Statewide Network Needs and Plan

Summary

The State's network and Internet bandwidth capacity stand as one of the great efficiency enablers in government. The available network capacity is the foundation for a multitude of technologies and services that directly relate to increasing the efficiency and effectiveness of state government. Network capacity must increase to meet Montana's demand for information technology.

Network Needs

Network capacity, or "bandwidth", is the highway infrastructure of the modern information technology driven world. Imagine a four lane highway in Montana with a few cars, and lots of on and off-ramps. Traffic flows smoothly, and everyone gets to where they need to go without much hassle. However, today, there are more than just a few cars on that highway. Bottlenecks are starting to happen, drivers are increasingly frustrated, interchanges are clogged, and now even more vehicles that want to utilize that same highway infrastructure. This additional network traffic is caused by increasing consumer demands around mobile computing, access to government services, and increasing use of interactive media like video. State government needs for disaster recovery services, centralization of program services, and ever increasing use of applications to deliver services to the State taxpayer have also increased the requirements for network capacity. While some of this network traffic is not necessarily new, the use of the network is ever increasing, which puts an even greater strain on the network infrastructure. Just like adding a new lane to a four lane highway can help with congestion, so can adding additional lanes of increased network capacity. Without expansion of the network "highway" there is not enough available capacity to meet the demands, traffic grinds to a halt, cars stall out, and there is gridlock.

Fundamentally, the increased number of cars on the highway (e.g. additional network traffic) is warranted. It is this network traffic that enables additional efficiencies within the state. One good example is the use of interactive media by state agencies. Web based video conferencing solutions allow individuals from across the state and country to participate in conferences without having the expense of traveling. The use of web based video conferencing also allows the public the opportunity to participate from a location that is convenient to them. Training costs for employees are reduced by utilizing web sessions versus in person. In addition, a number of agencies are using video sharing websites for training their employees on specific topics. Instead of purchasing a week long class, the individual can focus in on a five minute video that provides just the specific information they need.

The ability for the state to find additional efficiencies with increasing use of technology will be predicated on the network capacity available to provide new or enhanced services. Without the necessary network capacity, or additional lanes on the highway, programs will not be able to provide the required services and the citizens will be negatively impacted.

Currently, the state of Montana has 10Gbps (Gigabit per second) links at the Helena datacenter. The network "core" connection that hooks up Helena to Billings runs at 1 Gbps. For the "edges" of the network, which are the State offices outside of Helena, the capacity is much lower and commonly runs at 1.5 Mbps (Megabits per second) or slower[1]. Depending on the applications used by the office a 1.5 Mbps service will support about 10-15 individuals. Given the current growth trends described by Cisco in the Visual Networking Index report[2], the state will need a fifteen fold increase in the current capacity within the core and over a 1,000 fold increase at the edges by 2017.

In addition to ensuring capacity, the state must also ensure that the state network complies with legal, regulatory, and contractual requirements for the protection of information that traverses the network. This protected information includes, but is not limited to, personal information and federally protected tax and criminal justice information. Any increased capacity of the State network has to be done in a manner so that protected information can continue to be transmitted securely across the network.

Drivers

Network capacity or bandwidth usage across all sectors of the economy has and will continue to grow. Adoption of new web based services and technologies have increased Internet traffic eightfold since 2005. According to Cisco's VNI report, North America will see an annual growth rate of 30% each year. It is expected that by 2015 the equivalent of 4 billion DVD's worth of traffic each month will traverse the Internet. It is expected that the state's use of network capacity will follow the national trend. Major upcoming new applications for DPHHS, DOJ, and DLI will continue to drive the need for increase network capacity for the State.

Having a robust network is also a concern for economic development within the State. The City of Bozeman recently met with the State CIO, Dick Clark, and outlined their concerns around access to high-speed broadband (see Attachment A).

While it is problematic to find specifics, forecasting capacity needs into the future based on historical trends is possible. Jakob Nielson has charted his network capacity since 1984, when he utilized a 300 baud (300 bits per second) acoustic modem. Recently, in 2010, he upgraded to a 31 Mbps cable modem. The result was the visualization of a consistent trend in his Internet capacity, that is the capacity doubled every 2 years, a phenomenon which has become to be known as Nielsen's Law[3].

