COMMUNITY ANCHOR INSTITUTIONS AND U.S. IGNITE

Community anchor institutions are at the forefront of combining high-capacity bandwidth with innovative educational, informational and medical services to improve the quality of life for all Americans. In fact, certain broadband providers specialize in serving the high-bandwidth needs of anchor institutions. Together, these institutions and broadband providers are well-positioned to share their expertise in deploying and using successful next-generation technologies. For these reasons, community anchor institutions and the broadband providers that support them can play an important role in helping the U.S. Ignite project achieve its objectives.

I. Community Anchor Institutions Are Large Users of High-Capacity Broadband.

Schools, health care providers, libraries and other community anchor institutions aggregate multiple users and use high-end applications that require very high-capacity broadband services. This is especially true of universities and hospitals, which have been at the forefront of developing innovative data services, often transmitted over multi-gigabit, fiber-based networks. K-12 school districts and library consortia are increasingly using fiber-based networks as students, teachers, library patrons, job-seekers, and administrators demand more bandwidth. As large users of broadband networks, these institutions can bring an informed perspective to network deployment and use, especially for innovative, high-end applications that are often developed on campuses.

II. Community Anchor Institutions Often Develop Their Own Innovative Applications or Serve as Test-Beds for New Services.

Community anchor institutions often develop some of the most innovative and high-bandwidth applications and technologies. In fact, these institutions are often the best examples of network-enabled innovation, as they bring together geographically-dispersed users to communicate, innovate and create over very high bandwidth networks. Having pioneered the use of broadband for distance learning, educational institutions are now engaged in using intense data analytics to create individual education plans for students. Hospitals use broadband for the implementation of tele-health and electronic medical records transfer technologies. Libraries have developed universal web-based information repositories of rich video and text resources accessible only over high speed connections. (See attachment for some examples of innovative online educational and medical services.) Community based media outlets are engaged in digital media production, archiving and distribution that can support education, health and other purposes such as interactive high-definition town hall meetings. The U.S. Ignite Initiative could encourage these institutions to develop next-generation applications, or to serve as test-beds for innovative applications and services developed by others.

III. Broadband Providers that Specialize in Serving Anchor Institutions are Well-Positioned to Design, Deploy, and Manage Next-Generation Broadband Platforms.

Broadband providers that specialize in serving anchor institutions are accustomed to designing, deploying and managing next-generation networks for innovative, high-bandwidth needs. These broadband providers include Internet2, NLR, over 35 state Research and Education (R&E) networks,

municipalities, community-based media networks, and commercial fiber providers. These organizations have years of experience building and operating broadband networks to serve a unique set of applications and users, and they consistently seek to expand their network capacity to handle growing demands.

IV. Community Anchor Institutions Are Located Throughout the U.S. and Can Help to Distribute Innovative Applications to the General Public.

Community anchor institutions (CAIs) are located in every community across the U.S. Once an application has been "proven", anchor institutions can be a useful distribution channel for new educational, medical, governmental, and other applications. CAIs are trusted members of the community; the general public has confidence in using services made available by CAIs. As they did for first generation broadband in the 1990's, CAIs can popularize advanced services among the general public in a way that will stimulate demand for next-generation broadband services and applications. In other words, CAIs can provide the critical mass of end-users/consumers that will help "prime the market" for the new broadband services and applications.

V. U.S. Ignite Could Help Community Anchor Institutions Fulfill their Mission to Serve the Public.

CAIs increasingly need very high bandwidth broadband technologies to provide essential services to millions of consumers every day – services such as remote telemedicine, distance learning, e-government programs, job-training, public safety, and basic research. Schools, libraries and health care providers often specialize in serving elderly, low-income, disabled, and other vulnerable segments of society. Furthermore, community anchor institutions are looking toward the future, as they are leading the drive to develop new models of education, such as enhanced individualized learning programs, advanced information storage and retrieval services, and remote diagnostic medical care. For this reason, the National Broadband Plan Goal #4 called for every American community to have affordable 1 Gigabit per second capability to community anchor institutions.

