

Session #2229: Designing Resilient ProLiant Network Connections

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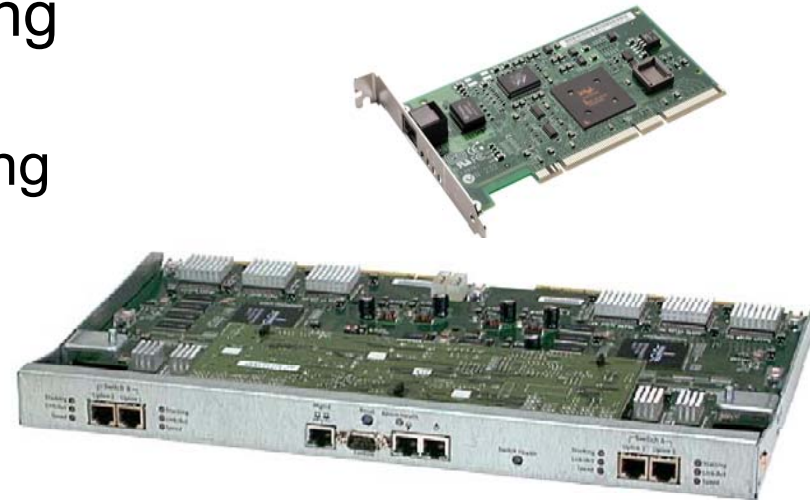
Austin Development Group

Industry Standard Servers



Austin Development Group

- Group Charter: ProLiant Networking
 - ProLiant Network Adapters
 - ProLiant Network Adapter Teaming
 - ProLiant Blade Switches



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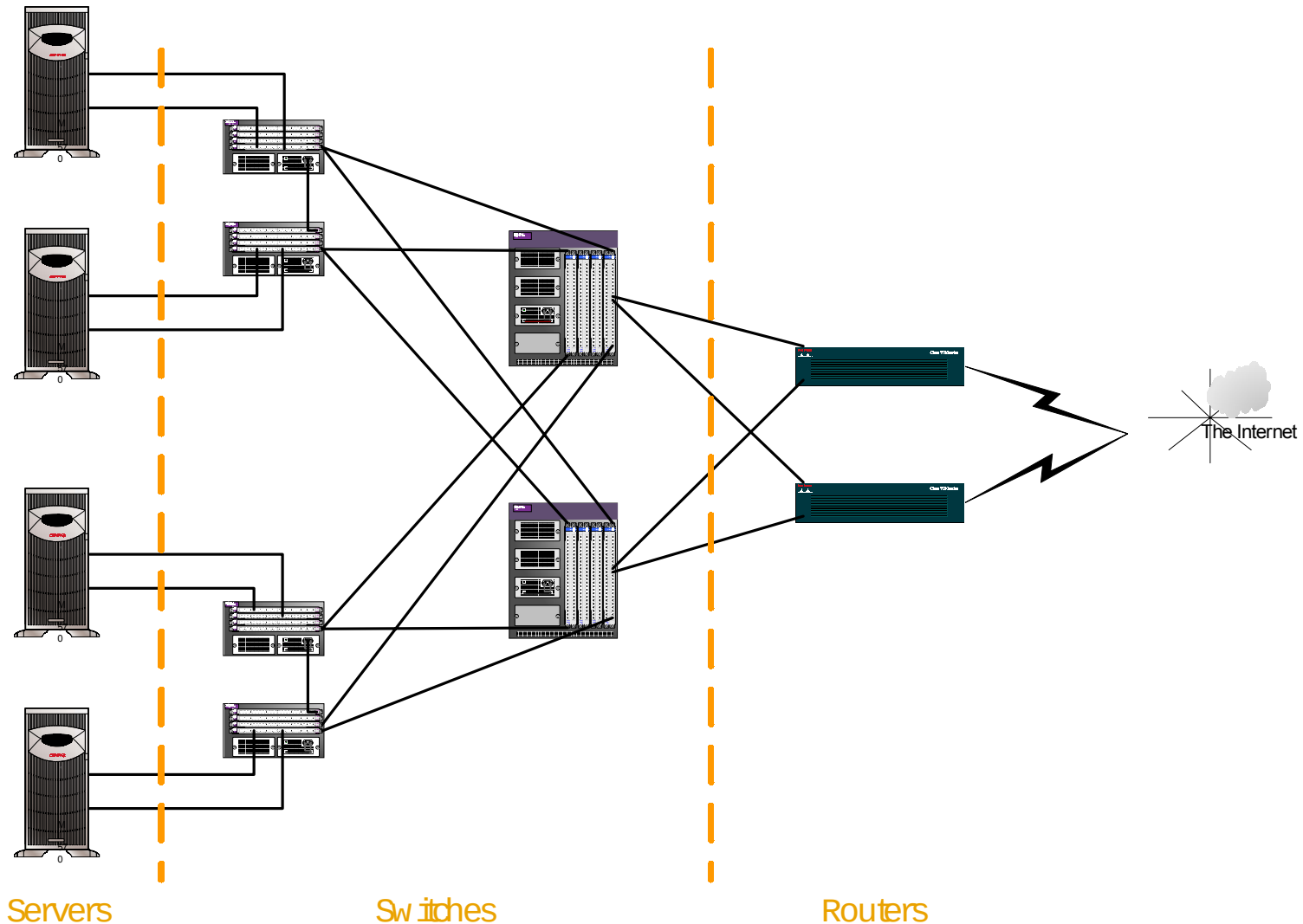
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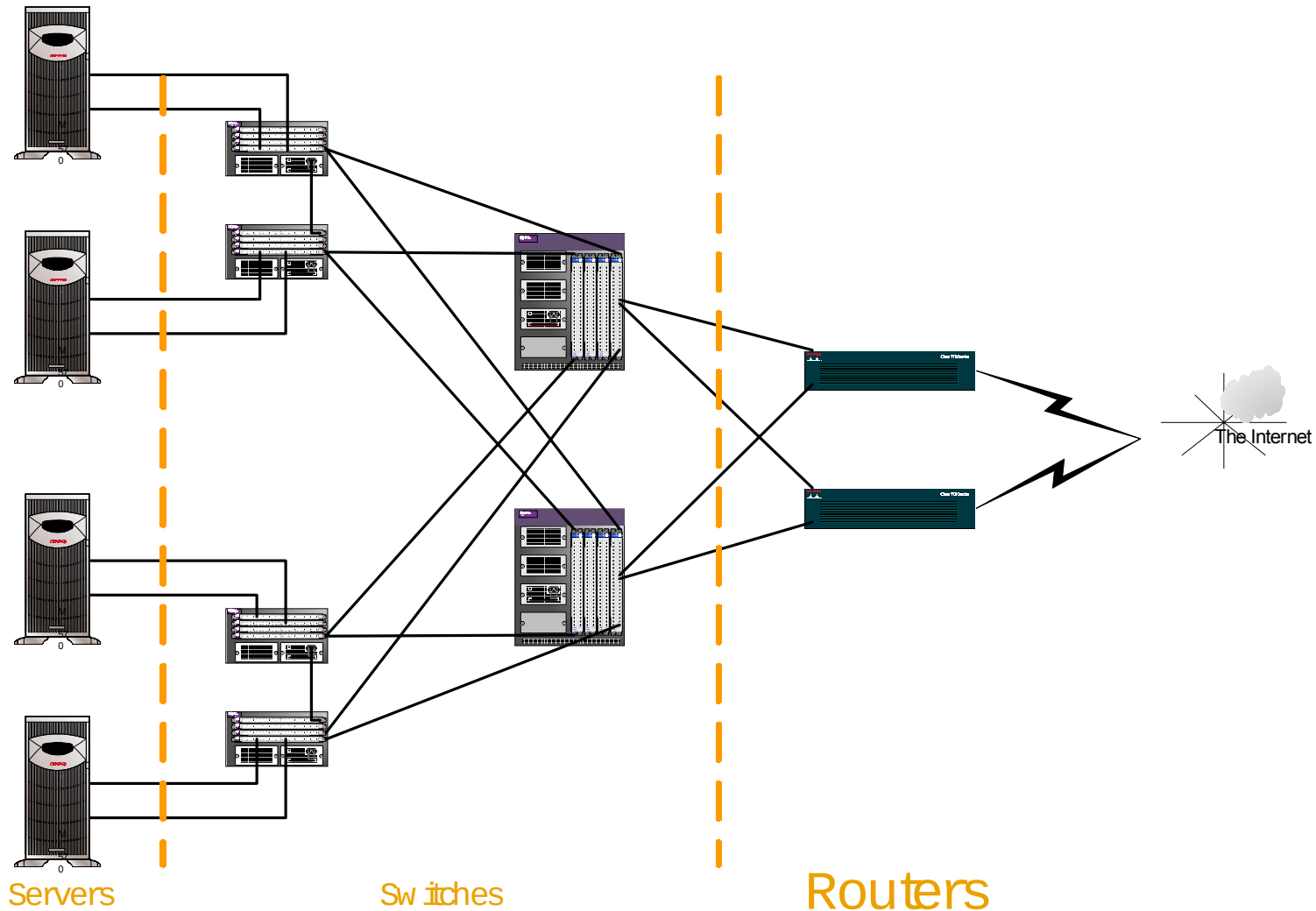
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Network Resilience: The Big Picture



