E-Rate Services Proposal

Villa Park School District 45

Request for Proposal

470#: 250004421 / **ACD:** December 3, 2024

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December 2, 2024

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COMCAST BUSINESS
Powering Possibilities™

COMCAST BUSINESS

Transmittal Letter

December 2, 2024

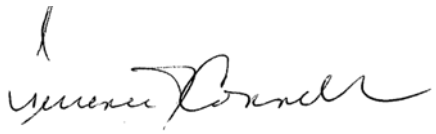
Comcast Business Communications, LLC ("Comcast") looks forward to a mutually rewarding business relationship with your organization. Comcast Business is pleased to provide this proposal (the "proposal") for the requested E-Rate services.

Your organization is responsible for compliance with applicable state and local procurement laws. It is our understanding that your organization, based on this request for proposal, is not seeking services pursuant to the State Procurement code or under a current cooperative purchasing agreement between Comcast Business and the State under which your organization is a qualified buyer.

As you proceed in the selection process, please feel free to contact your Comcast Business representative with any questions, comments, or concerns.

No statement made in the proposal shall be considered a contractual term unless expressly included in the Comcast Business Services Agreement included with Comcast's proposal or as agreed upon by the parties as a result of contract negotiations. ***This proposal and the Comcast Business Services Agreement comply with all USAC guidelines, including the Lowest Corresponding Price rules***. Comcast Business, as part of the post bid submission process, would be amenable to negotiating limited modifications to the Services Agreement appended to the attached proposal, to address additional items (if any) that your organization feels are critical to its consideration and use of the Comcast Business solution.

Sincerely,
Comcast Business Communications, LLC



Terrence J. Connell
Senior Vice President

COMCAST BUSINESS

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Comcast Business Communications, LLC, a Pennsylvania limited liability company, on behalf of itself and its applicable operating affiliates and subsidiaries (including, but not limited to, Comcast Cable Communications Management, LLC); together offering services throughout this Network Service Proposal identified as "Comcast".

Executive Summary

Technology is redefining the learning landscape. Advanced networks and digital solutions are critical for education. Comcast Business is uniquely positioned to provide end-to-end network solutions for education. Comcast Business' integrated Internet and data products are delivered over an extensive network that is physically diverse from the phone companies. Our technology services can help your organization remain agile and resilient as you improve the quality of education – in the classroom, across the district and in students' homes.

Comcast Business' proposal offers a flexible solution that is capable of meeting your demands. Other Comcast Business advantages include:

Performance

- Dedicated bandwidth up to 100 Gbps. Enables video streaming, distance learning, online assessments, and digital learning

Resilient, robust enhanced network to support your operations

- High network availability with a diverse and redundant core network architecture
- Annual investments to expand and strengthen the network

Highly reliable and scalable Ethernet data and Internet services tailored to meet your needs

- Manageable services that grow with your organization
- Bandwidth in flexible increments from 1Mbps to 100Gbps

Our Comcast Business Promise

- Dedicated Project Managers
- Proactive Monitoring to the Customer Premise
- 24x7 Dedicated Enterprise Support

Commitment to Education in the Community

internet essentials FROM COMCAST

Internet Essentials – Since 2011, Comcast Business has connected 10 million people to the Internet at home through Internet Essentials, the nation's largest and most comprehensive broadband adoption program.

PROJECT UP

$1B committed in cash over the next 10 years to further close the digital divide.

LIFT ZONE FROM COMCAST

Lift Zones - Working with our network of non-profit partners and city leaders, Comcast Business launched 1,250+ WiFi-connected "Lift Zones" in community centers nationwide. The program helps students get online, participate in distance learning and do their schoolwork.

Tens of Millions of people reached with connectivity, skills, training, and resources.

Comcast Business is pleased to submit this proposal for advanced, efficient and affordable high-bandwidth digital communications services and looks forward to developing a solid business relationship with you and to assisting your organization in addressing its communication needs. Comcast Business is confident that the solutions presented in this proposal will provide a cost-effective solution that supports business objectives and quality requirements and will enhance your overall communication services portfolio.

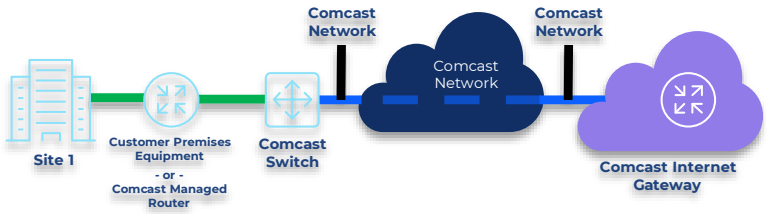
This proposal is valid for 90 days.

Solution Overview

Comcast is uniquely positioned to offer long-term value to support current and future technology requirements. Based on the requirements specified Comcast would specifically propose provisioning the following as a solution.

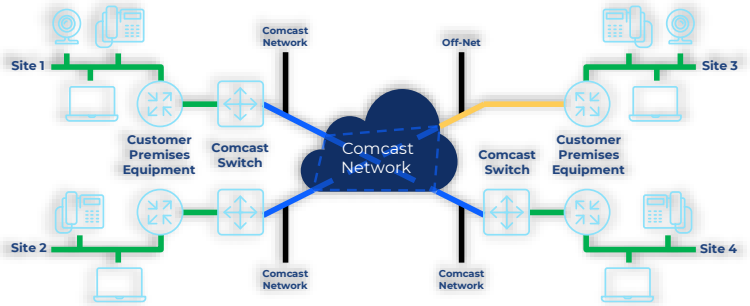
Comcast Business Ethernet Dedicated Internet Service

EDI is a reliable, high-performance Internet service for schools that have outgrown coax-based Internet. EDI provides an Ethernet Virtual Connection (EVC) from the customer premises location to a Comcast Internet Point of Presence (POP) router. Our Ethernet interface enables compatibility with your LAN. EDI is a symmetrical, dedicated Internet access service provisioned on an Ethernet platform that is easy and fast to upgrade. Comcast Business will provision Internet connectivity for the sites to jointly access the Internet.



