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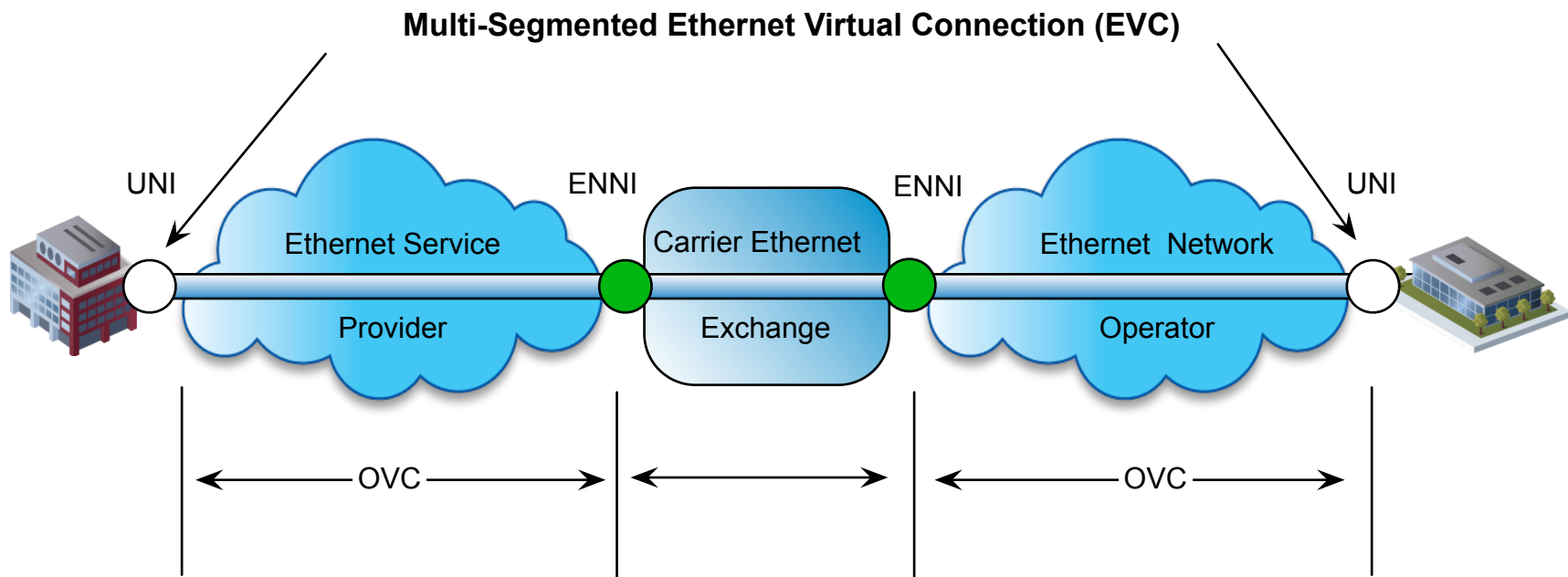
Carrier Ethernet Exchange