Network Resilience: Routers

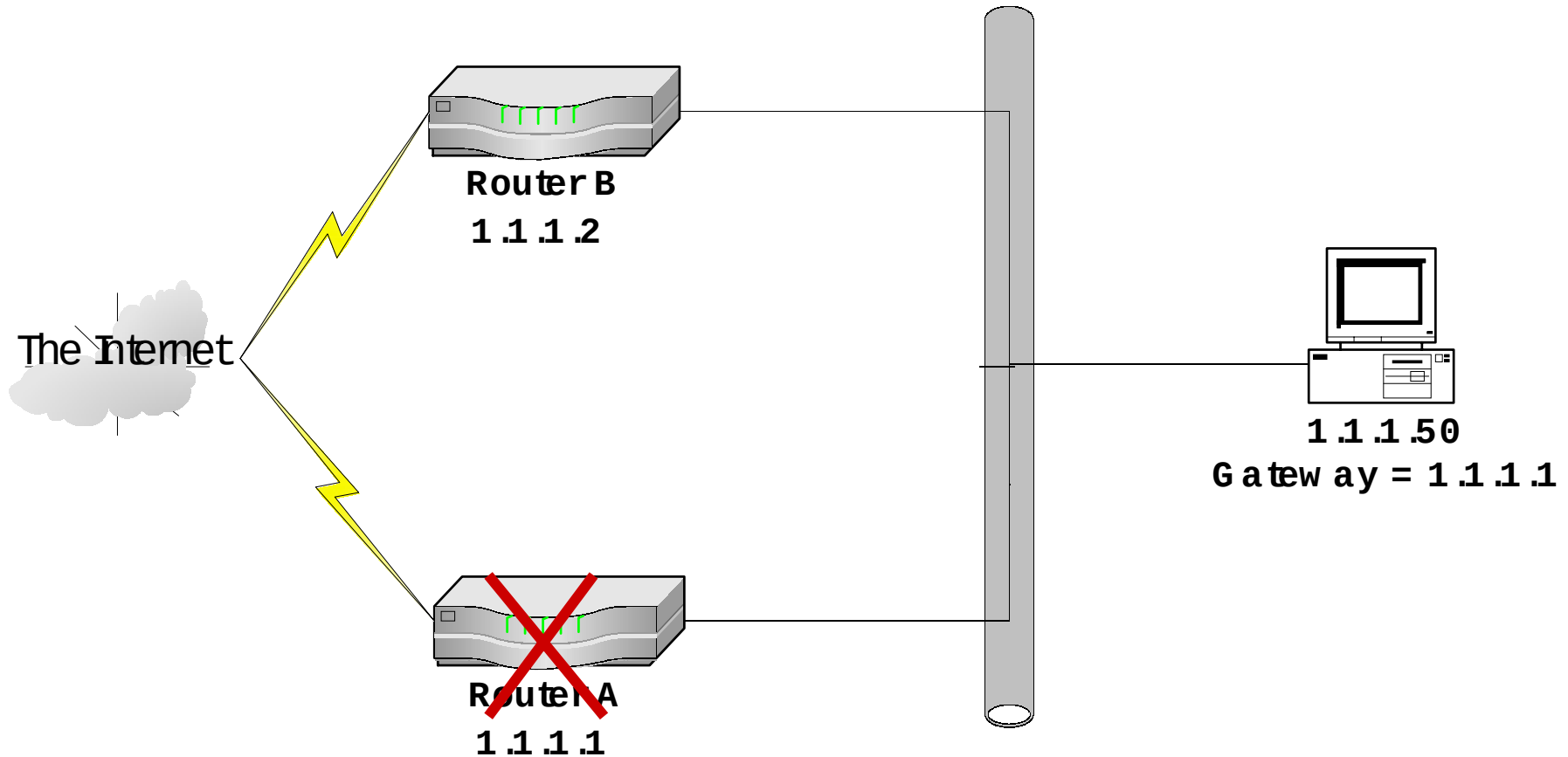


Routers: Resilience Mechanisms

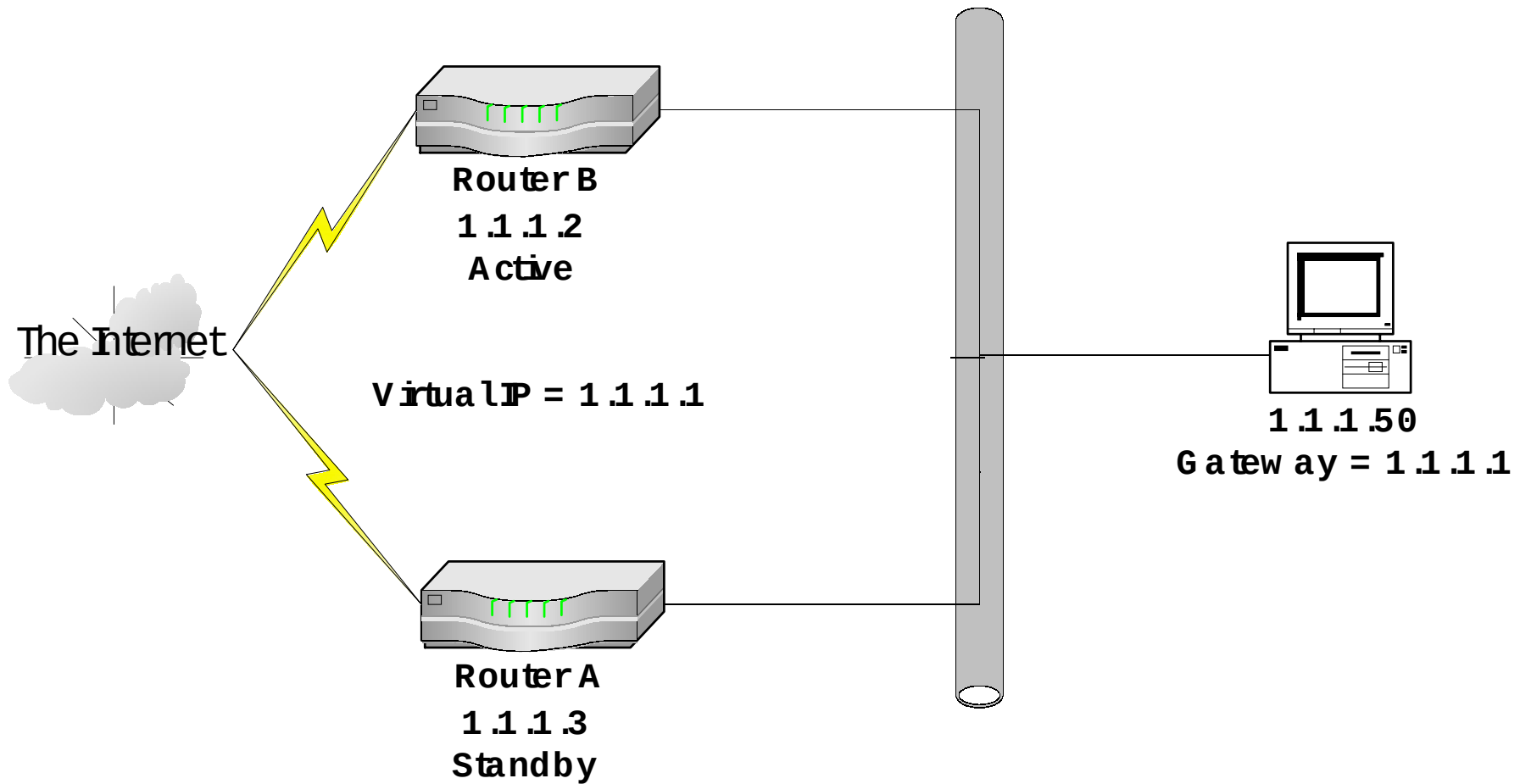
- Redundancy Between Routers
 - Routing Protocols: EIGRP, OSPF, RIP, BGP, etc.

