LUMOS NETWORKS

Request for Information

CRFI 0210 ISC1500000002

for

THE STATE OF WEST VIRGINIA PURCHASING DIVISION
RFI TO REPLACE MPLS CONTRACT

July 30, 2015

Greg Florence – Major Account Manager
304-414-0411
florenceg@lumosnet.com

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ADDENDUM ACKNOWLEDGEMENT FORM
SOLICITATION NO.: CRFI ISC1500000002

Instructions: Please acknowledge receipt of all addenda issued with this solicitation by completing this addendum acknowledgment form. Check the box next to each addendum received and sign below. Failure to acknowledge addenda may result in bid disqualification.

Acknowledgment: I hereby acknowledge receipt of the following addenda and have made the necessary revisions to my proposal, plans and/or specification, etc.

Addendum Numbers Received:
(Check the box next to each addendum received)

[X]	Addendum No. 1	[ ]	Addendum No. 6
[ ]	Addendum No. 2	[ ]	Addendum No. 7
[ ]	Addendum No. 3	[ ]	Addendum No. 8
[ ]	Addendum No. 4	[ ]	Addendum No. 9
[ ]	Addendum No. 5	[ ]	Addendum No. 10

I understand that failure to confirm the receipt of addenda may be cause for rejection of this bid. I further understand that any verbal representation made or assumed to be made during any oral discussion held between Vendor's representatives and any state personnel is not binding. Only the information issued in writing and added to the specifications by an official addendum is binding.

Lumos Networks, LLC
Company

Authorized Signature

7/30/2015
Date

NOTE: This addendum acknowledgement should be submitted with the bid to expedite document processing.
Revised 6/8/2012

Purchasing Divison
2019 Washington Street East
Post Office Box 50130
Charleston, WV 25305-0130

State of West Virginia
Request for Information
21 — Info Technology

Proc Folder: 120401

Doc Description: Request for Information (CRFI) to replace MPLS contract

Proc Type: Request for Information

Date Issued	Solicitation Closes	Solicitation No	Version
2015-06-25	2015-07-30 13:30:00	CRFI 0210 ISC1500000002	1

BID CLERK
DEPARTMENT OF ADMINISTRATION
PURCHASING DIVISION
2019 WASHINGTON ST E
CHARLESTON WV 25305
US

Vendor Name, Address and Telephone Number:

Lumos Networks
1200 Greenbrier St
Charleston, WV 25311
304-414-0411

FOR INFORMATION CONTACT THE BUYER

Guy Nisbet
(304) 558-2596
guy.l.nisbet@wv.gov

Signature X Guy Florence **FEIN #** 84-1452950 **DATE** 7/30/15

All offers subject to all terms and conditions contained in this solicitation

'ARTMENT OF ADMINISTRATION OFFICE OF TECHNOLOGY 1900 KANAWHA BLVD E, BLDG 5 10TH FLOOR CHARLESTON WV25305 US	WV OFFICE OF TECHNOLOGY BLDG 5, 10TH FLOOR 1900 KANAWHA BLVD E CHARLESTON WV 25304 US

Line	Comm Ln Desc	Qty	Unit Issue
1	See Attached Request for Information Files		

Comm Code	Manufacturer	Specification	Model #
81161700			

Extended Description :

Requesting information for the replacement of the current MPLS contract (MPLS07)

ADDITIONAL TERMS AND CONDITIONS

See attached document(s) for additional Terms and Conditions

INSTRUCTIONS TO VENDORS RESPONDING TO A REQUEST FOR INFORMATION

1. REVIEW DOCUMENTS THOROUGHLY: The attached documents contain a solicitation for information only. Please read these instructions and all documents attached in their entirety.

2. VENDOR QUESTION DEADLINE: Vendors may submit questions relating to this Solicitation to the Purchasing Division. Questions must be submitted in writing. All questions must be submitted on or before the date listed below and to the address listed below in order to be considered. A written response will be published in a Solicitation addendum if a response is possible and appropriate. Non-written discussions, conversations, or questions and answers regarding this Solicitation are preliminary in nature and are non-binding. Submitted e-mails should have the solicitation number in the subject line.

   Question Submission Deadline: July 9, 2015, by 10:00 AM.EDT.

   Submit Questions to: Guy L. Nisbet, Buyer Supervisor
   2019 Washington Street East
   Charleston, WV 25305
   Email: Guy.l.nisbet@wv.gov

3. VERBAL COMMUNICATION: Any verbal communication between the Vendor and any State personnel is not binding.

4. RESPONSE SUBMISSION:

   The RFI response must be no more than 50 typed pages using 11 point font or larger, with borders no less than 1/2 inch. The RFI number shall be typed on each page, and all pages will be numbered.

   All responses must be delivered to the Purchasing Division at the address listed below on or before the date and time of the Submission Deadline. Any response received by the Purchasing Division staff is considered to be in the possession of the Purchasing Division and will not be returned for any reason. The Purchasing Division will not accept responses, modifications of responses, or any other documentation associated with the response by email. Acceptable delivery methods include hand delivery, delivery by courier, or facsimile. ELECTRONIC RESPONSES THROUGH WVOASIS ARE NOT BEING ACCEPTED FOR THIS SOLICITATION. The response delivery address is:

   Department of Administration, Purchasing Division
   2019 Washington Street East
   Charleston, WV 25305-0130

   FAX NUMBER FOR RESPONSES IS: (304)558-3970

Responses should contain the following information on the face of the envelope or the response may be rejected by the Purchasing Division:

REQUEST FOR INFORMATION: CRFI ISC1500000002
BUYER: GUY L. NISBET
RESPONSE OPENING DATE: Thursday, July 30, 2015
RESPONSE OPENING TIME: 1:30 PM EDT

5. RESPONSE OPENING: Responses submitted for this Solicitation will be opened at the location identified for RESPONSE SUBMISSION (above) on the date at time listed above. Delivery of a response after the opening date and time may result in the response being discarded. For purposes of this Solicitation, a response is considered delivered when the response is time stamped by the official Purchasing Division time clock.

6. ADDENDUM ACKNOWLEDGMENT: Changes or revisions to this Solicitation will be made by an official written addendum issued by the Purchasing Division. Vendor should acknowledge receipt of all addenda issued with this Solicitation by completing an Addendum Acknowledgment Form, a copy of which is included with each Addendum issued. Failure to acknowledge addenda may result in the response being discarded. The addendum acknowledgment should be submitted with the response.

7. COMMUNICATIONS LIMITATIONS: In accordance with West Virginia Code of State Rules §148-1-6.6, communication with the State of West Virginia or any of its employees regarding this Solicitation during the solicitation period, except through the Purchasing Division, is strictly prohibited without prior Purchasing Division approval. From the date the Request for Information is issued and the until after the Response Opening Date and Time, contact regarding this solicitation between Vendors responding to this solicitation and individuals employed by the State is restricted to the Buyer listed above as the contact for Vendor Questions.

8. DISCLOSURE: Vendor's response to this Solicitation is considered a public document and will be disclosed to the public in accordance with the laws, rules, and policies governing the West Virginia Purchasing Division. Those laws include, but are not limited to, the Freedom of Information Act found in West Virginia Code §§29B-1-1 et seq. and the competitive bidding laws found in West Virginia Code §§5A-3-1 et seq., 5-22-1 et seq., and 5G-1-1 et seq.

If a Vendor considers any part of its response to be exempt from public disclosure, Vendor must so indicate by specifically identifying the exempt information, identifying the exemption that applies, providing a detailed justification for the exemption, segregating the exempt information from the general response information, and submitting the exempt information as part of its response but in a segregated and clearly identifiable format. Failure to comply with the

foregoing requirements will result in public disclosure of the Vendor's response without further notice. A Vendor's act of marking all or nearly all of its response as exempt is not sufficient to avoid disclosure and WILL NOT BE HONORED. Vendor's act of marking a response or any part thereof as "confidential" or "proprietary" is not sufficient to avoid disclosure and WILL NOT BE HONORED. A legend or other statement indicating that all or substantially all of the response is exempt from disclosure is not sufficient to avoid disclosure and WILL NOT BE HONORED. Additionally, pricing or cost information will not be considered exempt from disclosure and requests to withhold publication of pricing or cost information WILL NOT BE HONORED.

