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2012

Arizona's Strategic Plan for Digital Capacity

Expanded & Reference Version {Draft}

DIGITAL ARIZONA
COUNCIL

October 15, 2012

Digital Arizona

{ Expanding Innovation
Through Connectivity

 **ASET**
Arizona Strategic Enterprise Technology

 **Digital Arizona**
PROGRAM

Arizona's Strategic Plan for Digital Capacity

Expanded & Reference

NOTE: This is the Expanded & Reference Version. The Summary and Full Report versions are available at: [www.digitalarizona.gov/Digital Arizona Council/Strategy.html](http://www.digitalarizona.gov/Digital_Arizona_Council/Strategy.html)

Preface

Improving Arizona's digital capacity is critical to the future well-being of Arizonans. This is the first ever Arizona citizens' report on digital capacity.

Five citizen task groups drafted initial recommendations that were further developed by the Strategic Planning Task Group. Chair of this task group is Michele Norin, Chief Information Officer (CIO) for the University of Arizona. Ms. Norin is the winner of the CIO of the Year Award in 2011, given by the Arizona Technology Council.

The Strategic Planning Task Group reported out a draft to the Digital Arizona Council (DAC). The Council is chaired by Aaron Sandeen, State CIO and Arizona Department of Administration (ADOA) Deputy Director. Twenty Arizona citizens from diverse backgrounds who serve on the DAC, ultimately amended and voted to approve this report.

The Digital Arizona Council members recommend that this strategic plan be a living document. As such, it should be reviewed, changed and used over time.

Providing staff support for this effort is the ADOA's Arizona Strategic Enterprise Technology (ASET) office, under the direction of State CIO Aaron Sandeen.

Daily coordination was provided by ASET's Director of Digital Planning Michael Golden, industry technologist and thought leader in the area of advanced connectivity architecture; Galen Updike, former Arizona State Representative, who serves as Arizona's Broadband Development Manager, with Jeffrey Crane, serving as Project Manager.

ASET's office address is 100 N. 15th Ave. Suite 400, Phoenix, AZ 85007, and their main phone number is: (602) 542-2250

ASET's website is: <http://aset.azdoa.gov/>

The Digital Arizona Program's website is: <http://DigitalArizona.gov/>

The project's email address is: question@DigitalArizona.gov

ASET engaged Data-Site Consortium, Inc. to support the generation of this Broadband Strategic Plan and coordinate the gathering of stakeholder inputs and drafting of said document. The consulting team was led by Mark Goldstein and included Oris Friesen, Mike Keeling, and Brad Zerbe.

Disclaimer

This report is written by a citizens group of volunteers. None of the information in this report should be construed as official public policy of the Arizona State government. However, funding to assist in producing this report is from a federal grant managed by an Arizona State agency.

Digital Arizona

Turning IDEAS into ACTION!

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Arizona's Strategic Plan for Digital Capacity

Executive Summary

“In this 21st century economy, Internet access and jobs go hand-in-hand.”

Governor Janice K. Brewer (Brewer, 2012)

Americans in the 21st century increasingly rely on high-capacity digital connectivity at ever-increasing speeds to engage, to compete, and to succeed in the global economy. Arizona's economic competitiveness demands that affordable digital capacity be available to all of its communities and citizens. Far too many Arizonans do not have access to, cannot afford, or do not use high-capacity digital services today. **It is the mission of the Digital Arizona Council to turn this “digital divide” into a “digital opportunity.”** Enabling all Arizona residents and institutions to realize their potential in the Information Age is certainly one of the State's most significant challenges this century.

Digital capacity encompasses the physical plant for high-speed access to the Internet and advanced digital services, as well as a broad range of digital end-user equipment such as computers, smart phones, tablets, and entertainment devices. This digital infrastructure will be as important to the economy and quality-of-life of Arizona residents in the 21st century and beyond as other essential infrastructures such as electric power, water, and highways have been in the past. Advancing our digital infrastructure will be fundamental to progress in every area of society including education, healthcare, research, business, public safety, government and the environment.

Census data reveals Arizona ranks 18th in coverage among the states and District of Columbia with 79.1% of Arizonans living in households with Internet access and ranks 31st in individuals accessing the Internet at home at 64.6%. In another study, Arizona ranks 34th among the fifty states in average digital connection speeds. In a letter to Arizona State legislators, Arizona Department of Education Superintendent John Huppenthal stated that the minimum speed required to support their education transformation plans is 6 megabits per second per student at school and at home. However, this Internet service speed offering is only available to 72% of rural areas and 57% of sparsely populated rural areas in the State. Until this deficit is corrected in rural areas, statewide plans for educational transformation cannot be fully implemented.

There are major barriers to overcome for rural Arizona's digital buildout. These include the costs and delays in permitting processes, lack of consistent rules among jurisdictions, inadequate long-distance connections (middle mile) infrastructure, and lack of network resiliency. Digital service providers need help from state and local governments in reducing regulatory barriers and leveraging state and regional government owned assets to motivate and justify their investments in rural Arizona, where there is less population density and fewer potential customers. Toward this end, the Governor recently signed into law the landmark Digital Arizona Highways Act of 2012, allowing conduit for fiber optics to be built along Arizona's highways using State rights-of-way. The Arizona Strategic Enterprise Technology Office through the Digital Arizona Program outlined in this strategic plan is analyzing the potential for using this system and possible mechanisms for its funding and implementation. This is an important first step in realizing an Arizona digital capacity infrastructure strategy.

Creating Arizona's leading-edge digital infrastructure for the 21st century is a task that must be shared by government, industry, educators, researchers, first responders, community institutions, entrepreneurs and philanthropists. Together, these stakeholders should implement a comprehensive plan consisting of the following ten recommendations:

DIGITAL BUILDOUT - Facilitate the buildout of high-speed digital infrastructure by the private sector in cooperation with government entities (at all levels) to provide for the needs of all Arizonans

INCREASE ADOPTION - Increase the use and adoption of high capacity digital connectivity and technologies

LEADERSHIP MATTERS - Formalize and sustain state-level and regional digital leadership

PLANNING AND ECONOMIC DEVELOPMENT ARE CRITICAL - Drive digital-related local community planning and economic development

OUTREACH - Drive community outreach through policies, programs, and local engagement

EDUCATION AND JOB READINESS – Facilitate the implementation of underlying technologies, digital curricula, collaboration, and professional development to promote improvements in education and workforce development

IMPROVE HEALTHCARE – Facilitate the expansion of a robust statewide telehealth ecosystem

ADVANCED RESEARCH - Catalyze and enable an environment of discovery, innovation and research

PUBLIC SAFETY COMMUNICATION - Support and align with the public safety community in enhancing and leveraging operations and communication capabilities

ENERGY AND THE ENVIRONMENT – Support the leveraging of digital capacity to reduce/optimize energy consumption and protect the environment.

This document contains detailed actions that will enable each of the above recommendation areas of the plan to be accomplished.

In this strategic plan, we envision the long-term benefits of digital capacity development for the State of Arizona. It will transform education, healthcare, and research, improve public safety and government operations, create major new opportunities for business and employment, reduce energy consumption and protect the environment, and enable a long-term future of sustainable economic development. We have emphasized the most cost-effective, flexible approaches to build this digital capacity infrastructure. Arizona needs to remove barriers and develop public policies and market-driven strategies that encourage private-sector investment to provide cost-effective high-speed broadband Internet access and advanced digital services throughout the State. Our primary strategy is to enable the private sector to provide the digital infrastructure and services, but government and alternative funding should be considered where the private return on investment is not sufficient for this to occur.

We believe the long-term benefits to the state and nation will greatly outweigh the costs of the required digital infrastructure. The Digital Arizona Program will create models to quantify the long-term benefits and costs for sample rural communities in the near future. Given that these statewide and national benefits are critical to our future, we believe there is a strong case to be made for state and federal government assistance in supporting communities in developing the required digital capacity infrastructure and corresponding services. This will be an investment in Arizona and the United States that will yield immense societal returns for current and future generations.

Digital Arizona Council (DAC) Strategic Plan Task Force Letter

Dear Fellow Arizonans,

The Arizona Strategic Plan for Digital Capacity is the product of many volunteers. They represent a diverse cross section of your fellow citizens. Their interest is in the future of Arizona's digital capacity for the betterment of all Arizonans.

Together this document represents a consensus viewpoint.

The Arizona Strategic Plan for Digital Capacity is approved by the Digital Arizona Council in the final form you see here. It is a strategic roadmap for the future of digital capacity in Arizona. This is a living document that will be monitored, changed and adapted to meet the digital needs of Arizonans.

This report takes into account the Governor's Four Cornerstones of Reform, the Governor's P20 Council Arizona Education Reform Plan, and Arizona's Statewide Strategic IT plan, plus the Governor's recently signed Digital Arizona Highways Act of 2012. This report aligns with these other goals and reforms.

When creating a report, it is not unusual to have different views from diverse interests. However, this report received a great deal of equanimity and consensus from those who participated in its creation, and those who voted to adopt it.

All agreed that development of digital capacity in Arizona is key to Arizona's future. Having access to adequate digital capacity for all Arizonans is vital. Capacity and speed of the digital systems in our State are decisive factors in success with this incredible tool.

Success is measured by how Arizona's digital capacity is used creatively in Arizona's private sector, government, economic development, education, healthcare, public safety; and in the "pursuit of happiness" by our fellow Arizona citizens.

The Digital Arizona Council

Acknowledgements

The DAC thanks the many Arizona volunteers who served on various task forces and Arizona's State employees who contributed and helped make this strategic plan possible.

Six task groups with some 70 participants gave their time to help. Without the assistance of these volunteer citizens this first ever Arizona citizen digital report would not have been possible.

The DAC provides governance, advice, and balanced representation for Arizona's diverse Digital Stakeholders, for the Digital Arizona Program (DAP).

The Council includes twenty one member positions with seven positions from each of three diverse groups.

The digital provider category includes Incumbent Local Exchange Carriers (ILECs), cable companies, cellular/LTE, fixed wireless, satellite, wholesale backhaul, urban and rural representation.

In the business/community citizen category there are representatives from healthcare, education, manufacturing, tourism, retail, and rural, urban and tribal communities.

Government representatives include State agencies as customers and as policy makers; plus local governments as customers and as policy makers. The members of the DAC are:

- Aaron Sandeen, State CIO and ADOA Deputy Director (DAC Chairman)
- Michael Bernstein, Co-Founder, Simply Bits, LLC
- Honorable Robert Burns, Former Arizona State Senate President
- Teri Drew, Regional Director, Northern Arizona Council of Governments
- Jodie Filardo, Community & Economic Development Director, Town of Clarkdale
- Jeremy Graves, Chief Operating Officer, Marketing & Sales, Valley Telecom Group
- John Halikowski, Director, Arizona Department of Transportation
- John Huppenthal, Arizona Superintendent of Public Instruction, Department of Education
- Michael Keeling, President, Data-Site Consortium, Inc.
- Tom McCloud, Director, DHG Manufacturing, Intel Corporation
- Michele Norin, Chief Information Officer, University of Arizona
- Alan Pitt, MD, Neuroradiologist, Barrow Neurological Institute
- Leroy Shingoitewa, Chairman, Hopi Tribe
- Kenneth McMahon, VP/General Manager-Phoenix, CenturyLink, Inc.
- Hyman Sukiennik, Vice President, Cox Business Arizona, Cox Communications
- Craig Sullivan, Executive Director, County Supervisors Association of Arizona
- Kelly Udall, Town Manager, Town of Pinetop-Lakeside
- Daman Wood, Vice President, Wholesale Markets, Airband
- Emerson Yearwood, Assistant General Counsel, Regulatory Affairs, Cable One, Inc.
- Steven Zylstra, President & CEO, Arizona Technology Council

Digital Capacity is the Foundation for Arizona's 21st Century Economy

Arizona celebrates its centennial this year. Major infrastructure projects were key to Arizona's first century of growth, including the Hoover and Roosevelt Dams, the Central Arizona Project, railroads, and the interstate highway system. Arizona's digital capacity infrastructure will be as important to the economy and quality-of-life of Arizona residents in this century and beyond as other essential infrastructures, such as electric power, water, and transportation were in the past. The building of roads, highways, and railroads fostered commerce, international trade, and jobs; so, too, does this new information superhighway as it processes and moves information 24 hours a day, with a capability and speed dictated only by the capacity of the digital infrastructure. Advancing our digital infrastructure will be fundamental to progress in every area of society including education, healthcare, research, business, government, public safety, agriculture, energy and the environment.

The term "Digital Capacity" refers to high-speed (often called broadband) wireline and wireless access to the Internet and a broad range of digital end-user equipment, which together form the digital capacity infrastructure. Advanced digital services provided to consumers beyond basic internet service include mechanisms that guarantee quality of service and security. Advanced digital capacity also provides support for content delivery to improve user experiences in viewing Web sites, video streams, conferencing and collaboration services. Digital end-user equipment includes computers, servers, local area networks, supercomputers, tablets, smart phones, smart electric meters, smart appliances, digital cameras, entertainment devices, and sensors.

Competing and succeeding in the 21st century global economy requires Arizona to deploy and expand digital capacity that delivers high-capacity connectivity to all its communities and citizens. Yet, far too many Arizonans either do not have access to, cannot afford, or do not use high-capacity digital services today.

There are two primary infrastructure components in network services required to deploy broadband into a community - last mile and middle mile. Middle mile is the means by which high capacity connections are delivered to a community. The last mile is the capacity that is available within a community.

If a shared middle mile infrastructure is not available at reasonable rates, communities, or last mile providers, must construct their own middle mile infrastructure. This increases overall costs that can significantly increase the end users' monthly rates. Due to recent advancements in wireless, and other technologies, last mile deployment of broadband is becoming more cost-effective, even in unserved and poorly served areas of the state with sparse populations. A number of companies have expressed interest in providing last mile service in these areas. In order to deploy their networks, and charge reasonable rates, they must have access to sufficient and reasonably priced middle mile connections.

Major barriers to rural Arizona's Digital buildout include the costs and delays in construction permitting processes, lack of consistent rules among multiple jurisdictions, inadequate long distance backhaul (called middle mile) infrastructure capacity, and lack of network connectivity redundancy. Broadband providers report that the cost of obtaining permits and delays in approvals are significant barriers to digital capacity investment and deployment. Such excessive delays and costs reduce the return on investment (ROI) for the private providers in our state; especially in rural Arizona where there is less population density and fewer potential customers. (FCC, 2010, p. 131)

Arizona also lacks wide area interconnected fiber-optic rings to create robust statewide digital connections. Many communities are essentially stranded islands of digital capacity lacking fail-safe redundancy and inadequate backup in emergencies. There have been numerous Arizona

communities that have experienced prolonged broadband Internet and 9-1-1 outages resulting in millions of dollars in economic damage. Ideal digital infrastructure is constructed in rings or interconnects so if there is a cut in the line, the system can route traffic in other directions. (Data Site Consortium and International Research Center, 2009, p. 50)

It is the mission of the Digital Arizona Council (DAC) to turn this “digital divide” into a “digital opportunity”. Enabling all Arizona residents, educational institutions, libraries, healthcare providers, public safety jurisdictions, businesses and government agencies to realize their potential in the Information Age may be the State’s most significant challenge this century.

How Will Digital Capacity Availability and Use Impact Arizona?

About 680,000 Arizonans live in rural areas (US Census Bureau, 2010). Without adequate digital capacity in parts of rural Arizona, students there will continue to have many fewer educational opportunities than urban students. Young people, bored and frustrated by the inadequate digital systems that cannot run their applications, will seek a future elsewhere. Business opportunities and jobs will be limited. Rural healthcare will continue to suffer.

With expanded digital capacity, rural businesses will not be limited to customers just in their area, but can sell on the Internet and address a national and global market. Businesses that require robust digital capacity to operate could locate in rural Arizona, creating new jobs. Advanced uses of telemedicine in rural Arizona healthcare facilities could provide enormous benefits with the availability of infrastructure for healthcare messaging, health monitoring and health collaboration. Telemedicine can reduce patient travel costs and time, provide an additional revenue sharing stream for financially-struggling rural hospitals, give immediate access to additional emergency and specialty care from medical experts in other locations, speed up medical records transmission, transmit x-rays for quicker results, provide remote diagnosis and treatment, improve the quality of care and save lives.

Improved digital capacity for Arizona opens up a world of educational opportunities for Arizona’s school children. These include satisfying the Common Core Assessment requirements, online tutoring and e-learning systems for individualized instruction at a student’s own pace in school or at home. Other education opportunities include distance learning with experts in other locations, collaboration between urban and rural schools, live remote field trips to places all over the world, online academic competitions and interactive exchanges with students in other locations.

Digital infrastructure benefits extend beyond schools to higher education, libraries, and research institutions. For example, libraries can become centers of excellence in job search for the unemployed. Advanced research and development in healthcare, biology, aerospace engineering, science, and national security will be enabled by the capability to transmit massive amounts of data through interconnecting high-performance computer networks.

Government operations will become more accessible and effective for all Arizona citizens. More and more government services will be offered online. The Arizona Department of Administration’s (ADOA) Arizona Strategic Enterprise Technology (ASET) Office operates the State’s web portal and has the bold goal to eventually provide to all Arizona citizens online digital government services that are “available anywhere, at any time, to every Arizonan.” (ASET, 2012) Public safety will be improved by enabling interoperability of voice, data and video communications among all first responders to emergencies such as forest fires and life threatening accidents. Law enforcement will be enhanced with high-speed remote access to data communications capabilities. To make these goals a reality, Arizona needs world-class digital connectivity.

Advanced digital infrastructure can enable Arizona to move along the path of sustainable economic

development reducing energy consumption and protecting the environment for current and future generations. It will allow individuals and organizations to substitute telecommunications for travel via telework, distance learning, teleshopping and e-commerce, remote healthcare practices, and e-government. “American families can save nearly \$8,000 a year on entertainment, travel, housing, automotive and other costs by using broadband Internet connectivity, according to data issued by the Internet Innovation Alliance” (Engebretson, 2010). The electric power network can be modernized to become a smart grid that effectively uses renewable solar and wind sources for power generation, optimizes electric power consumption by end users and makes possible the mass deployment of electric and hybrid electric vehicles.

This document explains the broad range of benefits for education, healthcare, research, economic development, public safety, government operations, energy and the environment that could be realized with an advanced Arizona digital capacity infrastructure.

Arizona’s Digital Networking Capacity Gap

Individuals and organizations are continually demanding higher-speed and higher-capacity networking access over time for running more advanced applications and to achieve better performance. For example, an Apple iPhone 4s requires three times the amount of bandwidth as an Apple iPhone 3. A rural hospital can evolve from e-mailing X-rays and Magnetic Resonance Imaging (MRI) scans to providing services to local patients from specialists at an urban hospital through telepresence video-conferencing.

The Federal Communications Commission’s (FCC) National Broadband Plan (FCC, 2010) uses a legal definition for broadband Internet access based on minimum upload and download speeds. These broadband speed definitions and requirements, beginning in Kilobits per second (Kbps) and moving to Megabits per second (Mbps), increase dramatically over time.

- *1999 definition: 200 Kbps download, 200 Kbps upload*
- *2012 definition: 4Mbps download, 1Mbps upload*
- *2015 definition: 50 Mbps download, 20 Mbps upload*
- *2020 definition: 100Mbps download, 50 Mbps upload (FCC, 2010, p. 9)*

Thus, in 2020, the National Broadband Plan goal for the speeds to meet the definition of broadband access, compared to the 1999 definition, will be 250 times greater for upload speeds, and 500 times greater for download speeds. Clearly, a flexible, cost-effective digital infrastructure strategy must be developed to keep pace with these rapidly-rising digital networking capacity requirements.

New census data reveals:

- Arizona ranks 18th among the 50 states and the District of Columbia in coverage with 79.1% of Arizonans living in households with Internet access.
- Arizona ranks 31st in individuals accessing the Internet at home at 64.6%.
- Arizona ranks 15th in Individuals with a household computer at 84.2%.
- Finally, Arizona ranks 24th with 40.4% of individuals in the state having access to the Internet from a location outside their home. (US Census Bureau, 2010)

Arizona’s own broadband data collection through the National Telecommunications and Information Administration (NTIA) grants yield significant real-world data. For an Internet connection speed of 6

Mbps download, the download speed recommended by the Arizona Department of Education (ADE) for its education transformation plans, the service availability percentages for households is only 72% for rural areas, and only 57% for sparsely populated rural areas, leaving some 43% of households in sparsely populated rural areas without such higher-performance services. See Appendix A for more detailed analyses.

Akamai Technologies gives another view using data gathered across its global server network, which serves an estimated 20% of the world's Internet traffic, to provide continually-updated visualizations of global Web traffic and performance. In their most recent reporting for Q2 2012;

- Arizona ranks 45th among the 50 states and the District of Columbia with a 4.8 Mbps average speed experienced by broadband subscribers.
- For average peak speed, Arizona ranks 48th with 19.7 Mbps.
- For overall broadband adoption of over 4 Mbps, Arizona ranks 44th with 43% of the population utilizing such services realizing a 24% increase in subscribership from 35% in Q3 2007.
- For high broadband adoption over 10 Mbps, Arizona ranks 43rd with 8% of the population utilizing such services realizing a 135% increase in subscribership from 6% in the last year and a 450% increase from 2% in Q3 2007.

Further details and comparisons can be found in Appendix A of the Expanded & Reference Version.

From another study:

- Arizona currently ranks 34th among the fifty states in average digital connection speeds.

Among our neighbors:

- California ranks 8th
- Nevada 9th and
- Utah ranks 2nd. (Woolley, 2011).

The current NTIA Broadband Mapping grants run through 2014 and it remains uncertain whether any federal support for the states' efforts will be provided after that. So, if Arizona wishes to continue with its broadband data collection, mapping and analysis efforts after that time, plans must be put in place and resources found to support its continuation.

Rural Digital Capacity Buildout: Digital Arizona Highways Act of 2012

There are major barriers to overcome for rural Arizona's digital buildout. These include the costs and delays in permitting processes, lack of consistent rules among jurisdictions, inadequate long-distance connections (middle mile) infrastructure, and lack of network capacity resiliency. Digital service providers need help from Arizona state and local governments in reducing regulatory barriers and leveraging state and local government-owned assets to motivate their investment in rural Arizona, where there is less population density and fewer potential customers.

Toward this end, Governor Jan Brewer recently signed into law the landmark Digital Arizona Highways Act of 2012, allowing conduit for fiber optic cables to be built along Arizona's highways

using State rights-of-way. Now Arizona's legal definition of transportation, within rights-of-way of Arizona's highways, includes transport of information as well as vehicles (Arizona Council of Engineering Companies of Arizona, 2012). (Arizona State Senate, 2012) (Arizona State Legislature, 2012) This legislation essentially creates "two highways for (nearly) the price of one." The cost to lay fiber conduit along highways is approximately the same order of magnitude as the cost to paint the stripes on the highway (ASET, 2011). However, in support of the intent of the Digital Highways Law, the Arizona Department Of Transportation (ADOT) is encouraged to review its rules regarding where and how fiber-conduit might be deployed along it's rural highway rights-of-way for the purpose of facilitating and lowering conduit construction costs within the context of reasonable safety standards and federal rules to accelerate rural fiber conduit build-outs. Many other state DOTs have identified multiple ways to safely and creatively accelerate build-outs in rural highway rights-of-way.

The ASET Office through the Digital Arizona Program (DAP) is analyzing the potential for using this system and possible mechanisms for its funding and implementation. This is an important first step in realizing an Arizona digital capacity infrastructure strategy. It enables private-sector deployment of middle-mile infrastructure to reach rural communities in a cost-effective manner, and the fiber-optic cables provide the flexibility for virtually unlimited amounts of capacity to support any future networking applications. Last mile connectivity to end users in rural communities also needs to be addressed. A cost-effective, flexible proposal for this includes multiple-use cell towers that transmit high-capacity microwave beams to major end-user sites, such as schools, libraries, hospitals and other Internet Service Providers (ISPs). The towers can be shared for other applications including public safety (possibly in the new federal government FirstNet network) to reduce costs.

The State of Arizona is not in the business of competing with the private sector and has long held to the tenet of being an anchor tenant or reliable customer to suppliers and providers of broadband. Such a customer relationship can help a provider justify private investment and the extension of service portfolios to rural and higher business risk areas. In fact, certain kinds of State participation in the telecom business and granting of State assets are prohibited by the gift clause provisions of the Arizona Constitution (Arizona State Constitution, 1912). Arizona does not want to subsidize business, but rather to facilitate and support business and be its reliable partner and customer in the telecommunications and broadband arena.

Complementary to the Digital Arizona Highways Act of 2012, a recent federal Executive Order will allow and enable broadband construction that is up to 90 percent cheaper and more efficient along Federal roadways and properties. Currently, the procedures for approving broadband infrastructure projects on properties controlled or managed by the Federal Government, including large tracts of land, roadways and more than 10,000 buildings across the nation, vary depending on which agency manages the property. This new Executive Order will ensure that agencies charged with managing Federal properties and roads take specific steps to adopt a uniform, simplified, and accelerated approach for allowing broadband carriers to build networks on and through those assets and speed the delivery of connectivity to communities, businesses and schools. (Office of the White House, 2012)

A Comprehensive Plan for Arizona's 21st Century Economy Based on Digital Infrastructure

The DAC believes that Arizona's stakeholders will need to achieve the following objectives:

Provide sufficient ubiquitous digital capacity to Arizona's citizens and institutions to support common applications available at any specific point in time, while recognizing that future digital demand will increase exponentially over time.

Provide ultra-high bandwidth digital capacity for advanced research in areas of demand such as in and around research universities and institutions.

Increase adoption and use of digital broadband by those who cannot afford it, do not have access to digital capacity in a public place, or who need training in how to utilize the opportunities available through the Internet including research for job opportunities, making employment applications and job training.

Enable and facilitate the private sector to provide more digital capacity to rural Arizona by leveraging State assets, unlike other states that have built state-owned networks that compete with the private sector.

To meet these objectives, public and private-sector stakeholders should undertake a comprehensive plan that will establish the foundation for Arizona's 21st century economy. Creating Arizona's leading-edge digital infrastructure for the 21st century is a task that must be shared by industry, government, educators, healthcare providers, first responders, researchers, community institutions, entrepreneurs and philanthropists. Together, these stakeholders should adopt and implement the following strategic plan consisting of ten recommendations. This strategic plan contains detailed descriptions and multiple specific actions that will enable each of the ten recommendation areas of the plan to be accomplished.

We conclude this strategic plan with a discussion of next steps. This includes the establishment by the ASET's Digital Arizona Program (DAP) of sample rural community models to demonstrate the broadband networking applications and quantify the long-term benefits and costs. We summarize the actions required from various responsible organizations to execute this plan. We also discuss the federal government, state government, and private sector funding options that must be considered to realize the full implementation of this plan, which will yield immense returns for current and future generations in Arizona and the United States as a whole. . Important public funding sources and options to consider are: expanding the federal government eRate program for telecommunications services and digital equipment for schools and libraries, creatively using federal FirstNet public safety assets to support a mutually beneficial cost-effective buildout of rural digital infrastructure, using the State's universal service and reforming the federal universal service fee on telecommunications services to build the state and nation's next-generation digital infrastructure and rewarding electric utility companies that use emerging energy-saving broadband technologies. It is important to involve stakeholders in a consensus based approach when evaluating these options.

Achieving the benefits that digital capacity will produce requires Arizona to adopt aggressive goals that in turn drive commitments and action. The recommendations in this report will serve as a roadmap and underlying mechanisms for rapidly expanding broadband in unserved and poorly served areas of the state; innovate new applications; increase awareness about broadband; and ensure that Arizonans have the resources and skill to take advantage of abounding digital capacity. Securing and maintaining Arizona's global leadership requires a vision and commitment to digital capacity goals and tasks that need be shared by government, entrepreneurs, philanthropists, industry, educators, researchers, and community institutions.

A call to action....

The following Ten Recommendations and Associated Action Items cover a wide range of issues and possibilities for how to actively expand essential digital capacity, its many applications and its widespread use throughout all of Arizona. Our goal is to create parity and beyond in being competitive with other states and countries for this century's economic growth and well-being.

Some of the actions described are quite broad. Others are very specific. The Digital Arizona Program, led by its Council will continue to focus on those actions directly relating to facilitating the private sector's expansion of the needed physical infrastructure and its performance in concert with local, regional and tribal communities.

However, there are many other important actions defined in this plan that are not directly within the scope of the Digital Arizona mission. It is our hope that the many diverse stakeholders whose own missions are dependent on improved and expanded digital capacity will embrace those actions proposed in this plan that they can act on directly.

Great progress can be made when Arizona's individual citizens, companies, communities and governments at all levels each recognize that Arizona's standing in the world with regard to Digital Capacity is their challenge too and begin to act so that bold and positive action can be taken.

-- Michael Golden, Director, Digital Arizona Program and Broadband Planning, ASET

Recommendation #1: DIGITAL BUILDOUT

Facilitate the build-out of high-speed digital infrastructure by the private sector in cooperation with government entities (at all levels) to provide for the needs of all Arizonans.

“Reliable, affordable access to high-capacity digital infrastructure has become as essential as water, sewer, transportation and electricity service in creating healthy and successful communities in the 21st century.” This is true for all communities, not just the urban and affluent ones. (Bolin, 2007)

However, rural portions of Arizona, which are unserved or poorly served by digital availability, are shut out of many improvements to education, healthcare, economic opportunities and quality of life. Some 677,662 Arizonans live in rural areas. (US Census Bureau, 2010; US Census Bureau, 2010) By comparison, the population of Arizona’s second largest city - Tucson - is 510,116.

In a March 7, 2012, letter to Arizona State Legislators, Arizona Superintendent John Huppenthal stated: “The minimum speed that is educationally sufficient to support ADE’s transformational plans is 6 Megabits per second per student.” This speed enables uninterrupted video communication and streaming and rapid downloads of educational content whether a student is at home or at school.” (Huppenthal, 2012)

The Arizona Digital map funded by a federal grant and managed through the state of Arizona’s DAP www.DigitalArizona.gov shows that at these educationally sufficient speeds of 6 Mbps download, the availability percentages for households decline to 72% for rural areas, and 57% for sparsely populated rural areas. Appendix A has more detailed tables and views.

However, it is important to note that speed standards are a moving target. In a 2003 State of Arizona study high speed digital capacity was defined at speeds of over 0.2 mbps, a number that is 30 times less than the 6 mbps standard. (Tritle, 2003) The federal government has set significantly higher speed goals by 2015 and again by 2020 that dwarf today’s minimum speed standards. The digital traffic flowing over the Internet is increasing exponentially. Increasingly sophisticated applications and the ever increasing use of video over the Internet for communication, education, healthcare, and entertainment is creating huge traffic demand on all digital delivery systems. The significance of this fact is that build-out of digital capacity capable of handling these increasing demands is an ongoing process and is critical to keeping rural Arizona from falling behind the rest of the state and the world.

Major barriers to rural Arizona’s Digital build-out include the costs and delays in permitting processes, lack of consistent rules among multiple jurisdictions, inadequate long distance capacity between metro areas and rural communities, and lack of network capacity redundancy. Digital providers report that the cost to get permits and the time to get to market are significant barriers to digital deployment—often representing half of a project’s cost. Right-of-way permitting delays and costs reduce the ROI for the private digital provider industry in Arizona; especially in rural areas where there is less population density and fewer potential customers. (FCC, 2010, p. 131)

Government policies and actions at all levels can either hinder or accelerate reducing the proportion of Americans that lack broadband connectivity. Substantial evidence shows that where government opens up its public rights-of-way (PROW) it lessens restrictions on the availability of privately owned Rights of Way (ROW), and reduces barriers that results in rapid increases of broadband connectivity. Arizona’s state government is not in the business of competing with the private sector but rather support business and be their reliable partner and customer in the telecom and broadband arena.

Arizona's strategic planning focus should be on the reduction of right of way and public rights of way barriers to further deployment of broadband connectivity in order to change the private digital provider "investor equation" and to accelerate private sector investment and build-out of middle mile and last mile digital capacity to rural Arizona.

- **Implement the State of Arizona legislation codifying two highways for the price of one and support Arizona Department of Transportation (ADOT) efforts to deploy conduit including rural pilot projects on an accelerated basis**

The Governor's new legislation SB 1402, signed on April 5, 2012, increases incentives for the private sector to build more and faster needed middle mile digital infrastructure to help meet Arizona's most important 21st century infrastructure need by allowing the state's highway rights of way to be utilized by the private sector for digital fiber build-out. (Arizona State Legislature, 2012)

This will dramatically speed up approval processes and reduce the cost of bringing high capacity digital connectivity to Arizona. Using Arizona's highway rights-of-ways is a natural location for long-haul fiber conduit since state highways connect major urban areas to remote population centers. Without the additional cost of access to rights of way the cost to dig and provide the conduit is roughly the same cost as painting the stripes on the highway. This legislation creates the potential for having two highways for nearly the cost of one.

Transportation highways for automobiles and trucks create nearby economic activity. So too will electronic highways that can now be built in rights-of-ways alongside Arizona's public transportation highways. (Utah Education Network, 2012)

Arizona has some 4,000 miles of highways that qualify under the Governor's new legislation to use their right-of-ways to build fiber conduit (highways in urban areas are exempted in the law). ASET through its DAP analyzed the potential for using this system. Working in conjunction with the State Land Department that has sophisticated mapping tools, some 2,000 to 3,000 rural trench miles have been identified that when built out could reach all rural Arizona communities.

Further, a significant opportunity for collocating fiber capacity is developing as the Arizona and Nevada Departments of Transportation work together on the two-year Interstate 11 (I-11) and Intermountain West Corridor Study. Congress recognized the importance of the portion of the Corridor between Phoenix and Las Vegas and designated it as future I-11 in the recent transportation authorization bill, Moving Ahead for Progress in the 21st Century Act (MAP-21). The study includes detailed corridor planning of a possible high priority interstate link between Phoenix and Las Vegas, and high-level visioning for potentially extending the corridor north to Canada and south to Mexico.

The study "Essential Infrastructure for Information Delivery," served as the foundation for the passing of the Arizona Digital Highways Law. (Keeling, 2011) It is anticipated that the Law will be implemented by DAP within the ASET Office of ADOA in partnership with ADOT and private sector providers and contractors. These relationships will be essential to support ADOT's and private providers' efforts to deploy conduit on an accelerated basis.

The DAP office will leverage market forces. This plan will provide the DAP office the authority to receive and distribute funding in support of digital infrastructure projects. It creates voluntary

permitting processes for digital capacity as best practices for jurisdictions that elect to adopt them, including rural Arizona government jurisdictions that do not have large legal and technical staffs to research and create such standards.

It is anticipated that the DAP will have the authority to price and manage leases to providers for access to Digital Highway conduits. This program is not intended to be a regulator but will coordinate with ADOT and digital providers in determining when and where optimum conduit construction should occur and how the funding will be provided. The program will also provide long range digital infrastructure strategic planning.

The DAP is distinct from the Office for the Arizona in that the DAP is not intended to be a traditional command - control structure. Instead, the program will focus on market constructs with the ability to mediate digital development disputes within its defined scope on a voluntary basis.

Seed capital is being sought to start development, and the generation of new revenue from leased conduit will then pay for building additional capacity. Providers may potentially invest in upfront development. The DAP will also seek additional federal and foundation funding.

Citizen benefits are driven by affordable services resulting from the DAP's barrier - reducing and market making collaborations with providers, ADOT and others.

The Digital Arizona Council recommends that the Digital Arizona Program have the following authority and goals:

Enable through administrative action by the State of Arizona the establishment of guidelines and best practices via the DAP for digital infrastructure including permitting, ROW, and sharing including:

- A voluntary municipal application process
- E-permits
- A permitting timeline for standard types of permits
- Metrics to measure efficiency of the permitting process and compliance to issued permits
- Guidelines for the use of blanket permits for large, long-term infrastructure placements
- Best practice guidelines on the placement of above ground facilities to speed deployment
- Rationalize best practice standards for conduit construction to assist ADOT in digital highway conduit buildout, incorporating industry standards and providing relief in soil depth requirements, the use of previously disturbed portions of rights-of-way, and other cost effective construction techniques in trenching fiber.
- Guidelines for placing standard spare conduit in the Rights-of-Way at times of construction

Further, Digital Arizona Council recommends that the DAP:

- Disseminate and advocate broad adoption of uniform permitting standards among communities and other stakeholders.
- Support and advocate private and Non-Governmental Organization (NGO) adoption.
- Establish straightforward and voluntary PROW/ROW dispute resolution methods.
- Standardize processes and time-periods for obtaining PROW/ROW permits from state entities and local governments associated with constructing digital infrastructure in Arizona.
- Work to limit ROW/PROW fees to their cost basis.

- **Encourage and support public/private partnerships to upgrade and provision Arizona’s digital infrastructure in the most cost-effective manner**

The most effective use of private/public partnerships to expand digital capacity is for government to share its resources more effectively with private digital providers. (Malik, 2012) If the government belongs “to the people” then this resource should be utilized to help expand digital capacity to the people of Arizona.

One example of a public/private partnership is the recently passed legislation SB 1402 cited above that allows private companies to have conduit along state highways right-of-way corridors to reduce the cost and time to market for digital infrastructure. Companies pay the state “at cost” the amount of money to gain access to this right-of-way. (Arizona State Legislature, 2012) (Arizona State Senate, 2012)

Another significant example of public/private partnerships is the sharing of tower space for equipment or co-location. This is discussed in more detail in Recommendation 9.

- **Support antenna and equipment placement on public-owned or controlled properties**

Another important public/private partnership digital buildout concept, in addition to tower locations, is utilizing government assets to place digital antenna and other equipment on the roofs and even sides of government buildings, on poles, and other creative locations that are physical assets owned or controlled by state or local governments. Many buildings and other structures that offer ideal locations for such equipment are owned by government. (FCC, 2010, p. 131)

Local and state government should make their buildings available for antenna and equipment placement at little or no cost. Just as tower co-location reduces cost, so does access to building locations. Conduit and/or fiber also travel over utility poles and in other places. Making access to these structures is important, too. (FCC, 2010, p. 131)

The National Broadband Plan states:

“Federal, state and local governments should do two things to reduce the costs incurred by private industry when using public infrastructure. First, government should take steps to improve utilization of existing infrastructure to ensure that network providers have easier access to poles, conduits, ducts and rights-of-way.

Second, the federal government should foster further infrastructure deployment by facilitating the placement of communications infrastructure on federally managed property and enacting “dig once” legislation. These two actions can improve the business case for deploying and upgrading broadband network infrastructure and facilitate competitive entry.” (FCC, 2010, p. 131)

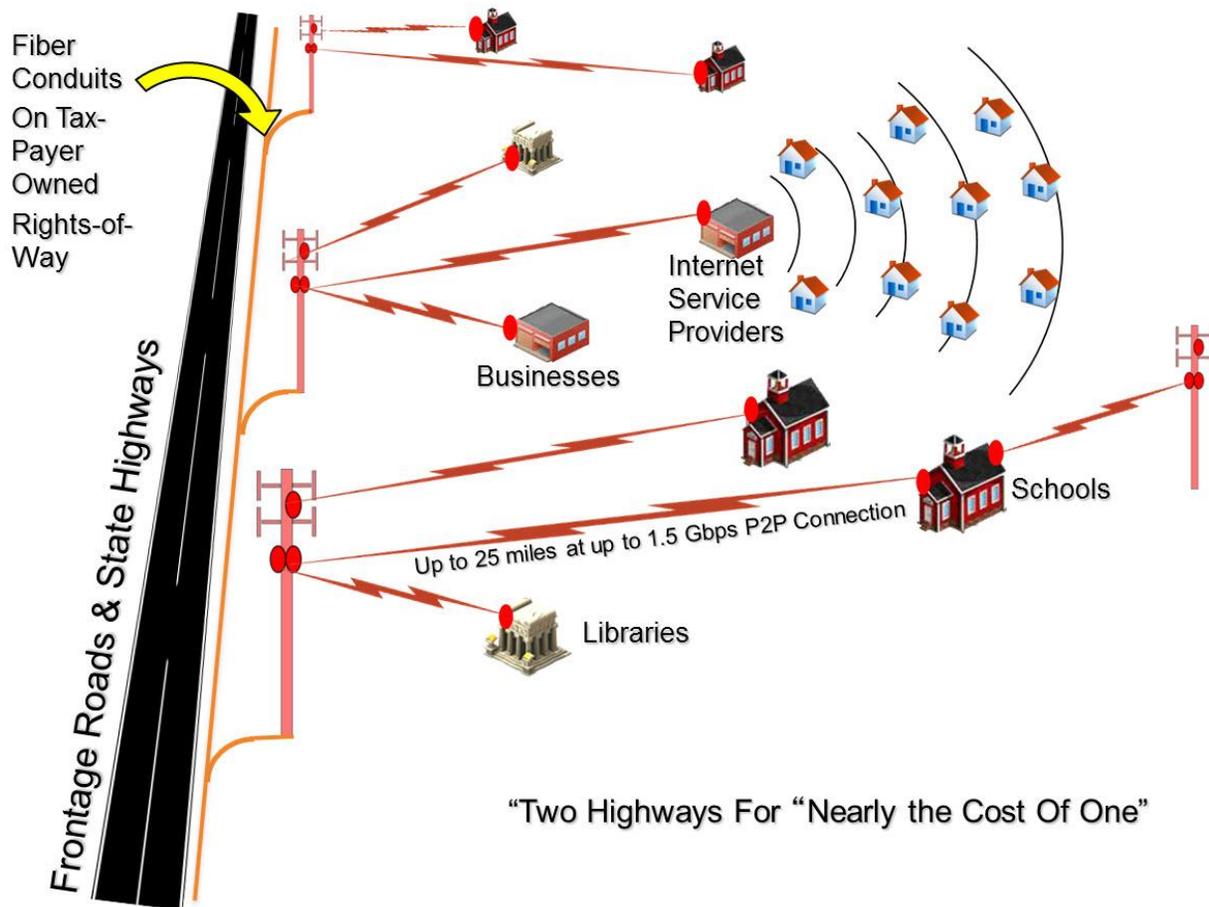
Just as wireless networks use publicly owned spectrum, wireless and wired networks rely on cables and conduits attached to public roads, bridges, poles and tunnels. Securing rights to this infrastructure is often a difficult and time-consuming process that discourages private investment. Because of permitting and zoning rules, government often has a significant role in network construction. Government also regulates how broadband providers can use existing private infrastructure like utility poles and conduits.

- **Assess and pursue anchor tenancy opportunities for government entities in the digital planning process to facilitate demand aggregation**

An additional public/private partnership opportunity is for government to serve as an “anchor tenant” and partner with private sector entities to create enough aggregated demand in rural areas to justify digital providers investing in their locale.

“Anchor tenant” is a term to describe a large digital Internet customer. (Swire, 2009) In rural Arizona the largest digital customers are often government entities. This includes state agency offices in rural Arizona, county and city government, law enforcement agencies, K12 schools, community colleges, libraries, community centers, hospitals and other major institutions.

Figure 1: Digital Arizona Tactical Model Illustration



(ASET, 2011)

Together these anchor tenants provide the consistent monthly cash flow funding needed to enable a digital provider serve the greater local rural community, including small businesses and individuals. Without such anchor tenant financial support there is no business model to sustain digital service to rural residents and small businesses. It is essential that rural anchor institutions embrace digital capacity and support local area providers by serving as a customer. Anchor tenants are part of the digital planning process. (Broadband in Rural Areas, 2012) (Levin, The Network Investor Equation, 2012)

Figure 2: The Network Investor Equation

$$\begin{array}{cc} \text{Costs} & \text{Benefits} \\ \hline C + O > (1-r)R + SB + (-CL) \end{array}$$

Network Investor Equation Definitions:

C - Capital Expenditures

O - Operating Expenditures

r - Risk

R- Revenues

SB- System Benefits (Benefits that drive increased revenues outside the communities where the new or incremental investments are made.)

CL- Losses due to competition

Changing the Network Investor Math

$$\begin{array}{ccc} \uparrow & \uparrow & \uparrow \\ C + O < (1-r)R + SB + (-CL) \\ \downarrow & \downarrow & \downarrow \end{array}$$

(Levin, The Network Investor Equation, 2012)

The ideas presented above are all intended to drive and improve the “network investor equation” which is a concept developed by Blair Levin served as the Executive Director of the Omnibus Broadband Initiative. In his role at the FCC, Mr. Levin oversaw the development of the Congressionally mandated National Broadband Plan. Previously, Mr. Levin served as Chief of Staff to FCC Chairman Reed Hundt from December 1993 through October 1997 where he oversaw the implementation of the historic 1996 Telecommunications Reform Act, the first spectrum auctions, the development of digital television standards, and the Commission’s Internet initiative. and served in the investment banking industry in the area of communications. Mr. Levin is currently the Executive Director of Gig.U, an organization that seeks to accelerate the deployment of ultra-high-speed networks to leading U.S. universities and their surrounding communities.

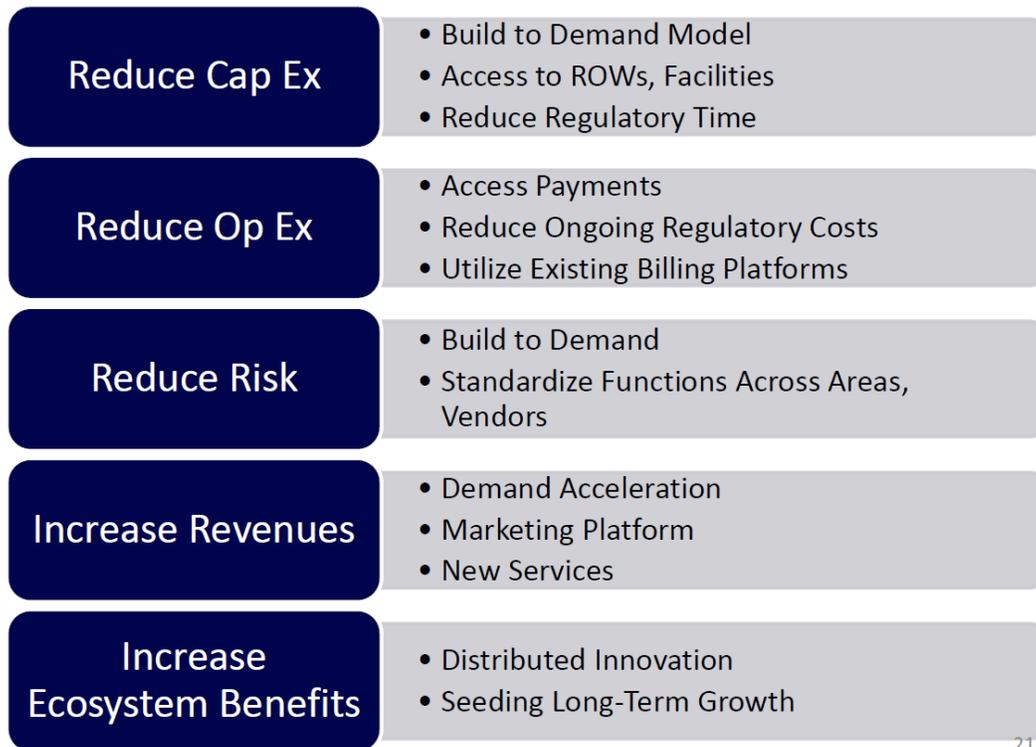
Mr. Levin’s formula presented above is intended to show how digital providers and policy makers can influence the factors involved in creating a positive return on investment in areas where providing digital connectivity can be challenging such as in rural Arizona. The DAP has current federal funding in its grant to coordinate demand aggregation in areas of need and is organizing Arizona’s COGs and other rural entities to create demand aggregation opportunities.

Influencing each of the factors in the formula as shown above, reduces right-of-way costs and time to market impacting a reduction in capital expenditures (Cap Ex). Co-location of towers reduces capital

expenditure requirements for digital providers. Aggregating demand through anchor tenants as digital customers increases digital provider revenues. Further recommendations below positively impact this formula for digital providers.

An implementation and funding model is shown below as an example manner in which the State of Arizona could implement the Digital Arizona Highways Act of 2012 (also known as 2012 SB 1402). This model incorporates federal recurring funds from the Universal Service Administrative Company’s (USAC) Schools and Libraries Division (SLD). The USAC/SLD funds are annual recurring grant funds available to Arizona K12 schools and libraries. This is just one of many possible sources of funds.

