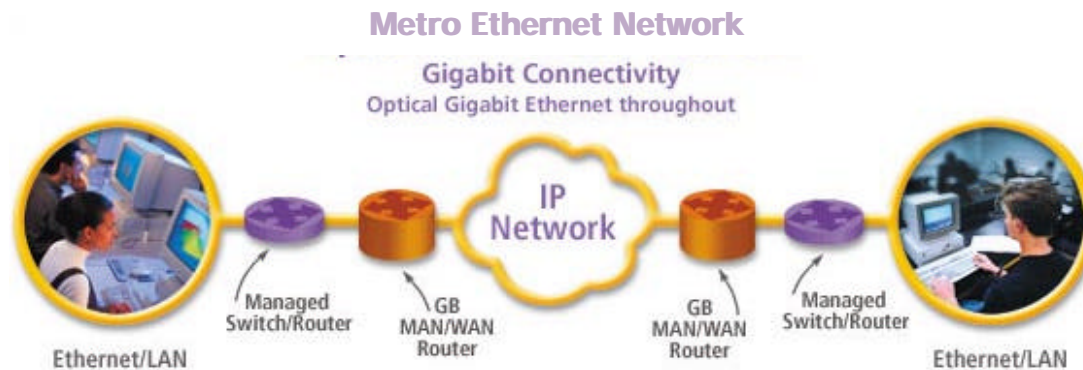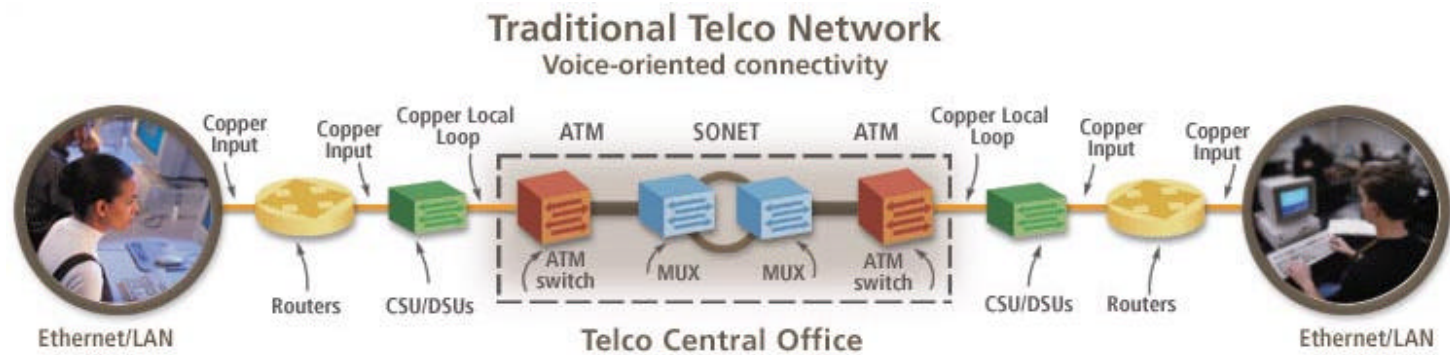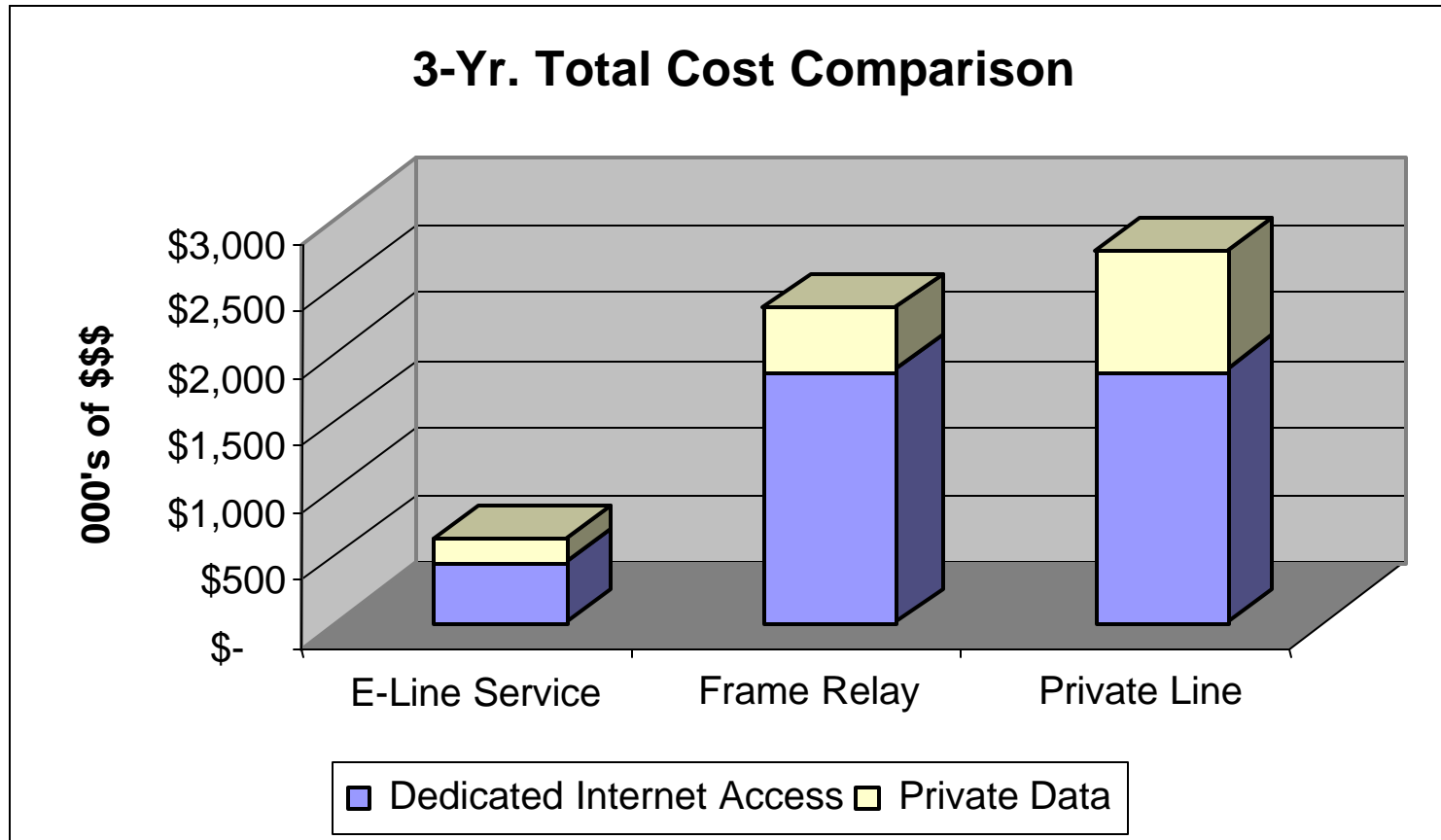# Metro Ethernet

