

## SEALED PROPOSAL

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For the West Virginia Office of Technology  
Additional Enhancements for the Broadband Technology Opportunities  
Project ("BTOP")

VENDOR:

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Submitted by *C. D. White* 10-9-2012

## BTOP Addition West Virginia Core Optical Network

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WV PROCUREMENT  
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## INTRODUCTION

### Executive Summary

Citynet, LLC is providing this response to the Request for Information (“Response”) of the West Virginia Office of Technology with respect to additional enhancements that can be added to West Virginia’s Broadband Technology Opportunities Program (“BTOP”) stimulus grant. This Response provides a comprehensive description of Citynet’s proposed BTOP enhancement referenced as the West Virginia Core Optical Network Project (the “WVCore Project”).

West Virginia’s current BTOP stimulus project emphasizes expansion of localized connectivity through investment in fiber optic infrastructure and Long Term Evolution (“LTE”) wireless facilities. This BTOP infrastructure will aid the State’s broadband expansion efforts by providing localized connectivity within West Virginia’s unserved and underserved communities. These localized improvements in connectivity highlight the State’s remaining challenge of improving overall broadband performance. Overall broadband performance is best viewed as total “throughput” delivered to end users over the BTOP infrastructure or other available “last mile” facilities and that performance is solely dependent on the size and quality of the available upstream connections to the national Internet backbone system. The national Internet backbone system was largely deployed from 1997 to 2002 and focused on interconnecting large demographic markets (“Metropolitan Service Areas” or “MSAs”) leaving West Virginia with limited access to this system. Therefore, West Virginia does not enjoy the full breadth of connectivity and performance currently available in other states with large MSA population centers (*i.e.*, the “throughput” mentioned above). In addition, this challenge limits the availability of next-generation services and applications such as Gigabit Ethernet services, Cloud Computing and Video Conferencing opportunities.

The WVCore Project represents an innovative approach to extend broadband performance into West Virginia’s key service aggregation markets by establishing express routes (on/off ramps) with the national Internet backbone system. The design attributes of the WVCore Project purposely target robust service offerings over route diverse connections to ensure optimum reliability. In addition, the primary links are further diversified over multiple national carrier systems such as Broadband One, CenturyLink, Cogent, Level3, Zayo Bandwidth, Time Warner Telecom, and others located in the nearest primary carrier interexchange facilities in Pittsburgh, PA and Columbus, OH. The WVCore Project will provide West Virginia with nine (9) GigaPop facilities by which localized traffic will have direct high-capacity access to the national Internet backbone system, including the ability to bridge services to the localized BTOP funded assets.

This approach provides a number of key benefits critical to facilitating a true broadband experience in West Virginia. Those benefits include:

- Extending high-capacity Internet backbone links into West Virginia markets;
- Enabling next-generation broadband services and applications;
- Improving end-user performance and experience (*i.e.*, throughput);
- Leveraging existing infrastructure and operating facilities;
- Targeting high-job creation economic development zones;
- Extending high-capacity services to BTOP funded assets;
- Extending high-capacity services to other last mile service providers;
- Lowering costs for existing broadband providers;
- Lowering market entry barriers for future broadband providers;
- Supporting BTOP goals and objectives; and
- Providing rapid implementation timeline for immediate relief.

Those benefits will be achieved via expanded GigaPop facilities in West Virginia’s key data aggregation markets: Beckley, Bluefield, Bridgeport/Clarksburg, Charleston, Huntington, Martinsburg, Morgantown, Parkersburg and Wheeling. The WVCORE Project is a compelling and innovative approach that compliments the State’s existing BTOP project.

### Funding Summary

Total Project Cost	\$ 7,920,000
Funds Requested	\$ 5,395,000
In-Kind Match	\$ 2,525,000 (32%)

### NTIA Guidelines

The WVCORE Project outlined in this document is formatted to comply with NTIA guidelines as provided to West Virginia’s BTOP Coordinator.

