National Science Foundation, Directorate for Computer Information Science and Engineering
Division of Advanced Networking Infrastructure & Research (ANIR)

NSF Cooperative Agreement No. ANI-9730202
May 2001 Monthly Status Report

Submitted June 19, 2001

Tom DeFanti, Maxine Brown, Andy Johnson, Dan Sandin, Jason Leigh, Andy Schmidt, Laura Wolf
Electronic Visualization Laboratory
University of Illinois at Chicago

Linda Winkler
Argonne National Laboratory

Jim Williams, Stephen Peck
Indiana University

Table of Contents

A. Summary of Technical Activities 1
A.1. Euro-Link Network Status and Institutions 1
A.2. Engineering Services 2
A.3. NOC Services 3
B. Euro-Link Performance Analysis Tools 3
C. Accomplishments 4
C.1. Meetings 4
C.2. Publications 5
C.3. Software Releases 5
D. Collaboration Activities 5

A. Summary of Technical Activities

A.1. Euro-Link Network Status and Institutions

A.1.a. CERN

CERN is preparing a project proposal to the European Union (EU) for a high-speed research link between CERN and StarLight, in addition to the existing 155Mbps circuit that they plan to upgrade to 622Mbps by April 2002.

A.1.b. IUCC

Hank Nussbacher of IUCC asked Euro-Link participants if they will allow the NOC to SNMP poll their routers to make the STAR TAP Weather Map <http://hydra.uits.iu.edu/startap-atm/> more informative. (See NOC Services, Section A.3.)

A.1.c. NORDUnet

Peter Villemoes reported that NORDUnet completed a tender for USA connectivity, to take effect July 1, 2001. NORDUnet will have an STM-4c (OC-12, 622Mbps) link directly between Stockholm and the Abilene PoP in New York, and 155Mbps from New York to STAR TAP in Chicago. KPNQwest is the provider. NORDUnet had considered connecting at 622Mbps to StarLight (peering with Abilene in Chicago), but was concerned that there

might not be sufficient Abilene capacity in Chicago for both NORDUnet and SURFnet. STAR TAP management is working with Internet2 to resolve this problem, and NORDUnet will seriously consider connecting to StarLight once the current Abilene situation is resolved.

A.1.d. Renater2

In late May, responding to email from Linda Winkler about Renater's re-establishing peering with the STAR TAP Router, Dany Vandromme responded that he definitely wanted to do so, but first had to sort out technical issues with France Telecom. It seems that they recently changed their circuit arrangements with France Telecom in Chicago, which caused them to lose peering with most research networks. Linda needs PVC information in order to proceed.

A.1.e. SURFnet

On July 1, 2001, SURFnet will close its New York PoP and bring two 622Mbps connections (one provided by Teleglobe and the other by Global Crossing) to the StarLight facility (710 N. Lake Shore Drive on Northwestern University's campus) in Chicago. On September 1, 2001, SURFnet will bring a 2.5 Gbps lambda connection from Amsterdam to StarLight (provided by Teleglobe).

SURFnet engineer Erik-Jan Bos is in contact with Internet2's Steve Corbató about Abilene/SURFnet peering in Chicago.

SURFnet is in the process of building its PoP at 710 N. Lake Shore Drive. Equipment shipped from the Netherlands has arrived in Chicago. Initially, SURFnet will have one Cisco 12008 router installed at StarLight, plus one Cisco 2620 for out-of-band access to the Cisco 12008. The 12008 will have OC-12c POS connections to both Teleglobe and Global Crossing, and an OC-12c ATM connection to STAR TAP. Between the 12008 and STAR TAP they will install a small ATM switch to access 6TAP. This will also involve a router dedicated to IPv6, which SURFnet will connect to a v6-exchange facility at the StarLight location as soon as it becomes available.

A.2. Engineering Services

A.2.a. StarLight/Abilene Connectivity

There was a great deal of discussion between STAR TAP (Tom DeFanti, Linda Winkler, Joe Mambretti) and Internet2 (Heather Boyles, Steve Corbató and Doug Van Houweling) about increasing Abilene's bandwidth in Chicago for Euro-Link networks. A meeting was held at EVL May 29th in Chicago between STAR TAP and Internet2 to discuss future plans. See Section C.1.

A.2.b. StarLight/STAR TAP Connectivity

STAR TAP is contracting for two OC-12 connections from the StarLight facility at 710 N. Lake Shore Drive to the Ameritech NAP. [Ameritech does not yet offer OC-48 service.] One of these OC-12s will be dedicated to SURFnet/Abilene traffic. The second link is to be shared by SURFnet (for non-Abilene traffic) and other NRNs that co-locate at 710. Ameritech assures us that these connections will be operational on July 1.