Figure 3: How Community Efforts Can Change the Math



21

Source: Blair Levin, Executive Director, Gig.U & former Director of the FCC National Broadband Plan (Levin, How Community Efforts Can Change the Math, 2012)

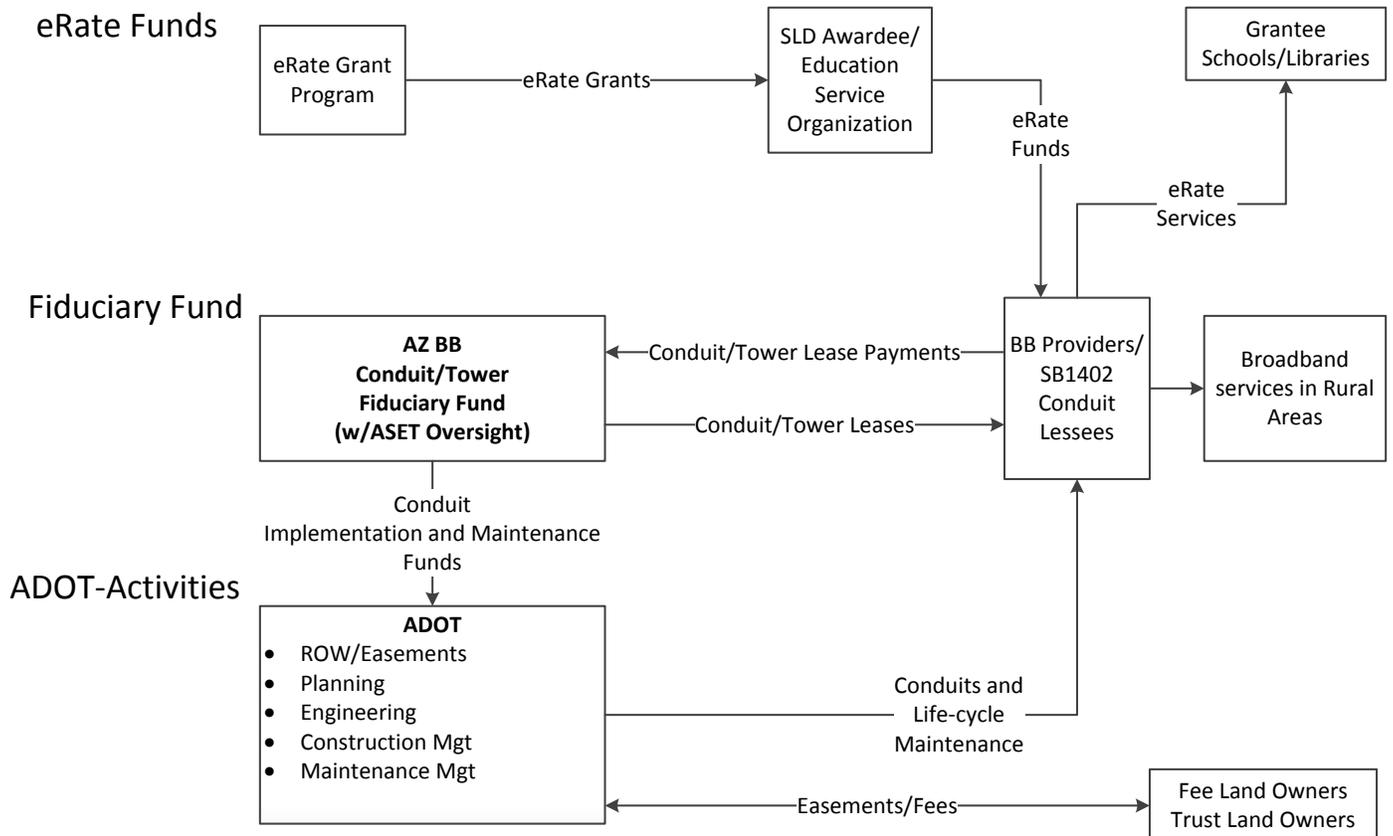
These funds and other funds, if organized in a fashion as shown in the model, can provide recurring revenue to rural Arizona broadband providers. In-turn these providers could utilize a portion of the funds for procuring fiber conduits and/or towers along Arizona roadways leading to the rural K12 schools, libraries and other broadband users. In return, the providers obtain long-term leases of the conduit and towers of interest to each of them.

The providers are free to utilize the leases in any manner that is commercially viable. Such utilization includes subleasing or otherwise negotiating the leases with other providers. In this fashion, the financing of conduits and towers is more likely to be restructured-over-time for enabling connectivity in rural areas by multiple providers. Typically, some providers will sell broadband services directly to users while others will concentrate on wholesale services to the retail providers. It is this combination of providers jointly using the conduits and towers, having flexibility for financial restructuring over the lease term, which should allow market forces to drive the expansion of retail and wholesale digital capacity throughout rural Arizona over time.

Additionally, within the above public-private partnership constructs, ASET is exploring financing means including securitizing the leases, tax-advantaged bonding, and closer planning and funding efforts with user educational, medical-services and economic-development stakeholders.

As shown, oversight of business and funding issues associated with broadband conduits and towers in State roadway rights-of-way is provided by ASET. ASET provides an initial forum for providers and other interested parties to explore potential routing and leasing options, and negotiate the provider leases. ASET is also envisioned to contractually provide any necessary fiduciary instruments that are necessary for assuring providers that their funds will only be used for agreed to purposes.

Figure 4: Possible Digital Arizona Program Funding Model Example



Also, as shown, the ADOT provides oversight of actual construction, maintenance, and construction safety management of the broadband conduits and towers—as well as associated life-cycle maintenance. It is envisioned that many of ADOT’s current roadway planning, engineering and related standards and procedures will be utilized. Leveraging these existing standards and procedures will allow conduit and tower projects to proceed-to-completion much more quickly and safely.

Similarly, because the Digital Arizona Highways Act of 2012 expands the definition of “transportation” (as it relates to ADOT) to include the “transport of information ” as well as vehicles, it is envisioned that many existing environmental and archeological studies can be re-utilized. In addition, ADOT currently interfaces efficiently with underlying fee-land-owners and trust-land trustees as required for establishing or expanding easements associated with the broadband conduits and towers.

Per the Digital Arizona Highways Act of 2012 all State rights-of-way and associated State-provided

services are made available at cost. These costs, including administrative costs, make up the lease-rate for the conduits and tower sites that are paid by the broadband providers. Ownership of the conduits and tower sites resides with the State.

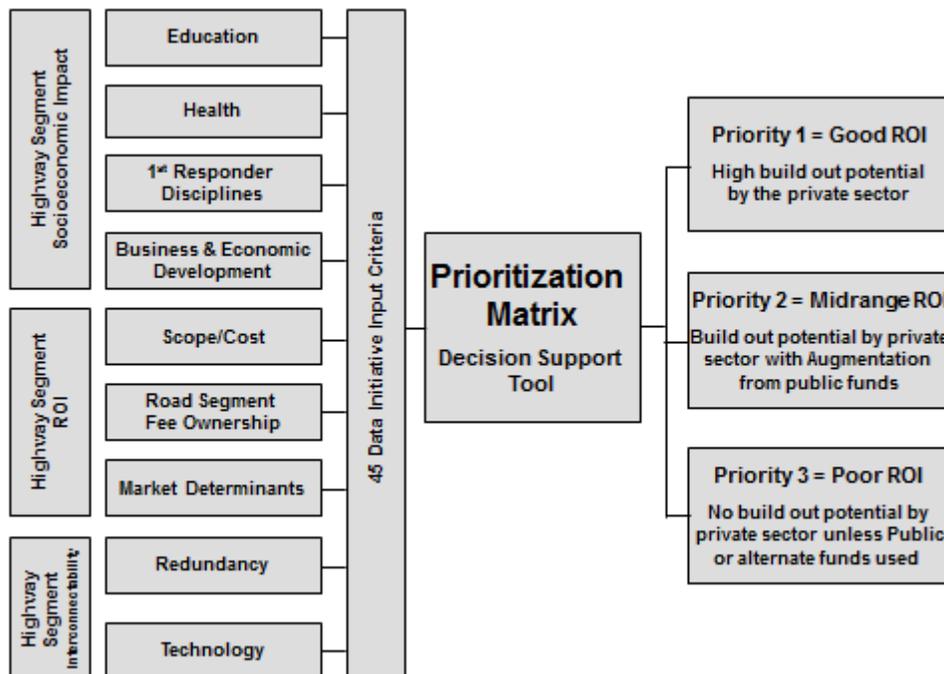
- **Drive digital infrastructure deployment to become more robust, redundant, and resilient over time to expand capacity for advanced applications and minimize the potential for interrupted service across the State**

Arizona’s digital map for middle mile fiber consists largely of a series of stranded runs that lack redundant paths so there are minimal fiber interconnects between incumbent local exchange carriers’ (ILECs) areas to provide backup in emergencies, as well as stranded communities without sufficient backhaul altogether. All major digital providers in Arizona that have middle mile capacity that is built should be interconnected to other existing middle mile capacity for the purpose of providing state-wide fail-safe redundancy to protect Arizona’s digital system. (Data Site Consortium and International Research Center, 2009, p. 50)

A prioritization matrix has been developed to support the evaluation and prioritization of DAP demonstrations and the subsequent statewide buildout staging process. This prioritization matrix will be an ongoing useful tool to determine the proper sequencing and staging of digital highway conduit buildout. This sophisticated decision matrix assists the decision making process by focusing on road segments rather than individual communities as the basis for evaluation on both empirical (data driven) and subjective levels. The tool supports a Management By Objective (MBO) framework oriented around three high level Objectives:

- Highway segment socioeconomic impact (high level physical impact)
- Highway segment ROI (prioritization by financial viability and return to providers)
- Highway segment interconnectability (SONET Ring viability and redundancy)

Figure 5: DAP Buildout Prioritization Matrix



Within the high level objectives, nine key priorities are identified to assist the gathering of vital information within over 45 key data initiatives. The resulting informative picture will assist in determining a “staged” buildout approach. Below is an illustration that provides further insights into this prioritization matrix process:

- **Provide access to state rights-of-way on a cost-recovery basis for fiber middle mile and wireless providers in unserved and rural areas**

A key DAP activity is to work with ADOT and private providers in managing conduit leasing and related issues. This work is done on a cost-recovery basis only so that capital costs to digital providers are kept as low as possible through the “two highways for (nearly) the price of one” concept. The DAP will also work to facilitate providers who seek the utilization of other rights-of-way such as utility towers, canals, railroads, etc.

By law, funding requirements for highway conduit construction must come from sources other than existing ADOT funding or the State’s general fund. ADOT manages all engineering and physical construction and traffic safety issues around construction.

The Digital Arizona Highways legislation – SB 1402 - allows rural Arizona highways to be used to connect Arizona’s cities and towns and become telecommunications corridors, not merely vehicular traffic highways; all without use of State General Funds or local funds. This cost-recovery provision can be made a requirement as part of an administrative action for the DAP.

The ADOT Director is enabled to construct trenches with multiple fiber conduits and cell tower sites along rural ADOT managed highways rights-of-way. Conduits will be made available to qualified carrier-class providers on a cost-recovery lease basis. Lease pricing is to be non-discriminatory. (Arizona State Legislature, 2012)

The 5-year cost estimates of this program are:

- \$25,000 to \$45,000 on average per rural conduit for each trench mile
- Approximately 2,500 to 3,000 rural trench miles
- \$15 million to \$20 million per year cost
- Covers entire state in 7 to 10 years
- Then program “sunsets” to maintenance mode only

Conduit Capacity Capabilities Impact:

This concept provides for up to 43 million Gigabits per second (Gbps) of incrementally implemented digital fiber-optic traffic along any single highway. This capacity can be distributed to communities by up to 21 million potential 1.5 Gbps point-to-point radio beams from dishes installed on cell towers supported by the highway fiber. With multiple dishes each cell tower could support - ten 1.5 Gbps Beams (15 Gbps) to each rural community. This potential capacity will support at least 100 years of incrementally and exponentially increasing demand for that capacity in rural communities and can support services that are equivalent to those available in metropolitan areas.

Every 15 Gbps of capacity beamed to a rural community represents the equivalent of:

- One Hundred and Fifty - 100 megabit simultaneous Internet connections
- Six Hundred - 25 megabit simultaneous Internet connections
- 1,800 simultaneous high-definition TV streams
- 5,400 Internet Hi Definition Internet Protocol Television (IPTV) subscribers

- **Develop and Advocate for New Rights-of-Way/Permitting Standards and Procedures to Facilitate Faster Deployment of Digital Services**

Digital service providers claim that non-uniform, inconsistent permitting and rights-of-way reuse policies at all levels of government are the major source of delays and economic disincentives to building more capacity, especially in poorly served rural areas. Many State and Federal agencies that control land and right-of-way do not yet appear to be committed to the national agenda for accelerating broadband capacity by expediting and simplifying their processes and working in a coordinated and uniform way with each other. (FCC, 2010, pp. 172-173)

Creating ROW and permitting best practice standards for consideration by local rural government entities is difficult because of limited budgets, and also because of smaller legal and technical staffs than are available in larger jurisdictions. A confusing patchwork of different regulations and requirements by jurisdictions in close proximity to each other frustrates digital providers and increases their costs for legal compliance and reduces their chances of starting digital buildout projects in rural Arizona. (Keeling, 2011)

Many state and local governments have taken steps to encourage and facilitate fiber conduit deployment as part of public works projects like road construction. Similarly, in November 2009, the FCC established timelines for states and localities to process permit requests to build and locate wireless equipment on towers. In addition, a federal executive order was issued on June 14, 2012 entitled “Accelerating Broadband Infrastructure Deployment,” which will significantly change the cost, speed and access to federal highways, lands and buildings for the buildout of digital infrastructure. (Office of the White House, 2012)

A November 2011 study conducted for the ASET Office and entitled “Essential Infrastructure for Information Delivery” makes six recommendations, including requiring a fixed time period for application decisions by government entities, and limiting the amount charged for fees. (Keeling, 2011)

Note: Regarding the original recommendation #6 in the November 2011 study, entitled Essential Infrastructure for Information Delivery: It was initially recommended that the State take over responsibility for administering ROW associated with utility poles, ducts, conduits, as well as related land easements for deploying fiber and towers that are currently under the jurisdiction of the FCC. However in consultation with service providers in Arizona, the DAC Strategic Task Force now feels this is unnecessary due to apparent industry satisfaction with current federal processes and administration.

- **Develop and pursue funding sources and mechanisms such as grants, digital bonds, public-private partnerships, and tax incentives to aid infrastructure deployment**

Creating tax incentives to build infrastructure brings down the cost of buildout and can mean the difference between yes or no to a digital provider, in determining to pursue a rural buildout project. The Arizona State Legislature recently created such tax incentives for other technology companies and this concept could be expanded to current Arizona digital providers. (Citation pending)

State tax credits for rural digital buildout for providers are another way to stimulate infrastructure buildout. Other states have used similar incentives. The cost to build rural digital infrastructure is significant because of the lack of population density. The cost to rural consumers is often higher and

reduces demand. Rural schools in Arizona often pay three times more for broadband than similar service in urban schools because of distance charges. (Citation pending)

An important grant opportunity which may help Arizona advance its digital buildout is to leverage Arizona's portion of the \$7 billion in funds allocated for the build out a National Public Safety Broadband Network (NPSBN) to be overseen by the First Responder Network Authority (FirstNet) working in conjunction with the States.

A solution to our Public Safety communications interoperability challenges has been a national goal since the tragedies of September 11, 2001. The NPSBN will go a long way toward solving many of the issues. . FirstNet's NPSBN is intended to allow first responders from different agencies, departments and jurisdictions to effectively communicate with each other in an emergency.

The allocated \$7 billion will go a lot further toward fulfilling our coverage needs if the types of cooperative sharing arrangements that DAP has been proposing are considered and implemented. (Strickling, 2012) For instance, to obtain optimal 4G LTE coverage, more tower sites will be required in each local jurisdiction. If those site requirements could leverage local governmental buildings and structures, and if Public Safety would allow sharing of the existing LMR tower sites for wireless use by all users then a mutual benefit could be realized.

Arizona's portion of the FirstNet funds could also be leveraged through the SB 1402 initiative allowing FirstNet and other digital providers to use the same trench, with separate conduits for each purpose and provider.

The initial phase of the FirstNet grant process will begin with \$135M in funds set aside for State and Local Implementation Planning (SLIGP). Details of the SLIGP grant guidance are not currently available, however, Arizona will be ready when they are available through the efforts of the PSIC Office, the Public Safety Communications Advisory Commission (PSCC) and the ASET department.

There are also several federal American Recovery and Reinvestment Act (ARRA) digital grants that were awarded to entities in the State of Arizona under the ARRA funding that expand digital capacity in rural areas and on tribal nations. Most of the money impacting Arizona is for infrastructure grants and many of these grant projects are currently under construction. The DAP maintains a list of these grants on the website. **(DAP, 2012) (PSIC, 2012)**

The federal government also funds significant digital infrastructure development through a nominal fee on monthly telephone bills. This fund is called the Universal Service Fund (USF). This fund is managed for the FCC by an independent organization called the Universal Service. There are four major program areas funded by this fund, including the eRate program to fund broadband and telephone connectivity as well as technology and equipment for schools and libraries. The "e" in eRate stands for "education" but the program is most commonly referred to as eRate. (USAC, 2012)

eRate funding pays for some of the cost of Internet and telephone service to schools and libraries. The reimbursement rate is based on economic need and determined by a federal formula involving the school lunch program. Schools with the greatest need have 90% of their costs reimbursed.

The application process to apply for eRate is complicated. Many schools are denied funding because of application mistakes. Most schools that successfully apply for eRate utilize professional eRate consultants to assist them because of the complicated nature of the process. However, many schools in great need cannot afford an eRate consultant to help them, and have a much higher rejection rate from USAC as a result. (New York Times, 2000)

Other barriers include the lack of funding on the part of schools for the needed “match” to the federal dollars. (New York Times, 2000) This required match can be 10%, 20%, or more. For a “90% school,” \$10,000 buys \$100,000 in broadband services or computer related equipment, with \$90,000 in funding coming from the USF administered by USAC. The required match can be from the school, or any other source such as a private individual, foundation, or special state agency fund. (E-Rate Program Office, 2012)

Because of these profound challenges to Arizona schools and libraries in applying for eRate the state legislature saw fit to create an eRate fund within ADOA’s ASET Office, where the broadband expertise of the state resides. (E-Rate Program Office, 2012). The currently unfunded state’s eRate fund is allowed to accept tax-deductible contributions from corporations, corporate foundations and individuals. (E-Rate Program Office, 2012)

This Arizona eRate fund is authorized to provide matching funds for schools in need, and to fund professional eRate consultants to schools that cannot afford them on their own. The fund conducts research on eRate to help identify the schools most in need that are not applying for eRate because of the challenges they face. (E-Rate Program Office, 2012)

Craig Barrett, former CEO and Chairman of Intel Corporation and Chair of the Governor’s education task force called Arizona Ready, recently commented that Arizona companies need to do more to help schools. (Barrett, 2011)

In 1989, the Arizona Corporation Commission (ACC) adopted rules in Decision No. 56639 establishing the Arizona Universal Service Fund (AUSF). Those rules are contained in Title 14, Chapter 2, Article 12 of the Arizona Administrative Code. The AUSF is currently designed to ensure that customers living in high cost areas of the state receive basic telephone service at reasonable and affordable rates. At the present time, only one carrier receives AUSF support. The ACC has a proceeding underway to consider modifications to the proposed rules to support intrastate access charge reform. However due to recent preemptive actions of the FCC the status of the AUSF rule changes addressing intrastate access charge reform is uncertain at this time. Other changes to the rules, not proposed in the current proceeding, would have to go through the rulemaking process at the Commission and be approved by the ACC.

Chattanooga has received national attention for building one of the most advanced digital networks of any city utilizing its rights of way authority and building digital infrastructure through its publicly owned utility EPB.

There is nothing in Arizona statutes to prevent jurisdictions in this state from doing similar projects. However, the DAC would encourage the use of such bond-funding mechanisms to be used only for long-distance conduit builds to communities under the auspices of the state’s DAP to continue to leverage and encourage private sector investment and local-service buildouts of services at a much lower direct cost to those communities who might pursue such a program. If communities do not build their own networks, but rather encourage and facilitate providers, they should see more choice of services, competition, and more affordable costs for citizens.

Summary of Needed Actions to Support Recommendation #1: DIGITAL BUILDOUT

Implement the State of Arizona legislation that codified two highways for the price of one and support ADOT efforts to deploy conduit including rural pilot projects on an accelerated basis.

- ADOA ASET should authorize DAP to support ADOT's efforts to deploy conduit including rural pilot projects on an accelerated basis and other DAP actions listed and recommended by DAC in this plan.
- DAP should create a comprehensive working budget solution for the digital buildout needs of the five and 10 year cost estimates for the program.

Encourage and support public/private partnerships to upgrade and provision Arizona's digital infrastructure in the most cost-effective manner

- DAP should review the requirements to utilize state owned assets for locating private sector digital equipment that does not fall under the category of highway rights of way to determine what actions need to be taken to share state assets to advance digital buildout and reduce costs to providers. Based on this review the DAP and any other appropriate state agencies should take action to implement and improve such access by private digital providers.
- DAP should coordinate with private sector digital capacity providers and drive activities that improve the Network Investor Equation.

Support antenna and equipment placement on public-owned or controlled properties

- DAP should facilitate tower co-location with government and private entities, and when public safety entities are involved DAP should work in coordination with the ASET's PSIC Office.

Assess and pursue anchor tenancy opportunities for government entities in the digital planning process to facilitate demand aggregation

- DAP should use its existing federal grant dollars to build local support for digital demand aggregation that will give incentives to digital providers to buildout digital capacity in rural Arizona.
- ADOA should review its digital needs and those of other state agencies to determine digital demand aggregation opportunities for state facilities and remote state workers in rural Arizona. (See chapter 10 on telecommuting.) The state government of Arizona should be a leading anchor tenant throughout the state, especially in rural Arizona.

Drive digital infrastructure deployment to become more robust, redundant, and resilient over time to expand capacity for advanced applications and minimize the potential for interrupted service across the State

- DAP should coordinate with middle mile digital providers to connect with other Arizona middle mile digital capacity. DAP should address any rights of way barriers or provider concerns that would prevent this process.

Provide access to state rights-of-way on a cost-recovery basis for fiber middle mile and wireless providers in unserved and rural areas

- DAP should facilitate deployment of additional connectivity to rural Arizona by leveraging the state and industry's continuing investments in rural highways and by working with the Director of the ADOT to encourage broadband conduit installation as part of rural highway construction projects wherever DAP and ADOT determine it is reasonable and feasible.

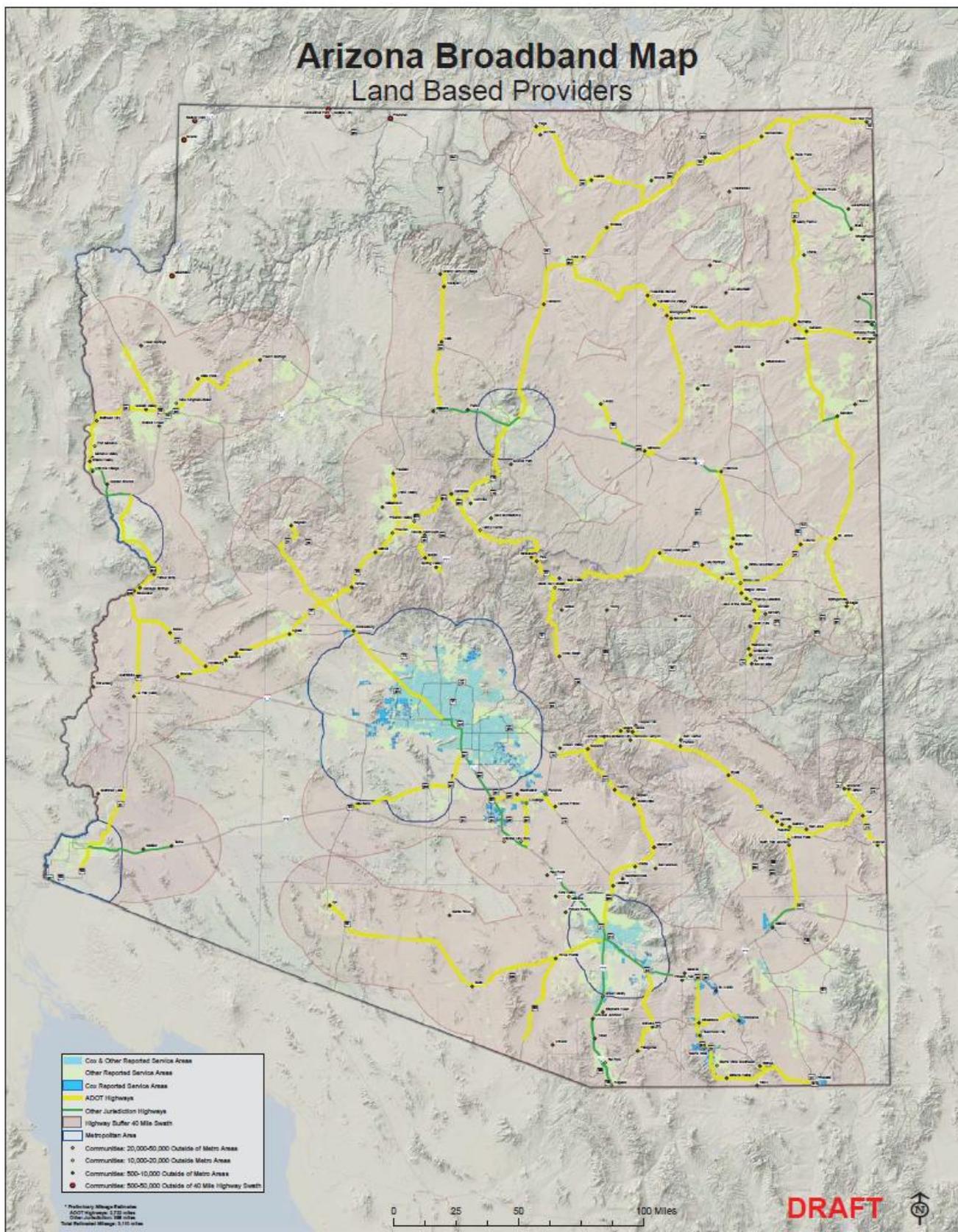
Develop and advocate for new rights-of-way/permitting standards and procedures and best practices to facilitate faster deployment of digital services

- Establish voluntary ROW dispute-resolution processes that are non-binding upon local governments, state agencies, and providers.
- DAP should create model legislation, policies and procedures for local governments and State agencies to base digital capacity ROW applications on a standard format and use standard decision criteria for making decisions granting ROW and circulate this model to appropriate government entities for consideration.
- DAP should recommend to local governments and State agencies to make decisions regarding digital capacity ROW applications within a fixed period of time, based on specific published parameters.
- DAP should make model recommendations to local governments and State agencies to limit digital capacity ROW fees assessed by local governments to only direct and administrative costs having a nexus with the ROW application or related zoning application.

Develop and pursue funding sources and mechanisms such as grants, securitized long-term leases, digital capacity bonds, public-private partnerships, and tax incentives to aid infrastructure deployment

- Create tax incentives for rural digital providers to encourage more digital buildout in areas of need.
- PSIC, PSCC and SIEC should leverage the FirstNet grant funds to benefit Arizona's digital buildout synergistically with FirstNet's buildout.
- DAP should conduct an outreach effort to Arizona corporations and foundations asking them to donate to the state's eRate fund to help Arizona's schools earn more federal reimbursement dollars.
- The ACC should consider consigning the AUSF funds to Arizona's eRate program to benefit school technology needs for students with input from providers and other stakeholders.

Figure 6: Arizona Broadband Map – Potential Arizona Highways for Enhanced Middle Mile Digital Capacity for 98% of Rural Communities



(ASLD, 2012)

Recommendation #2: INCREASE ADOPTION

Increase the use and adoption of high capacity digital connectivity and technologies

There are other barriers to digital Internet access and usage, in addition to the lack of digital infrastructure in rural Arizona.

Not every individual knows how to use the Internet. Some are apprehensive about trying it. Others have no access to learning how to use the Internet effectively; or are unaware of such opportunities in their community. (FCC, 2010, pp. 167-168)

The State of Washington brought together a group of technology experts and defined digital literacy as having the “skills required in order to utilize the equipment and Internet effectively for essential services, education, employment, civic engagement and cultural participation.” (Saunders, 2011)

Thirty-six percent of people who do not use the Internet say cost is their biggest obstacle. Among 31 developed nations the U.S. ranks seventeenth from the top nation in Internet access affordability. (FCC, 2010, pp. 167-168)

Some people live far from the nearest library or community center where Internet access is available for free. Others are homebound and do not have transportation. (FCC, 2010, pp. 167-168)

The United States invented and developed the Internet. The national average adoption rate for using broadband is 65%. This ranks 14th among 31 developed nations. (FCC, 2010, pp. 167-168) This means one-third of our nation’s population does not use the Internet. In South Korea and Singapore the adoption rate is 90%. (FCC, 2010, pp. 167-168)

For people without a high school degree in America it is even worse, a 24% adoption rate. For Americans over 65 years of age it is 35%. For people with income under \$20,000 a year it is 40%. For people with disabilities it is 42%. For rural Americans it is only 50%. (FCC, 2010, pp. 167-168)

Some 10 million students nationwide do not have home access to the Internet. (FCC, 2010, pp. 167-168) Classroom teachers report a stark difference in the learning abilities between students with and without home Internet. Teachers find it difficult to teach to a divided class of such learners. Studies show that home Internet use increases academic learning. (FCC, 2010, pp. 167-168)

- **Support and advocate for programs by industry and nonprofits to ensure that every household has sufficient high-speed Internet access, digital devices, and the skills to use them**

The Connect to Compete Program was announced last fall by the cable industry and FCC Chairman Julius Genachowski. This program is a partnership effort to address the issue of broadband adoption challenges through a low cost opportunity for connecting low income families to broadband and educating them about the opportunities. (FCC, 2011)

The Connect to Compete Program is expected to begin by the third quarter of this year. Under this program families with at least one child receiving free school lunches through the National School Lunch Program are eligible for the \$9.95 monthly Internet and low-cost computer offerings. There are no installation or activation fees and no modem rental fees. This is an average discount of 70%

off typical monthly broadband service costs. If every eligible family took advantage of the offer it would constitute a \$2.5 billion in-kind contribution. (FCC, 2011)

Arizona schools need to provide digital devices such as laptops and tablets to students in need in order to make home Internet a reality. Schools can save significant funds by switching from bound textbooks to digital ones. Some textbooks used in Arizona are several years old. Because information changes so quickly having a digital textbook is better because it can be updated anytime. (Attwell, 2006)

A \$150 refurbished computer will be made available to all eligible school lunch families through a company called Recemtech as part of the Connect to Compete program. There is also a \$250 computer option that will be introduced, and many software companies are offering computer training and other software. Morgan Stanley will offer credit to families who cannot afford the upfront costs of these computers. (FCC, 2011)

Studies show that home computer access increases student academic performance. The U.S. is currently ranked 18th in the world in access to digital Internet by students. (FCC, 2011)

- **Create a community technology resources database detailing community hotspots and facilities, training programs, technical support organizations, and sources for affordable digital devices**

Many people in need of access to the Internet simply are not aware of places where they can go to obtain this capability for accessing information that is vital to improving their lives. This includes information for job searches, resume writing and training programs. Such locations include places where citizens can utilize free community hotspots and public computer facilities such as libraries and computer centers, and even many fast food restaurants.

A community resource database with information on local computer and digital learning opportunities, community hotspots and affordable services is needed. A community technology resource database can help inform people of digital availability, training and choices. This database needs to be provided in online and written form in public places. Non-digital marketing needs to be done to drive people to this available information.

- **Promote the use of community institutions to provide technology access and training**

Libraries are key centers of influence and opportunities to utilize digital resources. Many digital tutorials are available online for free or are provided by funding through the state and local Arizona libraries.

Technology access at some libraries in Arizona is not adequate. Many libraries have limited computer facilities, digital bandwidth or space. Waiting times can be long, and those using the computers are often limited to an hour or half an hour, which often is not enough time to complete tutorials, a job search, or writing a resume. Eight percent of Fortune 500 companies post job openings online only – and require online applications. (Gillett, FCC Launches Connect America Fund , 2012)

People who are unemployed often have to cancel their home Internet subscriptions, and use public facilities like libraries or community centers to do their job searches and applications. More

computers in many of Arizona's libraries are required, as is greater bandwidth. (Huffington Post, 2010)

One of the three major federal digital grant areas funded under ARRA is the increased "adoption" or use of digital capacity by individuals. Arizona won two library grants under ARRA, one of which provides 1,000 computers to over 80 libraries throughout much of Arizona. A second grant award funded Job Hub centers in 22 libraries, and includes at least one Job Hub center located in every county in Arizona. (Broadband & Public Libraries, 2012)

With the new change in eRate rules public schools can now make available their computer resources for non-students after hours. (GITA, 2010) These computer resources can now be used for adult education classes and computer training. Schools could generate revenue for themselves through such a program. (Riordan, 2010)

Community Colleges provide an ideal venue for teaching people technology. Community Centers are another venue, such as Senior Centers, American Legion and VFW halls, Boys and Girls Clubs, the YMCA and YWCA. Churches, synagogues and mosques can also help. All these institutions can create programs and provide computer training to their members and other people in need.

This promotion of the use of community institutions can be carried out with assistance from Arizona's regional COGs. There are federal grant digital planning funds available through the State of Arizona's ASET DAP for local planning to assist with initiatives such as this.

- **Support community-based institutions in expanding digital literacy programs**

The most important support community institutions need in creating or expanding digital literacy programs is identifying and recruiting qualified individuals who can teach and conduct such programs to train groups and individuals.

Many young people today know how to use computers well. In fact, some of the most knowledgeable users of computer technology today are Arizona's younger citizens. The funds to pay individuals to teach community digital literacy programs on a grand scale are simply not available from government or other sources.

However, many young people in high school are required to provide a certain number of hours of community service in order to graduate. Students at the college level, including those who belong to service clubs or fraternal or sorority organizations, are also required to do the same.

Creating a Digital Arizona Corps of high school students and some college students who need community service hours in order to graduate or maintain their membership in their school based clubs should be utilized to provide digital training to those in need. These qualified digitally literate Arizona students are essentially an army of complementary computer teaching talent waiting to be tapped to help others learn how to navigate the digital divide.

Students can teach senior citizens and others how to set up their own email accounts and Facebook and Twitter pages to communicate with their friends and grandchildren. Students can help community institutions set up web pages and teach people how to maintain and update them. Students can help people surf the Internet for job opportunities and information on a host of topics. They can teach software programs to people.

Community institutions such as libraries and community centers can partner with local high schools and even colleges to provide these services. These community institutions can then market to their members and make them aware of these services from the Digital Arizona Corps.

Local schools can choose to adopt this campaign initiative as part of their organized community service activities. Every public school in Arizona at the high school level generally has at least one identified school employee who coordinates and serves as a liaison for students to community organizations for the purpose of creating, organizing and implementing community-based services of many kinds.

It is also important to note that Statistics released by the U.S. Education Department show that some 32 million U.S. adults lack basic prose literacy skill. This means they can't read a newspaper or the instructions on a bottle of pills. This is approximately 1 in 7 adult Americans. (Britt, 2010) For individuals in these circumstances a more formal literacy program is needed in conjunction with digital training in order to be effective. Adult literacy education can be delivered very effectively through on-line curricula with out the stigma and embarrassment associated with live instruction that can act as a barrier to overcoming the problem.

- **Develop a marketing plan and educational campaign to promote digital adoption and its fundamental importance to Arizona's future**

Marketing the availability of these programs through community institutions to their members will be effective. The marketing plan can tap into the people who want digital learning and who already participate in community institutions that provide or will provide such digital training.

As noted above, places of worship, senior centers, the YMCA and YWCA can all market to their participants. Homebound people can be reached by working through other community groups such as Meals on Wheels. Retirement facilities should participate in this program and bring these services to some of their residents.

Each local group can take on its own marketing plan and program to best fit its membership and outreach efforts. The key is to have resources in place to drive and support a Digital Arizona Corps of young and enthusiastic volunteers from high schools and colleges who understand computer technology.

The Digital "tool kit" recommended by the DAC above can assist with guiding community institutions to implement such a program. However, a greater marketing program is needed to reach out to community institutions to encourage them to become involved in providing such digital training. This marketing plan should utilize community-based organizations that have statewide structures and market using a "top down" approach by first identifying and meeting with their statewide leaders and allowing these leaders to work with their member chapters in implementing such a program. The DAP has funding through its federal grant to assist in the creation of these marketing plans and efforts.

- **Focus on removing barriers for re-use of digital technologies to help bridge the social digital divide**

Encourage the removal of policy barriers to the use of used computer equipment being donated to Arizona students who could benefit from it. (Citation pending)

- **Address the digital divide by increasing affordability through private and public programs of direct and indirect subsidy, lowering the cost of infrastructure, and fostering enhanced competition**

Some of individuals surveyed who did not use the Internet said cost was the main reason. (FCC, 2010, pp. 167-168) One of the most effective things that the federal government and Arizona can do is permit Lifeline customers to apply Lifeline discounts to any broadband service or package that also includes basic voice service. (FCC, 2010, pp. 172-173)

Currently the discount is on only one voice line, fixed or mobile. There are an estimated 24.5 million households that should qualify for Lifeline but only 7 million participated - about 29%. (FCC, 2010, pp. 172-173) State participation rates vary dramatically with some states as high as 75% and others as low as 10%. Arizona has a participation rate in Lifeline for those eligible of less than 20%. (FCC, 2010, pp. 172-173) (USAC, 2011) This Lifeline program may soon be available for digital connections, instead of just traditional telephone service, and can help with demand aggregation in rural Arizona, increasing incentives for digital providers to provide service. This issue is under review by the federal government and large-scale changes are expected under the new Connect America program. The DAP will track these changes and seek to optimize with providers and community stakeholders any opportunities made possible.

- **Disseminate best practices to address privacy, safety, and Internet identity concerns.**

Another barrier to computer adoption is the fear of invasion of privacy, safety concerns and identity theft. Education and training on how to use the Internet in safe and secure ways to mitigate those concerns can greatly reduce these barriers.

Summary of Needed Actions to Support Recommendation #2: INCREASE ADOPTION

Support and advocate for programs by industry and nonprofits to ensure that every household has sufficient high-speed Internet access, digital devices, and the skills to use them

- It should be a goal for every student in Arizona to have Internet access to a home computer or equivalent digital device and Internet service of at least 6 Mbps upload and download speed.
- Support the vision that every student in Arizona should have a digital device capable of connecting to the school's Cloud or Learning Management System, with enough storage and display capability to support online textbooks and other educational reading, video and distance learning materials and applications.
- Encourage the Arizona digital provider community and its associations to enlist 100% of their members in Arizona to participate in the Connect to Compete Program. Every school in Arizona that has participants in the national school lunch program that qualify should be involved with this opportunity. Schools should assign appropriate staff to identify students in need and reach out to local digital providers to coordinate efforts.

- Encourage ADE to inform the leadership of Arizona’s educational services agencies, school districts, individual schools, charter and private schools about this opportunity through its regular communication channels and activities.
- Literacy Volunteers of America should partner with the Digital Arizona Corps in improving computer literacy.

Create a community technology resources database detailing community hotspots and facilities, training programs, technical support organizations, and sources for affordable/digital devices

- The DAP working in conjunction with Arizona’s six COG regional organizations should identify, create and maintain such a database and coordinate the dissemination of such listings on state and local Arizona government websites, and provide links to this website to community and nonprofit organizations, libraries, schools, community colleges, universities and other appropriate entities and venues; and also provide such information in printed form available to the public at the locations listed above. DAP should take an inventory of community computer classes offered by community institutions such as those listed above and make that inventory available to the public on-line.

Promote the use of community institutions to provide technology access and training

- Every library in Arizona should provide free technology training to Arizona residents through online or in person programs, and this program should be led and coordinated through the Arizona State Library, Archives and Public Records (ASLAPR).

Support community-based institutions in expanding digital literacy programs

- DAP should create or identify a “tool kit” that can be used by community institutions to create, implement and market their own technology training program for their members, participants and the community at large.
- Community based computer training programs should incorporate issues and concerns regarding IT security into their training that can be coordinated with information provided at the state level to these organizations.

Develop a marketing plan and educational campaign to promote digital adoption and its fundamental importance to Arizona’s future

- DAP should create a marketing plan and an educational campaign at the state level utilizing available federal broadband grant funds in coordination with the ADE and DAC.
- Coordination of digital training opportunities through community institutions should be a state initiative created jointly by DAP and ADE. A training program guide for potential instructors should be created with funding from the private sector or nonprofit organizations.

Focus on removing barriers for re-use of digital technologies to help bridge the social digital divide

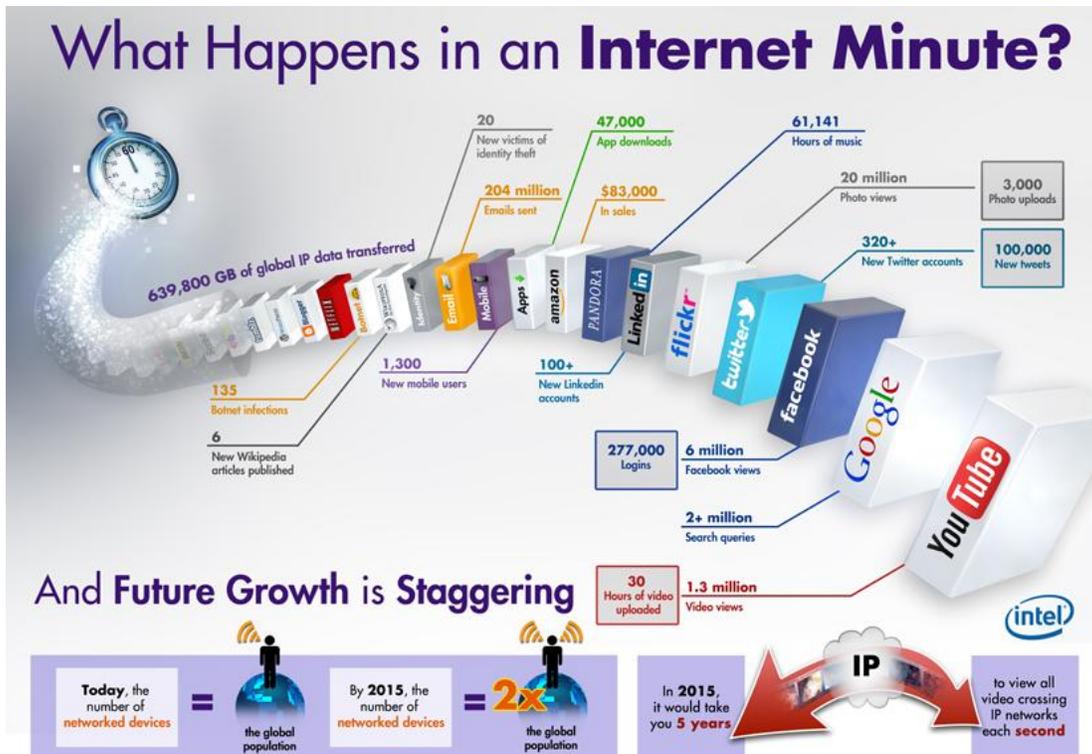
- DAP should advocate for reducing the barriers to the donation of used computer equipment to schools for students and other individuals in need.

Address the digital divide by increasing affordability through private and public programs of direct and indirect subsidy, lowering the cost of infrastructure, and fostering enhanced competition.

- Digital providers operating in Arizona and their associations who are knowledgeable and best equipped, should take the lead role in creating innovative digital inclusion strategies and programs by bringing together, coordinating and working with nonprofit organizations, and State agencies such as the Department of Economic Security. Such initiatives could be modeled after the Connect to Compete Program for students in need, and could help other financially and otherwise challenged individuals, such as Persons with Disabilities (PWD), homeless individuals, the aged, people residing in homeless shelters, shelters for abused women and children, people in transition, and others in need of assistance with digital technology and access,
- The ACC should review and consider additional marketing efforts to encourage more Arizonans to utilize the Lifeline program.

Disseminate best practices to address privacy, safety, and Internet identity concerns.

Figure 7: What Happens in an Internet Minute?



“Network infrastructure as a topic lacks the appeal of slick mobile devices, cool social and location apps, streaming music or viral videos. Yet without the fast-flow of data a robust network infrastructure supports, they all come to a grinding halt. This infographic demonstrates the enormity of the need for network capacity beyond just mobile and video uses and forecasts a future that assures that network providers will be scrambling to keep pace.” (Intel Corporation, 2012)

Mobile Data Traffic Forecast for North America in 2016

- In North America, mobile data traffic will grow 17-fold from 2011 to 2016, a Compound Annual Growth Rate (CAGR) of 75%.
- In North America, mobile data traffic will reach 1,964,477 Terabytes (1.96 Exabyte’s) per month in 2016, the equivalent of 491 million DVDs each month or 5,414 million text messages each second.
- In North America, mobile data traffic will reach an annual run rate of 24 Exabyte’s in 2016.
- North American mobile data traffic will grow 4 times faster than North American fixed IP traffic from 2011 to 2016.
- In North America, mobile data traffic will account for 7% of North American fixed and mobile data traffic in 2016, up from 1% in 2011. (An official Cisco VNI fixed IP traffic forecast through 2016 will not be released until June 2012.)
- In North America, mobile data traffic in 2016 will be equivalent to 4x the volume of the entire North American Internet in 2005.
- In North America, average mobile connections will generate 4,165 megabytes of mobile data traffic monthly in 2016, up 1,185% from 324 megabytes per month in 2011, a CAGR of 67%.

(Cisco Corporation, 2012)

Recommendation #3: LEADERSHIP MATTERS

Formalize and sustain state-level and regional digital leadership

"We live in an environment where the Internet and its associated services are accessible and immediate, where people and businesses can communicate with each other instantly, and where machines are equally interconnected with each other.

The exponential growth of mobile devices, big data, and social media are all drivers of this process of hyper connectivity. Consequently, we are beginning to see fundamental transformations in society. Hyper connectivity is redefining relationships between individuals, consumers and enterprises, and citizens and the state." (Dutta, Bilbao-Osorio, & Geiger, 2012, p. 3)

Daily life is connected life, its rhythms driven by endless email pings and responses, the chimes and beeps of continually arriving text messages, tweets and retweets, Facebook updates, pictures and videos to post and discuss. Our perpetual connectedness gives us endless opportunities to be part of the give-and-take of networking. (Rainie, 2012)

"It is introducing new opportunities to increase productivity and well-being by redefining the way business is done, generating new products and services, and improving the way public services are delivered." (Dutta, Bilbao-Osorio, & Geiger, 2012, p. 3)

Federal funding runs out in 2014 for Arizona's digital capacity mapping and planning grant. However, the need for broadband in Arizona keeps growing.

The National Broadband Plan's milestone goal for digital capacity speeds in 2015 is 50 Mbps download, 20 Mbps upload. The plan's goal is that by 2020 one hundred million U.S. households will have digital speeds of 100 Mbps download and 50 Mbps upload. The current definition is 4 Mbps download, and 1 Mbps upload. (FCC, 2010, p. 9)

Arizona's digital infrastructure needs to grow after 2014 to meet this requirement. The demand for digital capacity is increasing exponentially. Formal state and government leadership needs to continue to meet this demand.

- **Continue the current ASET Broadband Office Mapping and Planning Activities past the end of federal grant funding in December 2014**

This growing and changing digital industry is so vital to our Arizona economy, education, healthcare, individuals and business that ongoing leadership and funding at the state level is needed beyond the funding of this current federal grant.

This State Strategic Digital Plan needs to be a living document with ongoing evaluation and changes. A professional project manager should be utilized to oversee the implementation of these initiatives and monitor their progress.

A funding mechanism should be identified for maintaining the semi-annual broadband mapping process that provides vital data as to needs and digital deficits in Arizona; along with the planning dollars it needs to sustain state and regional digital leadership in a formal way. The state needs to continue to employ a digital team under the direction of the state CIO's office that facilitates and

coordinates these activities.

Funding is also needed to maintain and update regional strategic digital planning done through the four rural regional COGs. These entities have some funding and staff; and bring together key people from throughout their rural regions for economic development and planning, advising the state on location of highways, and other important infrastructure efforts. The COGs are ideal organizations to partner with in rural regional digital planning efforts.

DAP is likely to produce some revenue to pay for digital projects, staff and activities from private sector sources. FirstNet federal grant funds may be available for some of these activities. However, the funding stipulations for this \$7 billion national grant opportunity are not yet defined. There may be additional federal grant money made available by the time this federal grant runs out, although it appears that this is unlikely. The Arizona Legislature should appropriate funds to continue these efforts, if needed.

- **Continue the Digital Arizona Council leadership role in promoting sufficient digital connectivity initiatives**

The DAC should be formalized on a permanent basis, and this Council should help drive the digital connectivity initiatives of the state. The Council membership should continue to reflect the diverse areas of interest in digital capacity, and to be chaired, as it is now, by the state CIO.

Many other states have utilized a formal digital infrastructure state leadership structure with funded staff, prior to the awarding of federal ARRA grants to the states to create such entities. This formal structure helps these states to build their digital capacity, including rural areas. The states of North Carolina and Utah are two of the best examples. (Woolley, 2011)

Utah has a highly coordinated digital program. Their digital infrastructure is ranked second in the nation in average broadband speed among the states. As already mentioned, Arizona ranks 37th. (Woolley, 2011)

The National Broadband Plan, which was used in part as a model for Arizona's strategic plan, noted about the national effort: "This plan is in beta, and always will be. Like the Internet itself, this plan will always be changing - adjusting to new developments in technologies in markets, reflecting new realities and evolving to realize previously unforeseen opportunities." (FCC, 2010, p. 333)

- **Promote public/private partnerships through the creation of community-based digital leadership councils to increase demand in communities with insufficient digital capacity**

The optimal way to promote public/partnerships is through community-based digital leadership councils and to work through Arizona's six existing COGs.

Four of these COGs are rural including the Northern Arizona Council of Governments (NACOG), the Central Arizona Association of Governments (CAAG), the Southeastern Arizona Governments Organization (SEAGO) and the Western Arizona Council of Governments (WACOG).

These COGs already have memberships that are ideal for advancing digital capacity initiatives in their jurisdictions. These entities have formal funding and paid staff. They are actively involved in recommending needed highway projects in their areas. With the passage of SB 1402, which allows

state highway ROWs to be utilized to build digital capacity, they are a natural focal point for regional leadership in digital capacity. The COGs are diverse in their membership and include elected officials, business leaders, education and healthcare leadership and others.

The COGs' planning processes need to be coordinated with the State Strategic Plan. These efforts will be coordinated through the planning portion of ASET's federal digital grant, which should be continued after the grant funding ends in 2014. These activities are currently under the ASET DAP and should continue there.

- **Promote regional strategic plans that align with the state strategic plan**

Through these four rural COGs authentic regional strategic plans for digital capacity can be created. The COGs already have sophisticated strategic plans for other important initiatives and needs of their area. These plans can be utilized in building out the COGs' digital capacity strategic planning since digital capacity will drive almost all the other goals and initiatives in the COGs' current strategic plans - including economic development and job creation.

Initial funding for this regional strategic planning comes through the current federal digital grant under the administration of ADOA ASET. This funding is being coordinated overall by ASET but involves other organizations such as the long standing Arizona Telecommunications and Information Council (ATIC), and its newer sister organization the Arizona Telecommunications and Information Institute (ATI Institute) which is a qualified 501(c)(3).