Nan Chen
President, MEF
Email: Nan@Atrica.com

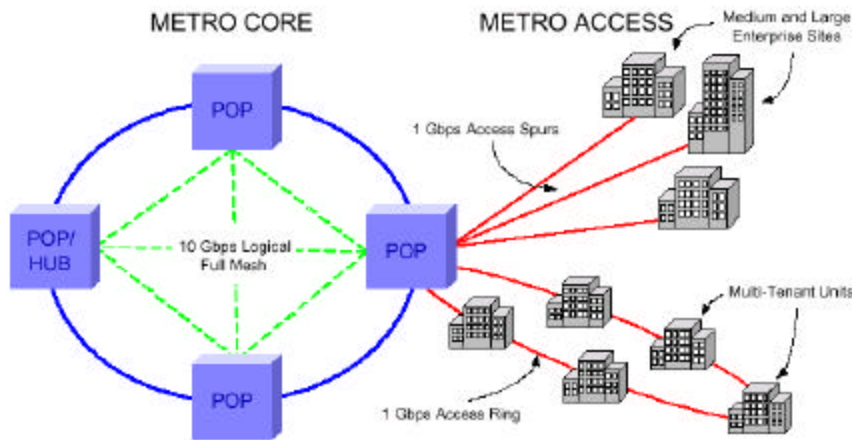# Why Metro Ethernet ?
- *Value, Simplicity, Scalability*

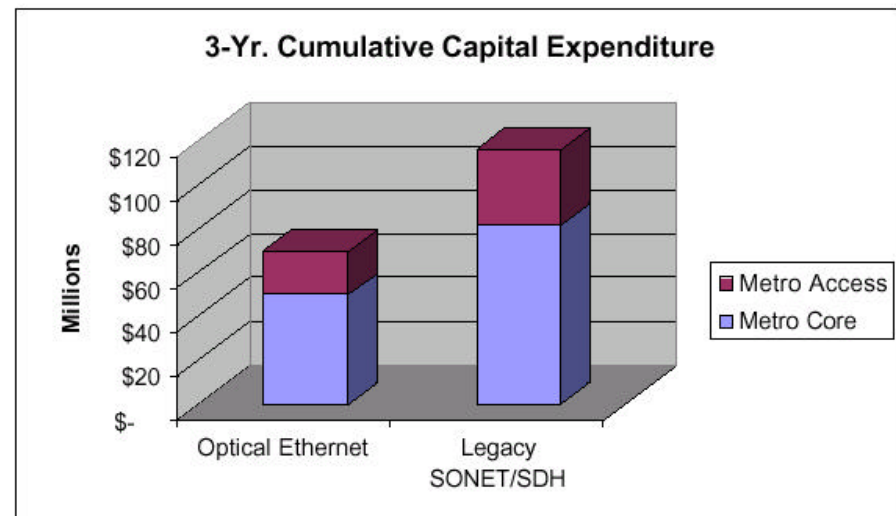# Metro Ethernet Value For Enterprise

3-Yr. Total Cost Comparison

000's of $$$

- $3,000
- $2,500
- $2,000
- $1,500
- $1,000
- $500
- $-

E-Line Service   Frame Relay   Private Line

☐ Dedicated Internet Access ☐ Private Data

METRO Ethernet Forum

Metro Ethernet Value
For Service Providers

METRO CORE   METRO ACCESS   Medium and Large Enterprise Sites

POP

POP/ HUB

10 Gbps Logical Full Mesh

POP

POP

1 Gbps Access Spurs

Multi-Tenant Units

1 Gbps Access Ring

Network Strategy Partners:

– CAPEX savings of 39% vs. legacy SONET/SDH network

– OPEX savings of 49% vs. legacy SONET/SDH

3-Year Cumulative Operating Expenditures

Millions

$140
$120
$100
$80
$60
$40
$20
$-

Optical Ethernet   Legacy SONET/SDH

■ Environmentals
□ Ongoing Operations

3-Yr. Cumulative Capital Expenditure

Millions

$120
$100
$80
$60
$40
$20
$-

Optical Ethernet   Legacy SONET/SDH

■ Metro Access
□ Metro Core

Source: 2003 MEF
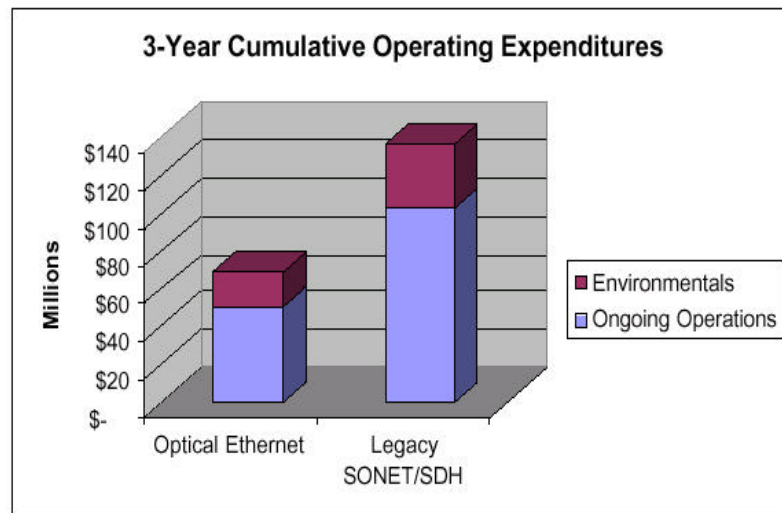
Metro Ethernet:
Scalable E-LAN and E-LINE Services
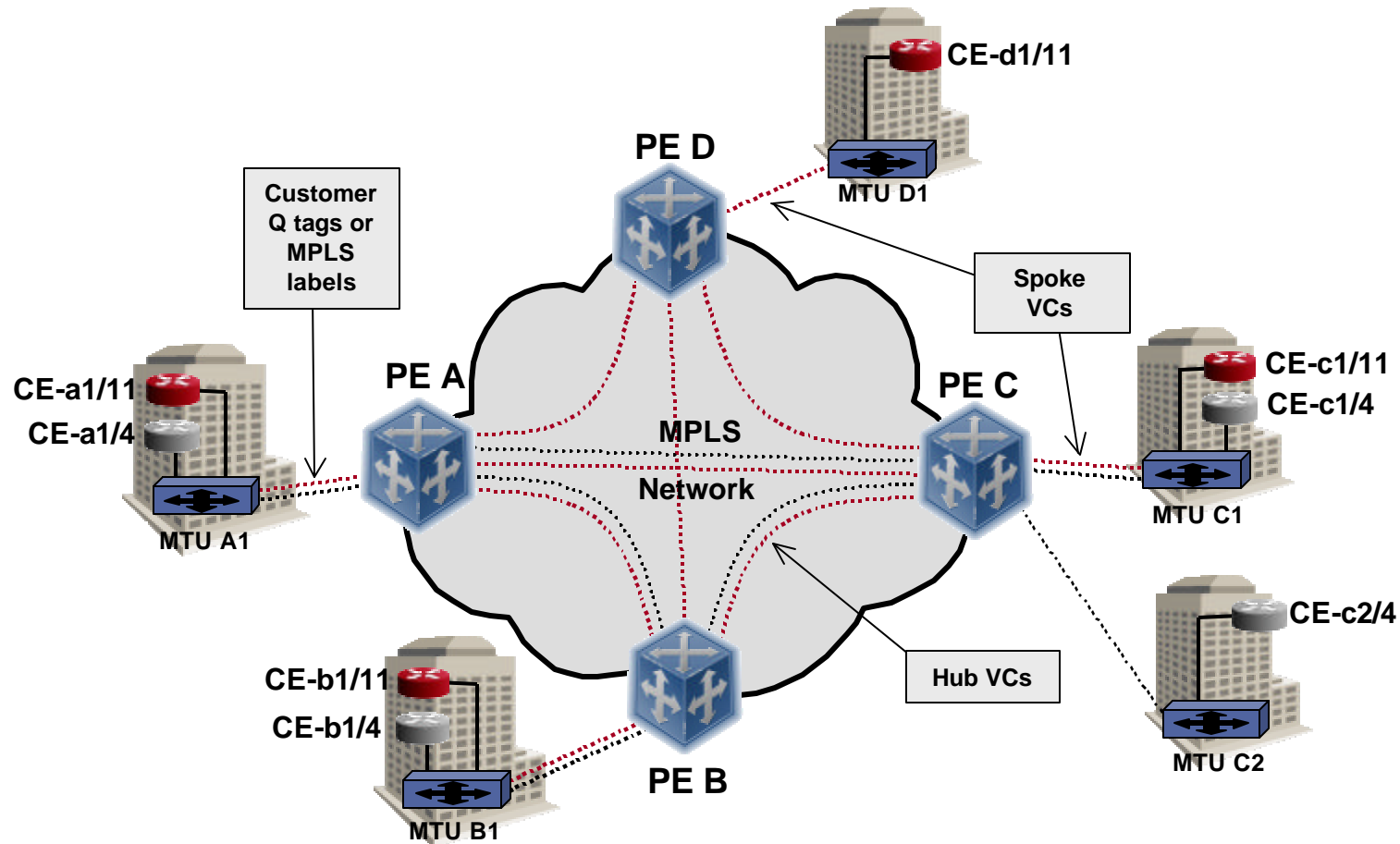
Metro Ethernet:
Inter-Metro Solution

MTU D

PE D

1 VC per service
for this example

MTU H

PE H

1 VC per service
for this example

LSP Full
Mesh

PE A

PE C

IP / MPLS
Metro
Network

PE E

IP / MPLS
Metro
Network

PE G

MTU A

MTU G

PE B

MTU C

MTU E

PE F

MTU B

MTU F

METR Ethernet Forum
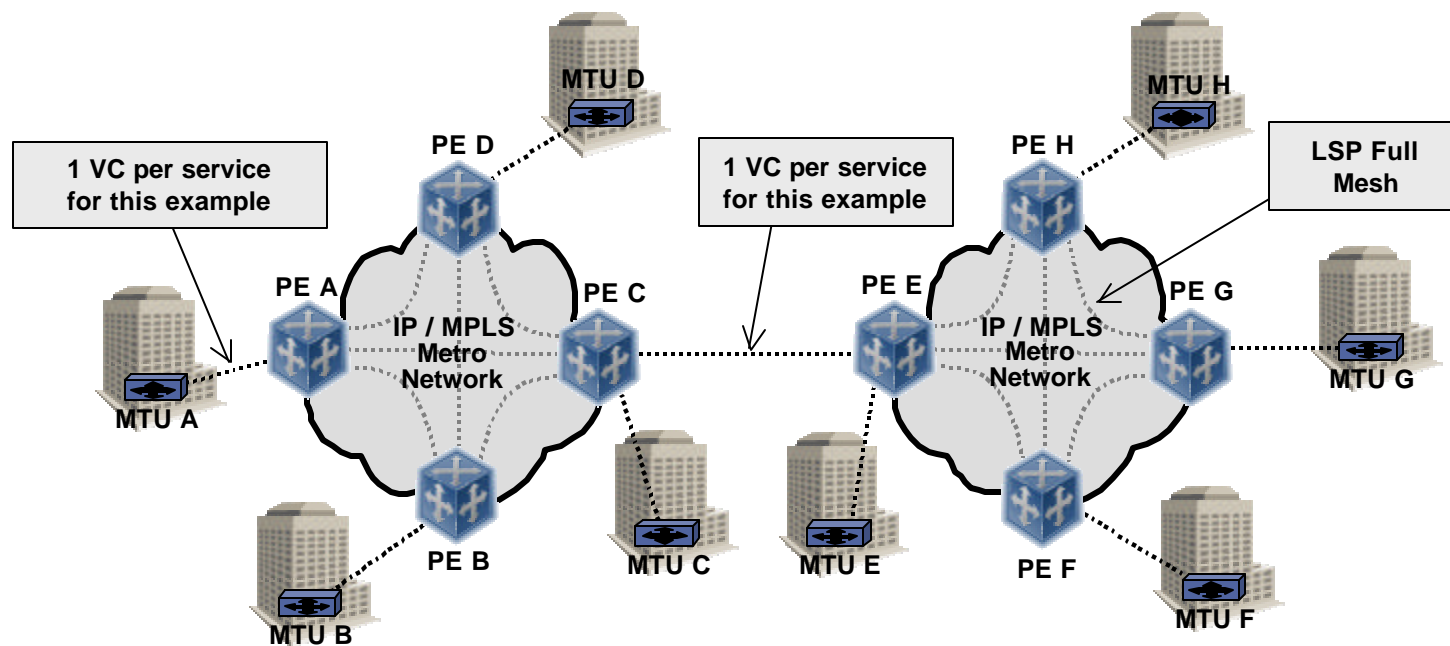
Metro Ethernet Evolution

