IRHN Technical Design Narrative

Overall Design Approach

The primary purpose for the IRHN is to meet the requirements specified in WC Docket No. 02-60 for Rural Health Care Pilot grants. The IRHN has two specific goals that meet these requirements in the network design satisfying the grant requirements. The first goal is for the IRHN to provide broadband communications between healthcare organizations for information exchange, telemedicine and telehealth applications. The second goal for the IRHN is to connect to the Lambda Rail or Internet 2 for communications with other regional medical networks, national healthcare information exchanges or governmental resources available to healthcare providers. To satisfy the needs of healthcare, the IRHN network design is engineered to carry large volumes of networking traffic and the design allows for expansion of the system as healthcare needs expand. The network design will bring added value to hospital groups by providing point-to-point connectivity, transport services to create an Internet Service Provider (ISP) network and having the ability to create other network layers that would be essential to healthcare needs. Each of these design proposals will be addressed in further detail.

IRHN Closed Network

All members of the IRHN will have access to the IRHN closed network as part of the initial installation. The technical design allows for each member to be connected either by a 1 Gigabit (Gb) or 100 Megabit (Mb) connection depending on the accessibly of fiber or wireless to the healthcare facility. The IRHN closed network allows open communications between IRHN healthcare providers and will communicate with other IRHN members throughout the State of Illinois.

The primary structure of the IRHN, at minimum, is to provide a high speed network capable of transferring medical imaging, video and electronics records throughout the State of Illinois between all members of the IRHN network. This particular network is considered to be a closed network that is not opened to the public internet. The purpose for the IRHN being a closed network is to preserve the integrity of a high speed healthcare network for the purpose of transporting healthcare content. The network design further assists healthcare providers in their compliance with the Health Insurance Portability and Accountability Act (HIPAA) by providing a closed network that will minimize threats otherwise propagated throughout the public internet space. Even though the IRHN is a closed network, IRHN members will still be required to secure their local networks as a precautionary process.

Methods of Connectivity into the IRHN

The IRHN pilot grant has provisioned two primary types of connectivity for the initial build of the IRHN. All connectivity into the network will be ethernet based and will not accommodate traditional telecommunications services without conversion to ethernet (i.e. T-3, T-1, Sonet, etc.).

Fiber Connected IRHN Members

If the IRHN member is connected to the fiber network then the connectivity provided from the IRHN pilot program will be 1Gb ethernet. If the IRHN member is considered a Point of Presence (POP) location then the connectivity will be a fiber patch cable from the IRHN equipment to the hospital network using a 1310 baseband connection. This same method will be used if an IRHN member is using a broadband provider to access the POP location via a local fiber connection or a metro fiber ring.

Wireless Connected IRHN Members

Not all healthcare organizations will have the ability to connect directly into the fiber optic backbone network. One of the alternate means for this connectivity will be a wireless connection that will connect into a IRHN POP location. The IRHN technical group will engineer a wireless link from the IRHN POP location to an IRHN member. This connection will provide a 100Mb symmetrical link between the IRHN member and the IRHN POP location where they can obtain access into the IRHN. The connection point into the network will be a 100Mb copper connection between the wireless equipment and the IRHN member network.

Other Methods of Connectivity

The IRHN is an ethernet based system and can offer services between 10mb and 10Gb. For IRHN members that do not require the transfer of large amounts of information (i.e. Small clinics, Doctor Practices, etc.) or healthcare providers do not not have access to fiber or wireless options may have to rely on connectivity at lower rates through other media types using a third party internet service provider. The IRHN encourages healthcare providers to use third party internet service providers to provide broadband transport between the IRHN POP and their healthcare facility. Third party connections are not funded as part of the IRHN grant and healthcare facilities will have to directly pay for any recurring expenses. Since the only requirement for an IRHN member to participate in the IRHN is to have an ethernet connection interface, the IRHN can adapt to the local providers speeds. The connection provided by a third party internet service provider will be required to be a point to point private connection and not provided over the public internet space.

Healthcare Resources

The IRHN closed network will provide opportunities for Heath Information Exchanges (HIE) or other types of medical systems that can be utilized across a network. These systems can either be shared by hospital groups or contracted with specialized healthcare facilities to be accessible to healthcare providers in the State of Illinois. Since the IRHN is a closed network, it will help maintain the integrity of

these systems and avoid the constant assault of common threats found over the public network. HIE systems can assist IRHN members in several ways:

- Smaller clinics or practices can utilize HIE systems over the network as opposed to obtaining the expenses of a system locally.
- Larger hospital systems can exchange data between HIE systems.
- HIE systems will have access to other resources throughout the Internet 2 network.

