

# **RPR MAC**

***Distributed Cut-through Switching***

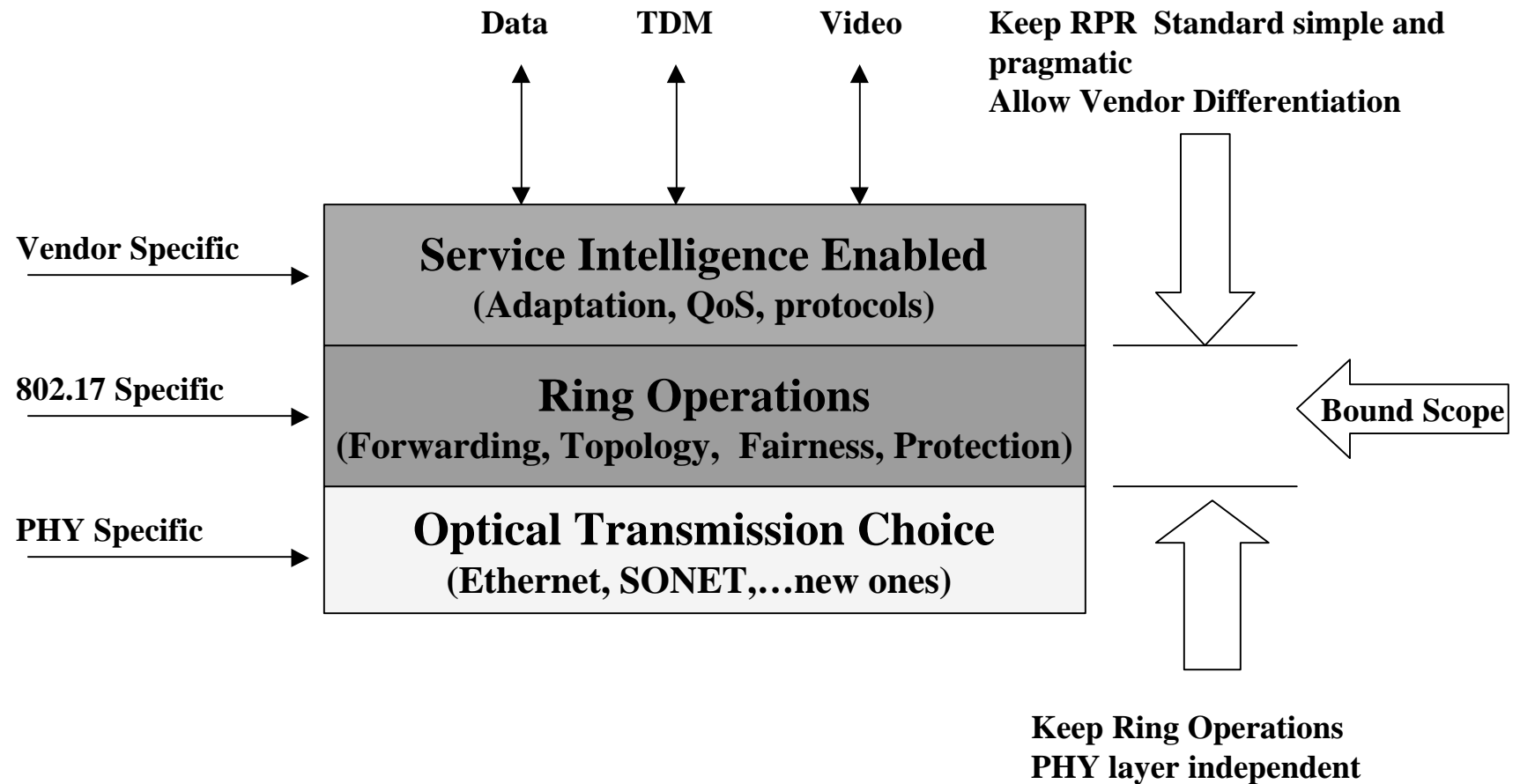
**Frederic Thepot [fthepot@dynarc.com](mailto:fthepot@dynarc.com)**

