

Automatic Cut-Through Paths

System and Network Engineering
Research Project 2
Class 2005 - 2006

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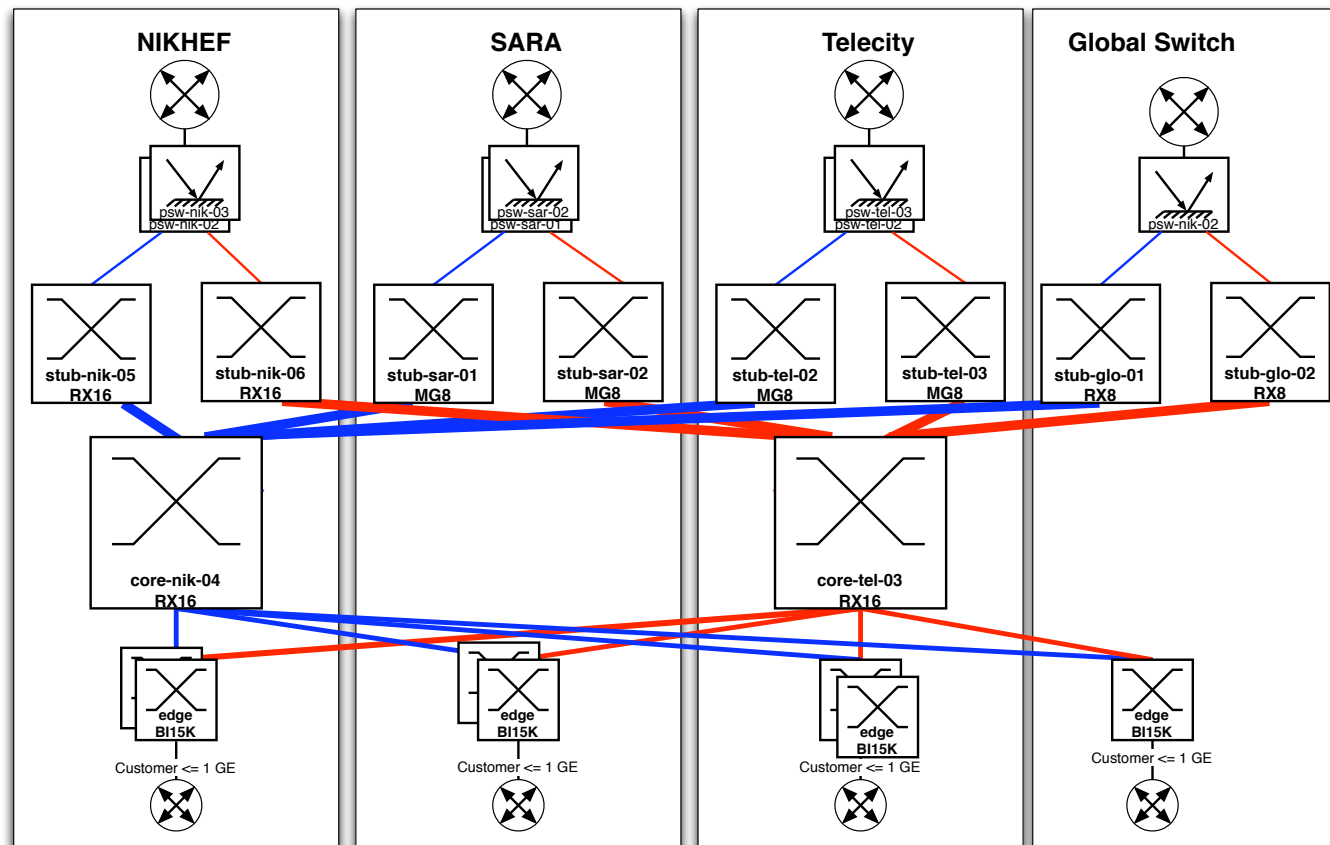


Agenda



- ▶ AMS-IX network
- ▶ Problem definition
- ▶ Cut-through path
- ▶ RBridges
- ▶ Additional solution
- ▶ Conclusion

AMS-IX network (1)