1G/10G

T1/E1
OC-n/STM-n
10/100M
1G

1G

1G/10G

1G/10G
OC-n/STM-n

**10GE
DWDM**

OC 48/192
STM-16/64

1G

DSLAM

1G

DSLAM

DCS

**Core
TDM / Data Network**

ADM

7
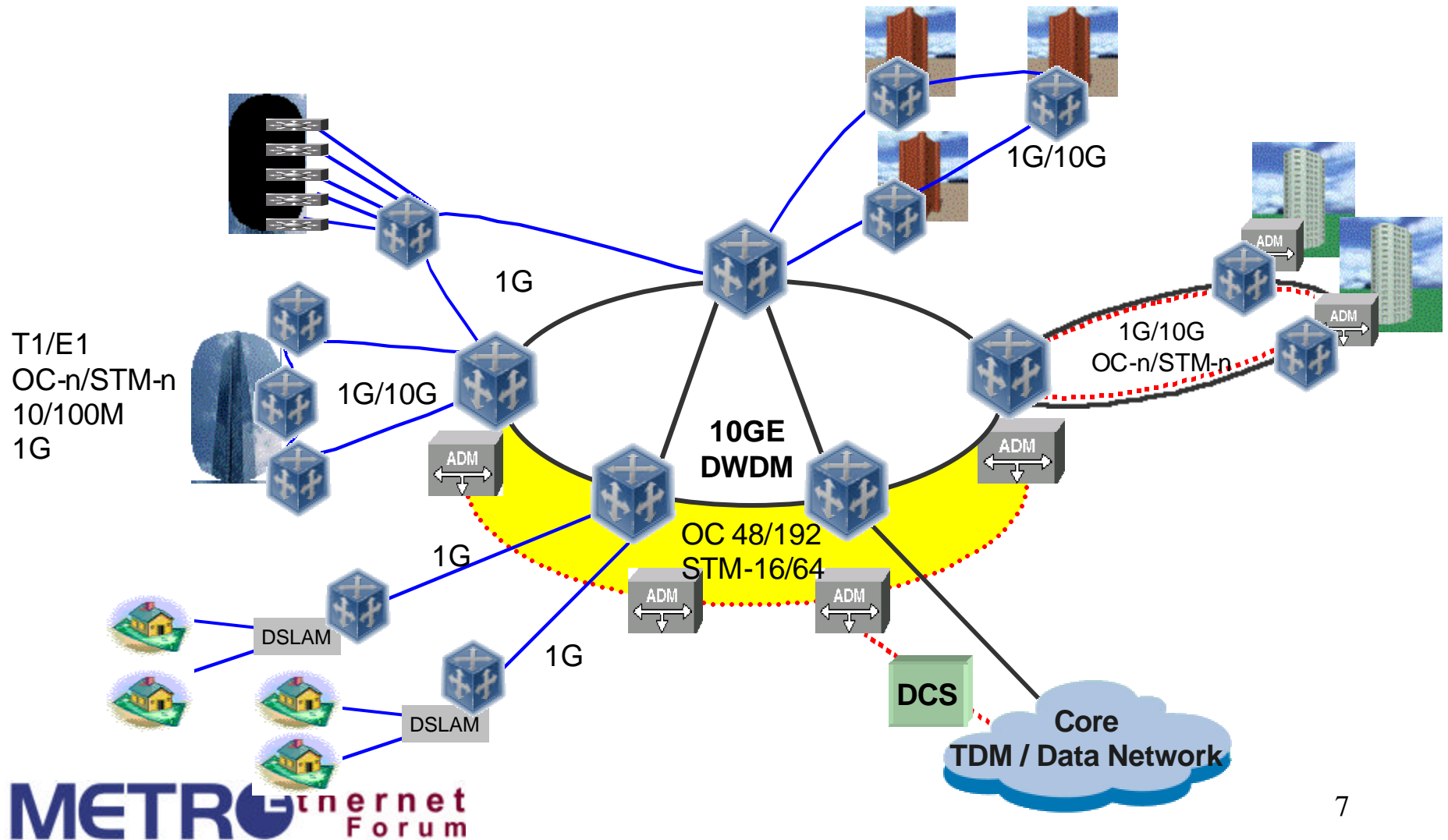
Market for Metro Ethernet

- Strong demand for metro Ethernet in APAC and Europe (RBC Capital Market)
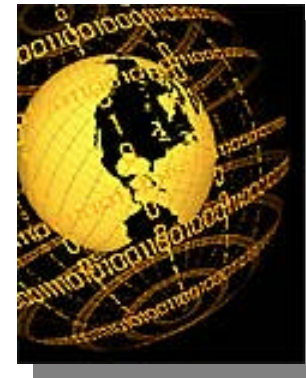
- $4 Billion metro Ethernet equipment forecast for 2005 – Infonetics

- $14 Billion metro Ethernet service revenue is to be realized in 2005 (Gartner, 2003)

Metro Ethernet Forum Mission

Accelerate adoption of Ethernet as the technology of choice in metro networks worldwide

MEF Membership

Membership is Growing …

As of 6/30/03

- ADC
- ADVA Optical
- Agere Systems
- Agilent Technologies
- Alcatel
- AMCC
- Appian Communications
- Atrica Inc.
- Avaya, Inc.
- Axerra Networks
- BellSouth
- Ciena Corp.
- Cisco Systems
- Coriolis Networks
- Corning
- Corrigent Systems
- Crosswave Communications, Inc.
- Ensemble Communications

- Ericsson AB
- Extreme Networks
- Foundry Networks
- France Telecom R&D LLC
- Fujitsu Network Communications
- Harmonic
- Hatteras Networks, Inc.
- Hitachi America, Ltd
- Huawei Technologies
- Industrial Technology Research Institute
- Internet Photonics, Inc.
- JDS Uniphase
- Juniper Networks
- KDDI R&D Laboratories, Inc.
- Korea Telecom
- Lantern Communications, Inc.
- Lucent Technologies
- Luminous Networks, Inc.