Vendor will be required to defend any claimed exemption for nondisclosure in the event of an administrative or judicial challenge to the State's nondisclosure. Vendor must indemnify the State for any costs incurred related to any exemptions by the Vendor. Any questions regarding the applicability of the various public records laws should be addressed to Vendor's own legal counsel prior to response submission.

Instructions understood.

West Virginia Office of Technology

REQUEST FOR INFORMATION

The WV Office of Technology is issuing this Request for Information for the purpose of gathering information to develop procurement specifications by identifying viable network infrastructures, customer service and support requirements, and security needs, as well as other related capabilities and methodologies that best fit the State of West Virginia's needs for a replacement of the current statewide MPLS07 network. Information provided will assist the WV Office of Technology in strategic planning and will assist in the procurement process.

CURRENT ENVIRONMENT:

The State of West Virginia operates and maintains statewide networks for data, video and voice transmission that are shared between government and education entities including state agencies, higher education, K-12 schools, libraries and county/municipal units of government. There are over 2000 local access and aggregation circuits statewide under existing telecommunications contracts. Today the State's data circuits are backhauled to state backbone sites for transport and access to core systems and services.

The State's current network is a mix of old and new technology with the State's Points of Presence (POPs) at Charleston, Clarksburg and Flatwoods. The WV Office of Technology manages the State's connections to the network, and is responsible for billing the State entities for their usage of the network with postalized rates (rates are currently equalized across all locations by service type).

PURPOSE:

The WV Office of Technology plans to solicit proposals for the replacement of the current MPLS contract (MPLS07) with Verizon and Frontier. We plan to implement these changes in stages.

The first component will be the statewide provision of all telecommunications data transport services (Statewide Transport) – Point-to-Point Private Line Services, Ethernet Dedicated and Multi-point Switched Services, Frame Relay Services, Asynchronous Transfer Mode Services and Multi-protocol Label Switching (MPLS) Services. The second component will be to transition over time the Ethernet Transport circuits from the statewide contract (i.e., the County Contracts). And the third component will be to provide Session Internet Protocol (SIP) trunking and related services statewide.

Three identified areas of concern in specifying requirements for all three of the procurement components are:

1) Network Architecture and Design: Because different vendors approach telecommunication network design differently, WVOT needs to assess the vendors' network architecture in the State of WV for applicability in deploying the requested services.

2) Service/Support Infrastructure: Many vendors may be able to provide telecommunications services in WV; equally important to the State is their ability to support these services with qualified technical personnel on a 24x7x365 basis – either by telephone or onsite, whichever is necessary to resolve network issues affecting the services provided based upon the severity of the problem. On behalf of the State Agencies, the WVOT must assess the support infrastructure in place – the degree in which the vendor has identified criteria to measure its own customer service and maintenance performance (Average Response Times, Mean Time to Repair, etc.), network availability (Uptime statistics, Latency, Congestion, etc.), and communication plans for Severity Level 1, 2, 3 type outages and Network Change Management procedures, as well as documented results to assess the vendor's performance against their own metrics.

3) Security Practices: Due to the ever-growing need to focus on network security and associated vulnerabilities, the WVOT needs to consider the security policies and practices of vendors being considered for contracted services. Qualifiers would include documented corporate policies, access requirements, documented measures in place for security breaches, employee certifications and clearance plans, etc.

4) For the Ethernet Transport on a County-wide level, additional concerns include Limited Coverage, Service Offerings, Redundancy, and Support Staff. Competitive Carriers may have limited coverage areas, limited service offerings, and may have less redundancy and less support staff.

5) Lastly, WVOT is interested in any other issues the State should consider in a transition from a single vendor award to multiple vendor awards for Ethernet Transport at a County-wide level.

RESPONSE REQUIREMENTS:

1. There will not be a contract as a result of this RFI and the State is not liable for any cost incurred by vendors in replying to this RFI. If an RFQ/RFP is issued, the information provided by the vendors in response to this RFI will assist the State of West Virginia in developing the procurement document. This RFI does not obligate the State to reply to the RFI responses,

to issue an RFQ/RFP, or to include any RFI provisions or responses provided by the vendors in any RFQ/RFP.

2. Responses should address the following as they relate to the proposed development of the WVOT replacement vehicle for the current MPLS07 contract.

2.1 Executive Summary. Provide an executive summary that includes an overview of your solution, its advantages, and what makes your solution unique.

2.2 Provide informational responses to each of the five issues identified above

2.2.1 Network Architecture and Design

2.2.1.1 Statewide Transport Services

2.2.1.2 Ethernet Transport for Counties

2.2.1.3 Statewide IP Trunking and Related Services

2.2.2 Service/Support Infrastructure

2.2.2.1 Statewide Transport Services

2.2.2.2 Ethernet Transport for Counties

2.2.2.3 Statewide IP Trunking and Related Services

2.2.3 Security Practices

2.2.3.1 Statewide Transport Services

2.2.3.2 Ethernet Transport for Counties

2.2.3.3 Statewide IP Trunking and Related Services

2.2.4 Ethernet Transport at a County Level

2.2.4.1 Limited Coverage, Service Offerings, Redundancy, and Support Staff

2.3 Other factors to consider in transitioning to a multi-vendor award

Lumos Networks has read the request for information and our responses are on following pages.

Lumos Networks is pleased to respond to the State of West Virginia RFI for Replacement of Current MPLS Contract CRFI 0210 ISC1500000002

2.1 Executive Summary

Lumos Networks Corp. (NASDAQ: LMOS), a leading fiber-based service provider of data, voice and IP-based telecommunication services in the Mid-Atlantic region and has existing fiber in Virginia, West Virginia, and portions of Pennsylvania, Maryland, Ohio and Kentucky. We use an on-network service strategy that ensures redundancy and reliability.

Lumos Networks provides Dedicated Internet Access Bandwidth, Ethernet Point to Point and Multipoint Bandwidth solutions, including Wave, as well as IP voice services.

Below are the key points and benefits of the Lumos Networks offered services:

Lumos Networks is a fiber-based network solutions provider. We architect fiber-based solutions to accelerate business growth for carriers and enterprise and government customers over a dense network offering data, voice, and IP services. For more than a century, we have provided the most advanced technology to customers in Virginia, West Virginia and portions of Pennsylvania, Kentucky, Ohio, and Maryland. We are the proven leader in our region, providing 21,000 business and government customers world-class fiber optic services and customer support.

Lumos Networks is continually expanding its footprint to build the network of the future to ensure connectivity and accessibility to the latest technology. Our dense fiber network of 7,400 long haul miles is connected to 95 collocation facilities over our six-state region and is monitored by our dual redundant 24x7 Network Operations Centers.

Lumos Networks differentiates itself by personalizing the customer experience. Long-term customer relationships are the foundation of our success. We are committed to serving businesses with accountability, responsiveness, and integrity. We live and work in the communities where you do business. We listen and develop solutions. We are trusted advisors.

We bring our customers the latest technology and innovative services – even before they are available in large metropolitan areas. Below are milestones of our current services that will ensure your business stays connected:

- Ethernet services were introduced in 2001 and provides a fiber-based backbone that maximizes speed, connectivity and Quality of Service while providing the preferred transport for advanced services including IP telephony, video streaming, medical imaging, and data transfer.
- In 2014, Lumos Networks expanded its' Ethernet services to include Layer 2 solutions

- Lumos is a certified member of the Metro Ethernet Forum (MEF), one of only 65 service providers worldwide who have met the industry's highest standards.
- As a member of the Equinix Ethernet Exchange, we bring global connections to your business.
- In 2004, Lumos Networks introduced Voice over IP and was nationally recognized by Cisco Systems as IP Innovator of the Year.
- Fiber to the home was launched in 2007 in our Incumbent areas providing Integrated IP Video, Voice and Broadband Internet Services.
- In 2010, the Shenandoah Valley Technology Council gave Lumos Networks its "High Tech Company" award
- In 2011, Alleghany Highlands awarded Lumos Networks "Business of the Year" for bringing fiber to rural areas.