Other jurisdictions are eligible for this funding, including rural counties and towns, and regions within the COGs that make sense based on geography, common interests or common economic factors such as tourism, mining or agriculture. These strategic efforts factor in and coordinate with recent federal broadband grant recipients. For example, several Native American reservations received significant digital funding and many of these projects are in construction. There are synergies with nearby communities from these types of grants. (DAP, 2012)

- **Monitor, influence, and align federal digital capacity legislation, rules, regulations, judicial decisions, and funding programs.**

The National Broadband Plan suggests a lengthy list of federal reforms that can be implemented to reduce barriers to digital development. (FCC, 2010) While Arizona's Legislature cannot change these laws, the Governor's office has a lobbyist in Washington, D.C., that can advocate for these changes and the Arizona Congressional delegation and their key staff can be made aware of the state's broadband efforts and federal barriers that should be changed to help.

A point person in the office of ASET, such as the Arizona Director of Digital Planning, should brief the federal Congressional delegation, their key staff, and appropriate federal agency staff such as at the FCC in promoting passage of ROW reforms and other initiatives on the national level. The State of Arizona also benefits by having one of its key DAP Leadership Team members serve as the current president of the National Rural Telecom Congress. He is active in this capacity on federal ROW topics and other key issues.

- **Work with the Arizona Corporation Commission to evolve the state Universal Service Fund to support digital services and related initiatives**

Under its 1989 Decision No. 56639, the ACC established an intrastate universal service fund (AUSF) to maintain statewide average rates and availability of basic telephone service – as reasonably as

possible. The AUSF is funded by all telecommunications providers that interconnect with the public switched network or that provide intrastate toll service. The current AUSF monthly Access Line Assessment Rate is \$0.009524 per access line; the Monthly Interconnecting Trunk Assessment Rate is \$0.095241; and the Monthly Intrastate Toll Revenue Assessment Rate is 0.3225%.¹ These rates generate approximately \$750,000 to \$1 million per year and support in part affordable service in a portion of Frontier's service territory in Arizona.²

The ACC has an open docket³ for considering possible repurposing the AUSF in part. However, given recent actions by the Federal Communications Commission ("FCC") the ACC Staff "does not believe that the current record is sufficient to support any revised recommended reforms,...." Further, Staff advised that the "Commission should hold the current docket in suspension until the jurisdictional issues are sorted out at the Tenth Circuit Court of Appeals; or until someone demonstrates a need for Commission action prior to that time."

Other proposed changes to the AUSF, not encompassed within the current proceeding now on hold at the ACC, would have to go through the rulemaking process at the ACC and be approved by the Commission.

Because the ACC is open to someone demonstrating a clear need for the ACC to act; there exists an opportunity for consigning AUSF funds for digital buildout for Arizona's schools through the Education eRate Office at ADOA with input from important stakeholders. These funds should be utilized for the State's eRate program to augment matching funding from schools. Through the federal eRate program, these additional matching funds this can bring as much as 90% additional broadband funding to Arizona. This equates to a potential \$9 million in extra broadband funding for Arizona schools every year.

In order to repurpose the fund in part to specifically support broadband deployment in poorly served areas or funding for other purposes, such changes would have to be proposed to the Commission as part of a new rulemaking proceeding, and the Commission would have to approve a rulemaking package to go through the normal rulemaking process for adoption.

An example of collaborative efforts between a state office of information technology and the state public utilities commission to promote broadband deployment in unserved areas is SB12-129,⁴ a senate bill sponsored in the Colorado legislature last session.

¹ *In the Matter of the Notice of Proposed Amendments to the Arizona Universal Service Fund*, Docket No. RT-00000H-97-0137, Decision No. 72727 (January 6, 2012); See also, Procedural Order, Docket No. RT-00000H-97-0137, (January 25, 2012).

² *Id.* at para 3.

³ The ACC opened a generic docket (RT-00000H-97-0137) in 1997. Recently the Commission consolidated the docket with another generic access charge docket (T-00000D-00-0672) for the purpose of determining whether or not the AUSF needs reforming.

⁴ http://www.leg.state.co.us/clics/clics2012a/csl.nsf/fsbillcont3/7a5cc6e4177ac95f87257981007dff8e?open&file=129_01.pdf

Summary of Needed Actions to Support Recommendation #3: LEADERSHIP MATTERS

Continue the current ASET Broadband Office Mapping and Planning Activities past the end of federal grant funding in December 2014.

- DAP should utilize its revenue stream from leasing conduit to maintain its office and staff and continue to fund the Arizona digital mapping project and its outreach activities under DAP, and pursue other revenue and grant funding opportunities if available to continue the activities of the state's digital projects and planning.

Continue the Digital Arizona Council leadership role in promoting sufficient digital connectivity initiatives

- Arizona's state government should continue to ensure funding of Arizona's Digital Strategic Plan under the leadership of its chair, the state CIO, as a living document with consistent updates and professional project management tracking of its implementation. The need for such planning is needed for the foreseeable future.

Promote public/private partnerships through the creation of community-based digital leadership councils to increase demand in communities with insufficient digital capacity

- DAP outreach planning activities should continue under DAP past the ending of the federal grant planning funds in 2014.

Promote regional strategic plans that align with the state strategic plan

- DAP should promote regional strategic plans through the COGs.

Monitor, influence, and align federal digital legislation, rules, regulations, judicial decisions, and funding programs

- DAP should provide information to the Governor's Office on federal digital issues.

Work with the Arizona Corporation Commission to evolve the state Universal Service Fund to support digital services and related initiatives

- DAP should work closely with the ACC to hold hearings with stakeholder input for establishing sufficient record on its open docket and take other necessary actions for redirecting its AUSF funds to the ADOA eRate fund. ADOA should manage its eRate program such that these additional matching funds this can bring as much as \$9 million in extra broadband funding for Arizona schools and libraries every year.

Recommendation #4: PLANNING AND ECONOMIC DEVELOPMENT ARE CRITICAL

Drive digital-related local community planning and economic development

Sufficient digital capacity is a basic requirement for all Arizona communities. It is needed to provide communication, to spur innovation and to increase productivity in the community. The potential for local economic development is greatly enhanced with access to broadband. Broadband is an important factor in improving the quality of life for individuals and growing the local economy.

Digital capacity is critical to increasing job opportunities in rural areas, for senior citizens and for individuals with disabilities. It frees people up to work from home and to establish home-based businesses. It enables farmers and ranchers to have better access to market information. It provides people with disabilities access to education, distance learning, job certification and employment opportunities.

Digital capacity helps local economies create jobs. A 2011 McKinsey Global Institute study concludes that the Internet accounts for 21% of all Gross Domestic Product (GDP) growth over the last 5 Years in developed countries. (Pélissié du Rausas, Manyika, Hazan, Bughin, Chui, & Said, 2011) A 2007 MIT study concludes that in counties with broadband deployment the sales per capita grew almost twice as fast as counties without it. Digital deployment increased employment by over 5% with such deployments having a greater impact in smaller, rural communities. (Gillett, Lehr, Osorio, & Sirbu, 2006)

A 2011 Chalmers University study concluded that every doubling of broadband speed increased GDP by 0.3%. (Rohman, 2012) If this Chalmers University calculation is applied to rural Arizona's economy it potentially has the following impact:

Arizona Annual GDP - \$277 billion
X 15% (rural portion of Arizona GDP)
X 0.6% (4 x increases in rural digital capacity - 1 mbps to 4mbps).
= **\$249 million potential Arizona Rural Increase/Year from digital capacity expansion**

Another recent study reports that a 10 percent increase in broadband penetration in high income countries such as the United States would cause a 1.2 percent increase in GDP. (Johnson, 2012) Other research institutions report similar findings. (Broadband Commission for Digital Development, 2012)

- **Conduct regional and community-based market assessments and create a Digital Gap Analysis Program (GAP) leading to an economic development plan**

Gap analysis is a frequently used tool that helps identify the gaps between a current situation and a future state that is a goal, along with the tasks needed to complete and close the gap.

The COGs are ideally situated to carry out GAP analyses for a given region. A map below shows the COGs and what counties are included in each region.

The COGs are made up of elected officials, business leaders and community leaders who come

together to promote their regions economically and otherwise. COGs have professional staffs and ongoing funding. They play a key role in helping to determine the buildout of state highways in their region. This is ideal since the recent passage of SB 1402 allows digital conduit to be built along Arizona's state highways.

COGs can do formal strategic planning and these plans are part of their efforts to plan digital capacity for rural Arizona. A federal grant provides funding and coordination for digital planning in Arizona. This planning is incorporated into the COGs' strategic planning.

These digital plans should consider previous efforts and recommendations, reports and information from the region or community and understand its current situation. It is unlikely that one economic development plan that focuses on digital capacity is deployed with equal effectiveness in every community. Economic considerations vary among communities, and even from region to region. For example, a development plan designed to benefit cotton farming does not have the same effectiveness in an industrial mining community.

The digital capacity GAP should primarily target job creation and business expansion in order to increase tax revenues, or lighten the tax burden (or both). A secondary benefit will be promotion of the community's general welfare.

Each community or region assesses its current economy (its markets), workforce, consumers, and other resources in terms of digital capacity. This assessment should highlight the perceived impact or effectiveness of current digital capacity, as well as the expected future impact of improved digital capacity. This market assessment feeds data into a GAP project appropriate to the community or region.

Conducting a Digital GAP project will help a community to:

- consider its current situation
- identify and review previous efforts, studies and output from community stakeholders
- determine its current digital capacity
- establish a target - i.e. analyze where it wants to be
- determine the capacity that is required to reach that target
- determine deficits (gaps) between its current digital capacity and the target
- suggest strategies and tactics that will get them to the target

A GAP project contrasts a region's deficits against its ideals. The community employs its leadership, stakeholders, subject-matter experts, and other guides to produce a plan that helps the community identify, with regard to digital capacity, what is necessary to diminish the gaps that separate constituents from the economic environment they desire.

The Arizona Commerce Authority's (ACA) activities are factored into creating these digital goals. An outreach program funded by the State's digital planning and mapping grant is under the direction of ASET, and is underway. Other partners in this project are ATIC, and the ATI Institute.

- **Find and define digital provider market opportunities**

The local market assessment analysis serves as a fountain of data that feeds planning. The Arizona Digital Mapping process provides important data in this planning process. There are other existing databases and reference sources such as REF USA that are part of the planning and marketing

process.

There are two flavors of market opportunities for digital providers to build in rural Arizona. One is that increased digital capacity can improve a local economy by providing a resource that attracts new market opportunities. The second is because service providers historically have enjoyed better economy in densely-populated areas, rural communities and regions should develop local digital-capacity markets and make them attractive to service providers.

Developing local markets require documentation and qualification of the community components that require or might desire digital capacity for:

- Community Anchor Institutions
- Public-safety facilities
- Retailers and other brick-and-mortar storefronts
- Service organizations, etc.
- Individual, at-home, consumers, and other commercial operations

Communities survey these entities to determine how extensive digital-capacity provisions are adopted. In addition to, and in some cases in place of a GAP project; a community researches, defines, and documents economic opportunities from which it derives increased benefit. There are clusters of rural communities in close proximity that can join together. This should be framed in digital capacity contexts.

Some illustrations:

- A region might ask whether increased digital capacity attracts more tourists to the area.
- Would more digital capacity satisfy the requirements of fulfillment centers or call centers seeking greater economy in rural areas?
- Would more digital capacity make schools, libraries, public-safety organizations, health-delivery facilities, and other community-anchor institutions more attractive to families seeking to relocate?

Some communities derive benefit from comparing themselves against similar communities elsewhere. Particular Arizona economic sectors should compare against other similar states or countries. Ultimately the planning need is to:

- Document Community Anchor Institutions
- Help providers determine revenue estimates
- Help determine expansion projections

A Request for Proposals (RFP) based on the market you define for services, potential for aggregating demand, demographics, and GAP analysis help start the process.

“Changing the math” to create digital buildout is outlined in Blair Levin’s formula in Recommendation #1. COGs help change the math with demand aggregation, grants, simplifying permits and easements, having access to state conduit, and providing the towers.

Arizona can participate in a grant application with a local entity in amounts less than \$1.5 million. In these grant situations, nonprofit entities are typically the grant applicant, such as a COG. COGs pass the grant dollars through the service providers for resources and technical assistance. Grant support funding is available through Arizona’s federal digital planning and mapping grant.

- Model and measure economic impacts against proposed digital capacity policy initiatives**

Employ community resources to conduct the measurements. Use subject-matter experts to develop the measurement models. The primary goals are job creation and job retention. These are measured in order to determine return on investment, and create leverage for sustained and future development funding. A secondary, or resulting, measurable goal is to sustain or increase the community's tax revenues while maintaining or reducing the distinct tax burdens. The tertiary measurable goal is to decrease opportunity costs.

ASET Digital Capacity Success Measures for Rural Arizona are:

- Non-metro digital capacity increased by 20% by 2014 over current baseline
- Increased middle mile capacity (Both Gbps/sec per mile & actual route miles) increased by 100% by 2014.
- Minimum 1 Gbps to every school in Arizona by 2015
- Sustainable funding model established by end of 2012.

Summary of Needed Actions to Support Recommendation #4: PLANNING AND ECONOMIC DEVELOPMENT ARE CRITICAL

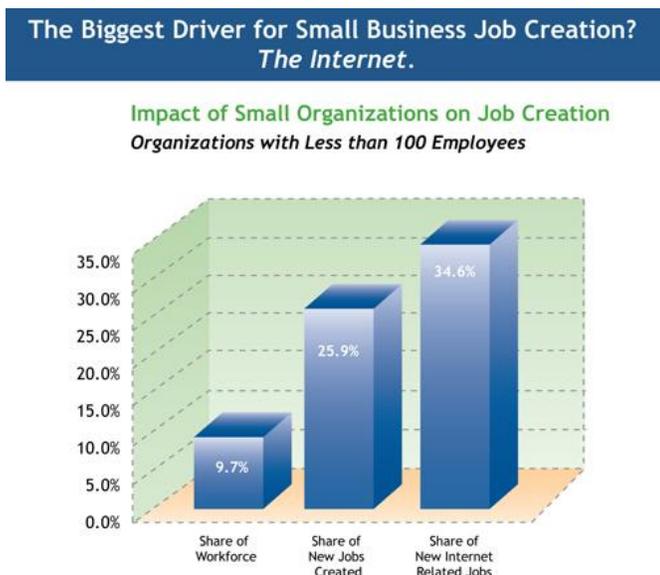
Conduct market assessments and prepare gap analyses

Find and define market opportunities

Model and measure economic impacts against proposed digital capacity policy initiatives

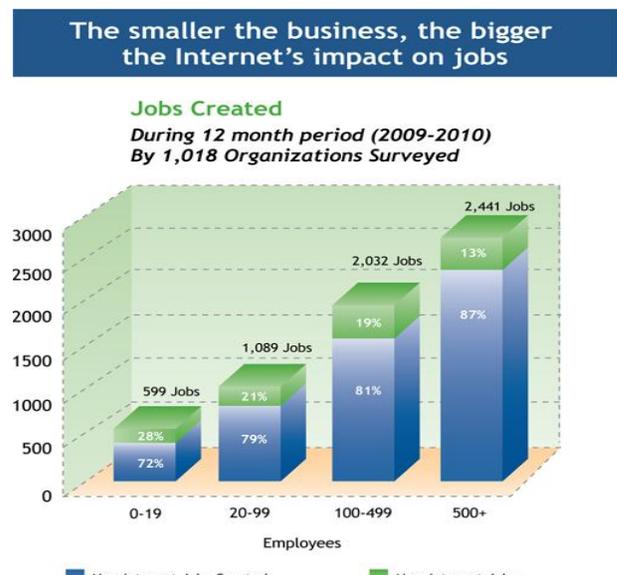
- Arizona's COG's regional and local communities should create digital plans that are imbedded, complement and synergize their current economic development planning and lead to economic growth and jobs.

Figure 8: The Internet Drives Job Creation



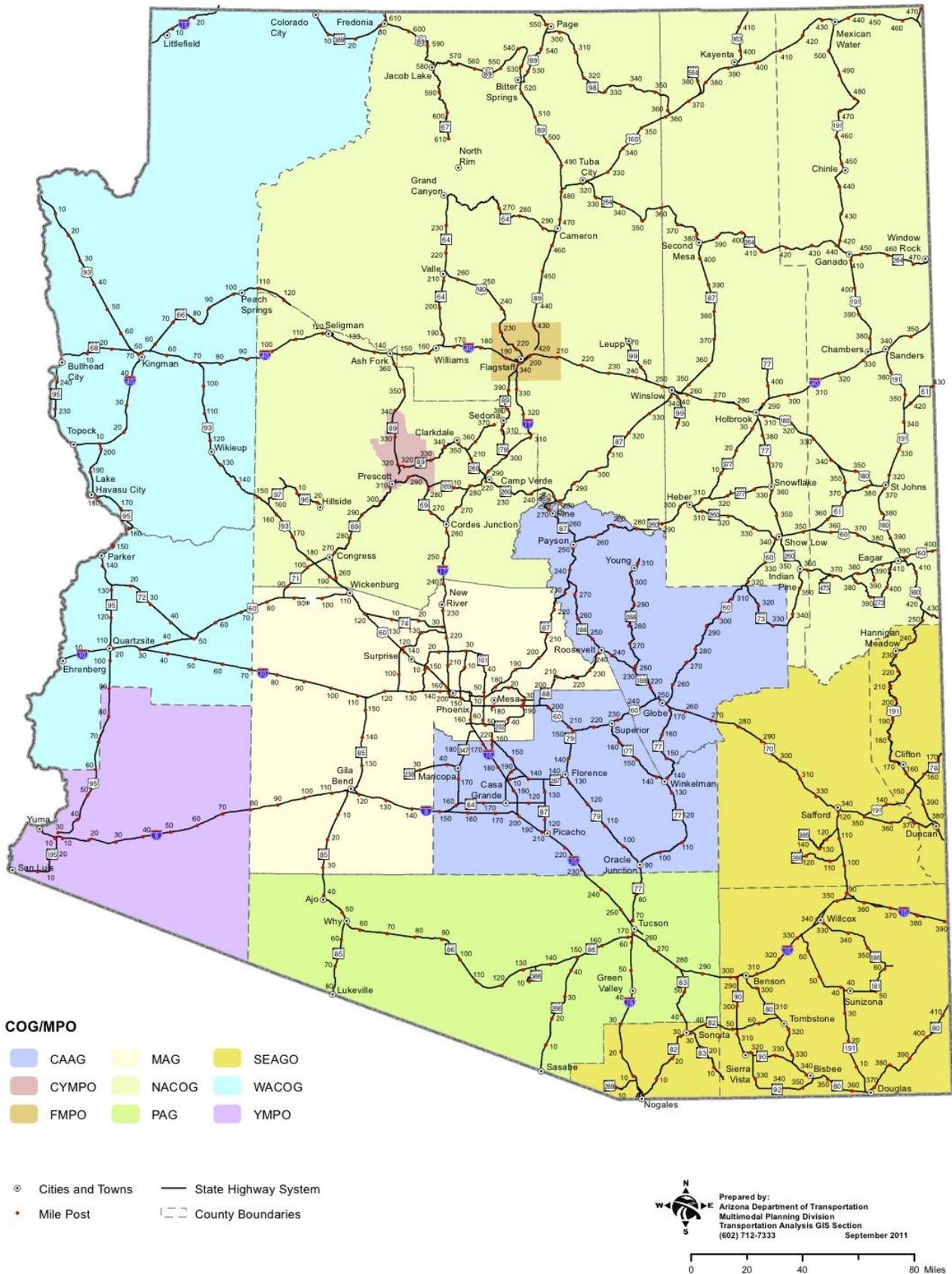
(Strategic Networks Group, 2012)

Figure 9: The Internet's Impact on Jobs



(Strategic Networks Group, 2012)

Figure 10: Arizona Councils of Government (COGs) & Metropolitan Planning Organizations (MPOs)



(ADOT, 2011)

Recommendation #5: OUTREACH

Drive community outreach through policies, programs and local engagement

Community outreach provides information, coordination, education and access to supportive resources that stimulates and guides the development and implementation of local and statewide digital initiatives. An outreach and awareness campaign covering all of Arizona needs to be developed. It should showcase the usefulness and benefits of broadband and online resources across all segments of society.

Programs and policies for outreach will include COGs and local communities that:

- Develop and implement plans to address infrastructure development, applications that ride over the infrastructure and strategies to bridge the digital divide.
- Identify and then establish relationships, collaboration, coordination, information sharing and communication among key public, private and nonprofit stakeholders committed to seeing the expansion of broadband deployment in Arizona.

Initiatives should include:

- Regional/community planning and support;
 - Arizona digital stakeholder collaboration;
 - Statewide events such as a conference or summit;
 - Mechanisms for provider input, collaboration and communication;
 - Community demonstration projects; and
 - Feedback of issues and ideas to state level leaders.
- **Provide resources and informational seminars on digital capacity to communities and regional organizations**

Digital technology changes rapidly. Information on latest trends is not always easily identified. Much of this cutting edge information is encased in technical journals.

Many rural communities do not have access to adequate information about digital capacity in their respective locations to support decision-making on advanced broadband deployment. This applies to local businesses, residents, educational facilities, critical services such as police and fire, healthcare institutions and government offices.

There is federal funding in the digital mapping and planning grant for ASET to implement webinars and public presentations focusing on digital capacity issues with experts and opportunities to disseminate technical information about broadband availability data collection, plus research results and information on opportunities to enhance broadband within Arizona.

These events should be delivered at sites around the state in conjunction and coordination with the various development organizations in rural Arizona such as the COGs, selected MPOs and others.

The DAP and ATIC should provide resources, such as a website or websites that provide access to information about strategies and resources for planning and deployment of digital capacity, including overviews and summaries of all state level broadband planning initiatives, entities and contacts. This is to be done as part of the existing <http://www.digitalarizona.gov/> website or in conjunction with a new website.

The DAP and ATIC should provide a calendar of events related exclusively to digital capacity planning initiatives. ASET and ATIC should ensure periodic two-way communication periodic communication with community leaders, COGs and other interested parties in the form of an email, newsletter, blog or other social media applications.

The DAP and ATIC should develop an online database of key leaders and interested parties representing digital capacity interests. ASET's DAP should provide up-to-date broadband maps (e.g., <http://broadbandmap.az.gov/map/>) for the state that show the availability levels of broadband capacity for all of Arizona.

- **Provide collaboration opportunities related to digital concerns to communities and regional organizations**

There is a need for collaborative two-way flows of information between rural areas and statewide planning and coordinating organizations. Examples of such statewide entities include ASET, ATIC, ATI Institute, the Arizona Association for Economic Development (AAED), the Arizona Technology Council and the ACA.

The DAP and ATIC should provide and coordinate periodic statewide digital capacity roundtables for all stakeholders with audio, web and video conferencing available. These roundtables include one or two featured presentations at each meeting, updates and information sharing, project and vendor showcases and informal networking opportunities

The DAP and ATIC, in conjunction with the COGs, should provide and coordinate one regional workshop in each of the rural regions in the state (e.g., CAAG, Flagstaff MPO, NACOG, SEAGO, WACOG and the Yuma MPO). These sessions complement the statewide roundtables by focusing on regional digital capacity topics.

The DAC and ATIC should organize and coordinate a statewide telecommunications summit meeting focusing on digital capacity. This includes disseminating information concerning grants and other funding opportunities, sharing of best practices among users and providers, networking with people with shared interests, and providing input to policy makers on removing barriers and accelerating deployment of broadband.

- **Provide to communities digital last-mile infrastructure planning templates and checklists**

The DAP and the ATI Institute should design and develop contracting templates and processes to quickly engage skilled individuals or contractor companies to perform short and long term projects approved by ASET for use by regional broadband NGOs, including Tribal authorized organizations, and by regional or local Arizona political subdivisions (such as counties, cities, towns, school districts, etc.).

These templates are being developed as part of the federal digital grant planning process. Digital planning assists in maximizing resources spent on expanding digital buildout.

- **Provide digital technical consulting to communities for analyses, planning, proposals, and implementation**

The ATI Institute should assist in the development of technical assistance contracts for local government and local and regional economic development organizations. This consists of analyses, planning documents, proposals and implementation assistance.

This also includes the development of templates and processes that will help local organizations in applying for technical assistance. This is a component of the current Broadband Technical Assistance Project Consultant (BTAPC) Grant awarded to the ATI Institute. Original funding for this effort extends from the federal digital grant received by ASET and managed by the DAP. The ATI Institute is selected to assist ASET in meeting these federal digital planning grant requirements.

This activity intends to assist rural Arizona entities in the digital planning process and to create optimal plans that can maximize the impact of greater digital capacity in their areas.

- **Provide assistance to community and regional organizations in writing digital grant applications**

The ATI Institute will assist local entities to compete for broadband grant opportunities issued by the Federal Government; by various philanthropic organizations, such as the Kellogg Foundation, Knight Foundation, and Gates Foundation, and by institutions of higher learning. This is a component of the current BTAPC Grant that was awarded to the ATI Institute.

Summary of Needed Actions to Support Recommendation #5: OUTREACH

Provide resources and informational seminars on digital capacity to communities and regional organizations

Provide collaboration opportunities related to digital concerns to communities and regional organizations

Provide to communities digital last-mile infrastructure planning templates and checklists

Provide digital technical consulting to communities (analyses, planning, proposals, and implementation)

Provide assistance to community and regional organizations in writing digital grant applications

Provide a statewide coalition structure where community stakeholders and champions can support and influence the direction of state level digital capacity initiatives.

- The ASET Office, ATIC and the ATI Institute should work together to provide adequate support resources.
- ATIC, an NGO, should assist the DAP in developing and providing a series of webinars and public events.

Recommendation #6: EDUCATION AND JOB READINESS

Facilitate the implementation of underlying technologies, digital curricula, collaboration and professional development to promote improvements in education and workforce development

“A tidal wave is about to hit us.”

**Gordon Wishon
Chief Information Officer
Arizona State University**

Commenting on the rapid changes taking place in education technology today.

- **Encourage the connection of universities, colleges, schools, libraries and students' homes with sufficient digital capacity to enable advanced e-learning applications and serve the needs of the rapidly evolving statewide data based decision support system.**

Some of the most advanced applications of K12 education technology taking place anywhere are in Arizona schools. Imagine high school students taking a math probability lesson from a -- Harvard math professor, live, 2,600 miles away, or students in Eloy, Arizona, learning French from the National Online Teacher of the Year, teaching from Arkansas. (deLuzuriaga, 2010)

A list of exemplar Arizona schools in education technology and a summary of their efforts is in the appendix. This list can be reached here [Arizona Exemplar eLearning Institutions and Initiatives](#).

In America, 45,000 K12 students took online classes in 2000. By 2009, the number was more than 3 million students. (Nagel, 2009) Professor Clayton Christensen of Harvard's Business School predicts in his book "Disrupting Class" that by 2019 half of all high school classes will be online. (Christensen C. M., 2008)

In Florida, students attending Florida Virtual Schools (FLVS) average higher AP and state standardized assessment scores. Students that have a computer and digital access in the home have a 6% to 8% higher graduation rate than those who do not. (FCC, 2012) 20% of Arizona's students do not have access to home Internet. Arizona's graduation rate in 2009 is 72.5%. The national average in 2009 is 75.5%. (Balfanz, Bridgeland, Bruce, & Fox, 2012)

In a March 7, 2012, letter to Arizona State Legislators, Arizona Superintendent John Huppenthal stated: "The minimum speed that is educationally sufficient to support ADE's transformational plans is 6 Megabits per second per student. This speed enables uninterrupted video streaming and rapid downloads of education content whether a student is at home or at school." (Huppenthal, 2012)

The National Broadband Plan, (FCC, 2010) makes it a long-term goal to provide 1 Gbps per second of digital service to schools. There are schools in Arizona that have only 3 Mbps of digital capacity, a tiny fraction of the capacity that 1 Gbps provides. There are many schools and homes in Arizona that cannot meet these standards.

More and more homework assignments, grades, progress reports and communication

between teachers, students and parents are provided online through the Cloud or eLearning Management Systems. Students without home Internet easily fall behind. Parents without home internet have difficulty monitoring their children's academic progress. Many schools only provide grades and homework assignments online. Parents' involvement in their children's education is one of the most important factors in their success. (Editorial Projects in Education, 2012)

Blended learning is a popular model in education. Inspired by the Khan Academy, in many blended learning models students learn information at home with online digital instruction then apply it in class. Teachers assist in their traditional roles, but also serve more in the role of mentor and coach. Students often work together in projects. (Christensen C. M., 2012)

Arizona's Education reform plan prepared by the P20 Council appointed by Governor Brewer. notes the importance of "high quality data systems to inform instruction, drive innovation and improve accountability." (P20 Council, 2010) Having adequate bandwidth to all of Arizona's schools is a foundation for these data systems to be utilized. (Huppenthal, 2012)

One of the great benefits that technology can provide education for teachers and students is a measurable history that can be utilized to track students' progress, catch learning gaps and problems early and fix them, and improve overall results. (Deschel, 2012) The State is creating such systems today. (Masterson, 2012)

Testing can put an enormous load on IT systems and digital capacity when tens of thousands of online classes are growing dramatically. Adequate bandwidth will be necessary to make these systems work. (Masterson, 2012)

ADE's IT department is currently operating and developing three data based decision support services for P-20 + Workforce with longitudinal databases. The Student Accountability Information System (SAIS) and Student Longitudinal Data Base (SLDB) with dashboard are two systems that are finally in operation after 15 years of development. ADE IT developments are refocusing from the state level governance decision support to decision support of real-time learning in schools. (Masterson, 2012)

The Arizona Education Learning and Accountability System (AELAS) is currently in business case development mode with significant outreach to school customers to determine their needs. AELAS is expected to become operational in 2013. Their Arizona Education Network site serves to accelerate the adoption of innovation in schools. The Integrated Data to Enhance Arizona Learning (IDEAL) portal system for teacher professional development and digital curriculum provisioning has greater potential for use. The AELAS information on customer needs will be reflected in the enhancement of IDEAL. (Masterson, 2012)

The new Partnership for Assessment of Readiness of College and Careers (PARCC) assessment testing is required to be taken online. With numerous students taking this test simultaneously, many schools simply do not have the digital capacity and infrastructure to conduct this test at their schools.

Arizona currently does not have a statewide high capacity digital network. (Manfield, 2011) Utah created a statewide education network that reaches Utah's schools with significant bandwidth and offers many online eLearning classes. Many other states have statewide education networks. (Utah Education Network, 2012) To make a statewide education network successful students need adequate digital capacity at school and at home. The walls between universities, colleges, schools, libraries and students' homes are coming down. Some Arizona high school students are graduating today with their high school diploma

and simultaneously their community college degree, paid for by their K12 school. School districts throughout Arizona are now actively signing Intergovernmental Agreements (IGAs) and sharing resources. (Northern Pioneer College, 2012) Even Harvard, MIT and Stanford now offer hundreds of non-credit classes taught by their professors online available for free to anyone with enough digital connectivity.

- **Evaluate the bandwidth, technology, and support needs of educational stakeholders to create an adequate, effective and accessible learning support system**

Many K12 school districts' IT departments are overwhelmed with the daily activity of running and managing their systems and have little time to evaluate their bandwidth, technology and support needs. This at a time when the opportunities through education technology are changing and improving dramatically.

Some school districts in Arizona are so small that the IT staff is a teacher who knows the most about computers. Arizona has over 225 public school districts and over 500 charter schools. One public school district in Arizona has ten students. There are many other school districts with only a few hundred students in isolated and remote parts of Arizona with little access to bandwidth and the opportunities the outside world could bring to their students if they only had enough bandwidth capacity.

Many of these smaller school districts have limited funding needed for technology infrastructure. Technology is most efficient when purchased and utilized on a wider scale for larger student populations.

Arizona's schools, colleges and training centers have a widely varying current use of digital capacity. Some have self-contained IT systems with servers providing digital curriculum and data based assessment support with little need for outside connectivity. Others have hybrid systems with heavy dependence on interactive video and Internet resources for instruction, communication, simulation, interaction and individualized pace curriculum.

Most entities have strategic plans that forecast future digital needs. But many are based on extension of current practices without taking into account the emerging transformation to full eLearning for all students. Just sampling current plans and then extrapolating for all of Arizona will not provide reliable information.

Developing a forecast of broadband access need over the next ten years is difficult for an emerging technology such as eLearning in 2100 schools. There are two major components:

- The extension of today's plethora of eLearning solutions from a small number of exemplar schools and programs to the entire population of 2100 schools and 1.1 million students. This will give us a starting point in 2012 of what could be in the future if there no further increases in per-student digital capacity needs.

There is a need to develop an understanding of emerging technology eLearning solutions from major vendors, venture capitalists and other experts to garner a prediction of growth of per-student digital capacity needs over what is represented by exemplar schools.

Then compare this bottom up forecast with the top-down driven exceptions presented by ADE, FCC, and others and get quantitative results.

- **Consider State and national network expansion initiatives for students, workforce and faculty living in limited-access communities.**

As mentioned above, the 2010 census shows 677,662 people in rural Arizona. Arizona is unique in its vast Native American Reservations and rural topography. (Rural Assistance Center, 2012) Many students, workforce and teachers living in limited-access communities can benefit from state and national network initiatives. The Digital Arizona Highways Act of 2012 allows the ADOT to lay multi-cable conduit beside Arizona highways and for providers to use this conduit. This removes a significant cost barrier to vendors increasing their incentive to build fiber-optic cables into rural and isolated communities. Once in reach of a community, a microwave tower can connect to the fiber and beam the final miles to schools and other telecommunication hubs for last mile hookups.

By the end of 2012 it is expected that prototype rural communities are selected and digital extensions underway. A critical aspect is the commitment of the community to rapidly adapt and use this utility for education and training, healthcare, economic development and citizens.

There is an effort in Arizona to create network IT standards for a statewide education network called SEDNet (SACCNNet Education Network). (SEDNET, 2012) Networks succeed if the key parties have enough digital bandwidth, collaborate, and utilize it. Arizona's students would benefit tremendously and have many new opportunities if Arizona had a statewide education network with sufficient digital capacity to connect all of the state's K12 schools, community colleges and universities.

A national network called the National LambdaRail (NLR) is a super high speed intranet system that is used by the top universities and research institutions in the world. Recently, K12 schools have started to use this network, and a similar network called Internet2, to conduct classes and guest lectures with some of the top minds from Harvard, Duke and universities in Europe, Asia and Australia.

The first K12 in the world to get on the NLR is in Arizona. Only an existing member can allow another institution to gain access to this 12,000 mile fiber system which goes through Arizona and has a super computer center located in Phoenix. ASU and the University of Arizona are members of the NLR.

- **Provide decision support information on digital curricula and online classes**

The annual cost of digital curricula and online services is millions of dollars statewide and growing significantly. Districts, schools and other small entities can be overwhelmed with all the choices they have and may not have the current expertise needed to make satisfactory acquisition decisions without support.

A Consumers Report model should be used to generate decision information through AELAS. County Educational Service Agencies should provide extension service support, modeled after the highly successful Agricultural Extension service.

Arizona with its lead in university based eLearning research, a large eLearning industry enterprise cluster, and many exemplar applications, should be a primary source of digital curricula and online service information. In fact, this Arizona based eLearning knowledge center should provide services outside of Arizona to garner broader sources of revenues and also provide visibility to Arizona based providers.

Developing online classes, digital content and curricula, or specifying to schools which

offerings they can use, is an innovative process that is best left to the universe of public and private entities that are experts in this area. They provide this critical resource in the three acquisition modes commonly known as free, fee and open source. When total curricula costs of use and effectiveness is assessed, including product support and upgrades, reliability, and research basis, educator training and delivery system enhancements, the type of mode may not be a factor.

The Arizona Telecommunications and Information Institute (ATI Institute) partnered with Microsoft Corporation and their Shape the Future team to have a Digital Inclusion Economic Impact Model for Arizona executed by their partner The Arnold Group at no cost to ATI Institute or the State. The model is designed to measure the economic and social impact of digital inclusion initiatives and has been performed across the U.S. in five states and seven cities to date.

The Digital Inclusion Economic Impact Model was run based on a variety of Arizona data provided. The model's target segment consists of disadvantaged school-age children and their families as this group has the greatest long-term effect for the realization of the benefits. Arizona modeling results indicate that students with a home PC and broadband access increase their chance of graduating from High School by 6-8 percentage points and experience an average increase of \$1.2M in additional economic and social impact over their lifetime. The affected individuals will also have more employment opportunities benefiting from significant lifetime creation of jobs. By targeting students in poverty, over \$32.4 billion in total lifetime economic and social impact can potentially be realized.

- **Facilitate the provision of access to digital curricula to the education community and student and workers homes**

ADE's IDEAL portal system is undergoing significant upgrades. Online content and courses are vectored from provider to Arizona education. This "library" provides a menu of online learning classes and opportunities presented in a way that is easily accessible and searchable by school curriculum directors, teachers, parents and students.

There are an enormous number of online learning classes, classroom supplemental materials and professional development tools available. (Rivero, 2011) IDEAL should host the eLearning knowledge center to have a one-stop location for both decisions as well as access.

Project Tomorrow has created annual reports since 2007 on trends in education. In their latest report released on June 26, 2012, their findings included: A majority of teachers, school site administrators and district level administrators now report participating in an online class for their own professional development. For teachers, this is an increase of 148% since 2007. Thirty percent of teachers say that online professional development is their preferred approach for continuing education. A positive correlation exists between educators' experiences with online learning and their interest in mobile learning in school. (Project Tomorrow, 2011)

Vail Unified School District created an innovative program called Beyond Textbooks. Vail is the number one rated school district in Arizona. Every one of its schools has earned the designation "excelling." (Werr, 2010)

Beyond Textbooks is a successful comprehensive education program. Vail is partnering with approximately 70 school districts and schools in Arizona who are using the program. One of the most impressive aspects to the Beyond Textbooks instructional program is the curriculum framework and calendar of the standards linked to resources and assessments online. (Vail School District, 2012)

Arizona's State Library hosts a major website with enormous amounts of free information and materials, including subscriptions to articles and journals. (ASLAPR, 2012) This comprehensive online library provides digital curricula links to students and workers in their homes. The online library includes business videos from the Harvard Faculty Seminar Series. There is legal and health information; and a section called "Tools for Tough Times" on dealing with difficult economic times. There is another State Library website section called the National Digital Newspaper Project that digitizes Arizona's newspapers as part of the state's centennial efforts. (Arizona Newspaper Project, 2012)

Some 22 libraries in Arizona, with at least one in every county, have Job Hub centers providing comprehensive assistance to individuals looking for job training and resources. (GITA, 2010) Arizona's State Library and local libraries should increase the awareness of this valuable free resource for Arizona citizens.

- **Support development of state supported technology and digital curricula literacy programs for both students and teachers**

Arizona should increase the use of online classes and digital curricula. One gating factor is 100% uptime of computer systems and fundamental knowledge of use of system software, Internet and applications. 63% of Arizona's students did not meet the state's digital literacy standards in 2006 based on a 25,000 sample survey of Arizona's 8th and 9th graders. (US Dept of Education, 2009)

Fortunately computer based systems grow more robust each year and skilled implementation of systems can mitigate many problems. Learning to maintain and use the equipment, software and digital curricula must be addressed for every student and teacher.

- **Encourage implementation of training programs for teachers on how to effectively use digital curricula and distance learning to effectively transform classrooms to an e-learning model**

None of these resources are of much value unless educators and trainers have developed their practice to effectively use the full potential of eLearning. The chicken-egg issue is that all this technology must be in the learning environment to effectively learn an eLearning teaching practice. 70% of Arizona's teachers in 2006 did not meet the state's own Technology Competency Standards for Teachers. (US Dept of Education, 2009)

A second complicating factor is that in both pre-service and in-service environments the teacher/trainer eLearning savvy level will run from novice to expert.

A third challenge is the current level of investment for in-service human resource development. Teachers, professors, educators, and trainers are the new high-tech workforce. As such they must be afforded the same level of education, training and professional development in the use of eLearning systems and pedagogies as our other high tech workforces are given. The typical annual investment by Boeing or Intel is between \$1000 to \$3000 for their engineers and technicians. The last reported figure in education is \$100 to \$300. (Citation pending)

Arizona's 70,000 teachers, classroom aides and instructional support cadre is transforming from legacy education to eLearning. Their initial professional development needs are greater than a technology based industry making marginal changes each year.

- **Organize to provide assistance to small school and library districts in making E-rate applications**

The eRate program, funded by the universal service fee on telephone bills, helps to defray the costs of telephone and digital services to schools. The amount of funds depends on the school poverty rate that is determined by a formula based on the school free and reduced lunch program. Individual schools and libraries must apply, and the application process is complex. Arizona has enacted state level measures to support school applications and secure funding at the state level. (USAC, 2012) Increased assistance should be provided to many of Arizona's 2,100 schools and hundreds of libraries to assure that tens of millions of additional funds flow into the state to support education and workforce development. (GITA, 2012)

- **Support policies to ensure that all youth become proficient in workplace skills including lifespan eLearning skills during their time in school**

21st century skills are built on a foundation of core subjects (math, science, arts, language, etc.) with 21st century themes. Learning and innovation skills include critical thinking and problem finding and solving, creativity, communication and collaboration.

Life and career skills include flexibility and adaptability, initiative and self-direction, social and cross-cultural interaction and productivity with accountability. Digital literacy skills include information literacy, information and communications technology literacy and media literacy.

Employers have transformed their processes, systems and technologies to embrace student and employee entrants with this set of skills. Without a rich mix of these skills, entrants will be at a significant disadvantage for job success.

Some states like Michigan require students take at least one on-line class before receiving their diploma. (Michigan Department of Education, 2006) (McClintock & Michelle Gayles, 2012) Arizona must go well beyond this minimum requirement. As the eLearning system becomes operational, every student engaged by this system will automatically use computer applications to complete homework, take tests and search for information online. But more importantly, the pedagogy and expectations for students must change.

Digital literacy is not enough. Pedagogy at all levels must be flexible and adaptable to student communication and collaboration. Lock step, top down learning must give way to a balance with creativity, innovation and self-accountability. Students must learn at every grade level to participate in their own decisions on both their learning path, and a level of learning that constitutes success.

Within the 21st century skills model we ask students to be Olympic level champions in over a decathlon of subjects. The only way for success is that the student be actively engaged and that his or her "calling" based motivation is supported at each step of the way, with gifts and talents factored into learning decisions. For the lower capability and interest levels a C is a success grade. When a child has an intersection of talent and motivation, the personal learning plan is drafted to expect A level performance.

When these professional practices of the workplace are brought into all levels of our schools and colleges, workplace skills foundations will be developed for all students. Only then will outside Science, Technology, Engineering and Mathematics (STEM) speaker programs, student internships, apprenticeships and part-time jobs become effective means for student workplace learning.

eLearning provides the means to effectively teach and learn the 21st skills including core subjects individualized for the student. By shifting focus to student performance based measurements needs, Arizona's educational leadership, parents, students and employers will achieve the results they want.

- **Support community institutions that support informal learning in after school programs and job training**

“Extending the school day” through after school programs is a big plus in educating students. (McClintock & Michelle Gayles, 2012) The California digital plan encourages educators to connect to such programs through boys and girls clubs and YMCA’s and YWCA’s and other similar types of organizations. (The California Broadband Task Force, 2008)

Scottsdale Boys and Girls Clubs (SBGC) have a well-developed after school education program that has research results that show positive improvement. They connect the Internet2 advanced IT network to the Vestar branch. This chapter won the national outstanding branch award last year. (Boys and Girls Club, 2012)

- **Foster partnerships with community institutions that provide technology access and transition services support to students with disabilities and other special needs**

Community institutions provide specialized services to Arizona’s special needs students, who are about 1% to 2% of Arizona students. Some services are part time and some are residential. (Boys and Girls Club, 2012) The use of eLearning technologies has been pioneered for decades with these students and many advances have been made. (Boys and Girls Club, 2012)

- **Assess state and local statutes, rules and regulations and determine which are barriers to adoption of 21st century education and workforce practices and provide recommendations for changes**

One of the benefits of the online learning aspect of eLearning is that it opens up a world of potential teacher facilitated, but student driven, learning experiences. However, under current Arizona law an out of state university professor with a Ph.D., cannot legally teach K12 students for credit. (Citation pending) Well-intended and beneficial incremental changes to state statutes have produced a complex mess with many conflicts, obsolete statutes, barriers to student learning, and unintended consequences. Many requirements need to be changed to reflect eLearning in education.

Two events happened in the 1970s. An ASU Education Specialist degree student reviewed all the Arizona statutes that addressed education, developed a taxonomy and produced an index of state laws. (Shoob, 1974) This 170-page document was purchased by ADE and the superintendent published copies sent to all school districts. An ASU Education Doctorate student, who was also a Motorola engineer and a Senate Majority Leader, produced a dissertation on transforming Arizona education funding laws to greatly improve school equity by using state funds to supplement local school funds. Thirty years later it is time to reprise both of these efforts. (Kret, 1972)

A statute criterion should be developed that looks to the future of 21st century eLearning supported education and training; and its emerging practices, innovation - flexibility needs, and student centered approach. Finally the changes and enabling legislation needed to revise the entire system of statutes should be determined.

This study should be used by the Arizona Legislature and Governor to implement a complete overhaul of the state body of education law in statute. The results should be used by other branches of government to revise rules and regulations that govern Arizona education, professional development and training.

Summary of Needed Actions to Support Recommendation #6: EDUCATION AND JOB READINESS

Encourage the connection of universities, colleges, schools, libraries and students' homes with sufficient digital capacity to enable advanced e-learning applications and serve the needs of the rapidly evolving statewide data based decision support system

- Every student in Arizona K12 education should have a digital device and sufficient home connection to the Internet.
- Advanced Placement and college classes should be made available to all Arizona secondary school students through a statewide learning network. A robust digital system should provide access to distance learning partnerships with other school districts, colleges and other online providers. Local inequities in distribution of educators especially in areas such as STEM need to be relieved.

Evaluate the bandwidth, technology, research and support needs of educational stakeholder to create an adequate, effective and accessible learning support system.

- Statewide digital connectivity with sufficient bandwidth is needed in Arizona for the coming statewide data based decision support system. Arizona must address the emerging digital needs of every P-20 student at school and at home. If Arizona is to be the state exemplar in education technology, then the combined leadership of the Governor, the Arizona Legislature, the State School Board and the Arizona State School Superintendent is essential.
- Smaller school districts should pool their IT resources or combine staff expertise in order to create better digital opportunities for their administrators and students. Some of these efforts should be organized by and implemented at the county superintendent education service agency level.

Consider state and national network expansion initiatives for students, workforce and faculty living in limited-access communities.

- ASU, UofA and NAU should offer professional development classes through their education department's professors and scholars for STEM programs, and other classes to benefit Arizona's K12 teachers and administrators and delivered through the Governor's five regional centers utilizing video conferencing technology to reduce travel and costs.
- Promote collaboration between urban and rural schools on distance learning and sharing resources. Urban schools offer more classes and have more teachers than rural schools. There are talented teachers in urban and rural Arizona. These activities should be coordinated through the Governor's five regional centers, ADE, the fifteen elected county school superintendent's county education service agencies and with the school districts interacting amongst themselves.

Provide decision support information on digital curricula and online classes.

- A statewide review of the most outstanding schools and their best practices should be conducted by ADE, and featured on ADE's website.

Facilitate the provision of access to digital curricula to the education community, students and workers homes.

- All community pre-K, and after school and weekend, and job training programs should have access to sufficient digital capacity. They should be welcomed to use the emerging state/county/district intellectual infrastructure including IDEAL, SEDNet and AELAS and a host of other resources.
- School districts should reach out to after school institutions and assist them in providing quality “extend the school day” after school programs.

Support development of state supported technology and digital curricula literacy programs for both students and teachers.

- ADE should coordinate and encourage digital collaboration among universities, community colleges, schools, and libraries to improve education opportunities for students and adult workers. These opportunities can be made known through the IDEAL website.
- The State of Arizona should fund and provide an entity that studies and develops a working expertise in availability and attributes over a wide range of offerings from the three modes of vendors. Any secondary research evidence of effectiveness should be acquired. Depending on school, college or training center, rubrics to support local acquisitions should be developed.
- A Consumers Report model should be used to generate decision information through AELAS. County Educational Service Agencies should provide extension service support, modeled after the highly successful Agricultural Extension service.

Encourage implementation of training programs for teachers on how to use digital curricula and distance learning to effectively transform classrooms to an e-learning model

- ADE should provide through IDEAL a content aggregation of online content available in an easy to use format for teachers wishing to utilize digital content available for education and teaching. Such content is currently available but it is in different locations and for busy teachers with limited planning time the availability of an easy to use digital content provider library will accelerate the adoption and use of education technology in the classroom.
- ADE should review and develop updated program offerings that are essential for students and teachers. This basic training should be provided with online modular systems with formative assessment on IDEAL. The more advanced training for using instructional applications is usually provided and maintained by the digital curriculum vendor. The IDEAL site should only provide an index and URLs for provider training materials.
- The pre-service systems in our colleges of education must rapidly complete their transformation to produce eLearning savvy pre-service teachers with significant practical experience. Their major challenge is that their professor cadre is steeped in legacy education pedagogy and that research based eLearning pedagogy is trailing behind eLearning adoption. Therefore significant effort should be made in supporting professorial practice transformation, rapid development of eLearning pedagogy based on emerging practices, and research in the area of eLearning across K-12, college education and workforce training.

- The State of Arizona should provide certification for eLearning savvy educators as well as some system for their ongoing professional development and training.
- The human resource departments of Arizona's business colleges should address how their professors educate training specialists in the workforce development field using 21st century means and methods.

Organize to provide assistance to small school and library districts in making E-rate applications

- Increasing the financial support of the state's eRate office will help bring millions of additional eRate dollars to Arizona's schools.

Support policies to ensure that all youth become proficient in 21st century workplace skills including lifespan eLearning skills during their time in school.

- Students must be exposed to technology tools in the classroom and at home in order to be prepared to succeed in college or the workplace. Students without knowledge and experience in using digital devices are at a significant competitive disadvantage.

Support community institutions that support informal learning in after school programs and job training.

- The Arizona Technology Council as the lead organizer and working with Greater Phoenix Leadership and the Arizona Chamber of Commerce and Suns Charities should establish visiting K12 speaker programs in which business and government executives visit schools to discuss the science, technology, engineering, and mathematics skills needed for workers in the new economy.

Foster partnerships with community institutions that provide technology access and transition services support to students with disabilities and other special needs.

