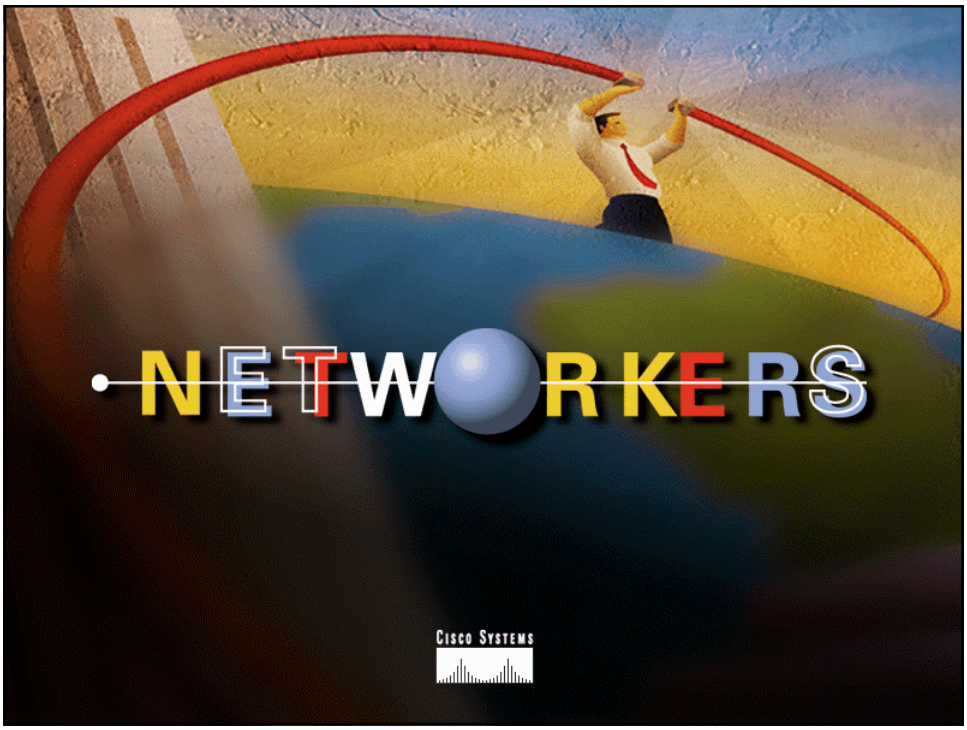

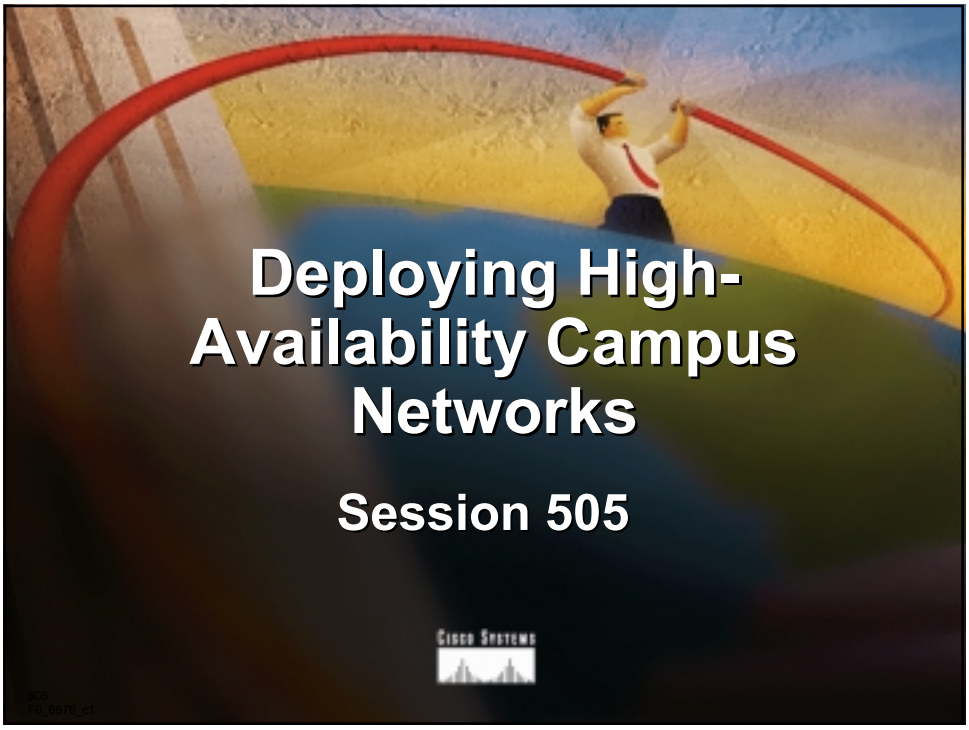

Agenda

- Introductions/Goals
- HA—Lifecycle (Case Study)
- Summary
- Q&A

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Introductions/Goals

- Who are we?
- What are you faced with?
- Why and what of HA?
- What are we going to do?
- What are you going to do?

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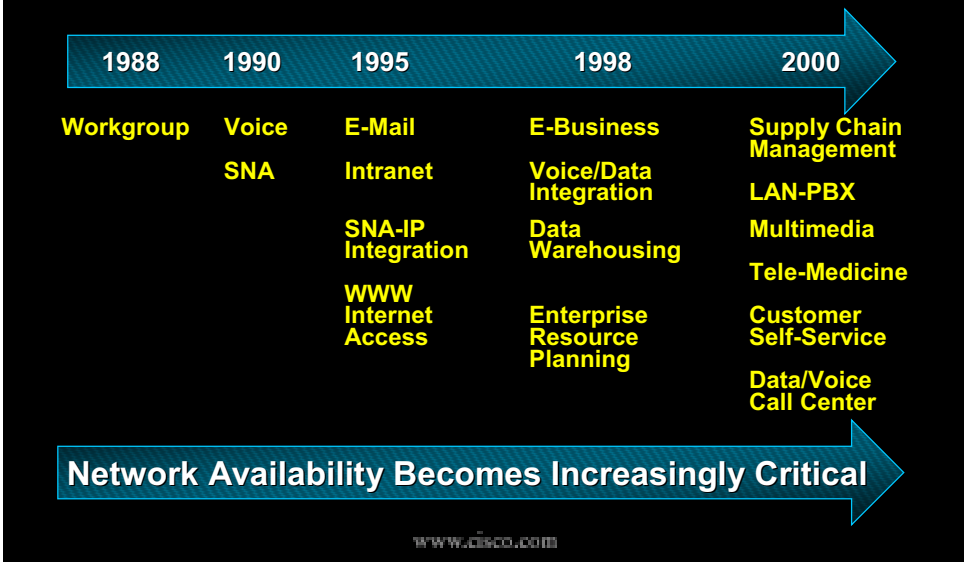
What You Are Faced With!



Where You Are Going to Be?

Where Do You Want to Go?

Availability	Downtime Per Year (24x7x365)
99.000%	3 days, 15 hours, 36 Minutes
99.500%	1 day, 19 hours, 48 Minutes
99.900%	8 hours, 46 Minutes
99.950%	4 hours, 23 Minutes
99.990%	53 Minutes
99.999%	5 Minutes
100%	The Holy Grail !!

Planned vs. Unplanned Downtime

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Measuring High Availability

- Available user minutes less impacted user minutes
- Link status up percentage
- Successful ping response percentage

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What Is an HA Network—1?

	Availability Requireme	Unplanned Downtime	Redundancy	H/W MTTR Replacement	Service Mgmt
Reliable Network	99.9%	8 Hours 46 Minutes	No	Up to 24 Hours	No
HA Network	99.99%	53 Minutes	Yes	Up to 4 Hours	Yes
Non-Stop Network	99.9999%	32.6 Sec	Yes	2 Hours	Yes

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What Is an HA Network—2?

	Staffing	Change	Host Connectivity	Process and Procedures	Diversity	Cost
Reliable Network	After-Hours Pager	Normal Change Mgmt	Standard NIC	Some	No	$
HA Network	24X7 NOC and Escalation	Change Testing and Validation	HA Servers	Required	Some	$$
Non-Stop Network	24X7 Expertise Onsite	Parallel Solution	Fault-Tolerant Servers	Required	Required	$$$$$

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What Are We Going to Do?

- Take you on a journey—hang on for the ride!
- What it takes to achieve high availability?
- Expose you to Cisco recommended best-practices!
- Review the do's and don'ts of Cisco HA features!

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What Are You Going to Do?

- Do your homework!
- Target your availability!
- Think about how you will measure availability!
- Hopefully incorporate some of our suggestions
- Give us feedback

  (has-feedback@cisco.com)

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What We Think High Availability Is

Network High Availability Is a Combination of:

Best of Breed Technology
People and Expertise
Process
Partnerships

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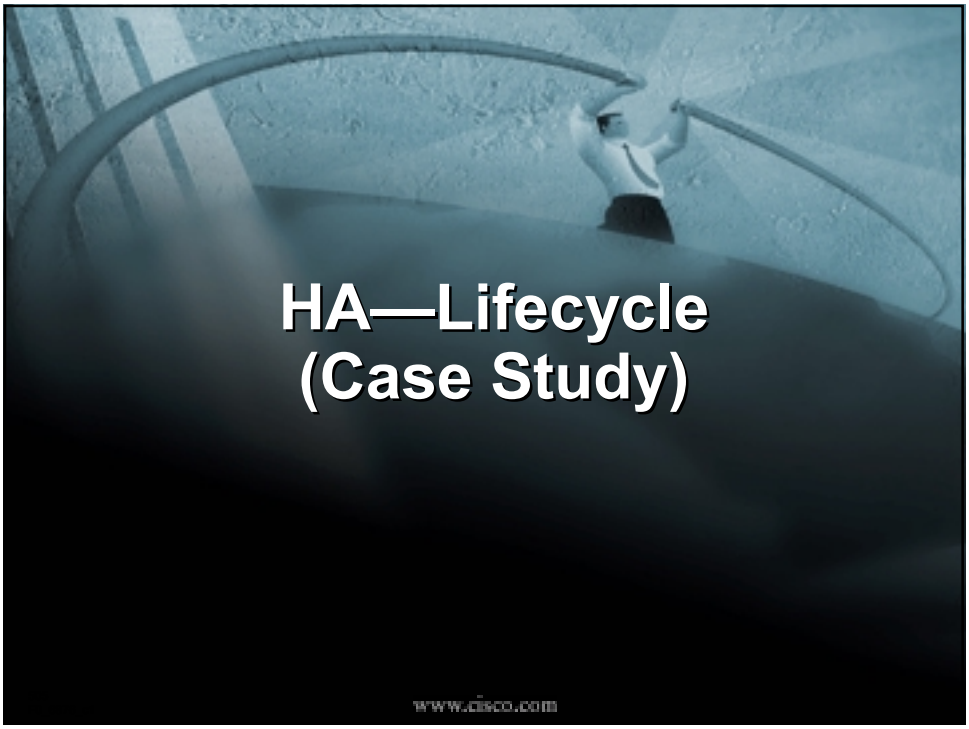

HA Myth

If the network works

… don't fix it !!

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"The most important questions are, 'What kind of network are we designing,' and 'What are its requirements?' We need to understand where minimal levels of network availability are acceptable vs. where maximum availability is a critical necessity.

If we always try to impose the requirement of 24-by-7 availability in all segments of our corporate network, we may be setting ourselves up for failure."

Network Architect
CIO Magazine

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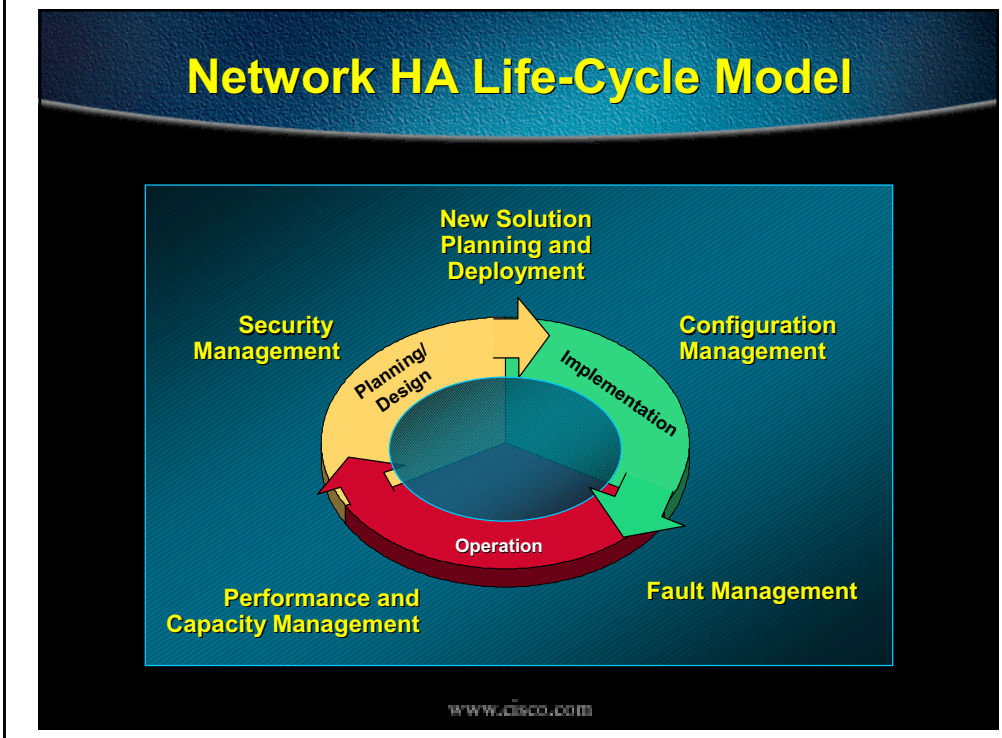