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MEF Membership

Membership is Growing …

As of 6/30/03

- **Lycium Networks**
- **Mahi Networks**
- **MetNet Communications, Inc.**
- **Mindspeed Technologies**
- **Native Networks**
- **NEC Corp.**
- **Nortel Networks Corp.**
- **NTT Advanced Technology Corp.**
- **PMC-Sierra**
- **Procket Networks**
- **Raza Microelectronics**
- **Redux Communications**
- **Riverstone Networks**
- **Rockefeller Group Telecommunications Services, Inc.**
- **SBC Communications, Inc.**
- **Scientific Atlanta**

- **Siemens A/G**
- **SII Network Systems**
- **Spirent Communications**
- **Telcordia Technologies**
- **Telesyn**
- **Tellabs**
- **Terabeam**
- **TiMetra Inc.**
- **Transwitch**
- **T|Pack A/S**
- **UNH- InterOperability Lab**
- **UTStarcom**
- **Verizon Communications**
- **Vitesse Semiconductor**
- **Vivace Networks, Inc.**
- **Zarlink Semiconductor**
- **ZTE Corporation**

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MEF Priorities and Scope

- The primary priorities of the MEF are <u>to define</u>:
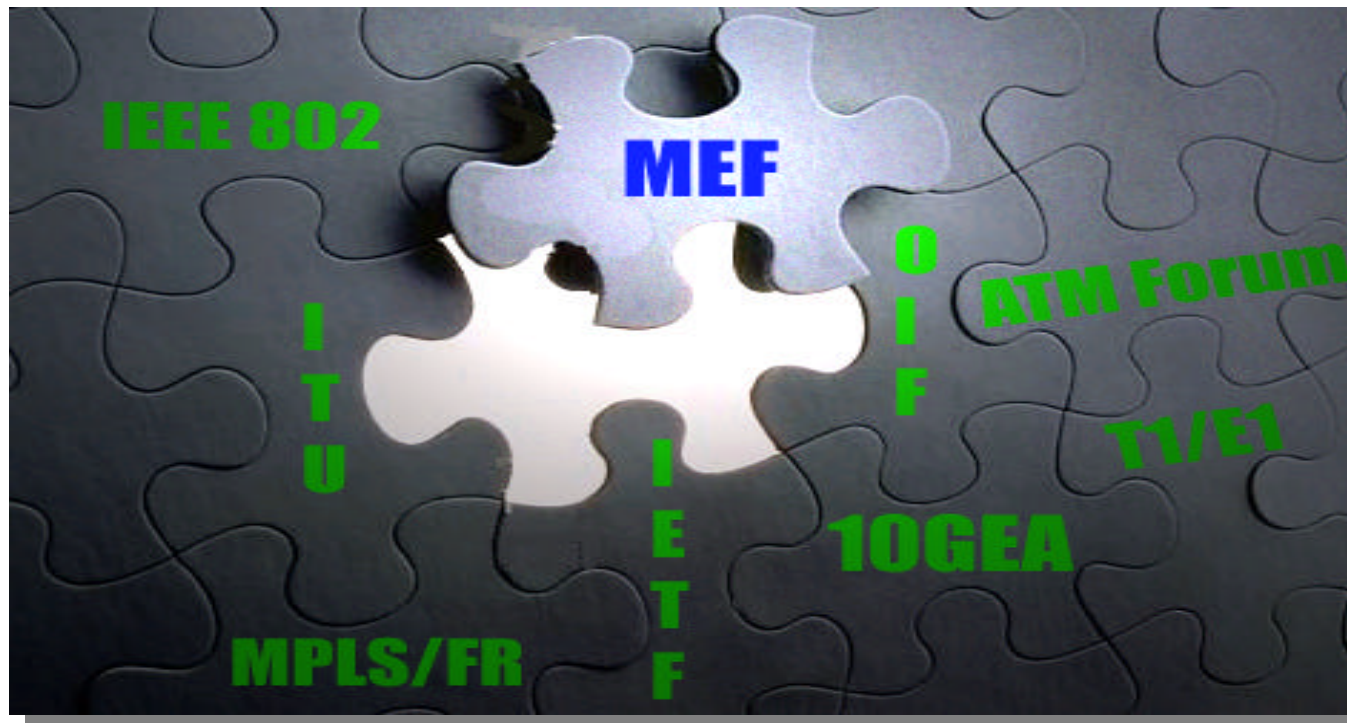 - a. **Ethernet Services** for metro transport networks
    - Such services shall be delivered over native Ethernet-based Metro networks and could also be supported by other transport technologies.
  - b. **Carrier-class Ethernet-based metro transport technologies** *by* specifying *architecture, protocols and management* for Ethernet-based metro transport networks
- The secondary priorities of the MEF are (when deemed necessary) <u>to define</u>:
  - a. Work to be done by other organizations on other transport technologies (liaison activity)
  - b. Non-Ethernet interfaces, if not defined by other organizations.

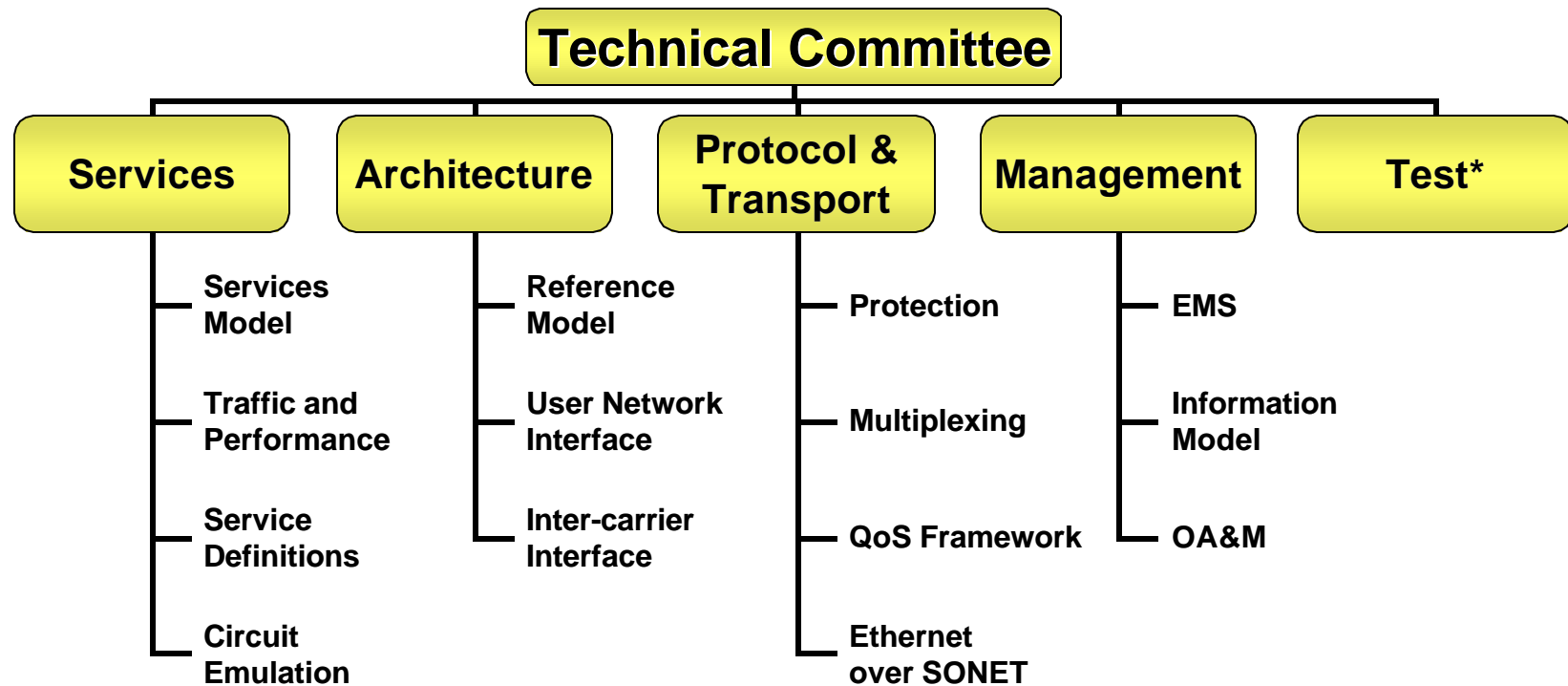# *Metro Ethernet Forum Technical Overview*