- Redundancy for Access Devices
 - Hot Swap Router Protocol (HSRP - Cisco)
OR
 - Virtual Router Redundancy Protocol (VRRP – RFC 2338)

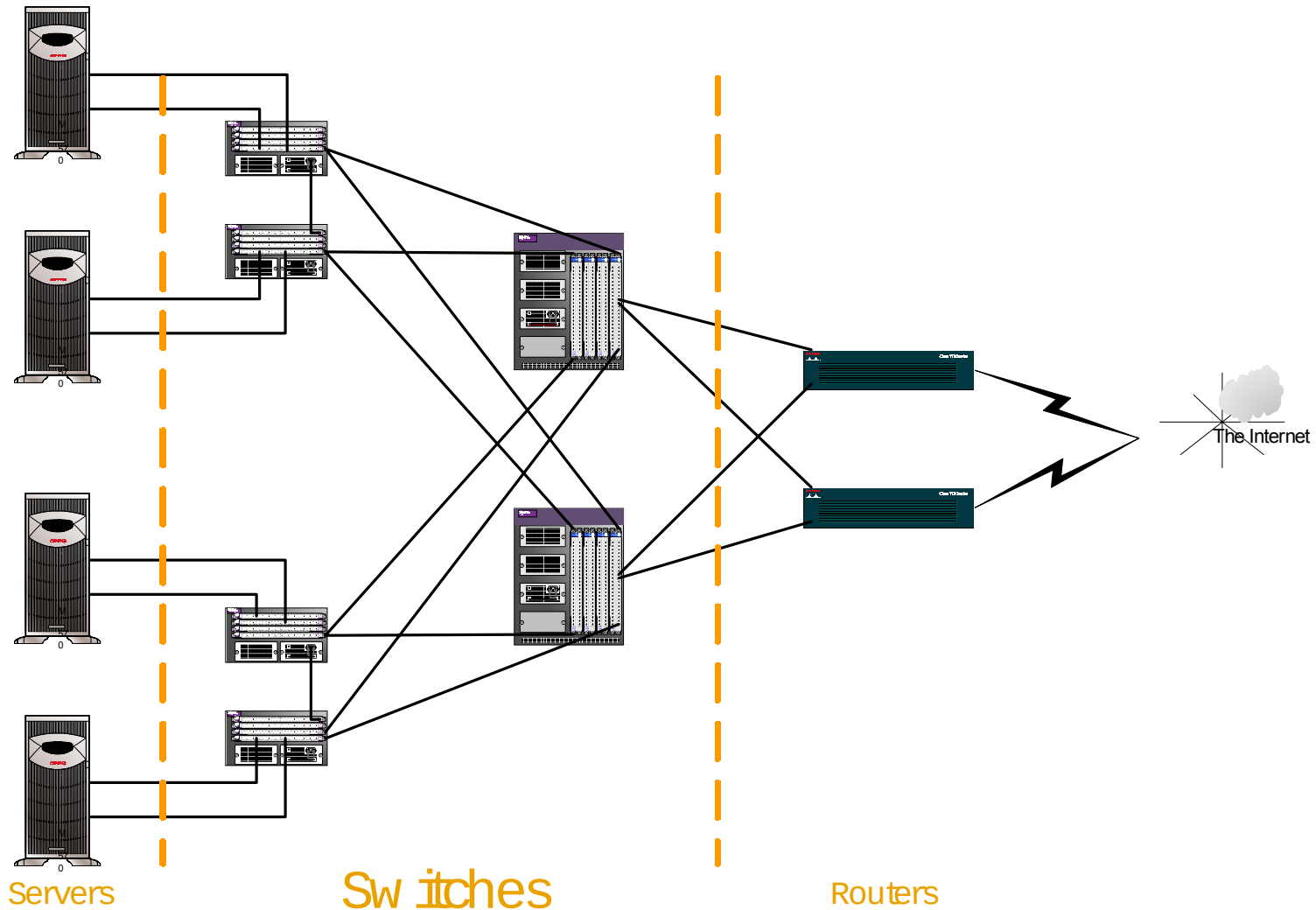
Gateway Redundancy?