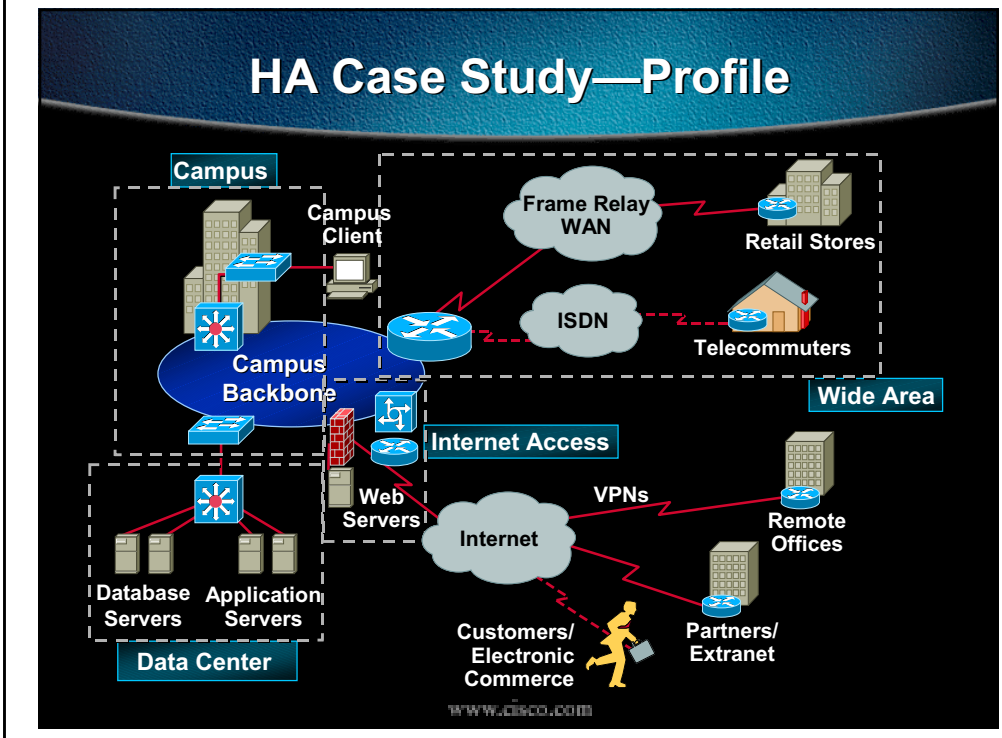

Major Risk Q&A

- Congestive degradation
- Capacity (peaks unanticipated)
- Solutions validation
- Software quality
- Inadvertent configuration change
- Major fiber cut or carrier failure
- Power
- Attack
- Critical services failure (e.g., DNS/DHCP)
- Protocol implementations/ misbehavior
- Hardware fault

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Enterprise Customer (Past Year History—Major Outages)

- Fiber Cut in Local Loop
  (no local loop redundancy in design)
- Implementation failure in new deployment
  (solution not validated and excess resources)
- Network melt-down, routing didn't converge
  (not enough memory/CPU for route change)
- Network failure in major department
  (organization not monitoring primary device failure)
- Denial of service attack
  (weak firewall monitoring and security configuration)

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Enterprise Customer (Pain in $ Per Hour)

- Manufacturing company, 5000 employees, $2 billion revenue
  - Operation hours = 10hrs/day, 5 days/week
  - Revenues/hour = $769K/hr
  - Overall company dependency on network/computer access = 80%
  - Revenue cost/hr downtime = $615K
  - Revenue lost for year = $615K x 8 hours = $5 million
- Productivity loss
  - Avg annual salary = $50K
  - Avg hourly wage = $27.17
  - Overall employee dependency on network/computer access = 60%
  - Productivity loss = 5000 x 27.17 x .6= $81K/hr
  - Total productivity loss for the year = $81K/hr x 8 hours = $650,000
- Cost to customer loyalty

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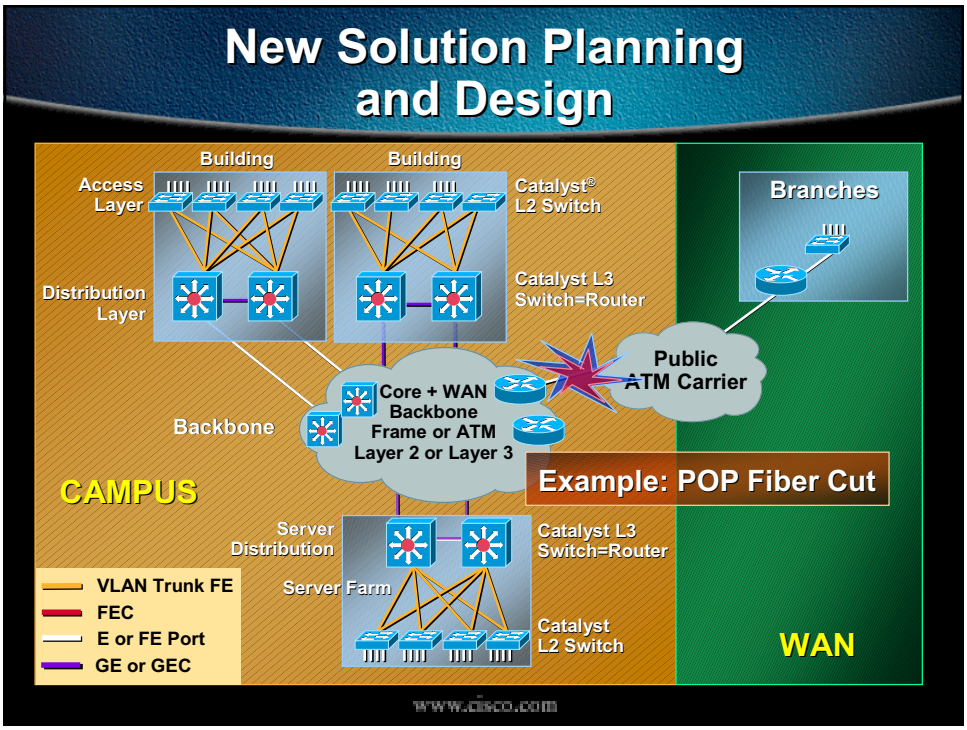

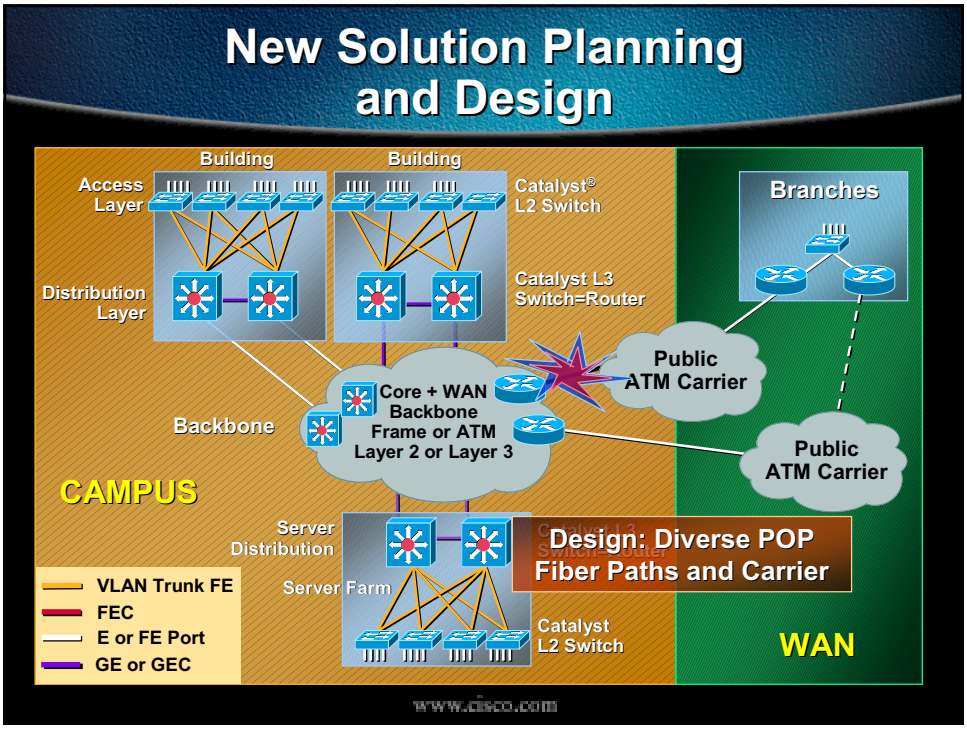

New Solution Planning and Design

- Business/application requirements
- Availability objectives
- Network resiliency/design
- Manageability, service levels and metrics
- Scalability objectives
- Performance objectives
- Cost-benefit analysis

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New Solution Planning and Design

- Service level management
  - Hardware replacement and MTTR
  - Time to resolve by problem priority
  - Capacity planning service definition
  - Performance management service definition
  - Availability management service definition
  - Error detection and resolution service definition

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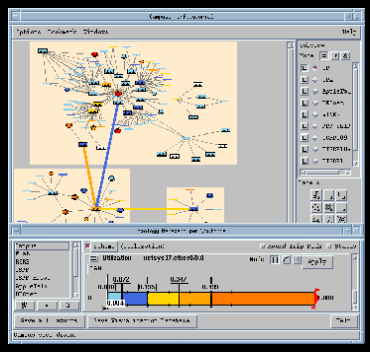
Netsys Service Level Management

- Performance baseline
- End-to-end traffic Baseline with RMON collectors, SNMP and NetFLow statistics
- Define Service Level Performance Policies
- Assess Service Level Policy Performance



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Multilayer Campus Model + Redundancy

- Think about redundancy/resiliency/diversity at layer 1/2/3 and 7
- Redundant building blocks
  - Minimize scope of outages
- L3 routing across backbone
  - Load balancing
  - Fast deterministic failover
- Redundant to wiring closet
  - UplinkFast/BackboneFast for L2
  - HSRP for L3 failover
  - Load balancing
  - Fast deterministic failover

