

Immersive Medical TelePresence 2006

Opening Remarks and the Purpose of the Workshop

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IMT-2006 Phoenix

Thanks

- Thanks to
 - The Working Group that had the idea for this conference and pushed it through
 - Michael J. McGill
 - Ted Hanss
 - Chris Hodge
 - Bob Riddle
 - Stephen Papadopoulos of BNI
 - Donna Goyette and others of the BNI staff
 - Marie Modrell and others of the Internet2 staff
 - Our sponsors
 - Others I am sure I have missed

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Agenda

- Why IMT-2006 ?
- What do we hope to accomplish here ?
- What can technology do (and not do) for telemedicine ?
- Uses for high bandwidth in Medicine
- Some questions to consider.
- Steps for the future.

Why IMT-2006 ?

- At one level, this is simple.
- The beginning of this workshop was a series of discussions and emails in the Spring of this year, after the SURA-VIDE meeting in Atlanta, about the increasing medical interest in high quality video and high-bandwidth medicine in general.
 - I spoke up and said, “I know the perfect place for it.”
 - And here we are...

Why IMT-2006 ?

- At another level...
- Given that there *is* increasing interest in high-bandwidth medicine, the most important thing we can do is to bring the players together and begin to form a community together.
- This is what we are starting here.
- So, the biggest question facing us is, is there a critical mass to continue this ?
 - Should there be a IMT-2007 ? And, what form should it take ?

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High Bandwidth Medicine

- As we all know, there is rapid progress in
 - Bandwidth availability
 - CPU power
 - Data storage availability
- I wanted to describe a little of what is (and is not) going to be possible soon.
 - I will focus on video
 - It's technically very demanding
 - I understand the problems better...

What Does Video Require ?

- Low quality Video Conferencing : 128 Kbps
- Good quality SD Video Conferencing: 512 Kbps
- HD Video Conferencing : > 1 Mbps
- Broadcast Quality SD : 6 Mbps
- Broadcast Quality HD : 16 Mbps
- DV Video : 30 Mbps
 - (very low latency)
- Real Time 3-D imaging : 1 Gbps ?
 - (~ 1000 HD quality screens)

What Can Networks Deliver ?

- Internet 2 or other RENs
 - Now : 10 Gbps backbone
 - Usage this morning is at the 1-2 Gbps level
 - The Next Generation Internet2
 - Initially provisioned with 10 Gbps wavelengths
- Commercial Networks
 - Of course, these vary widely, but T1 circuits (1.5 Mbps) for video-conferencing access are now common, and bandwidth charges as low as 10's of \$ / Mbps / Month are obtainable in cities.
 - So, basically every quality up to and including DV can be supported.

What Can't Networks Deliver ?

- Latency is still set by physics
 - Speed in fiber is still about $1/3$ to $1/2$ c
- Typical Latencies :
 - Within a hospital complex, 1 msec RT
 - Within a city 10 msec RT
 - Regional 30 msec RT
 - National (US) 80 msec RT
 - Transatlantic 120 msec RT
 - Global (US-India) 240 msec RT
 - Satellite (1 hop) 240 msec RT

(Note : in normal conversation, RT latencies start to become bothersome at about 200 msec.)

Uses for High Bandwidth in Medicine

- Teaching, training
 - Surgery and elsewhere (for example, here at BNI)
 - High bandwidth, can tolerate latency.
- Remote Diagnosis
- Telepsychiatry
 - Medium to High bandwidth
- Consultations (Dr to Dr)
 - All Medium to High bandwidth, but can tolerate latency
- Trauma Evaluation
- Disaster Triage
 - The biggest problem may be arranging bandwidth and electricity
- Tele Surgery
 - High bandwidth, **cannot** tolerate latency, high risk to life

Some Questions to Consider

- As it becomes **possible** to record everything that happens in a surgery, will it rapidly become viewed as **necessary** ?
 - Black Box or Big Brother ?
 - 50 Mbps x 5 hours = 113 Gbytes
 - A hospital could easily require Terabytes / day of storage.
- Will the existing network services be suitable for high bandwidth applications with high risk to life, or will Medicine migrate to a specialized network ?
 - A related question is, who can be held responsible if people die because of network outages ?

Another Question to Consider

- How will standards be set for
 - Video displays
 - Auxiliary Data
 - Recording ?
- Can the existing standards bodies do this for Medicine, or will there need to be specialized groups or bodies for this ?

Hospital Network Requirements

- I know of large Hospitals that are run off of 1 100-Base-T spanned Ethernet LAN
 - This is not likely to be sufficient in the high-bandwidth future.
- Suppose 1000 beds, each with 512 Kbps Videoconferencing capabilities, 10 operating rooms, each with 50 Mbps video / data feeds, and 1 Operating Theater, @ 200 Mbps.
 - Internal requirement is 1.2 Gbps
 - External bandwidth requirement is > 100 Mbps.
 - This is on top of existing uses, such as VOIP or prescriptions.

Conclusion

- The falling cost of bandwidth and improvements in video and data casting abilities are going to lead to improved medical care and better efficiencies.
- It is hard, in my opinion, to see where the end is. We are too close to the beginning.
- At the end of the conference, we need to re-address the community here and how we go forward.