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Overview



E-NNI = External Network Network Interface

UNI = User Network Interface

OVC = Operator Virtual Circuit

CEE: Key Objectives

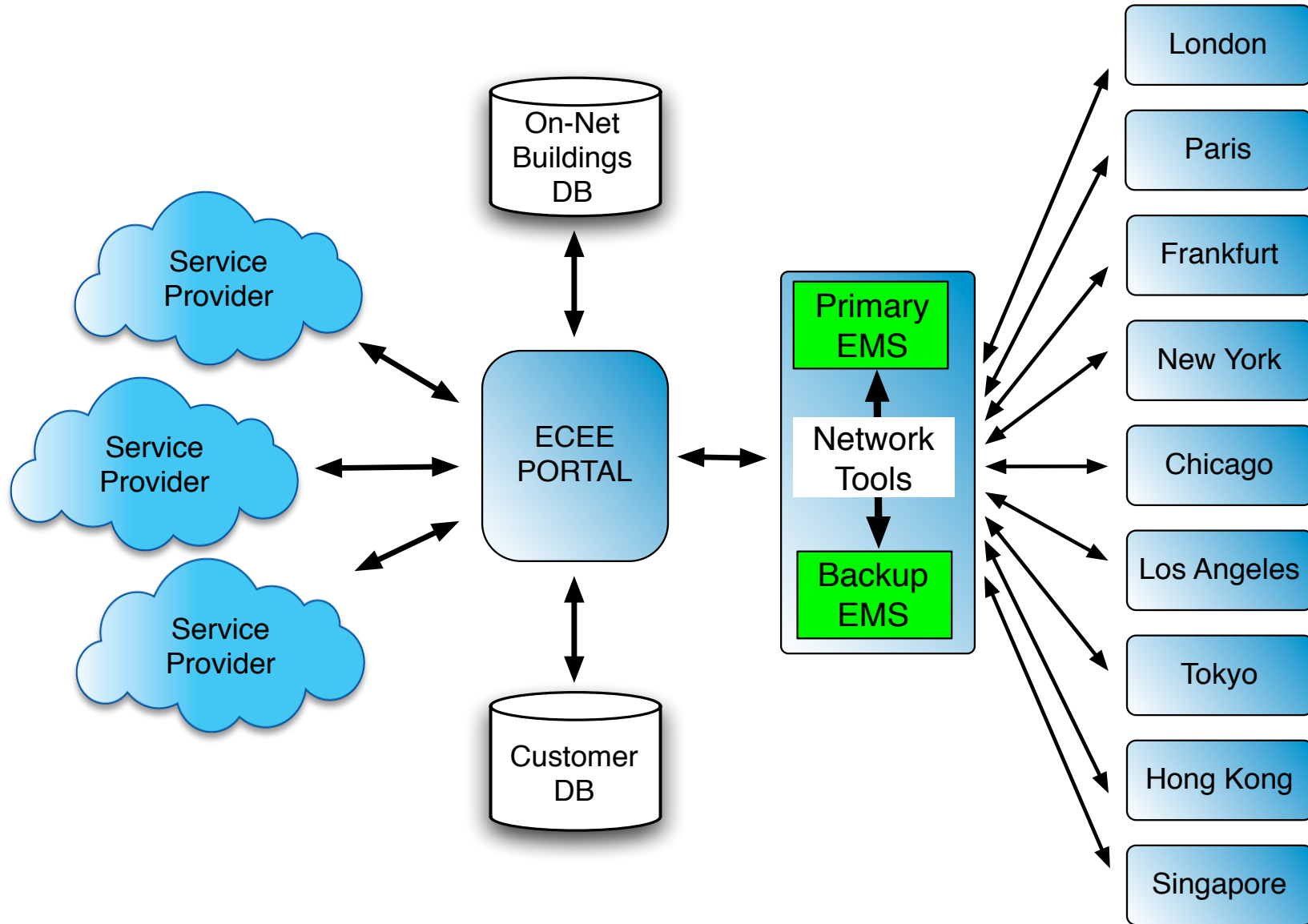
- Facilitate multi-segmented Ethernet services
- Accelerate Ethernet service delivery
- Increase geographic distribution & reach

“If it makes sense to do this anywhere, it makes sense to do it everywhere”

