

# Network Resiliency: Fault Tolerance for Your Critical Applications

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## Outline

- What is network resiliency?
- Why it's important
- Examples of resiliency in telecomm services
  - Commercial Reserve E-Line
  - Local Ring Enhancement service
- Resiliency checklist

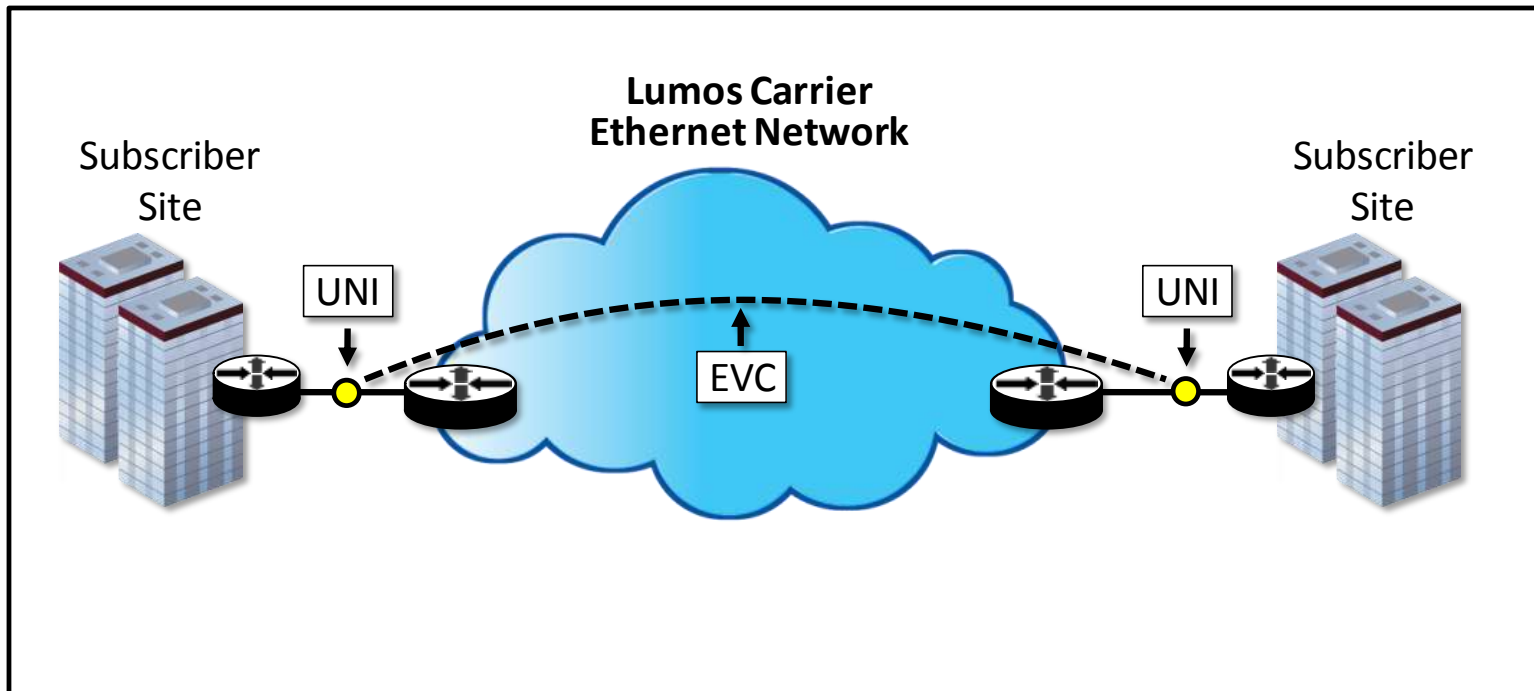


# Network Resiliency

- What is
- Why it's important

# **RESILIENCY EXAMPLE: COMMERCIAL RESERVE E-LINE SERVICE**

# E-Line Service Components

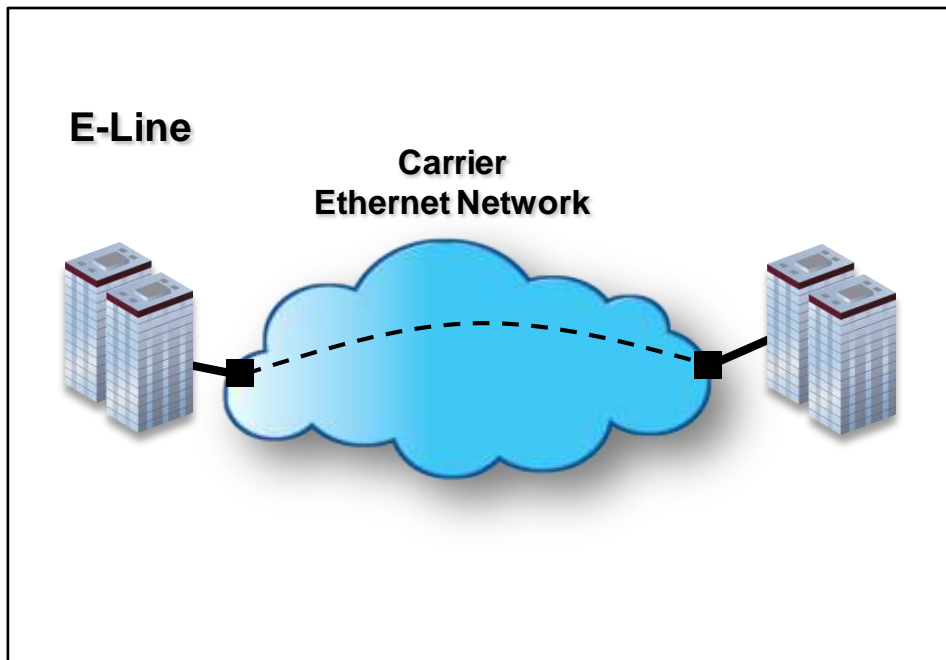


- **User Network Interface (UNI)**
  - Demarcation point between service provider and customer responsibility
  - Speed-specific, standard Ethernet interfaces (1 Gbps, 10 Gbps)
