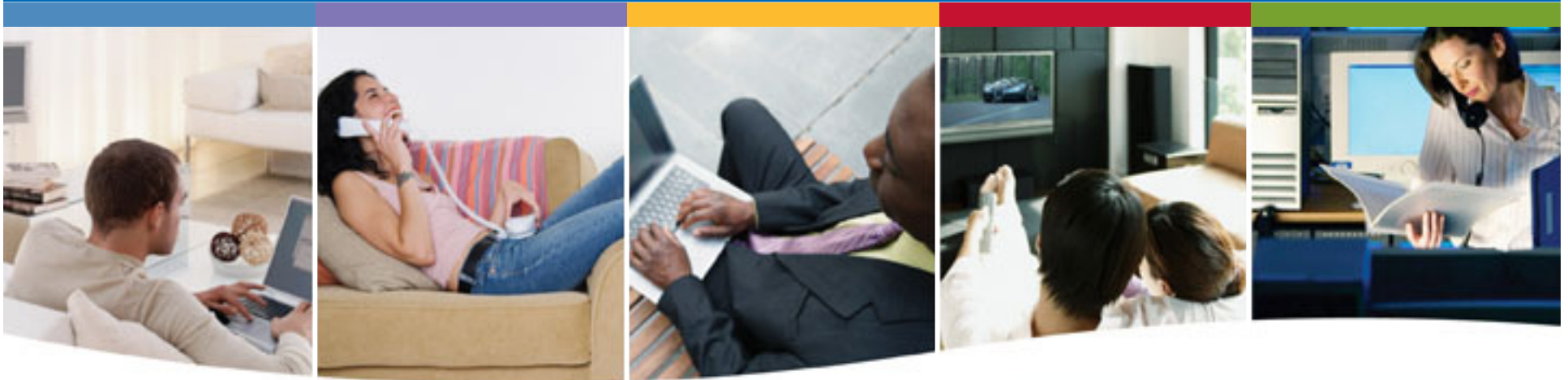




Z H O N E

Access for a Converging World



## EtherXtend 2100/2200 Series & Network Extenders

*Product Family Overview*

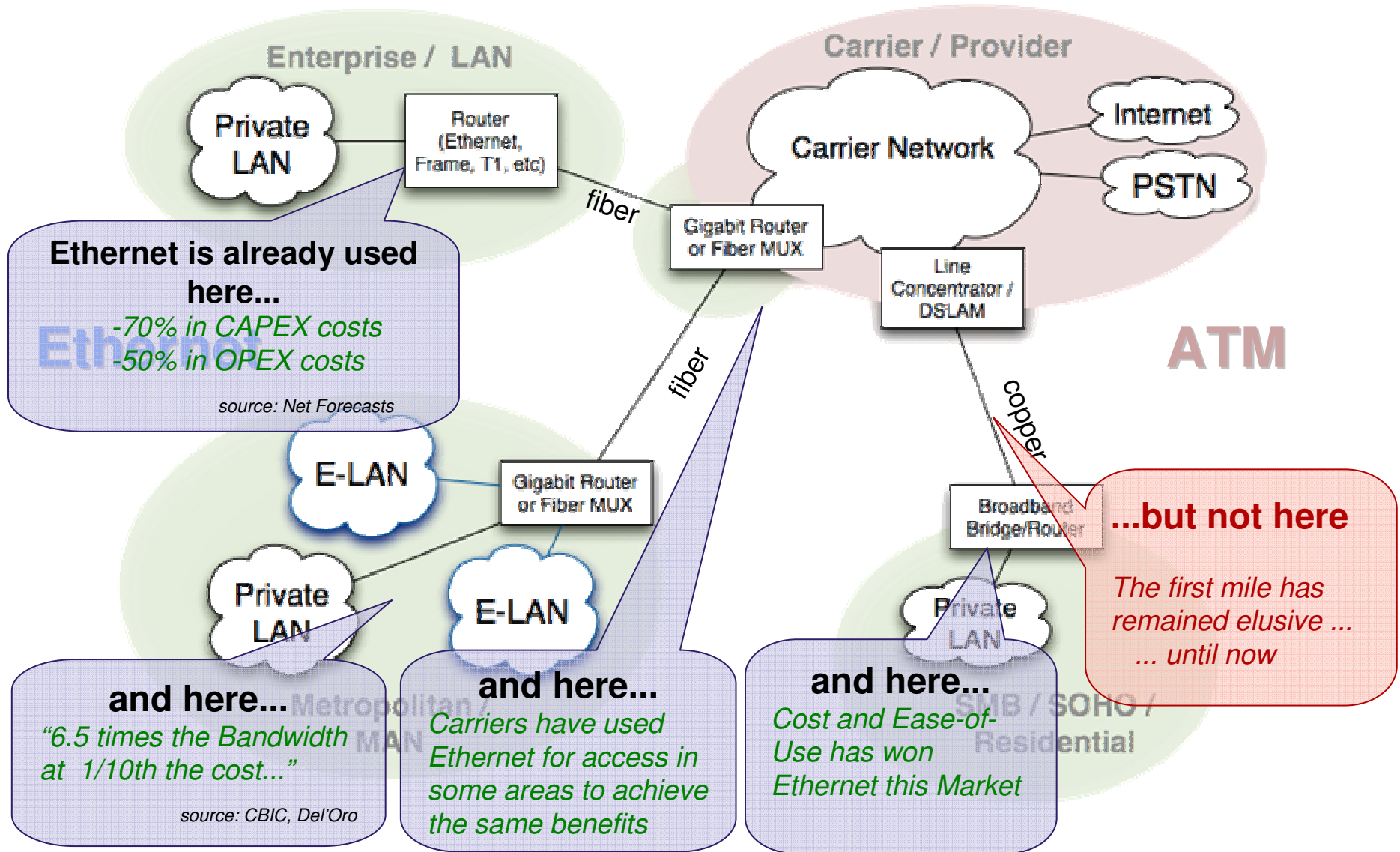
**Feb 2008**



## Ethernet Offers Significant Benefits...

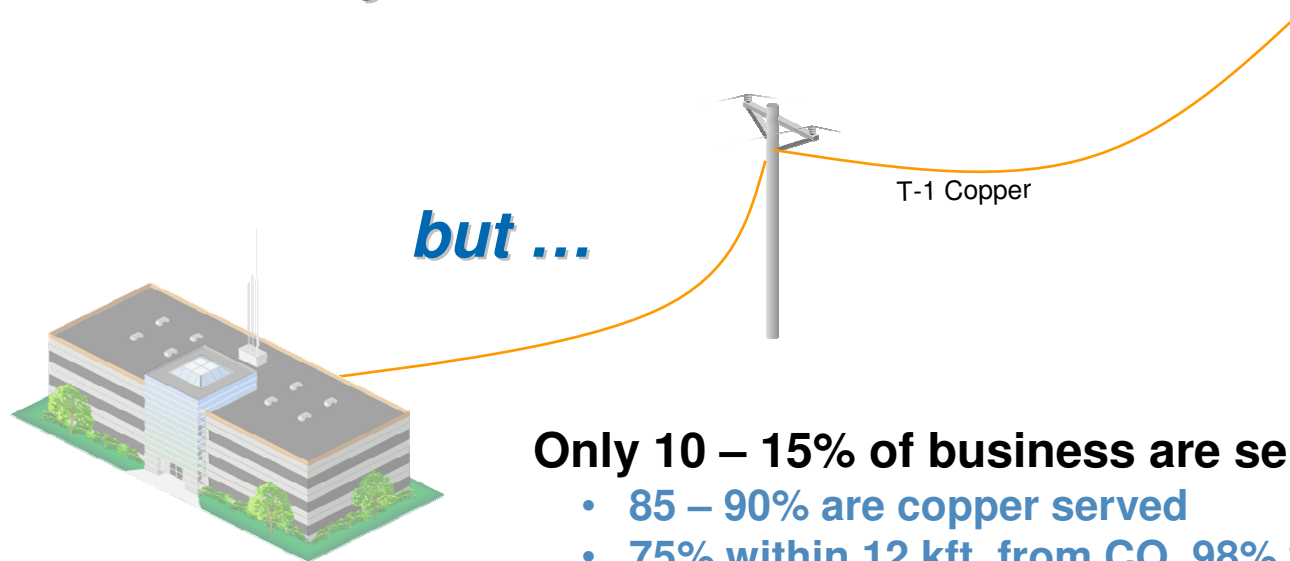
- ▶ Ethernet is everywhere - data, video and even voice are all becoming IP
- ▶ Ethernet delivers high capacity symmetrical capabilities
- ▶ Ethernet allows seamless LAN-to-WAN connectivity
- ▶ Ethernet is quick & easy to deploy
- ▶ Ethernet is replacing ATM/SONET from access to the core
- ▶ Ethernet interfaces / equipment is more cost effective than ATM/TDM

# Why Ethernet?



# Ethernet Access

## *Historically Ethernet was Delivered over Fiber*



**Only 10 – 15% of business are served by fiber today**

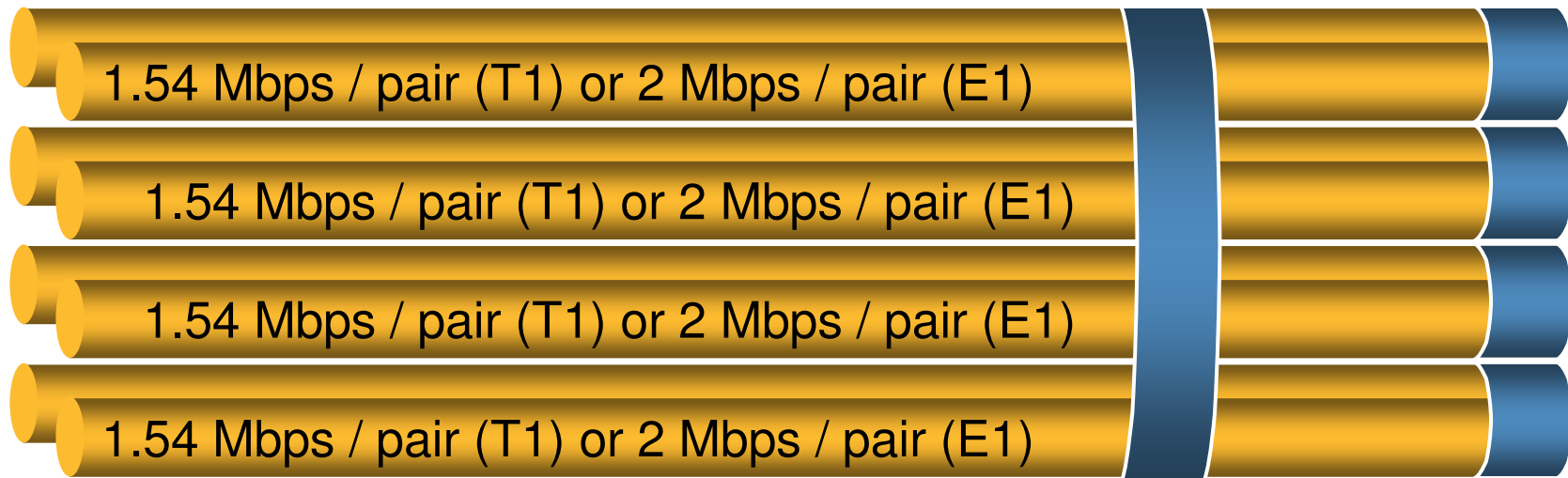
- 85 – 90% are copper served
- 75% within 12 kft. from CO, 98% within 20 kft.

**Economics are driving use of Ethernet over TDM**

- Leasing a dry UNE-P ranges from \$10 - \$15 per month