Comcast Business Ethernet Network Service

Comcast Business Ethernet Network Service is a reliable, cost-effective alternative to traditional hub and spoke network topologies using Frame Relay, TDM private lines or ATM, offering a flexible and scalable network solution. Perfect for organizations with many locations and high data traffic, Comcast Business Ethernet Network Service enables customers to connect physically distributed locations across a Metropolitan Area Network (MAN) as if they are on the same Local Area Network (LAN).



Summary

The proposed solution was designed to enable demanding IP based applications. The network easily meets the infrastructure demands of bandwidth-intensive applications and limits the need to purchase or configure additional technology. This service has high availability so that interruptions are minimized.

You will also have the ability to have a network solution that meets today's requirements but is capable of scaling to other locations or to meet future bandwidth demands. Your organization will have the ability to scale that connection and bandwidth can be added very quickly, often within hours. If, or when, you need additional network capacity, an upgrade agreement would be negotiated with Comcast Business and the billing terms would be specified in that agreement.

With Comcast Business, your organization will leverage our extensive fiber network for a reliable and scalable network and connection to the Tier 1 Internet backbone using a simple Ethernet interface that allows for true plug and play compatibility. Comcast Business has uniquely diverse routing, commonly physically disparate from most other Telco provider's networks. Additionally, with Comcast Business there are no local loop charges, typical with other service providers.

At each of the locations specified in this response, Comcast Business will install network edge equipment that will facilitate the connection between your network and ours. As part of the service,

Comcast Business will provide, monitor and maintain the edge devices. Comcast Business also provides web-based monitoring and reporting tools available 24x7 upon request.

With Comcast Business you will receive a trusted data transport solution from the largest broadband provider offering superior flexibility in configurations and pricing. Combine our years of commercial experience with leading edge innovative technology and service capabilities and differentiation among networking service providers becomes clear.

Additional Services Available

Comcast Business Distributed Denial of Service (DDoS) Mitigation Service[1]

DDoS attacks are getting bigger and more frequent. A primary target of DDoS is educational institutions where the computers, servers and infrastructure that have modernized education have become tempting targets for cybercriminals and disgruntled students. Low-security remote learning programs also have created new vulnerabilities as students and staff connect from home.

When added to Comcast Business Ethernet Dedicated Internet, Comcast Business DDoS Mitigation can provide threat detection and mitigation to respond to DDoS volumetric and flood attacks such as UDP Floods, Web Flood, and DNS Application Floods. Comcast Business DDoS Mitigation Service is a subscription-based offering that detects DDoS attack traffic, alerts customers when an attack starts and initiates mitigation to thwart the attack. It makes it possible for schools to fend off cyberattacks. When a school subscribes to DDoS Mitigation Service, Comcast Business will work closely with the school to tailor the service to specific network information and requirements. The team preconfigures countermeasure options and conducts acceptance tests before the service is activated. DDoS Mitigation Service monitors network traffic for a specified set of IP addresses. When a DDoS attack is detected, the system alerts the customer by email, text message or both depending on customer preferences.

In addition to scrubbing traffic, Comcast Business makes use of BGP Flowspec to automatically drop traffic Layers 3 and 4. During the mitigation process, as a first line of defense, Comcast Business can drop or rate limit the suspicious traffic at the closest peering edge router to avoid the need for scrubbing this traffic. The specification uses filtering rules that are based on BGP protocols and provides an additional layer of mitigation against large-scale volumetric attacks.

During mitigation, all traffic directed at a district's Internet connections is diverted to cloud-based scrubbing centers dispersed throughout the U.S. to filter malicious traffic. Once all traffic is filtered, the service forwards clean, legitimate traffic to the network and servers through secure tunneling. This helps the school district to maintain uptime of Internet services even when under a DDoS attack.

DDoS MITIGATION SERVICE OPTIONS

Comcast Business DDoS service options and the accompanying mitigation options are designed for customers' security sensitivities, attack frequency, and time period. Customers are mitigated 24x7x365 in the Comcast Business Security Operations Center.

Unlimited Subscription

Your subscription includes an unlimited number of mitigation incidents in a monthly billing cycle. No additional mitigation incident fees will be charged with this subscription level. With this option, there are two choices:

1. Automatic mitigation. SLA: Within 5 minutes
2. On-demand mitigation. SLA: Within 15 minutes

[1] Restrictions apply. Not available in all areas. Services and features vary depending on level of service. DDoS Mitigation is not eligible for E-Rate funding but may be purchased separately.

Comcast Business Managed Router

The Comcast Business Managed Router sits at the customer premises between the LAN and the network. Our router is available over internet circuits and can handle a variety of protocols to help organizations meet their performance requirements. The router includes a stateful firewall with standard templates or customization capabilities to meet your specific network requirements. Stateful inspection keeps track of each connection in the state table, with three standard capabilities: Disable, Normal and Strict. The managed router can be added to Comcast Business Internet or Ethernet service for full lifecycle support and includes:

- Fully managed onboarding experience
- Technical consultation and solution design
- Optimized configuration and installation
- Monitoring and management
- Equipment maintenance and replacement as necessary

Comcast Business SD-WAN

Comcast Business Software-Defined Wide Area Networking (SD-WAN) leverages our software-defined networking platform to deliver virtual network functions, creating a connectivity service that is highly available, application-oriented, simple to operate and cost-effective. A next generation virtual private network (VPN) over Internet transport, our SD-WAN solution tightly integrates a massively scalable set of virtual network functions for ease of operations and management.