AMS-IX network (2)

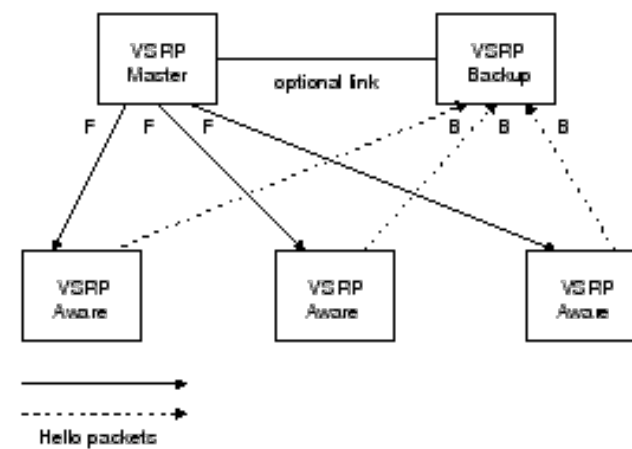
▶ VLANs

- Internet, multicast...

- Quarantine

▶ Virtual Switch Redundancy Protocol

- Foundry Networks proprietary



AMS-IX network (3)



▶ Customer statistics

- Number of customers: 240
- Number of routers: 390

▶ Traffic statistics

- Average load: 90 Gb/s
- Peak load: 150 Gb/s

Problem definition (1)

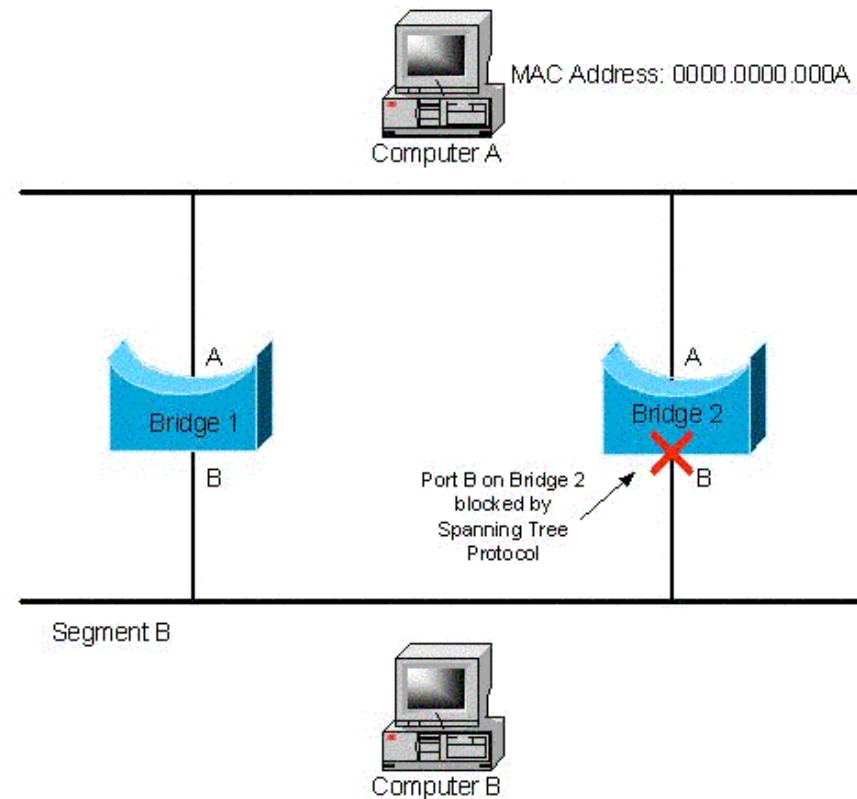
▶ Cut-through switching

▶ Layer two network

- Loops

- Broadcast

- Spanning tree



Avoidance of Network Loops

Problem definition (2)

▶ Management

- Thresholds
- Sampling
- Computation
- Configuration

Cut-through path (1)

► Why

- Lessen load on core switches
- Lessen traffic congestion
- Involves less jitter
- More bandwidth capacity
- More efficient traffic streams