**Lars Ramfelt [larsh@dynarc.com](mailto:larsh@dynarc.com)**

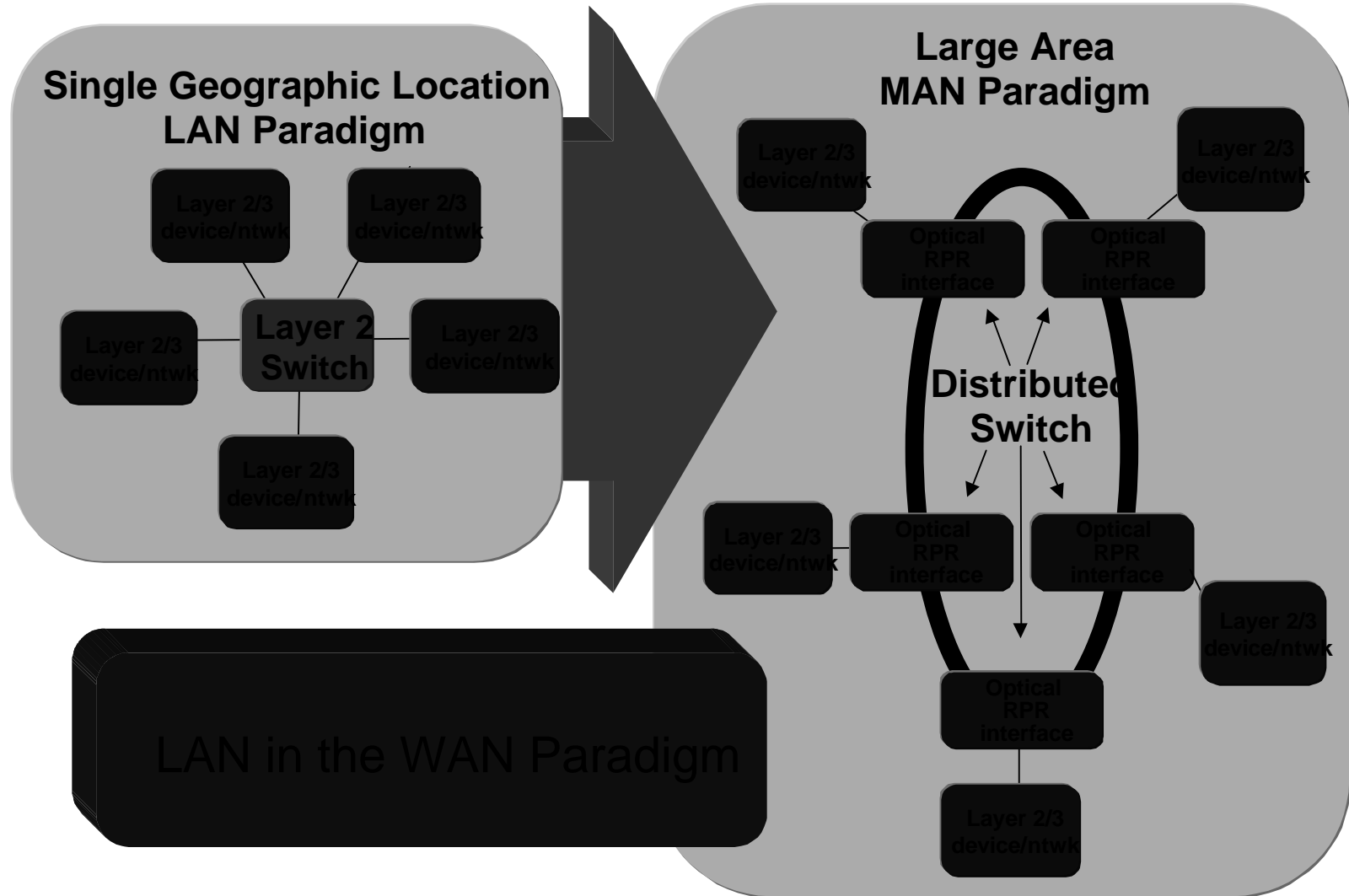
# Agenda

- What we see in the standard?
- What shouldn't be precluded?
- The Cut-Through concept and Architecture
- Distributed Switch Architecture
- Overall Control Plane
- Why Traffic engineering is requires links between traffic management and protection switching?

# The Common Strategy

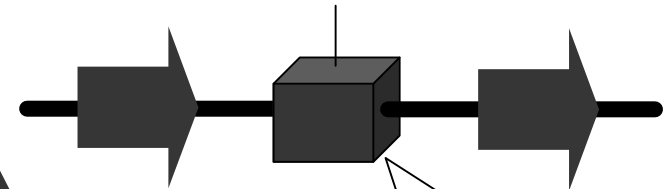
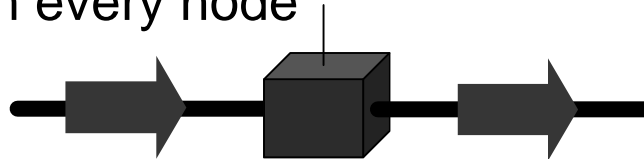


# RPR Conceptual View



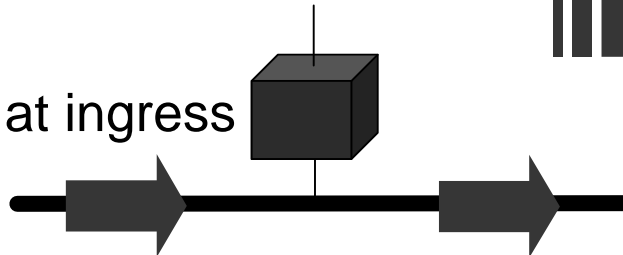
## Scalability with Cut-through Switching in the Ring