### Transport Challenge

The State’s existing BTOP grant award prioritizes the installation of infrastructure (*i.e.*, fiber optic cable extensions and LTE wireless technologies) to State Agencies, Community Anchor Institutions and K-12 Schools. While that infrastructure will aid the State’s localized broadband expansion efforts into West Virginia’s unserved and underserved communities, it does not address the upstream connectivity issue (often referred to as “transport capacity”). As noted above, performance is best viewed as total throughput delivered to end users over the BTOP infrastructure and is highly dependent on the size and quality of upstream connections to the national Internet backbone system.

To facilitate a true broadband experience, the State’s BTOP efforts should be expanded, where possible, to address the following broadband necessities: localized connectivity and adequate upstream links to the national Internet backbone system. Solving the upstream connectivity issue is best served by focusing on: (a) raw bandwidth capacity or total speed; (b) upstream

reliability and route diversity; (c) next-generation service capability (*e.g.*, MPLS IP, Gigabit Ethernet, Video and VoIP); and d) diversity and quality of the upstream links (*i.e.*, national carrier interconnections).

### Analysis

The Executive Office of the State of West Virginia (“EOWV”) has consulted with numerous in-state resources and has solicited industry input in order to address the complexities of West Virginia’s broadband challenges. The bulk of these challenges have consistently revolved around two key issues: (a) the lack of adequate infrastructure and (b) the lack of adequate upstream connectivity to the nation’s primary Internet backbone system. The State’s BTOP grant is focused on addressing the long-term importance of localized connectivity. The WVCORE Project represents a cost effective opportunity that compliments the State’s BTOP efforts while addressing the State’s broadband transport challenge. WVCORE is an innovative solution to remedy the upstream connectivity challenge while supporting the State’s overall BTOP efforts. The WVCORE Project will deliver route diverse upstream connectivity to dual Internet exchange facilities in Pittsburgh, PA and Columbus, OH, and extend a fully integrated optical core network (*i.e.*, an express routing system) capable of transporting 10 Gigabits of capacity to West Virginia’s markets (and high-capacity secondary access points). These secondary access points, a/k/a GigaPops, provide the most efficient method by which to aggregate high-capacity upstream links while disseminating downstream performance and provide express gateway systems with direct access to the national Internet backbone system. The design not only provides the State with a methodology by which performance of BTOP assets can be improved, but also directly benefits West Virginia’s key economic development zones by providing critical technology infrastructure for high-job creation institutions, businesses and last mile service providers.

## PROJECT IMPACTS

### Impacts to West Virginia

The WVCORE Project will provide an immediate impact by improving West Virginia's access to the national Internet backbone system by extending robust 10 Gigabit facilities to key data aggregation points - "GigaPops". The GigaPops will function as virtual gateways to extend broadband connectivity and boost broadband performance on express paths to localized infrastructure which includes the newly deployed fiber and wireless infrastructure and other last mile provider infrastructure.

The impacts of the GigaPops include:

- Establishing localized GigaPop data exchange facilities;
- Introducing next-generation high-capacity broadband transport technologies;
- Enabling innovative broadband-based applications (Cloud Computing, VoIP, and Video);
- Extending core backbone functions to the State's core economic development zones;
- Facilitating growth for high-job creation businesses and institutions;
- Improving West Virginia's value proposition for future economic development;
- Lowering overall broadband acquisition costs which can be passed on to end users;
- Extending services and bandwidth to BTOP funded infrastructure; and
- Providing rapid implementation and relief for existing localized broadband assets.

### Impacts to Broadband Performance

The WVCORE Project will provide high-capacity bandwidth connectivity (upstream and downstream) to each newly expanded GigaPop facility over a fully diverse 10 Gigabit optical core. That connectivity, in turn, feeds localized infrastructure by delivering higher levels of bandwidth at an affordable price which enhances the performance for all end-user constituents (*i.e.*, more bandwidth per user). This open-access system also provides next-generation services such as Gigabit Ethernet and 100 Megabit Ethernet that further enhance performance characteristics. Functionally speaking, the WVCORE system will provide a virtual gateway directly to the national core Internet backbone system.

