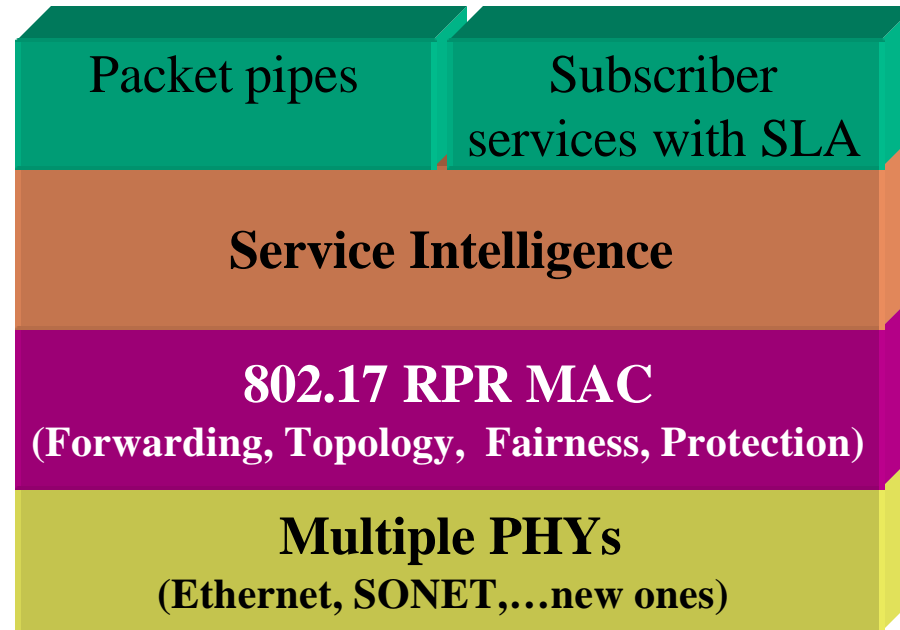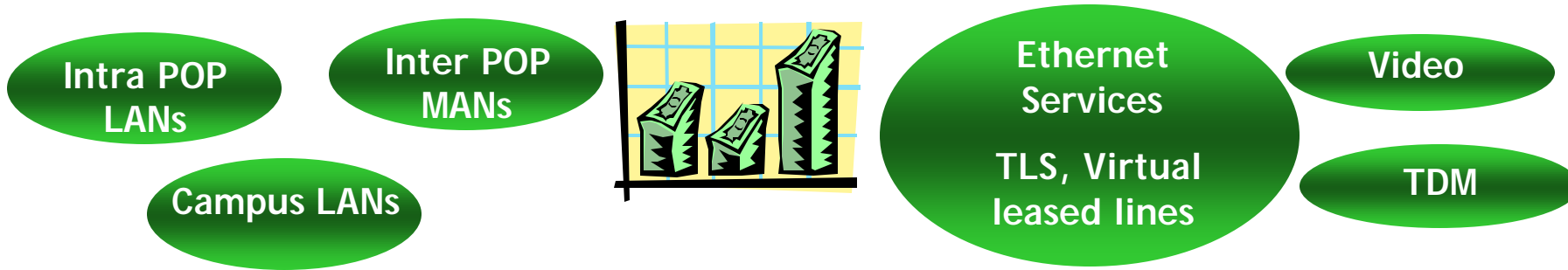# MAC Overview

IEEE 802.17
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Proposal Highlights and Comparison

- Market addressed
- Proposal Highlights
  - Resilience
  - Fairness/Bandwidth Management
  - Frame Format
  - PHY
- Why are we stuck and how do we move forward?

Enabling a broader market

Intra POP LANs

Inter POP MANs

Campus LANs

Ethernet Services

TLS, Virtual leased lines

Video

TDM

Packet pipes	Subscriber services with SLA

Service Intelligence

802.17 RPR MAC
(Forwarding, Topology, Fairness, Protection)

Multiple PHYs
(Ethernet, SONET,…new ones)

The MAC must be PHY-agnostic, and service-enabling

RPR Applications

- Packet pipes
  - Intra POP LANs
  - Inter POP MANs and WANs (ISP, MSO, etc.)