Scheduling in every node

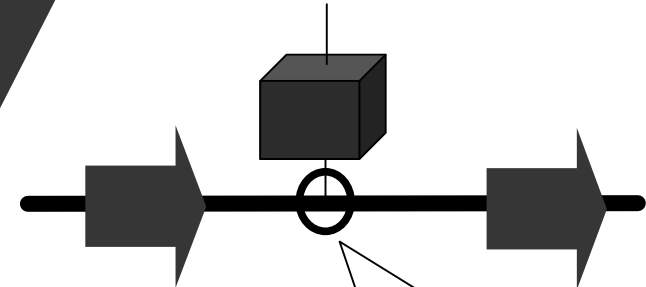


Switch must be upgraded

Scheduling at ingress



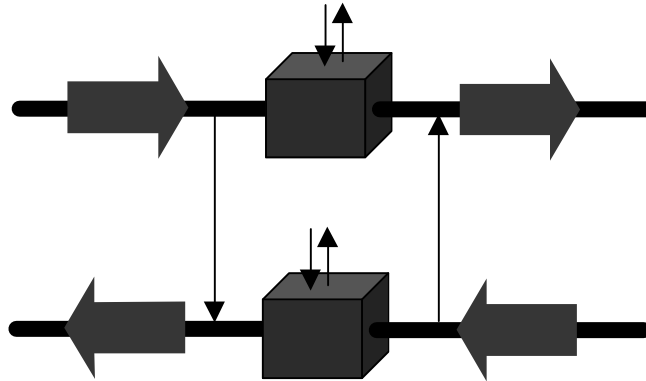
Increased  
traffic on  
link



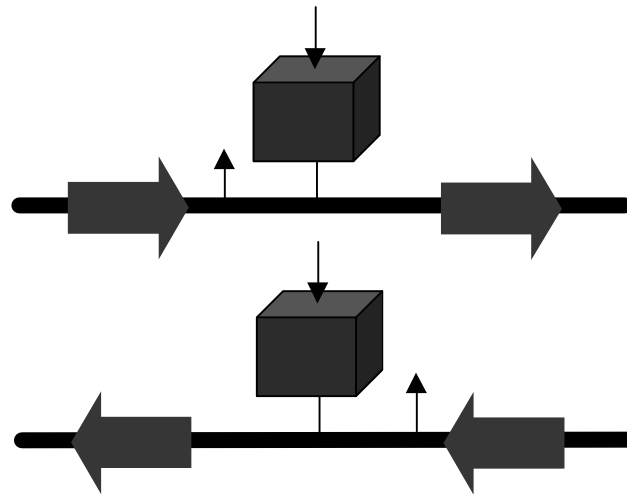
Interface cards must be  
upgraded or changed