### Impacts to Broadband Applications

The WVCORE Project's ability to improve both speed and service quality also provides added benefits that enable end-users (including businesses, consumers and community institutions) to expand use of next-generation IP-based applications such as Video Conferencing, Integrated Session Initiation Protocol ("SIP") Services, Cloud Computing and Disaster Recovery/Data Mirroring Services.

### Impacts to Economic Development

The WVCORE Project's GigaPop facilities are located in West Virginia's primary economic development zones where having access to enhanced broadband services is critical for job retention and new job creation. The WVCORE network and its associated GigaPop facilities are directly available for use by all constituents (businesses, consumers, community institutions and last mile providers), and thereby producing the ability to directly enable high-job creation businesses and institutions.

### Impacts to Data Aggregation and Transmission

The WVCORE GigaPop facilities are purposely positioned in West Virginia's major markets to maximize their reach to downstream local communities (*i.e.*, underserved and unserved communities). Like a major highway system that expedites travel to and from major markets, which in turn interconnects with State roads and highways in order to reach one's ultimate destination, the GigaPop facilities function in the same manner by efficiently aggregating and distributing bandwidth to downstream communities. In this regard, each GigaPop facility provides the following dual benefits: a) geographic access that is distributable to localized infrastructure; and b) the ability to simultaneously serve the needs of West Virginia's major business communities.



### Project Approach & Timeline

The WVCORE Project utilizes existing and fully operational facilities and infrastructure and delivers on the performance objectives by leveraging next-generation optical equipment. The Project involves the allocation, purchase, provisioning, and installation of this equipment and is purposely designed for rapid implementation in concurrence with BTOP established guidelines.

Project Timeline:

<b>Phase</b>	<b>Description</b>	<b>Duration (days)</b>
1	Execute Purchase Agreement and Purchase Order	10
2	Delivery and Acceptance of Equipment	30
3	Stage and Configure Equipment	15
4	Deploy and Install Equipment	15
5	Test and Accept Equipment	15
6	Ready for Service	0
	<b>Total Duration</b>	<b>85</b>

## GOALS AND OBJECTIVES

### Operating Goals and Objectives

The operating objective of the WVCORE Project is to extend high-capacity broadband transport facilities into and throughout West Virginia. Those facilities will serve as express routes that connect West Virginia's key data aggregation markets to the national Internet backbone system and result in the establishment of West Virginia-based data exchange points, GigaPops. The GigaPop facilities are critical operating components that extend high-capacity services (*i.e.*, more bandwidth) and next-generation services (Gigabit Ethernet, VoIP, and Video, etc.) to localized aggregation points. The result will allow the State of West Virginia to address its challenge with limited and often constrained upstream connectivity necessary to support users with a true broadband experience. The GigaPop facilities also serve to bridge these high performance services to the State's BTOP funded infrastructure currently under deployment (*i.e.*, localized fiber optic cables and LTE wireless facilities). The WVCORE Project represents an innovative approach that improves the State's BTOP project and supports a rapid implementation timeline in accordance with BTOP requirements. In summary, the WVCORE Project will:

- 1) Meet rapid implementation timeline in accordance with NTIA objectives;
- 2) Leverage next-generation optical technology to speed time-to-market;
- 3) Enable West Virginia's key economic development zones;
- 4) Establish localized express transport system to national Internet backbone;
- 5) Lower overall broadband acquisition costs;
- 6) Extend high-capacity services to underserved markets; and
- 7) Bridge legacy infrastructure with localized BTOP infrastructure;