- Leasing a T-1 UNE-L ranges from \$100 - \$350 per month

***Loop Bonding Technologies can be used to increase bandwidth over copper facilities***

# T1/E1 Bonding

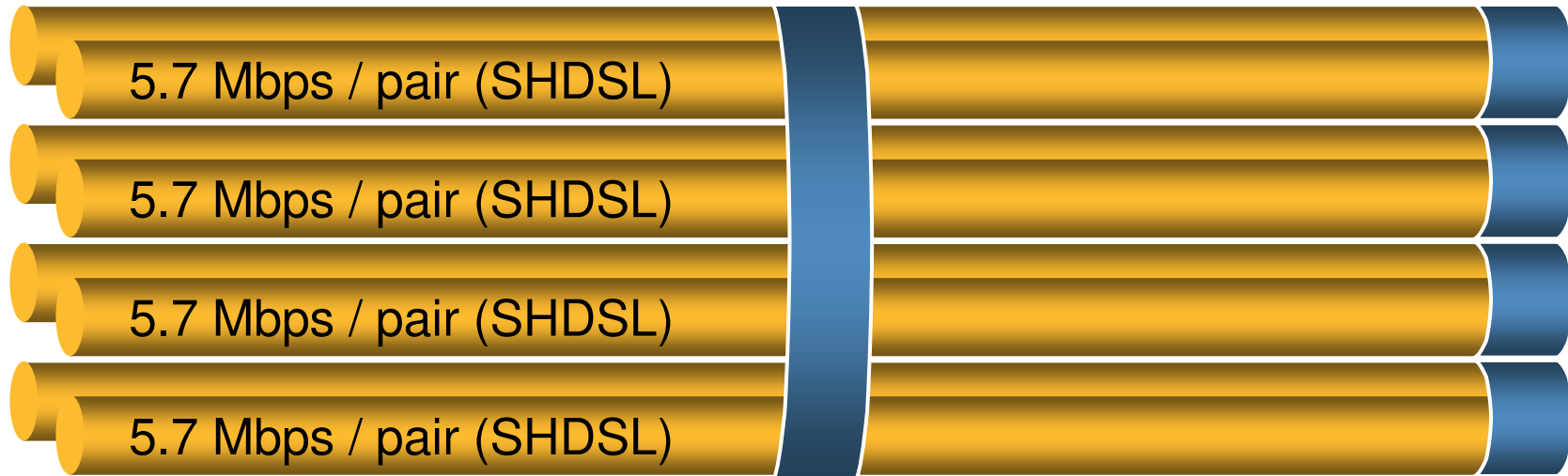


## *Optimum Bonded Performance using DS1 (T1/E1)*

- *1.5/2 Mbps (one T1/E1)*
- *3/4 Mbps (two T1/E1)*
- *6/8 Mbps (four T1/E1)*
- *12/16 Mbps (eight T1/E1)*

*Unlimited reach  
uses existing T1/E1 facilities*

## Copper Bonding (over SHDSL.bis)



### *Optimum Bonded Performance using G.SHDSL.bis w/ Extended Rates*

- 5.7 Mbps (one pair)
- 11.4 Mbps (two pairs)
- 22.8 Mbps (four pairs)
- 45.6 Mbps (eight pairs)

*Greater bandwidth on fewer copper pairs*

# Benefits of Loop Bonding

- ▶ Effective re-use of existing copper for bandwidth
- ▶ Ability to scale bandwidth to service need by adding pairs
- ▶ Lower CAPEX than having to install new fiber, new electronics
- ▶ Performance and reliability comparable to fiber
- ▶ Offers choices of media from (T1/E1, SHDSL, DS3) for bonding

# Zhone is the market leader in loop bonding

Proven, reliable, economic solutions you can trust...



