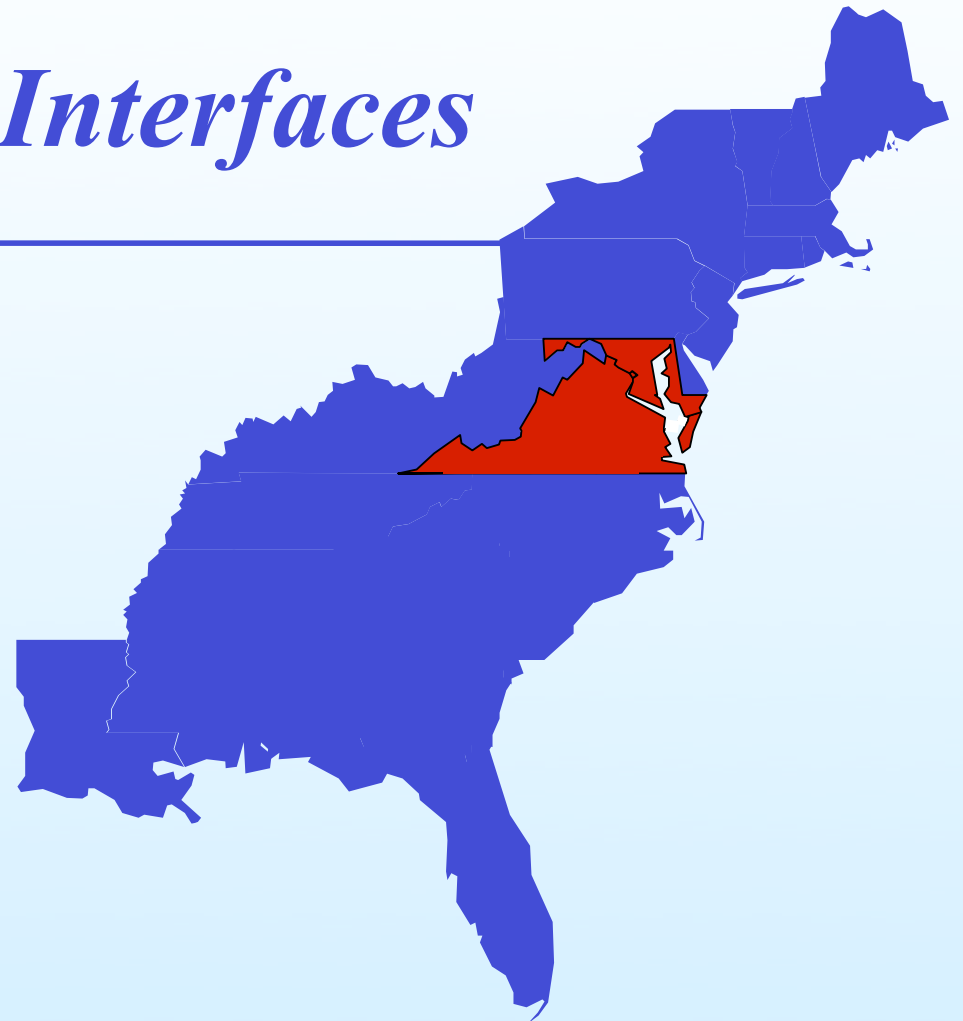


GEC-4 Substrate WG

Generalized Interfaces

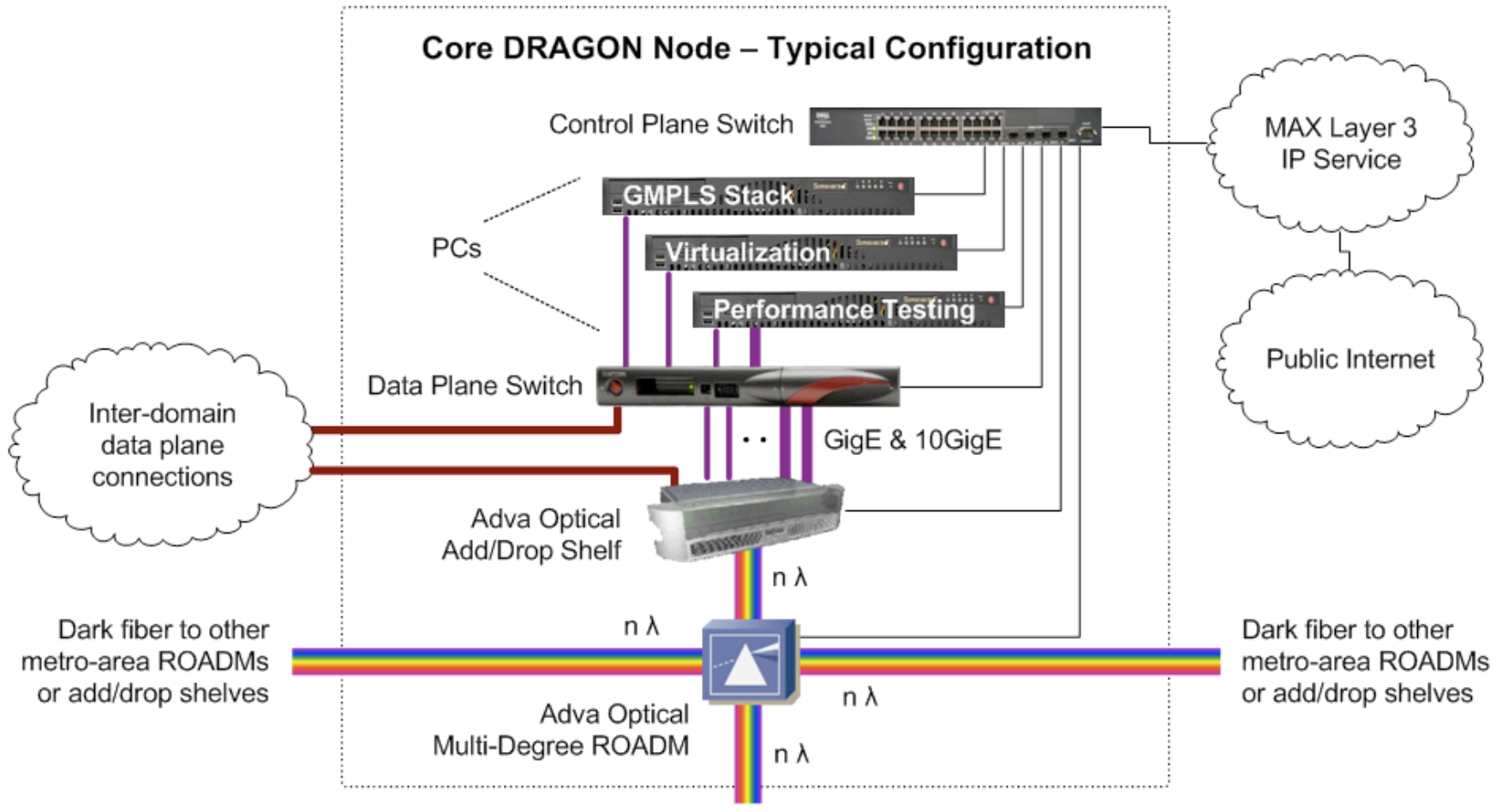
Chris Tracy
Jarda Flidr
Peter O'Neil
Cluster B Participant
April 1st, 2009



