Remote Operations & Maintenance

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- GAN != Remote Operations
- What might Remote Operations look like?
- Bandwidth & collocation
- Two activities to watch:
  - Multipurpose Virtual Laboratory
  - The Access Grid
- Social impact
- Conclusions

GAN != Remote Operations

"Ambitious accelerator projects should be carried out by a world wide collaboration of accelerator laboratories" (A. Wagner)

A GAN is:

distributed symmetric collaboration of equal partner institutions

speak of a "site laboratory", not a "host laboratory"

partners are responsible for sub-systems matching their expertise

Remote Operations allows experts to remain intimately involved

But "Remote Operations" is a separable topic!

Eg can/do speak of "non-GAN-like Remote Operations"

2001: **2** ICFA reports on GAN, 1 management, 1 technical

2002: **3** Workshops: Cornell, LBNL, Shelter Island

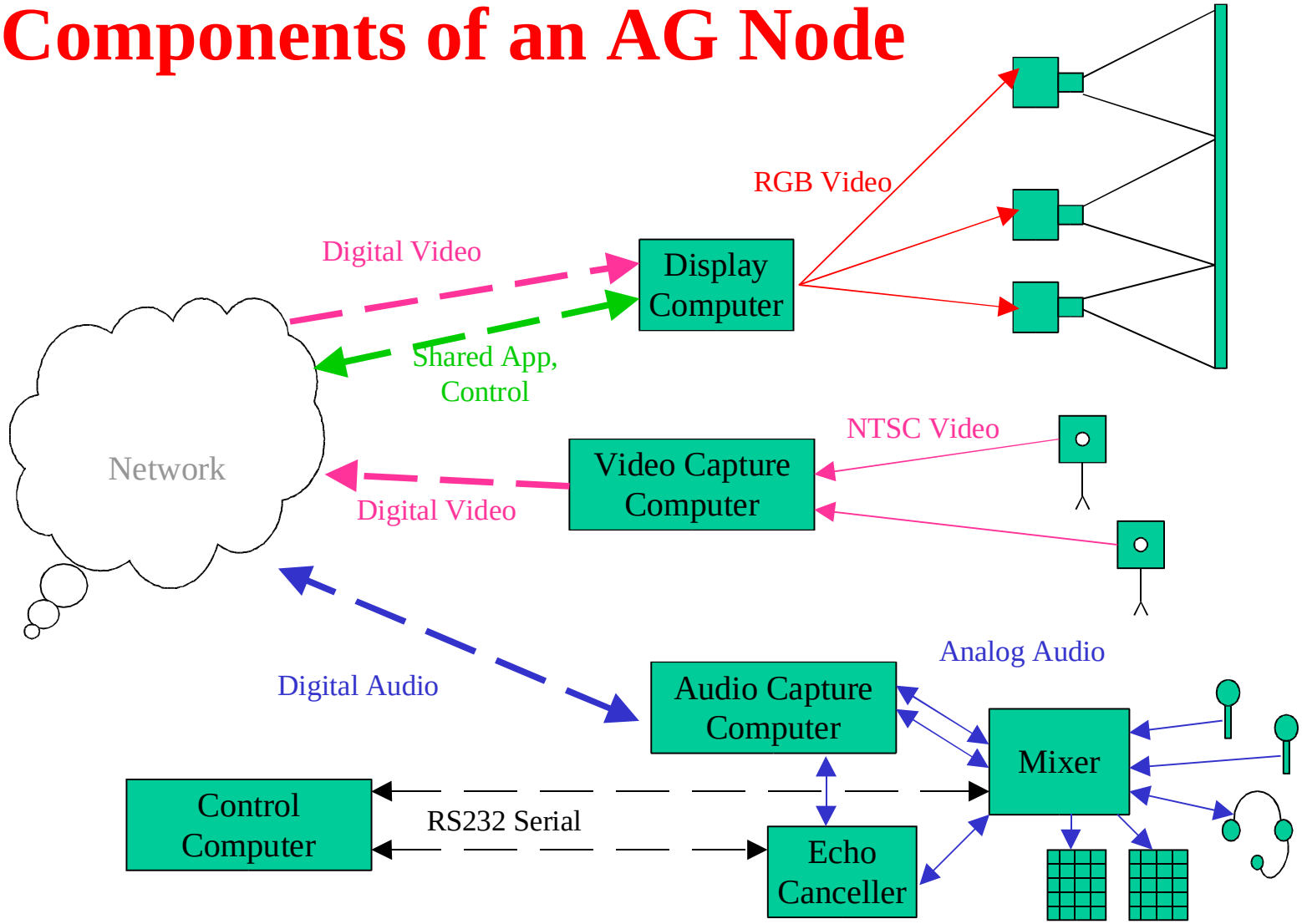
2003: **1** Workshop: Trieste (Oct.)