CEE: Key Components

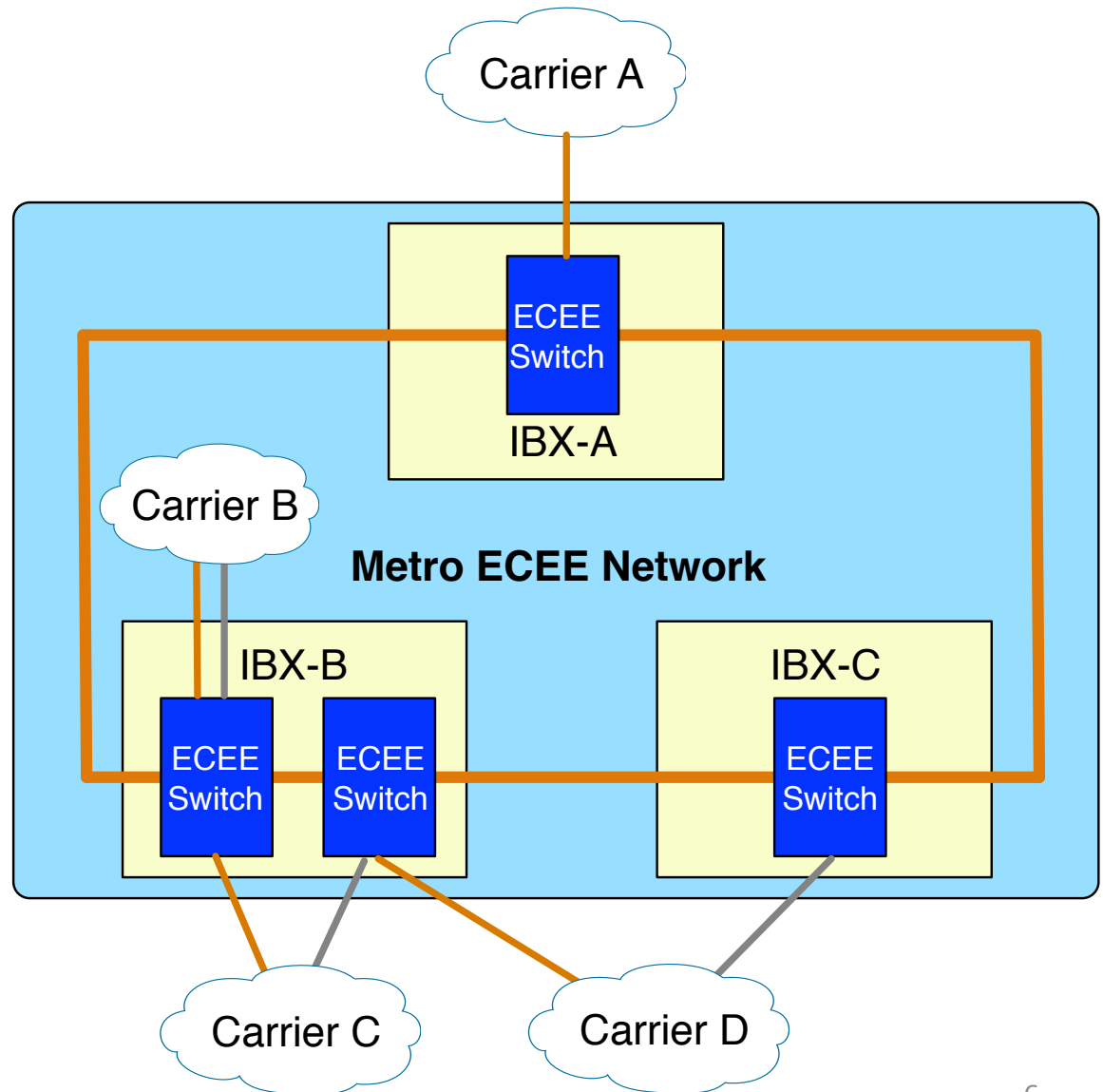
- Ethernet Exchange switch fabric(s)
 - Alcatel-Lucent 7450 (SR/ESS Platform)
 - Metro-Area/Redundant Topologies
- Exchange Portal Features
 - The Marketplace (match buyers & sellers)
 - Alcatel-Lucent 5620SAM (SAM-0)
 - Automate Service Provisioning
 - SLA Monitoring (statistics distribution)
 - Troubleshooting

