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An affiliate of Hospital Sisters Health System

A Case Study of
HSHS Division (Western Wisconsin)'s
Community Area Network Tele-Radiology Hub

A collaborative broadband approach to provide reliable, efficient and cost-effective teleradiology services to hospitals and clinics
Forging a private-public solution to advance healthcare solutions

Summary: This May 2011 case study follows the development of two hospitals' collaboration with other public and private stakeholders to develop a cost-effective infrastructure to support a Tele-Radiology Hub to integrate patient care by sharing large diagnostic digital imaging files across western Wisconsin and eastern Minnesota.

Introduction

In medical emergencies, and with critical or even routine surgical procedures, time and easy access to medical images can be the critical factor that can save a life, improve the clinical diagnostic process and outcomes, or just simply lower costs and increase the speed of care. As a solution, a hub or clearing house for medical images now provides these healthcare organizations across western Wisconsin and Eastern Minnesota the ability to send or view images they or others have acquired. Broadband capabilities made available with a regional CAN (Community Area Network) in conjunction with access to advanced networking capabilities provided by WiscNet for longer haul and multistate connectivity are the foundational elements for success of this Teleradiology image hub.

Both radiologists and physicians require fast, dependable and quality broadband transmission capabilities to access large diagnostic digital image files. This fast and dependable Teleradiology hub allows access to uploaded medical images and provides fast and accurate "reads" for a variety of care situations; trauma, emergency room, critical care, surgical preplanning, operating room surgical procedures, and a wide range of specialist / referral diagnosis across many regional area hospital and clinic locations. The ability to provide 24/7 radiologist and physician access to this imaging Tele-Radiology Hub with high speed connectivity between hospitals, clinics and multiple radiologists' and physicians homes has improved both the quality of care and the speed of care in this regional area. This Teleradiology imaging hub + community and regional broadband solutions has helped bend the healthcare cost curve down, provide dependable quality healthcare technology, and filled a clinical needs gap in this regional area that addressed the problems of:

1) A shortage of 24/7 on-call radiologists able to quickly respond to patient needs
2) Delays in moving imaging data between healthcare organizations that results in re-acquiring images at the current point of care
3) Delays in on-call radiologists responding to pager requests in a geographic area
4) The high cost of providing 24/7 on-call radiologists at multiple locations in western Wisconsin and eastern Minnesota

5) The prohibitively high cost of paying for commercial ultra-high speed broadband over long distances for multiple locations
6) The lack of advanced commercial broadband networks that have the technical features, dependability, and always available bandwidth that are critical for this type of mission critical applications

For many years Western Wisconsin and many parts of eastern Minnesota did not have robust broadband connectivity to manage large high definition CT scan, MRI, ultrasound, or other advanced digital diagnostic imaging files. Broadband at 1 - 10 Gb/sec was unavailable at any price for the majority of the regional area. Lesser speeds were available from commercial providers, but were prohibitively expensive to implement in a widely deployed high speed broadband imaging network. Costs were in the thousands of dollars per month for each location as you reached the desired speeds for fast image transfer and that would approach the needs and speeds of patient care. To provide a 2 a.m. weekend or holiday "read," a radiologist would either need to be physically located in the hospital or in a nearby location with high speed broadband. It was difficult and expensive to staff both HSHS hospitals in western Wisconsin with 24/7 radiologists to meet the needs of these hospitals in addition to servicing many other regional area hospitals and clinics. Lacking the ability to provide immediate radiological services or physician access to images acquired by area clinics and hospitals could mean the difference between life and death.
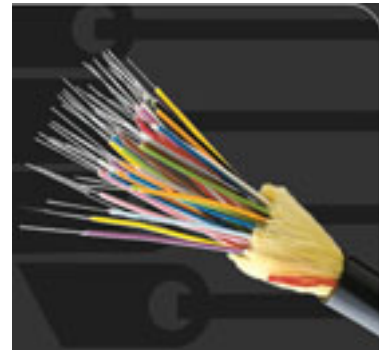
Reducing Costs
Through Economies of Scale:

The Tele-Radiology Hub hosted by HSHS Division (Western Wisconsin) serves more than 43 healthcare organizations. Any linear foot of the 72 mile fiber optic CINC network backbone may be serving as many as 18 members, including hospitals, clinics, schools, libraries, along with city and county government. Organizations share in substantial cost savings by mutually investing in infrastructure and sharing applications.