Unfortunately, community anchor institutions often cannot obtain the affordable, high-capacity broadband services that they need. The demand for greater broadband grows every day, yet state and local government resources to fund broadband deployment and use are shrinking. The National Broadband Map revealed that community anchor institutions are "largely underserved" today. U.S. Ignite could help to drive the deployment of more efficient broadband services and applications that will benefit American consumers and vulnerable populations served by anchor institutions.

In summary, including community anchor institutions and the broadband providers that serve them into the U.S. Ignite Initiative could stimulate next-generation educational, informational and medical applications and help consumers obtain the essential services that they need to participate in the 21st century economy and society. For these reasons, the SHLB Coalition would be pleased to work with the Obama Administration as it moves forward on this Initiative. For further information, contact John Windhausen, Coordinator of the SHLB Coalition, at (202) 256-9616 or by e-mail at jwindhausen@telepoly.com.

EXAMPLES OF NEXT-GENERATION BROADBAND APPLICATIONS INVOLVING COMMUNITY ANCHOR INSTITUTIONS.

Example 1: Music Master Classes

The instructor/master musician is in town A, with students in towns B, C, and D. With sufficient bandwidth and high quality video and audio, the instructor and the students can hold a music class synchronously. The instructor can watch the students perform and demonstrate for the students, in the same way the instructor would in a traditional, face-to-face setting. Since the video and audio are coordinated to be synchronous, the group can even perform together. This delivers the same quality of instruction as face-to-face, but now can be done when the instructor and students are distributed geographically, freeing the instruction of some of the constraints of location and time.

This model could be used in additional academic disciplines such as the studio arts, including painting (e.g., geographically distributed students could share a model); sculpture; architecture, and photography. At its core, this model enables the sharing of the relatively scarce "commodity" (a master's expertise) with a community that is geographically distributed. The key to success is having sufficient network capacity with low latency to make it seem as if all participants are in the same room. Example: http://www.usc.edu/schools/music/news/usc_thornton_news/internet2_master_class.html

Example 2: Transmission of Medical Images.

While many observers note the importance of exchanging medical records, high-bandwidth broadband is particularly important for the transfer of medical *images*. The American Telemedicine Association notes that

> [t]he highest end uses currently involve transmission of radiological images. A single image can vary from 2 MB for a simple black and white x-ray to 3 Gbits or more for a 64 slice CT scan. Speed requirements also vary depending on the type of data compression used or if video applications are included. PACs (picture archival and communications systems) operated within a hospital using a closed-system (such as ethernet) can provide speeds from 2-10 Gbits per second to handle the size and complexity of data. Sending hundreds of images to an outside reading center requires very large connections, although the speed is normally only downstream.
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> [Remote Intensive Care Unit] (ICU) services allow multiple hospitals to share specialists to care for intensive care patients. Such remote ICU centers use broadband connections to each of the participating units, often using redundant connectivity to guard against potential telecommunications outages.

Source: The American Telemedicine Association (http://www.internet2.edu/health/library/02-60-12-03-2009-ATA.pdf.)

Example 3: Augmented Reality

Augmented reality is a network-based application that adds an information layer on top of what the student is seeing or hearing. This enables students to learn in environments outside the classroom, situated in a real world location. For example, students in a semester-abroad program could tour Rome or Florence and receive textbook-like information about historical sites while on-site.

Learning research tells us that learning is deepened and more effective when the learning environment is interactive, enabling students to do things in addition to listening to a presentation. Augmented reality can be used to build curricular environments that are highly interactive for students. It can be used to add a third dimension (such as three-dimensional geometry). Some augmented reality projects are also collaborative, with students being able to contribute information to the data that is used to supply the augmented information.

Examples:
iTacitus http://www.itacitus.org/
Skidmore map http://academics.skidmore.edu/blogs/onlocation/2010/10/21/augmenting-reality/
MIT http://education.mit.edu/projects/mitar-games

Example 4: Video Consultations for Patient Treatment.

