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**Delaware Broadband Data and
Development**

Spring 2011 Data Submission White Paper

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1 Introduction

As part of the American Recovery and Reinvestment Act (ARRA), the National Telecommunications and Information Administration (NTIA) released its State Broadband Data and Development Grant Program¹ Notice of Funds Availability (NOFA). The NTIA then awarded the State of Delaware funding to create a database of broadband deployment (Project) in the State of Delaware (State). GeoDecisions and its team partner CBG Communications, Inc. (CBG) have been retained by the State of Delaware (collectively referred to as the "State Parties") to perform a variety of tasks as part of the Broadband Data Development process, with the goal being creation of maps of the State showing where broadband is available, Providers' names, and speeds or bandwidth provided to citizens, businesses, and anchor institutions throughout the State.

The NOFA requires mapping of facilities-based Providers' availability of broadband speed internet access in the State. The NTIA, in the NOFA, defined broadband as "Broadband service is 'available' to an end user at an address if a broadband service provider does, or could, within a typical service interval (7 to 10 business days) without an extraordinary commitment of resources, provision two-way data transmission to and from the Internet with advertised speeds of at least 768 kilobits per second (Kbps) downstream and at least 200 Kbps upstream to the end user at an address."

The following specific project tasks were to be performed and completed by GeoDecisions and CBG with oversight by State staff:

- Drafting, negotiation, establishment, and status reporting of all Non-Disclosure Agreements (NDAs) with broadband service Providers to support the Delaware broadband expansion initiative.
- Mapping of broadband Providers and service attributes, including technologies utilized and advertised speeds available to end users.
- Support of field verification of broadband mapping (using an approximately 35% sampling rate).
- Development of web-based mapping applications.
- Project, task, and contract management.
- Review of Provider marketing materials.
- Assistance in developing criteria for web-based surveys and speed tests.
- Quality Control and review of all deliverables.
- Assistance in the development of a data maintenance document.
- Identification and assessment of broadband infrastructure (using an approximately 35% sampling rate).

¹ [http://broadbandusa.gov/files/BroadbandMappingNOFA\(FederalRegisterVersion\).pdf](http://broadbandusa.gov/files/BroadbandMappingNOFA(FederalRegisterVersion).pdf)



- Participation in weekly status and project meetings with internal staff, NTIA, the University of Delaware, the State of Delaware, Providers, and all other stakeholders.
- Submission of weekly status reports.

The Project began with meetings with the State, GeoDecisions, and CBG to map out the processes that needed to occur in order to produce an accurate map that included all known broadband Providers that were willing to participate in the project. It should be noted that broadband Providers (Providers) were not required to participate in the Project but were encouraged to provide data specific to their networks so the State would have maps that were as accurate as possible. Providers that applied for federal grant funds for network expansion or upgrades, however, would be eliminated from consideration for these grants if they did not cooperate with the State on this project.

1.1 List Compilation

The first task was to compile a list of all known broadband Providers throughout the State and contact information for each of these Providers. Information from FCC databases, Internet research, and the State Parties' overall understanding of the broadband industry was utilized to compile the list.

1.2 NDA Negotiation

Contact was then made to each of the Providers to determine whether they had facilities in the State that provided broadband to end users. If so, the Providers were encouraged to participate in the project by providing the pertinent data needed to create the State's maps. Many Providers believe that some of the information required from them for participation is confidential and cannot be released to the general public. To overcome this obstacle, the State Parties created a Non-Disclosure Agreement (NDA) template whereby information deemed confidential by the Providers would not be released publicly by the State Parties. The NDA also ensured that all information requested from the Providers is available for release to the NTIA as required by the NOFA. Based on the variation among Providers on what information is deemed confidential and varying interpretations of the template NDA, negotiations were held with many of the Providers to modify the NDA to meet the Providers' needs while still allowing the State Parties to utilize and share the information as required in the NOFA. Once the Providers and the State Parties signed an agreed-upon NDA, the data gathering process proceeded.

1.3 Data Gathering

As each Provider signed an NDA with the State Parties, they were referred to GeoDecisions' mapping department where they were asked to provide specific data in formats that would be compatible with the State's mapping process. Although many of the Providers had previously provided system data to the Federal Communications Commission (FCC), those submissions showed availability at the Census Tract level. The requirements of this Project were for mapping of network availability at the Census Block



level, which is more granular than previously submitted data. Furthermore, in Census Blocks that are larger than 2 square miles, data was gathered at the street segment level (eg. From # 1 First Street to #111 First Street). As Providers supplied this data, GeoDecisions created maps of the State showing where each of the Providers' footprint(s) was located, as well as other required attributes such as advertised speeds available in these areas and the technologies utilized to provide service to end users.

1.4 Provider Data Submittal

NTIA 3rd data submission included 20 Broadband providers data, 9 of the providers has submitted new data updates; the following is a brief description the data provided:

1- AT&T Mobility LLC.

DBA Name: AT&T

FRN	0004979233
Date of submission	2/10/2011
Type of Data Submission	<ul style="list-style-type: none">• Coverage Shape File• Excel Sheet
Census Blocks	N/A
Road Segments	N/A
Middle Mile infrastructure	No
Technology of Transmission	Terrestrial Mobile Wireless
Data description	ATT provided a shape file that showed coverage over the three counties of Delaware state. The excel sheet provided contained speed data, Technology of transmission & Mobile Spectrum.

2- Cavalier Telephone LLC.

DBA Name: Cavalier

FRN	0018547729
Date of submission	3/18/2011
Type of Data Submission	<ul style="list-style-type: none">• Excel Sheet with Block coverage• Excel sheet with Middle Mile Address
Census Blocks	734
Road Segments	147
Middle Mile infrastructure	14
Technology of Transmission	Asymmetric xDSL Other Copper Wireline
Data description	Two excel sheet, one with blockId and coverage information (speed, technology), the other excel sheet has an address location for Middle Mile Infra-structure.

**3- Comcast Cable Communications, LLC.**

DBA Name: Comcast

FRN	0004441663
Date of submission	2/11/2011
Type of Data Submission	<ul style="list-style-type: none">• Excel Sheet of changes of block coverage since last submission• Excel Sheet of changes of of street coverage since last submission• Excel Sheet with speed information
Census Blocks	10836
Road Segments	1281
Middle Mile infrastructure	No
Technology of Transmission	Cable Modem - Other Cable Modem - DOCSIS 3.0
Data description	Three excel sheets, the excell sheets were expressing the difference in coverage between june 2010 and December 2010.

4- DIECA Communications, Inc.

DBA Name: Covad Communications Company

FRN	0003753753
Date of submission	2/16/2011
Type of Data Submission	<ul style="list-style-type: none">• Text file tab delimited with block coverage• Text File with Subscriber-Weighted Nominal Speed
Census Blocks	8564
Road Segments	No
Middle Mile infrastructure	No
Technology of Transmission	Asymmetric xDSL Symmetric xDSL Other Copper Wireline
Data description	Two text file tab delimited.

5- Leap Wireless International, Inc.

DBA Name: Cricket Communications, Inc.

FRN	0002963528
Date of submission	2/11/2011
Type of Data Submission	<ul style="list-style-type: none">• Shape file with Coverage, Technology, Spectrum, and speed
Census Blocks	N/A
Road Segments	N/A
Middle Mile infrastructure	No
Technology of Transmission	Terrestrial Mobile Wireless
Data description	Coverage Shape file.

**6- Level 3 Communications, LLC.**

DBA Name: Level 3 Communications, LLC.

FRN	0003723822
Date of submission	1/24/2011
Type of Data Submission	<ul style="list-style-type: none">•End User Address location text file•Middle Mile Address location and X,Y coordinate text file.
Census Blocks	9
Road Segments	No
Middle Mile infrastructure	12
Technology of Transmission	Optical Carrier/Fiber to the End User
Data description	Two text files; End user text file address location with technology and speed information, and Middle mile Address location with X,Y coordinates, Servicing capacity and Type.

7- Medicom Communications Corp.

DBA Name: Mediacom Delaware LLC.

FRN	0003572633
Date of submission	3/17/2011
Type of Data Submission	<ul style="list-style-type: none">•Excel sheet with End User Address location
Census Blocks	1713
Road Segments	224
Middle Mile infrastructure	No
Technology of Transmission	Cable Modem - DOCSIS 3.0
Data description	An excel sheet that has End Users Address, also it contain informatio about End User Type.

8- T-Mobile USA, Inc.

DBA Name: T-Mobile.