HSRP/VRRP



Network Resilience: Switches

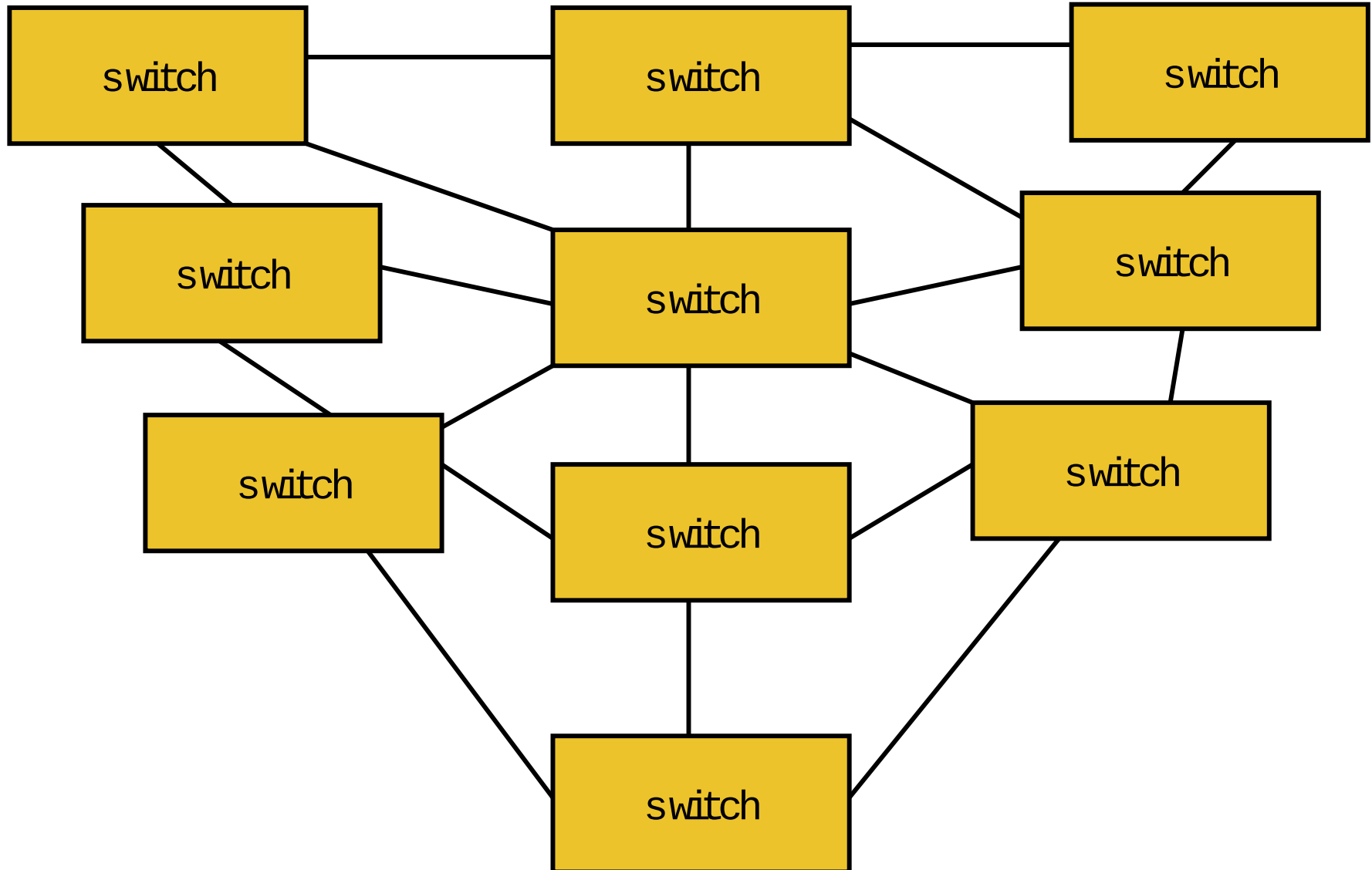


Switches: Resilience Mechanisms

- Hardware Redundancy
 - e.g. Cisco's High Availability feature

- Redundancy Between Switches
 - Uplink Redundancy
 - Port Bonding/Port Trunking
 - Spanning Tree Protocol (STP)

without STP



Spanning Tree (STP)



I think that I shall never see
A graph more lovely than a tree.
A tree whose crucial property
Is loop-free connectivity.
A tree that must be sure to span
So packets can reach every
LAN.

First, the root must be selected
By ID, it is elected.

Least cost paths from root are
traced.

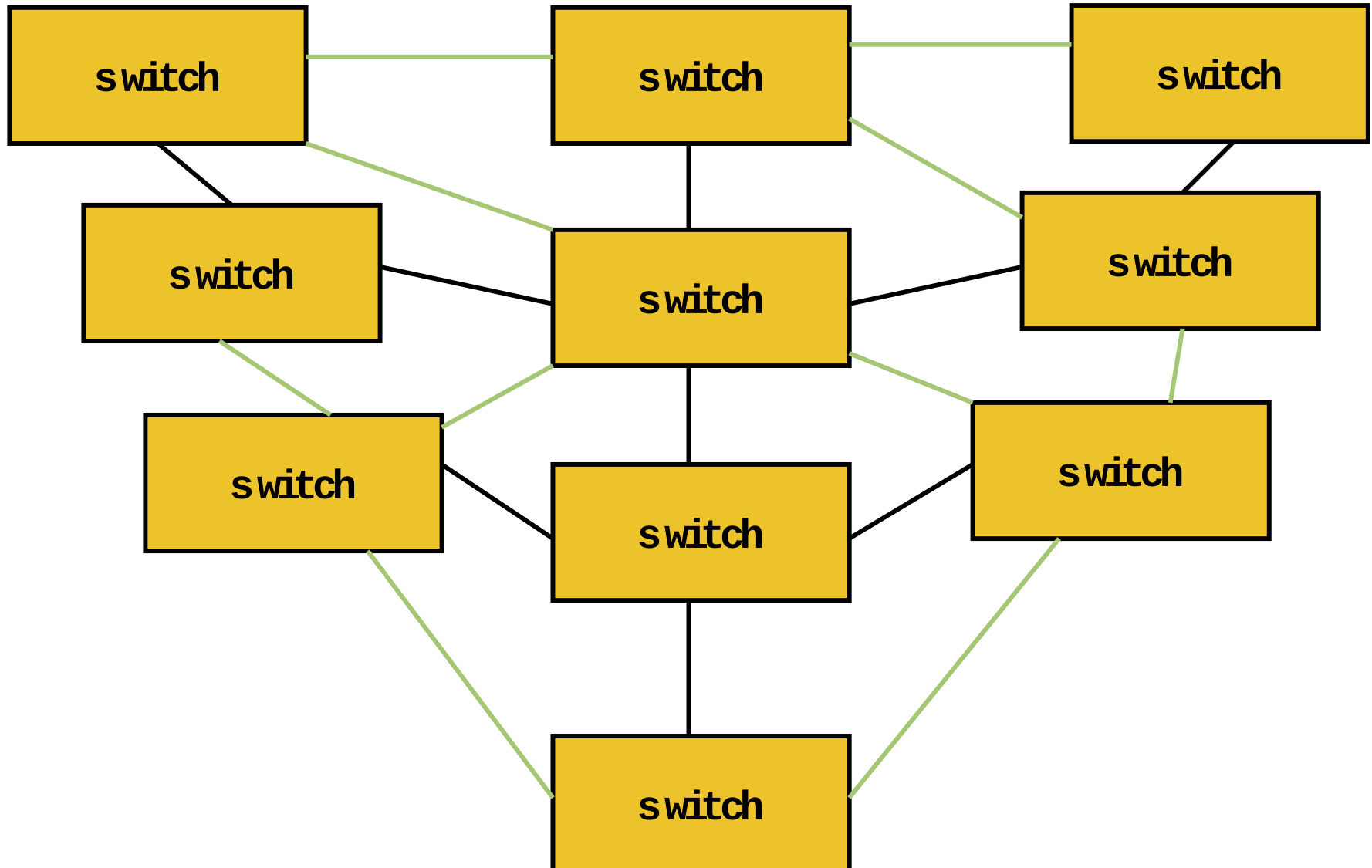
In the tree, these paths are
placed.

A mesh is made by folks like
me,

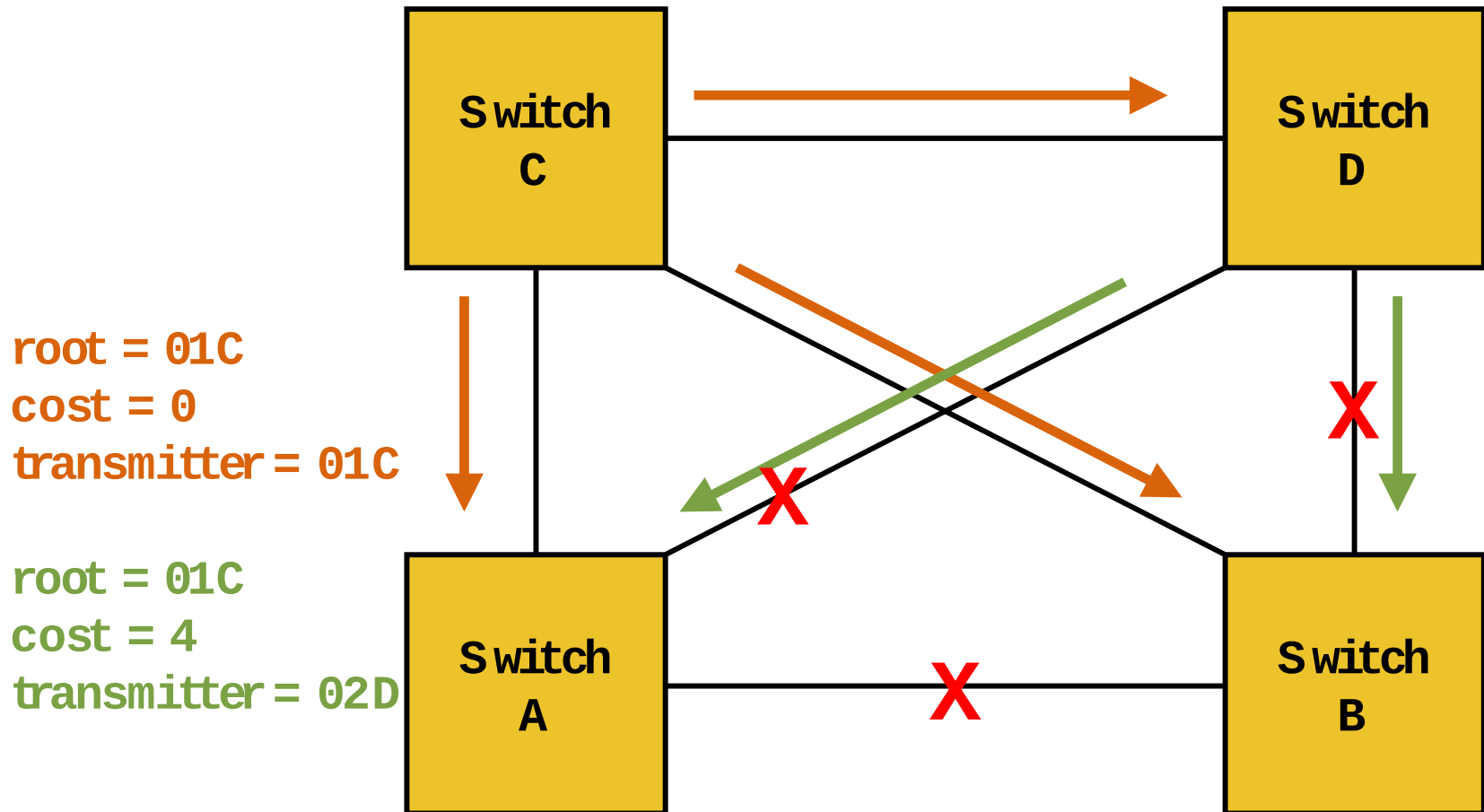
Then bridges find a spanning
tree.

