Draft Proposal for a Global TeleHealth Digital Network

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Draft Proposal for a Global TeleHealth Digital Network: TeleHealth Information and Communication Based Topology

Summary

This document outlines the basic needs in regards to videoconferencing for discussion. An outline will be developed during this and subsequent meetings to provide a foundation for a Telehealth Video Resource Center. Included is information on the underlying technology for conducting health-based videoconferencing, the processes involved to build an infrastructure that will support a telehealth videoconferencing center, and the concept of Information and Communication Technology (ICT) based activities and what effect they will have on worldwide healthcare activities.

Abstract

With the advent of high bandwidth optical networks and global access to National Research and Educational Networks (NREN), more and more ICT (Information and Communication Technology) applications and collaborative tools are becoming available to the masses all across the world. Innovative use of ICT provides a solution for bridging the digital divide . Further, development in Telehealth applications has also made it possible to use it as a first step for developing such an infrastructure for today's Global Village.

The case study provides a concept for a Technology based Community where TeleHealth applications can be used through processes mentioned.

This process allows how technology can be used as a tool for TeleHealth. It is the first look towards how ICT can change the way we live and interact in this new era.

This concept opens a gateway to the world for a Multimedia collaborative setup using high bandwidth optical networks for, affordable TeleHealth services to the remote and desolate communities.

Background Case Study

Project Description: Global TeleHealth Digital Network for Bridging Digital Divide
City: Columbus
Country: USA
Web address: www.osc.edu
Up and running since: 03-24-2005

User group: Academia, Government, industry, NGO's, Not-for-Profits and Private Citizens
Geographical focus: Global
What you can learn from the project: Setting up an ICT-based virtual collaboration community to bridge the digital divide.

Objectives and innovation

Information and communication technology has revolutionized not only computer technology but all aspects of life. A collaborative environment can become an asset for underdeveloped regions of the world, including rural communities. For example, collaborative envrironments can allow secure telehealth global networks for fully equipped hospitals to provide services to underserved regional centers and can include even remote instrumentation for diagnosis.

Suggested Approach and Topologies:

In the above-mentioned case study, the objective was to design a virtual network that would support multimedia and collaborative applications. One of the major components used H.323 based high-definition videoconferencing for these activities, H.323 is an International Telecommunication Union (ITU) standard used for Internet-based delivery of voice video and data.

Suggested Equipment:

The suggested equipment at each site is a hardware-based, high definition H.323 unit that also supports H.239, an H.323 standard that separates video and data traffics in two different channels. This allows high-resolution images as well as audio. All major vendors such as LifeSize, Tandberg, Polycom and Sony now market such equipment. The unit can be nicely integrated into room systems and can also be optimized for telepresence, which creates an illusion of all virtual sites being in the same room just across each other.

To get the best possible results all equipment needs to be high-definition, end-to-end including any projectors, LCD panels, video switchers and mixers etc.

Site Certification Process:

A site certification process is necessary so that each site is standardized and optimized in regards to equipment and dedicated contacts for a specific event. Each site is requested to fill out a web-based database form that allows the Ohio Supercomputer Center staff to receive all relevant information. This information is also kept for future interactions with the site; if any changes occur, then the sites must re-certify. Please see the following example for typical database entries:

Name: Jon Miller
Title: Technology Coordinator
Phone: 614-292-9191
Organization: Ohio Supercomputer Center
Organization Website: http://www.osc.edu
Email: support@oar.net
Timezone: Eastern Time / +5
External IP: 65.123.45.20
Connection Speed: 2 mbps to 5 mbps
Equipment Make/Model: LifeSize Room
Video Equipmet Software Version: Release 3.5.2 - 31Mar2008
Phone in room (ER): 614-292-9191
Internet 2 Connectivity or similar network: Yes
Number of Sites: 2
Date and time to test: Friday, February 15, 2008 - 9:00 AM EST

As soon as OSC staff receive the information, a test is scheduled. Initially the testing is done using network tools to check if there are any bottlenecks between the site to the Multipoint Control Unit (MCU).   If a technical problem is noticed, then a report with some suggestions are sent.

Once any problems are resolved, then a physical test with the videoconferencing equipment using an MCU is done. This is generally run for few hours at a time when the requesting sites network is the most busy.

During the certification process, the sites are also requested to have Skype installed on one of their computers for any backstage communication; this allows all the technical folks and presenter to be informed of any changes and suggestions during the event.