The FCC's National Broadband Plan identifies real-time video over broadband is one of the most significant ways that broadband can improve the breadth and quality of our health care. For instance, the NBP notes that

> [v]ideo consultation is especially beneficial for extending the reach of under-staffed [specialists] to patients residing in rural areas, Tribal lands and health professional shortage areas (HPSAs). For example, the American Heart Association and American Stroke Association recommend use of video consultation technology for stroke patients to help overcome the dearth of neurologists and to make decisions about whether to deliver the life-saving, clot-busting drug known as tPA.
>
> In addition to increasing access to otherwise unavailable care, video consultations combined with store-and-forward technologies (e.g., sending images to a specialist at night, as opposed to obtaining a diagnosis during a patient's visit) could lead to significant cost savings from not having to transport patients. Avoiding costs from moving patients from correctional facilities and nursing homes to emergency departments and physician offices, or from one emergency department to another, could result in $1.2 billion in annual savings.
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> Video consultation and remote access to patient data may also be critical during pandemic situations. If hospitals are at capacity or if isolation protocols are necessary to prevent the spread of infection, these technologies can help health care providers assist more patients and help patients avoid public areas.

Source: FCC's National Broadband Plan, Chapter 10 [footnotes omitted].

Example 5: Virtual Worlds

Networked virtual environments (net-VE) are software systems in which users interact with each other in real-time within some shared virtual environment. Massively Multiplayer Online Games (MMOs), and more specifically, virtual worlds such as Second Life are a popular example; these games allow large number of users to play together in fictional digital worlds. Virtual worlds are typically designed to create a very high degree of immersion. Many feature 3D graphics and stereo sound, and have extremely interactive environments. But the primary selling point of many virtual worlds is the large number of players that they can support. In many modern MMOs, it is already popular for groups of up to 80 players to work cooperatively in a "raid". While high-bandwidth, low-latency Internet is now becoming ubiquitous, this is not enough to solve the scalability issues that net-VEs are beginning to encounter.

Second Life is a virtual world, a computer application that mimics the real world. Users establish alternative identities, called avatars; the user then acts in the virtual world by means of this avatar. Virtual worlds are heavily used by higher education for curricular purposes, with Second Life being the most common. K-12 schools and libraries also have a significant presence on Second Life. Many institutions have invested significantly in “islands” and other environments that they use for their courses. For instance, Community Virtual Library is a library alliance of real-life libraries that hold a wide variety of in-world seminars, conferences etc. (See, http://infoisland.org/).

Virtual worlds can have high curricular value in contexts where students are geographically diverse and yet need to have a “place” to come together in order to do work. They can also be especially engaging environments for NetGen students, who are familiar with the virtual worlds of video games.

However, Second Life is notorious for its network bandwidth requirements. Even a small number of users at a single location can swamp local network capacity. This is an issue shared by most virtual world environments. These scalability problems arise in part because of the need to maintain consistency between all the players. To maintain consistency, all net-VEs have a transaction management layer that employs a commercial database. However, the transaction layer also introduces severe scalability problems. First, as users move about the virtual environment, they send transactions to the net-VE at an extremely high rate. Even the fastest MMOs cannot handle more than about 10 frames per second through their database transaction layer. Second, the transaction layer architecture of most current net-VEs requires that significant parts of their application logic be executed on the server side. As a result, the scalability of an application is strongly related to the computational footprint of a single user. Robust network capacity can break the “logjam” by enabling more participants to interact in a single virtual world environment. Much of the pedagogical richness of the virtual world comes from high participation rates.

Examples:
U Wisconsin Milwaukee
http://maps.secondlife.com/secondlife/U%20Wisconsin%20Milwaukee/70/145/24
Penn State http://gaming.psu.edu/SLGetInvolved
Cornell: http://www.cs.cornell.edu/bigreddata/games/MMO.php)