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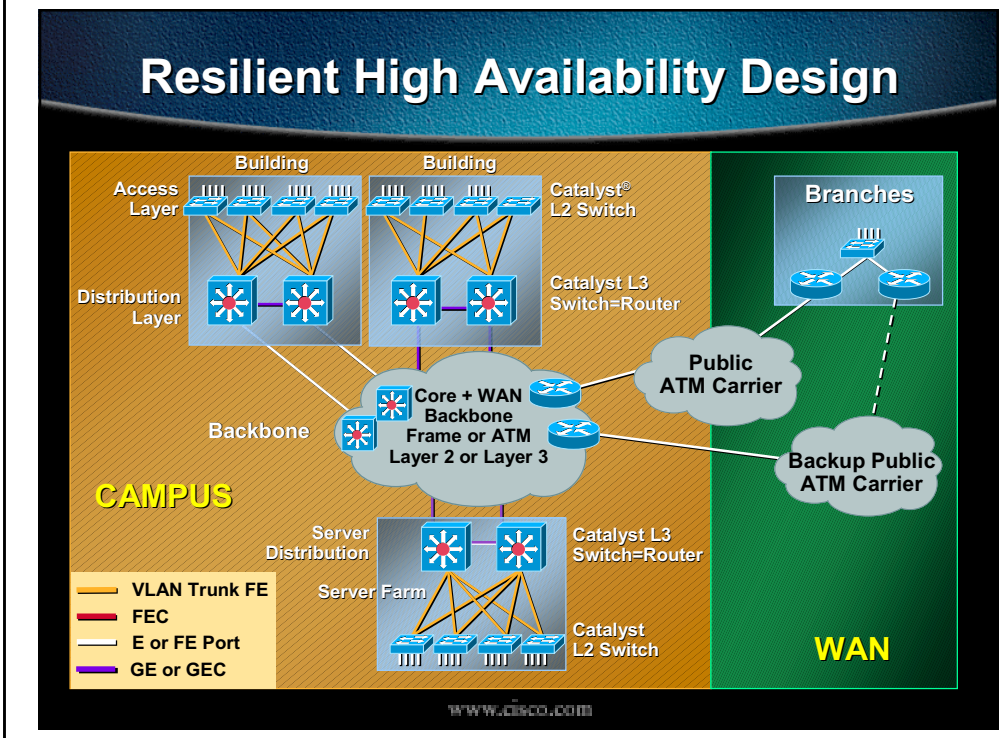
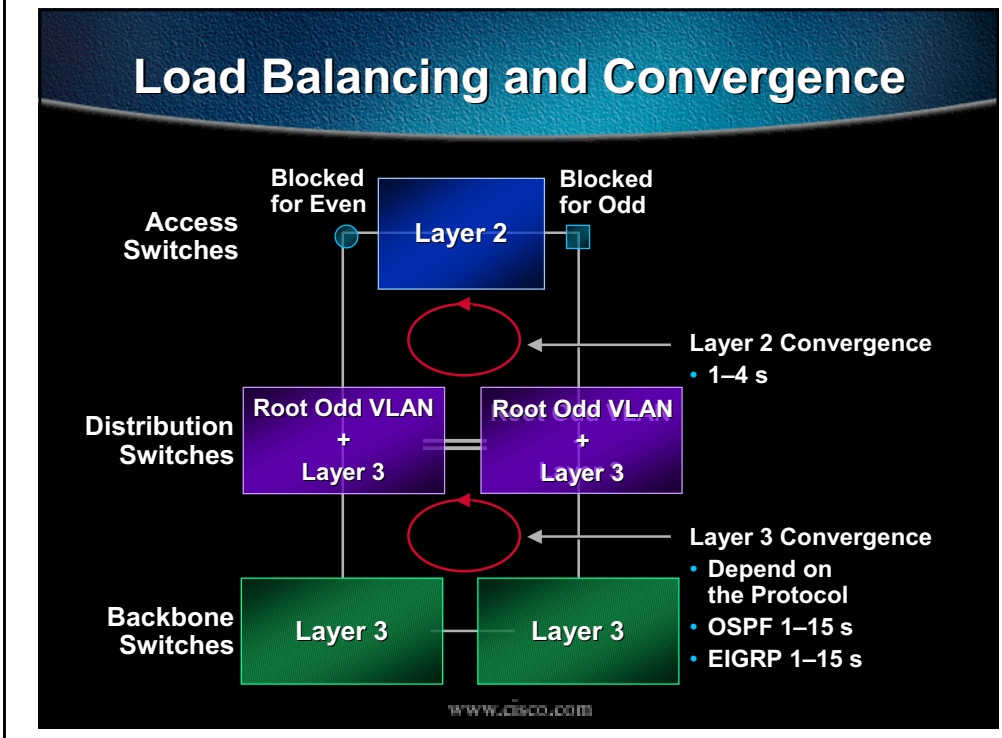
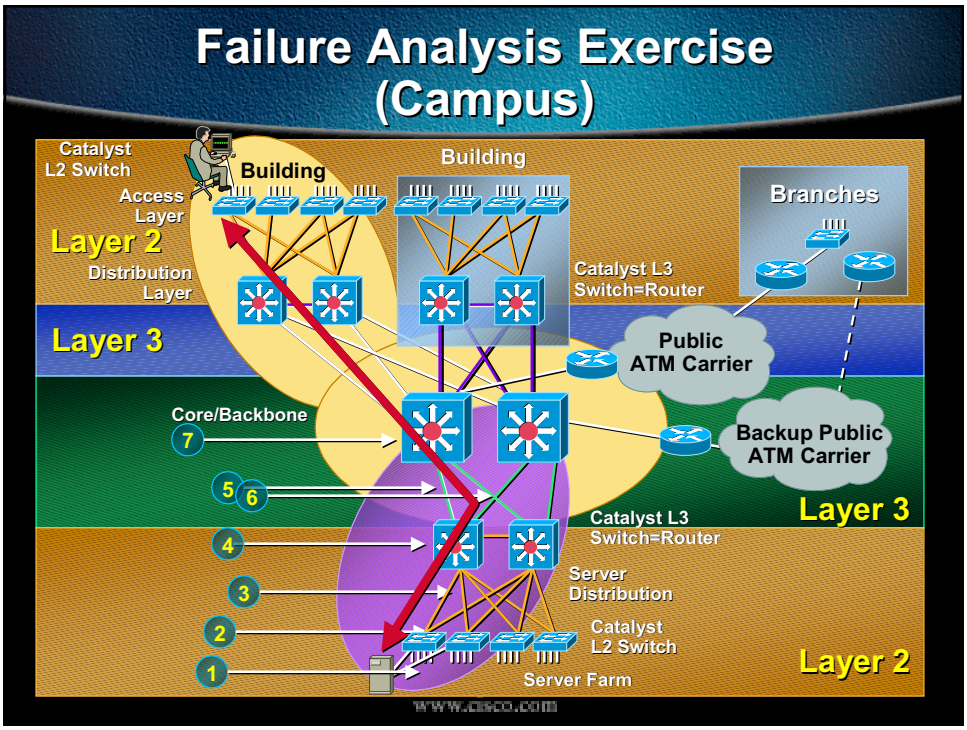
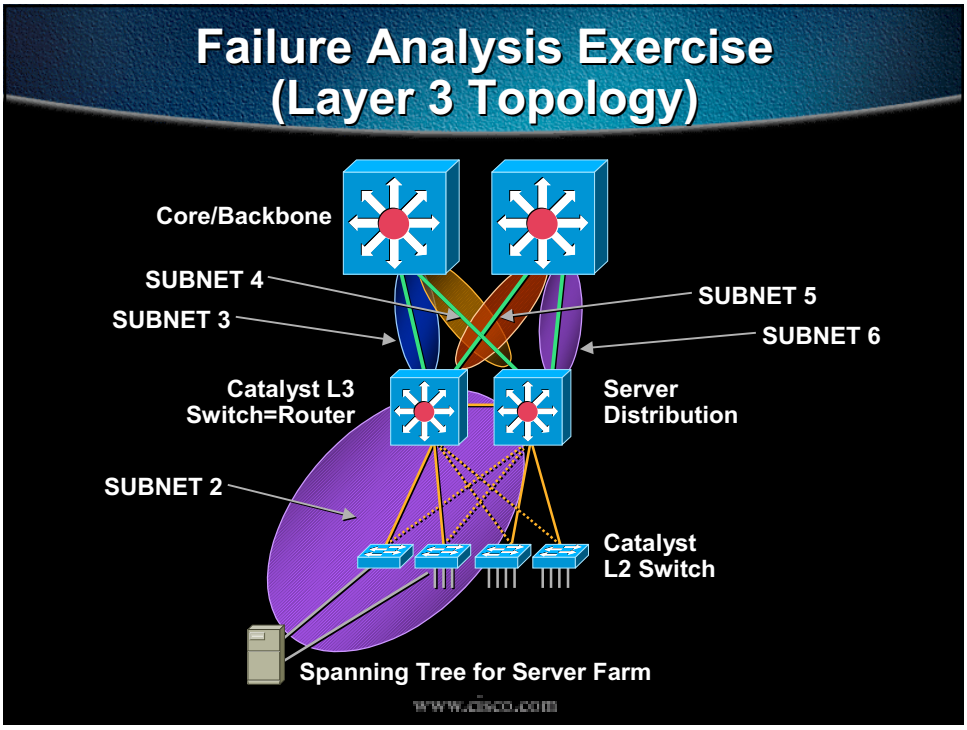
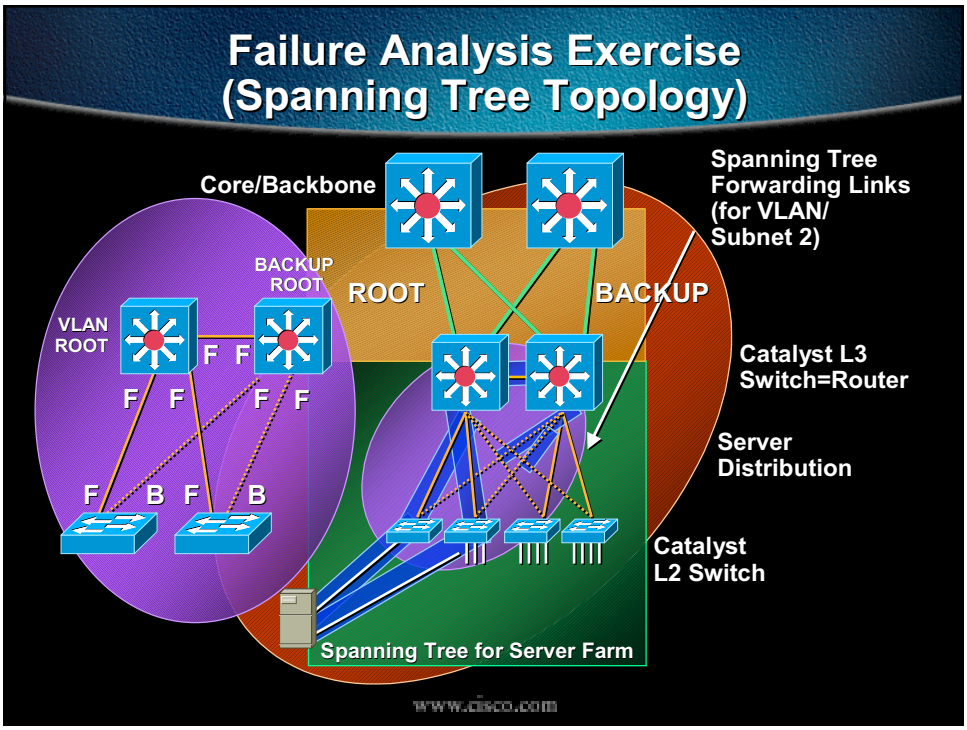
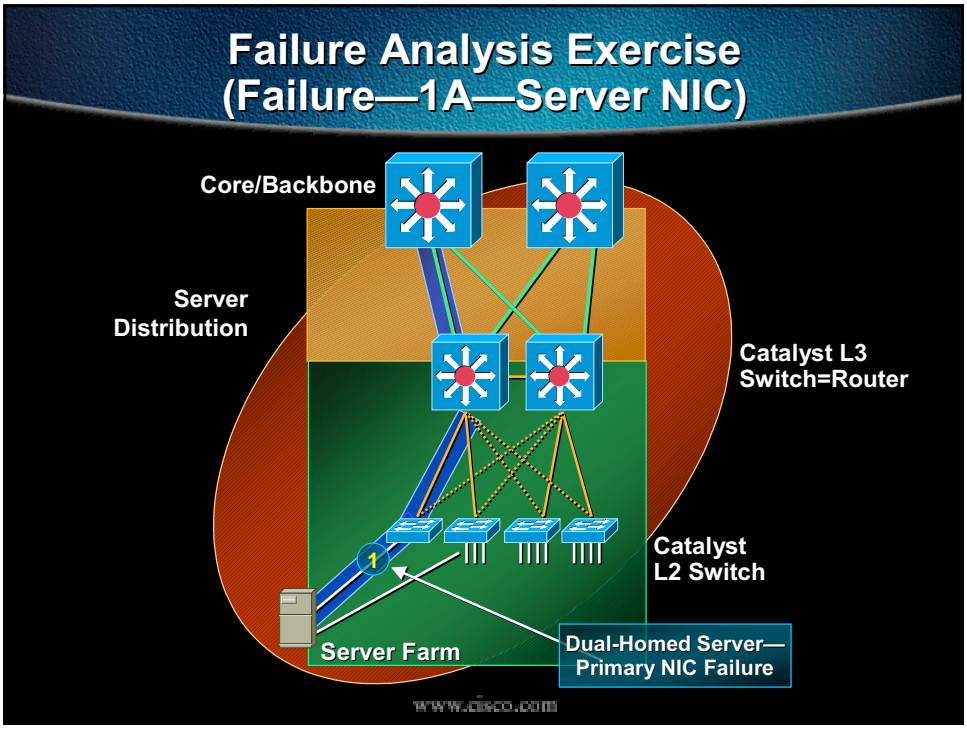