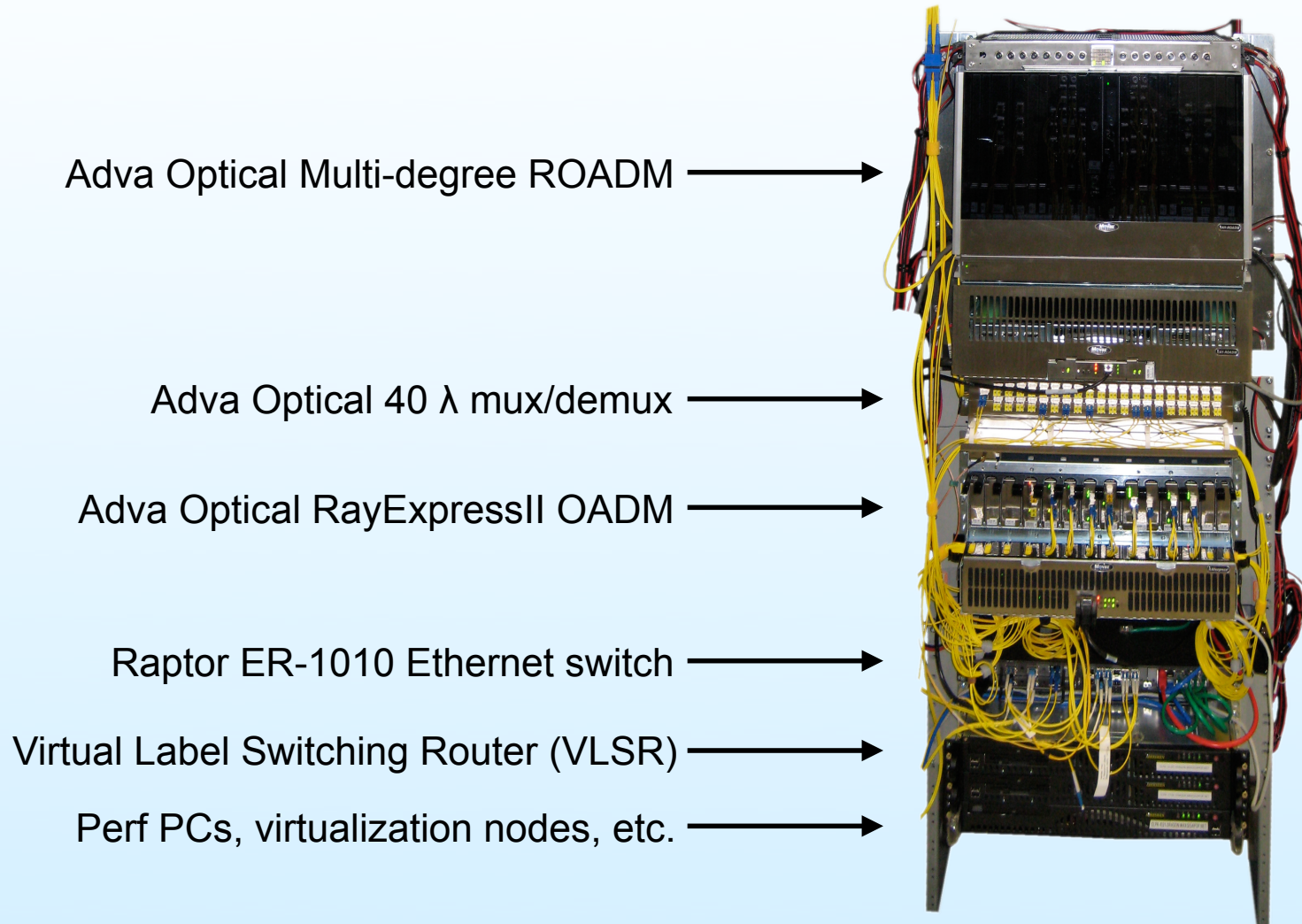
Integrating Dynamic Circuits into GENI

- DRAGON Substrate
 - Typical Core Node (logical and physical view)
 - Overall Network Topology
- GEC4 Demo
 - Summary
 - Lessons Learned
 - Future Work
- Generalized Interfaces
 - Generic Network Element
 - “Unified” Control Interface
 - DRAGON Virtual Label Switching Router (VLSR)