- Subscriber services with SLAs
  - Virtual private lines
  - VPNs and TLS
  - Transport of Real-time applications like voice and video
  - Circuit Emulation for TDM services

Requirements for Packet pipes

- Resilience

- Spatial reuse

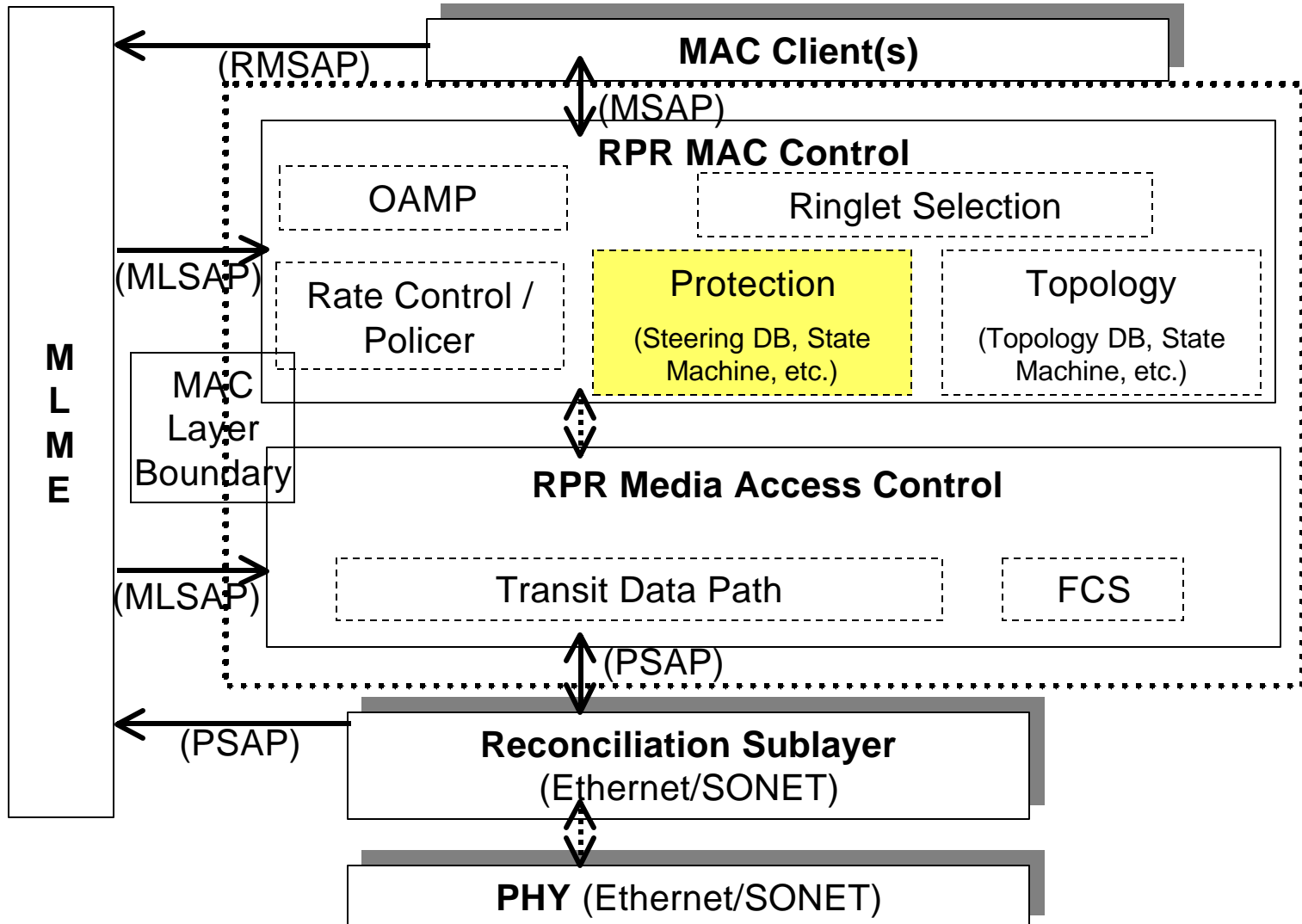- Equal allocation of unused bandwidth

Requirements subscriber services with SLAs
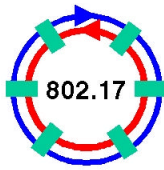
- Resilience
- Spatial Reuse
- Equal allocation of unused bandwidth

- Weighted fair allocation of bandwidth

- Support for different service types
  - Guaranteed rate services (TDM)
  - Committed rate services (real-time and non real-time data with BW guarantees)
  - Best Effort services

- Selective service restoration

- Minimum packet loss (Loss less ring)

- Minimum delay and jitter for real-time applications

- Customer Separation

- Payload Preservation

Alladin (ZZ draft) MAC reference model
Addressing Carrier Requirements

MAC Client(s)

(RMSAP)

(MSAP)

RPR MAC Control

OAMP

Ringlet Selection

Rate Control / Policer

Protection
(Steering DB, State Machine, etc.)

