Ms. Marlene H. Dortch
Secretary
Federal Communications Commission
445 Twelfth Street, S.W.
Washington, DC 20554

Re: *EX Parte Communication,* GN Docket No.s 09-51 and 02-60

Dear Ms. Dortch:

As the FCC moves rapidly toward A Notice of Proposed Rulemaking initiating reforms to the Universal Service Rural Health Care Fund to expand the reach and use of broadband connectivity by health care providers throughout the nation the members of the Rural Health Care Pilot community as organized by Internet2 respectfully request that the issues addressed in the attached document be considered and addressed.

Respectfully submitted,

Michael McGill

Cc: Thomas Buckley
Mohit Kaushal, MD

The following discussion addresses important points that should be addressed in the FCC's upcoming Notice of Proposed Rulemaking (NPRM). The NPRM could be a significant vehicle to address broadband issues relevant to health care, the adoption of health information exchange and telemedicine services and the expansion of health care access in both normal and disaster situations.

- Reliability
    - Many of the FCC's Rural Health Care Pilot Programs (RHCPPs) are expected to employ an Application Service Provider (ASP) to provide an Electronic Health Record (EHR). Reliability of the network is critical to assure the availability of health records for providing care. See for example the requirements from the Southeastern Ohio Health Care Network in Appendix A.
    - The National Broadband Plan reports that the carriers only provide assurances of reliability with "commercial" network service at considerable extra cost.
    - The NPRM affords the FCC the opportunity to gather information on the minimum levels of reliability, including physical redundancy, that are required to support medical and other public service areas versus what is currently available in local markets and what steps the FCC can take to encourage reliability. In addition, the NPRM affords an opportunity to canvas opinion on whether current pricing practices encourage or discourage the reliability of the broadband connection and whether these are considered fair and reasonable.
    - Reliability is a significant need for Health IT in general and Health Information Exchange in particular and should be added to the list of characteristics to be subsidized and encouraged.
- Quality of Service (QoS)
    - Closely aligned with Reliability is the Quality of Service (QoS) including bit rate, delay, jitter, packet dropping probability and/or bit error rate.
    - Over-provisioning the bandwidth can ameliorate some issues with QoS, but not all. In a clinical situation these are critical factors for the accuracy of the medical information being transmitted, especially live medical imaging data.
    - Teleconferencing is the core capability at the root of major telemedicine applications. A purveyor of today's teleconferencing product recommends the following QoS settings:
        - Packet Loss—The packet loss target should be below 0.05 percent on the network.
        - Jitter—the peak-to-peak jitter target is under10 msec.
        - Latency—the one-way network latency target is below 150 msec.

        - Bursts—the network infrastructure must account for bursts up to 64 KB per video input (camera or auxiliary).
    - The National Broadband Plan reports that the carriers only provide assurances of QoS with “commercial” network service at considerable extra cost.
    - The NPRM affords the FCC the opportunity to gather information on the minimum QoS that may be required to support medical and other public service areas versus what is available and current pricing practices for QoS and if they are considered fair and reasonable.
    - QoS is a significant need for Health IT and should be added to the list of characteristics to be subsidized.
- Bandwidth
    - The proposed definitions of broadband from the US Broadband Plan are 4mbs of service for small health care institutions and 100mbs for hospitals. The Notice of Proposed Rule Making (NPRM) provides an opportunity to gather comments and data to support or challenge these requirements.
    - Bandwidth requirements differ depending on the type of service being provided by the health care site. For example, the sharing of text based medical records is a relatively low bandwidth activity compared to the need to share high quality images or oncology planning. Health information exchange services are evolving and the text-based medical record traffic incorporates more visual and audio content. Thus, the need for baseline bandwidth is also increasing, even for small medical practices. Appendix B illustrates the potential impact in time of different medical files as transmitted at different access circuit bandwidths. Also as the population ages and health care addresses "aging in place” affordable broadband to the home should be coordinated with other FCC programs.
    - The bandwidth recommended by an advanced teleconferencing vendor whose product is comparable to the capability needed for telemedicine applications can vary from 10.8 Mbps to as high as 20.4 Mbps.
    - The investment in the broadband infrastructure resulting from the creation of the new rules will need to last a minimum of 6 years and likely two to three times that span of time. Technology and process evolution are expected to result in significant bandwidth demands that will need to be supported by these network investments.
    - As the use of telemedicine expands into the offices, clinics and small hospitals, a long-term goal of 100 MB and 1 GB service is not unreasonable.
    - The NPRM should encourage the investment in bandwidth requirements to meet current and future needs. The NPRM affords the FCC the