What might (multi-site) Remote Operations look like?

Access Grid Node: designed for group to group interaction

All participants can see, & naturalistically hear, all others

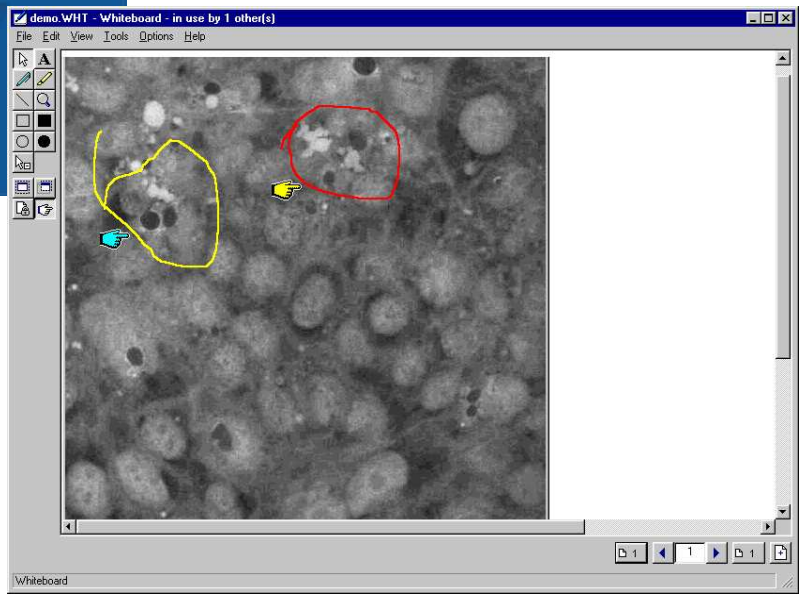
Components of an AG Node



Smaller group meeting ...

Eg a shift change

or expert consultation

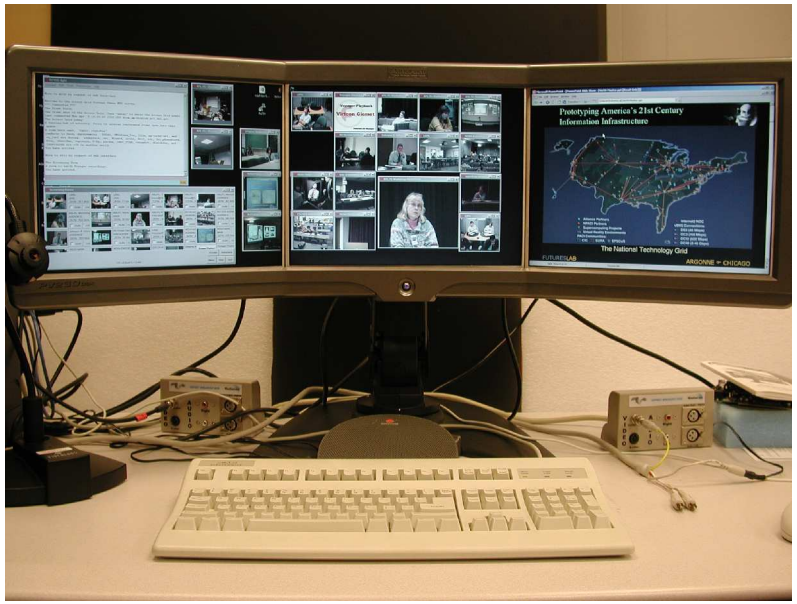


Shared whiteboards/displays

Sense of "presence"