- Radia Perlman

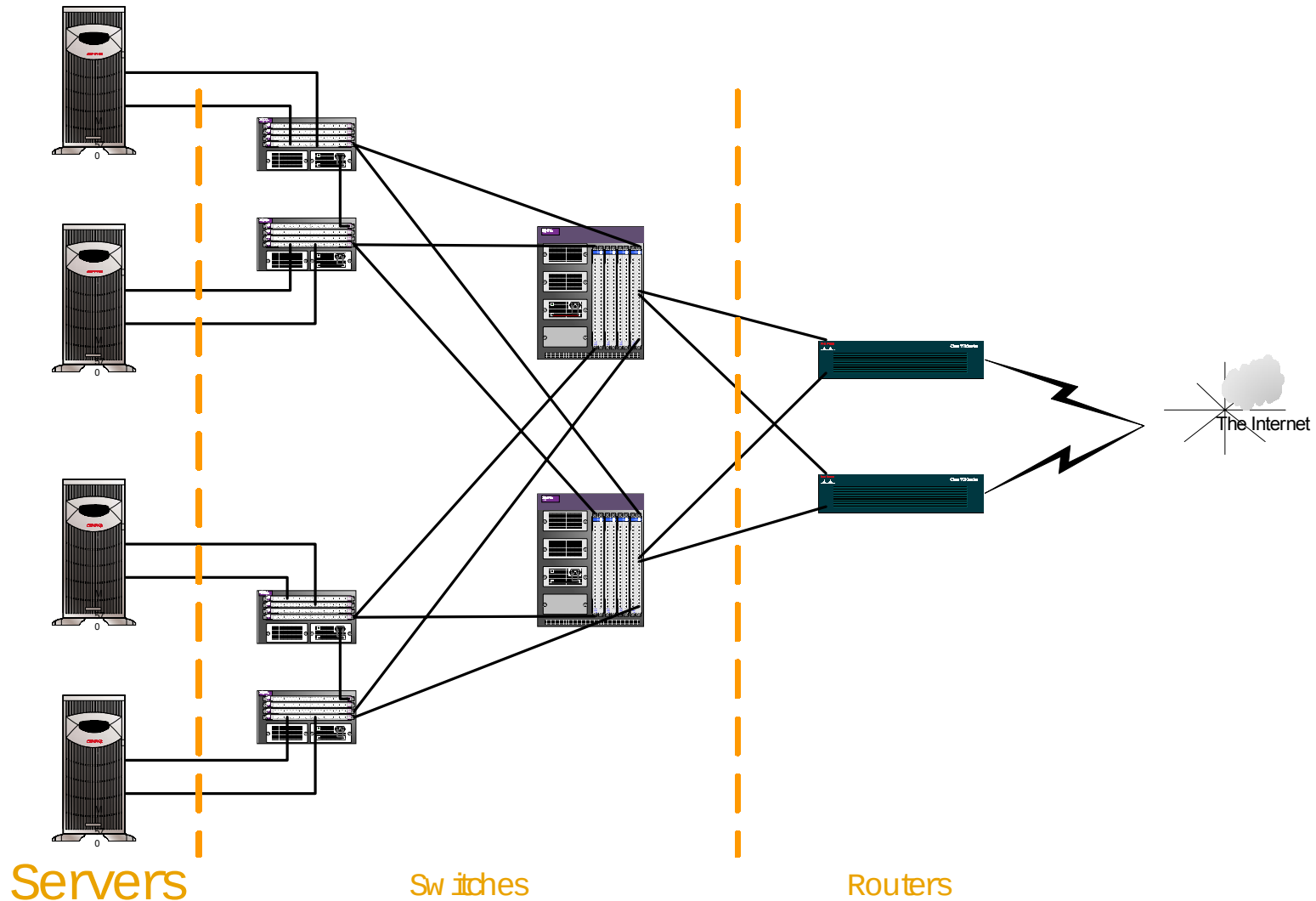
with STP (no loops)



spanning tree protocol (STP)



Network Resilience: Servers



Servers: Resilience Mechanisms

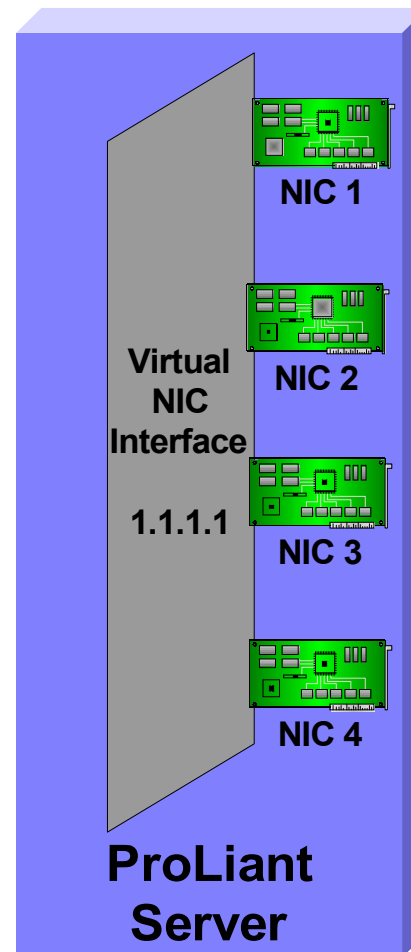
- Clustering
 - e.g Microsoft Network Load Balancing
- Dual Homing
 - Must use multiple IP addresses
- Routing Protocols
 - OSPF, RIP, etc.
- Network Adapter Redundancy
 - Hot Plug (Add/Remove/Replace)
 - Network Adapter Teaming

HP Network Adapter Teaming Technology

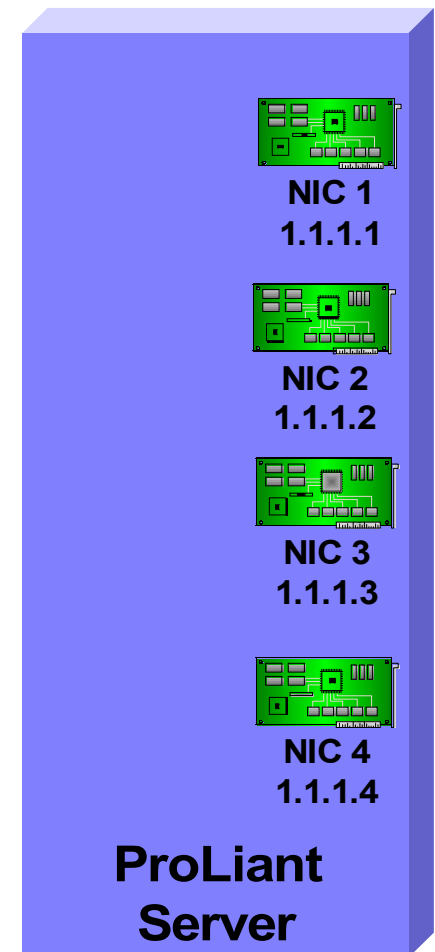
Goal:

“To create a Virtual Network Adapter (NIC) consisting of multiple physical NIC ports to provide fault tolerance and load balancing capabilities”

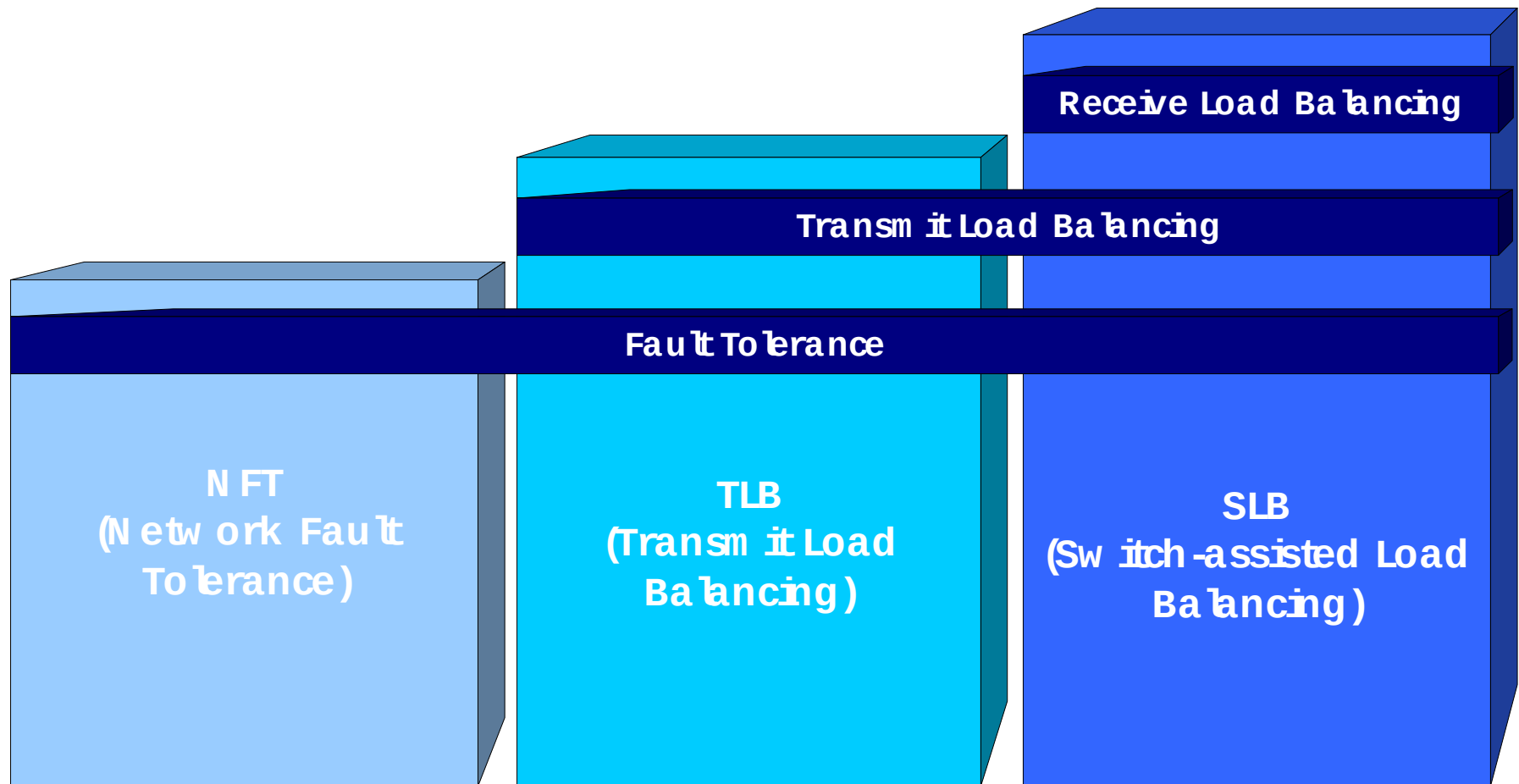
With Teaming



Without Teaming



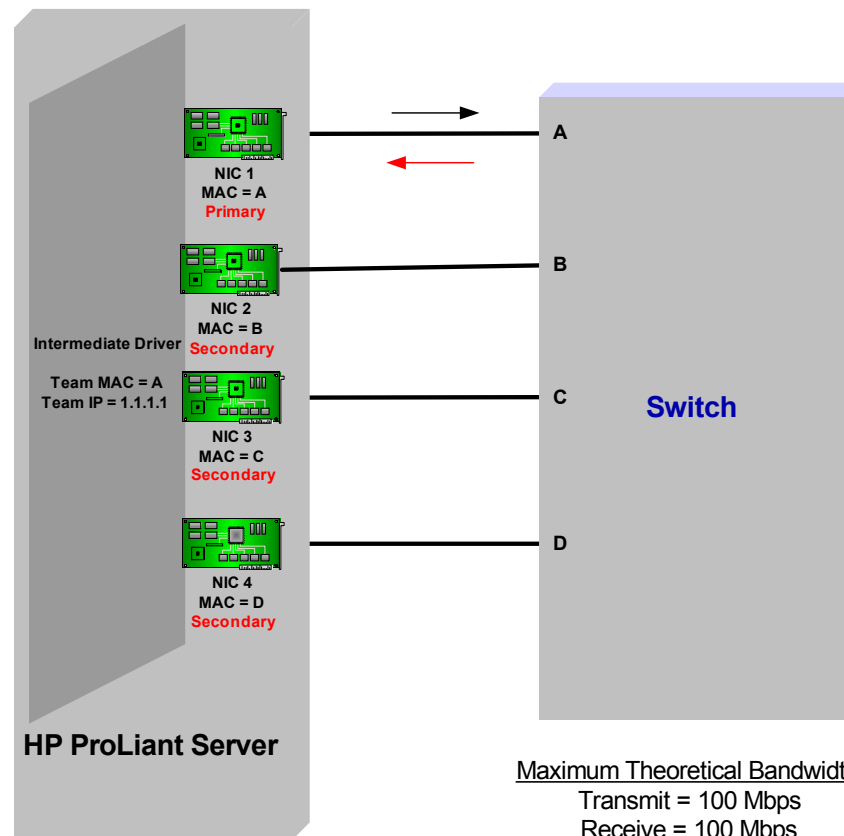
Network Adapter Teaming: Three Modes



NFT: Network Fault Tolerance

- Simple redundancy
- Two to eight adapters in a fault tolerant team
- One adapter is defined as the primary
 - Only the primary adapter transmits and receives
 - May have a preferred primary
 - All others are secondary and in standby mode
- Any speed, any media
- Team can be split across switches
 - But they must be on the same broadcast domain
- Can be configured to carry multiple VLANs

NFT: Network Fault Tolerance



TLB: Transmit Load Balancing

- Two to eight adapters in a team
 - All other adapters (non-Primary) transmit only
- Primary adapter transmits and receives
- Must support a common speed
- Team can be split across switches
 - But they must be on the same broadcast domain
- Can be configured to carry multiple VLANs