opportunity to gather information that will assist in assuring that appropriate bandwidth is allocated to meet the needs of the institution now and in the future.

- Disaster Response
    - In disaster situations, it is often the local institution that is on the front line of the response. A broadband network connection that assures access to Emergency Departments and Public Health resources may literally be a life and death resource.
    - In regions of the country prone to hurricanes, tornadoes and other natural disasters, the reliability of the broadband network is critical to ensure that physicians have the ability to access the electronic records of people in movement who are fleeing the disaster or seeking refuge.
    - The NPRM presents an opportunity to gather data and information about both the physical and contractual opportunities to provide a network that has a high probability of meeting disaster requirements. There is an opportunity for coordination with the Public Safety sections of the US Broadband Plan.
- Affordability
    - Establishing appropriate price targets for broadband networking is a difficult and complex process. Yet, options may exist that either address the issue directly or provide indirect measures (for example though an analysis of demand).
    - Aggregating demand in other non-health domains could provide an economy of scale. providing "urban rate discounts" for rural broadband Internet services, similar to the current telemedicine and e-rate discounts for other forms of connectivity.
    - The NPRM should take the opportunity to gather data and information to address price points and to determine rules that encourage the appropriate adoption of broadband by healthcare.
- Scope
    - Health Care is critical to all areas of the US but it is not the only use of broadband resources. In fact, there are regions of the country where broadband is being analyzed as a community resource for economic development or other rationales. The aggregation of broadband demand, including health care, must be viewed positively and encouraged.
    - Broadband may be provided by a resource other than the common carriers. The NPRM should gather data and information about the non-common carriers and evaluate the support of these resources.
    - Closely aligned with aggregation of bandwidth is the need to allow and support the continued aggregation of institutions into an effective

community. The genius of the RHCPP was in part that it encouraged development of communities of health institutions that acted for the group.

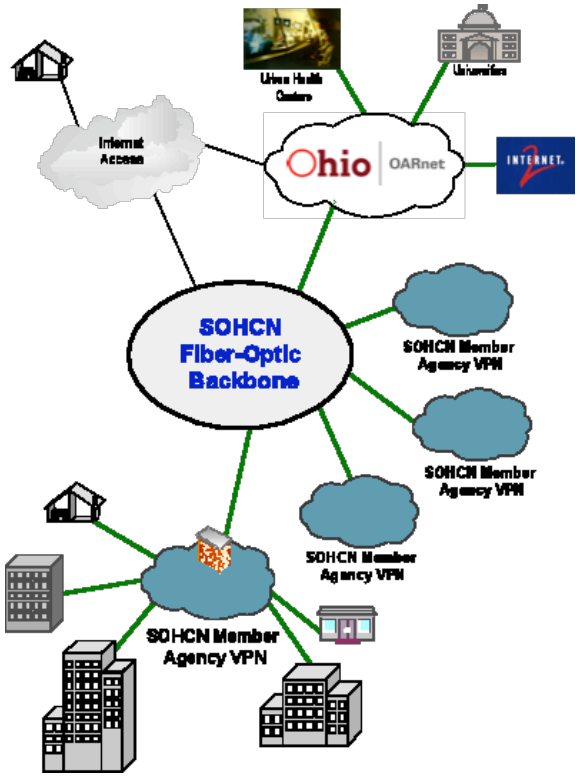
- The NPRM should address the benefits of these communities and encourage and support them.
- The NPRM should address how to incorporate the following types of organizations into their rule:
  - Data Centers that serve health organizations and communities
  - Administrative sites that support functions for eligible health organizations
  - Long-term care facilities, skilled nursing and visiting nurse headquarters
  - For-profit health care providers serving at risk rural residents (may require congressional action)
  - Consortium headquarters that support eligible entities
- Any change to the type of organizations should be applicable to all program participants including the existing RHCPP participants.
- Effective and secure International connectivity and peering with other international networks are needed as the country addresses global public health and border health issues. Examples include increasing international public health concerns, such as tuberculosis, HIV/AIDS, pandemic influenza, chem-bio terrorism, that require improved surveillance, situational awareness, consequence management, sharing data and information that would include rural sites, larger centers and national or international agencies. Means of addressing international connectivity should be addressed or coordinated.