Serendipitous encounters (coffee room, corridor) are essential to communication & "team building"

Communication modes must be as simple and reliable as a telephone



Remote Control Room

Scenarios:

1) symmetric synchronous
2) symmetric sequential
3) Asymmetric

Asymmetric:

Don't duplicate the entire control room, just enough identical displays, plus "presence"

Operations user groups

"Ops" = everything to make accelerator work well

commissioning, running, pushing performance understanding
troubleshooting, repairing, and maintaining, upgrading

Operations User Groups:

ops crews and co-ordinators
accelerator physicists
instrumentation (& other subsystem experts)
application programmers
control system integration experts
system administrators

Bandwidth and collocation

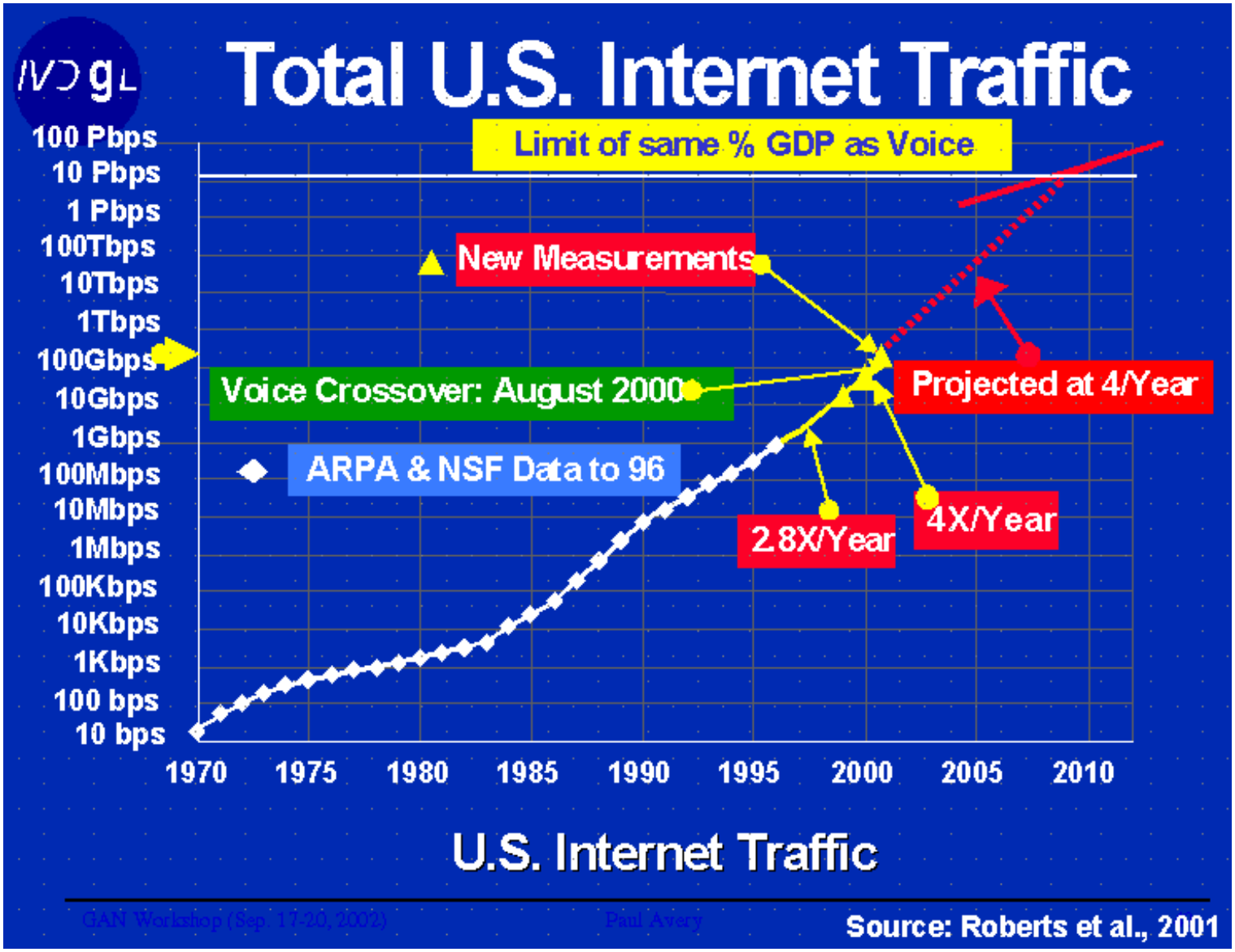
Collocation: feeling of presence in the other location

