Zhone EFM Solutions Overview

Bandwidth Changes Everything™

Agenda

Ethernet in the First Mile Benefits
Markets and Applications
Zhone EFM Products Overview
CPE Management Features

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Ethernet in the First Mile Benefits

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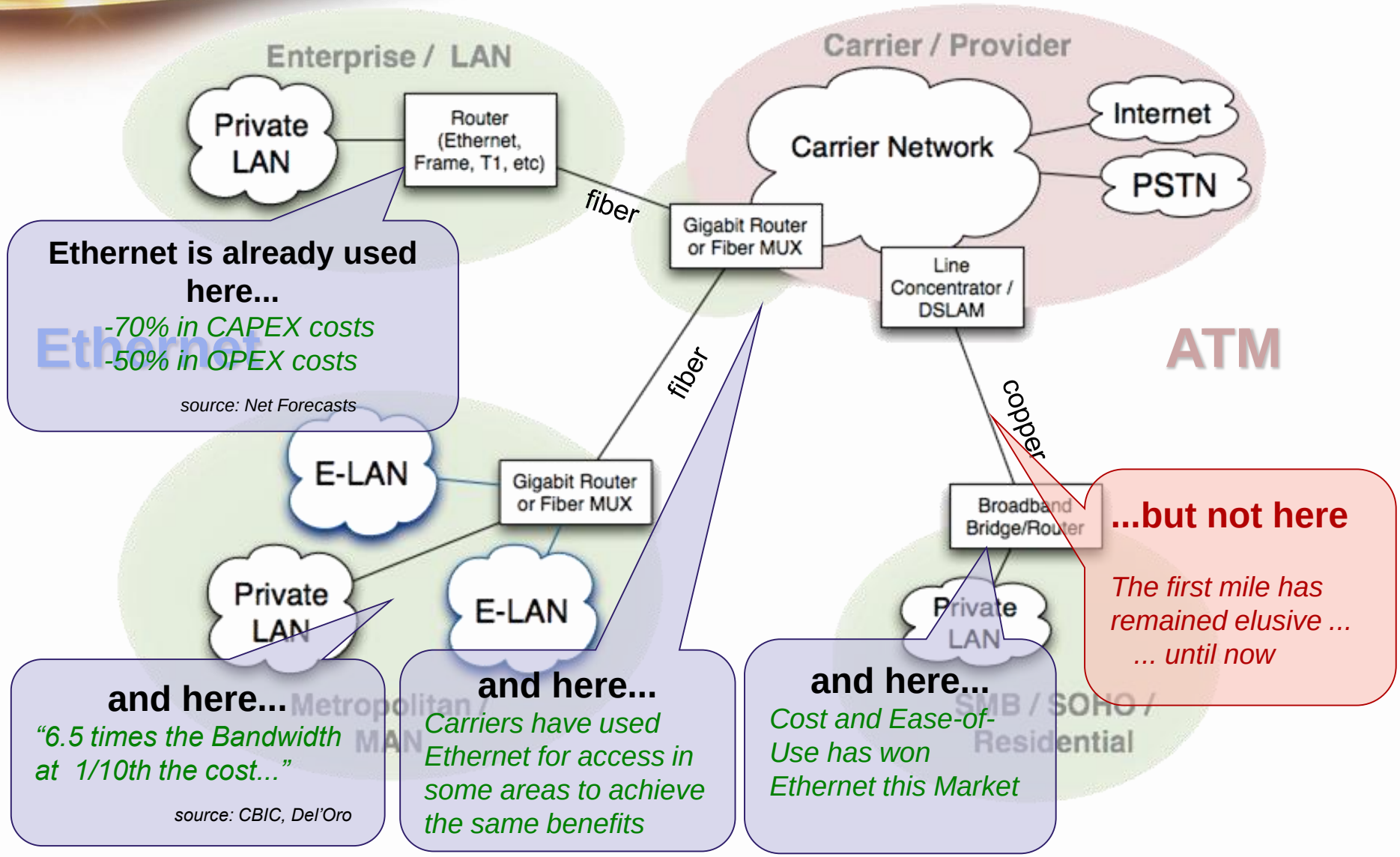
Ethernet Benefits

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 is already used here...

-70% in CAPEX costs
-50% in OPEX costs

source: Net Forecasts

and here...

"6.5 times the Bandwidth at 1/10th the cost..."

source: CBIC, Del'Oro

and here...

Carriers have used Ethernet for access in some areas to achieve the same benefits

and here...

Cost and Ease-of-Use has won Ethernet this Market

...but not here

The first mile has remained elusive ...
... until now

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Ethernet enables new services

- **Carrier Ethernet:** The broad class of services that extend Ethernet connectivity beyond the boundaries of an enterprise or residential LAN. Examples include:
- **E-LAN Services** also known as **Transparent LAN Service (TLS):** Using Ethernet access-network connectivity to create a seamless Ethernet LAN extension from the subscriber/enterprise network to the WAN & across the WAN to other locations. It is considered a native Ethernet multi-point service using Layer 2 functionality. E-LAN services are an alternative to frame relay.
- **E-Line Services** also known as **Ethernet Private Line (EPL):** Point-to-point services over Ethernet in the access network, generally Internet or VoIP connections. Can also include VPN type services. This is also an alternative to traditional frame relay, as well as fractional or full T1/E1 service, & even dial-up applications.
- **TDMoE Services:** Some service providers merely use Ethernet as a simplified means of delivering T1/E1 TDM services due to the attractive economics.
  TDMoE is transparent to the end subscriber who still sees a T1/E1 rate connection. TDMoE with a carefully-controlled clock reference for TDM timing-critical applications (such as cellular voice backhual) is also known as pseudo-wire, or PWE.
- **SLA E-LAN Services:** Larger business may want fully guaranteed bandwidth for TLS services between their locations. Adding Service Level Management via IP SLA provides an added value service tier for these customers.

ZHONE

Choices for Ethernet in the Access Network

	Ethernet in the First Mile (EFM)			
Category	Metro Ethernet	Active Ethernet	EFM over Copper	Pre-Standard **Ethernet over Copper**
Standard	**MEF* 10 Technical Specification**	**IEEE 802.3ah EFM**	**IEEE 802.3ah EFM**	**None (Net-to-Net protocol)**
Physical Medium	**1 single-mode optical fiber with WDM**	**1 single-mode optical fiber**	**1 to 8 voice-grade Cat-3 copper pairs**	**1 to 8 voice-grade Cat-3 copper pairs**
Topology	**Ring, star**	**Point to point**	**Point to point**	**Point to point**
Physical Layer	**1000/10000 Base T**	**10/100/1000 Base T**	**SHDSL.bis**	**T1, E1, SHDSL.bis**
Data Rates	**1–10 Gbps**	**10/100/1000 Mbps**	**Up to 12.7 Mbps per pair (max 100 Mbps)**	**1.5–5.7 max Mbps per pair (to 45 total)**
Reach	**10–40 km (6–25 mi.) depending on optics**	**10–40 km (6–25 mi.) depending on optics**	**Up to 7 km (4.5 mi.)**	**Unlimited for T1/E1; < 7 km / 4.5 mi. for SHDSL.bis**
Target Segments	**Large enterprises**	**Small/medium enterprises (SME) Residential triple play**	**SME (inc. T1/E1 or frame relay replacement)**	**SME (inc. T1/E1 or frame relay replacement)**

**MEF = Metro Ethernet Forum*

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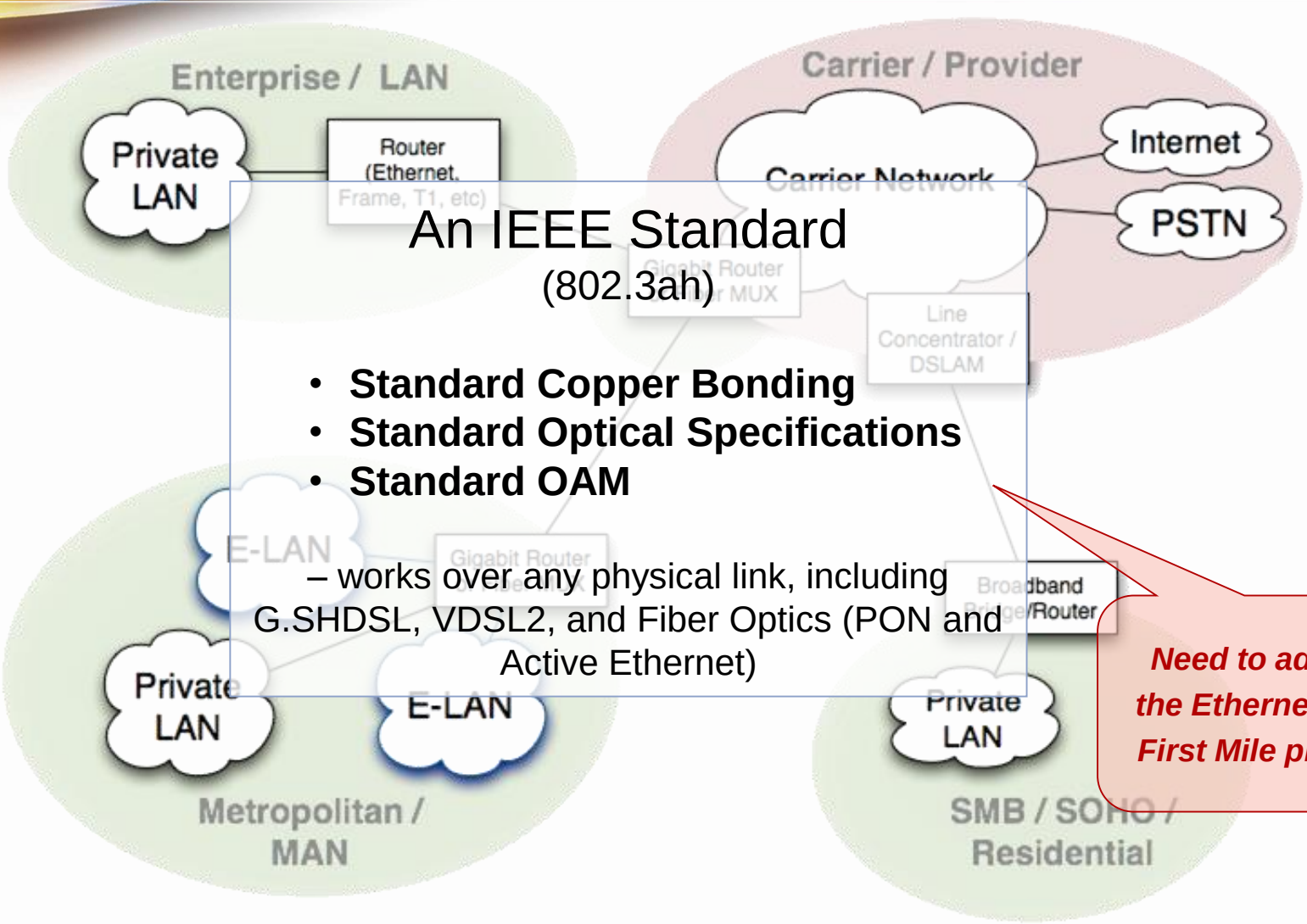
What is EFM?