At the core of Comcast Business SD-WAN are three key capabilities: VPN (securely encapsulating customer data), Internet security and firewall, and dynamic routing functions. It allows distributed enterprise WANs to be centrally configured, managed and pushed out to geographically dispersed locations consistently and cost effectively. SD-WAN reduces dependence on proprietary premises-based equipment and its expensive, labor-intensive management, while offering unprecedented levels of network agility.

Valuable features include application-based routing and local Internet breakout, the ability to support load balancing/failover between Comcast Business connections and customers' existing networks and the flexibility to support multiple WAN topologies, including any-to-any, hub and spoke and full mesh.

Comcast Business Voice Services[2]

Comcast Business offers a complete portfolio of voice services supported by one of the largest VoIP networks in the country. The Comcast Business Advanced Voice portfolio, which includes Comcast Business VoiceEdge™ and Comcast Business SIP and PRI Trunking, offers scalable solutions that build efficiency in any business.

[2] Voice services are not eligible for E-Rate funding but may be purchased separately.

COMCAST BUSINESS

Price Proposal

Comcast Business is pleased to provide the following pricing in response to this proposal.

Option One: Ethernet Network Service (ENS) and Ethernet Dedicated Internet Service (EDI):

Location and Service	Qty.	Product	Bandwidth	Unit Price	MRC
Comcast Ethernet Network Service (CoS)					
District Office/Jefferson Middle School 255 W Vermont St Villa Park, IL 60181	2	ENS	10,000 Mbps	$ 870.00	$ 1,740.00
Ardmore Elementary School / 225 S Harvard Ave Villa Park, IL 60181	1	ENS	5,000 Mbps	$ 770.00	$ 770.00
Jackson Middle School / 301 W Jackson St Villa Park, IL 60181	1	ENS	5,000 Mbps	$ 770.00	$ 770.00
North Elementary School / 150 W Sunset Ave Villa Park, IL 60181	1	ENS	5,000 Mbps	$ 770.00	$ 770.00
Schafer Elementary School / 700 E Pleasant Ln Lombard, IL 60148	1	ENS	5,000 Mbps	$ 770.00	$ 770.00
Stevenson Elementary School / 18W 331 15th St Lombard, IL 60148	1	ENS	5,000 Mbps	$ 770.00	$ 770.00
Westmore Elementary School / 340 S School St Lombard, IL 60148	1	ENS	5,000 Mbps	$ 770.00	$ 770.00
York Center Elementary School / 895 E 14th St Lombard, IL 60148	1	ENS	5,000 Mbps	$ 770.00	$ 770.00
Early Childhood Center / 251 W Jackson St Villa Park, IL 60181	1	ENS	5,000 Mbps	$ 770.00	$ 770.00
District Office/Jefferson Middle School 2 55 W Vermont St Villa Park, IL 60181	1	EDI	5,000 Mbps	$,2,580.00	$2,580.00
IPv4 Static Address Block /26 (62)	1			$80.00	$80.00
		MRC	**NRC**		
Total (36 Month Term)		**$ 10,560.00**	**$ 0.00**		

Optional IPs

IPv4 Sub-net Blocks	Usable IPs	MRC	NRC
/30	2	$20.00	$0
/29	6	$25.00	$0
/28	14	$30.00	$0
/27	30	$50.00	$0
/26	62	$75.00	$0
/25	126	$100.00	$0
/24	254	$200.00	$0

Optional Comcast Business DDoS Subscription

Unlimited DDoS Subscription Per Month Per Circuit E-Rate	
EDI Bandwidth	**Unlimited MRC**
1 Mbps < 1,000 Mbps	$400.00
2,000 Mbps < 9,000 Mbps	$600.00
10,000 Mbps +	$1,000.00
Activation Fee	**NRC**
Per Circuit	$500.00

Optional Comcast Business Managed Router

Comcast Managed Router per Month per Circuit / NRC is $550 for each site						
		Model	**Equipment Rental**	**Router Service**	**Managed Service**	**Total MRC**
JUNIPER NETWORKS	Small	SRX-320	$5	$60	$45	$110.00
	Medium	SRX-345	$30			$135.00
	Large	SRX-1500	$250			$355.00
CISCO	Small	ISR 1111 or C-1121	$5	$60	$45	$110.00
	Medium	ISR 4331 or C-1161	$30			$135.00
	Large	ISR 4461 or C-8300	$295			$400.00
	Small 1 Mbps - 250 Mbps		Medium 1 Mbps - 1.5 Gbps		Large 1 Mbps – 10 Gbps	

Cisco large models have dual power supplies

Cisco large models: AC or DC priced the same

Terms and Conditions— unless otherwise stated herein, this proposal is conditioned upon negotiation of mutually acceptable terms and conditions. **Proposal Pricing**—Pricing proposed herein *complies with USAC rules regarding Lowest Corresponding Price and* is based upon the specific product/service mix and locations outlined in this proposal, is subject to Comcast standard terms and conditions for those products and services and the Comcast E-Rate Rider unless otherwise stated herein. Any changes or variations in the standard terms and conditions, the products/services, length of term, locations, and/or design described herein may result in different pricing. Prices quoted do not include applicable taxes, surcharges, or fees. In accordance with the tariffs or other applicable service agreement terms, Customer is responsible for payment of such charges.