Depends on fidelity of the communications channels

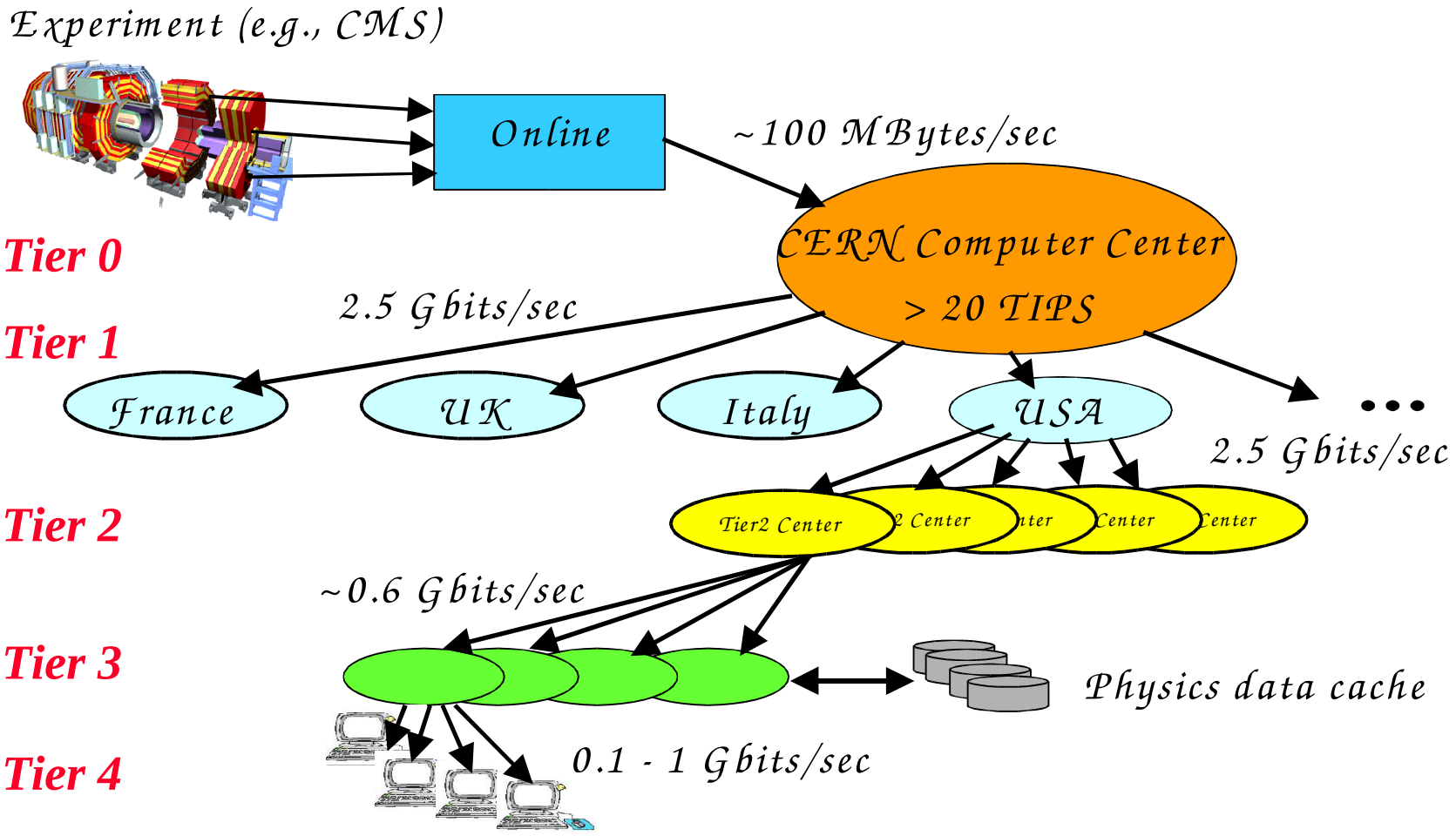
- low latency/lag
- **high-bandwidth** (match to senses)