An IEEE Standard

(802.3ah)

- **Standard Copper Bonding**
- **Standard Optical Specifications**
- **Standard OAM**

– works over any physical link, including G.SHDSL, VDSL2, and Fiber Optics (PON and Active Ethernet)

Need to address the Ethernet in the First Mile problem

Ethernet over Copper: Benefits

Symmetrical Bandwidth

- Business needs are the same up and down stream
- Native Ethernet
- Simple Layer 2 approach
- VLANs replace PVCs
- Simple connection to PLS core/ mesh networks

Loop Bonding

- Re-use copper pair in place
- Higher bandwidth – single connection
- Scalable – add pairs when needs grow
- Create more service tiers
- Solves problem of costly fiber installs when more bandwidth is demanded

No encapsulation overhead

- IP services transported on Ethernet with no ATM encapsulation

Network & Customer end requires no re-build or costly equipment

- EFM aggregation requires only moving copper at distribution frame
- Same switches & routers used
- Customer replaces CSU/DSU with EAD & connects directly to their Ethernet switch or hub router

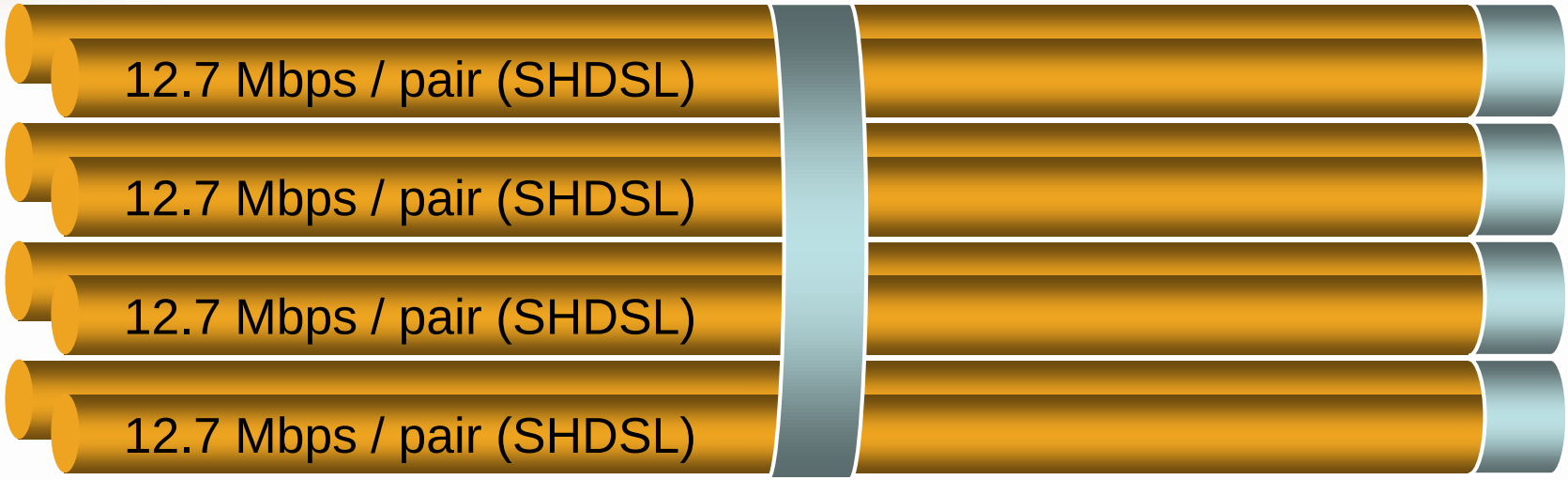
Flexibility & Reliability

- Hitless add/drops of bonded pairs
- Pairs with unequal performance. quality can be bonded – achieve aggregate bandwidth
- If one pair goes down, bond group stays up
- Traffic is synchronized across one, single link

Simplicity & Ease

- Requires little equipment
- Factory pre-provisioned for plug & play
- Installs in minutes
- Turn up rapid & simple

Loop Bonding (over SHDSL.bis)



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

- *5.7 Mbps TCPAM 16/32 up to 12.7 Mbps TCPAM 64 (one pair)*
- *11.4 Mbps TCPAM 16/32 up to 25.4 Mbps TCPAM 64 (two pairs)*
- *22.8 Mbps TCPAM 16/32 up to 50.8 Mbps TCPAM 64 (four pairs)*
- *45.6 Mbps TCPAM 16/32 up to 101.6 Mbps TCPAM 64 (eight pairs)*

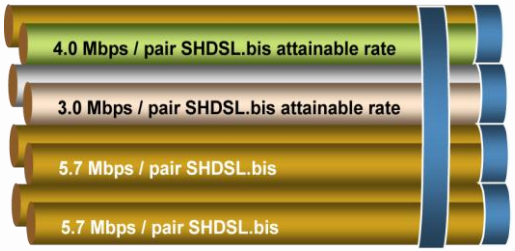
Greater bandwidth on fewer copper pairs

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

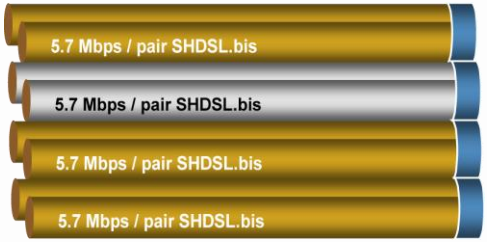
Bonding Performance Advantages

In addition to the fundamental achievement of 12.7 Mbps/pair for up to 8 pairs in a bond group, EoC offers advantages under real-world operating conditions.



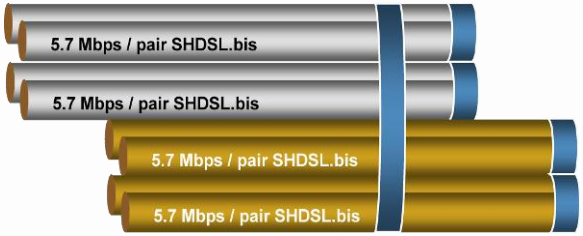
Bonding unequal rate pairs—SHDSL.bis EFM

- Aggregate rate of bond group delivered with pairs of unequal rate performance
- Unlike older (MLPP, ATM) bonding where all pairs fell back to the lowest rate



Loss of pair in bond group

- Lose pair & bond group continues to function
- Loses bandwidth of the lost pair
- When pair is restored, bond group auto-discovers & recovers to original state



Hitless add/drops

- Can add or drop pairs in bonded groups
- Can also move pairs to different bond groups

Agenda

Ethernet in the First Mile Benefits

Markets and Applications

Zhone EFM Products Overview

CPE Management Features

Ethernet over Copper Markets & Applications

Small/Medium Enterprises (SMEs)

- E-LAN, E-Line services with IP SLA, routing, VLANs, etc.
- Frame relay replacement
- T1/E1 replacement using PWE

3G/4G Cellular Operators

- High-bandwidth backhaul substitute for T1/E1 where fiber is not practical
- Site aggregation & monitoring

Municipalities

- School, government metro LAN connectivity
- Surveillance, security, traffic monitoring, light metering

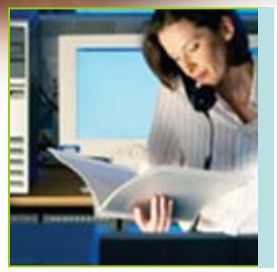
Geographically Distributed Utilities

- High-bandwidth site-to-site connectivity on low-cost medium, for monitoring & communications

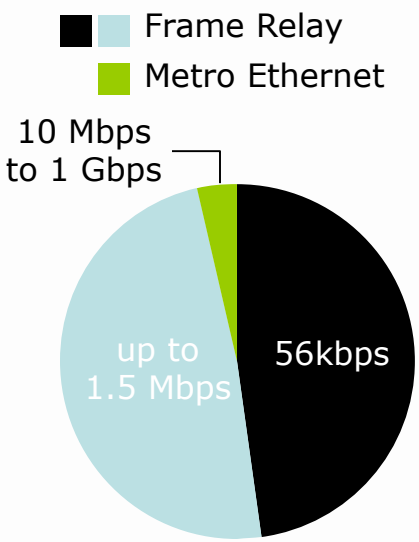
Value to SMEs of Ethernet Services

- **Fundamental benefits from WAN connectivity via Ethernet over copper**
  - Higher-bandwidth service options (from 12 to 100 Mbps) available wherever copper is, without the cost of fiber runs
  - Simplified network setup & administration via single physical layer protocol in LAN & WAN
  - Easy path to convergence on all-IP communication
- **Benefits from advanced features**
  - Transparent LAN services for seamless multi-location IT integration
  - Multiple Ethernet virtual private line connections from single customer premise device
  - QoS control by service class for traffic prioritization
  - End-to-end SLAs & network statistics for proactive network performance management

Replacing Frame Relay & T1/E1 for SMEs



Current Mix of Enterprise Access Service Technologies
(1.4m total sites)



2006 US stats from Vertical Systems Group

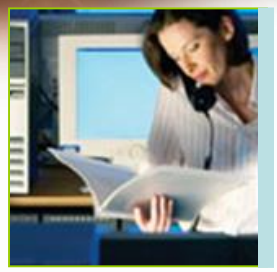
Incumbents

- Overcomes T1/E1 limits to meet growing bandwidth demands of SME segment
- Leverages existing copper plant
- Supports transition to IP network
- Improves competitiveness while lowering cost structure (simpler to install, maintain, & operate)

Alternative Carriers

- High-revenue & high-margin leverage of unbundled dry copper pairs
- Congruent with IP-based network core

Carrier Ethernet Business Services



- Existing Copper Loops
- City or multi-city Ethernet networks
- LAN to WAN extensions
- Bandwidth scaled by location
- Municipality and Traffic Monitoring

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Cellular Backhaul Opportunity

- The Problem:
  - Mobile operator revenue shifting toward data
  - Backhaul bandwidth requirements rising rapidly
  - Point-to-point microwave or fiber backhaul are often impractical
- Multiple T1/E1 lines is default approach today
- EFM over copper, with PWE to accommodate T1/E1 interface to base stations & maintain proper timing, is an attractive alternative
- Expected to be a large & growing opportunity over the coming years

Cellular Backhaul

Agenda

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CPE Management Features
Competition
Case Studies

The MXK
Multi-service Access Platform

Bezel with Fan assembly & status LEDs

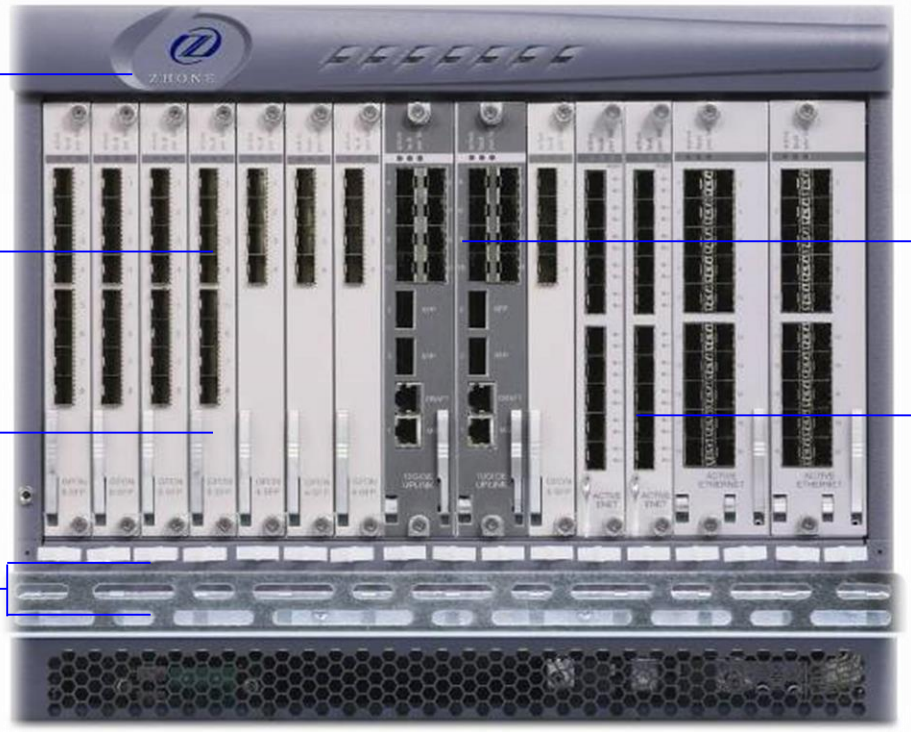
14 line cards (19”)
18 line cards (23”)

Hot swappable

FIBER

4/8 x GPON
20 x Active Ethernet

Fiber Tray & Cable Management



MXK 819, 823

Redundant controllers + uplinks

UPLINKS

2x 10G + 8x1G
8x1G
4x1G

COPPER

ADSL2+
POTS
SHDSL EFM
T1/E1 EFM
VDSL2
T1/E1 PWE

Front and Rear Power, Alarms, Cable Entry

Removable fan & filter assembly with status LEDs

7 line cards
Hot swappable

MXK 319

Redundant controllers + uplinks

All components I-temp hardened for remote node applications

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MXK: Superior Service Intelligence

- **Native IP network control, with a wealth of QoE and security features, including…**
  - Multicast IGMP
  - Q-in-Q-in-Q
  - 3-color policing
  - 802.1p
  - Secure bridging, SSH, SFTP, HTTPs, port access, ACLs
  - EAPS
  - RSTP