### Business Objectives

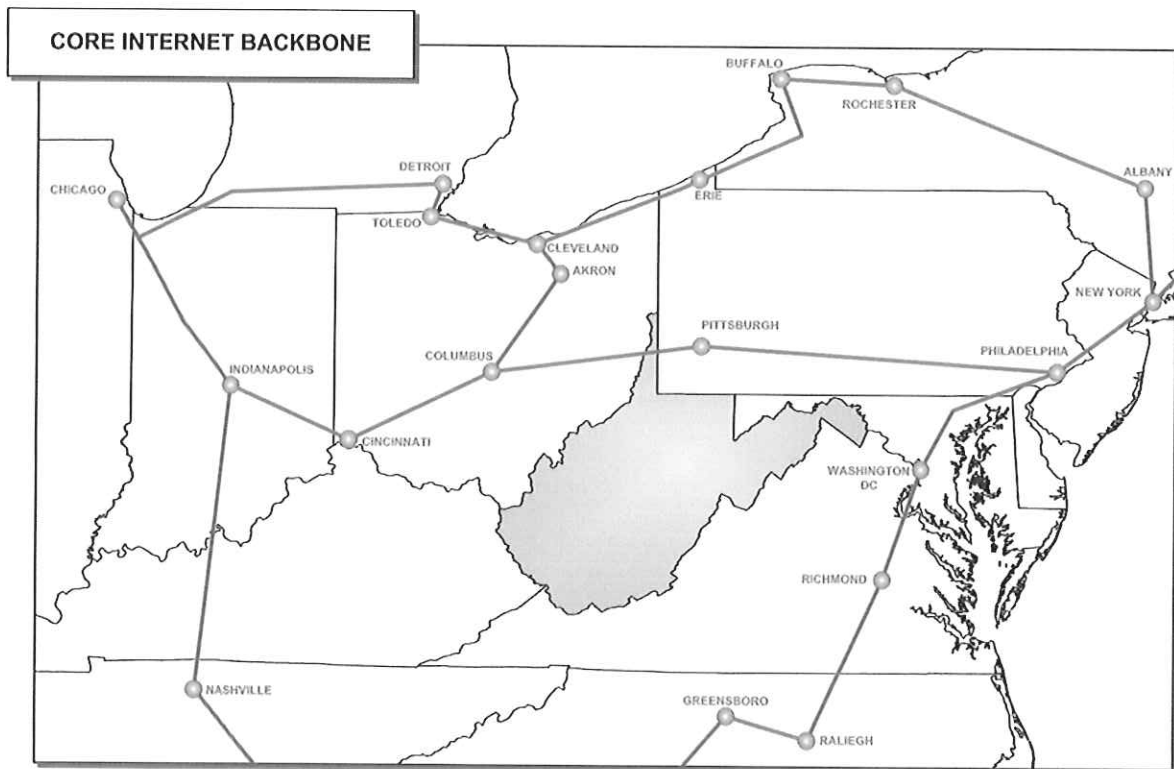
The business objectives of the WVCORE Project focus on improving the affordability and availability of localized broadband connectivity to the national Internet backbone system with dual exchange points in Pittsburgh, PA and Columbus, OH. By facilitating access in this manner, the State will be able to foster localized economic development opportunities while simultaneously empowering extension of services to downstream communities. Services to be offered will include 100 Megabit Ethernet, Gigabit Ethernet, DS3 (45 Mbps), OC3 (155 Mbps), OC12 (622 Mbps), and OC48 (2.5 Gbps) transport. Delivery of those services to West Virginia's localized communities will enable the deployment of innovative next-generation IP-based applications such as Video Conferencing, Cloud Computing, VoIP, and Integrated SIP services.

## PROPOSED SOLUTION

### Architecture

The WVCORE Project will deploy a multiservice transport system based on Cisco Systems® proven 15454 SONET platform. This platform is well tested throughout the carrier transport industry and it provides the reliability, cost benefits and flexibility necessary to support the service objectives of the WVCORE network. The network configuration consists of a primary fully diverse 10 Gigabit SONET ring (West Ring) and a subtending 2.5 Gigabit SONET ring (East Ring). Network reliability is provided by: (a) the physically diverse nature of the primary routes; (b) the physically diverse nature of the upstream exchange points in Pittsburgh, PA and Columbus, OH; (c) the physically diverse connections to upstream providers such as Broadband One, CenturyLink, Cogent, Level3 Communications, Zayo Bandwidth and others; and (d) the automatic reroute and fault tolerance capabilities of the SONET Unidirectional Path Switched Ring (“UPSR”) protocol.