IRHN educational partners will be available over the IRHN as another valuable resource. Broadband applications will allow healthcare facilities access to online training and live educational classes or training essential to the ongoing needs of the medical community. With the IRHN high speed network, these educational opportunities can be performed in high definition quality speeds using intensive tools that require large broadband capacities.

Hospital to Hospital/Clinic

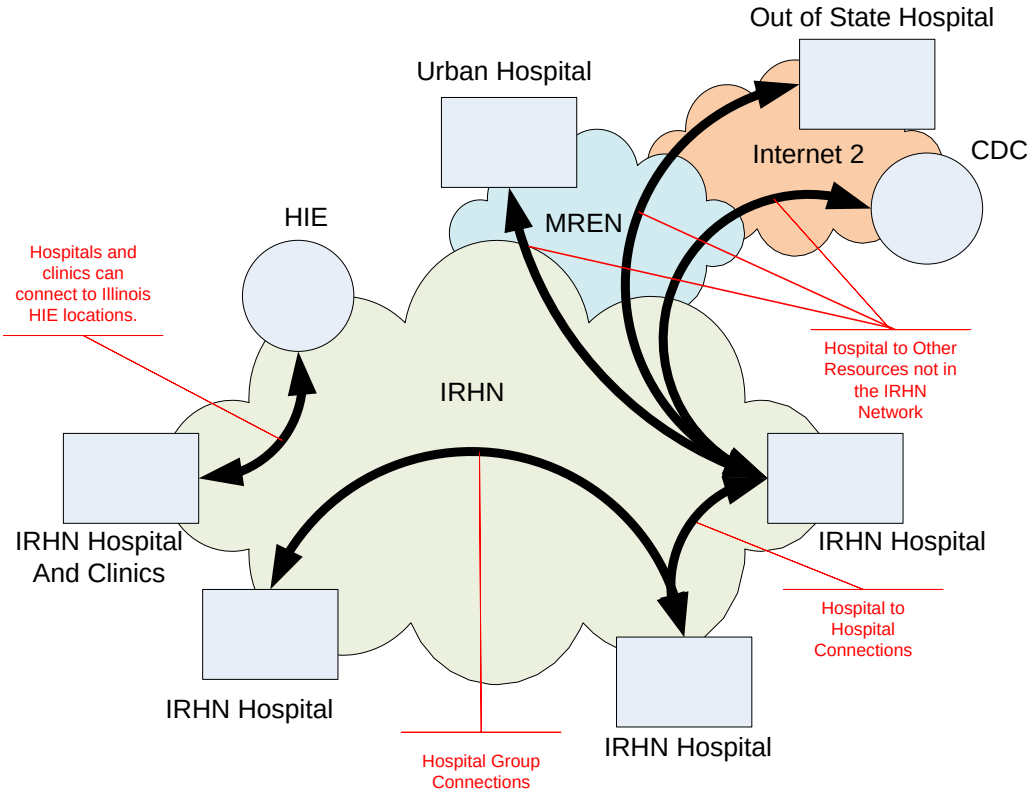
One of the benefits of the IRHN is it will allow members of the IRHN to communicate seamlessly with each other. IRHN healthcare facilities will have the ability to communicate at high speed between each other. This can provide for new collaborations or support current ones between rural and urban hospitals. IRHN members can share or obtain medical expertise otherwise not available in the rural areas. The design of the IRHN high speed network will permit the exchange of large imaged medical records between IRHN members for specialized cases that may not be a long term commitment between members.

Within the IRHN members can share data center locations for disaster recovery. With the high speed access available to IRHN members, collaboration is encouraged for healthcare facilities to locate offsite equipment to prevent a monumental loss of patient data. These sites can be utilized in several ways.

- Develop a complete backup data center that can result in cold restoration of systems.
- Develop a warm back data center that will utilize the IRHN high speed backbone in the event of local system failures for seamless recoveries.
- Share data center space to avoid building a costly offsite location.
- Work with virtualized systems over the high speed IRHN backbone for seamless restoration of systems in the event of a disaster.
- Perform instant backup procedures for less data loss in the event of a disaster.

