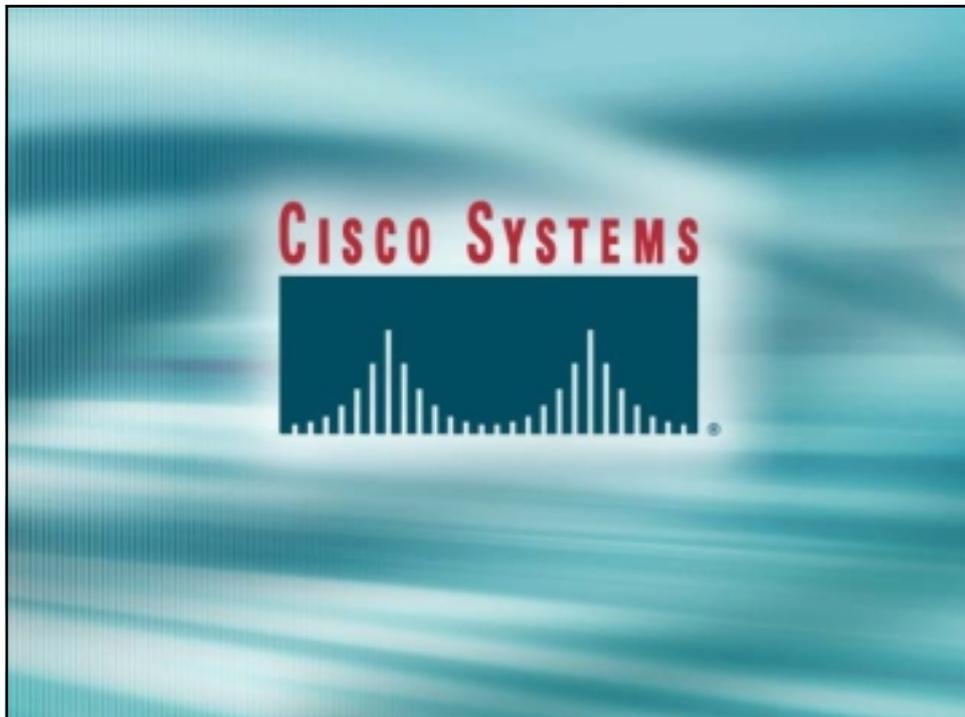




IP + Optical Big Bang Seminar
WI2001



Cisco Ethernet Over Copper Solution

Nov 5 , 2001

Song Young-Soo

Agenda

- **MxU Market Overview**
- **Long Reach Ethernet Overview**
- **LRE Technology and Competing Technology**
- **BBSM Solution**
- **CIMO Program**



MxU Market Overview

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End User Benefits of High-Speed Internet Access

MxU growth: \$371 million '00 - \$2 billion in '04

<div style="background-color: #cccccc; padding: 2px; font-weight: bold; text-align: center;">MDU</div> <ul style="list-style-type: none"> • High-Speed Internet <ul style="list-style-type: none"> - Web-surfing - Email • Telecommuting/SOHO • Emerging: <ul style="list-style-type: none"> - IP Telephony - Video, HDTV, and music streaming 	<div style="background-color: #cccccc; padding: 2px; font-weight: bold; text-align: center;">Hospitality</div> <ul style="list-style-type: none"> • Business Services <ul style="list-style-type: none"> - Secure Access to Corp. Network (VPNs) - Email, fast downloads • Conference services • Vacation guests <ul style="list-style-type: none"> - Video, HDTV, and music streaming 
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MTU

Security, Internet, E-mail, VPN, IP Telephony

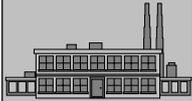
Source: Cahners In-stat Group

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Characteristics of Enterprise Campus Environments

Cisco.com

Demand for high-speed connectivity over long distances exists in various Enterprise campus environments