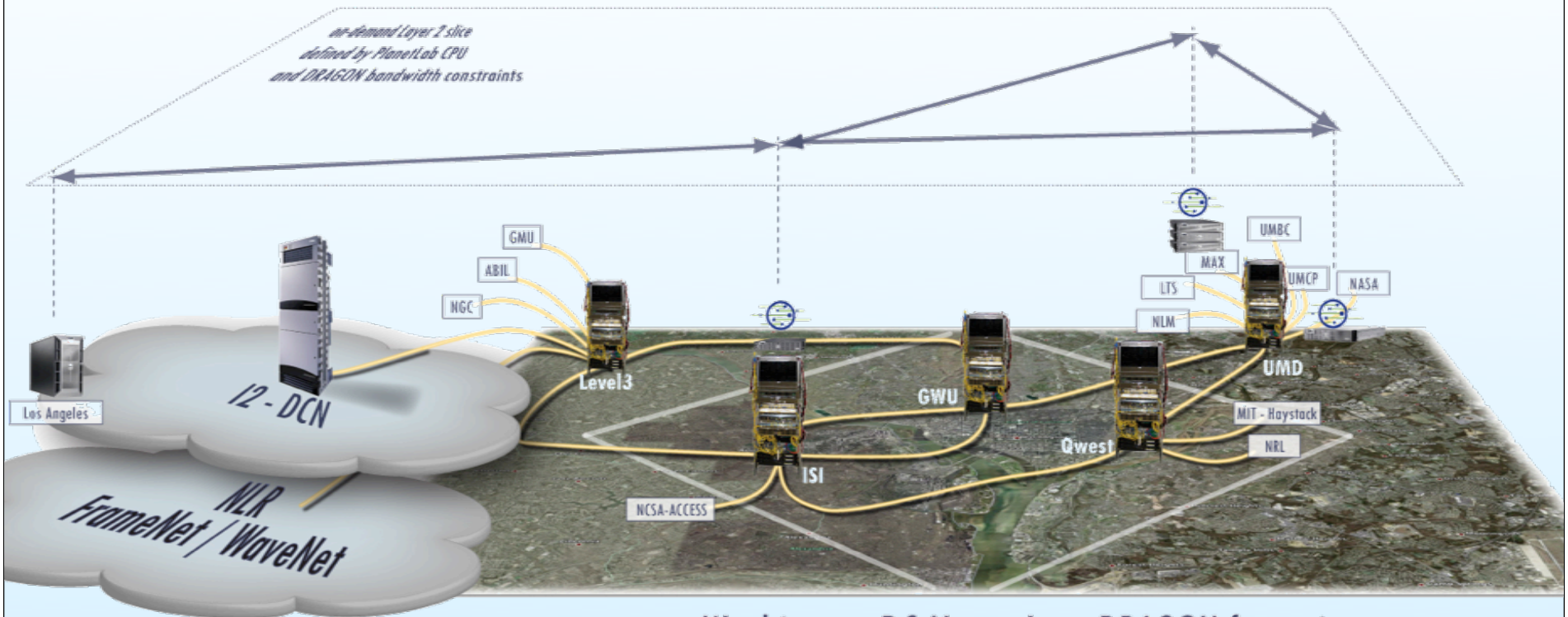
DRAGON Substrate: Typical core node (logical)



DRAGON Substrate: Typical core node (physical)



