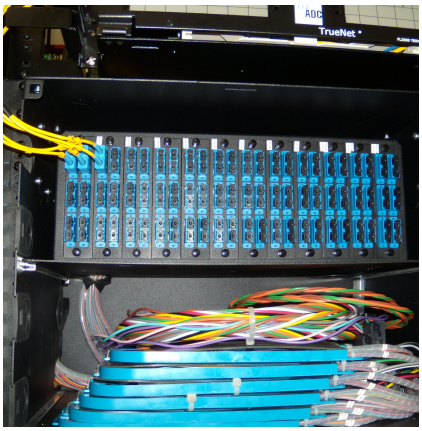
Prepared for Washington County, Maryland



Broadband Impact Study: Needs Assessment

MAY, 2013

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Contents

Overview

Introduction

Over the next thirty years, the businesses, residents, and institutions of Washington County, Maryland will spend about $3.6 billion for telecommunications services--in today's dollars, unadjusted for inflation and unadjusted for price increases. Some analysts believe that the average household bill for services delivered via broadband may double in the next ten years, which would make the thirty year projection easily reach twelve billion. Currently, there exists a substantial opportunity to capture more of these funds and direct them towards greater job creation and business opportunities for the county.

In a discussion at a broadband conference in April (2008), FCC Commissioner Deborah Tate indicated that demand for bandwidth is doubling every two years, and that the FCC expects that the typical bandwidth needed by businesses and residents in 2015 (just two years) will exceed 50 megabits.

Community livelihood and the economic future in Washington County is dependent upon the availability of affordable high speed broadband services--at the bandwidths that will be needed to conduct business in the future ("big" broadband), not at today's "little" broadband speeds. Businesses large and small are already heavy users of the Internet, and their bandwidth needs will increase dramatically as two business trends accelerate:

Business travel costs are increasing rapidly as the cost of fossil fuel increases. Both the cost of ordinary commuting to the workplace is increasing as well as the cost of out of town business travel by air. Businesses are already investing heavily in HD quality business videoconferencing systems, and will make more use of them to reduce travel costs. These HD quality business videoconferencing systems require dramatic increases in bandwidth that are not affordable or in most cases even available in certain areas of Washington County.

More and more workers and business people are working from home, either on a part time or a full time basis. New work from home job opportunities are growing rapidly, but most of those jobs require a wired Internet and a wired phone connection to qualify. Many corporate and business employees will be seeking permission to work more from home (e.g. one or two days per week) to reduce travel costs. Some major businesses in other parts of the U.S. are already actively planning to have 20% of their workforce work full time from home to reduce employee travel costs and office energy costs. Corporate employees working from home require high bandwidth services to be connected to the office network and to use corporate videoconferencing systems. These corporate network services will require 35-50 megabit connections within five years.

This report assesses and analyzes Washington County, so that the county can take advantage of the emerging business and residential growth within the area. This can only be accomplished if the county has the right telecommunications infrastructure that will support the needs of existing businesses and also attract new businesses.

THE CURRENT BROADBAND BUSINESS MODEL IS BROKEN

The current business model for selling broadband is an anachronism that evolved in the early nineties with the introduction of dial up Internet access. At that time, there was little more than email and a few text-based Web pages available on the Internet, and selling bandwidth "by the bucket" worked fine. For something like $20/month, subscribers got a "bucket of bandwidth" that was defined by some upper limit on that bandwidth, like 14,400 bits/second or 56,000 bits/second.

As the Web evolved to include video and audio, and as new services like telephone over the Internet (Voice over IP, or VoIP) became available, more bandwidth was needed to support these uses. Broadband was and still is sold by the "bucket," but the bucket is now larger, with the DSL bucket typically advertised as something like 1/2 megabit/second, and cable modem service typically promoted as 1-3 megabits/second. We are still buying bandwidth by the bucket.

This business model is fundamentally broken. There is no way to fix it. The broadband business model of selling bandwidth by the bucket means providers make the most money if their customers do not use the service at all. They make the least amount of money if customers like the service and use a lot of it. This approach is upside down from most other businesses. It leads to odd behavior by the service providers that causes them to punish or even disconnect customers that use too much of the service.

From an economic development perspective, this is disastrous. Local businesses should not be punished for using too much of an essential business service. An apt analogy would be if the Department of Transportation told a businesses that the tractor trailers they were using were "too big" and henceforth all deliveries had to be made by pick up truck. We know intuitively that this would make the business uncompetitive with businesses in other regions that had roads that supported tractor trailers.

Recent analysis indicates that rural areas are five times more likely to have slower connection speeds compared to urban areas, three times more likely compared to small cities, and twice as likely when compared to towns. Usage figures show that the top 1 percent of broadband connections are responsible for 20 percent of the Internet traffic and the top 10 precent consume 60 percent of the bandwidth. This disparity in usage is indicative of an infrastructure model that has failed to create a fair playing field.

Economic Impact Analysis

Broadband is not a silver bullet for communities. Broadband investments need to be tied to a wider set of community and economic development strategies that help make communities engaging and interesting places to locate and run businesses, and to make communities a vibrant and safe place to live. Communities that have made broadband investments without taking the time to identify a broader set of goals and expected outcomes have usually been disappointed when broadband investments have not had much of an impact. However, it is clear that broadband investments are critical for economic viability.

- In 2008, U.S. industries invested over $455 billion dollars in telecom and technology investment, including over $60 billion in broadband.
- A 2011 report from the McKinsey Global Institute studied the Internet's growing impact on the economy. The report found that the Internet accounted for 21% of GDP growth in the last five years for mature countries, and this number is only expected to climb higher.
- $8 trillion dollars is exchanged through e-commerce annually.

The financial analysis below demonstrates 30 year expenditures for routine and normal telecom services for businesses, residents, schools, and institutions for Washington County.

Washington County 30 Year Telecom Expenditure Analysis			
	Households still on dial-up	Households with "little" broadband cable modem/DSL/ wireless	Households with no Internet
Total households	56,386		
Total businesses	10,044		
Household Percentage	5%	73%	22%
Number of households	2,819	41,162	12,405
Average monthly telecom expenditures	Local phone: $25 Long distance: $25 Cable/satellite TV: $65 Dial up Internet: $20	Local phone: $25 Long distance: $25 Cable/satellite TV: $75 Broadband Internet: $45	Local phone: $25 Long distance: $25 Cable/satellite TV: $65
Annual cost/household	$1,620	$2,040	$1,380
30 year expenditure	$137,017,980	$2,519,100,936	$513,563,688
Total residential expenditures	$3,169,682,604		
Total expenditures[1]	**$3,645,134,995**		

[1] Business, schools, institutions, and government costs estimated conservatively at 15% of residential expenditures. Source: Mediamark Research, Inc.

Over the next three decades, about $3.6 billion dollars will be spent on telecom services. This is a very conservative estimate that does not take into account the ever expanding demand for new kinds of services. The model looks only at current demand. A community investment in a community-owned and managed digital road system, where all services are provided by the private sector, would have substantial benefits.

Community investments in infrastructure will accelerate the availability of broadband options within the community, especially in the business and retail sector. It is important to note that the government entities would not sell services to the public and would not compete with private sector firms. Instead, private sector firms, including existing telecom providers, would use the new infrastructure to compete with each other. Service providers using the network would pay a small portion of revenue to the network for the use of the infrastructure.

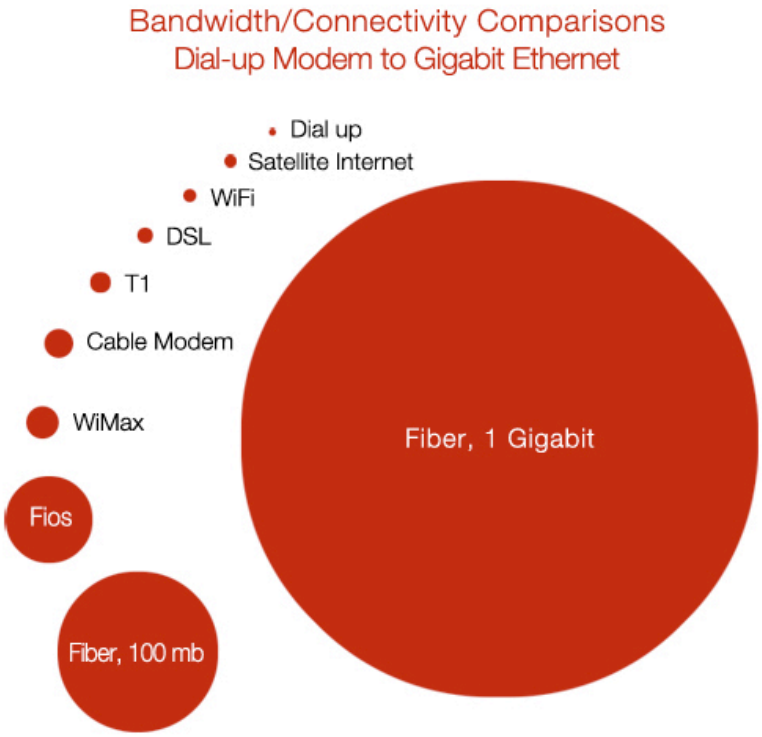
National and International Trends

Defined: The Web, Internet, & Broadband

What's the difference between the Web, the Internet, and broadband? These terms are often used interchangeably, but they are not all the same. Accordingly, the Internet is defined as a system of interconnected computer networks that is available globally and publicly. These computer networks are comprised of countless government entities, for-profit organizations, non-profit organizations, academic institutions, and private organizations that are all tied together by a network of wired and wireless technologies. The Internet serves a multitude of purposes. The Internet provides access to log on to Facebook, stream television shows on your computer screen, and send emails.

The Web or otherwise known as the World Wide Web is a system of interconnected hypertext documents communicated and interpreted through the Internet through a browser. The basic foundation of the Web and the Internet is Hypertext Transfer Protocol (http), which is a technical language that allows people to view text and images between computers.

According to broadband.gov, broadband service is often associated with high-speed Internet access that is always on and faster than traditional dial-up access. Broadband service is able to provide higher-speeds of data transmission than dial-up service because broadband has a greater capacity to carry content. There are two characteristics that often describe broadband: speed and "always on."



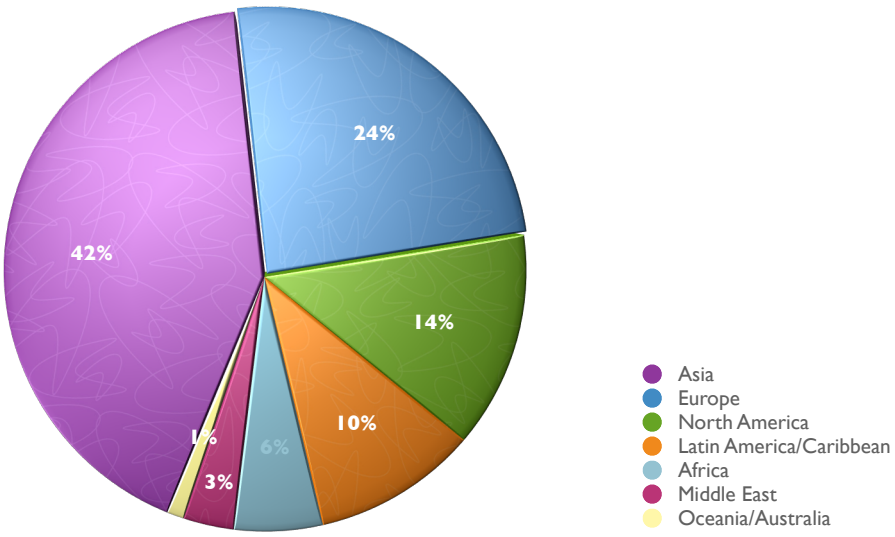
A good analogy can be made between the volume of data an Internet connection is able to manage and the carrying capacity of a water pipe. The diagram above illustrates the relative capacity of each of the so-called broadband technologies. Fixed wireless, satellite and cable are thought to have very little additional future capacity through advances in engineering. Cable is believed capable of achieving somewhat greater bandwidth capacity in the future.

Optical fibers themselves transmit at the speed of light so the speed limitation on a fiber network is a function of the electronics that power the lasers. Today, there are real-world networks offering Gigabit-per-second Internet connections.

Who isn't online?

The Internet has become increasingly widespread in our society and for good reason. In order to support a high demand for Internet, the infrastructure must be in place. High capacity networks are seen as strategic infrastructure that serves as the catalyst for sustainable economic growth. According to Pingdom, an Internet monitoring service, there were over 1.97 billion Internet users worldwide. Of the 1.97 billion Internet users, 825.1 million of them come from Asia, 475.1 million come from Europe and 266.2 million come from North America. 2010 experienced a 14% increase in Internet users since the previous year. In addition, there were 107 trillion emails sent, a 39.1% increase in Apache websites, 88.8 million .COM domain names existing, 25 billion tweets sent, and 2 billion videos watched on youtube per day in 2010.

Internet Users Divided by Region, June 2010



Source: http://royal.pingdom.com/2011/01/12/Internet-2010-in-numbers/

What happens in just one day on the Internet?

- Enough information is consumed to fill 168 million DVDs.
- 294 billion emails are sent.
- 2 million blog posts are written.

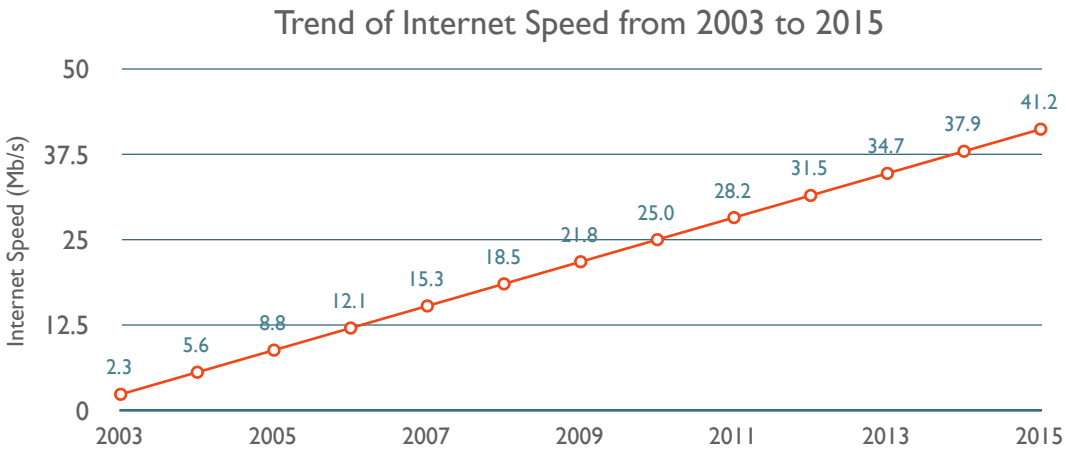
- 172 million people visit Facebook.
- 40 million people visit Twitter.
- 22 million visit LinkedIn.
- 250 million photos are uploaded.
- 22 million hours of TV and movies are watched on Netflix.