Collaboration to Support HSHS Care Integration

To establish a Tele-Radiology Hub with high speed connectivity, HSHS Local Systems, Sacred Heart Hospital (Eau Claire, WI) and St. Joseph's Hospital (Chippewa Falls, WI), joined the Chippewa Valley Internetworking Consortium (CINC), an emerging community area network. Through CINC collaboration and sharing of resources and applications with all members of this consortium, these hospitals actively contributed in building and expanding a network that is providing connectivity from 1-10Gbps to many healthcare organizations in the regional area.

High speed broadband connection speeds are critical for the transfer of medical images to radiologists and physicians to facilitate a patient's diagnosis and treatment. Diagnostic files, such as produced by a CT or MRI or other advanced imaging modalities can be significantly larger than the typical Hollywood movie download for a series of images that have been aquired. Many of these advanced imaging modalities for both traditional diagnostic imaging and advanced cardiology studies are now producing 500MB - 1TB files to be transferred for a single image series or study.

The Federal Communications Commission defines broadband as any connection that transfers data at speeds greater than 768 kilobits (Kbps) per second. For example, with a speed of 768 Kbps to 1.5 Mbps, a typical consumer movie (6144 MB in size) download experience would be over nine hours. With speeds between three and six Mbps, the movie download would be longer than two hours. With speeds of 100 Mbps to 1 Gbps, the movie would take 50 seconds. Today, thanks to CINC and WiscNet, these hospitals enjoy the benefits of using advanced broadband networks capable of speeds up to 10 Gbps and mission

critical levels of redundancy required by these medical applications. These levels of speed and reliability provided by CINC and Wiscnet, are still widely unavailable in the regional area commercially at any cost. The ability to have access to cost effective advanced broadband networks has made the dream of a high speed Tele-Radiology Hub a reality.

The Tele-Radiology Hub is an example of the HSHS Care Integration strategy. Collaboration with other community and regional organizations reduces costs through economies of scale and by sharing expenses for advanced broadband networks and common imaging storage and retrieval applications. Sharing infrastructure and applications allows services to be delivered faster, more efficiently and in a more coordinated manner. The Care Integration strategy unifies health care delivery in communities across the regional area by using technology and relationships to link patients, providers and care facilities. In a nation with an extremely fragmented healthcare delivery system, Care Integration reinvents medicine to both provide superior value to patients and promote efficiency for reduced costs. Care Integration unifies health care delivery by using technology and relationships to link patients, providers and care facilities.

A Tele-Radiology Hub Solution

HSHS Division (Western Wisconsin) collaborated with other CINC stakeholders to share in the capital fiber investment to build community wide advanced networking infrastructures that are also interconnected with WiscNet. With this advanced broadband infrastructure, a Tele-Radiology Hub was established that now connects more than 43 healthcare organizations in western Wisconsin and eastern Minnesota. These sites are both imaging consumers and producers. HSHS Division (Western Wisconsin), through Sacred Heart and St. Joseph's hospitals, hosts the imaging hub to act as a clearing house and a "sandbox" to provide imaging access to Medical X-Ray Consultants (MXC Imaging Services), a regional radiologist group and also physicians in the regional area affiliated with the HSHS hospitals. This hub also provides remote reads and image access for regional patient referrals to Sacred Heart and St. Joseph's hospitals. The hub currently uses an amalgam of advanced broadband networks of CINC, WiscNet, private wireless, and also traditional general internet to provide a wide range of connectivity. With a front-end investment in fiber infrastructure that drives advanced broadband networks, the hub uses a far more sustainable and cost effective model than a traditional fee-for-service only broadband model. The ability to sustain these types of imaging hubs or image exchange capabilities will require newer and even more cost effective access to advanced broadband networks as medical imaging needs continue to escalate.