There are many more benefits that can be utilized over the IRHN closed network that allows members to communicate freely between each other. Overall this model will assist healthcare facilities in the savings of broadband infrastructure costs. The IRHN closed network is represented in Figure A.

Figure A
IRHN Closed Network



Metropolitan Research and Education Network (MREN), National Lambda Rail (NLR) and Internet 2

The IRHN will be a member of MREN and will be the gateway for connectivity into other regional healthcare networks that provide for healthcare needs. MREN is located in Starlight at 710 North Lake Shore Drive in Chicago Illinois and is considered the optical hub of the world. MREN connects several medical institutions in the Chicago urban areas as well as other advanced medical facilities outside of Illinois that provide for research and development in healthcare. Northern Illinois University is a MREN partner with NIUNet connected into the MREN network. Through MREN, NIUNet can provide a gateway for IRHN members to have access to suburban healthcare partnerships over high speeds if required. MREN opens the opportunity for an extensive network of healthcare professionals throughout the State of Illinois.

As part of the requirements of the rural healthcare pilot, Internet 2 or NLR connectivity is a requirement. The partnership the IRHN has with MREN allows the IRHN to establish the Internet 2 and NLR connectivity gateway for rural healthcare. The Internet 2 or NLR is where the IRHN facilities can communicate across the United States with other healthcare groups or government databases like the

Center for Disease Control (CDC) or Health and Human Services (HHS). While new HIE strategies are being developed, the Internet 2 or NLR will be critical for healthcare organizations and the distribution of healthcare records. The Internet 2 and NLR will be the gateway to provide or obtain information for a nationwide HIE system. MREN and the Internet 2 or NLR will be part of the closed network for the IRHN and the IRHN members will have unrestricted access to resources over MREN and Internet 2 or NLR as specified for the healthcare network.

Enhancements Added to the IRHN

To better meet the needs of healthcare, the IRHN has developed strategies to enhance the services for the IRHN. The network is engineered to provide other services outside the closed network bringing a value add to common services often required for day to day operations. The design of the IRHN is provisioned to keep the operating and maintenance costs low while allowing flexibility to expand and add services.