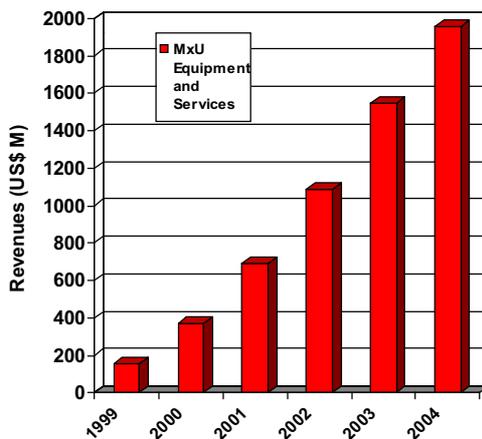
Manufacturing 	<ul style="list-style-type: none">• Long runs of wiring for large open spaces• Existing wiring expensive to replace• Demand for >10 Mbps for multimedia applications• Noise immunity
Education 	
Healthcare 	

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Property Owner Benefits of High-Speed Internet Access

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Property Owner Benefits:

- Incremental revenue
- Reduce operating costs
- Increased occupancy
- Branding / community development platform

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Challenges to Overcome

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- **More bandwidth over single pair: support new video on demand (VoD) applications**
 - Achieve Ethernet performance
- **Overcome Ethernet distance limitation**
- **Drive down per-line costs while driving up performance**
- **Retain key QoS, security, provisioning and management features**
- **Ensure service is easy to use and provides platform for future services**

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Long Reach Ethernet Overview

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Cisco MxU In-Building Product Strategy

Cisco.com

- Deliver Catalyst Switch Platform to Address all MxU Building Types (wiring environment, bandwidth)
- **Deliver performance, cost benefits of Ethernet to MxU market**
 - 5 Mbps to 15 Mbps to drive new service provider services
 - Video, gaming, voice
- **Aironet Wireless LAN Complements Solution**
- **Strong Network Management Focus: Installation, Building Diagnostics, In-room CPE Monitoring**
- **Building Broadband Service Manager Application**
 - Plug-and-Play end user access and self activation
 - Authentication/Billing/PMS Interface/Credit Card Authorization
 - Customized connect screen and Web portal
 - Dynamic Bandwidth Selection

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Long-Reach Ethernet (LRE) Features

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- **5, 10, 15 Mbps throughput symmetric modes**
 - Maps directly to full-duplex Ethernet
 - Next-generation applications: Video conferencing, IP entertainment
- **Traverse long distances**
 - Up to 5,000 feet over existing Category 1/2/3 wiring
- **Co-exists with POTS and digital phones on the same wire**
 - Requires POTS Splitter
- **Co-exists with ISDN/ADSL in the same bundle**
- **Based on robust Catalyst switching platform**

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Solution Components

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Catalyst 2900 LRE XL Switches



10/100/1000 L2 or L3 Catalyst switch:
Stack aggregator



Cisco LRE 48 POTS Splitter



Cisco Router: 17XX/26XX: VoIP, VPNs



Cisco 575 LRE CPE Device



Cisco Building Broadband Service Manager
(Radius Authentication, NAT, DHCP, DNS,
User Self-Activation, Dynamic Bandwidth
Selection), Third-party Account/Billing

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Catalyst 2900 Series LRE XL

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- Based on industry-leading Catalyst 2900 XL platform
- IOS Based
- 802.1Q VLANs
- 802.1p CoS
- Management
 - CLI
 - Switch Clustering
 - Cluster Management Suite
 - Embedded Web Tool
- Security
 - Private VLAN Edge (unicasts to uplink port only)
 - Multicast control
 - TACACS+ (authentication)
- 24/12 LRE Ports (RJ-21)
- 4 10/100 Ethernet Ports (RJ-45)
 - For stacking or connection to router or server
- 1 Rack Unit High
- 1 SKU: 24/12 LRE + 4 10/100

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LRE Stack

Cisco.com



- L2 aggregator for lowest cost or upgrade with L3 aggregator for increased security and QoS

- Cisco Switch Clustering technology manages stackable and standalone units like chassis

Manage all units from single IP address, even geographically dispersed switches

Remote monitoring of CPE through switch management

Provides stack view and topology map of Catalyst 3500 XL, 2900 XL, 2900 LRE XL, 1900 switches