FRN	0006945950
Date of submission	2/18/2011
Type of Data Submission	<ul style="list-style-type: none">•Shape file with Coverage Area•Text File with technology and Spectrum•Excel sheet with Subscriber Weighted Nominal Speed.•No Middle Mile Notice.
Census Blocks	N/A
Road Segments	N/A
Middle Mile infrastructure	No
Technology of Transmission	Terrestrial Mobile Wireless



Data description	A shape file that provides Broadband coverage with two different speed ranges for upload and download, the Technology and spectrum were provided by a different text file, Nominal speed came from an excel sheet.
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9- Cellco Partnership and its Affiliated Entities.

DBA Name: Verizon Wireless.

FRN	0003290673
Date of submission	2/18/2011
Type of Data Submission	<ul style="list-style-type: none">• Shape file for 4G Coverage• Shape File for 3G Coverage• Word document with Specturms and speed.
Census Blocks	N/A
Road Segments	N/A
Middle Mile infrastructure	No
Technology of Transmission	Terrestrial Mobile Wireless
Data description	The Two shape file provided Coverage area for different speed range (4G – 3G), a word document gives a discription of the speed and the spectrum used.

1.5 Data Processing

The method for processing the data varies depending on the data recived from each provider, the following is a breif summary of the steps taken to process the data for each provider.

1-AT&T Mobility LLC.

Processing Mobile Coverage Area	<ul style="list-style-type: none">• Apply Repair Geometry on coverage Shape file• Load Repaired Shape file into Transfer data model using append.• Use excel sheet values to calculate technology, spectrum and speed.• Result is stored in BB_Service_Wirless
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2- Cavalier Telephone LLC.

Processing Census Block Coverage Area	<ul style="list-style-type: none">• Census block coverge excel sheet exported into dbf after adjusting column name (less than 11)• Select statement on the dbf file to separate Technology coverage 10 blocks & Technology Coverage 30 blocks.• Template of 2000 Census block < 2SQM joined twice, one time with Technology 10 dbf file (create Census
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Processing Middle Mile infrastructure Points	<ul style="list-style-type: none">block coverage of Asymmetric xDSL), second time with Technology Coverage 30 (create Census block coverage of Other Copper Wireline).Merge is applied on both Census blocks to create Census Block CoverageCensus Block Coverage is Loaded to Transfer Data model using append.Result is stored in "BB_Service_CensusBlock" <ul style="list-style-type: none">Middle mile address excel sheet is loaded into ArcMap.Excel sheet is Geocoded using "10.0 US Geocode Services (ArcGIS Online), Middle Mile location (X,Y) acquiredMiddle mile is loaded to Transfer data model using append.Result is stored in "BB_ConnectionPoint_MiddleMile"
Processing Service Overview	<ul style="list-style-type: none">Template County feature class is loaded into ArcMapMaximum Download and upload speed is calculated in each countryTwo Overview county layer is produced, one layer per technology.County layers are merged.County layer are loaded into Transfer Data model using append.Data stored in "BB_Service_Overview"

3- Comcast Cable Communications, LLC.

Processing Census Block Coverage Area	<ul style="list-style-type: none">Excel sheet with Census block difference is added to Arcmap and exported into dbf.Select statement to split dbf file into New (added) block coverage, & Deleted (removed) block coveragePerform join between previous submission blocks & Deleted dbf to mark deleted block, then perform delete.New Template of 2000 block is joined with New (added) blocks (match only), result is exported as New added blocks.New added blocks is merged with Previous submission modified blocks to come with Current coverage.Current Coverage blocks are loaded into Data transfer model using append.Result is stored in "BB_Service_CensusBlock"
Processing Service	<ul style="list-style-type: none">Template County feature class is loaded into ArcMap



Overview	<ul style="list-style-type: none">Maximum Download, upload speed and Subscriber Weighted Nominal speed is calculated in each countryTwo Overview county layer is produced, one layer per technology.County layers are merged.County layer are loaded into Transfer Data model using append.Data stored in "BB_Service_Overview"
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4- DIECA Communications, Inc.

Processing Census Block Coverage Area	<ul style="list-style-type: none">Load provided text file into excelExport text file into dbf after altering columns namesSeparate dbf file into 3 technologies dbf files (Asymmetric xDSL - Symmetric xDSL -Other Copper Wireline)Perform Join 3 times with Template census 2000 census block (one join per technology)Merge the 3 feature classes into one coverage feature class.Load the output feature class into the transfer data model.Result is stored in "BB_Service_CensusBlock"
Processing Service Overview	<ul style="list-style-type: none">Template County feature class is loaded into ArcMapMaximum Download, and upload speed is calculated in New Castle county for each technology.Three Overview county layer is produced, one layer per technology.County layers are merged.County layer are loaded into Transfer Data model using append.Data stored in "BB_Service_Overview"

5- Leap Wireless International, Inc. (Cricket)

Processing Mobile Coverage Area	<ul style="list-style-type: none">Apply Repair Geometry on coverage Shape fileLoad Repaired Shape file into Transfer data model using append.calculate technology, spectrum and speed.Result is stored in BB_Service_Wirless
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6- Level 3 Communications, LLC.

Processing End User Address	<ul style="list-style-type: none">Text file loaded into ArcmapGeocoded text file using "10.0 US Geocode Services (ArcGIS Online), address location (X,Y) acquiredFormat address field to match data model fields.Load point feature into data transfer model using
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	<ul style="list-style-type: none">append.Result is stored into "BB_Service_Address"
Processing Census Block Coverage Area	<ul style="list-style-type: none">Select by location End user points that are located inside Census block less than 2 SQM, and export the result as Points Less than 2SQMSpatial join end user point and Census block 2000.Export Joined blocks as a Block Coverage.Load Block coverage into data transfer model using append.Result is stored in "BB_Service_CensusBlock"
Processing Middle Mile infrastrcutre Points	<ul style="list-style-type: none">Middle mile address text file is loaded into ArcMap.Text file is Geocoded using "10.0 US Geocode Services (ArcGIS Online), Middle Mile location (X,Y) acquiredMiddle mile is loaded to Transfer data model using append.Result is stored in "BB_ConnectionPoint_MiddleMile"
Processing Service Overview	<ul style="list-style-type: none">Template County feature class is loaded into ArcMapMaximum Download and upload speed is calculated in each countryOverview county layer is producedCounty layer is loaded into Transfer Data model using append.Data stored in "BB_Service_Overview"

7- Medicom Communications Corp.

Processing End User Address	<ul style="list-style-type: none">Excel file loaded into ArcmapGeocoded text file using "10.0 US Geocode Services (ArcGIS Online), address location (X,Y) acquiredFormat address field to match data model fields.Load point feature into data transfer model using append.Result is stored into "BB_Service_Address"
Processing Census Block Coverage Area	<ul style="list-style-type: none">Select by location End user points that are located inside Census block less than 2 SQM, and export the result as Points Less than 2SQMSpatial join end user point and Census block 2000.Export Joined blocks as a Block Coverage.Load Block coverage into data transfer model using append.Result is stored in "BB_Service_CensusBlock"
Processing Service	<ul style="list-style-type: none">Template County feature class is loaded into ArcMap



Overview	<ul style="list-style-type: none">• Maximum Download and upload speed is calculated in each country• Overview county layer is produced• County layer is loaded into Transfer Data model using append.• Data stored in "BB_Service_Overview"
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8- T-Mobile USA, Inc.

Processing Mobile Coverage Area	<ul style="list-style-type: none">• Apply Repair Geometry on coverage Shape file• Load Repaired Shape file into Transfer data model using append.• calculate technology, spectrum and speed.• Result is stored in "BB_Service_Wireless"
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9- Cellco Partnership and its Affiliated Entities. (Verizon Wireless)

Processing Mobile Coverage Area	<ul style="list-style-type: none">• Apply Repair Geometry on coverage on both shape file (4G-3G) Shape file• Load Repaired Shape files into Transfer data model using append.• calculate technology, spectrum and speed, for each type of coverage.• Result is stored in "BB_Service_Wireless"
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1.6 Map Creation/Interactive Web Application

An interactive web application was developed to enable the general public to view a map of Delaware's broadband availability in each of its three counties. Users will be able to see which forms of broadband exist in each area of the State and can also search for Providers by address. This web application is necessary in order to access and employ the data collected. In essence, the data collected is in a static state; this web application will move the data into dynamic, usable form.

With the creation of the web application, the State will move forward in meeting the requirements of this project's grant as outlined in the NOFA. The web application was created in a manner that honors the guidelines established in each NDA executed with each respective Provider. A publically accessible, interactive website is the best means by which the citizens/taxpayers can be informed of broadband availability and options. The applications serve as a hub of broadband coverage information. The resultant functionality is expected to improve service for several user groups. From a citizen standpoint, the application will serve as a gateway to access or improve access to broadband services. Citizens can use the application to gain knowledge of providers, technologies, and access level at their residence or place of business. Planners can use the site to aid in infrastructure construction plans to improve broadband access and capabilities to their assigned region of the State. The State Legislature will use the application to notify politicians of district relevant broadband capabilities and as a catalyst in policy making and a various array of legislative actions.