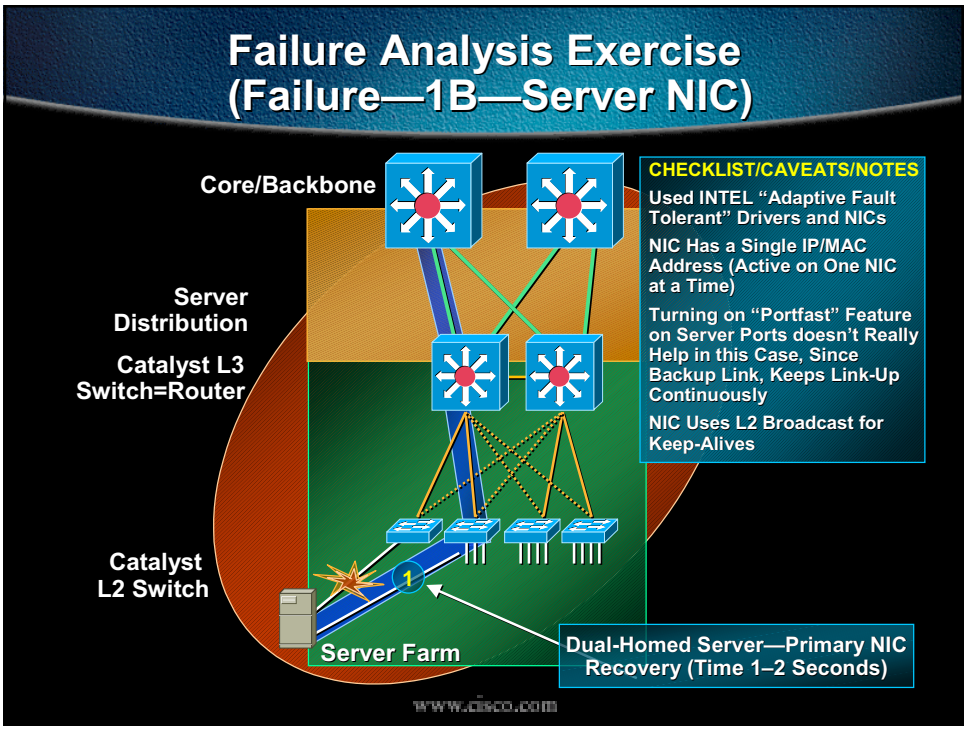


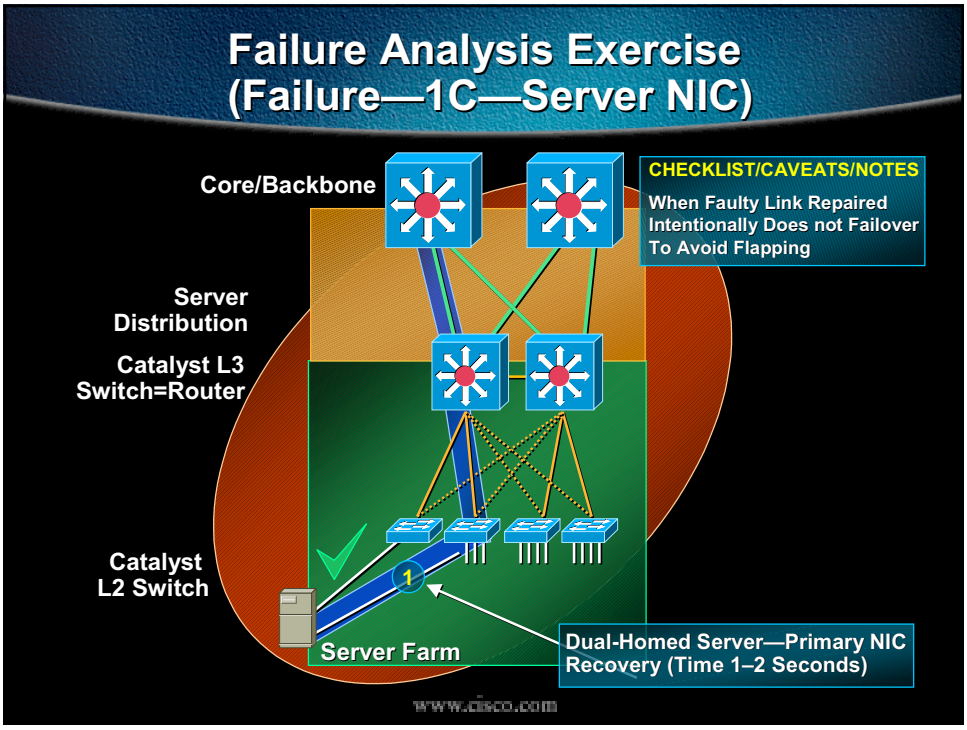




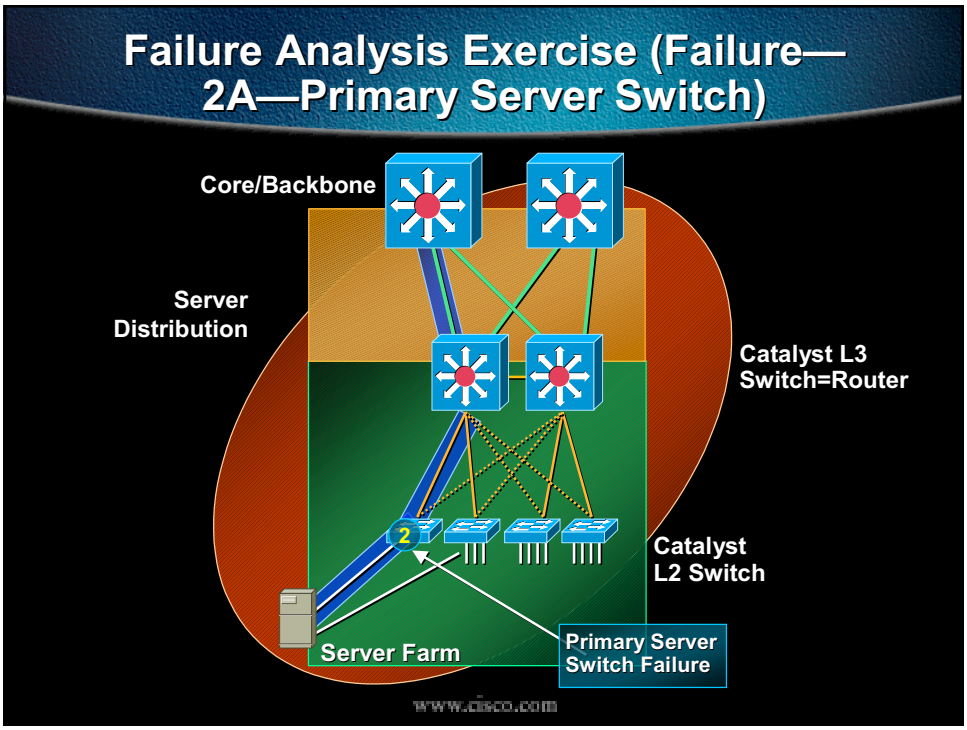




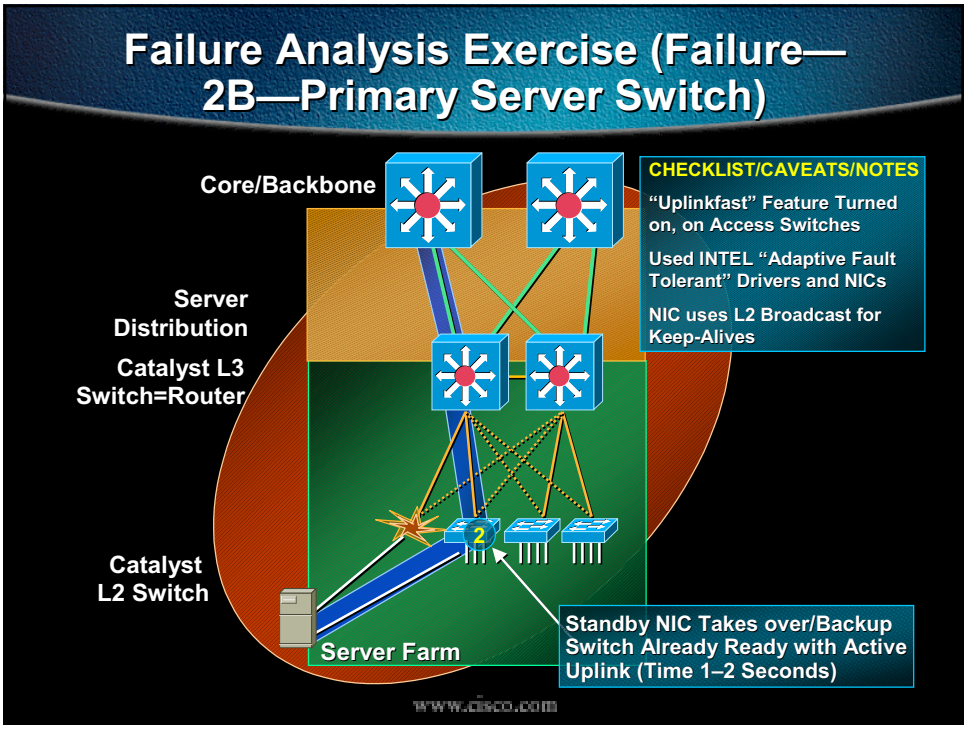


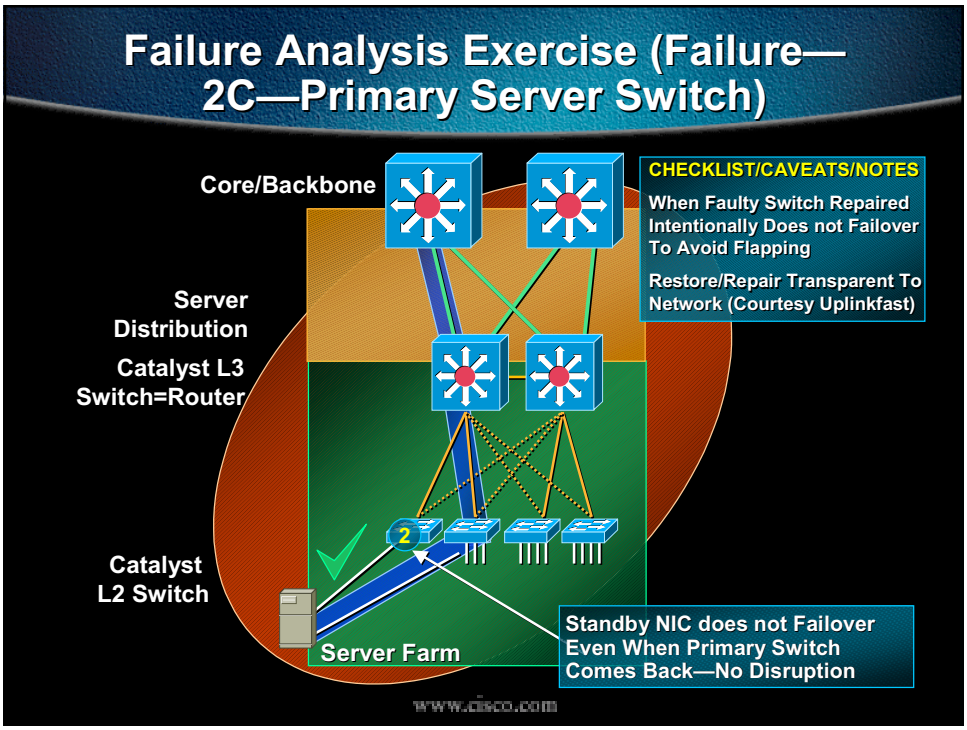


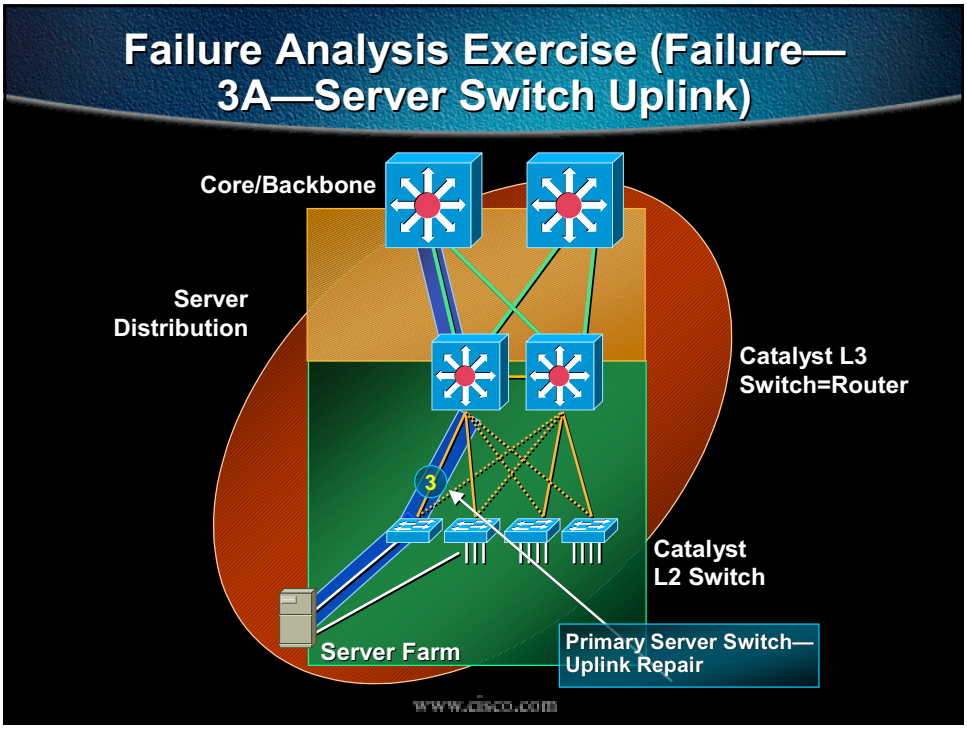
Failure Analysis Exercise (Failure—2A—Primary Server Switch)

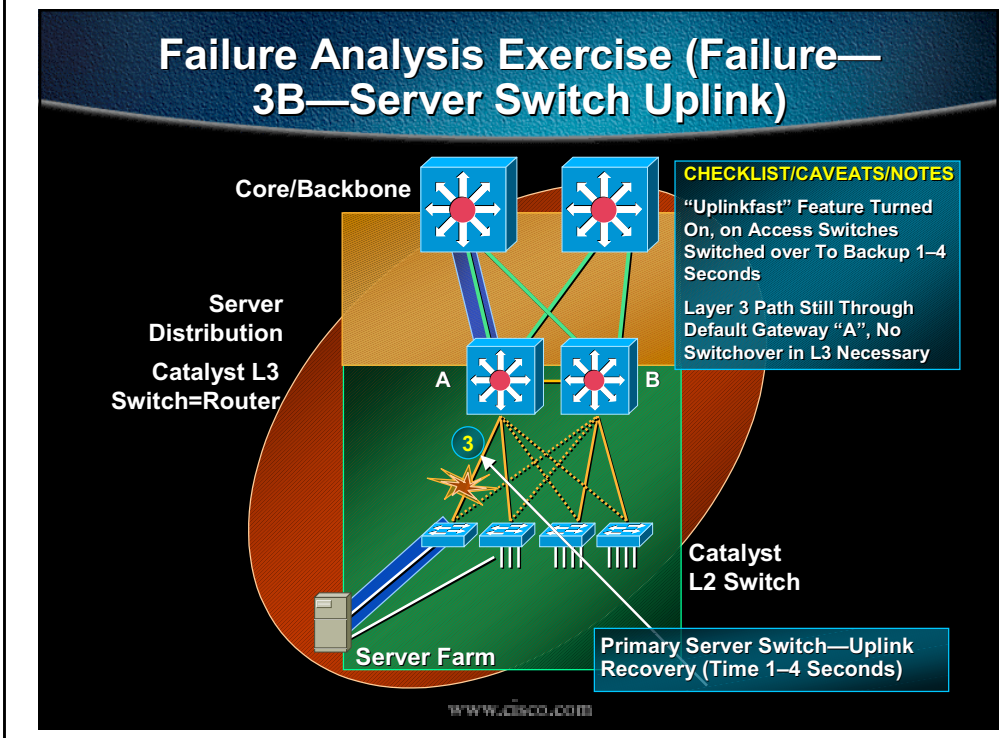


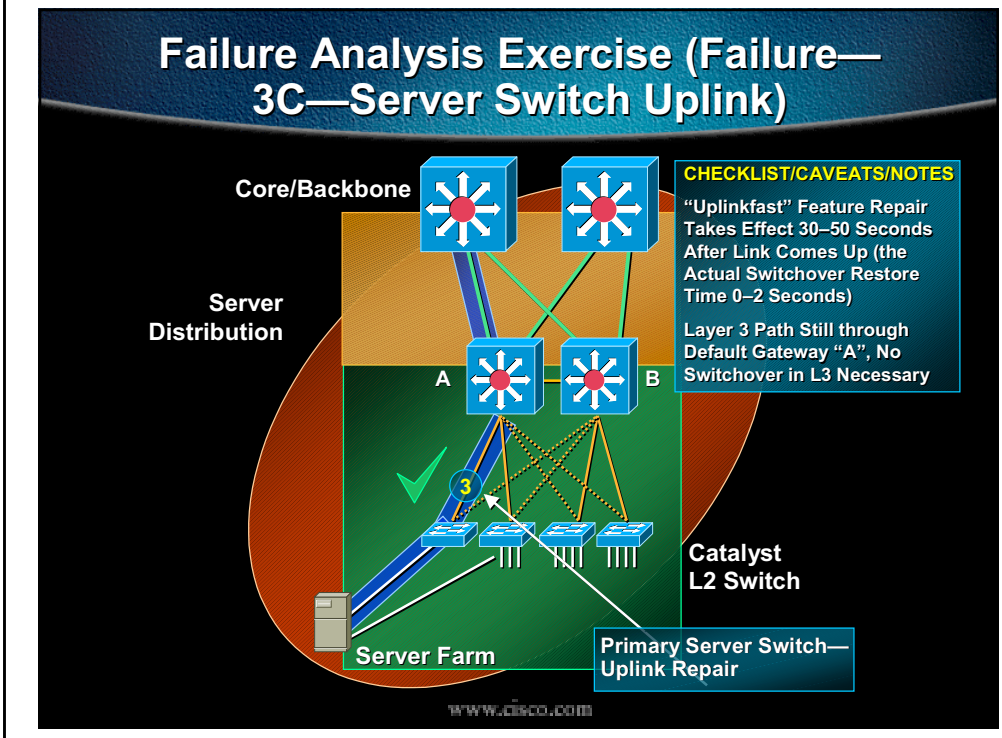
Failure Analysis Exercise (Failure—2B—Primary Server Switch)