  - Two (2) per E-Line Service, one at each end location
- **Ethernet Virtual Connection (EVC)**
  - Association of two UNIs; traffic passes only between UNIs associated with the same EVC
  - Speed- and grade of service- specific; pay for speed, pay for performance
  - One (1) per each E-Line service

# Commercial Reserve E-Line

Type I Ethernet service with:

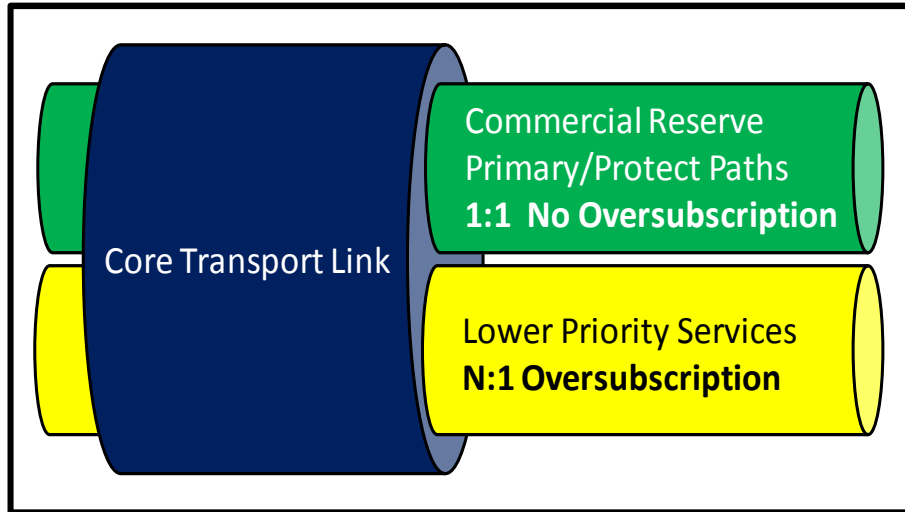
- E-Line (point-to-point) topology
- Specific design requirements to enhance reliability
- Failover and traffic prioritization mechanisms
- Inherent scalability and cost/price customer advantages



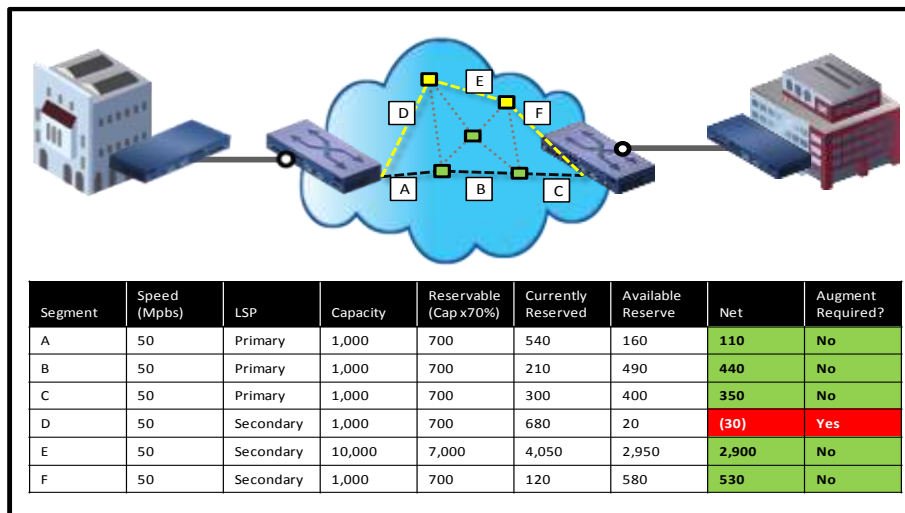
What attributes distinguish  
“Commercial Reserve”?

