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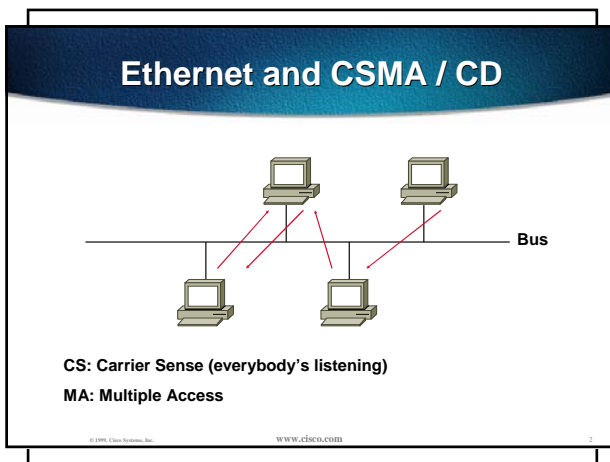
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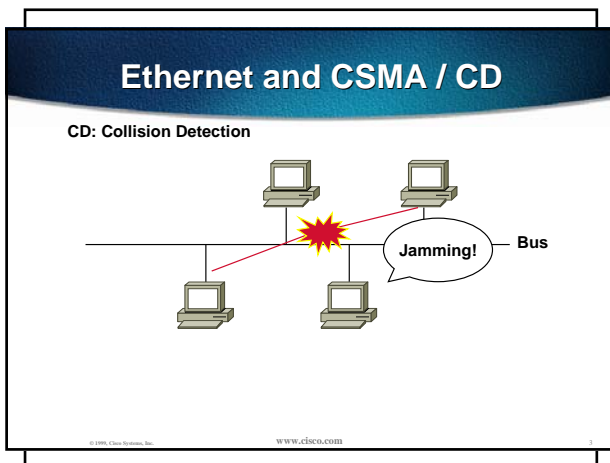
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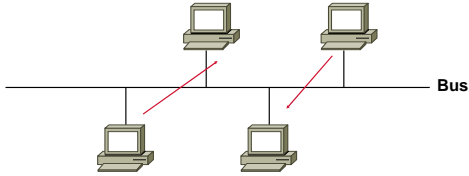
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## Ethernet and CSMA / CD



After a Collision both Devices wait and retransmit,  
they calculate their waiting time with the unique MAC-Address

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## Ethernet Constraints

- Limited users within segment
- No security

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Switch  
vs.  
Hub

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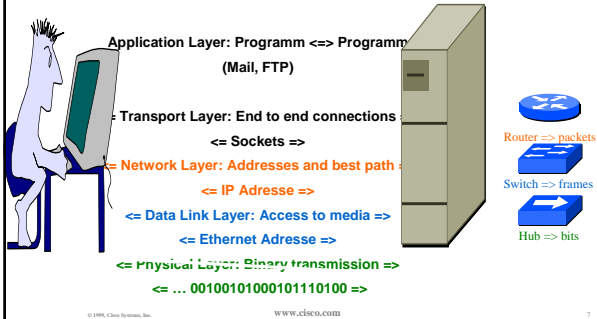
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# HomeRun Training

## The Internetworking Model



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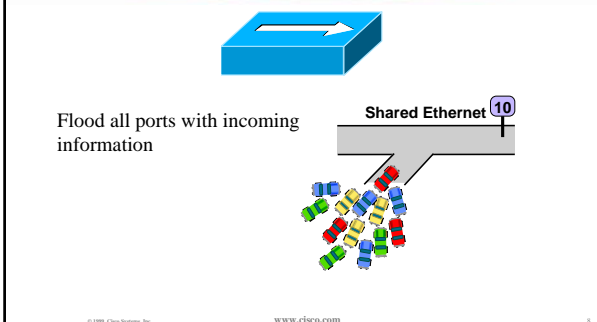
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## Hubs (Shared Ethernet)



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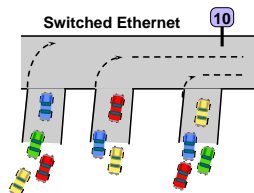
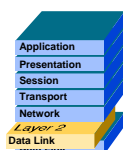
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## LAN Switches

- Enables dedicated access
- Eliminates collisions and increases capacity
- Supports multiple conversations at a time



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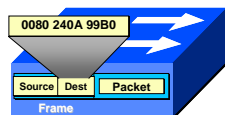
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## Layer 2 Switching



Switching

MAC Address	Output Interface
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.	
.	
0080 240A 99B0	Ethernet 12

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## Switching II

Reto Burger  
[reto.burger@burger-inf.ch](mailto:reto.burger@burger-inf.ch)



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## Early Warning Signs

- Very slow file transfers
- Print server timeouts
- High hub utilization rates
- High collision rates
- Thinking about using multimedia



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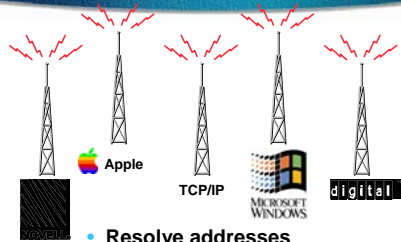
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# HomeRun Training