Appendix A

4.1. Logical View [Informational]

A single connection to the SOHCN will provide the health care facility the connectivity needed for:

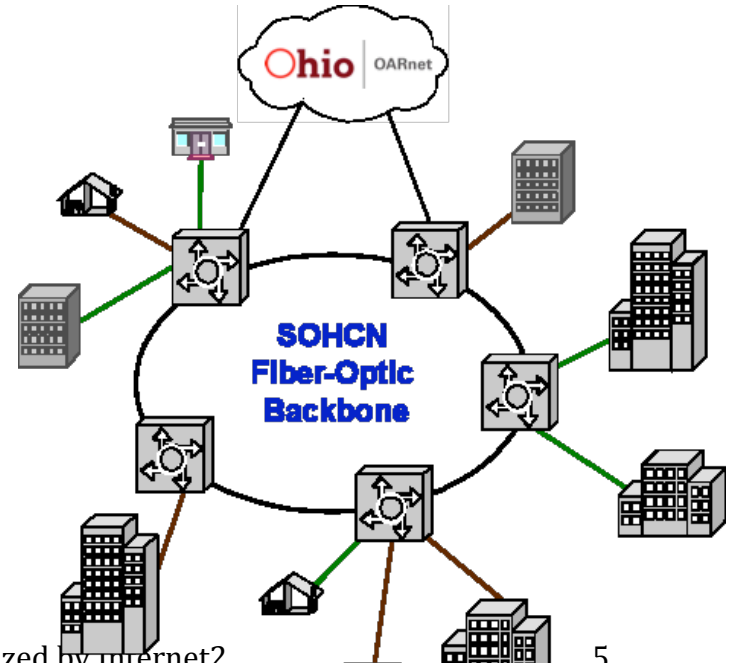
- Secure intra-agency communications based on encrypted VPNs established and managed using firewalls under the control of the SOHCN Member.
- "Any-to-any" connectivity within the SOHCN and OARnet with access control and encryption performed by firewalls under the control of the SOHCN Members and the external parties with whom they are communicating.
- Real-time applications supporting video and audio. Requires end-to-end network performance to meet stringent latency, packet loss and jitter performance requirements.
- Internet access.



4.2. Physical View [Informational]

From a physical perspective, the diagram to the right illustrates a simplified view of one possible network design. The intended SOHCN features include:

- One or more fiber optic rings forming the SOHCN backbone.
- Fiber optic rings are physically diverse.
- If multiple rings are proposed, the rings must interconnect in geographically distant locations via diverse fiber paths.
- Self-healing fail-over in the event of a fiber cut in the ring.
- High capacity architecture able to meet current and future needs of the



SOHCN over the next ten to twenty years.

4.3. Classes of Connections [Informational]

The SOHCN envisions two classes of connections to serve the Members.

- ***Dedicated Bandwidth*** = Technologies that provide continuous, 100% bandwidth connectivity at speeds ranging from 1.5 Mbps to 40 Gbps across the SOHCN. These can be point-to-point connections or Layer 3 connections operating with mechanisms guaranteeing end-to-end operations at full port speed across the SOHCN.
- ***Shared Bandwidth*** = Technologies that provide burstable capacity up to the purchased port speed and guaranteed capacity at the purchased committed information rate (CIR) at speeds ranging from 1.5 Mbps to 1 Gbps.

4.4. Categories of Facilities [Informational]

The SOHCN has identified four categories of facilities for which we request varied levels of redundancy and connection speeds.