- **Increased service options**
- **Better Quality of Experience**
  - Improve customer retention
  - Generate customer goodwill
- **Tailor services to meet business needs**
- **Sophisticated security and control**

Superior Service Intelligence → **Higher Revenues**

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MXK Uplink Cards

- Variety of interface configurations for efficient network design
  - 2X10G + 8X1G
  - 8X1G
  - 4X1G
- I-Temp card, XFP, SFP
- Carrier-class features
  - Active/standby redundancy without external cable
  - Link aggregation
  - Network redundancy
  - Traffic Management

MXK EFM SHDSL Line Card

MXK EFM Module

24 port EFM G.SHDSL (Single Slot)

- Cross Card bonding support
- 802.3ah EFM
- Ability to transfer Synchronous timing Via SHDSL lines

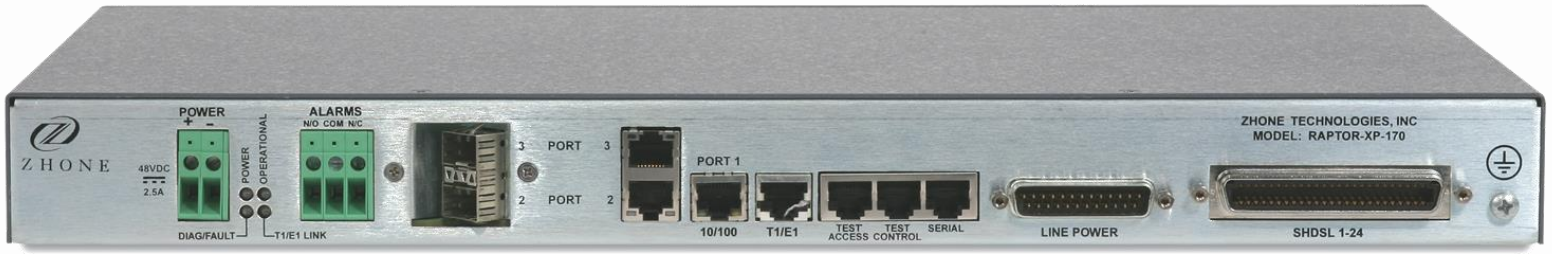
Optimum Performance with Extended Rates (TCPAM64)

12.7 Mbps (one pair)
25.4 Mbps (two pairs)
50.8 Mbps (four pairs)
101.6 Mbps (eight pairs)

1U Raptor-XP-170 Models

- **1U high**
  - 17.3 in x 10.0 in.
  - 439 mm x 254 mm
- **Uplink Options**
  - 2x FE/GE ports
- **DSL Support**
  - 24 SHDSL.bis Ports
- **Web GUI**
  - Intuitive Web Interface for device provisioning & management
- **Front and Rear LEDs**
- **Test access and test access control on unit rear**
- **Models with Line Power or Wetting Current**
- **Optional models with SELT/DELT**

- **RAPTOR-XP-170-WC**
  24-PORT SHDSL, 2 FE/GE, W/ WETTING CURRENT
- **RAPTOR-XP-170-LP**
  24-PORT SHDSL, 2 FE/GE, W/ LINE POWER
- **RAPTOR-XP-170-WC-S/D**
  24-PORT SHDSL, 2 FE/GE, W/ WC, W SELT/DELT
- **RAPTOR-XP-170-LP-S/D**
  24-PORT SHDSL, 2 FE/GE, W/ LP, W SELT/DELT



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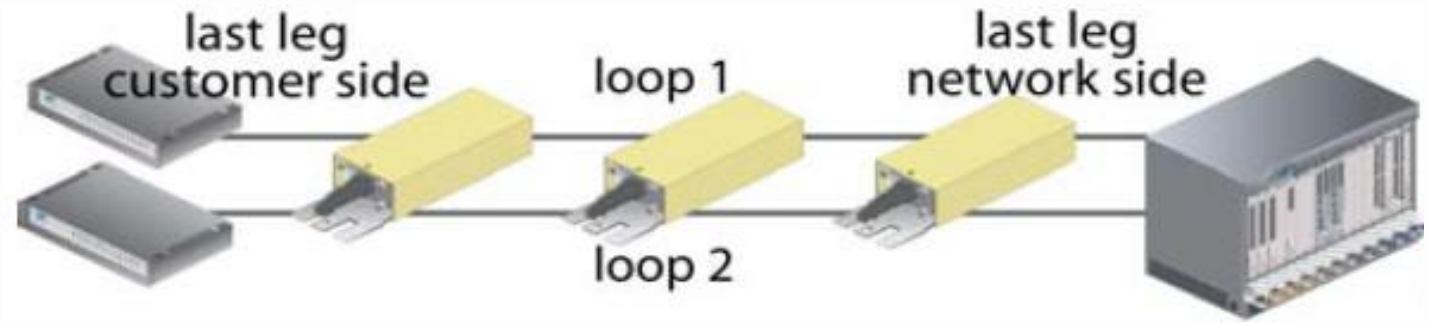
ETHERXTENDER Advantage

- **Extend loop to reach far-off customers**
  - Like all DSL technologies, SHDSL speeds drop with increased distance and fails to work with long loops
  - Repeaters can expand the sphere of reachable customers from the CO
- **Increase speed by shortening loop segments**
  - A subscriber may be reachable without a repeater, but the loop distance prevents training at the desired speed
  - A repeater will split the loop into two or more segments and each shorter segment will train at a higher rate than the original long loop.



Repeaters Extend Distance

- Services requiring a particular bandwidth limit the reach from the CO and the number of subscribers eligible for the service.
- Extend service reach with ETHERXTENDER and increase the number of subscribers reached.

	0 repeater	4 repeaters	8 repeaters
2 pairs	**10Mbps @ 4kft** **5Mbps @ 9kft**	**10Mbps @ 20kft** **5Mbps @ 45kft**	**10Mbps @ 36kft** **5Mbps @ 81kft**
8 pairs	**40Mbps @ 4kft** **20Mbps @ 9kft**	**40Mbps @ 20kft** **20Mbps @ 45kft**	**40Mbps @ 36kft** **20Mbps @ 81kft**

Repeaters Increase Bandwidth

- Target subscriber is known, but the loop is too long to provide the required bandwidth
- Add ETHERXTENDER to shorten loop segments and increase delivered bandwidth.

	0 repeater	1 repeater
2 pairs	**3Mbps @ 12kft**	**8Mbps @ 12kft**
8 pairs	**12Mbps @ 12kft**	**32Mbps @ 12kft**

EFM SHDSL Repeater Card

- **Designed to fit type 239 enclosure**
- **DIP switch manages line power. No other programming required.**
  - Position1 – Power fed from subscriber side. Do not allow power to continue to next segment.
  - Position 2 – Forward power to next segment.
  - Position 3 – Power fed from network side. Do not allow power to continue to next segment.
- **Each repeater supports two pairs.**
- **Up to 8 repeaters on a pair**

2-Card Repeater Enclosure

- Supports up to two cards
- Supports up to 4 loops (two loops on each card)
- Weather-tight cable fittings
- Replaceable gas tube lightning surge protection on all four ports of each circuit
- Option for 5 foot or 30 foot cable

REPEATER-ENCL-2SLOT-30FT

REPEATER-ENCL-2SLOT-5FT

8-Card Repeater Enclosure

- Supports up to 8 cards
- Pressurized enclosure may be mounted above or below ground
- Gas tube lightning surge protection on all four ports of each circuit
- Relative humidity: 95% without pressurization, 100% when pressurized.
- Option for 30 foot air or gel cable

REPEATER-ENCL-8SLOT-AIRCBL

REPEATER-ENCL-8SLOT-GELCBL

Line Powered Repeater

- The ETHERXTENDER is line powered for convenience and robustness. Local power is not required.
- Zhone's MALC, MXK, and 1U XP-170 are capable of passing power over the SHDSL loops. Copper pairs carry both data traffic and power.
- Power on the line can be passed through one repeater to the next allowing for multiple repeaters to be powered from a single power source in the CO.
- Line power over SHDSL is supported on
  - MXK (up to 432 ports)
  - MALC (up to 480 ports)
  - XP-170 (24 ports)

Power Shelf

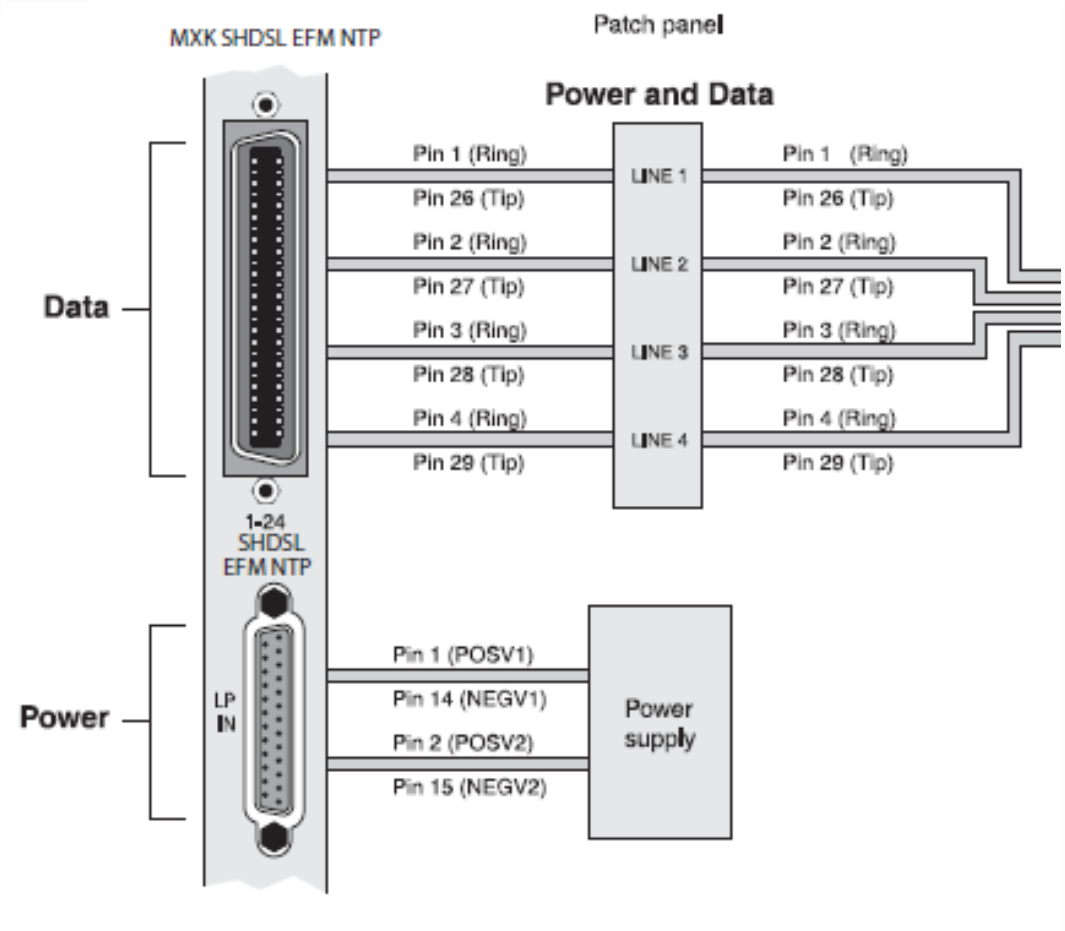
The ETHERXTENDER is powered over the copper pairs with +/-135V.

Zhone sells an Argus power shelf with cables designed for our SHDSL CO products.

CSM3536-SHELF CSM3536 Line Power Shelf (without fan & baffle)
CSM3536-CONTROL-MODULE (one module powers 4 pairs, 2 repeaters)
CSM35-POWER-MODULE CSM35 Line Power Module 135 Volt
CSM3536-CBL-DC-POWER (one per power module)
CSM3536-CBL-MALC-LINE-POWER (one per EFM card)

Power shelf shown with XP-170

Line Powered Repeater



- The MXK, MALC, and XP-170 support a power interface which would connect to the line power shelf.
- Data and power exit the SHDSL interface which is a standard 50-pin AMP connector.