Existing Conditions

Although the U.S. once led the way in the World Wide Web, the U.S. has now fallen to the 27th place among developed nations for broadband usage according to a report conducted by the OECD (Organization for Economic Co-operation and Development) in 2012.

In addition, limited choices often force U.S. consumers to purchase slower bandwidth speeds at a higher cost as compared to other nations. However, increasing bandwidth speed at an affordable price point will be necessary to compete in a global economy. The speed of the bandwidth can have a significant impact at the local, state, federal, and international level in regards to the standard of living and economic development.

The networks embedded from the Internet serves the purpose of maintaining and creating jobs, facilitating telemedicine, improving education, ensuring public safety, and providing public services. Just within the past decade, the key purposes of the Internet were intended for basic use to hop onto the web. However, the Internet is now used for both play and for work.



With greater use of the web, comes faster broadband speeds. Broadband speeds have increased from 300 Kb/s in 2003 to 25 Mb/s in 2010 according to a report conducted by Cisco. Despite the fact that global IP traffic has increased eightfold over the past 5 years, and will increase fourfold over the next five years, ***most U.S. Internet connections are not sufficient*** enough to support interactive home-based medical monitoring, multi-media distance learning, or to send and receive data to run a home-based business as denoted by the Cisco Visual Networking Index.

In other words, the U.S. is average on the playing field of first generation broadband measures. The U.S. is an even weaker performer on providing reasonable prices for high and next-generation speeds. This surmounts to a large concern if consumers of broadband want to compete globally for business concerns and enjoy the same connectivity capabilities as others worldwide.

- Global IP traffic has increased eightfold over the past 5 years, and will increase four fold over the next 5 years.
- In 2015, there will be 6 million Internet households worldwide generating over a terabyte per month in Internet traffic.
- Traffic from wireless devices will exceed traffic from wired devices by 2015.
- Internet video is now 40% of consumer Internet traffic, and will reach 62% by the end of 2015.
- From a study of 13 countries, the Internet has contributed on average 3.4 percent to GDP. Additionally, the Internet contributes to more GDP than agriculture, energy, and other better-established industries from the 13 countries studied.

Rural and Urban Disparities

Rural communities are more likely to have inadequate advertised rate of high-speed Internet access when compared to the rates of big cities and suburbs. In fact, typically broadband availability rates are a third lower for rural communities than cities and suburbs. The availability of speed does not vary significantly between central cities and suburbs. However, the same cannot be said for very rural areas. Very rural areas tend to have significantly less maximum advertised transmission speeds. This is troubling considering very rural areas contain the communities that need maximum advertised transmission speeds the most to perform services like telemedicine, telework, and online education. [1]

Next Generation Connectivity

"Next generation" is the term used to describe future planning for the next step in network connectivity and infrastructure. This may suggest an emphasis on deploying fiber-to-the-home (FTTH). But why? By pulling fiber deeper into the neighborhood and providing greater access to connectivity, this allows the infrastructure to be in place to accommodate future communication needs, capacities, and innovations. The U.S. is currently the only country where fiber is being deployed in largely suburban areas with single family homes. However, many countries are on the lookout to improve broadband speed and subscribership.

[1] http://www.dailyyonder.com/rural-broadband-access-still-lags/2013/06/06/6192

Next generation broadband reaps in a number of substantial benefits in functionalities. This service is powerful and may serve an interest to various customer groups. There are four main functionalities of "Next-Generation Broadband":

- Dramatically faster file transfer speeds for both uploads and downloads
- The ability to transmit streaming video, transforming the Internet into a far more visual medium
- Means to engage in true-real time collaboration
- The ability to use many applications simultaneously

Clearly, consumers have a strong interest in a visual medium from when and wherever they are. YouTube is the second most popular search engine after Google, which demonstrates the need to support the infrastructure to transmit streaming video.

In addition to video streaming, true-real time collaboration also provides an effective way for people to interact from wherever they are. People can engage in a two-way, real-time collaboration, so that fruitful, visual conversations can be held between friends, family, business associates from the state, country, or internationally.

Because of fiber networks, employees have the capabilities of working from their home. Findings suggest that if all Americans had fiber to the home, this would lead to a 5 percent reduction in gasoline use, a 4 percent reduction in carbon dioxide emissions, $5 billion in lower road expenditures, and 1.5 billion commute hours recaptured.

Significance of Big Bandwidth for the Future

According to the 2009 report from the World Bank on information and communications technologies, for every ten additional broadband subscribers out of 100 inhabitants are correlated in high income countries with GDP growth increases of 1.21%.

Prosperity

As suggested from the statistic above, the Internet generates growth. In more than a handful of countries, GDP growth doubled to over 21% due to the Internet. Although some jobs have been eliminated due to the emergence of the Internet, nearly 1.2 million jobs have been created over the past 15 years from the Internet. The McKinsey's global SME survey suggests that 2.6 jobs were created for every one destroyed.

Health Care Delivery

According to "The 2008 State New Economy Index" healthcare can be significantly improved in the future through greater use of information technology and connectivity to the web. Healthcare costs can potentially be cut by $80 billion annually. The cost of health care continues to rise annually. For instance, health care as a share of U.S. GDP has almost doubled from 8.8 percent to 15.3 percent in 2005. One aspect of health care that is gaining steam is electronic prescribing. Electronic prescribing cuts medical transaction costs by eliminating the need for confirmation phone calls and faxes and reduces the chance of health risks due to prescription delays. This is a particularly useful asset for communities in rural areas who do not have convenient access to medical assistance.

Government and Civic Life

The term E-Government refers to networked information technologies online to serve constituents. The Internet cuts costs for many state governments from reducing the paper trail to expediting services through the Web like renewing drivers' licenses and paying taxes. Furthermore, E-government will become a setting for online based discussions between constituents and bureaucrats. This allows for greater transparency in hopes of garnering a better perception of how government functions. More local and state governments and the federal government are attempting to involve constituents through webinars, blogs, wikis, and videos.

Education

Students benefit greatly through the use of computers and Internet. Nearly every public school in America has access to the Internet. In 2007, there were 180,000 more instructional computers in the schools than in 2006. Students who attend schools without access to computers and the Internet may be ill prepared for the work place. The prevailing use of information technologies in not only the United States, but also globally, is a clear indicator that future prosperity is in the hands of students who are able to understand and use the pertinent tools.

The Big Broadband Challenge

What is Broadband?

There is much confusion about the "true" definition of broadband. From the perspective of economic development, there can be no upper limit on the definition of broadband. Saying that broadband (as an example) is 5 megabits/second of bandwidth or 10 megabits/second is to immediately tell businesses in the region that there will be structural limits on their ability to do business in the future–it is dictating the size of truck that can be used to deliver goods and services. Here is the only appropriate definition of broadband:

Broadband is whatever amount of bandwidth is needed to support a business' ability to compete in the global economy.

Broadband is a community and economic development issue, not a technology issue. The essential question is not, "What system should we buy?" or "Is wireless better or cheaper than fiber?" Instead, the question is:

"What do our businesses and residents need to be able to compete globally over the next thirty years?"

In short, Washington County today has "little broadband" in the form of DSL and cable modem service, along with a very limited amount of "big broadband" in the form of fiber to a few businesses and institutions.

If Washington County is to make investments in broadband and telecommunications infrastructure, it is absolutely critical that those investments are able to scale gracefully to meet business and economic development needs for decades. This drives the solution towards an integrated fiber and wireless system, rather than a wireless only service orientation. Wireless is able to provide basic Internet access needs, but is not able to support advanced video and multimedia services. Some off the shelf business videoconferencing systems in use today require a minimum of 50 megabits of bandwidth--far beyond the capabilities of any wireless system. Two key concepts that should drive community investments in telecom are:

"Broadband" is not the Internet

Bandwidth is not a fixed number

Broadband and "the Internet" are often used interchangeably, but this has led to much confusion. Broadband refers to a delivery system, while "the Internet" is just one of many services that can be carried on a broadband network. The challenge for communities is to ensure that businesses and homes have a broadband network with sufficient bandwidth to deliver all the services that will be needed and expected within the next three to four years, including but not limited to "the Internet."

Bandwidth needs for the past decade have been growing by 25% to 50% per year, and show no sign of slowing. As computers and associated hardware (e.g. video cameras, audio equipment, VoIP phones) become more powerful and less expensive, new applications and services are continually emerging that drive demand for more bandwidth. The table below indicates

the likely growth in bandwidth, based on current uses, emerging high end equipment, and research lab/university/government networks already deployed and in use. Lightpaths refer to placing multiple wavelengths (paths) of light on a single fiber. High end commercial equipment already in production is routinely placing 20+ lightpaths on a single fiber, with each lightpath capable of carrying data at gigabit speeds. This technology will move down to ordinary business and residential network equipment over the next ten to fifteen years. Current fiber being installed will require only a relatively inexpensive equipment upgrade to increase carrying capacity over the same fibers.

From a report by the Information Technology and Innovation Foundation (March, 2009), listed below are the bandwidth requirements for services already commonly in use and for emerging services like telepresence business videoconferencing.

Application/Service	Upstream Bandwidth Requirement	Downstream Bandwidth Requirement
Medium resolution videoconferencing	1.2 megabits	1.2 megabits
Streaming video (720p)		1.2 megabits
Standard definition TV		4 megabits
Basic HD videoconferencing (720p)	1.2 to 4 megabits	1.2 to 4 megabits
Telepresence high resolution HD videoconferencing	5 megabits	5 megabits
Video home security service	10 megabits	
HD digital television (1080p)		15 megabits
Telepresence very high resolution HD videoconferencing (1080p)	15 megabits	15 megabits

Note that the business videoconferencing services all require symmetric bandwidth. This is a critically important issue, as current incumbent "little broadband" services like DSL and cable modem systems do not offer symmetric bandwidth (where the upstream and downstream bandwidth is equal). Using this information we can project what Washington County homes and businesses will need in the coming years.

	Next 2-4 years	Next decade	Twenty years
Small business needs (1-9 employees)	10-25 megabits of symmetric bandwidth and 5-10 megabits of Internet access	100 megabits of symmetric bandwidth and 20-40 megabits of Internet access	Gigabit+ symmetric bandwidth and 50 to 100 megabits of Internet access

	Next 2-4 years	Next decade	Twenty years
Medium-sized business needs (10-100 employees)	50-100 megabits of symmetric bandwidth and 10-20 megabits of Internet access	Gigabit symmetric bandwidth and 50 to 100 megabits of Internet access	Multiple gigabit symmetric circuits and lightpaths and 100+ megabits of Internet access
Large business needs (100-1000+ employees)	Gigabit+ symmetric bandwidth and 100+ megabits of Internet access	Multiple gigabit symmetric connections and 250 to 500 megabits of Internet access	Multiple gigabit symmetric circuits and lightpaths and 1 Gigabit+ of Internet access
Residential needs	25-50 megabits of symmetric bandwidth and 4-8 megabits of Internet access	100 megabits of symmetric bandwidth and 20-30 megabits of Internet access	A Gigabit symmetric circuit and/or lightpaths, with 50 to 100 megabits of Internet access

Use Trends and Service Needs Analysis

Mark Peterson, a Professor of Community and Economic Development at the University of Arkansas who studies the impact of broadband access and affordability on rural communities, wrote recently, "Broadband connectivity is not the infrastructure of the future, it is the infrastructure of the present." Washington County faces a challenge in economic development infrastructure with primarily "little broadband" (i.e. DSL, wireless, and cable services) when many communities, regions, and countries have already made the decision to focus resources on the development of "big broadband," which is typically fiber with a minimum capacity of 100 megabits or Gigabit to the premises.

- A third of IBM employees work from home at least part time, and the company has reported annual savings of $110 million.
- Australia's government is converting the entire telecommunications infrastructure for the country to an open access system by buying a major portion of Telstra assets. Telstra, which is currently the country's primary incumbent telecom provider, will become a service provider on the new open network.
- Fiber to the premises attracts home buyers, who are willing to pay $2000 to $4600 more for a house with fiber service.
- Fiber to the home users say they are able to work from home more often, averaging 7.3 workdays per month, reducing their carbon footprint and decreasing wear and tear (and maintenance) on roads.
- More than 13% of homes in the U.S. had been passed by fiber by mid 2009.

- Nationally, less than 10% of homes have no access to any kind of broadband service, but in the region, more than 16% of homes still have no broadband access, or 50% higher than the national average.

In its March, 2009 report, the ITIF (Information Technology & Innovation Foundation) listed some of the next generation services and applications enabled by high performance, affordable broadband. The table on the next page lists these and other services that all represent broadband-enabled applications and services that must be available in Washington County if it is to remain economically viable.

Residential and Business	Videoconferencing
	IP TV (Internet Protocol TV)
	HD streaming video
	Ultra hi-def (BluRay) video streaming
	Video on demand (e.g. Netflix)
	Place-shifted video
	Cloud computing services
	Online and cloud-based gaming
	Smart homes, buildings, and appliances, including smart electric meters, AMR (automated meter reading), and AMI (advanced metering infrastructure)
	Remote computer aided design (CAD)
	Work from home jobs
	Business from home
	3D graphic rendering and CGI server farms
	Remote network management and managed services
	Virtual collaboration spaces (e.g. enhanced GoToMeeting, Webex style services)
Public Safety	Intelligent transportation applications (smart road systems)
	Public safety and first responder networks
	Emergency dispatch and coordination
	Webcast agency meetings (e.g. virtual meetings)
	Online training for first responders, fire, and rescue
Society	Broadcast of local sports events
	Videoconferencing of community and town hall meetings for wider participation
	Wider availability of nonprofit and community organization services
Health Care	Teleconsultations
	Telepathology
	Telesurgery
	Remote patient monitoring
	Remote diagnosis

	Remote medical imaging
	Grid computing for medical research
Education and Research	Distance education
	Virtual classrooms
	Remote instrumentation
	Multi-campus collaboration
	Digital content repositories and distribution (digital libraries)
	Data visualization
	Virtual laboratories
	Grid computing for academic research

When analyzing future service needs, it is important to take into account ALL services that may be delivered over a broadband connection. As we noted in the previous section, "broadband" is not a service--it is a delivery medium. If we think about broadband using a roads analogy, broadband is the road, not the trucks that use the road. Internet access is a service delivered by a broadband road system, and that Internet service is just one of many services that are in demand. Today, congestion on broadband networks is not due just to increased use of email and Web surfing, but many other services.

- By 2015 (just two years from now), the FCC thinks bandwidth requirements will be fifty times (50x) what they are today (current average bandwidth to homes and businesses is 1-2 megabits). In Japan, where they have had 100 megabit connections to homes and businesses available for several years, they are already observing congestion--meaning 100 megabit pipes are already filling up.

- Americans are watching more than 10 billion videos per month over the Internet. The table and chart below illustrate the growth in average bandwidth to the home over the past fourteen years.

The FCC's prediction of a 50x increase in bandwidth needs in just two years indicates that DSL and cable modem services will be inadequate, especially for businesses, but also for home uses of telecom services.