***A packet add-drop switch with ingress scheduling is the simplest RPR device able to scale in speed and size.***

## Functional Architecture

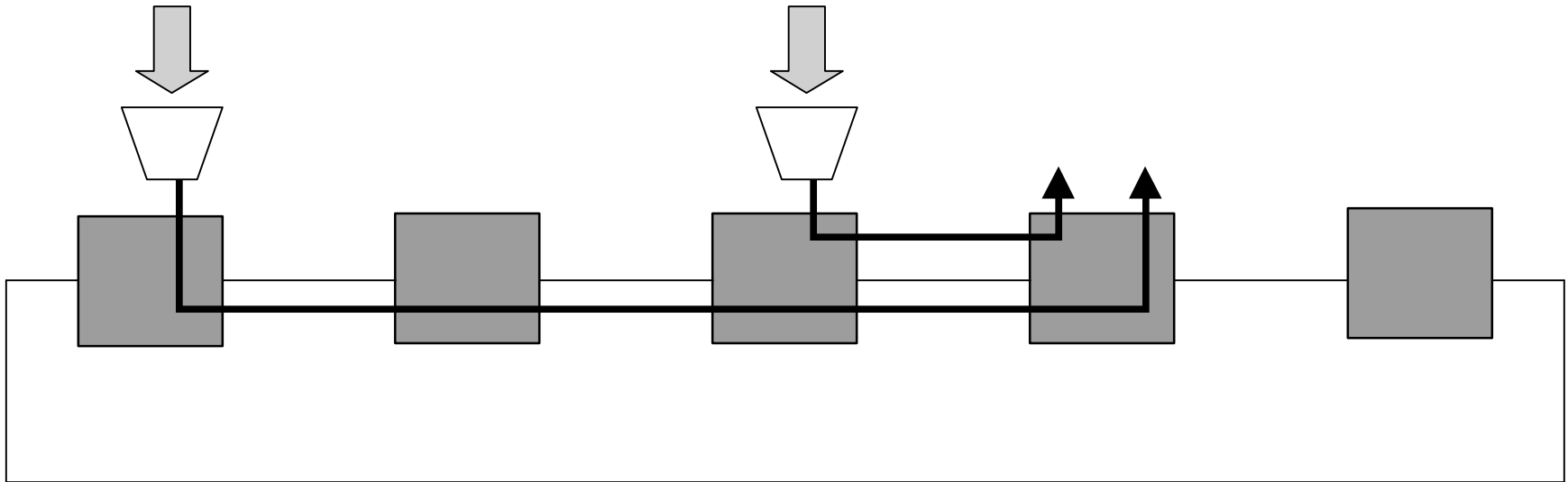


What we don't want:  
A single MAC system



What is needed:  
A paralel MAC system

## RPR: DISTRIBUTED traffic management



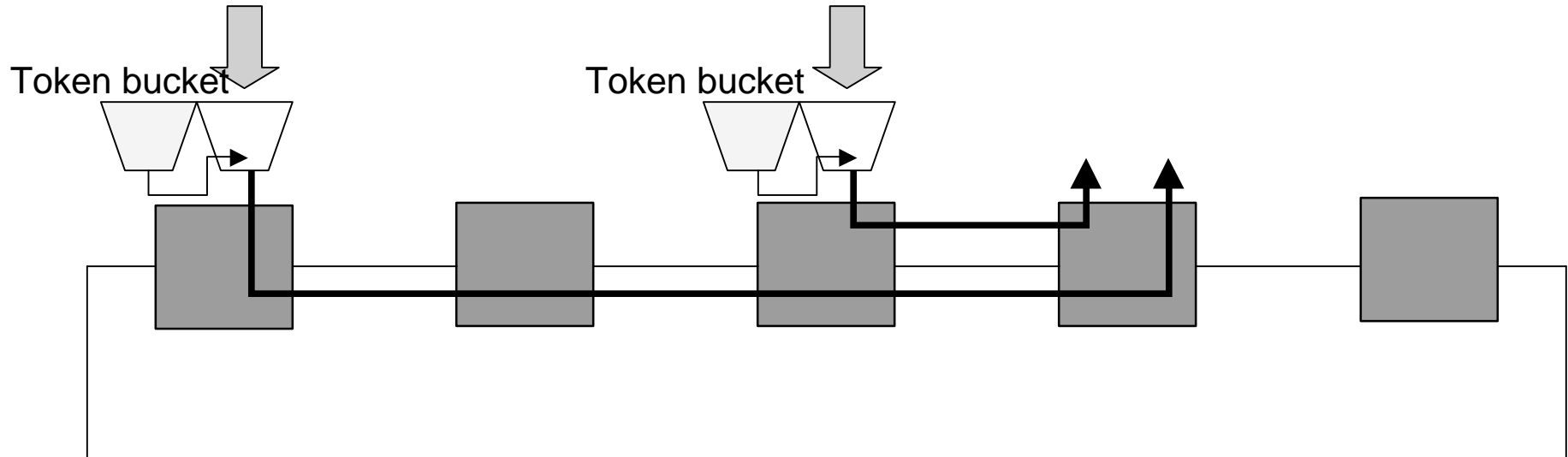
- Scheduling happens only at ingress
- No rescheduling at intermediate nodes!
- Asymmetric model: switched ports, ring ports
- Simple and inexpensive buffer management

## Traffic Management Requirements

- Traffic Schemes are generally asymmetrical
- Sum of node traffic flows gives forecasted aggregated needs
- Possible bandwidth allocation between nodes done dynamically on the fly
- Support for IP DiffServe
- Simple provisioning
- Distributed Scheme that can scale