- Students with disabilities should have full access to sufficient connectivity and the state intellectual infrastructure and should be made available to them through their school that is responsible for facilitating these opportunities with community institutions and others that provide these support services.

Assess state and local statutes, rules and regulations and determine which are barriers to adoption of 21st century education and workforce practices and provide recommendations for changes.

- A comprehensive study of all state statutes that affect education and training and a revised taxonomy and index should be developed by the ADE.
- An assessment of all statutes should be made to develop proposed changes and deletions to fix conflicts and remove obsolete statutes that absorb school dollars that could be better utilized for investment in education technology.

Figure 11: Arizona E-Learning Strategic Views from eSATS

What Worked in the Past Will Not Work For the 21st Century

19th and 20th Century Education
 Fine Tuned One-Size Fits All.
 Focus Was on Discipline Knowledge,
 With Standards Set At State Level

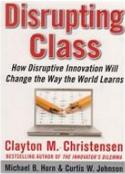



Individualized Student Education is Crafted With **Personal Learning Plan** Based in Motivation and Skills. Specific Performance Levels are Set That Reflect What is Needed for a Successful Life for that Student: Mastery Would Require "A" Level Achievement. Proficiency Requires "B" Level Knowledge Competency Would Target "C" Level Skill.

This Pathway Will Require Full Implementation of eLearning

Good Informal Start

Computer-Learning Disruptive Innovation

Finish the Job for All Arizona Students

Data Based Decision Support From State to Student
 Digital Curricula + Formative Assessment
 Ubiquitous Access - Properly Implemented 1:1 Interface/Student
 1 Gbps for Every School by 2014 to 10 Gbps for All 2100 AZ Schools
 eLearning Training, Education and Professional Development for
 All 70,000 Arizona Teachers Serving 1.2 Million Students

Must Build Out Multiple Physical Infrastructures

Internet Access, Portals, Data System with
 With Bandwidth Increase of 2000% by Year 2020



Properly Implemented Student Interface Devices
 2:1 Student/Interface by Year 3
 1:1 Student/Interface by Year 6



Acquire Professional Workstations for 70,000 Teachers Now

Refurbish all 2100 Legacy Schools into 21st Century Schools



Integrated: State - County - District - School - Student

(Kraver, 2011)

Recommendation #7: IMPROVE HEALTHCARE

Like a person suffering from a debilitating disease, healthcare delivery in the United States is ailing. The U.S. spends significantly more per capita and a higher percentage of GDP on healthcare than other developed nations, yet our patient outcomes (e.g., mortality, safety, access to medical care) are disparate and inconsistent. Moreover, the rapidly rising costs of healthcare delivery are making medical care increasingly unaffordable to the average citizen and threaten our national financial viability. Not unlike a very ill patient on life support, this confluence of issues requires immediate attention and action. Something needs to be done to fix the American healthcare delivery system; it is not sustainable in its current form. [From “A Roadmap to High-Value Healthcare Delivery” by Cortese and Smoldt] (Cortese, 2012)

Facilitate the expansion of a robust statewide telehealth ecosystem

Twenty five years ago all a doctor needed was a telephone with dial tone. Today a doctor needs enough bandwidth for real-time collaboration while viewing MRIs.

Healthcare is 18% of our nation’s GDP and will cross 20% before 2020. In 2040 there will be twice as many Americans over 65 as there are now. Three-quarters of America’s health costs are for chronic conditions. There will be physician shortages as this generation of doctors is retiring. (FCC, 2010, p. 199)

Health Information Technology (HIT) can reduce costs, increase physician productivity, and improve care:

- e-prescribing can catch harmful drug interactions.
- Testing results can be done faster with less errors.
- Vaccination reminders should save some 39,000 lives a year.
- Video consults can speed the decision to administer clot-busting drugs for stroke victims.
- The American Heart and American Stroke Associations recommend them.
- Rural patients could have remote access to medical specialists in urban areas.
- Telepsychology and telepsychiatry can allow patients to do sessions remotely.
- Emergency room visits for nursing home patients and even prisoners should be reduced.
- Savings are estimated at \$1.2 billion a year.
- Physicians can receive medical testing data on patients quickly through their phones if away.
- Sensors can be used to monitor diabetics remotely and dispense the correct insulin electronically.
- Heart patients can be monitored remotely. (FCC, 2010, pp. 201-203)

The FCC adopted new rules in May 2012 making the U.S. the first country in the world to dedicate spectrum for Medical Body Area Networks – which enables advanced health monitoring that will improve the quality of care, lower costs, and ultimately save lives.

Previously, the Commission dedicated spectrum for Medical Micropower Networks, which has the potential - literally - to enable paraplegics to stand. (Genachowski, 2012)

There are many other applications, but none of them can work without the proper digital capacity.

With the adoption of SB1402, Arizona enters a new era for collaborative healthcare for the citizens of our state. The enhanced connectivity offers opportunities to fundamentally change the way we care for one another. Execution on this opportunity will require a focus on sustainable business practices if we are to obtain the full value of the opportunity.

Deployment of robust digital capacity will enable near real-time access to patient records for hospitals, offices and homes. Statewide efforts to increase electronic medical record (EMR) adoption and health information exchanges (HIE), rely on high speed, mobile Internet that is often lacking in urban and rural environments. Applications are critical to reduce over-utilization related to redundant ordering practices so prevalent in healthcare today. Information in real-time is critical for appropriate, cost-effective, medical decision making. (FCC, 2010, p. 209) Quality video consultations require 6 Mbps upload and download. Even greater bandwidth to transmit new technologies such as 3D imaging will become important. (FCC, 2010, p. 209)

Beyond data there is more opportunity enabled by SB 1402. Healthcare is typically thought of as the process of diagnosis and treatment of disease, both data driven endeavors. This neglects one of the primary drivers of the healthcare economy - worry. When we are sick, we need reassurance. When this is not immediately available to the patient, the nurse or the generalist, bad things happen. We tend to seek answers and help through tests and patient transfers. We are required to elevate the level of care, often with no real long-term value to the patient. Knowing answers sooner can help reduce unnecessary worry and cost.

- **Facilitate the development of infrastructure to support healthcare messaging, health monitoring and health collaboration**

It is widely accepted that technology is one way to deliver better or cost effective healthcare. Although Electronic Medical Records (EMR) and Health Information Exchange (HIE) are part of this solution, there is a value leak if information is not shared with the right people at the right time. The Digital Arizona Council works to support infrastructure for healthcare messaging, health monitoring and health collaboration.

Healthcare messaging among care providers is currently archaic. The paging system was developed in the 1950's. This system has remained the primary way the medical industry communicates with each other. This limits the ability to deliver the right provider at the right time or even to actually find that person. There are many modalities where physicians and other healthcare providers could message each other more robustly. Outside of the pager there is e-mail and cell phones which are now relatively ubiquitous. The message ties back into emergency preparedness, as well as routine clinic care.

Health monitoring can refer to patient monitoring and is relevant in multiple arenas. One of the more interesting opportunities that now exists is to provide electronic monitoring devices as a part of an Enhanced Intensive Care Unit (EICU), such as that being deployed at Banner Healthcare System. They have approximately 500 patients who are actively monitored and experiencing better outcomes

compared to a routine ICU. This is somewhat counter intuitive but it has been demonstrated with data. Monitoring can be extended so that we include our most expensive patients. Patients at home who need to have monitoring for weight, blood pressures and blood glucose can allow active bandwidth to be deployed so that these patients may stay at home and on task, improving overall patient health and reducing costs.

Health collaboration is defined as the opportunity to put a care team together for a given patient. The federal government has come forward with recommendations to have shared risk and wellness for patients as opposed to transactional medicine. Care teams allow a multitude of people to be engaged in the overall health of patients, improving their care and reducing costs. Collaboration does not require video transmission in all circumstances. However, there are many times when video is an absolute requirement. Video transmission can present opportunities to best understand the patient and to develop a relationship with that patient. Without video, physicians and other healthcare providers cannot achieve a level of relationship required in a medical environment.

There are several use cases that are currently underway that show the value of these three concepts: messaging, monitoring and collaboration. Hospice of the Valley, one of the largest hospice providers in the country and based in Arizona, is now using social workers in the home to interact with patients and communicate with the physician in real time. This enables social workers to begin diagnoses and treatment in the home, and prevent expensive tests and transfers of patients to the hospital. Hospice of the Valley has been able to show a decrease of hospitalization of 50%, and decreases of 30% in emergency room visits leveraging this technology. The DAC support for broadband infrastructure offers the opportunity to extend this.

The Northern Arizona Regional Behavioral Health Authority has been using TeleHealth in a myriad of circumstances to take care some of Arizona's large population of behavioral health patients. There are multiple opportunities in terms of improving care and reducing costs associated with patients with co-morbidities. Specifically, patients with behavioral health issues such as schizophrenia or manic depression disorders often find it difficult to find a care team that can manage both their psychiatric and medical illness. Bandwidth again would allow the use of telepsychiatry in the emergency departments throughout the state, as well as medical management of behavioral health patients in the psychiatric hospitals. Currently this disconnect has costs that run into the millions for the state of Arizona.

In addition, another issue for telepsychiatry is the hospitalizing of psychiatric patients. Psychiatric patients are required to have a psychiatrist sign off before they can become a floor patient. This requires many of our rural access hospitals to place psychiatric patients in ICUs when a lower level of care is all that is required for their medical condition, until a psychiatrist can sign off.

Employer health is an opportunity to improve the overall business climate in Arizona. Employer health effectively means healthcare to the desk top. In today's world we require people to miss a half day or full day of work so they can come to the doctor's office and spend ten minutes in many cases reviewing their chronic illness. However, across the country there is an active effort to put health to the desk top where patients can register to see a nurse or see a doctor and do all the things that can be done in a brick and mortar clinic from their work place. Costs can be reimbursed using the standard model of insurance.

We are also seeing states moving in this direction where virtual visits are viewed as the same as in person visits. One opportunity would be to further leverage the school system. We have nurses at schools that are currently cost centers. These nurses should be converted to wellness clinics for both students and teachers. Half day visits for chronic illnesses would be converted into something that is more cost effective, and certainly better for student, teacher, parent and provider.

Healthcare and emergency preparedness clearly have an overlap. There is a considerable interest

in being able to leverage all of our care providers throughout the state in case of an emergency. Currently we do not have processes in place to allow us to do this effectively. There is an expectation that the federal government will support this financially and encourage it through legislation.

Thus messaging, monitoring and calibration in the virtual space all play a role in emergency preparedness. The state of Arizona needs to leverage. This will require bandwidth, people and process.

Although issues of information management are critical (e.g., EMR and HIE), the Digital Arizona Council feels that there is equal value in offering opportunities that center on messaging, monitoring and collaboration as discussed above. The Digital Arizona Council has made some specific recommendations for moving forward as to how a broadband infrastructure could be leveraged for cost effective care in the state of Arizona. These suggestions are merely the start of what will be a long road to improved care and reduced costs leveraging technology.

- **Support the expansion of electronic health records (EHR) exchange and Health-e Connections**

To date, telemedicine has been limited by a number of factors, not the least of which is the lack of ubiquitous digital capacity. Medical images can require higher bandwidth. SB1402 provides the infrastructure to begin the conversations and application deployment to enable the right provider to care for the patient in near real-time, to provide reassurance while still at home or office rather than requiring transfer. (FCC, 2010, p. 209)

The use of EHR can improve patient care by giving providers more complete and timely patient information to make well-informed decisions quickly and safely. For example, an EHR can identify the patient's drug allergies and drug interactions. The system can provide vaccination reminders. Patients can be monitored remotely for early detection. (FCC, 2010, p. 193) The U.S. ranks near the bottom in nearly every category used to gauge the adoption of EHR among 11 developed countries. (FCC, 2010, p. 193)

The federal government is spending significant funds to help create the use of EHR technology. Physicians can earn extra money by using EHR with Medicare and Medicaid. There are other financial incentives which give way to penalties by 2015. (Center for Medicare and Medicaid Services, 2012)

This program is called "Meaningful Use" and is an actual set of standards created by the Centers for Medicare & Medicaid Services (CMS) Incentive Programs that governs the use of electronic health records. The benefits of the meaningful use of EHRs include complete and accurate information, better access to information and patient empowerment.

The three major challenges for EHR are adoption, use and connectivity. Connectivity is where the Digital Arizona Council can help most. Other initiatives are underway to create an EHR initiative in Arizona. There are many involved in this process. (Arizona Governor's Office of HIE Exchange, 2010)

Arizona Health-e Connection manages the "Regional Extension Center" grant which is focused on EHR adoption and utilization. ASET manages the "Health Information Exchange Cooperative Agreement Grant". Both are ONC programs and are closely linked together. ASET's focus is to "enable" and jumpstart health information exchange in a variety of ways including both "pull-based" exchange and "push-based" exchange. The Health Information Network of Arizona is also an active participant in this process.

Figure 12: The Arizona Health Information Exchange



(Arizona Governor's Office of HIE Exchange, 2010)

- **Facilitate the attraction and support of advanced health information initiatives such as the Institute for Advanced Health**

Arizona benefits from a number of large and prestigious healthcare providers that can provide a backbone for a successful health information initiative.

The Chan Soon-Shiong Institute for Advanced Health (CSS Institute) “assumed financial responsibility” for the National Lambda Rail in July 2011. The Institute’s founder, Patrick Soon-Shiong, M.D., wishes to use this intranet network also as a secure “medical information highway.” (Institute for Advanced Health, 2011) This includes advanced bioinformatics research, a health grid, and the creation of a national health information network.

The NLR is a 12,000 mile advanced optical network that goes through Arizona. The University of Arizona and Arizona State University are members. The NLR has a new supercomputing center near the Phoenix Airport and another new significant facility in Scottsdale, and plans for more development near the Phoenix Airport. (Institute for Advanced Health, 2011)

The NLR has 280 research institutions and federal agencies as members. Speeds of up to 100 Gbps are possible. (Institute for Advanced Health, 2011)

“The Iowa Health System peers with NLR at the Starlight facility on Northwestern University's Chicago campus so that its hospitals and clinics in over 70 communities in Iowa, Illinois and Nebraska can securely and reliably connect with data and specialists elsewhere in the U.S. and in other countries.” (NLR, 2009)

There are partnership opportunities with the NLR that should be investigated by those involved in creating the EHR initiatives for Arizona.

The Arizona Health Information Management Association has over 800 members and seeks “to be a change agent towards a common goal of a computerized patient record,…” (Healthcare Information and Management Systems Society, 2012)

The Governor’s Office of Health Information Exchange (HIE) (migrating to ADOA ASET oversight) has federal grant funds to move forward information exchange initiatives for Arizona. Part of this organization’s operational plan includes working with the ASET Office and the University of Arizona to determine digital applications for rural Arizona healthcare delivery. Arizona Health-e Connection and Health Information of Arizona are two other organizations that provide leadership in this area.

The challenge is to bring together all the many stakeholders in creating a HIE. This includes hospitals, physicians, insurers, patient advocates, healthcare workers, government health agencies and others.

The Governor’s Office of HIE (migrating to ADOA ASET oversight) should continue to lead this effort.

- **Foster sustainable e-health business models**

Currently the Centers for Medicare and Medicaid Services reimburse approximately \$2 million in telehealth services out of an annual budget of over \$300 billion. (Tapper, 2012)

Finding sustainable e-health business models is a challenge. For example, there is no common lexicon for coding in virtual space. Medical facilities and doctors utilize medical codes for every procedure for which they seek reimbursement. Telemedicine provides opportunities for new ways to practice medicine and reimbursement formulas and codes need to be devised and standardized.

Strong payer involvement is needed in expanding and simplifying reimbursement. The health insurance community on the government and private side will be essential to making such a system workable. These efforts are often overlooked by the providers of care. These efforts should include associated downstream revenue with improved worker productivity.

Additionally Arizona’s universities can be a model of this new medicine and are encouraged to offer virtual services for their students and employees rather than strictly brick and mortar clinics. Medicaid has been responsive to creating medical insurance reimbursement codes for telemedicine.

- **Encourage the use of medical expertise wherever it exists (licensing issues)**

The DAC encourages emergency preparedness in the healthcare space via messaging, monitoring and collaboration. This could be in conjunction with other process and could be directed out of the office of the Arizona Chief Information Officer (CIO).

Current medical licensing restrictions impair the use of telemedicine. Hospitals are credentialed and when they are treating patients they serve as the responsible party. However, when a patient is in one hospital and utilizing the telehealth services of another hospital the credentialing and reimbursement rules collide.

This issue is very important to rural hospitals that face particularly challenging financial conditions. When rural patients in Arizona do not use their local hospitals but instead go to urban hospitals revenue is lost. If rural patients can use their local hospitals and healthcare facilities they can still have access to specialists when needed through telemedicine. Telemedicine produces more revenue for these rural hospitals and in many cases avoids unneeded transportation.

Should it be required, many medical tests can be performed at rural hospitals and the results transmitted to specialists. With current technology scope results, MRI's, scans, and x-rays can be diagnosed via telemedicine channels to provide both emergency and second opinion support.

A new ruling allows for urban and rural co-credentialing based upon relationship agreements. (Citation pending – Dr. Pitt?) Avenues to simplify urban-rural relationships for licensing and credentialing should be supported, such as reciprocity. There should also be improved reimbursement and visibility for telepsychiatry and other behavioral medical services statewide.

- **Facilitate the implementation of a shared vision, strategic plan, and sustainable business model for the health network**

It is important to recognize that many of the HIE initiatives are underway. But the HIE will not work unless there is a shared vision. A strategic plan has been developed by ADOA in the implementation of its HIE grant initiative. Strategic planning is fundamental to HIE's success.

More problematic is the sustainable business model which is new territory and, as recommended above, the talent at Arizona's research universities should be utilized in creating a successful business model.

"The Arizona HIE Marketplace is a program administered by Arizona Health-e Connection (AzHeC) under the direction of the State of Arizona and ASET to provide viable options for HIE to all Arizona providers and to assist providers in participating in secure HIE. AzHeC is assisting in developing a marketplace for the Direct approach, based on services offered by health information service providers (HISPs)." (Arizona Health-e Connection, 2012)

"Direct exchange is simple and inexpensive. It is a secure e-mail connection between providers, other healthcare entities or patients. While pricing will vary, its basic cost per month is approximately equivalent to the co-pay for one office visit. It requires no capital investment, and it allows a practice to have a secure and private connection with its referral network and with other healthcare entities such as labs." (Arizona Health-e Connection, 2012)

Arizona's HIE can bring together the business community within our state in conjunction with the

major providers (such as Dignity Health, Banner, and Mayo) by offering public relations and other incentives out of the Governor's office for success for on-site healthcare clinics via virtual medicine to improve overall worker productivity. This elevates Arizona's visibility as an employer-friendly state with support for healthcare.

Arizona's HIE initiative working with its partners is the leadership entity for these types of activities.

- **Leverage the Digital Arizona Council to ensure progress and accountability for telemedicine**

The DAC can ensure progress and accountability in the area of telemedicine by continuing to incorporate it as an element in its ongoing strategic planning efforts. This Arizona Strategic Plan for Digital Capacity is intended to be a living document with project planning management and periodic updates.

The ASET Digital Office can track this progress and accountability.

- **Facilitate the expansion of existing telemedicine and e-health networks and initiatives that have shown success**

Entrepreneurs and businesses will also advance telemedicine and make it a growing field. While most of these entrepreneurs are also physicians or other health professionals they are not the traditional office physician. Telemedicine is used in many different ways.

One company in Arizona that is pioneering this work recently won the North American E-Health Service Company Award of the Year. Their market niche is dealing with some 66% of patients who visit emergency rooms but do not need to. This new concept is essentially a replacement for the traditional home doctor visit. (Stat Doctors, 2012)

One simply registers an account and once an individual is registered they can call and connect live with board certified emergency room physicians. You can use your traditional phone or smart phone. They have a virtual waiting room that tells you how long your wait time is. (Stat Doctors, 2012)

These physicians deal with common medical conditions. They keep online records of your visits for you to see and will send progress notes to your primary care physician. This company utilizes EHRs and ePrescribing. This new approach to healthcare helps to relieve the need for emergency room visits and reduces costs. (Herrick, 2007)

There is an entire new field emerging called mobile health. This system allows physicians to monitor patients remotely through communications networks at all times. Physicians who are not at the office can review test results, pharmaceutical information, and diagnostic data using Personal Data Assistants (PDAs) and Smartphones. Emergency Medical Technician (EMT) responders use field laptops. Sensors can be used that are non-invasive to track present time health information such as the patient's heart or sugar levels. (FCC, 2010, p. 18)

The Veterans Administration has a successful model it uses with some 32,000 veterans with chronic conditions. This national program is called Care Coordination/Home Telehealth. The average cost each year per patient is \$1,600. The Veterans Health Administration home primary care costs \$13,121 a year. A nursing home costs the VHA \$77,745 per year. (Darkins, Ryan, Kobb, Foster, Wakefield, & Lancaster, 2008, p. 1123)

- **Support mechanisms for sustainable e-health networks**

Downstream revenue and job creation in rural areas will evolve telehealth. This will create jobs. (Monegain, 2010) Some 18.2% of the nation's GDP was healthcare in 2011. (Brandt, 2012)

Arizona has had recent major success with its Medicaid program leading an effort to create payer codes for telemedicine. (AHCCCS, 2012) This is a breakthrough and came about in part through conversations with the DAC.

The major barrier now is Medicare, which currently is not making changes needed to advance a sustainable e-health network. Medicare's rules are currently outdated. (ATA, 2011) Without Medicaid and Medicare as leaders and major drivers of e-health networks and new reimbursement models and available codes for Telehealth a sustainable business model for this new form of medicine will not be created.

- **Encourage increases in the availability and use of e-health applications**

Telemedicine is an entire new way to practice medicine. (Herrick, 2007) It was not taught in medical school and payers have never dealt with it before on a large scale. All stakeholders should add to their skill sets and be able to provide telemedicine services.

It is wonderful to have a doctor speaking to a patient face-to-face, but in this age of technology, this same conversation can take place on a video conference call, with the doctor reading the chart, speaking to his patient hundreds of miles away. It is difficult for top notch specialists to afford to relocate to smaller communities, and it is not an efficient use of resources to send specialists to remote areas even on a weekly or bi-monthly basis. But having them literally a video call away improves the quality of life, can present unnecessary trips via ambulances and helicopters and save lives. (Satava, 2007)

The Arizona Health Care Cost Containment System (AHCCCS) needs to encourage telemedicine. AHCCCS has been very forward thinking in its expressed support of face to face, whether in person or virtual. It will pay via the same codes. However, few healthcare providers know about the new codes and education needs to take place to make telemedicine successful. By not moving the patient (lowering the barriers for access), compliance goes up, and costs go down long term. This has an indirect benefit. Rural care centers are the economic backbone of many rural communities. Every time a patient leaves their community for services in the city, money leaves with them. Supporting this model and keeping patients local can be an economic driver for jobs in rural Arizona.

- **Encourage the removal of barriers for appropriate reimbursement by health plans**

Reimbursement plans for telemedicine are not adequate to ensure sustainability. (Herrick, 2007) (Tapper, 2012) The payment policies are unclear and confusing. This discourages others from using Telehealth.

- **Improve the capacity to provide e-health to everyone everywhere**

One of the best ways to increase e-health is to go where the patients are. Local schools are ideal locations as healthcare centers. The office is another location. Arizona should use state resources such as schools and libraries to become centers of wellness.

Bringing together digital providers from the office, parents from work and children from school will avoid costly travel and diminished productivity typically associated with frequent clinic visits required for those with chronic conditions. Those who do seek regular healthcare will now have a much easier opportunity to obtain it.

Care transitions are the future of healthcare. Moving from home to hospital to nursing home to home all represent a distinct opportunity to improve care and lower costs. The payers are currently looking for ways to improve these transitions. Unfortunately, the hand offs are never clean - people don't get their medicines, they don't remember what they are supposed to do, they feel alone. Reassurance, enabling presence for the family to see a provider or a home health nurse to see a doctor, means that care can begin in the home, not on return to the hospital. This lexicon of care transitions and reassurance will resonate with the hospitals and payers. They need to be brought into the ecosystem.

Encourage families to get involved with the care of their loved ones, being “present” during healthcare encounters. Ultimately, much of the responsibility for care falls to the family who are currently disconnected (via distance) from the care of their loved one. The healthcare ecosystem is made up of all those who care about the patient - not just practitioners.

Organizing healthcare centers at K12s and other public facilities will take the combined leadership of schools, library officials, government officials, healthcare providers and state healthcare leaders. An existing structure should be found to effectuate this, or an existing one should be utilized.

- **Support concepts and language that ties in public safety, first responders, and ongoing care**

Hospital medical emergency systems should be integrated into public safety emergency planning.

Public safety emergency alert systems can incorporate physicians, nurses and other healthcare professionals to arrive at a specific place during a disaster to help. Pre-planning is needed to make this possible. Digital devices can be used to send messages and coordinate responses. (Rao, Eisenberg, & Schmitt, 2007)

Digital devices are being used more and more to connect EMTs directly with the hospital and transmit vitals and other information while on the scene and in transit. (FCC, 2010, p. 201)

Physicians who monitor patients remotely should be able to summon emergency assistance quickly through digital devices when patients at home are showing difficult signs. (FCC, 2010, pp. 201-202)

The Arizona Department of Emergency & Military Affairs (DEMA) mission is to plan and coordinate disasters. (DEMA, 2012)

- **Encourage guidance on payer codes and a common lexicon for coding in the virtual space**

As mentioned above, face to face, whether virtual or in person, is supported by AHCCCS and the Medicare providers. The same codes can be applied to real-time medical encounters, as long as the provider can see the patient (not telephonic) and the provider is a typical billing agent (MD, PA, NP).

However, this is not widely known here by many of the providers throughout the State. Use cases are often limited to older models with consideration of rural access. Education as to what is possible remains a primary impediment to success in this arena. Ideally, similarly to California, codifying this business relationship of face to face, whether virtual or real, should be considered. Outreach to professional medical associations to reach their members should accelerate participation.

Summary of Needed Actions to Support Recommendation #7: IMPROVE HEALTHCARE

Facilitate the development of infrastructure to support healthcare messaging, health monitoring and health collaboration

Support the expansion of an EHR Exchange and Health-e connections

Facilitate the attraction and support of advanced health information initiatives such as the Institute for Advanced Health

Foster sustainable e-health business models

- Arizona's state health agencies such as AHCCCS and its universities can collaborate with these essential partners to better define the benefits of telemedicine from a business, policy and healthcare perspective.

Encourage the use of medical expertise wherever it exists (licensing issues)

Facilitate the implementation of a shared vision, strategic plan, and sustainable business model for the health network

- The Arizona Medical Board and the Legislature should provide new and clearer rules that encourage the use of telemedicine, including in rural areas of the state.
- Payers should be encouraged by the State to begin pilot programs reducing readmission and patient travel. This should be part of the ongoing RFP discussions AHCCCS is currently having.

Leverage the DAC to ensure progress and accountability for telemedicine

Facilitate the expansion of existing telemedicine and e-health networks and initiatives that are showing success

Support mechanisms for sustainability of e-health networks

- AHCCCS should provide a leadership role. State and federal government elected leaders and health experts need to strongly encourage Medicare to adopt new rules and proper codes in order to advance telemedicine. Without Medicare as an "anchor" tenant, telemedicine will have limited ability to advance. With Medicare's help and by physicians, hospitals, payers and government agencies working together to create a common platform, telemedicine will succeed in the U.S. and improve America's health.

Encourage increases in the availability and use of e-health applications

- Telemedicine needs to be incorporated into the curriculum of medical and nursing schools and other professional medical education programs. The University of Arizona College Of Medicine, as the leading public healthcare institution in Arizona, should take the lead in organizing an education summit to discuss telehealth curriculum with other health educators. Health worker associations for physicians, nurses and other healthcare professionals should inform their members about telemedicine.

Encourage the removal of barriers for appropriate reimbursement by health plans

- Arizona should require that all payers set up a system for payment of telemedicine services. These policies should be in writing.

Improve the capacity to provide e-health to everyone everywhere

- Arizona should use state resources such as schools and libraries to become centers of wellness. The Governor's HIE initiative leaders can provide direction.

Support concepts and language that ties in public safety, first responders, and ongoing care

- DEMA can review its emergency plans to integrate Arizona's hospitals and staff to respond as part of the emergency team.

Encourage guidance on payer codes and a common lexicon for coding in the virtual space

- Efforts should be made to help providers understand reimbursement models via telehealth by AHCCCS. Education should take place. There is an imbedded structure in place to teach the various stakeholders this new model. This should be orchestrated via stakeholder membership organizations such as the State Medical Societies and other related hospital administrative organizations.

Recommendation #8: ADVANCED RESEARCH

Catalyze and Enable an Environment of Discovery, Innovation and Research

Advanced research and development in science today depends increasingly on transmitting massive amounts of data through interconnecting high-performance computing arrays. Super-high-speed network capacity allows scientists and researchers to collaborate from a distance. Arizona needs these kinds of advanced networks available in strategic areas of the State such as universities and surrounding research parks, and other high-end research facilities.

Future innovation and discovery in healthcare, genomics, proteomics, biology, physics modeling, aerospace engineering, astronomy and national security will depend heavily upon the availability of high capacity networks. The states and nations that have the best networks will lead in discovery and the resulting economic benefits.

- **Identify big data and telepresence high impact areas and application areas that are most likely to enhance existing strengths.**

90% of the world's data has been created in the last two years. (IBM, 2012)

The world's largest genomic research institute is the Beijing Genomics Institute in China. They produce some 2,000 human genomes in a day. Its data is so massive that it takes weeks to transmit it over a normal Internet. (PCMag.com, 2012)

Big data is also big business. Imagine analyzing hundreds of billions of meter readings to improve power consumption. Tracking hundreds of millions of trades each day looking for fraud. Analyzing 12 terabytes of Tweets each day to improve product sentiment. (Pollack, 2011)

"A new era in computing that will see machines perform at least 1,000 times faster than today's most powerful supercomputers is almost upon us. By the end of the decade, exaFLOP computers are predicted to go online heralding a new chapter in scientific discovery. What is an exaFLOP? Computer scientists measure a supercomputer's performance in FLOPS, an acronym for Floating Point Operations per Second, while "exa" is a metric prefix which stands for quintillion (or a billion billion)". (PCMag.com, 2012) An exascale computer could perform approximately as many operations per second as 50 million laptops.

Today, the fastest supercomputers operate at the petaFLOP level....performing in excess of one quadrillion (or a million billion) operations per second.

The first computer to break through the petaFLOP barrier was IBM's Roadrunner in 2008.... Today, the crown is held by Japan's K computer developed by RIKEN and Fujitsu,....that operates at over 10 petaFLOPS.

The kind of space that you need is similar to that of a football field....The K computer contains a mind-boggling 88,128 computer processors and is made up of 864 refrigerator-sized cabinets." (Knight, 2012)

The Big Data Revolution in Arizona is being led by the state's universities and other research institutions including the Translational Genomics Research Institute (TGen) in Phoenix, and the NLR that is under the financial responsibility of the CSS Institute.

The NLR has a new supercomputing center in Phoenix and another major facility in Scottsdale. The first K12 in the world to utilize the NLR for telepresence education is in Arizona. (NLR Blog, 2010)

The upgraded network will have an unprecedented 8.8 Terabits of capacity and use brand new 100 Gigabit Ethernet technology. The Internet2 Network is the first national network to deploy 100 GigE waves on its entire footprint, and will become the most sophisticated research and education platform in the world.” (Internet2, 2012)

ASU is working with Internet2 and is one of only ten universities in the nation that is part of a pilot project to create the “world’s first transcontinental network deployment of 100G technology.” (ASU, 2012).

Ohio will soon see a ten-fold boost to its broadband network speeds,...highlighting the first ever state-led initiative that will leverage astonishing network speeds of 100 Gbps to advance research and job growth across Ohio's medical research, higher education, manufacturing, engineering and technology networking corridors. (Office of the Governor of Ohio, 2012)

Caroline Whitacre, Vice President for Research for The Ohio State University: “Ohio's research broadband backbone is already the envy of many other states. Accelerating its capacity to 100 Gbps will make Ohio even more attractive to medical research, manufacturing, engineering and other technology sectors. This will put Ohio far ahead of the pack in university research collaboration and competition for federal grants.” (Whitaker, 2012)

A goal should be for Arizona to have new 100 Gigabit Ethernet technology connections to its three major universities and other high research institutions needing high bandwidth.

- **Facilitate Arizona becoming a world leader in high bandwidth medicine including genomics and proteomics, building on existing biotech and healthcare strengths**

Arizona is in an extraordinary situation to position itself as a world leader in high bandwidth medical research. With its existing assets and population base it can leverage itself to become the bandwidth medicine leader to benefit Arizonans and the rest of the world.

From the Biotechnology Industry Organization’s State Bioscience Industry Development Study in partnership with Battelle, “Arizona’s bioscience industry continues to grow at a rapid rate. Industry firms have increased employment by 30 percent overall since 2001 (through 2010) and have even added jobs since 2007, a period which includes the deep national recession. These growth rates continue to outpace those for the national bioscience sector. Since 2001, all five major subsectors have experienced net job growth in the state, led by research, testing, and medical labs which has grown its employment base by more than 50 percent since 2001. The State is well concentrated in bioscience-related distribution with a location quotient of 1.10.” (Battelle and BIO, 2012)

The world class TGen is in Phoenix, Arizona. TGen conducts experiments today that were impossible a few years ago. TGen is a nonprofit organization that was founded in 2002 by Dr. Jeffrey Trent, who was the founding Scientific Director of the National Human Genome Research Institute. Arizona is fortunate that Dr. Trent located TGen here. Arizona governments provided incentives to TGen to headquarter in this state. (TGen, 2012)

When the impact of TGen-generated business spin-offs and commercialization are included, the study shows, TGen in 2010 produced \$25.04 for every \$1 invested, supported 1,124 jobs, generated \$10.1 million in state tax revenues, and \$137.7 million in total annual economic impact. (TGen, 2011)

One of the fastest computer data-processing links dedicated to aid such biomedical research has been implemented between laboratories at TGen in Phoenix and the facilities of the High-Performance Computing Initiative of the ASU Ira A. Fulton Schools of Engineering. (TGen, 2010)

Using a supercomputer called Saguaro 2, ASU computer engineers are moving voluminous amounts of information to TGen researchers at as much as 100 times faster than previous systems. The new system is capable of quickly processing trillions of bits of DNA information. It will allow TGen scientists to accelerate the analysis of next-generation whole genome sequences - readouts of the entire three billion chemical letters in an individual's DNA. (TGen, 2010)

The Mayo Clinic is one of the top medical practice and research groups in the world. It has three main locations including Scottsdale/Phoenix, Arizona. It employs some 5,000 people in the state. (Wikipedia, 2012)

Mayo is an ideal partner to conduct clinical trials of TGen discoveries. Although in its infancy, many scientists and clinicians believe that Whole Genome Sequencing (WGS) holds great promise as a therapeutic decision making tool, much the way X-rays became a powerful tool for informing diagnosis and treatment of a wide spectrum of diseases in the early 1900's. (TGen, 2011)

WGS provides a macro view of an individual's complete genome - spelling out the DNA code of all 3 billion chemical bases - in both its healthy and disease state. This ultra-DNA analysis may soon become a standard part of treatment, rather than an exception. (TGen, 2011)

Last year, ASU announced it is relocating its biomedical-informatics program from downtown Phoenix to Mayo's Scottsdale campus. Mayo Clinic also will team with ASU on a new Mayo medical-school branch in Scottsdale that can begin teaching students by 2014. (Alltucker, 2012)

ASU School of Biomedical Informatics programs is being jointly developed with Mayo Clinic. The ASU-Mayo collaboration will include data on genetics, clinical and imaging and public health. (Flinn Foundation, 2011) ASU has bolstered its ties with Mayo Clinic on several fronts over the past decade, such as nursing education, research and dual-degree programs. (Flinn Foundation, 2011)

The University of Arizona Genetics Core (formerly known as GATC) offers access to state-of-the-art resources and services to help investigators, educators, students and the biotech community conduct and promote research in the field of genomics. (UAGC, 2012)

TGen North is the heart of TGen's Pathogen Genomics Division, led by Dr. Paul Keim, one of the world's foremost experts in anthrax and other dangerous infectious diseases. Dr. Keim is a professor of biology and the Cowden Endowed Chair in Microbiology at Northern Arizona University. The strategic plan for TGen North has been developed to focus on diagnostic, analytic, forensic and epidemiologic research related to pathogens important to medicine, public health and biodefense. These activities are linked across TGen North's four research centers: 1) Center for Public Health and Clinical Pathogens; 2) Center for Microbiomics and Human Health; 3) Center for Dangerous Pathogens; and 4) Center for Pathogen Information. (NAU, 2007)

Barrow Neurological Institute (BNI) is a worldwide leader in neuroscience diagnostics, pioneering treatments and research into complex neurological diseases and conditions. The Institute attracts patients, students and medical staff from all over the United States and more than 100 different countries. BNI is a leader in graduate medical education, and directs the largest neurosurgery residency program in the country. It also is consistently recognized by U.S. News & World Report as one of the country's top hospitals for neurology and neurosurgery. BNI is a part of St. Joseph's Hospital and Medical Center in Phoenix, Arizona. This healthcare system conducts nearly 1,000 clinical trials. (BNI, 2012)

The Children's Health Center-BNI-TGen Pediatric Neurogenetics Center (Center for Excellence) is located at the Children's Health Center, St. Joseph's Hospital and Medical Center. (TGen, 2005)

The BNI-ASU Center for Preclinical Imaging is a unique, National Institutes of Health (NIH)-funded imaging resource that is available to all academic and institutional biomedical researchers. The center brings together the leading imaging scientists in the Phoenix metropolitan area and their counterparts in all areas of biomedical research.

The mission of the BNI-ASU Center for Preclinical Imaging is to provide state-of-the-art imaging technology and expertise to researchers in and around Phoenix, Arizona. Key to that goal is their advanced preclinical MRI machine. The Center is a joint effort between BNI and ASU with the goals of providing a key piece of core technology to area researchers to advance biosciences across Arizona.

Together these research institutions provide the foundation for Arizona to be a leader in the use of high bandwidth medicine.

The State's role can be to continue to provide the incentives for current and prospective research institutions to do business in the state. The State can and should promote ultra-high-speed connectivity between these research institutions and collaborators outside the State with the goal of 100 Gigabit technology connections. This high bandwidth will enhance current research efforts in the State and bring incentives for other research institutions to start, expand or relocate in Arizona.

- **Work towards the creation of two to three Gigabit Development Zones in Arizona with gigabit availability at affordable prices to drive experimentation, innovation and economic growth through digital capacity**

“...networks are now the common medium for international research, for American research universities to continue to lead the world, it is not enough for the networks they use to be world-class; they must be world leading.” (Gig.U, 2012)

The natural location for these zones are in and around the state's major universities and near major research centers such as TGen in Phoenix, the Mayo Clinics in Scottsdale, and the University of Arizona College of Medicine in Tucson.

The City of Phoenix, ASU and the Mayo Clinic are jointly planning an “Arizona Biomedical Corridor” based on a memorandum of understanding signed April 3, 2012. This corridor will be in northeast Phoenix in and around the Mayo Clinic at 56th Street and Mayo Blvd, south of the Loop 101 freeway. The goal is to establish a major bioscience center in northeast Phoenix. “The corridor will accommodate biotechnology companies, clinical and academic uses and supporting commercial development.” (ASU, 2012)

A goal should be to establish the areas in and around Arizona's three major universities as Gigabit Development Zones. In rural Arizona, Payson is hoping to set up an ASU campus in Payson with an onsite student component, but also a significant international student body through online learning which might well justify an ASET/ADOT pilot project with conduit placed along the Beeline Highway (Arizona 87). Also, core biotech, medical, and healthcare industry centers would provide excellent prospects for Gigabit Development Zones such as the downtown Phoenix Biomedical Campus (<http://phoenix.gov/econdev/reinvest/focus/>) and the planned Arizona Biomedical Corridor at Desert Arizona

- **Facilitate the definition of and support high-performance digital initiatives for innovative programs to advance university research, industry collaboration, learning, and biotechnology**

The organization leading this idea is Gig.U with its University Community Next Generation Innovation

Project. ASU and the University of Arizona are among Gig.U's 37 members and community pairs. (Gig.U, 2012)

The goal behind Gig.U is to create super high speed capacity networks in and around universities and their community to drive university research, businesses who need bandwidth to the area, collaborate in research, and attract professors and students. (Gig.U, 2012)

The first major project of Gig.U was announced in May of 2012. The University of Maine, the local digital provider, and the town of Orono that surrounds the university announced an ultra-high-speed network that will provide about 1 Gbps. A quarter of a Gbps costs about \$60.00 per month, and a full Gbps about \$90 per month. (2012) (Gig.U, 2012) Generally, digital providers support such tax credits for companies agreeing to extend the specialized infrastructure into these localities.

Gig.U is working with its partners to develop more models such as the one in Orono, Maine. ASU and other members of Gig.U. have put out requests for information. Gig.U is expected to make more announcements similar to its recent project launch at the University of Maine. (Gonzales, 2011)

Arizona's universities are leading the effort to create Gbps zones in and around their communities. These are the most obvious locations where there is great demand for ultra-high-speed bandwidth due to the concentration of research.

The initial university efforts should go forward and their results will help guide future potential sites for gigabit zones, including university research efforts not centered on the main campuses. Currently Gig.U along with its two Arizona members, ASU and the University of Arizona are driving these initiatives in the state.

Summary of Needed Actions to Support Recommendation #8: ADVANCED RESEARCH

Identify big data and telepresence high impact areas and application domains that are most likely to enhance existing strengths.

Facilitate Arizona becoming a world leader in high bandwidth medicine including genomics and proteomics, building on existing biotech and healthcare strengths

Work towards the creation of two to three Gigabit Development Zones in Arizona with gigabit availability at affordable prices to drive experimentation, innovation and economic growth through digital capacity.

- Arizona should create "Gigabit Development Zones" that can provide the super-high-capacity bandwidth needed for major innovative research and high process computing needs.
- A goal should be to establish ASU and the University of Arizona and their surrounding communities as Gig.U projects. These efforts are and should be led by these universities themselves.

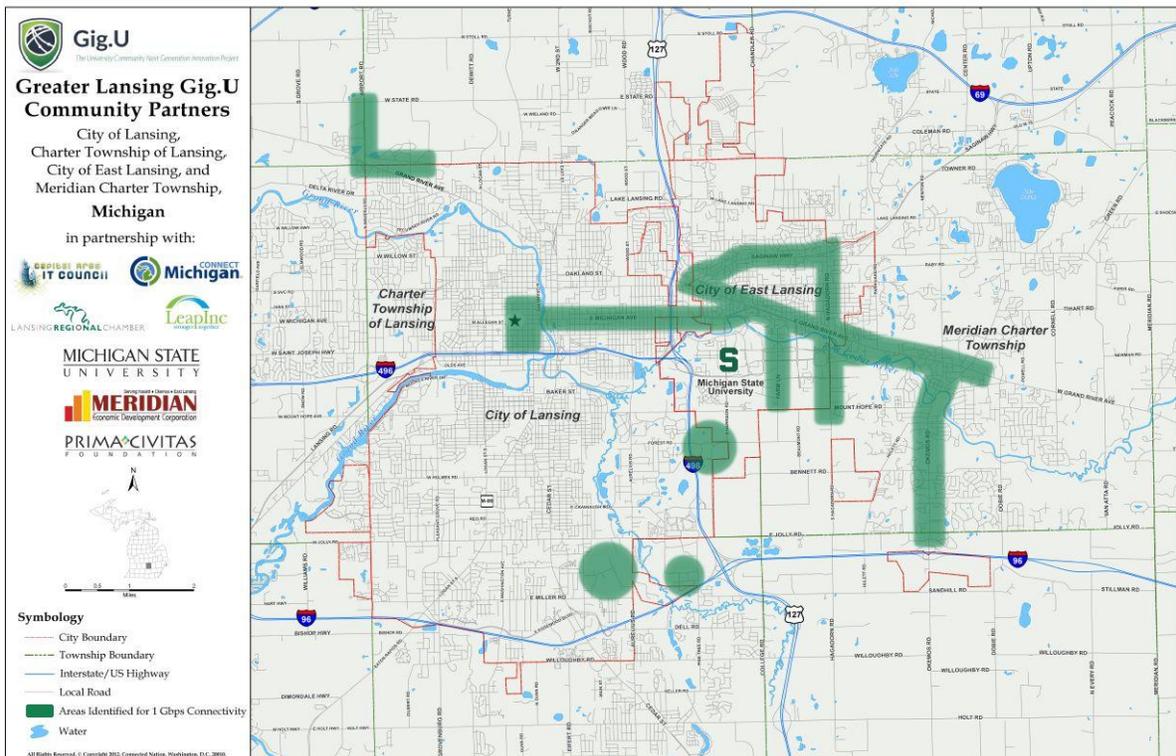
Facilitate the definition of and support high-performance digital initiatives for innovative programs to advance university research, industry collaboration, learning and biotechnology

Figure 14: National Gig.U Participants



(Levin, National Gig.U Participants, 2012)

Figure 15: Greater Lansing Gigabit Development Zone Example



(Levin, National Gig.U Participants, 2012)

Recommendation #9: PUBLIC SAFETY

Support and align with the public safety community in enhancing and leveraging broadband operations and communication capabilities

The entire public safety communications landscape changed dramatically with the passage of Public Law No: 112-96 on February 22, 2012. This legislation created the First Responder Network Authority (FirstNet) that will be responsible for the creation and maintenance the National Public Safety Broadband Network (NPSBN). (Strickland, 2012)

States will be responsible for working with FirstNet to develop the definition of requirements for their state's portion of the NPSBN within the context of the national architectural design. FirstNet will be taking each state's input, while managing to the overall budget and returning with a plan for the state's portion of the buildout. (NTIA, 2012)

The network is required to be self-supporting following a fee-based business model. There are also ample opportunities for the sharing of both spectrum and hardware (tower space, conduit, etc.) in public/private partnerships to bolster the net-zero financial model (NTIA, 2012)

Although it is speculation at this point, it seems reasonable that the shared use of the state and local infrastructure assets may be used as an "in-kind" credit for either greater coverage or reduced network fees.

This will present valuable opportunities for funding, network infrastructure and maintenance support. However, there will be constraints as FirstNet works through the issues of:

- Who can be on the network (specifically the wireless D-block spectrum, which is reserved for Public Safety);
- Policies and standards surrounding dynamic and preemptive priority on the D-block spectrum; and finally
- Defining what forms of public/private partnerships are acceptable.

Each of the following actions needs to be considered in the context of the overarching FirstNet architecture and governance. Also, with respect to the sharing of infrastructure, the most likely opportunities will center on fiber or microwave backhaul due to the security and reliability concerns about tower space. Therefore these actions are focused primarily on the fiber backhaul aspects.

- **Involve State agencies including the Department of Public Safety (DPS), Public Safety Interoperable Communications Office (PSIC), and Department of Emergency and Military Affairs (DEMA), as well as 9-1-1 public safety telecommunications entities, counties, cities, special districts, fire and law enforcement associations, and other public safety stakeholders in working together to create a digital capacity blueprint for future communications coordination and interoperability.**

Coordination for this major project rests with ASET's PSIC Office. The PSIC Office is responsible for "advancing interoperable communications in Arizona" and it provides staff support to the PSCC and the SIEC. (PSIC, 2012) In addition, the PSIC Office has been identified as the single point of contact for interactions with FirstNet.

PSCC's voting members represent a cross section of public safety stakeholders at the State and local levels. SIEC has done much planning in the area of interoperability. The grant dollars that potentially come to Arizona from FirstNet are in the tens of millions. While it is an extraordinary

opportunity to advance the interoperability of the public safety systems in Arizona, a great deal of planning will be involved.

- **Identify and support technological and policy solutions that promote the sharing of public safety infrastructure, where possible, to not only create an interoperable and robust communication system for Public Safety but also provide that infrastructure for other uses.**

SB 1402 provides an ideal opportunity to promote technical solutions for interoperability while supporting infrastructure for other uses. This legislation allows conduit to be buried along state rights-of-ways and can speed up dramatically the lengthy and costly permit approval process.

The legislation and policy allows multiple providers to utilize the same trench for their own conduit separated by protective tubing. This turbocharges the impact of the SB 1402 legislation and allows badly needed digital fiber to reach rural Arizona for public safety and a host of other digital uses such as eLearning, telemedicine, government, individuals and businesses.

- **Drive digital infrastructure deployment to become more robust, redundant, and resilient over time to expand capacity for advanced applications and minimize the potential for interrupted service across the State**

Fiber provides enormous capacity for digital buildout. As noted earlier, Arizona has a digital middle mile infrastructure with dead-ends that do not interconnect. Interconnection or redundancy allows transmissions to reroute themselves when there is a transmission break. Building this interoperability system across Arizona will create more redundancy in the state's interoperability system.

- **Continue to work with the Public Safety Interoperable Communications Office by providing assistance in the development of state and local policies, standards and procedures necessary to achieve wireless interoperability in Arizona**

ASET's PSIC is the natural "lead entity" to bring together the policy leadership. This is their legislative mission. Additional state digital expertise is within ASET at the DAP, which is coordinating SB 1402 implementation. Finally, statewide 9-1-1 management resides within ASET, so coordination will be streamlined.

- **Coordinate and align with the Public Safety Interoperable Communications Office in continuing to provide educational opportunities, grant preparation assistance and technical consultation to public safety programs seeking federal interoperability and modernization grants**

PSCC has provided technical consulting on over 30 federal interoperability grants. It can continue providing this support. A potential risk is a low adoption rate because the program is fee based.

Arizona received over \$75 million in digital grants under the ARRA funding. Some of these grants have a public safety interoperable mission and it is possible they can be leveraged in the creation of such a network.

It is likely that the cost of creating a FirstNet network in Arizona with the federal funding that is available is not enough to build out the entire system. Leveraging other opportunities need to be considered. It is anticipated that the FirstNet grant process will be administered by the NTIA under

the U.S. Department of Commerce. NTIA along with the United States Department of Agriculture (USDA) Rural Utilities Service (RUS) administered the ARRA digital grant process of some \$7.2 billion.