The degree of **immersion** achieved

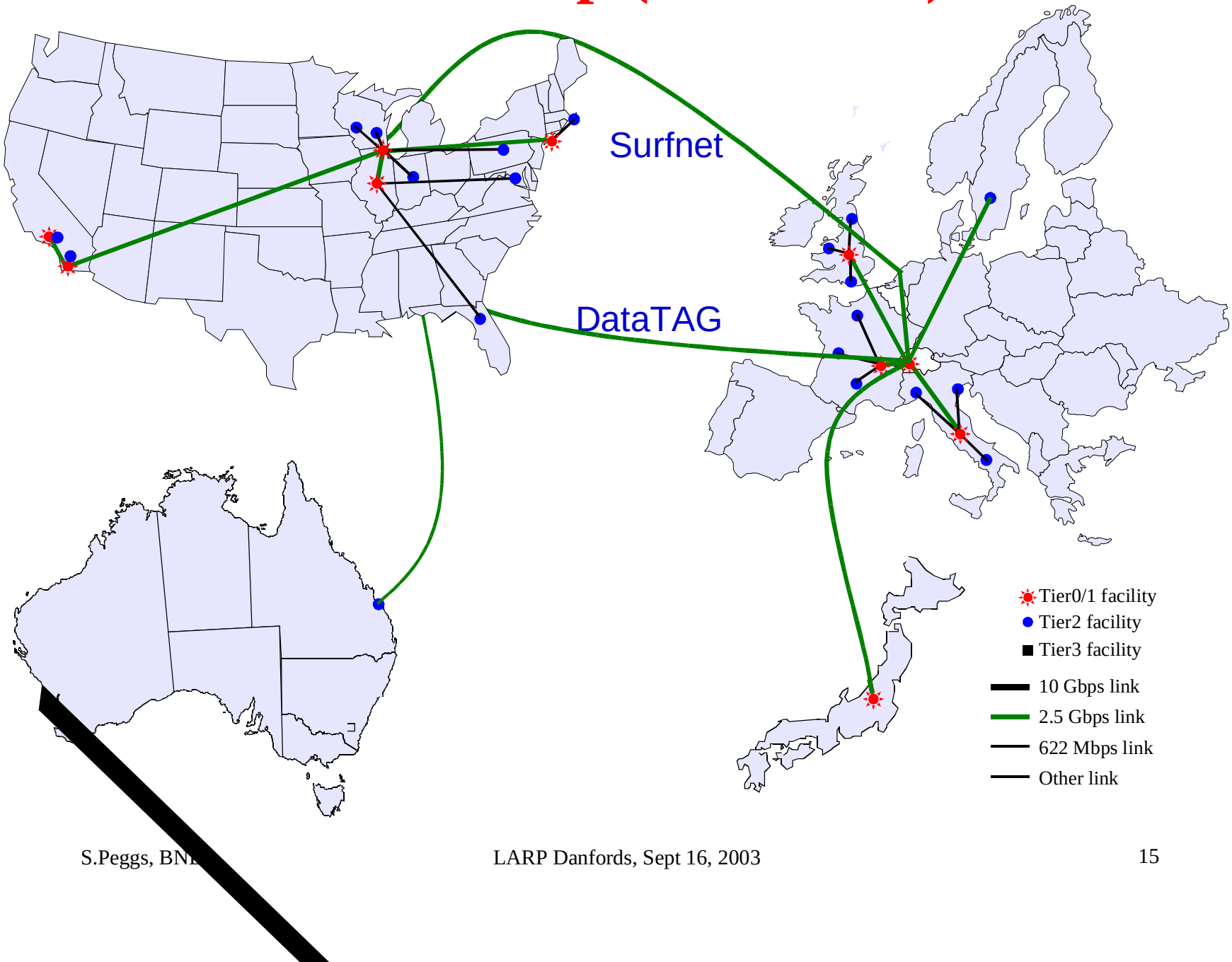
- transparency of the human-computer interfaces
- the completeness of the re-created world
- high-degree of task involvement