Some key strengths of which we are proud:

- Lumos Networks has been in the telecommunications business for 116 years. We are locally based and currently serve 21,000 business and government customers
- We deliver the industry's best customer service with call centers in Virginia and West Virginia. Over all we employ more than 550 people to deliver communication services with excellence and integrity
- Diversified leadership team with deep industry experience: CEO, CFO, and CRO have more than 72 years of telecommunications experience
- Fiber-based network with over 7,400 long haul miles provides high-bandwidth data services to businesses and carriers
- Local service and support with 'Single Point of Contact' with local account representatives and support
- Dual Redundant Network Operations Centers (NOC) in Waynesboro, VA and Canonsburg, PA with 24x7 monitoring.
- 100% digital platform with Lucent Technologies and Cisco-based network equipment. Lumos Networks has maintained a long-standing partnership with Cisco, meeting rigorous standards of service providers worldwide

In summary, we want to thank you for considering Lumos Networks to support the State of West Virginia RFI for Replacement of Current MPLS Contract for current and future service needs of the State. We continue to have the technology, support and financial strength to maintain the highest standards for communication services and infrastructure needs. More importantly, we are able to support you because of our local presence and commitment to serving you and your end customer's needs.

2.2.1- Network Architecture and Design

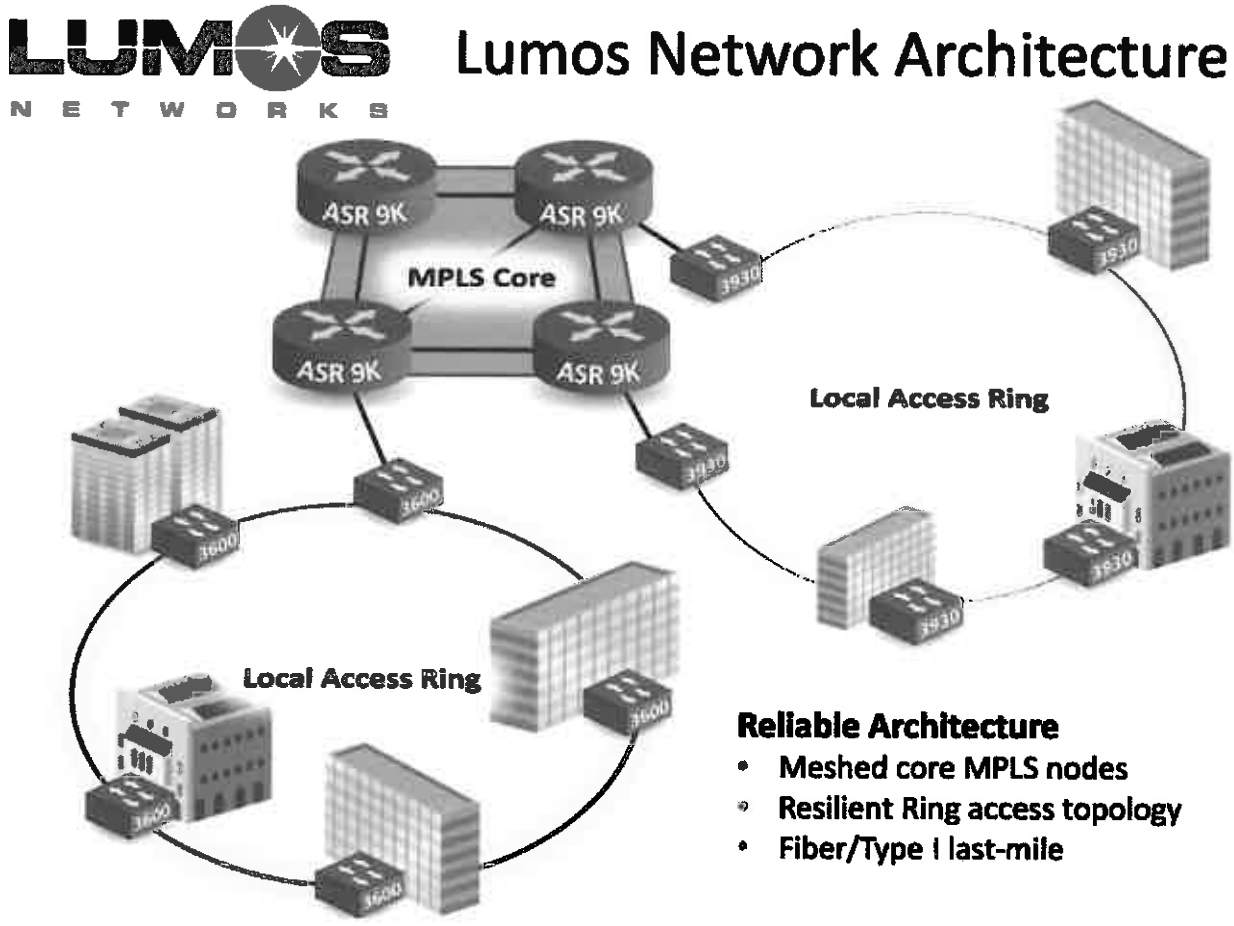
Transit & High Level Core Network Topology:

Lumos Networks' Ethernet solutions (both DIA and Layer 2 E-Line and E-LAN services) are built with the following attributes to mitigate a Customer's potential loss of service:

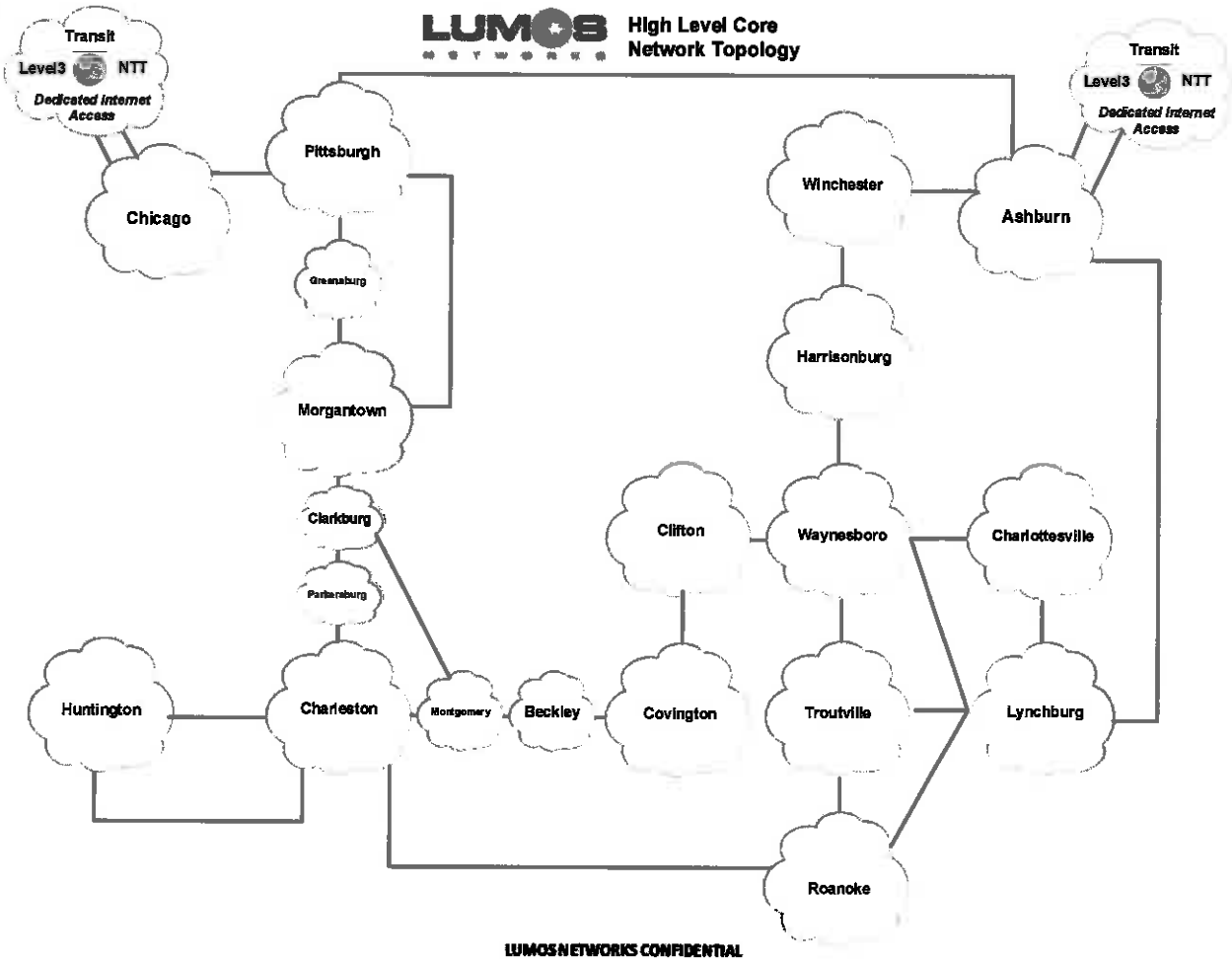
- Services are provided on fiber optic rings (providing redundancy), terminating at the customer premise on carrier class Ethernet switches
- Equipment installed at the customer premise includes battery backup and rectifiers to ensure smooth power through minor commercial power outages.
- The G.8032 routing protocol is employed in local access rings to provide sub 50ms recovery/re-convergence times in the event of a fiber cut in the ring.
- Carrier Class Ethernet gear (fully redundant/fault tolerant with generator backup) is installed in Lumos Networks' Points of Presence (POPs) and Central Offices (COs)
- POPs and COs are connecting through a core ring topology between geographically dispersed locations
- Lumos Networks' is positioned in two geographically dispersed Carrier Hotels for peering (Ashburn and Chicago) and connected to two transit providers in each location to ensure ingress and egress paths to the Internet.
- Lumos Networks has installed dual DNS and DHCP servers in geographically dispersed locations to ensure uptime.

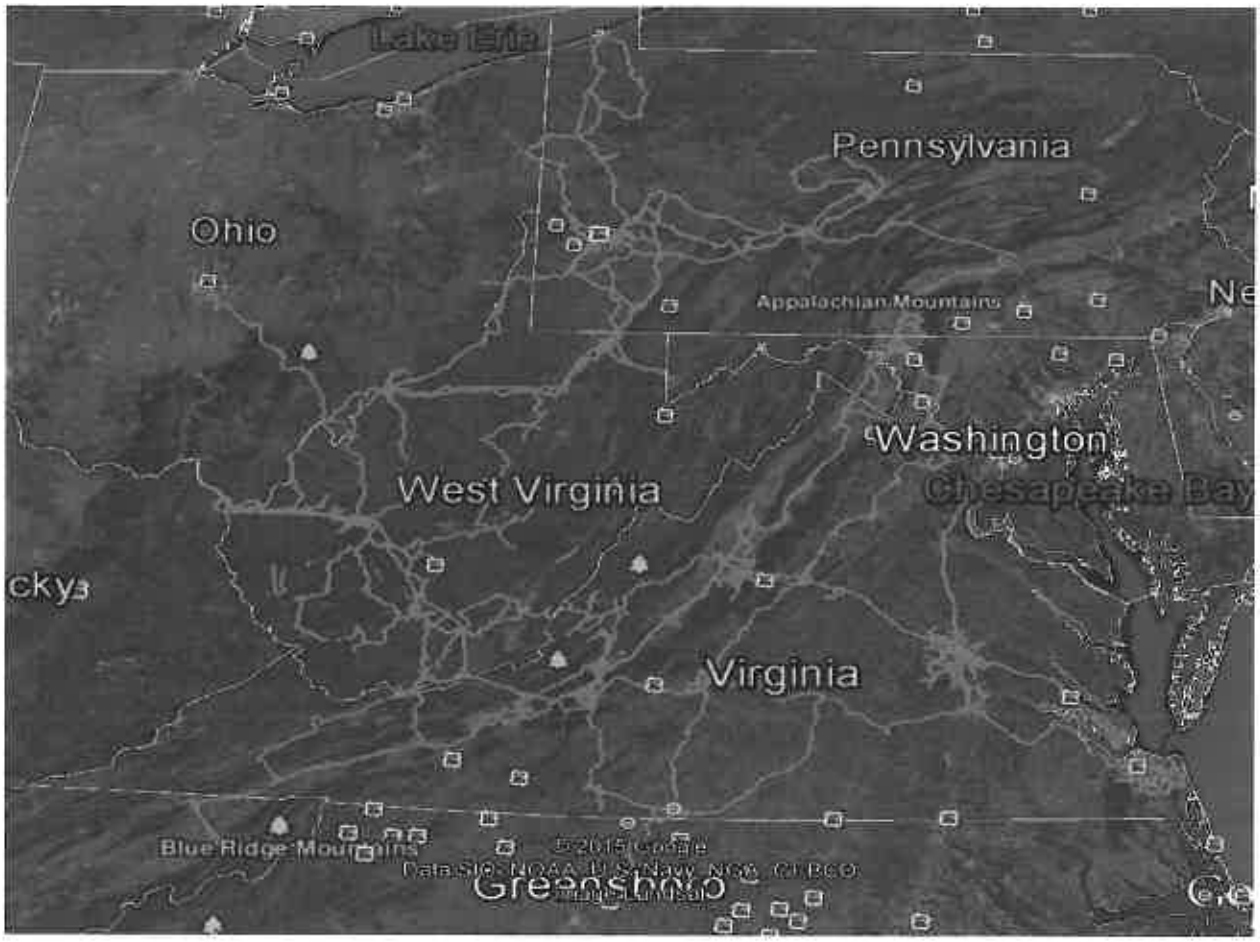
Lumos Networks has multiple Transit connections out of the Lumos Points of Presence (POP's) in Chicago, IL and Ashburn, VA. The high level diagram below illustrates our network architecture. Core network links are 100 gigabit per second.

This diagram illustrates a typical Ethernet topology. Lumos Networks has several local access rings that provide connectivity for the customer. These access rings are aggregated back to the Lumos MPLS core network.



The high level diagram below illustrates possible directions Ethernet traffic will route in the Lumos Networks core. Actual paths will vary as traffic will route the path of least resistance meaning shortest hop with least amount of latency.





Lumos Networks fiber network

Additional mapping insights can be seen at our website https://www.lumosnetworks.com/business/fiber-maps and we can design and compile other specifics that may be helpful in your review. Our goal is to highlight in this RFI response that we have significant fiber network in West Virginia currently and also can build into new locations. We can examine specific locations as needed and work through various pricing models to build to your specific location(s) if it is not near network currently. Examples of this model could include one-time charges for network build, variable monthly rate to encompass the build costs which helps avoid initial, upfront one-time capital costs and or a hybrid approach. We are happy to explore any variable that would enable us to serve you and your end users' needs/location(s).