Technical Specifications

Ethernet Dedicated Internet Description

Service description

Comcast's Ethernet Dedicated Internet (EDI) Service provides a reliable, simpler, more flexible, and higher bandwidth options than T1 or SONET-based dedicated Internet access services. The service is offered with a 10Mbps/100Mbps, 1Gbps, 10Gbps and 100Gbps Ethernet User-to-Network Interface (UNI) in speed increments from 1Mbps to 100Gbps subject to available capacity. The service provides an Ethernet Virtual Connection (EVC) from the customer premises location to a Comcast Internet Point of Presence (POP) router.

Section 1. Technical specifications

1.1 Ethernet User-to-Network interface. The Service provides bidirectional, full duplex transmission of Ethernet frames using a standard IEEE 802.3 Ethernet interface. Figure 1 lists the available UNI physical interfaces, their associated Committed Information Rate (CIR) bandwidth increments and the committed Burst Sizes (CBS).

UNI Speed	UNI Physical Interface
100Mbps	100BaseT
1Gbps	1000BaseT or 1000BaseSX
10Gbps	10GBASE-SR or 10GBASE-LR
100Gbps	100GBASE-LR4

CIR Increments	CBS (bytes)
1Mbps	25,000
10Mbps	250,000
100Mbps	2,500,000
1Gbps	25,000,000
10Gbps	25,000,000

Figure 1: Available UNI interface types and CBS values for different CIR Increments

1.2 Traffic management. Comcast's network traffic-policing policies restrict traffic flows to the subscribed, Committed Information Rate (CIR). If the customer-transmitted bandwidth rate exceeds the subscription rate (CIR) and burst size (CBS), Comcast will discard the non-conformant packets. The customer's router must shape their traffic to their contracted CIR.

1.3 Maximum frame size. The service supports a maximum transmission unit (MTU) frame size of 1518 bytes including Layer 2 Ethernet header and FCS.

1.4 Layer 2 Control Protocol (L2CP) Processing. All L2CP frames are discarded at the UNI.

1.5 IP Address allocation. IP address space is a finite resource that is an essential requirement for all Internet access services. Comcast assigns up to two (2) routable IP addresses to each customer circuit. Customer can obtain additional IP addresses if required based on American Registry for Internet Numbers ("ARIN") guidelines and by completing an IP address Ethernet Dedicated Internet Services request form; additional charges may apply.

1.6 Domain Name Service. Comcast provides primary and secondary Domain Name Service (DNS) DNS is the basic network service that translates host and domain names into corresponding IP addresses, and vice-versa.

1.7 Border Gateway Protocol (BGP) routing. Comcast supports BGP-4 routing as an optional service feature. BGP-4 allows customers to efficiently multi-home across multiple ISP networks. The service requires an Autonomous System Number (ASN) be assigned to a customer by the American Registry for Internet Number (ARIN). Customers should also be proficient in BGP routing protocol to provision and maintain the service on their router. Section 5 "Comcast BGP Policy" provides further details. Comcast supports private peering fi the customer is multi-homed to Comcast's network only.

Section 2. Monitoring, technical support and maintenance

2.1 Network monitoring. Comcast monitors all Comcast Services purchased by a customer on a 24x7x365 basis.

2.2 Technical support. Comcast provides customers a toll-free trouble reporting telephone number to the customer Enterprise Technical support (ETS) that operations on a 24x7x365 basis. Comcast provides technical support for service related inquiries. Technical support will not offer consulting or advice on issues relating Customer Premise Equipment (CPE) not provided by Comcast.

2.3 Escalation. Reported troubles are escalated within the Comcast ETS to meet the standard restoration interval described in the Service Level Objectives. Troubles are escalated within the ETS as follows: Supervisor at the end of the standard interval plus one (1) hour, to the Manager at the end of the standard interval plus two (2) hours, and to the Director at the end of the standard interval plus four (4) hours.

2.4 Maintenance. Comcast's standard maintenance window is Sunday to Saturday from 12:00am to 6:00am local time. Scheduled maintenance is performed during the maintenance window and will be coordinated between Comcast and customer. Comcast provides a minimum of forty-eight (48) hour notice for non-service impacting scheduled maintenance. Comcast provides a minimum of seven (7) days notice for service impacting planned maintenance. Emergency maintenance is performed as needed

Section 3. Service Level Objectives

Comcast provides Service Level Objective for the service, including network availability, mean time to respond, and mean time to restore. The service objectives are measured monthly from the Comcast point of demarcation.

3.1 Availability. Availability is a measured is a measurement of the percentage of total time that the service is operational when measured over a 30 day period. Service is considered "inoperative" when either of the following occurs: (i) there is a total loss of signal for the service, (ii) output signal presented to the customer by Comcast does not conform to the technical specifications in Section 1. Figure 2 lists the availability objectives for each access Ethernet access type.

Service (<250 miles)	
Availability (On-Net and Off-Net Services delivered via Fiber)	>99.99%
Availability (On-Net Services delivered via HFC Network)	>99.9%
Availability (Off-Net Services delivered via Non-Fiber)	>99.9%

Figure 2: Availability

3.2 Mean Time to Respond. Mean Time to Respond is the average time required for the ETS to begin trouble shooting a reported fault. The Mean Time to Respond objective is fifteen (15) minutes upon receipt of a fault notification or from the time a trouble ticket is opened with the ETS.

3.3 Mean Time to Restore. Mean Time to Restore is the average time required to restore service to an operational condition as defined by the technical specifications in Section 1 of this document. The Mean Time to Restore objective is four (4) hours for electronic equipment failure or six (6) hours for fiber optic facilities failure from the time a trouble ticket is opened with ETS.