- Bandwidth Reservation
- Path Protection
- Forwarding Priority

# Bandwidth Reservation

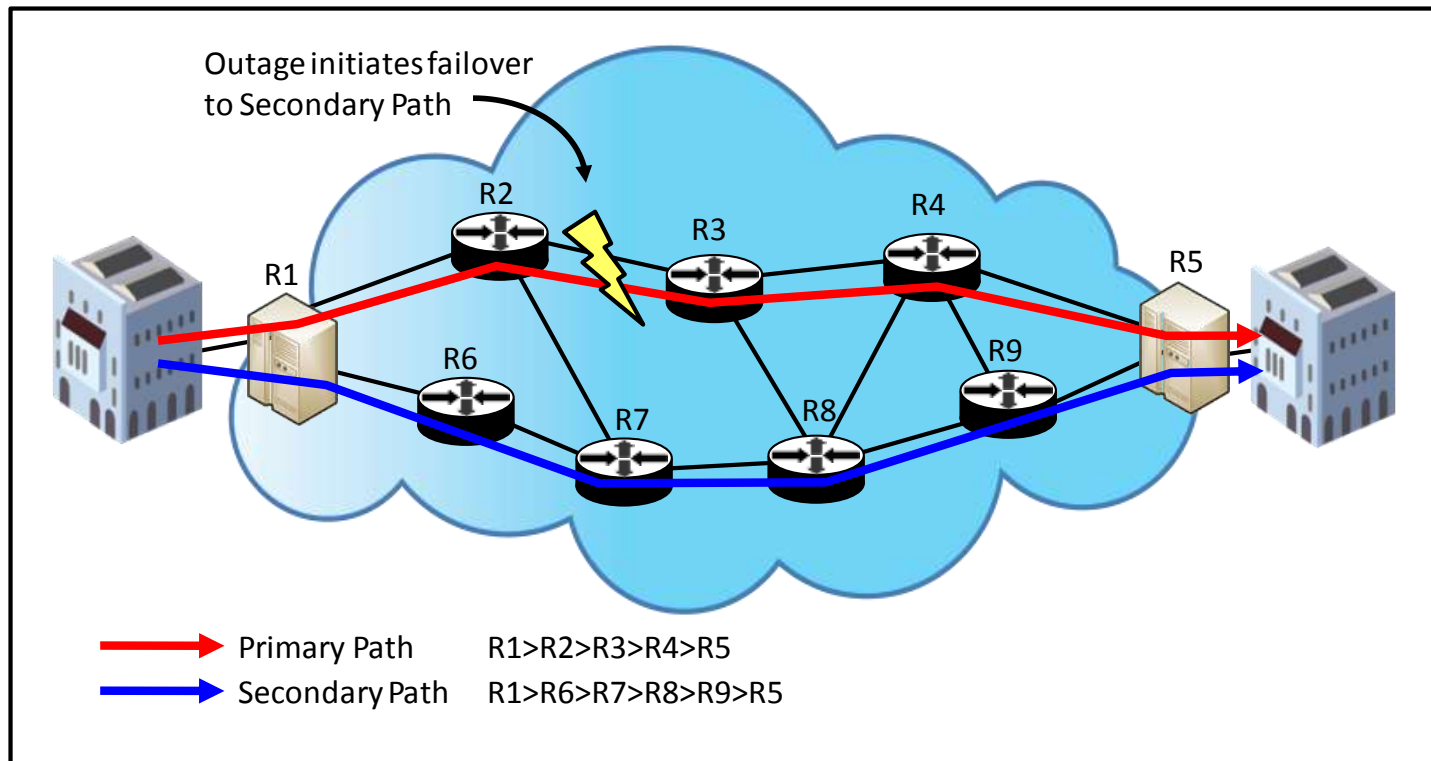


- Link capacity is allocated specifically for Commercial Reserve services
- Both Primary and Secondary Paths are non-oversubscribed, 1:1



- Visibility into capacity inventory at point of design and provisioning
- Augments, if required, are completed before service is provisioned

Commercial Reserve Service is inherently redundant

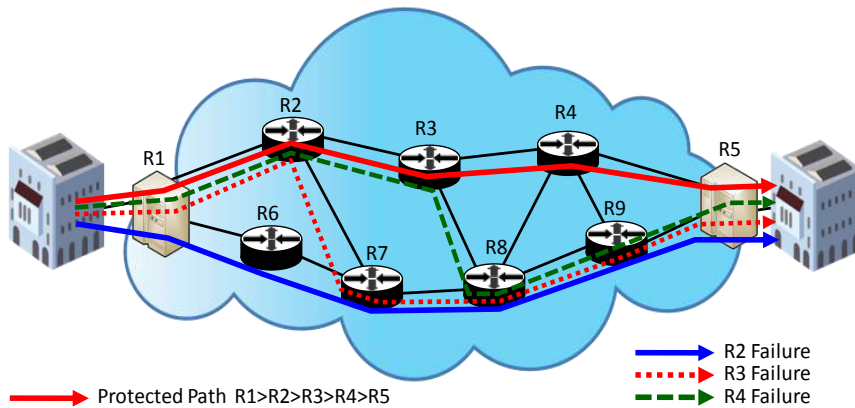


- Primary and Secondary paths are assigned through the MPLS core
- Paths are diverse from one another and non-oversubscribed
- If an outage occurs, failover to the secondary path is instant and automatic
- SONET-equivalent failover,  $\leq 50$  ms



## Forwarding Priority

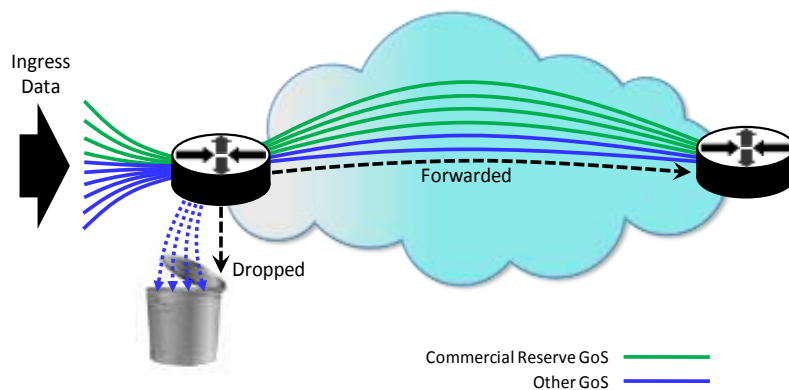
### Tertiary Routing



In the event of a failure on both the Primary and Secondary paths:

- Network leverages the best of any remaining shared network resources
- Traffic is routed over a tertiary path, determined dynamically, if available

### Forwarding Priority



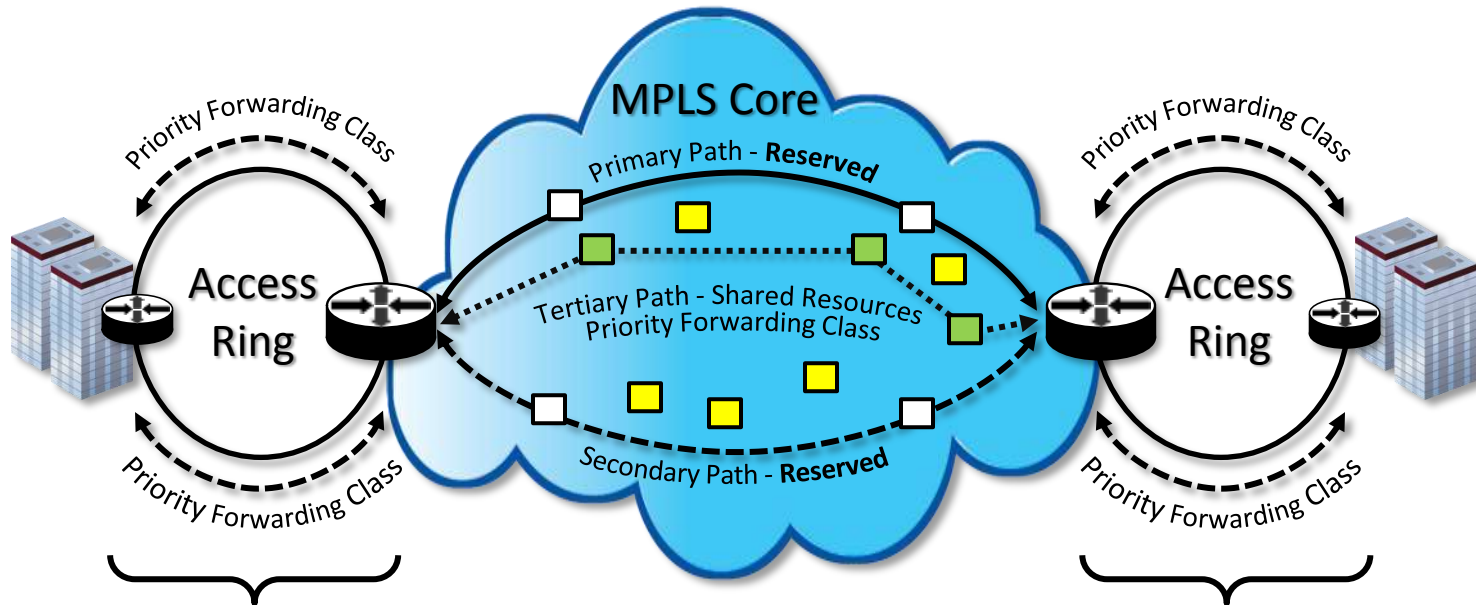
If tertiary route(s) become congested:

- Commercial Reserve has exclusive forwarding priority
- Commercial Reserve traffic is preserved over all other traffic types
- Lower priority frames are dropped first

# Attribute Application

## MPLS Core:

- Bandwidth Reservation
- Path Protection (Primary/Secondary)
- Forwarding Priority



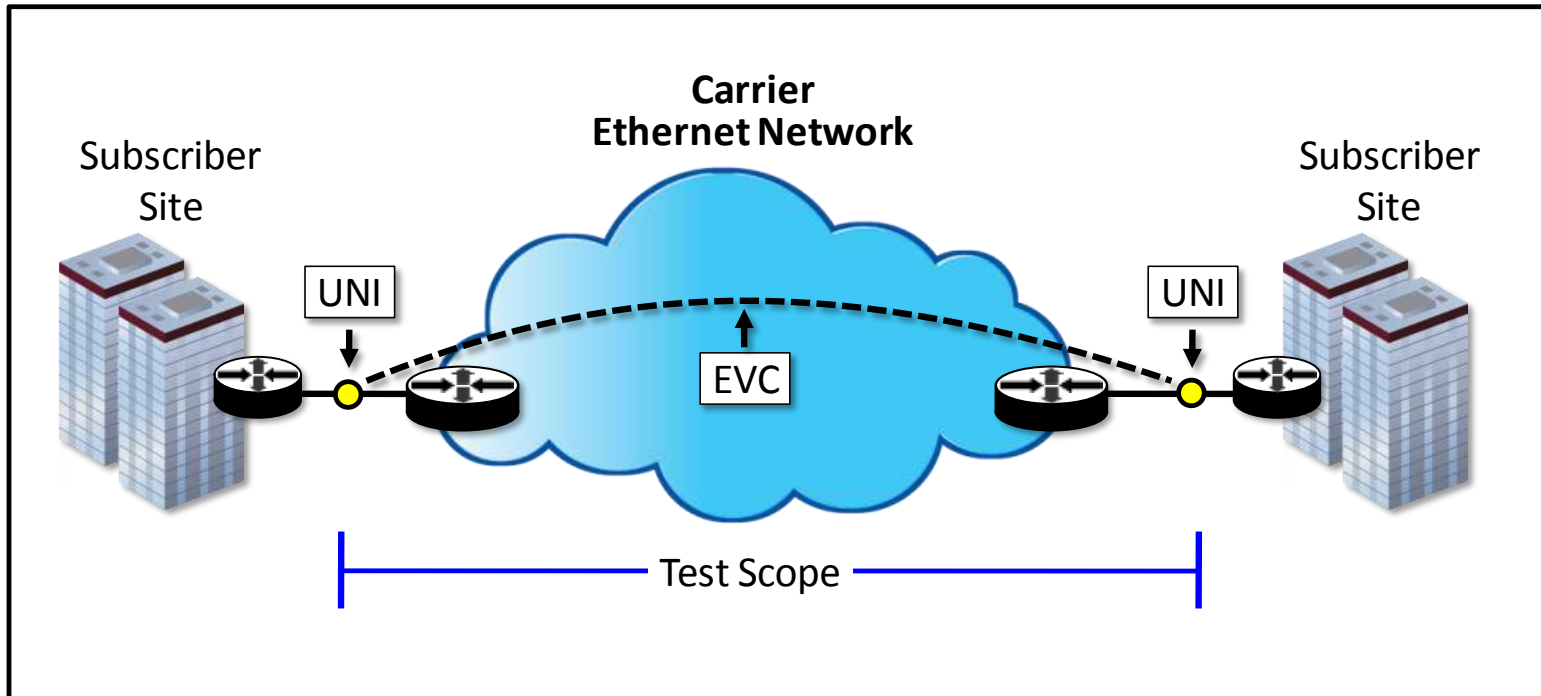
## Access Ring:

- Path Protection (Ring)
- Forwarding Priority

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# Initial Testing / Turn-up

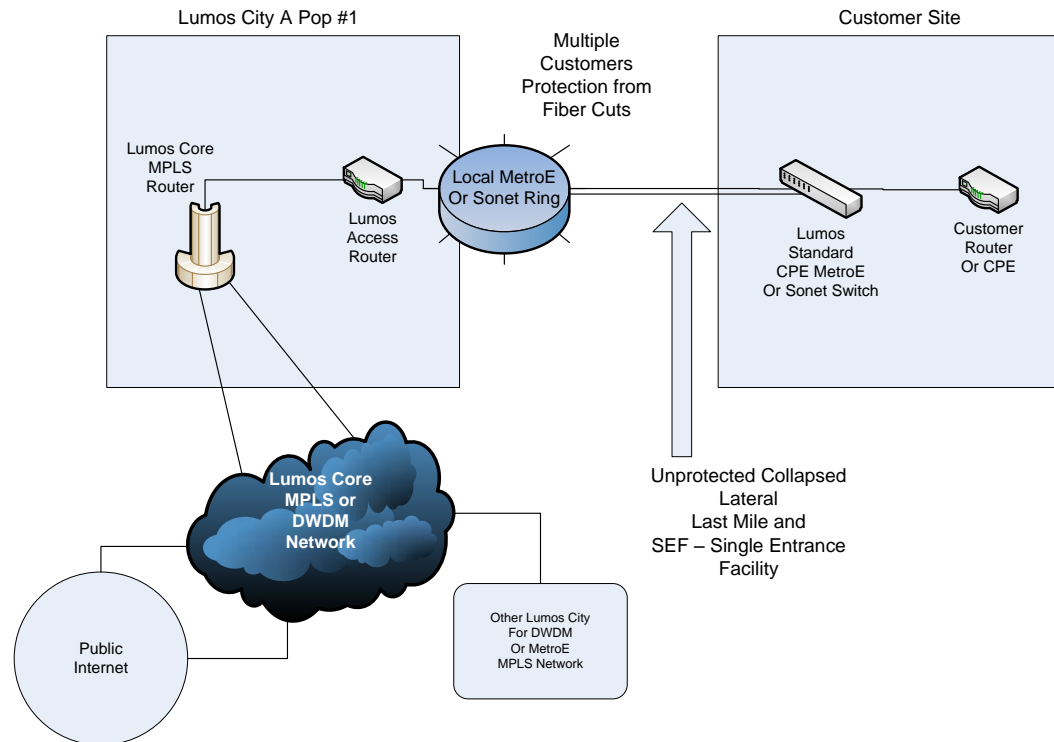


Initial testing – results delivered to customer:

- ITU-T Y.1564 test specification, industry-standard
- Measured from UNI to UNI, over the entire EVC
- Primary and Secondary paths tested individually
- Measures Frame Delay, Inter-Frame Delay Variation, and Frame Loss Ratio performance over a range of frame sizes and bit rates