- This means that current DSL, wireless, and cable modem services are completely inadequate for future needs. Current DSL offerings are in the range of 384 kilobits to 1.5 megabits for most residential users, 768 kilobits to 3 megabits for business DSL users, and there are severe distance limitations on DSL. Higher bandwidth (2-5 megabits) is possible, but as the DSL bandwidth goes up, the distance it can be delivered goes down.

- Current wireless offerings are in the range of 1/2 megabit to 1 megabit, and future WiMax services will only be able to deliver 2-4 megabits. Some wireless providers are rolling out 10-15 megabit services, but wireless does not scale up well with respect to cost. As bandwidth increases, the cost of the equipment also increases, and even a 15 megabit service is well short of the FCC projections of the need for 50 megabits of bandwidth in the near term. Wireless performance and capacity is heavily

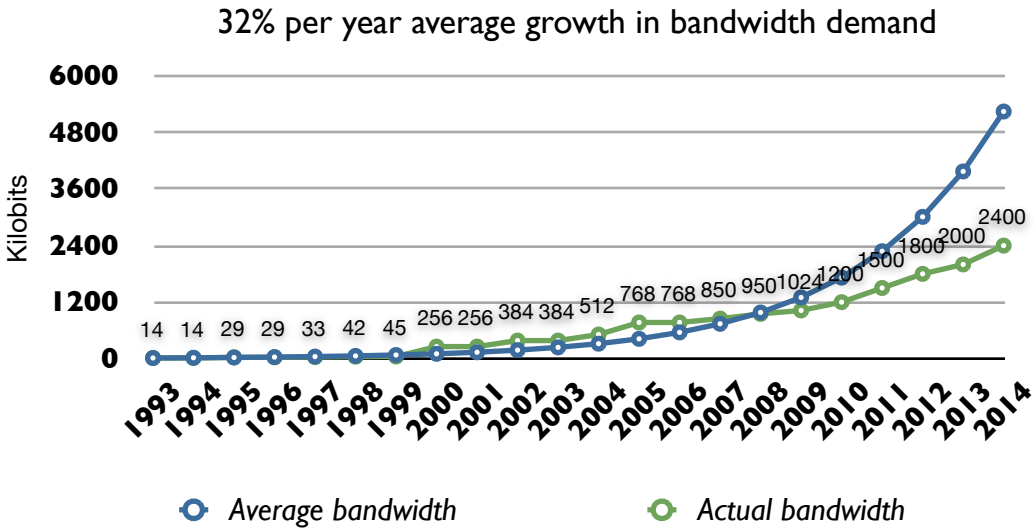
dependent upon backhaul (the local connection to the provider's core network); if this connection is also wireless, the bandwidth available at the access point is shared among all users, even if the rated capacity of an individual connection is 15 megabits. In other words, if the backhaul capacity is 100 megabits, and twenty local users are sharing that capacity, actual bandwidth available to any single user may be much lower than 15 megabits. If all the users are trying to watch video at the same time (not uncommon in early evening), performance can suffer drastically.

- Current average bandwidth for cable modem services is typically 1 to 2 megabits. It is important to note that cable providers make heavy use of the phrase "up to" in their advertising, and it is not unusual to see ads promoting cable modem speeds of "up to 6 megabits." However, that amount of bandwidth is shared among many users (often 200 or more) in a neighborhood, which results in much lower average speeds, and during peak use times in residential areas, the actual bandwidth available to a single household may be less than one megabit.

The challenge for Washington County is to ensure that the businesses, residents, and institutions in the community have a telecommunications infrastructure in place that will be able to handle the 50x bandwidth increase projected by the FCC (which is based on many years of real world data).

At the same conference, a talk by a DirecTV official provided additional insight into residential bandwidth needs. The DirecTV speaker noted that one of their biggest complaints is that the company does not have enough HD format programming. He went on to note that a single channel of "standard" HD content uses 10 megabits of bandwidth when delivered via IP-TV, and a live event like a race or sporting event (e.g. football) requires 15 megabits of bandwidth. The firm is already delivering video programming to end users using Internet-based IP-TV formats, and noted that many buildings and homes do not have the internal cabling to support the IP-TV bandwidth needs. He also indicated that their early IP-TV users cannot tell the difference between IP-TV delivery of video and traditional cable/satellite delivery.

In 1993, the year that the Blacksburg Electronic Village began offering the first residential Internet access in the world, the average connection speed was 14,400 bits per second. At the end of 2007, the average bandwidth to the home is fifty times that for DSL service (768,000 bits per second), and over 70 times that for the typical cable modem connection (about 1,000,000 bits per second). DSL speeds have flattened out (the green line on the chart) because DSL capacity has flattened out, not because demand has diminished. The blue line (average bandwidth) has been increasing steadily year by year.



Distance learning, entertainment, and video conferencing are three major applications of internet video. Distance learning from home with live video feeds will require high performance 2+ megabit connections in the near term (next 2-4 years), and over the next 4 to 7 years, there will be many distance learning courses that will incorporate live HD two-way video feeds, enabling students to participate in classroom discussions at a much higher quality level. Distance learning could be an important home-based application for workforce training and retraining. Some Idaho community colleges offer "hybrid courses" where a student attends several class sessions at the college and the remaining sessions online from their home, the library, or another location.

Entertainment will also drive bandwidth demand from the home, and the popularity of video sites like YouTube and Netflix provide a good indication of the long term demand for video in many forms, including:

- Live feeds (e.g. live TV shows, sports coverage, and live news reports).
- Video on demand (TV shows available for viewing at any time, rather than at scheduled times).
- Movies on demand (instead of going to the video store).
- Two way video conversations (family, friends).
- Video stored on home computers and distributed across the Internet (e.g. videos of grandchildren, family activities).
- Local video content streamed live or from a server (e.g. high school football games, other sporting events, council meetings, other civic activities).

Most homes in Washington County have multiple channels, meaning that a minimum of 25 megabits of bandwidth is required just to have both televisions on and tuned to two different channels. If a third person in the home is attending an evening distance learning course that uses HD video, the total bandwidth need would be more than 40 megabits.

Another source of increased demand, alluded to above, is multi-tasking. Surfing the Web while watching TV is becoming commonplace. With the proliferation of smart-phones, tablets, and laptop computers, the amount of potential users is also increasing. The chart below presents the Internet use frequency for residents in Washington County. When asked how often one used the Internet yesterday, nearly a quarter of residents within Washington County spend between 2 to 5 hours on the Internet.

Internet Use Frequency (total time spent yesterday)	Total	Percentage
Internet - Times looked at/used: 1 hr. - less than 2 hours	17,291	24.33%
Internet - Times looked at/used: 10 or more hours	2,315	3.26%
Internet - Times looked at/used: 2 hrs. - less than 5 hours	17,585	24.74%
Internet - Times looked at/used: 5 hrs. - less than 10 hours	7,979	11.23%
Internet - Times looked at/used: less than 1/2 hour	11,955	16.82%
Internet - Times looked at/used: 1/2 hr. - less than 1 hour	13,949	19.63%

Additionally, while it is safe to assume that consumers of the Internet typically use the computer as the main form to log on into the internet, the below table suggests that there is a growing trend in using a cellphone or smartphone for the Internet. Nearly a quarter of users access the internet via cellphones or smart phones.

Devices used to look at or use on the Internet	Total	Percentage
Any Computer	85,540	75.25%
Cellphone or Smartphone	28,141	24.75%

While bandwidth demands have steadily increased, the supply of adequate bandwidth has struggled to keep up. The result of this has been a mixed record of service and performance. The copper cable and wireless technologies are having a difficult time meeting current demand, and it will likely be technically impossible for them to meet future demand in the not-so-distant future. As a result:

- Most consumers receive well below the advertised speeds they are purchasing. Providers are forced to limit speeds or compress data during periods of high demand.
- Bandwidth during the evening may only be 30 percent of advertised peak speeds.
- Content providers have resorted to compressing the signal as a way to reduce data size. This results in a lower quality video signal that may appear distorted or blurry, if it comes through at all.

Service Bandwidth Needs for the Next Five Years

Using the same growth rate that has been documented for the past fourteen years, it is easy to see that DSL does not have the capacity to meet anticipated needs. In fact, in the next five years, bandwidth demand will triple if historical growth rates are maintained--and the average annual growth has been 32% per year since 1993. There is no reason to believe that this will change in the short term. The growth of video-oriented content like YouTube and many other video content services, including emerging movies on demand, will likely push bandwidth demands even higher than the historical growth rate.

As noted above, over the past fourteen years, average yearly growth has been 32%. The future projections for service needs are designed on an average annual growth of just 5%. ***The lower rate used for projections in this report provides a very conservative estimate of future need.*** The lower rate is also used because eventually, bandwidth needs to businesses and homes will flatten out as service demands mature and the infrastructure catches up. Skeptics who may suggest that no more bandwidth is needed than what is currently available may wish to study these charts carefully.

Broadband at Home Penetration Rate

The table below illustrates the rapid pace of adoption of the Internet and the demand for broadband. While it took eighteen years to reach the point where half of American households had technology like a color TV or a personal computer, the time required to reach that point for broadband access to the Internet was almost half that, or about 80% less time.

Another way to think about broadband is that it has been more popular than color television.

Adoption Time	Years to reach 50% use
Broadband at home	10
CD player	10.5
VCR	14
Cell phone	15
Color Television	18
Personal computer	18

Source: Pew/Internet Measuring Broadband Report, 2007

Service and Gap Analysis

Business Bandwidth Needs

The next table shows bandwidth consumption for several types of businesses and a projection of the bandwidth needed 5 and 10 years out. The cost of fuel is already affecting business travel decisions, and more and more businesses will invest in HD quality business videoconference systems to reduce the need for travel. These HD systems require substantial bandwidth; a two way HD video conference requires 20-25 megabits during the conference, and a three way conference requires 30-35 megabits during the conference. As more workers try to reduce the cost of driving to and from work by working part or full time from home, the business location must provide network access (Virtual Private Network, or VPN) to the employees working from home. These home-based workers will make extensive use of videoconferencing to attend routine office meetings remotely and to enhance communications with co-workers, including videoconferences with other home-based workers in the company. A VPN network providing remote access to just two or three home-based employees could require 50 megabits of bandwidth during normal work hours.

	Large Business		Small Business		Home Based Worker		Business From Home	
Description	A larger business with about 50 workstations.		A small business with 10 to 15 employees, and 7-10 workstations.		A single employee working at home for his/her company.		A home business with one or two employees working at home.	
	Concurrent Use	**Mbps**	**Concurrent Use**	**Mbps**	**Concurrent Use**	**Mbps**	**Concurrent Use**	**Mbps**
Telephone	20	1.28	5	0.32	1	0.064	1	0.064
TV		0		0		0		0
HDTV		0		0		0		0
Credit Card Validation	4	4	1	1		0		0
Security System	1	0.25	1	0.25	1	0.25	1	0.25
Internet	20	30	7	10.5	1	1.5	1	1.5
VPN Connection	5	25		0	1	5		0
Data Backup	5	7.5	1	1.5	1	1.5	1	1.5
Web Hosting	1	2		0		0		0
Telehealth (provider)		0		0		0		0
Workforce Training (online classes)	2	20	1	10		0	1	10
HD Videoconferencing	10	100	2	20	1	10	1	10
Totals		**190.0**		**43.6**		**18.3**		**23.3**
5 years from now (megabits)	**570**		**131**		**55**		**70**	
10 years from now (megabits)	**1710**		**392**		**165**		**210**	

Residential Bandwidth Needs

The table below depicts the bandwidth needed for typical residential services which are available now or will be available in the near future. In a next generation network all services will be delivered over a single network infrastructure which will require an access network that can support providing most services to most consumers simultaneously. Today's shared networks (cable and wireless in particular) rely on the "bursty" nature of traffic to provide services to end users. If all end users were consuming their "advertised" bandwidth today's cable and DSL networks would grind to a halt.

In fact, they already are; some cable providers have begun to receive heavy criticism for undocumented manipulation of data traffic. Existing cable modem network users are overwhelming the digital cable networks that were upgraded as little as three or four years ago, and the firms have had to artificially reduce the bandwidth available for certain kinds of high bandwidth services (e.g. peer to peer file sharing). Some cable providers have even run into capacity issues with the TV portion of their networks, and some consumers have observed that some HD TV channels have been so highly

compressed that picture quality has been noticeably degraded when compared to the same channel delivered by satellite.

The table below is designed to show bandwidth consumption in several scenarios. Network design requires a system than can meet peak demand across the entire network, meaning the network must be able to deliver peak bandwidth demand to a majority of households at the same time. Super Bowl Sunday is a typical example of a day when a majority of households may be watching a video at the same time. Political debates, season finales of popular shows, and even a typical Saturday afternoon during football season may see many households trying to access multiple channels of video simultaneously. This table shows the severe gap between current DSL, wireless, and cable modem options in the Washington County and projected future demand.

	Residential Daytime		Early Evening		Evening and Late Night		Snow Day	
Description	Intermittent Television and Internet use across a small percentage of households.		Increased television, telephone, and Internet use as children arrive home from school and employees from work. Use of other services increases.		Peak television and Internet use. Multiple TV's are on, phone and computer being used.		On top of typical daytime traffic children are home from school, and many employees are home working.	
	Concurrent Use	**Mbps**	**Concurrent Use**	**Mbps**	**Concurrent Use**	**Mbps**	**Concurrent Use**	**Mbps**
Telephone	1	0.064	1	0.064	1	0.064	1	0.064
Standard Definition TV	1	2.5	1	2.5	1	2.5	1	2.5
HD TV		0		0	1	6		6
Security System	1	0.25	1	0.25	1	0.25	1	0.25
Internet	1	1.5	1	1.5	2	3	3	4.5
Online Gaming		0		0		0		0
VPN Connection		0		0		0	1	5
Data Backup		0	1	1.5		0	1	1.5
Telehealth (subscriber)		0		0		0	1	4
Distance Learning / Workforce Training		0	1	10	1	10	2	20
HD Videoconferencing		0		0		0	1	14
Totals		**4.3**		**15.8**		**21.8**		**57.8**
5 years from now (megabits)	**13**		**47**		**65**		**173**	
10 years from now (megabits)	**39**		**142**		**196**		**520**	

Economic Impact Potential

Job Creation and Retention

As businesses inevitably rely more on dependable access to telecommunications to sustain their trade, they are also seeking fast and affordable networks as well. In many cases, cable and DSL companies are monopolies within a community. Unsurprisingly, these companies are able to provide unreliable and slow networks, since customers have no other choice but to purchase their products. As a result, numerous communities have taken the issue into their own hands and built their own networks. Communities are able to control the connections and the reliability of the services. Ultimately, affordable access to reliable internet services is a catalyst for economic growth and job creation.