Cut-through path (2)

► How

- Sampling process
- Filtering process
- Trigger
- Control server architecture

sFlow (1)

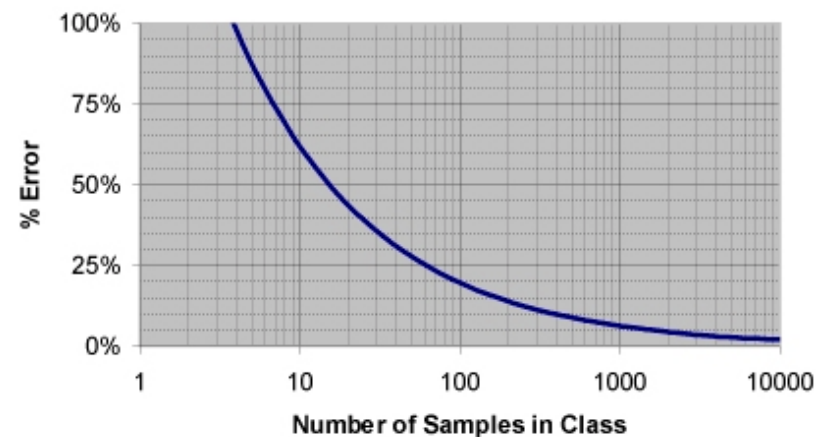
► What

- Packet-based sampling technology
- From layers two till seven
- Provide information about switch ports, MAC addresses, VLANs, IP addresses and ICMP/TCP/UDP/AS-based information

sFlow (2)

► Why

- Supported by the Foundry switches
- Inspecting all packets costs extensive CPU power
- Can handle volume of high speed backbone links
- Provides a result with quantifiable accuracy



Resource information

▶ SNMP

- Data transfer
- CPU utilization, memory utilization
- CAM statistics and process utilization
- Logging

Sampling process

▶ When

- A load of more than 90% for 30 minutes on a certain switch port
- A constant data flow of more than 4 Gb/s for 30 minutes on a certain switch port
- Determine the exact values after further research

Filtering process (1)

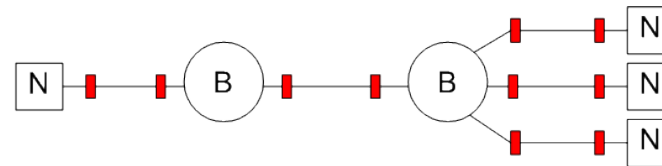
► How

- Starts when first sFlow data from a switch is collected

SSwitch	DSwitch	VLAN	SPort	DPort	SMAC	DMAC	Count	Priority	STime	TTL
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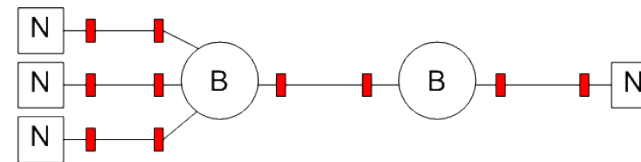
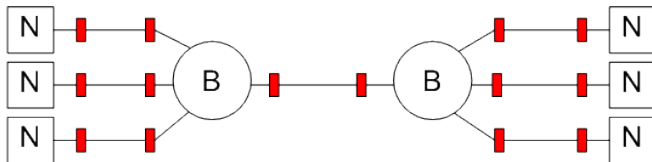
Filtering process (2)

- ▶ Sort flows based on priority and packet count
 - Per DSwitch, than per SPort & SSwitch and than per VLAN
 - “Priority & packet count” must reach threshold before the TTL ends, (decisions taken after TTL period)