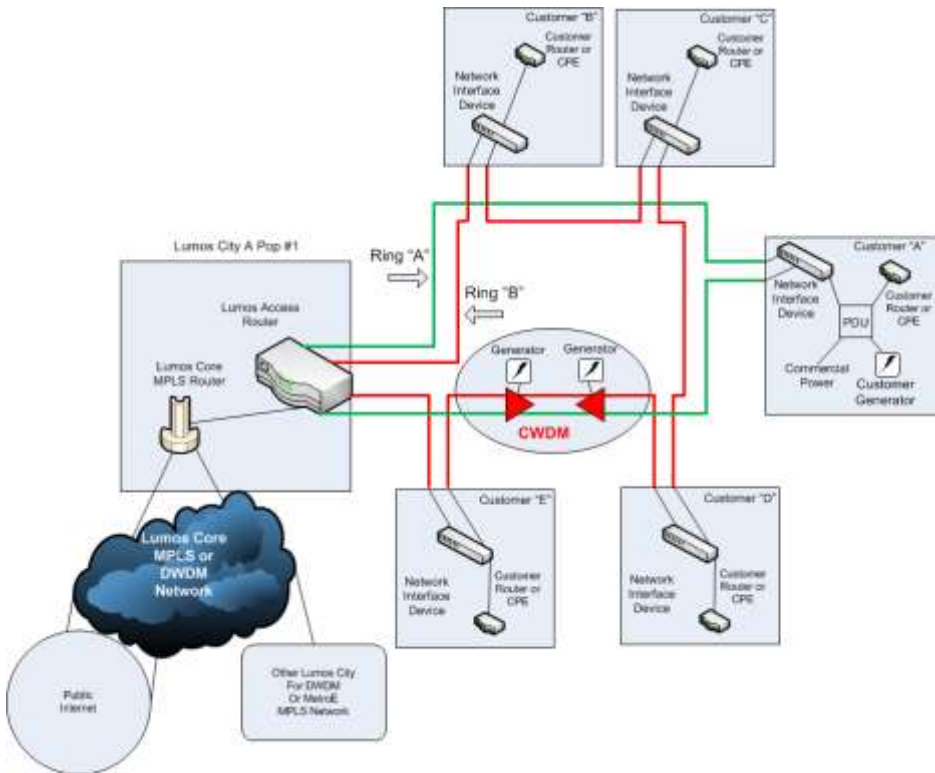
# **RESILIENCY EXAMPLE: LOCAL RING ENHANCEMENT SERVICE**

## ❖ Standard Local Access Configuration

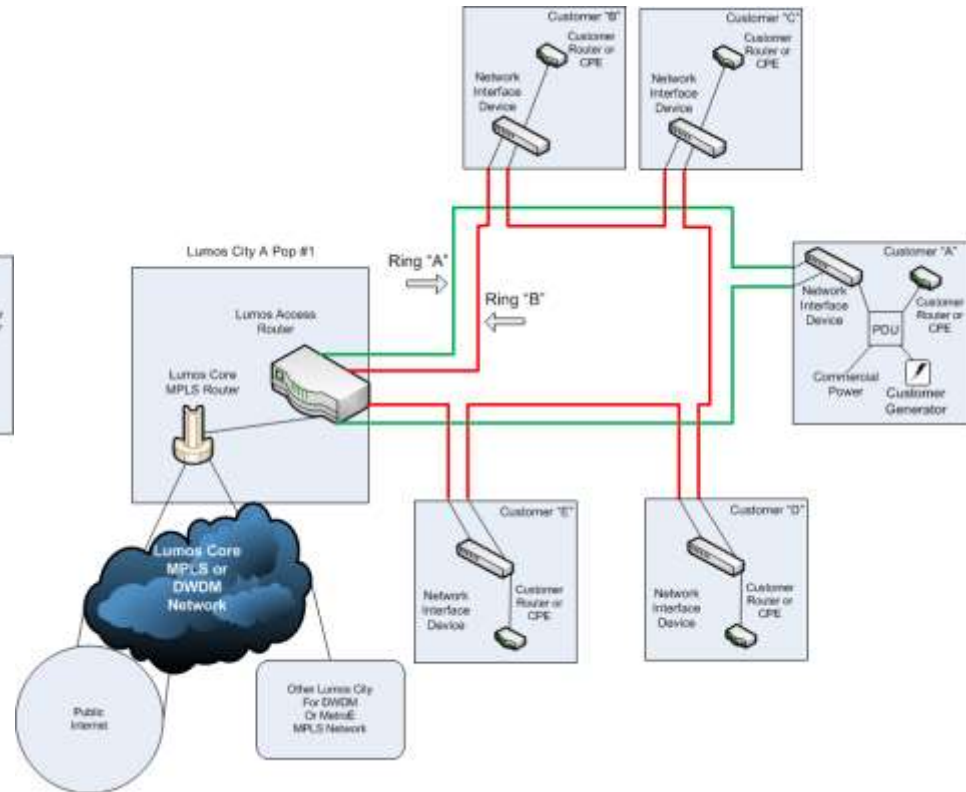


## ❖ Local Ring Options

### Private Dedicated Virtual Ring

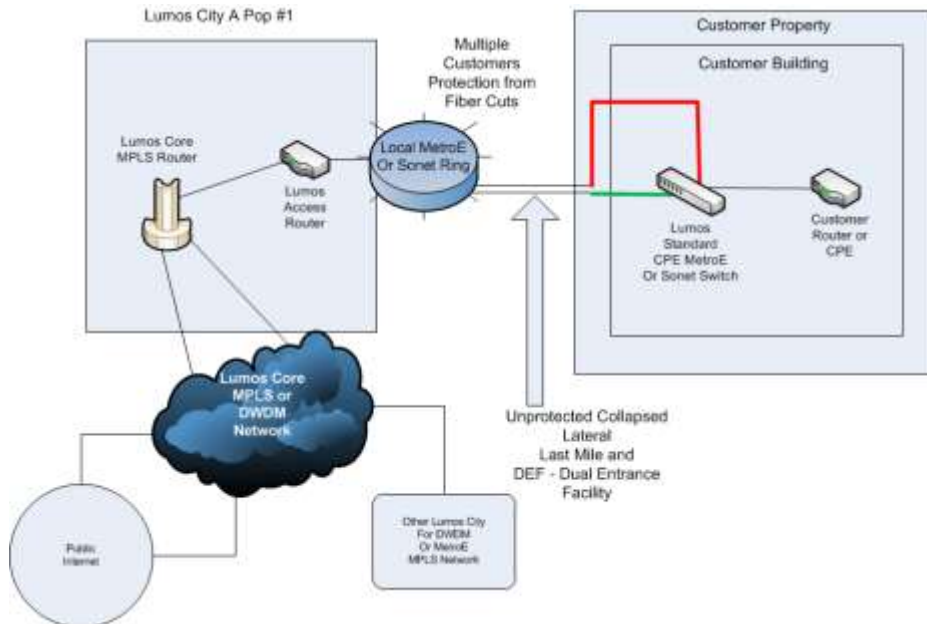


### Private Dedicated Physical Ring

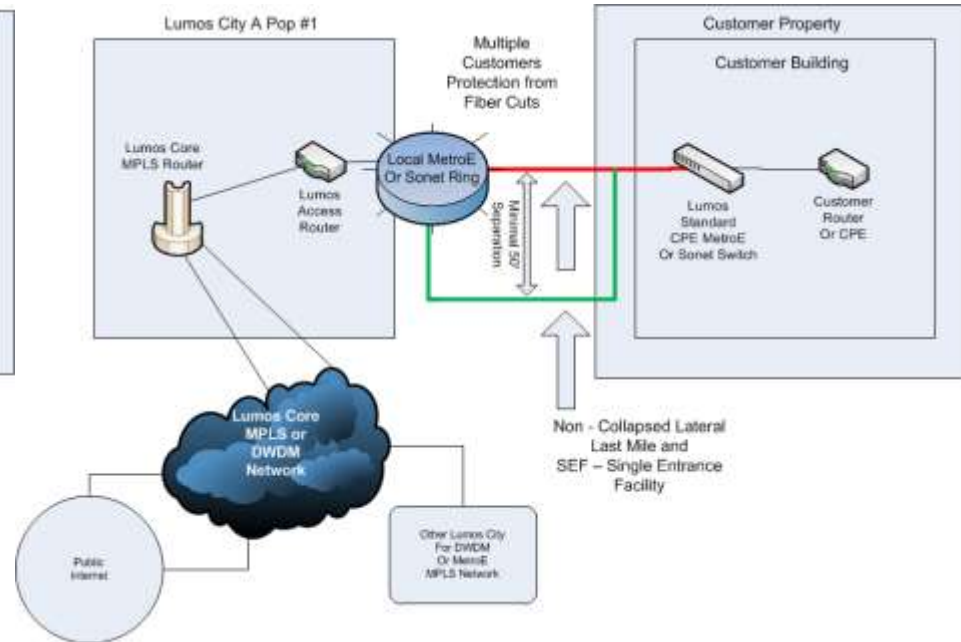