ECEE Portal Architecture

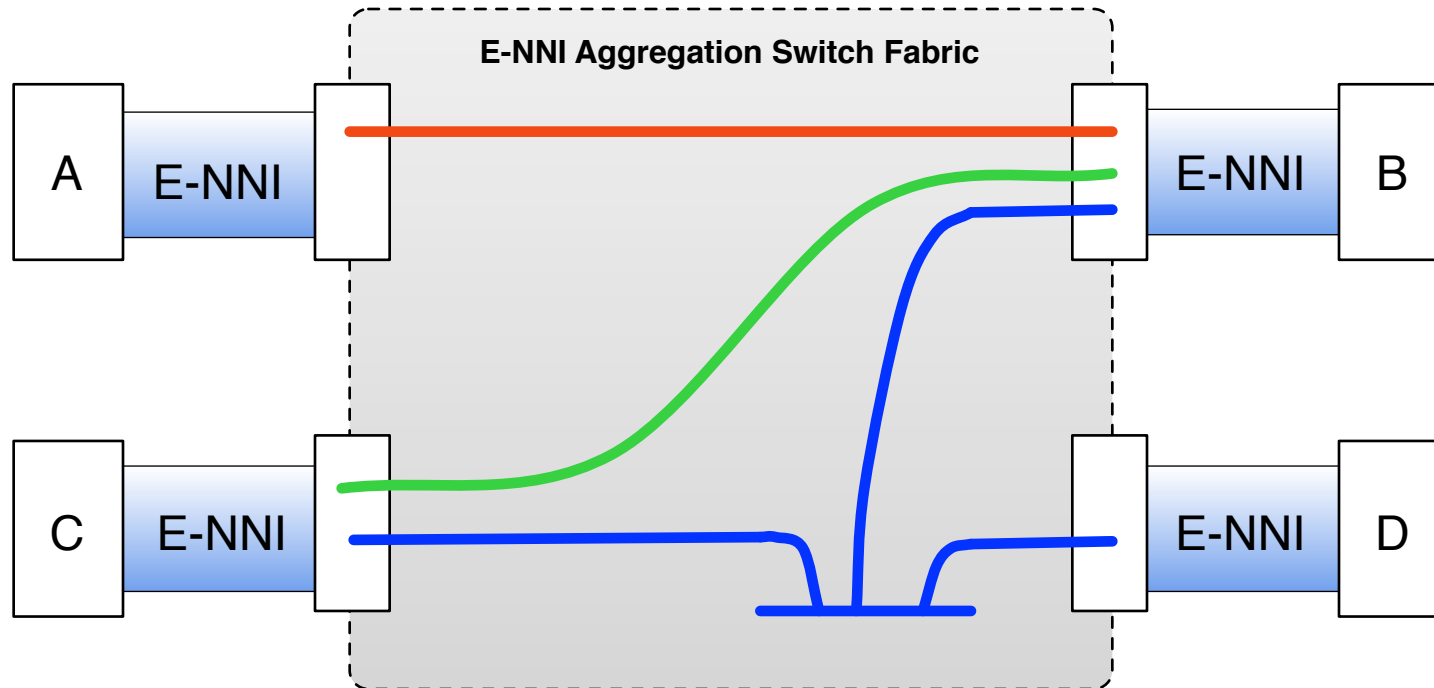


Physical Interconnect Types

- Port Types
 1. 1GbE
 2. 10GE
- Connection Methods
 - A. Single Circuit
 - B. Link Aggregation
 - C. Multi-Chassis LAG
 - D. Multi-Chassis w/
Redundant IBX