- Chanute, Kansas (Chanute Municipal Network): One of the reasons why Spirit Aero-Systems chose Chanute for their new manufacturing facility is because of their leading broadband infrastructure. As a result, the plant created over 100 new jobs.
- Bristol, Virginia (Optinet): This community has a public owned network that attracted companies like CGI and Northrup Grumman. These companies not only created 700 jobs, but also paid twice the average wage in the community due to the convenience of the network.
- Springfield, Missouri (SpringNet): When a carrier failed to meet the demands of Springfield, SpringNet was created and ultimately served to provide the necessary connectivity to create over 400 jobs to the community.
- Chattanooga, Tennessee(EPB Fiber): According to an academic study, the first ten years of the EPB fiber network will produce over 3,6000 new jobs correlated with the City's high speed internet, phone, and television services.
- Palm Coast, Florida was able to retain the city's largest employer (over 500 jobs) because the city-owned open access fiber network sharply reduced the cost of Internet access within the City.

Public Savings

When local governments build their own networks, they experience striking savings and greater reliability. How? Since the local governments own the network, they have the leverage to determine the future costs and when these price hikes would occur. Community anchor institutions like schools, libraries, and government facilities may reap in the greatest savings because they are no longer contracted to sign a lease to join a network.

- Martin County, Florida: Once the initial capital investment in the fiber asset is paid off, Martin County School District will save nearly $340,000 per year. In other words, the school district will only pay an estimated $6,000 per year for a gigabit connection to 26 locations.
- Bristol, Virginia: One study concluded that Bristol schools have saved $1 million from 2003-2008 just by self-provisioning phone services. This results in nearly $10 million in savings for the community.
- Martinsville, Virginia: Similarly to Bristol, Virginia, Martinsville saves between $130,000 and $150,000 annually because they do not need to lease telephone lines.
- Medina County, Ohio: When data needs were fulfilled by Time Warner Cable, Highland Public Schools spent $100,000 per year for the company's services. However, the county saved $82,000 in 2012 when it switched over to the Medina County municipal network since the cost was only $18,000 per year.
- The city of Wilmington, North Carolina uses its fiber network to turn the lights off at sports parks at night. Cameras have been placed at every sports and recreation field, along with remote control light switches. A single city employee can quickly check the cameras to see if anyone is still at a field, and if not, a couple of mouse clicks turn off the lights. The city expects to save $800,000 per year on electricity costs.

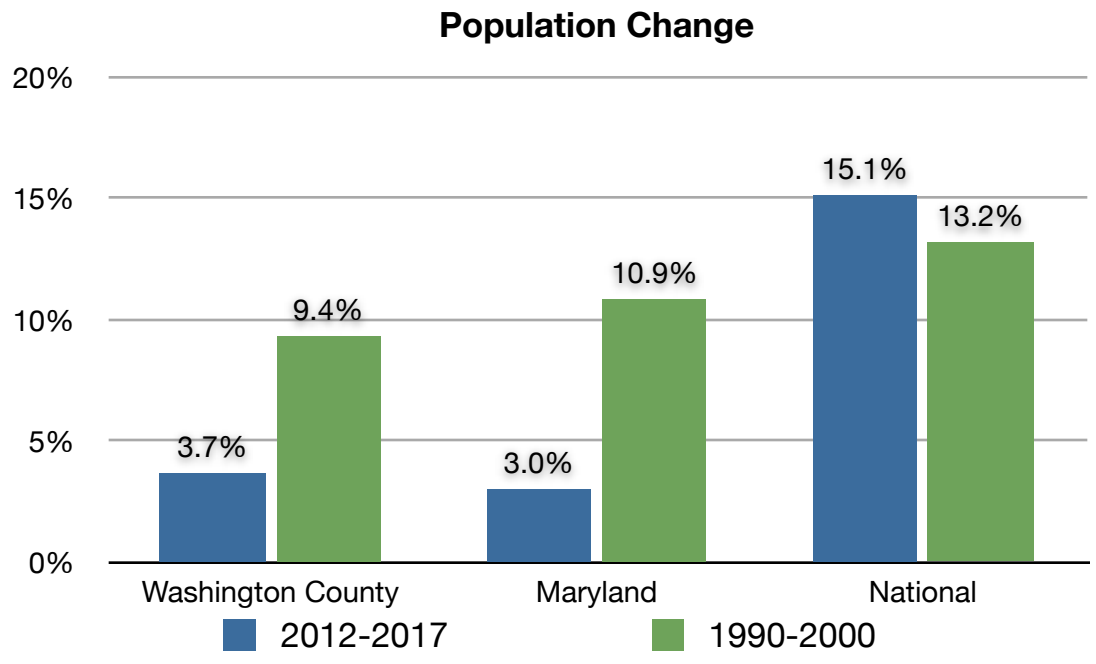
Demographic Analysis

Population

In the last twelve years, the Washington County experienced more population growth than the state and nationally. More of the growth is occurring in the outskirts of Maryland, but the percent increase in population density for both the county and state is expected to decrease. More specifically, Washington County had a population increase of nearly 17,000 in 2012 but there is only a projected increase of 5,492 in 2017. Improved and more affordable broadband services will play a key role in supporting work-from-home jobs and new business and entrepreneurial activities in the county in the coming years.

Year	Washington County		Maryland		National	
	Population	% Change	Population	% Change	Population	% Change
2017	153,966	3.38%	6,025,370	3.03%	324,003,515	15.14%
2012	148,925	12.88%	5,848,096	10.44%	312,838,761	11.17%
2000	131,935	9.36%	5,295,336	10.88%	281,399,035	13.20%
1990	120,640		4,775,842		248,584,653	

Source US Bureau of Census 1990, 2000 and 2010 Decennial Census SF1 DP-1
* US Census Bureau Population Estimates Program
* Weldon Cooper Center for Public Service, UVa

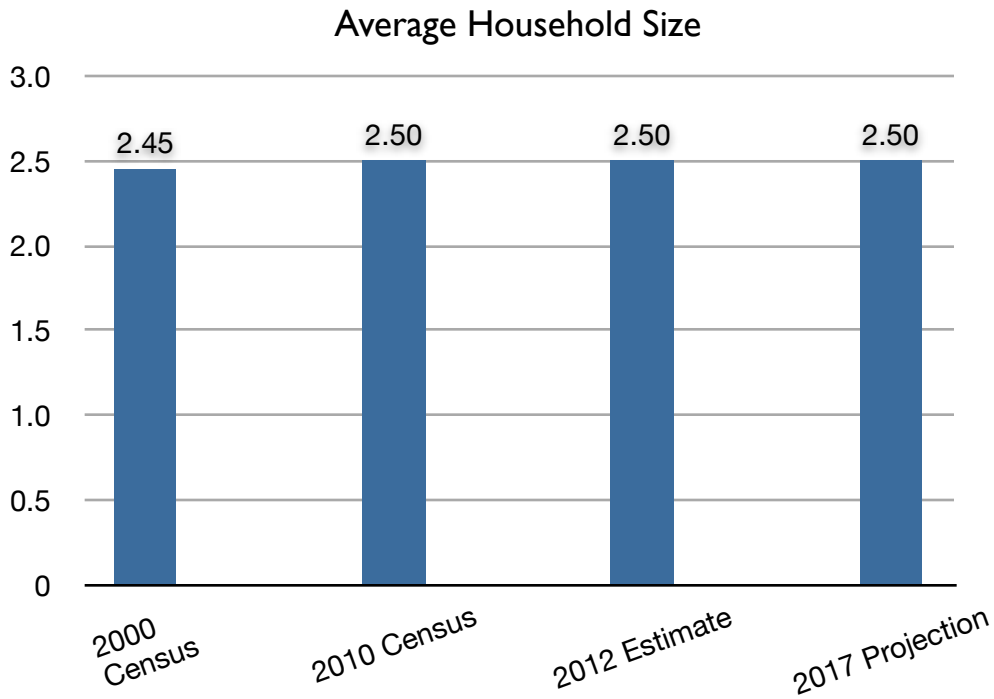


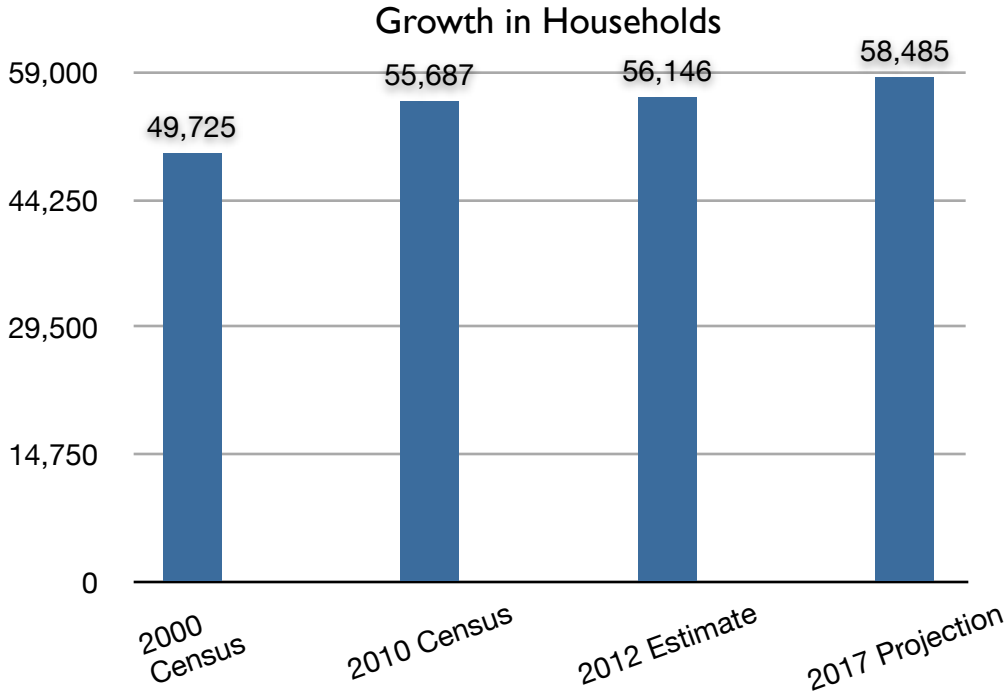
Household Size and Growth Trends

The number of households in Washington County is expected to rise in the next five years, while the number of persons living in the average household will remain close to the same. The size of an average household and the number of households are important data indicators when predicting broadband take rates and modeling potential income. Most services are subscribed on a per household basis, rather than on a per person basis.

When calculating infrastructure investment costs, household statistics are also important because duct and fiber connections are made to the household (premises). Projected steady growth in households suggests that the county will see steady demand for connections (as opposed to a situation where the number of households is shrinking). The table below shows housing projections using census data.

	2000 Census		2010 Census		2012 Estimate		2017 Projection		2000 to 2010	2012 to 2017
Total Households	49,729		55,687		56,386		58,773		12%	4%
Size of Household:										
1 Person	12,972	26%	14,831	27%	15,112	27%	15,959	27%	14%	5%
2 Person	17,577	35%	19,343	35%	19,569	35%	20,291	35%	10%	4%
3 Person	8,449	17%	9,129	16%	9,212	16%	9,540	16%	8%	4%
4 Person	6,790	14%	7,329	13%	7,308	13%	7,596	13%	7%	4%
5 Person	2,761	6%	3,140	6%	3,166	6%	3,290	6%	14%	4%
6 Person	804	2%	1,211	2%	1,222	2%	1,272	2%	51%	4%
7 + Person	373	1%	794	1%	797	1%	825	1%	113%	4%
Average Household Size	2.45		2.50		2.50		2.49		1.46	-0.27


Average Household Size
3.0
2.5
2.0
1.5
1.0
0.5
0
2.45
2.50
2.50
2.50
2000 Census
2010 Census
2012 Estimate
2017 Projection


Growth in Households
59,000
44,250
29,500
14,750
0
49,725
55,687
56,146
58,485
2000 Census
2010 Census
2012 Estimate
2017 Projection

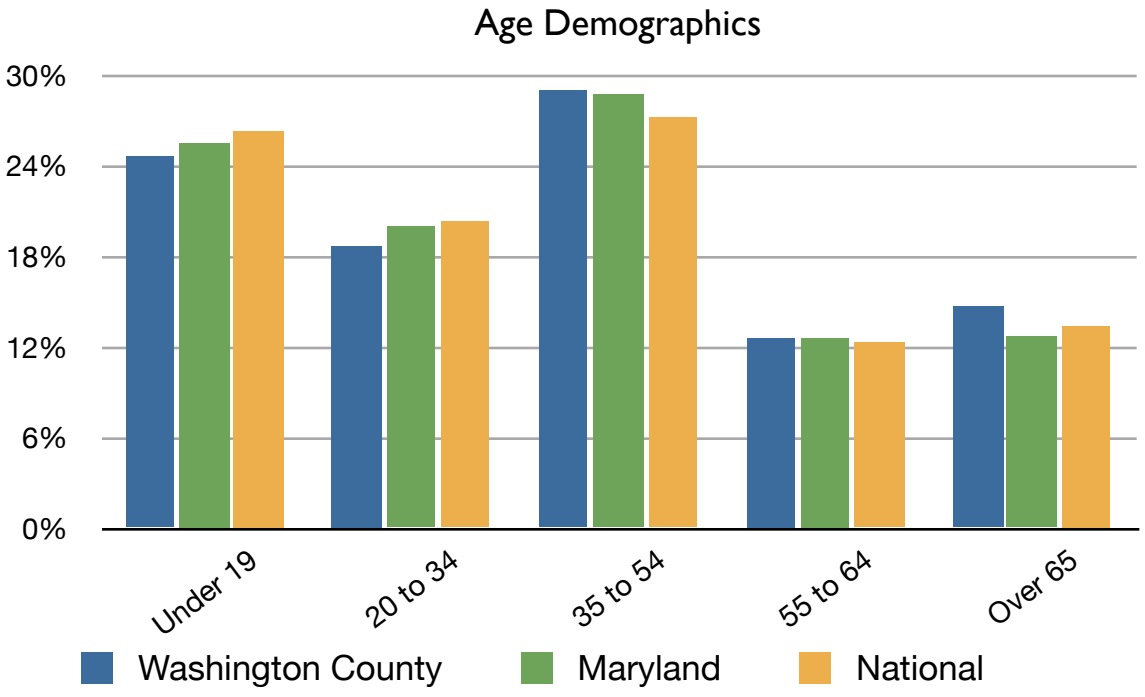
Age Distribution

Washington County's population is similar to the the state and national averages. However, Washington County does have a greater ratio of middle aged adults between the ages of 35 to 54 than the state and national levels. Different age groups use the Internet differently, and only high speed broadband can cater to the needs of each. Since a significant portion of Washington County contains a demographic that is generally employed, broadband infrastructure will become essential in ensuring the resources are available to sustain current businesses and attract new businesses to the county. The second largest demographic in Washington County are under 19. Younger generations are often avid consumers of online video and most working-aged people will benefit greatly from a high speed connection to their home. At the same time, an ongoing awareness and education effort is often needed to help older people make good use of technology.

During our work in other areas, local real estate agents consistently report that many home buyers will NOT look at homes that do not have affordable, high performance broadband connections, especially younger, first time home buyers. So broadband availability (or the lack of it) is changing where people choose to live.