## ❖ Lateral / Building Entry Options

### Dual Entrance Facility into Customer Premise

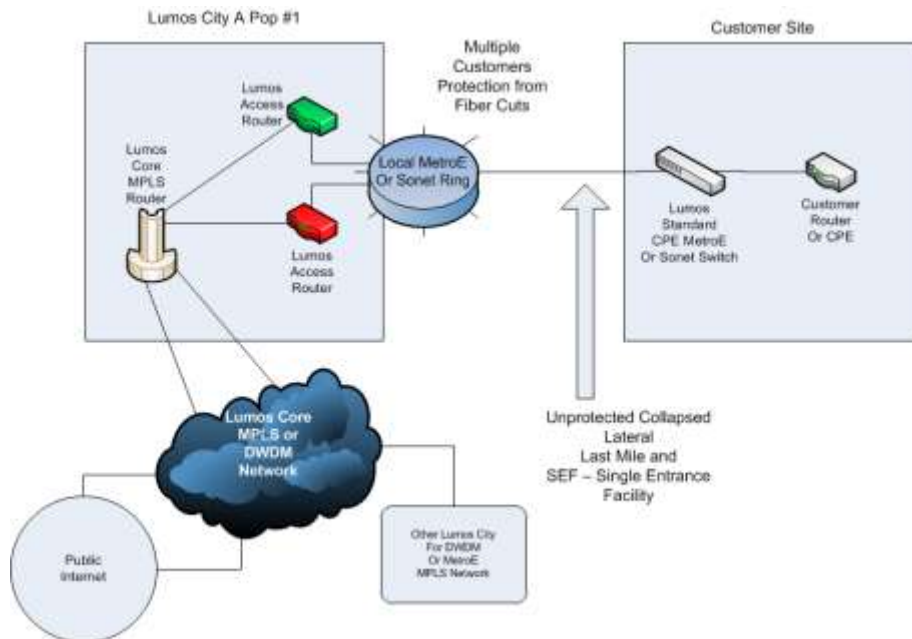


### Non Collapsed Lateral Last Mile

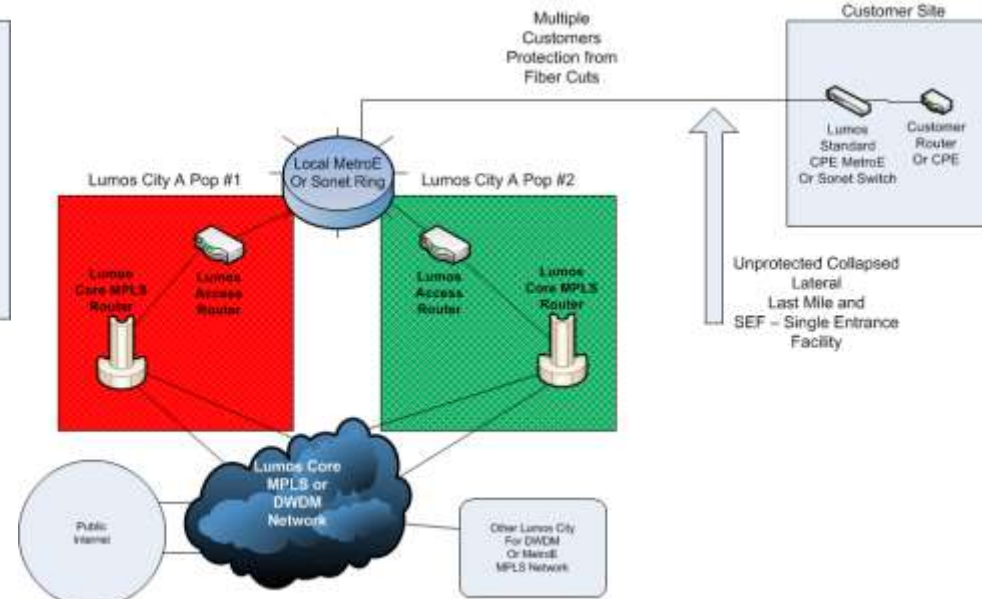


## ❖ POP Diversity Options

### Lumos Router in POP Diversity (if available)



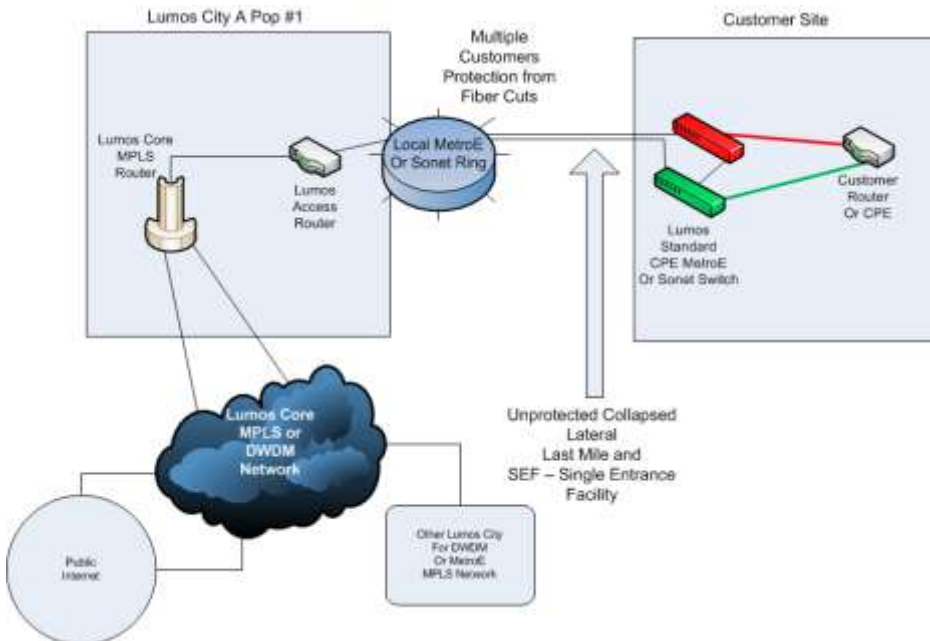