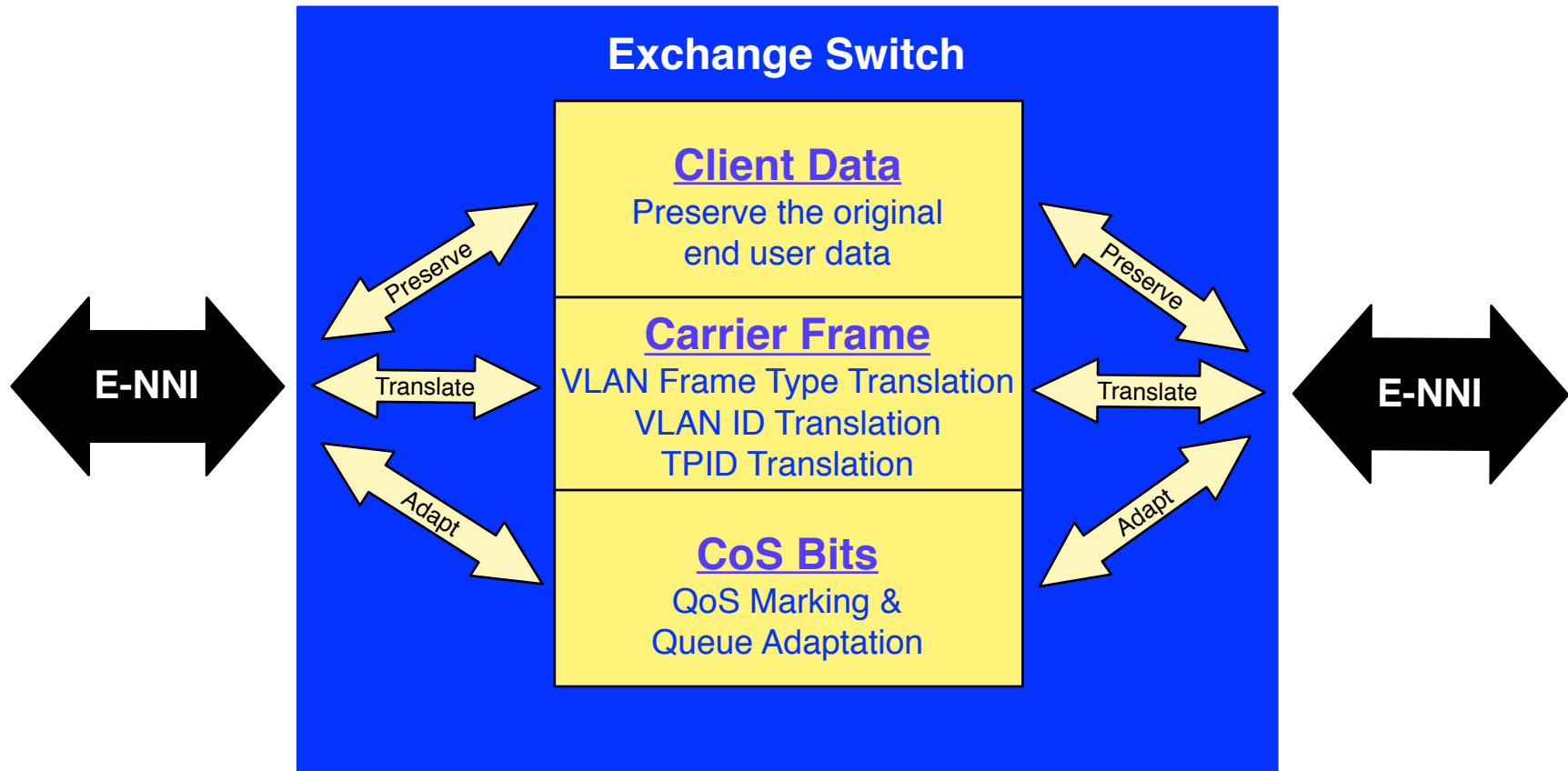


Exchange Service Topologies



- Point-to-Point Topology (E-Line)
- Multi-Point Topology (E-LAN)

Exchange Fabric Behavior

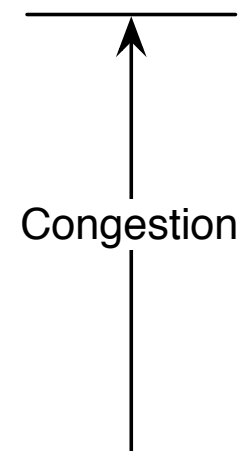


- Preserve: Data & Protocol Transparency
- Translate: Frame Handling
- Adapt: QoS Behaviors

Quality of Service

- The Bad News
 - It's written into the service provider product description
- The Good News
 - It's written into the service provider product description
- We have to support whatever comes our way
- Requires Good Network Queuing and Mapping
 - Modification from default behavior
 - MPLS switching = MPLS EXP bit mapping to Queues
 - Strict Priority Order Drop


Queue	MPLS EXP	Traffic Drop Behavior							
7	111	Green	Green	Green	Green	Green	Green	Green	Green
6	110	Green	Green	Green	Green	Green	Green	Green	Red
5	101	Green	Green	Green	Green	Green	Green	Red	Red
4	100	Green	Green	Green	Green	Green	Red	Red	Red
3	011	Green	Green	Green	Green	Red	Red	Red	Red
2	010	Green	Green	Green	Red	Red	Red	Red	Red
1	001	Green	Green	Red	Red	Red	Red	Red	Red
0	000	Green	Red	Red	Red	Red	Red	Red	Red



Ingress QoS Adaptation

- Default Ingress CoS Translation Table
 - Carriers need only create the policy once to match product description
 - Side Agnostic
 - All marking policies can be customized if desired
 - Can only use a 802.1p bit once
 - Can use more than one 802.1p bit to identify traffic on ingress only

Ingress Priority Level to Queue								Queues 802.1p Bits
Number of Queues								
1	2	3	4	5	6	7	8	
1	1	1	1	1	1	1	1	
				2	2	2	2	
		2	3	3	3			
		2	3	4	4			
	2	3	4	5	6	6	6	6
							7	7
		4	5	6	7	8	7	7
							8	8