METRO **Ethernet Forum**

Approach to Technical Standards

Build on existing standards work from other industry bodies – MEF only fills the technical gaps for Metro Ethernet Services and Transport

MEF Technical Work

Technical Committee

Services
- Services Model
- Traffic and Performance
- Service Definitions
- Circuit Emulation

Architecture
- Reference Model
- User Network Interface
- Inter-carrier Interface

Protocol & Transport
- Protection
- Multiplexing
- QoS Framework
- Ethernet over SONET

Management
- EMS
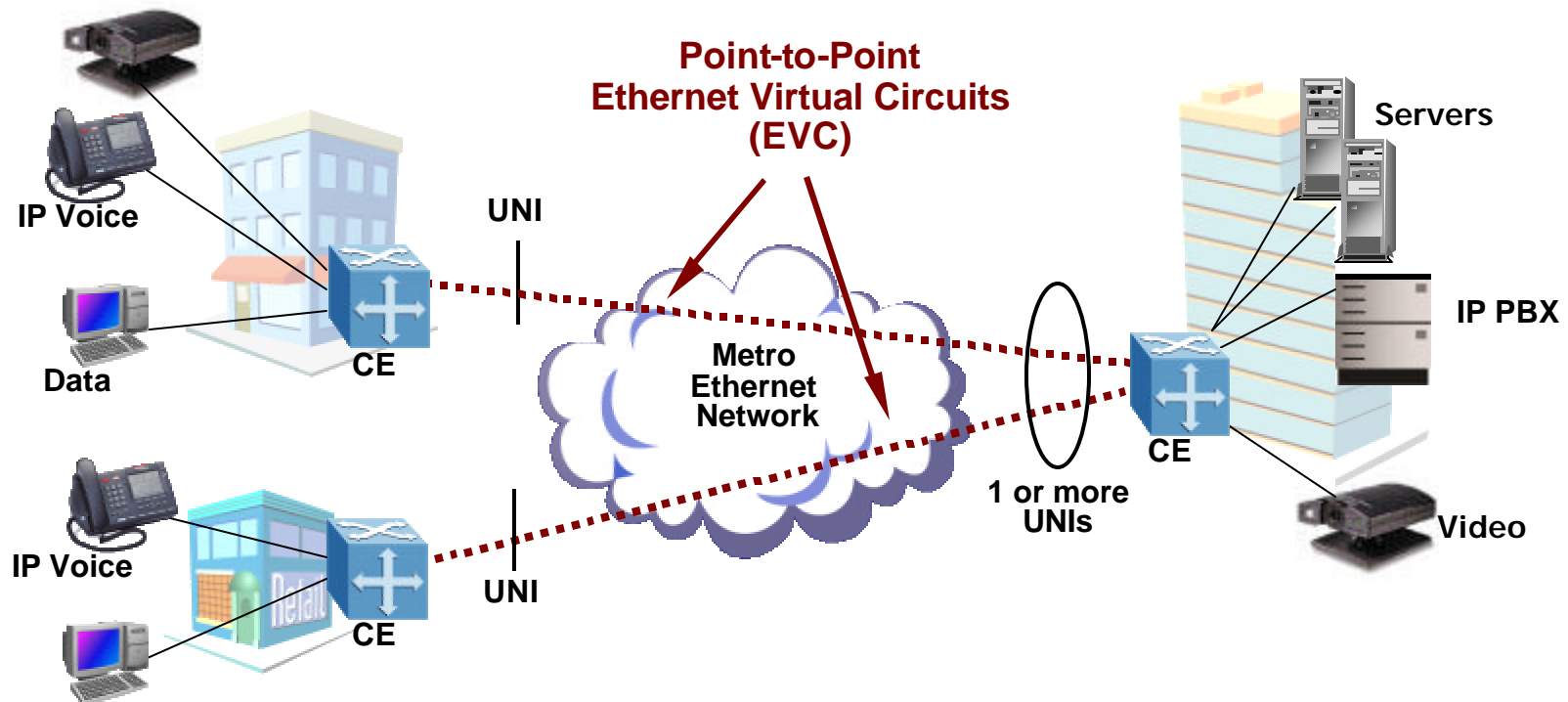- Information Model
- OA&M