### Lumos POP Diversity (in City and Cross City – if available)



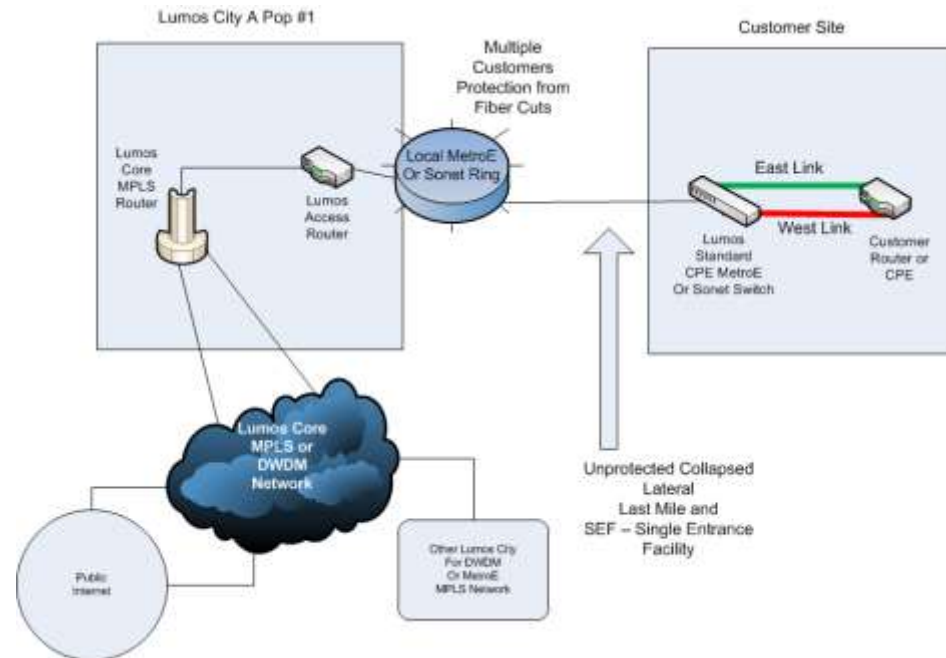


## ❖ Premises Equipment Options

### Redundant Lumos Router/Switch at Customer premise



### Redundant East/West Links from Lumos CPE to Customer's Network





# Resiliency Checklist