Topology
(Topology DB, State Machine, etc.)

(MLSAP)

M L M E

MAC Layer Boundary

RPR Media Access Control

Transit Data Path

FCS

(MLSAP)

(PSAP)

Reconciliation Sublayer
(Ethernet/SONET)

(PSAP)

PHY (Ethernet/SONET)

Proposal Highlights

Addressing Carrier Requirements

Topology and Protection

- Steering-based protection that meets sub 50 msec restoration requirement

- More efficient use of link capacity

- Enables differentiated services with different levels of protection

Proposal Highlights
Addressing Carrier Requirements

Fairness/Bandwidth Management

- Enables 100% spatial reuse
  - No HOL blocking
- Enables maximum utilization of every link on the ring
- Support for all service types
  - Guaranteed rate services (TDM)
  - Committed rate services (real-time and non real-time data with BW guarantees)
  - Best Effort services
- Enables variety of MAC client implementations
  - Best Effort, Priority based, Class of Service based, Flow based
- Simple
  - Very small transit buffer
  - No queuing and scheduling in transit

Proposal Highlights

Addressing Carrier Requirements

RPR Frame Format

- Resembles Ethernet frame format with the addition of a shim layer

- Enables delivery of Ethernet services
  - Customer separation tag similar to DLCI in Frame Relay and VPI/VCI in ATM

- Preserves customer payload
  - Header check separate from frame FCS implies FCS field is not modified
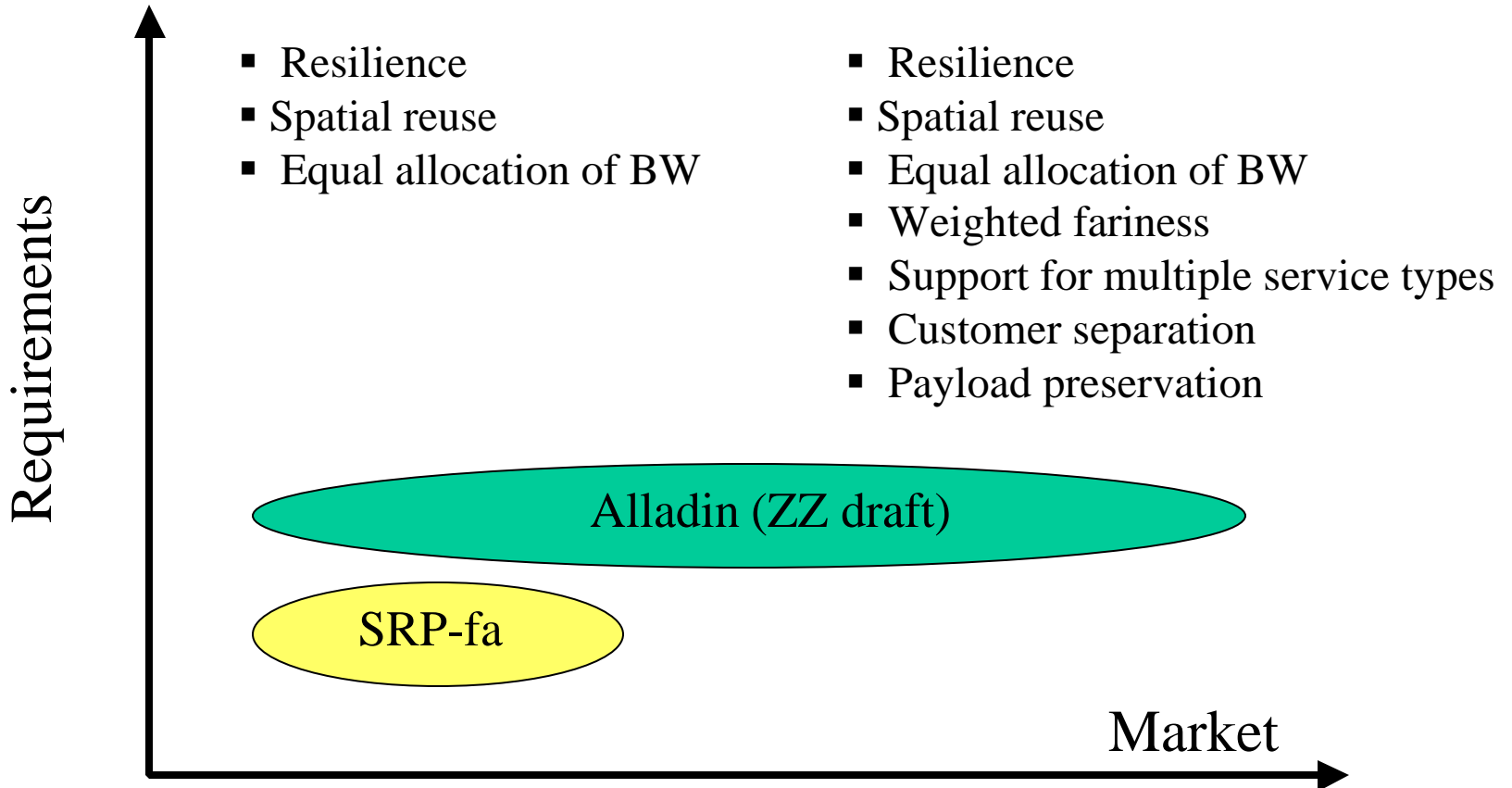
Proposal Highlights
Addressing Carrier Requirements