2.2.2 - Service/Support Infrastructure

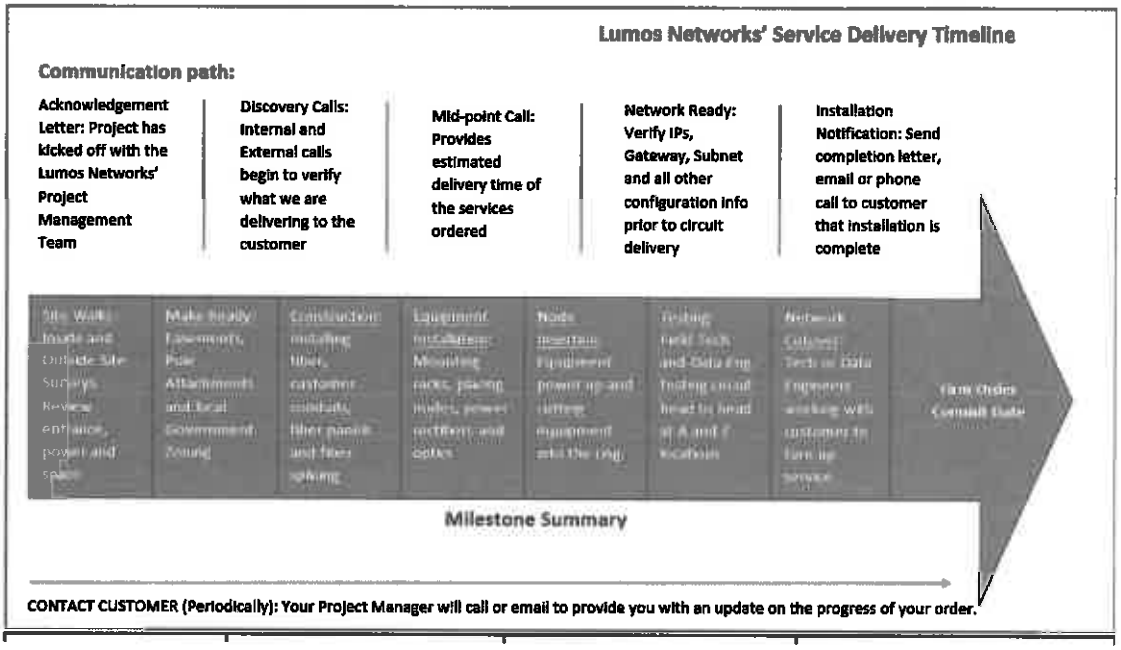
Lumos Networks Operations Centers provide 24/7/365 technical support at two geographically diverse locations: Waynesboro, VA and Canonsburg, PA.

The Network Operations Centers are staffed with Tier 1, 2, 3 Analysts to support Metro Ethernet, Fiber to the Cell and Optical Transport equipment and products.

Tier 1 teams will Triage the trouble with the customer on the line and work toward FIRST CALL RESOLUTION. Should FCR not be obtained the ticket will be handed off to an available Tier 2 technician who will work with the customer, customer's vendor, or equipment vendors to find resolution. Our Tier 3 team will support the Tier 1 and Tier 2 teams in all capacities during the lifecycle of the technical support incident.

Additionally, when a new agency or location activates service(s) with us we will provide an Escalation Contact list to provide additional resources should they be needed. We like to have open lines of communication and work hard for First Call Resolution and provide the Escalation list in support of our effort to restore services as quickly as possible.

Delivering initial service is very important to Lumos and the State. Lumos Networks uses specific project management teams and assigns specific project managers and team leads on each project that are responsible for coordinating all aspects and interactions to ensure accurate and timely completion. The below chart highlights our Project Plan of how we coordinate to ensure a successful transaction. Additionally we keep a KPI, Key Performance Indicator at Lumos for On Time Delivery by the month. We use the Initial FOC (firm order commitment date) that is an agreed upon date by Lumos and Customer. This date does not change and we track to completion for On Time or Earlier. We have a testing and acceptance team that is responsible for end to end testing and issuing a birth certificate that the circuit is ready to hand off.



Lumos Networks strives for high service levels. Above we describe our guided process and customer coordination to ensure our timely delivery of requested services. This also includes a testing phase to ensure the circuit is tested by Lumos Networks to ensure it is complete and working as requested as well as provides for customer testing to ensure the service requested is operation and works as needed. Once installed and tested, we get customer confirmation and issue a Birth Certificate closing out the initial phase of the service being installed and all agree it is operational. At some future time should there be any issue with the circuit we ask that our Network Operations team be contacted for them to test alongside with the customer. During implementation and testing we provide a complete list of contacts and escalation lists as needed to ensure the agency needs are met. These lists have also been made available in this RFP response. We use these teams to coordinate discovery and resolution to resolve any service issues.

Troubles are submitted through our Network Operations Center where an incident is opened. The incident is routed to the proper trouble team based on the product. Metro Ethernet and other fiber based incidents are submitted to the Lumos NOC. The Lumos NOC strives to pick the incident up within the first hour of the ticket being opened to begin initial trouble shooting. Escalations from customers may be requested at any time during the repair process, but it is requested to wait one hour between each escalation interval. Lumos will provide an escalation contact list to each customer.

Network Severity Definition Matrix				
Impact/Severity	1	2	3	4
Definition	**Critical**	**High**	**Medium**	**Low**
Description	**MASS Outage**	**OOS - Outage**	**Simplex/ Partial Outage**	**NSA / Low Impact**
Update Notification Interval (hr)	1	1	2	4
Minimum Escalation Interval (hr)	1	1	2	24
Immediate Notification	Tech, Sup, Mgr, Director, CTO	Tech, Sup, Mgr, Director	Tech, Sup, Mgr	Tech, Sup

Lumos On-Net (Type 1) Ethernet Service Level Agreement (SLA) includes:

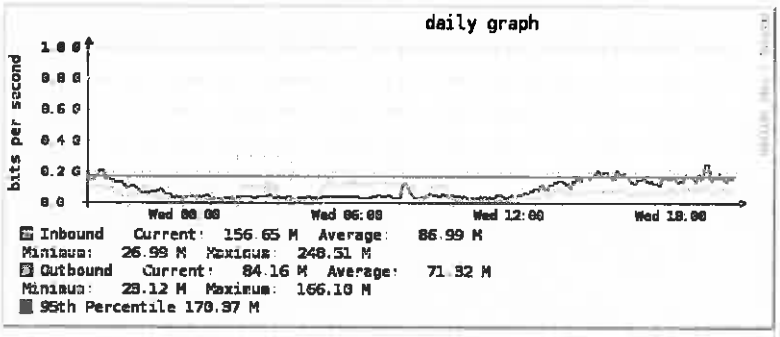
- **Mean Frame Delay** (One-Way) of less than or equal to 10ms per month.
- **Inter-Frame Delay Variation** of less than or equal to 3ms per month.
- **Frame Loss Ratio** of less than or equal to .0001 percent per month.
- **Availability:**
    - Protected is greater than or equal to 99.999% per month.
    - Unprotected is greater than or equal to 99.99% per month.
- **Mean Time to Repair (MTTR):**
    - Protected is 2 hours per month.
    - Unprotected is 4 hours per month.

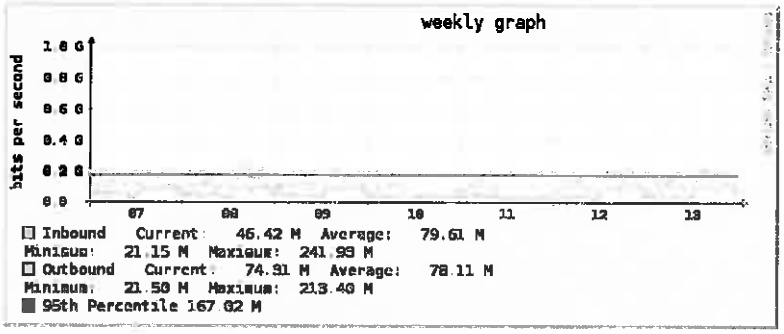
Network Change Management

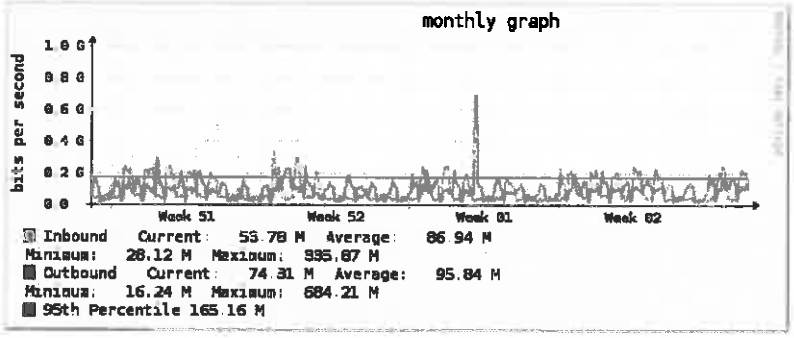
- 5 days notification on Data Reconvergence and Simplex events
- 10 Days notice on OOS maintenance work.
- Emergency Maintenance will be performed as necessary according to Immediate Action Limits