Zhone Ethernet Access Devices (EAD's)

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

EtherXtend Series 2100

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

EtherXtend Series 3100 / 3200 / 3400

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

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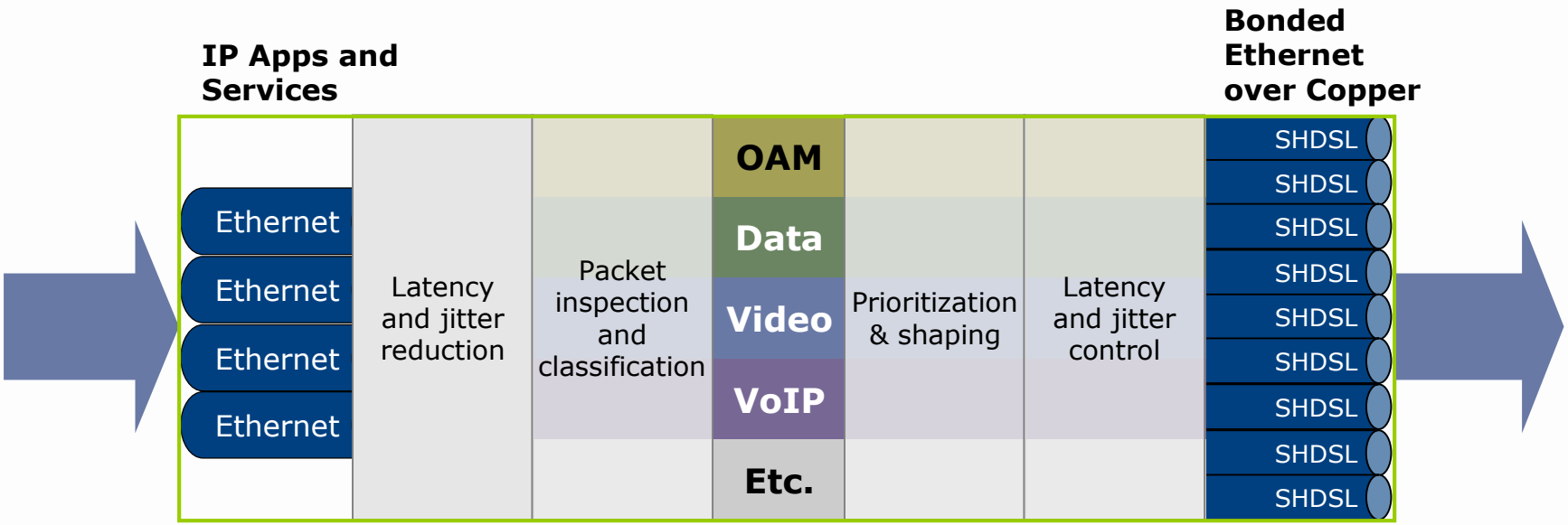
EtherXtend EADs

Any service, One Intelligent demarc

The customer is given a **single intelligent demarcation point** for their data services.



...with a powerful & secure engine in the middle...

EtherXtend 2100 Series EAD

ETHX-2111: – 1 EFM, 1 FE
ETHX-2112: – 1 EFM, 2 FE
ETHX-2122: – 2 EFM, 2 FE

- **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**
- **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 MXK, MALC, XP-170 or IPD 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 3200 Series EAD

- **802.3ah EFM standard Loop Bonding & OAM**
  - Interoperates with MXK, MALC, XP-170
  - Works in back-to-back mode
  - Supports Extended rates
- **Four LAN ports**
  - One 10/100/1000bT port (3244, 3248)
  - Three 10/100bT ports
  - Auto speed / duplex / Crossover detection
- **Wirespeed packet processing for data path features**
  - Per VLAN Bridging or Routing
  - PPPoE in Bridged or Routed mode
  - Double tagged VLANS (S-Tag)
  - TLS mode with S-Tag added to all LAN port traffic on ingress / stripped on egress
  - Integrated DHCP Server
  - NAT/PAT
- **4 or 8 Voice Ports (3244 or 3248 model)**
  - MGCP, SIP, SIP-PLAR
- **Management:**
  - ZMS CPE Manager
  - Web GUI
  - CLI

ETHX-3210: – 1 EFM, 4 FE
ETHX-3220: – 2 EFM, 4 FE
ETHX-3240: – 4 EFM, 4 FE
ETHX-3244: – 4 EFM, 3 FE, 1 GE, 4 POTS
ETHX-3248: – 4 EFM, 3 FE, 1 GE, 8 POTS

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Packet Processing Capacity (wire speed routing)

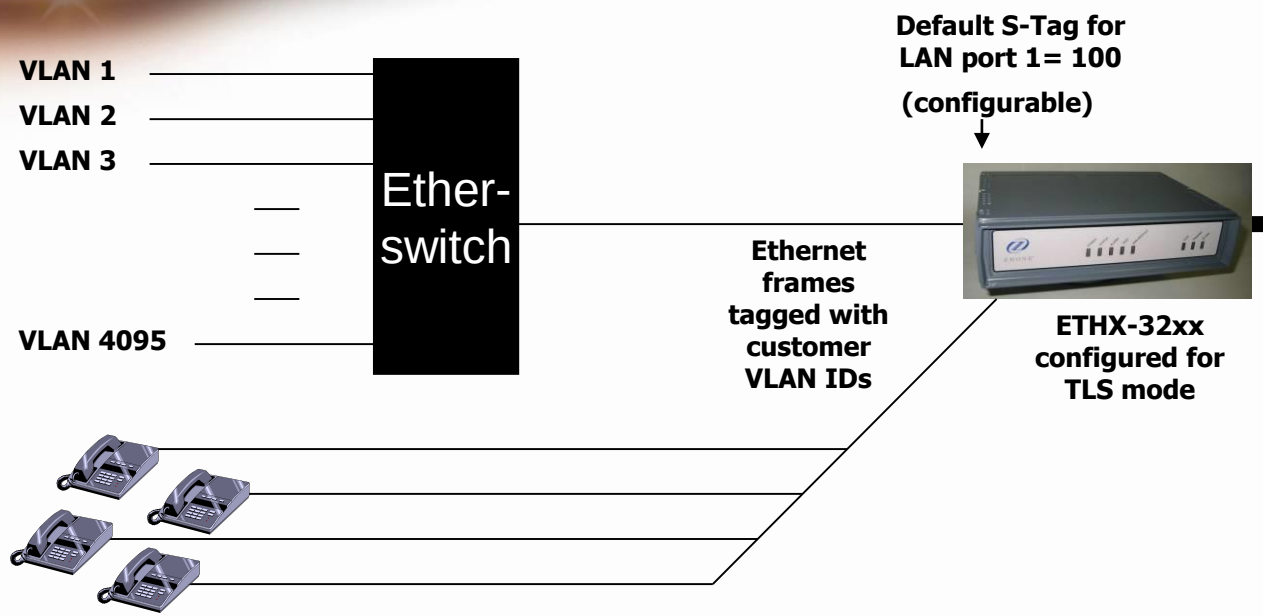
Routed Mode (through 22.8 Mbps SHDSL EFM uplink)

Frame Size	Passed Rate (Mbps)	(01,01,01) to (01,01,02) (pks/sec)	(01,01,02) to (01,01,01) (pks/sec)	Total pkts/sec
		100M -100M	100M -100M	
64	22.02	32765	32765	65530
128	22.76	19425	19425	38850
256	22.00	9964	9964	19928
512	20.35	4782	4782	9564
1024	21.45	2568	2568	5136
1280	21.45	2062	2062	4124
1518	21.43	1742	1742	3484

Bridged Mode (through 22.8 Mbps SHDSL EFM uplink)

Frame Size	Passed Rate (Mbps)	(01,01,01) to (01,01,02) (pks/sec)	(01,01,02) to (01,01,01) (pks/sec)	Total pkts/sec
		100M -100M	100M -100M	
64	22.76	33875	33875	67750
128	22.76	19425	19425	38850
256	22.00	9964	9964	19928
512	21.45	5041	5041	10082
1024	21.45	2568	2568	5136
1280	21.45	2062	2062	4124
1518	21.43	1742	1742	3484

ETHX-3200 Transparent LAN Service (TLS Mode)



DATA TRAFFIC:

Outer (S) Tag = 100

Inner (C) Tag = 1 – 4095

(whatever the Customer's Private Network uses)

VOICE TRAFFIC:

Inner (C) Tag = 200

(determined by Service Provider's network)

MANAGEMENT TRAFFIC:

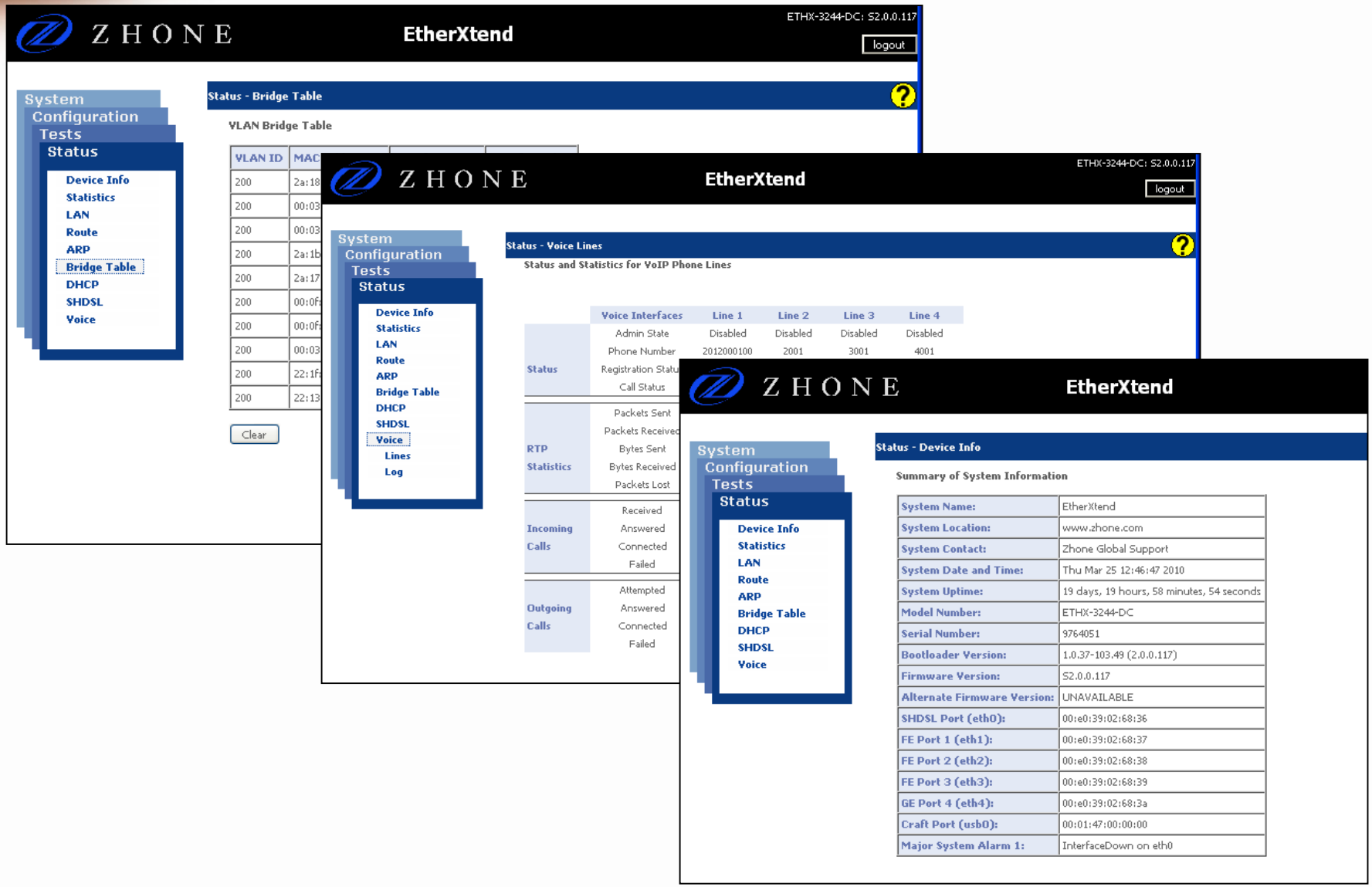
Inner (C) Tag = 7

DHCP Client Enabled

(ZMS CPE Manager)

- Customer network can use any number of VLAN IDs with no restrictions
- ETHX adds configured outer (S) tag to upstream traffic on LAN port ingress and strips the (S) tag on LAN port egress
- A TLS Bridge VLAN must be configured in the ETHX for each LAN port. Four simultaneous TLS Bridges can be supported.
- Configuration and handling of Voice traffic is unchanged
- Configuration and handling of Management traffic is unchanged