Pioneered Ethernet over copper with TNE, SNE, ENE network extenders



Integrated Ethernet over copper across entire family of BLC, IPD and DSLAM systems



Supports standards based EFM (802.3ah) as well as legacy Ethernet over Copper (EoC) solutions across CPE and access product line

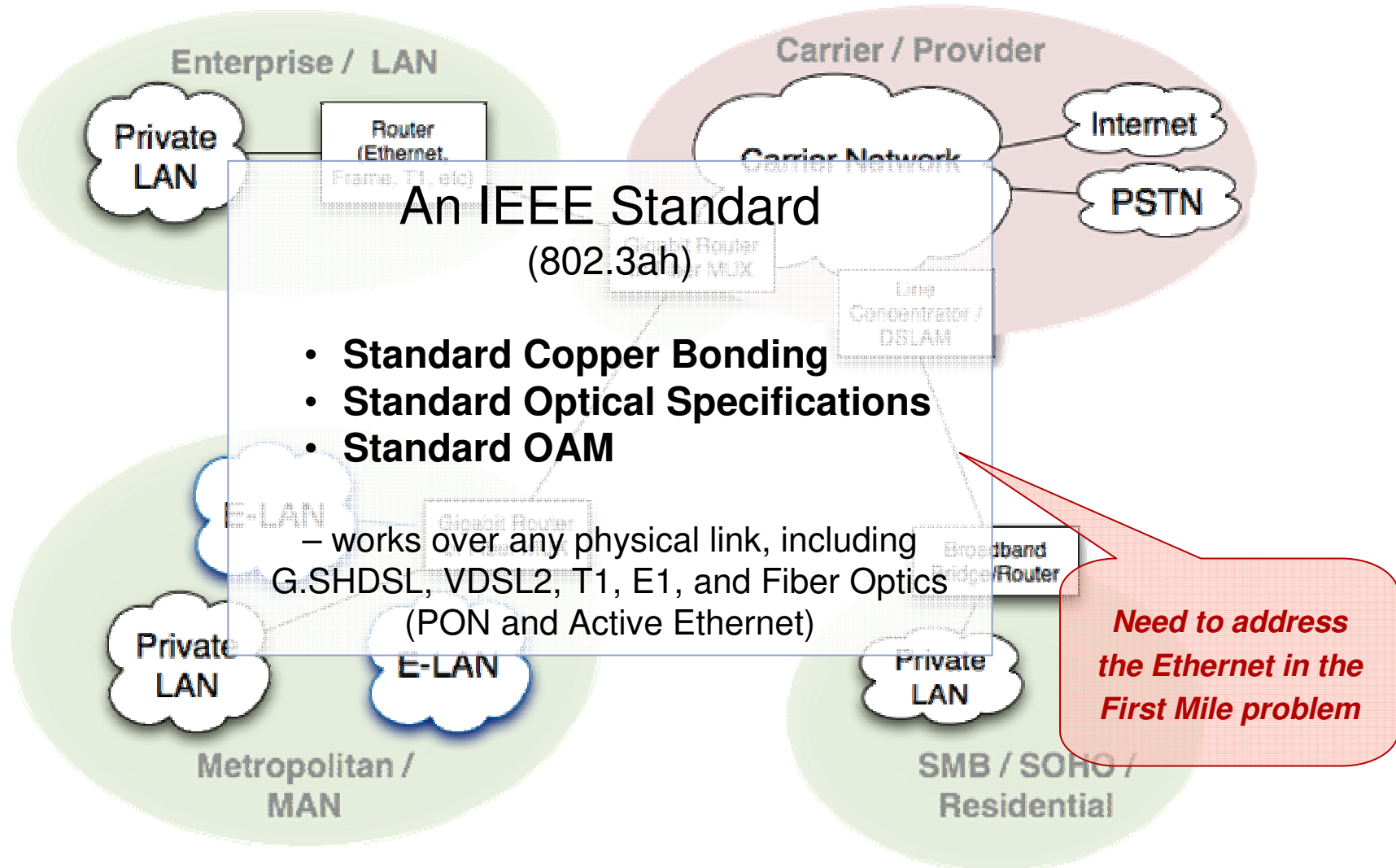


Widely deployed & field proven -  
More than 8 years worldwide in carrier networks,  
6 years providing Ethernet loop bonding





# What is Ethernet in the First Mile (EFM)?



# Zhone Product Strategy for EFM

Global leadership in enabling advanced IP services...



## Zhone's Challenge

- Not to strand existing customers due to new standards
- Provide standards-based path forward, and still support a large imbedded base
- Aggregation and CPE solutions with cross-compatibility

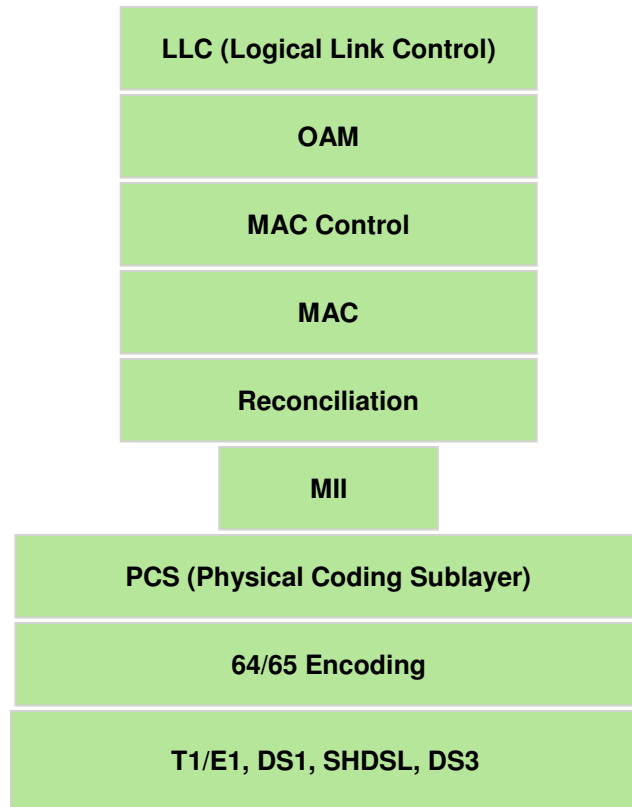
## Zhone's Solution

- Create product support for pre-standard and standards based EFM
- EFM development across all access products
- Offer a complete Ethernet Access Device product line with flexibility & choice