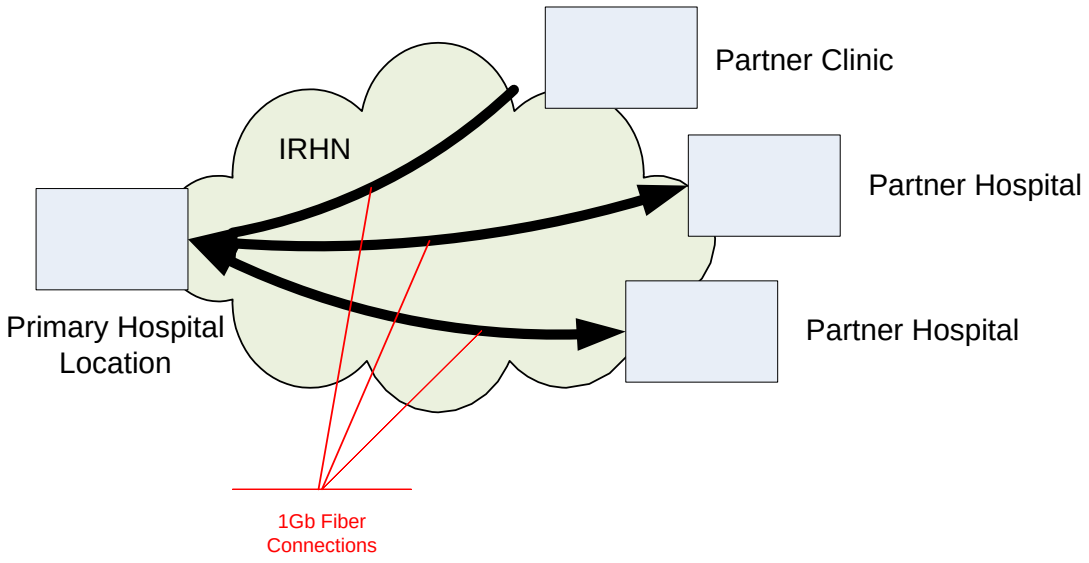
Hospital Groups

Healthcare facilities currently have many partnerships defined either throughout the State of Illinois or within a defined region. There is a need for these healthcare groups to exchange information between facilities. Many of these healthcare groups are interconnected with inadequate traditional services like T-1 (1.54Mb) and T-3 (45Mb) type connections that have high monthly rates associated with them. The IRHN will perform different roles for providing faster low cost services for these groups. First the IRHN can replace the current broadband connection between group facilities and become the primary carrier of traffic for the healthcare providers. Second, the IRHN can be used as a redundant service for the hospital group to add additional capacities to their facilities while maintaining traditional services as backup. Some examples of hospital group connections through the IRHN might be:

Fiber Connected Hospital Groups

If the healthcare provider in a specific region has a partnership with regional hospitals, they can be interconnected through the IRHN fiber network. Under the pilot at program 1Gb per location can be provided through the IRHN. If the hospital group requires speeds above 1Gb, the IRHN can provide additional bandwidth up to 10 Gigabit's however, this capacity is not currently built into the pilot budget. The IRHN will work with the hospital group on the specific costs to engineer and implement this type service if it is required. Figure B illustrates how a hospital group might connect using the IRHN.

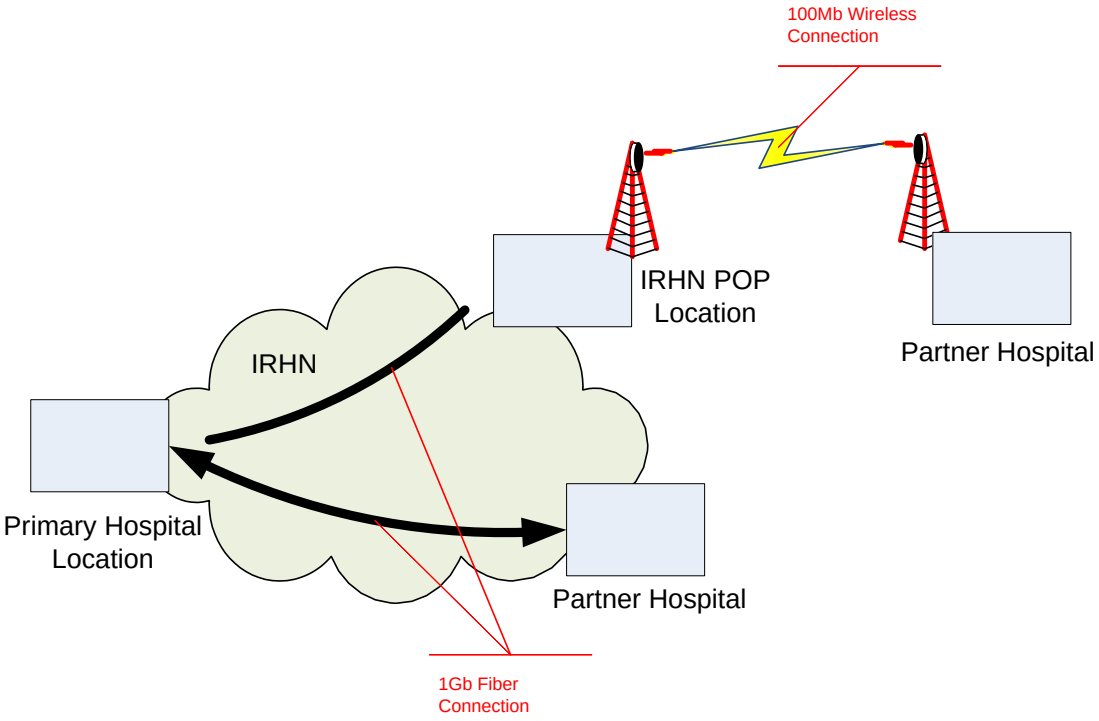
Figure B
Fiber Connected Hospital Groups



Wireless Connected Hospital Groups

Not all hospitals will have the ability to connect directly into the fiber optic backbone network. One of the alternate means for this connectivity is to have a wireless connection between the hospitals. This will restrict the hospital groups to a slower speed of 100Mb. Wireless connected locations typically will connect back to the IRHN fiber optic backbone to an IRHN POP location. Depending on the requirements, this connection can be directed to a hospital group. Figure C shows how a hospital group might be connected using a wireless connection into the IRHN fiber network.