EtherXtend 3200 Series EAD



ZHONE

EtherXtend 3100 Series EAD

- **802.3ah EFM standard Loop Bonding & OAM**
  - Interoperates with MXK, MALC, XP-170
  - Works in back-to-back mode
  - Supports extended rates
- **4 10/100 BaseT Ethernet LAN interfaces**
  - Wirespeed bridging w/ VLAN tagging & COS
- **48V powering option w/ extended temp range**
- **2 T1/E1 ports using Pseudo-wire technology**
- **Multiple PWE3 Timing recovery Modes**
  - Adaptive, Synchronous, Differential
- **Multiple PWE3 Encapsulation Modes**
  - MEF, UDP/IP, MPLS
- **Multiple PWE3 Modes**
  - SAToP, CESoPSN
- **MEF 18 Certified**
  - Meets ITU-T G.8261 clock accuracy requirements in Adaptive Mode, during varied network load conditions

ETHX-3142 – 4 EFM , 4 FE, 2 T1/E1
ETHX-3143 – 4 EFM , 4 FE, 2 E1

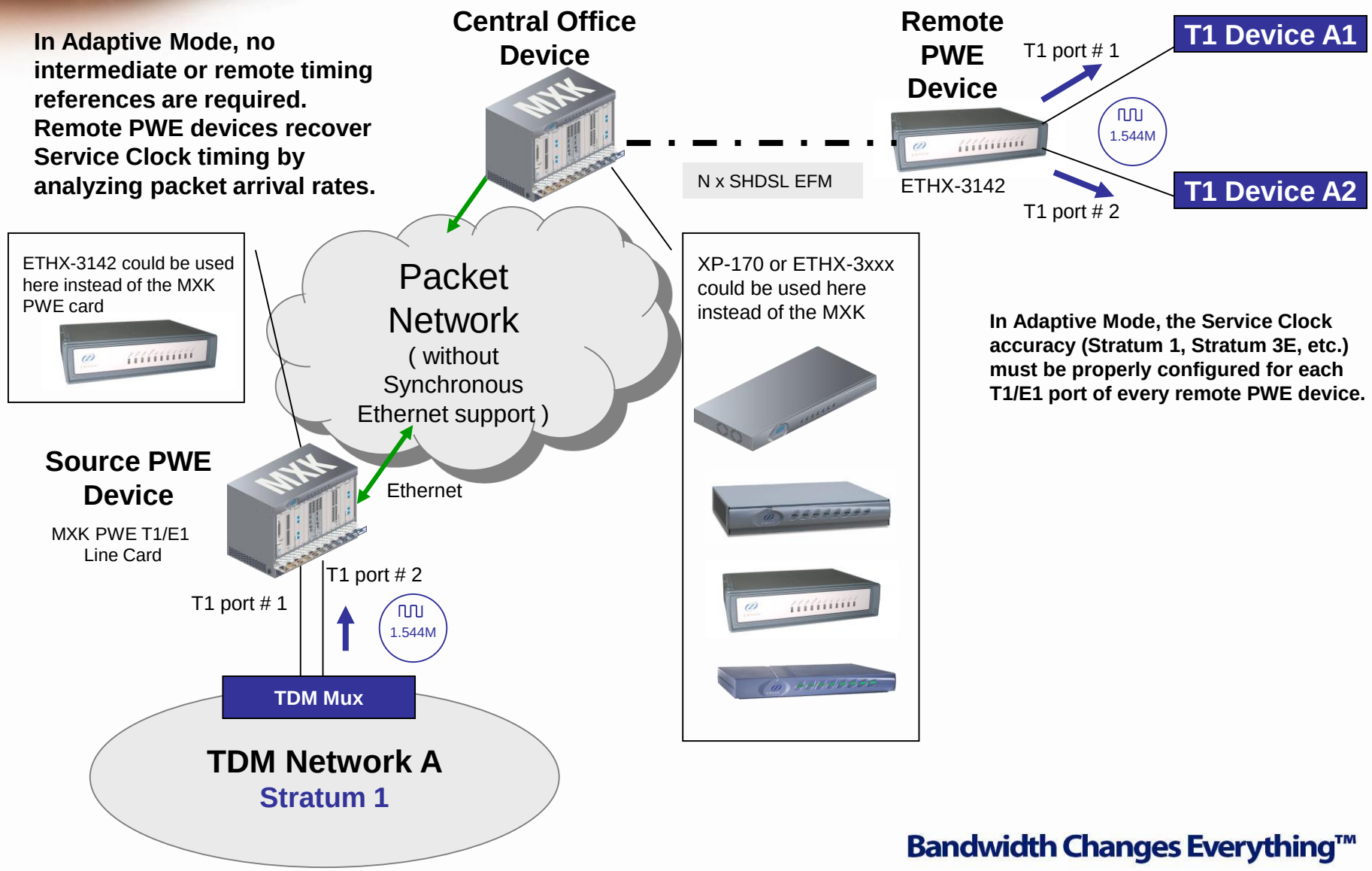
CARRIER ETHERNET
MEF
Certified Compliant
TM

Bandwidth Changes Everything™

- **Units operate in back to back mode (CO and CPE mode)**
- **Automatic load balancing on bonded ports for optimum throughput**
- **Seamless failure recovery**
  - Allows dropped lines to retrain and re-enter a bonded group automatically
- **Multiple Clock recovery mechanisms supported**
  - Differential Timing Mode
    - Uses Sync Ethernet to provide a common reference clock to originating and terminating PWE connections. Recommended mode for PWE connections through a packet network if common ref clock is available.
  - Adaptive Timing Mode
    - Recovers timing from PWE packet stream. Recommended for PWE connections through a packet network when a common clock reference is not available
  - Sync-SHDSL Timing Mode
    - T1/E1 timing reference delivered from CO to CPE using SHDSL Physical Layer. Recommend for PWE connections across a bonded EFM connection, with the PWE connection originating in the CO and terminating at the CPE.

Packet network, single Service Clock, No SyncE (Adaptive Mode)

In Adaptive Mode, no intermediate or remote timing references are required. Remote PWE devices recover Service Clock timing by analyzing packet arrival rates.



In Adaptive Mode, the Service Clock accuracy (Stratum 1, Stratum 3E, etc.) must be properly configured for each T1/E1 port of every remote PWE device.

Bandwidth Changes Everything™

EtherXtend 3400 Series EAD

- **802.3ah EFM standard Loop Bonding & OAM**
  - Interoperates with MXK, MALC, XP-170
  - Works in back-to-back mode
  - Supports extended rates
- **N2N Loop Bonding**
  - Interoperates with MXK, MALC, XP-170, IPD
  - Works in back-to-back mode
- **Four 10/100 BaseT Ethernet LAN interfaces**
- **4 ports of SHDSL.bis (3444 model)**
- **8 ports of SHDSL.bis (3484 model)**
- **Management:**
  - ZMS CPE Manager
  - Telnet
  - HTTP/HTTPS

ETHX-3444 – 4 EFM , 4 FE
ETHX-3484 – 8 EFM , 4 FE

ZHONE

EtherXtend Product Matrix

	Model	3140	3142	3143	3210	3220	3240	3244	3248	3444	3484
Ports and Features	SHDSL	4	4	4	4	4	4	4	4	4	8
	POTS							4	8		
	FE	4	4	4	4	4	4	3	3	4	4
	GE							1	1		
	T1/E1		2	2							
	PPPoE				●	●	●	●	●		
	DHCP Server				●	●	●	●	●		
	NAT/Firewall				●	●	●	●	●		
Temp	0C to 50C	●	●	●	●	●	●	●	●	●	●
	-40C to 65C (DC models)	●	●	●				●	●		
Power	12 VDC				●	●	●	●	●		
	48 VDC	●	●	●						●	●
	AC	●	●	●	●	●	●	●	●	●	●
VoIP	SIP							●	●		
	SIP PLAR							●	●		
	MGCP							●	●		
Manageme	CLI	●	●	●	●	●	●	●	●	●	●
	Web UI	●	●	●	●	●	●	●	●	●	●
	ZMS	●	●	●	●	●	●	●	●	●	●

Agenda

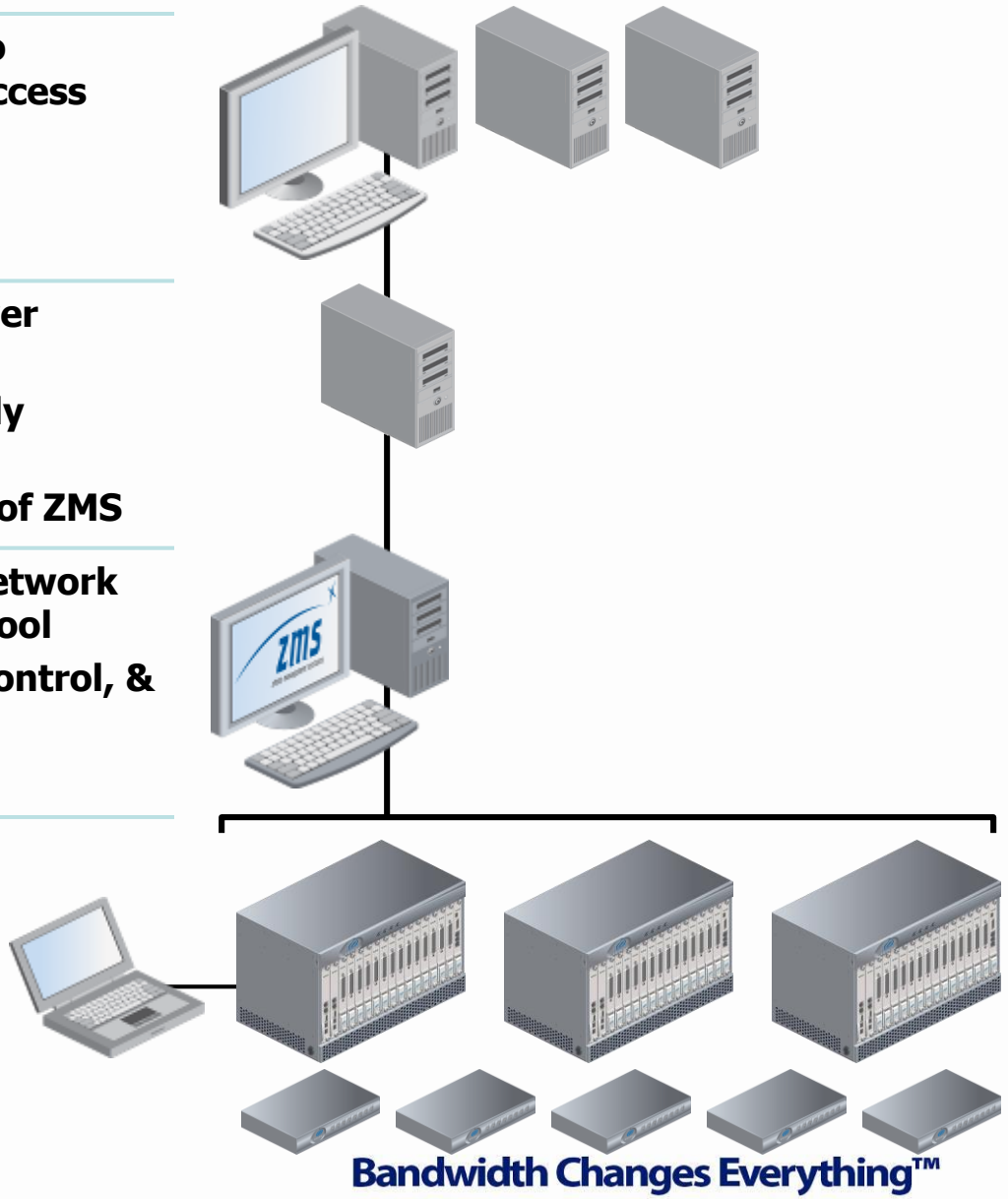
Ethernet in the First Mile Benefits
Markets and Applications
Zhone EFM Products Overview
CPE Management Features