Cost Factor

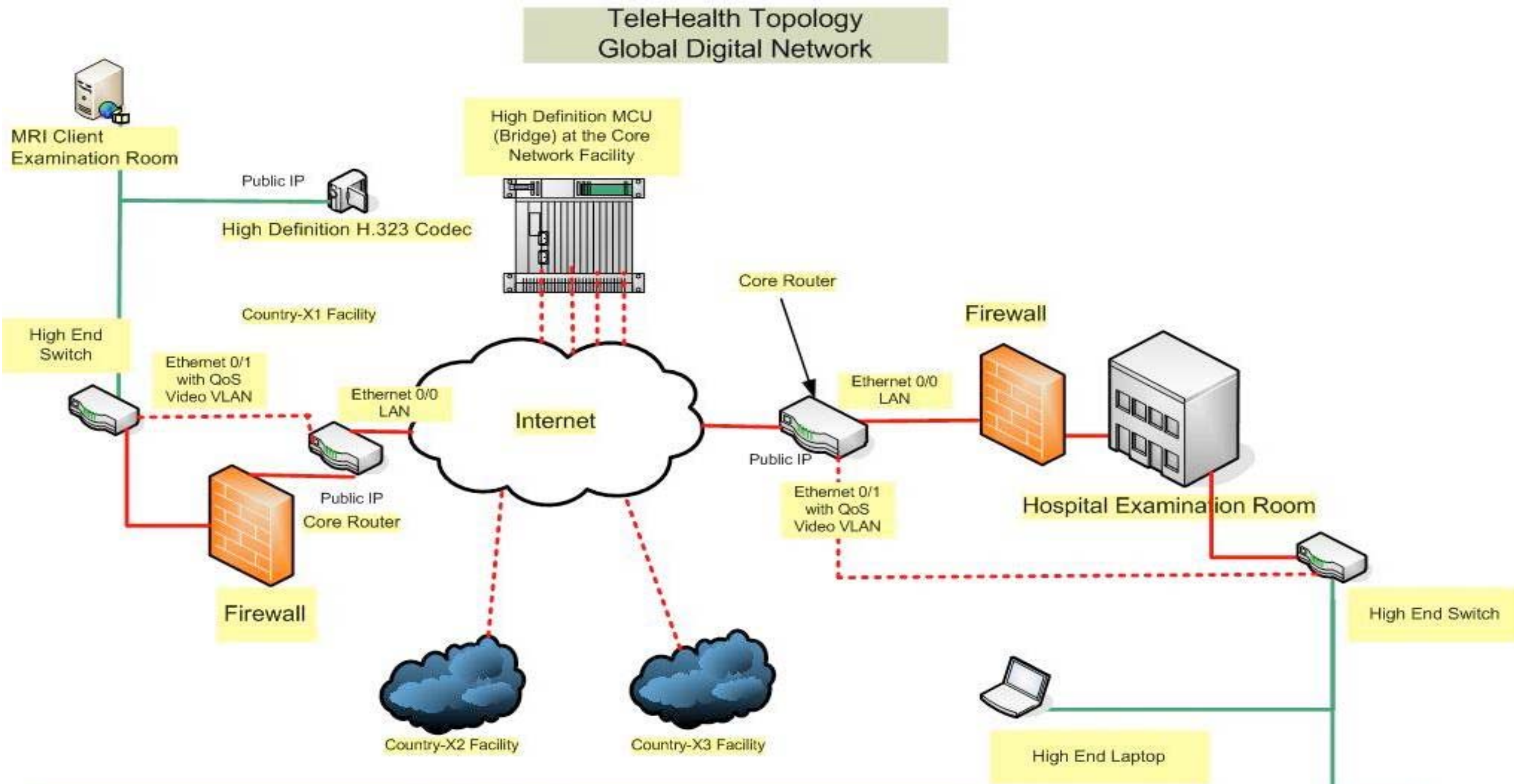
The following cost estimate is for a basic network setup; you may add more for remote instrumentation equipment like an MRI or electron microscope:

H.32-3 based High Definition videoconferencing units supporting H.239 range from $9,000 - $25,000.

At least one high-end laptop or PC at each site - $2000

Cables and other accessories - $500

Consider additional cost if networking equipment needs upgrading and the additional cost of peripheral items such as HD LCD, projectors, etc.



The topology quoted here could serve as Video VLAN for any facility.

If there are two Ethernet ports on your edge router one can feed your LAN and the other can be used as a Video VLAN. This configuration requires subnetting your public IP addresses and assigning one small subnet to this connection. A diagram is attached. Of course, your network requirements may differ from this one example.

In addition to configuring your network to bypass your local LAN traffic, you can set up Quality of Service (QoS) on your router to give priority to videoconferencing, this may be an option depending on the type of router you have.

Wide Area Network
Local Area Network

Implementing QoS through Better Practices

With these topologies, there is still a possibility of dealing with packet shapers, load balancing and other technical issues that may cause out-of-order packets. Eventually, the quality may be affected. A more robust solution would be to bypass almost all problems by using a second port of the router and dedicating a video VLAN.