Section 4. Customer responsibilities

Comcast provides CPE for provisioning its services and the delivery of the UNI. Comcast will retain ownership and management responsibility for this CPE. As a result, the CPE must only be used for delivering Comcast services. Customers are required to shape their egress traffic to the contracted CIR.

Customers have the following responsibilities related to the installation support, and maintenance of the Service.

4.1 Provide an operating environment with temperatures not below fifty-five (55) or above eighty0five (85) degrees Fahrenheit. Humidity shall not exceed ninety (90) percent at eighty-five (85) degrees Fahrenheit.

4.2 Provide secure space sufficient for access to one (1) standard, freestanding, equipment cabinet at each of the customer facilities, no further than fifty (50) feet from the customer router or switch.

4.3 Provide outside cable entry conduit(s), entry cable ground point, and internal building conduit to allow Comcast the ability to rod/rope a fiber optic cable to the point of demarcation.

4.4 Locate and mark all private underground utilities (Water, Electric, etc.) along path of new underground placement not covered by utility companies.

4.5 Provide a pull rope in any existing duct that Comcast is to use and ensure existing duct is serviceable for Comcast use.

4.6 Obtain 'right-of-way' entry easement for Comcast facilities and equipment from property owners at each customer location.

4.7 The customer is responsible for coring of the building's outside wall and internal walls. Upon request, Comcast can perform this activity on an 'as needed' basis for an additional one-time fee.

4.8 Provide UPS AC power equipment, circuit sizing to be determined, if applicable.

4.9 Emergency local generator backup service, if applicable.

4.10 Provide access to the buildings and point of demarcation at each customer location to allow Comcast and its approved Contractors to install fiber for service installation. Provide access to each location for regular (8am – 5pm) and emergency (24 hours) service and maintenance of Comcast's equipment and facilities.

4.11 Provide install and maintain a device that is capable of routing network traffic between the Service and the customer's Local Area Network (LAN)

4.12 Customer must provide a point of contact (POC) for installation, service activation and any maintenance activities.

Section 5. Comcast BGP policy

The following provides the routing requirements to interconnect with the Comcast network. Additional details of Comcast's BGP inbound/outbound network policy and traffic engineering is available upon request.

5.1 Customers must be multi-homed to run BGP, either.

a. multi-homed within Comcast's network
b. multi-homed with Comcast and another service provider

5.2 Customers must use an Autonomous System (AS) number assigned by a regional register American Registry for Internet Numbers (ARIN), Réseaux IP Européens (RIPE), or Asia Pacific Network Information Centre (APNIC) etc. that is registered to their organization.

a. All customer route announcements must be registered with a regional registrar. A route objective must exist for each route prefix in one of the well known global routing registries as RADB.
b. The customer ASN needs to be verifiable in WHOIS database
c. Comcast will only accept private peering when the customer is multi-homed to Comcast only.
d. Comcast will support a 4-byte ASN starting 01/01/2010 in accordance with ARIN policy.
e. Comcast will assign a private ASN in the range of 64512-65534 for private peering and not accept any customer provided private ASN.
f. Comcast will strip off the private ASN when advertising to peers.

5.3 Customers must use a router that supports BGPv4.

a. Comcast will not run BGP4 with customers connected on a link with less than 2Mbps bandwidth.
b. Customers are responsible to ensure their peering routers have adequate CPE processing power and memory space if a full Internet table is requested.
c. Comcast will employ all best-known practices to establish, maintain, and troubleshoot BGP4 sessions with all BGP4 compliant router vendors. However, Comcast makes no warranty that it can establish and maintain a BGP4 sessions with any CPE due to vendor interoperability.

5.4 Customers can specify one of the following received-prefixes options:

a. Default-route only
b. Comcast customer routes
c. Comcast customer routes + default-route
d. Full routes
e. Full routes + default-route

5.5 Customer must be capable of configuring their BGP session with Comcast. This includes all setup of neighbor statements and all sanity checks on customer CPE.

5.6 Comcast requests the use of an MD5 authentication key for all EBGP sessions the customer should specify the MD5 password.

5.7 Customers must prevent redistribution from their Interior Routing Protocol (IGP) into BGP. Customers should also apply restrictive filters on outbound announcements so that only the customer's intended outbound prefixes are announced to Comcast.

5.8 Comcast will assign a /30 IP address for the interfaces that connect to Comcast's network. This will be assigned from a Comcast address block publicly registered with ARIN and already advertised as part of a larger aggregate to the Internet.

5.9 Comcast will announce any portable or non-portable net block so long as this space is larger than /24, and the space is assigned to the customer via WHOIS or RWHOIS databases. If the net block does not belong to the customer and the net block is not already being announced from the customer's AS then Comcast will need to have an LOA (Letter of Agreement) from the true owner of the block stating that they are aware of, and are accepting of the fact that our customer wants to make the announcement through Comcast.

5.10 Comcast does not alter any of its BGP4 configurations, including route-maps, filter-policies, and communities, for any individual customer, but rather will dynamically alter BGP policy dependent on the customers' employment of predefined Comcast BGP communities. This ensures the Comcast network is built and maintained in a strategic, organized, and efficient fashion and reduces meantime-to-repair for BGP related trouble.

Ethernet Network Service Description

Service description

Comcast Ethernet Network Service (ENS) enables customers to connect physically distributed locations across a Metropolitan Area Network (MAN) as if they are on the same Local Area Network (LAN).
The service provides VLAN transparency enabling customers to implement their own VLANs without any coordination with Comcast. ENS is a reliable, more flexible, scalable, and cost-effective alternative to traditional hub and spoke network topologies using Frame Relay, TDM private lines or IP VPNs.