- ***Category 1***: Regional Health Centers (100 Mbps to 10 Gbps) with physical diversity required
- ***Category 2***: Small Hospitals, Urgent Care, Emergency Room (10 Mbps to 2.5 Gbps), with physical diversity required
- ***Category 3***: Clinics, Health Departments (5 Mbps to 1 Gbps)
- ***Category 4***: Physician Homes (5 Mbps to 100 Mbps)

6.2. Defining Physical Diversity [Response Required]

To answer in the affirmative regarding physical diversity in this RFP, the Respondent must provide fiber paths with zero (0) route miles in/on the same:

- Sheath
- Conduit
- Pole
- Manhole
- Geo-path with a minimum separation of one hundred (100) feet on the route and twenty (20) feet on the building entrance.

This definition of Physical Diversity applies and is binding to all mentions in this RFP and in the Carrier's response of:

- Physical Diversity
- Diverse Route
- Diverse Entry
- Any other description or depiction of physical diversity

6.3. Physical Diversity Requirements [Response Required]

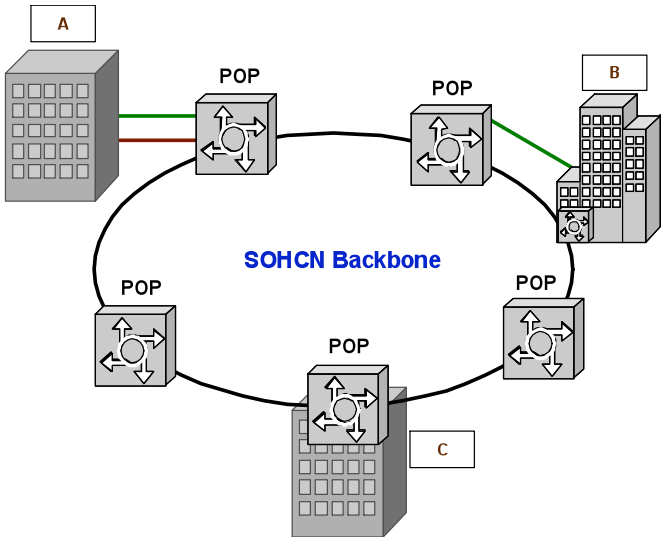
The SOHCN seeks diversity based on physical paths and electronics as illustrated in the following diagram. Pictured are the SOHCN Backbone and three connection options.

The SOHCN Backbone

The SOHCN Backbone, whether consisting of one ring or multiple rings, must be physically diverse both in the fiber entry to the POP and the routes between POPs.

Scenarios for Member Sites Requiring Diversity

For SOHCN Member sites where time sensitive remote medical care may be administered, we also seek redundancy based on three scenarios described in the following text and diagram.



- Scenario A

  The Carrier establishes a POP in the community to serve SOHCN Member facilities and to provide community broadband services. Two diverse fiber routes are extended to the SOHCN facility(ies) that require redundancy.

- Scenario B

  The SOHCN Backbone passes through the SOHCN facility. Optical-ring interface electronics are in place in the SOHCN Member facility to serve that facility's needs only. The Carrier also establishes a POP in the community to serve other SOHCN Member facilities and for providing community broadband services. In addition, a diverse fiber path is built from the SOHCN facility to the POP to provide further redundancy in the event that the optical ring electronics in the SOHCN facility fail.