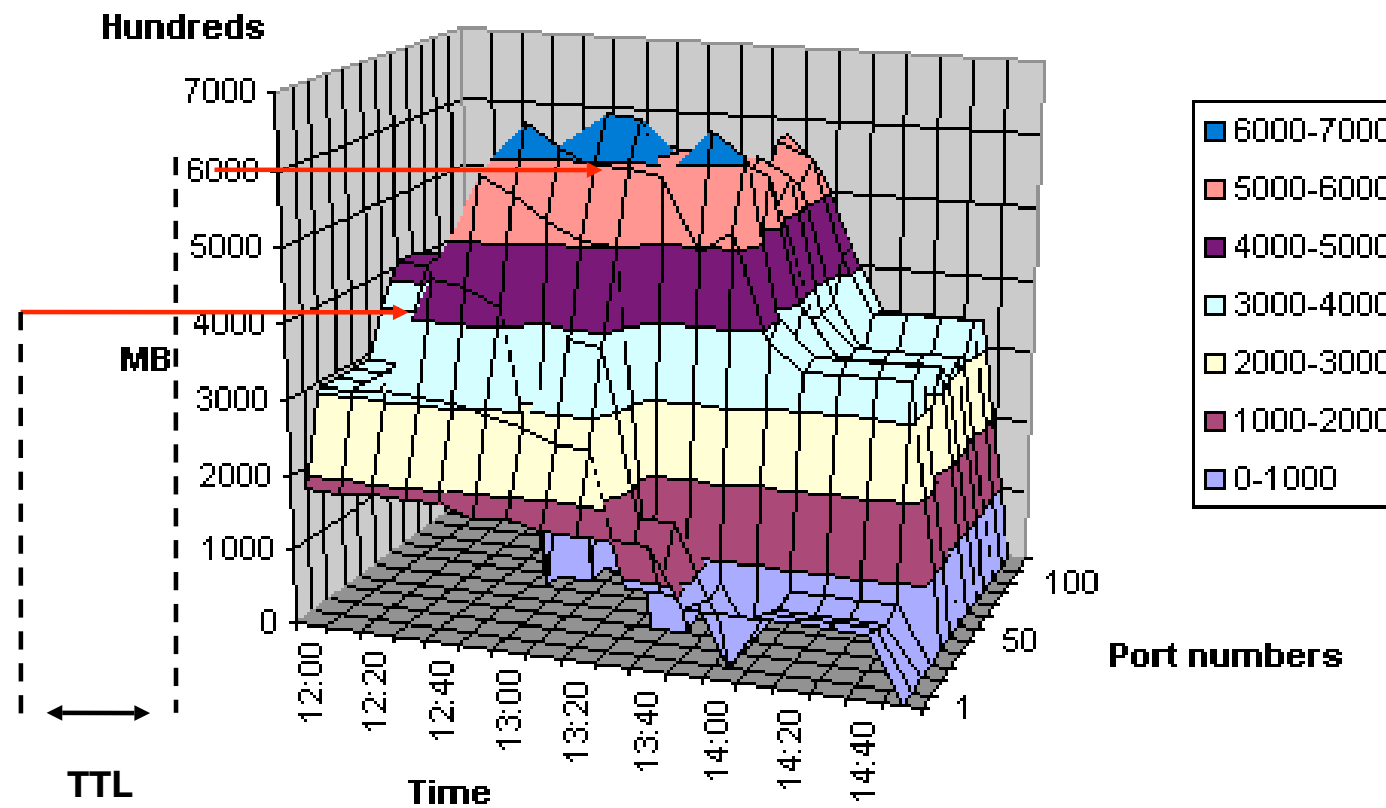
Filtering process (3)

- ▶ Combine the total flows per SPorts from the SSwitch
 - Calculate average



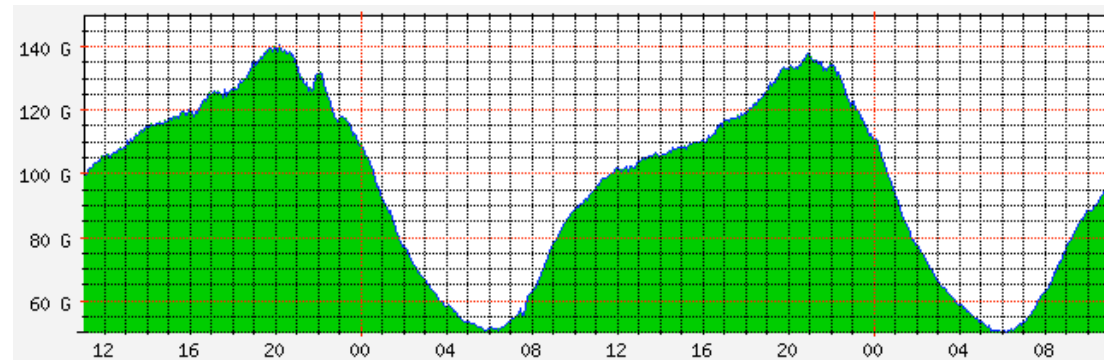
Filtering process (4)