1.7 Backlab Verification

As the first version of maps covering each of the State's Providers was completed, the State Parties performed backlab verification of the data gathered and input onto the maps. This backlab verification included researching the Providers' websites to verify that the advertised speeds on the websites were consistent with those documented by the Providers as part of their submission to the State. In addition, the team made phone calls to some of the Providers to further verify service availability and speeds where necessary to gain the highest level of confidence in the data gathered.

1.8 Provider Review

After the backlab process was completed for each of the Providers, the data was sent back to the Providers for their review and acknowledgement of the data as being accurate. This phase of the project also allowed the Providers to update their data if changes had occurred since the initial gathering of data by the State Parties. Each of the Providers' data was pulled out from the aggregate data base prior to sending it to the Provider for their review. This ensured that the State Parties maintained the agreed-to confidentiality of each of the Providers' data.

1.9 Field Verification

The final step for the State Parties to verify the accuracy of the data was to perform a field verification process. Prior to beginning field verification activities, The State parties developed a field verification guide for use by each member of the field verification team. The guide included systematic instructions and a checklist related to verification of each broadband system, technology, and service type. The guide and checklist were drafted, reviewed by all State Parties, and finalized prior to the beginning of field verification activities.

To ensure uniformity of the team's approach to field verification, field team training was also held immediately prior to the beginning of field verification activities.

Broadband system coverage was verified by sampling whether services were available at various points shown on the Providers' system coverage maps that were randomly chosen from all of the census blocks that are within the Providers' systems. Points were chosen to represent areas throughout the Providers' service territory, including system boundary edges.

The State Parties team sample looked to provide a sampling of all broadband Providers in the State, including large and small Providers across the State, being sure to include each of the three counties.

Team members spent a total of 19 days performing Field Verification functions including interviews and infrastructure identification at nearly 300 locations. In addition, the team performed approximately 150 speed tests of Cellular based wireless broadband provider



networks. Additionally, team members identified 87 tower locations in the State for potential broadband planning activities going forward.

1.10 Speed Tests

As part of the field verification process, State residents and businesses were given a business card-sized handout that briefly explained the project and pointed them to the state-specific speed test website. The State utilized a project-specific speed test web site² run by Ookla in order to gain information on users' addresses, satisfaction, and the upstream and downstream speeds associated with their broadband connection. Ookla is a company that provides a private web-based reporting portal where customer-specific testing can be performed and documented over time. The results of the speed tests performed on the Ookla site are stored and available to the State Parties at any time.

Ookla tracks the end users' Provider name, technology of connection, downstream and upstream speeds, and other parameters such as IP address.

In addition, testing similar to that done by residents and businesses was performed by State Party representatives on mobile wireless Providers' networks. This again verified availability and speeds on each of the five major cellular-based broadband Providers in the State.

1.11 Presentation to the NTIA

The data submitted in the State Broadband Data and Development (SBDD) project is governed by the Notice of Funds Availability (NOFA) first published in volume 74, number 129, on page 32545 of the Federal Register and subsequently clarified in volume 74, number 154, on page 40569 of the Federal Register. According to the NOFA, an NDA may be executed with broadband Providers prior to data collection. The NTIA has proposed a National States Geographic Information Council (NSGIC) data model as a means to store the collected broadband data. The NSGIC model includes five main feature classes as follows:

1.11.1 Broadband Service by Census Block (Less than 2 square miles in area)

This feature provides the atomic unit for mapping provider services that, when tied to census demographic and socio-economic data, can provide guidance for the build-out and adoption of broadband. The Census Block feature class is generated by different methods, depending on the data submitted by the Broadband service Provider. The main methods for generating census block data are as follows:

² <http://www.delawarespeedtest.com/>



- Broadband providers submit a list of served Census Blocks. In this case, the blocks are joined to the State's Census Block data to obtain its spatial location. Finally, the data are loaded into the Geodatabase model, and attributes are either transferred or filled in manually.
- Broadband Providers submit a list of end users. In this case, an overlay is needed between the submitted geocoded end user points and the State of Delaware Census Block feature class to obtain the list of Census Blocks.
- Broadband providers submit shape files or drawings with their boundary(s) of coverage. The boundary(s) is intersected by the Census Block feature class to obtain Census Block coverage.

1.11.2 Broadband Service by Census Block (greater than 2 square miles in area)

In order to provide a more granular representation of availability in Census Blocks larger than 2 square miles in area, these Census Blocks are described at a street segment level of detail.

There are two methods utilized to garner the data needed to generate street segment coverage maps. Depending on the data submitted by the providers, these methods can be summarized as follows:

- The broadband Provider submits a list of end user addresses. The nearest road segment is then selected, based on the attributes of the end user point.
- The broadband provider submits a shape file or drawing showing their coverage area. In this case, street segments are selected based on the intersection of its coverage area and street segment feature class.

1.11.3 Broadband Service - Wireless

The maps of wireless technologies provide a representation of the expected, modeled, or field-verified service areas associated with wireless carriers, their service levels, and their utilized spectrums. The data in this feature class are



generated based on a drawing (shape file) submitted by a wireless technology service Provider (Terrestrial Mobile Wireless - Terrestrial Fixed wireless [licensed or unlicensed] - Satellite), as well as through field verification of wireless data.

1.11.4 Broadband Service - Overview

This feature provides a coarse view of speeds at a county level so that any regional or systematic patterns of service and speed can be assessed and mitigated.

The State of Delaware has three counties. The maximum downstream and upstream speed has been stipulated for each provider, along with the technology that they are using to provide these speeds. Most providers were reluctant to provide pricing data, but some have provided data for weighted nominal speed.

1.11.5 Broadband Connection Points – Middle Mile

The purpose of broadband Connection Points, known as Middle Mile locations or points, is to give the locations and elevations of Interconnection points for service Providers working in the State of Delaware. Gathering infrastructure components (Middle Miles) helps leverage opportunities for network deployment after assessing gaps in broadband availability in the State.

The locations of Middle Mile points were provided by Providers either by their geographic coordinates (Latitude & Longitude) or by their street address(s), which are geo-coded to their spatial locations. Intersection between the Middle Mile points and Census block layer is needed to obtain Full Block ID (FULLFIPSID).

The above mentioned processes provided the State with the raw data to develop maps of the State showing where broadband is available, the maximum advertised levels of service, or speed offered to end users, and areas of the State that are unserved or underserved. This information will be updated every 6 months to show changes made by Providers that will impact the broadband landscape throughout the State. This report details some of the most pertinent information derived from the project and can be utilized to help the State during its Broadband Planning Project currently underway.

2 Areas of Delaware Unserved/Underserved by Broadband Providers

One of the main objectives of the NTIA, the State of Delaware, GeoDecisions, and CBG was to determine where broadband is not currently available in the State of Delaware. Having areas where broadband is not available to potential end users helps create a phenomenon known as a Digital Divide. The Digital Divide is defined as the inability of residents to access broadband and Internet services based on economic, educational, or geographic reasons.



The NTIA defines an unserved area as: "An area composed of one or more contiguous census blocks where at least 90 percent of households in the service area lack access to facilities-based terrestrial broadband service, either fixed or mobile, at the minimum broadband transmission speed (set forth in the definition of broadband above). A household has access to broadband service if the household can readily subscribe to that service upon request."

Furthermore, the NTIA defines an Unserved Area as "A service area is defined as consisting of one or more contiguous census blocks, where half the households lack access to minimum broadband service, or an area where no land or mobile service offers broadband with at least 3 Mbps, or areas where less than 40% of households subscribe to any service."

To obtain information about where broadband is not available in the State, the State Parties performed the above tasks to determine where broadband is available in the State and where it is not available to potential end users. After determining where broadband is not available, the State is in the process of utilizing this information to determine what may be done to expand existing networks to provide service to these unserved areas or how new Providers may be enticed into building networks to serve these parts of the State. This is being undertaken by the State and the University of Delaware as part of their planning activities in the next phase of this project.

Although some services delivered by satellite-based Providers meet the requirement for broadband of 768 Kbps downstream and 200 Kbps upstream, for the purposes of this report, we have not included them when detailing broadband availability. While any location within the State is capable of receiving satellite based service as long as there is a clear unobstructed view of the southern sky, the reasoning for not considering satellite-based Internet here is that often times realized speeds on satellite-based networks fall significantly below 768 Kbps in the forward direction and 200 Kbps in the upstream direction. That being said, satellite Internet is an option for citizens and businesses in the State when other high speed connections are not available.