- Scenario C

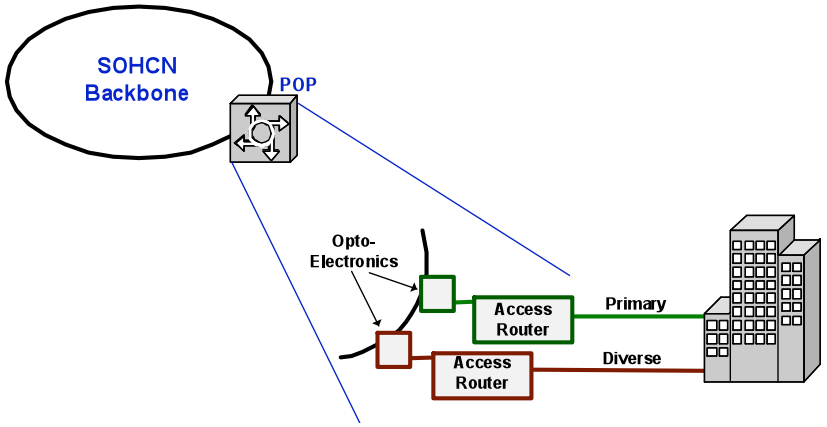
  The SOHCN Backbone passes through the SOHCN facility. The Carrier establishes a POP in the SOHCN facility. In addition to serving the hosting SOHCN facility, the Carrier extends services from this POP to serve other SOHCN Member facilities and provide community broadband services.

6.11. Levels of Redundancy in POPs serving the SOHCN [Response Required]

The SOHCN members intend to conduct mission critical business including real-time patient care across the network. Thus the detail regarding Carriers' network redundancy becomes a critical criterion. The following three examples indicate the level of detail we seek from Respondents in explaining how redundancy is provided.

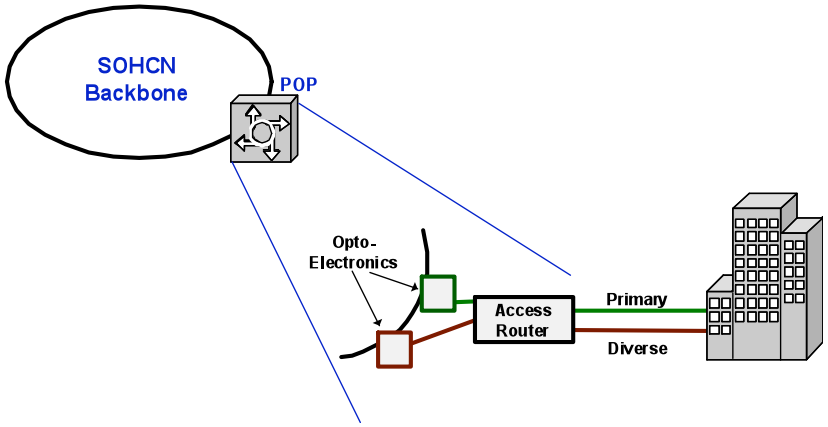
Example 1: Fully Redundant Electronics

In this example, both the opto-electronics and the customer access router segments of the POP enjoy full redundancy including separate chassis.



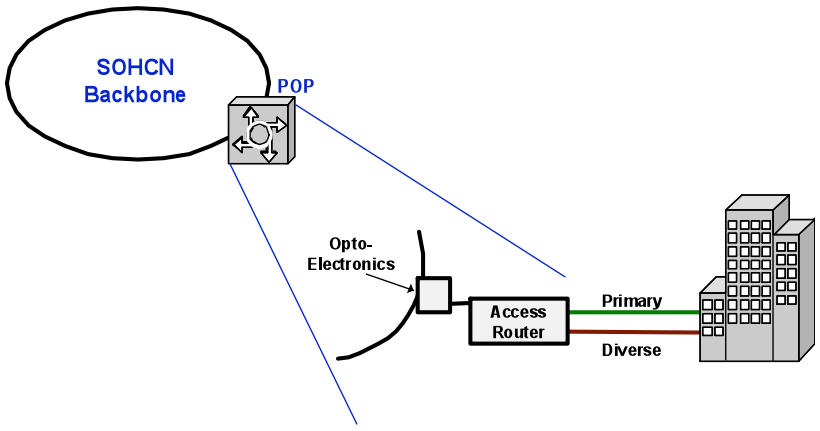
Example 2: Redundant Opto-Electronics Only

In this example, the opto-electronics enjoy full redundancy including separate chassis. A single access router chassis serves both the primary and diverse connections. The access router may have internal redundancy within the chassis.