ENS offers three Classes of Service (CoS): Basic, Priority, and Premium. CoS options enable customers to select the CoS that best meets their applications' performance requirements. The service is offered with 10Mbps/100Mbps, 1Gbps, 10Gbps and 100Gbps Ethernet User-to-Network Interfaces (UNI) and is available in increments from 1Mbps to 100Gbps.

Comcast's Ethernet Network Service is Certified MEF Compliant.

Section 1. Technical specifications

1.1 Ethernet User-to-Network Interface. The service provides bidirectional, full duplex transmission of Ethernet frames using a standard IEEE 802.3 Ethernet interface. Figure 1 lists the available UNI physical interfaces, their associated Committed Information Rate (CIR) bandwidth increments and the Committed Burst Sizes (CBS).

UNI Speed	UNI Physical Interface	CIR Increments	CBS (bytes)
100Mbps	100BaseT	1Mbps	25,000
1Gbps	1000BaseT or 1000BaseSX	10Mbps	250,000
10Gbps	10GBASE-SR or 10GBASE-LR	100Mbps	2,500,000
100Gbps	100GBASE-LR4	1Gbps	25,000,000
		10Gbps	25,000,000

Figure 1: Available UNI interface types and CBS values for different CIR Increments

1.2 Maximum number of UNIs. The service supports up to 100 UNIs per network. Additional UNIs are considered on an Individual Case Basis (ICB).

1.3 Class of Service options. The service offers three CoS options. The CoS options allow for differentiated service performance levels for different types of network traffic. It is used to prioritize customer mission-critical traffic from lesser priority traffic in the network. The customer must specify a CIR for each CoS to indicate how much bandwidth should be assigned to it. Figure 2 lists the service performance objectives associated with On-Net and Off-Net Services. Only Basic or Priority CoS are permissible for On-Net and Off-Net services delivered via the Comcast Hybrid Fiber Coax (HFC) Network. Locations delivered via Off-Net Services will only guarantee the CoS value for the On-Net portion of the service. However, the end-to-end service will honor the committed performance tier metrics.

1.4 CoS identification and marking. The customer must mark all packets using 802.1p CoS values as specified in Figure 3 to ensure the service will provide the intended CoS performance objectives specified in Figure 2. Locations delivered via On-Net or Off-Net Services delivered via the HFC Network will only honor Basic or Priority CoS values. All other values will be treated as Basic.

Performance Objective	Class of Service (CoS)		
	Premium	Priority	Basic
Services			
Latency (round trip)	< 14ms	< 46ms	< 90ms
Latency (Fiber-only, PT 1)	7ms	N/A	N/A
Jitter	< 2ms	< 10ms	< 20ms
Packet Loss (round trip)	< 0.001%	< 0.01%	< 1%
Availability (On-Net and Off-Net Services delivered via Fiber)	> 99.99%	> 99.99%	> 99.99%
Availability (On-Net Services delivered via HFC Network)	N/A	>99.9%	>99.9%
Availability (Off-Net Services delivered via Non-Fiber)	> 99.9%	> 99.9%	> 99.9%

Figure 2: CoS Performance Objectives

CoS	802.1p
Premium	5
Priority	2-3
Basic	0-1

Figure 3: CoS Marking

1.5 Traffic management. Comcast's network traffic-policing policies restrict traffic flows to the subscribed CIR for each service class. If the customertransmitted bandwidth rate for any CoS exceeds the subscription rate (CIR) and burst size (CBS), Comcast will discard this traffic. For packets marked with a nonconformant CoS marking, the service will transmit them using the Basic service class without altering the customer's CoS markings.

1.6 MAC addresses. Comcast supports up to 250 MAC addresses per UNI and up to 2500 MAC addresses per ENS Domain.

1.7 Maximum frame size. Services delivered via Fiber support a Maximum Transmission Unit (MTU) frame size of 1600 bytes to support untagged, tagged and Q-in-Q traffic with 802.1q or 802.1ad encapsulation types. Services delivered via On-Net Fiber can, upon request, support a MTU up to 9100 bytes to support untagged, tagged and Q-in-Q frame sizes. Services delivered via Off-Net Fiber may, upon request, support a MTU up to 9100 bytes to support untagged, tagged and Q-in-Q frame sizes, but only, and solely, to the extent the applicable Off-Net provider can support such MTU frame size. Services delivered via HFC support a Maximum Transmission Unit (MTU) frame size of 1522 bytes. All frames that exceed specifications shall be dropped.

1.8 VLAN Tag preservation. The service supports IEEE 802.1Q VLAN-tagged customer packets. All customer VLAN IDs and priority code points (IEEE 802.1p) for CoS are transmitted and received unaltered by the service. Untagged packets are mapped to the native VLAN specified by customer. Customers may configure their own VLANs on their customer owned Customer Premise Equipment (CPE) without coordination with Comcast. Comcast may reserve one VLAN for network management purposes.

1.9 Ethernet Service frame disposition. Different types of Ethernet frames are processed differently by the service. Frames may pass unconditionally through the network or may be limited as in the case of broadcast, unknown unicast and multicast frames to ensure acceptable service performance. Refer to Figure 4 for Comcast's service frame disposition for each service frame type.

Service Frame Type	Service Frame Delivery
Unicast	All frames delivered unconditionally
Multicast	All frames delivered conditionally
Broadcast	All frames delivered conditionally

Figure 4: Service Frame Delivery Disposition

1.10 Layer 2 Control Protocol (L2CP) processing. The service will discard, tunnel across the Comcast network, or peer (process) L2CP service frames at each UNI. Refer to Figure 5 for Comcast's L2CP disposition. For L2CPs with multiple disposition possibilities, the customer must specify to Comcast which disposition should be taken. The default disposition is to discard these L2CP service frames.