The State of Delaware has the 6th highest population density of the 50 states in the US. This helps the State's overall broadband availability in that broadband Providers are apt to serve high density areas because the cost to build a network is lower on a per-address passed basis. In other words, the amount of infrastructure needed to connect a given address to the Internet lessens as density increases. Conversely, the cost of building a network to more rural areas increases on a per-address (potential customer) basis to the point of not providing the broadband Provider the minimum potential return on their investment that they have established. Large companies have minimum potential customers per mile that must exist or they will not build infrastructure to an unserved area. For instance, a Provider may require 20 homes or businesses be passed per mile of new infrastructure before they will build it. In rural areas, there may be as few as 1 or 2 homes per mile. Therefore, the area will not be built out.

Although the State of Delaware has a relatively small number of areas, and therefore citizens, that do not have broadband available to them, this should still be a concern for the State and its planning group. As in other locales, the State will likely find during its planning project that broadband is a driving force in many aspects of life today, including economic development,



health care, all areas of business and institutional users, education, and entertainment to name a few. Consequently, the State will also likely find that encouraging expansion of broadband into the unserved areas of the State will have a positive impact on all of these aspects. Areas of the State that do not have access to broadband are shown on the map included as Attachment 1.

In addition to determining which areas of the State do not have access to broadband, demographics and socio-economic characteristics can be analyzed in areas of the State that do not have broadband availability. For instance, the State Parties have over-laid age, minority status, and income data onto the maps to determine which groups may be most impacted by the lack of broadband service in their areas. This information may prove valuable as the State's planning project moves forward. In addition, maps including other demographic and socio-economic characteristics can be created by the State Parties to show other groups that are impacted by the lack of broadband availability in areas of the State. The maps showing each of these parameters are included as Attachments 6, 7, and 8.

3 Areas of Delaware Served by a Single Broadband Provider

Similar to areas of the State that are unserved or underserved by any broadband Provider, the NTIA and the State desired to know what areas of the State are only served by a single Provider.

Areas that have a single broadband Provider imply that service is available in these areas but that there is no competition. Therefore, associated benefits that competition may bring, including lower pricing, higher speeds, and better customer service, are also not available in these areas. This project did not ask for or document any of these parameters, and therefore, other than speed and pricing information included in the Broadband Service Tiers – Residential, Business Governmental and Academia section of this report, they are not included in this report.

Similar to the unserved/underserved areas of the State, the State's high density makes it a good business decision for broadband Providers to build out the networks throughout most of the State since even with competition, these Providers can make a good return on their investment. As Attachment 2 shows, in addition to the areas of the State with no broadband availability, there are only a few small areas in the State that are not served by at least two Providers. Some of the areas served by fewer than two Providers include:

- An area east of Highway 301 and south of DE-896 in New Castles County
- Augustine State Wildlife Management Area and Silver Run Wildlife Area in New Castle County
- The area east of Highway 9 from Appoquinimink Wildlife Area southeast to Highway 6 East of Smyrna
- The area northeast of Smyrna to Highway 9



- The Bombay Hook National Wildlife Refuge area
- Dover Air Force Base
- The area south of Highway 6 between State Roads 42 and 15
- The Milford Wildlife Area
- The Prime Hook National Wildlife Refuge
- The area north of Highway 54 and south of Road 402 between Highway 30 and Highway 113 in Sussex County

As a percentage, the areas of the State with fewer than two broadband Providers equates to less than 0.5% of the Census Blocks in the State. Furthermore, the estimated total number of households in the State that are not served by a broadband Provider is 2,581 or 0.87% of all households. However, as these areas are utilized by residents of the State and as housing and other developments reach these areas, they will not be broadband ready. The lack of broadband availability may hamper expansion into these areas as the need arises in the future.

4 Areas of Delaware Served by Multiple Broadband Providers

The large majority of the State of Delaware has multiple broadband Providers, serving addresses within the area, with over 50% of the State having six or more Providers of broadband service. When including all areas of the State with two or more broadband Providers, over 99% of the State's Census Blocks are offered broadband service by multiple Providers. A map of the State of Delaware with color codes showing the number of Providers is included as Attachment 2 to the report.

Having multiple Providers helps promote competition among the Providers in given areas and should translate into the highest level of speed the Providers can offer at affordable costs. Having multiple Providers in an area also promotes higher customer service standards from Providers as they attempt to keep their existing customer base and increase their numbers of customers.

5 Types of Technology Used to Provide Broadband in Delaware

The NTIA classified broadband technologies into 11 categories plus a 12th category labeled "All Other". These categories represent both hardline cable networks (cable, phone lines, or fiber optic infrastructure connected to the residence or business) and wireless networks (signals are transmitted to and from an address or location). The NTIA further defined each of the technologies into more specific categories. The technologies utilized in Delaware are listed and defined below:

- **Asymmetrical xDSL**
DSL is a telephone system-based data communications service that utilizes modulation schemes that allow high-speed transmission of data on copper or phone lines. Asymmetrical xDSL is a design characteristic where return speed is lower than forward speed. This allows for more of the network's bandwidth capability or throughput to be utilized by the forward portion of the network allowing for faster downloads than uploads. This technology is utilized widely by telephone companies in the State to provide broadband service to end users.



- **Other Copper Wireline**

Non-DSL telephone system-based data communications service such as T-1 (1.54 Mbps). Other Copper Line technologies tend to be utilized more for business and anchor end users, as bandwidths are often guaranteed versus "up to" speeds.

- **Cable Modem – DOCSIS 3.0**

A cable modem is a device that converts information from one device (computer) to a usable form for another device (cable TV network). Specifically, information from a computer is converted to a useable format for transport on the cable TV network and converted back to a format useable by a computer at the receive site modem. DOCSIS 3 provides for multiple channels on the cable TV system to be combined and the combination used to enable higher data communications speeds or bandwidths. DOCSIS 3.0 is widely utilized by cable television network-based Providers throughout the State. Cable TV systems currently utilizing previous versions of DOCSIS will likely migrate to DOCSIS 3.0 in the near term to utilize its higher bandwidth capabilities.

- **Cable Modem – Other**

Similar to DOCSIS 3.0, except these are all prior versions and revisions of DOCSIS including 1.0, 1.1 and 2.0. These versions offer lower bandwidth or speed than DOCSIS 3.0. Only one Provider reported using Cable Modem – Other in the State. This Provider is primarily DOCSIS 3.0 and will likely migrate the remaining areas of the State from earlier versions of DOCSIS to DOCSIS 3.0 in the near future.

- **Optical Carrier/Fiber to the End User**

A communications network utilizing fiber optics up to or into a household, business, or other facility – also called Fiber to the Home (FTTH) or Fiber to the Premise (FTTP). Fiber optic cables allow for transmission of modulated light along an optical fiber for significant distances. Fiber optic cables are utilized throughout communications systems due to their ability to transmit signals over longer distances with higher bandwidths, while having significant reductions in noise and distortion effects compared to other wireline and wireless networks. This technology is replacing other traditional telephone technologies throughout more densely populated areas of the State. The local phone company in these areas will likely phase out the traditional phone system over the long term.

- **Satellite**

Wireless service provided between satellites and the end user. A dish-shaped antenna, similar to those used for satellite TV, is utilized at the end user's location to receive the downstream signal and to transmit the signal upstream. Satellite is available anywhere in the State where a clear view to the southern sky exists. Trees, buildings, and other obstructions are the only obstacles that may keep end users from accessing satellite internet.

- **Terrestrial Fixed Wireless – Unlicensed**



Broadband service typically provided in a point-to-point configuration from a central tower location, or through a series of towers (hops) as part of a mesh network, to an end user location. The frequencies utilized are not licensed by the FCC and therefore are susceptible to interference or competition for bandwidth from other non-licensed networks. The only system to report utilization of Fixed Wireless – Unlicensed is located in and around the Rehoboth Beach area of the State. This is a WiFi-based system that requires a subscription and is password protected.

- **Terrestrial Fixed Wireless – Licensed**

Broadband service typically provided in a point-to-point configuration from a central tower location, or through a series of towers (hops) as part of a mesh network, to an end user location. The frequencies utilized are licensed by the FCC and therefore are more immune to interference and competition for bandwidth from other networks.

- **Terrestrial Mobile Wireless**

Broadband service typically provided in a point-to-multipoint configuration from multiple tower locations, as part of a mesh network, to end user locations. The mesh configuration allows for mobile access to the broadband network. These networks are most commonly known as cellular data networks. The frequencies utilized are licensed by the FCC and therefore are more immune to interference and competition for bandwidth from other networks. Terrestrial mobile based, or cellular, broadband is available throughout the State with the exception of a few areas. These are shown on the accompanying maps as unserved areas of the State.