### Existing Internet Backbone Locations

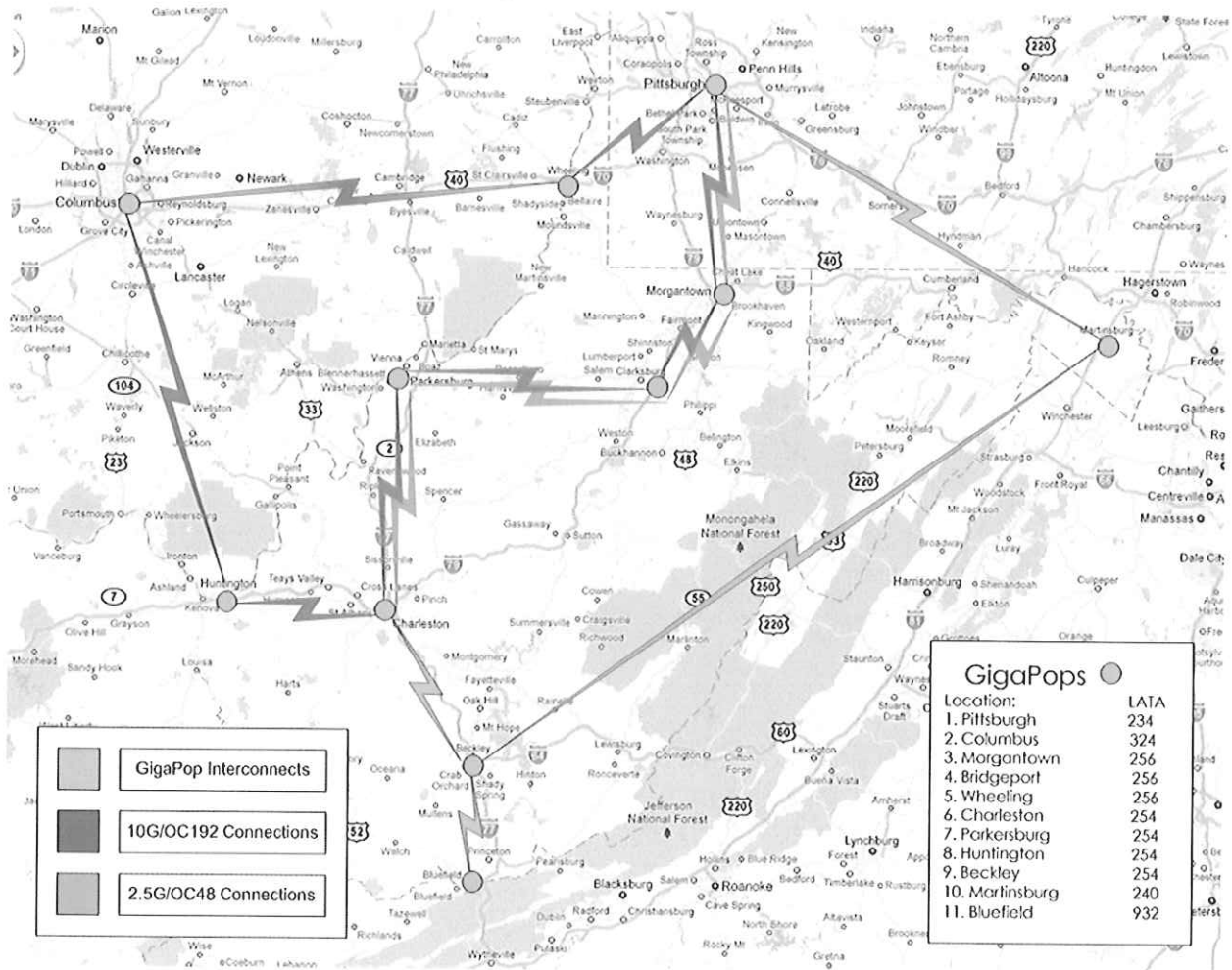


Existing Network Locations

National Internet Backbone Locations	
<b>Columbus, OH</b> 251 Neilston Street Columbus, OH 43215	<b>Pittsburgh, PA</b> 2500 Allegheny Center - Suite 138 Pittsburgh, PA 15212

West Virginia Locations		
<b>Beckley, WV</b>	<b>Charleston, WV</b>	<b>Morgantown, WV</b>
<b>Bluefield, WV</b>	<b>Huntington, WV</b>	<b>Parkersburg, WV</b>
<b>Bridgeport, WV</b>	<b>Martinsburg, WV</b>	<b>Wheeling, WV</b>

Proposed WVCORE Network Diagram



## Proposed Network Equipment Locations

See Existing Network Locations section.