There is \$135 million in Public Law No: 112-96 for NPSBN implementation planning for the states. An additional \$7 billion is available for the actual digital buildout. Wireless 4GLTE Spectrum has also been allocated and assigned to public safety

The FirstNet funding creates an enormous opportunity for Arizona to advance its public safety interoperable network and additionally its digital middle mile in rural Arizona for education, health, government, individuals and business by leveraging SB 1402 which creates two highways for (nearly) the price of one.

Summary of Needed Actions to Support Recommendation #9: PUBLIC SAFETY COMMUNICATION

Involve State agencies including DPS, PSIC and DEMA, as well as 9-1-1 public safety telecommunications entities, counties, cities, special districts, fire and law enforcement associations, and other public safety stakeholders in working together to create a digital capacity blueprint for future communications coordination and interoperability

Identify and support technological and policy solutions that promote the sharing of public safety infrastructure, where possible, to not only create an interoperable and robust communication system for Public Safety but also provide infrastructure for other uses.

PSIC can coordinate this FirstNet effort with all the stakeholders involved with the goal of maximizing the funding that will come to Arizona to enhance the state's public safety and utilizing any opportunities to leverage this funding to advance other digital buildout needs in rural Arizona.

Drive digital infrastructure deployment to become more robust, redundant, and resilient over time to expand capacity for advanced applications and minimize the potential for interrupted service across the State

Continue to work with the Public Safety Interoperable Communications Office by providing assistance in the development of state and local policies, standards and procedures necessary to achieve wireless interoperability in Arizona

Coordinate and align with the Public Safety Interoperable Communications Office in continuing to provide educational opportunities, grant preparation assistance and technical consultation to public safety programs seeking federal interoperability and modernization grants

Recommendation #10: ENERGY AND THE ENVIRONMENT

Support the leveraging of digital capacity to reduce/optimize energy consumption and protect the environment

Advanced digital infrastructure can enable Arizona to move on the path of sustainable economic development, reducing and optimizing energy consumption and protecting the environment for current and future generations. Reduced energy consumption will not only save consumers and businesses money, but the reduced oil and coal consumption will also provide cleaner air for Arizona residents. The digital infrastructure can provide these benefits by two means: 1) substitute telecommunications for travel; and 2) enable the creation of the electric utilities' "smart grid" of the future.

Sufficient digital capacity will allow individuals and organizations to substitute telecommunications for travel via telework, distance learning, online shopping and e-commerce, remote healthcare practices, and e-government. (Engebretson, 2010)

The electric power network can be modernized to become a smart grid that effectively uses renewable solar and wind power for power generation, optimizes electric power consumption by end users, and makes possible the mass deployment of electric and hybrid electric vehicles. The smart grid's objective is to efficiently use traditional and renewable energy resources for electric power generation and effectively manage supply and demand at end-user sites. This includes distributed supply sources such as end-user solar photovoltaic panels, distributed energy storage such as by using electric vehicles' batteries, and demand response from smart homes and buildings. The smart grid will also enable electric utilities to reduce their infrastructure investment costs and enhance overall system reliability.

- **Encourage telework and mobility capabilities to reduce travel and increase productivity**

"In a country that has been moaning about low productivity and searching for new ways to increase it, the single most anti-productive thing we do is to ship millions of workers back and forth across the landscape every morning and evening."

Alvin Toffler, Futurist and Author (<http://www.toffler.com/>)

"Don't drive to work one day and your (energy) consumption is reduced by 20%, two days 40%, etc.,"says Chuck Wilsker, President of the Telework Coalition. Now according to a recent survey from TechCast at George Washington University, less than 4% of private-sector employees across the US now work from home, but "that figure could reach as high as 30% by 2019."

Telecommuting and the broader concept of telework is increasingly popular to enable knowledge workers to better serve their modern enterprises. Advances in computer technology and telecommunications now enable employees to work part or full-time from home as well as from satellite offices, special telebusiness centers, or from the road.

Telework resoundingly delivers an important solution to cut down on gasoline consumption and air pollution by reducing the number of trips to and from jobs and other work-related travel. It yields numerous other benefits in improved employee productivity, satisfaction, and retention while reducing costs and improving bottom-line results. These and other benefits serve the employee as well as employers, the community, and the environment alike.

Certainly some types of jobs, such as those where the individual largely works alone, can communicate electronically or hands off work products such as electronic files, are particularly suitable for telework. Many of today's jobs readily lend themselves to performance from remote sites, as knowledge workers can communicate and collaborate with co-workers and customers independent of their location. This is due to advances in computer equipment, enterprise networking, and telecommunications services with increasing broadband availability.

There are however a variety of issues that are of concern in this process. Employers often need changes in management philosophy to manage by objectives rather than observation, and to manage projects and deliverables rather than individual activity. There are start-up and operating costs as well as legal and regulatory issues to consider. The enterprise's IT service group needs to evaluate its computer use and networks, and possibly enhance the external remote accessibility while augmenting security procedures. The implementing departments or finance staff should perform a formal ROI analysis of any incremental costs for implementing and supporting remote work and access to build the business case supporting the necessary enterprise investments in telework.

Chuck Wilsker, president and founder of The Telework Coalition, a telework education and advocacy group based in Washington, says 30% is a conservative estimate. "At least 40% of the (private-sector) workforce, representing 33 million Americans, have jobs that can be performed remotely, either part-time or full-time," he said, "and that number is going to be growing. We're an information-based economy." While the high cost of office space and the recession have contributed to the trend, Mr. Wilsker said, "Over the past 10 years, nothing has made the phone ring more than pain at the pump — hikes in the price of gasoline." (Bowden, 2012)

The Telework Coalition's research has shown that, contrary to what many believe, employees who work at home are more productive, retention is higher and recruiting is easier. The rising generation, Mr. Wilsker said, has grown up with mobile technology and they're demanding a more mobile lifestyle. (Bowden, 2012)

Cost analyses, he said, show economic benefits for both sides. Employers save an average of \$20,000 a year in office space, overhead, parking and the like. For the stay-at-home employee, who saves not only on gas and wear and tear on a car but also on clothing, dry cleaning, meals and other incidentals, the average savings is \$8,000 a year. (Bowden, 2012)

Ms. Rendeiro, a former president of the Global Workspace Association, travels extensively to talk about the changing workplace. "The workforce is moving into the mobile market. We are seeing it more and more," she said. "Large companies are downsizing their real-estate portfolios, using a 'work smarter, not harder' strategy. They're telling employees to work anyplace other than the corporate office." (Bowden, 2012)

Energy consumption can be reduced and productivity gains can be achieved in education through eLearning. It is estimated by Harvard Professor Clayton Christensen in his book "Disrupting Class" that half of all high school classes will be online by 2019. Some 3 million K12 students currently take online classes, and Arizona has been a leader in creating online education opportunities in the K12 environment. On the Navajo Nation, there is an automotive technology class that is taught by one instructor by video conference simultaneously to five different remote student locations. Students in rural Arizona can now get certain advanced AP classes that were previously only available to urban students. Students and adults taking online courses from universities and community colleges also greatly reduce their energy consumption and increase their productivity by not having to travel to campus regularly.

Greater bandwidth in rural areas also enables telemedicine opportunities that can dramatically reduce travel distance and time for patients in need. Online shopping reduces the need for rural Arizonans to

travel long distances for items not available in their local area. Local rural businesses can use digital access to sell their services and products throughout Arizona, the country and even around the world, without leaving their home or shop. For example, one rural couple builds and sells exotic bird cages all over the world, and almost all their business comes through the Internet.

- **Encourage Arizona governments and the private sector to create telecommuting jobs in rural Arizona**

The State of Arizona can provide telecommuting jobs to Arizonans in rural areas that will reduce energy consumption, help the environment, provide support to the local economy and contribute to demand aggregation of services for digital providers.

One of the most adaptable state jobs for home remote sites is customer service for various state agencies. The State of Arizona employs hundreds of Arizonans for customer service positions. In the private sector for example, when consumers call to make an airline reservation the agent is often an individual working from their home connected to the Internet and a reservation system by their company. There are many other state job categories that could be remote jobs for Arizonans working from their home.

Creating such jobs in rural Arizona would be one of the most effective ways the State of Arizona can create rural digital demand aggregation to encourage more digital infrastructure buildout, reduce unemployment in rural Arizona, reduce the amount of state taxpayers' money used for office space and reduce commuting miles and emissions that would help the environment. For example, Yuma County, Arizona often has the highest unemployment of any county in the nation hovering around 25%. Yuma County has an established customer service industry with the private sector.

Outsourcing state jobs to rural Arizonans help the local economies in areas of great need where job availability is limited. Unemployment on some of Arizona's rural Native American reservations is also high. Such a project could be an integral part of the state's strategy for rural economic development.

The software to ensure that workers are utilizing their time appropriately and other metrics to determine productivity are already well developed in the telecommuting industry. The State can leverage these existing resources and begin a telecommuting job effort of its own. A specific number of jobs should be set aside for telecommuting positions in areas of economic need. The State should provide tax credits to industries that create telecommuting jobs in Arizona and economic areas of need. Arizona already has a large customer service industry that it can build on.

- **Facilitate the expansion of the use of e-government at all levels of government**

More and more government services are available through the Internet to the citizens of Arizona reducing the need to travel by automobile and corresponding emissions. Arizona has actually been a leader among the states in using digital access to obtain government services, and has also privatized some government services that also use digital access.

Up until the first quarter of 2010, Arizonans in rural parts of the State had to drive hours to a state office location to obtain hunting or fishing licenses that today are available online. Driving school classes are available over the Internet. Creating a business entity can be done from one's home office computer. It also costs government less to provide an online service than to do a transaction in person saving taxpayers' money. Reducing consumers' driving hours can even save additional taxpayer funds by reducing the amount of wear and tear on highways increasing their life of use, and the costs needed to repair and replace them.

The ADOA ASET office does strategic IT planning for state government. A bold and audacious goal for ASET is to eventually provide to all Arizona citizens online digital government services that are available anywhere and at any time to every Arizonan. (ASET, 2012) To accomplish this goal Arizona, including rural Arizona, needs the digital connectivity to make it possible.

The State portal is operated by ASET and provides ever-improving opportunities to citizens to obtain government services. The state's websites have been consolidated and branded to give them a similar look and feel. This helps with ease of use. If a citizen can successfully navigate one state government website, they should find the next attempt familiar territory.

The best practices in state and local government in the use of web portals and providing eGovernment services can often be found in the annual contest sponsored by organizations such as the National Association of State CIO's (NASCIO). (NASCIO, 2011) The Center for Digital Government also has such contests and is an ongoing resource of the latest adaptations and advances in the use of government portals. (CDG, 2012) There are new online government services applications being created constantly that can save consumers a trip to a government office.

Because the State portal is revenue producing it creates the funding to constantly update the web system and improve and provide more eGovernment services.

- **Encourage the adoption of digital smart grid applications**

A number of insights for the smart grid section came from an interview with Andres Carvallo in June 2012. Mr. Carvallo was chief architect of Austin Energy's deployment of the first version of smart grid in the U.S., and is the author of "The Advanced Smart Grid." He is currently executive vice president and chief strategy officer of Proximity (www.proximity.com), which provides network management systems for wireless smart energy networks. (Carvallo, 2012)

The smart grid is a modernization of the electric power network to enable two-way flow of energy and information from the grid to end-user sites. Broadband is needed for smart grid communications between the electric utilities and the various types of digital devices required at end-user sites including smart meters, home/building energy management systems, smart appliances and smart inverters for solar photovoltaic panels and electric vehicles.

Smart meters can provide dynamically-changing electronic pricing information to end users based on the current costs of supplying the electricity, which may vary by time of day based on intermittent solar and wind power supplies. This enables end users to adjust their electricity consumption to optimize their costs based on the pricing of electric power.

Two-way communicating thermostats and in-home energy displays can dramatically drop peak demand by as much as 44%. Smart appliances are being built that use sensors to detect ideal times to operate. Such thermostats and appliances could even be controlled by a cell phone. At peak demand, higher-polluting energy generation sources have to be used more. Dropping peak demand allows utilities to choose alternative non-polluting sources of energy when they have a diversity of power supply.

End-user solar rooftop panels can be used to supply electricity to the home and building or supply and sell electricity back into the grid for general use. Electric and hybrid electric vehicles contain batteries, which can be used to store electric energy when supply costs are low, and also sell energy to the electric utilities when it is not required. These vehicles can interwork with local end-user solar photovoltaic panels to store their electric energy output as well. In this manner, electric vehicles are part of a system that takes maximum advantage of renewable solar and wind power, and thus the

smart grid helps enable their mass deployment. Arizona has become a center for the manufacture of solar power units and the use of solar power that is creating many new jobs.

The smart grid is also an effort to configure a national grid system that reduces the infrastructure costs and inefficiencies of power distribution through digitization. For example, there is excess utility capacity owned by utility companies that is used only a few days a year. The capital costs for power plants are enormous and by sharing electricity through a smart grid, major efficiencies and cost savings could be realized. Arizona could be an enormous economic beneficiary of the national smart grid concept. Already, Arizona provides excess energy capacity to neighboring California. A national smart grid would allow Arizona to provide such capacity to other parts of the country (such as the Midwest and East Coast during the winter) from its solar and other power plants.

The ACC is an ideal government body to encourage electric utility power network modernization and incorporation of renewable resource use, such as solar power and wind power, by establishing a smart grid network based on widespread deployment of the required digital capacity in residences and businesses. The ACC should encourage utilities to deploy smart grids by implementing a reward system of incentives and disincentives for non-participation, which would be a superior model to the current rate-of-return regulation that does not encourage utilities to maximize energy efficiency. The RUS should make loans to rural Arizona energy providers for smart grid projects. The State government could also initiate and promote smart grid development.

The ACC should also encourage utilities to provide a computer model to Arizona consumers with real-time information from smart meters so consumers can make wiser choices. A data privacy policy and guidelines will help make this possible for utilities to undertake. Most consumers have no idea what it costs to run their home computer, heating and cooling, refrigerator, dish washer, hot water heater or washing machines. Smart meters can give historical consumption data, real-time energy use and the actual cost of electricity at the moment it is being used. Informed consumers make better decisions.

Some key telecommunications considerations for smart grid development are wireless spectrum availability, telecommunications service provider offerings to enable smart grid services and security guarantees.

The 700 MHz spectrum, which is appropriate for smart grid applications, is intended to be allocated to public service entities. Utilities could partner with public safety agencies in lobbying the federal government for use of part of this spectrum. Telecom service providers need to be encouraged to offer services and pricing that would be efficient for smart grid deployment. This includes telemetry-type pricing for small bursts of data from end-user smart grid equipment, and MultiProtocol Label Switching (MPLS) VPN services with quality-of-service and security for mission-critical utility applications. The MPLS VPN services could be more cost-effective for utilities than dedicated fiber backhaul. Utilities and the National Institute of Standards and Technology have proposed comprehensive security standards for smart grid communications. The Department of Homeland Security may take responsibility for overall cyber-security issues. The State of Arizona should promote regulations to ensure that consumers can view required data on their energy consumption.

The ACC can also influence utility regulated rights-of-way policies that could allow for digital backhaul through multi-utility trenching that would include fiber cabling. Utilities should be allowed to install fiber optic cables along their power line trenches for backhaul needs. This could be coordinated for the needs of power, telecommunications, water and natural gas.

Starting in July 2009, the City of Tucson required all new residences to be “solar-ready” for photovoltaic electric panels and hot water heaters to reduce greenhouse gas emissions. Other cities and communities should consider similar new home and building standards. The Homebuilders

Association should encourage its builders to adopt such standards. The cost is only about \$150 per home and saves significant money over a solar install after a home is already constructed.

In addition, Arizona is an emerging state in the development and manufacture of smart grid equipment and software applications. (Hottenstein, 2012) The State government can encourage the development of business opportunities for small businesses in Arizona that provide smart grid equipment and software for end-user sites and utilities.

Summary of Needed Actions to Support Recommendation #10: ENERGY AND THE ENVIRONMENT

Encourage telework and mobility capabilities to reduce travel and increase productivity

Encourage Arizona governments and the private sector to create telecommuting jobs in rural Arizona

- The State of Arizona should undertake a major initiative to create remote digital jobs throughout the State including especially rural Arizona and economically challenged and disadvantaged regions, areas and communities. ADOA should conduct an in-depth review of potential job categories that can be in-home telecommuting positions such as customer service jobs. These job opportunities can then be targeted to areas of high unemployment in rural Arizona and on Native American lands.
- The State should provide tax credits to industries that create telecommuting jobs in Arizona and economic areas of need.

Facilitate the expansion of the use of e-government at all levels of government

- Local governments in Arizona can and should look to the State's portal websites as a model as well as the resources at NASCIO and the Center for Digital Government.

Encourage the adoption of digital smart grid applications

- The ACC should pursue policies that use a reward and consequence program to promote energy-efficient practices among utility providers and provide information to consumers to make smart decisions including real-time energy costs and innovative applications to reduce energy consumption. This is already being done in Arizona, and new and innovative ideas can create even more energy and environment benefits and reduce the effects of global warming.
- The ACC can influence utility regulated ROW policies that could allow for digital backhaul through multi-utility trenching that would include fiber cabling.
- The ACC can also advocate for the use of 700 MHz spectrum that can be used for smart grid application efficiencies. This could be coordinated for the needs of power, telecommunications, water and natural gas.

Digital Arizona: The Way Forward

In this strategic plan, we envision the long-term benefits of digital capacity development for the State of Arizona. Digital infrastructure is a key foundation for the development of the State in the future. It will transform education, healthcare, and research, improve public safety and government operations, create major new opportunities for business and employment, reduce energy consumption and protect the environment, and generally enable a long-term future of sustainable economic development. These benefits will be shared by every resident of Arizona now and in the future, and will very positively impact the nation as a whole.

We have emphasized the most cost-effective, flexible approaches to build this digital capacity infrastructure. Arizona needs to remove barriers and develop public policies and market-driven strategies that encourage private-sector investment to provide cost-effective high-speed broadband Internet access and advanced digital services throughout the state. Our primary strategy is to enable the private sector to provide the digital infrastructure and services, but public funding may be required where the private return on investment is not sufficient for this to occur.

We believe the long-term benefits to the State and nation will greatly outweigh the costs of the digital infrastructure and services, and we will attempt to quantify the long-term benefits and costs for sample rural community models in the near future. Given these statewide and national benefits that go far beyond traditional telecommunications services markets, we believe there is a strong case to be made for state and federal government funding to support communities in developing the required digital capacity infrastructure and corresponding services. This will be an investment in Arizona and the United States that will yield immense societal returns for current and future generations.

To meet these objectives, public and private-sector stakeholders should undertake a comprehensive plan, comprised of ten recommendations, which will strengthen the foundation for a 21st century economy. Advancing Arizona's global leadership is a task that will be shared by government, entrepreneurs, philanthropists, industry, educators, researchers, and community institutions. Together, stakeholders should implement these ten recommendations, which form a comprehensive plan to build a 21st century economy.

Next Steps

Sample Rural Community Models

The DAP will establish sample rural community models to demonstrate the broadband networking applications and quantify the long-term benefits and costs for these communities. As discussed in Recommendation 1, a prioritization matrix has been developed to support the evaluation and prioritization of DAP demonstrations and the subsequent statewide buildout staging process.

Summary of Action Items for ASET and DAC

The coordination of all these action items detailed in Recommendations 1 through 10 belongs under the DAP which implements the \$6.3 million federal digital grant on behalf of the State of Arizona. This planning project is under the state CIO's office within ASET. This project office should reach out to the appropriate responsible entities under the action items listed above and coordinate the overall effort to improve digital connectivity for Arizona.

The key initiatives that DAP can undertake to advance this strategic plan include:

- Work with ADOT to deploy fiber implementing SB 1402
- Establish sample rural community projects to demonstrate the broadband networking applications and quantify the long-term benefits and costs for these communities
- Advance right of way best practices for state and local government to reduce costs.
- Work with FirstNet to support cost-effective buildout of rural digital infrastructure for public safety and possibly other uses.

Federal Government, State Government, Private Sector Funding Options

Various federal government, state government, and private sector funding options should be considered to realize the full implementation of this strategic plan. These are summarized below:

- Using the State's universal service fee and reforming the federal universal service fee to apply to all telecommunications services and to be used to build the state and nation's next-generation digital infrastructure.
- Expanding the federal government eRate program for telecommunications services and digital equipment for schools and libraries.
- Creatively using federal FirstNet public safety funding to support cost-effective buildout of rural digital infrastructure.
- Instituting state tax credits for service providers' rural digital buildout.
- Rewarding electric utility companies that use emerging energy-saving broadband technologies for smart grid implementations.

This strategic plan should be revisited on an ongoing basis and revised as needed to meet the dramatically changing world of digital capacity and the changing and improving applications that come from it.

Appendix A: Digital Availability and Adoption in Arizona

Accurately knowing the conditions of broadband availability, its capacity, and deficits in all parts of our State, especially underserved rural areas, is critical information for decision-making and informed policy. Because the ASET Broadband Team including the Arizona State Land Department and contractor Data Site Consortium, Inc. has now spent over two years developing the Arizona Broadband GIS Survey and Assessment data, tools, and deliverables under a National Telecommunications and Information Administration (NTIA) Broadband Mapping grants, we can now begin to identify the actual availability and deficits in the State, on behalf of Arizona's broadband stakeholders and policy makers, with a reasonable degree of accuracy.

There is still much to do to make the data yet more accurate and useful to stakeholders as the data currently provided by service providers currently may overstate actual availability in two dimensions. First, for wire line services, availability is frequently shown as availability throughout an entire service territory and does not show in which streets, census blocks, and neighborhoods where physical plant is not actually available to connect all users. Second, as agreed with service providers, download and upload speeds for all types of services are reported as maximum advertised speeds. Digital providers have natural concerns for providing the exact location and diminution of digital middle mile assets for competitive and also security reasons.

The numbers vary considerably when compared to actual speeds experienced by users in most instances. To address these issues, so as to provide more accurate data to our stakeholders, we have a robust verification program using licensed databases, crowd-source data, and speed-test data captured by independent third parties. As the amount of this data is accumulated to a statistically significant level, we will begin to incorporate it in our broadband maps and analysis. We will also continue working with our service providers to obtain more granular and accurate service availability data wherever possible.

The current NTIA Broadband Mapping grants run through 2014 and it remains uncertain whether any federal support for the states' efforts will be provided after that. So, if Arizona wishes to continue with its broadband data collection, mapping, and analysis efforts after that time, plans must be put in place and resources found to support its continuation.

Arizona Digital Landscape and Situational Analysis

From the Arizona Broadband Analysis Project funded by NTIA grants we know that while a healthy 99.5% of Arizona households can get broadband of at least 768 Kbps download from at least one provider. As we move to rural areas that decreases to 97.6% of households. And for sparsely populated rural areas, the percentage decreases further to 95.7% of households leaving just over 4% of sparsely populated rural households without any broadband coverage at all.

When we consider the more reasonable modern connection speed of at least 3 Mbps download, the availability percentages start to visibly decline to 96% of households statewide, 82% for rural areas, and 72% for sparsely populated rural areas leaving some 28% of households in sparsely populated rural areas without what we would consider adequate bandwidth. At a somewhat higher connection speed of 6 Mbps download, the availability percentages more precipitously decline to 94.0% of households statewide, 72% for rural areas, and only 57% for sparsely populated rural areas leaving some 43% of households in sparsely populated rural areas without such higher performance services.

Looking at specific technologies, cable modem services at connection speeds of at least 3 Mbps download are available to 89% of households statewide, 56% for rural areas, and 35% for sparsely populated rural areas. The cable industry has invested heavily in a new generation of DOCSIS 3.0

services to be able to deliver connection speeds of 10 Mbps download or greater to 79% of households statewide, but that percentage declines to 47.0% of rural households and only 30% of sparsely populated rural households.

Mobile wireless services at connection speeds of at least 768 Kbps download, generally 3G services edging into 4G, are available to 98.8% of individuals statewide, 94% for rural areas, and 90% for sparsely populated rural areas. At connection speeds of at least 3.0 Mbps, well into 4G service range, mobile wireless services are available to only 79% of individuals statewide and a meager 21% of those living in rural areas. See the more detailed tables that follow in Appendix A for an expanded view.

ATI Institute partnered with Microsoft Corporation and their Shape the Future team to have a Digital Inclusion Economic Impact Model for Arizona undertaken by their partner, The Arnold Group focusing on disadvantaged school-age children and their families. Arizona modeling results indicate that students with a home PC and broadband access increase their chance of graduating from High School by 6-8 points and increase an average of \$1.2M additional economic and social impact over their lifetime. The affected individuals will also have more employment opportunities benefiting from significant lifetime creation of jobs. By targeting students in poverty, over \$32.4 billion in total lifetime economic and social impact can potentially be realized.

Digital Adoption: How Does Arizona Compare?

The US Census Bureau reports Computer and Internet Use in the United States from 2010 in depth on their site at <http://www.census.gov/hhes/computer/publications/2010.html>. The data reveals Arizona ranks 18th among the 50 states and the District of Columbia in coverage with 79.1% of Arizonans living in households with Internet access. Arizona ranks 31st in individuals accessing the Internet at home at 64.6%. Arizona ranks 15th in Individuals with a household computer at 84.2%. Finally, Arizona ranks 24th with 40.4% of individuals in the state having access to the Internet from a location outside their home. A summary of Arizona, average, top ranked, and bottom ranked State statistics are included in a separate page below.

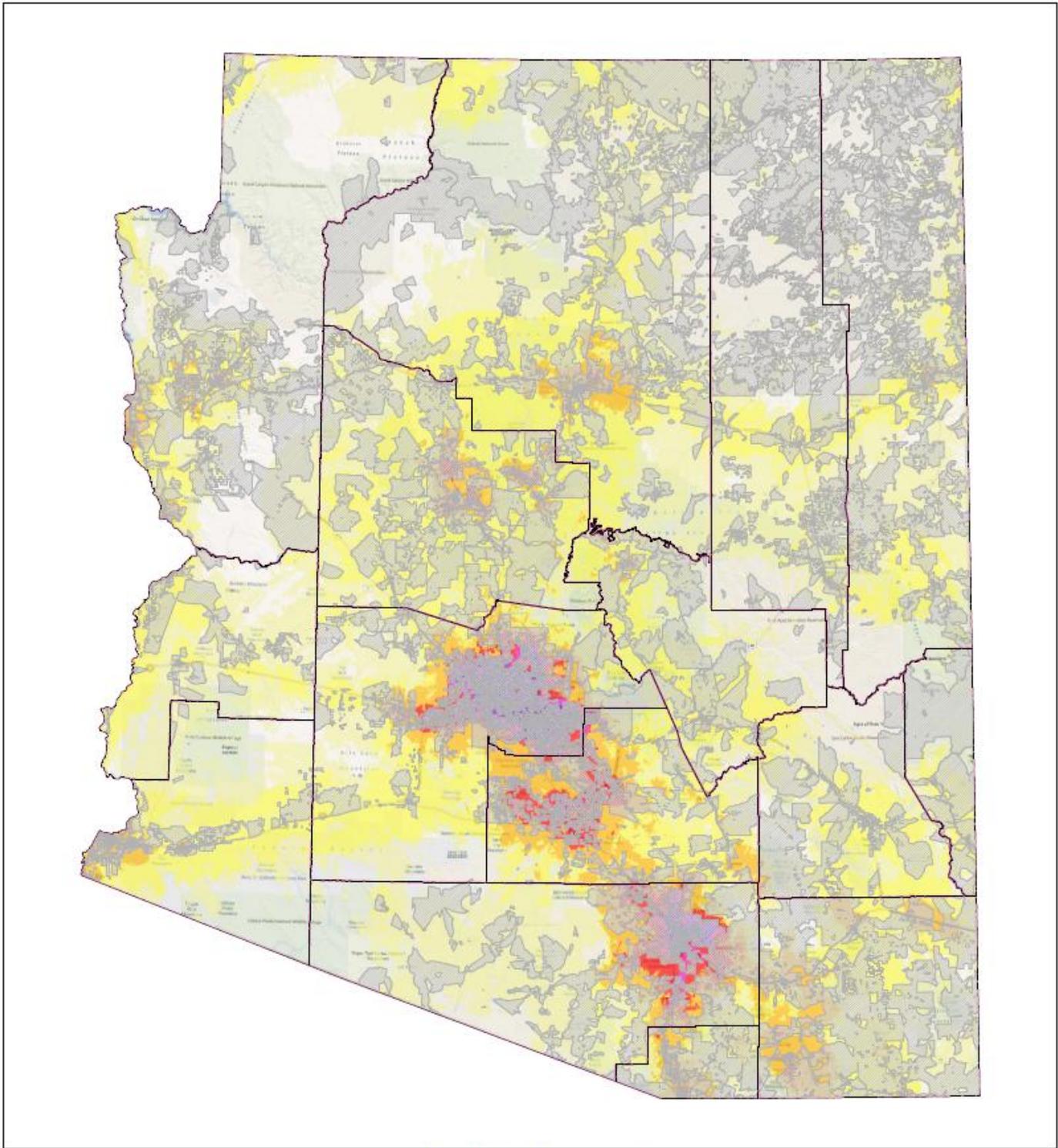
Akamai Technologies is the leading global service provider for accelerating content and business processes online. Akamai utilizes data gathered across their global server network, which serves an estimated 20% of the world's Internet traffic, to provide continually-updated visualizations of global Web traffic and performance. In their most recent reporting for Q2 2012, Arizona ranks 45th among the 50 states and the District of Columbia with a 4.8 Mbps average speed experienced by broadband subscribers compared to top ranked Delaware at 12.1 Mbps and bottom ranked Missouri at 3.6 Mbps. For average peak speed, Arizona ranks 48th with 19.7 Mbps compared to top ranked Delaware at 41.6 Mbps and bottom ranked Missouri at 15.7 Mbps.

For overall broadband adoption of over 4 Mbps, Arizona ranks 44th among the 50 states and the District of Columbia with 43.2% of the population utilizing such services compared with top ranked Delaware at 94.2% and bottom ranked Arkansas at 30.1% and has realized a 24% increase in over 4 Mbps subscribership from 34.7% in Q3 2007. For high broadband adoption over 10 Mbps, Arizona ranks 43rd with 8.1% of the population utilizing such services compared with top ranked Delaware at 38.8% and bottom ranked Arkansas at 3.0% and has realized a 135% increase in over 10 Mbps subscribership from 6.0% a year ago and a 450% increase from 1.8% in Q3 2007.

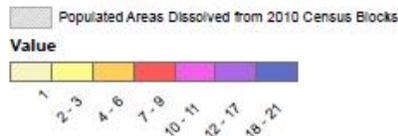
Further details and comparisons can be found in Appendix A.

In another study, Arizona currently ranks 34th among fifty states in average digital connection speeds. Our neighbor California ranks 8th, Nevada 9th. Delaware ranks 1st and Utah 2nd. (Woolley, 2011).

Figure 16: Arizona Broadband Provider Counts (Minus Satellite)



Arizona Broadband Mapping Program
 Provider Count (unique FRN's) - All Technologies and Spectra Except Satellite
 SPRING 2012 SUBMITTAL

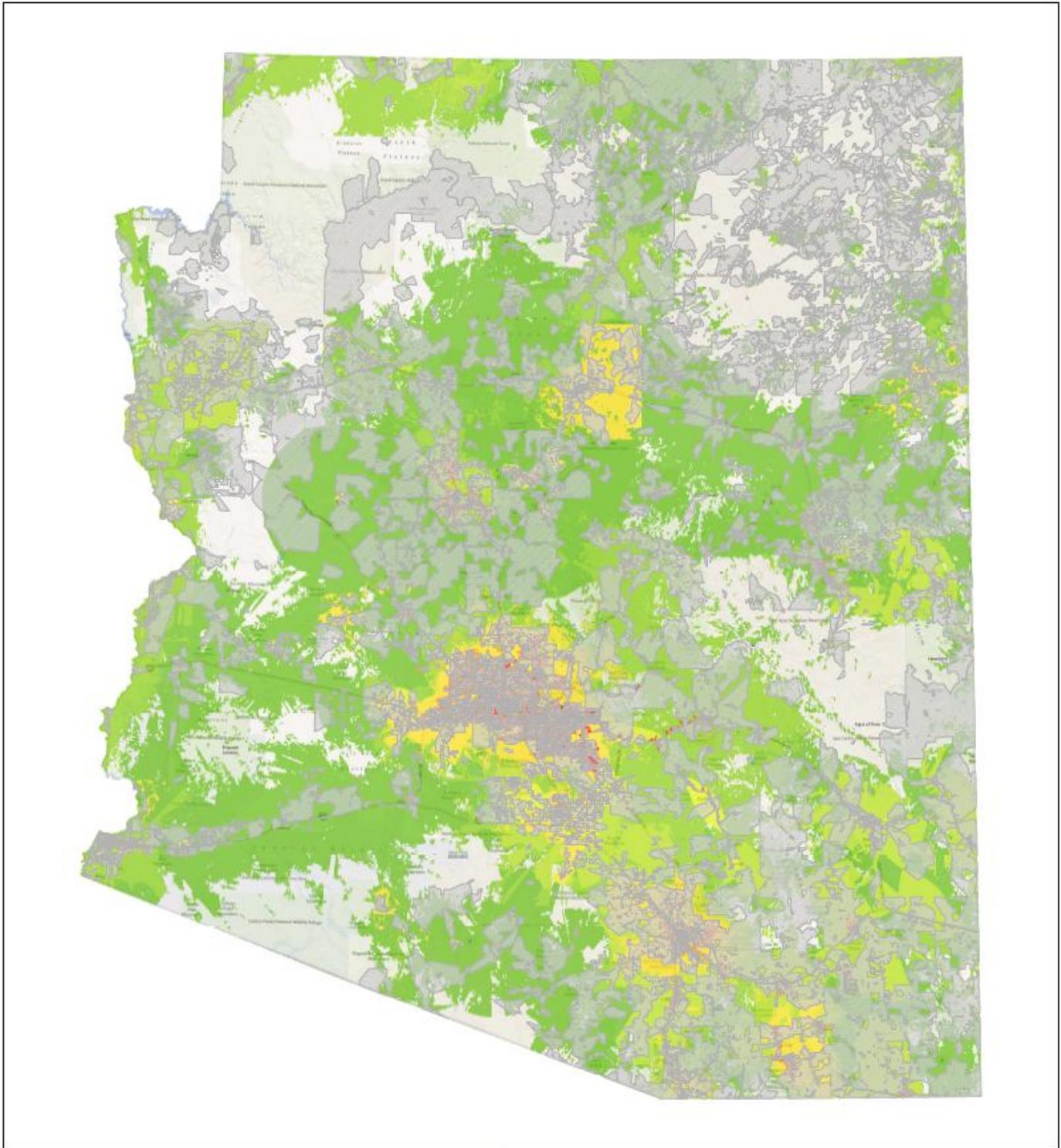


Map Date: 04/23/2012
 Author: TerraSystems SW, Inc.
 File: AZ12_ProviderCount_Spring2012.mxd

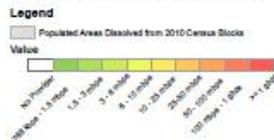
Note: Analysis for Census Block, Road Segment Buffers and Wireless Polygons. Some FRNs have more than one reported technology and/or spectra. Does not include Satellite Providers.



Figure 17: Maximum Advertised Download Speeds (Minus Satellite)

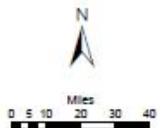


Arizona Broadband Mapping Program
 Maximum Advertised Download Speeds by NTIA Code, All Providers and Technologies Except Satellite
 SPRING 2012 SUBMITTAL



Map Date: 04/24/2012
 Author: TerraOptima SW, Inc.
 File: AZ00_MaximumSpeed_Spring2012.mxd

Note: Analysis for Census Block, Road Segment Buffers and Wireless Polygons. Does not include Satellite Providers.



Arizona Broadband Coverage Tables for Spring 2012:

All Technologies: Coverage for 768 Kbps Down and Above

All Technologies: Coverage for 3 Mbps Down and Above

All Technologies: Coverage for 6 Mbps Down and Above

Fixed Address: Technologies Coverage for 768 Kbps Down and Above

Fixed Address: Technologies Coverage for 3 Mbps Down and Above

Fixed Address: Technologies Coverage for 6 Mbps Down and Above

Cable Modem: Coverage for 768 Kbps Down and Above

Cable Modem: Coverage for 3 Mbps Down and Above

Cable Modem: Coverage for 6 Mbps Down and Above

Cable Modem: DOCSIS 3.0 Coverage for 10 Mbps Down and Above

Mobile Wireless: Coverage for 768 Kbps Down and Above

Mobile Wireless: Coverage for 3 Mbps Down and Above

Mobile Wireless: Coverage for 6 Mbps Down and Above

Arizona Broadband Coverage Table Notes:

Data presented here is as collected by the State of Arizona for the NTIA and FCC broadband maps and submitted in Spring 2012 for Broadband Provider (BP) coverage declared as of 12/31/11.

The Census Bureau identifies two types of urban areas: **Urbanized Areas (UAs)** of 50,000 or more people and **Urban Clusters (UCs)** of at least 2,500 and less than 50,000 people. Per the Census Bureau, “**Rural**” encompasses all population, housing, and territory not included within Urbanized Areas (UAs). For Arizona analysis purposes, “**Sparsely Populated Rural**” encompasses all population, housing, and territory not included within either Urbanized Areas (UA) or Urban Clusters (UC).

Using an Urban Area/Cluster GIS Layer, Arizona is calculated to have a total of 241,666 Census Blocks per the 2010 Census of which:

- 86,648 Census Blocks are in Urban Areas (UAs)
- 19,479 Census Blocks are in Urban Clusters (UCs)
- 106,127 Census Blocks total are in Urban Areas (UAs) or Urban Clusters (UCs)
- 155,018 Census Blocks are in Rural areas (Outside UAs only) with a population count of 1,274,234 and household count of 601,889
- 135,539 Census Blocks are in Sparsely Populated Rural areas (Outside both UAs and UCs) with a population count of 651,358 and household count of 329,022

For wireline providers, census blocks greater than 2 square miles intersected by covered road segments were added to their reported list of census blocks less than or equal to 2 sq. mi. For fixed and mobile wireless providers, census block counts were based on census blocks that intersected (were touched by) an overlaying wireless provider's service area. Satellite providers which tend to offer lower downstream and upstream data rates are not included in the Broadband Providers (BPs) for purposes of this analysis. All census blocks, regardless of area or water characteristic were included in this analysis.

All Technologies: Coverage for 768 Kbps Down and Above

(All NTIA Codes for Tech and MaxAdDown >= 3)

Statewide Coverage Overall	Census Block Count	Population Count	Population %	Household Count	Household %
Census Blocks with One Provider	28,799	69,418	1.1%	33,311	1.2%
Census Blocks with Two or More Providers	187,796	6,291,231	98.4%	2,796,947	98.3%
Total Coverage: Census Blocks with One or More Providers	216,595	6,360,649	99.5%	2,830,258	99.5%
Total Uncovered: Census Blocks with No Provider	25,071	31,368	0.5%	14,268	0.5%
Statewide Totals	241,666	6,392,017		2,844,526	
Rural Coverage	Census Block Count	Population Count	Population %	Household Count	Household %
Census Blocks with One Provider	28,799	69,418	5.4%	33,311	5.5%
Census Blocks with Two or More Providers	101,148	1,173,448	92.1%	554,310	92.1%
Total Coverage: Census Blocks with One or More Providers	129,947	1,242,866	97.5%	587,621	97.6%
Total Uncovered: Census Blocks with No Provider	25,071	31,368	2.5%	14,268	2.4%
Rural Totals	155,018	1,274,234		601,889	
Sparsely Populated Rural Coverage	Census Block Count	Population Count	Population %	Household Count	Household %
Census Blocks with One Provider	28,229	57,341	8.8%	29,504	9.0%
Census Blocks with Two or More Providers	82,268	562,779	86.4%	285,288	86.7%
Total Coverage: Census Blocks with One or More Providers	110,497	620,120	95.2%	314,792	95.7%
Total Uncovered: Census Blocks with No Provider	25,042	31,238	4.8%	14,230	4.3%
Sparsely Populated Rural Totals	135,539	651,358		329,022	

All Technologies: Coverage for 3 Mbps Down and Above

(All NTIA Codes for Tech and MaxAdDown >= 5)

Statewide Coverage Overall	Census Block Count	Population Count	Population %	Household Count	Household %
Census Blocks with One Provider	36,757	331,414	5.2%	161,626	5.7%
Census Blocks with Two or More Providers	119,495	5,839,078	91.3%	2,568,132	90.3%
Total Coverage: Census Blocks with One or More Providers	156,252	6,170,492	96.5%	2,729,758	96.0%
Total Uncovered: Census Blocks with No Provider	85,414	221,525	3.5%	114,768	4.0%
Statewide Totals	241,666	6,392,017		2,844,526	
Rural Coverage	Census Block Count	Population Count	Population %	Household Count	Household %
Census Blocks with One Provider	32,669	223,541	17.5%	106,004	17.6%
Census Blocks with Two or More Providers	37,391	832,526	65.3%	384,513	63.9%
Total Coverage: Census Blocks with One or More Providers	70,060	1,056,067	82.8%	490,517	81.5%
Total Uncovered: Census Blocks with No Provider	84,958	218,167	17.2%	111,372	18.5%
Rural Totals	155,018	1,274,234		601,889	
Sparsely Populated Rural Coverage	Census Block Count	Population Count	Population %	Household Count	Household %
Census Blocks with One Provider	28,519	143,421	22.0%	74,006	22.5%
Census Blocks with Two or More Providers	24,736	340,244	52.2%	161,586	49.1%
Total Coverage: Census Blocks with One or More Providers	53,255	483,665	74.2%	235,592	71.6%
Total Uncovered: Census Blocks with No Provider	82,284	167,693	25.8%	93,430	28.4%
Sparsely Populated Rural Totals	135,539	651,358		329,022	

All Technologies: Coverage for 6 Mbps Down and Above

(All NTIA Codes for Tech and MaxAdDown >= 6)

Statewide Coverage Overall	Census Block Count	Population Count	Population %	Household Count	Household %
Census Blocks with One Provider	30,208	519,410	8.1%	255,051	9.0%
Census Blocks with Two or More Providers	104,064	5,533,396	86.6%	2,417,154	85.0%
Total Coverage: Census Blocks with One or More Providers	134,272	6,052,806	94.7%	2,672,205	94.0%
Total Uncovered: Census Blocks with No Provider	107,394	339,211	5.3%	172,321	6.0%
Statewide Totals	241,666	6,392,017		2,844,526	
Rural Coverage	Census Block Count	Population Count	Population %	Household Count	Household %
Census Blocks with One Provider	24,714	349,710	27.4%	169,365	28.1%
Census Blocks with Two or More Providers	23,730	591,240	46.4%	265,282	44.1%
Total Coverage: Census Blocks with One or More Providers	48,444	940,950	73.8%	434,647	72.2%
Total Uncovered: Census Blocks with No Provider	106,574	333,284	26.2%	167,242	27.8%
Rural Totals	155,018	1,274,234		601,889	
Sparsely Populated Rural Coverage	Census Block Count	Population Count	Population %	Household Count	Household %
Census Blocks with One Provider	17,723	162,997	25.0%	80,996	24.6%
Census Blocks with Two or More Providers	15,475	228,676	35.1%	107,601	32.7%
Total Coverage: Census Blocks with One or More Providers	33,198	391,673	60.1%	188,597	57.3%
Total Uncovered: Census Blocks with No Provider	102,341	259,685	39.9%	140,425	42.7%
Sparsely Populated Rural Totals	135,539	651,358		329,022	

Fixed Address Technologies: Coverage for 768 Kbps Down and Above

(NTIA Codes of Tech 10-50, 70-71 and MaxAdDown >= 3)

Statewide Coverage Overall	Census Block Count	Population Count	Population %	Household Count	Household %
Census Blocks with One Provider	41,289	220,407	3.5%	107,204	3.8%
Census Blocks with Two or More Providers	138,398	6,068,108	94.9%	2,686,133	94.4%
Total Coverage: Census Blocks with One or More Providers	179,687	6,288,515	98.4%	2,793,337	98.2%
Total Uncovered: Census Blocks with No Provider	61,979	103,502	1.6%	51,189	1.8%
Statewide Totals	241,666	6,392,017		2,844,526	
Rural Coverage	Census Block Count	Population Count	Population %	Household Count	Household %
Census Blocks with One Provider	40,528	210,335	16.5%	102,877	17.1%
Census Blocks with Two or More Providers	52,519	960,397	75.4%	447,823	74.4%
Total Coverage: Census Blocks with One or More Providers	93,047	1,170,732	91.9%	550,700	91.5%
Total Uncovered: Census Blocks with No Provider	61,971	103,502	8.1%	51,189	8.5%
Rural Totals	155,018	1,274,234		601,889	
Sparsely Populated Rural Coverage	Census Block Count	Population Count	Population %	Household Count	Household %
Census Blocks with One Provider	36,994	139,945	21.5%	77,718	23.6%
Census Blocks with Two or More Providers	37,448	414,164	63.6%	203,862	62.0%
Total Coverage: Census Blocks with One or More Providers	74,442	554,109	85.1%	281,580	85.6%
Total Uncovered: Census Blocks with No Provider	61,097	97,249	14.9%	47,442	14.4%
Sparsely Populated Rural Totals	135,539	651,358		329,022	

Fixed Address Technologies: Coverage for 3 Mbps Down and Above

(NTIA Codes of Tech 10-50, 70-71 and MaxAdDown >= 5)

Statewide Coverage Overall	Census Block Count	Population Count	Population %	Household Count	Household %
Census Blocks with One Provider	41,150	409,803	6.4%	199,747	7.0%
Census Blocks with Two or More Providers	109,041	5,722,494	89.5%	2,516,931	88.5%
Total Coverage: Census Blocks with One or More Providers	150,191	6,132,297	95.9%	2,716,678	95.5%
Total Uncovered: Census Blocks with No Provider	91,475	259,720	4.1%	127,848	4.5%
Statewide Totals	241,666	6,392,017		2,844,526	
Rural Coverage	Census Block Count	Population Count	Population %	Household Count	Household %
Census Blocks with One Provider	34,155	249,668	19.6%	118,693	19.7%
Census Blocks with Two or More Providers	30,773	779,376	61.2%	363,310	60.4%
Total Coverage: Census Blocks with One or More Providers	64,928	1,029,044	80.8%	482,003	80.1%
Total Uncovered: Census Blocks with No Provider	90,090	245,190	19.2%	119,886	19.9%
Rural Totals	155,018	1,274,234		601,889	
Sparsely Populated Rural Coverage	Census Block Count	Population Count	Population %	Household Count	Household %
Census Blocks with One Provider	29,878	158,140	24.3%	82,976	25.2%
Census Blocks with Two or More Providers	18,468	301,460	46.3%	145,000	44.1%
Total Coverage: Census Blocks with One or More Providers	48,346	459,600	70.6%	227,976	69.3%
Total Uncovered: Census Blocks with No Provider	87,193	191,758	29.4%	101,046	30.7%
Sparsely Populated Rural Totals	135,539	651,358		329,022	

Fixed Address Technologies: Coverage for 6 Mbps Down and Above

(NTIA Codes of Tech 10-50, 70-71 and MaxAdDown >= 6)

Statewide Coverage Overall	Census Block Count	Population Count	Population %	Household Count	Household %
Census Blocks with One Provider	35,918	842,032	13.2%	400,393	14.1%
Census Blocks with Two or More Providers	87,749	5,130,157	80.2%	2,241,802	78.8%
Total Coverage: Census Blocks with One or More Providers	123,667	5,972,189	93.4%	2,642,195	92.9%
Total Uncovered: Census Blocks with No Provider	117,999	419,828	6.6%	202,331	7.1%
Statewide Totals	241,666	6,392,017		2,844,526	
Rural Coverage	Census Block Count	Population Count	Population %	Household Count	Household %
Census Blocks with One Provider	22,494	374,179	29.4%	179,984	29.9%
Census Blocks with Two or More Providers	17,294	515,763	40.5%	235,461	39.1%
Total Coverage: Census Blocks with One or More Providers	39,788	889,942	69.9%	415,445	69.0%
Total Uncovered: Census Blocks with No Provider	115,230	384,292	30.1%	186,444	31.0%
Rural Totals	155,018	1,274,234		601,889	
Sparsely Populated Rural Coverage	Census Block Count	Population Count	Population %	Household Count	Household %
Census Blocks with One Provider	15,212	161,458	24.8%	82,639	25.1%
Census Blocks with Two or More Providers	9,597	182,839	28.1%	87,888	26.7%
Total Coverage: Census Blocks with One or More Providers	24,809	344,297	52.9%	170,527	51.8%
Total Uncovered: Census Blocks with No Provider	110,730	307,061	47.1%	158,495	48.2%
Sparsely Populated Rural Totals	135,539	651,358		329,022	

Cable Modem: Coverage for 768 Kbps Down and Above

(NTIA Codes of Tech 40-41 and MaxAdDown >= 3)

Statewide Coverage Overall	Census Block Count	Population Count	Population %	Household Count	Household %
Census Blocks with One Provider	98,964	5,532,246	86.5%	2,435,714	85.6%
Census Blocks with Two or More Providers	2,293	191,659	3.0%	91,945	3.2%
Total Coverage: Census Blocks with One or More Providers	101,257	5,723,905	89.5%	2,527,659	88.8%
Total Uncovered: Census Blocks with No Provider	140,409	668,112	10.5%	316,867	11.2%
Statewide Totals	241,666	6,392,017		2,844,526	
Rural Coverage	Census Block Count	Population Count	Population %	Household Count	Household %
Census Blocks with One Provider	21,093	674,410	52.9%	318,336	52.9%
Census Blocks with Two or More Providers	1,102	40,354	3.2%	21,065	3.5%
Total Coverage: Census Blocks with One or More Providers	22,195	714,764	56.1%	339,401	56.4%
Total Uncovered: Census Blocks with No Provider	132,823	559,470	43.9%	262,488	43.6%
Rural Totals	155,018	1,274,234		601,889	
Sparsely Populated Rural Coverage	Census Block Count	Population Count	Population %	Household Count	Household %
Census Blocks with One Provider	8,511	189,921	29.2%	101,844	31.0%
Census Blocks with Two or More Providers	844	24,586	3.8%	12,936	3.9%
Total Coverage: Census Blocks with One or More Providers	9,355	214,507	33.0%	114,780	34.9%
Total Uncovered: Census Blocks with No Provider	126,184	436,851	67.0%	214,242	65.1%
Sparsely Populated Rural Totals	135,539	651,358		329,022	