► Example:



Bandwidth prediction

- ▶ Traffic cycle



- ▶ Several algorithms for bandwidth prediction

- ▶ Forecast traffic flows with long lifetime

- Use for setting priority

Cut-through creation (1)

▶ How (1)

- Huge amount of traffic is flowing between two customers
- Flow triggers cut-through path creation
- Create a new VLAN
- Photonic switch connects two edges

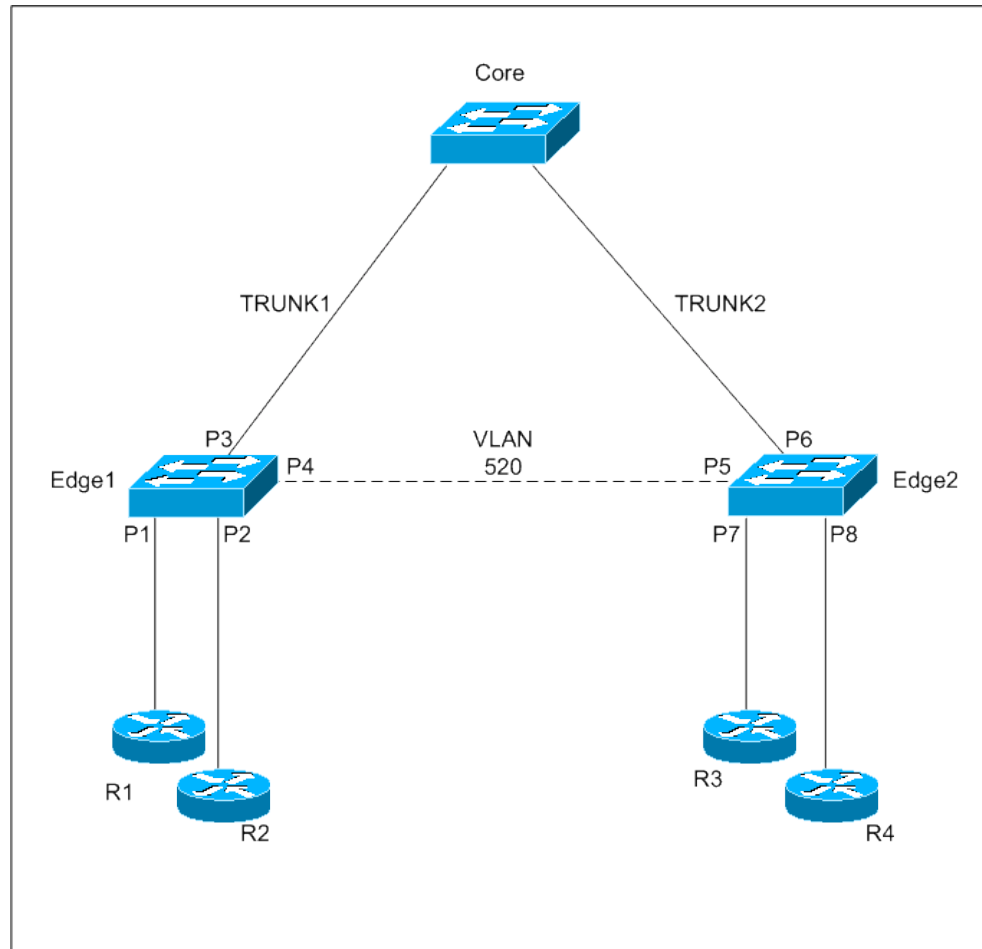
Cut-through creation (2)

