Endoscopy Training Over High-Speed Networks: A Tale of Three Technologies

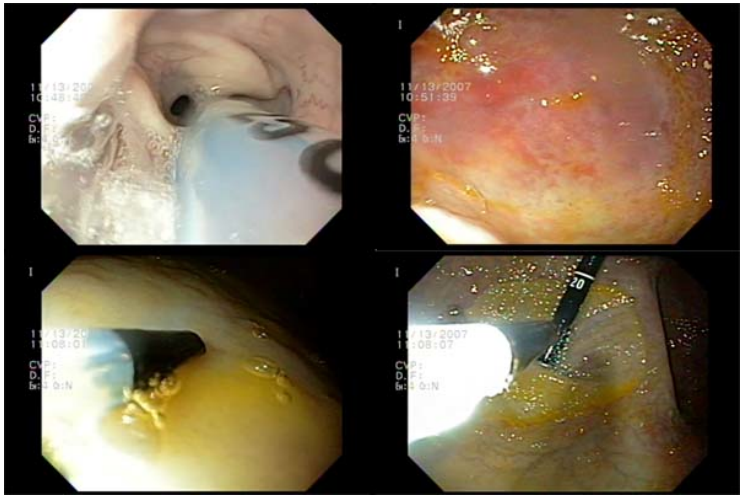
José G. Conde, Priscilla Magno,
Manuel Más and Aníbal Vega

Internet2 Health Sciences Workshop
Internet2 Fall Member Meeting
San Antonio, Texas
October 8, 2009

Streaming of Endoscopic Videos to the Johns Hopkins Hospital over High-Speed Networks

November 13, 2007

Streaming of Endoscopic Videos from the UPR Experimental Surgery Lab to the Johns Hopkins Hospital over High-Speed Networks



Use of DVTS for Live Transmission of Medical Endoscopic Procedures During a Medical Symposium in Puerto Rico

March 10-11, 2008

PRE-CONFERENCE SYMPOSIUM:
Endoscopic Imaging and Therapies for Gastrointestinal Neoplasia: Today and Tomorrow