Service Provider Challenges with CPE/ONT Management

- **The amount and complexity of CPE (Customer Premises Equipment) / ONT (Optical Network Termination) devices in end user's network has increased over the past years**
- **There is a big challenge for service providers to manage and control all these devices and the services running on them remotely from the central office (CO) and/or from the network operations center (NOC)**
- **Service Providers are looking for:**
  - Faster, easier and error-free deployments with fully managed, plug-and-play provisioning
  - Reduced network downtime by ensuring timely repair of CPEs/ONTs
  - Business-critical network reliability delivered through automated equipment and environmental monitoring, access, and control
  - Minimizing total cost of ownership and improve remote site recovery by maintaining accurate CPE/ONT records and automating firmware upgrades and configuration changes
  - Lower operational costs and reduce downtime using purpose-built telecom CPE management solutions
  - Avoiding unnecessary calls to the service provider's customer support

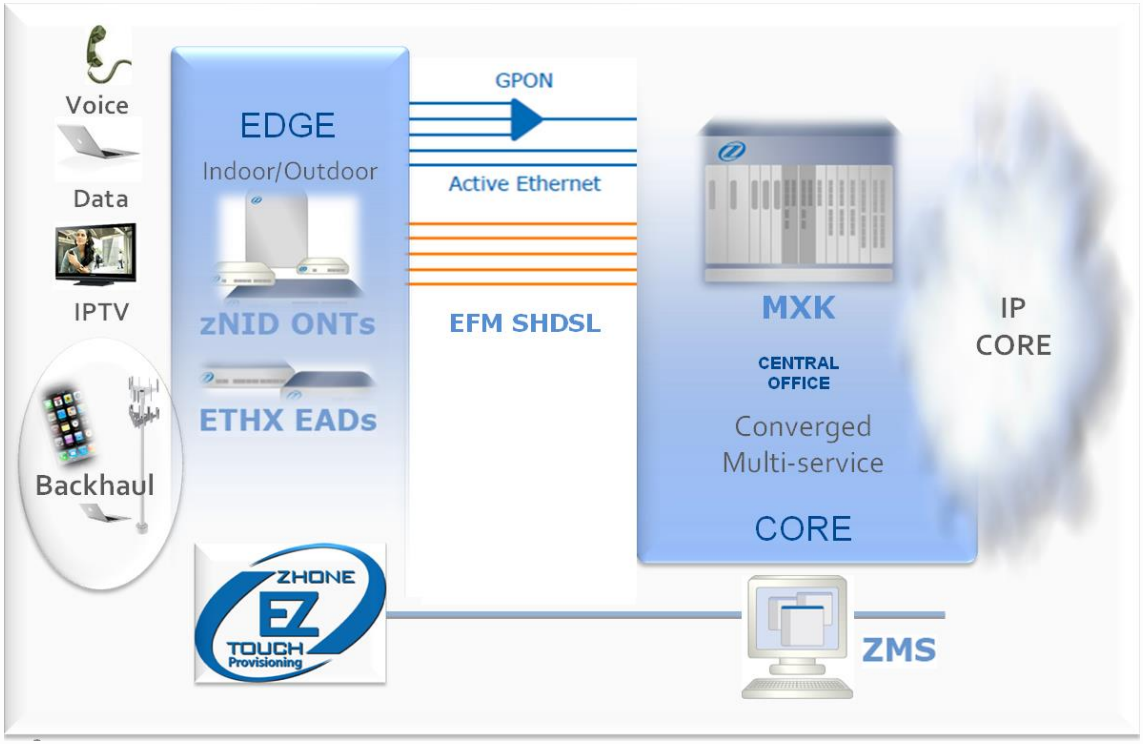
ZMS - Powerful, scalable management & integration

Carrier OSS	• **Single integration to manage complete access network**
Zhone OSS Gateway	• **Powerful client-server architecture** • **Flexible & completely programmable** • **Function calls to all of ZMS**
ZMS Element Management System	• **Manage all Zhone network elements with one tool** • **Service definition, control, & reporting**
Web GUI, CLI, scripts	• **Direct configuration interface** • **Easy-to-use GUI** • **Powerful CLI & scripts for automation**



Introducing
ZHONE EZ TOUCH Provisioning

- **ZHONE EZ TOUCH Provisioning**
  - provides powerful CPE/ONT Management/Provisioning solution for Zhone SHDSL EFM CPEs (ETHX) and AE / GPON (non-OMCI) ONTs (zNIDs)



Capabilities
ZHONE EZ TOUCH Provisioning

- **ZHONE EZ TOUCH Provisioning extends ZMS features to the CPE/ONT device level**
  - Manual or Automatic / Individual or in Bulk execution of the following features:

GPON & AE ONTs
- **zNID 22xx**
- **zNID 24xx**
- **zNID 422x**
- **zNID 9xxx**

SHDSL EFM CPEs
- **ETHX-31xx**
- **ETHX-32xx**
- **ETHX-34xx**

CPE Manager (NAT/PAT)

Software Upgrades

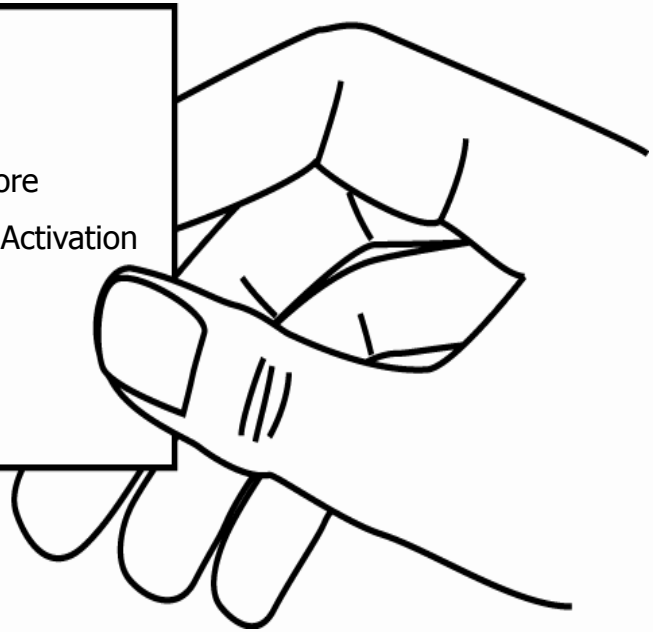
Configuration File Backup and Restore

Configuration Script Download and Activation

Telnet and Web cut-through

Centralized Alarm reporting

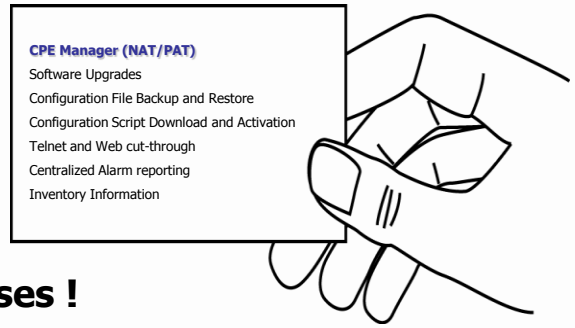
Inventory Information



ZHONE EZ TOUCH Provisioning

Bandwidth Changes Everything™

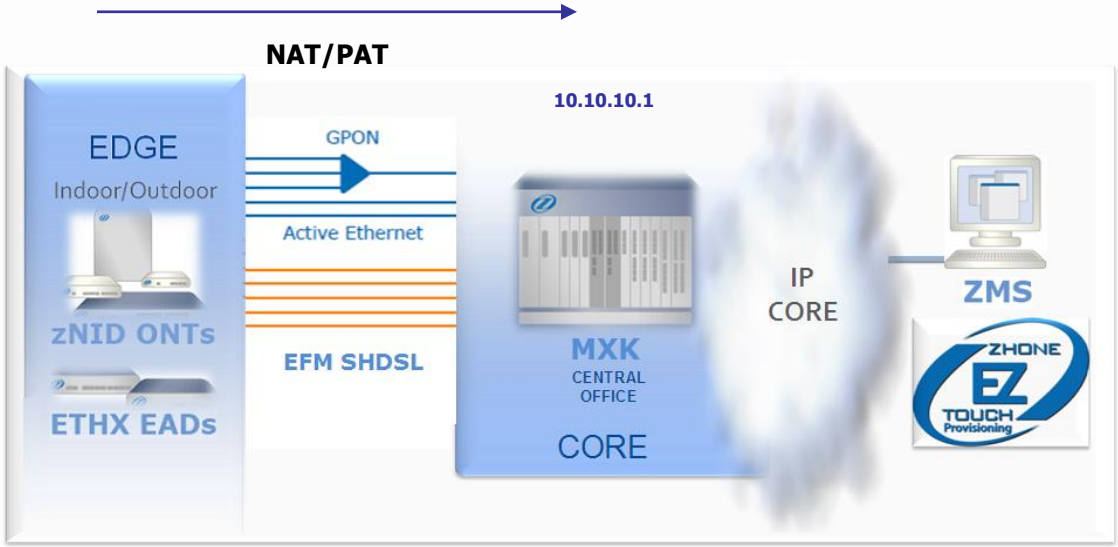
Features
ZHONE EZ TOUCH Provisioning



- **Basic CPE Manager (NAT/PAT) feature – Conserves IP Addresses !**
  - There is no need to assign routable IP addresses to every CPE/ONT device:
  - ZMS manages all supported CPE/ONT devices attached via the MXK's IP Address using NAT/PAT
    - MXK NAT/PAT feature determines binding of UDP port #to Interface # for CPE Management

AE or GPON ONT
192.168.1.1
Slot 7 – Ports 1, VLAN 7 DHCP

EtherExtend
192.168.1.2
Slot 1 – Ports 5-8, VLAN 7 DHCP



AE or GPON ONT
10.10.10.1
UDP Port 203

EtherExtend
10.10.10.1
UDP Port 202

Bandwidth Changes Everything™

Features
ZHONE EZ TOUCH Provisioning

CPE Manager (NAT/PAT)
Software Upgrades
Configuration File Backup and Restore
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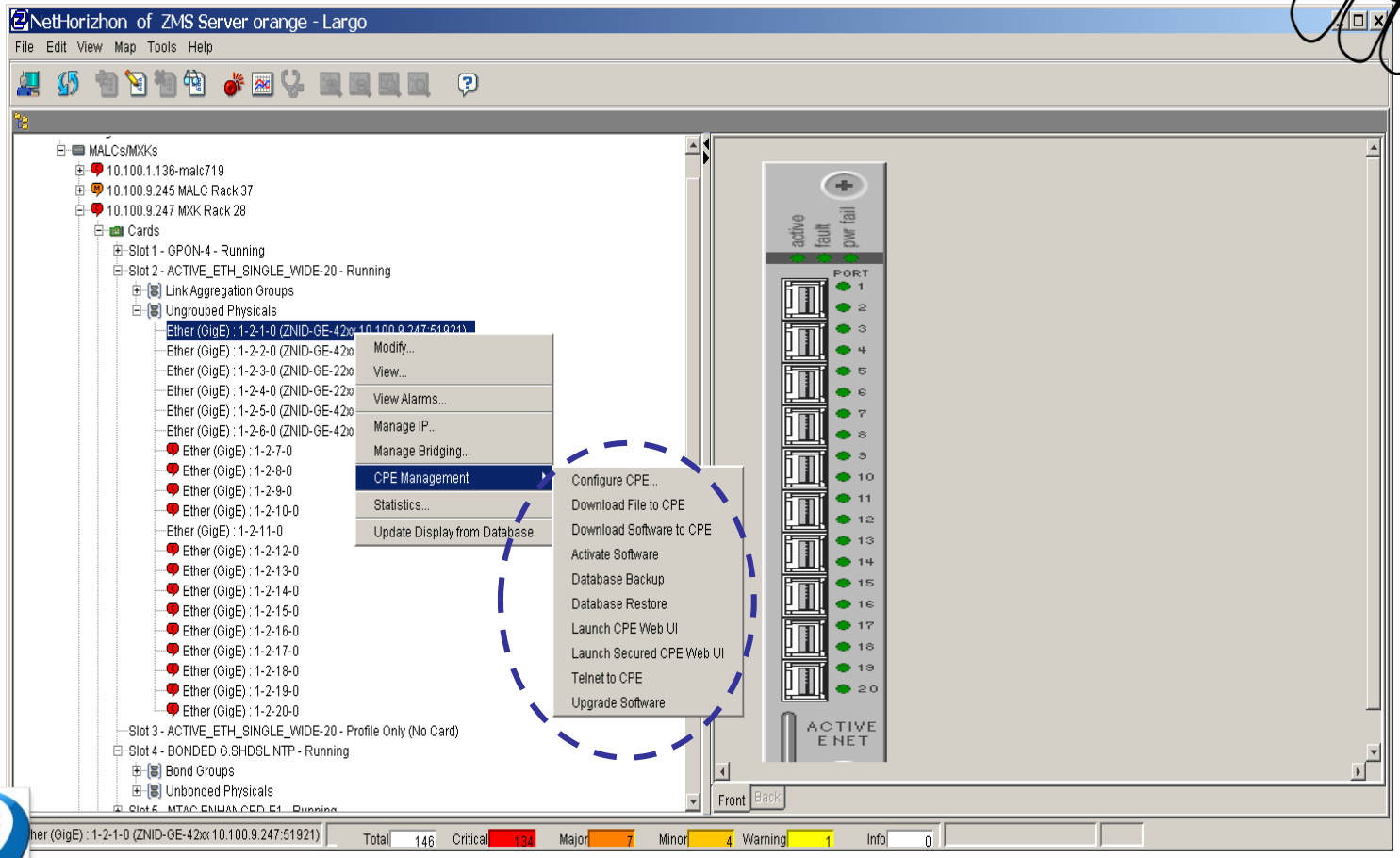
Inventory Information