▶ How (2)

- Create MAC filter based on destination MAC addresses
- Configure an egress filter on switch port
 - Encapsulate Internet VLAN tagged frames with the new VLAN tag
 - 802.1ad (Provider Bridges)

Cut-through creation (3)

► How (3)



Control server architecture (1)



► Why

- To collect data
- Consider the priorities
- Makes calculations
- Automatically configures a dynamic cut-through path
- To manage all resources

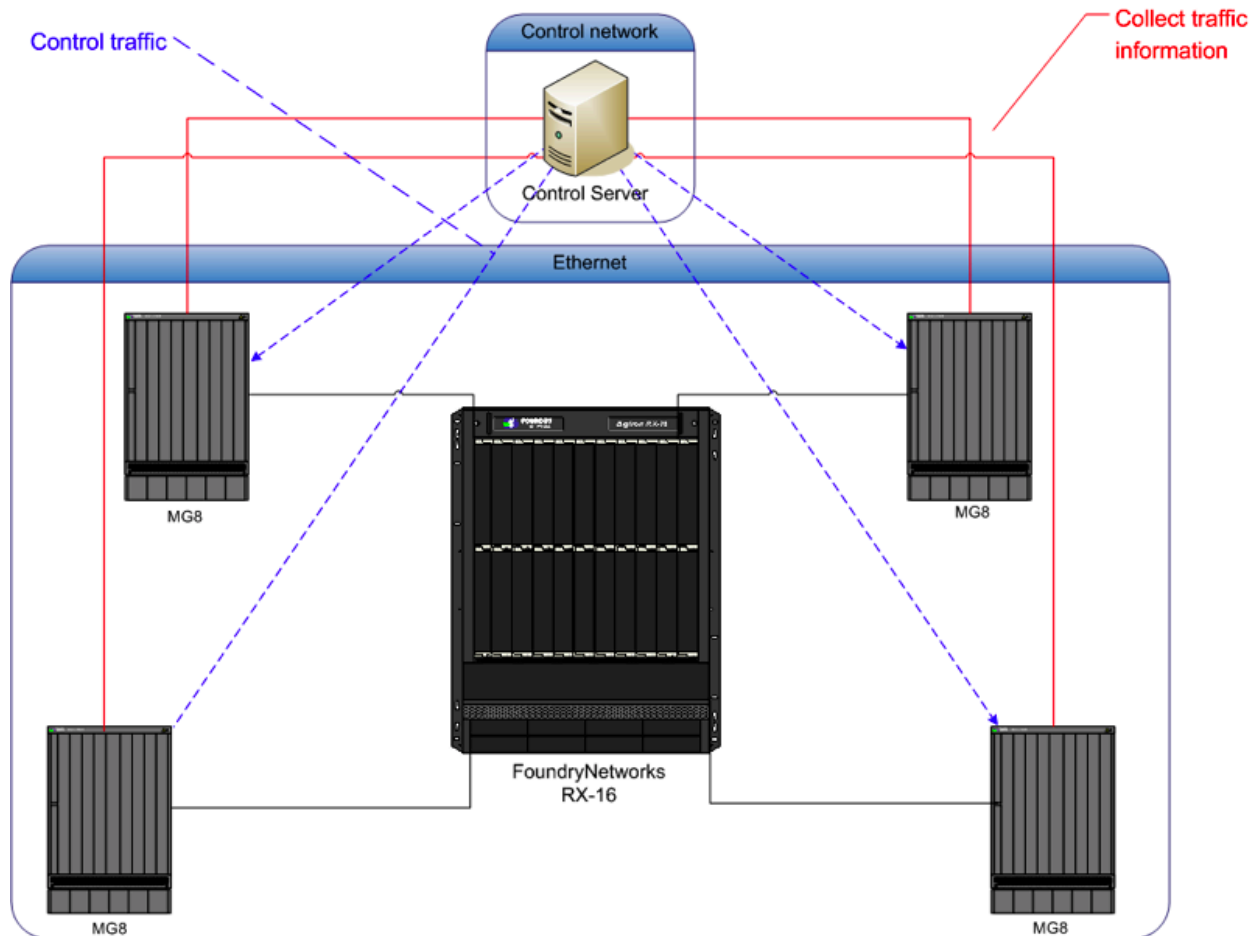
Control server architecture (2)