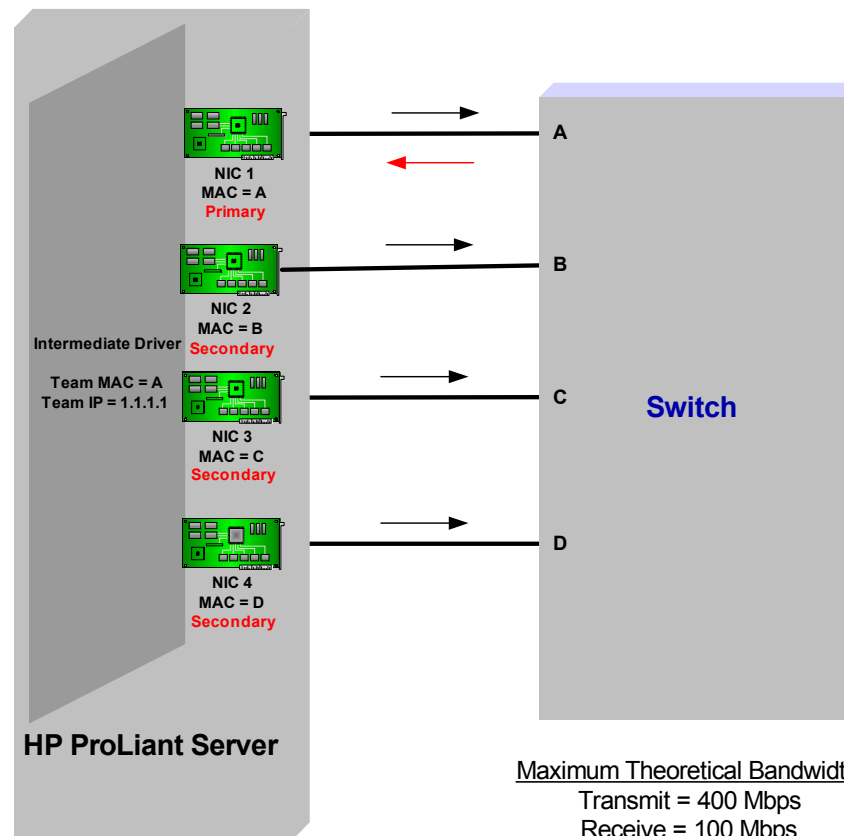
Example:

TLB Team of 4 Fast Ethernet NICs

Transmit Throughput = 400Mb

Receive Throughput = 100Mb

TLB: Transmit Load Balancing



SLB: Switch-assisted Load Balancing

- a.k.a Port Trunking
- Two to eight adapters in a team
- All adapters transmit & receive
 - Same speed, same media
- Must be used with an intelligent switch that supports port bonding (e.g. 802.3ad, EtherChannel, etc.)
- All ports must be part of the same switch port trunk/etherchannel group
- Can be configured to carry multiple VLANs

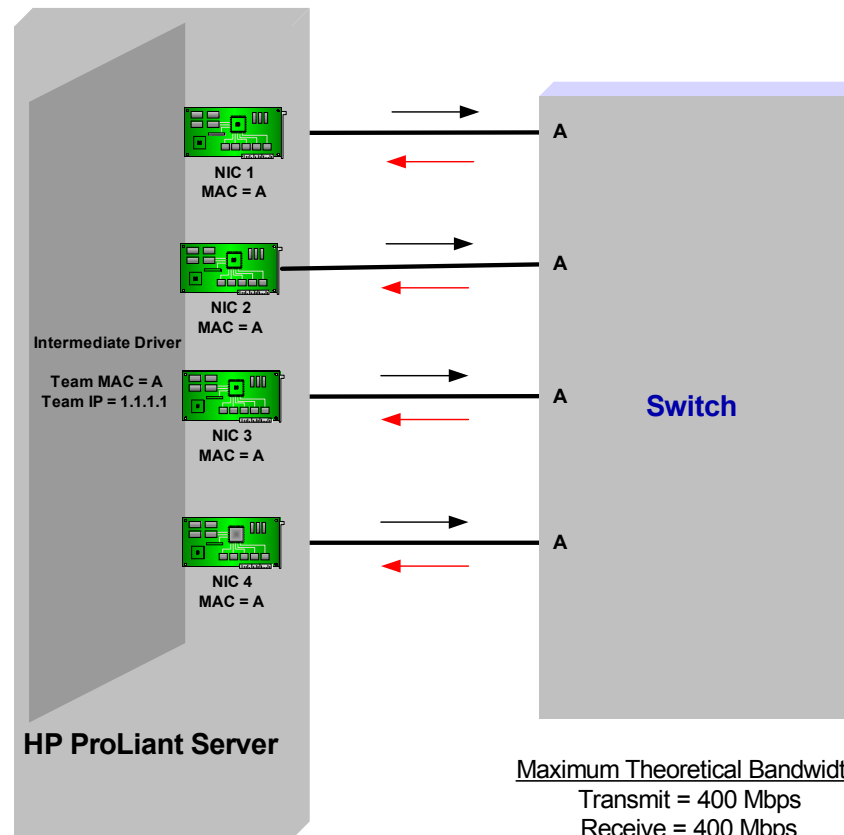
Example:

SLB Team of 4 Fast Ethernet NICs

Transmit Throughput = 400Mb

Receive Throughput = 400Mb

SLB: Switch-assisted Load Balancing



Teaming Mode Comparison Table

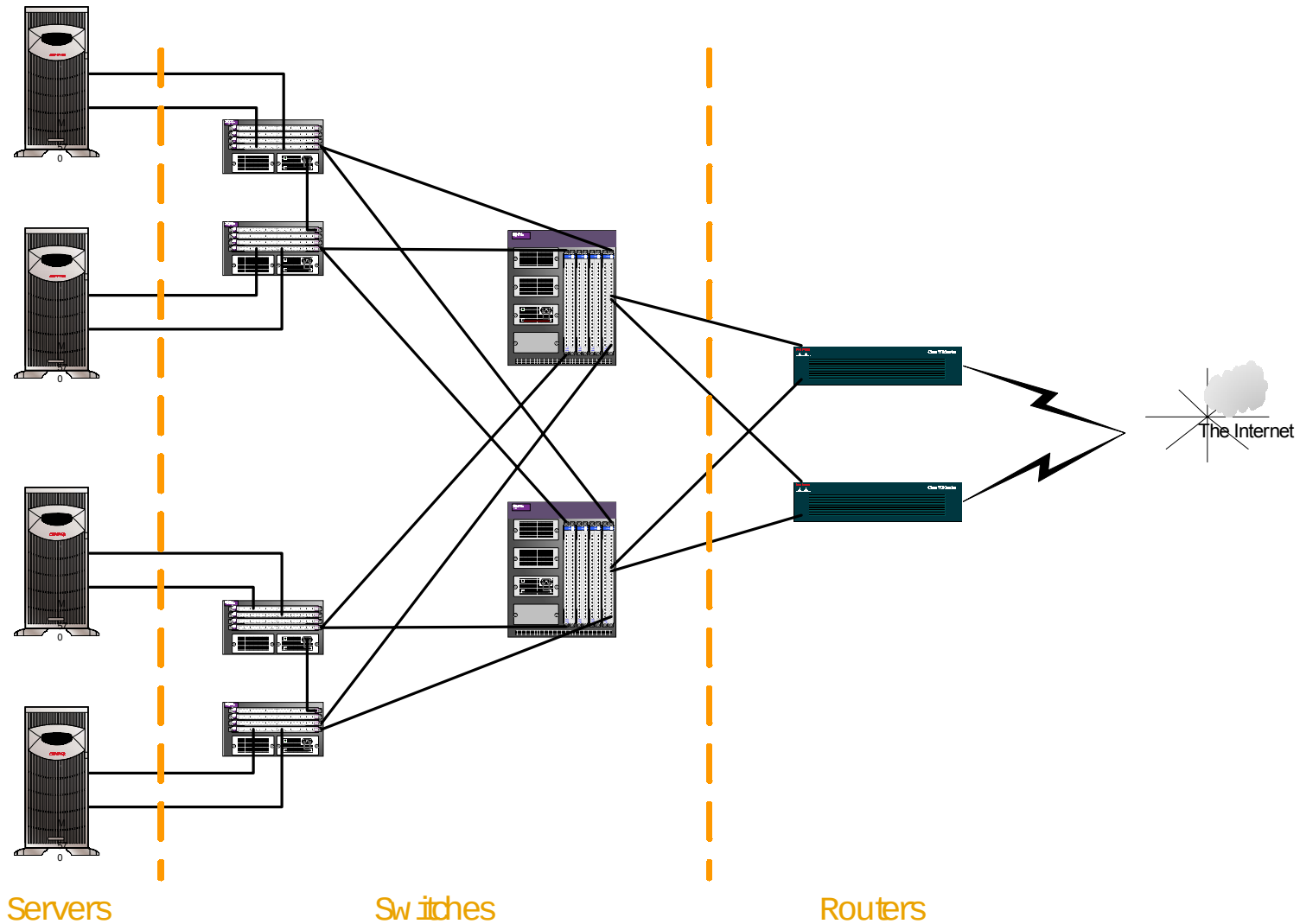
	NFT	TLB	SLB
Number of NICs supported per Team	2-8	2-8	2-8
Supports network adapter Fault Tolerance	X	X	X
Supports Transmit Load Balancing		X	X
Supports Receive Load Balancing			X
Requires a switch that supports the feature			X
Can connect a single Team to more than one switch for switch fault tolerance	X	X	Depends on Switch
All NICs must support a common speed		X	X
Can Team NICs of different media	X	X	X

Teaming Mode Comparison

Table Cont.