Cable Modem: Coverage for 3 Mbps Down and Above

(NTIA Codes of Tech 40-41 and MaxAdDown >= 5)

Statewide Coverage Overall	Census Block Count	Population Count	Population %	Household Count	Household %
Census Blocks with One Provider	99,031	5,560,533	87.0%	2,451,737	86.2%
Census Blocks with Two or More Providers	2,219	162,641	2.5%	75,521	2.6%
Total Coverage: Census Blocks with One or More Providers	101,250	5,723,174	89.5%	2,527,258	88.8%
Total Uncovered: Census Blocks with No Provider	140,416	668,843	10.5%	317,268	11.2%
Statewide Totals	241,666	6,392,017		2,844,526	
Rural Coverage	Census Block Count	Population Count	Population %	Household Count	Household %
Census Blocks with One Provider	21,093	674,410	52.9%	318,336	52.9%
Census Blocks with Two or More Providers	1,102	40,354	3.2%	21,065	3.5%
Total Coverage: Census Blocks with One or More Providers	22,195	714,764	56.1%	339,401	56.4%
Total Uncovered: Census Blocks with No Provider	132,823	559,470	43.9%	262,488	43.6%
Rural Totals	155,018	1,274,234		601,889	
Sparsely Populated Rural Coverage	Census Block Count	Population Count	Population %	Household Count	Household %
Census Blocks with One Provider	8,511	189,921	29.2%	101,844	31.0%
Census Blocks with Two or More Providers	844	24,586	3.8%	12,936	3.9%
Total Coverage: Census Blocks with One or More Providers	9,355	214,507	33.0%	114,780	34.9%
Total Uncovered: Census Blocks with No Provider	126,184	436,851	67.0%	214,242	65.1%
Sparsely Populated Rural Totals	135,539	651,358		329,022	

Cable Modem: Coverage for 6 Mbps Down and Above

(NTIA Codes of Tech 40-41 and MaxAdDown >= 6)

Statewide Coverage Overall	Census Block Count	Population Count	Population %	Household Count	Household %
Census Blocks with One Provider	99,021	5,560,121	87.0%	2,451,497	86.1%
Census Blocks with Two or More Providers	2,219	162,641	2.5%	75,521	2.7%
Total Coverage: Census Blocks with One or More Providers	101,240	5,722,762	89.5%	2,527,018	88.8%
Total Uncovered: Census Blocks with No Provider	140,426	669,255	10.5%	317,508	11.2%
Statewide Totals	241,666	6,392,017		2,844,526	
Rural Coverage	Census Block Count	Population Count	Population %	Household Count	Household %
Census Blocks with One Provider	21,083	673,998	52.9%	318,096	52.9%
Census Blocks with Two or More Providers	1,102	40,354	3.2%	21,065	3.5%
Total Coverage: Census Blocks with One or More Providers	22,185	714,352	56.1%	339,161	56.4%
Total Uncovered: Census Blocks with No Provider	132,833	559,882	43.9%	262,728	43.6%
Rural Totals	155,018	1,274,234		601,889	
Sparsely Populated Rural Coverage	Census Block Count	Population Count	Population %	Household Count	Household %
Census Blocks with One Provider	8,507	189,921	29.2%	101,844	31.0%
Census Blocks with Two or More Providers	844	24,586	3.8%	12,936	3.9%
Total Coverage: Census Blocks with One or More Providers	9,351	214,507	33.00%	114,780	34.9%
Total Uncovered: Census Blocks with No Provider	126,188	436,851	67.0%	214,242	65.1%
Sparsely Populated Rural Totals	135,539	651,358		329,022	

Cable Modem: DOCSIS 3.0 Coverage for 10 Mbps Down and Above

(NTIA Codes of Tech 41 and MaxAdDown >= 7)

Statewide Coverage Overall	Census Block Count	Population Count	Population %	Household Count	Household %
Census Blocks with One Provider	87,703	5,058,342	79.1%	2,222,389	78.1%
Census Blocks with Two or More Providers	1,171	58,000	0.9%	29,227	1.1%
Total Coverage: Census Blocks with One or More Providers	88,874	5,116,342	80.0%	2,251,616	79.2%
Total Uncovered: Census Blocks with No Provider	152,792	1,275,675	20.0%	592,910	20.8%
Statewide Totals	241,666	6,392,017		2,844,526	
Rural Coverage	Census Block Count	Population Count	Population %	Household Count	Household %
Census Blocks with One Provider	17,461	534,536	41.9%	264,935	44.0%
Census Blocks with Two or More Providers	888	34,113	2.7%	18,230	3.0%
Total Coverage: Census Blocks with One or More Providers	18,349	568,649	44.60%	283,165	47.00%
Total Uncovered: Census Blocks with No Provider	136,669	705,585	55.4%	318,724	53.0%
Rural Totals	155,018	1,274,234		601,889	
Sparsely Populated Rural Coverage	Census Block Count	Population Count	Population %	Household Count	Household %
Census Blocks with One Provider	7,171	155,112	23.8%	86,827	26.4%
Census Blocks with Two or More Providers	671	19,315	3.0%	10,642	3.2%
Total Coverage: Census Blocks with One or More Providers	7,842	174,427	26.8%	97,469	29.6%
Total Uncovered: Census Blocks with No Provider	127,697	476,931	73.2%	231,553	70.4%
Sparsely Populated Rural Totals	135,539	651,358		329,022	

Mobile Wireless: Coverage for 768 Kbps Down and Above

(NTIA Codes of Tech 80 and MaxAdDown >= 3)

Statewide Coverage Overall	Census Block Count	Population Count	Population %	Household Count	Household %
Census Blocks with One Provider	44,456	200,836	3.1%	112,568	4.0%
Census Blocks with Two or More Providers	163,901	6,113,473	95.7%	2,700,403	94.9%
Total Coverage: Census Blocks with One or More Providers	208,357	6,314,309	98.8%	2,812,971	98.9%
Total Uncovered: Census Blocks with No Provider	33,309	77,708	1.2%	31,555	1.1%
Statewide Totals	241,666	6,392,017		2,844,526	
Rural Coverage	Census Block Count	Population Count	Population %	Household Count	Household %
Census Blocks with One Provider	44,456	200,836	15.8%	112,568	18.7%
Census Blocks with Two or More Providers	77,253	995,690	78.1%	457,766	76.1%
Total Coverage: Census Blocks with One or More Providers	121,709	1,196,526	93.9%	570,334	94.8%
Total Uncovered: Census Blocks with No Provider	33,309	77,708	6.1%	31,555	5.2%
Rural Totals	155,018	1,274,234		601,889	
Sparsely Populated Rural Coverage	Census Block Count	Population Count	Population %	Household Count	Household %
Census Blocks with One Provider	40,838	121,679	18.7%	75,065	22.8%
Census Blocks with Two or More Providers	62,054	467,334	71.7%	226,878	69.0%
Total Coverage: Census Blocks with One or More Providers	102,892	589,013	90.4%	301,943	91.8%
Total Uncovered: Census Blocks with No Provider	32,647	62,345	9.6%	27,079	8.2%
Sparsely Populated Rural Totals	135,539	651,358		329,022	

Mobile Wireless: Coverage for 3 Mbps Down and Above

(NTIA Codes of Tech 80 and MaxAdDown >= 5)

Statewide Coverage Overall	Census Block Count	Population Count	Population %	Household Count	Household %
Census Blocks with One Provider	15,840	450,768	7.1%	186,834	6.6%
Census Blocks with Two or More Providers	78,507	4,596,670	71.9%	1,991,990	70.0%
Total Coverage: Census Blocks with One or More Providers	94,347	5,047,438	79.0%	2,178,824	76.6%
Total Uncovered: Census Blocks with No Provider	147,319	1,344,579	21.0%	665,702	23.4%
Statewide Totals	241,666	6,392,017		2,844,526	
Rural Coverage	Census Block Count	Population Count	Population %	Household Count	Household %
Census Blocks with One Provider	10,056	156,651	12.3%	63,969	10.6%
Census Blocks with Two or More Providers	7,556	107,765	8.5%	45,347	7.6%
Total Coverage: Census Blocks with One or More Providers	17,612	264,416	20.8%	109,316	18.2%
Total Uncovered: Census Blocks with No Provider	137,406	1,009,818	79.2%	492,573	81.8%
Rural Totals	155,018	1,274,234		601,889	
Sparsely Populated Rural Coverage	Census Block Count	Population Count	Population %	Household Count	Household %
Census Blocks with One Provider	8,860	93,286	14.3%	41,012	12.5%
Census Blocks with Two or More Providers	6,922	75,095	11.5%	32,657	9.9%
Total Coverage: Census Blocks with One or More Providers	15,782	168,381	25.8%	73,669	22.4%
Total Uncovered: Census Blocks with No Provider	119,757	482,977	74.2%	255,353	87.6%
Sparsely Populated Rural Totals	135,539	651,358		329,022	

Mobile Wireless: Coverage for 6 Mbps Down and Above

(NTIA Codes of Tech 80 and MaxAdDown >= 6)

Statewide Coverage Overall	Census Block Count	Population Count	Population %	Household Count	Household %
Census Blocks with One Provider	15,840	450,768	7.1%	186,834	6.6%
Census Blocks with Two or More Providers	78,507	4,596,670	71.9%	1,991,990	70.0%
Total Coverage: Census Blocks with One or More Providers	94347	5047438	79.0%	2178824	76.6%
Total Uncovered: Census Blocks with No Provider	147,319	1,344,579	21.0%	665,702	23.4%
Statewide Totals	241,666	6,392,017		2,844,526	
Rural Coverage	Census Block Count	Population Count	Population %	Household Count	Household %
Census Blocks with One Provider	10,056	156,651	12.3%	63,969	10.6%
Census Blocks with Two or More Providers	7,556	107,765	8.5%	45,347	7.5%
Total Coverage: Census Blocks with One or More Providers	17,612	264,416	20.8%	109,316	18.1%
Total Uncovered: Census Blocks with No Provider	137,406	1,009,818	79.2%	492,573	81.9%
Rural Totals	155,018	1,274,234		601,889	
Sparsely Populated Rural Coverage	Census Block Count	Population Count	Population %	Household Count	Household %
Census Blocks with One Provider	8,860	93,286	14.3%	41,012	12.5%
Census Blocks with Two or More Providers	6,922	75,095	11.5%	32,657	9.9%
Total Coverage: Census Blocks with One or More Providers	15,782	168,381	25.80%	73,669	22.40%
Total Uncovered: Census Blocks with No Provider	119,757	482,977	74.2%	255,353	77.6%
Sparsely Populated Rural Totals	135,539	651,358		329,022	

U.S. Census Bureau Computer and Internet Use 2010:

The US Census Bureau reports Computer and Internet Use in the United States from 2010 in depth on their site at <http://www.census.gov/hhes/computer/publications/2010.html> where you can access more detailed statistics and comparisons by State and individual characteristics.

The data reveals Arizona ranks 18th among the 50 states and the District of Columbia in coverage with 79.1% of Arizonans living in households with Internet access. Arizona ranks 31st in individuals accessing the Internet at home at 64.6%. Arizona ranks 15th in Individuals with a household computer at 84.2%. Finally, Arizona ranks 24th with 40.4% of individuals in the state having access to the Internet from a location outside their home. A summary of Arizona, average, top ranked, and bottom ranked State statistics follows:

Total Population 2010

Arizona: 6.340M, U.S.: 292.065M

Individual Lives in Household with Internet Access

Arizona ranks #18 of 51: 79.1% (5.017M)

U.S. Average: 75.9% (221.767M)

New Hampshire ranks #1 with 86.2%

New Mexico ranks #51 with 64.1%

Individual Accesses the Internet at Home

Arizona ranks #31 of 51: 64.6% (4.098M)

U.S. Average: 65.0% (189.960M)

New Hampshire ranks #1 with 76.0%

Mississippi ranks #51 with 51.8%

Individual Accesses the Internet from Some Location Outside of Home

Arizona ranks #24 of 51: 40.4% (2.558M)

U.S. Average: 113.526M, 38.9%

District of Columbia ranks #1 with 53.1%

Kentucky ranks #51 with 32.7%

Individual Lives in Household with a Computer

Arizona ranks #15 of 51: 84.2% (5.340M)

U.S. Average: 81.4% (237.744M)

New Hampshire ranks #1 with 90.7%

New Mexico ranks #51 with 71.1%

Type of Computer for Individuals Who Live in Household with a Computer

Desktop or laptop: Arizona: 81.9% (5.194M)

U.S. Average: 79.6% (232.346M)

Handheld: Arizona: 24.1% (1.528M)

U.S. Average: 21.2% (62.008M)

Other: Arizona: 0.6% (0.38M)

U.S. Average: 0.7% (2.056M)

Akamai State of the Internet for Arizona:

Akamai Technologies (<http://www.akamai.com/>) is the leading global service provider for accelerating content and business processes online. They developed a set of breakthrough algorithms for intelligently routing and replicating content over a large network of distributed servers without relying on centralized servers typically used by Web site owners. Akamai has placed tens of thousands of servers around the world supporting customers large and small in ending the "World Wide Wait" through intelligent Internet content delivery and distributes an estimated 20% of the world's Internet traffic.

Akamai utilizes data gathered across their global server network to provide continually-updated visualizations of global Web traffic and performance which is distilled into quarterly "State of the Internet" reports, which are available <http://www.akamai.com/stateoftheinternet/>.

Akamai's dynamic mapping system serves as a weather map for not only the entire Akamai network, but also the Public Internet as they collect enormous amounts of data on Internet performance. Two of these sources are from "ping" and "traceroute," common utilities that provide information on latency, packet loss, and routing. Akamai uses this information, along with its sophisticated algorithms and global deployment, to optimally route traffic between Akamai data centers on the public Internet.

Akamai was kind enough to provide Arizona with State-by-State data through the second quarter of 2012. In their most recent reporting for Q2 2012, Arizona ranks 45th among the 50 states and the District of Columbia with a 4.8 Mbps average speed experienced by broadband subscribers compared to top ranked Delaware at 12.1 Mbps and bottom ranked Missouri at 3.6 Mbps. For average peak speed, Arizona ranks 48th with 19.7 Mbps compared to top ranked Delaware at 41.6 Mbps and bottom ranked Missouri at 15.7 Mbps.

For overall broadband adoption of over 4 Mbps, Arizona ranks 44th among the 50 states and the District of Columbia with 43.2% of the population utilizing such services compared with top ranked Delaware at 94.2% and bottom ranked Arkansas at 30.1% and has realized a 24% increase in over 4 Mbps subscribership from 34.7% in Q3 2007. For high broadband adoption over 10 Mbps, Arizona ranks 43rd with 8.1% of the population utilizing such services compared with top ranked Delaware at 38.8% and bottom ranked Arkansas at 3.0% and has realized a 135% increase in over 10 Mbps subscribership from 6.0% a year ago and a 450% increase from 1.8% in Q3 2007.

We have generated charts comparing Arizona performance compared to the U.S. average from Q3 of 2007 through Q2 of 2012, which are embedded below for Average, Average Peak, Overall Broadband Adoption, High Broadband Adoption, and Narrowband Broadband Adoption. Akamai has acknowledged some analysis and reporting anomalies for the previous several quarters which lead to a perceived drop in Arizona performance for the most recent quarter, but believes the recent figures represent a more accurate view.

Figure 18: Akamai State of the Internet - Arizona Average Connection Speed

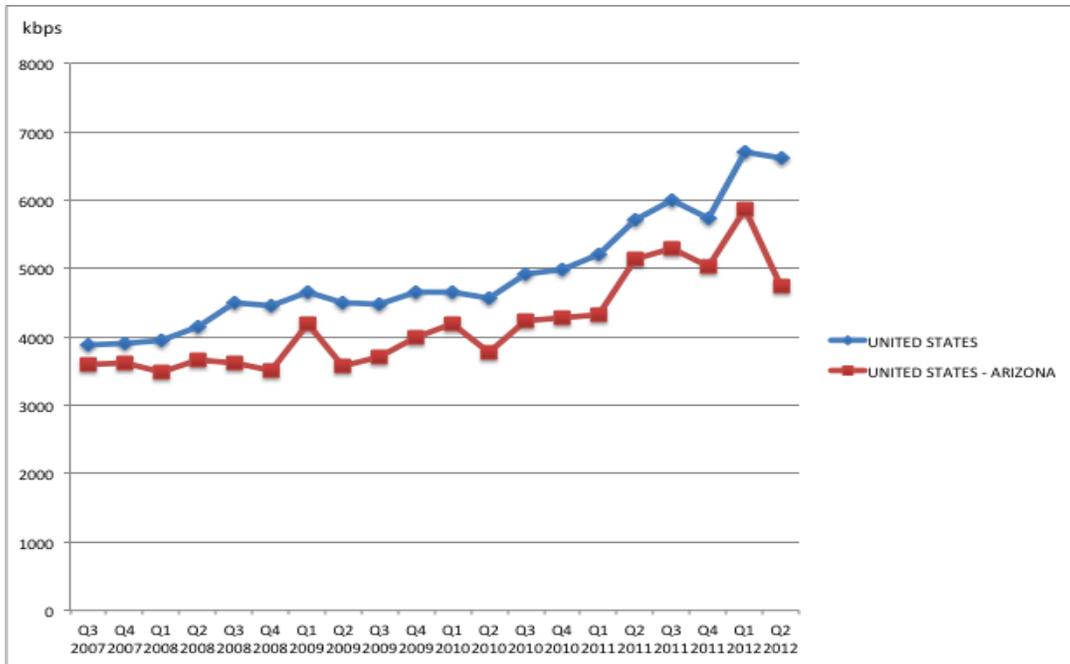


Figure 19: Akamai State of the Internet - Arizona Average Peak Connection Speed

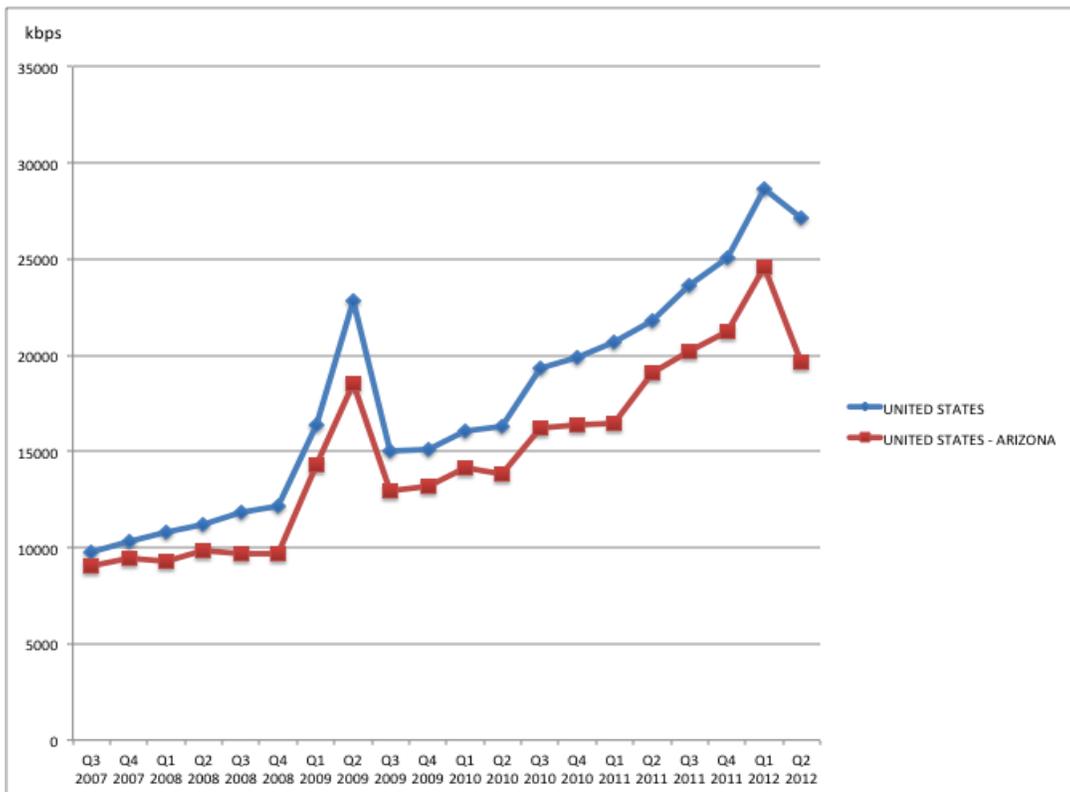


Figure 20: Akamai State of the Internet - Arizona Overall Broadband Adoption

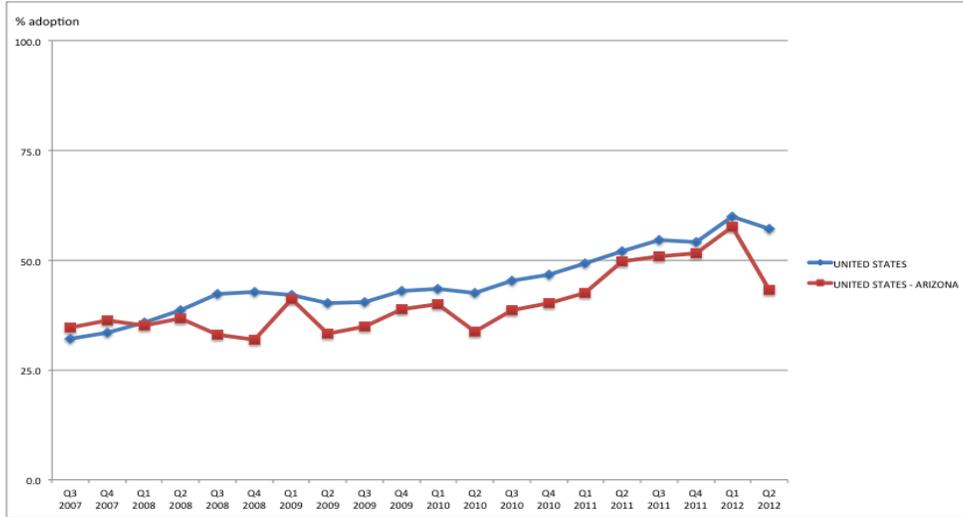


Figure 21: Akamai State of the Internet - Arizona High Broadband Adoption

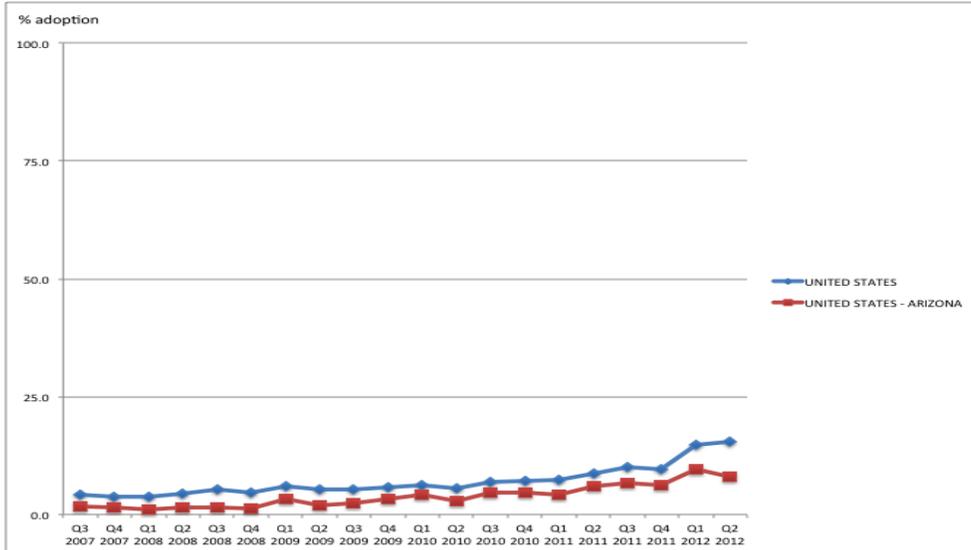
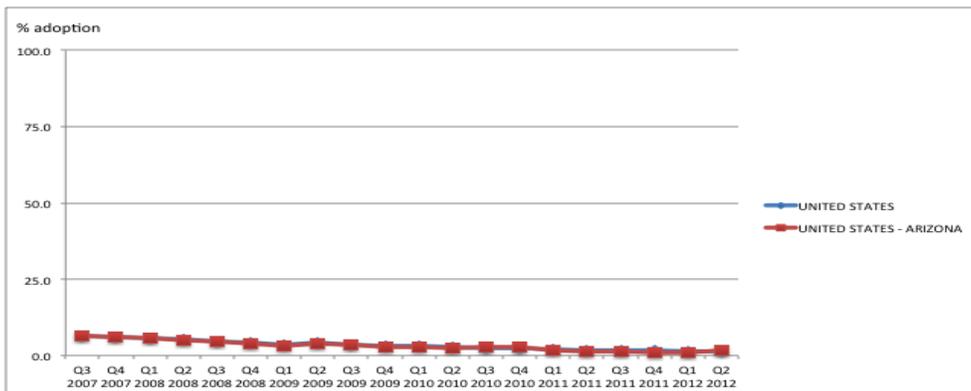


Figure 22: Akamai State of the Internet - Arizona Narrowband Broadband Adoption



Arizona Digital Inclusion Economic Impact Model:

The Arizona Telecommunications and Information Institute (ATI Institute - <http://aztii.org/>) partnered with Microsoft Corporation (<http://www.microsoft.com/>) and their Shape the Future team to have a Digital Inclusion Economic Impact Model for Arizona executed by their partner The Arnold Group (<http://www.the-arnold-group.com/>) at no cost to ATI Institute or the State. The model is designed to measure the economic impact of digital inclusion initiatives and has been performed across the U.S. in five states and seven cities to date.

Microsoft's Shape the Future team, whose focus is on creating the public/private partnerships that are necessary to create broad-reaching, sustainable and successful digital inclusion programs worked with The Arnold Group to develop a model to quantify the social and economic benefits of Digital Inclusion and the cost of Digital Exclusion. The goal of the Shape the Future program is to help governments imagine and attain universal technology access for all their citizens to drive greater employability, economic recovery, and a better future.

An economic tool to ascertain the social and economic benefits of digital inclusion was run based on a variety of Arizona data provided. The model provides simple, straightforward, and meaningful data about Arizona and digital inclusion opportunities that can be customized to reflect actual user scenarios. The model's target segment consists of disadvantaged school-age children and their families as this group has the greatest long-term effect for the realization of the benefits.

Arizona modeling results indicate that students with a home PC and broadband access increase their chance of graduating from High School by 6-8 percentage points and experience an average increase of \$1.2M in additional economic and social impact over their lifetime. The affected individuals will also have more employment opportunities benefiting from significant lifetime creation of jobs. By targeting students in poverty, over \$32.4 billion in total lifetime economic and social impact can potentially be realized.

Now that the statewide study is complete, the tool as provided to ATI Institute can be freely used with local communities by government, consultants, and the communities themselves, so they too can begin to understand the benefits of digital inclusion at a local level. The kind of data collected to seed the model included:

- GDP, Population, Tax Rate
- Investment Costs and Options
- Education Infrastructure Readiness
- Income Levels Based on Education Level
- High School Graduation Rates
- Economically Disadvantaged Definitions
- Children's Statistics
- Adult Prison Figures
- Social Benefits
- Medical Benefits
- E-Government Benefits
- Government General Obligation Bond Rate
- ROI - Lifetime Years Calculations

Microsoft Background on the Digital Divide and the Imperative for Digital Inclusion:

Worldwide, countries have committed to improving access to quality education as a critical part of improving their economies and societies. Technology access for students, teachers and parents has been identified as a critical enabler that makes it possible for anyone, anywhere to get a top quality education. For all citizens, access to this 'digital society' delivers tangible economic, employment and social opportunities. For governments, increasing digital inclusion accelerates the growth of a high-employment economy by accelerating global competitiveness. Public/Private Partnerships (PPPs) can create meaningful and effective solutions to these educational, economic and social challenges by making technology access a right for all, not a privilege for some.

The United States has become a fundamentally digital place. However, it is not the world's leader in the number of internet users. The global leader in terms of total users is China with 389M connected users compared to 245M in the US. In order to maintain competitiveness, the US must bridge its digital divide. For most of us, life without internet access is unimaginable. A computer is critical for basic tasks such as writing resumes, completing school assignments, contacting friends and colleagues, searching for information and shopping. For digital citizens, the internet is a portal to crucial information about current events, job opportunities, government and social services, health and wellness and myriad other topics. Yet these tools for living are by no means universally available. Constrained by cost, a significant number of disadvantaged citizens are missing out on the basic tools that engender participation in modern life. This 'digital divide' has a significant, negative impact on the communities it affects, by limiting their access to information, employment and social networks. This ultimately negatively affects our local and overall global competitiveness.

On the upside, however, bridging this divide has genuine, measurable benefits for individuals and the broader community. This economic model demonstrates the scale of these benefits, and makes a strong case for expanding the process of 'digital inclusion' to other disadvantaged areas of United States. There are approximately 14.3% of Americans below poverty level in 2010. This means their income is below \$22,162 for a family of 4. The majority of these individuals and their households do not have regular internet access. This is primarily attributed to three main factors: 1) having a PC and broadband internet access is cost prohibitive, they cannot afford it; 2) most individuals in this demographic do not have the right skills to use it; and 3) many do not understand the benefits of having a PC and broadband access. These obstacles perpetuate the digital divide by limiting this demographics' access to information, employment and social networks and reinforces a vicious cycle of low level of education, underemployment, and reliance on social welfare programs.

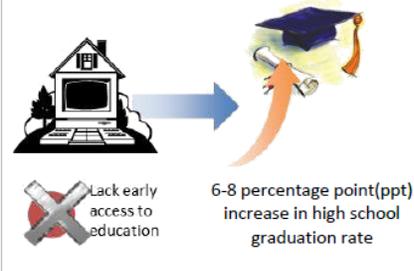
Digital inclusion is a chance for governments, communities and individual citizens to shape their future and create new jobs, opportunities for innovation and economic growth.

Figure 23: Arizona Digital Inclusion Economic Impact Model Summary

People below poverty (<\$22,162 for family of 4):	980,543
School aged children below poverty:	242,103
Year	2011
Arizona:	6,420,893
Below Poverty	980,543
<5	117,919
5-17	242,103
18-64	550,670
+65	69,852
Above Poverty	5,440,350
<5	360,647
5-17	946,988
18-64	3,338,611
+65	794,103

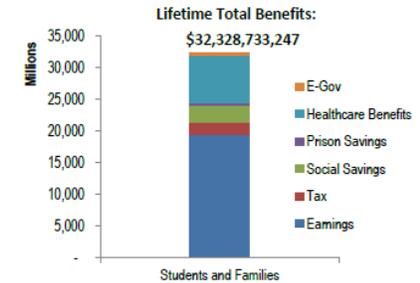
Due to this economic disadvantage, they are at the greatest risk of dropping out of high school, becoming disengaged in society, and reinforcing their economic predicament

By providing students and their families with a PC and broadband internet access, it reduces the hurdle of early access to education, improves their engagement at school and with society, and also increases their chance of graduating high school and going on to college



Solution Approach	
All Households	
All Households	783,831
Total PC Investments	783,831
students	
Net New Jobs Created	
1,201	
Lifetime unemployment rate reduction (5-17)	
0.2%	

This translates into multiple benefits including: significant increase in lifetime earnings, tax revenues for the gov't, reduced dependency on social and health care programs, reduced chances of incarceration, and increased efficiencies and reduced cost in gov't services



The total return on the investment is significant and justifies the effort and upfront costs



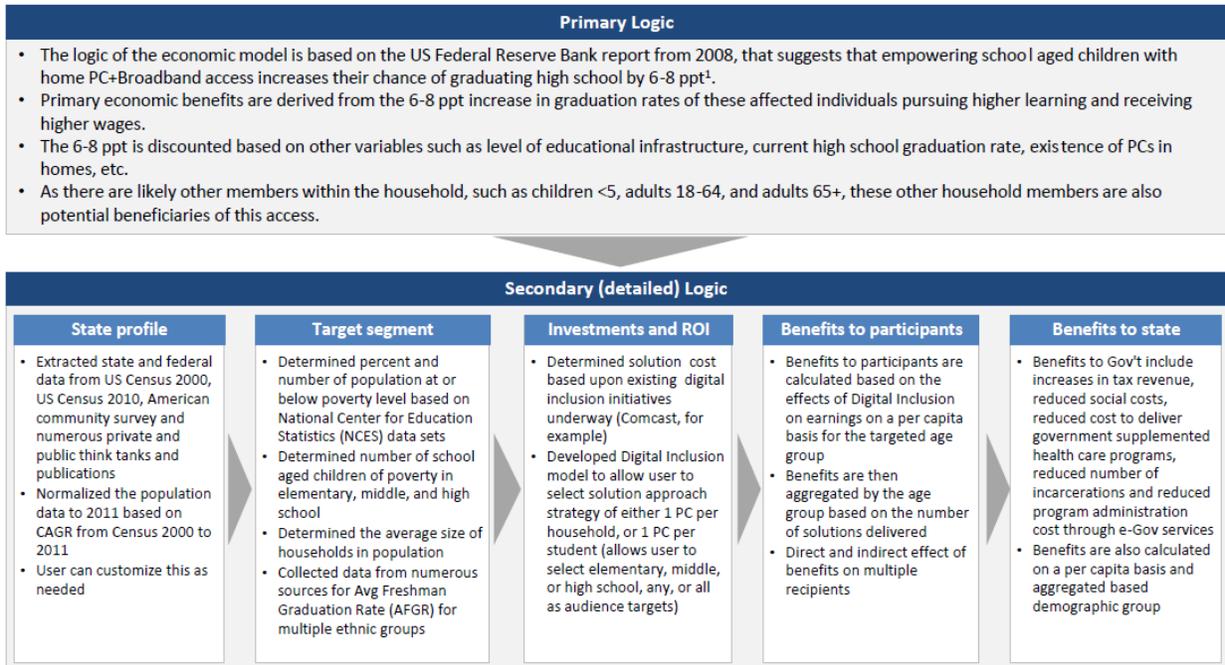
Note: Tax benefits include income, sales, and property taxes as applicable

Model results based on assumptions presented in Key Parameter Values

Date: 8/8/2012

Disclaimer: This economic model is meant to be used to estimate the potential economic benefits of digital inclusion. This tool utilizes publically available research and data related to digital inclusion, graduation rates, income differences and government program costs. Although the model utilizes research that show statistical significant results, the results of the model does not take into consideration current educational, general economic and budgetary situations. It is not intended to predict or guarantee the economic benefits due to digital investments (e.g. this tool should only be used as a reference, and not as a calculator for future revenue or cost reduction of government programs).

Figure 24: Digital Inclusion Economic Impact Model Approach



¹Note: <https://federalreserve.gov/pubs/iftdp/2008/958/iftdp958.htm>

Figure 28: By Targeting Students in Poverty, Over \$32.4 Billion in Total Economic & Social Impact Can Potentially be Realized

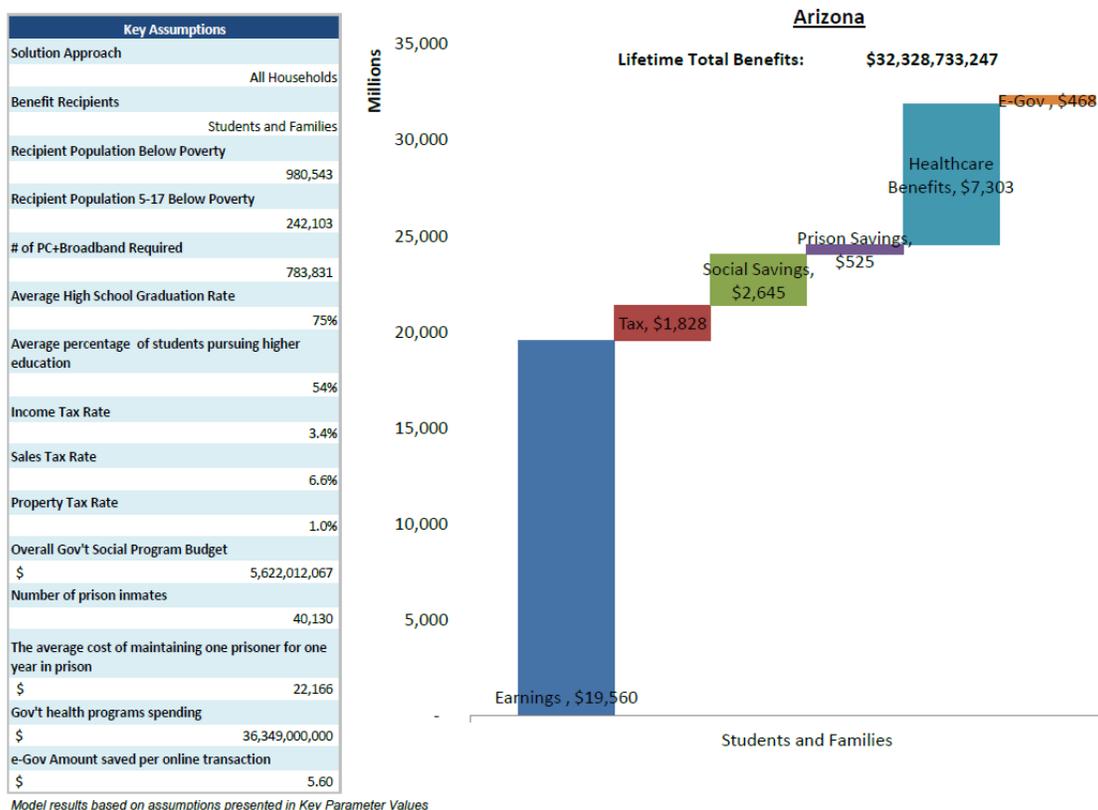


Figure 29: Arizona Economic Impact Model Key Parameters

Parameter	Current Value	Default Value	Default?
Earnings Benefits			
Population Below Poverty	933,113	933,113	yes
Average High School Graduation Rate	75%	75%	yes
Average percentage of students pursuing higher education	54%	54%	yes
Tax Benefits			
Standard deduction	\$ 4,677	\$ 4,677	yes
Income Tax Rate	3%	3%	yes
Sales Tax Rate	6.60%	6.60%	yes
Property Tax Rate	1.0%	1.0%	yes
Social Program Benefits			
Overall Gov't Social Program Budget	\$ 5,622,012,067	\$ 5,622,012,067	yes
Benefits % to poverty group	60%	60%	yes
Fixed cost %	40%	40%	yes
Prison Cost Reduction Benefits			
The average cost of maintaining one prisoner for one year in prison	\$ 22,166	\$ 22,166	yes
Number of prison inmates	40,130	40,130	yes
% of population from poverty	60%	60%	yes
Health Care Benefits			
e-Health savings benefits	\$ 217	\$ 217	yes
% of BB users consuming eHealth services	35%	35%	yes
Gov't health programs spending	\$ 36,349,000,000	\$ 36,349,000,000	yes
Benefits % to poverty group	60%	60%	yes
Fixed cost %	80%	80%	yes
E-Government Benefits			
Amount saved per online transaction	\$ 5.60	\$ 5.60	yes
Number of Transactions per month	1	1	yes
% of BB users transacting with e-Gov services	33%	33%	yes

Appendix B: Digital Capacity Resources

Federal Resources

State Digital Capacity Plans and Resources

Arizona State Resources

National Nonprofit Organizations

National Trade Associations

Arizona Nonprofit Organizations and Trade Associations

National eLearning and Technology in Education Resources

Arizona eLearning and Technology in Education Resources

National Telehealth Resources

Arizona Telehealth Resources

National eGovernment Resources

Arizona eGovernment Resources

National Discovery, Innovation and Research Resources

Arizona Discovery, Innovation and Research Resources

National Smart Energy and Environmental Resources

Arizona Smart Energy and Environmental Resources

National Public Safety Communications Resources

Arizona Public Safety Communications Resources

National Native American Resources

Arizona Native American Resources

Arizona Statistical Resources

Community Toolkits, Economic and Financial Modeling

Miscellaneous Resources

Federal Resources:

White House - <http://www.whitehouse.gov/>

Technology Issues - <http://www.whitehouse.gov/issues/technology>

21st Century Digital Infrastructure -
<http://www.whitehouse.gov/issues/technology#id-4>

Executive Order -- Accelerating Broadband Infrastructure Deployment (6/14/12) -
<http://www.whitehouse.gov/the-press-office/2012/06/14/executive-order-accelerating-broadband-infrastructure-deployment>

USA.gov - <http://www.usa.gov/>

Citizen Services - <http://www.usa.gov/Citizen/Services.shtml>

Government Benefits, Grants, and Financial Aid -
<http://www.usa.gov/Citizen/Topics/Benefits.shtml>

Benefits.gov - <http://www.benefits.gov/>

Find Government Agencies - <http://www.usa.gov/Agencies.shtml>

Tribal Governments and Native Americans - <http://www.usa.gov/Government/Tribal.shtml>

Federal Communications Commission (FCC) - <http://www.fcc.gov/>

The FCC regulates interstate and international communications by radio, television, wire, satellite and cable in all 50 states, the District of Columbia and U.S. territories. It was established by the Communications Act of 1934 and operates as an independent U.S. government agency overseen by Congress.

Legacy FCC Site - <http://transition.fcc.gov/>

FCC Encyclopedia - <http://www.fcc.gov/encyclopedia>

National Broadband Plan - <http://www.fcc.gov/topic/national-broadband-plan>

Broadband USA - <http://www.broadbandusa.gov/>

Broadband.gov Plan Site - <http://www.broadband.gov/plan/>

Chapter 6: Infrastructure -
<http://www.broadband.gov/plan/6-infrastructure/>

U.S. CRS Report: The National Broadband Plan (7/9/10) -
<http://www.fas.org/sqp/crs/misc/R41324.pdf>

Connecting America Fund - <http://www.fcc.gov/encyclopedia/connecting-america>

National Broadband Map - <http://broadbandmap.gov/>

Measuring Broadband America Report Series -
<http://www.fcc.gov/measuring-broadband-america>

Measuring Broadband America (8/11) -

<http://www.fcc.gov/measuring-broadband-america/2011/august>

Report (PDF) -

http://transition.fcc.gov/cgb/measuringbroadbandreport/Measuring_U.S._Main_Report_Full.pdf

Measuring Broadband Speeds (7/12) -

<http://www.fcc.gov/measuring-broadband-america/2012/july>

Report (PDF) -

<http://transition.fcc.gov/cgb/measuringbroadbandreport/2012/Measuring-Broadband-America.pdf>

Wireline Competition Bureau - <http://www.fcc.gov/wireline-competition-bureau>

Broadband Acceleration Initiative -

<http://www.fcc.gov/encyclopedia/broadband-acceleration>

Wireless Telecommunications Bureau (WTB) - <http://wireless.fcc.gov/>

Tower Overview - <http://www.fcc.gov/topic/tower>

Tower and Antenna Siting Issues - <http://wireless.fcc.gov/siting/>

Antenna Structure Registration (ARS) Search -

<http://wireless2.fcc.gov/UIsApp/AsrSearch/asrRegistrationSearch.jsp>

Broadband Opportunities for Rural America -

http://wireless.fcc.gov/outreach/index.htm?job=broadband_home

Spectrum Dashboard - <http://reboot.fcc.gov/reform/systems/spectrum-dashboard>

U.S. CRS Report: The Federal Communications Commission: Current Structure and Its Role in the Changing Telecommunications Landscape (2/21/12) -

<http://www.fas.org/sqp/crs/misc/RL32589.pdf>

U.S. Department of Commerce (DOC) - <http://www.commerce.gov/>

The U.S. Department of Commerce promotes job creation, economic growth, sustainable development and improved standards of living for all Americans by working in partnership with businesses, universities, communities and our nation's workers. The department touches the daily lives of the American people in many ways, with a wide range of responsibilities in the areas of trade, economic development, technology, entrepreneurship and business development, environmental stewardship, and statistical research and analysis.

National Telecommunications and Information Administration (NTIA) -

<http://www.ntia.doc.gov/>

NTIA is the Executive Branch agency that is principally responsible for advising the President on telecommunications and information policy issues. NTIA's programs and policymaking focus largely on expanding broadband Internet access and adoption in America, expanding the use of spectrum by all users, and ensuring that the Internet remains an engine for continued innovation and economic growth.