	Washington County	Maryland	National
Under 19	24.6%	25.5%	26.3%
20 to 34	18.9%	20.0%	20.3%
35 to 54	19.1%	28.7%	27.2%
55 to 64	12.5%	12.6%	12.3%
Over 65	14.4%	12.7%	13.4%

Source US Bureau of Census 2010 Decennial Census SF3 DP-2

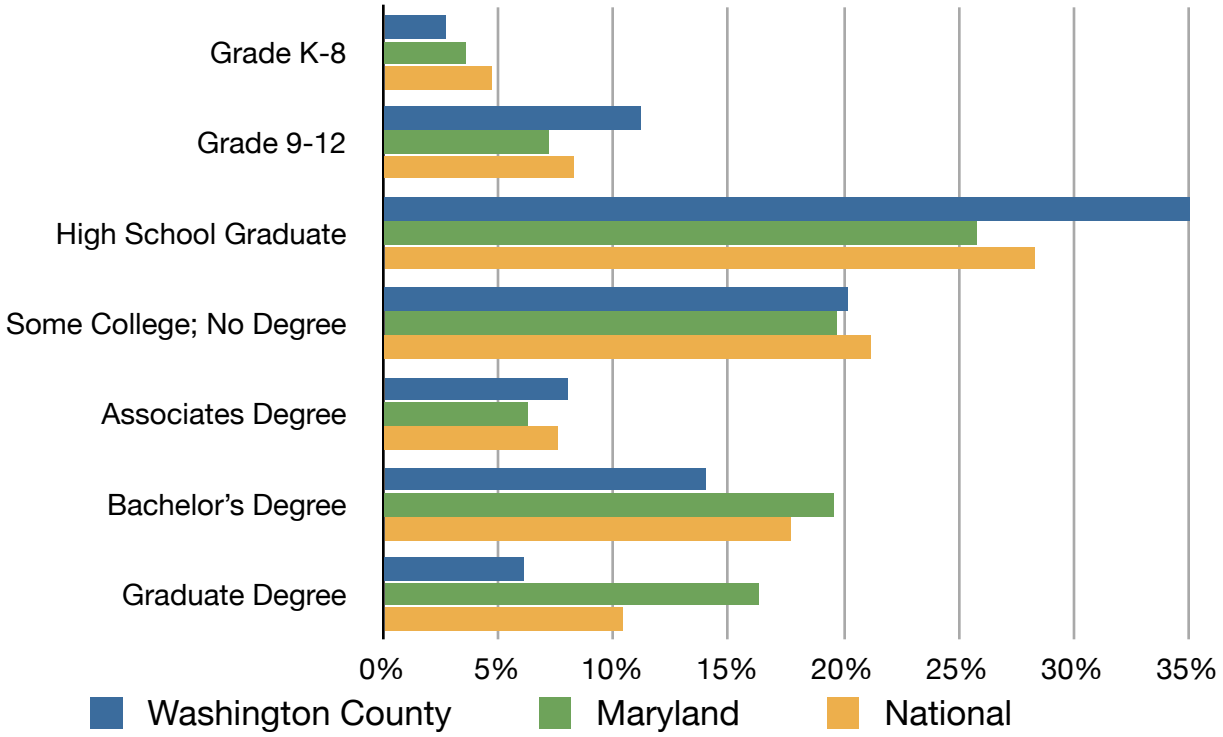


EDUCATION

Washington County exceeds the state and national averages in producing individuals with high school diplomas and associates degrees. However, the county trails behind the state and national averages in obtaining bachelor's and graduate degrees. Increased availability of broadband is important to education because increased awareness and connectivity would allow residents to complete or improve their education and skill set by attending online classes. Increased connectivity could also attract a diverse mix of residents (e.g., business people and entrepreneurs who can work from home).

	Washington County	Maryland	National
Grade K - 8	2.7%	3.6%	4.7%
Grade 9 - 12	11.2%	7.2%	8.3%
High School Graduate	36.7%	25.8%	28.3%
Some College, No Degree	20.2%	19.7%	21.2%
Associates Degree	8.0%	6.3%	7.6%
Bachelor's Degree	14.0%	19.6%	17.7%
Graduate Degree	6.1%	16.3%	10.4%

Source US Bureau of Census 2010 Decennial Census SF3 DP-2



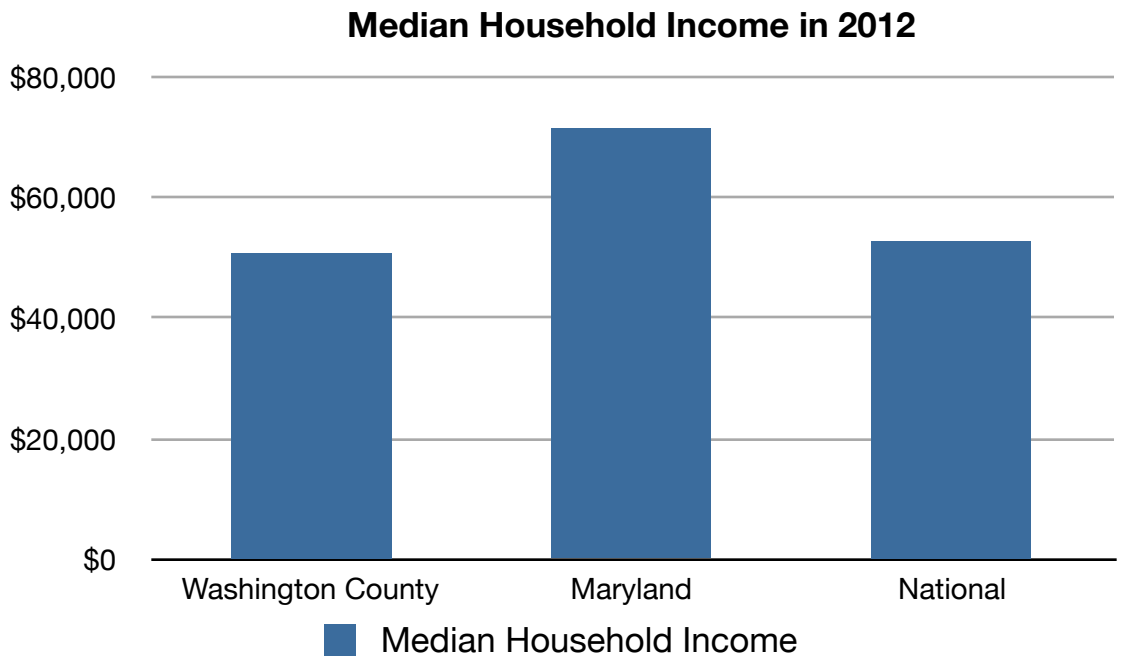
Median Household Income

The Median Household Income in Washington County is much lower than the state average, but comparable to the national average. This income disparity should be an important consideration for broadband expansion. County investments in broadband infrastructure could spur increased competition and lower prices for residents and businesses, thus making access more affordable. This may be especially important to limited income students.

Improved Internet access within the county would continue to shift some employment and job opportunities towards office and professional employees. Home-based businesses and working from home jobs, either part time or full time, could contribute more to the local economy, and affordable, high performance "big broadband" at home is already considered a requirement among white collar professionals.

2012 Estimates	Washington County	Maryland	National
Median Household Income	$50,872	$71,442	$52,822

Source US Bureau of Census 2010 Decennial Census SF3 DP-3

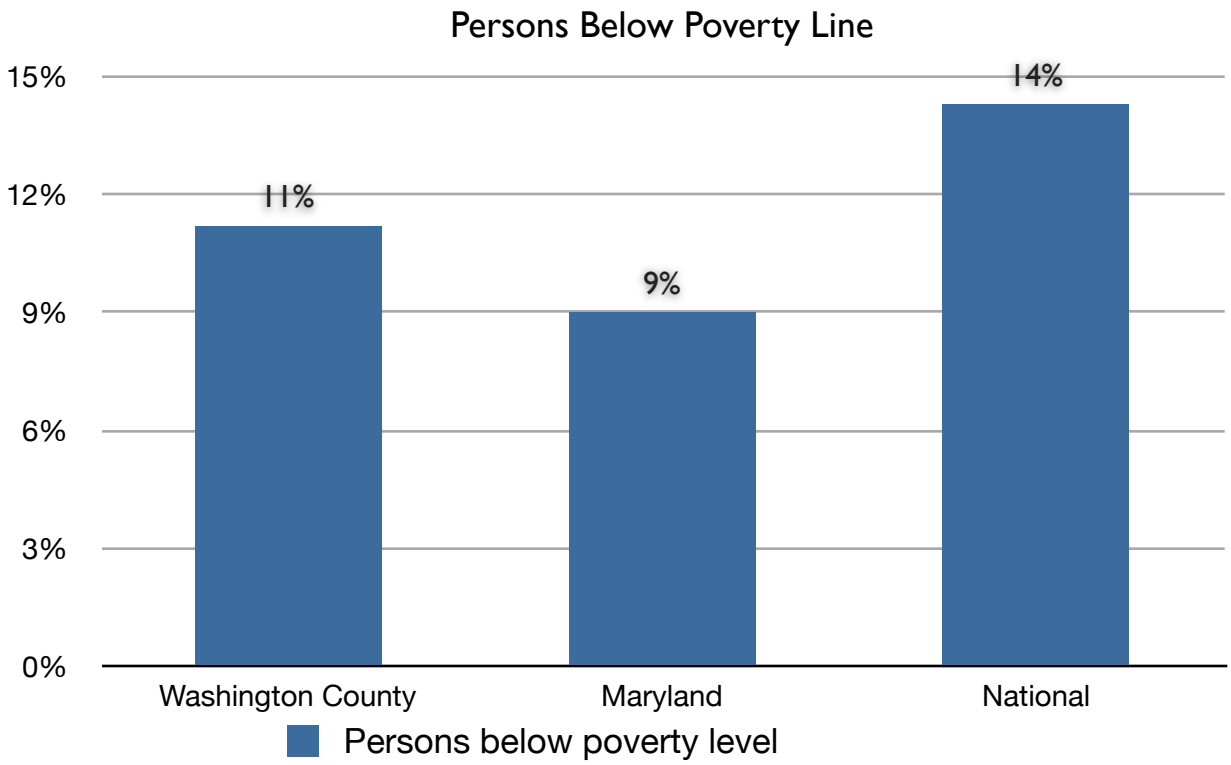


Families Below Poverty Level

The following table compares the poverty level for the county to the state, and national averages. Washington County appears to have a higher poverty rate compared to the state, but it is lower than the national average. However, low income is still a significant concern to some residents in Washington County. Broadband access can facilitate work-from-home businesses, provide access to online degree programs, and attract more business investment and job opportunities to the area.

	Washington County	Maryland	National
Persons below poverty level	11.2%	9.0%	14.3%

Source US Bureau of Census, State and County Quickfacts
Accessed 2011, Data from 2009



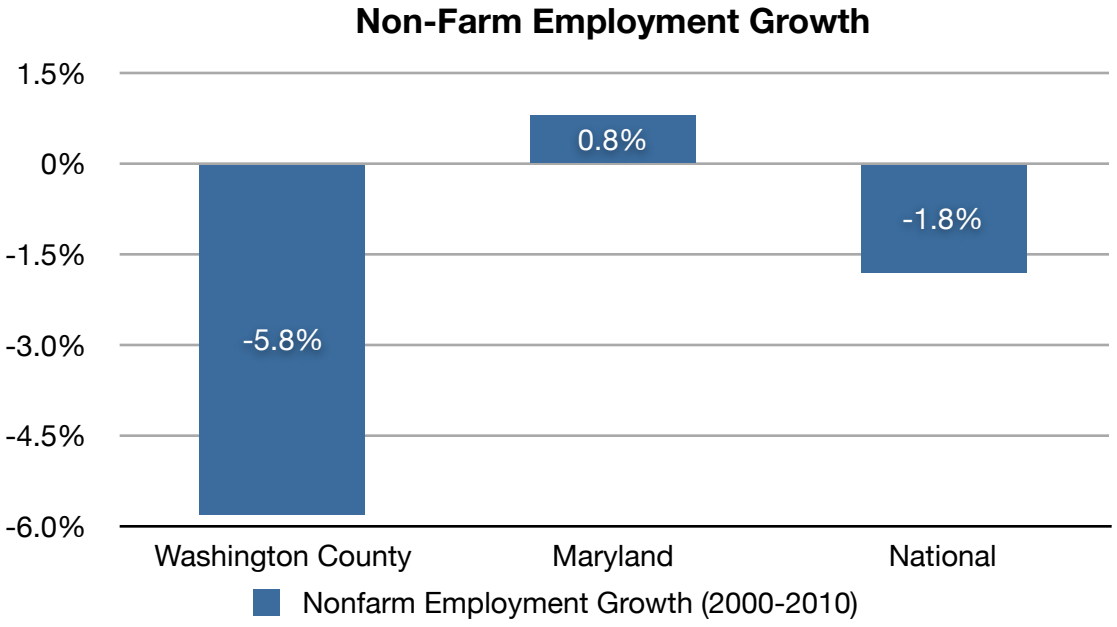
NON-FARM EMPLOYMENT GROWTH

While the state experienced minimal employment growth, Washington County and the nation experienced negative growth. However, the county's negative growth was greater than the national average. The county may need to pursue investments in broadband infrastructure that will attract employers to locate to the area to produce jobs. In addition, the broadband infrastructure will also serve as an attraction for individuals willing to relocate to the area for the jobs available from greater broadband connectivity. A joint CMU/MIT study released in 2005 showed that regions with good distribution of broadband service enjoyed more economic growth than regions without quality access to broadband services.

A study by the Phoenix Center showed that broadband was also an important tool for jobseekers; those looking for jobs were more likely to find work than those on dial-up or those without any Internet access.