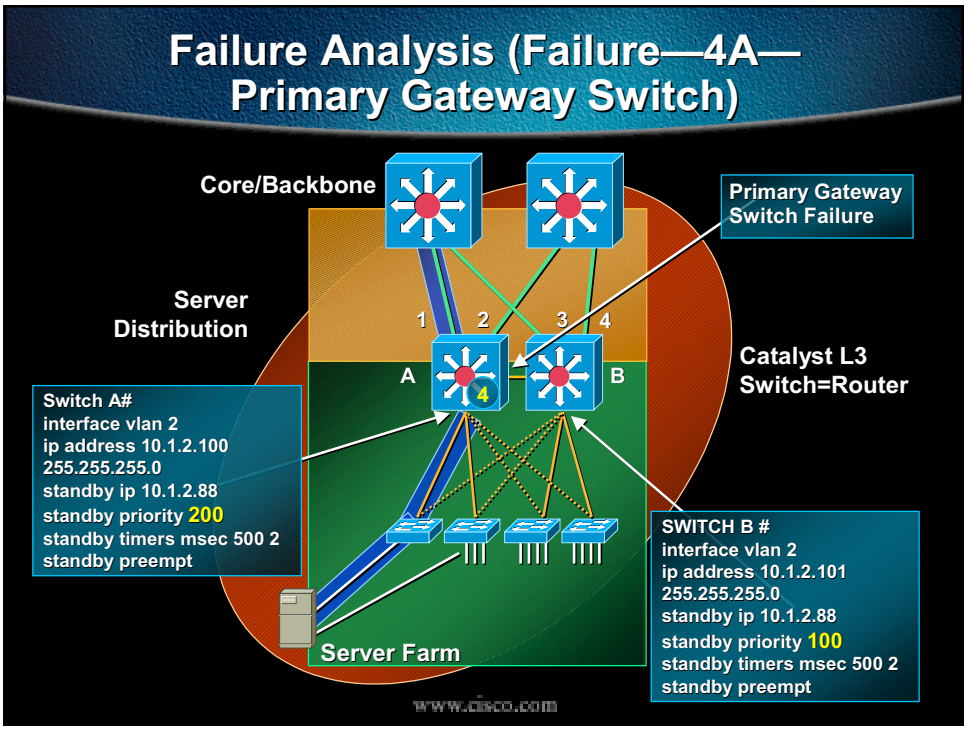




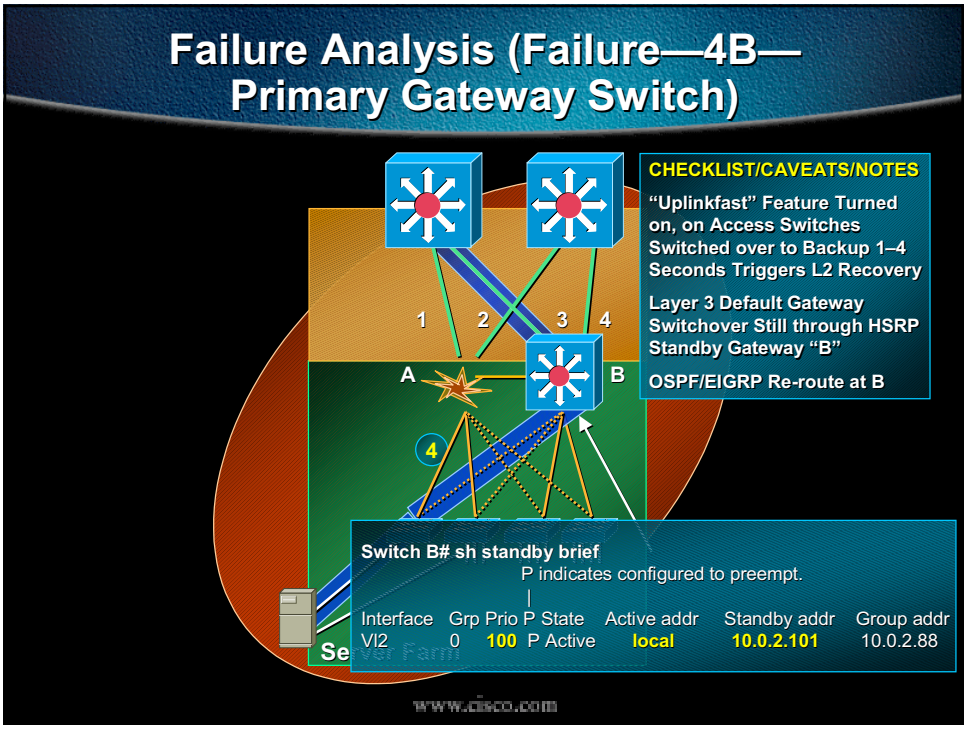




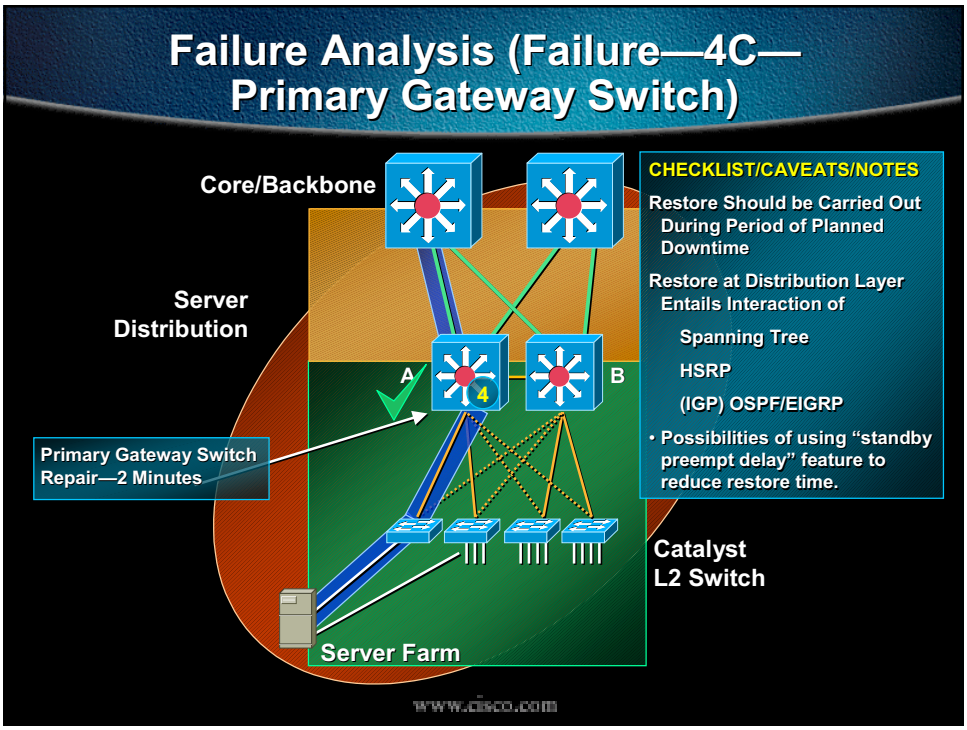
Failure Analysis (Failure—4A—Primary Gateway Switch)



Failure Analysis (Failure—4B—Primary Gateway Switch)



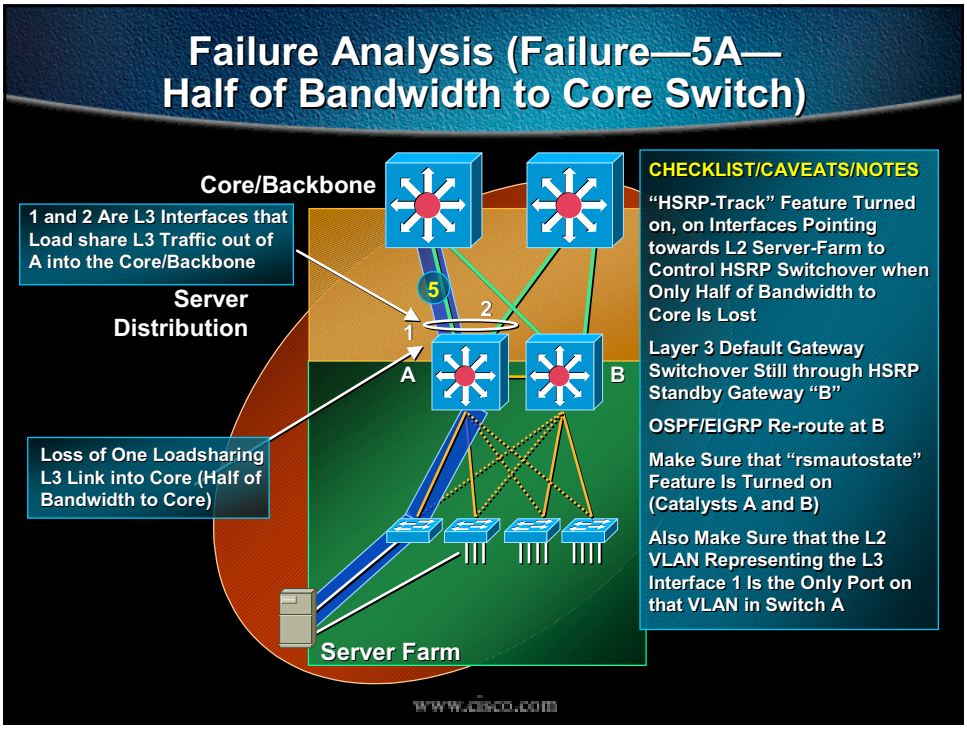
Failure Analysis (Failure—4C—Primary Gateway Switch)



CHECKLIST/CAVEATS/NOTES

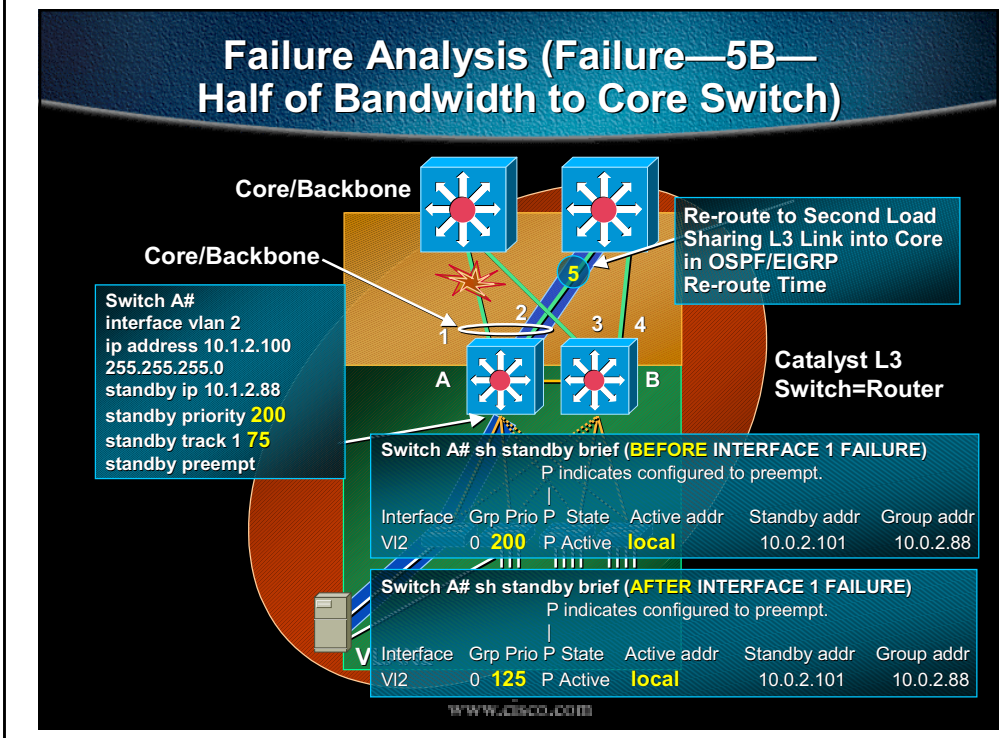
- Restore Should be Carried Out During Period of Planned Downtime
- Restore at Distribution Layer Entails Interaction of
  - Spanning Tree
  - HSRP
  - (IGP) OSPF/EIGRP
- Possibilities of using "standby preempt delay" feature to reduce restore time.

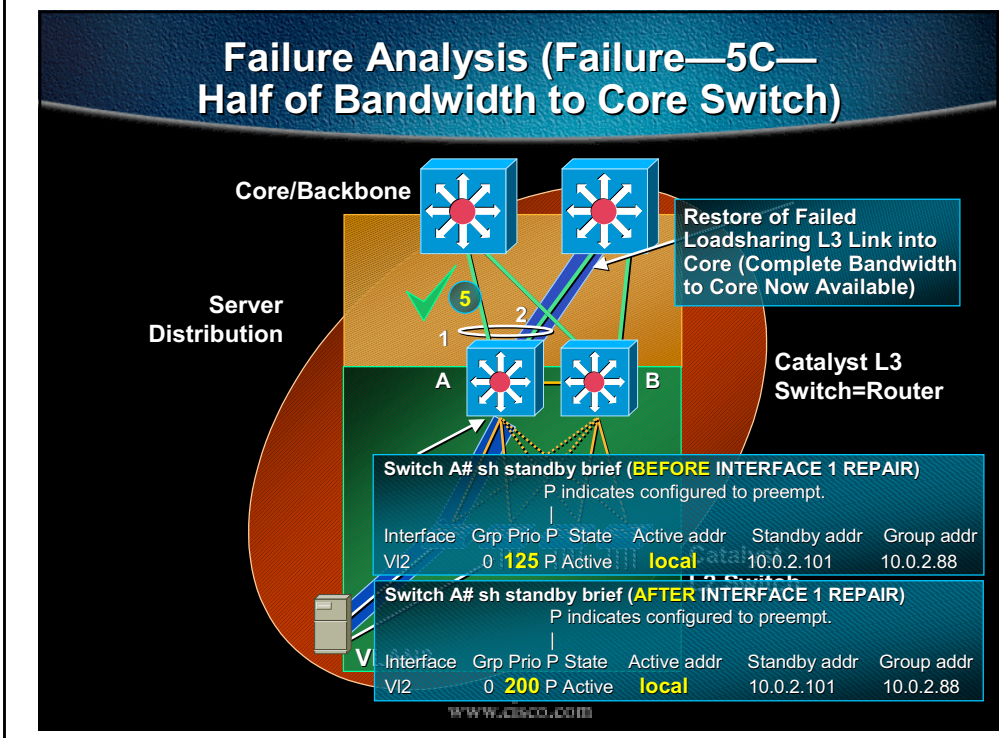
Failure Analysis (Failure—5A—Half of Bandwidth to Core Switch)



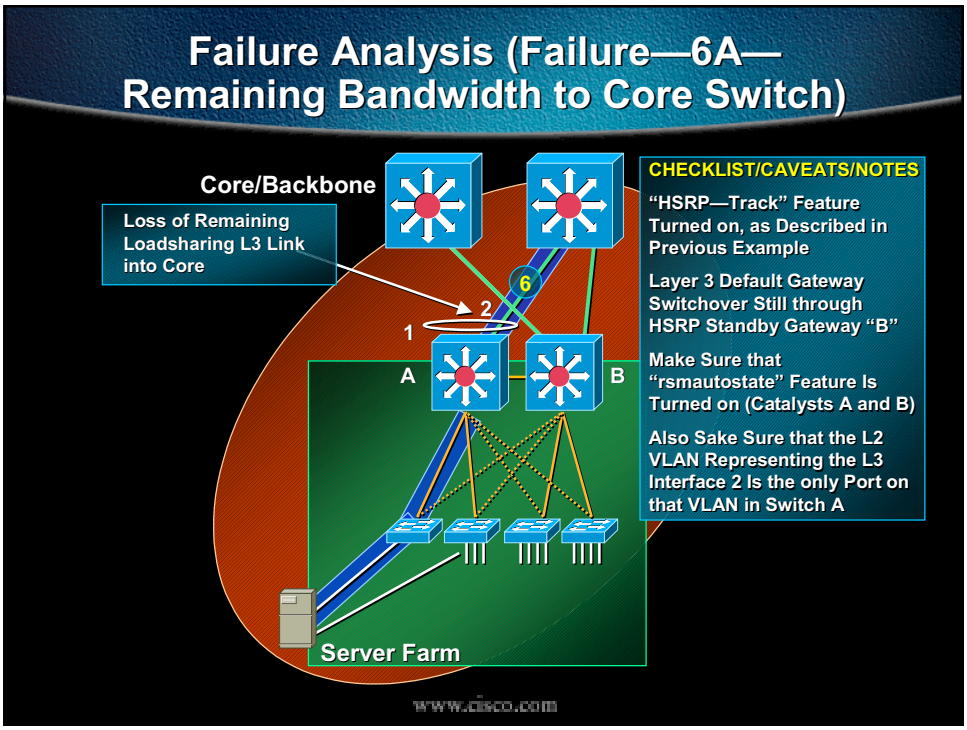
CHECKLIST/CAVEATS/NOTES

- "HSRP-Track" Feature Turned on, on Interfaces Pointing towards L2 Server-Farm to Control HSRP Switchover when Only Half of Bandwidth to Core Is Lost
- Layer 3 Default Gateway Switchover Still through HSRP Standby Gateway "B"
- OSPF/EIGRP Re-route at B
- Make Sure that "rsmautostate" Feature Is Turned on (Catalysts A and B)
- Also Make Sure that the L2 VLAN Representing the L3 Interface 1 Is the Only Port on that VLAN in Switch A