A description of StarLight's project goals, facility and proposed services has been added to the STAR TAP web page at <http://www.startap.net/starlight/>

On May 21, Linda Winkler successfully installed a Cisco 6509 Ethernet switch at the StarLight facility.

A.2.c. International Transit Network (ITN)

The STAR TAP CONNECT web page has been updated to include information about the International Transit Network, as well as Distributed STAR TAP and NAP connectivity (Ameritech provisioning) information. <http://www.startap.net/CONNECT/>. STAR TAP links to CA*net3 and Internet2 ITN information <http://www.canet3.net/optical/peering_info/intl_peering.html> <http://www.internet2.edu/abilene/html/itnservice.html>

A.2.d. STAR TAP Router and Peering

On May 10, maintenance procedures began at the AADS/NAP in Chicago to replace the existing STAR TAP/TransPAC router with a new Juniper M5 router. Intermittent outages occurred in following days as routes were

moved. The router will enable STAR TAP engineers to provide connecting networks with advanced services, such as line-speed forwarding, traffic filtering and sampling, MPLS, and Class of Service.

Korea's (KOREN/KREONet2) connected to STAR TAP and began passing packets May 2. In coming months, STAR TAP member networks will also have an opportunity to peer with networks from Ireland (HEAnet) and Brazil (FAPESP-ANSP, the Sao Paulo research network, and RNP, the national research network). The Saõ Paulo/Brazil Foundation for the Advancement of Research (FAPESP) 155 Mbps link to Miami has been operational since December 2000. Connection to STAR TAP is still pending resolution of Cable & Wireless issues.

On May 30, UIUC's National Center for Supercomputing Applications (NCSA) connected to STAR TAP and began passing traffic. (NOTE: NCSA previously shared its MREN institutional membership with UIUC, but now has established a separate link to the NAP.)

On May 31, University of Iowa upgraded its port bandwidth from DS-3 to OC-3.

The STAR TAP Logical Map, Architecture Diagram and Peering Matrix have been updated and posted to the STAR TAP web site.
<http://www.startap.net/ENGINEERING/GENINFO.html>
<http://www.startap.net/ENGINEERING/STARTAP_PeeringMatrix.pdf>

A.2.e. 6TAP

No updates to report.

A.2.f. STAR TAP NLANR Web Cache

No updates to report.

A.2.g. DiffServ

No updates to report.

A.3. NOC Services

The NOC is upgrading and modifying its network traffic tools to be compatible with the new Juniper M5 Router. It expects to complete the process by the end of June.

Hank Nussbacher of IUCC recently began discussions with the NOC and Euro-Link participants to ask if they will allow SNMP polling to make the STAR TAP Weather Map <http://hydra.uits.iu.edu/startap-atm/> more informative. To date, IUCC and CERN have offered to comply. Jim Williams raised the issue again at the June 5 STAR TAP International Advisory Committee meeting at INET.

The NOC has set Friday, June 15 as the production date for Footprints, the new interim trouble ticket system for Abilene and the Global Networks. This system will provide increased functionality for tracking and escalating trouble tickets, increased accessibility to trouble tickets for those in TransPAC, STAR TAP and Euro-Link administration, and much more robust reporting. The NOC will be providing ticket summary updates on associated web pages. Eventually, the NOC will permanently replace Footprints with Peregrine Systems.

Ongoing activities: The Global Research NOC is preparing to issue a regular, online newsletter in the next few months. John Hicks is working on adapting MIRnet-type traffic graphs for the Euro-Link and TransPAC projects.

B. Euro-Link Performance Analysis Tools

B.1.a. Network Monitoring Tools

Bandwidth Utilization Radar Map

EVL student Brenda Lopez has enhanced the iGrid 2000 STAR TAP network map, (which showed bandwidth utilization of networks participating in iGrid), to illustrate all country-to-country source and destination of packets arriving at STAR TAP/Euro-Link. The map is currently operational, and should appear on the web site by mid-June.

This summer she plans to develop snapshots of network traffic spikes to STAR TAP/Euro-Link, rather than just previous history.

uCAN: unified Collaboratory for Analyzing Networks

EVL student Naveen Krishnaprasad started development of the unified Collaboratory for Analyzing Networks (uCAN) software, which will enable remote network researchers and application developers to collaboratively execute an application and monitor network utilization, as well as other application-specific parameters.