	Washington, County	Maryland	National
Nonfarm employment growth	-5.8%	0.8%	-1.8%

Source US Bureau of Census 2000-2009 State and County Quickfacts



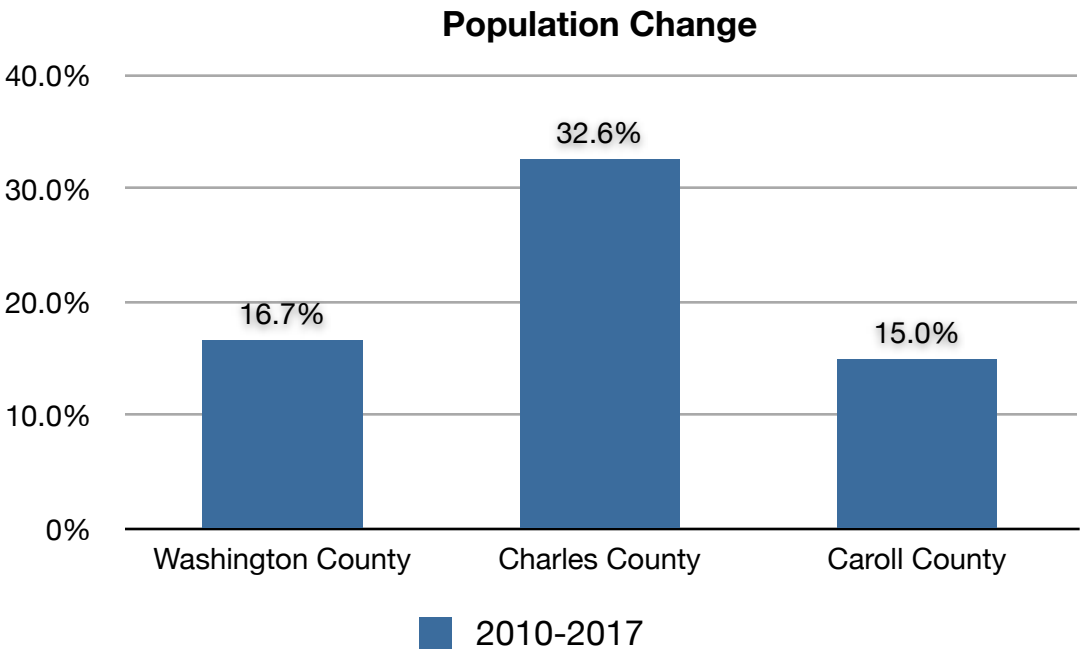
County Comparison

Washington County, Charles County, and Carroll County are all counties located in the state of Maryland. Each county is uniquely different, especially in terms of demography and broadband adoption. Charles County and Carroll County have more similarities in broadband adoption and use than Washington County. The following section may help identify some of the characteristics that distinguish each county from one another.

Population

Washington County, Charles County, and Carroll County have all experienced population growth over the last several years. Notably, Charles County is expected to experience twice the amount of population growth when compared to Washington County by 2017. In the last two years, Washington County only experienced a 1% population change increase, while Charles County experienced an increase of 3%. When compared to Washington County, Carroll County has experienced less of a change in population growth, but Carroll County is expected to grow slightly more than Washington County from 2012 to 2017.

Year	Washington County		Charles County		Carroll County	
	Population	% Change	Population	% Change	Population	% Change
2017	153,966	3.4%	159,853	5.8%	173,514	3.6%
2012	148,925	1.0%	151,118	3.1%	167,501	0.2%
2010	147,430	11.7%	146,551	21.6%	167,134	10.7%
2000	131,935		120,543		150,915	

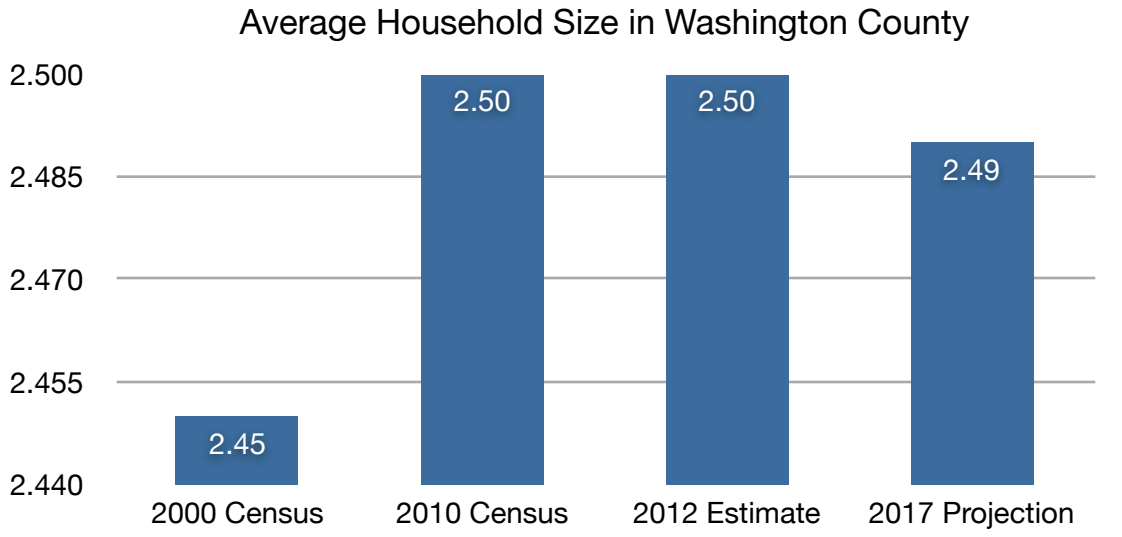


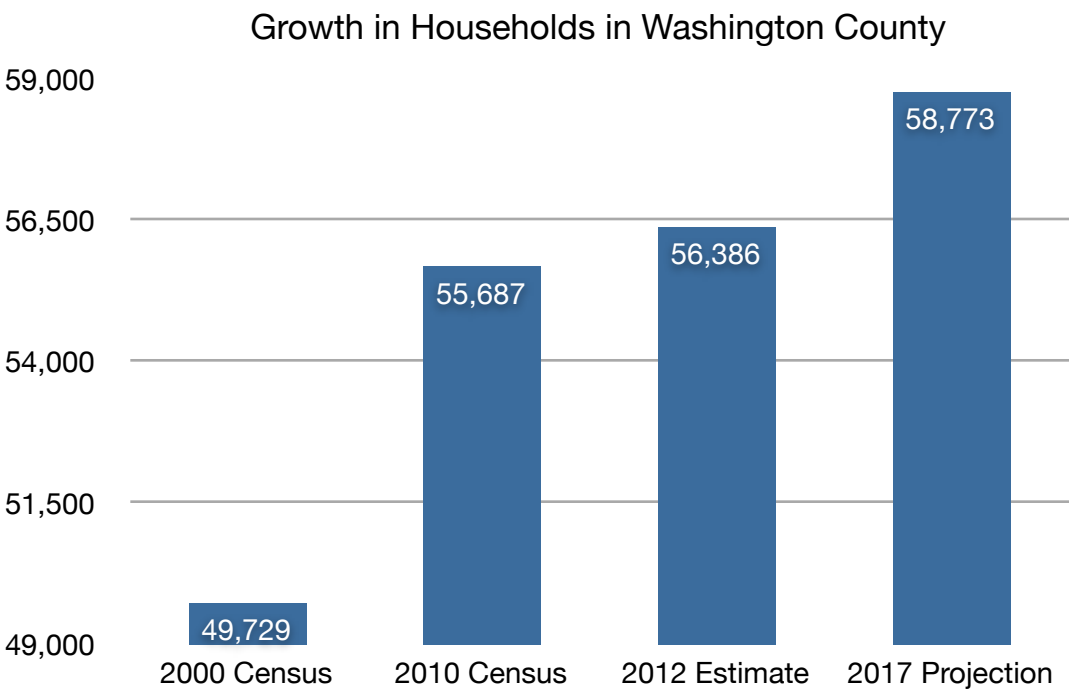
Source US Bureau of Census 2000, 2010 and 2012 Decennial Census SF1 DP-1
* US Census Bureau Population Estimates Program

Household Size and Growth Trends

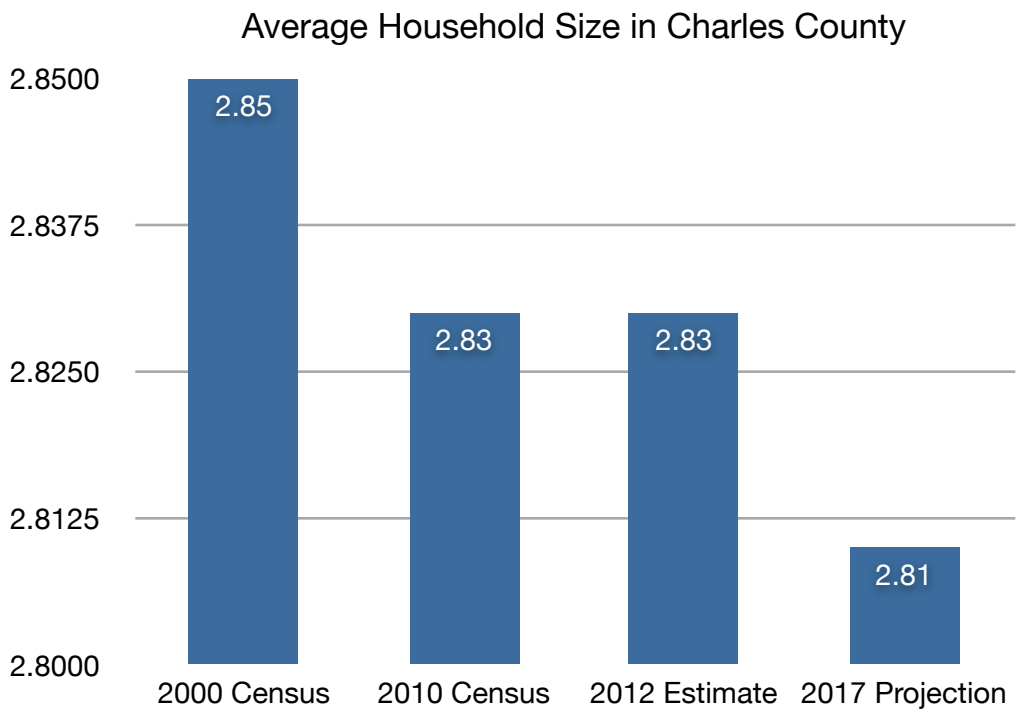
The total number of households has increased since 2000 and is expected to increase by 2017 for Washington County, Charles County, and Carroll County. The average household size of each of the counties are relatively similar, with both Charles and Carroll County having just slightly larger averages over the last decade. However, Washington County experienced the the lowest rate of growth between 2000 and 2010 when compared to Charles and Carroll County. Moreover, Washington County is also expected to grow at a slower pace in total households by 2017.

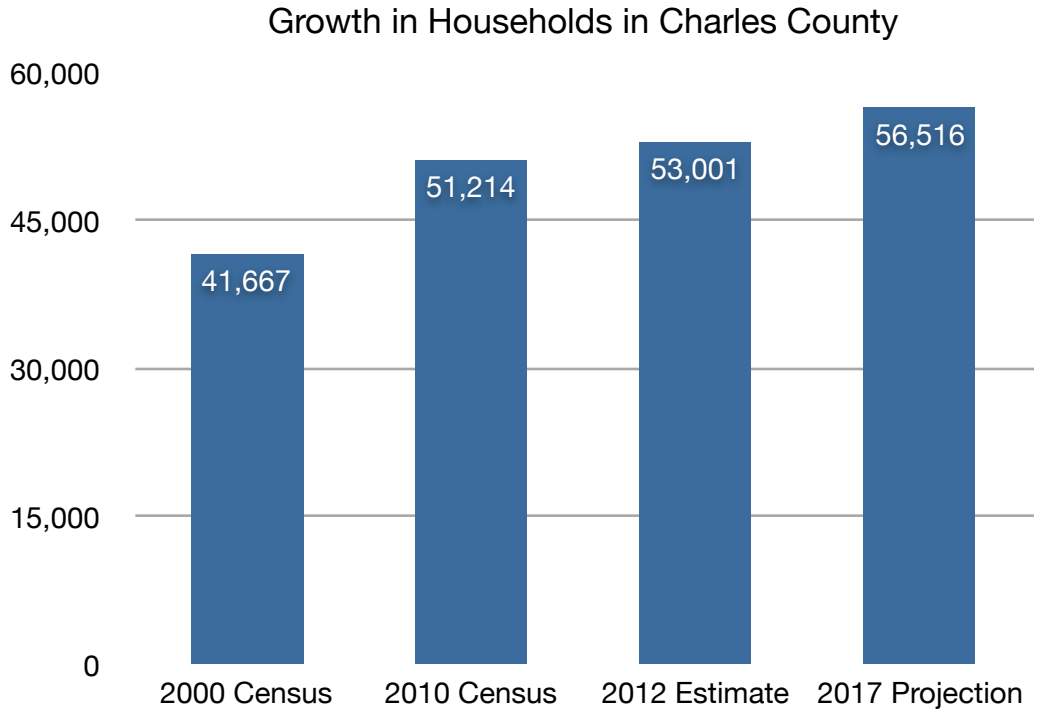
Washington County	2000 Census	2010 Census	2012 Estimate	2017 Projection	2000-2010	2012-2017
Total Households	49,729	55,687	56,386	58,773	12.0%	4.2%
Size of Household:						
1 Person	26.0%	26.6%	26.8%	27.1%	2.3%	1.1%
2 Person	35.3%	34.7%	34.7%	34.5%	-1.7%	-0.6%
3 Person	16.9%	16.3%	16.3%	16.2%	-3.6%	-0.6%
4 Person	13.6%	13.0%	12.9%	12.9%	-4.4%	0.0%
5 Person	5.5%	5.6%	5.6%	5.5%	1.8%	-1.8%
6 Person	1.6%	2.1%	2.1%	2.1%	31.3%	0.0%
7+ Person	0.7%	1.4%	1.4%	1.3%	100.0%	-7.1%
Average Household Size	2.45	2.50	2.5	2.49		