Lessons

The major hurdles were:

- No existing examples prior to the project
- Remote multimedia collaboration tools firewall and packet-shaper issues
- Connection and quality issues
- Network security policies for most of, health care, government, and commercial not-for-profit entities do not allow open firewall applications so the proposed topology needed to work through the existing firewalls
- Overloaded switches routers can cause problems in terms of adding jitter and latency

Recommendations

Based on extensive testing and years of production the lessons learned could be summarized into few points. There are many requirements to ensuring a successful videoconference or remote instrumentation. Here are the seven recommended steps for implementing at your institution:

1. No one knows your equipment and network better than you.
Having onsite staff to operate equipment and troubleshoot problems is critical to success. H.323 is highly dependent on networks, and network engineers will be your best resources for fixing problems. On the other hand, H.323 is not an added service, but instead, has a very sensitive nature and users need to follow this set of best practices.

2. Have enough bandwidth.
All internal network connections and paths should be at least 100MB FULL DUPLEX hard coded from both sides of any routers and/or switches and videoconferencing equipment (Fig. 1). Older equipment and switches supporting 10MB HALF DUPLEX are not recommended. Duplex mismatches tend to cause most of the problems, following are the recommended settings.

Recommended Duplex settings (Fig. 1)

SETTINGS			RESULTS	
switch	device		switch	device
auto	auto		auto	auto
half	half		half	half
full	full	GOOD!	full	full
auto	full	BAD!	half	full
full	auto	BAD!	full	half
auto	half		half	half
half	auto		half	half

Videoconferencing efforts will be optimized when only 50% of the total available bandwidth is being used and there is no other competitive traffic.

You may also want to add this bandwidth requirement for videoconferencing to your H.323 topology if you are setting up a VPN/VLAN. For example:

- 384 kbps call will require 768 kbps dedicated
- 512 kbps call will require 1024 kbps dedicated
- 768 kbps call will require 1536 kbps dedicated
- 1472 kbps call will require 2944 kbps dedicated
- 1920 kbps call will require 3840 kbps dedicated

Note: Units generally support High Definition starting at speeds of 1 mbps and above.

3. No handmade Ethernet cables.
Regardless of how good your staff is at making Ethernet cables, the cables won't be good enough. Factory-made Cat 6 augmented or above should be used these are shielded and do not allow cross talk. Try to keep cables away from electrical fields and outlets. Cable runs should be as short as possible.

4. No hubs, only switches and routers.
Use only programmable high quality switches and routers in your videoconferencing networks. Hubs should be eliminated. No Netgear or Linksys auto-negotiable switches should be used. Also, make sure routers and switches have enough processing power, the network should be configured in a way that high utilization paths should be avoided for video traffic. Any broadcast and multicast traffic should be isolated from the video network VLAN's are a real good solution.

5. Put video equipment outside the firewall or use VPN concentrator
Videoconferencing, remote instrumentation equipment and firewalls, NATS, or packet-shapers don't play well together. Regardless of how well you configure the firewall and

packet-shapers, it still may cause problems. Packet -shaping and load balancing is another important factor to consider since the video streams and remote instrumentation traffic diverted through more than one route or physical connection can induce out-of-order packets, causing serious problems.

It is recommended that if the facility edge router has a second open router port, use it for bypassing all the packet-shapers, firewalls etc. and use it as a video and remote instrumentation LAN. VPN devices have built-in firewalls that can provide all the added protection for this second port. The traffic remains isolated from all the LAN traffic while the built-in VPN firewall is not bombarded by the extra LAN traffic, thus keeping the quality good. This topology quoted above could serve as a secure-encrypted multimedia and remote instrumentation VLAN for any facility (more benefits can be discussed at a later stage).

This configuration requires sub-netting your public IP addresses and assigning one small subnet to this connection. In addition to configuring your network to bypass your local LAN traffic, you can set up Quality of Service (QoS) on your router to give priority to the traffic; this may be an option, depending on the type of router you have and there are bandwidth constrains.

6. All video equipment should have the latest software.
Software is constantly being improved and upgraded. It is crucial to update your software to ensure compatibility and ease of use.

7. Test, Test, Test.
Test your equipment well before the event and make sure everything is working as expected. Changing your IP address may cause significant delays in making a connection. Also, any video mixing boards may induce unwanted effects in the video and/or audio quality.

Summary

In summarizing this virtual environment, it could well be pointed out that considerable discussion has taken place in recent years with respect to secure ICT applications. While the topology in this case study focuses on meeting local needs first, the ultimate goal of this virtual community-oriented topology development approach is to allow diverse groups to benefit from the R&D efforts of the developed regions and to provide secure services. This model is a very flexible and scaleable ICT based topology, which can be used for any environment and for great benefit to these communities.

Extensive work has also been done on developing a secured encrypted multimedia topology which will meet or exceed any HIPAA requirement for such an environment. This topology can further be modified to support other applications that can assist with ICT based socio-economic development of any underdeveloped or underserved regions.
