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A. Summary of Technical Activities

A.1. Euro-Link Network Status and Institutions

A.1.a. CERN

CERN peers with the vBNS, vBNS+, ESnet, CA*net, IUCC, NORDUnet, SURFnet, RENATER2, APAN, Abilene, and MREN (Fermi and Northwestern) networks. They are confident that their 20Mbps bandwidth to STAR TAP will be upgraded to at least 45Mbps by April 2000. Now that the infrastructure is in place, CERN is focusing on applications and IPv6, and has been talking with Brian Carpenter of IBM and the International Center for Advanced Internet Research (iCAIR) at Northwestern University about deploying QoS-aware applications. Also, during the IDC '99 conference, CRC/Ottawa was connected through STAR TAP to CERN, and ultimately to the conference center in Madrid.

A.1.b. IUCC

Israel currently peers with the vBNS, CA*net, APAN, SingAREN, TANet2, Abilene, and ESnet, and is in the process of peering with vBNS+ and NISN.

A.1.c. NORDUnet

NORDUnet currently peers with CA*net, APAN, SINET, SingAREN, Abilene, ESnet, NREN, vBNS, and MREN (Argonne, Northwestern).

A.1.d. RENATER2

RENATER2 currently peers with vBNS. We are still waiting to learn what other networks RENATER2 is peering with.

A.1.e. SURFnet

SURFnet currently peers with CA*net, APAN, SINET, SingAREN, Abilene, DREN, ESnet, NREN, vBNS and MREN (Northwestern, UIC, UIUC).

SURFnet is increasing its trans-Atlantic bandwidth to 2x OC-3 sometime next month. They are also adding two more OC-3s worth of non-European connectivity from an ISP out of Amsterdam, one of which should be delivered next month. In the first half of next year, the second OC-3 will be put in service, yielding OC-12 speed non-European connectivity dedicated to SURFnet. SURFnet is also upgrading its connection to STAR TAP from its PoP in New York, from DS-3 to OC-3; Ameritech has started the provisioning process.

A.2. Engineering Services

A.2.a. STAR TAP Router

On November 3, we brought up the STAR TAP Router to facilitate peering among the 20 National Research Networks (NRNs) connected to STAR TAP. NRNs currently peering with the Router are CA*net, NREN, APAN, CERN, IUCC, NORDUnet and SURFnet; the remaining NRNs will be added as peers by the end of 1999. Due to their relatively tight policy restrictions, the vBNS, Abilene, and ESnet are not currently planning to peer with the STAR TAP Router.

A.2.b. STAR TAP DiffServ Router

Ian Foster and the Globus project are part of the UIC DOE/NGI EMERGE project [http://www.evl.uic.edu/cavern/EMERGE/]. Once our QoS experiments work across MREN sites, we will extend them internationally, starting with Russia, Singapore and Amsterdam. In particular, Foster is working on Bandwidth Brokering, which is of interest to the international community. The STAR TAP Cisco 7507 DiffServ router, to be used for UIC international EMERGE experiments, will be shipped to UIC from the vendor on November 10. [Note: EVL's DiffServ Router arrived November 3 and is currently being installed in EVL's machine room.]

A.2.c. 6TAP

The 6TAP [www.6tap.net], an IPv6 service run by ESnet and hosted by STAR TAP, is up and running. A 6TAP IPv4 router will be placed at STAR TAP in order to support IPv6 over IPv4 tunnels. The 6TAP project members would also like to deploy an IPv6 Performance Testing PC at STAR TAP. We are currently working with Ameritech to find co-location space.

A.2.d. STAR TAP Web Caches

*NLANR Caching project…*Duane Wessels has agreed to build a Web Cache, running the Squid caching software, for deployment at STAR TAP. We are currently at the end stage of equipment acquisition, and expect to be able to ship the components to Duane in early November for an early December installation. Once installed at STAR TAP, Duane will integrate the cache into NLANR's Global Caching Hierarchy.

*Internet2 Distributed Storage Initiative/Novell…*We are working with Jamshid Mahdavi of Novell and Micha Beck of Internet2 to deploy an Internet2/Novell Cache system at STAR TAP. We expect to receive a status update from Jamshid and Micha at the NLANR/Internet2 Tech Meetings in early December in Miami.

A.2.e. A.2.e. STAR TAP Performance Measurement Systems

*NLANR AMP (Active Measurement Platform) box…*We installed an AMP box at STAR TAP last week and data is being displayed on the NLANR AMP web site [http://amp.nlanr.net/active/amp-startap/vBNS/body.html]. The STAR TAP Web Group is working on setting up pointers to the STAR TAP page from the NLANR AMP web site.

Advanced Network & Services' Surveyor box…At present, the Surveyor-required GPS feed is not available within the Ameritech NAP. We are working with both Advanced Network & Services and AADS to explore other options.

A.2.f. Routing Registry

There are plans to eventually use the Internet2 Routing Registry (RR) to configure the STAR TAP Router's routing filter. The Internet2 Routing Registry Project has not been very active lately. We hope to get an update and possibly contribute towards progress on this project at the NLANR/Internet2 Tech Meetings in early December.

A.2.g. Renting Co-Location Space at Ameritech

STAR TAP currently has rack space co-located at Ameritech that is owned by MREN. We are in the process of renting a second rack for the STAR TAP, IPv6 and DiffServ routers, etc. Four racks – STAR TAP, STAR TAP, MREN, and MREN/Merit – would be co-located. We are working with the Ameritech STAR TAP Account Team on this issue.

A.2.h. Contact Information

Administrative, technical and NOC contacts for Euro-Link countries are now posted on the STAR TAP web site, at http://www.startap.net/ABOUT/points.html

A.2.i. Peering Matrix

We are collecting Euro-Link direct peering information that will soon be posted to the STAR TAP web site.