## Broadcasts Consume Bandwidth



- Resolve addresses
- Distribute route information
- Find network services

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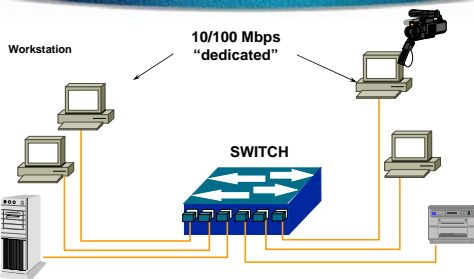
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## Switching (Dedicated Media)



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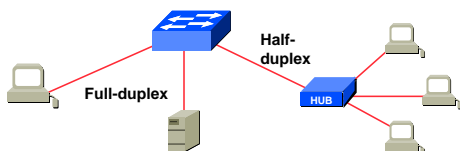
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## Using Full-Duplex



- Node must
  - Be directly attached to a dedicated switched port
  - Have installed adapter that supports full-duplex

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# HomeRun Training

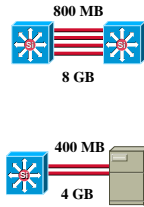
## Fast/Giga EtherChannel

- Switch to Switch
- Switch to Server
- Switch to Router

- **Solution:**

Scalable bandwidth up to  
800 MB—FDX or 8 GB—FDX

True load balancing across links



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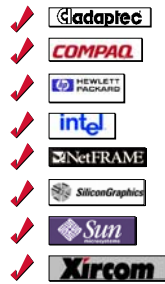
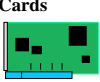
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## Fast EtherChannel Partners

Enterprise  
Servers



Network  
Interface  
Cards



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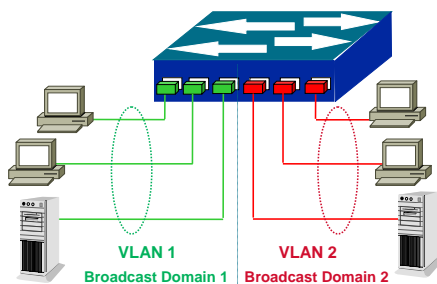
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## VLAN Overview



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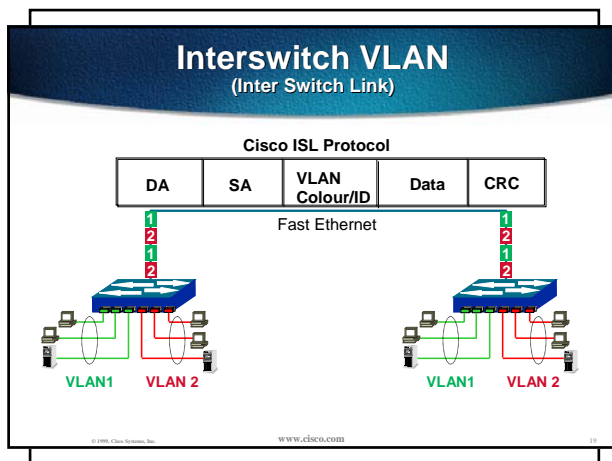
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# HomeRun Training




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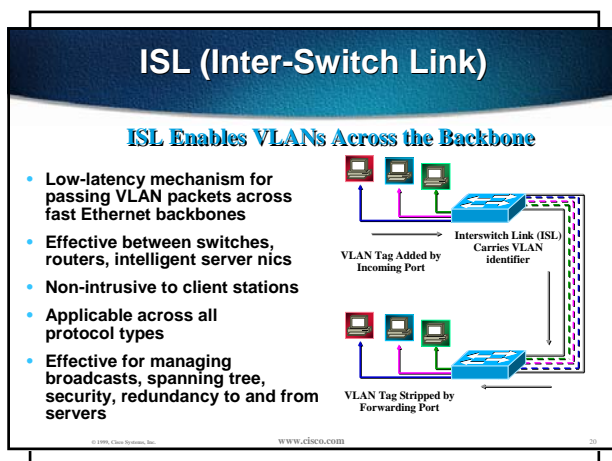
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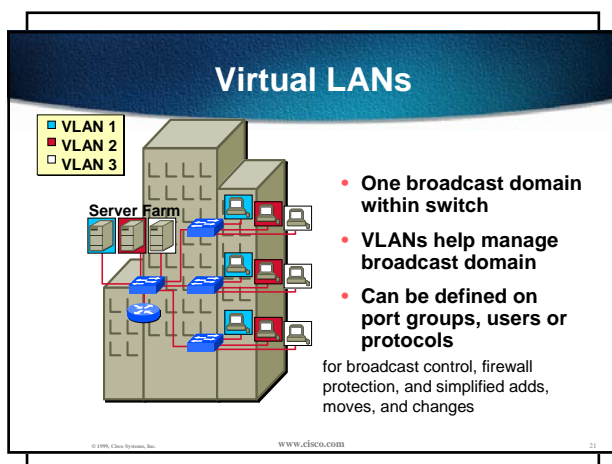
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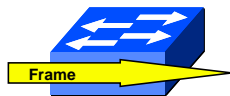
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# HomeRun Training

## Switching Methods

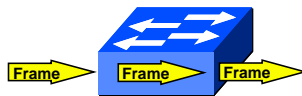
### Cut-through

- Switch checks DA and immediately begins forwarding frame



### Store-and-forward

- Complete frame is received before forwarding



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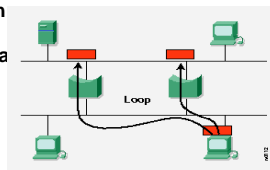
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## Spanning Tree Protocol

The Spanning Tree Protocol stops Loops (caused through several possible paths). this is reached by obstruction of a Ports. Nevertheless, the option sticks on an alternative-path (Failover) with cancellation of a network-component.