Test*
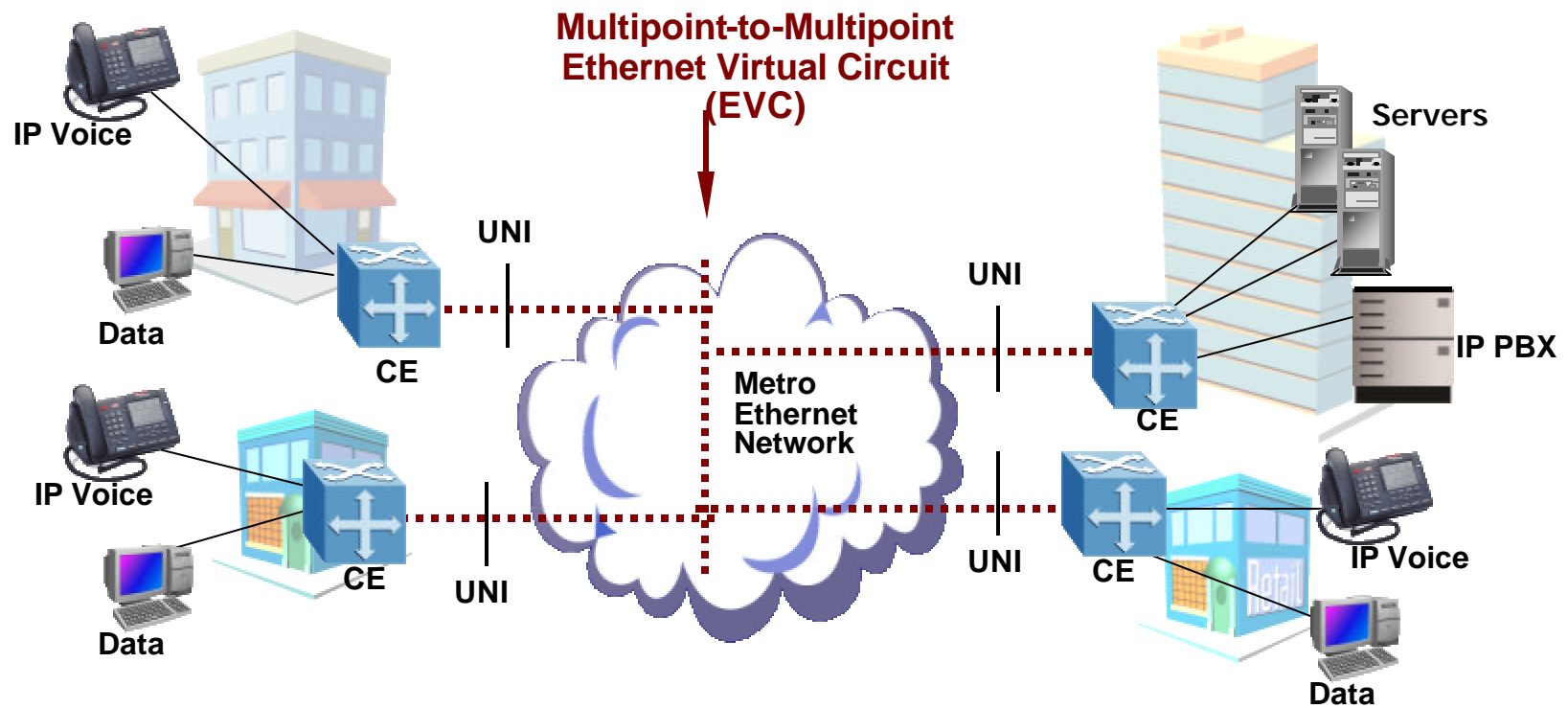
*New Area

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Main Technical Work in the MEF

- Ethernet Service Technical Specifications
  - E-LINE and E-LAN Services
  - Circuit Emulation Services (CES) over Ethernet
- User Network Interface (UNI) definition
- Transport Networks Features
  - Protection – sub 50 millisecond resiliency
  - QoS – foundation of end-to-end SLA's
  - NNI – Ethernet hand-off between carriers
  - Multiplexing – securely and transparently carries customers' traffic
- End-to-end management
  - OAM – Carrier-class management

Ethernet LINE (E-LINE) Service

Point-to-Point Ethernet Virtual Circuits (EVC)

IP Voice

Data

CE

UNI

Metro Ethernet Network

1 or more UNIs

CE

Servers

IP PBX

Video

IP Voice

CE

UNI

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Data

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Ethernet LAN (E-LAN) Service

Multipoint-to-Multipoint Ethernet Virtual Circuit (EVC)

IP Voice

Data

CE

UNI

Metro Ethernet Network

UNI

Servers

CE

IP PBX

IP Voice

Data

CE

UNI

UNI

CE

IP Voice

Data

METRO Ethernet Forum

Ethernet Services Framework
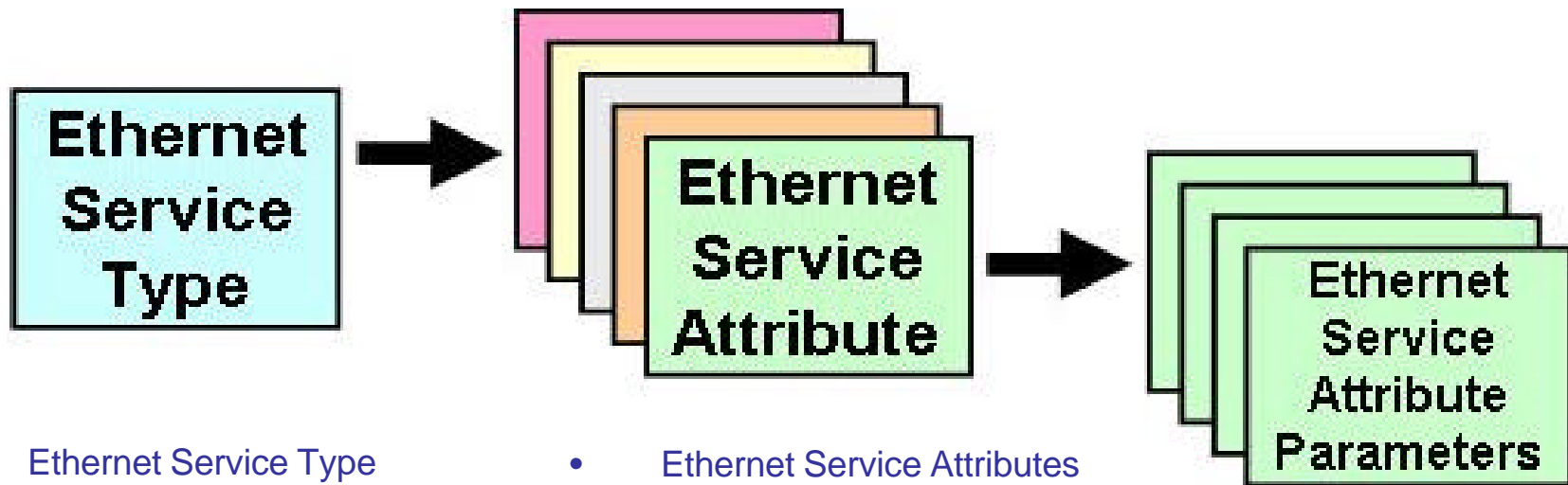
- Ethernet Service Type
  - Ethernet Line
  - Ethernet LAN

- Ethernet Service Attributes
  - Ethernet Physical Interface
  - Traffic Parameters
  - Performance Parameters
  - Class of Service (CoS)
  - Service Frame Delivery
  - VLAN Tag Support
  - Service Multiplexing
  - Bundling
  - Security Filters

- Traffic Parameters
  - Committed Info Rate (CIR)
  - Peak Info Rate (PIR)
  - Etc.