6 Advertised Upstream and Downstream Transmission Speeds

Broadband Providers often advertise both downstream and upstream speeds as “up to” speeds. In other words, a Provider will advertise speeds “up to” 4 Mbps in the downstream direction and “up to” 1 Mbps in the upstream direction. Consumers may believe that those are the speeds they will most often realize when utilizing the Provider’s network for internet access. However, in reality, the actual speeds offered on the network may be significantly less than the advertised “up to” speeds.

Many broadband networks deployed today utilize a shared bandwidth design whereby the network is developed based on customers sharing the total available bandwidth on the network. This is an effective way for a Provider to offer fast speeds to large areas while minimizing the amount of infrastructure needed and thereby reducing the cost of deployment. In many cases, this design provides speeds sufficient for most subscribers’ needs that are well within the definition of broadband. However, the actual speeds will most often be lower than the advertised speeds because of the shared bandwidth design, and in some cases they will fall below the threshold stipulated for broadband.

An example of this is – if a network has a total available bandwidth equating to a download speed of 10 Mbps and one person is accessing the network, they will realize speeds at or near 10 Mbps. However, if 10 people are accessing the same network at the same time, they will divide the available network bandwidth among them. Although the actual results will vary,



based on the level of utilization of bandwidth by each of the users, for purposes of this example, the result would be approximately 1 Mbps available to each of the 10 people accessing the network. In this example, we assume all 10 users are accessing significant amounts of bandwidth that may be required to download music, video, and large files or that may be required to watch live video. In reality, all 10 users will likely be utilizing differing levels of bandwidth at any given time. This phenomenon makes it difficult to evaluate advertised speeds within a given system, between systems, and throughout the State and beyond.

The Providers that supplied speed information, as verified during the backlab verification process, reported the following ranges of speed by technology:

- **Asymmetrical xDSL**
Speeds between 768 Kbps to 10 Mbps in the downstream direction with speeds between 768 Kbps to 6 Mbps in the upstream direction.
- **Other Copper Wireline**
Speeds between 768 Kbps to 25 Mbps in the downstream direction with speeds between 200 Kbps to 10 Mbps in the upstream direction.
- **Cable Modem – DOCSIS 3.0**
Speeds between 10 Mbps to 100 Mbps in the downstream direction with speeds between 1.5 Mbps to 25 Mbps in the upstream direction.
- **Optical Carrier/Fiber to the End User**
Speeds between 50 Mbps to greater than 1 Gbps in the downstream direction with speeds between 10 Mbps to greater than 1 Gbps in the upstream direction.
- **Satellite**
Speeds between 768 Kbps to 6 Mbps in the downstream direction with speeds between 200 Kbps to 1.5 Mbps in the upstream direction.
- **Terrestrial Fixed Wireless – Unlicensed**
Speeds between 1.5 Mbps to 3 Mbps in the downstream direction with speeds between 768 Kbps to 1.5 Mbps in the upstream direction.
- **Terrestrial Mobile Wireless**
Speeds between 768 Kbps to 3 Mbps in the downstream direction with speeds between 200 Kbps to 1.5 Mbps in the upstream direction.

7 Samples of Actual Upstream and Downstream Transmission Speeds

Several methods were used to obtain a sampling of the actual broadband transmission speeds achieved by residents, businesses, and institutions. For example, State residents and businesses were given a business card-sized handout that briefly explained the Project and pointed them to the State-specific speed test and survey website. The State utilized a Project-



specific Ookla speed test website³ and survey in order to gain information on users' addresses, satisfaction, and the upstream and downstream speeds associated with their broadband connection. In addition, the State Parties' team members performed approximately 150 speed tests, primarily on wireless networks. The locations of these speed tests are included on Attachment 3.

Another verification method, in addition to utilizing the above-mentioned methodologies for verifying system coverage and characteristics, was for team members to enter into discussions with residents in the area. Residents were asked if they knew if a particular Provider's service was available, if they were or had recently been a customer, and if they know what speeds they could achieve. Residents often times did not know what their service level and speeds were but did know who the broadband service Provider was. Questions such as how much they were paying for the service led to a better understanding of their service level. Approximately 1,400 speed test cards were handed to residents or left behind where nobody was available. These cards encouraged the residents to visit the State speed test and survey website, as listed on the card, to assist the State in gathering actual speed data. Thus far, nearly 650 speed tests have been performed by both State Party team members on site and residents and business personnel at their locations throughout the State.

It should be noted that there are many variables that can affect speed test results. Of these, the most significant are the performance characteristics of the computer or device being utilized by the end user performing the test, the number of computers or devices at a location accessing the internet at the same time, the level of throughput being utilized by each, and the day and time of day when the tests are performed. For these reasons, speed tests are best analyzed in the aggregate to give a good understanding of typical speeds being realized. In other words, all cellular tests should be averaged to get an accurate understanding of actual speeds that can be expected from that given technology. Furthermore, speeds for a given Provider can be averaged to again get a better understanding of the actual speeds available from that Provider.

Of the nearly 650 speed tests performed to date, the overall average speeds of all technologies and Providers) were approximately 6.8 Mbps downstream and 3.0 Mbps upstream. Further broken down by technology, the average speeds are:

Technology	Downstream	Upstream
All Technologies Combined	6.8 Mbps	3.0 Mbps
Mobile Wireless	1.5 Mbps	550 Kbps
Cable Modem – Residential	10.7 Mbps	3.2 Mbps
Cable Modem – Business class	11.6 Mbps	3.3 Mbps
DSL	10.3 Mbps	4.4 Mbps

³ <http://www.delawarespeedtest.com/>



Fiber To The Premises/Business	23.9 Mbps	14.0 Mbps
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As described above, these are aggregate numbers that represent an average of these tests taken by end users. Actual speeds at a given location will vary from these speeds. Overall, the speed tests indicate speeds comparable to those advertised by the providers. For example, mobile wireless providers offer speeds between 768 Kbps to 3.0Mbps (some offer a lower maximum speed) in the downstream direction. The speed tests show an average speed of 1.5 Mbps in the downstream direction. Cable modem DOCSIS 3.0 is advertised to offer speeds between 10 Mbps and 100 Mbps. The average tested speed was 10.7 Mbps. This is on the low end of what is advertised and may reflect end users with a lower than maximum speed plan. In other words, although speeds up to 50 Mbps may be offered to residential end users, many may be signed up for a service with a maximum throughput of 20 Mbps or less, which brings the aggregate average speed for cable modem DOCSIS 3.0 down. Fiber to the premise is similar to cable modem DOCSIS 3.0 in that the tested speeds are lower than the advertised maximum speeds of between 50 Mbps and 1 Gbps. These higher end speeds are more costly and therefore not likely to be the highest selling tier of service. Therefore, the speed tests done on the lower tiered service will bring the overall aggregated average speed down from the advertised "up to" speeds. DSL service is the only technology that had tested aggregated average speeds near the top of the advertised maximum speed range. In fact, the advertised maximum speeds for DSL are between 768 Kbps and 10 Mbps, and the tested speeds for DSL came in at 10.3 Mbps.

8 Broadband Service Tiers – Residential, Business and Anchor Institutions

One of the goals of the project was to find the maximum downstream and upstream speeds offered by the various Providers in the State. The goal was not necessarily to determine the various levels of service or speed being offered up to the maximum by the Providers. However, speed tiers or levels are an important component of determining what services are available to end users, as many will not require or be able to afford the fastest available speeds but do want or need a higher speed connection than is available via a dial-up connection.

Broadband service is provided in many different speed tiers through the various technologies. Most Providers offer more than one level of service or speed whereby end users who need or desire faster connectivity can opt for the highest level of service, and end users who only need lower levels of service can elect to purchase a slower connection at a reduced cost. Speed tiers differ considerably between Providers and are dependent on the technology utilized to provide the service. For instance, Providers using cable modem DOCSIS3 technology offer maximum speeds of between 10 Mbps to 100 Mbps in the downstream direction, while mobile wireless Providers in the State offer maximum downstream speeds between 768 Kbps and 3 Mbps.