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## SPAN Port

- A single port can be configured to monitor one, all, or any group of other switch ports
- Monitors traffic seen on the switch bus only
- Useful for an RMON probe or sniffer
- Uses configured switching mode

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# HomeRun Training

## Switching Summary



- Collision-free Ethernet
- Simple uplinks to high-speed backbones
- Quick network response
- Increased user productivity
- Allows implementation of VLAN

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**And now:  
5 Minuten Pause**

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## Home Run Lab

Using Visual Switch Manager



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# HomeRun Training

# Cisco Visual Switch Manager

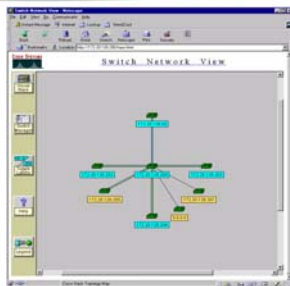
- **Device management through Web-based Interface**



28

## Switch Network View

- **Enables full topology view of the network**



29

## Cisco Visual Stack

- Provides stack view of Catalyst 2900 XL switches



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# HomeRun Training

## Cisco Visual Switch Manager (CVSM) 2.0 Enhancements

- Single IP-address based management
- Web-based anytime anywhere access
- Device level monitoring
- Cluster Management
- Built-in HTTP server



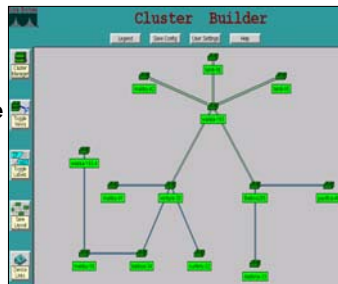
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## Cluster Builder View

- Displays network topology of Cluster
- Cluster members added through simple point and click
- All Cluster switches have same 'enable' password



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## Cluster Manager

- Detailed front-panel view of Switch Cluster
- Allows selection and configuration of switch ports
- Member switches can have their own IP address



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# HomeRun Training

## Cluster Software Upgrade

- Convenient software upgrade to multiple switches at a time
- Only similar switches can be upgraded as a group

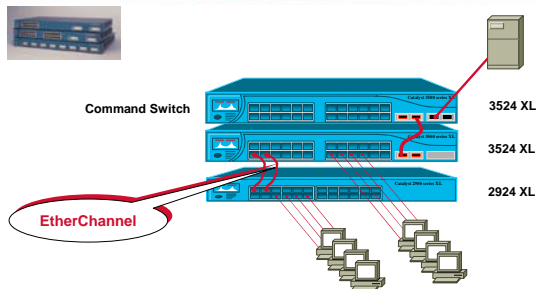


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## LAB Switch Cluster

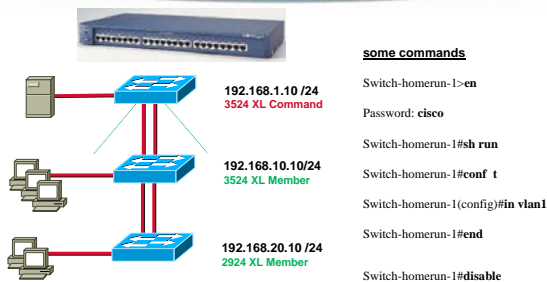


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## LAB Addressing Schema

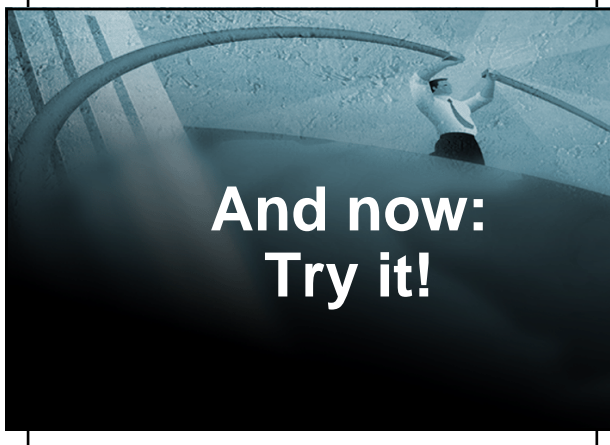


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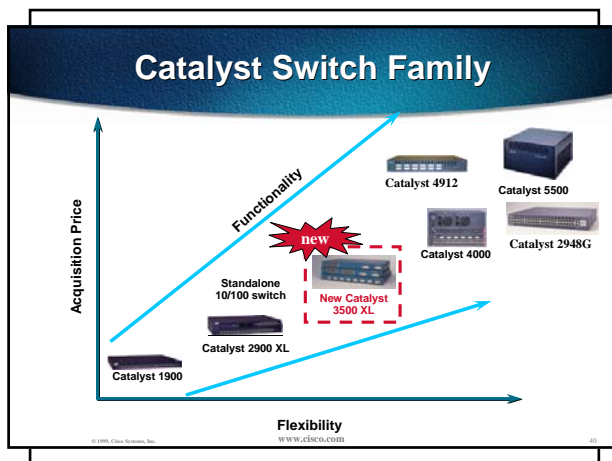
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# HomeRun Training