## Impact on Community Anchor Institutions (“CAIs”)

The WVCORE Project seeks to extend core transport facilities to improve service options and performance by establishing key data exchange centers within West Virginia. This network design provides a complimentary strategy to extend and empower services (bridge services) in support of the State’s BTOP funded infrastructure. Therefore, the WVCORE Project will empower and improve performance and access services to all of the community anchor institutions as outlined in the State’s existing BTOP grant, including State Agencies, Higher Education, K-12, Police, Fire and Safety Agencies with further extensibility to last mile providers, businesses and other high-job creation institutions.

## Impact on the Number of Interconnection Points

Pittsburgh, PA and Columbus, OH represent “carrier hotel” facilities that provide dynamic upstream interconnection points to a host of national carriers (*i.e.*, the national Internet backbone systems).

### Columbus, OH

Broadband One  
Cogent Communications  
Horizon Communications  
Level 3 Communications  
OARNET  
Time Warner Cable  
Time Warner Telecom  
Zayo Bandwidth

### Pittsburgh, PA

Broadband One  
CenturyLink (formerly Qwest)  
Level 3 Communications  
Switch & Data  
Zayo Bandwidth

The WVCORE network envisions the creation of Peering Hubs in Morgantown and Charleston, WV. Additionally, nine key data exchange facilities will be established in Beckley, Bluefield, Bridgeport/Clarksburg, Charleston, Huntington, Martinsburg, Morgantown, Parkersburg and Wheeling. These carrier-neutral GigaPops will provide the following benefits to broadband providers:

- Transport cost savings (more bandwidth);
- Zero cost to interconnect;
- Improved network latency;
- Access to multiple Tier 1 Internet Providers;
- 99.999% Network Availability;
- More efficient network utilization; and
- The opportunity to create unique public-private partnerships.

The following broadband providers have expressed interest in interconnecting with this network:

CAS Cable	nTelos
Citynet	Shentel
Digital Connections	StratusWave
Digital Soup	Suddenlink Communications
Micrologic	West Virginia Network (WVNET)
Horizon Communications	WV Office of Technology (WVOT)

Broadband providers will be able to interconnect with the WVCore network at each of the GigaPop locations at the following rates:

- 100 Megabit Ethernet
- Gigabit Ethernet
- DS3 (45 Mbps)
- OC3 (155 Mbps)
- OC12 (622 Mbps)
- OC48 (2.5 Gbps)

### Environmental Assessments

Equipment upgrades will be installed in existing telecommunication facilities. The WVCore Project does not impact any streams, involve any ground disturbances or modify any structures more than 50 years of age. Citynet does not anticipate that any State or Federal environmental assessments will be required to support this Project, nor will it impact or require changes to the State's completed environmental assessment ("EA") in support of the BTOP project.

### Funds Requested

Citynet is requesting that the West Virginia Office of Technology award Citynet with a sub-recipient grant in the amount of \$5,395,000, which excludes the matching fund component (see Matching Funds Requirement section below) to facilitate a complete implementation of the WVCore Project. If the requested funding amount is not fully available, Citynet is prepared to coordinate with the State's BTOP team to identify and implement as many GigaPop locations as possible and can fully implement material benefits for a more limited number of locations subject to available BTOP grant funds.

### Matching Funds

Citynet has already completed capital investments for portions of this project that qualify as in-kind matching contributions in the amount of \$2,525,000, equal to a 32% matching component.