March 10 and 11

CONFERENCE

March 12 - 15

NURSING WORKSHOP

March 12

JOHNS HOPKINS MEDICINE
CONTINUING MEDICAL EDUCATION

DIVISION OF GASTROENTEROLOGY
presents

Eighth Annual

Gastroenterology and Hepatology

Viva la Vida

March 10 - 15, 2008

Intercontinental San Juan Hotel
San Juan, Puerto Rico

KLINIKUM der Johannes Gutenberg-Universität Mainz

Centro Comprensivo de Cáncer

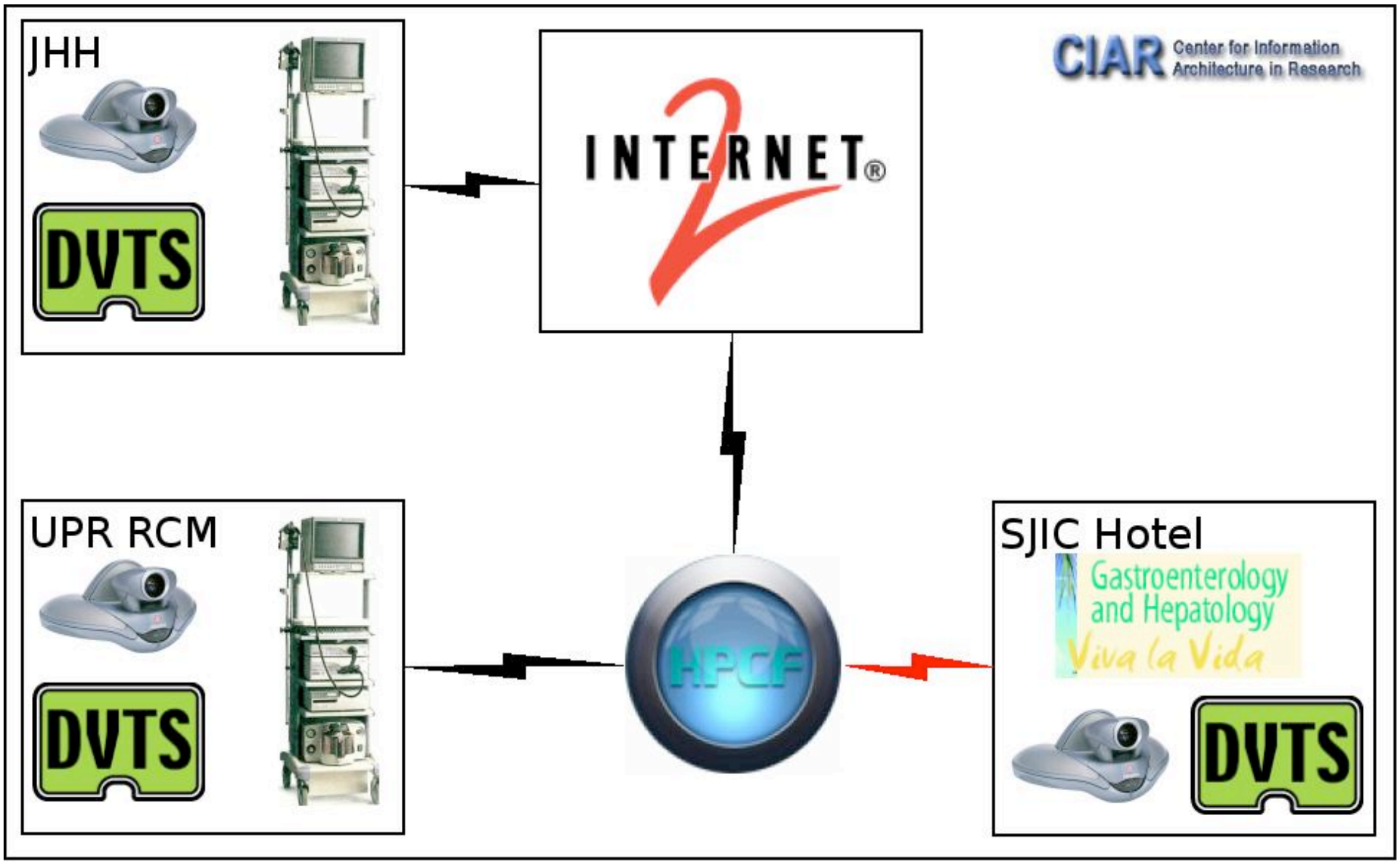
ASGE

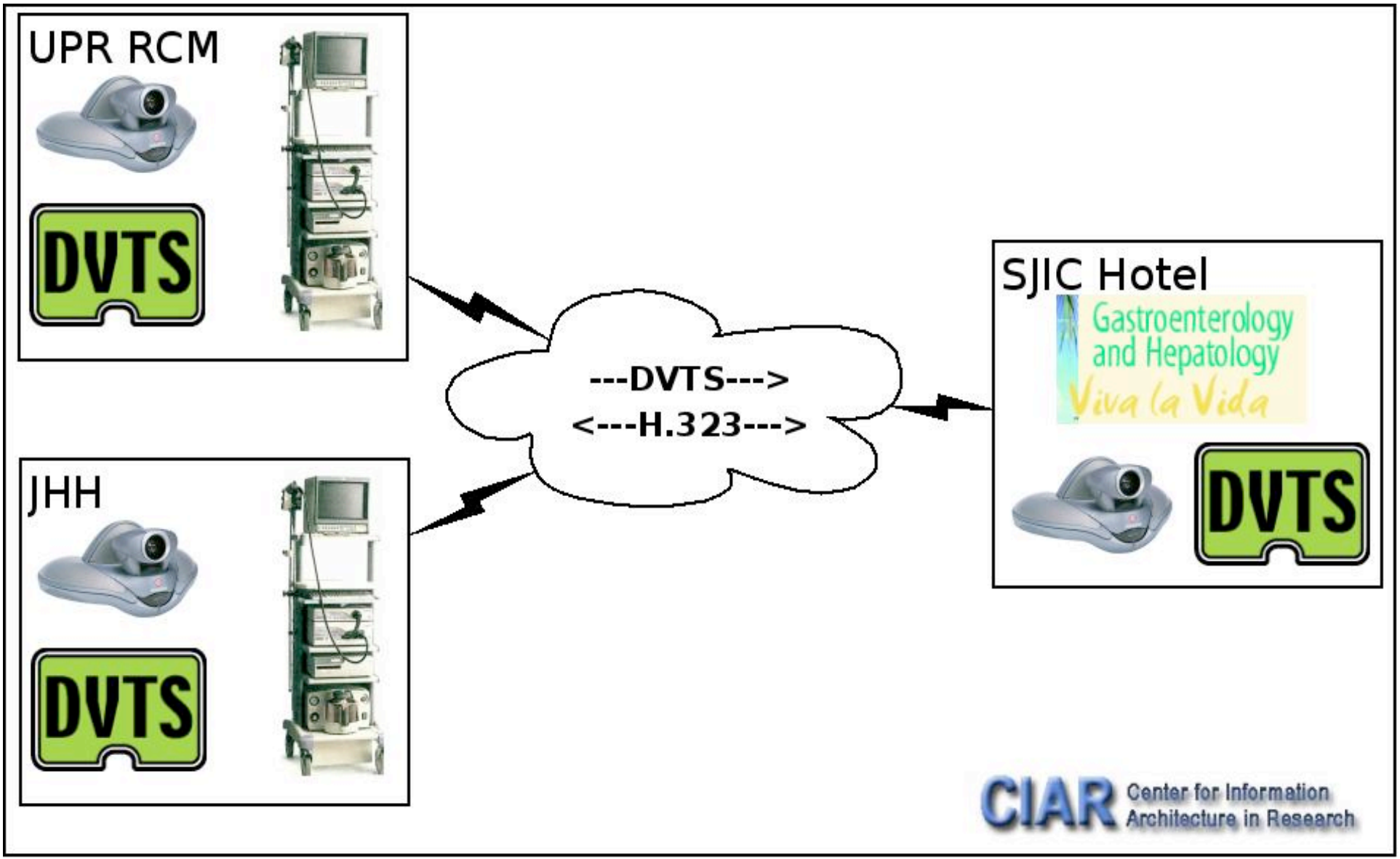
Jointly presented by The University of Mainz, Germany and The University of Puerto Rico Cancer Center
Endoscopic Nursing Workshop jointly provided by The Institute for Johns Hopkins Nursing
This course meets the guidelines as established in the "Framework for Post-Residency Surgical Education and Training" and is endorsed by the Society of American Gastrointestinal Endoscopic Surgeons (SAGES).