DRAGON Substrate: Network Topology



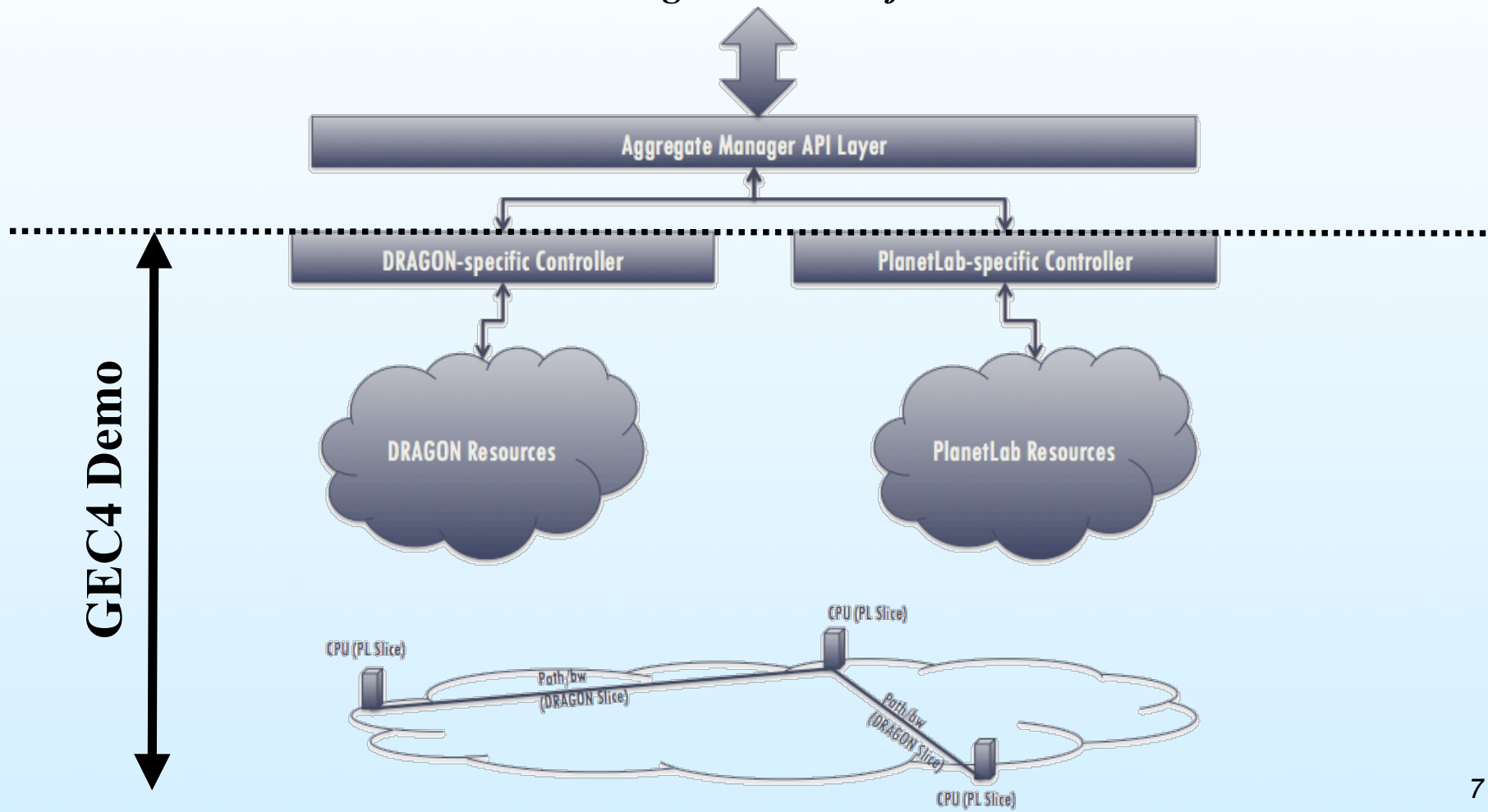
Washington DC Metro Area DRAGON footprint

GEC4 Demo: Summary

- Demonstrated initial interoperability between:
 - PlanetLab “slivers” (vservers)
 - DRAGON dynamic circuits (end-to-end VLANs)
 - non-PlanetLab servers (whole systems, no VMs..)
- Simple proof-of-concept integration
 - tagged VLAN interfaces can be created inside a vserver
 - vserver provides adequate network performance for disk-to-disk or memory-to-memory transfers
- Reservations for network and compute resource are not tightly coupled yet