Egress QoS Adaptation

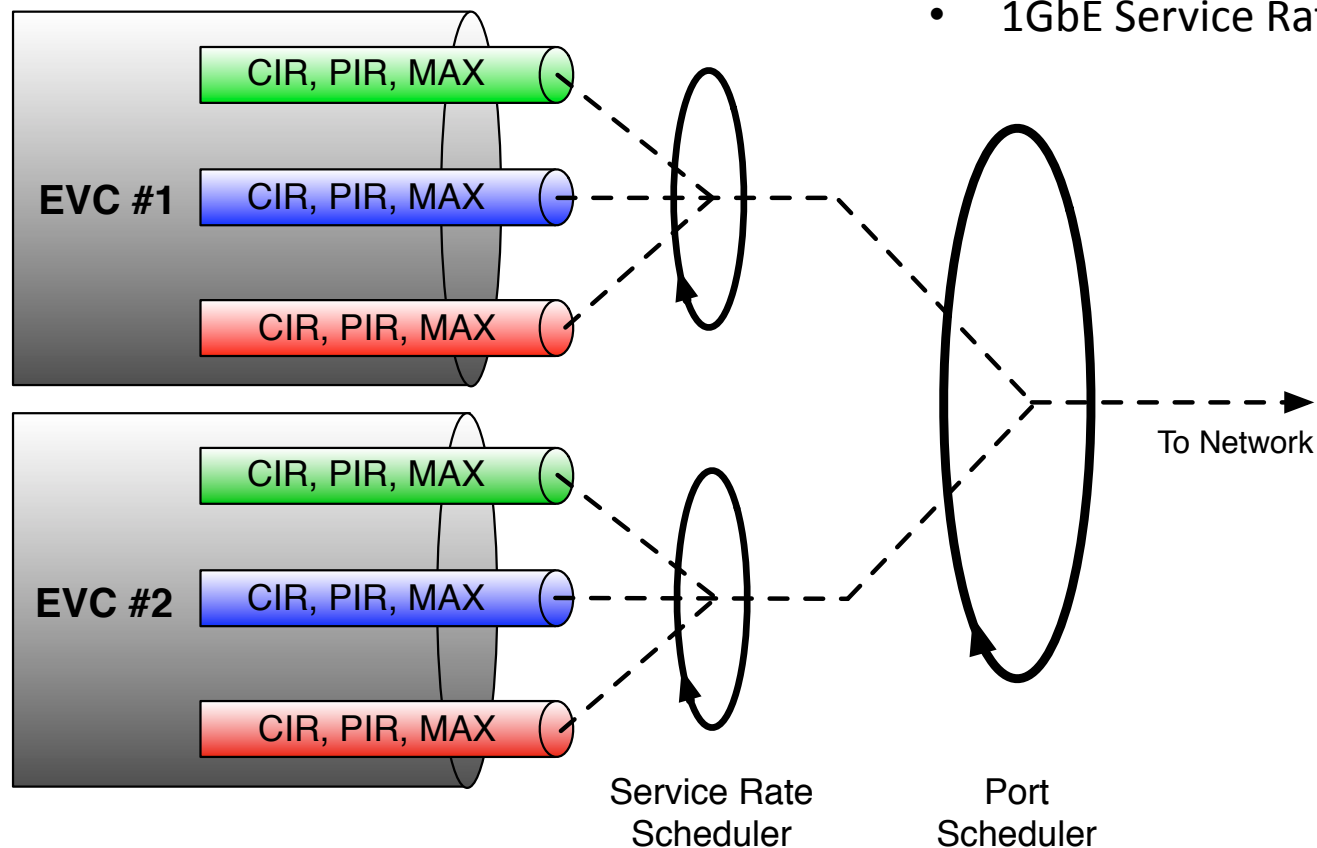
- Default Egress CoS Translation Table
 - Carriers need only create the policy once to match product description
 - Side Agnostic
 - All marking policies can be customized if desired
 - Only one 802.1p bit (mark) per egress queue

Egress Queues to Priority Level									
Queues 802.1p Bits	Number of Queues								
	8	7	6	5	4	3	2	1	
	1	1	1	1	1	1	1	1	1
	2	2	2						
	3	3	3	2	2	2	2		
	4	4	4	3					
	5	5	5	4	3	2			
	6	6	6	5	4	3	2		
	7								
8	7								