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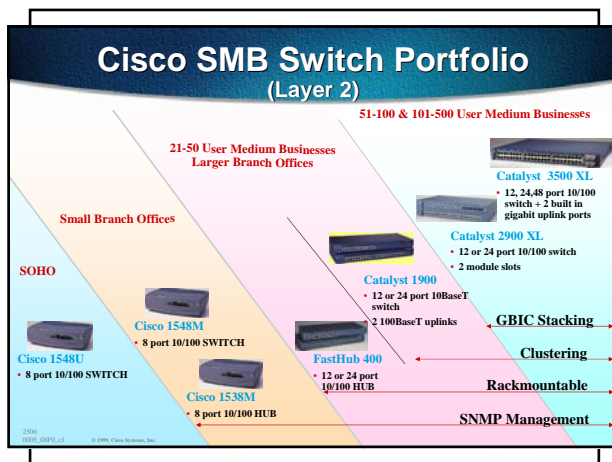
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## Catalyst 1900 Series

- 12 or 24 switched 10BaseT ports + one switched AUI
- 1024 MAC addresses
- Two, fixed 100BaseT ports on all models
  - Two 100BaseTX ports or;
  - One 100BaseTX port and one 100BaseFX port
- Smaller nine inch-deep footprint
- SPAN port (Switched Port Analyzer)
- Optional redundant power supply

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# HomeRun Training

## Catalyst 2900 Series XL Fast Ethernet Switches



Standard and Enterprise Editions

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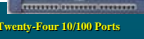
## Catalyst 2900 XL Series



**Catalyst 2912 XL**  
Twelve 10/100 Ports  
Cisco Switch Clustering (SA6)  
One RU. Ideal for SMB LAN  
Standard and Enterprise Editions  
Low-Port Density



**Catalyst 2924 XL**  
Twenty-Four 10/100 Ports  
Two fiber uplinks Ports  
Cisco Switch Clustering (SA6)  
One RU. Ideal for desktop and server connectivity  
Standard and Enterprise Editions  
High-Port Density



**Catalyst 2924M XL**  
Twenty-Four 10/100 Ports  
Two versatile module slots  
Cisco Switch Clustering (SA6)  
Ideal for LAN aggregation, desktop and server connectivity  
Standard and Enterprise Editions  
Versatile Modularity

Unit Price

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## Catalyst 2912 XL

- Ideal for small-medium sized networks as LAN aggregator
- 12 10BaseT/100BaseTX ports
- ISL/802.1Q VLAN trunking on all ports
- 2,048 MAC addresses
- Available in Standard or Enterprise Editions



12 10BaseT/100BaseTX Ports

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## Catalyst 2924 XL

- Ideal for desktop connectivity
- 24 10BaseT/100BaseTX ports
- ISL/802.1Q VLAN trunking on all ports
- 2,048 MAC addresses
- Available in Standard or Enterprise Editions



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## Catalyst 2924C XL

- Ideal for desktop connectivity with low cost fiber uplinks
- 22 10BaseT/100BaseTX ports
- 2 100BaseFX ports
- ISL/802.1Q VLAN trunking on all ports
- 2,048 MAC addresses
- Available in Standard or Enterprise Editions



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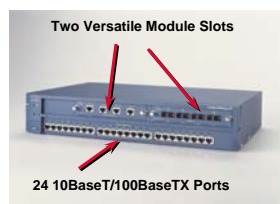
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## Catalyst 2924M XL

- Ideal for desktop connectivity or workgroup aggregation
- 24 10BaseT/100BaseTX ports
- Two slots to accommodate available modules
- ISL/802.1Q VLAN trunking on all ports
- 8,192 MAC addresses
- Available in Standard or Enterprise Editions



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# HomeRun Training

## Versatile Modularity

- Two versatile module slots (2924M XL and 2912MF XL)
- Optional ISL/802.1Q expansion modules:
  - 4-port 10BaseT/100BaseTX switch module
  - 2-port 100BaseFX switch module
  - 4-port 100BaseFX switch module
- Gigabit Ethernet and ATM interface modules

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## Catalyst 2900M XL Modules

- ISL/802.1Q VLAN modules
  - 4-port 10/100 TX module
  - 2-port 100BaseFX module
  - 4-port 100BaseFX module
  - ISL/802.1Q support
- Gigabit Ethernet module
  - Single-port 1000BaseX module with GBIC-based media slot
  - ISL/802.1Q support
  - FCS: Q1CY99
- ATM modules
  - Single-port OC-3 ATM modules, including:
    - UTP
    - Multi-mode fiber
    - Single-mode fiber, medium reach (10Km)
    - Single-mode fiber long reach (40Km)
  - FCS: Q2CY99



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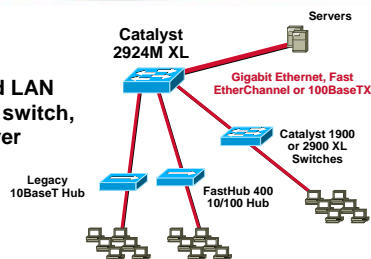
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## Backbone for Small to Medium-Sized LAN