► How

- Separate networks, one private
- Control process must be physically separated from the filtering process
- Validate all configuration steps (roll back)
- Control server should be redundantly for failover in the event of a system failure

Control server architecture (3)



RBridges (1)

- ▶ Transparent Interconnection of Lots of Links (TRILL)

- ▶ Problems

- Inefficient paths
- Convergence
- Backup paths
- Ethernet extensions

- ▶ Required properties

- Services
- Loop mitigation
- VLAN
- Security

RBridges (2)

- ▶ Advantages of routers and bridges
- ▶ “Routing” on layer two
- ▶ Full mesh possible
- ▶ Ethernet frame encapsulation
- ▶ Hardware or firmware
- ▶ Approximately 2 years

RBridges (3)

- ▶ General operations
 - Peer and topology discovery
 - Designated RBridge election
 - Ingress RBridge Tree computation
 - Link-state routing
 - Advertisements

RBridges (4)

▶ Ingress / Egress RBridge

- Encapsulation
- Decapsulation

outer header			shim header		original frame
DestAddr RBr.	SrcAddr RBr.	Prot. type	TTL	egress/ingress RBr.	original frame

RBridges (5)

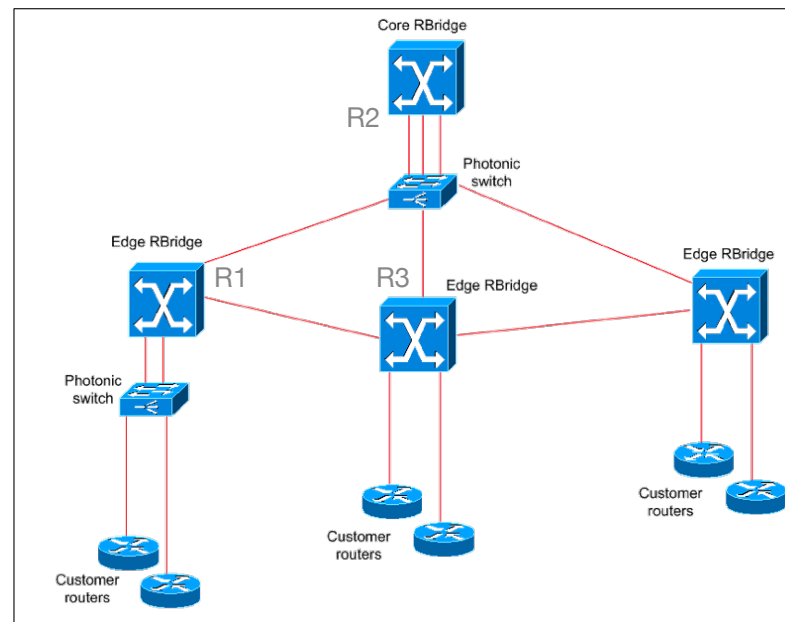
▶ Hop-by-hop vs. edge-by-edge

- Different headers

▶ Forwarding

- Unicast
- Broadcast
- Multicast

outer header			shim header		original frame
DestAddr RBr.	SrcAddr RBr.	Prot. type	TTL	egress/ingress RBr.	original frame



Additional solution (1)