Figure C
Wireless Connected Hospital Groups

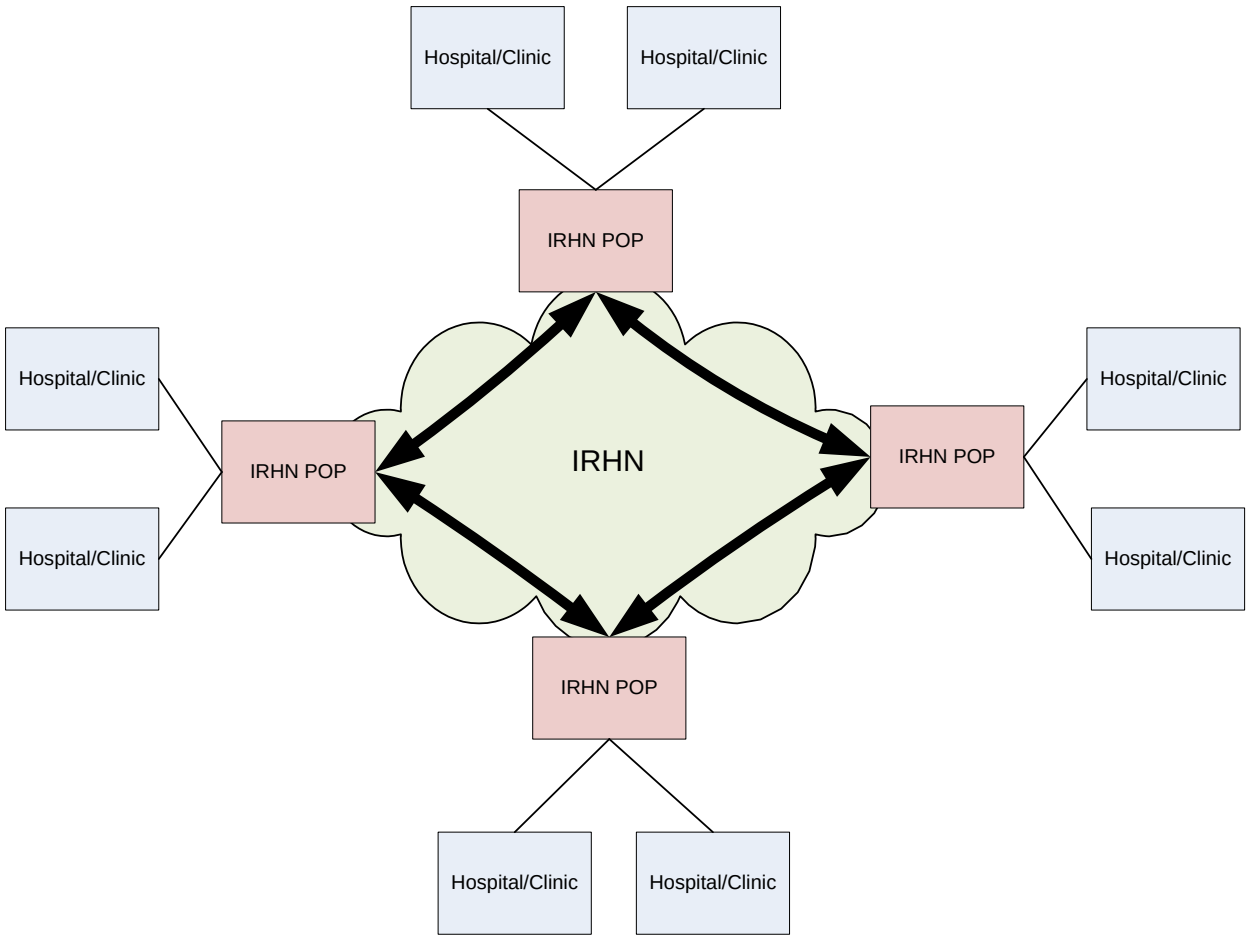


Point of Presence Locations (POP)

The IRHN is a cooperative network build that will provide healthcare facilities the ability to obtain broadband services at lower costs. The IRHN design relies on its members to act as a cooperative and provide space for network equipment and connectivity for the IRHN. The IRHN members will be expected to grant broadband access for other healthcare providers throughout the region to locations where IRHN has agreed to locate services. The purpose for this design is to keep the cost low for the IRHN members and minimizing equipment in telecommunications co-location spaces.