	NFT	TLB	SLB
Maximum theoretical transmit/receive throughput (in Mbps) with maximum number of 100 Mbps adapters	100/ 100	800/ 100	800/ 800
Maximum theoretical transmit/receive throughput (in Mbps) with maximum number of 1000 Mbps adapters	1000/1 000	8000/1 000	8000/ 8000
Load Balances TCP/IP Traffic	X	X	X
Load Balances non-IP Traffic			X
All NICs transmit using same MAC address			X
All NICs use the same IP address on the network	X	X	X

Network Resilience: The Big Picture



Whitepapers and References

- HP Network Adapter Teaming Technology
 - <http://h18000.www1.hp.com/products/servers/networking/whitepapers.html>

- Network-Level Redundancy/Resilience For High-Availability Campus LANs
 - <http://www.cisco.com/warp/public/779/largeent/learn/technologies/campuslan.pdf>

- Network Adapter and Teaming Drivers
 - <http://h18007.www1.hp.com/support/files/networking/nics/index.html>

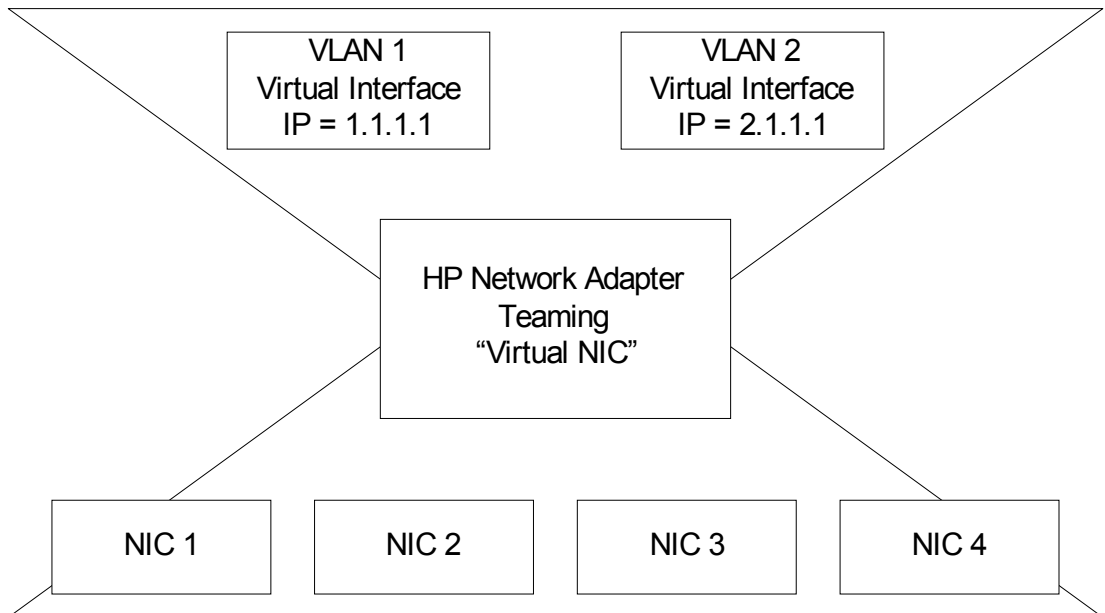


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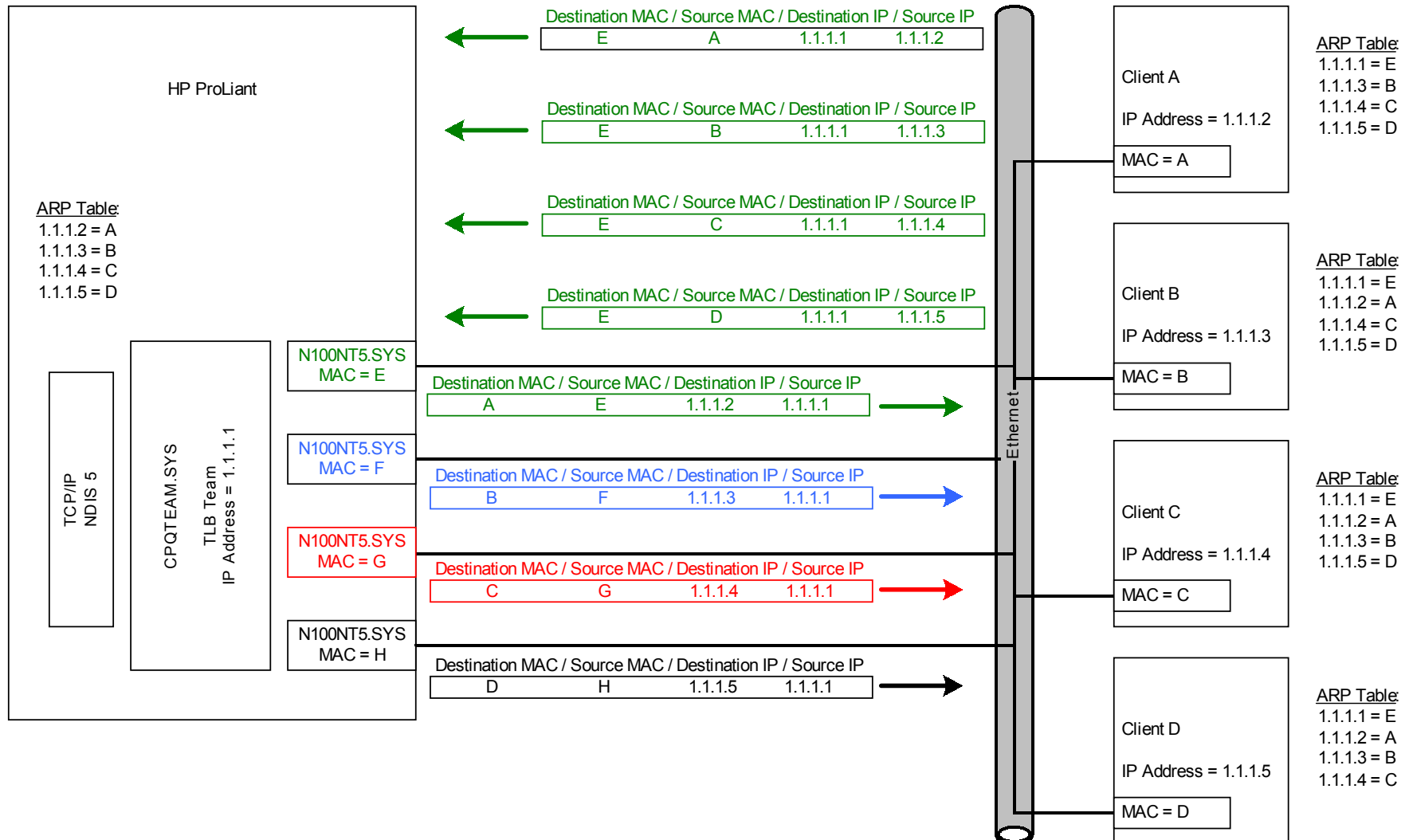
Backup Slides

HP Network Adapter Teaming & VLANs

- Allows a Team to operate on more than one broadcast domain
- Uses 802.1Q Tagging
- Requires the switch to be configured appropriately
- Works the same as VLANs on a single NIC except with NIC redundancy and load balancing



Overview of Server Communication Using TLB



Overview of Server Communication Using SLB