Destination MAC Address	Layer 2 Control Protocol	L2CP Frame Disposition
01-80-C2-00-00-00	STP, RSTP, MSTP	Discard (All UNIs)
01-80-C2-00-00-01	PAUSE	Discard (All UNIs)
01-80-C2-00-00-02	LACP, LAMP	Discard (All UNIs)
01-80-C2-00-00-02	Link OAM	Peer or Discard (disposition specified per UNI)
01-80-C2-00-00-03	802.1X	Discard (All UNIs)
01-80-C2-00-00-07	E-LMI	Discard (All UNIs)
01-80-C2-00-00-0E	LLDP	Discard (All UNIs)
01-80-C2-00-00-20 through 01-80-C2-00-00-2F	GARP, MRP	Tunnel (All UNIs)

Figure 5: L2CP Frame Disposition

1.11 Online reporting. Comcast provides the customer with password-protected access to online reports containing historical network traffic information. Reports may vary based on the customer solution.

Section 2. Monitoring, technical support and maintenance

2.1 Network monitoring. Comcast monitors all Comcast Services purchased by a customer on a 24x7x365 basis.

2.2 Technical support. Comcast provides customers a toll-free trouble reporting telephone number to the customer Enterprise Technical Support (ETS) that operates on a 24x7x365 basis. Comcast provides technical support for service-related inquiries. Technical support will not offer consulting or advice on issues relating to CPE not provided by Comcast.

2.3 Escalation. Reported troubles are escalated within the Comcast ETS to meet the standard restoration interval described in the Service Level Objectives. Troubles are escalated within the Comcast ETS as follows: Supervisor at the end of the standard interval plus one hour; to the Manager at the end of the standard interval plus two hours, and to the Director at the end of the standard interval plus four hours.

2.4 Maintenance. Comcast's standard maintenance window is Sunday to Saturday from 12:00am to 6:00am local time. Scheduled maintenance is performed during the maintenance window and will be coordinated between Comcast and the customer. Comcast provides a minimum of forty-eight (48) hour notice for non-service impacting scheduled maintenance. Comcast provides a minimum of seven (7) days notice for service impacting planned maintenance. Emergency maintenance is performed as needed.

Section 3. Service Level Objectives

Comcast provides Service Level Objectives for the service, including network availability, mean time to respond, and mean time to restore. The service objectives are measured monthly from the Comcast point of demarcation.

3.1 Availability. Availability is a measurement of the percentage of total time that the service is operational when measured over a 30 day period. Service is considered "inoperative" when either of the following occurs: (i) there is a total loss of signal for the service, (ii) output signal presented to the customer by Comcast does not conform to the technical specifications in Section 1.

3.2 Mean Time to Respond. Mean Time to Respond is the average time required for the ETS to begin troubleshooting a reported fault. The Mean Time to Respond objective is fifteen (15) minutes upon receipt of a fault notification or from the time a trouble ticket is opened with the ETS.

3.3 Mean Time to Restore. Mean Time to Restore is the average time required to restore service to an operational condition as defined by the technical specifications in Section 1 of this document. The Mean Time to Restore objective is four (4) hours for electronic equipment failure or six (6) hours for fiber optic facilities failure from the time a trouble ticket is opened with the ETS.

Section 4. Customer responsibilities

Comcast provides CPE for provisioning its services and the delivery of the UNI. Comcast will retain ownership and management responsibility for this CPE. As a result, the CPE must only be used for delivering Comcast services. Customers are required to shape their egress traffic to the contracted CIR.

Customers have the following responsibilities related to the installation, support, and maintenance of the Service.

4.1 Provide an operating environment with temperatures not below fifty-five (55) or above eighty-five (85) degrees Fahrenheit. Humidity shall not exceed ninety (90) percent at eighty-five (85) degrees Fahrenheit.

4.2 Provide secure space sufficient for access to one (1) standard, freestanding, equipment cabinet at each of the customer facilities, no further than fifty feet from the customer router or switch interface.

4.3 Provide outside cable entry conduit(s), entry cable ground point, and internal building conduit to allow Comcast the ability to rod/rope a fiber optic cable to the point of demarcation.

4.4 Locate and mark all private underground utilities (Water, Electric, etc.) along path of new underground placement not covered by utility companies.

4.5 Provide a pull rope in any existing duct that Comcast is to use and ensure existing duct is serviceable for Comcast use.

4.6 Obtain 'right-of-way' entry easement for Comcast facilities and equipment from property owners at each customer location.

4.7 The customer is responsible for coring of the building's outside wall and internal walls. Upon request, Comcast can perform this activity on an 'as needed' basis for an additional one-time fee.

4.8 Provide UPS AC power equipment, circuit sizing to be determined, if applicable.

4.9 Emergency local generator backup service, if applicable.

4.10 Provide access to the buildings and point of demarcation at each customer location to allow Comcast and its approved Contractors to install fiber for service installation. Provide access to each location for regular (8am - 5pm) and emergency (24 hour) service and maintenance of Comcast's equipment and facilities.

4.11 Provide, install and maintain a device that is capable of routing network traffic between the Service and the customer's Local Area Network (LAN).

4.12 Customer must provide a point of contact (POC) for installation, service activation and any maintenance activities.

Section 5. Definitions

5.1 Latency. Latency, also known as Frame Delay, is defined as the maximum delay measured for a portion of successfully delivered service frames over a time interval.

5.2 Jitter. Jitter, also known as Frame Delay Variation, is defined as the short-term variations measured for a portion of successfully delivered service frames over a time interval.