## RPR: DISTRIBUTED token bucket



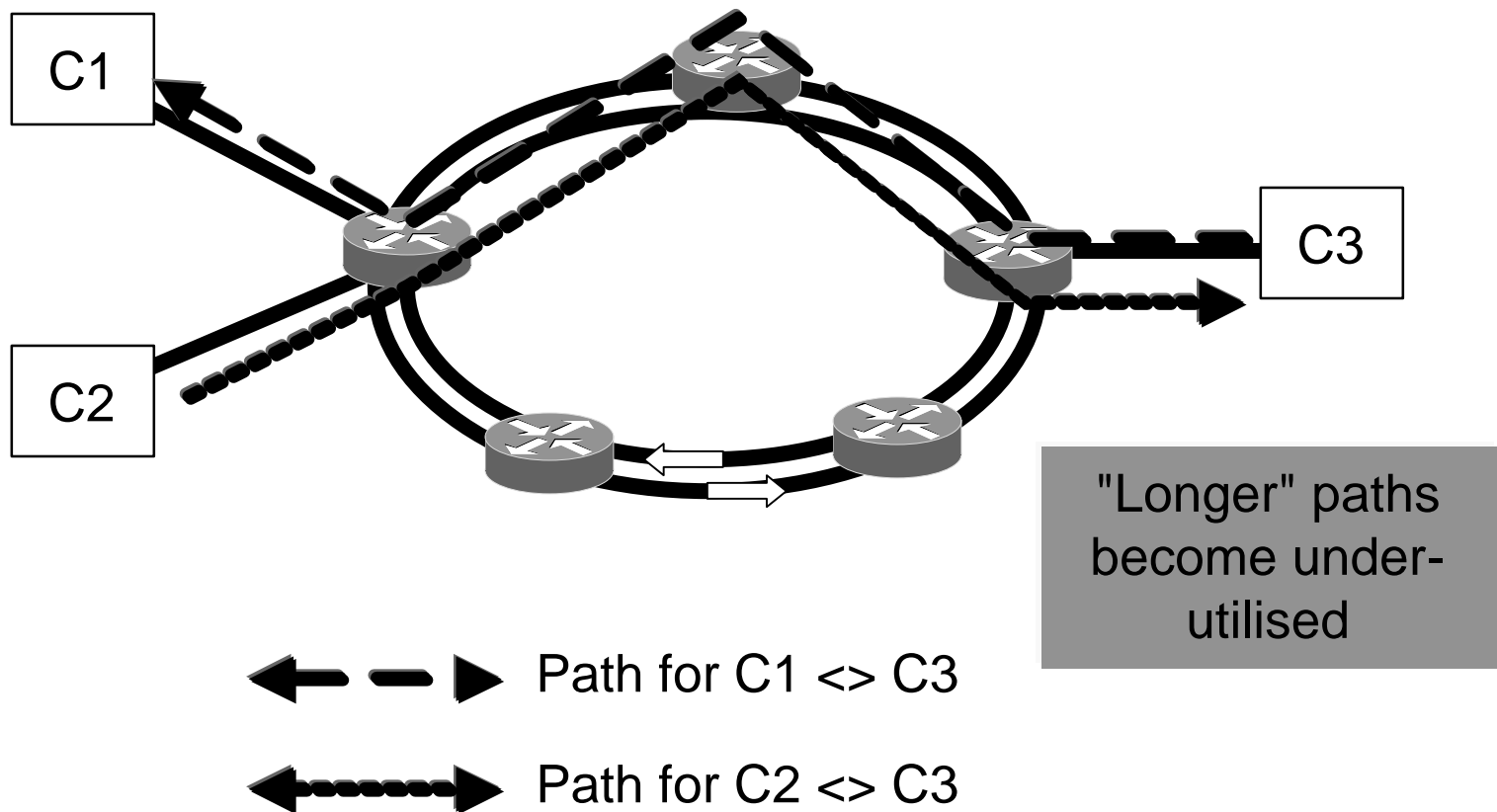
- Scheduling is achieved by a token bucket
- You can send when there is no traffic on the ring port and you are given a token
- A token correspond to a given bandwidth: 1Mbps
- Token Distribution is part of the control plane

## RPR response to congestion

- Congestion in a node on the ring can be remedied immediately by reallocating spare bandwidth with the control plane through token distribution
- If a node is underdimensioned regarding its throughput
  - Another node can be introduced next to it on the ring
  - The backplane can be upgraded to double its processing capacity
- If the concerned ring is close to its maximum throughput
  - The ring can be segmented into two rings with maximum throughput in each
  - The link speed can be upgraded on-line by replacing the interface cards, thus increasing the ring throughput with a proportional factor