In 2007, the Montana University System needed additional network capacity and access to the new national research network called "Internet 2". The University system joined a consortium, called the "Northern Tier Network", which allowed them the ability to upgrade their network connections from 300 Mbps to 10 Gbps. Even at that time, University of Montana CIO Ray Ford stated, "Will we need all of this bandwidth? We think we will. In fact, we think we'll need not just a little more bandwidth, but orders of magnitude more bandwidth to support applications we don't currently use – either because we can't or because the applications haven't yet been invented." Capacity requirements for the future need to take into consideration applications and services that are not even in existence

today. For example, 70% of Apple Inc's profits in 2011 came from products that were not technologically feasible just four years ago.

Much of the current growth within Montana has been driven by four business needs. First is the consolidation of information technology systems from remote locations to centralized areas. Consolidation of information into centralized data centers increases efficiencies by reducing cooling costs and more effectively pooling system resources. Instead of a device being dedicated to one system, it is shared by a large number of systems. This decreases the amount of hardware to provide the same level of service. This scenario is only viable when the State network has the network capacity to provide the service throughout the State.

Secondly, growth in Internet capacity is required to provide access to web-based services for the citizens of the State. Applications, such as the Montana Enhanced Registration and License Information Network (MERLIN) at the Department of Justice, the Automated Licensing System (ALS) Fish, Wildlife, and Parks, and the Combined Healthcare Information in Montana Eligibility System (CHIMES), allow citizens to interact with government from the comfort of their homes. Additionally, some systems such as the Medicare Management Information System (MMIS) at the Department of Public Health and Human Services will be housed outside of the core state network and will require additional Internet capacity to properly function. Each application can provide increased efficiencies and opportunities for the state, however each application also demands increased state network capacity.

Third, the increased mobility of the government employees has increased Internet and network capacity requirements. Devices such as mobile phones, tablets, and laptop computers increase the mobility and allow employees to more closely serve the citizens. Whether a highway patrol officer accesses criminal data during a traffic stop or a legislator looks up information on a tablet during legislative session, the mobility of the application and data drives the increase network capacity requirements

Fourth, the use of streaming interactive media content has become ubiquitous in the modern Internet age. No longer just a fad, interactive media content, including high definition audio and video, is a cornerstone of the next generation Internet enabled communications. Converged communications, where the network carries a combination of voice, video, and data is an area that is now being explored to provide new and enhanced voice and video services. Bringing the government to the people via video and web conferencing increases capacity requirements. Video recordings such as those created by the Legislative Branch that cover meetings, hearings, and the legislative session can be reviewed by anyone either live or on demand. Providing sufficient network capacity for that interactive media is key to enabling those next generation communication tools.

Benefit

Core areas of government can benefit and find additional efficiencies when network capacity is increased. For example, courts may make more use of video arraignments, which cuts the expense of transportation. Additionally, in areas where courts are overstretched, it can allow for other judges to preside by videoconference. Additional

network capacity also enables the increasing the sharing of information. An example is the Integrated Justice Information System (IJIS) that links criminal information from federal, state, and local law enforcement systems. This system results in increased information at critical times for public safety officers.

As more efficiency is realized from implementation of Information Technology services, as cited above, further development can then occur in underserved areas. When network capacity increases, it allows for State offices to link in to the network more easily, for less expense, and with greater results. An example of this is the reduction of the number of file servers in remote offices by the Department of Corrections. Increased network capacity and changing technology allowed the Department to remove file servers from numerous offices outside of Helena reducing equipment, maintenance, and administration costs.

Current Network Costs

The costs for network capacity inside Montana are quite variable due to the geography and population densities of the state. What can be a modest price in some areas; can be quite expensive in others. For example, a T-1 (1.45 Mbps) circuit costs $1,555/month in Glasgow, $2,163/month in Libby, $2,536/month in Broadus, and $1,430/month in Roundup while the same T-1 circuit costs $300/month in cities like Helena, Bozeman, Billings, Missoula and Great Falls.

The major costs for the State network come in four main areas. The first is the cost of the State's Internet connection which was recently awarded to CenturyLink (Qwest) for $12.75Mega Bytes (MB)/month for a 200Mbps connection in Helena and to VisionNet $18 MB/month for a 100Mbps connection in Billings. Just looking at increasing the Internet connection for the State network to 1Gbps even at today's lowest rates would cost an additional $633,600 per biennium.

The second area of costs is the "core" network or the "Interstate highway" that connects Missoula, Helena, Bozeman and Billings. That connection currently consists of two 1Gbps connections and two remote office aggregation sites (e.g. "offramps") of 1.5 Gbps capacity each. The State obtains the core network connection from Bresnan (Optimum/CableVision) for approximately $58,500 / month.