Making exact comparisons between broadband service Providers is difficult for a variety of reasons, the most significant of which is that most Providers offer "up-to" speeds. As an example, an end user on one Provider's network with "up-to" speed of 1.5 Mbps may realize



close to that maximum speed at most times. However, a customer on another Provider's network with "up-to" speed of 1.5 Mbps may only realize half of that speed at most times. This makes it difficult to accurately determine which Provider has the speeds that will consistently provide the level of service needed by the end user. Other issues that can make shopping for a broadband Provider difficult are introductory pricing, bundled pricing (where broadband service must be purchased with another service such as phone or TV), and long-term contracts. Introductory pricing may provide a benefit in the short term, while offering less competitive pricing in the long term. Long-term contracts can lock an end user into a plan they may not need over the course of the contract term or lock them into a plan that does not fulfill their needs in the future. Additionally, some Providers such as mobile broadband and satellite services have established throughput limits, such as 5 gigabits of throughput per month. After a customer hits that level of throughput, they may be charged additional fees or their service level is cut back significantly for the remainder of the month (such as is done by some satellite based Providers).

Providers are also continually changing their service offerings and pricing. As end users needs for speed continue to increase, Providers continue to offer higher levels of speed with new additional features as discussed elsewhere in this report. Another aspect that must be considered by potential end users is installation, equipment, and activation fees. These can vary from \$0.00 to over \$100.00. Many Providers that require installation or equipment fees run promotions where these fees are waived or reduced for a limited time.

Other add-ons or extras, which may or may not offer value to the end user, that some Providers offer as a part of their service are security tools such as anti-spam and anti-virus software, home networking, specific web content free such as Disney, ESPN3, and others.

Some examples of available plans and non-introductory, non-bundled pricing as researched on Providers' websites include the following:

Cable Modem Providers (all "up-to" speeds)		
Downstream Speed	Upstream Speed	Price per Month
1.0 Mbps	512 Kbps	\$32.95
1.5 Mbps	384 Kbps	\$40.95
3 Mbps	Unadvertised	\$29.95
15 Mbps	3 Mbps	\$59.95
20 Mbps	4 Mbps	\$69.95
50 Mbps	10 Mbps	\$114.95

Fiber To The Premise (FTTP all "up-to" speeds)		
Downstream Speed	Upstream Speed	Price per Month
15 Mbps	5 Mbps	\$54.99
25 Mbps	25 Mbps	\$69.99



50 Mbps	20 Mbps	\$144.99
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Satellite (all "up-to" speeds)		
Downstream Speed	Upstream Speed	Price per Month
1.2 Mbps	200 Kbps	\$69.99
1.5 Mbps	256 Kbps	\$109.98
1.6 Mbps	250 Kbps	\$79.99
2.0 Mbps	300 Kbps	\$119.99

Mobile Wireless (all "up-to" speeds)		
Downstream Speed	Upstream Speed	Price per Month
1.4 Mbps	200 Kbps	\$40/50/60*
1.4 Mbps	800 Kbps	\$20/35/50/80*
*Based on monthly throughput, \$20 = 1 Gbit allowance, \$80 = 10 Gbit allowance		

DSL (all "up-to" speeds)		
Downstream Speed	Upstream Speed	Price per Month
1 Mbps	384 Kbps	\$19.99
3 Mbps	768 Kbps	\$29.99
7.1 Mbps	768 Kbps	\$39.99
8 Mbps	Not advertised	\$39.95

Fixed wireless (Not licensed all "up-to" speeds)		
Downstream Speed	Upstream Speed	Price per Month
1.5 Mbps (residential)	Not advertised	\$39.99
1.5 Mbps (business)	Not advertised	\$49.99

As the tables above show, shopping for the plan that meets the specific, consistent needs of an end user can be confusing. Many other options and additional features are offered by Providers that are not shown in the examples above, including virus protection, spam filters and pop-up blockers, and subscription only websites. In addition, end users must decide if long-term commitments are a concern for them prior to signing up for many types of broadband service offerings.

Some Providers such as the cable modem, DSL, and wireless Providers also offer business class service. These services may be identical to residential service with additional add-on services,



such as Outlook for e-mail, and may include a higher level of, or faster, service response when problems arise.

In addition, some Providers offer faster speeds as business class service at a higher monthly cost. These Providers also will offer business class and residential class services to Anchor Institutions. Some Providers will offer higher speeds on a per site basis, such as fiber optic connections, with speeds as high as 1 Gbps symmetrical such as those supplied to the cities of Dover and Wilmington and the University of Delaware.

As shown below in the Broadband Availability at Anchor Locations section, Anchor locations' requirements vary significantly based on their size, the number of internet users, and the applications being run at the location. Costs will vary on these services based on speed and necessary infrastructure expansions needed to connect the Anchor Institution.

9 Locations of Tower Utilized to Provide Broadband

During the Field Verification portion of the project, the State Parties noted the locations of towers that are utilized by cellular Providers and for other radio communications.

These locations have been plotted onto a map for potential future reference. These locations can serve as transmit and receive sites for wireless broadband Providers. As a potential wireless Provider evaluates whether to deploy a network to offer broadband to residents and businesses, one of the most significant costs can be construction of a tower that is high enough to provide service to the surrounding areas. These existing towers may have space available that can be leveraged for placement of broadband related antennas at a significantly lower cost than building new towers and therefore may allow a Provider to deploy a network where one may not otherwise exist. The available space must be at a height on the antenna that will meet the needs of a new occupant on the tower. Furthermore, like any business, the Provider must recoup their investment over a set period of time. Using a lower cost option such as existing towers may allow a Provider to offer service at a lower monthly cost to the end user.

The goal during the Field Verification phase of the project was to document all towers passed while performing the more pertinent task of verification of broadband availability where the Providers indicated service was available. This process did not identify all towers in the State but does provide a useful database that can be built upon over time. The Towers that were located are shown on the map included as Attachment 4.

10 Wireless Spectrums Utilized to Provide Broadband

Several wireless frequency spectrums are being utilized by the various wireless Providers to offer broadband service. These include both fixed and mobile wireless Providers. As part of the data request sent to all of the Providers, they were asked to include which frequencies they are utilizing to offer broadband service in a wireless format. The spectrums utilized, as reported by the Providers, are as follows:

Cellular Providers are using several spectrum ranges including:



- 700 MHz band
 - 698 – 758 MHz
 - 775 – 788 MHz
 - 805 – 806 MHz
 - 824 – 849 MHz
 - 862 – 869 MHz
 - 1.850 – 1.915 GHz
 - 1.930 – 1.995 GHz
 - 1.710 – 1.755 GHz
 - 2.100 – 2.155 GHz

A fixed wireless Provider is using the WiFi band of 2.4 GHz to provide service on an unlicensed network. It is open to the public but requires a password to utilize the network. Satellite Providers are using licensed frequencies as provided by the FCC in the L-band, Big LEO, Little LEO, and 2 GHz spectrums.



11 Broadband Availability at Anchor Locations

The NTIA's NOFA required that "Awardees shall provide NTIA with a list of community anchor institutions in their state, along with the associated information described below." The information gathered includes address data, Provider name, technology, and speeds of broadband connection. The NOFA defined Community Anchor Institutions ("Anchors" or "CAI") in the following manner: Schools, libraries, medical and healthcare Providers, public safety entities, community colleges and other institutions of higher education, and other community support organizations and entities.

The State tasked the Institute for Public Administration at the University of Delaware (IPA) with performing the tasks of gathering the information needed related to Anchor Institutions.

The IPA first compiled a master list of all Anchors throughout the State. This list was then subdivided into categories of:

- Schools – K-12 (public and private)
- Libraries
- Medical/Healthcare facilities (public and private)
- Public Safety entities (public and private)
- Universities, colleges and other post-secondary (public and private)
- Other community support – governmental
- Other community support – non-governmental

The IPA verified each Anchor's name, street address, map coordinates, and proper categorization into the above groups. A few of the small municipalities only have Post Office boxes on file for addresses and were therefore mapped with the Post Offices' mailing address.

The initial list of known Anchors in the State, as reported in May 2010, totaled 650. Through the process of making follow-up contacts to identify the level of Internet connectivity the Anchors were utilizing, a March 2011 adjusted total of 645 Anchors was determined. The IPA has been able to elicit usable responses from 455 of those 645 Anchors. Of that subset of 455 respondents, 440 do have broadband connections, while 15 report that they do not have broadband. The remaining 190 Anchors have been non-responsive, to date. The IPA has received information from 95% of all known public/governmental Anchors in the State, with private institutions making up the majority of the non-responsive Anchors. The IPA continues to attempt to make contact with the Anchors that have not yet been included in the study.

Of the 455 Anchors that have been responsive to date, nearly 97% report they have some level of broadband connectivity to their Internet Service Provider (ISP). This leaves just over 3% that do not have broadband.