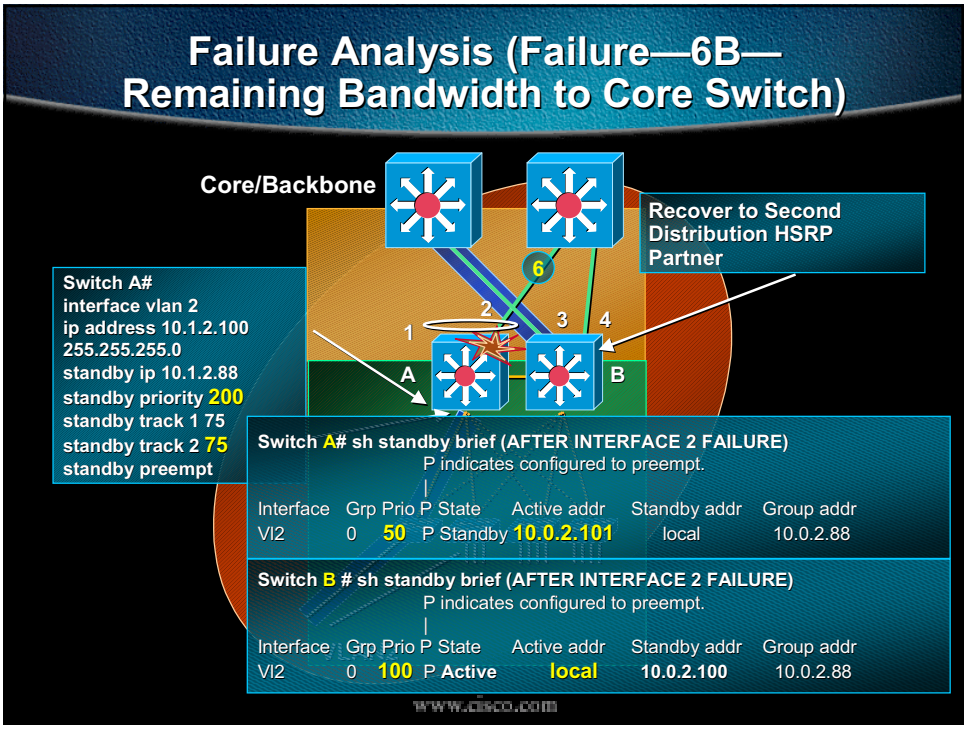
Failure Analysis (Failure—6A—Remaining Bandwidth to Core Switch)



CHECKLIST/CAVEATS/NOTES

- "HSRP—Track" Feature Turned on, as Described in Previous Example
- Layer 3 Default Gateway Switchover Still through HSRP Standby Gateway "B"
- Make Sure that "rsmautostate" Feature Is Turned on (Catalysts A and B)
- Also Sake Sure that the L2 VLAN Representing the L3 Interface 2 Is the only Port on that VLAN in Switch A

Failure Analysis (Failure—6B—Remaining Bandwidth to Core Switch)



Switch A#
interface vlan 2
ip address 10.1.2.100 255.255.255.0
standby ip 10.1.2.88
standby priority 200
standby track 1 75
standby track 2 75
standby preempt

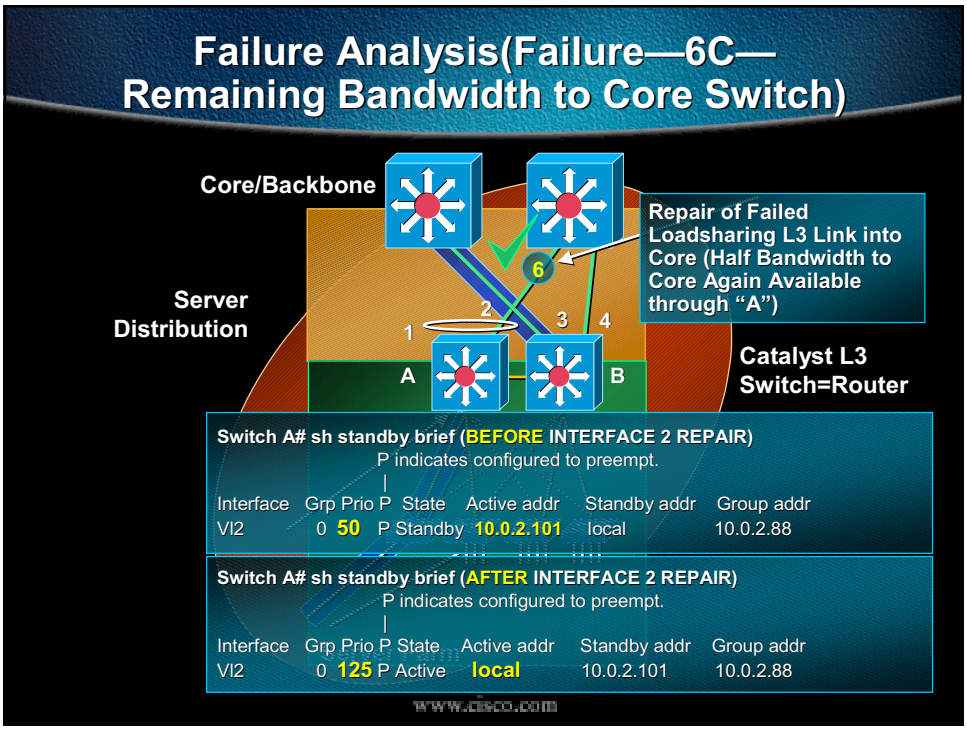
Switch A# sh standby brief (AFTER INTERFACE 2 FAILURE)
P indicates configured to preempt.

Interface	Grp	Prio	P	State	Active addr	Standby addr	Group addr
Vl2	0	50	P	Standby	10.0.2.101	local	10.0.2.88

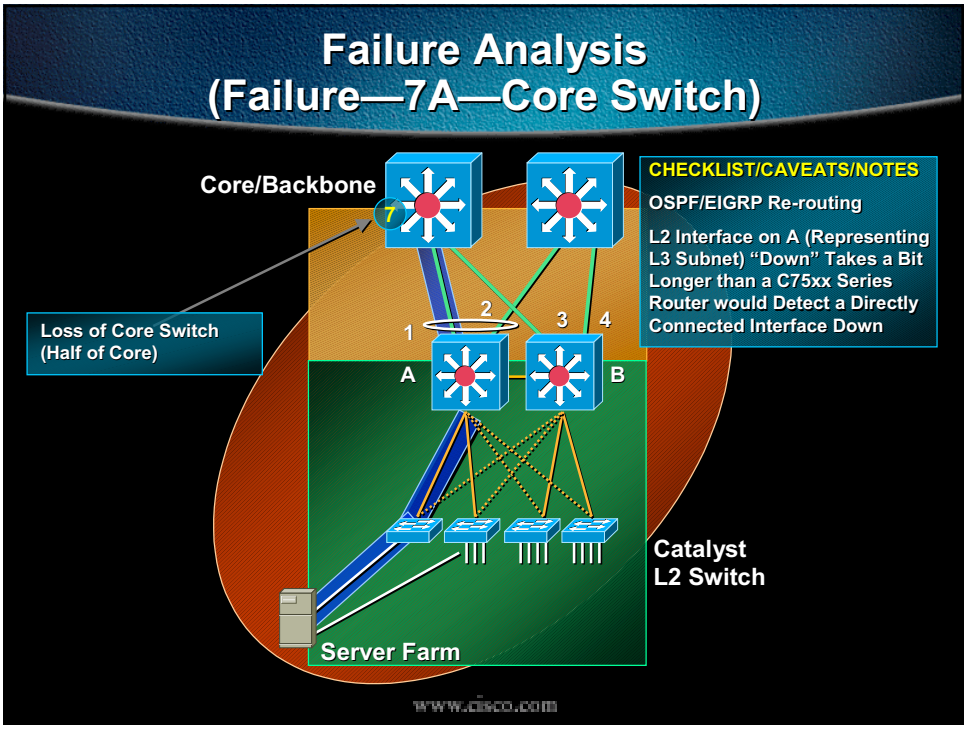
Switch B # sh standby brief (AFTER INTERFACE 2 FAILURE)
P indicates configured to preempt.

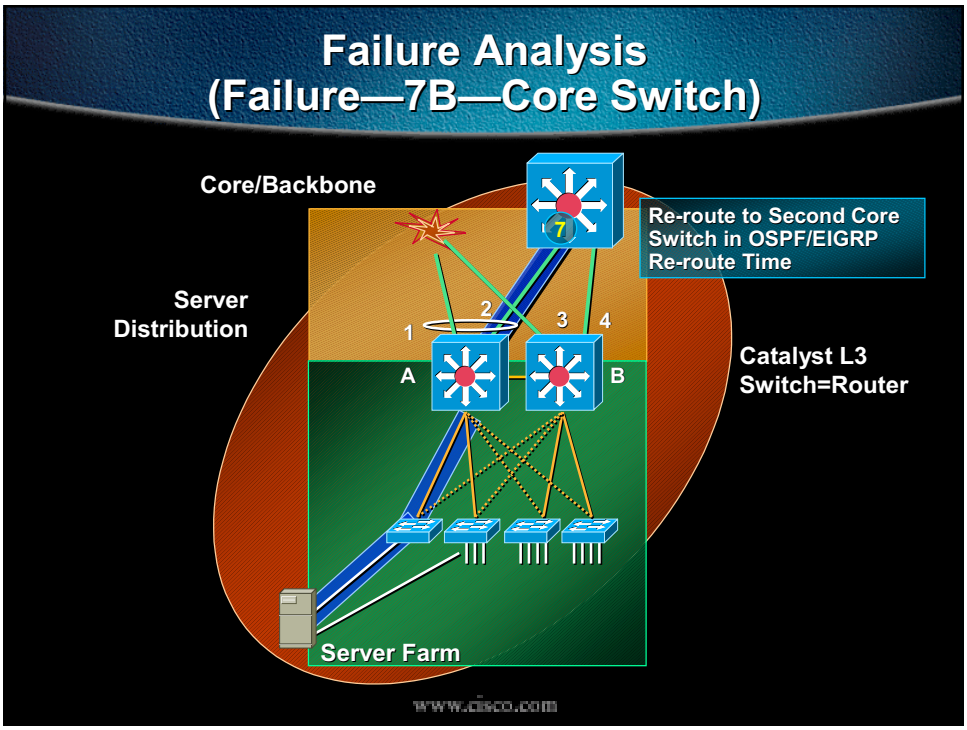
Interface	Grp	Prio	P	State	Active addr	Standby addr	Group addr
Vl2	0	100	P	Active	local	10.0.2.100	10.0.2.88

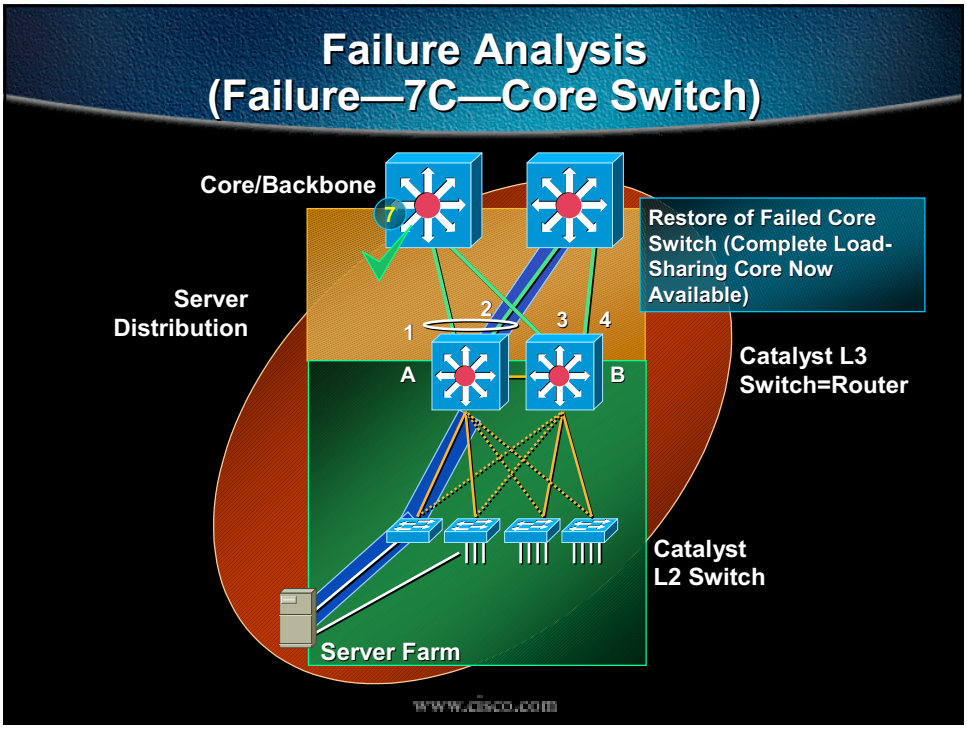
Failure Analysis(Failure—6C—Remaining Bandwidth to Core Switch)



Failure Analysis (Failure—7A—Core Switch)







Campus Failover Layer 2 Recovery Characteristics

- STP
  - Tune ‘diameter’ to 2 on root switch
  - Improves recovery by reducing ST to a triangle
- PortFast
  - Access/desktop ports only
  - Move directly from linkup into forwarding
- UplinkFast
  - No tuning—3 seconds—wiring closet only
  - Only applies to VLANs with loop (triangle)
- Backbonefast
  - Improves convergence (1–2 sec + 2xFwd_delay) for indirect link failures
  - Eliminates maxage timeout

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Campus Failover Layer 3 Recovery Characteristics

- HSRP
  - No tuning—2 seconds—distribution
  - Use of the ‘track’ feature
- RSMAUTOSTATE
  - Protecting against black hole-ing of traffic
- OSPF
  - Hello timer 1 sec, dead timer 3 sec *
  - Recovery 6 seconds across backbone
- EIGRP
  - Hello timer 1 sec, hold timer 3 sec *
  - Recovery 3 seconds across backbone

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WAN High Availability

- Re-think carrier connectivity
  - DMARC to CSU/DSU
  - Multiple building entrance facilities
  - Local loop, Sonet, DACS and channel banks
  - Geophysical diversity
  - Bandwidth redundancy

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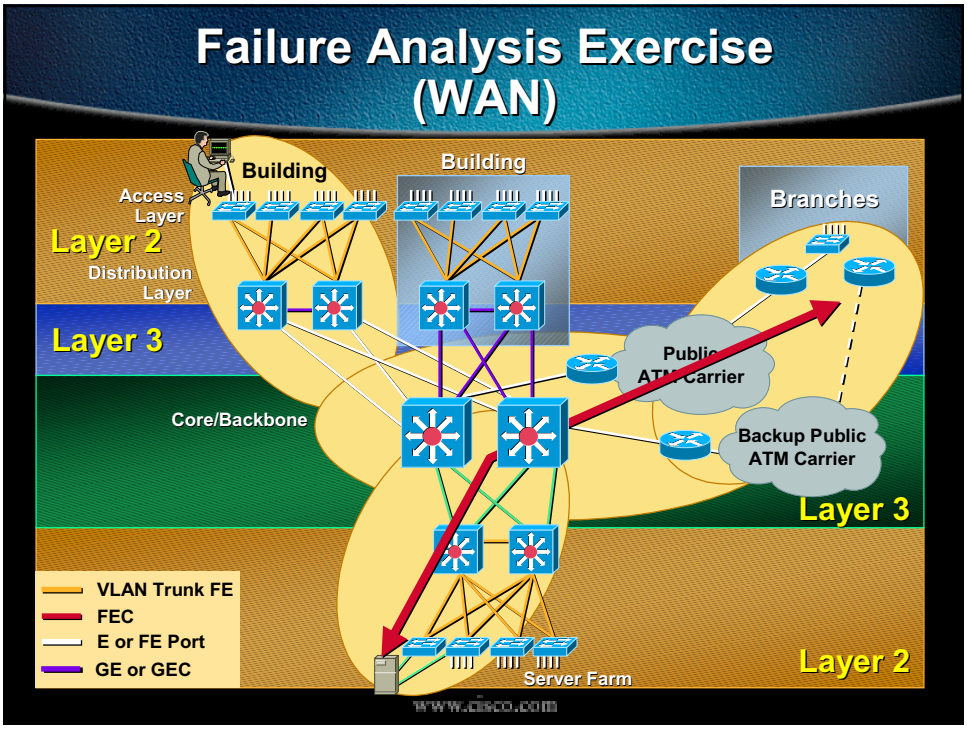
Failure Analysis Exercise (WAN)