- **CPE Manager features in ZMS**



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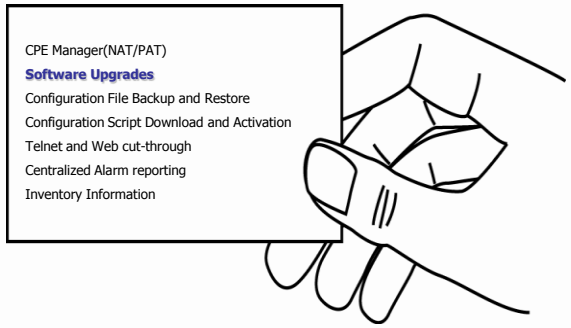
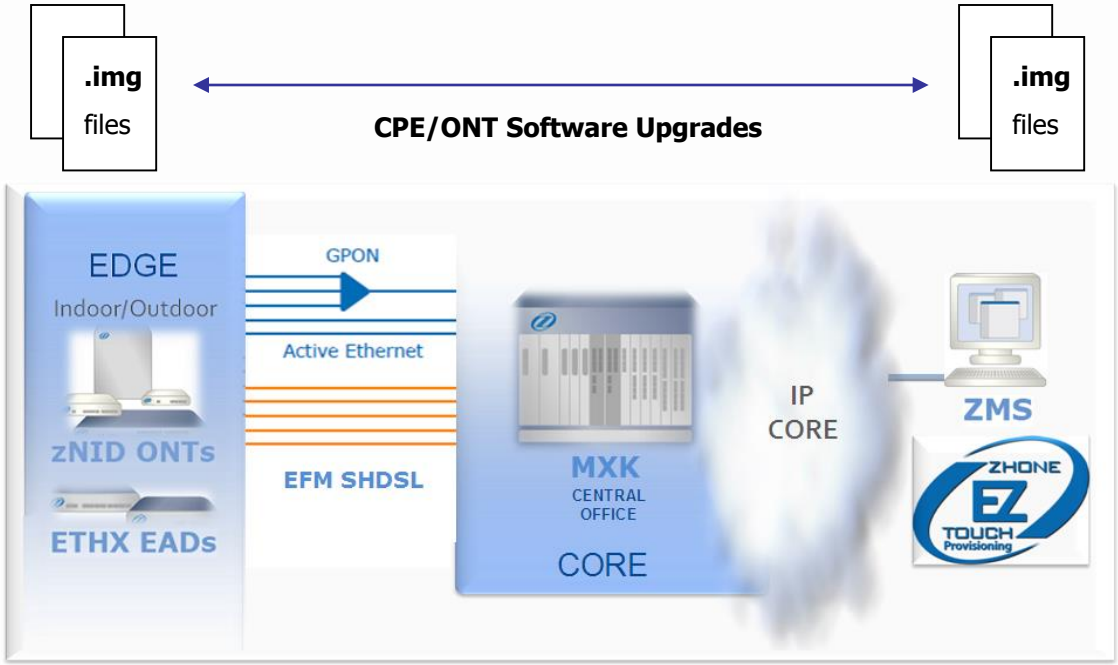
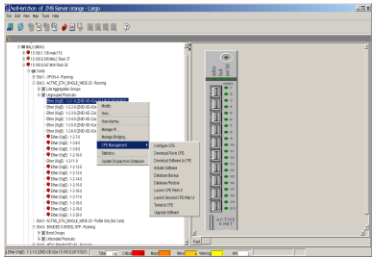
Features
ZHONE EZ TOUCH Provisioning

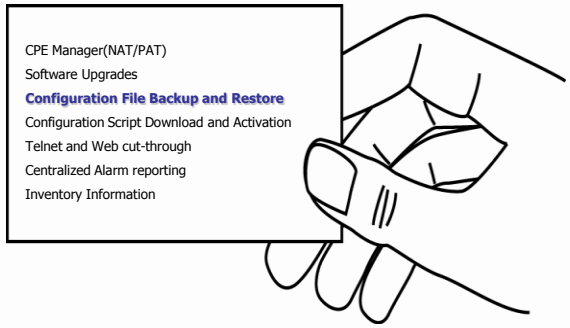


- **Software Upgrades**
  - Select one or all CPEs/ONTs on any MXK chassis/card/port and initiate or schedule a Software Upgrade (Download & Activation)

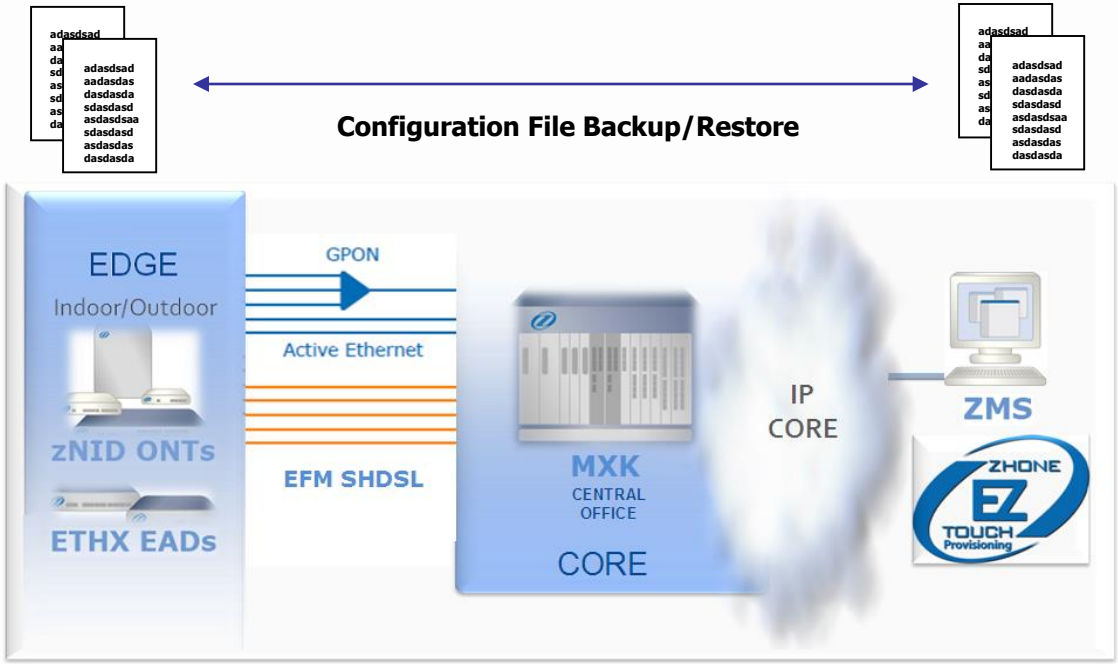


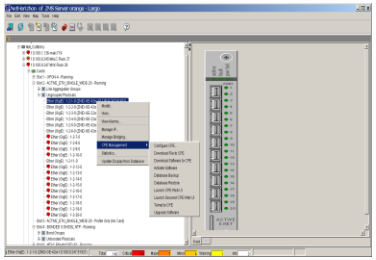


Features
ZHONE EZ TOUCH Provisioning



- **Configuration File Backup and Restore**
  - Select one or all CPEs/ONTs on any MXK chassis/card/port and initiate or schedule a Configuration Backup/Restore.





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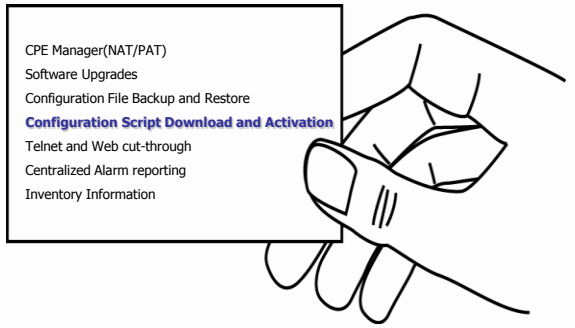
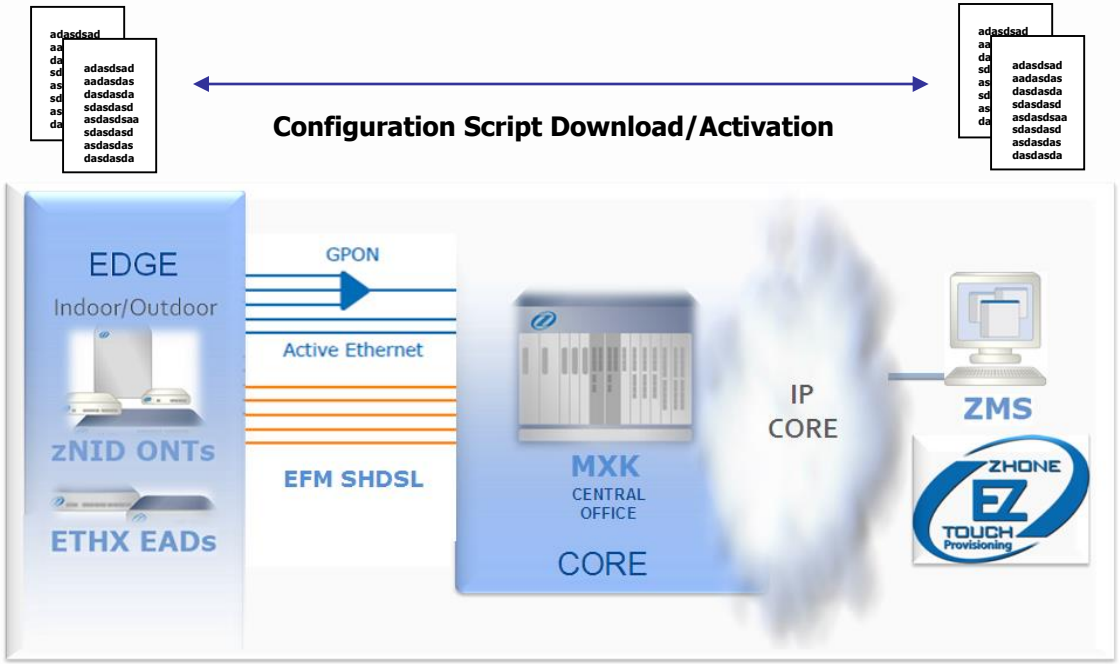
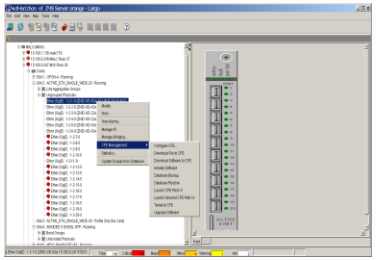


- **Configuration Script Download and Activation**
  - Select a CPE/ONT and initiate or schedule the execution of one or more Configuration Scripts.
  - Configuration Scripts may be used to change any parameters in a supported CPE/ONT.