Objectives – Pre-Conference Symposium

After attending this activity, the participant should be able to:

1. Briefly summarize the principles and evidence for the evaluation and treatment of gastrointestinal neoplasia using currently available and novel endoscopic imaging modalities and minimally invasive therapies
2. Demonstrate basic and advanced techniques of endoscopic imaging and therapies for gastrointestinal neoplasia through live endoscopic procedures
3. Obtain the hands-on experience for gastrointestinal and surgical endoscopists for confocal endomicroscopy, endoscopic mucosal resection, endoscopic submucosal dissection, radiofrequency ablation, cryotherapy, EUS-guided therapy, and natural orifice transluminal endoscopic surgery (NOTES)


JHH
DVTS
INTERNET2
CIAR Center for Information Architecture in Research
UPR RCM
DVTS
HPCF
SJIC Hotel
Gastroenterology and Hepatology
Viva la Vida
DVTS


UPR RCM
DVTS
JHH
DVTS
---DVTS--->
<---H.323--->
SJIC Hotel
Gastroenterology
and Hepatology
Viva la Vida
DVTS
CIAR
Center for Information
Architecture in Research

Key Components

- Image Processor:
  - Olympus Evis Exera II CV-160

- Light Source:
  - Olympus Evis Exera II CLV-160

Key Components

- DVTS software
  - Open source
  - Low latency
  - SD resolution (488 @ 30 fps)
  - Uncompressed video (30 Mbps)
  - Portable

Key Components

- Canopus ADVC110
  - DVTS compatible
  - Very stable
  - Consistent results

Key Components

- Datavideo SE-500
  - Inexpensive S-Video and composite video switcher
  - Manage feeds from more than one instrument/room into a single DVTS feed per site.
  - Two persistent DVTS feeds (one per site) at the hotel to facilitate coordination.

Key Components

- Polycom H.323 Endpoints
  - Of-the-shelf solution for interactions
  - Compact, fits on the operating/procedure room
  - Solves the most overlooked but essential component in a video conference: the audio channel
  - Acceptable video quality for interactions

Key Components

- Codian MCU 4205
  - For management of H.323 videoconference interactions
  - Extensive conference customization options
  - Easy to do tweaks on the fly via browser
  - Used as a video switcher between sites to minimize disruptions, creating a better experience for the attendants at the hotel

Key Components

- Skype Chat
  - Of-the-shelf functionality.
  - Back channel for technicians.