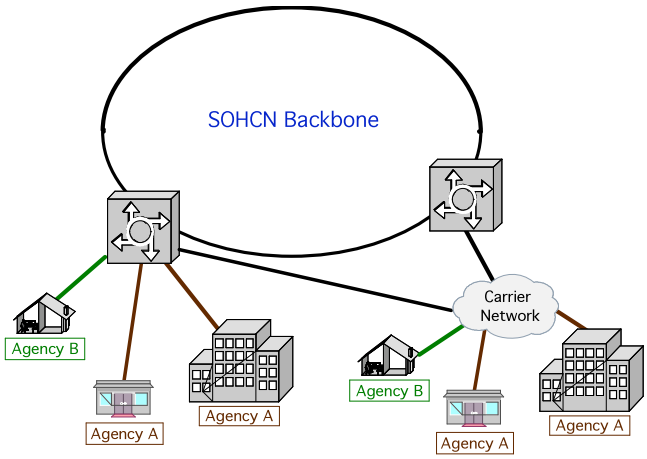
Example 3: Minimal Redundancy

In this example, a single chassis is used for opto-electronics and the access router. Internal redundancy within the chassis may exist.



7.1. Introduction [Informational]

In this section, we seek solutions that offer dedicated bandwidth solutions for the connectivity requirements of SOHCN Member sites to the serving SOHCN POP at speeds of 1.5 Mbps and above. While we list specific types of connections, this list is by no means intended to exclude other options. We are interested in any and all technology options.



If provided on a Layer 3 network, dedicated bandwidth connections must operate with mechanisms guaranteeing end-to-end operations at full port speed within the SOHCN.

If the dedicated bandwidth solution traverses a secondary Carrier network before connecting to the SOHCN Backbone, then the secondary Carrier network must be connected to at least two geographically dispersed SOHCN POPs using physically diverse fiber paths as pictured in the diagram above. Each of the redundant aggregate links to the SOHCN Backbone must be of sufficient capacity to provide 100% of the combined dedicated bandwidth SOHCN facility connections. Of course, this requires the Carrier to expand these aggregate links as SOHCN Members upgrade connection speeds to their facilities over the life of the contracts. The cost of the connectivity from the secondary Carrier network to the SOHCN Backbone must be included in the pricing for the individual facility connections.

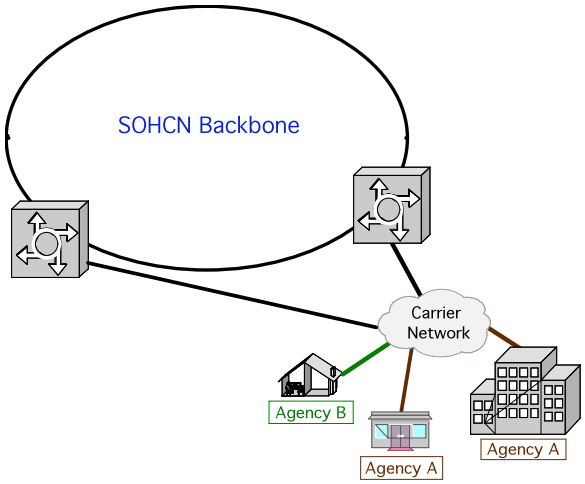
7.2. Examples of Dedicated Bandwidth Solutions [Informational]

The types of dedicated bandwidth interfaces envisioned include:

- Point-to-Point Metro-Ethernet
- Copper-Based Data Service
- Fiber-Based Data Services
- Traditional Leased Lines
- Direct Fiber-Optic Connections: Direct fiber-optic links offer the constituents the ability to drive the connection at whatever speed the equipment at both ends will accommodate. The Respondent must include the cost of fiber continuity maintenance in the monthly service costs.
- Carrier Alternates: Carrier alternates providing functionally equivalent services are also encouraged.

8.1. Introduction [Response Required]

In this section, we seek solutions that offer shared bandwidth connectivity from the SOHCN Member sites to the serving SOHCN POP. While we list specific types of connections, this list is by no means intended to exclude other options. We are interested in any and all technology options.