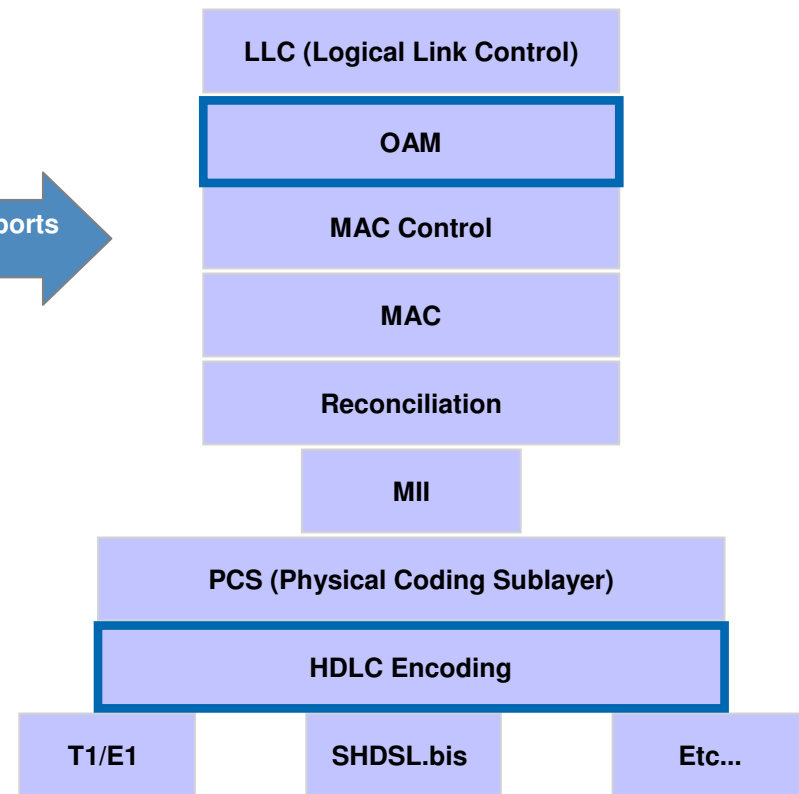
# Standards vs Proprietary Based EFM

Allow support for legacy Ethernet bonded services...

### 802.3ah EFM



### Net-2-Net (N2N) Loop Bonding



Zhone Supports Both!