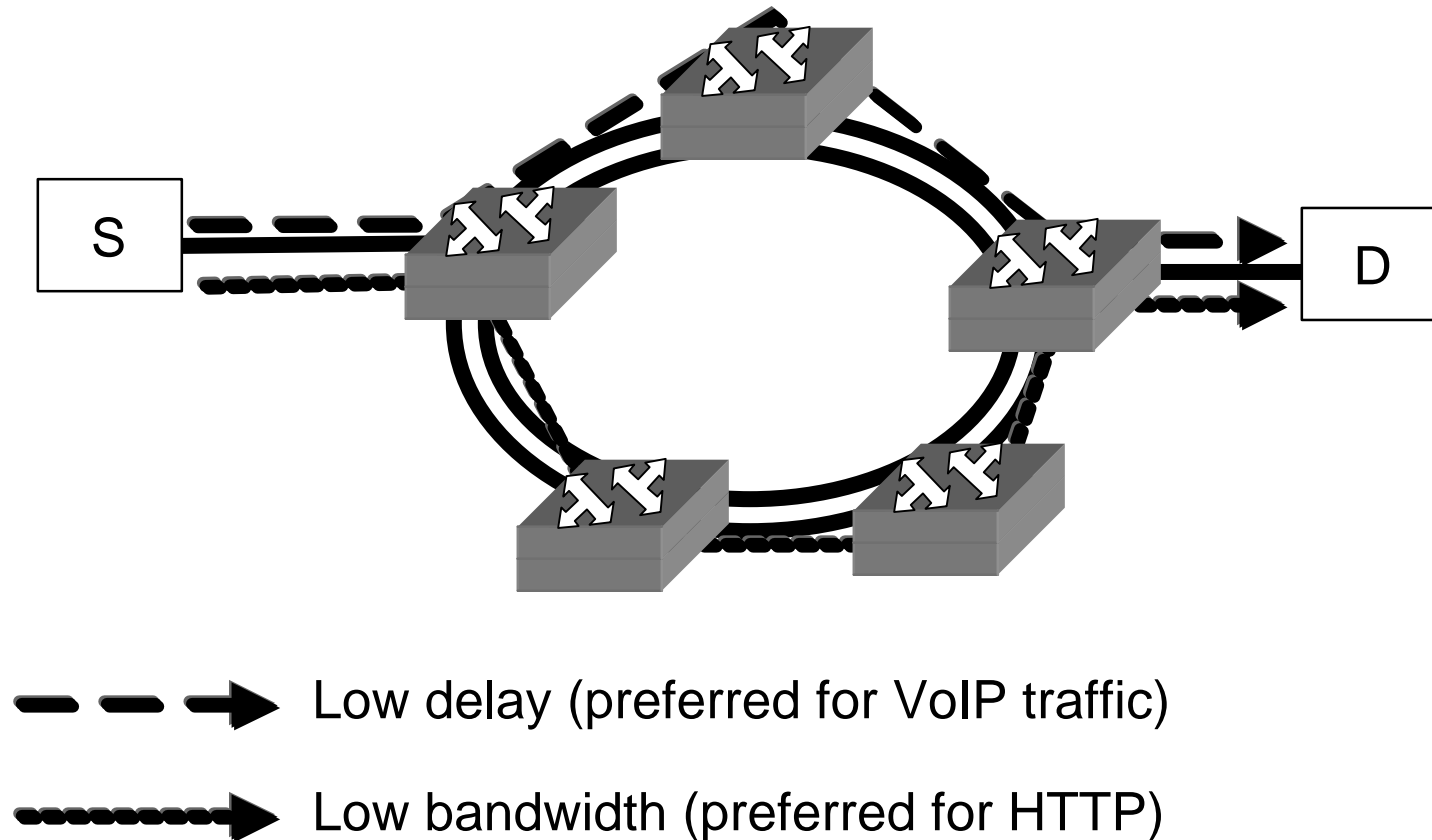
## Today Bandwidth Bottlenecks

Today routing protocols create a single "shortest path"