← Traffic Direction →

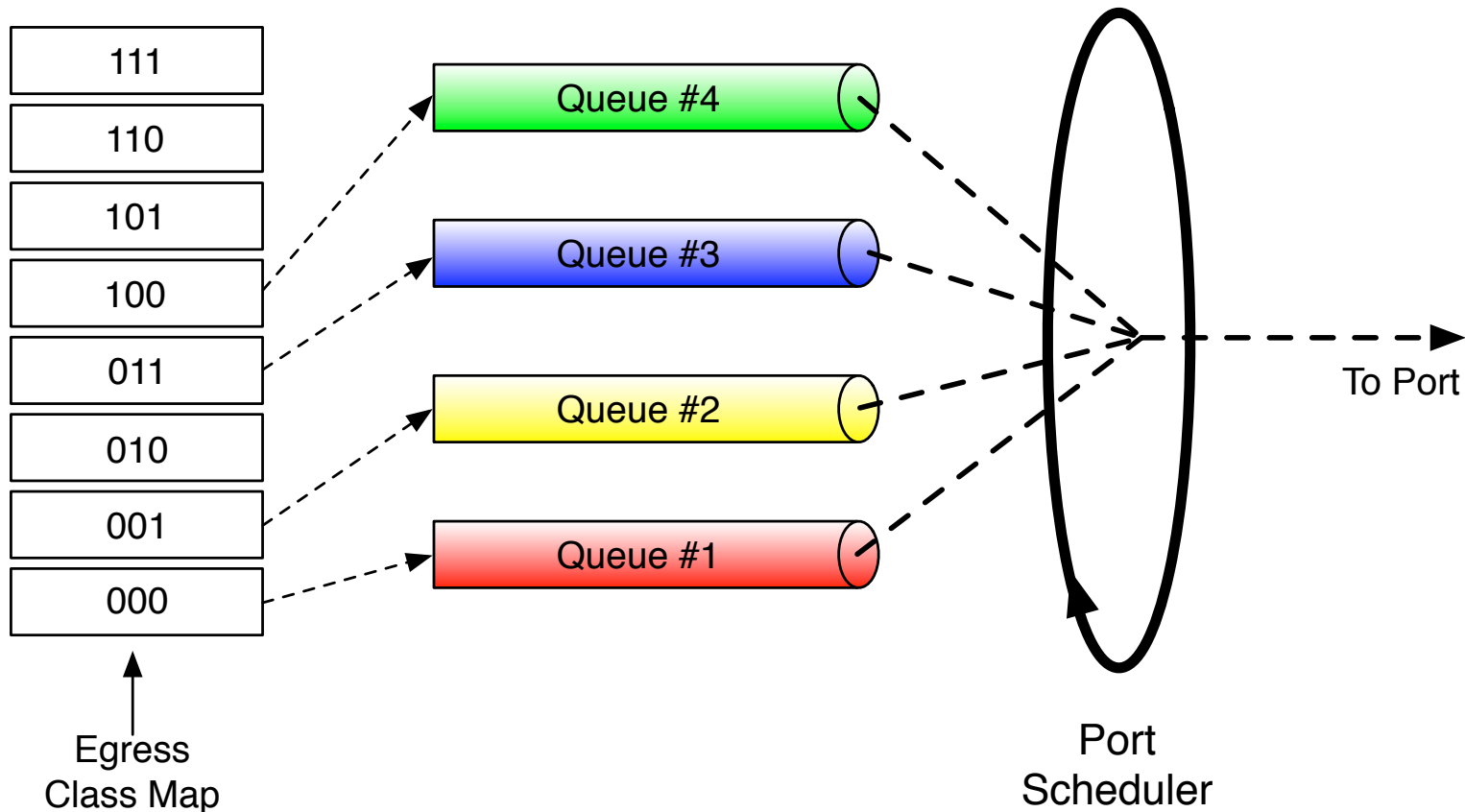
Ingress Scheduling

- Weighted Queues (priority order drop)
- Per Queue Parameters (optional)
 - Committed Information Rate (CIR)
 - Peak Information Rate (PIR)
 - Maximum Rate
- Service Rate (optional)
 - Typically match the carrier product description
 - Example:
 - 100M Service Rate
 - 1GbE Service Rate



