technicians still have not been trained with Ethernet. This can create further potentially substantial "experience curve" savings beyond what is reflected in today's figures.

Ethernet equipment also takes time to be adopted into a network. Most service providers have a large install base of legacy equipment serving existing customers. As Ethernet is increasingly worked into this legacy network, the service provider will be better able to leverage its efficiencies over a greater number of services and customers.

But the equipment vendors still need to address certain service provider issues and concerns. These revolve around making vendor equipment carrier class and finalizing certain industry standards to rectify certain limitations of Ethernet equipment. However, resolving these issues and concerns will only drive greater OpEx savings delivered by Ethernet.

## About the Metro Ethernet Forum

The Metro Ethernet Forum (MEF) is a non-profit organization dedicated to accelerating the adoption of Optical Ethernet as the technology of choice in metro networks worldwide.

The Forum is comprised of leading service providers, major incumbent local exchange carriers, top network equipment vendors and other prominent networking companies that share an interest in metro Ethernet. Since its inception in May 2001, the MEF has maintained a steady growth in membership and has become the recognized leading focal point for Metro Ethernet activities. As of Oct, 2003, the MEF had over 60 members.

## For further information and how to obtain this report

The complete version of this business case study is available exclusively to MEF members, free of charge, and is one of an ongoing series of business case studies now available. For information on becoming a member of the MEF, please contact the Metro Ethernet Forum at:

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# Appendix

## Methodologies

### *Scenario Model*

Based on government data, estimations were made regarding the number of buildings and the number of establishments or tenants for each building, for a medium-sized city. Using these estimates, a customer penetration level was derived for each of the three years representing the number of services would be added each year.

- 8-or-more customers could be won in the first year,
- 6-or-more customers could be won in the second year, and
- 4-or-more customers could be won in the third year

The customer penetration levels were assumed as follows.

| Building Type | Customer penetration level | | |
|---|---|---|---|
| | Year 1 | Year 2 | Year 3 |
| Three Floors | n/a | n/a | **2%** |
| Four to Nine Floor | n/a | **3%** | **6%** |
| Ten or More Floors | **5%** | **10%** | **15%** |

The scenario model was performed, based on assumptions as follows:

- Point-to-point services were contrasted (E-Line versus Private Line)
- Multipoint services were contrasted (E-LAN versus Frame Relay / ATM)
- The split between point-to-point and multipoint each year is:
    - 80 / 20 in Year 1
    - 70 / 30 in Year 2
    - 60 / 40 in Year 3
- The frequency of Bandwidth Upgrades is:
    - 2% in the first year of the life of a service
    - 10% in the second year of the life of a service
    - 20% in the third year of the life of a service
- The frequency of Site Additions is 5% of services each year
- The frequency of Service Additions is:
    - 10% in the first year of the life of a service
    - 20% in the second year of the life of a service
    - 30% in the third year of the life of a service
- The requirement for NOC functions is 5% of services in service

Using these estimates and assumptions, the results of the operating expenditures study were applied to the scenario model. These results provide averages for various operating expenditure functions, for incumbent service providers, competitive service providers and wholesale service providers.
The assumptions regarding the frequency of Bandwidth Upgrades and Service Additions are aggressive if applied to today's legacy services; however Ethernet has the ability to greatly facilitate an increase in their occurrence. As service providers increase the installed base of Ethernet-based services and as customers better understand the ability of change Ethernet usages, the frequency of Bandwidth Upgrades and Service Additions could increase. In a few years, it is entirely possible that Bandwidth Upgrades and Service Additions would increase significantly from levels experienced today.

The network operating functions of Planning Engineering, Field Technicians, CO / POP Technicians and NOC operations were tracked by the study and applied to the scenario model. There functions were tracked by in terms of time as well as cost, and both were applied to this scenario model.

## *OpEx Study*

The study was conducted by gathering research and data from 36 service providers in Europe and North America. These service providers were defined as Incumbents, Competitors or Wholesalers.

**Incumbent service providers** are defined as service providers that offer local telephone service, originally and possibly still as a monopoly. In addition to retail services, Incumbents offer a wide variety of business data services, including Frame Relay, ATM, Private Line and Ethernet. In most cases, these services are offered over copper access infrastructure for low bandwidths and over fiber for high bandwidths.

**Competitive service providers** were set up to compete with the incumbent service providers. These service providers almost exclusively focus on business customers, and mostly deliver services using fiber access infrastructure. Some competitors use a mix of fiber and copper, with copper loops leased from the incumbent service providers. Competitor service offerings to businesses include Private Line, Ethernet, ATM and occasionally Frame Relay.

**Wholesale service providers** provide services to other service providers, and occasionally large enterprises looking for large bandwidth services. Wholesalers sell Private Line and Ethernet data services, in addition to other services, such as wavelengths, that are not covered by this study. Most Incumbents also have wholesale service offerings, but these were not considered for this study.

## *The Models*

The analyses and comparisons are focused on European and North American service providers. From a European perspective, the study is being conducted in Euros (€) while for North America, U.S. dollars ($) is being used. These currencies are used to track the average salaries for the various employees associated with network operations.

Models were created to track the Initial Provisioning of a service, the Bandwidth Change of the service, the Site Addition for a customer, and the NOC Operations for all services. Within each model, a variety of service provider operating processes are tracked. Each of these models tracked the processes for Incumbents, Competitors and Wholesalers, separately for North America and Europe.

These operating processes involve Planning Engineering, Field Technicians, CO / POP Technicians and NOC Operations, and were tracked based on the various steps associated with each process. For each step, an hourly time required to complete the step was estimated. The cost of each step and overall process was then computed. These costs were then applied to each of the models for tracking customer deliverables.

With respect to access infrastructures, the legacy services were assumed to be transported over a TDM infrastructure, SONET for North America and SDH for Europe. The Ethernet services were transported either over TDM or direct over fiber; these methods will be referred to as Ethernet-over-SONET/SDH and switched Ethernet or Ethernet-over-fiber.