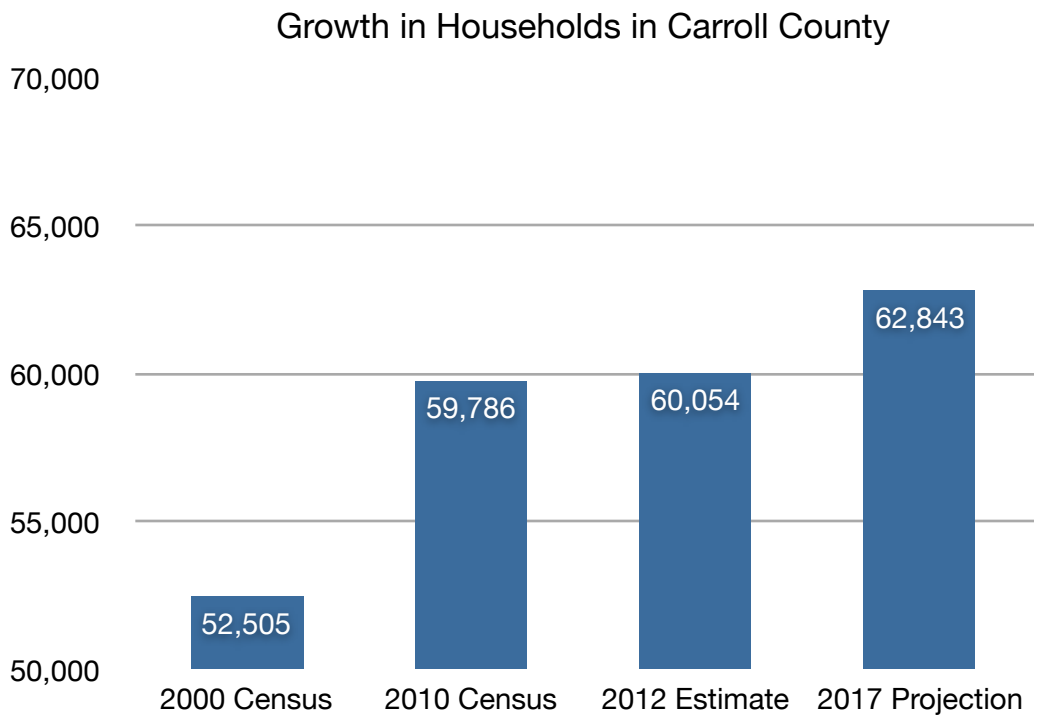


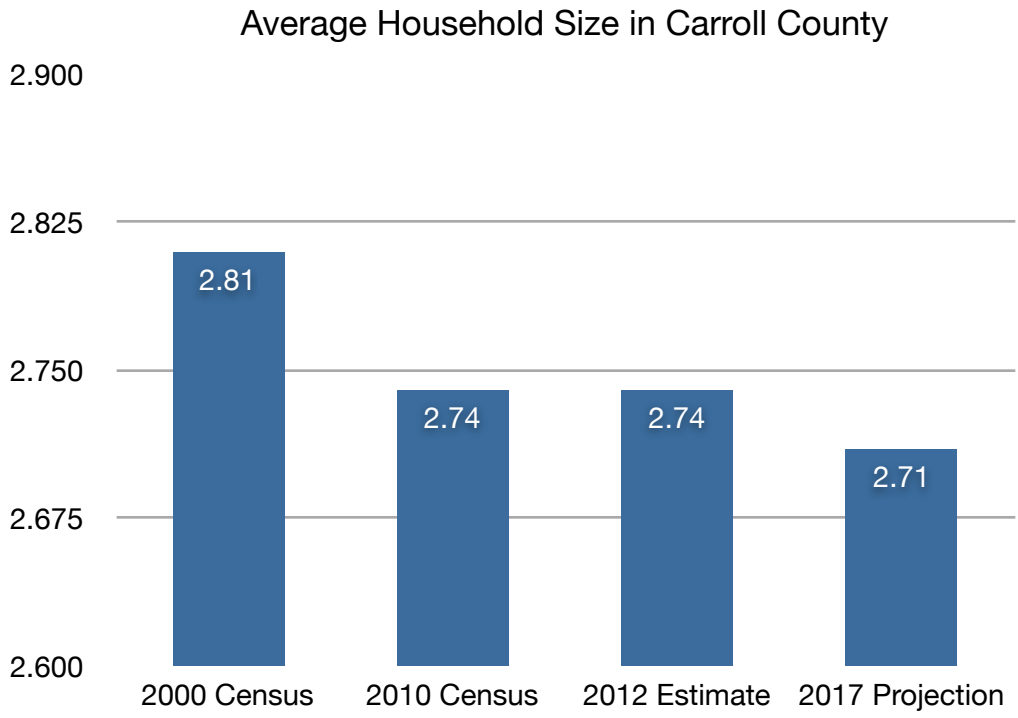
Charles County	2000 Census	2010 Census	2012 Estimate	2017 Projection	2000-2010	2012-2017
Total Households	41,667	51,214	53,001	56,516	22.9%	6.6%
Size of Household:						
1 Person	17.1%	19.7%	20.0%	20.5%	-80.3%	2.5%
2 Person	30.7%	30.3%	30.3%	30.1%	-1.3%	-0.7%
3 Person	20.8%	19.6%	19.5%	19.3%	-5.8%	-1.0%
4 Person	18.6%	16.5%	16.4%	16.3%	-11.3%	-0.6%
5 Person	8.3%	8.3%	8.3%	8.2%	0.0%	-1.2%
6 Person	2.9%	3.2%	3.2%	3.2%	10.3%	0.0%
7+ Person	1.3%	2.1%	2.0%	2.0%	61.5%	0.0%
Average Household Size	2.85	2.83	2.83	2.81		


Average Household Size in Charles County
2.8500
2.8375
2.8250
2.8125
2.8000
2.85
2.83
2.83
2.81
2000 Census
2010 Census
2012 Estimate
2017 Projection


Growth in Households in Charles County
60,000
45,000
30,000
15,000
0
41,667
51,214
53,001
56,516
2000 Census
2010 Census
2012 Estimate
2017 Projection

Carroll County	2000 Census	2010 Census	2012 Estimate	2017 Projection	2000-2010	2012-2017
Total Households	52,505	59,786	60,054	62,843	13.87%	4.64%
Size of Household:						
1 Person	17.5%	19.9%	20.2%	20.9%	13.7%	3.5%
2 Person	32.5%	33.2%	33.1%	32.9%	2.2%	-0.6%
3 Person	19.0%	17.9%	17.8%	17.6%	-5.8%	-1.1%
4 Person	19.0%	17.2%	17.1%	17.0%	-9.5%	-0.6%
5 Person	8.3%	7.5%	7.5%	7.5%	-9.6%	0.0%
6 Person	2.3%	2.6%	2.6%	2.5%	13.0%	-3.8%
7+ Person	1.1%	1.4%	1.4%	1.4%	27.3%	0.0%
Average Household Size	2.81	2.74	2.74	2.71		

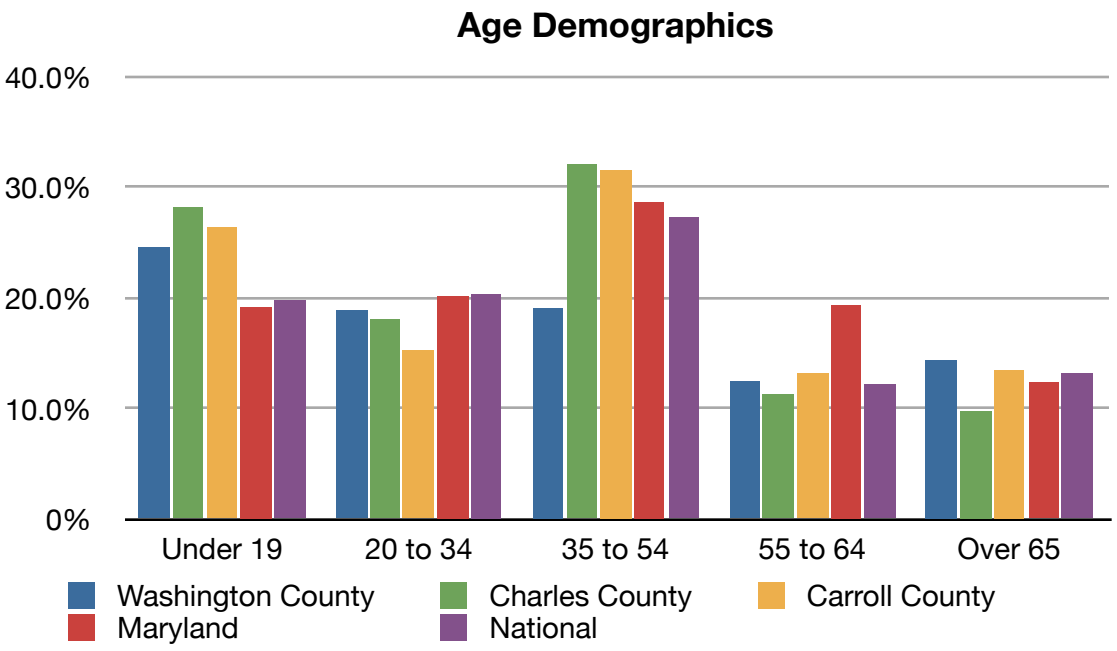

Growth in Households in Carroll County
70,000
65,000
60,000
55,000
50,000
52,505
59,786
60,054
62,843
2000 Census
2010 Census
2012 Estimate
2017 Projection


Average Household Size in Carroll County
2.900
2.825
2.750
2.675
2.600
2.81
2.74
2.74
2.71
2000 Census
2010 Census
2012 Estimate
2017 Projection

Age Distribution

Individuals 19 or younger make up the largest portion of the population in Washington County. On the other hand, individuals between the ages of 35 to 54 make up the largest portion of the population in Charles and Carroll County. The median age in Washington County is 40 years old, which is between the median ages for Charles and Carroll County. Washington County also has the greatest proportion of seniors (individuals over the age of 65) than Charles County, Carroll County, the state, and nationally. A larger proportion of the elderly when compared to surrounding counties, the state, and nationally may imply a demand for more services like healthcare to accommodate the needs of the elderly. Since Charles County and Carroll County have a larger proportion of individuals under the age of 19 and middle aged individuals (35 to 54) than Washington County, this may lead to a stronger workforce with young people filling the roles of retiring baby boomers and an existing population with experience to train the incoming age demographic into the workforce. The successful growth of workforce development depends in part upon the availability of broadband infrastructure to ensure that individuals of all age groups have the resources to perform competitively locally, regionally, and nationally.

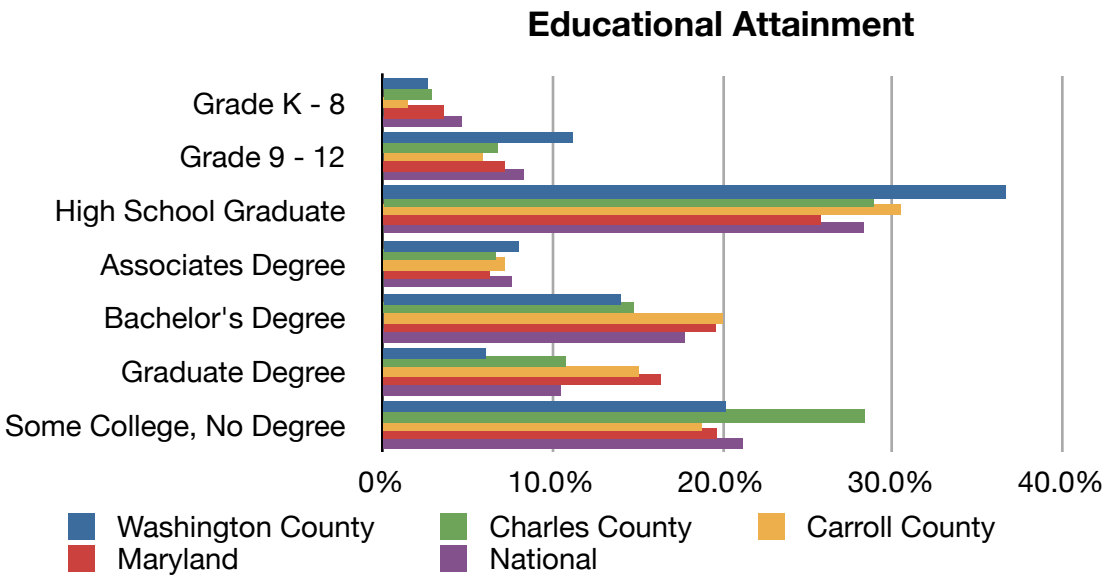
Population	Washington County	Charles County	Carroll County	Maryland	National
Under 19	24.6%	28.2%	26.4%	19.2%	19.8%
20 to 34	18.9%	18.1%	15.3%	20.2%	20.4%
35 to 54	19.1%	32.1%	31.6%	28.7%	27.3%
55 to 64	12.5%	11.3%	13.2%	19.4%	12.2%
Over 65	14.4%	9.8%	13.5%	12.4%	13.2%
Median Age	40.0	38.0	42.0	38.0	37.0



EDUCATION

The number of high school graduates in Washington County greatly exceeds the proportion of high school graduates in Charles and Carroll County. However, in this day and age, the requirement to have a college degree for the purposes of employment is nearly necessary to ensure a better quality of life and stable income. Washington County trails behind both Charles County and Carroll County in the proportion of individuals with not only a bachelor's degree but also an advanced graduate degree. The implementation of broadband infrastructure may help bridge the gap in educational attainment in Washington County. More and more universities are offering online coursework for students to complete their degrees without ever setting foot on a college campus. Individuals with just a high school degree or some college coursework can enroll in classes online to fulfill college degree requirements. As evidenced by the age distribution section above, Washington County has a rather large proportion of young individuals under the age of 19. Including skill sets that involve using the Internet is highly important in helping students succeed in college as well as attaining a job after high school and college. As discussed in the following section, Charles County and Carroll County both have an average higher median income than Washington County, and this may be attributed to lower educational attainment.

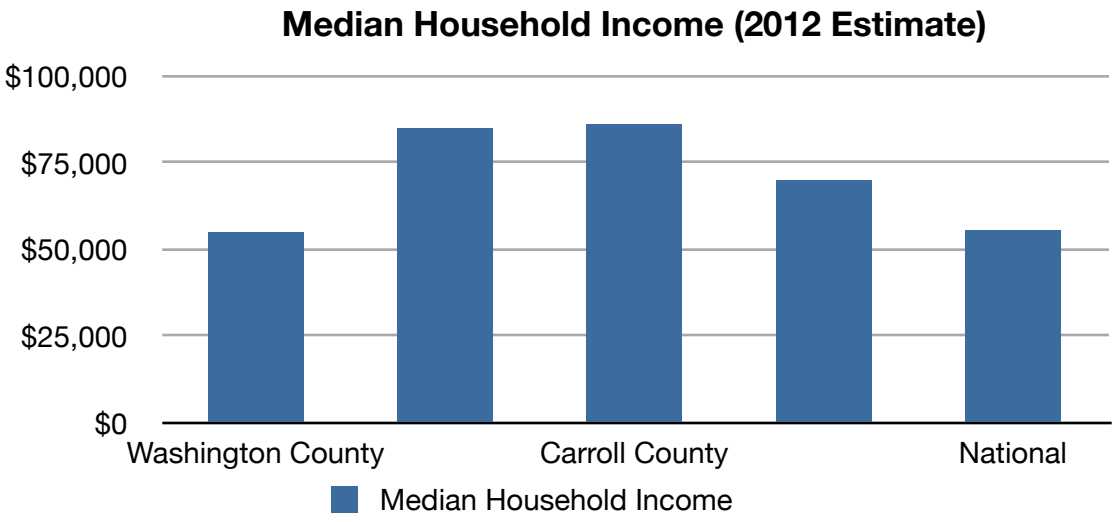
	Washington County	Charles County	Carroll County	Maryland	National
Grade K - 8	2.7%	2.9%	1.5%	3.6%	4.7%
Grade 9 - 12	11.2%	6.8%	5.9%	7.2%	8.3%
High School Graduate	36.7%	28.9%	30.5%	25.8%	28.3%
Associates Degree	8.0%	6.7%	7.2%	6.3%	7.6%
Bachelor's Degree	14.0%	14.8%	20.0%	19.6%	17.8%
Graduate Degree	6.1%	10.8%	15.1%	16.4%	10.5%
Some College, No Degree	20.2%	28.4%	18.8%	19.7%	21.2%



Median Household Income

Washington County's median household income average is significantly less than Charles County and Carroll County. This income difference has significant repercussions for the overall quality of life in the county and can impact the amount gained from local income tax revenues. The data may suggest that the median household income disparity is due to the proximity of Charles County to the Washington, D.C. area, which tends to have greater job opportunities. However, technology can enable individuals to telework, or work from home, so that geographic location is less of a deterrent. By investing in the broadband infrastructure, more individuals may be able to work from home while earning a comparable income to those who are geographically closer to business districts like Washington, D.C. and northern Virginia.