A.2.j. SC'99

We are working with several SC'99 participants to help them set up routing between SC'99 and sites behind Euro-Link networks.

A.3. Euro-Link Performance Analysis Tools

A.3.a. Network QoS of Real-Time Multimedia

We are implementing a packet-level Forward Error Correction scheme; both parity-based and XOR-based.

An alpha version of EVL's CAVE-based Netlogger visualization tool (QoSIMoTo: QoS Internet Monitoring Tool) is complete. This tool visualizes historic as well as real-time Netlogger data consisting of bandwidth, latency and jitter.

A.3.b. Petri-Net Network Modeling

Based on EVL's summer evaluations of its Petri-Net models for UDP and TCP, we are now building higher-level Petri-Net models of the audio and video data sent over networks during typical tele-immersive sessions. As a test case, EVL is looking at the video regularly moving between its location in Chicago and the NCSA ACCESS Center in Washington, D.C.

A.3.c. Network Monitoring

There are no results at this time. Performance monitoring is being postponed until Netlogger is re-integrated into the next-generation CAVERNsoft code (currently under development).

A.4. NOC Services

In early October, Doug Pearson of Indiana University, who is managing the STAR TAP/Euro-Link/TransPAC NOC, came up with a list of immediate action items to get NOC Operations up and running. The target date for implementation is December 1, at which time NOC Engineering takes over. This list, along with task assignments, is on the web at [http://www.transpac.org/startapnoc.html]. Jim Williams <william@indiana.edu> is coordinating this implementation. Tasks include:

- Define roles and expectations
- Set up noc@startap.net as a Majordomo list [Note: noc@euro-link.org is also being set up.]
- Develop a NOC web site [Note: the Euro-Link web site is in the process of being set up and will link to Euro-Link NOC pages.]
- Develop internal documentation, including contact names, L2 peering problems and peering requests, circuit information, network diagrams, VP/VC information, equipment configuration, etc.

- Set up engineering operations' communication procedures and processes
- Set up weekly management problem reporting
- Define monitoring points to determine network utilization and network recommendations, etc.
- Implement network tools (router command proxy, log watcher, etc.)
- Security and access for people and machines−i.e., describe differences among Indiana University, STAR TAP and Abilene people for authentication and authorization; define what management devices need controlled access to STAR TAP hardware (in line with Abilene fashion)
- Hardware inventory, maintenance contracts, etc.

Note: Indiana University will initially extend TransPAC NOC services to incorporate STAR TAP and Euro-Link – as the tools and processes apply across the board. At that point, they will maintain three logical NOCs inside one physical NOC; problem reporting, activity tracking, and documentation will be maintained individually for STAR TAP, Euro-Link and TransPAC.

B. Accomplishments

B.1. Meetings Attended

October 28, 1999. Visit to EVL by France Telecom (FT), to discuss ways in which FT can better support members of the STAR TAP community. (They currently bring RENATER2 to STAR TAP.) Maxine Brown and John Jamison attended; Jason Leigh supervised CAVE demonstrations. FT attendees:

- Daniel Mayer, Manager Carrier Services, FT, NY
- Patrick Jamin, Internet Technical Director, FT Branche Reseaux, France
- Christopher Chaillot, Internet Backbone Engineering, FT Branche Reseaux, France
- Jean-Claude Bourgoint, VP Internet Carrier Services, FT Branche Reseaux, France

October 20, 1999. Visit to Cable & Wireless offices in Chicago, to discuss ways in which C&W can better support members of the STAR TAP community. (They currently bring CERN to STAR TAP.) Tom DeFanti, Maxine Brown and John Jamison from UIC/EVL attended. C&W attendees:

- Mark Luptak, International Account Manager
- Heather Lence, Major Account Representative
- John (Iain) McFadyen, Global Services Special Programs Office
- Chris Altman, Technical Sales Consultant
- Amy Meldgin, District Sales Manager

October 10-13, 1999. UCAID/Internet2 Meeting, Seattle, Washington. Tom DeFanti and Maxine Brown attended. An International Dinner (Sunday, October 10); International Task Force Meeting chaired by Tom DeFanti (Monday, October 11); GigaPoP/International meeting (Tuesday, October 12).

October 4-5, 1999. DOE NGI Meeting, Washington, D.C. Tom DeFanti, Jason Leigh, Alan Verlo and John Jamison attended.

B.2. Publications

Leigh, Jason, Andy Johnson, Maxine Brown, Dan Sandin, Tom DeFanti, "Tele-Immersion: Collaborative Visualization in Immersive Environments," IEEE Computer, December 1999 (to appear). (Features a description of the work being down with SARA in Amsterdam.)

B.3. Software Releases

Anton Koning of SARA (the Academic Computing Services Amsterdam), has been working with EVL to incorporate its CAVERNsoft software into their Saranav application in order to facilitate CAVE-to-CAVE network performance tests between Chicago and The Netherlands. Saranav is a Performer-based CAVE application to load

and view 3D polygonal datasets in the CAVE. It has numerous command-line options to control various visualization and navigation parameters, as well as an extensible menu system to control the application. Koning has made this software available to the CAVE Research Network User's Society (CAVERNUS) at [http://www.ncsa.uiuc.edu/VR/cavernus/shared.html].

B.4. Other International Activities

Tom DeFanti, member of the External Advisory Committee, Center for Parallel Computers (Parallelldatorcentrum, PDC) at the Royal Institute of Technology (Kungl Tekniska Högskolan, KTH), 1999-present. [http://www.pdc.kth.se]

C. Summary of Award Expenditures (October)

The spending rate is within budget. We are continuing to work with Indiana University to complete paperwork in order to execute the UIC subcontract.