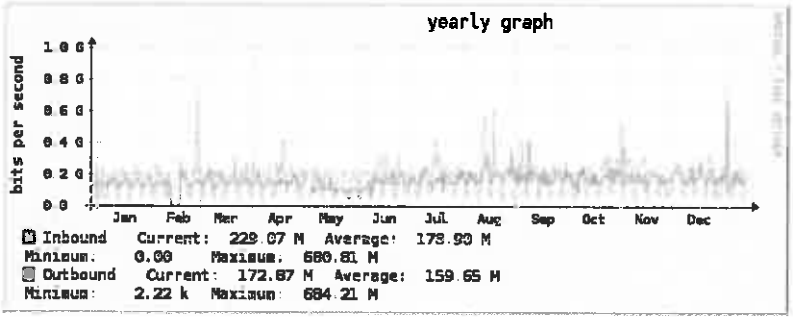
Monitoring & Reporting:

Lumos Networks offers its Ethernet customers a web portal to be able to see traffic utilization and errors on individual circuits in daily, weekly, monthly, and yearly graphs. The below pictures show utilization examples of a 1Gb circuit with Lumos:









Customer Support / Account Management:
Our lead will be the Account Manager working with the state of West Virginia to aid in assisting the agencies(s) to determine and pick the best services and network configuration to serve their needs. Once services are activated we host a "first bill review" call with the agency, if desired, to review that everything is as desired/ordered and ensure all services are active and billed as quoted. Our Enterprise Support team also coordinates any billing questions/concerns and within that team we can provide escalation contacts as well. This team can be contacted via email or phone.

2.2.3 - Security Practices

Lumos Networks' Ethernet solutions (both Dedicated Internet Access and Layer 2 E-Line and E-LAN services) are built with the following attributes to mitigate a Customer's potential loss of service:

- Services are provided on fiber optic rings, terminating at the customer premise on carrier class Ethernet switches
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- Lumos Networks has installed dual DNS and DHCP servers in geographically dispersed locations to ensure uptime.
- Lumos Networks has two 24x7x365 Network Operations Centers (Waynesboro, VA and Canonsburg, PA) to proactively monitor and troubleshoot alarms in the network facilities.
- We employee additional physical security measures for our infrastructure, IT and Facilities.

Lumos Networks does not provide detailed/proprietary information concerning our infrastructure security or information technology security for security purposes. We are happy to facilitate further discussions with our Chief Technology Officer, Craig Drinkhall and team, as needed.

2.2.4 – Ethernet Transport on a county-wide level

Ethernet Point to Point / Multipoint

Many organizations need high-performance, resilient, point-to-point connectivity to run the key applications they depend on to serve their customers. We have the services and network experience needed to find a solution for your business and support your applications.

As the State of West Virginia offers additional providers' services, the State and its agencies gain diverse carrier options including; network design and provider diversity, continuity of operations and disaster recover/failover options and potential route diversity that enhance the States mission of replacing the current MPLS contract with options to best serve agencies.

Lumos Networks complete network design and architecture is available throughout our footprint/coverage map and our dual redundant NOC's support all of our markets and customers.

We understand the State's desire to issue awards by county and want to highlight that using this methodology you may limit yourself to the current provider given their legacy position of being the local exchange carrier. Newer network technology providers, like Lumos with our high speed fiber optics, offer a broad area of coverage but may not cover all counties and or all parts of counties, just as many or most other competitive providers. We likely reach the majority of locations and can build to others and offer competitive pricing, diverse products, paths and continuity of operations options. Our team can assist agencies or IT in determining locations that are on or near net and then explore options to build to off net locations. In some situation we can partner with other providers to provide access to buildings where we have access and they don't, or we can use partner provider's networks (Type 2 requests) to reach an agency where we do not have existing network. We approach partnering as a consultative interaction and will explore all options available to best serve the agencies and IT.

Lumos Ethernet provides the configuration flexibility to join sites, the bandwidth scalability to feed applications, the access to reach the Internet and private VPNs at business speeds, and the service resiliency to keep your network running. In addition, **Lumos Ethernet service is (Metro Ethernet Forum) MEF-certified** so it interoperates smoothly with the existing networks at your sites. Lumos Ethernet is ideal for enterprises that need to connect sites with a versatile, scalable, carrier-class network fabric.

Lumos Ethernet is a Layer 2 service so it is transparent to your existing network, which simplifies administration and preserves control. We connect your sites without the need for your staff to modify IP routing information or exchange it with us. In addition, your staff can make IP routing changes to your network without coordinating with Lumos. Essentially, Lumos Ethernet connects your sites without any impact to your existing IP routing; your sites operate as if they were simply connected by an Ethernet cable.

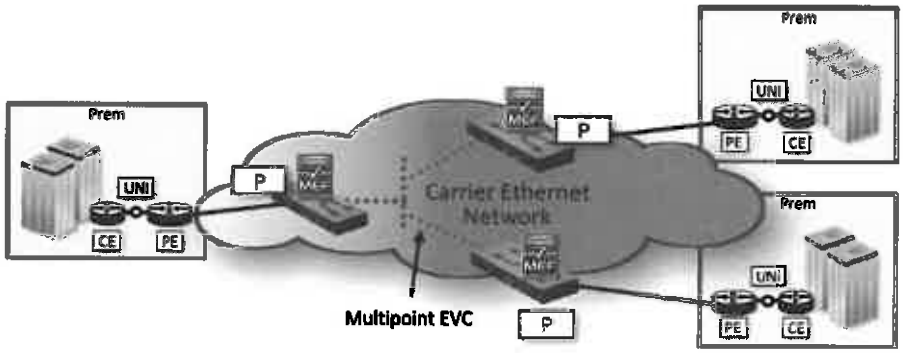
Lumos Ethernet Features and Specifications

- Topologies -- E-Line, E-LAN, E-Tree, or E-Access
- MEF Certification – for all topologies
- QoS – Six tier, end-to-end QoS model
- Access – Type 1 (on-net) and Type 2 (off-net)
- Ports – 10Mbps, 100Mbps, 1Gbps, and 10Gbps
- Speeds –Select speeds to suit your needs
- Service Level Agreements (SLAs) – Carrier-class for service availability

Layer 2 Ethernet Network:

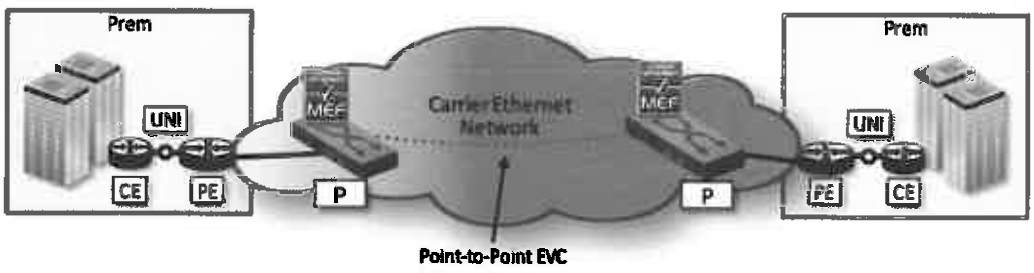
E-LAN Service:

- E-LAN connects two or more locations in an any-to-any multipoint EVC configuration. All endpoints may forward frames freely between one another. From the customer's view, appears/behaves as an Ethernet LAN between sites.