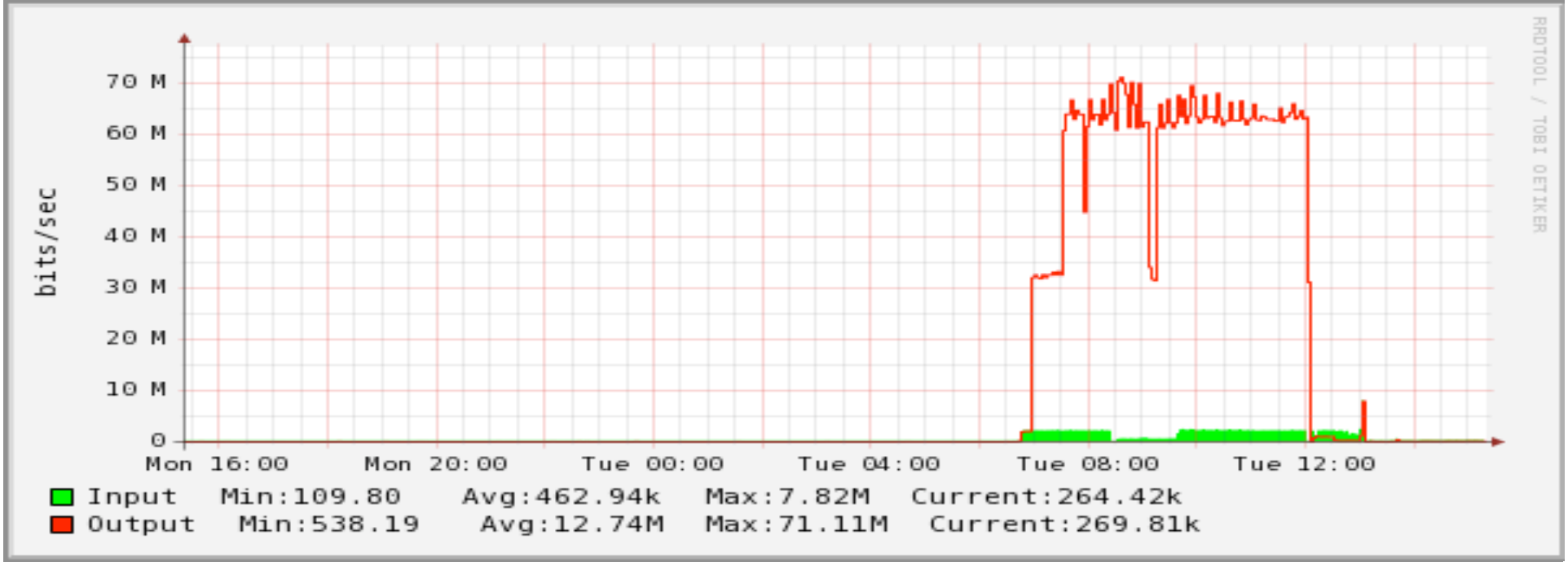
Key Components

- 4 Telephones
  - One for the site coordinators at each endoscopy site (2) in charge of all the coordination technicians and endoscopists.
  - One wireless phone for the general coordinator a the hotel.
  - One cellphone with headset for the event moderator at the hotel.

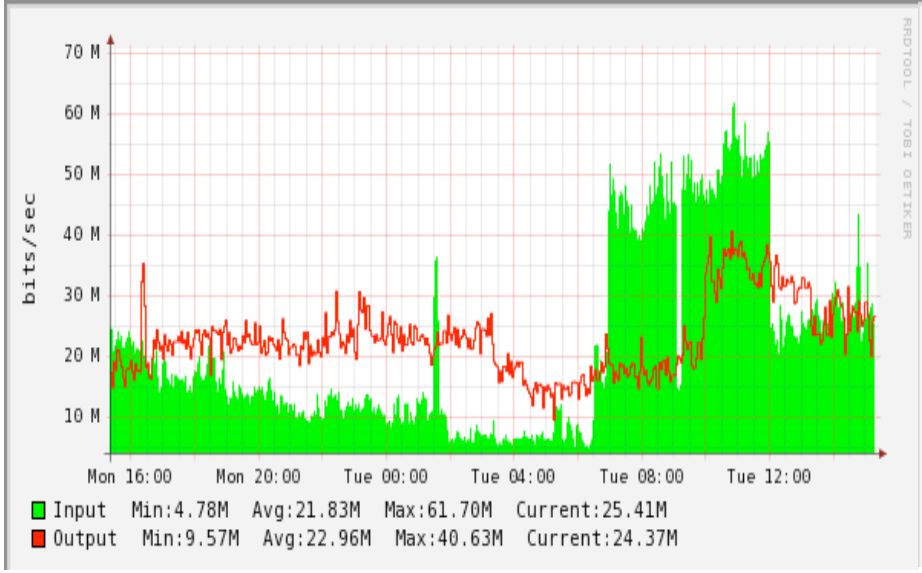
Streaming of Endoscopic Videos from the UPR Experimental Surgery Lab and from the Johns Hopkins Hospital to Viva la Vida Symposium