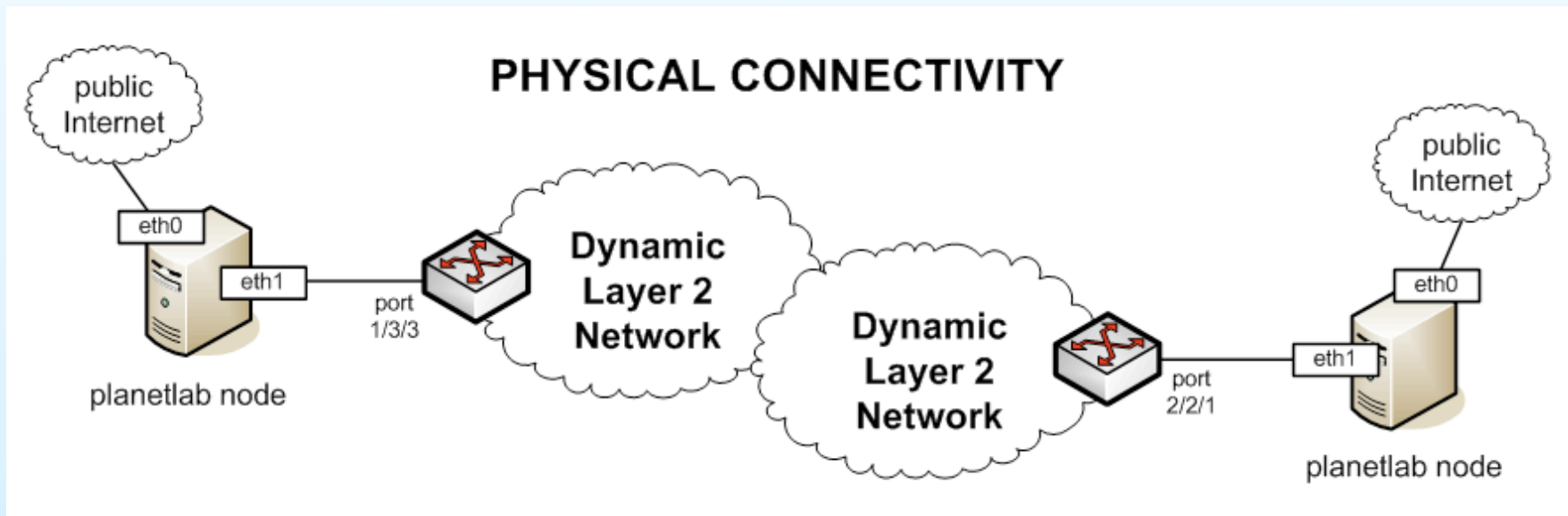
GEC4 Demo: Summary

Clearing House Interface



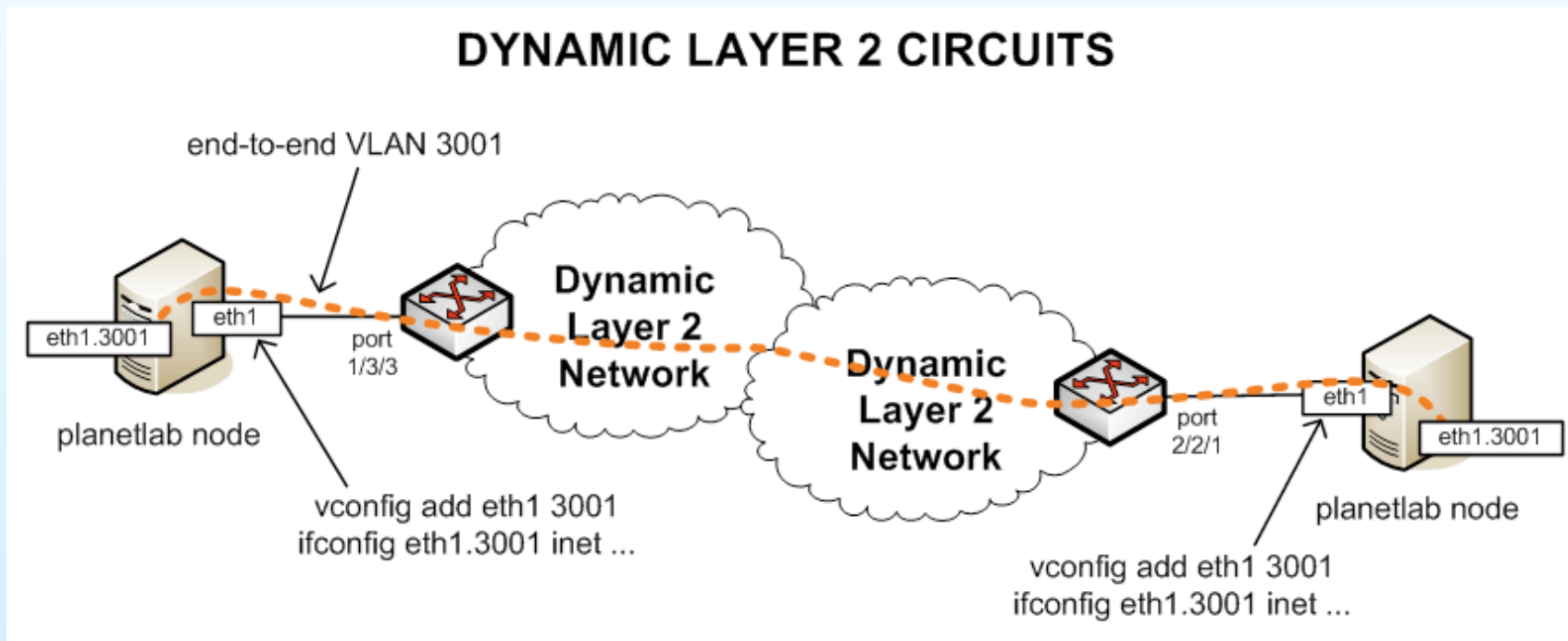
GEC4 Demo: Summary

- Several PlanetLab nodes were deployed
 - spare GigE port on each PC connected to edge of dynamic Layer 2 Ethernet network, for example:



GEC4 Demo: Lessons Learned

- Required manual configuration of VLAN tags on PlanetLab nodes
 - Currently no PLCAPI function to manage dynamically

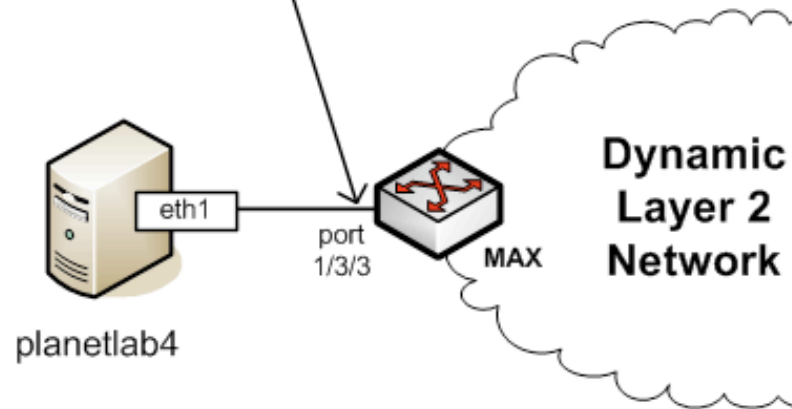


GEC4 Demo: Lessons Learned

- PlanetLab nodes assume Layer 3 IP network connection
 - No knowledge of dynamic network edge port “identifier”