The third major cost factor is what is called the "middle mile". This is the cost of getting a circuit from the two network hubs (Helena and Billings) to the location (town/city) of the remote state office. The costs for the middle mile or the "secondary roads" are comprised of a couple of different models. One carrier includes these as an explicit cost for mileage from Helena/Billings to the location in question in addition to the local loop costs. With a different carrier those costs are included the total end-to-end circuit charge which also includes the local loop circuit.

The forth cost driver is what is known as the "local loop" charge. That is the cost of connecting the State office to the in-town/city network carrier location. As noted above that cost can be seen as an explicit charge in the circuit cost or included in the overall circuit cost.

The current network design for the State is based on a “Star” network topology philosophy, which utilizes Helena and Billings as the two centers of network connection and interconnects between the network circuit providers in the State. This design as shown in the diagram below allows for redundancy with individual logical circuits to each city/town, but with the trade-off of more expense.

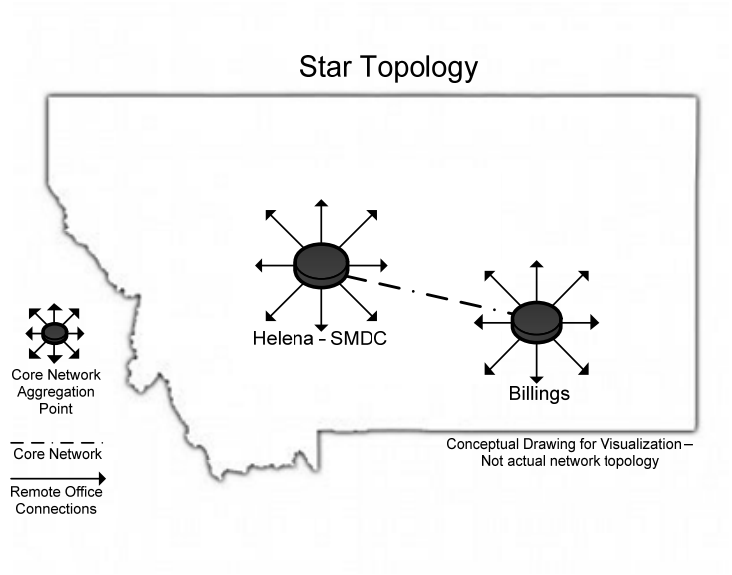

Figure 1 - Conceptual drawing of current State Network

Future Network Costs

The State network of the future will undergo a fundamental design philosophy change to obtain greater service at lower costs. The State is working towards implementing a “Hub and Spoke” network design, which will increase the use of network aggregation points (e.g. “Interstate highway interchanges”) allowing larger circuits to be placed between cities/towns. This will increase capacity to the remote locations, allowing for reduced costs and additional and enhanced services at those locations. In addition, the use of aggregation hubs allows increased network capacity and connections to be obtained directly from rural local providers (“secondary roads”).

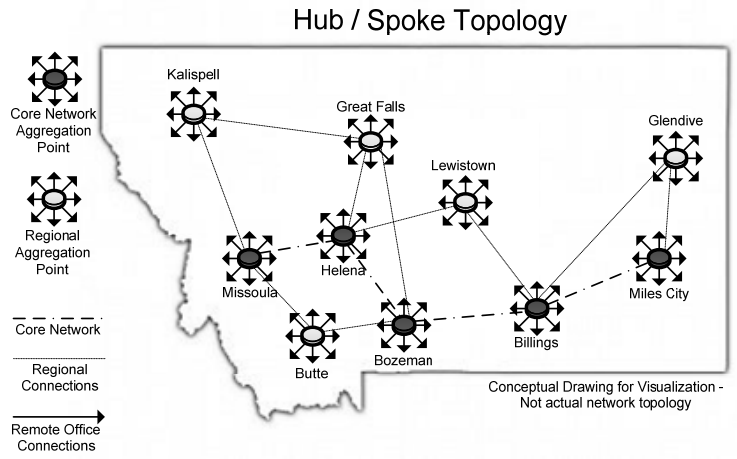

Figure 2 - Conceptual drawing of future State Network

The costs for both types of topology can be seen in these examples. For the "Star" topology, the State has multiple links to the town of Shelby including a link between Helena and the Toole County Courthouse and another separate link between Helena and the Crossroads Correctional Center. Both links cost $1,362 per month.