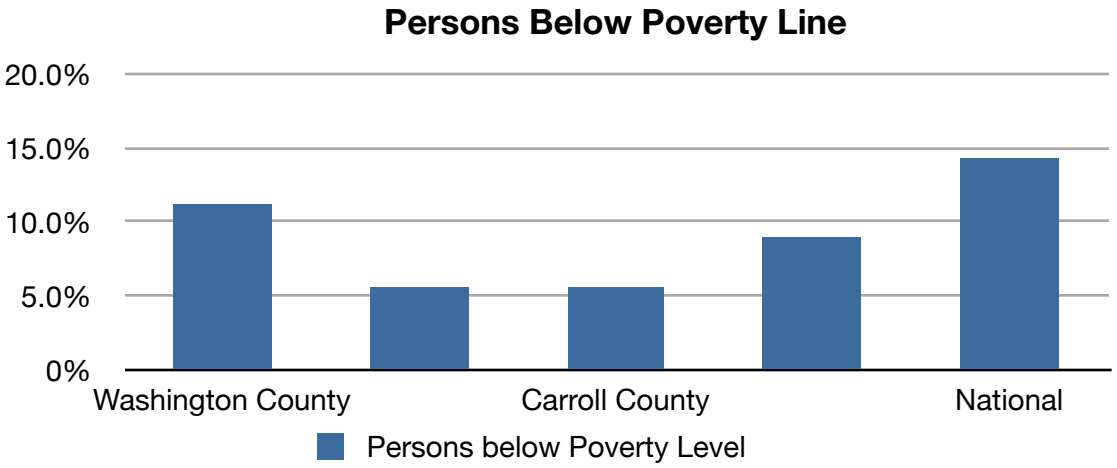
	Washington County	Charles County	Carroll County	Maryland	National
Median Household Income	$54,927	$84,984	$86,079	$70,176	$55,535



Families Below Poverty Level

The proportion of families who fall below the poverty level in Washington County is nearly double the amount of families who fall below the poverty level in Charles County and Carroll County. Regionally, this is an alarming rate and may be attributed to lower educational attainment and low household income. In order to overcome this obstacle, broadband infrastructure could help individuals gain better skill sets related to computer and Internet use and search and apply for jobs online.

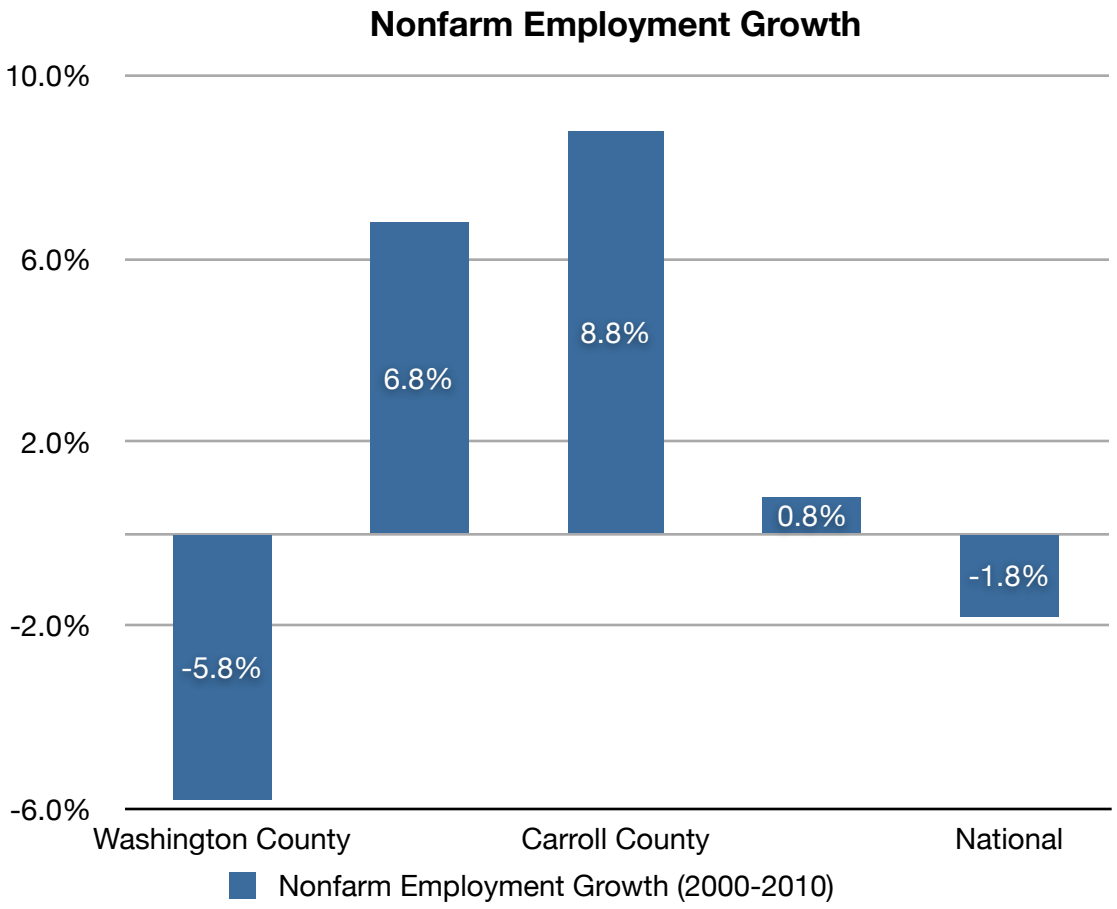
	Washington County	Charles County	Carroll County	Maryland	National
Persons below Poverty Level	11.2%	5.6%	5.6%	9.0%	14.3%



Non-Farm Employment Growth

Washington County experienced negative non-farm employment growth as opposed to the increase in non-farm employment growth in both Charles County and Carroll County between 2000 and 2010. One strategy for Washington County to increase non-farm employment growth and compete for employers regionally, the implementation of broadband infrastructure could attract employers to locate their offices to Washington County if the infrastructure is in place for the businesses to conduct competitive services.

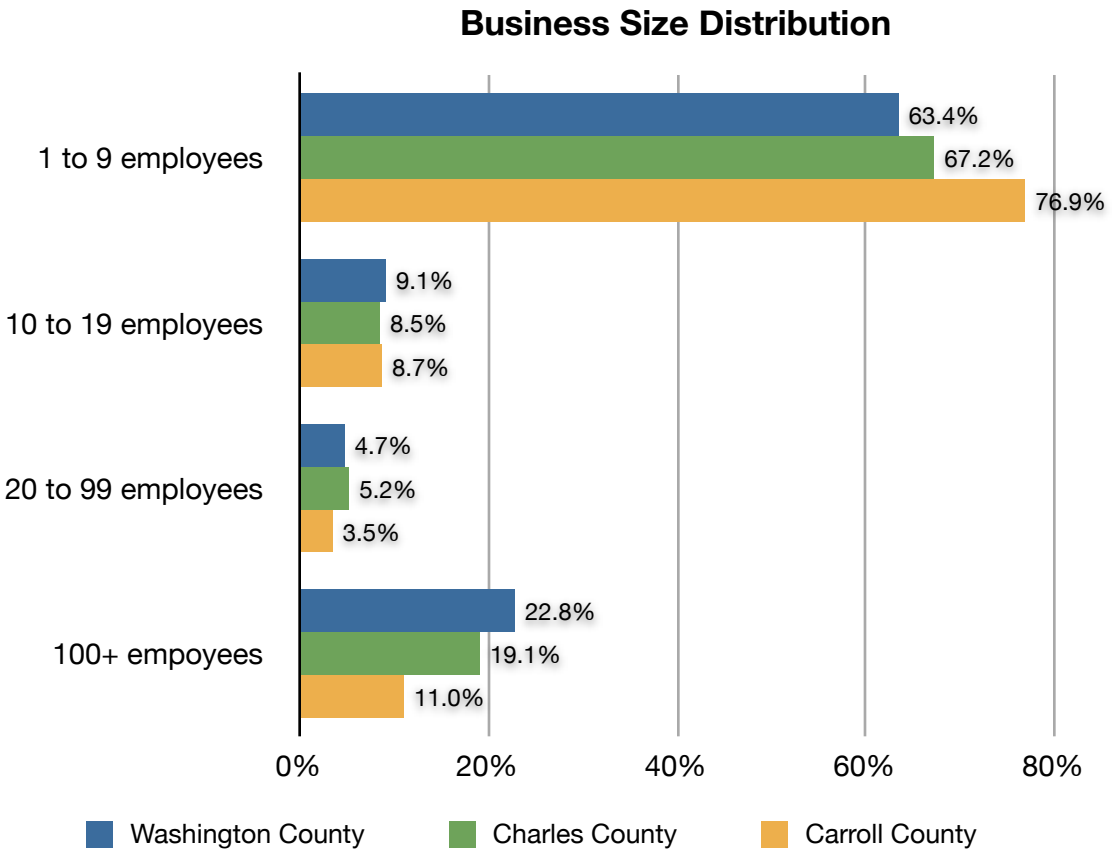
	Washington County	Charles County	Carroll County	Maryland	National
Nonfarm Employment Growth (2000-2010)	-5.8%	6.8%	8.8%	0.8%	-1.8%



Business Size Distribution

Washington County falls in between Charles County and Carroll County in terms of total number of businesses. All three counties have the greatest proportion of businesses with 1 to 9 employees. The proportion of number businesses with 1 to 9 employees in Washington County does not fall too far behind Charles and Carroll County. As far as the other categories of business size distribution, Washington County does not vary significantly when compared to Charles County and Carroll County with the exception of the 100+ employees category. Washington County actually has double the amount of 100+ employees businesses than Carroll County.

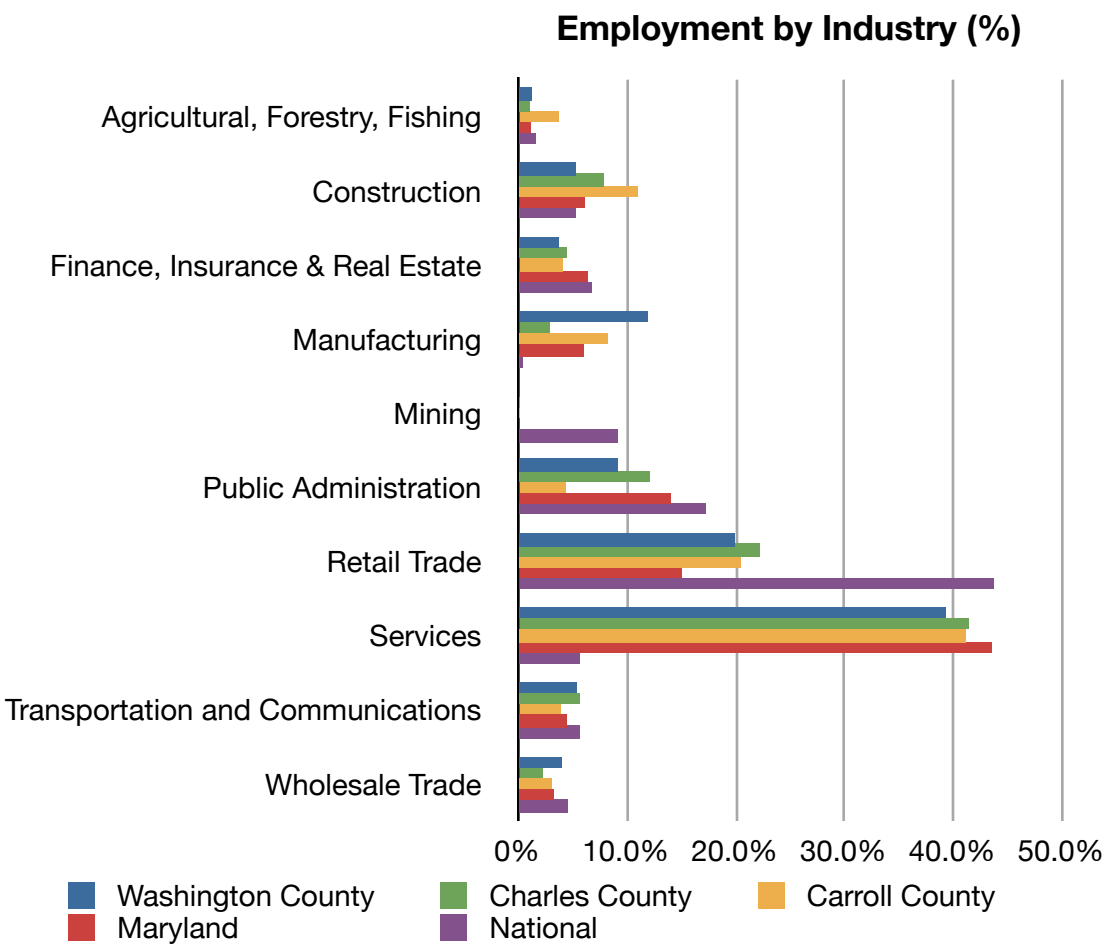
Business Size Distribution	Washington County	Charles County	Carroll County	Maryland	National
1 to 9 employees	63.4%	67.2%	76.9%	69.6%	70.4%
10 to 19 employees	9.1%	8.5%	8.7%	9.9%	9.3%
20 to 99 employees	4.7%	5.2%	3.5%	4.6%	4.7%
100+ employees	22.8%	19.1%	11.0%	16.0%	15.6%
Total businesses	3,489	2,668	4,258	138,607	7,601,169



Employment by Industry

Washington County's strongest industry based on employment are services based. The services industry also dominates in Charles County and Carroll County in terms of employment. However, the proportion is lower for Washington County than Charles County and Carroll County. Construction, finance, insurance, real estate, and retail trade are all sectors that have greater proportions of employment in Charles County and Carroll County than Washington County. Broadband infrastructure can impact the growth of jobs in services. As more organizations are dependent upon using the Internet to communicate and expedite daily tasks, there will be a greater demand of hiring staff to provide services.

Employment by Industry	Washington County	Charles County	Carroll County	Maryland	National
Agricultural, Forestry, Fishing	1.3%	1.1%	3.7%	1.2%	1.6%
Construction	5.3%	7.9%	11.0%	6.1%	5.3%
Finance, Insurance & Real Estate	3.7%	4.5%	4.1%	6.4%	6.8%
Manufacturing	11.9%	2.9%	8.3%	6.0%	0.4%
Mining	0.0%	0.2%	0.1%	0.1%	9.1%
Public Administration	9.2%	12.1%	4.3%	14.0%	17.3%
Retail Trade	19.9%	22.2%	20.4%	15.0%	43.7%
Services	39.3%	41.4%	41.1%	43.6%	5.7%
Transportation and Communications	5.4%	5.7%	3.9%	4.5%	5.7%
Wholesale Trade	4.0%	2.2%	3.1%	3.3%	4.6%


Employment by Industry (%)
Agricultural, Forestry, Fishing
Construction
Finance, Insurance & Real Estate
Manufacturing
Mining
Public Administration
Retail Trade
Services
Transportation and Communications
Wholesale Trade
0%
10.0%
20.0%
30.0%
40.0%
50.0%
Washington County
Charles County
Carroll County
Maryland
National