The breakdown of all known Anchors is as follows:

- Schools – K-12 (public and private)
Total = 266
With Broadband = 233



Without Broadband = 1
Non-responsive = 32

- Libraries
Total = 32
With Broadband = 32
Without Broadband = 0
Non-responsive = 0
- Medical/Healthcare facilities (public and private)
Total = 27
With Broadband = 13
Without Broadband = 0
Non-responsive = 14
- Public Safety entities (public and private)
Total = 119
With Broadband = 55
Without Broadband = 1
Non-responsive = 63
- Universities, colleges and other post-secondary (public and private)
Total = 22
With Broadband = 22
Without Broadband = 0
Non-responsive = 0
- Other community support – governmental
Total = 79
With Broadband = 58
Without Broadband = 8
Non-responsive = 13
- Other community support – non-governmental
Total = 100
With Broadband = 26
Without Broadband = 5
Non-responsive = 69

The speeds achieved by the Anchors vary considerably overall. There are also significant variances within categories of Anchors. For example, of the 218 public schools, 175 reported the use of Optical Carrier/Fiber with downstream and upstream speeds of 10 Mbps, while 43 reported the use of Other Copper Wireline with downstream and upstream speeds of 1.5 Mbps. Technology usage and speeds among the 15 private schools that responded ranged from Cable Modems with downstream speeds of 1.5 - 3 Mbps and upstream speeds of 768 Kbps - 1.5 Mbps, to Optical Carrier/Fiber with downstream and upstream speeds of 25 Mbps or greater. Among the libraries (all of which are on the State network and use Optical Carrier/Fiber), 4



reported downstream and upstream speeds in the range of 100 Mbps - 1 Gbps, while the other 28 reported downstream and upstream speeds in the range of 10 Mbps - 25 Mbps. The highest downstream and upstream speeds of any CAIs (greater than or equal to 1Gbps in both directions, using Optical Carrier/Fiber) were reported by the cities of Dover and Wilmington and the University of Delaware. Of all the entities that did indicate they had broadband service, the slowest connections were reported by non-governmental community support institutions (typically Senior Centers), some of which were using DSL connections with downstream speeds as low as 768 Kbps - 1.5 Mbps and Upstream speeds of 200 Kbps or less.

In addition to determining if Anchors have broadband, the data collection effort for March 2011 addressed whether the Anchor provides public access to WiFi. In the case of Delaware's libraries, the responses are not fully indicative of the level of available public access to broadband. While all 32 of the libraries do provide public access to broadband, only 11 had the capability to provide public WiFi in March 2011. System-wide availability of public WiFi at Delaware libraries was reported as being in the process of implementation, with completion expected in May 2011. In addition to the libraries, several other Anchors had previously reported to the IPA that they did provide public access to broadband. None, however, were responsive to the March 2011 update in terms of specifically identifying the on-site availability of public WiFi. By allowing public access to broadband, anchor institutions can help serve populations in the State that otherwise may not have broadband access available to them. These include people living in unserved areas of the State or who cannot afford access at their residence. IPA plans to focus on these Anchors in its planning activities to determine how such facilities best meet the needs of population groups that do not otherwise have access.

12 Conclusion

The State of Delaware, with direction and grant funds from the NTIA, began the process of determining the level of broadband availability in the State of Delaware in early 2010. As components of the project, Providers were asked to provide data detailing where they provide broadband service, the advertised maximum downstream and upstream speeds, and the technology deployed to offer the service. The data gathered from the Providers was verified using multiple methods, including checking the data against websites; field verification and speed tests by State Party team members and the general public. The data was then sent to the Providers for one final check for accuracy.

Because, in part, the State has a relatively high population density, broadband providers offer service throughout much of the State. Additionally, in more than 50% of the State more than six different Providers offer broadband in the same areas. Over 99% of the State has broadband service availability from at least two Providers.

There are several technology types being utilized in the State to provide broadband to residents, businesses, and Anchors. These vary from telephone-based technologies such as asymmetrical DSL and other copper wireline to cable-modem based technologies, optical carrier or Fiber-To-The end user, satellite, and fixed and mobile wireless. Each of the technologies brings broadband to end users in different ways and fills various needs such as speed, price, reliability and mobility.



Determining and documenting speed offerings can be a complicated task. Most broadband providers offer “up to” speeds. The actual speeds of these networks at a given time may vary drastically from the “up to” speed that is advertised. In addition, Providers often include other services such as virus protection, anti-spyware, and others or require a customer to bundle their broadband service with other services such as phone or TV to get the best price. Consumers need to weigh all aspects of the Providers’ service prior to signing up for service and potentially signing a long-term contract.

As a part of the Project, the State Parties documented existing cellular and other communications towers throughout the State. These locations may provide a potential cost reduction for future broadband providers to enter the broadband marketplace.

This may allow the State to encourage build out of existing wireless networks or deployment of new networks where broadband service is lacking today.

The Institute for Public Administration at the University of Delaware (IPA) has had contact with 455 of the 645 known Anchor Institutions in the State. Of these, only 15 do not have broadband service today. The State should continue to make efforts to contact the Anchors that have not responded thus far. The State should then work with the Anchors during its Planning Project to determine if the broadband services available to the Anchors are meeting their needs today, as well as being able to meet their anticipated short- and long-term needs in the future.

The State can utilize availability documentation gathered during this Project to help direct the Planning Project that is currently underway. During the Planning Project, the State and the University of Delaware’s Institute for Public Administration will determine broadband-related needs of the general public, businesses, and Anchor Institutions throughout the State in today’s environment as well as into the future.

13 Glossary of Terms

Access Point (AP) – Transmitter and receiver utilized to create a wireless connection between devices. End users connect wirelessly to the network via an Access Point.

Asymmetrical Speeds – A network system design characteristic where return speed is lower than forward speed. This allows for more of the network’s capability or throughput to be utilized by the forward portion of the network allowing for faster downloads than uploads.

Broadband – (as defined in the NTIA’s NOFA) – Data transmission technology that provides two-way data transmission to and from the Internet with advertised speeds of at least 768 kilobits per second (Kbps) downstream and at least 200 Kbps upstream to end users, or providing sufficient capacity in a middle mile project to support the provision of broadband service to end users within the project area.

BPL (Broadband-Over Powerline) – A network utilizing electrical conductors (a power Provider’s lines) as its transport medium.



Cable Modem – A device that converts information from one device (computer) to a usable form for another device (cable TV network), i.e., Information from a computer is converted to a useable format for transport on the cable TV network and converted back to a format useable by a computer at the receive site modem.

Community Anchor Institutions – Schools, libraries, medical and healthcare Providers, public safety entities, community colleges and other institutions of higher education, and other community support organizations and entities.

Digital Divide – The inability of residents to access broadband and Internet services based on economic or geographic reasons.

Digital Subscriber Line (DSL) – A telephone system-based data communications service that utilizes modulation schemes that allow high-speed transmission of data on copper or phone lines.

Downstream, also known as “download” or “forward direction” – Connectivity path from a network service Provider, or ISP, to the customer's location.

Fiber Optic Cable – Cable made from glass that provides the medium for transmission of light along a designated path. Single mode fiber is utilized to transport light over long distances.

Fiber To The Premises (FTTP) – A communications network utilizing fiber optics up to or into a household, business or other facility, also called FTTH or Fiber To The Home.

Fixed Wireless – Broadband service typically provided in a point-to-point configuration from a central tower location, or through a series of towers (hops) as part of a mesh network, to a customer premise location.

Gigabits per Second (Gbps) – One billion bits of information transmitted between devices in one second, i.e., 1 Gbps = 1,000,000,000 bits of information transported over a network per second.

Internet Protocol (IP) – Internetworking protocol used to transmit data across and between switched networks. Also specifies the formatting and addressing scheme of information packets.

ISP – Internet Service Provider – Private company or other organization offering connectivity to the Internet.

Kilobits Per Second (Kbps) – One thousand bits of information transmitted between devices in one second, i.e., 256 Kbps = 256,000 bits of information transported over a network per second.

Megabits per Second (Mbps) – One million bits of information transmitted between devices in one second, i.e., 1.5 Mbps = 1,500,000 bits of information transported over a network per second.



Middle Mile/Backbone/Backhaul – Transmission media utilized to connect APs or network nodes within a system to each other and to the main network and to the Internet. Backhauls can consist of fiber optic cables, WiMAX, and other wireless technologies.

Symmetrical Speeds – A system design characteristic allowing equal speeds in the forward and return paths of the network.

Upstream – Also known as “upload” or “return direction” – Connectivity from the customer back to the network service Provider or ISP.

Voice over IP (VoIP) – Transmission of voice communications as IP packets, allowing for transportation of voice over the Internet, LANs and WANs.

Wi-Fi (Wireless Fidelity) – Wireless local area networks based on the IEEE’s (Institute of Electrical and Electronics Engineers, Inc.) 802.11 standards. 802.11 refers to a group of standards in place today as well as standards that are currently being developed.