Based on Ethernet First Mile:  
DSL Forum & IEEE 2007



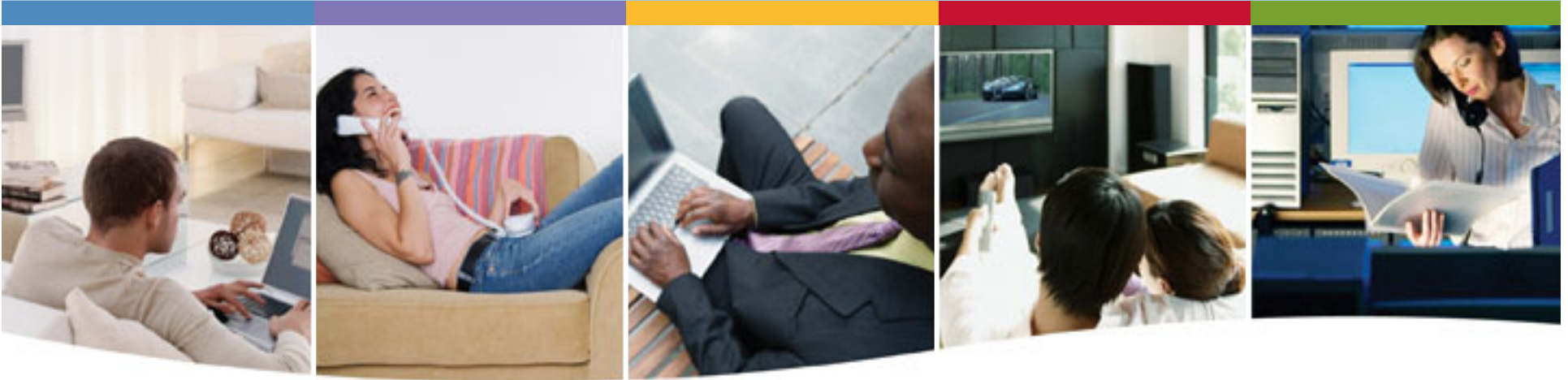
## Legacy: pre-standard

Based on Ethernet Last Mile  
Metro Ethernet Forum 1999- 2007



Z H O N E

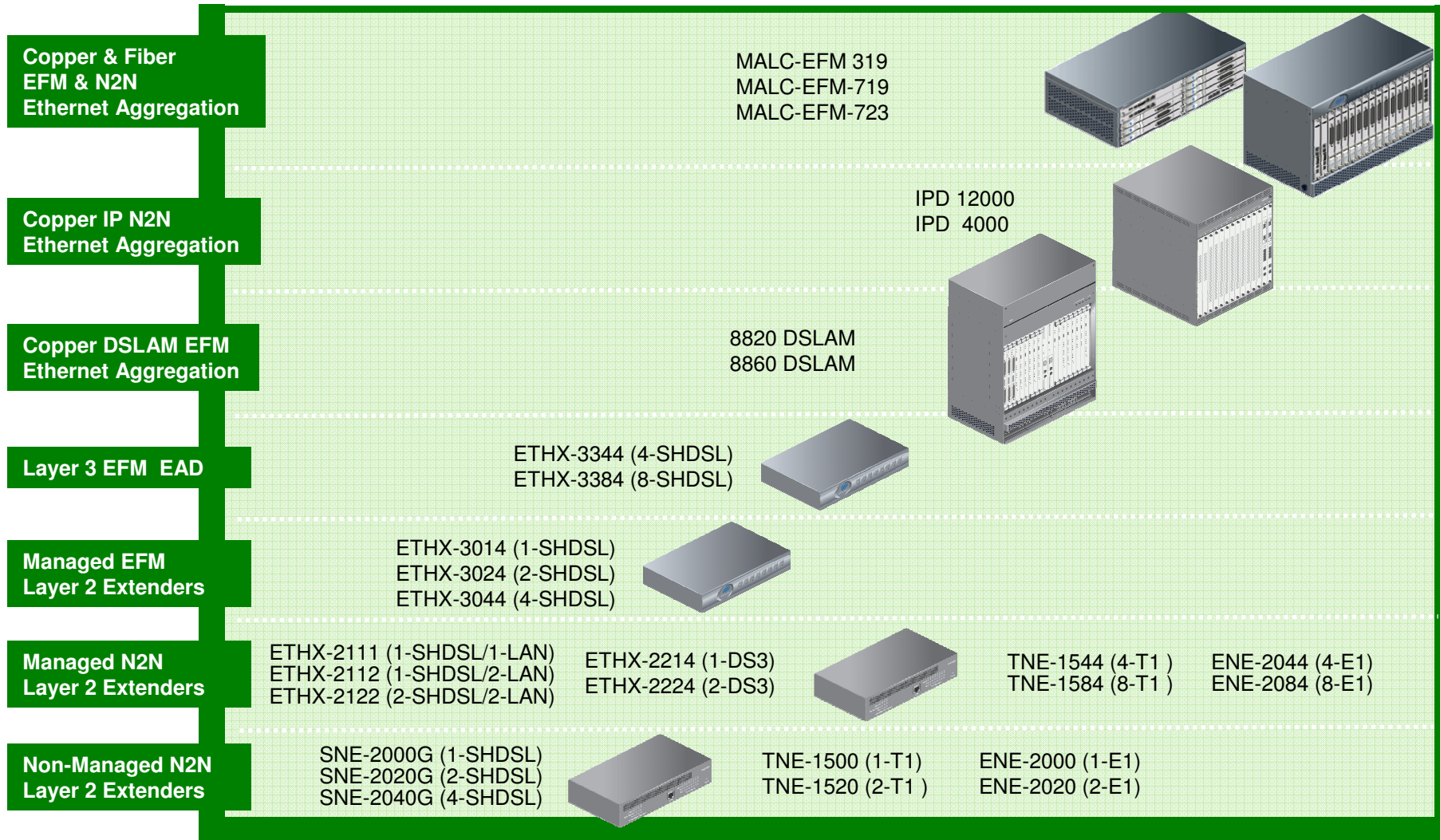
Access for a Converging World



**Ethernet over Copper (EoC)  
Product Family**

# Zhone EtherXtend Product Family

## Features, functions and economics for every need



# IP DSLAM (IPD) Ethernet Aggregation

**IPD** 4000  
12000



- EoC Ethernet + loop bonding (legacy)
- SHDSL EFM services card (SIM2000)
- SHDSL.bis EFM line card (ESIM5700)
- T1 EFM services card (TIM1500)
- E1 EFM services card (EIM2000)
- Layer 2 switching, Layer 3 aware
- IP QoS& CoS
- VLAN support

# Zhone Ethernet Access Devices ( EAD's)

Backwards & forwards compatibility for legacy and new standards... Choices of capacity, features and economics



## Network Extenders (TNE, ENE, SNE)

When value and proven performance are important, Zhone Ethernet Extenders offer the port options and capabilities that have made them a standard for Ethernet over Copper around the world.

## EtherXtend Series 2100 / 2200

When higher capacity is needed, with more advanced features and backwards compatible to legacy equipment with proven EoC technology

## EtherXtend Series 3000 / 3300

When OAM, SLM and 802.3ah compliance are required for your network and services...fully managed and higher loop bonding capacity.

# Ethernet Network Extenders

## ► Ethernet over Copper

- Transparent LAN
- LAN Extensions
- In-building (risers)
- On Campus Connectivity
- Breaking through the T1/E1 bandwidth chasm

## ► Configuration-Free, Plug & Play Options

- **SNE2000G, SNE2020G, SNE2040G**
  - 1, 2, or 4 ports of SHDSL at 2.3 Mbps per port
  - 1-Ethernet port
- **TNE1500 / ENE2000**
  - 1-T1 / E1 port
  - 1-Ethernet port
- **TNE1520 / ENE2020**
  - 2-T1 / E1 ports
  - 1-Ethernet port

## TNE, ENE, SNE Family



## ► Fully Managed Options

- **TNE1544 / ENE2044**
  - 4-T1 / E1 ports
  - 4-Ethernet ports
- **TNE1584 / ENE2084**
  - 8-T1 / E1 ports
  - 4-Ethernet ports
- **OAM via CLI, SNMP, Web**
- **MTM Support**

**Field Proven, Reliable, Dependable**



- **Ethernet over bonded Extended Rate SHDSL.bis**
  - 5.7 Mbps via 1-SHDSL.bis port
  - 11.4 Mbps via 2-SHDSL.bis ports
- **Available in 1 or 2 port versions**
  - ETHX-2111: One (1) SHDSL port + one (1) 10/100BT port
  - ETHX-2112: One (1) SHDSL port + two (2) 10/100BT port
  - ETHX-2122: Two (2) SHDSL ports + two (2) 10/100BT ports
- **Standalone unit (customer premise packaging)**
  - Available in AC version using external power supply
  - Configured from factory as either *Provider* or *Subscriber* mode of operation
  - Factory configured *Provider* units can be provisioned as either *Provider* or *Subscriber* units
- **Net-2-Net Bonding Protocols**
  - Proven, Ethernet-over-Copper bonding technology (Net-2-Net)
  - Operate in book-ended configurations, or
  - Interoperate with IPD or MALC SHDSL line cards for CO Aggregation
- **Multimedia Traffic Management (MTM) support**
  - ToS, DiffServ and 802.1p QoS support
  - 802.1Q VLAN support
- **Flexible OAM&P functionality**
  - DHCP Client
  - Command Line Interface (CLI)
  - Integrated Web Based Management Interface
  - SNMP support

## EtherXtend Series 2100 Series



# EtherXtend Series 2100 – Benefit Analysis

## ETHX-2100 vs SNE Net. Extenders

- **ETHX-2100 offers 25% more bandwidth on 50% of pairs**
  - Each SHDSL-LT port offers 5.7Mbps vs 2.3Mbps on SNE
    - 150% more bandwidth per port, or alternatively
    - 25% more bandwidth on 50% of the pairs
  - Customers who use 2-port SNE can use ETHX-SHDSL-1- LT (1-port)
  - Customers who use 4-port SNE can use ETHX-SHDSL-2- LT (2-ports)
- **Fewer pairs significantly lowers ongoing operating expenses**
  - Reduced monthly leasing costs per pair (CLECs)
  - Reduced monthly maintenance costs per pair (for CLECs and ILECs)
- **Flexible OAM&P, QoS, and VLAN Support**
  - Simple 'Plug & Play' operation with factory defaults simplifies installation
  - MTM facilitates bandwidth management and SLA agreements
  - DHCP Client coupled with Web GUI, Telnet CLI, and SNMP support reduces ongoing operating expense

- **Ethernet over DS3 (up 2-ports / 90 Mbps)**
  - Requires use of *unframed* DS3 facilities
- **Available in 1-DS3 or 2-DS3 port versions**
  - ETHX-2214: One (1) DS3 port + four (4) 10/100BT ports
  - ETHX-2224: Two (2) DS3 ports + four (4) 10/100BT port
- **Standalone unit (CPE packaging)**
  - Available in DC and AC versions
  - AC via external power supply
- **Net-2-Net Bonding Protocols**
  - Proven, Net-2-Net bonding technology
  - Operate in book-ended configurations with other ETHX-22xx models
    - User configurable as either *Provider* or *Subscriber* mode
- **Multimedia Traffic Management (MTM)**
  - ToS, DiffServ and 802.1p QoS support
  - 802.1Q VLAN support
- **Flexible OAM&P Functionality**
  - DHCP Client
  - Command Line Interface (CLI)
  - Integrated Web Based Management Interface
  - SNMP support

## EtherXtend Series 2200 Series



**Ethernet at near native  
speeds over leased DS3  
facilities of fiber  
multiplexer**

## ► Overview

- Ethernet over bonded Extended Rate SHDSL.bis
  - ETHX-3014: 1-SHDSL.bis ports for 5.7 Mbps
  - ETHX-3024: 2-SHDSL.bis ports for 11.4 Mbps
  - ETHX-3044: 4-SHDSL.bis ports for 22.8 Mbps
  - Each model supports four (4) 10/100 BT LAN ports
- Standalone unit (CPE packaging)
  - Available in AC version via external power supply (US, UK, EU)