This physical switch port has a globally unique ID (using URN scheme):
urn:ogf:network:domain=dragon.maxgigapop.net:node=MAX:port=1-3-3:link=*

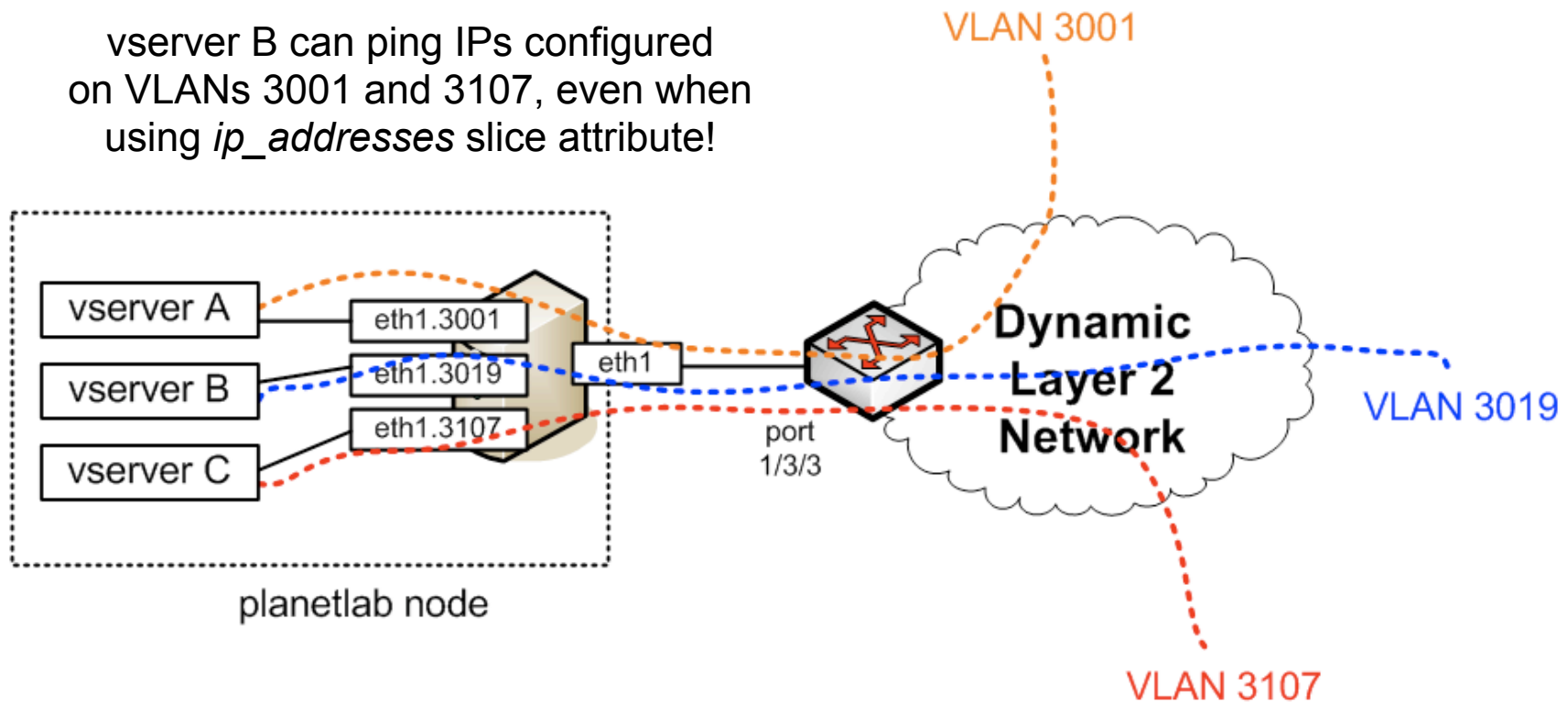
URN may be found using a distributed hierarchal lookup service (DNS-like):
planetlab4-eth1.dragon.maxgigapop.net



GEC4 Demo: Lessons Learned

- vservers do not completely isolate traffic, example:

vserver B can ping IPs configured on VLANs 3001 and 3107, even when using *ip_addresses* slice attribute!