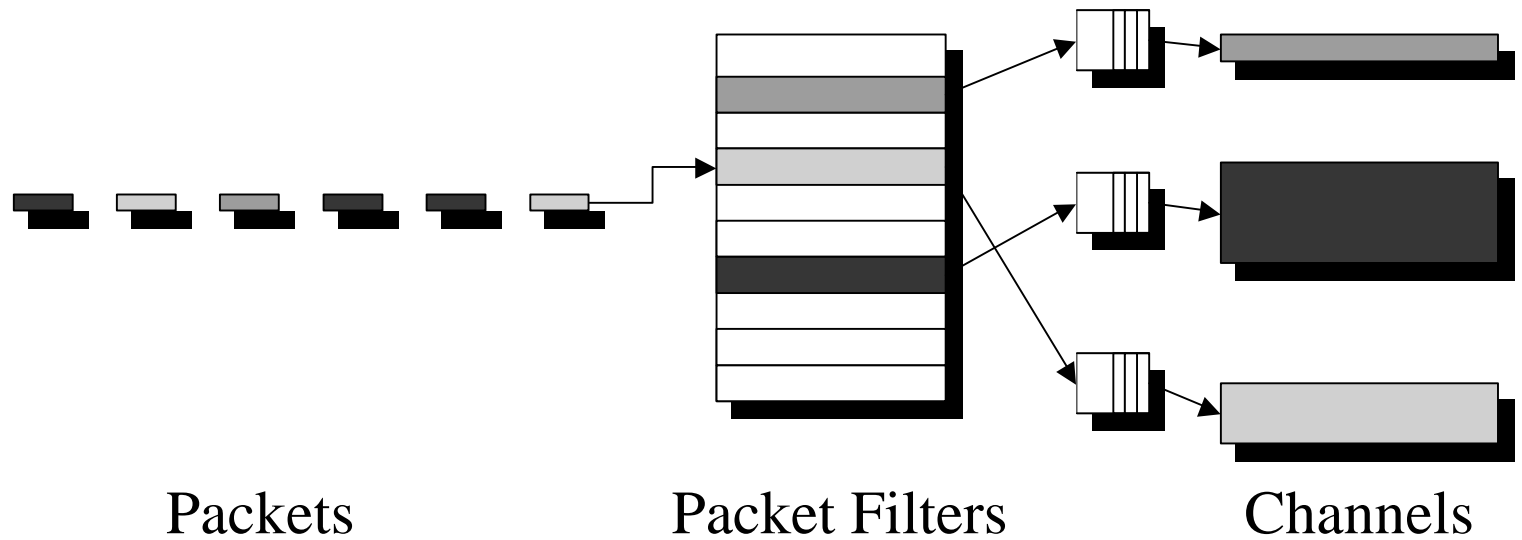


## RPR Ring Awareness

Source device determines the type of path on the basis of the service



## Packets, Filters and Channels



- Packet filters are mapped to resource reservations (channel specifications)
- Channels created on demand (first packet arrives)

## RPR Channels

- Three variations: Unicast, Multicast, Broadcast
- Created by a control message
- Control channel is bi-directional
- Switch nodes create channels on behalf of the sender
- A multi-hop channel must get OK from every switch along its path
- Portion of the bandwidth
- Synchronous between the sender and the receiver
- Virtually no loss of data

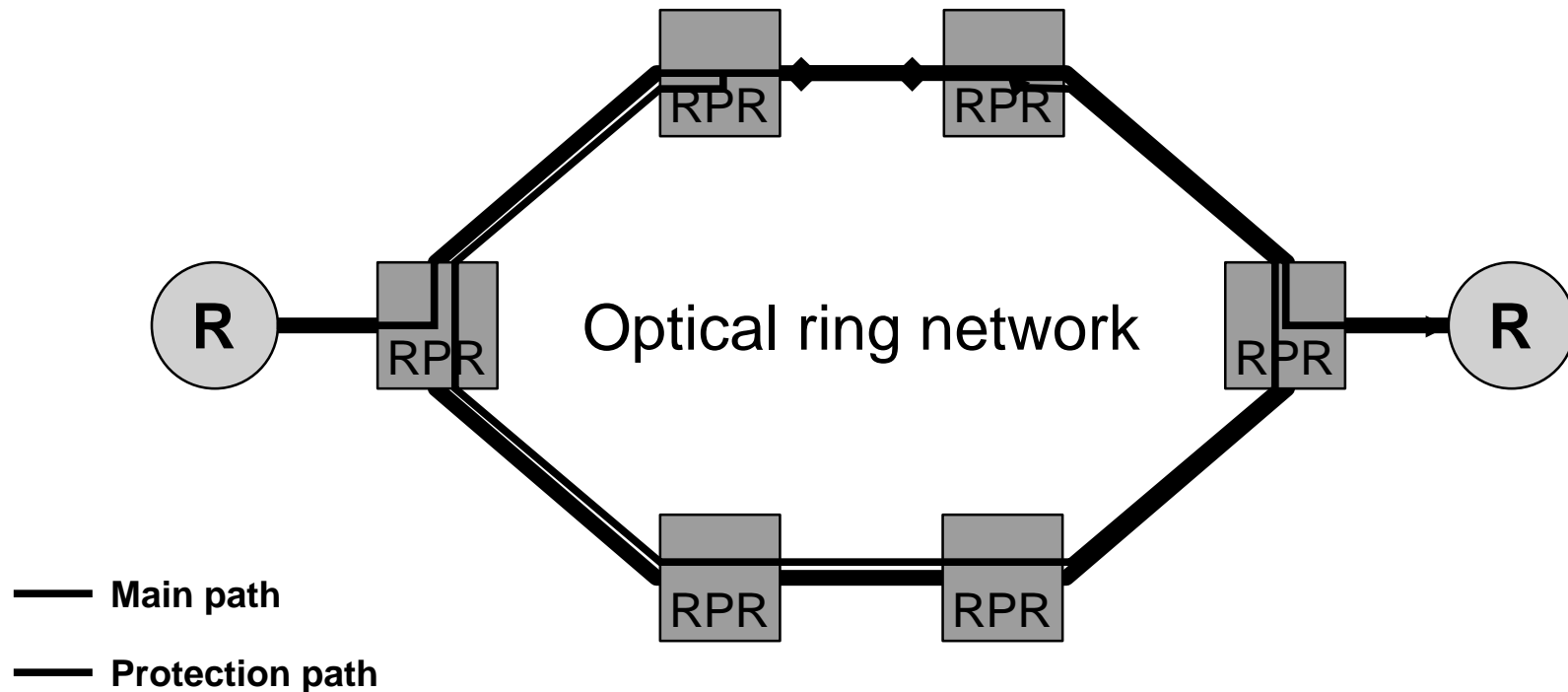
## Control Plane v Data Plane

*The data plane actually carries the information while the control plane sets up pathways through the data plane*