WiMAX (Worldwide Interoperability for Microwave Access) – Wireless wide area networks based on the IEEE’s 802.16 standards. Capable of transmission speeds up to 70 Mbps over 70 miles with actual speed and coverage far less based on applications and terrain.

Version Information

Version Num.	Edit Date	Edited By	Comments
0.1	12/07/10	Nielsen, Robinson	Draft Document
1.0	12/10/10	Jensen, Conway	Draft Document Revisions
1.1	04/26/11	Jensen	Spring 2011 Updates
1.2	6/13/11	Tuttle	Updated 2011 Anchor Stats



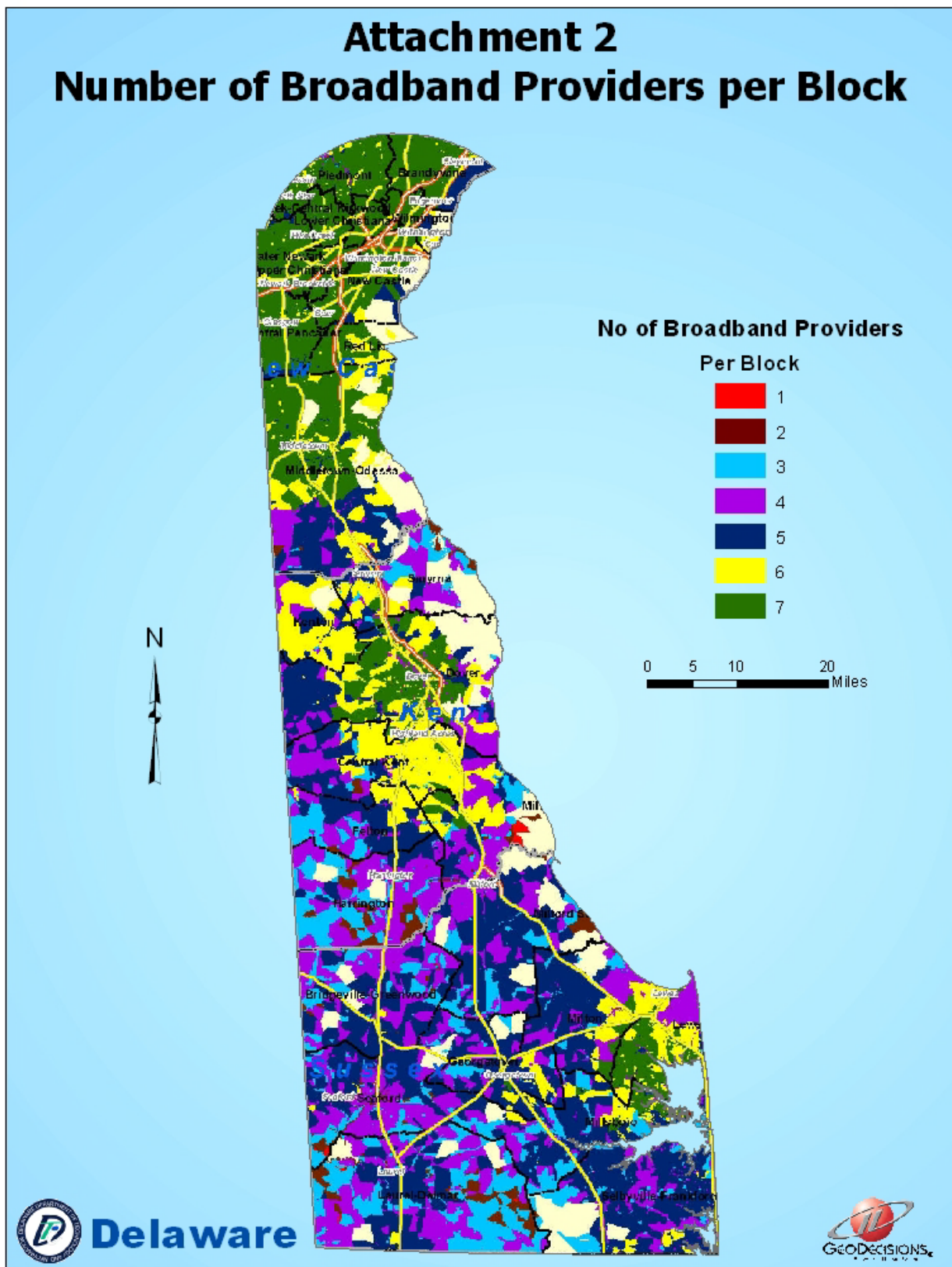
Attachments

Attachment 1 Areas With No Access To Broadband



Attachment 2

Number of Broadband Providers per Block



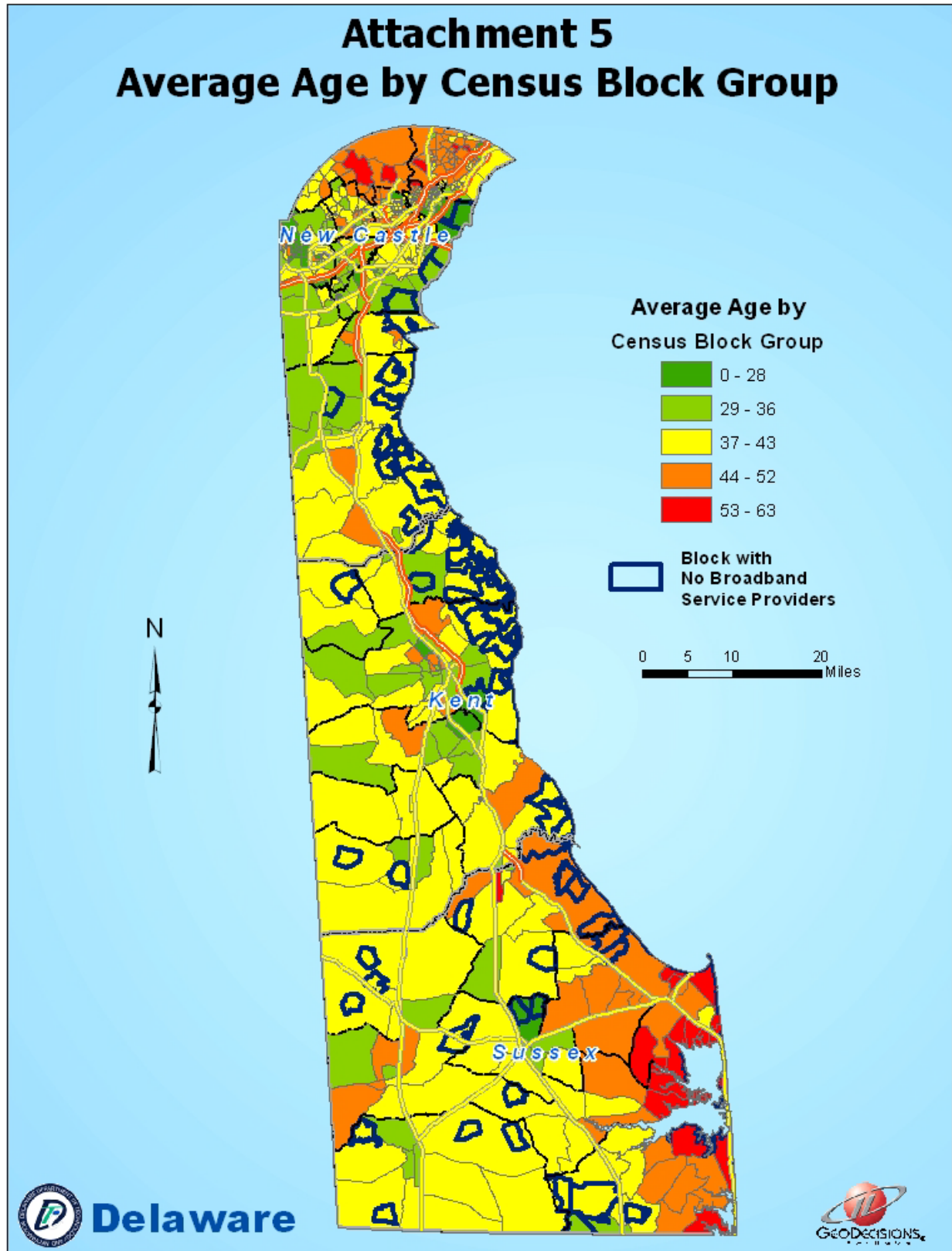
Attachment 3 State Parties Speed Test Locations



Attachment 4 Known Tower Locations



Attachment 5 Average Age by Census Block Group



Attachment 6

Minority Percentage (Non-White) by Census Block Group