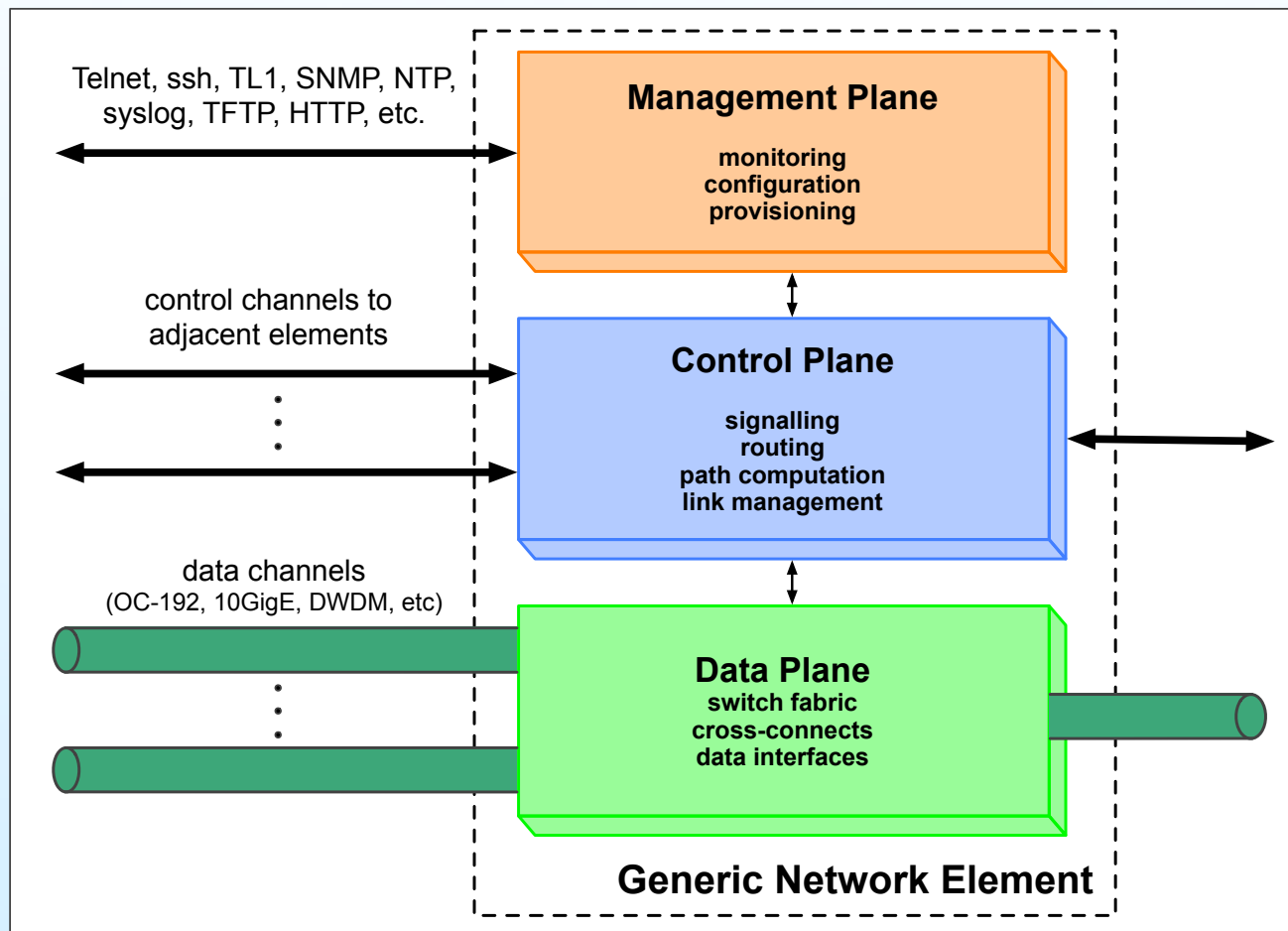


GEC4 Demo: Future Work

- Extend PLCAPI to support dynamic tagged VLAN interface addition/removal and configure IP addresses
 - instead of running vconfig/ifconfig manually...
- Implement PlanetLab node attribute to map physical NIC (e.g. eth1) to globally unique edge port interface on dynamic network (urn:ogf:network:[...])
- Investigate alternatives to vservers for better traffic isolation
 - e.g. PlanetLab Japan uses Kernel-based Virtual Machine (KVM) instead of vservers

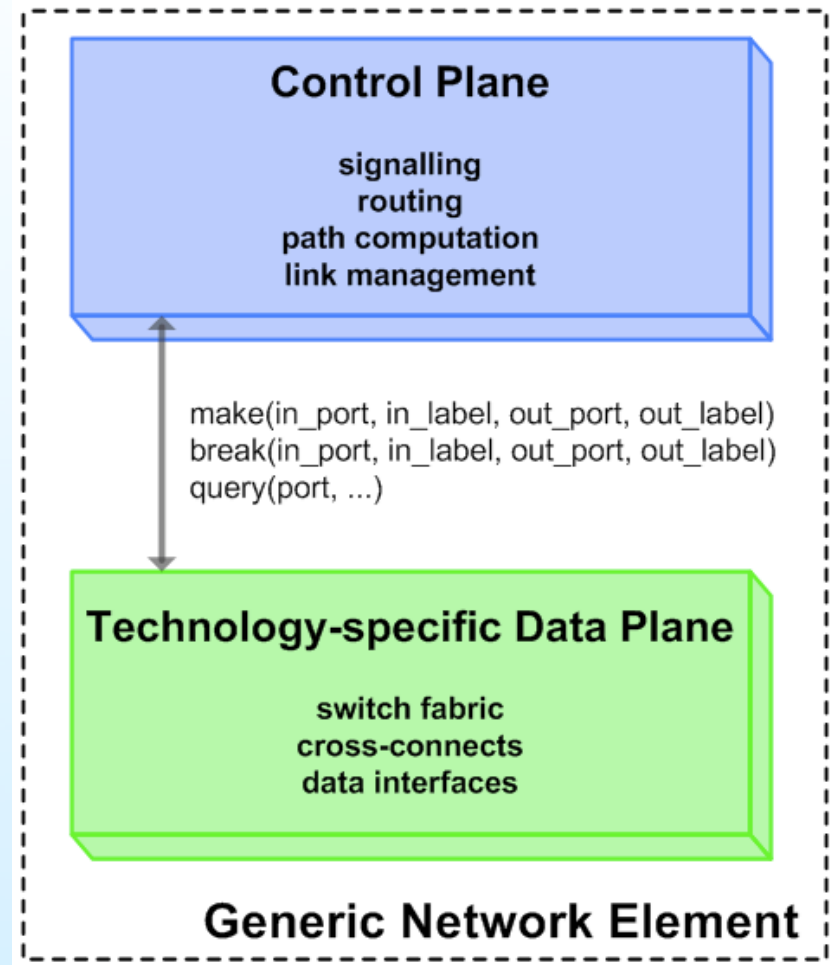
Generic Network Element

– Consider the major components inside a typical network element:



“Unified” Control Interface

- Concept of what a “label” is depends on switching capability:
 - IP router - label would be arbitrary number in IP/MPLS shim header
 - SONET/SDH - label would be a list of timeslots (e.g. 1-192)
 - Ethernet - label could be the VLAN ID
 - Lambda switch - label would be the physical wavelength (e.g. 1552.52nm)
 - “white light” fiber switch - no need for label, in/out port is sufficient



DRAGON Virtual Label Switching Router (VLSR)

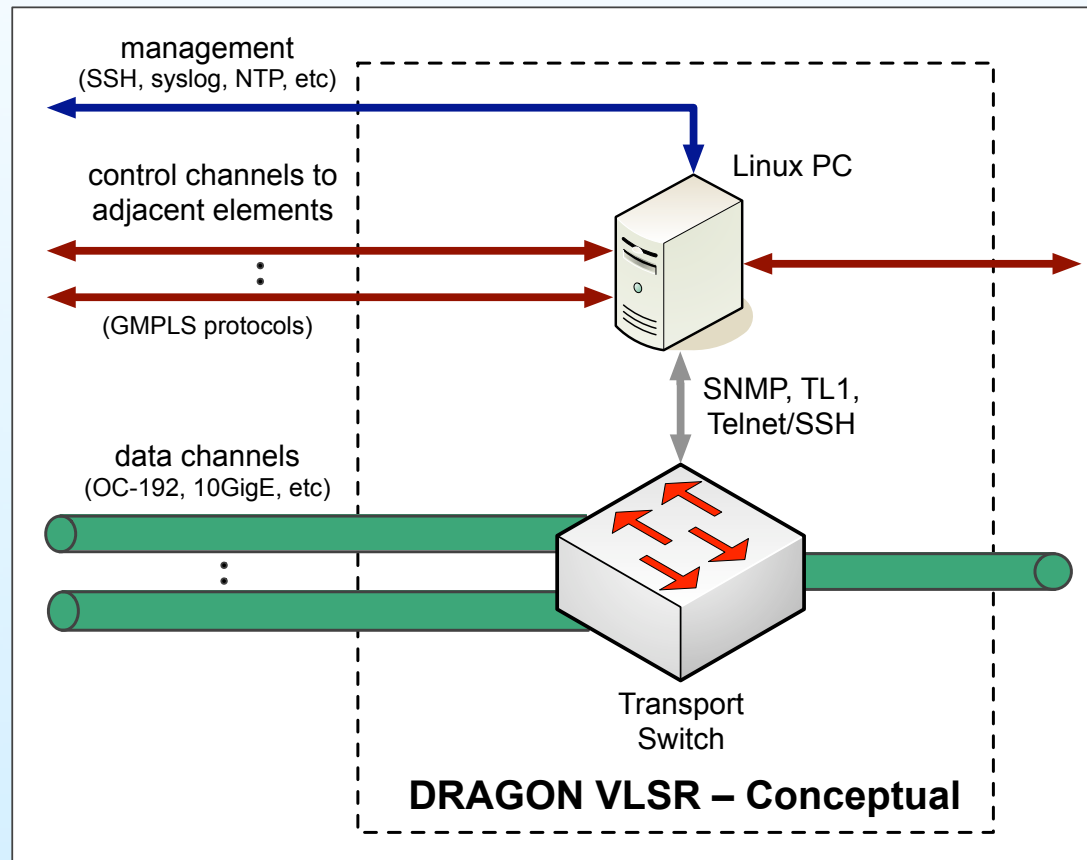
- Open-source implementation of distributed GMPLS RSVP signaling and OSPF routing with Traffing Engineering (TE) extensions
- Manages and provisions transport elements which do not support GMPLS, such as:
 - Ethernet switches
 - SONET/SDH digital cross-connects
- Supported equipment currently includes:
 - Cisco Catalyst 3750/65xx, HP ProCurve 5406, Raptor ER-1010, Dell PowerConnect 5224/5324/6024/6024F/6224, Extreme Summit 1i/5i/7i, Force10 E300/E600/E1200/S2410/S50V, Intel Express 530T, SMC 8708L2/8848, Juniper EX4200, Ciena CoreDirector, Linux PC w/ NICs
- Potential for interoperability with other GMPLS-speaking network elements
 - demonstrated interoperability with Adva Optical lambda switches and Calient DiamondWave fiber switches

DRAGON Virtual Label Switching Router (VLSR)

- Unix PC implements GMPLS control plane protocols (open-source package)
- Provides GMPLS protocol support for devices which do not support GMPLS

Control channels may be provisioned in-band or out-of-band

(e.g. GRE/IPsec tunnel over out-of-band Layer 3 network or in-band control VLAN over Ethernet data channel)



Signalling RFCs:
 RFC 2205
 RFC 3209
 RFC 3471
 RFC 3473
 RFC 3477
 (GMPLS-RSVP-TE)

Routing RFCs:
 RFC 2328
 RFC 2370
 RFC 3630
 RFC 4202
 RFC 4203
 (GMPLS-OSPF-TE)