*RPR MAC and RPR BW both solve performance scalability problem by decoupling control and data planes*

## Wrapping Ring Protection

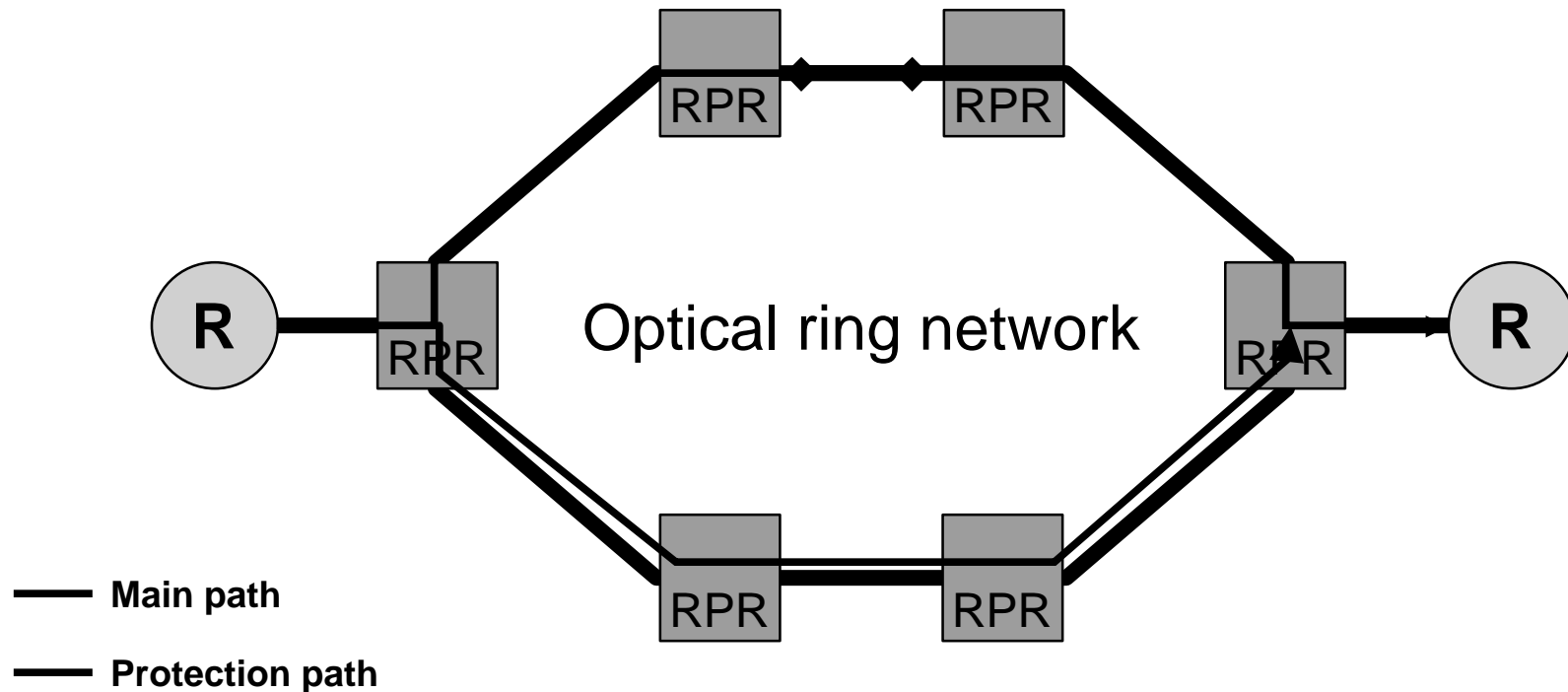
- Fast protection
- No control on traffic engineering
- Spans are used twice with limited SRP awareness





## Steering Ring Protection

- Fast protection if pre-computed routes
- Full control on traffic engineering
- No need for dual control plane



## Some Conclusions

- Cut Through Scheme is having some requirements on the MAC:
  - A control plane is needed to enable schedulers to work as one distributed switch
  - Control plane is also in charge of the steering of protection switching with communication of traffic management information
- It is a system approach on a ring and rings can be composed of different systems