## ► Supports 802.3ah EFM

- 802.3ah EFM compliance
- 802.3ah OAM compliance
- Interoperates with other EFM offerings:
  - Point-to-point with ETHX-3000 or ETHX-3300 Series EADs
  - MALC-EFM-SHDSL-24 line cards
  - 8986 Line cards on 8820/8620 DSLAMs

## ► Operates in bridged mode

- Future upgrade for NAT & routing

## EtherXtend SHDSL.bis 802.3ah EFM & OAM



## ► Overview

- Ethernet over bonded Extended Rate SHDSL.bis
  - ETHX-3344: 4-SHDSL.bis ports for 22.8 Mbps
  - ETHX-3384: 4-SHDSL.bis ports for 45.6 Mbps
  - Each model supports four (4) 10/100 BT LAN ports
- Standalone unit (customer premise packaging)
  - Available in AC and DC versions
  - AC via external power supply (US, UK, EU)

## ► Supports **802.3ah EFM and Net-2-Net Bonding**

- 802.3ah EFM compliance
- 802.3ah OAM compliance
- Backward support for legacy N2N loop bonding
  - ETHX-2100 at 5.7 Mbps per port
  - SNE Network Extenders at 2.3 Mbps
- Auto detect 802.3ah or N2N at aggregation

## ► IP SLM latency/jitter/data-loss measurements

## ► Priority queuing

## ► Bridge or Route support on every port

## EtherXtend SHDSL.bis 802.3ah EFM & N2N Bonding



**Enables fiber quality and  
fiber bandwidth over  
existing copper for transport**

## EtherXtend EAD Product Summary

|   | 3300 Series           | 3000 Series           | 2200 Series          | 2100 Series           | TNE                             | SNE               | ENE                             |
|---|-----------------------|-----------------------|----------------------|-----------------------|---------------------------------|-------------------|---------------------------------|
| <b>WAN Interface</b>                      | SHDSL.bis<br>5.7 Mbps | SHDSL.bis<br>5.7 Mbps | DS3<br>45 Mbps       | SHDSL.bis<br>5.7 Mbps | T1<br>1.544 Mbps                | SHDSL<br>2.3 Mbps | E1<br>2.048 Mbps                |
| <b>WAN Ports</b>                          | 4 or 8                | 1, 2 or 4             | 1 or 2               | 1 or 2                | 1, 2, 4<br>or 8                 | 1, 2 or 4         | 1, 2, 4<br>or 8                 |
| <b>Bandwidth<br/>(at max ports)</b>       | Up to<br>45.6 Mbps    | Up to<br>22.8 Mbps    | Up to<br>90 Mbps     | Up to<br>11.4 Mbps    | Up to<br>12 Mbps                | Up to<br>9.2 Mbps | Up to<br>16 Mbps                |
| <b>Loop Bonding</b>                       | 802.3ah EFM<br>N2N    | 802.3ah EFM<br>EFM    | N2N                  | N2N                   | N2N                             | N2N               | N2N                             |
| <b>LAN Interfaces<br/>10 / 100 Base-T</b> | 4                     | 4                     | 4                    | 1 or 2                | 1 (1/2 port)<br>4 (4/8 port)    | 1                 | 1 (1/2 port)<br>4 (4/8 port)    |
| <b>Management</b>                         | 802.3ah<br>inband     | CLI, Web,<br>SNMP     | CLI, Web,<br>SNMP    | CLI, Web,<br>SNMP     | CLI, Web,<br>SNMP<br>(4/8 port) | Unmanaged         | CLI, Web,<br>SNMP<br>(4/8 port) |
| <b>QoS</b>                                | 802.1p                | 802.1p                | 802.1p               | 802.1p                | 802.1p                          |                   | 802.1p                          |
| <b>Layer 2<br/>Layer 3</b>                | Bridging<br>Routing   | Bridging<br>L3 aware  | Bridging<br>L3 aware | Bridging<br>L3 aware  | Bridging<br>L3 aware            | Bridging          | Bridging<br>L3 aware            |

# EAD Compatibility Matrix



|                                  | MALC-EFM-SHDSL-bis | MALC-EFM-T1 / E1 | DSLAM 8986-B1 SHDSL.bis | IPD ESIM-5700 SHDSL.bis | IPD SIM-2000 G.SHDSL | IPD TIM-1500 T1 | IPD EIM-2000 E1 |
|----------------------------------|--------------------|------------------|-------------------------|-------------------------|----------------------|-----------------|-----------------|
| <b>EtherXtend 3300 Series</b>    | ●                  |                  | ●                       | ●                       | At 2.3 Mbps          |                 |                 |
| <b>EtherXtend 3000 Series</b>    | ●                  |                  | ●                       |                         |                      |                 |                 |
| <b>EtherXtend 2100 Series</b>    | ●                  |                  |                         | ●                       | At 2.3 Mbps          |                 |                 |
| <b>Network Extender TNE (T1)</b> |                    | ●                |                         |                         |                      | ●               |                 |
| <b>EtherXtend SNE Series</b>     | At 2.3 Mbps        |                  |                         | At 2.3 Mbps             | At 2.3 Mbps          |                 |                 |
| <b>EtherXtend ENE Series</b>     |                    | ●                |                         |                         |                      |                 | ●               |