METRO Ethernet Forum

World's First Metro Ethernet Service Interoperability Demo:
Metro Ethernet…At Your Service!

Laying the foundation for mass-market metro Ethernet services deployment

MEF SuperDemo Highlights

First major public Metro Ethernet services (E-Line and E-LAN, as defined by the MEF) interoperability demo across a live multi-vendor network

Demonstration of Ethernet as a true service enabling platform in addition to a simpler, lower-cost transport or connectivity platform
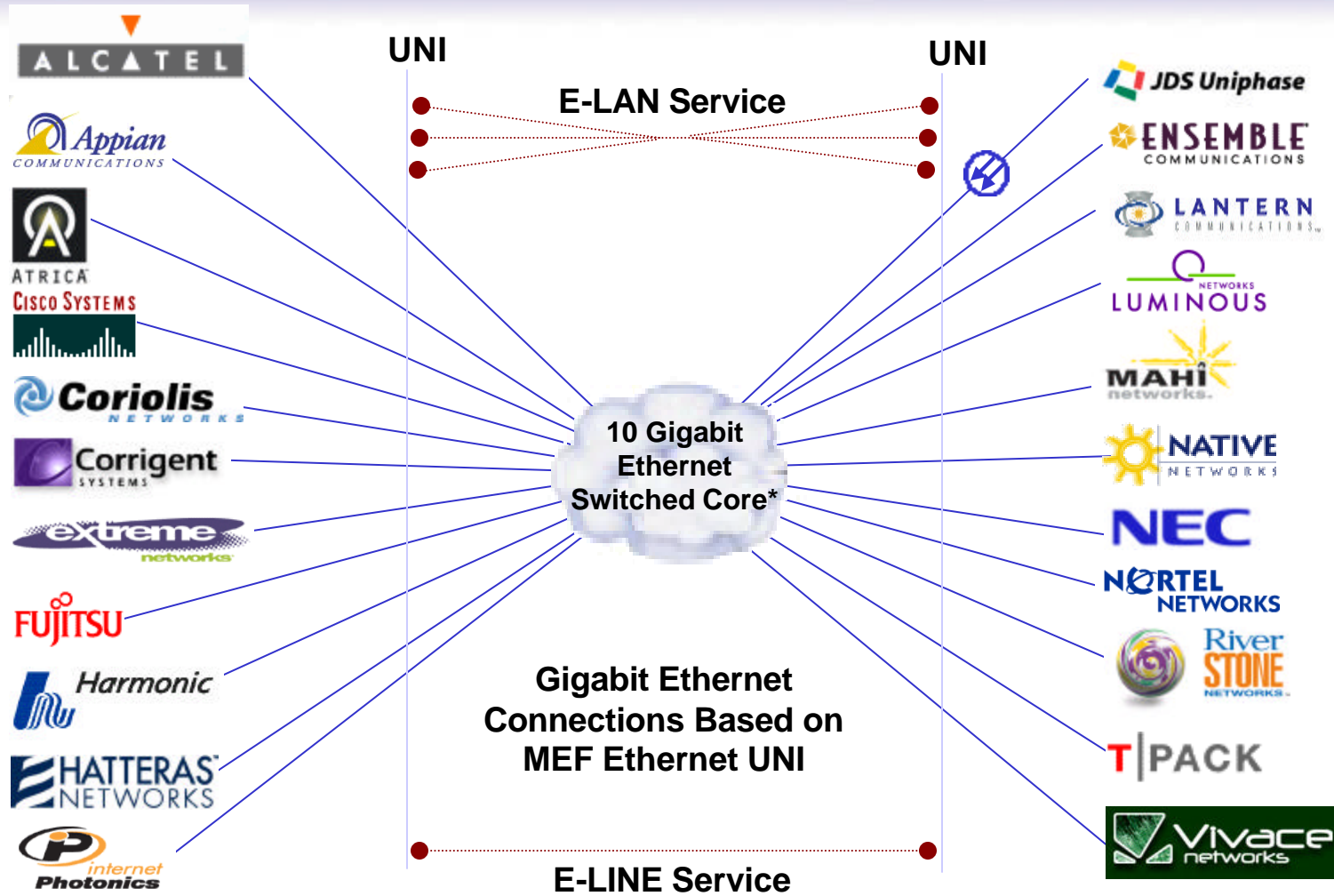
Showcase wide variety of Metro Ethernet services that are simple, scalable, reliable and can be deployed today to generate new revenue

Highlights MEF's role is leading and defining the development of the emerging Metro Ethernet Network

Metro Ethernet…At Your Service!

UNI   UNI

E-LAN Service

10 Gigabit Ethernet Switched Core*

Gigabit Ethernet Connections Based on MEF Ethernet UNI

E-LINE Service

ALCATEL
Appian COMMUNICATIONS
ATRICA
CISCO SYSTEMS
Coriolis NETWORKS
Corrigent SYSTEMS
extreme networks
FUJITSU
Harmonic
HATTERAS NETWORKS
internet Photonics

JDS Uniphase
ENSEMBLE COMMUNICATIONS
LANTERN COMMUNICATIONS
LUMINOUS NETWORKS
MAHI networks
NATIVE NETWORKS
NEC
NORTEL NETWORKS
River STONE NETWORKS
T|PACK
Vivace networks

Video Server provided by: entone

Fiber and patch panels provided by: CORNING Discovering Beyond Imagination

Participating Test Equipment Vendors:

SPIRENT Communications

Agilent Technologies

Additional CES Demonstrations by:

Lycium Networks

Redux communications

ZARLINK SEMICONDUCTOR

Summary

- – Metro Ethernet building blocks are here with combination of technologies
- – Ethernet is a carrier-class technology today being implemented in the metro worldwide
- – Metro Ethernet Forum accelerates the process through standardization
- – Metro Ethernet…is at your service TODAY!

METRO Ethernet Forum

Carrier-Class Ethernet for Metro

www.MetroEthernetForum.org