PHY reconciliation sub-layers

- Enables "truly" PHY agnostic MAC

- Support for Ethernet, GFP and POS through industry standard interfaces

- Simple mapping from MAC frame format to PHY

Why are we stuck?

We started off addressing different market needs

Requirements (vertical axis)

Left column:
- Resilience
- Spatial reuse
- Equal allocation of BW

Right column:
- Resilience
- Spatial reuse
- Equal allocation of BW
- Weighted fariness
- Support for multiple service types
- Customer separation
- Payload preservation

Alladin (ZZ draft)

SRP-fa

Market (horizontal axis)
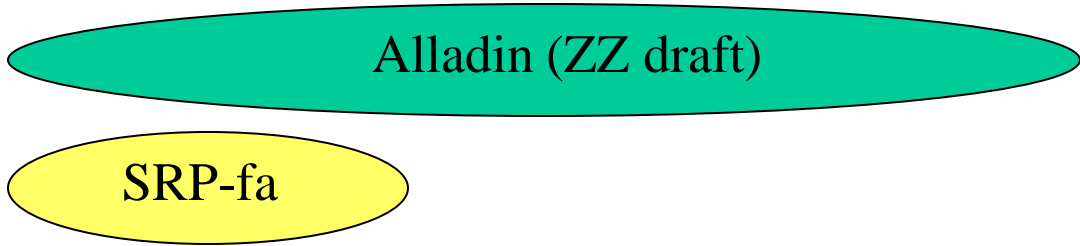
Packet Pipes
- Intra POP LANs
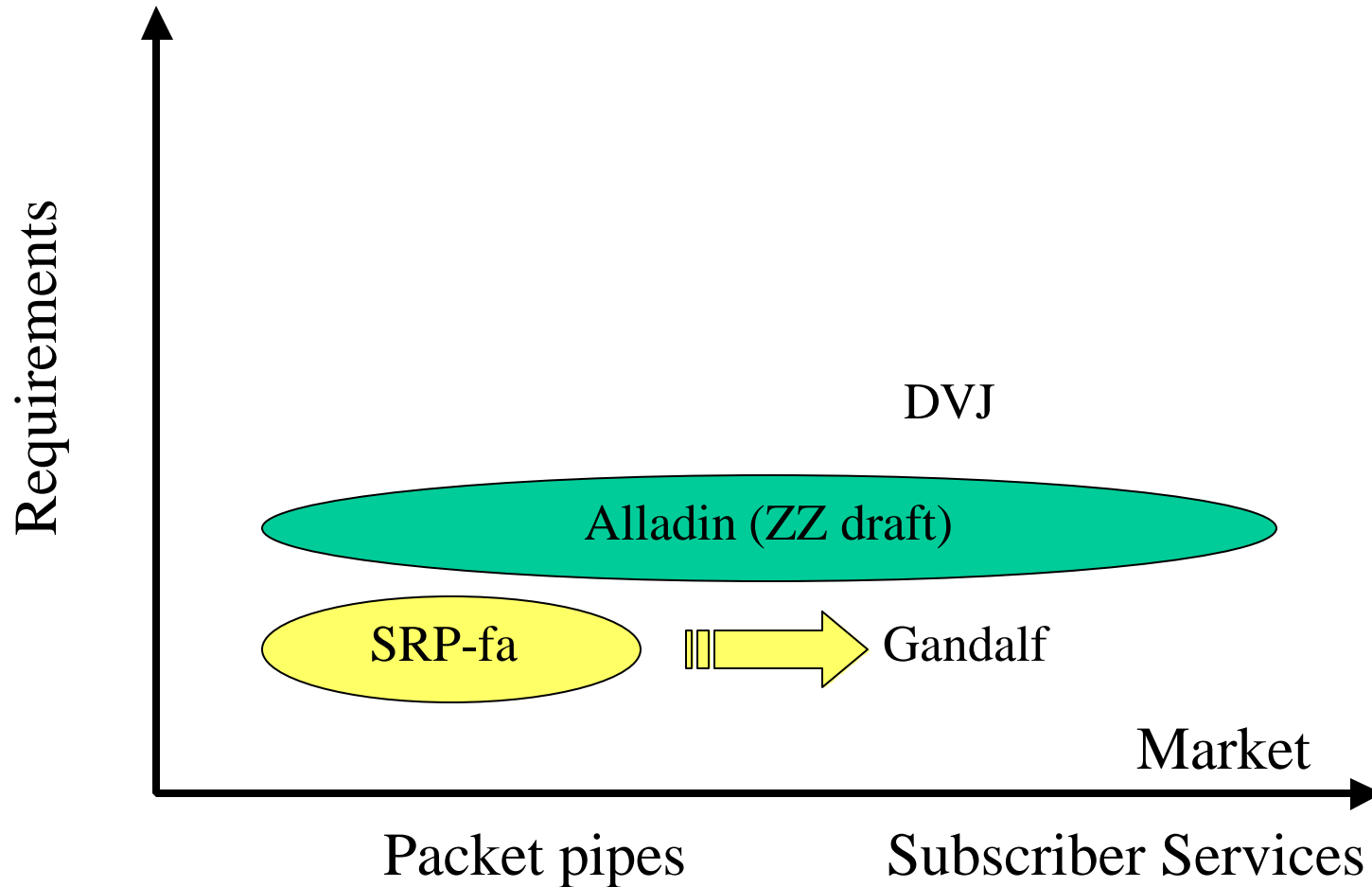- Inter POP MANs