Once all of the POP locations are in place, members of the IRHN will be directed to use one of these locations as a connectivity point into the IRHN. Once connectivity is established at any of the defined IRHN POP locations, ethernet services at various rates can be obtained from these locations. An illustration of POP connectivity is shown in Figure D.

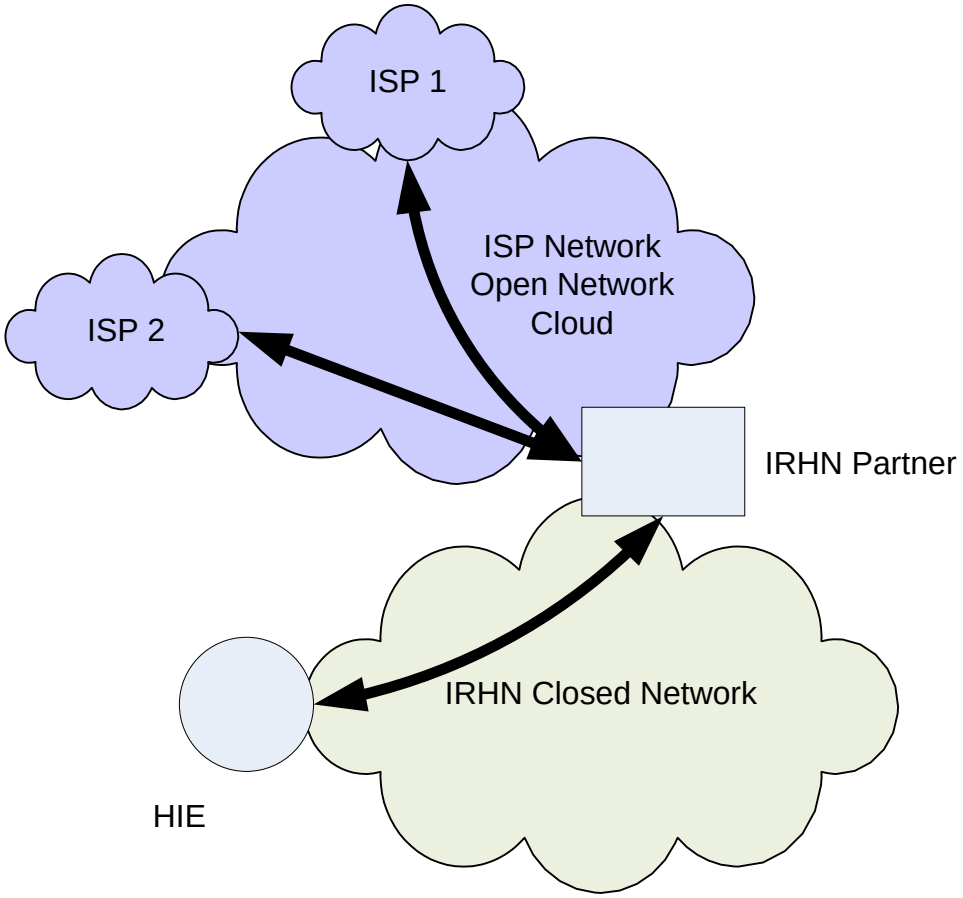
Figure D
POP Design



ISP Network Cloud

The IRHN can create networks within itself. To provide additional services to healthcare facilities, an Internet Service Provider (ISP) network is part of the design. This network is considered to be an open network that will provide IRHN members the ability to contract for ISP services to the public internet. The IRHN will be the transport to these providers where IRHN can invoke competition for services among vendors for the best value and price. Currently two locations have been defined where internet services can be obtain. These locations are at Starlight, 710 North Lake Shore Drive, Chicago IL, using Cogent Communications and the DuPage National Technology Park in West Chicago, IL using DTNP Partners. It is anticipated as the IRHN is built out, more ISP service opportunities will be available. Figure E shows how the ISP cloud can connect an IRHN member.

Figure E
ISP Open Network Cloud



Other Network Clouds

The design of the IRHN is flexible and will allow for other layers of networks as required by IRHN members. The network has the ability to carry digital television or voice over IP (VOIP) and additional closed networks as required. With this flexibility, the IRHN is positioned to provide the IRHN members with additional services as they become available.