Total U.S. Internet Traffic
100 Pbps
10 Pbps
1 Pbps
100Tbps
10Tbps
1Tbps
100Gbps
10Gbps
1Gbps
100Mbps
10Mbps
1Mbps
100Kbps
10Kbps
1Kbps
100 bps
10 bps
1970
1975
1980
1985
1990
1995
2000
2005
2010
Limit of same % GDP as Voice
New Measurements
Voice Crossover: August 2000
ARPA & NSF Data to 96
Projected at 4/Year
2.8X/Year
4X/Year
U.S. Internet Traffic
GAN Workshop (Sep. 17-20, 2002)
Paul Avery
Source: Roberts et al., 2001

Global LHC Data Grid

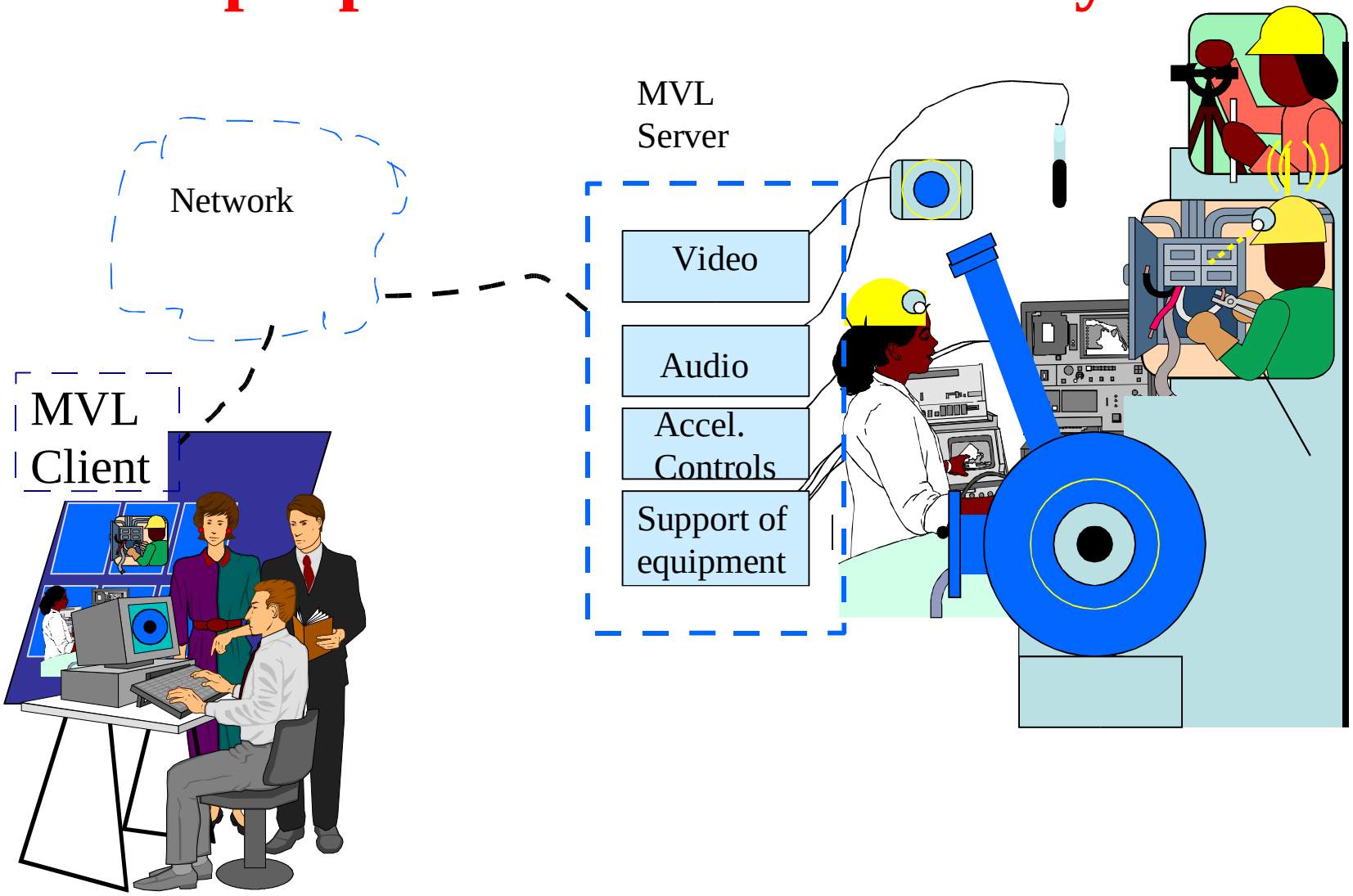


iVDGL Map (2002-2003)



Two activities to watch

Multipurpose Virtual Laboratory



Goals:

Create a versatile set up, easy to transport and install
Naturalistic video and audio technology
Accelerator controls, access to stored data, e-logs

Institutions:

DESY, Daresbury, Elletra, GSI, INFN Milan, Saclay,
U. Rome, U. Valencia
Non-European institutions expressing informal interest

Status:

MVL is still in the early **ESGARD** proposal stage
(European Steering Group on Accelerator R&D)
80 FTE-years? 3 years?

Access Grid

Goals:

Enable complex multi-site A/V
collaborative interactions
Improve the experience beyond videoconferencing
Sense of presence, natural interaction
Use quality but affordable IP based audio/video

Status:

Over 100 nodes world wide
Many routine uses:
management, classes, Kids on the Grid, beer seminar
No human factors studies completed - lots of anecdotes
New software under development

Social impact