A Patient Perspective

An example that demonstrates the Tele-Radiology Hub from a patient point of view is told by Ross Wilson (who also happens to be the CINC Fiscal Agent). His young daughter had surgery on her leg in a large Minneapolis, MN, hospital. After coming home to recuperate, she awoke in the evening to find her leg cold and the surgeon in Minnesota advised going to the nearest hospital emergency room (which happened to be St. Joseph's in Chippewa Falls, WI) for a Doppler ultrasound test. The test uses sound waves to evaluate blood as it flows through a blood vessel and was critical in ruling out a blood clot, a possible post-surgical complication that would be life-threatening. The high resolution Doppler imaging video, after being "read" by a radiologist, would help the surgeon determine if the coldness was symptomatic of a clot which would require emergency treatment. Unfortunately, it was late in the day on a weekend, and there was little likelihood that a radiologist would be available to immediately read the results on-site, and like a CT, MRI or PET scan, the digitized ultrasound Doppler file is a large image/video file and would take an extended amount of time to download with traditional methods without the availability to access high speed advanced broadband networks. The alternatives normally would be to transport the file on physical media (DVD) to a radiologist, transfer the file at a slower speed over traditional networks, or wait for an hour or more to have a radiologist travel to the hospital to read the ultrasound images. In this case, after the diagnostic imaging procedure was completed, the ultrasound file was instantly transmitted to the HSHS Division (Western Wisconsin) Tele-Radiology Hub located at Sacred Heart Hospital over a highly redundant 10Gb/sec advanced broadband CINC fiber network and

then accessed by a radiologist who was on call, but located at his home south of Eau Claire (approximately 20 miles away). Within minutes the file was downloaded, opened and "read," and the patient in Chippewa Falls was reassured that it was not a life threatening blood clot, but that she could go home, apply warm compresses, and rest. Not only did the Tele-Radiology hub expedite an emergency "read" to reassure a patient, it prevented a costly and unnecessary ambulance transport to a larger city hospital or an extended wait for access to a radiologist or the image file to be transferred to a diagnostic reading location.

A Community Area Network Catalyst

The Tele-Radiology Hub was only made possible through collaboration with other organizations that make up the membership of CINC and the interconnection with regional advanced broadband networks such as WiscNet. CINC is a regional Community Area Network work group formed in 1999 that is committed to "Broadband Serving the Public Interest." Today it has 18 members, 72 miles of fiber with 150 connections and coordinates regional communication infrastructure projects with city, county and state government, educational institutions, libraries, non-profits, and technology providers. CINC facilitates network creation that is innovative, competitive, and sustainable to help the western Wisconsin region to be innovative, competitive, and economically viable.

The CINC network promotes economic development, expands educational opportunities and improves the availability and efficiency of government services. A consortium investment model that has produced a robust community wide network of fiber optic backbones, and an expanding public and private WiMAX/LTE and WiFi initiative, CINC is a best practice community area network that utilizes inter-governmental agreements and memorandums of understanding to currently structure its membership. Should a stakeholder disengage from CINC, it does not diminish the operability and connectivity and infrastructure enjoyed by the other parties. CINC's low- or no-ownership capitalized multi-stakeholder model that minimizes costs and maximizes collaboration provides a new approach in providing cost effective advanced broadband networks and infrastructure. As a community area network with minimal fees (for fiber locates, support and network maintenance), the outcome service level, broadband speed and overall quality of connectivity greatly exceeds traditional carrier centric costs and delivery of service models. Unlike more traditional carrier based models, CINC members own, define and direct their collaborative future.

CINC members, represented by Chief Information Officers, include:

1. CESA 10
2. Chippewa County
3. Chippewa Falls School District
4. Chippewa Valley Technical College (Chippewa Falls, Eau Claire & Menomonie)
5. City of Chippewa Falls
6. City of Eau Claire
7. Dove Healthcare
8. Eau Claire Area School District
9. Eau Claire County
10. Elk Mound School District
11. Indianhead Federated Library System
12. Luther Midelfort Mayo Health System
13. Osseo - Fairchild School District
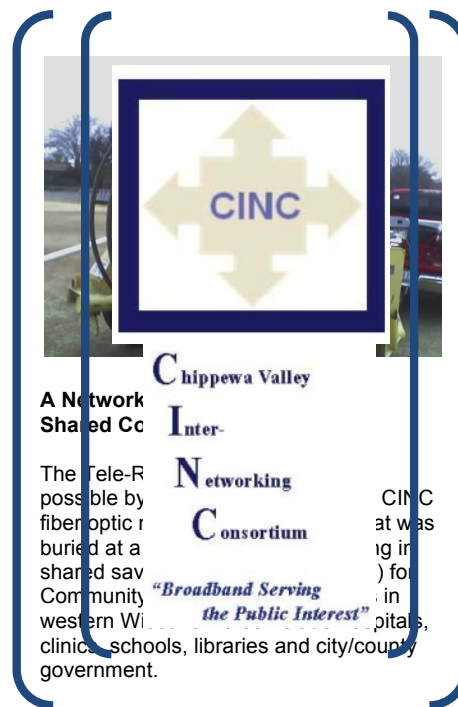
14. Sacred Heart Hospital (Eau Claire)
15. St. Joseph's Hospital (Chippewa Falls)
16. University of Wisconsin-Eau Claire
17. UW Health (Eau Claire & Augusta)
18. Wisconsin Department of Transportation

Rather than being an organization with employees and a payroll, CINC is directed by an executive board and technical group committee that supply workforce hours for physical and technical support. The governing board provides oversight to committees that manage infrastructure. Because CINC is a virtually integrated consortium of Chief Information Officers and representatives of stakeholder organizations, members themselves provide the necessary operational staff resources. Much like a condo association, members each share in the operational responsibilities and costs. This structure serves to hold vendors accountable, make sure all stakeholders are satisfied, and assure that there is a technical and financial return on projects.

Each CINC member is invested and acts together with other stakeholders to provide ongoing maintenance for a shared advanced networking infrastructure. Member organizations are able to provide greater and more dependable service at less cost to patrons, taxpayers and customers. A technical and fiscal synergy brings about value greater than the sum of the stakeholders. In a network project implementation, interested stakeholders may take a lead by providing time and project assistance. Projects begin in a conceptual phase with a timeline and objectives. Shared interests and resources help identify technical solutions. Member needs (such as lowering costs and sharing infrastructure) are met by working together to solve mutual problems. Over the years, CINC members have found that solving problems together can provide better solutions and can help identify innovative and cost effective solutions that were not initially on the table.

Funding & Sustainability

CINC projects are funded by the institution(s) that receive the greatest benefit from the project. This process of capitalizing projects may also involve a lead organization with support from secondary stakeholders. Stakeholders each individually determine their own return on investment on a project in order to justify contributing to the project. This process involves invitations for partnerships, negotiations, and allows each CINC member to evaluate their own benefit in order to make a proposal to their own governing board. Projects are sometimes completed in incremental phases. One CINC member's need often turns into another's opportunity. As a result, CINC projects have the unique advantage of being driven by both needs and opportunities. Because member organizations have different fiscal years, CINC is able to complete projects and accomplish timelines with exceptional agility (as compared to other public or private sector organizations).

The broadband access between Sacred Heart and St. Joseph's hospitals is using a highly redundant pair of 10 GBps networks running on the underlying CINC fiber infrastructure. This Tele-Radiology Hub application is only one of many applications that have been enabled by the existence of these advanced broadband capabilities. As hospitals expand telemedicine and as Wisconsin's medical exchanges gain momentum, the Wisconsin Plan's broadband model is a demonstration of the unique ability of a community area network with integrations to WiscNet and Internet 2 that open new possibilities and make possible cost-effective advances in technology by reducing duplicative applications and enabling critical new ones. These advances are appreciated by consumers, patrons, patients and taxpayers alike.

Keys to Minimizing Costs & Maximizing Benefits

- Create a Community Area Network model that shares infrastructure expenses and fiber benefits
- Share maintenance costs (i.e. Diggers Hotline and repairs)
- Invite additional public and private stakeholders to participate in new infrastructure and share in maintenance costs

Additional Resources:

For additional information on Sacred Heart and St. Joseph's hosptials' experience in CINC, WiscNet, or Internet 2, contact Pete Nohelty at 715.717.5026 or email at pnohelty@shec.hshs.org .

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