Subscriber Services
- Ethernet services (VLL, TLS)
- Real-time apps
- TDM

How do we move forward?

- Vote on one of the three proposals as baseline
- Pick 2 or 3 proposals as inputs to a baseline
- Keep voting until one proposal garners majority support
- Compromise

How do we move forward?

First agree on the markets we address

Comparing Proposals

Feature comparison?

Feature	Gandalf	DVJ	ZZDraft
Fairness Mechanism	#$#@$$%@	)(*^*^^&	!#@!$#!#!@#!@
Transit buffer	@#@#!@#!@#!	$%$^^^&	!@#$#@#!@##
Protection mechanism	@#$@#$#$#$@	!@##$#%%	@#$#@$@$@#@
…	…	…	…

These become religious debates and don't get us anywhere

Preferred approach to Proposal comparison

- How well does it address Customer requirements?

- Does it meet all the voted objectives?

- How does it perform?

- Is it technically feasible?

- Cost and complexity

Recap: RPR Carrier Requirements Summary

- Optimization for Ethernet Services

- Support for Circuit Emulation

- Ring size (MAN < 200 km, RAN < 1000 km)

- Payload preservation

- No packet loss on the ring under normal operating conditions

Recap: RPR Carrier Requirements Summary

- Customer traffic separation

- Quality of Service (Service categories, Customer SLAs)

- Efficiency (Maximize link utilization)

- Availability (sub 50 msec. restoration, Configurable protection)

- FCAPS (Performance monitoring – Statistics, SLAs)

Performance-based comparison

Performance	Alladin	Gandalf	DVJ	
Flow control convergence				
Stability				
Flow control fault tolerance				
Fairness index				
Spatial reuse				
Link utilization				
Not affected by node failure				
Delay and jitter				

Cost and Complexity based comparison

Cost & Complexity	Alladin	Gandalf	DVJ	
Memory				
Logic (flow control)				

The challenge before the Working Group

- Create a MAC that enables carriers to maximize revenue generating services over a given network infrastructure

- How can we have high link utilization and still guarantee service quality?

Compromise?

- Compromise works when we are all solving the same problem
  - Hence let us agree on the market and objectives FIRST
- WIN-WIN compromises require the different sides working together
  - Unilateral updates tend to be WIN-LOSE

Questions