Streaming of Endoscopic Videos from the UPR Experimental Surgery Lab and from the Johns Hopkins Hospital to Viva la Vida Symposium

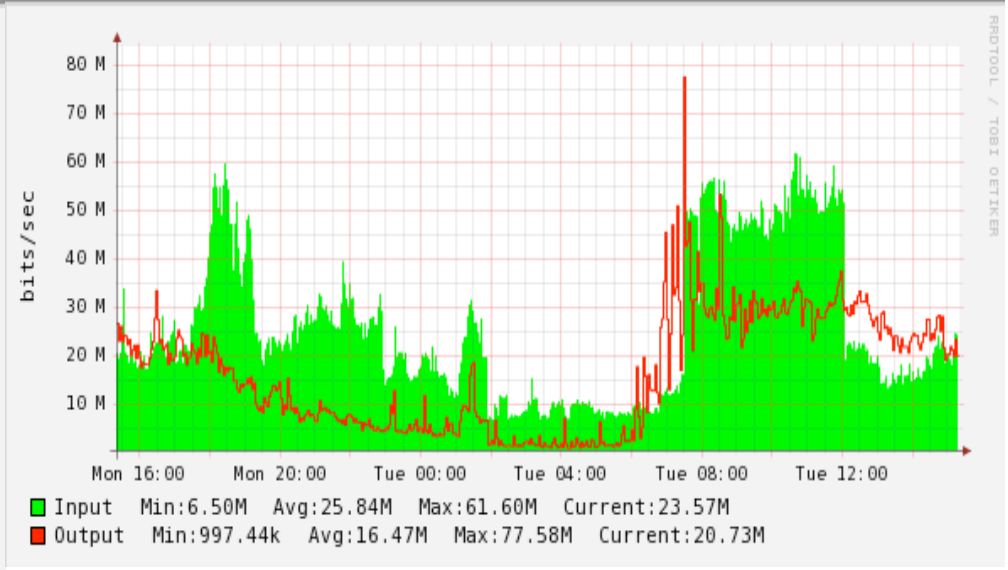
HPCf-Intercontinental I/O Statistics



FIU/Internet2(GE) I/O Statistics



OC3_ATM from RCM I/O Statistics



Test of Multisite Endoscopic Video Streaming with Conference XP

September 18, 2008

Key Components

- Image Processor:
  - Olympus Evis Exera II CV-160

- Light Source:
  - Olympus Evis Exera II CLV-160

Key Components

- Shared source
- Low latency
- Multicast/unicast capabilities
- SD resolution (488 @ 30 fps)
- UP to 30 Mbps stream
- Portable
- Clients for sending or receiving endoscopy video at each site
- Multicast venue server and unicast reflector
- Venues are password-protected and stream is encripted (triple DES with 192 bit key).

Key Components

Polycom H.323 endpoints

Canopus ADVC110

Codian MCU 4205

Skype Chat

Sites

- Transmitting
  - Experimental Surgery Lab, UPR School of Medicine
- Receiving
  - Office of High-Performance Computing and Communications Collaboratory, National Library of Medicine, NIH
  - Digital Media Group Studio, Johns Hopkins Hospital
  - Office of Enabling Technologies, University of Michigan School of Medicine - unicast
  - ICELab, Rochester Institute of Technology
  - UPR High-Performance Computing facility - and reflector host

HD Endoscopy

- Endoscope camera:
  - Olympus GIF-H180
  - HD capable

- Image Processor:
  - Olympus Evis Exera II CV-180
  - HD capable

- Light Source:
  - Olympus Evis Exera II CLV-180

HD Endoscopy

Transmission Hardware

- LifeSize Room 200
  - HD capable at:
    1080i @ 60 fps
    1080p @ 30 fps
    720p @ 60 fps
  - H.264 codec (6 Mbps)
  - Embedded HD Multipoint Control Unit (4 visible connections)
  - Encryption (H.235)

HD Endoscopy

Interface: Component Video Cables

Image processor monitor

HD videoconference unit

Acknowledgments

LATIN AMERICA

GASTROENTEROLOGY & HEPATOLOGY

JOHNS HOPKINS DIGITAL MEDIA GROUP

Puerto Rico Cancer Center

University of Washington
Computer Science & Engineering

Center for Collaborative Technologies at the University of Washington

Surgical Research Lab
UPR School of Medicine

Acknowledgments

This project is supported **by grant number G12RR03051 (RCMI Program, University of Puerto Rico Medical Sciences Campus)** from the National Center for Research Resources (NCRR), a component of the National Institutes of Health (NIH). Its contents are solely the responsibility of the authors and do not necessarily represent the official views of NCRR or NIH.