- Small and medium-sized LAN backbone for switch, hub, and server aggregation



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# HomeRun Training



The New Catalyst 3500 Series XL Product Line

new

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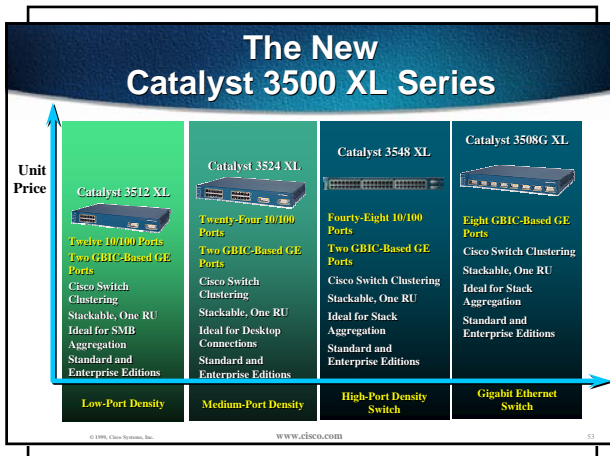
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The New Catalyst 3500 XL Series

Unit Price	Catalyst 3512 XL	Catalyst 3524 XL	Catalyst 3548 XL	Catalyst 3508G XL
	<p>Twelve 10/100 Ports</p> <p>Two GBIC-Based GE Ports</p> <p>Cisco Switch Clustering</p> <p>Stackable, One RU</p> <p>Ideal for SMB Aggregation</p> <p>Standard and Enterprise Editions</p>	<p>Twenty-Four 10/100 Ports</p> <p>Two GBIC-Based GE Ports</p> <p>Cisco Switch Clustering</p> <p>Stackable, One RU</p> <p>Ideal for Desktop Connections</p> <p>Standard and Enterprise Editions</p>	<p>Forty-Eight 10/100 Ports</p> <p>Two GBIC-Based GE Ports</p> <p>Cisco Switch Clustering</p> <p>Stackable, One RU</p> <p>Ideal for Stack Aggregation</p> <p>Standard and Enterprise Editions</p>	<p>Eight GBIC-Based GE Ports</p> <p>Cisco Switch Clustering</p> <p>Stackable, One RU</p> <p>Ideal for Stack Aggregation</p> <p>Standard and Enterprise Editions</p>
	Low-Port Density	Medium-Port Density	High-Port Density Switch	Gigabit Ethernet Switch

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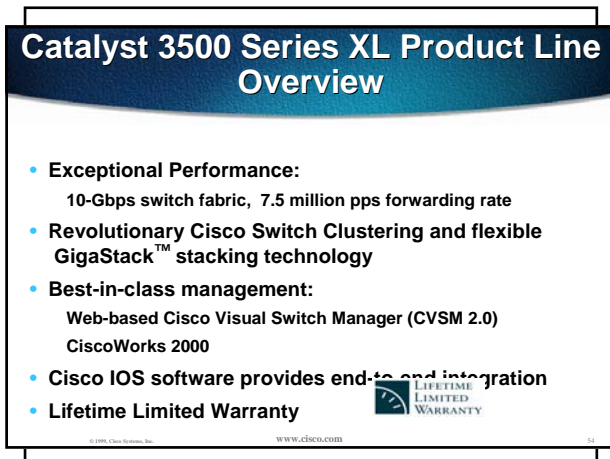
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Catalyst 3500 Series XL Product Line Overview

- **Exceptional Performance:**
  - 10-Gbps switch fabric, 7.5 million pps forwarding rate
- **Revolutionary Cisco Switch Clustering and flexible GigaStack™ stacking technology**
- **Best-in-class management:**
  - Web-based Cisco Visual Switch Manager (CVSM 2.0)
  - CiscoWorks 2000
- **Cisco IOS software provides end-to-end integration**
- **Lifetime Limited Warranty**

www.cisco.com

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## Standard Edition and Enterprise Edition Features

### Standard Edition

- CVSM 2.0
- Network Time Protocol (NTP)
- Port-Based VLANs
- CGMP Fast Leave
- Network Port
- Fast EtherChannel and Gigabit EtherChannel

### Enterprise Edition

#### All Standard Edition Features plus:

- ISL and 802.1Q VLAN Tagging Support
- VLAN Trunking Protocol (VTP)
- Uplink Fast
- TACACS+
- 802.1p software (future)

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## Catalyst 3512 XL

- Ideal for desktop connectivity or SMB aggregation
- 12 10BaseT/100BaseTX ports
- Two GBIC-based Gigabit Ethernet/stacking ports
- Nonblocking, wire-speed performance
- ISL/802.1Q VLAN trunking on all ports
- Built-in Cisco Switch Clustering
- 8192 MAC addresses
- Available in Standard or Enterprise Editions

Two GBIC-Based Gigabit Ethernet Ports



12 10BaseT/100BaseTX Ports

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## Catalyst 3524 XL

- Ideal for desktop connectivity or workgroup aggregation
- 24 10BaseT/100BaseTX ports
- Two GBIC-based Gigabit Ethernet/stacking ports
- Nonblocking, wire-speed performance
- ISL/802.1Q VLAN trunking on all ports
- Built-in Cisco Switch Clustering
- 8192 MAC addresses
- Available in Standard or Enterprise Editions