If the shared bandwidth solution traverses a secondary Carrier network before connecting to the SOHCN Backbone, then the secondary Carrier network must be connected to at least two geographically dispersed SOHCN POPs using physically diverse fiber paths as pictured to the right. Each of the redundant aggregate links to the SOHCN Backbone must be of sufficient capacity to provide 200% of the combined CIR of the SOHCN facility connections served. Of course, this requires the Carrier to expand these aggregate links as SOHCN Members upgrade connection speeds to their facilities over the life of the contracts. The cost of the connectivity from the secondary Carrier network to the SOHCN Backbone must be included in the pricing for the individual facility connections.

Performance Specs and Definitions

Service Name	[Name/Designation]
Type	**Dedicated Bandwidth to OARnet**
Rate Table	[Number]
End-to-End Performance	
Maximum Bit Error Rate	[in "x" number of bits]
Minimum Packet Delivery	[%]
Maximum Latency	[Milliseconds]
Maximum Jitter	[Milliseconds]

Maximum Bit Error Rate = the guaranteed maximum error rate to be experienced using the Respondent's network.

Minimum Network Packet Delivery = the guaranteed minimum percentage of packets delivered end-to-end using the Respondent's network.

Maximum Latency = "not to exceed" average round-trip transmission time (in milliseconds) between the constituent site and the OARnet POP location across the SOHCN network provided by the Respondent.

Maximum Jitter = also known as *delay variation*, Jitter is defined as the variation or difference in the end-to-end delay between received packets of an IP or packet stream (in milliseconds) from the constituent site to/from the OARnet POP location across the SOHCN network provided by the Respondent.

Appendix B

Table-1: Comparison of Transfer Times for Medical Files of Increasing Sizes with Increasing Transfer Speeds, in Minutes

	4 Mb/sec	10 Mb/sec	25 Mb/sec	100 Mb/sec	1,000 Mb/sec	Total Bits Transferred
One Gigabyte of Data (1 Gb)	1.1178	0.4471	0.1788	0.0447	0.0045	8,048,000,000
Text of single clinical document (HL7 CDA format) (25 Kb)	0.0017	0.0007	0.0003	0.0001	0.0000	201,200
Ultrasound (200 Kb)	0.0134	0.0054	0.0021	0.0005	0.0001	1,609,600
Standard chart (healthy patient) (5 Mb)	0.3353	0.1341	0.0537	0.0134	0.0000	40,240,000
X-ray (10 Mb)	0.6707	0.2683	0.1073	0.0268	0.0000	80,480,000
Chest radiograph (16 Mb)	1.0731	0.4292	0.1717	0.0429	0.0001	128,768,000
MRI (45 Mb)	3.0180	1.2072	0.4829	0.1207	0.0121	362,160,000
PET Scan (100 Mb)	6.7067	2.6827	1.0731	0.2683	0.0268	804,800,000
Mammography study (4 images) (160 Mb)	10.7307	4.2923	1.7169	0.4292	0.0429	1,287,680,000
64-slice CT scan or Human genome (sequence data only) (3 Gb)	201.2000	80.4800	32.1920	8.0480	0.8048	24,144,000,000
Cellular pathology study (6 slides) (25 Gb)	1,676.6667	670.6667	268.2667	67.0667	6.7067	201,200,000,000