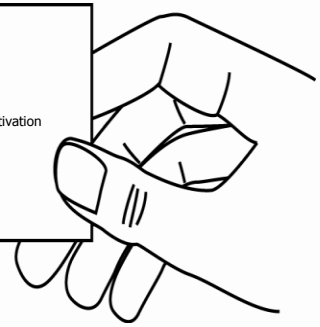




Bandwidth Changes Everything™

Features
ZHONE EZ TOUCH Provisioning

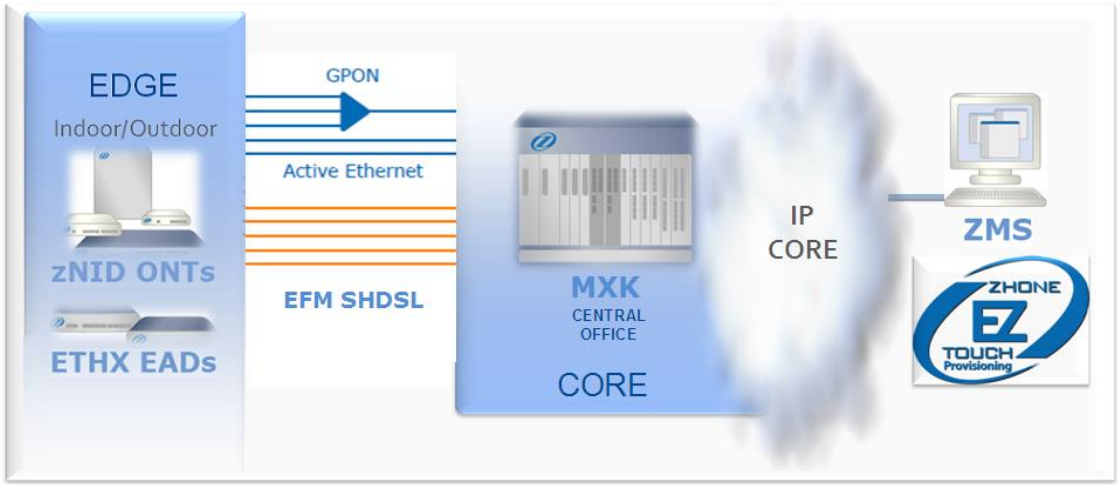
CPE Manager(NAT/PAT)
Software Upgrades
Configuration File Backup and Restore
Configuration Script Download and Activation
Telnet and Web cut-through
Centralized Alarm reporting
Inventory Information

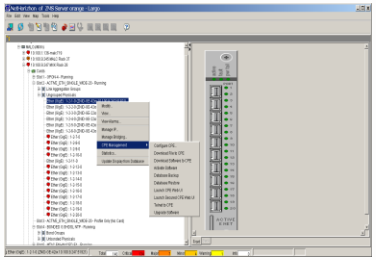


- **Single Click Telnet / Web cut-through to attached CPE/ONT devices**
  - Telnet or HTTP cut-through to any CPE/ONT device for troubleshooting/configuration.

Telnet and WebUI cut-through to CPE/ONT

ZMS PC Client





ZHONE EZ TOUCH Provisioning

Bandwidth Changes Everything™

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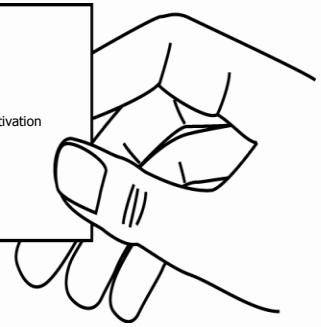
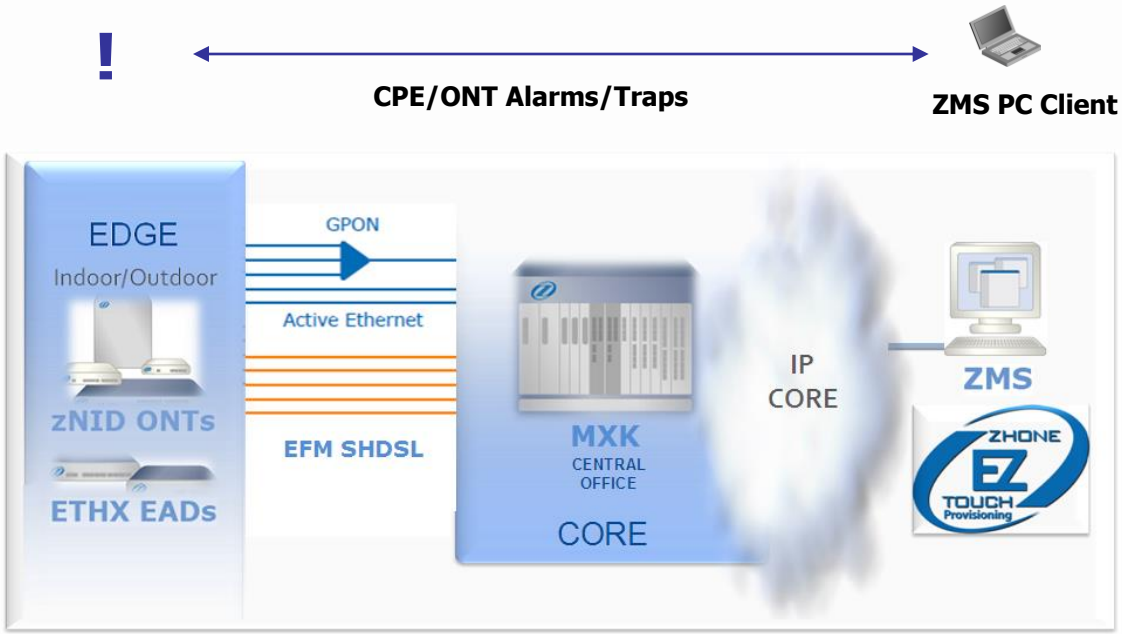
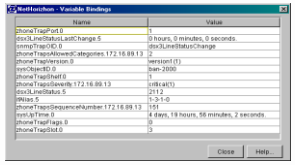
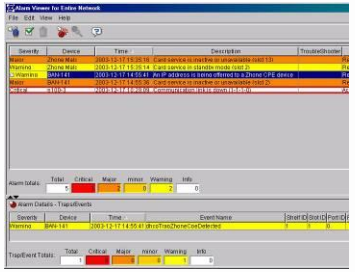


- **Centralized reporting of CPE/ONT Alarms**
  - ZMS polls newly-connected CPE/ONT devices to learn status of any existing Alarms
  - Alarm status may be refreshed for all selected devices on a selected MXK basis

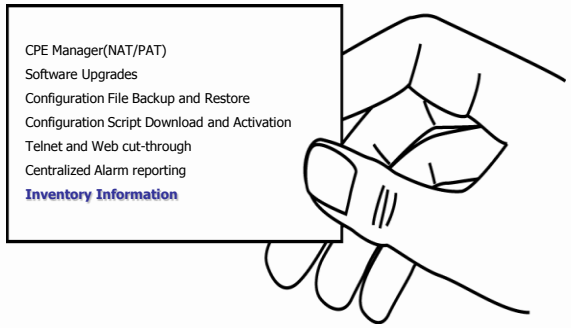




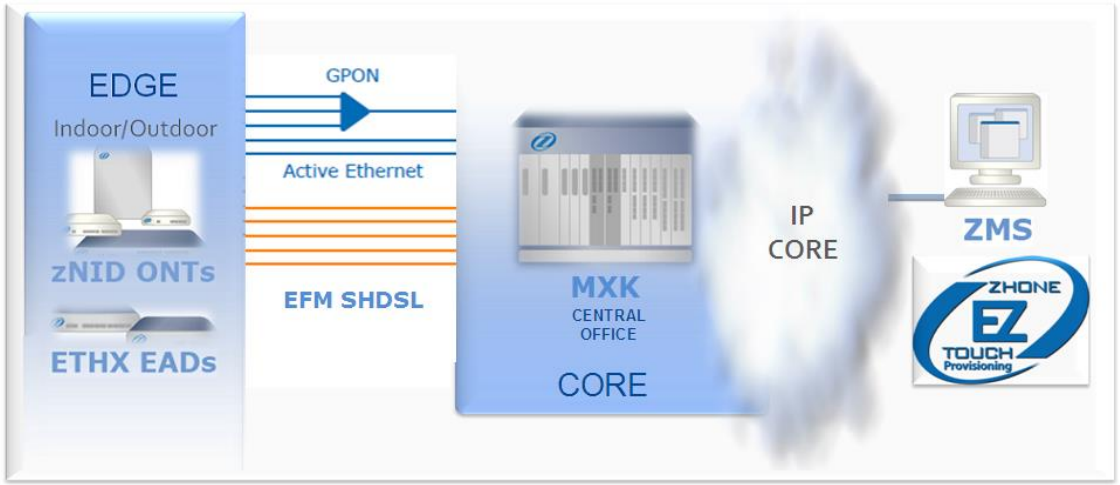


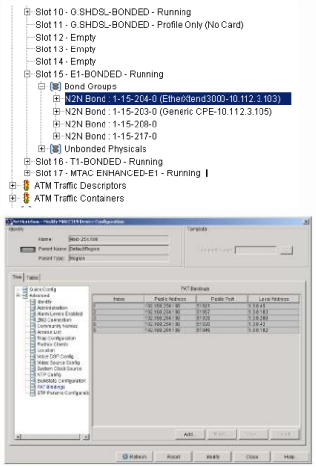
Bandwidth Changes Everything™

Features
ZHONE EZ TOUCH Provisioning



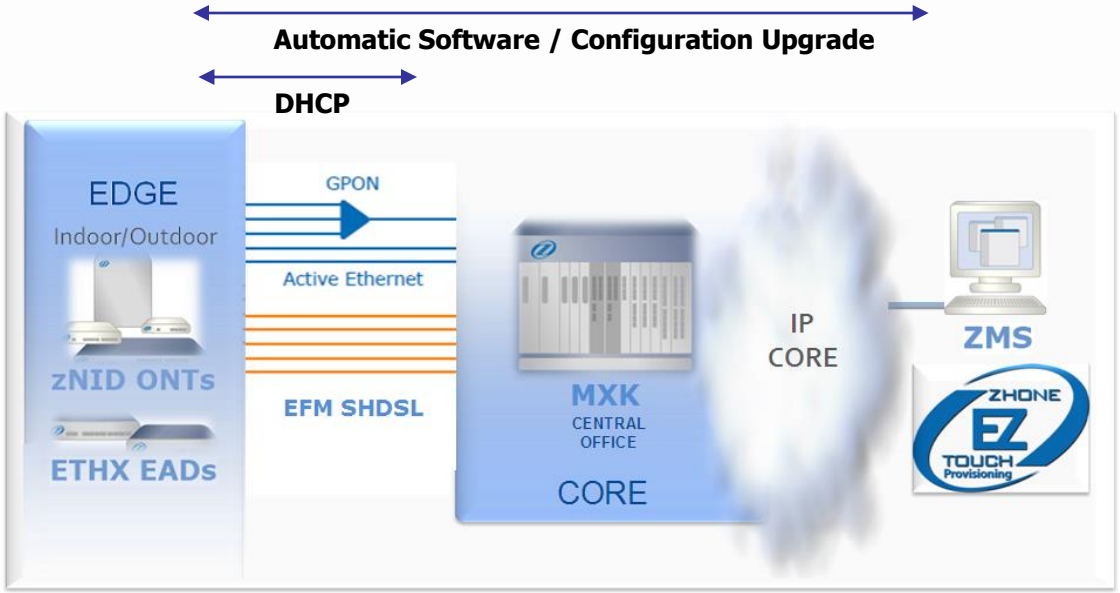
- **CPE/ONT Inventory**
  - ZMS compiles a list of all CPE/ONT devices attached to any selected MXK
  - Includes: Region, MXK Name, Slot Number, Interface Name, CPE Model #, Serial #, IP Address & UDP port





Features
ZHONE EZ TOUCH Provisioning

- **New ZHONE EZ TOUCH Provisioning features enhance CPE Configuration Management**
  - New features enable ZMS and MxK to automatically maintain CPE/ONT software version and boot time configuration on Zhone manufactured CPEs/ONTs
  - Requires CPE Manager to be configured initially on desired MxK interface(s) (SHDSL EFM bond groups, OLT port, Active Ethernet port, etc.)



AE or GPON ONT
192.168.1.1
Slot 7 – Ports 1, VLAN 7 DHCP

EtherExtend
192.168.1.2
Slot 1 – Ports 5-8, VLAN 7 DHCP

AE or GPON ONT
10.10.10.1
UDP Port 203

EtherExtend
10.10.10.1
UDP Port 202