Two GBIC-Based Gigabit Ethernet Ports



24 10BaseT/100BaseTX Ports

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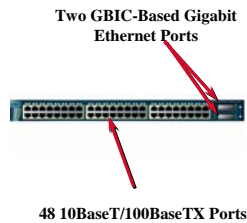
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# HomeRun Training

## Catalyst 3548 XL

- Ideal for desktop connectivity or as SMB Core Switch
- 48 10BaseT/100BaseTX ports
- Two GBIC-based Gigabit Ethernet/stacking ports
- Nonblocking, wire-speed performance
- ISL/802.1Q VLAN trunking on all ports
- Built-in Cisco Switch Clustering
- 8192 MAC addresses
- Available in Standard or Enterprise Editions



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## Catalyst 3548 XL <sup>new</sup>

The Ideal Stackable 10/100 Switch with 48 ports and Integrated Gigabit Ethernet

- Top price/performance
- Superior manageability and scalability
- High density in compact design
- QoS/VoIP support
- Gigabit uplink and stacking options



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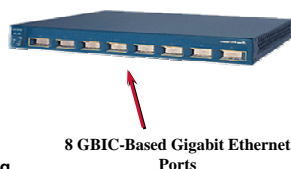
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## Catalyst 3508G XL

- Ideal for high-performance stack matrix aggregation
- Eight GBIC-based Gigabit Ethernet/stacking ports
- Deliver 5-Gbps forwarding rate to a cluster of switches
- ISL/802.1Q VLAN trunking on all ports
- Built-in Cisco Switch Clustering
- 8192 MAC addresses
- Available in Standard or Enterprise Editions



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### Performance Benchmark Test

(Mier Communication Inc., May 1999)

Full Stack (8 Cisco/Nortel, 4 3com) Throughput Test : No Local / 100% Interswitch Traffic

Packet Size	Cat 3524XL	Nortel BayStack 450-24T	3Com SuperStack II 3300
64	1.58 Gbps	0.43 Gbps	1.08 Gbps
512	1.80 Gbps	1.43 Gbps	1.64 Gbps
1518	2.31 Gbps	1.34 Gbps	1.70 Gbps

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### Catalyst 3500 Series XL Pricing

Product Number Base Models	Product Description	List Price SFr.
WS-C3512-XL-EN	Catalyst 3512 XL Enterprise Edition	4600.00
WS-C3524-XL-EN	Catalyst 3524 XL Enterprise Edition	5520.00
WS-C3548-XL-EN	Catalyst 3548 XL Enterprise Edition	9210.00
WS-C3508G-XL-EN	Catalyst 3508G XL Enterprise Edition	9210.00
WS-X3500-XL	GigaStack GBIC with 50cm stacking cable	461.00

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### GigaStack™ GBIC

Versatile, Low-Cost Stacking Solution



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## Cost-Effective Gigabit Uplinks

- Cost-effective dual integrated GBIC ports
- Deployment flexibility  
SX, LX/LH, ZX, GigaStack
- 5.4 Gbps forwarding rate
- Gigabit EtherChannel
- Higher availability via uplink fast
- High-speed stack aggregation  
Catalyst 3508G XL



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## GigaStack Stacking GBIC

- Gigabit Ethernet stacking technology
- Plugs into a standard 3500 XL or 2900 XL GBIC slot
- Copper-based cabling technology  
(1 meter maximum length)



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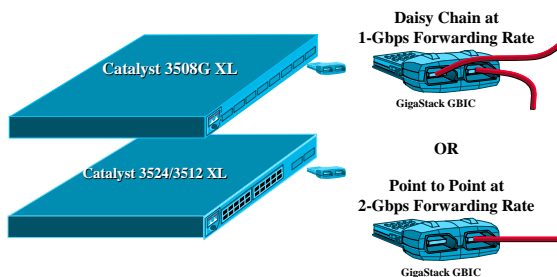
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## GigaStack GBIC Connection Options



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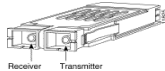
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## Gigabit Interface Converter (GBIC)

**SX**  
The WS-G5484, 1000BaseSX operates on ordinary **multi-mode** fiber optic link spans of up to **550 m** in length

**LX/LH**  
The WS-G5486, 1000BaseLX/LH interfaces fully comply with the IEEE 802.3z 1000BaseLX standard. However, their higher optical quality allows them to reach **10 km** over **single-mode fiber (SMF)** versus the 5 km specified in the standard

**ZX**  
The WS-G5487, 1000BaseZX operates on ordinary **single mode** fiber optic link spans of up to **70 km** in length. Link spans of up to 100 km are possible using premium single mode fiber or dispersion shifted single mode fiber (premium single mode fiber has a lower attenuation per unit length than ordinary single mode fiber; dispersion shifted single mode fiber has both lower attenuation per unit length, and less dispersion)



Supported end of 1999

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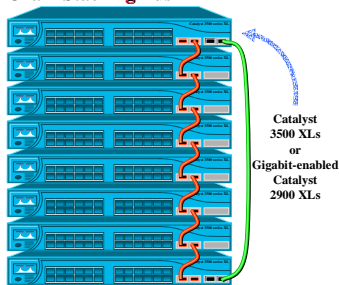
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## GigaStack Application 1: Independent Stacking Bus

### Single Daisy-Chain Stacking Bus

- Up to nine switches can be daisy-chained through GigaStack GBICs
- Delivers 1-Gbps independent stack bus to the entire stack
- Supports redundant loop back for added fault tolerance