Total Project Cost	\$ 7,920,000
Funds Requested	\$ 5,395,000
In-Kind Match	\$ 2,525,000

## Sustainability

The WVCORE Project's sustainability will be made possible through Citynet's existing business operation and will capitalize on portions of the network already completed by Citynet. Citynet is a well-established broadband carrier which has existing business operations, personnel and operating facilities at each of WVCORE's proposed locations. A partnership with Citynet provides the State of West Virginia with a unique opportunity to expand broadband availability where needed through a collaborative effort with an in-state partner. Citynet will be the private sector provider responsible for implementation, service provisioning and maintenance of the WVCORE system. Citynet will fund all ongoing operational expenses by leveraging its existing operations and economies of scale. As a private sector partner, Citynet will provide all services in accordance with the open-access and non-discrimination guidelines as established by the NTIA and the State of West Virginia. The partnership will provide the State of West Virginia with a well-balanced public-private initiative to facilitate the implementation of the WVCORE Project and to sustain its operating presence into the future.



## SUMMARY

### Strategic Purpose

The strategic purpose of the WVCORE Project rests in the recognition that performance of any last mile system is solely dependent on the speed, reliability and overall performance of its respective upstream linkage (*i.e.*, “middle mile” transport) to the national Internet backbone system. West Virginia has recognized that localized last mile infrastructure is necessary to extend broadband services to the end-user community (including consumers, businesses and community institutions) and that its performance remains limited to the transport capacity that feeds those systems. Given its demographic makeup, West Virginia was bypassed by developments that transpired in the formation of the national Internet backbone system. Therefore, it stands to reason that innovative solutions that cost-effectively extend those capabilities into West Virginia are highly desirable. The WVCORE Project provides an innovative solution that is well-balanced for the State’s needs and is complimentary to its existing BTOP funded efforts.

### Project Advantages

The WVCORE Project’s approach will leverage next-generation technology to rapidly expand the much needed transport systems in a cost effective and highly efficient manner. Through the State’s sponsored partnership with Citynet, the State will be able to leverage Citynet’s existing interconnection facilities, experience and overall business operation to rapidly deploy this creative solution. The WVCORE Project is an extension of Citynet’s existing expansion efforts and will be fully implemented within 85 days, while mitigating the need for any additional environmental assessments. The advantages of the WVCORE Project include:

- Offers an innovative approach to extend national Internet backbone system into WV;
- Provides a highly cost-effective solution to resolve the State’s transport challenge;
- Can be implemented in rapid fashion;
- Empowers West Virginia’s economic development and job-creation centers;
- Provides high-capacity transport connectivity to key data aggregation centers;
- Feeds and empowers all last mile infrastructure including BTOP funded assets;
- Drastically improves end-user performance (consumer, business, and community institutions);
- Enables next-generation IP based applications (Cloud Computing, video, Integrated SIP, etc.);
- Leverages an established private partner network (expertise and sustainability);
- Requires no additional environmental assessments; and
- Compliments existing State BTOP initiatives.

The WVCORE Project is a compelling solution that will greatly improve West Virginia’s ability to keep up with growing Internet performance standards while retaining and improving the State’s economic development base.

## **CONSTRAINTS**

### **Project Constraints**

The only known constraint is final project approval by the NTIA

### **Related Projects**

The WVCORE Project as outlined in this document is directly related to the State's existing BTOP Project. The WVCORE Project will provide added performance benefits to all last mile facilities and will include added benefits to retain and improve the State's key economic development zones.

No other related projects are known at this time.

### **Critical Project Barriers**

None

## **PROJECT PHASES**

### **Phase 1: Execute Vendor Purchase Agreement and Order Equipment**

Duration in Days: 10

Purchase Agreements will be completed, including the negotiation of maintenance requirements, and Purchase Orders will be executed.

### **Phase 2: Delivery and Acceptance of Equipment**

Duration in Days: 30

Vendor(s) will have 30 days to ship all equipment for final delivery.

### **Phase 3: Stage and Configure Equipment Setup**

Duration in Days: 15

Equipment will be staged and pre-configured for final deployment on the WVCore network.

### **Phase 4: Deploy and Install Equipment**

Duration in Days: 15

Equipment will be delivered to final network locations and installed.

### **Phase 5: Test and Accept Equipment for Live Traffic**

Duration in Days: 15

Equipment will be tested for integration with the Network Operations Center and various OSS systems for final preparation and acceptance.

### **Phase 6: Ready for Service**

Duration in Days: 0

The WVCore network will be fully operational and ready for traffic.