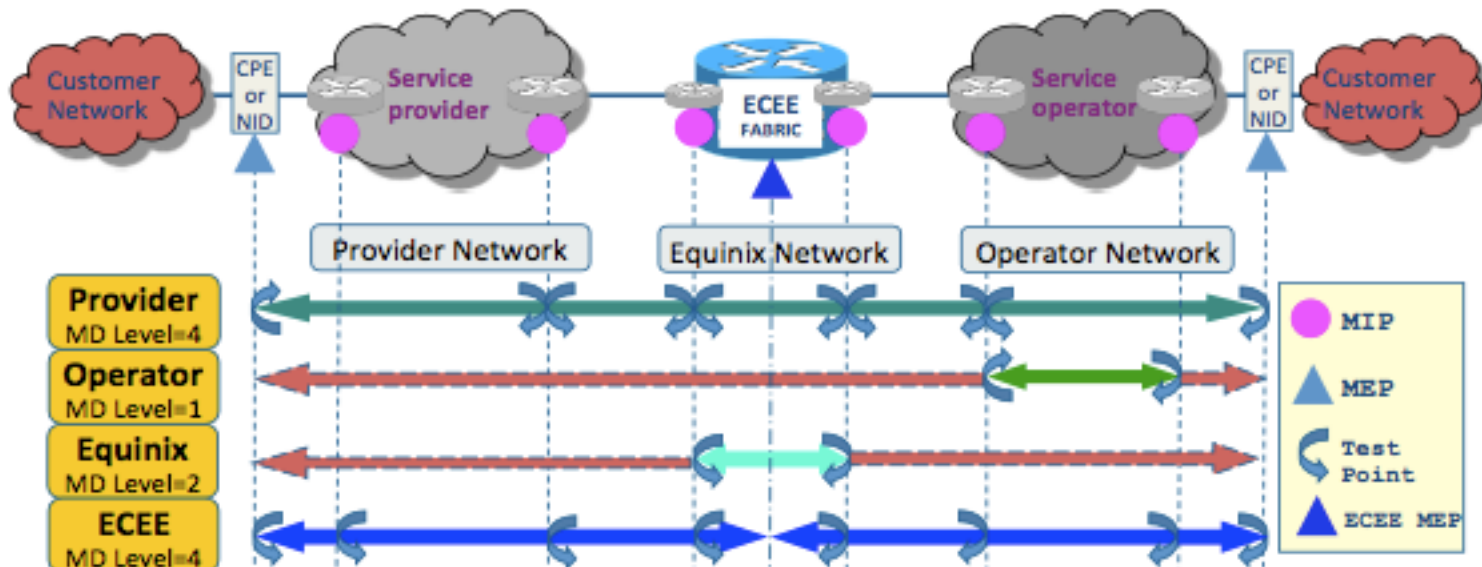
Egress Scheduling

- Mirrors of Ingress QoS Policy
 - Number of Queues
 - Class maps
- Weighted Queues (priority order drop)
- All eight (8) MPLS EXP or 802.1p Bits expressed in class map policy
- Per Queue Parameters (optional)



Ethernet OAM

- IEEE 802.1ag
 - Hierarchical Maintenance Domain
 - Maintenance Association, MIPs & MEP
 - Connectivity Fault Management
- ITU-T Y.1731
 - ← All that (plus)
 - Frame loss measurement
 - Frame delay measurement



Lessons

- Field Verification & Testing Difficulties
- RFC2544 Testing
 - Throughput
 - Burst Rate
 - Frame loss
 - Latency
 - Not Multi-Service Aware
- The Stacked NIDs Problem
- Ethernet OAM (to much to expect?)
- What's next?

References

- The Metro Ethernet Forum. *Technical Specification MEF 26, External Network Network Interface (ENNI) – Phase 1* . January 2010.
http://metroethernetforum.org/PDF_Documents/technical-specifications/MEF26.pdf
- Balakrishnan, R. (May 2008). *Advanced QoS for Multi-Service IP/MPLS Networks*. (Wiley)
- ITU-T Recommendation Y.1731 - OAM functions and mechanisms for Ethernet based networks
- ITU-T Recommendation Y.156 - OAM functions and mechanisms for Ethernet based networks



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Questions?

Thank You