Broadband - <http://www.ntia.doc.gov/category/broadband>

Recovery Act Broadband Programs - <http://www2.ntia.doc.gov/>

Digital Literacy Initiative - <http://digitalliteracy.gov/>

National Broadband Map - <http://www.broadbandmap.gov/>

Broadband Adoption Research - <http://www.ntia.doc.gov/data>

State and Local Rights-of-Way Guide -
<http://www.ntia.doc.gov/legacy/ntiahome/staterow/statelocalrow.html>

Broadband Grants - <http://www.ntia.doc.gov/grants-combined>

Broadband Technology Opportunities Program (BTOP) -
<http://www.ntia.doc.gov/category/broadband-technology-opportunities-program>

State Broadband Initiative (SBI) - <http://www2.ntia.doc.gov/SBDD>

Arizona Projects - <http://www2.ntia.doc.gov/arizona>

National Broadband Map Datasets - <http://www2.ntia.doc.gov/broadband-data>

Estimating the Economic Impact of the Broadband Stimulus Plan (2/09) -
http://www.elinoam.com/raulkatz/Dr_Raul_Katz_-_BB_Stimulus_Working_Paper.pdf

Economic Development Administration (EDA) - <http://www.eda.gov/>

Measuring Broadband's Economic Impact (MIT 2/06) -
http://cfp.mit.edu/publications/CFP_Papers/Measuring_bb_econ_impact-final.pdf

Bureau of Economic Analysis - <http://www.bea.gov/>

Federal Funding Opportunities - <http://www.eda.gov/ffo.htm>

Regional Economic Accounts - <http://www.bea.gov/regional/>

U.S. Department of Agriculture (USDA) - <http://www.usda.gov/>

Rural Utilities Service (RUS) - http://www.rurdev.usda.gov/Utilities_LP.html

Rural Development Loan Assistance - http://www.rurdev.usda.gov/RD_Loans.html

Farm Bill Broadband Program -
http://www.rurdev.usda.gov/utp_farmbill.html

Rural Development Grant Assistance - http://www.rurdev.usda.gov/RD_Grants.html

Community Connect - http://www.rurdev.usda.gov/utp_commconnect.html

Distance Learning and Telemedicine Program (DLT) -
http://www.rurdev.usda.gov/UTP_DLT.html

Telecommunications Bulletins -
http://www.rurdev.usda.gov/RDU_Bulletins_Telecommunications.html

Universal Service Administrative Company (USAC) - <http://www.usac.org/>

Schools and Libraries Program (E-Rate) - <http://www.usac.org/sl/>

Eligible Services List 2013 -

http://www.usac.org/_res/documents/sl/pdf/ESL_archive/EligibleServicesList-2013.pdf

Rural Health Care - <http://www.usac.org/rhc/>

U.S. Department of Transportation (DOT) - <http://www.dot.gov/>

Federal Highway Administration (FHWA) - <http://www.fhwa.dot.gov/>

Publications & Statistics - <http://www.fhwa.dot.gov/resources/pubstats/>

Office of Infrastructure - <http://www.fhwa.dot.gov/infrastructure/>

Intelligent Transportation Systems (ITS) Library -

<http://www.its.dot.gov/library.htm>

Rural Interstate Corridor Communications Study -

http://ops.fhwa.dot.gov/int_its_deployment/rural/congrpt0807/03potben.htm

Telecommunications Handbook for Transportation Professionals: The Basics of Telecommunications (9/04) -

http://www.ops.fhwa.dot.gov/publications/telecomm_handbook/index.htm and

http://www.ops.fhwa.dot.gov/publications/telecomm_handbook/telecomm_handbook.pdf

Rural Interstate Corridor Communications Study Report to States - Cost Estimates - FHWA Operations <http://ops.fhwa.dot.gov/publications/fhwahop09021/03cost.htm>

Future Uses of Highway Rights of Way Study (4/12) -

<http://www.fhwa.dot.gov/policy/otps/rowstudyproj.htm>

Bureau of Transportation Statistics (BTS) - <http://www.bts.gov/>

TranStats - <http://www.transtats.bts.gov/>

U.S. Census Bureau - <http://www.census.gov/>

American Community Survey - <http://www.census.gov/acs/www/>

Computer and Internet Use in the United States: 2010 -

<http://www.census.gov/hhes/computer/publications/2010.html>

Table 3A. Reported Internet Usage for Individuals 3 Years and Older, by State: 2010 -

<http://www.census.gov/hhes/computer/files/2010/table3A.xls>

Table 3B. Presence and Type of Computer for Individuals 3 Years and Older, by State:

2010 - <http://www.census.gov/hhes/computer/files/2010/table3B.xls>

U.S. Congressional Research Service (CRS) - <http://www.loc.gov/crsinfo/>

Federation of American Scientists (FAS) CRS Reports Access - <http://www.fas.org/sqp/crs/>

Broadband Internet Access and the Digital Divide: Federal Assistance Programs (4/12/11) - <http://www.fas.org/sqp/crs/misc/RL30719.pdf>

Rural Broadband: The Roles of the Rural Utilities Service and the Universal Service Fund (5/9/12) - <http://www.fas.org/sqp/crs/misc/R42524.pdf>

Access to Broadband Networks: The Net Neutrality Debate (2/21/12) - <http://www.fas.org/sqp/crs/misc/R40616.pdf>

The National Broadband Plan (7/9/10) - <http://www.fas.org/sqp/crs/misc/R41324.pdf>

The Federal Communications Commission: Current Structure and Its Role in the Changing Telecommunications Landscape (2/21/12) - <http://www.fas.org/sqp/crs/misc/RL32589.pdf>

Spectrum Policy in the Age of Broadband: Issues for Congress (6/21/12) - <http://www.fas.org/sqp/crs/misc/R40674.pdf>

Public Safety Communications and Spectrum Resources: Policy Issues for Congress (9/1/10) - <http://www.fas.org/sqp/crs/misc/R40859.pdf>

Institute of Museum and Library Services (IMLS) - <http://www.ims.gov/>

Broadband Issue Area - <http://www.ims.gov/about/broadband.aspx>

Building Digital Communities: Getting Started (3/12) - <http://www.ims.gov/assets/1/AssetManager/BuildingDigitalCommunities.pdf>

Building Digital Communities: New Resource to Help Communities Bridge the Digital Divide (3/12) - http://www.ims.gov/assets/1/AssetManager/BuildingDigitalCommunities_Framework.pdf

Building Digital Communities: A Framework for Action (1/12) - http://www.ims.gov/assets/1/workflow_staging/AssetManager/2140.PDF

State Digital Capacity Plans and Resources:

AZ: Digital Arizona Program - <http://digitalarizona.gov/>

Digital Arizona Council (DAC) -

http://www.digitalarizona.gov/Digital_Arizona_Council/About_DAC.html

Task Groups - http://www.digitalarizona.gov/Digital_Arizona_Council/Task_Groups.html

Strategic Plan - http://www.digitalarizona.gov/Digital_Arizona_Council/Strategy.html

Arizona Strategic Enterprise Technology Office (ASET) - <http://aset.azdoa.gov/>

Arizona Broadband Map - <http://broadbandmap.az.gov/map/>

Arizona Broadband Map (Policy) - <http://broadbandmap.az.gov/CommunityPlanningMap/>

Planning Help - <http://broadbandmap.az.gov/HelpPlanning/index.htm>

Research & Analysis - http://www.digitalarizona.gov/About/Current_Work.html

Arizona GIS (Geographic Information System) Broadband Survey (2009) -

http://www.digitalarizona.gov/images/Current_and_Historical_Docs/AZ%20GITA%20Broadband%20Assessment%20GIS%20Study%20Jan2009.pdf

CA: California Broadband Council - <http://broadbandcouncil.ca.gov/>

The State of Connectivity, Building Innovation Through Broadband (1/08) -

<http://broadbandcouncil.ca.gov/WorkArea/DownloadAsset.aspx?id=44>

Broadband Task Force History & Recommendations (2/11) -

http://www.cio.ca.gov/broadband/pdf/California_Technology_Agency_Report_on_Broadband_Task_Force_7_Recommendations.pdf

California Executive Order S-21-06 - <http://gov.ca.gov/news.php?id=4818>

CO: Colorado Broadband Data and Development Program -

<http://www.colorado.gov/cs/Satellite/OIT-StatelInitiatives/CBON/1251575390656>

Bottom-Up Regional Statements -

<http://www.colorado.gov/cs/Satellite/OEDIT/OEDIT/1251588546249>

Regional Economic Development Plans (2010) -

<http://www.colorado.gov/cs/Satellite/OEDIT/OEDIT/1251588672781>

Local Technology Planning Team Lessons Learned -

http://www.colorado.gov/cs/Satellite?c=Document_C&childpagename=OIT-StatelInitiatives%2FDocument_C%2FCBONAddLinkView&cid=1251610054179&pagename=CBONWrapper

I'll Vote for You If You Make My Netflix Work: The Five A's of Community Broadband in

Colorado (Book by Frank Ohrtman) - <http://www.illvoteforyouifyoumakemynetflixwork.org/>

GA: Georgia Broadband Excellence - <http://www.georgiabroadband.net/>

Georgia Statewide Broadband Strategy Position Paper (12/10) -

<http://www.georgiabroadband.net/Portals/0/State%20Broadband%20Strategy%20-%20Rich%20Calhoun%20December%203%202010%20-%20Read%20Only%20-%20Final.pdf>

IA: Connect Iowa - <http://www.connectiowa.org/>

Research - <http://www.connectiowa.org/research>

The Great Rural America Paradox Blog Post (7/12) -

<http://www.connectiowa.org/blog/post/great-rural-america-paradox>

ID: Link Idaho - <http://www.linkidaho.org/>

Regional Planning Teams and Tools -

<http://www.linkidaho.org/lid/default.aspx?page=43#Priorities>

IL: Broadband Illinois - <http://www.broadbandillinois.org/>

Research - <http://www.broadbandillinois.org/Research.html>

Chicago Broadband Challenge -

<http://digital.cityofchicago.org/index.php/the-broadband-challenge/>

LA: Louisiana State Broadband Office - <http://broadband.la.gov/>

Broadband Lifecycle - http://broadband.la.gov/lbi_communities_lifecycle.asp

Lafayette Utilities System's Fiber-to-the-Home Project - <http://www.lus.org/site184.php>

MS: Broadband for Mississippi - <http://msbb.broadmap.com/>

Mississippi Broadband Connect Coalition (MBXX) -

<http://msbb.broadmap.com/mississippi-broadband-connect-coalition.html>

Broadband Strategic Plan - <http://msbb.broadmap.com/strategic-plan.html>

Mapping Mississippi's Digital Future (Fall 2011) -

<http://msbb.broadmap.com/strategic-plan/strategic-plan.pdf>

MO: MoBroadbandNow - <http://mobroadbandnow.com/>

2011 Annual Summit - <http://mobroadbandnow.com/mo-broadband-initiatives/2011-summit/>

Regional Technical Planning Toolkit (RTPT) -

<http://mobroadbandnow.com/files/2011/03/Toolkit.pdf>

NC: Connect Nevada - <http://www.connectnv.org/>

Planning - <http://www.connectnv.org/planning>

Connect Nevada Report (10/10) -

http://www.connectnv.org/documents/NevadaPlanningReport_screen.pdf

NC: North Carolina Broadband - <http://ncbroadband.gov/>

NC Broadband Research - <http://ncbroadband.gov/broadband-101/e-nc-research>

PR: Connect Puerto Rico - <http://www.connectpr.org/>

Puerto Rico Strategic Broadband Plan (5/12) - <http://www.connectpr.org/strategic-plan?lang=en>

Executive Summary (1.5MB PDF) - http://www.connectpr.org/sites/default/files/connected-nation/Puerto%20Rico/files/executive_summary.pdf

Full Report (27MB PDF) - http://www.connectpr.org/sites/default/files/connected-nation/Puerto%20Rico/files/pr_bb_plan_final.pdf

UT: State of Utah Broadband Project - <http://www.utah.gov/broadband/index.html>

Utah Broadband Advisory Council - <http://blog.broadband.utah.gov/about/broadband-advisory-council/>

Utah Broadband Advisory Council Report (6/12) - <http://utahbroadband.files.wordpress.com/2012/06/utah-broadband-advisory-council-report3.pdf>

Governor's Office of Economic Development (GOED) - <http://business.utah.gov/>

Broadband Mapping and Planning - <http://business.utah.gov/programs/broadband/>

Automated Geographic Reference Center (AGRC) - <http://gis.utah.gov/>

Broadband Internet Data Download - <http://gis.utah.gov/data/utilities/broadband-internet/>

VA: NetworkVirginia (Virginia Tech) - <http://www.networkvirginia.net/>

eCorridors Program - <http://www.ecorridors.vt.edu/>

Accelerate Virginia - <http://www.acceleratevirginia.org/>

Accelerate Your Community - http://acceleratevirginia.org/accelerate_your_community/

Blacksburg Electronic Village (BEV) - <http://top.bev.net/new/>

Publications - http://top.bev.net/new/final_report.php

Final Public Report (9/04) - http://top.bev.net/Final_Public_Report.pdf

Virginia Information Technology Agency (VITA) - <http://www.vita.virginia.gov/>

WA: Washington State Broadband Office - <http://broadband.wa.gov/>

Creating Opportunities for Washington Broadband Report (2010) - <http://broadband.wa.gov/sites/default/files/docs/WashingtonStateBroadbandReport.pdf>

2011 Annual Report on Broadband in Washington - <http://broadband.wa.gov/sites/default/files/docs/2011BBAnnualRptFINAL.pdf>

WI: University of Wisconsin Extension - <http://www.uwex.edu/>

Broadband Initiative - <http://www.uwex.edu/academic-affairs/initiatives.html>

Building Community Capacity through Broadband - <http://broadband.uwex.edu/>

Arizona State Resources:

Arizona Governor's Office - <http://www.azgovernor.gov/>

Arizona.gov Official Web Site - <http://az.gov/>

Arizona Travel Guide - <http://www.arizonaguide.com/>

Arizona Governor's Office of Health Information Exchange (HIE) - <http://hie.az.gov/>

Strategic Plan (3/11) - http://hie.az.gov/docs/app_plans/AZHIEStrategicPlanv1_10.pdf

Governor's Arizona Ready Education Council - <http://www.arizonaready.com/> & <http://azgovernor.gov/AzReady/>

Arizona State Legislature - <http://www.azleg.gov/>

Arizona State Senate - <http://www.azsenate.gov/>

Arizona House of Representatives - <http://www.azhouse.gov/>

Arizona Revised Statutes (ARS) - <http://www.azleg.state.az.us/ArizonaRevisedStatutes.asp>

Arizona Department of Administration - <http://www.azdoa.gov/>

Arizona State Enterprise Technology (ASET) Office - <http://aset.azdoa.gov/>

Arizona Broadband Project - <http://digitalarizona.gov/>

Arizona Broadband Map - <http://broadbandmap.az.gov/map/>

Arizona Broadband Map (Policy) - <http://broadbandmap.az.gov/CommunityPlanningMap/>

Planning Help - <http://broadbandmap.az.gov/HelpPlanning/index.htm>

Digital Arizona Council (DAC) - http://www.digitalarizona.gov/Digital_Arizona_Council/About_DAC.html

Task Groups - http://www.digitalarizona.gov/Digital_Arizona_Council/Task_Groups.html

Strategic Plan - http://www.digitalarizona.gov/Digital_Arizona_Council/Strategy.html

Research & Analysis - http://www.digitalarizona.gov/About/Current_Work.html

Arizona GIS (Geographic Information System) Broadband Survey (2009) - http://www.digitalarizona.gov/images/Current_and_Historical_Docs/AZ%20GITA%20Broadband%20Assessment%20GIS%20Study%20Jan2009.pdf

eGov Program - <http://aset.azdoa.gov/e-gov>

Health Information Exchange (HIE) - <http://hie.az.gov/>

Public Safety Interoperable Communications (PSIC) - <http://www.azpsic.gov/>

Telecommunications Program Office (TPO) AZNet - <http://www.aznet.gov/>

Arizona Department of Transportation (ADOT) - <http://www.azdot.gov/>

Geographic Information Systems for Transportation (GIS-T) Section - <http://www.azdot.gov/mpd/gis/index.asp>

GIS-T Projects - <http://www.azdot.gov/mpd/gis/projects/index.asp>

ADOT Maps - <http://www.azdot.gov/mpd/gis/maps/index.asp>

Arizona State Highway System - <http://www.azdot.gov/mpd/gis/maps/pdf/shs.pdf>

ADOT Engineering and Maintenance Districts - http://www.azdot.gov/mpd/gis/maps/pdf/eng_maint_dist_mp.pdf

Interstate 11 (I-11) and Intermountain West Corridor Study - <http://i11study.com/wp/>

Report TRQS-02 - Arizona I-19 Wi-Fi Corridor: Assessment of Opportunities for Probe Data Operations (10/05) - <http://www.azdot.gov/TPD/ATRC/publications/QuickStudies/PDF/TRQS-02.pdf>

Report TRQS-03 - Arizona I-19 Wi-Fi Corridor: Concept Demonstration of Probe Vehicle Tracking (3/07) - <http://www.azdot.gov/TPD/ATRC/publications/QuickStudies/PDF/TRQS-03.pdf>

Arizona State Land Department (ASLD) - <http://www.land.state.az.us/>

ASLD's mission is to manage State Trust lands and resources to enhance value and optimize economic return for the Trust beneficiaries, consistent with sound stewardship, conservation, and business management principles supporting socioeconomic goals for citizens here today and generations to come, as well as to manage and provide support for resource conservation programs for the well-being of the public and the State's natural environment.

Real Estate Division - <http://www.land.state.az.us/divisions/realestate.htm>

Sales & Commercial Leasing Section - <http://www.land.state.az.us/programs/realestate/sections/sales.htm>

Commercial Leasing Section - http://www.land.state.az.us/programs/realestate/sections/comml_leasing.htm

Right-of-Way Section - <http://www.land.state.az.us/programs/realestate/sections/row.htm>

Information Systems & Resource Analysis Division - <http://www.land.state.az.us/divisions/infoSystems.htm>

Arizona Land Resource Information System (ALRIS) - <http://www.land.state.az.us/alris/index.html>

ALRIS GIS Data - <http://www.land.state.az.us/alris/layers.html>

Arizona State Cartographer's Office (SCO) - <http://sco.az.gov/>

Arizona Geographic Information Council (AGIC) - <http://www.agic.az.gov/>

Telecommunications Site Rental Schedule for 2010 - http://www.land.state.az.us/news/2009/103009_news.htm

Arizona Corporation Commission (ACC) - <http://www.azcc.gov/>

The Arizona Corporation Commission (ACC) is established via Article 15 of the Arizona Constitution with elected Commissioners and has responsibilities that go beyond traditional public utilities regulation including regulation of telephone services, facilitating the incorporation of businesses and organizations, securities regulation, and railroad/pipeline safety. By virtue of the Arizona Constitution, the Commissioners function in an Executive capacity, they adopt rules and regulations thereby functioning in a Legislative capacity, and they also act in a Judicial capacity sitting as a tribunal and making decisions in contested matters.

Utilities Division - <http://www.azcc.gov/Divisions/Utilities/>

Telephone - <http://www.azcc.gov/divisions/utilities/telecom.asp>

Telecommunications Industry Page -
<http://www.azcc.gov/divisions/utilities/telecom/industry.asp>

Arizona Universal Service Fund (AUSF) -
<http://www.azcc.gov/divisions/utilities/telecom/ausf-faqs.asp>

Telecommunications Rules -
http://www.azsos.gov/public_services/Title_14/14-02.htm#ARTICLE_5

Arizona Goes Solar - <http://arizonagoessolar.org/>

Arizona Commerce Authority (ACA) - <http://www.azcommerce.com/>

Arizona Facts & Figures - <http://www.azcommerce.com/facts-and-figures/>

Arizona Community Profiles -
<http://www.azcommerce.com/facts-and-figures/community-profiles/>

Maps & GIS Data - <http://www.azcommerce.com/facts-and-figures/maps/>

Arizona Broadband Initiative Framework Analysis and Report (4/07) -
<http://old.azcommerce.com/doclib/prop/originals/arizona%20broadband%20initiative%20framework.pdf>

Innovation Arizona - <http://www.innovationaz.com/>

Arizona Research Centers - <http://www.innovationaz.com/resources/research.asp>

Solar Arizona - <http://www.azsolarstate.com/>

Aerospace & Defense Arizona - <http://www.azaerospace.com/>

Arizona Department of Real Estate - <http://www.re.state.az.us/>

Laws, Rules, Policy Statements and Advisories -
<http://www.re.state.az.us/LawBook/LawBook.aspx>

Arizona Attorney General - <http://www.azag.gov/>

Publications - <http://www.azag.gov/publications.html>

Arizona Department of Education - <http://www.azed.gov/>

Educational Technology Group - <http://www.azed.gov/educational-technology/>

E-Rate - <http://www.azed.gov/educational-technology/e-rate/>

Multimedia Resource Links -

<http://www.azed.gov/educational-technology/2011/09/14/multimedia-resource-links/>

Information Technology - <http://www.azed.gov/information-technology/>

Arizona's Common Core Standards -

<http://www.azed.gov/standards-practices/common-core-state-standards/>

Resources and Tools - <http://www.azed.gov/standards-practices/resources-and-tools/>

Research and Evaluation Division - <http://www.azed.gov/research-evaluation/>

State Report Cards - <http://www.azed.gov/research-evaluation/report-cards/>

School and District Report Cards - <http://www10.ade.az.gov/ReportCard/>

Indian Education - <http://www.azed.gov/indian-education/>

Arizona State Library, Archives and Public Records - <http://azlibrary.gov/>

E-Rate Resources - <http://azlibrary.gov/erate/>

Library Services and Technology Act (LSTA) in Arizona - <http://azlibrary.gov/lsta/>

Digital Government Information Initiatives - <http://azlibrary.gov/diggovt/index.aspx>

Arizona Tribal Library Resources - <http://azlibrary.gov/extension/tribal.aspx>

Arizona Memory Project - <http://azmemory.azlibrary.gov/cdm/>

Statewide Access to Databases - <http://azlibrary.gov/extension/statewidedb.aspx>

Tools for Tough Times - <http://www.azlibrary.gov/about/helpinfo.aspx>

Arizona Small Business Development Centers (SBDC) Network - <http://www.azsbdc.net/>

Tools and Resources - <http://www.azsbdc.net/tools-resources/>

Resources and Links - <http://www.azsbdc.net/tools-resources/resources-links/>

Arizona Commission for the Deaf and Hard of Hearing (ACDHH) - <http://www.acdhh.org/>

Arizona Telecommunications Equipment Distribution Program (AzTEDP) -
<http://www.acdhh.org/home/aztedp>

Resource Directory - <http://www.acdhh.org/resources/directory>

Northern Arizona University (NAU) - <http://www.nau.edu/>

Arizona Rural Policy Institute (ARPI) at The W. A. Franke College of Business -
<http://www.franke.nau.edu/RPI/>

National Nonprofit Organizations:

National Governors Association (NGA) - <http://www.nga.org/cms/home.html>

NGA is the bipartisan organization of the nation's governors that promotes visionary state leadership, shares best practices, and speaks with a collective voice on national policy.

Communications Key Issue - <http://www.nga.org/cms/home/federal-relations/nga-key-committee-issues/page-edc-issues/col2-content/main-content-list/communications.html>

State Priorities in Communications Policy Position -
<http://www.nga.org/cms/home/federal-relations/nga-policy-positions/page-edc-policies/col2-content/main-content-list/state-priorities-in-communicatio.html>

National Conference of State Legislatures (NCSL) - <http://www.ncsl.org/>

NCSL is a bipartisan organization that serves the legislators and staffs of the nation's 50 states, its commonwealths and territories providing research, technical assistance, and opportunities for policymakers to exchange ideas on the most pressing state issues. NCSL is an effective and respected advocate for the interests of state governments before Congress and federal agencies.

Telecommunications and Information Technology Issue -
<http://www.ncsl.org/Default.aspx?TabID=756&tabs=951,71,531#951>

Telecommunications Technology and Regulation -
<http://www.ncsl.org/Default.aspx?TabID=756&tabs=951,71,540#540>

Broadband Statutes - <http://www.ncsl.org/default.aspx?tabid=13455>

2010 Enacted Broadband Legislation -
<http://www.ncsl.org/default.aspx?tabid=21125>

Transforming Health Care Through Technology: NCSL Partners Project -
<http://www.ncsl.org/default.aspx?tabid=22228>

The Council of State Governments (CSG) - <http://www.csg.org/>

Telecommunications Policy Area -
<http://knowledgecenter.csg.org/drupal/category/policy-area/technology/telecommunications>

Broadband Policy Area - <http://knowledgecenter.csg.org/kc/view-policy-areas/825>

National Association of Regulatory Utility Commissioners (NARUC) - <http://www.naruc.org/>

NARUC is the national association representing the State Public Service Commissioners who regulate essential utility services, including energy, telecommunications, and water. NARUC members are responsible for assuring reliable utility service at fair, just, and reasonable rates. Founded in 1889, the Association is an invaluable resource for its members and the regulatory community, providing a venue to set and influence public policy, share best practices, and foster innovative solutions to improve regulation.

Committee on Telecommunications - <http://www.naruc.org/committees.cfm?c=53>

Ad Hoc Committee on National Wireless Consumer Protection Standards -

<http://www.naruc.org/committees.cfm?c=59>

Staff Subcommittee on State Universal Service Fund Administrators -
<http://www.naruc.org/committees.cfm?c=27>

Staff Subcommittee on Telecommunications -
<http://www.naruc.org/committees.cfm?c=26>

National Regulatory Research Institute (NRRI) - <http://www.nrri.org/>

National Inventory of Broadband Projects and Programs -
<http://communities.nrri.org/web/telecom-broadband-adoption/706-project-home>

Telecommunications Research Papers -
<http://www.nrri2.org/web/guest/research-papers?categoryId=351279>

Fundamentals of Telecommunications Regulation: Markets, Jurisdiction, and Challenges (1/11) -
http://www.nrri.org/pubs/telecommunications/NRRI_telecomm_overview_jan11-03.pdf

Taking Another Look at Federal/State Jurisdictional Relationships in the New Broadband World V1.1 (2/12) -
<http://www.nrri2.org/documents/317330/0a215d85-787a-4ca0-a1fd-fcc59f28ffe0>

The Year in Review: The Status of Telecommunications Deregulation in 2012 (6/12) -
<http://www.nrri2.org/documents/317330/0179150e-ef83-4e94-bf94-80c7af830ab6>

National League of Cities (NLC) - <http://www.nlc.org/>

NLC is dedicated to helping city leaders build better communities. Working in partnership with the 49 state municipal leagues, NLC serves as a resource to and an advocate for the more than 19,000 cities, villages and towns it represents.

Information Technology & Communications Committee -
<http://www.nlc.org/influence-federal-policy/policy-committees/information-technology-communications>

National Association of Counties (NACo) - <http://www.naco.org/Pages/default.aspx>

NACo is the only national organization representing county government. Driven by a strong membership, NACo's Board of Directors represents counties across America.

Legislation & Policy - <http://www.naco.org/legislation/Pages/default.aspx>

Telecommunications & Technology Steering Committee -
<http://www.naco.org/legislation/policies/Pages/TT.aspx>

International City/County Management Association (ICMA) - <http://icma.org/en/icma/home>

Public Policy - http://icma.org/en/icma/priorities/public_policy/overview

Center for Sustainable Communities -
http://icma.org/en/results/sustainable_communities/home

Center for Public Safety Management -
http://icma.org/en/results/public_safety_management/home

Arizona City/County Management Association - <http://www.azmanagement.org/>

National Association of Telecommunications Officers and Advisors (NATOA) -
<http://www.natoa.org/>

NATOA is the premier local government professional association that provides support to members on the many local, state, and federal communications laws, administrative rulings, judicial decisions, and technology issues impacting the interests of local governments.

Policy/Advocacy - <http://natoa.org/policy-advocacy/>

Broadband - <http://natoa.org/broadband/national-broadband-plan.html>

Local Government Officials Principles Relating to Rights-of-Way (8/98) -
http://www.natoa.org/documents/Local_Government_Principles_Relating_to_Rights-of-Way.pdf

Transmitting Antenna RF Emission Safety: Rules, Procedures, and Practical Guidance (6/00) - http://www.natoa.org/documents/FCC_LSGAC_RF_Guide.pdf

NATOA Local Government Official's e-Guide to Communications Facilities Siting (\$50 Members/\$100 Non-Members) -
<http://www.natoa.org/documents/FacilitiesSitingFlyerUpdated.pdf>

National Association of State Chief Information Officers (NASCIO) -
<http://www.nascio.org/>

NASCIO's mission is to foster government excellence through quality business practices, information management, and technology policy.

State Connectivity and Broadband Working Group -
<http://www.nascio.org/committees/broadband/>

Bowling for Broadband 2: Toward Citizen-Centric, Broadband-Based E-Government (8/06) - http://www.nascio.org/publications/documents/NASCIO-Bowling_for_Broadband2.pdf

Bowling for Broadband: The Role of the State CIO in Promoting High-Speed Internet Access (9/04) - http://www.nascio.org/publications/documents/NASCIO-CIO_and_Broadband.pdf

National Regulatory Research Institute (NRRI) - <http://www.nrri.org/>

Telecommunications Community - <http://www.nrri.org/web/telecommunications>

Telecommunications Knowledge Base -
<http://communities.nrri.org/web/telecommunications/nrri-research-papers>

Rural Telecommunications Congress (RTC) - <http://www.ruraltelecon.org/pages/>

RTC is a national membership organization dedicated to assuring that rural areas in the United States have access to the information and support they need to obtain and use advanced telecommunications services and technology for social and economic development.

Broadband Planning - <http://www.ruraltelecon.org/pages/BroadbandPlanning.aspx>

Community Toolkit -
http://www.ruraltelecon.org/pages/Portals/0/Content_files/Community%20Toolkit%20Rough%20Outline%20%20REV%201.pdf

Rural Telecommunications Group (RTG) - <http://ruraltelecomgroup.org/>

RTG is a trade association representing rural wireless carriers who provide wireless telecommunications services, such as cellular telephone service and Personal Communications Services, to regions with less than 100,000 subscribers comprising secondary, tertiary, and rural markets. RTG membership is comprised of both independent wireless carriers and wireless carriers that are affiliated with rural telephone companies that have joined together to speed delivery of new, efficient, and innovative telecommunications technologies to the populations of remote and underserved sections of the country.

Advocacy - <http://ruraltelecomgroup.org/advocacy/>

RICA/RTG Fall Forum and RTG Annual Meeting 11/2/11 in Phoenix, AZ - <http://ruraltelecomgroup.org/types/events/>

American Planning Association (APA) - <http://www.planning.org/>

APA is an independent, not-for-profit educational organization that provides leadership in the development of vital communities.

Technology Division - <http://www.planning.org/divisions/tech/index.htm>

Resources - <http://www.planning.org/resources/>

APA Planning Books - <http://www.planning.org/apastore/>

Planning and Broadband: Infrastructure, Policy, and Sustainability (7/12) - <http://www.planning.org/apastore/Search/Default.aspx?p=4193>

American Public Works Association (APWA) - <http://www.apwa.net/>

APWA serves professionals in all aspects of public works and acts as an effective voice of public works throughout North America. APWA includes not only personnel from local, county, state/province, and federal agencies, but also private sector personnel who supply products and services to those professionals.

Advocacy - <http://www.apwa.net/Topics/Advocacy>

Utility and Public Right-of-Way - <http://www.apwa.net/Topics/Utility-and-Public-Right-of-Way>

Resource Center - <http://www.apwa.net/ResourceCenter/>

Utility and Public Right-of-Way - <http://www.apwa.net/ResourceCenter/Category/Utility-and-Public-Right-of-Way>

International Right of Way Association (IRWA) - <https://www.irwaonline.org/eweb/StartPage.aspx>

Region 1 (AZ, CA, HI, NV) - <http://www.irwaonline.org/eweb/DynamicPage.aspx?Webcode=region01>

Phoenix Chapter - <http://www.irwachapter28.org/>

Tucson Chapter - <http://www.irwa73.org/>

International Municipal Lawyers Association (IMLA) - <http://www.imla.org/>

IMLA is a nonprofit, professional organization that has been an advocate and resource for local government attorneys since 1935 and serves as an international clearinghouse of legal information and cooperation on municipal legal matters.

Sections -

http://www.imla.org/index.php?option=com_content&task=view&id=82&Itemid=170

Including a Telecommunications & Franchise Section (no specific link)

Public Technology Institute - <http://pti.nw.dc.us/>

Topics Index - <http://www.pti.org/index.php/ptiee1/cl/C32>

Web Management and E-Government Topic - <http://www.pti.org/index.php/ptiee1/inside/C29>

Public Safety Technology Topic - <http://www.pti.org/index.php/ptiee1/inside/C25>

Energy Star for Local Governments - <http://www.pti.org/index.php/ptiee1/inside/C128>

National Trade Associations:

PCIA - The Wireless Infrastructure Association - <http://www.pcia.com/>

PCIA - The Wireless Infrastructure Association is the trade association representing the companies that make up the wireless telecommunications infrastructure industry. Members include the carriers, infrastructure providers and professional services firms that own and manage more than 130,000 telecommunications facilities throughout the world.

Advocacy -

http://www.pcia.com/index.php?option=com_content&view=article&id=30&Itemid=33

Federal -

http://www.pcia.com/index.php?option=com_content&view=article&id=14&Itemid=34

State -

http://www.pcia.com/index.php?option=com_content&view=article&id=15&Itemid=35

Local -

http://www.pcia.com/index.php?option=com_content&view=article&id=16&Itemid=36

Model Ordinances -

http://www.pcia.com/index.php?option=com_content&view=article&id=17&Itemid=37

Model Legislation -

http://www.pcia.com/index.php?option=com_content&view=article&id=78&Itemid=159

References -

http://www.pcia.com/index.php?option=com_content&view=article&id=18&Itemid=38

Distributed Antenna System (DAS) Forum - <http://www.thedasforum.org/>

AWS Clearinghouse - <http://www.awsclearinghouse.com/>

Frequency Coordination -

http://www.pcia.com/index.php?option=com_content&view=article&id=32&Itemid=10

CTIA - The Wireless Association - <http://www.ctia.org/>

CTIA - The Wireless Association is an international nonprofit membership organization that represents the wireless communications industry. Membership includes wireless carriers and their suppliers, as well as providers and manufacturers of wireless data services and products.

Advocacy - <http://www.ctia.org/advocacy/>

Policy Topics - http://www.ctia.org/advocacy/policy_topics/

Broadband - http://www.ctia.org/advocacy/policy_topics/topic.cfm/TID/37

Spectrum, Tower Siting & Antennas -

http://www.ctia.org/advocacy/policy_topics/topic.cfm/TID/65

Research - <http://www.ctia.org/advocacy/research/>

Legislative Search -

<http://www.ctia.org/advocacy/research/index.cfm/AID/10586>

National Exchange Carrier Association, Inc. (NECA) - <http://www.neca.org/>

Government Relations -

https://www.neca.org/cms400min/NECA_Templates/Government_LP.aspx

Washington Watch -

https://www.neca.org/cms400min/NECA_Templates/PublicInterior.aspx?id=6024

Resources -

https://www.neca.org/cms400min/Neca_templates/Resources_Landing_Page.aspx

Organization for the Promotion and Advancement of Small Telecommunications Companies (OPASTO) - <http://www.opastco.org/>

Advocacy - <http://www.opastco.org/site/advocacy/>

Resources - <http://www.opastco.org/site/resources/>

United States Telecom Association - <http://www.ustelecom.org/>

Broadband Industry - <http://www.ustelecom.org/broadband-industry>

Issues - <http://www.ustelecom.org/issues>

Broadband Infrastructure - <http://www.ustelecom.org/issues/broadband-infrastructure>

Universal Service - <http://www.ustelecom.org/issues/universal-service>

National Telecommunications Cooperative Association (NTCA) - <http://www.ntca.org/>

Rural Telecommunity - <http://www.ntca.org/rural-telecommunity.html>

Advocacy - <http://www.ntca.org/advocacy/advocacy/>

Advocacy Issues - <http://www.ntca.org/advocacy/advocacy-issues/>

Broadband - <http://www.ntca.org/advocacy/broadband/>

Universal Service - <http://www.ntca.org/advocacy/universal-service/>

Rural Health Care -

<http://www.ntca.org/advocacy/ntca-health-care-update-august-14-2009.html>

Position Papers - <http://www.ntca.org/position-papers/ntca-position-papers.html>

NTCA Smart Grid Resource Center -

<http://www.ntca.org/smart-grid/ntca-smart-grid-resource-center.html>

National Cable Television Association (NCTA) - <http://www.ncta.com/>

Legislative & Regulatory Issues - <http://www.ncta.com/Issues.aspx>

CableLabs - <http://www.cablelabs.com/>

Cable in the Classroom (CIC) - <http://www.ciconline.org/>

Society of Cable Telecommunications Engineers (SCTE) - <http://www.scte.org/default.aspx>

Technical Resources - <http://www.scte.org/resources/resources.aspx>

SCTE Cactus Chapter (Phoenix) - <http://chapter.scte.org/cactus/>

Telecommunications Industry Association (TIA) - <http://www.tiaonline.org/>

Policy - <http://www.tiaonline.org/policy/>

Standards - <http://www.tiaonline.org/standards/>

Resources - <http://www.tiaonline.org/resources/>

Telecom Association - <http://www.telecomassociation.com/>

Voice & data telecom agents, channel partners, independent consultants, network service integrators, business phone system equipment VARs & vendors

Fiber to the Home (FTTH) Council - <http://www.ftthcouncil.org/>

Knowledge Center - <http://www.ftthcouncil.org/en/knowledge-center>

FTTH Fiber Primer 2011 - http://s.ftthcouncil.org/files/bbp_marapr_primer_2011.pdf

Regulatory - <http://www.ftthcouncil.org/en/regulatory/>

The Fiber Optic Association, Inc. - <http://www.thefoa.org/>

FTTx: Fiber To The Home/Premises/Curb - <http://www.thefoa.org/FTTX/index.html>

FOA Guide To Fiber Optics & Premises Cabling - <http://www.thefoa.org/tech/ref/contents.html>

FOA Reference Guide to Outside Plant Fiber Optics (book) - <http://www.thefoa.org/FOArgOSP.html>

BICSI - <https://www.bicsi.org/>

BICSI Standards Program - <https://www.bicsi.org/double.aspx?!=3672,3306&r=3308>

BICSI Bookstore - <https://www.bicsi.org/bookstore.aspx>

Arizona Nonprofit Organizations and Trade Associations:

Arizona Telecommunications & Information Council (ATIC) -

<http://arizonatele.com/atic/>

ATIC is an economic development foundation that functions as Arizona's recognized and authoritative organization guiding technology policy development, serving as a leading source of information and expertise on telecommunications and information technology matters. ATIC develops, promotes and supports initiatives and guides adoption of effective public policies that encourages wide-scale deployment and availability of telecommunication services and information technologies to insure economic prosperity for the Arizona community, expand the region's global competitive advantage, enable continued educational advancement, and support an enhanced quality of life.

ATIC Strategy Committee - <http://arizonatele.com/atic/strategy/default.htm>

ATIC DHS WiFi Security Project for First Responders (2006) -

<http://www.arizonatele.com/atic/wireless/>

ATIC Multi-tenant Building Telecom Access Study (MBTAS 2000) -

<http://www.researchedge.com/MBTAS/>

Arizona Telecommunications & Information Institute (ATI Institute) -

<http://aztii.org/>

ATI Institute is dedicated to supporting and promoting initiatives in the area of advanced telecommunications and information infrastructure that lead to effective deployment and availability of innovative and state-of-the-art broadband services and information technologies for the entire Arizona community.

Arizona New Mexico Cable Television Association (AZ-NMCTA) -

<http://www.azcable.org/>

AZ-NMCCA works closely with state and federal lawmakers to implement a positive legislative program for the cable television industry. AZ-NMCCA has successfully obtained state theft of service legislation, codified a state sales tax exemption, put a cap on state license fees, and was instrumental in developing the 1984 & 1996 Federal Cable Communications Acts. AZ-NMCCA offers guidance and assistance to cable television systems in dealing with local government relations issues.

Society of Cable Telecommunications Engineers (SCTE) - <http://www.scte.org/default.aspx>

SCTE Cactus Chapter (Phoenix) - <http://chapter.scte.org/cactus/>

Arizona Wireless Association (AZWA) - <http://azwa.org/>

AZWA seeks to cultivate relationships within the wireless industry and with Arizona's cities and towns and to create a unified voice that supports the development of quality wireless networks, the enhancement of the communities we serve, and a spirit of charitable giving.

Arizona Association for Economic Development (AAED) - <http://www.aaed.com/>

Arizona Economic Development Directory - <http://www.ecodevdirectory.com/arizona.htm>

The League of Arizona Cities and Towns - <http://www.azleague.org/>

Member Cities and Towns -

<http://www.azleague.org/index.cfm?fuseaction=about.cities>

Legislative Issues - <http://www.azleague.org/index.cfm?fuseaction=legislative.main>

Resources & Research -

<http://www.azleague.org/index.cfm?fuseaction=resources.main>

Arizona Chamber of Commerce and Industry - <http://www.azchamber.com/>

Policy Briefs & Publications - <http://www.azchamber.com/policy/policy-briefs>

Useful Links - <http://www.azchamber.com/about/useful-links>

Local Chambers Directory - <http://www.azchamber.com/localchambers/index.cfm?ID=34>

International City/County Management Association (ICMA) - <http://icma.org/en/icma/home>

Arizona City/County Management Association - <http://www.azmanagement.org/>

Arizona Councils of Government (COGs)

Central Arizona Association of Governments (CAAG) - <http://www.caagcentral.org/>

Maricopa Association of Governments (MAG) - <http://www.mag.maricopa.gov/>

Northern Arizona Council of Governments - <http://www.nacog.org/>

Pima Association of Governments (PAG) - <http://www.pagnet.org/>

Southeastern Arizona Governments Organization (SEAGO) - <http://www.seago.org/>

Western Arizona Council of Governments (WACOG) - <http://www.wacog.com/>

Arizona Technology Council (AZTC) - <http://www.aztechcouncil.org/>

Technology Advocacy & Technology Public Policy - <http://www.aztechcouncil.org/advocacy>

Arizona Technology Workforce Study (9/11) -

<http://www.aztechcouncil.org/External/WCPages/WCWebContent/WebContentPage.aspx?ContentID=1132>

TechConnect Magazine -

<http://www.aztechcouncil.org/cwt/external/wcpages/initiatives/techconnect.aspx>

Arizona Energy Consortium (AEC) - <http://www.aztechcouncil.org/committees/aec>

In Cooperation with ASU W. P. Carey School of Business L. William Seidman Research Institute

Arizona's Technology Workforce: Issues, Opportunities, and Competitive Pressures (9/11) Executive Summary - <http://www.aztechcouncil.org/External/WCPages/WCWebContent/WebContentPage.aspx?ContentID=1133>

Arizona's Technology Workforce: Issues, Opportunities, and Competitive Pressures (9/11) Study - <http://www.aztechcouncil.org/External/WCPages/WCWebContent/WebContentPage.aspx?ContentID=1132>

Arizona Investment Council (AIC) - <http://www.arizonaaic.org/>

Greater Arizona eLearning Association (GAZeL) - <http://gazel.org/>

Directory of Providers of eLearning Technologies and Services - <http://gazel.org/products>

eLearning System for Arizona Teachers and Students (eSATS) - <http://esats.org/>

Arizona Health-e Connection (AzHeC) - <http://www.azhec.org/>

Health Information Network of Arizona (HINAZ) - <http://www.ehealthnetworkaz.org/>

Arizona Telemedicine Program (ATP) - <http://www.telemedicine.arizona.edu/>

Arizona Telemedicine Council - <http://www.telemedicine.arizona.edu/atc.cfm>

Arizona Telemedicine Network - <http://www.telemedicine.arizona.edu/network.cfm>

Southwest Telehealth Resource Center (SWTRC) - <http://www.southwesttrc.org/>

Science Foundation Arizona (SFaz) - <http://www.sfaz.org/>

STEM Education initiative - <http://www.sfaz.org/live/page/stem>

STEM Immersion Matrix - <http://www.sfaz.org/stemimmersion>

Information and Communications Technology Research - <http://www.sfaz.org/live/collection/research/10714>

Arizona BioIndustry Association (AZBio) - <http://www.azbio.org/>

Flinn Foundation Arizona's Bioscience Roadmap - <http://www.flinn.org/bio-roadmap>

Arizona Nanotechnology Cluster - <http://www.aznano.org/>

Coalition for a Connected West - <http://www.connectedwest.org/>

Arizona - <http://www.connectedwest.org/states/arizona/>

CANAMEX Smart Corridors & CyberPort Projects <http://www.canamex.org/>

Urban Land Institute (ULI) Arizona Chapter - <http://arizona.uli.org/>

Strategic Plan 2012-2014 -

<http://arizona.uli.org/~media/DC/Arizona/Documents/Publications/ARIZONA%20Strategic%20Plan%202012%202014%20042511.ashx>

Community Plan -

<http://arizona.uli.org/sitecore/content/District%20Councils/Sites/ULI%20Arizona/Community%20Building/CommunityPlan.aspx>

American Public Works Association (APWA) Arizona Chapter - <http://arizona.apwa.net/>

Intelligent Transportation Society of Arizona (ITS AZ) - <http://www.itsaz.org/>

Arizona Section of Institute of Transportation Engineers (AZITE) - <http://azite.org/>

Arizona Association of County Engineers (AACE) - <http://www.azace.org/>

American Council of Engineering Companies (ACEC) of Arizona - <http://www.acecaz.org/>

International Right of Way Association (IRWA) Region 1 (AZ, CA, HI, NV) - <http://www.irwaonline.org/eweb//DynamicPage.aspx?Webcode=region01>

Phoenix Chapter - <http://www.irwachapter28.org/>

Tucson Chapter - <http://www.irwa73.org/>

National eLearning and Technology in Education Resources:

U.S. Department of Education - <http://www.ed.gov/>

Infrastructure: Access and Enable -

<http://www.ed.gov/technology/netp-2010/infrastructure-access-and-enable>

Universal Service Administrative Company (USAC) - <http://www.usac.org/>

Schools and Libraries Program (E-Rate) - <http://www.usac.org/sl/>

Eligible Services List 2013 -

http://www.usac.org/_res/documents/sl/pdf/ESL_archive/EligibleServicesList-2013.pdf

U.S. Congressional Research Service (CRS) - <http://www.loc.gov/crsinfo/>

Federation of American Scientists (FAS) CRS Reports - <http://www.fas.org/sgp/crs/>

Science, Technology, Engineering, and Mathematics (STEM) Education: A Primer (8/1/12) - <http://www.fas.org/sgp/crs/misc/R42642.pdf>

An Analysis of STEM Education Funding at the NSF: Trends and Policy Discussion (4/9/12) - <http://www.fas.org/sgp/crs/misc/R42470.pdf>

National Education Association (NEA) - <http://www.nea.org/>

Legislation Action Center - <http://www.nea.org/home/LegislativeActionCenter.html>

Reference Center - <http://www.nea.org/home/32073.htm>

Council of Chief State School Officers (CCSSO) - <http://www.ccsso.org/>

Legislation & Advocacy - http://www.ccsso.org/What_We_Do/Legislation_and_Advocacy.html

Common Core State Standards Initiative - <http://www.corestandards.org/>

Resources - <http://www.corestandards.org/resources>

iNACOL (International Association for K-12 Online Learning) - <http://www.inacol.org/>

Advocacy - <http://www.inacol.org/advocacy/>

Research - <http://www.inacol.org/research/>

State Educational Technology Directors Association (SETDA) - <http://www.setda.org/>

The Broadband Imperative: Recommendations to Address K-12 Education Infrastructure Needs Report (5/12) -

http://www.setda.org/c/document_library/get_file?folderId=353&name=DLFE-1517.pdf

The Bill & Melinda Gates Foundation - <http://www.gatesfoundation.org/>

U.S. Libraries - <http://www.gatesfoundation.org/united-states-libraries/Pages/overview.aspx>

The Center for Education Reform - <http://www.edreform.com/>

Online Learning - <http://www.edreform.com/issues/online-learning/>

CER's Digital Learning Toolkit (12/11) - http://www.edreform.com/wp-content/uploads/2012/04/CER_DigitalLearning_Toolkit.pdf

Digital Learning Now - <http://digitallearningnow.com/>

10 Elements of High Quality Digital Learning - <http://digitallearningnow.com/ten-elements-of-high-quality-digital-learning/>

Education Week Magazine - <http://www.edweek.org/>

Digital Directions - <http://www.edweek.org/dd/>

E-Learning Topic Area - <http://www.edweek.org/topics/e-learning/index.html>

Preparing for Change Report PDF (1/12) - <http://www.edweek.org/media/preparingforchange-17standards.pdf>

E-Learning Series Reports - <http://www.edweek.org/ew/collections/e-learning-2010/e-learning/>

Technology Topic Area - <http://www.edweek.org/topics/technology/index.html>

Technology Counts Reports - <http://www.edweek.org/ew/tc/index.html>

Research Topic Area - <http://www.edweek.org/topics/research/index.html>

Arizona Topic Area - <http://www.edweek.org/topics/states/arizona/index.html>

EDUCAUSE - <http://www.educause.edu/>

Research and Publications - <http://www.educause.edu/research-and-publications>

EDUCAUSE Library - <http://www.educause.edu/library>

Information Literacy - <http://www.educause.edu/library/information-literacy>

EDUCAUSE Core Data Service (CDS) - <http://www.educause.edu/research-and-publications/research/core-data-service>

Edutopia (George Lucas Educational Foundation) - <http://www.edutopia.org/>

Technology Integration Core Strategy - <http://www.edutopia.org/technology-integration>

Special Reports - <http://www.edutopia.org/edutopia-special-reports>

T.H.E. Journal - <http://thejournal.com/Home.aspx>

21st Century School Resource Center - <http://thejournal.com/pages/resource-centers/resource-center-21st-century.aspx>

GSV Advisors - <http://gsvadvisors.com/>

American Revolution 2.0: How Education Innovation is Going to Revitalize America and Transform the U.S. Economy (7/4/12) - <http://gsvadvisors.com/wordpress/wp-content/themes/gsvadvisors/American%20Revolution%202.0.pdf>

Fall of the Wall: Capital Flows to Education Innovation (7/12) - http://gsvadvisors.com/wordpress/wp-content/themes/gsvadvisors/GSV%20Advisors_Fall%20of%20the%20Wall_2012-8-3.pdf

Arizona eLearning and Technology in Education Resources:

Arizona Governor's Office - <http://www.azgovernor.gov/>

Governor's Arizona Ready Education Council - <http://www.arizonaready.com/> & <http://azgovernor.gov/AzReady/>

Arizona Department of Education - <http://www.azed.gov/>

E-Rate & Educational Technology - <http://www.azed.gov/educational-technology/e-rate/>

Technology Plans - <http://www.azed.gov/educational-technology/technology-plans/>

Arizona State Library, Archives and Public Records - <http://azlibrary.gov/>

E-Rate Resources - <http://azlibrary.gov/erate/>

Library Services and Technology Act (LSTA) in Arizona - <http://www.azlibrary.gov/lsta/>

Science Foundation Arizona (SFAz) - <http://www.sfaz.org/>

STEM Education initiative - <http://www.sfaz.org/live/page/stem>

STEM Immersion Matrix - <http://www.sfaz.org/stemimmersion>

Arizona State University (ASU) - <http://www.asu.edu/>

ASU Education Innovation - <http://edinnovation.asu.edu/>

ASU Technology Based Learning and Research (TBLR) - <http://tblr.asu.edu/>

Greater Arizona eLearning Association (GAZeL) - <http://gazel.org/>

Directory of Providers of eLearning Technologies and Services - <http://gazel.org/products>

eLearning System for Arizona Teachers and Students (eSATS) - <http://esats.org/>

National Telehealth Resources:

U.S. Department of Health and Human Services (HHS) - <http://www.hhs.gov/>

Office of the National Coordinator for Health Information Technology - http://healthit.hhs.gov/portal/server.pt/community/healthit_hhs_gov_home/1204

U.S. National Library of Medicine (NLM) - <http://www.nlm.nih.gov/>

PubMed/MEDLINE - <http://www.ncbi.nlm.nih.gov/pubmed/>

Consumer Health - <http://www.nlm.nih.gov/medlineplus/>

MedlinePlus Connect (Linking Patient Portals and EHRs to Consumer Health Information) - <http://www.nlm.nih.gov/medlineplus/connect/overview.html>

Office of the National Coordinator for Health Information Technology (ONC) HealthIT.gov - <http://www.healthit.gov/>

Policy Researchers & Implementers - <http://www.healthit.gov/policy-researchers-implementers>

Providers & Professionals - <http://www.healthit.gov/providers-professionals>

Patients & Families - <http://www.healthit.gov/patients-families>

Benefits of Electronic Health Records (EHRs) - <http://www.healthit.gov/providers-professionals/benefits-electronic-health-records-ehrs>

Policymaking, Rules, & Regulation: Meaningful Use - <http://www.healthit.gov/policy-researchers-implementers/meaningful-use>

Centers for Medicare & Medicaid Services - <http://www.cms.gov/>

EHR Incentive Programs - <http://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms/index.html?redirect=/EHRIncentivePrograms>

Research, Statistics, Data & Systems - <http://www.cms.gov/Research-Statistics-Data-and-Systems/Research-Statistics-Data-and-Systems.html>

Universal Service Administrative Company (USAC) - <http://www.usac.org/>

Rural Health Care - <http://www.usac.org/rhc/>

Health Information Management & Systems Society (HIMSS) - <http://www.himss.org/>

American Medical Informatics Association (AMIA) - <http://www.amia.org/>

American Telemedicine Association (ATA) - <http://www.americantelemed.org/>

National Telecommunications Cooperative Association (NTCA) - <http://www.ntca.org/>

Advocacy Issues - <http://www.ntca.org/advocacy/advocacy-issues/>

Rural Health Care -

<http://www.ntca.org/advocacy/ntca-health-care-update-august-14-2009.html>

Continua Health Alliance - <http://www.continuaalliance.org/>

Connected Health Vision -

<http://www.continuaalliance.org/connected-health-vision.html>

Health Transformation Institute (HTI) - <http://www.healthcaretransformationinstitute.org/>

Joint venture of the U of A, ASU, and the Chan Soon-Shiong Family Foundation

Engineering to Create a Health Care System -

<http://healthcaretransformationinstitute.org/page/engineering-create-health-care-system>

A Roadmap to High-Value Healthcare Delivery (7/12) -

<http://www.healthcaretransformationinstitute.org/page/publications-0>

Report PDF - http://healthcaretransformationinstitute.org/sites/default/files/HVHC_070612%20final.pdf

Useful Links - <http://www.healthcaretransformationinstitute.org/page/useful-links>

Biotechnology Industry Organization (BIO) - <http://www.bio.org/>

Battelle/BIO State Bioscience Industry Development 2012 -

<http://www.bio.org/articles/battellebio-state-bioscience-industry-development>

Report PDF (Arizona state profile on pages 50-51) -

http://www.bio.org/sites/default/files/v3battelle-bio_2012_industry_development.pdf

Coalition for a Connected West - <http://www.connectedwest.org/>

mHealth - <http://www.connectedwest.org/category/mhealth/>

Arizona Telehealth Resources:

Arizona Governor's Office - <http://www.azgovernor.gov/>

Arizona Governor's Office of Health Information Exchange (HIE) - <http://hie.az.gov/>
(Migrating to ADOA ASET for oversight)

Strategic Plan (3/11) - http://hie.az.gov/docs/app_plans/AZHIEStrategicPlanv1_10.pdf

ASET Unconnected Healthcare Providers Health Information Exchange (HIE) Grant Program Guidance (10/1/12) -
http://hie.az.gov/docs/app_plans/ASET_Unconnected_Providers_Program_Guidance_Final.pdf