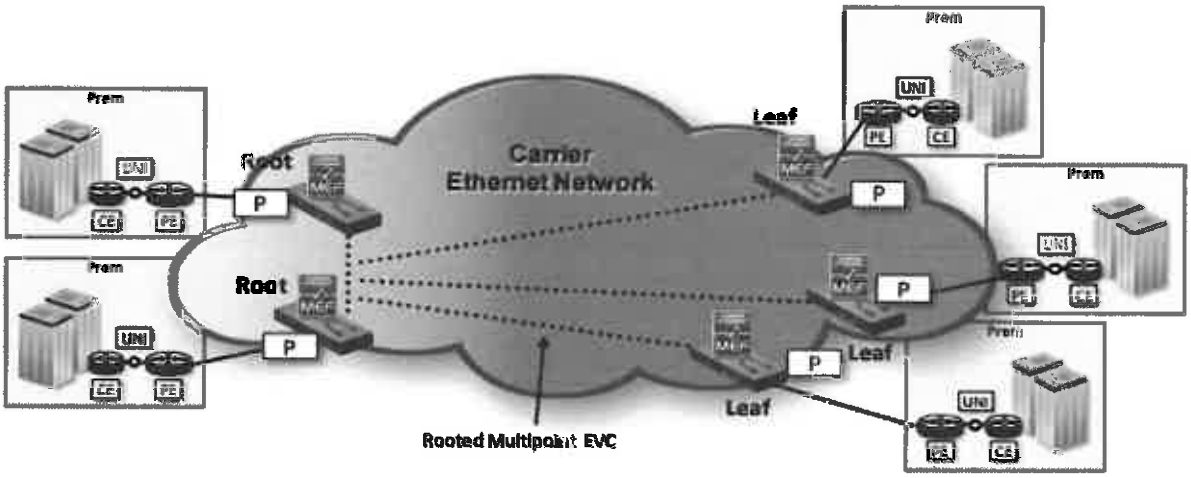
E-Line Service:

- E-Line is the most basic Carrier Ethernet topology. E-Line is a layer-2 service that connects two sites in a point-to-point configuration. E-Line often serves as a more flexible, reliable, and economical alternative to traditional TDM point-to point private lines.



E-Tree Service:

- Ethernet service that connects one or more roots and multiple leaves in a rooted multipoint configuration. Roots may forward frames freely to any endpoint, leaf or root. Leaves may forward frames only to roots.



Lumos Ethernet Benefits:

- **Flexibility:** Lumos Networks Ethernet service supports point-to-point, rooted point-to-multipoint, and multipoint to multipoint topologies to connect sites in a manner that best suits Customer application needs.
- **Scalability:** Lumos Ethernet offers a range of speeds to easily accommodate Customer network growth.
- **Resiliency:** Lumos Ethernet includes resiliency mechanisms including Metro Ethernet ring topologies to ensure traffic delivery, as well as end-to-end Quality of Service (QoS) options for traffic prioritization across the entire Lumos network path.
- **Routing & QoS:** Lumos Ethernet is a Layer 2 service. This allows the Customer full control of IP routing and QoS policies.
- **Standards Compliant:** Lumos Ethernet is MEF-certified to ensure that the service interoperates smoothly with Customer existing networks.

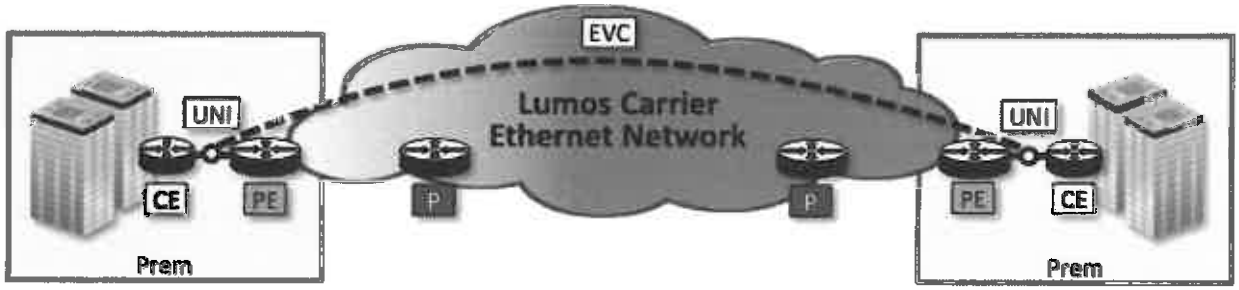
Metro Ethernet Forum:

- **What is the MEF?**
  - Metro Ethernet Forum
  - Governing standards body for Ethernet
  - Establishes product & design standards / best practices
  - Certifies manufacturers, service providers, and professionals

- **How is Lumos involved with the MEF?**
  - The network and equipment Lumos uses to provide Ethernet services is MEF certified
  - The Ethernet services Lumos provides are MEF certified
  - Lumos employs a group of MEF certified professionals

- **Why is MEF certification important?**
  - Positions Lumos as a leading, knowledgeable, capable Ethernet provider
  - Allows prospects to qualify Lumos quickly, easily, and objectively
  - Instantly differentiates Lumos from non-certified carriers

Network Components:



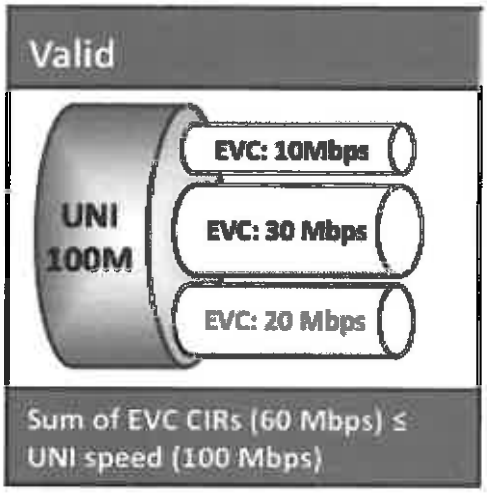
- **User Network Interface (UNI):** Interface/port that serves as the point of demarcation between the Customer and Lumos Networks.
    - **Private UNI:** UNI with a single EVC. Lumos Networks will provide Customer sites with Private UNIs for WAN services.
    - **Multiplexed UNI:** UNI with multiple EVCs.
- **Ethernet Virtual Connection (EVC):** An association of two or more UNIs that identifies as a point-to-point, rooted point-to-multipoint, or multipoint-to-multipoint path between Customer sites in the Lumos Networks Carrier Ethernet Network.
- **Customer Edge Device (CE):** Device controlled by the Customer and physically located in the Customer premise. CE devices interface directly with Provider Edge (PE) devices and other customer network elements.
- **Provider Edge Device (PE):** Device controlled by Lumos that is physically located in the Customer facility. PE devices interface directly with CE devices and P devices (Lumos Networks core network elements).
- **Provider Core Device (P):** Device controlled by Lumos Networks that is physically located in a Lumos Networks facility. P devices interface directly with PE devices and other P devices.