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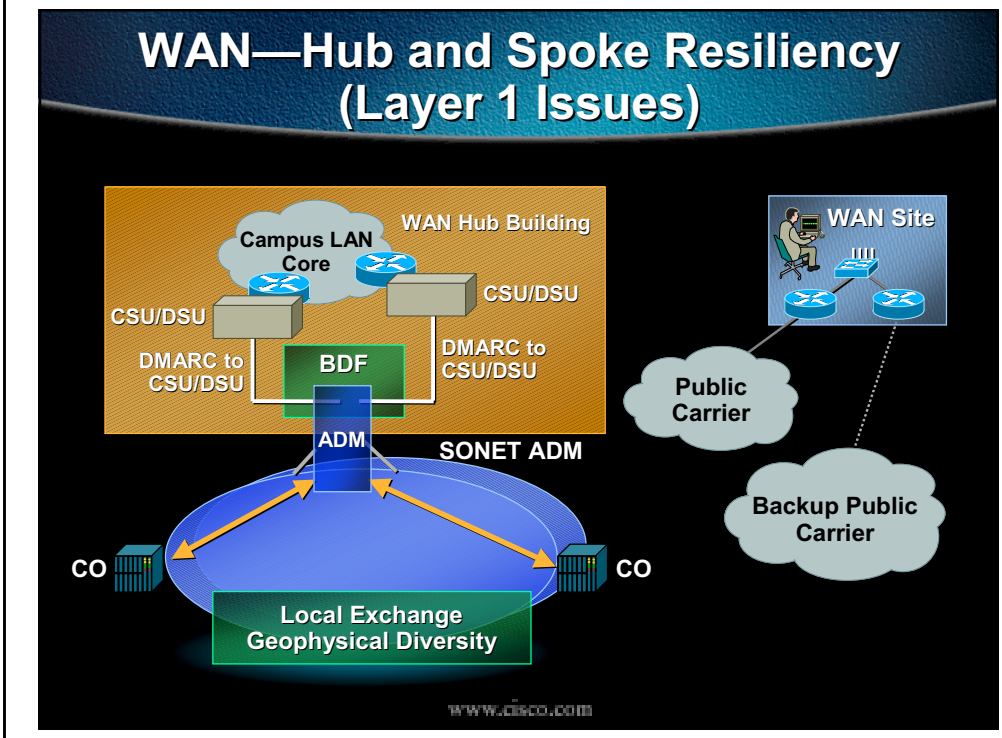
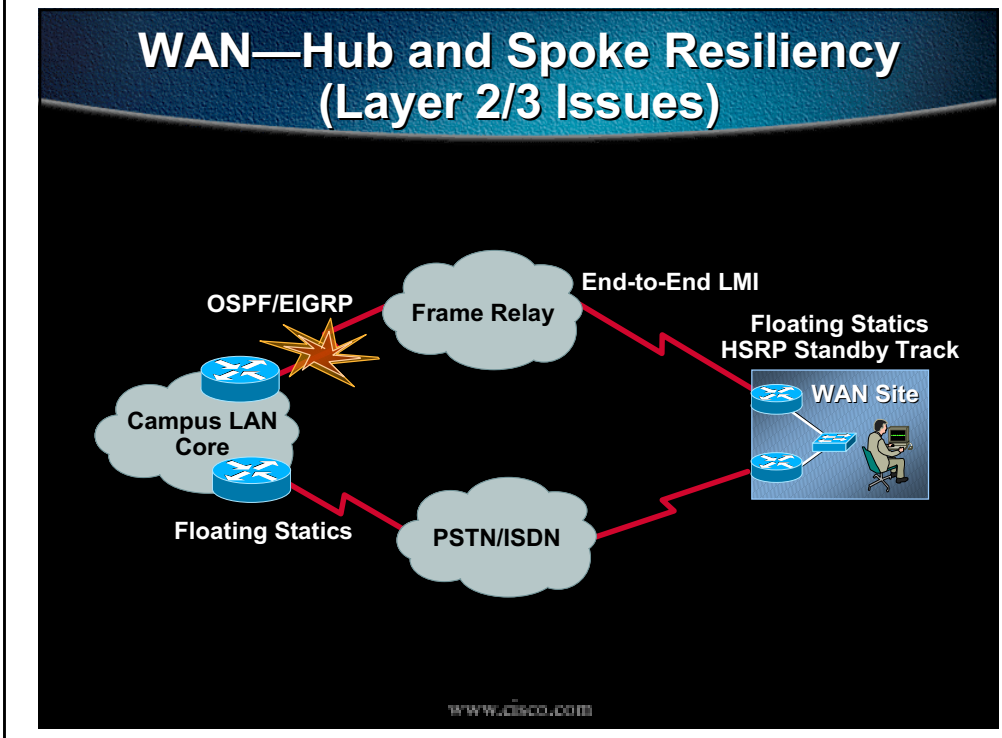
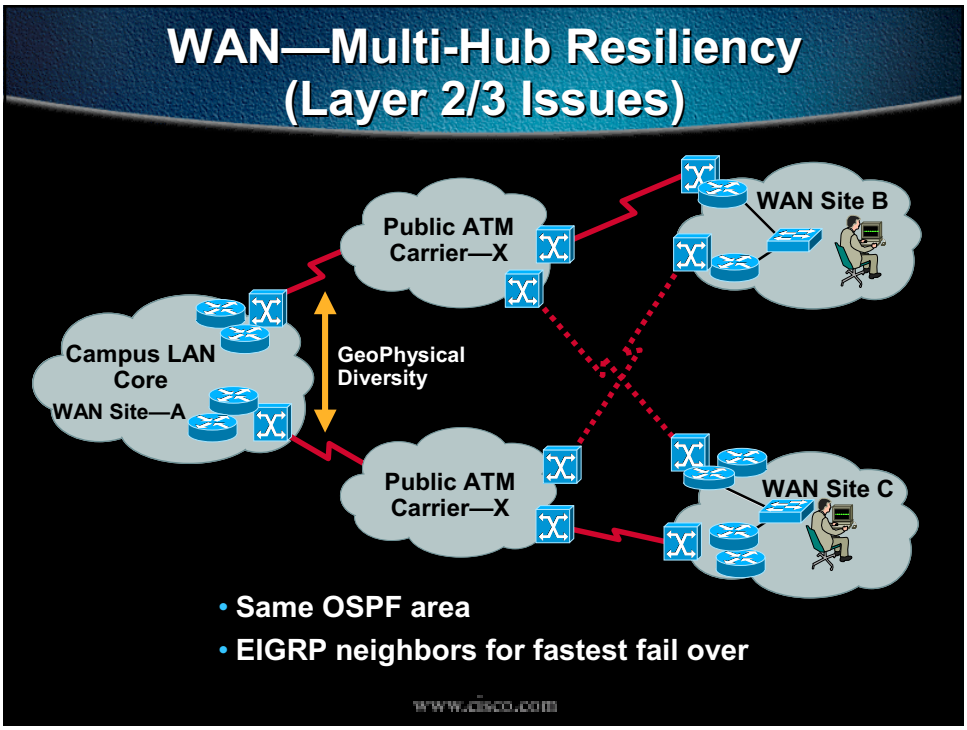
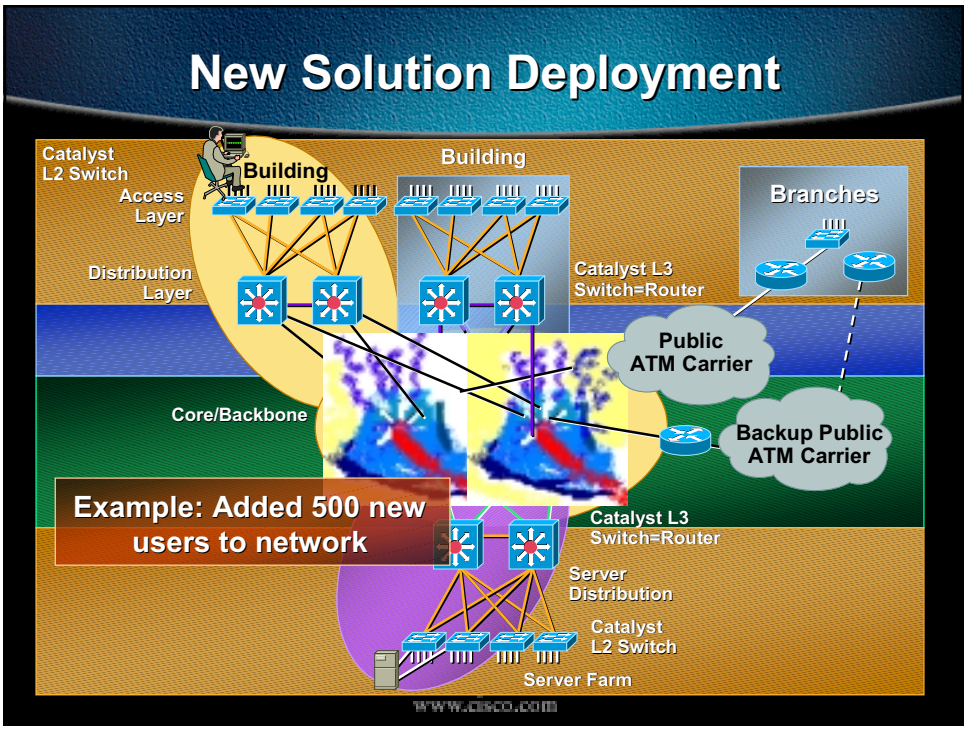






New Solution Deployment



New Solution Deployment

- Design review with vendor
- Test plan (to reflect your app/network scenarios)
- Lab validation
- Solution pilot
- Solution templates
- Staffing
- Training
- Operational support handoff

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Configuration Management—1

- Maintaining configuration consistency
- Inventory management
- IP address management
- Software version control
- Password management
- Wiring and naming conventions
- Documentation

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Configuration Management—2

- **Change management**
  - **Change management procedures**
  - Risk analysis
  - Testing and validation for high risk change
  - Backout plan
  - Network management and documentation update
  - Change management metrics

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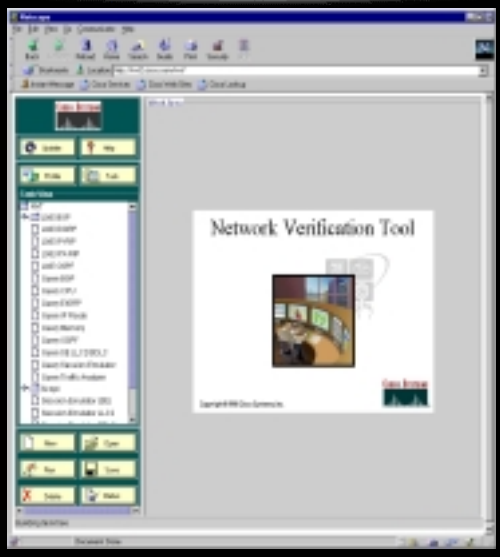
Overview of NVT



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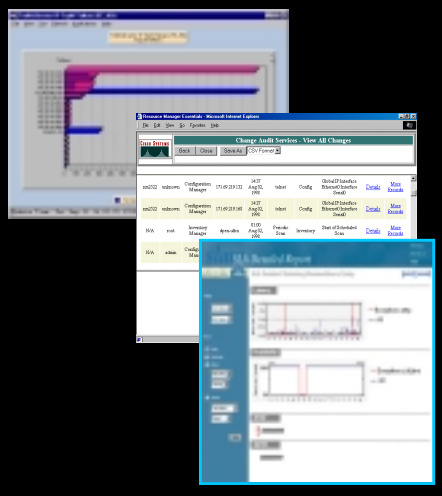
CW2000 High Availability Network Management

- **Traffic analysis**
  - Identify and monitor critical applications, users, and traffic
- **Change management**
  - Enforces and reports on network changes
- **Service Level Management**
  - Latency and availability analysis



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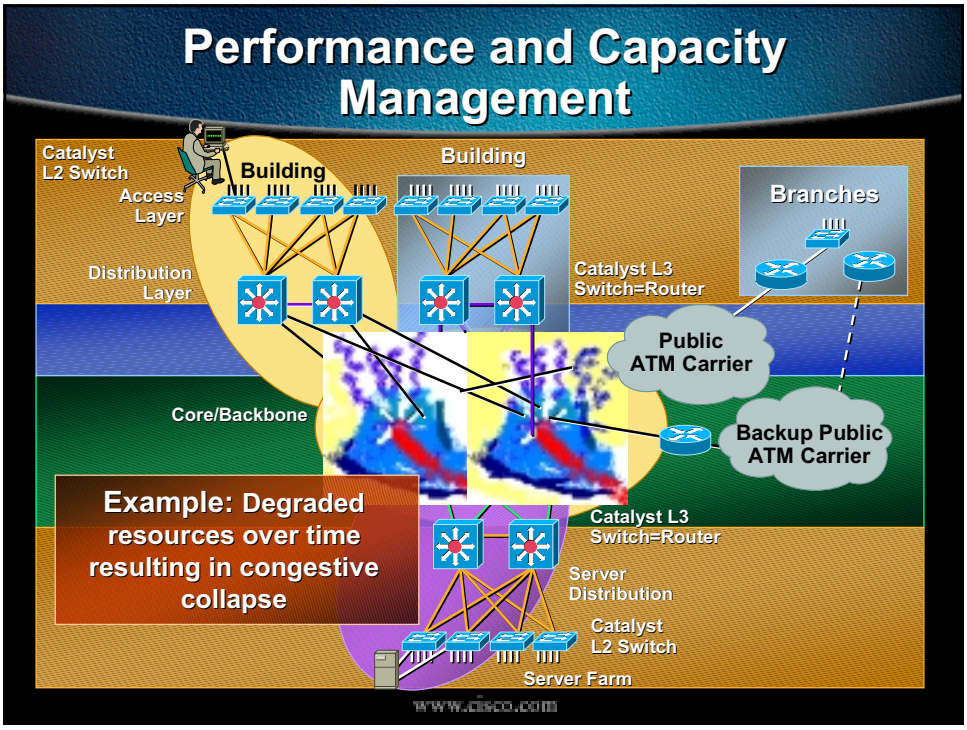

Performance and Capacity Management

- Performance and capacity management
  - What-if analysis (network and application)
  - Baselining
  - QOS management
  - Periodic review plan and upgrade criteria
  - Exception management