Upgrade all switches at once from any PC browser

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Cisco 575 LRE CPE Device

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- Converts LRE to standard 10/100 Ethernet
- Integrated POTS Splitter for telephone attachment
- 2 RJ-11 connectors for Line input and telephone
- 1 RJ-45 connector for 10/100 Ethernet
- Managed remotely from switch using Cisco Web interface

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POTS Splitter

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Cisco LRE 48 POTS Splitter

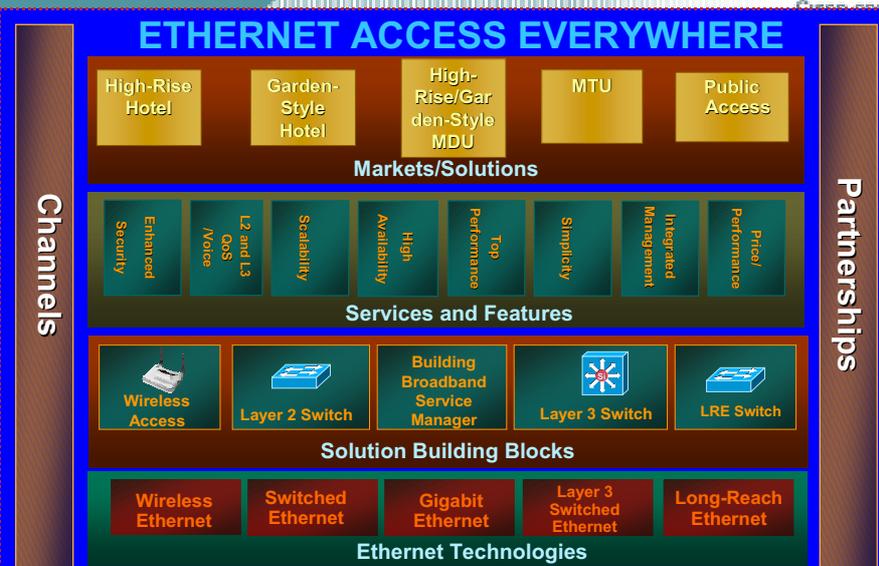
- Enables coexistence of LRE and POTS on the same wiring
- 48 ports in a 1RU form factor
- Passive device
- Six RJ-21 connectors: Two each for connectivity to patch panel, the LRE switch(es), and the on-site PBX system

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MxU “Ethernet Access Everywhere” Framework

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Cisco MxU Solutions

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- Form close partnerships with customers to develop effective solutions
- Form MxU solution ecosystems with content and technology vendors
- Establish solutions testing labs to test interoperability of Cisco and partner MxU solutions (IP Video Services, VoIP, Wireless LAN, Caching, VPN)



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LRE Technology Basics

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LRE Technology — Modulation

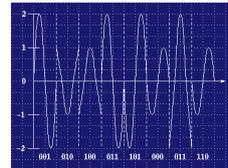
Cisco.com

- **Uses quadrature amplitude modulation (QAM)**

Modulation using two carriers out of phase by 90° and modulated by separate signals

Uses both signal amplitude and phase to define each symbol

Uses various QAM modulations (QAM-256, QAM-128, QAM-64, QAM-32, QAM-16, QAM-8, QAM-4) based on line specification and the rate definition



- **LRE supports multi-QAM in order to achieve performance as close to the physical limit as possible while maintaining low cost and power**

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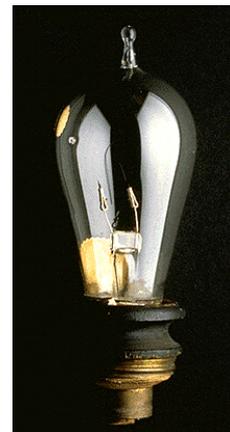
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LRE Technology — Frequency Domain

Cisco.com

- **Transports data over telephone wires originally intended for 300 Hz - 3.4 kHz**
- **Uses frequency division duplexing (FDD)**

Enables service providers to overlay LRE on existing POTS, ISDN or PBX signaling services



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LRE Technology — Errors and Interference

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