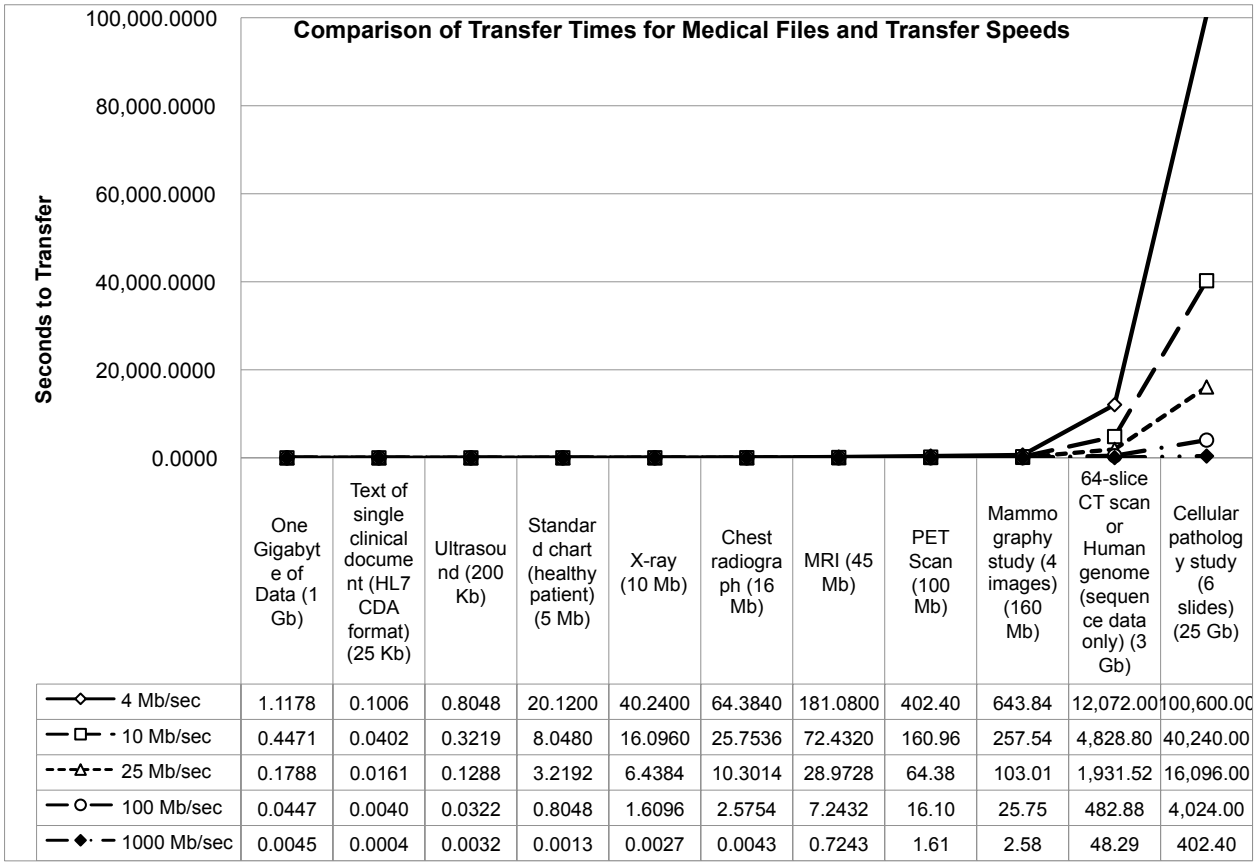
Assumptions:

Block size = 8000 bytes (Large blocks enabled)

Overhead = 48 bytes/packet

Throughput = 50% of subscribed bandwidth

Figure-1: Comparison of Transfer Times for Medical Files of Increasing Sizes with Increasing Transfer Speeds, in Minutes



	One Gigabyte of Data (1 Gb)	Text of single clinical document (HL7 CDA format) (25 Kb)	Ultrasound (200 Kb)	Standard chart (healthy patient) (5 Mb)	X-ray (10 Mb)	Chest radiograph (16 Mb)	MRI (45 Mb)	PET Scan (100 Mb)	Mammography study (4 images) (160 Mb)	64-slice CT scan or Human genome (sequence data only) (3 Gb)	Cellular pathology study (6 slides) (25 Gb)
4 Mb/sec	1.1178	0.1006	0.8048	20.1200	40.2400	64.3840	181.0800	402.40	643.84	12,072.00	100,600.00
10 Mb/sec	0.4471	0.0402	0.3219	8.0480	16.0960	25.7536	72.4320	160.96	257.54	4,828.80	40,240.00
25 Mb/sec	0.1788	0.0161	0.1288	3.2192	6.4384	10.3014	28.9728	64.38	103.01	1,931.52	16,096.00
100 Mb/sec	0.0447	0.0040	0.0322	0.8048	1.6096	2.5754	7.2432	16.10	25.75	482.88	4,024.00
1000 Mb/sec	0.0045	0.0004	0.0032	0.0013	0.0027	0.0043	0.7243	1.61	2.58	48.29	402.40