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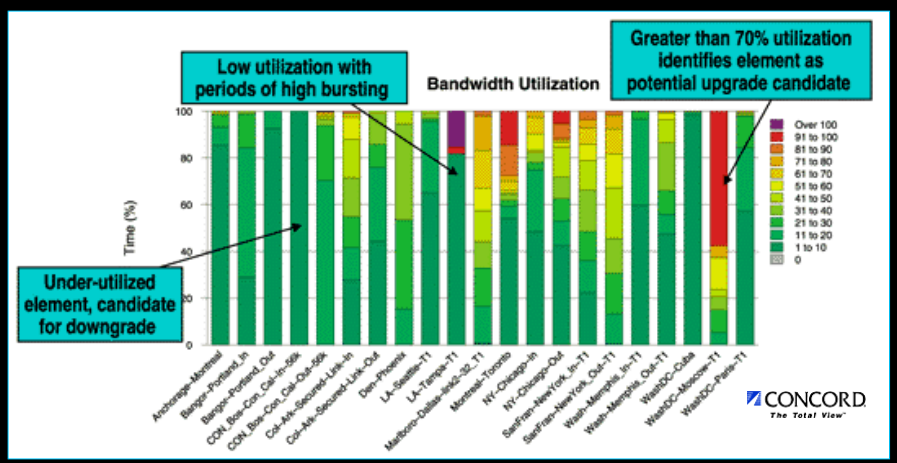
Capacity Planning Tools



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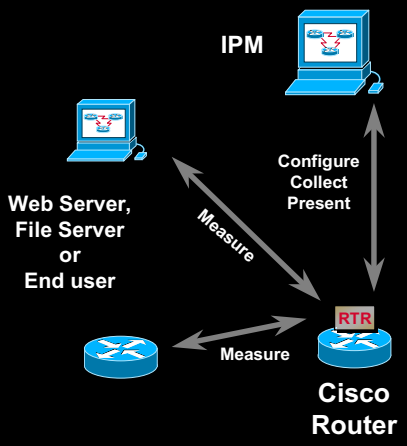
Internet Performance Monitor

- **WAN troubleshooting**
  - Complements CiscoWorks 2000
  - Measures hop-by-hop response time and availability
  - Evaluates thresholds and generates alarms
  - Provides real-time and historical reports
- **Utilizes RTR agent embedded in Cisco IOS**
  - No extra management hardware required
  - Leverages large installed base of Cisco routers



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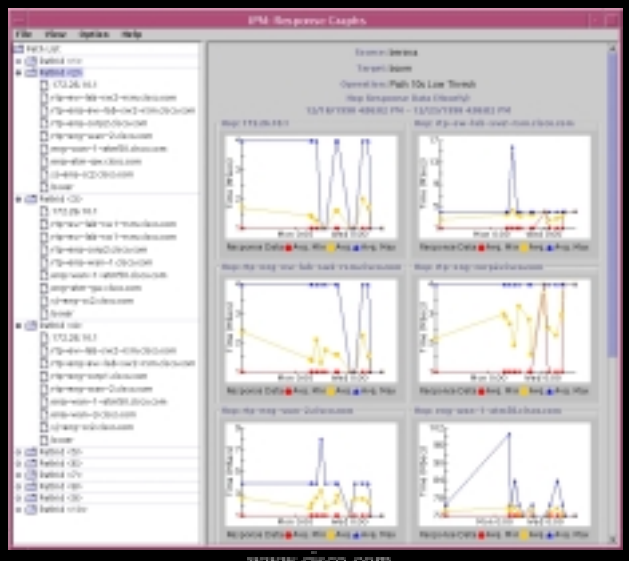
IPM Hop-by-Hop Reports



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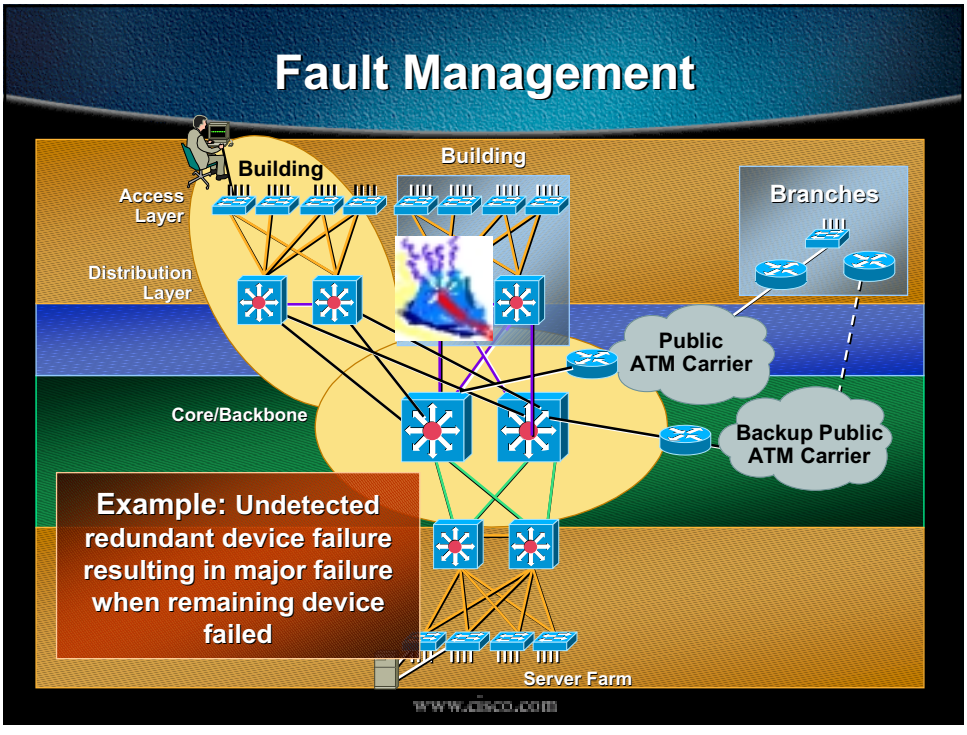

Fault Management

- Fault management
  - 7 x 24 detection, notification, escalation, resolution for link/hardware/network failures
  - Proactive fault analysis plan (MIB variables, threshold violations, Syslog events, review plan)
  - Infrastructure (TFTP, Syslog, NTP, time-stamps, out-of-band management, vendor access)
  - Help desk systems (metrics, accountability)

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Fault Management Tools

- Fault management tools
  - CW2000 (CRM)
  - Cisco debug/MIBs/Syslog
  - RMON thresholding and traps
  - Platform vendors and third party tools

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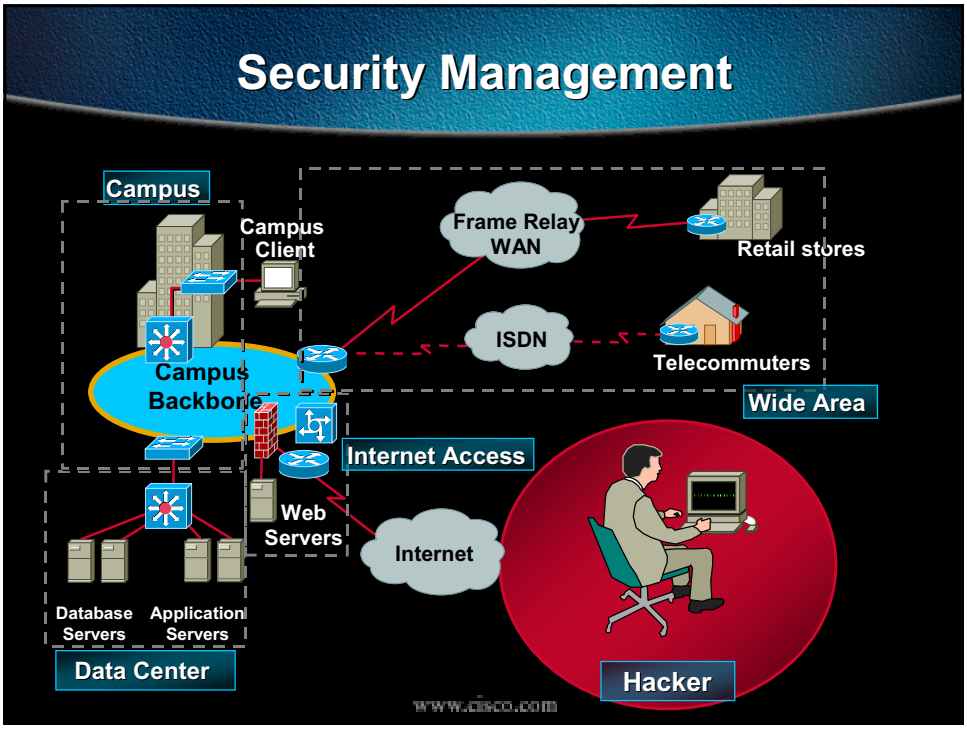

Security Management

- Security policy and procedures
  - General security procedures
  - Internet access
  - Dial-in access
  - Partner access
- Security operations
  - Internet/partner monitoring
  - CERT/vendor advisory review
  - Security configuration practices
  - Termination practices

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Security Policy Management

Security Manager

Policy-based PIX Management

- Visual security policy development environment
- Scalable, network wide operations for Internet, intranet, and extranet topologies
- Windows-based, manage from Win95/98/NT clients
- Web reports integrate with CiscoWorks2000

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Partnering for End-to-End HA

- Service and Support
- Applications
- Databases
- Servers
- Storage
- Network

- Technology integration
- Testing and certification
- Service and support Integration
- Partnering with
  - NIC vendors
  - Server platform vendors
  - Database vendors
  - Storage vendors
  - ISV's
  - Service partners

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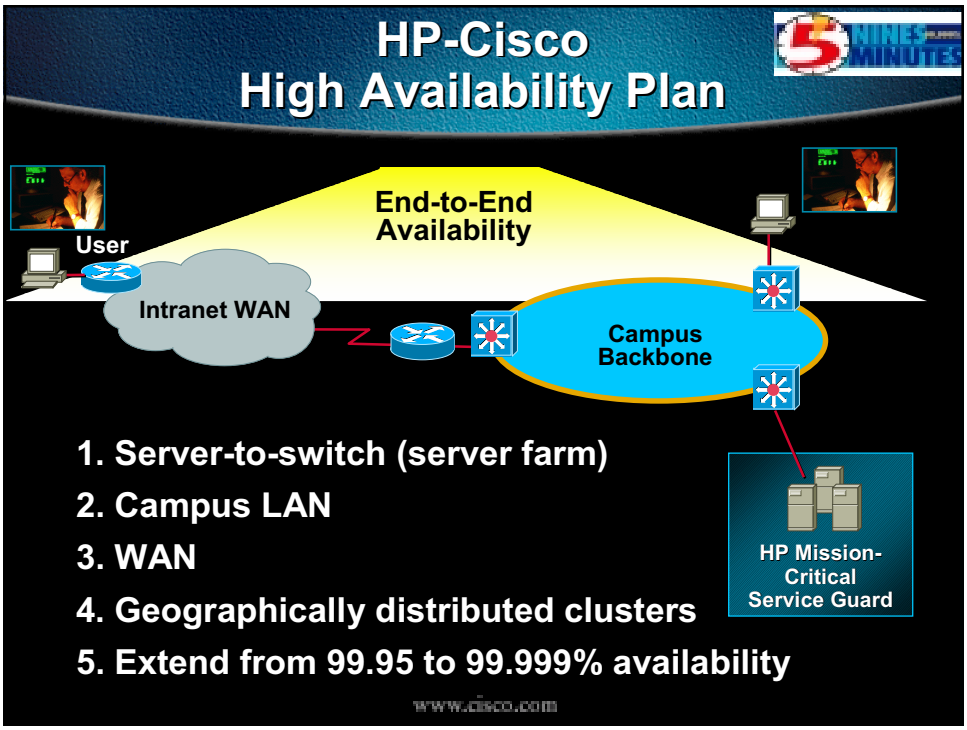

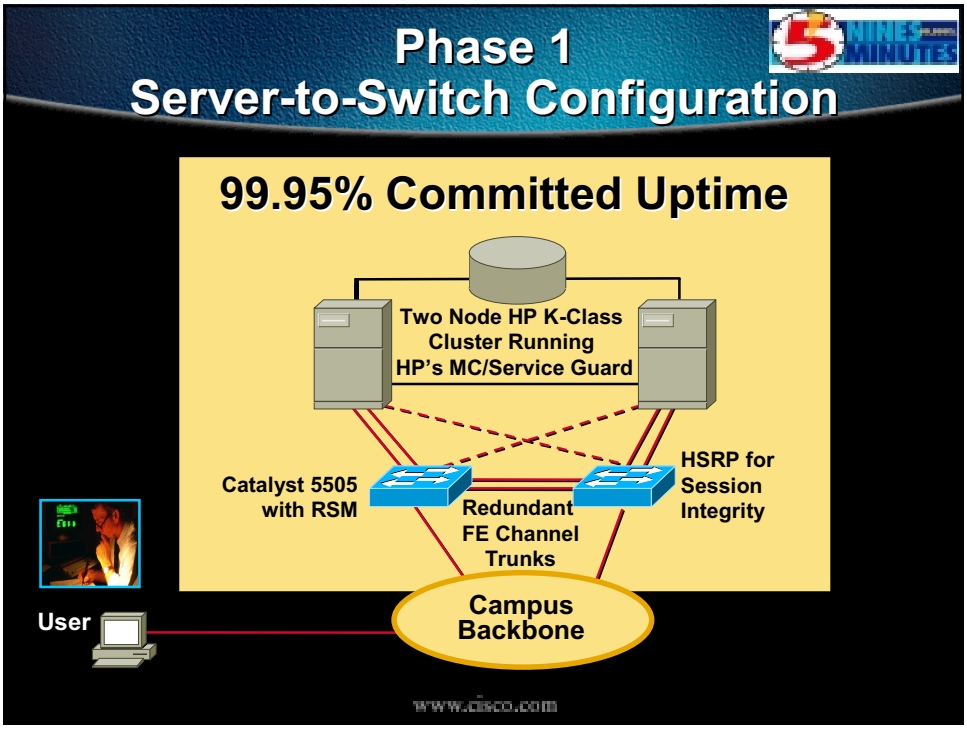

Seven Habits of Keeping Highly Available Networks Available!

- Redundancy and resiliency (know your SPFs)
- Evaluate risk and manage change (what-if analysis, testing and validation)
- Reward proactive process and mgmt improvements
- Assign individual responsibility to key management areas (capacity planning, QoS, change management)
- Service-level definitions and agreements for key network practices, performance, capacity and mgmt
- Fix it fast! (monitoring tools, MTTD, hardware sparing and MTTR)
- Buy only Cisco products :-)

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Related Sessions/Pointers

- Implementing Network Management Best Practices (Session # 804)
- Introduction to Capacity and Performance Management (Session # 609)
- Deploying Campus-Based Protocols (Session # 504)
- Deploying EIGRP/IGRP (Session # 307)
- Deploying OSPF/NLSP/IS-IS (Session # 308)
- Headquarters or Centralized Location (Session # 1402)
- Troubleshooting the Catalyst 5000 Series (Session #506)
- White Paper: http://www.cisco.com/warp/public/779/largeent/learn/technologies/availability.html

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