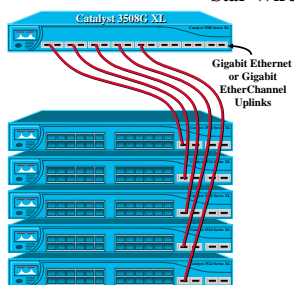
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## Application 2: Stack with Catalyst 3508G XL

### Star-Wired Stack



- High-performance aggregation through Catalyst 3508G XL
- Delivers 5-Gbps forwarding rate to the stack
- 2-Gbps full-duplex on each point-to-point connection

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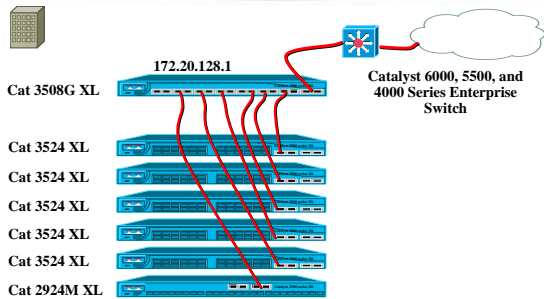
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## Cluster Application: Medium Business/Large Branch



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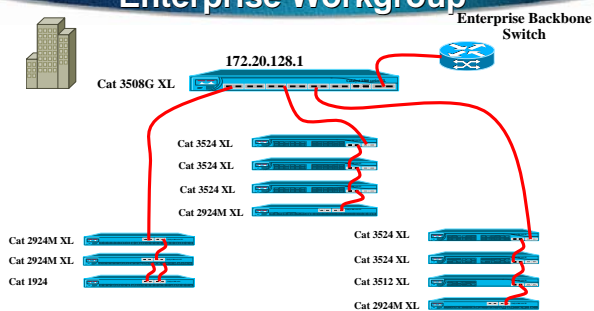
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## Cluster Application: Enterprise Workgroup



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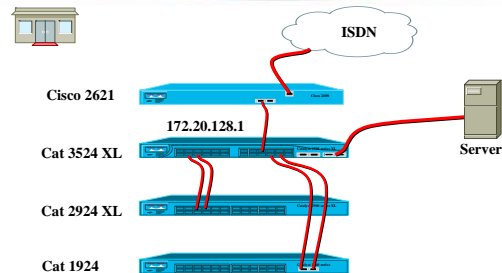
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## Cluster Application: Small/Medium Office



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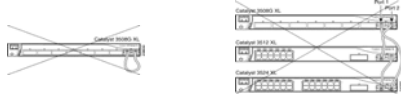
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# HomeRun Training

## Design Guideline for GigaStack GBIC



- **Incorrect GigaStack GBIC configurations**
  - Switch performance degrades
  - Stacking Bus becomes unusable
- **Incompatible GigaStack GBIC cables**
  - Do NOT use 1394 (Firewire) cables

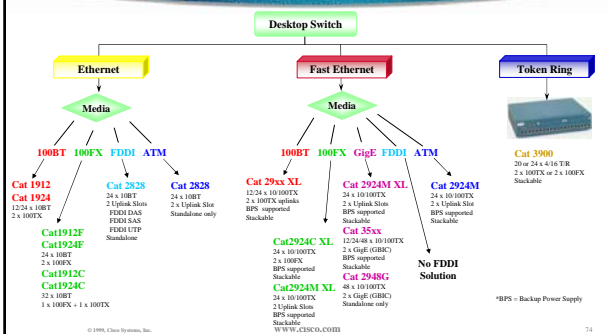
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## Cisco Switch Walkthrough

(Stackable and Standalone)

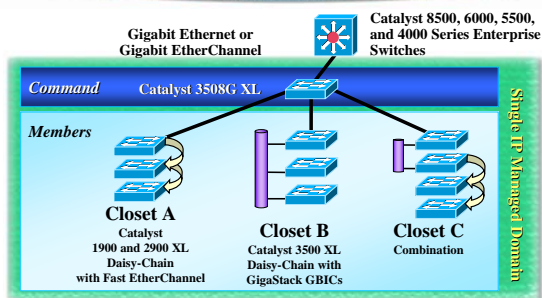


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## Switch Clustering



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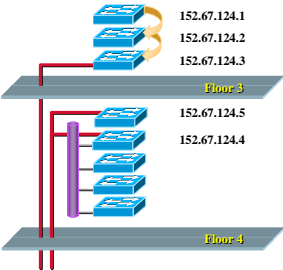
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## Management with First-Generation Stacking

- Initial installation and configuration of each stack/device
- No integrated management interface
- Separate troubleshooting for each device
- Wasted IP addresses
- Separate firmware upgrade for each stack/device



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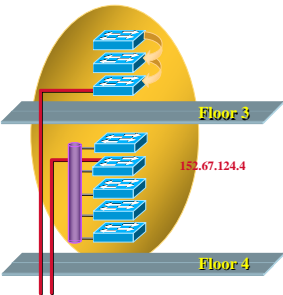
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## Management with Switch Clustering

- Initial installation and configuration of the entire cluster
- Embedded cluster-wide Web management interface
- Troubleshooting across entire cluster from a single Web page
- Conserving IP addresses
- Rapid firmware upgrade across the cluster