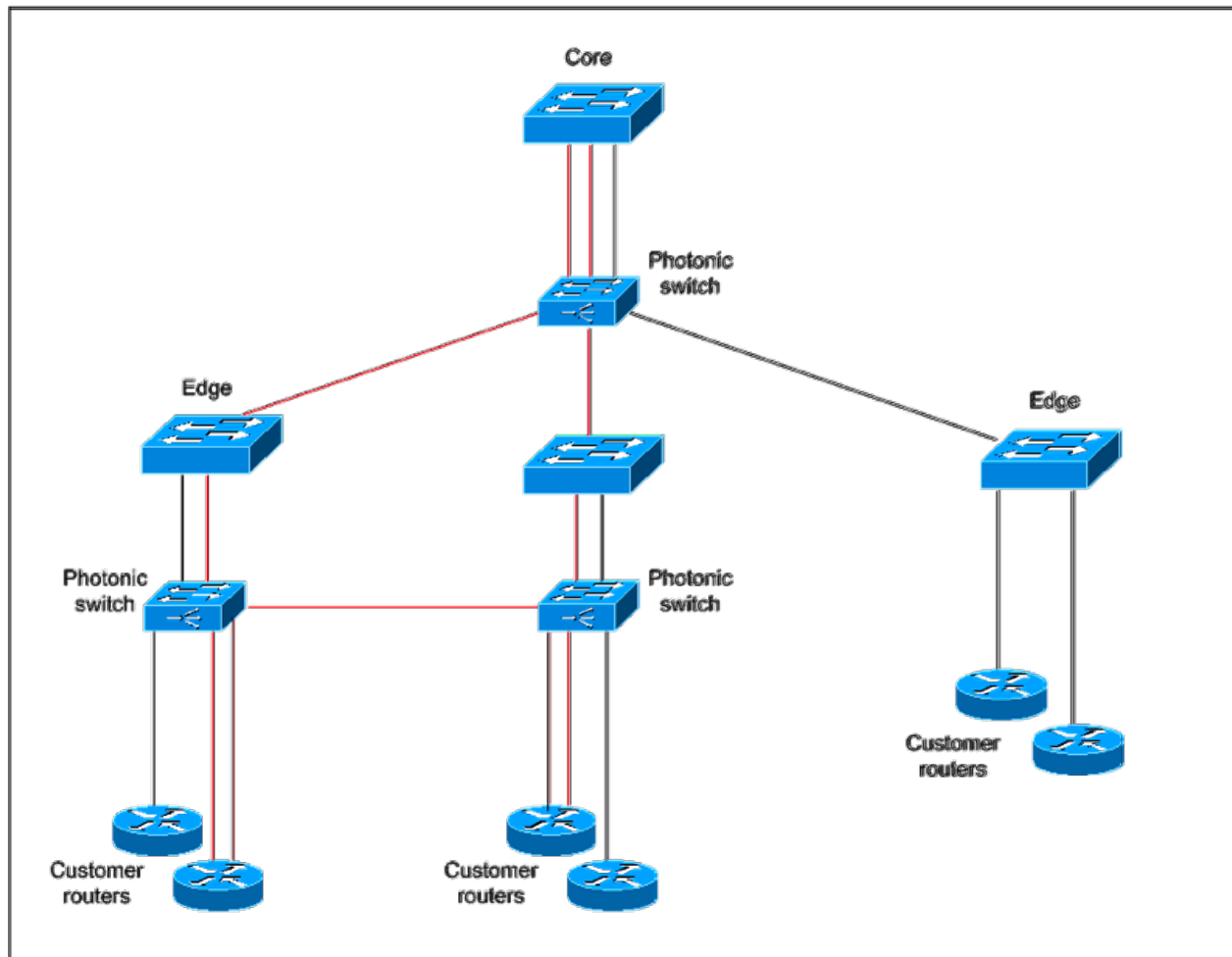


- ▶ Two uplinks

- Secondary path

- Adding customer routing tables

Additional solution (2)



Conclusion (1)

- ▶ Capacity problem (approx. in 1,5 year), best solution?
 - 100 Gb/s capable switch ports

- ▶ RBridges
 - Full mesh layer two topology
 - Uses all paths efficiently
 - No STP and VSRP needed
 - 1 to 2 years

Conclusion (2)

- ▶ Interim solution could be the use of VLANs
 - Automatically configured cut-through VLANs, when specific traffic flow reaches threshold
 - Control architecture takes care of the sampling, filtering, computation and triggering process

Future

- ▶ Further research to determine thresholds
- ▶ Development software
- ▶ Build test environment
- ▶ Other technologies
 - GMPLS
 - Looks like a solution
 - No hardware support

Questions

Thanks for the attention