"A **memex** is a device in which an individual stores all his books, records, and communications, .. with exceeding speed and flexibility .. piece of furniture at which he works. .... It affords an immediate step .. to **associative indexing**, .. whereby any item may be caused at will to select immediately and automatically another." V. Bush, Atlantic Monthly, 1945

memex + associative indexing = world wide web

Global Hawk (Air Force)

- First Flight: February 1998
- Over 100 flights, over 1200 flight hours
- System includes: 1 air vehicle with sensors, 1 ground station
- 51 air vehicles and 9 ground stations planned

- Sensors: Synthetic Aperture Radar and Electo-Optical/Infrared
- Endurance: 35+ hours
  - 24 hours at 1200 nm
- Max Altitude: > 65,000 feet
- Payload Weight: 2,000 lbs
- Initial operating base: Beale AFB, CA
- Contractor: Northrop Grumman

"It's possible that in our lifetime we will be able to run a conflict without ever leaving the United States"

Lt Col. D. Branham, USAF, NY Times, April 20, 2003

Conclusions

1) Remote operations also have powerful potential in non-GAN-like applications, eg LARP

2) The challenges to successful implementation are as much social and cultural as technical

3) Evolving technologies from the Access Grid to the Multipurpose Virtual Laboratory deserve close attention

4) New modes of communication must become as simple and reliable as a telephone before broad acceptance is assured.

Shelter Island workshop participants (Sept 2002)

When bandwidth is free / new paradigms will prevail / but with what effect?