

# Data Flow, Networks, and Protocols

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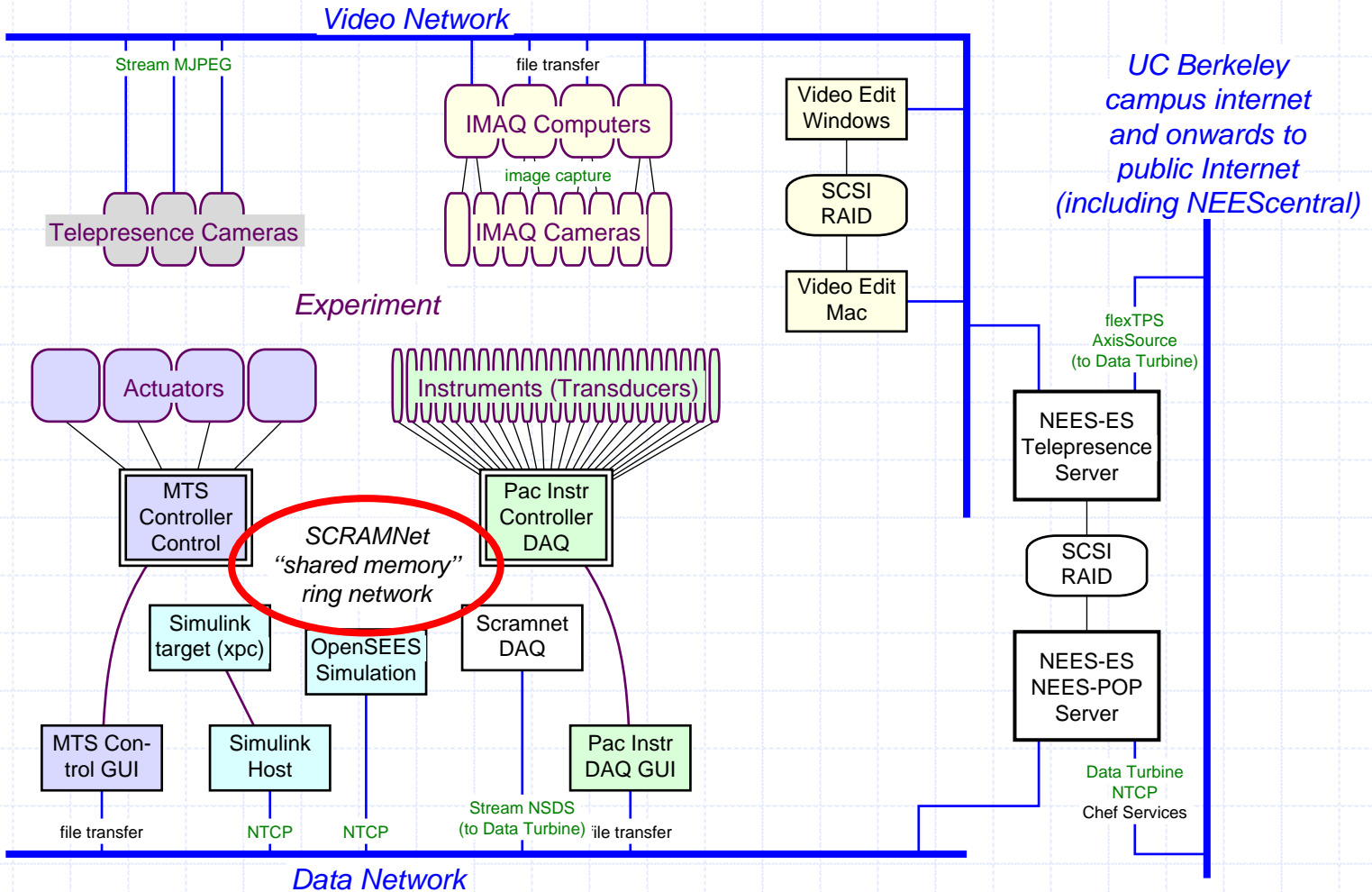
The George E. Brown, Jr. Network for Earthquake Engineering Simulation



# Three Uses for Data

- ◆ Feedback for hybrid simulation models and processes (high sample rate and low latency).
- ◆ Streaming to observers and researchers (low sample rate, some latency)
- ◆ Capture for post-experiment analysis and archive (high sample rate and high latency).

# Network Diagram



# DAQ Data Capture to Files

- ◆ Mostly involves processes proprietary to the Pacific Instruments DAQ.
- ◆ Complete set of all readings.
- ◆ Could be large (depends on sample rate).
- ◆ Not available until acquisition run completes.
- ◆ “Export” post-run processing required.
- ◆ Likely exported data files are uploaded to NEEScentral.

# DAQ Data Streamed to Internet

- ◆ Pacific Instruments DAQ writes readings to SCRAMNet.
- ◆ “SCRAMNet DAQ” (application based on Paul Hubbard’s “Fake-DAQ”) reads data and sends to Data Turbine (DT).
- ◆ Clients connect to DT with Real-Time Data Viewer (RDV).

# NEES Telepresence

- ◆ Telepresence cameras stream Motion JPEG.
- ◆ NEES application “FlexTPS” gets MJPEG streams and serves them via web server.
- ◆ Clients view near real-time videos using their web browser.

# Stream Video with DAQ Data

- ◆ Telepresence cameras stream Motion-JPEG.
- ◆ NEES application “AxisSource” gets MJPEG stream and sends it to the Data Turbine.
- ◆ Clients view images (with numeric data) using the Real-Time Data Viewer.
- ◆ Images and numeric data are fairly synchronized.

# Image Acquisition

- ◆ Most cameras have specialized control and image-capture applications that run on computers.
- ◆ At end of acquisition run, applications write images to computer disks in industry-standard image and video formats.
- ◆ Also capture image and video from tape (DVRs) and compact flash (still images).
- ◆ Files uploaded to computers for video editing.
- ◆ Likely files uploaded to NEEScentral.

# Hybrid Simulation

- ◆ Simulation models interact with physical experiments using SCRAMNet to convey state information and commands.
- ◆ Models (we use MATLAB and OpenSEES) run on simulation computers.
- ◆ The simulation computers convey results to an intermediate computer (xPC) that divides large-sized simulation steps into substeps (interpolate where it can, extrapolate where it must) in accord with rate of MTS system (1024 Hz).

# Thank you!

Development and operation of the nees@berkeley equipment site is sponsored by NSF.

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