## Aggregation Platforms

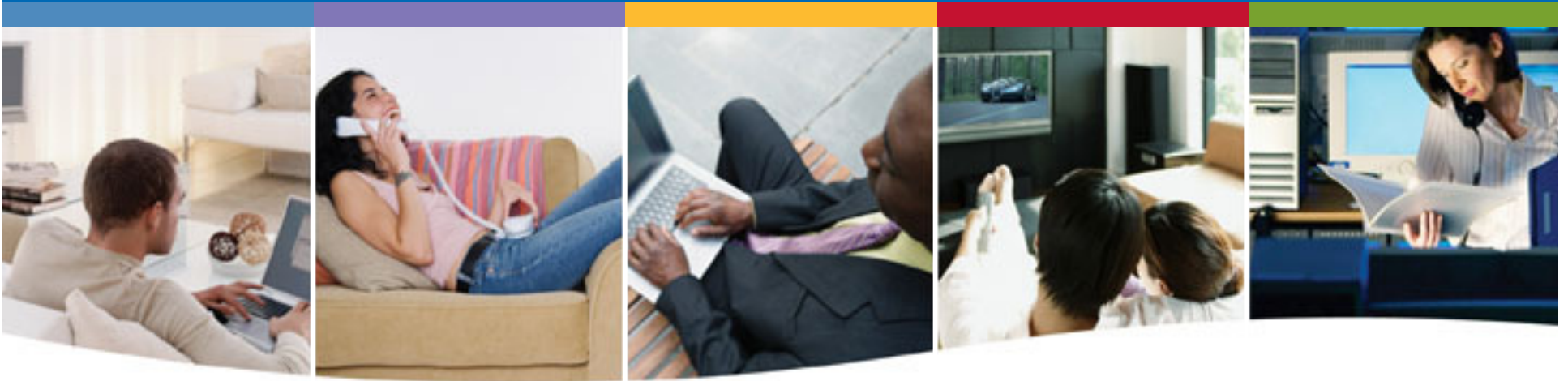
|  | MALC-EFM                                 |  | 8800 /8620 DSLAM           | IPD 4000 / 12000 DSLAM       |                             |                             |                             |
|--|--|--|----------------------------|------------------------------|-----------------------------|-----------------------------|-----------------------------|
| Line Card                              | MALC-EFM-SHDSL-24                        | MALC-EFM-T1/E1-24                        | 8986-B1-000                | ESIM-5700-48                 | SIM2000-24                  | TIM1500-24                  | EIM2000-24                  |
| Access Interface                       | SHDSL.bis<br>5.7 Mbps                    | T1/E1                                    | SHDSL.bis<br>5.7Mbps       | SHDSL.bis<br>5.7 Mbps        | SHDSL<br>2.3 Mbps           | T1                          | E1                          |
| Loop Bonding                           | 802.3ah,<br>N2N                          | N2N                                      | 802.3ah                    | N2N                          | N2N                         | N2N                         | N2N                         |
| Ports per Card                         | 24                                       | 24                                       | 24                         | 48                           | 24                          | 24                          | 24                          |
| Shelf Capacity<br>(card slots / ports) | 319: 8/192<br>719: 16/384<br>723: 20/480 | 319: 7/192<br>719: 17/384<br>723: 19/480 | 8820: 18/432<br>8620: 3/72 | 12000: 12/576<br>4000: 4/192 | 12000: 12/288<br>4000: 4/96 | 12000: 12/288<br>4000: 4/96 | 12000: 12/288<br>4000: 4/96 |
| Management                             | CLI, Web,<br>SNMP<br>ZMS                 | CLI, Web,<br>SNMP<br>ZMS                 | CLI, Web,<br>SNMP          | CLI, Web,<br>SNMP            | CLI, Web,<br>SNMP           | CLI, Web,<br>SNMP           | CLI, Web,<br>SNMP           |
| QoS                                    | 802.1Q<br>802.1p                         | 802.1Q<br>802.1p                         | 802.1Q<br>802.1p           | 802.1Q<br>802.1p             | 802.1Q<br>802.1p            | 802.1Q<br>802.1p            | 802.1Q<br>802.1p            |
| Layer 2<br>Layer 3<br>Layer 4          | Bridging<br>Routing<br>Aware             | Bridging<br>Routing<br>Aware             | Bridging                   | Bridging<br>Aware            | Bridging<br>Aware           | Bridging<br>Aware           | Bridging<br>Aware           |
| IP SLA                                 | ■  | ■  |                            |                              |                             |                             |                             |
| Network Timing<br>Wetting Current      | Optional<br>Cards                        |  |                            |                              |                             |                             |                             |





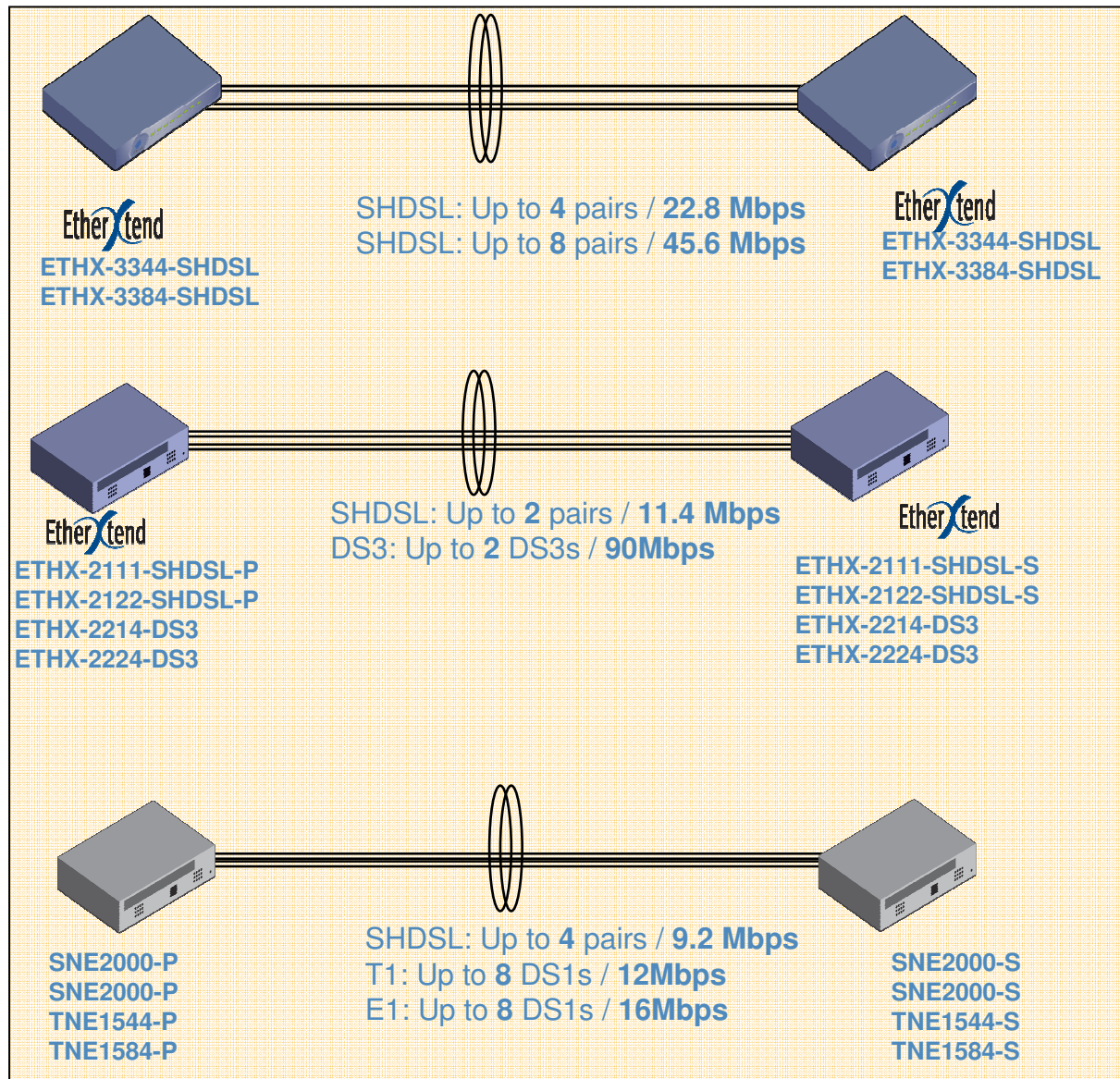
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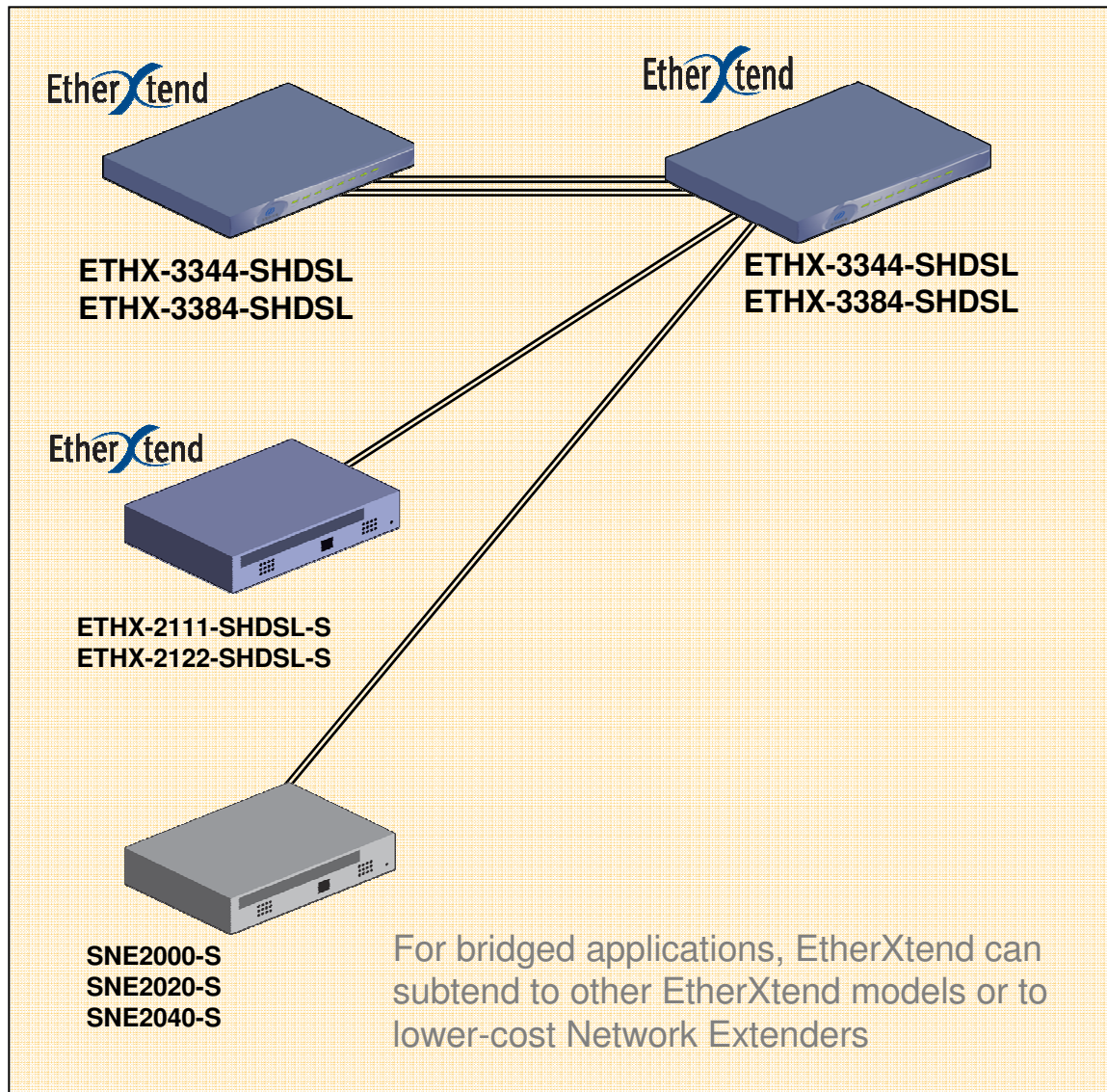
**Deployment Scenarios**