Arizona Health-e Connection (AzHeC) - <http://www.azhec.org/>

Arizona HIE Marketplace - http://www.azhec.org/?page=HIE_Marketplace

Health Information Network of Arizona (HINAz) - <http://www.ehealthnetworkaz.org/>

Arizona Telemedicine Program (ATP) - <http://www.telemedicine.arizona.edu/>

Arizona Telemedicine Council - <http://www.telemedicine.arizona.edu/atc.cfm>

Arizona Telemedicine Network - <http://www.telemedicine.arizona.edu/network.cfm>

ATP Map (9/12) - <http://www.telemedicine.arizona.edu/app/sites/default/files/u5/ATP%20Map%20Sept%202012.pdf>

Southwest Telehealth Resource Center (SWTRC) - <http://www.southwesttrc.org/>

Health Information Network of Arizona (HINAz) - <http://www.hinaz.org/>

What is Health Information Exchange? - <http://www.hinaz.org/health-information-exchange>
Resources - <http://www.hinaz.org/resources>

Arizona Health Information Management Association (AzHIMA) - <http://azhima.org/>

Healthcare Information & Management Systems Society (HIMSS) Arizona Chapter - <http://azhimss.org/>

Advocacy - <http://azhimss.org/advocacy/advocacy.html>

Arizona State Physicians Association (ASPA) - <http://www.azspa.com/>

ASPA Connected Community (Practice Management, EHR & Clinical Integration Services) -
<http://www.aspaconnectedcommunity.com/en/default.aspx>

Arizona State University (ASU) - <http://www.asu.edu/>

Center for Health Information and Research (CHiR) - <http://chir.asu.edu/home>

Arizona HealthQuery (AZHQ) Data - <http://chir.asu.edu/data>

Research - <http://chir.asu.edu/research>

National eGovernment Resources:

Government Technology - <http://www.govtech.com/>

Center for Digital Government - <http://www.centerdigitalgov.com/>

Reports and Papers - <http://www.centerdigitalgov.com/papers>

Lessons in Applied Innovation from State and Local Government (5/12) - http://media2.govtech.com/documents/CDG12_Trending+Up+Paper.pdf

Government Technology Magazine - <http://www.govtech.com/>

Library - <http://www.govtech.com/library/>

Arizona Digital Government Summit 2012 (5/23-24/12 in Phoenix) - <http://events.govtech.com/events/arizonadgs2012>

E-Government - <http://www.govtech.com/e-government/>

Digital Communities - <http://www.digitalcommunities.com/>

Wireless/Mobile/Broadband - <http://www.govtech.com/wireless/>

Public CIO Magazine - <http://www.govtech.com/pcio>

Emergency Management Magazine - <http://www.emergencymgmt.com/>

Library - <http://www.emergencymgmt.com/papers>

Pew Research Center - <http://pewresearch.org/>

Pew Internet & American Life Project - <http://www.pewinternet.org/>

Government Topic Area - <http://www.pewinternet.org/topics/Government.aspx>

Public Technology Institute - <http://pti.nw.dc.us/>

Web Management and E-Government Topic - <http://www.pti.org/index.php/ptiee1/inside/C29>

Arizona eGovernment Resources:

Arizona Revised Statutes (ARS) - <http://www.azleg.state.az.us/ArizonaRevisedStatutes.asp>

Arizona Department of Administration - <http://www.azdoa.gov/>

Arizona State Enterprise Technology (ASET) Office - <http://aset.azdoa.gov/>

eGov Program - <http://aset.azdoa.gov/e-gov>

Arizona State Library, Archives and Public Records - <http://azlibrary.gov/>

Digital Government Information Initiatives - <http://azlibrary.gov/diggovt/index.aspx>

National Discovery, Innovation and Research Resources

National Science Foundation (NSF) - <http://www.nsf.gov/>

About the NSF - <http://www.nsf.gov/about/>

Cyberinfrastructure Program Area - <http://www.nsf.gov/dir/index.jsp?org=OCI>

Computer & Information Science & Engineering Program Area -
<http://www.nsf.gov/dir/index.jsp?org=cise>

National LambdaRail (NLR) - <http://www.nlr.net/>

NLR Overview Brochure - http://www.nlr.net/docs/NLR_OverviewBrochure.pdf

NLR Innovation Examples - <http://www.nlr.net/action.php>

Presentations - <http://www.nlr.net/presentations.php>

Institute for Advanced Health Announces High Performance Secure "National Health Intranet"
(7/27/11) - <http://www.nlr.net/release77.php>

University Community Next Generation Innovation Project (Gig.U) - <http://www.gig-u.org/>

FAQs - <http://www.gig-u.org/faqs>

Internet2 - <http://www.internet2.edu/>

Research - <http://www.internet2.edu/research/>

US Ignite Partnership - <http://us-ignite.org/>

Next Gen Applications - <http://us-ignite.org/next-gen-applications/>

Global Environment for Network Innovation (GENI funded by NSF) - <http://geni.net/>

Arizona Discovery, Innovation and Research Resources

Science Foundation Arizona (SFaz) - <http://www.sfaz.org/>

STEM Education initiative - <http://www.sfaz.org/live/page/stem>

Information and Communications Technology Research -
<http://www.sfaz.org/live/collection/research/10714>

National Smart Energy and Environmental Resources

U.S. Department of Energy (DoE) - <http://energy.gov/>

SmartGrid.gov - <http://www.smartgrid.gov/>

Database of State Incentives for Renewables and Efficiency (DSIRE) - <http://www.dsireusa.org/>

Links - <http://www.dsireusa.org/links/>

American Public Power Association (APPA) - <http://www.publicpower.org/>

Energy Efficiency Resource Central - <http://www.publicpower.org/EERC/index.cfm>

Smart Grid - <http://www.publicpower.org/legislative/legreg.cfm?itemnumber=28475>

National Science and Technology Council (NSTC) Smart Grid Report “A Policy Framework for the 21st Century Grid: Enabling Our Secure Energy Future” (6/11) - http://www.publicpower.org/files/PDFs/nstc_smart_grid_june2011.pdf

Community Broadband Current News - <http://www.publicpower.org/legislative/index.cfm?ItemNumber=9878>

The Municipal and Utility Guidebook to Bringing Broadband Fiber Optics to Your Community (9/08) - <http://www.publicpower.org/files/PDFs/MuniFiberReportFinalDraft.pdf>

Broadband Policy Area - <http://knowledgecenter.csg.org/kc/view-policy-areas/825>

National Association of Regulatory Utility Commissioners (NARUC) - <http://www.naruc.org/>

National Regulatory Research Institute (NRRI) - <http://www.nrri.org/>

Smart Grid Research Papers - <http://www.nrri2.org/web/guest/research-papers?categoryId=351335>

National Electrical Manufacturers Association (NEMA) - <http://www.nema.org/>

Smart Grid & Cybersecurity Energy Policy - <http://www.nema.org/Policy/Energy/Smartgrid/Pages/default.aspx>

The Smart Grid Return on Investment (ROI) Catalog (2/12) - <http://www.nema.org/Policy/Energy/Smartgrid/Documents/NEMA-SGC-ROI.pdf>

High Performance Buildings Initiative - <http://www.nema.org/Technical/HPB/Pages/default.aspx>

National Telecommunications Cooperative Association (NTCA) - <http://www.ntca.org/>

NTCA Smart Grid Resource Center - <http://www.ntca.org/smart-grid/ntca-smart-grid-resource-center.html>

SmartEnergyPortal.net (Penton Media) - <http://smartenergyportal.net/>

RenewableEnergyWorld.com - <http://www.renewableenergyworld.com/>

Rocky Mountain Institute (RMI) - <http://www.rmi.org/>

Knowledge Center - <http://www.rmi.org/Knowledge-Center/Library>

Solar Energy Industries Association (SEIA) - <http://www.seia.org/>

Issues and Policy - <http://www.seia.org/policy>

Research and Resources - <http://www.seia.org/research-resources>

Arizona State Solar Policy - <http://www.seia.org/state-solar-policy/arizona>

Clean Edge - <http://www.cleandedge.com/>

State Clean Energy Index - <http://www.cleandedge.com/research/state-index>

U.S. Metro Clean Tech Index - <http://www.cleandedge.com/research/metro-index>

CleanTech Open - <http://www.cleantechopen.com/>

Arizona Smart Energy and Environmental Resources

Arizona Governor's Office - <http://www.azgovernor.gov/>

Arizona.gov Official Web Site - <http://az.gov/>

Governor's Office of Energy Policy - <http://www.azenergy.gov/>

Renewable Energy - <http://www.azenergy.gov/Renewable/Default.aspx>

Arizona Department of Environmental Quality - <http://www.azdeq.gov/>

Arizona Commerce Authority (ACA) - <http://www.azcommerce.com/>

Solar Arizona - <http://www.azsolarstate.com/>

Research Partners - <http://www.azsolarstate.com/research-partners>

Arizona Corporation Commission (ACC) - <http://www.azcc.gov/>

Arizona Goes Solar - <http://arizonagoessolar.org/>

Arizona Technology Council (AZTC) - <http://www.aztechcouncil.org/>

Arizona Energy Consortium (AEC) - <http://www.aztechcouncil.org/committees/aec>

Arizona Solar Center - <http://azsolarcenter.org/>

Arizona Solar Energy Industries Association (AriSEIA) - <http://www.arizonasolarindustry.org/>

Database of State Incentives for Renewables and Efficiency (DSIRE) - <http://www.dsireusa.org/>

Arizona Incentives/Policies for Renewables & Efficiency -

<http://www.dsireusa.org/incentives/index.cfm?re=1&ee=1&spv=0&st=0&srp=1&state=AZ>

Arizona Students Recycling Used Technology (AZ StRUT) - <http://www.azstrut.org/>

National Public Safety Communications Resources:

National Telecommunications and Information Administration (NTIA) -

<http://www.ntia.doc.gov/>

Remarks of Deputy Assistant Secretary Gomez at PSCR Demonstration Network Stakeholders Meeting (3/6/12) - <http://www.ntia.doc.gov/speechtestimony/2012/remarks-deputy-assistant-secretary-gomez-pscr-demonstration-network-stakeholder>

White House Fact Sheet: 21st-Century Communications for our First Responders (6/16/11) - <http://www.whitehouse.gov/the-press-office/2011/06/16/fact-sheet-21st-century-communications-our-first-responders>

Nationwide Public Safety Broadband Network Report (6/11)
<http://www.whitehouse.gov/sites/default/files/uploads/publicsafetyreport.pdf>

U.S. Congressional Research Service (CRS) - <http://www.loc.gov/crsinfo/>

Federation of American Scientists (FAS) CRS Reports Access - <http://www.fas.org/sgp/crs/>

Public Safety Communications and Spectrum Resources: Policy Issues for Congress (9/1/10) - <http://www.fas.org/sgp/crs/misc/R40859.pdf>

Federal Emergency Management Agency (FEMA) - <http://www.fema.gov/>

Ready.gov - <http://www.ready.gov/>

National Preparedness Coalition - <http://community.fema.gov/connect.ti/READYNPM>

APCO International (Public Safety Communications) - <http://www.psconnect.org/Home/>

APCO International is the world's largest organization of public safety communications professionals. It serves the needs of public safety communications practitioners worldwide and the welfare of the general public as a whole by providing complete expertise, professional development, technical assistance, advocacy, and outreach.

Resources - <http://www.psconnect.org/Resources/AllLibraries/>

Armed Forces Communications and Electronics Association (AFCEA) - <http://www.afcea.org/>

SIGNAL Magazine - <http://www.afcea.org/signal/>

Resources - <http://www.afcea.org/mission/intel/resource.asp>

Public Technology Institute - <http://pti.nw.dc.us/>

Public Safety Technology Topic - <http://www.pti.org/index.php/ptiee1/inside/C25>

International City/County Management Association (ICMA) - <http://icma.org/en/icma/home>

Center for Public Safety Management -
http://icma.org/en/results/public_safety_management/home

Arizona Public Safety Communications Resources:

Arizona Department of Administration - <http://www.azdoa.gov/>

ASET Office - <http://aset.azdoa.gov/>

Public Safety Interoperable Communications (PSIC) - <http://www.azpsic.gov/>

Arizona Department of Public Safety (DPS) - <http://www.azdps.gov/>

Technical Services Division (TSD) -
http://www.azdps.gov/About/Organization/Technical_Services/

Operational Communications (OpComm) Bureau -
http://www.azdps.gov/About/Organization/Technical_Services/Operational_Communications/

Emergency Medical Services Communications (EMSCOM) -
http://www.azdps.gov/About/Organization/Technical_Services/EMSCOM/

Arizona Department of Emergency and Military Affairs (DEMA) - <http://www.azdema.gov/>

Arizona Division of Emergency Management (ADEM) - <http://www.dem.azdema.gov/>

Operations Section - <http://www.dem.azdema.gov/operations/index.html>

Communications Logistics - <http://www.dem.azdema.gov/logistics/comm/comm.html>

Radio Systems - <http://www.dem.azdema.gov/logistics/comm/radiosys.html>

Mobile Communications -
<http://www.dem.azdema.gov/logistics/comm/mobilecomm.html>

Arizona Department of Homeland Security (AZDOHS) - <http://www.azdohs.gov/>

Resources & Links - <http://www.azdohs.gov/Resources.asp>

Arizona Fusion Center (AKA Arizona Counter Terrorism Information Center - ACTIC) -
<http://www.azactic.gov/>

Links & Resources - <http://www.azactic.gov/Links/>

National Native American Resources:

U.S. Department of the Interior - <http://www.interior.gov/>

Bureau of Indian Affairs - <http://www.bia.gov/>

Western Regional Office (Phoenix) -

<http://www.bia.gov/WhoWeAre/RegionalOffices/Western/index.htm>

Indian Health Service (HIS) - <http://www.ihs.gov/index.cfm>

EPA's American Indian Environmental Office - <http://www.epa.gov/indian/>

ED's Office of Indian Education (OIE) - <http://www.indianeducation.org/>

USA.gov - <http://www.usa.gov/>

Tribal Governments and Native Americans - <http://www.usa.gov/Government/Tribal.shtml>

National Indian Education Association (NIEA) - <http://www.niea.org/>

Policy - <http://www.niea.org/Policy.aspx>

Research - <http://www.niea.org/Research.aspx>

National Congress of American Indians (NCAI) - <http://www.ncai.org/>

Policy Issues - <http://www.ncai.org/policy-issues>

Resources - <http://www.ncai.org/resources>

Native Public Media (NPM in Flagstaff, AZ) - <http://www.nativepublicmedia.org/>

Policy Program - <http://www.nativepublicmedia.org/programs/policy-program>

NPM Publications - <http://www.nativepublicmedia.org/publications>

Native American Rights Fund (NARF) - <http://www.narf.org/>

Tribal Telecom 2012 (2/2-3/12 in Chandler) - <http://www.tribaltelecom2012.com/>

Tribal Telecom 2013 (2/11-13/12 in Chandler) - <http://www.tribaltelecomconference.com/>

Law Office of Randal T. Evans, PLLC - <http://www.evanslawaz.com/>

Arizona Native American Resources:

Arizona Commerce Authority (ACA) - <http://www.azcommerce.com/>

Arizona Facts & Figures - <http://www.azcommerce.com/facts-and-figures/>

Arizona Community Profiles -

<http://www.azcommerce.com/facts-and-figures/community-profiles/>

Arizona Department of Tourism - <http://www.arizonaguide.com/>

American Indian Culture - <http://www.arizonaguide.com/things-to-do/native-cultures>

Arizona Department of Education - <http://www.azed.gov/>

Indian Education - <http://www.azed.gov/indian-education/>

Arizona Department of Health Services - <http://www.azdhs.gov/>

Native American Liaison - <http://www.azdhs.gov/diro/tribal/>

Arizona State Land Department (ASLD) - <http://www.land.state.az.us/>

Arizona State Forestry Division - <http://www.azsf.az.gov/>

Arizona Tribal Transportation (ADOT) - <http://www.aztribaltransportation.com/>

Arizona Commission of Indian Affairs (ACIA) - <http://www.azcia.gov/>

Links - <http://www.azcia.gov/links.asp>

Inter Tribal Council of Arizona (ITCA), Inc. - <http://www.itcaonline.com/>

Maps - http://itcaonline.com/?page_id=16

Other Links - http://itcaonline.com/?page_id=18

Arizona Indian Chamber of Commerce of Arizona - <http://aiccaz.com/>

Resources - <http://aiccaz.com/resources/>

Arizona Indian Gaming Commission (AIGC) - <http://www.azindiangaming.org/>

Arizona State University (ASU) - <http://www.asu.edu/>

American Indian Policy Institute (AIPI) - <http://aiipi.clas.asu.edu/>

ASU Morrison Institute for Public Policy - <http://www.asu.edu/copp/morrison/>

University of Arizona (UA) - <http://www.arizona.edu/>

Indigenous Peoples Law & Policy (IPLP) Program, UA James E. Rogers College of Law - <http://www.law.arizona.edu/depts/iplp/index.cfm>

IPLP Monthly Newsletter - <http://www.law.arizona.edu/depts/iplp/newsletter/index.cfm>

Native Nations Institute for Leadership, Management and Policy (NNI), UA Udall Center for Studies in Public Policy - <http://www.nni.arizona.edu/>

Native Peoples Technical Assistance Office (NPTAO - <http://www.nptao.arizona.edu/>)

U of A NPTAO Resources - <http://www.nptao.arizona.edu/resources.cfm>

UANativeNet (formerly ArizonaNativeNet) - <http://www.uanativenet.com/>

American Indian Language Development Institute's (AILDI) - <http://www.u.arizona.edu/~aildi/>

Northern Arizona University (NAU) - <http://www.nau.edu/>

Center for American Indian Economic Development (CAIED) - <http://www.cba.nau.edu/caied/>

Institute for Native Americans - <http://www.nau.edu/sbs/ina/> & <http://www4.nau.edu/ina/>

Arizona State Library, Archives and Public Records - <http://www.lib.az.us/>

Tribal Libraries - <http://www.lib.az.us/libdir/typeSearch.aspx?RecordID=72bb5fb7-f82b-4574-94ef-270c72aac084>

National Tribal Telecommunications Association (NTTA) - <http://www.nationaltribaltelecom.org/> and <http://www.gilanet.net/nttA.htm>

Primary members are Tribally owned and Operated telephone companies including in Arizona:

Fort Mojave Telecommunications, Inc. - <http://www.ftmojave.com/>

Gila River Telecommunications, Inc. - <http://www.gilanet.net/>

Hopi Telecommunications, Inc. (HTI) - <http://www.hopitelecom.com/>

Saddleback Communications (Salt River Pima-Maricopa Indian Community) - <http://www.saddlebackcomm.com/>

San Carlos Apache Telecommunications Utility, Inc. (SCATUI) - <http://www.scatui.net/>

Tohono O'odham Utility Authority (TOUA) - <http://www.toua.net/>

Navajo Nation Telecommunication Regulatory Commission (NNTRC) - <http://www.nntrc.org/>

Arizona Native Assets Coalition - <http://www.aznativeassets.org/>

Heard Museum of Native Cultures and Art (Phoenix) - <http://www.heard.org/>

Digital Library - <http://heard.org/digitallibrary/index.html>

Museum of Northern Arizona (MNA, Flagstaff) - <http://www.musnaz.org/>

Focus on the Land and Peoples of the Colorado Plateau

Center for Desert Archaeology (Tucson) - <http://www.cdarc.org/>

Archaeology Southwest Magazine - <http://www.archaeologysouthwest.org/what-we-do/information/asw/>

Arizona Statistical Resources:

ASU Morrison Institute for Public Policy - <http://morrisoninstitute.asu.edu/>

Arizona Indicators - <http://arizonaindicators.org/>

UA Eller Economic and Business Research Center - <http://ebr.eller.arizona.edu/>

EBR Database Online (Subscription) -
http://ebr.eller.arizona.edu/datacenter/EBR_Database.aspx

Key Economic Indicators - <http://ebr.eller.arizona.edu/indicators/>

UA Eller Arizona's Economy Quarterly - <http://azeconomy.eller.arizona.edu/>

Arizona Department of Administration - <http://www.azdoa.gov/>

Office of Employment and Population Statistics - <http://www.azstats.gov/>

Publications - <http://www.azstats.gov/publications.aspx>

Arizona Employment Report (5/12) -
<http://www.azstats.gov/pubs/labor/PrMay12.pdf>

Arizona Joint Legislative Budget Committee (JLBC) - <http://www.azleg.gov/jlbc.htm>

Economic Analysis - <http://www.azleg.gov/jlbc/econdoc2.htm>

Arizona Governor's Office of Strategic Planning and Budgeting (OSPB) -
<http://www.ospb.state.az.us/>

Arizona Commerce Authority (ACA) - <http://www.azcommerce.com/>

Arizona Facts & Figures - <http://www.azcommerce.com/facts-and-figures/>

Arizona Community Profiles -
<http://www.azcommerce.com/facts-and-figures/community-profiles/>

Maps & GIS Data - <http://www.azcommerce.com/facts-and-figures/maps/>

Arizona Department of Economic Security - <https://www.azdes.gov/>

Reports - <https://www.azdes.gov/appreports.aspx>

Arizona Department of Health Services - <http://www.azdhs.gov/>

Vital Records, Health Data, & Evaluation - http://www.azdhs.gov/vit_dir.htm

Health Status and Vital Statistics Site - <http://www.azdhs.gov/plan/>

Arizona Health Status and Vital Statistics Annual Reports -
<http://www.azdhs.gov/plan/report/ahs/index.htm>

Arizona Department of Education - <http://www.azed.gov/>

Research and Evaluation Division - <http://www.azed.gov/research-evaluation/>

State Report Cards - <http://www.azed.gov/research-evaluation/report-cards/>

School and District Report Cards - <http://www10.ade.az.gov/ReportCard/>

ArizonaEconomy.com (Elliot Pollack & Co.) - <http://www.edpco.com/>

Statistics: United States Economy - http://www.edpco.com/content/statistics_us.aspx

Statistics: Arizona Economy - http://www.edpco.com/content/statistics_arizona.aspx

US Census Bureau - <http://www.census.gov/>

American FactFinder - <http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml>

Arizona QuickLinks - <http://quickfacts.census.gov/qfd/states/04000lk.html>

Arizona State & County QuickFacts - <http://quickfacts.census.gov/qfd/states/04000.html>

Center for Economic Studies (CES) - <http://www.census.gov/ces/>

Longitudinal Employer-Household Dynamics (LEHD) - <http://lehd.did.census.gov/led/>

Arizona State Data - <http://lehd.did.census.gov/led/partnersonly/arizona/>

American Community Survey - <http://www.census.gov/acs/www/>

Computer and Internet Use in the United States: 2010 -
<http://www.census.gov/hhes/computer/publications/2010.html>

U.S. Department of Commerce (DOC) - <http://www.commerce.gov/>

Bureau of Economic Analysis - <http://www.bea.gov/>

Regional Economic Accounts - <http://www.bea.gov/regional/>

U.S. Department of Labor - <http://www.dol.gov/>

Bureau of Labor Statistics - <http://www.bls.gov/>

Databases, Tables & Calculators by Subject - <http://www.bls.gov/data/>

Arizona Information - http://www.bls.gov/ro9/ro9_az.htm

USDA Arizona Statistics - http://www.nass.usda.gov/Statistics_by_State/Arizona/index.asp

Data.gov - <http://www.data.gov/>

Interactive Datasets - <https://explore.data.gov/catalog/next-gen>

Raw Data Catalog - <https://explore.data.gov/catalog/raw/>

ThisWeKnow (Citizen Portal to Data.gov) -
<http://www.greenriver.com/portfolio/thisweknow.html>

National Bureau of Economic Research (NBER) - <http://nber.org/>

Data - <http://nber.org/data/>

Small Business Administration (SBA) - <http://www.sba.gov/>

SizeUp (Analyze Your Business) - <http://www.sba.gov/sizeup>

SizeUp FAQ - <http://sizeup.com/help/faq>

Local Resources - <http://www.sba.gov/category/navigation-structure/starting-managing-business/managing-business/local-resources>

SBA Arizona District Office - <http://www.sba.gov/about-offices-content/2/3097>

Small Business Development Centers (SBDC) - <http://www.asbdc-us.org/index.html>

SCORE - <http://www.score.org/>

Business Guides by Industry - <http://www.sba.gov/category/navigation-structure/starting-managing-business/managing-business/business-guides-industry>

Telecommunications & Media - <http://www.sba.gov/content/telecommunications-media>

City-Data.com - <http://www.city-data.com/>

Arizona City Data (Over 6000 Population) - <http://www.city-data.com/city/Arizona.html>

The Henry J. Kaiser Family Foundation - <http://www.kff.org/>

State Health Facts - <http://www.statehealthfacts.org/>

Arizona Profile - <http://www.statehealthfacts.org/profileglance.jsp?rgn=4&rgn=1>

Health Reform Source - <http://healthreform.kff.org/>

Research & Analysis - <http://healthreform.kff.org/en/research-and-analysis.aspx>

Kids Count (Annie E. Casey Foundation) -
<http://www.aecf.org/MajorInitiatives/KIDSCOUNT.aspx>

Knowledge Center - <http://www.aecf.org/KnowledgeCenter.aspx>

Data Center - <http://datacenter.kidscount.org/>

Arizona Data -

<http://datacenter.kidscount.org/data/bystate/StateLanding.aspx?state=AZ>

Arizona Children's Action Alliance (CAA) - <http://www.azchildren.org/>

Research and Reports -

<http://www.azchildren.org/display.asp?pageId=11>

Census Data Online - <http://www.kidscount.org/census/>

Publications and Resources -

<http://www.aecf.org/KnowledgeCenter/PublicationsSeries/KCDatabookProds.aspx>

2011 KIDS COUNT Data Book -

<http://www.aecf.org/KnowledgeCenter/Publications.aspx?pubguid={E78A80B5-988E-4FB5-A070-8279A5170B35}>

Esri Business Analyst - <http://www.esri.com/software/businessanalyst/index.html>

Esri Updated Demographics - http://www.esri.com/data/esri_data/demographic.html

Data Variables - http://www.esri.com/data/esri_data/pdfs/esri-updated-demographics-data-list.pdf

Esri Community Analyst - <http://www.esri.com/software/arcgis/community-analyst>

Community Analyst Data - <http://www.esri.com/software/arcgis/community-analyst/variables>

Data Variables -

Infogroup - <http://www.infogroup.com/>

InfoUSA.com - <http://www.infousa.com/>

ReferenceUSA - <http://www.referenceusa.com/>

Library Locator - <http://www.referenceusa.com/Static/LibraryLocator>

ReferenceUSA Data Modules -

<http://referenceusa-resourcecenter.com/about/database-descriptions/>

Resource Center - <http://referenceusa-resourcecenter.com/>

D&B Market Insight -

<http://www.dnb.com/sales-marketing/find-new-customers-markets/14909147-1.html>

Claritas (Nielsen) SiteReports - <http://www.claritas.com/sitereports/default.jsp>

Ranking America - <http://rankingamerica.wordpress.com/>

Community Toolkits, Economic and Financial Modeling:

Broadband Communities Magazine - <http://www.bbpmag.com/>

FTTH Financial Analyzers - <http://www.ftthanalyzer.com/>

Municipal Broadband - <http://www.bbpmag.com/MuniPortal/FTTHLand.php>

Public Broadband Resources - <http://www.bbpmag.com/MuniPortal/publicorg.php>

National E-Commerce Initiative's Connecting Communities - <http://www.connectingcommunities.info/>

Resources -

<http://srdc.msstate.edu/ecommerce/curricula/connectingcommunities/resources.html>

Rural Telecommunications Congress (RTC) - <http://www.ruraltelecon.org/pages/>

Broadband Planning - <http://www.ruraltelecon.org/pages/BroadbandPlanning.aspx>

Community Toolkit -

http://www.ruraltelecon.org/pages/Portals/0/Content_files/Community%20Toolkit%20ROUGH%20Outline%20%20REV%201.pdf

W2i Digital Inclusion Forum - <http://w2i.com/>

Broadband Adoption Toolkit - <http://broadbandadoptiontoolkit.com/>

Blandin Foundation (Minnesota) - <http://www.blandinfoundation.org/>

Broadband Initiatives - <http://broadband.blandinfoundation.org/>

Toolkit - <http://broadband.blandinfoundation.org/toolkit/>

Nebraska Broadband - <http://broadband.nebraska.gov/>

Engaging People. Linking the World: Broadband Planning Workbook -

http://etraining.unl.edu/c/document_library/get_file?uuid=d7b74d0f-c89b-4c74-907d-ec3331eebb03&groupId=1874&.pdf

I'll Vote for You If You Make My Netflix Work: The Five A's of Community Broadband in Colorado (Book by Frank Ohrtman) - <http://www.illvoteforyouifyoumakemyflixwork.org/>

Strategic Networks Group (SNG) - <http://www.sngroup.com/>

Regional Economic Development -

<http://www.sngroup.com/sng-offerings/awareness-adoption-support/>

Digital Economy Index (DEI) -

<http://www.sngroup.com/sng-offerings/gap-need-demand-identified/>

Research Library - <http://www.sngroup.com/research-library/>

Microsoft Shape the Future Program -

<http://www.microsoft.com/publicsector/ww/programs/shape-the-future/Pages/index.aspx>

Microsoft Commits to Bringing Technology Access to 1 Million Low-Income Youth (9/20/11) -

<http://www.microsoft.com/en-us/news/press/2011/sep11/09-20CGIPR.aspx>

The Arnold Group - <http://www.the-arnold-group.com/>

City of Charlotte Project L.I.F.T. - <http://projectliftcharlotte.org/>

Project L.I.F.T. Summary -

http://www.projectliftcharlotte.org/uploads/project_lift/docs/2011-01-27_cms_school_investment_study_group.pdf

Project L.I.F.T. Strategic Plan -

http://www.projectliftcharlotte.org/uploads/project_lift/docs/Project_LIFT_Strategic_Plan_021212.pdf

Regional Economic Models, Inc. (REMI) - <http://www.remi.com/>

Policy Insight (PI+) - <http://www.remi.com/products/pi>

World Economic Forum - <http://www.weforum.org/>

Global Information Technology -

<http://www.weforum.org/issues/global-information-technology>

The Global Information Technology Report 2012 - Living in a Hyperconnected World - http://www3.weforum.org/docs/Global_IT_Report_2012.pdf

Network Readiness Index - <http://www.weforum.org/issues/global-information-technology/gitr-2012-data-platform>

Lone Eagle Consulting - <http://www.lone-eagles.com/>

Broadband Entrepreneurship and Digital Literacy Curriculum - <http://lone-eagles.com/guides.htm>

Grant Writing Resources - <http://www.lone-eagles.com/granthelp.htm>

The Baller Herbst Law Group - <http://www.baller.com/>

Community Broadband - http://www.baller.com/comm_broadband.html

National Broadband Strategy - http://www.baller.com/national_broadband.html

State Restrictions on Community Broadband Services or Other Public Communications Initiatives (as of 7/1/11) - [http://www.baller.com/pdfs/BallerHerbstStateBarriers\(7-1-11\).pdf](http://www.baller.com/pdfs/BallerHerbstStateBarriers(7-1-11).pdf)

A Practical Primer on Pole Attachments (update 3/1/12) -

<http://www.baller.com/pdfs/BallerHerbstPracticalPrimerPoleAttachments.pdf>

Institute for Local Self Reliance - <http://www.ilsr.org/>

Broadband Initiatives - <http://www.ilsr.org/initiatives/broadband/>

Broadband at the Speed of Light (4/12) -
<http://www.ilsr.org/broadband-speed-light/>

Community Broadband Networks - <http://www.muninetworks.org/>

Resources - <http://www.muninetworks.org/content/resources>

Publicly Owned Broadband Networks: Averting the Looming Broadband Monopoly (3/23/11) - <http://www.muninetworks.org/reports/publicly-owned-broadband-networks-averting-looming-broadband-monopoly>

Report - <http://www.newrules.org/sites/newrules.org/files/cmtty-bb-map.pdf>

New America Foundation - <http://newamerica.net/>

Public Media Policy, Spectrum Policy, and Rethinking Public Interest Obligations for the 21st Century (6/12) -
http://newamerica.net/publications/policy/public_media_policy_spectrum_policy_and_rethinking_public_interest_obligations_f

Report -
http://oti.newamerica.net/sites/newamerica.net/files/policydocs/PublicMedia_Spectrum_Paper_1.pdf

The Cost of Connectivity (7/12) -
http://newamerica.net/publications/policy/the_cost_of_connectivity

Report -
http://newamerica.net/sites/newamerica.net/files/policydocs/The_Cost_of_Connectivity.pdf

Open Technology Institute - <http://oti.newamerica.net/dashboard>

From the Digital Divide to Digital Excellence -
http://www.newamerica.net/publications/policy/from_the_digital_divide_to_digital_excellence

Report (2011) -
<http://www.newamerica.net/sites/newamerica.net/files/policydocs/NAF%20Municipal%20and%20Community%20Wireless%20Report.pdf>

New America Foundation: Experts Explore Measures to Close the Digital Divide Article (4/13/12) -
http://oti.newamerica.net/pressroom/2012/experts_explore_measures_to_close_the_digital_divide

Wireless Future Project - <http://wirelessfuture.newamerica.net/>

Measurement Lab (M-Lab) - <http://oti.newamerica.net/mlab>

California Emerging Technology Fund (CETF) - <http://www.cetfund.org/>

Model Policies and Ordinances - <http://www.cetfund.org/investments/initiative-smart-communities/model-policies-ordinances>

A Resource Guide: Getting Connected for Economic Prosperity and Quality of Life (10/10) -

http://www.cetfund.org/files/CETF_Resource_Guide_Model_Policies_web_120207.pdf

Public Policy Institute of California (PPIC) - <http://www.ppic.org/>

Does Broadband Boost Local Economic Development Activity? (1/10) -

http://www.ppic.org/content/pubs/report/r_110jkr.pdf

Technical Appendix - http://www.ppic.org/content/pubs/other/110JKR_appendix.pdf

Progressive Policy Institute (PPI) - <http://progressivepolicy.org/>

Communications Issues - <http://www.progressivepolicy.org/category/issues/communications/>

Telecom Issues - <http://www.progressivepolicy.org/category/issues/telecom/>

Investment Heroes: Who's Betting on America's Future? (7/12) -

http://progressivepolicy.org/wp-content/uploads/2012/07/07.2012-Mandel_Carew_Investment-Heroes_Whos-Betting-on-Americas-Future.pdf

International Telecommunications Union (ITU) - <http://www.itu.int/>

Telecommunication Development Sector (ITU-D) - <http://www.itu.int/en/ITU-D/Pages/default.aspx>

Statistics - <http://www.itu.int/ITU-D/ict/>

Publications - <http://www.itu.int/en/publications/Pages/default.aspx>

The State of Broadband 2012: Achieving Digital Inclusion for All (09/12) -

<http://www.broadbandcommission.org/Documents/bb-annualreport2012.pdf>

Trends in Telecommunication Reform 2012: Smart Regulation for a Broadband World -

<http://www.itu.int/pub/D-REG-TTR.13-2012>

Measuring the Information Society 2012 - <http://www.itu.int/en/publications/ITU-D/Pages/publications.aspx?lang=en&media=electronic&parent=D-IND-ICTOI-2012>

Executive Summary (Free PDF) -

http://www.itu.int/dms_pub/itu-d/opb/ind/D-IND-ICTOI-2012-SUM-PDF-E.pdf

Full Report (minus Annex 4) - http://www.itu.int/ITU-D/ict/publications/idi/material/2012/MIS2012_without_Annex_4.pdf

Continental Automated Buildings Association (CABA) - <http://www.caba.org/>

Research Publications - <http://www.caba.org/research-publications>

Resources - <http://www.caba.org/caba-resources>

Life Cycle Cost Calculator - <http://www.caba.org/lifecycle>

Tools - <http://www.caba.org/tools>

Miscellaneous Resources:

Broadband for America (BfA) - <http://www.broadbandforamerica.com/>

Issues - <http://www.broadbandforamerica.com/issues>

Resources - <http://www.broadbandforamerica.com/resources>

Internet Innovation Alliance (IIA) - <http://internetinnovation.org/>

10 Facts About Broadband and Jobs - <http://internetinnovation.org/library/special-reports/10-facts-about-broadband-and-jobs/>

Pew Research Center - <http://pewresearch.org/>

Pew Internet & American Life Project - <http://www.pewinternet.org/>

Broadband Topic Area - <http://www.pewinternet.org/topics/Broadband.aspx>

Home Broadband 2010 -

<http://www.pewinternet.org/Reports/2010/Home-Broadband-2010.aspx>

Mobile Helping Narrow Digital Divide, But Not For All (4/12) -

<http://www.pewinternet.org/Media-Mentions/2012/Pew-Mobile-Helping-Narrow-Digital-Divide-But-Not-For-All.aspx>

Mobile Topic Area - <http://www.pewinternet.org/topics/Mobile.aspx>

Digital Differences (4/12) -

<http://www.pewinternet.org/Reports/2012/Digital-differences.aspx>

Digital Divide Topic Area -

<http://www.pewinternet.org/topics/Digital-Divide.aspx>

Future of the Internet Topic Area -

<http://www.pewinternet.org/topics/Future-of-the-Internet.aspx>

Education Topic Area - <http://www.pewinternet.org/topics/Education.aspx>

Libraries Topic Area - <http://www.pewinternet.org/topics/Libraries.aspx>

Government Topic Area - <http://www.pewinternet.org/topics/Government.aspx>

Download Data - <http://www.pewinternet.org/Data-Tools/Download-Data.aspx>

Cisco Systems: The Connected Life -

http://www.cisco.com/en/US/netsol/ns705/networking_solutions_solution.html

Visual Networking Index (VNI) -

http://www.cisco.com/en/US/netsol/ns827/networking_solutions_sub_solution.html

VNI Forecast Model Tool - http://www.ciscovni.com/vni_forecast/index.htm

VNI IP Traffic Chart (What's a Zottabyte?) -

http://www.cisco.com/assets/cdc_content_elements/networking_solutions/service_provider/visual_networking_ip_traffic_chart.html

Living the Connected Life White Paper (11/06) -

http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/net_implementation_white_paper0900aecd8057ead.pdf

Mobile Transformation -

http://www.cisco.com/en/US/netsol/ns810/networking_solutions_sub_solution.html

Cloud Index -

http://www.cisco.com/en/US/netsol/ns1175/networking_solutions_sub_solution.html

Akamai Visualizing the Internet -

http://www.akamai.com/html/technology/visualizing_akamai.html

State of the Internet Quarterly Report - <http://www.akamai.com/stateoftheinternet/>

Broadband Adoption Trends - <http://www.akamai.com/html/technology/dataviz5.html>

Real-Time Web Monitor - <http://www.akamai.com/html/technology/dataviz1.html>

Net Usage Index by Industry - <http://www.akamai.com/html/technology/nui/industry/index.html>

Net Usage Index for Mobile Web -

<http://www.akamai.com/html/technology/nui/mobile/index.html>

Akamai Internet Visualization App (iTunes Store) -

<http://itunes.apple.com/in/app/akamai-internet-visualization/id502695146>

iPass, Inc. - <http://www3.ipass.com/>

Surveys & Reports - http://www3.ipass.com/resource-center/surveys_reports/

Mobile Workforce Report (Quarterly) - <http://mobile-workforce-project.ipass.com/>

Mobile Enterprise Report - <http://info.ipass.com/forms/mobile-enterprise-report/>

White Papers & Insight Briefs - <http://www3.ipass.com/resource-center/whitepapers/>

Organisation for Economic Co-operation and Development (OECD) - <http://www.oecd.org/>

OECD Communications Outlook - http://www.oecd-ilibrary.org/science-and-technology/oecd-communicationsbuildoutlook_19991460

OECD Library - <http://www.oecd-ilibrary.org/>

OECD Digital Economy Papers - http://www.oecd-ilibrary.org/science-and-technology/oecd-digital-economy-papers_20716826

Information and Communication Technologies and Productivity Growth: A Survey of the Literature - http://www.oecd-ilibrary.org/science-and-technology/information-and-communication-technologies-and-productivity-growth_5k9bh3jllgs7-en

World Bank - <http://www.worldbank.org/>

Information and Communication Technologies - http://econ.worldbank.org/external/default/main?pagePK=64165397&piPK=64165419&theSitePK=469372&function=BrowseFR&menuPK=64165080&siteName=&searchMenuPK=&conceptattcode=644292&pathtreeid=TERATOPIC_SUBTOPIC&sortattcode=DOC DT+Desc

Arizona Exemplar eLearning Institutions and Initiatives

Arizona K-12 Exemplars:

BASIS Schools Inc.: <http://www.basisschools.org/>

BASIS Schools currently operates six charter schools in Arizona (Chandler, Flagstaff, Oro Valley, Peoria, Scottsdale, Tucson). The academic curriculum at BASIS is among the most accelerated in the country with students' success inextricably linked to good study habits which are at the core of the program. The guiding philosophy is to implement a rigorous liberal arts curriculum, hold students and teachers accountable for results, and recruit and retain teachers who are knowledgeable in their discipline and effective at communicating difficult concepts in an understandable way.

Carpe Diem: <http://carpediemschools.com/>

Carpe Diem has received national attention for its dramatic increase in test scores for its students - far above the state average.

One advantage of the use of computers in education is you can customize learning to the student. They can learn at their own pace and if they have challenges there are teachers and facilitators (called coaches) to help. The school uses a comprehensive learning system designed by e2020 - a Scottsdale based company. Progress is tracked carefully using another system and students receive positive feedback for progressing.

Paradise Valley High School: <http://www.pvschools.net/>

The first K12 in the world to get on the National LambdaRail (NLR) is the Paradise Valley Unified School District (PVUSD). The NLR is an ultra-high performance private intranet system that goes through Arizona on its way out to the San Diego Supercomputing Center. The NLR was created by Harvard, MIT, NASA the National Institutes of Health, and advanced research institutions and universities.

Paradise Valley USD is perhaps the most advanced K12 in the world in cutting edge e-learning technology applications. ASU and the University of Arizona are members of the NLR. ASU provides the connection to the NLR for Paradise Valley. Harvard decided to provide a connection to a similar network called Internet2 to schools in Boston and Cambridge.

PVUSD built the largest district-wide wireless network in the nation for a school district connecting 47 campuses over 98 square miles for some 33,500 K12 students. Inter-campus calls go over the network and are free. PVUSD was one of the first entities in the world to use wireless microwave for telepresence video, and did an event with Harvard University.

<http://news.harvard.edu/gazette/story/2010/09/2600-miles-and-one-screen-apart/>

The school recently consolidated over 60 traditional computer servers into two blade servers at its data center saving several tens of thousands of dollars a year in electricity costs alone.

Vail Unified School District: <http://www.vail.k12.az.us/>

Vail's successful Beyond Textbooks program is highlighted above. This online digital resource is being used by over 50 other school districts in Arizona. Vail was rated the top school in Arizona last year. All of its schools were considered "excelling."

Wilson School District: <http://www.wsd.k12.az.us/>

Although the district has been identified as one of the most at-risk district in the State of Arizona due to poverty of the community, it boasts a state of the art technology program. A typical classroom is equipped with a computer for each student, overhead projectors, document cameras, electronic white boards, and auditory enhancement to support the integration of technology into the curriculum delivery and instruction in the classrooms.

Boys and Girls Clubs of Greater Scottsdale: <http://www.bgcs.org/>

The Boys and Girls Clubs of Greater Scottsdale have a well-developed after school education program that has research results that show positive improvement. The Vestar branch of the Scottsdale Boys and Girls Club is the first boys and girls club in the world to connect to the Internet2 advanced IT network. The Vestar Chapter won the national boys and girls club of the year award nationwide in 2012: <http://vestarbranch.bgcs.org/>

Arizona Higher Education Exemplars:

Arizona State University (ASU): <http://www.asu.edu/>

Arizona State University has more students than any other traditional campus based university in the United States. ASU now offers online instruction. The University hosts many important events including the annual Education Innovation Summit which brings together education entrepreneurs investors and thinkers. ASU's Mary Lou Fulton Teacher's College graduates more education majors than any other school. ASU is also a member of Gig.U.

Grand Canyon University: <http://www.gcu.edu/>

Grand Canyon University in Phoenix started as a private faith based school founded in 1949. It became a for-profit university in 2004. It is owned by Grand Canyon Education, and the stock trades on the NASDAQ under the symbol LOPE. The school has grown dramatically since and offers traditional campus classes and online classes.

Northern Arizona University (NAU): <http://nau.edu/>

Northern Arizona University has a particularly well developed online and distance learning program with extensive remote location interconnections by wireline and satellite known as NAUNet. They offer a large number of online majors at numerous remote sites around the state

NAU has a virtual private network service that allows students to connect to the university network remotely using a secure transmission. This secure network allows students that are not on campus to be directly connected to the campus network.

Rio Salado College: <http://www.riosalado.edu/Pages/default.aspx>

Rio Salado College is almost entirely internet based, including the student union. They offer 48 different start times for classes each year. The college has some 62,000 students with approximately 42,000 students in online enrollment throughout the United States, and with students in a number of foreign countries. The school has a strong program for military students.

Rio Salado College uses a forecasting model that can predict early on a student's likely success in class. This information is used so that teachers can intervene early and help students succeed.

Scottsdale Community College: <http://www.scottsdalecc.edu/>

Scottsdale Community College has received much attention for its desktop virtualization initiative in response to the need to support remote learners all over the world. Instead of using college approved devices, the IT department supports any device, including even one student's PlayStation 3, using a web interface. Part of this concept is sometimes called "bring your own device." This topic is receiving a lot of discussion and schools throughout the country are trying to make decisions regarding devices students bring to class or use remotely. Scottsdale Community College has been a leader and innovator in this area.

University of Arizona (UA): <http://www.arizona.edu/>

The University of Arizona is one of 37 universities that have joined Gig.U. <http://www.gig-u.org/> The project's goal is to create zones in and around university campuses that offer the advantages of ultra-high-speed computer networking. These hubs can draw research and business that can benefit from these resources. They also have one of the most sophisticated, mature, and extensive telemedicine networks anywhere, the Arizona Telemedicine Program (ATP - <http://www.telemedicine.arizona.edu/>).

University of Phoenix: <http://www.phoenix.edu/>

The University of Phoenix is headquartered in Arizona and is the largest university in the world. This institution pioneered the use of distance learning in the college arena and also offers traditional classes.

Glossary

Definition of acronyms used in this document:

ACA	Arizona Commerce Authority
ACC	Arizona Corporation Commission
ADE	Arizona Department of Education
ADOA	Arizona Department of Administration
ADOT	Arizona Department of Transportation
AELAS	Arizona Education Learning and Accountability System
AHCCCS	Arizona Health Care Cost Containment System
ARRA	American Recovery and Reinvestment Act
ASET	Arizona Strategic Enterprise Technology
ASLAPR	Arizona State Library, Archives and Public Records
ASU	Arizona State University
ATI Institute	Arizona Telecommunications and Information Institute
ATIC	Arizona Telecommunications and Information Council
AUSF	Arizona Universal Service Fund
AzHeC	Arizona Health-e Connection
BNI	Barrow Neurological Institute
BTAPC	Broadband Technical Assistance Project Consultant
CAAG	Central Arizona Association of Governments
CAGR	Compound Annual Growth Rate
COG	Council of Governments
CSS Institute	Chan Soon-Shiong Institute for Advanced Health
DAC	Digital Arizona Council
DAP	Digital Arizona Program
DEMA	Department of Emergency & Military Affairs
EHR	Electronic Health Record
EMR	Electronic Medical Record
EMT	Emergency Medical Technician
EPB	Chattanooga Electric Power Board (formerly)
FCC	Federal Communications Commission
FirstNet	First Responder Network Authority
FLVS	Florida Virtual Schools
GAP	Gap Analysis Program
Gbps	Gigabits per second
GDP	Gross Domestic Product
HIE	Health Information Exchange
HIT	Health Information Technology
IDEAL	Integrated Data to Enhance Arizona Learning
IGA	Intergovernmental Agreement
IP	Internet Protocol
IPTV	Internet Protocol Television
Kbps	Kilobits per second
MBO	Management By Objective
Mbps	Megabits per second
MPLS	MultiProtocol Label Switching
MPO	Metropolitan Planning Organization
MRI	Magnetic Resonance Imaging

NACOG	Northern Arizona Council of Governments
NASCIO	National Association of State CIOs
NBP	National Broadband Plan
NGO	Non-Governmental Organization
NIH	National Institutes of Health
NLR	National LambdaRail
NPSBN	National Public Safety Broadband Network
NTIA	National Telecommunications and Information Administration
PARCC	Partnership for Assessment of Readiness of College and Careers
PDA	Personal Data Assistant
PROW	Public Rights of Way
PSCC	Public Safety Communications Advisory Commission
PSIC	Public Safety Interoperable Communications
PWD	Persons with Disabilities
RFP	Request for Proposals
ROI	Return on Investment
ROW	Rights of Way
RUS	Rural Utilities Service
SAIS	Student Accountability Information System
SB	Senate Bill
SEAGO	Southeastern Arizona Governments Organization
SEDNET	SACCCNet Education Network
SIEC	Statewide Interoperability Executive Committee
SLD	Schools and Libraries Division
SLDB	Student Longitudinal Data Base
SONET	Synchronous Optical Network
STEM	Science, Technology, Engineering and Mathematics
TGen	Translational Genomics Research Institute
UAGC	University of Arizona Genetics Core
USAC	Universal Service Administrative Company
USDA	United States Department of Agriculture
USF	Universal Service Fund
VPN	Virtual Private Network
WACOG	Western Arizona Council of Governments
WGS	Whole Genome Sequencing

For a definition of additional acronyms and relevant broadband technical terms, see

FCC National Broadband Plan Appendix B Common Abbreviations -
<http://www.broadband.gov/plan/appendices.html#s18-2>

FCC National Broadband Plan Appendix C Glossary -
<http://www.broadband.gov/plan/appendices.html#s18-3>

FCC National Broadband Plan Appendices Download (PDF) -
<http://download.broadband.gov/plan/national-broadband-plan-appendices.pdf>

(FCC, 2010, pp. 341 - 360)

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