5.3 Packet Loss. Packet Loss, also known as Frame Loss, is the difference between the number of service frames transmitted at the ingress UNI and the total number of service frames received at the egress UNI.

E-Rate Overview

Federal Universal Service Programs for Schools and Libraries Experience

Comcast Business is an active partner in the education community and has helped school districts close the gap between the communication services they have and the advanced network services they need. E-Rate-eligible Ethernet network services can enable the future of education by providing high-speed network access to applications that are hosted elsewhere.

Comcast Business has a successful record of working with schools and libraries that receive funding under the federal Universal Service Support Mechanism for Schools and Libraries ("E-Rate Program"). Comcast Business provides E-Rate eligible services through its applicable operating affiliates and subsidiaries identified throughout this Network Services Proposal as "Comcast". Comcast Business certifies that it is fully authorized to participate in the E-Rate Program.

USF and CTF Programs Experience

Comcast Business has experience and a successful record of working with school districts that receive funding under the Federal Universal Service Support Mechanism for Schools and Libraries ("E-Rate Program") and the California Teleconnect Fund (CTF).

Agreement of Participation

Comcast Business agrees to comply with the written request of the Applicant (as defined by USAC), its agency, organization and or consultant administering, E-Rate on the Entity's behalf. Comcast Business reserves the right to request a Letter of Agency (LOA) that such party is authorized to receive information on behalf of the Entity (as defined by USAC).

Information and Documentation

Comcast Business agrees to provide requested information and or documentation to the Applicant, its agency, organization and/or consultant administering, E-Rate on the Applicant's behalf within a commercially reasonable period of time.

Reimbursement Process

Each funding year, applicants are required to notify Comcast Business of their invoicing mode selection through completion of the Comcast Business E-Rate Reimbursement Form. Applicants should contact Erate_Funding@cable.comcast.com to request a copy of this form each year.

- Applicants who select BEAR Reimbursement are required to file a FCC Form 472 (Billed Entity Applicant Reimbursement (BEAR) Form) providing they have paid in full for the services and are requesting to be directly reimbursed by USAC for the discounted amount. It is the applicant's responsibility to file a BEAR form online through the Schools and Libraries E-Rate Productivity Center (EPC) system. Billed entities will receive payment directly to their bank account. In order to begin direct BEAR payments, the applicant must have completed an FCC Form 498 to obtain an applicant 498 ID.
- Applicants who select the SPI Reimbursement method will be invoiced for the non-discounted amount (the applicant's share of the cost). The applicant is required to pay the non-discounted portion of the cost for services.

Service Provider Identification Number (SPIN) and FCC Registration Number (FRN)

Service Provider Name	SPIN	499 Filer	FRN
Comcast Business Communications, LLC	143003990	Y	0004321725
Comcast Cable Communications, LLC	143013564	N	
Comcast IP Phone, LLC	143035551	Y	
Comcast Phone, LLC	143034516	Y	

Company Overview

Headquartered in Philadelphia, Pennsylvania, Comcast Corporation is a global media and technology company with three primary businesses: Comcast Cable, NBCUniversal and Sky. Founded in 1963 as a single-system cable operator, Comcast is now one of the nation's largest and leading providers of information, communications and entertainment products and services.

Comcast Business, a division of Comcast Corporation's cable segment, is a leader in business technology – offering businesses and organizations a suite of Connectivity, Communications, Networking, Cybersecurity, Wireless, and Managed Solutions to help prepare for what's next. Powered by the nation's largest Gig-speed broadband network, and backed by 24/7 customer support, Comcast Business is one of the nation's largest cable providers to educational organizations, government, small, mid-size, and Enterprise businesses.

Comcast Business invests billions every year to continue to build our nationwide, fiber-rich network – giving organizations the robust performance needed to enable students to thrive. Our high-speed, high-capacity broadband and Ethernet services operate across our advanced network, and with the first and largest fully 40G backbone, and the deployment of the first 100G router interface, Comcast's network delivers reliable and scalable services for organizations of any size.

Core Values

Our core values are rooted in improving the communities where our employees, customers, and audiences live and work.

Diversity, Equity, and Inclusion (DE&I)

We believe that a diverse and inclusive company is a more innovative and successful company. Our approach to DE&I is focused on five key pillars: Governance, Workforce, Supplier Diversity, Programming, and Community Impact. Comcast NBCUniversal has a robust Supplier Diversity program with diverse Tier I and Tier II suppliers.

Sustainability

We believe in protecting the environment where we live and work, so we have a sustainable planet now and in the future.

In the Community

We provide and support programs intended to have a positive, sustainable impact on the communities we serve. Our long-standing commitment continues to be recognized by various organizations and publications.

Awards

Our growth and innovation has resulted in a number of awards for excellence in the services and support we provide. In addition, Comcast Business is the first carrier in the world to be MEF CE 2.0 certified, leading the industry and demonstrating our commitment to our customers.

Financial Information

Financial information is available at: https://www.cmcsa.com/financials.

For more information about Comcast Business visit http://business.comcast.com/about-us/comcast-business.

Comcast Business Contract Exceptions

No statement made in the proposal shall be considered a contractual term unless expressly included in a contract mutually negotiated between the parties as part of the post bid submission process. At that time, Comcast would be amenable to negotiating modifications to the Contract appended to the RFP, to the extent allowed by law or as mutually negotiated by the parties, and to address additional items (if any) that your organization feels are critical to its consideration and use of the Comcast solution. Comcast also reserves the right to include any additional terms and conditions upon which the above mentioned services are being specifically offered by Comcast as a highly regulated provider of such services.