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## Clustering Resolves Traditional Stacking Weaknesses

First-Generation Stacking	Cisco Switch Clustering
Physical Integration	Logical Integration
Limited to Single Wiring Rack	Location Anywhere on a LAN
Proprietary Interconnect	"Open" Interconnects
Limited Management Interface	Embedded Integrated Management Interface
4-8 Single IP Domain Size	Up to 16 Single IP Domain Size
Limited Stack Citizens	Broad Range of Cluster Members
No Investment Protection	Investment Protection and Future-Proofing
Fixed Price/Performance Point	Range of Price/Performance Options

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# HomeRun Training

## Solutions

- SOHO
- Small Branch Office
- Medium Business

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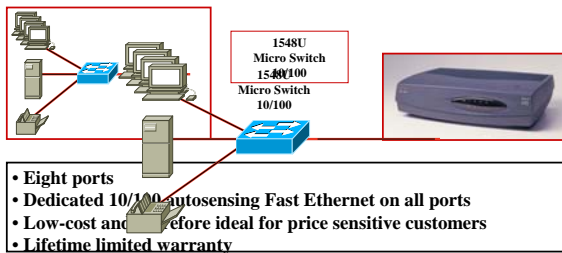
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## Simple LAN Infrastructure



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## Simple LAN Infrastructure

- Target customers:
  - Small office/home office (0-20)
  - Little or no growth in user community expected
  - Ease of installation & maintenance a requirement**
- Provides your customer with:
  - “Cheap and Cheerful” basic LAN connectivity

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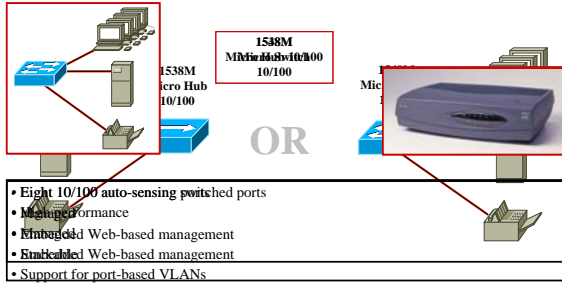
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## Small Branch Office LAN



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## Small Branch Office LAN

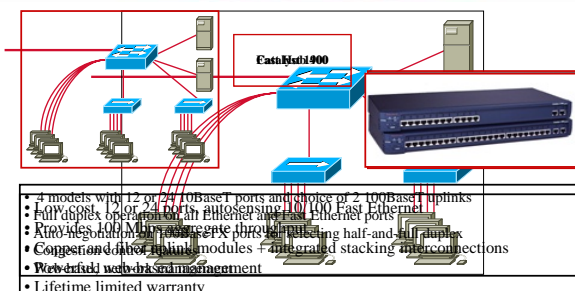
- **Target customers:**
  - Branch office (0-20 users)
  - Management from central site a requirement
  - Little or no growth in user community expected
- **Provides your customer with:**
  - High performance LAN at an ultra low cost

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## Medium Sized LAN (21-50 User)



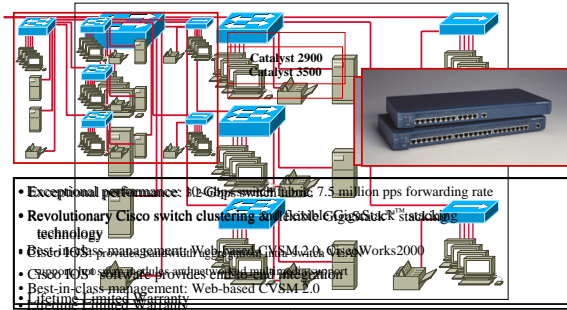
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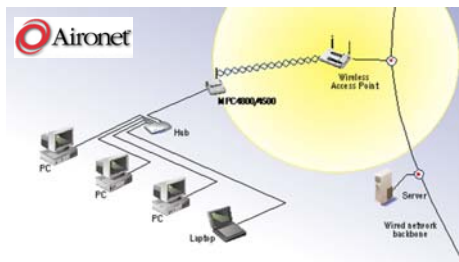
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## Medium Sized LAN (51-100 User)



## On the Horizon....

### • Wireless LAN Products



## Wireless LAN Products

### • Cisco Acquires Aironet Wireless Comms

1st Product under Cisco brand - 4800

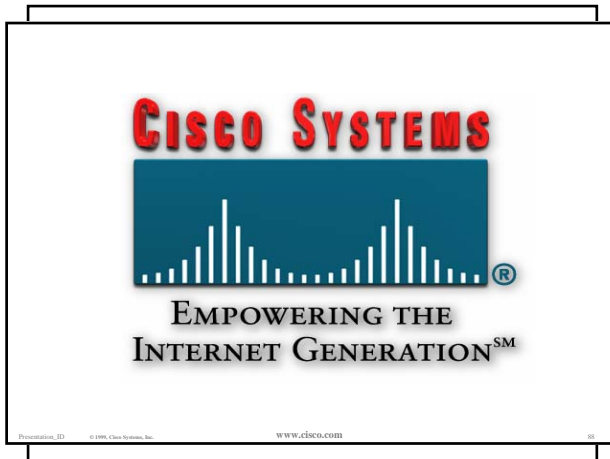
Launch scheduled for early May

### • For more information go to :

[www.aironet.com](http://www.aironet.com)



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