With "Hub and Spoke" topology, the current example is the city of Lewistown where redundancy of multiple links to the same city has been removed in favor of cost savings. An office in Lewistown serves as an aggregation point for 11 sites in Lewistown, sites in Stanford and Winnett, and the MSU Agricultural Station at Moccasin. The cost of just the local loop circuits range from a low of $579 to a high of $1,229 per month.

The first step to implement this future network is to address the ever increasing network capacity demands at the core. The State Information Technology Services Division (SITSD) has been directed to participate with the Montana University System's use of the Northern Tier Network. This multistate endeavor has driven down capacity costs for the university system. With the participation in the Northern Tier Network, the state will be able to obtain at least two 10Gbps links between Missoula, Helena, Bozeman, Billings, and Miles City from the University system. With the reduction in the cost of the "Interstate Highway", the state can redirect that money to improve the network capacity of the middle mile or local loops.

State Network Funding Approaches

The State network capacity infrastructure between the cities and towns is built and obtained from various commercial providers throughout the State. The providers range from major carriers like CenturyLink to local rural telephone companies like Lincoln Telephone Company. The State has a contract with two of the major providers (CenturyLink and Bresnan/Optimum) for statewide services to remote locations. Those two carriers generally obtain the necessary local connections from various other providers throughout the state to provide connectivity to the State network. The State itself has

almost no "owned" network capacity infrastructure. There are some minor exceptions, like some connections that run from one building to the next door building and some dedicated fiber in Helena that connects the capitol complex to the State of Montana Data Center (SMDC). The state does not have the resources available or the ability to be cost-effective in providing network connectivity to over 650 remote locations. The state relies on commercial providers for this.

Currently, the State network is funded through a rate recovery model via SITSD. Agencies pay STISD for circuits and capacity to connect to the state offices located throughout the State. SITSD then pays the various commercial network providers.

Whatever funding method is used, the IT research group Gartner cautions: "Governments that attempt to squeeze savings from IT by treating it as a program are largely missing the point. IT initiatives must be considered as *investments* that can make actual programs more productive or efficient."[5] No matter what the funding decision is, the State's network capacity should be considered as an investment instead of an expense and funded as such. The network capacity is a foundational infrastructure for providing effective and efficient services to the citizens of Montana.

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[1] 1Gbps = 1000 Mbps

[2] Cisco Visual Networking Index: Forecast and Methodology, 2010-2015, accessed 21 February 2012.

[3] http://www.useit.com/alertbox/980405.html, accessed 22 February 2012. This trend is supported by data from the Internet Society which shows a 50% increase per year. (http://www.isoc.org/isoc/conferences/bwpanel/docs/bp-growingp-201003-en.pdf, accessed 22 Feb 2012).

[4] UM IT Community Webpage, http://umitcommunity.wordpress.com/2009/02/20/no-longer-isolated/, access 22 February 2012.

[5] Gartner Research, "15 Options to Finance Government IT", accessed 21 February 2012.

Attachment A:

-----Original Message-----
From: Brit Fontenot <bfontenot@BOZEMAN.NET>
Sent: Tuesday, February 21, 2012 9:28 AM
To: Clark, Dick <dclark@mt.gov>
Cc: Chris Kukulski <CKukulski@BOZEMAN.NET>; Warren Vaughan <Warren.Vaughan@gallatin.mt.gov>; Michael Protz <Mprotz@BOZEMAN.NET>
Subject: Meeting with Montana's Chief Information Officer, Dick Clark

Hi Dick,

I just wanted to thank you for the meeting with Chris Kukulski, Warren Vaughan and me at Bozeman City Hall on Friday, February 17th. In that meeting we raised the following discussion points:

1) Bozeman and Gallatin County's interest in the broadband/ultra high speed internet issue;
2) The importance we place on broadband infrastructure for economic development, job creation, and industry diversification;
3) The Bozeman meeting for the Montana Broadband Project;
4) Broadband as a utility;
5) The 2001 Montana Information Technology Act;
6) The Helena data center and disaster recovery;
7) Public/private partnerships;
8) Telecom partnerships;
9) Commercial tax credits to offset the high cost of ultra high speed internet;
10) Affordability of broadband as the issue, not the access to the fiber (i.e. MSU);
11) Research is a driver of high speed internet; and
12) Reaching out to our local legislators

Your insight on these issues was invaluable and we sincerely appreciate you taking the time to visit about this important issue.

Best,
Brit
City of Bozeman
Dir. Of Economic Development