Ethernet UNI/EVC Speeds for E-Line, E-LAN, E-Tree Services:

- **UNIs**
    - 10 Mbps (Type 2 Access only) , 100 Mbps, 1 Gbps, 10 Gbps
- **EVCs**
    - 3, 5, 10, 20, 30, 40, 50 Mbps
    - 100, 200, 300, 400, 500 Mbps
    - 1, 2, 3, 4, 5, 10 Gbps

Design Considerations E-Line, E-LAN, E-Tree services:

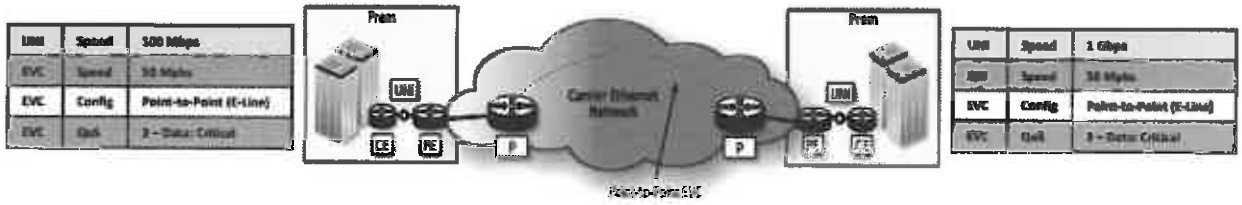
- **UNI vs. EVC speeds**
  - The UNI speed governs the maximum possible cumulative line rate supported
  - Each EVC has a CIR assigned to it; this is the actual speed of the service purchased
  - DIA may be added to any UNI. Capacity on the UNI is consumed the same as an EVC
  - The sum of the CIRs of all EVCs on a given multiplexed UNI must be ≤ the speed of the UNI



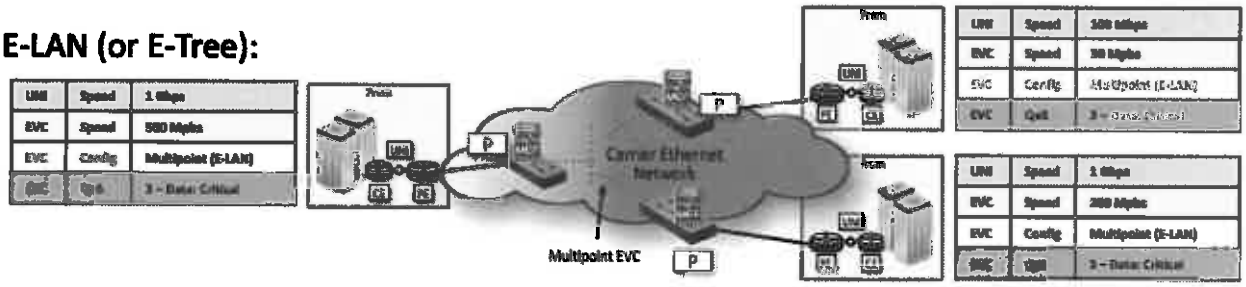
- **EVC connections (EVC-to-UNI connection points)**
  - All EVC connections associated with a given EVC must have the same QoS value
  - Both EVC connections associated with a given E-Line service must be the same speed
  - EVC connections associated with an E-LAN or E-Tree service may be of varying speeds

The diagrams below illustrate a typical E-Line and E-LAN configuration:

E-Line:



E-LAN (or E-Tree):



Lumos Ethernet service is available with end-to-end Quality-of-Service ("QoS") which prioritizes frames across the Lumos network:

- "Untrusted" QoS model - Customer markings are ignored
  - QoS applied at EVC level
  - All frames within a given EVC are prioritized identically, end-to-end
  - Frames are prioritized at network ingress and during transit, UNI to UNI

Low ← Priority → High	Forwarding Class	EVC-Based QoS Level	Typical Application
	5	**Real-Time Voice**	**Voice**
	4	**Real-Time Video**	**Video**
	3	**Data: Critical**	**Time-sensitive data**
	2	**Data: Transactional**	**Business applications / transactions**
	1	**Data: Basic/Bulk**	**Basic business data**
	0	**Data: Best Effort**	**Low-priority data**

SIP Trunking:

Lumos Networks provides a technically advanced SIP Trunking product that allows customers to use their connectivity efficiently by sharing the same circuit for voice, Internet and Wide Area Networking.

- Buy in increments of one so you only need pay for what you use
- If you have multiple sites, you can centralize SIP trunks and benefit from economies of scale to reduce total trunks required
- Consolidate all your traffic over one converged network.
- Our SIP Trunking service can scale up or down to suit your changing needs
- With Lumos SIP trunks you can order in increments of one.
- Reserve additional trunk capacity for those periods when normal call volumes are exceeded.
- Our SIP trunking service enables you to call your employees at other locations located in the Lumos Voice footprint regardless of location or number for free.
- Retain local numbers but route the calls to employees in a different office.
- Quality of Service (QoS) gives voice traffic priority over data Internet ensuring call quality
- Free caller id and call waiting

Lumos Networks currently supports the following IP PBX devices. If your IP PBX system is not listed below, contact us to arrange for a free 30 day trial to check for compatibility and certification.

- Adtran 7100
- Asterisk
- Avaya IP Office
- Cisco Unified Communications Manager (Call manager)
- Cisco Unified Communications Manager Express(Call manager Express)
- Cisco Unified Communications 500 Series for Small Business (UC-500)
- Sipxecs
- Toshiba Strata

PRI Over Integrated Access

Lumos Networks can provide PRI over Ethernet or T1 transport using an integrated access device (IAD). Using Ethernet transport this IAD can be connected to the Lumos provider edge (PE) switch and up to 46 PRI channels can be delivered to the customer from the IAD. On T1 transport the maximum number of PRI voice channels supported is 23. The IAD device can also deliver analog voice lines. Standard Voice and/or PRI rates apply. The availability of Lumos SIP and PRI services is contingent upon having a dial plan in place for a given exchange. An extensive extended dialing plan area is available allowing for local calling in a large portion of the Lumos Networks footprint.

Future, Long Term Vision and Strategic Plans

Lumos Networks' success and that of its customers for more than a century is the result of a well-established and evolving long-term vision and strategic plan focused on building the custom networks of the future, rather than reselling the networks of the past. Our ability to respond to and be ahead of emerging technologies has positioned us as a leader and a provider that exceeds industry standards and customer expectations.

The following have and continue to build a solid foundation for our success and that of our customers.

Advanced Fiber-Based Telecommunications

Lumos Networks, an MEF 2.0 certified provider, offers next-generation fiber-based communication solutions to customers across Virginia and the Mid-Atlantic region over an advanced fiber network of nearly 8000 fiber-route miles. Significant investments in our network, including the deployment of 100G links across our core footprint and into new markets, enable us to not only support our customers' current needs, but more importantly, future proof their networks to prepare for future bandwidth needs. After all, we've never heard of anyone needing less bandwidth.

Custom Solutions Tailored to Your Business

Your Network. Your Way. is more than our positioning statement; it's a clear differentiator for Lumos Networks and its philosophy. We know that no two companies are alike, so the networks that run them shouldn't be one-size-fits-all. Our customized solutions make us the telecommunications provider of choice for leaders in Virginia's industries, from education and finance to healthcare and state government and many more.

Connectivity to 30+ Data Centers and More

Lumos connects to thousands of sites in the region, including over 1450 lit buildings and more than 30 commercial and private data centers – all fiber fed along diverse network paths across our 100G backbone. We assure these connections with robust Service Level Agreements (SLAs) providing up to "five 9s" availability.

2.3 Other Factors to Consider in Transitioning to a Multi Vendor Award:

For locations that are too remote for providing fiber-based Ethernet services, the State may consider installing a public internet connection and connecting that location back to the department's network using a virtual private network (VPN) connection.

In the final design, there will be Ethernet transport from each carrier into the State's core network. Assuming the State's network is segregated by department or agency, there may be locations within a department that are served by different carriers. The State will need to provide routing in their core to connect a department's locations into one network.

We would like the State to review an option to allow Special Construction Charges to be considered to better serve an agency. Sometimes an agency location is not near our fiber network but they need our connectivity. Sometimes the costs associated with building to that location are such that a 1 year contract will not pay for the build. With other States/Agencies we have been able to serve more agency locations by 1) having a longer term contract that provides a return on investment to build to their location because we know that with a 5 year term, for example, our build costs will covered with the standard or adjusted monthly fee over a 5 year term and/or 2) the agency has the option to help offset the build cost to their location by paying capital upfront. This allows the agency to gain access to our network to serve their needs and allows for a lower monthly cost and or shorter term contract.

Longer term contracts, not 1 year, offer us the ability to provide the best pricing so we respectfully ask for longer term circuit contracts to offer best pricing and defray any build costs, where applicable.