# Deployment Options: Point-to-point



Any point to point application can upgrade to access aggregation without EAD replacement

# Deployment Options: Multi-Point

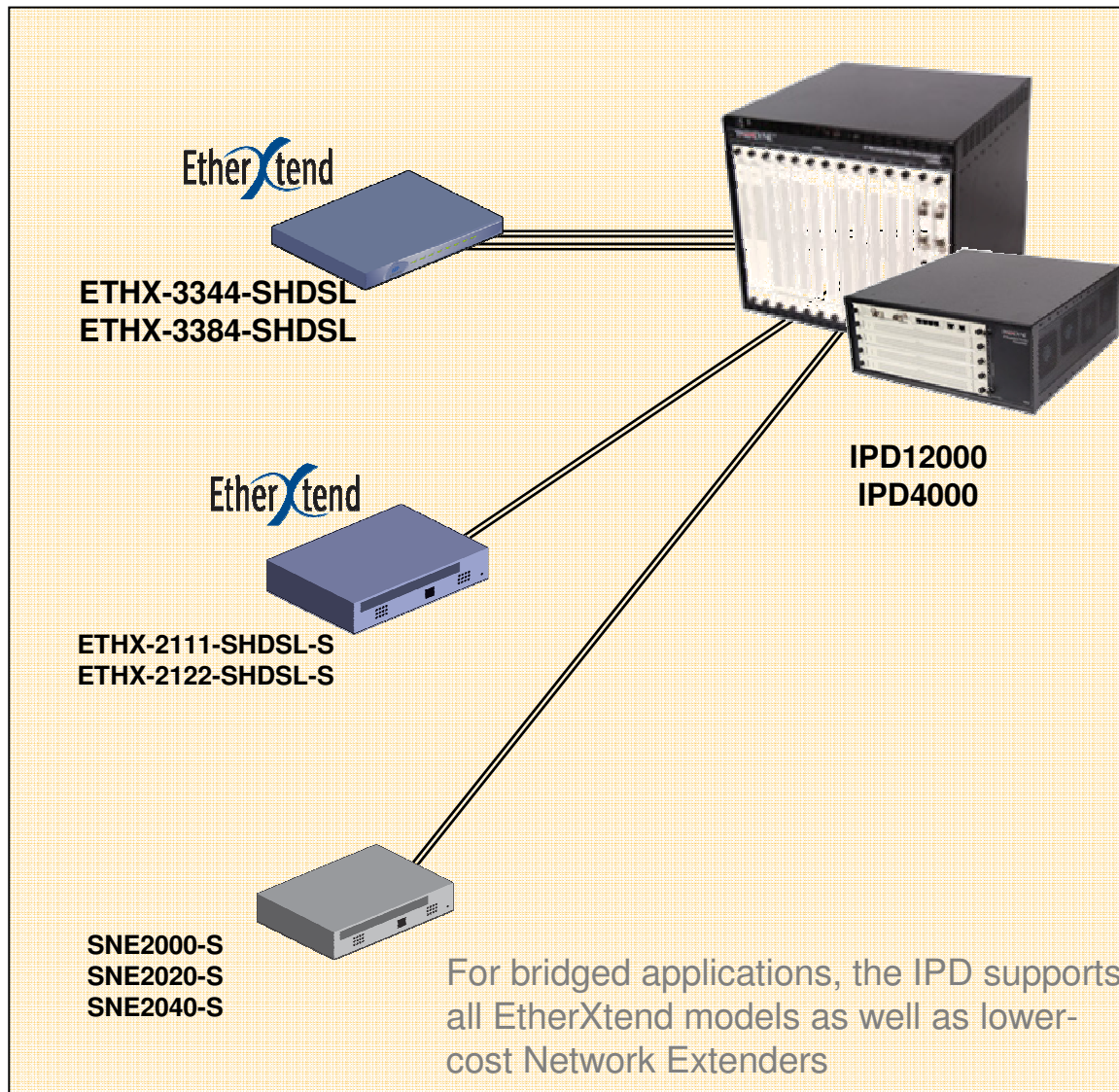


EtherXtend can **subtend** multiple units when used as CO aggregator

Subtending is supported for either 802.3ah or EoC, but not from the same device.

# Deployment Options: Access Aggregation

Up to 576 lines in a single shelf



IPD offers high-density **aggregation** in a multi-service platform

Support all EtherXtend and Legacy Network Extenders using Legacy EoC bonding

Zhone Way  
McAfee Coliseum  
EXIT ↓ ONLY

NORTH

INTERSTATE  
CALIFORNIA  
880

Thank You