B.1.b. Network Performance Studies for European/US Collaborative Art Project

EVL PhD graduate Dave Pape developed Yggdrasil, a script-based, authoring environment for networked VR applications, which enables non-programmers to create effective, behavior-rich art and science virtual-reality environments. EVL co-director Dan Sandin is extending the library for behaviors, performing network performance tests and developing applications. Sandin is supervising EVL student Joseph Tremonti in the development and execution of network performance tests to Austria, and later Sweden, Hungary and The Netherlands, in anticipation of the Ars Electronica Center's Festival in Austria, September 1-6. [http://www.aec.at] (See Section D, Collaboration Activities)

B.1.c. High Bandwidth Transmission Over Long Distance Networks

Parallel Socket Experiments

Jason Leigh and student Atul Nayak, in network performance studies with SARA in The Netherlands, were getting between 32-80Mbps throughput doing parallel TCP experiments over SURFnet's 155Mbps link. They have been unable to achieve 80Mbps throughput consistently; throughput appears to average at 32Mbps. They are working with UIC's National Center for Data Mining (NCDM) to incorporate codes to attempt to predict the number of parallel sockets that need to be opened for optimal throughput. No updates to report.

Reliable Blast UDP (RUDP)

Jason Leigh and student Eric He has improved and extended their RUDP algorithm to allow for smaller transmission buffer sizes. This is useful if a reliable **streaming** protocol is desired. No updates to report.

C. Accomplishments

C.1. Meetings

May 31, 2001. Tom DeFanti and Oliver Yu of EVL/UIC and Joe Mambretti of Northwestern University met with representatives of the Photonics Internet Forum (PIF), which was recently established by Japan's Ministry of Post & Telecommunications to make recommendations to the government to establish national policies and obtain research funds for photonic networking technologies for the IT industries and IT users in Japan. The PIF sent a delegation to North America, headed by Professor Aoyama, in order to see how US and Canadian governments and public sectors are handling photonic network testbeds, and how they provide research funding to research groups involved with photonic networking. The group visited STAR TAP/ StarLight, as well as NSF (Aubrey Bush) and CANARIE (Bill St. Arnaud). PIF representatives who visited STAR TAP/StarLight were:

- Tomonori Aoyama, University of Tokyo and Japanese Gigabit Networks
- Ken-ichi Kitayama, Osaka University
- Ken-ichi Sato, Photonic Transport Network Laboratory, NTT Network Innovation Laboratories
- Wataru Chujo, Ultrafast Photonic Network Group, Communications Research Laboratory,
- Masahiro Ojima, Telecommunication Systems Division, Hitachi, Ltd.
- Akira Hakata, Advanced Photonic Network Systems Development Div., Fujitsu Ltd.
- Shingo Inoue, Information Technology Research Department, Mitsubishi Research Institute, Inc.
- Sumiyasu Hidaka, Research Division, Support Center for Advanced Telecommunications Technology Research

May 29, 2001. Tom DeFanti, Maxine Brown and others from EVL/UIC, Joe Mambretti and Tim Ward of Northwestern, and Linda Winkler and Bill Nickless of Argonne met with Internet2's Doug Van Houweling, Heather Boyles, Steve Corbató and Greg Wood to discuss increasing Abilene bandwidth in Chicago for Euro-Link networks.

Abilene agreed to put an OC-48 router in the Qwest POP at the NBC Tower building in the September timeframe, and will connect to 710 with I-WIRE fiber once it's installed.

May 23-25, 2001. Tom DeFanti, Maxine Brown and Jason Leigh participated in the NCSA/Alliance All Hands Meeting (AHM). Leigh and 4 EVL students hosted a poster session describing EVL development and deployment activities, including Euro-Link network performance monitoring efforts and StarLight. DeFanti was the AHM general chair, and as part of the program, invited Bill St. Arnaud to talk about optical networks and Bob Grossman to talk about large-scale data mining.

May 18, 2001. Maxine Brown gave a presentation, "StarLight: In Support of Global Scientific Research Communities," in the Advanced Internet Session at the Internet Global Conference in Barcelona <http://www.igconference.net/>. The session was organized by Artur Serra of UPC, and also included speakers:

- Latif Ladid, Vice President of Ericsson and President of the IPv6 Forum
- Pascal Drabik, Scientific Officer, European Commission
- Xavier Kirchner, Director Centre de R&D, Nortel Networks, Barcelona

May 16-17, 2001. At the invitation of Artur Serra of the Universitat Politecnica de Catalunya (UPC), Maxine Brown visited the school to meet with networking and virtual-reality faculty and staff, as well as faculty at related schools and local government officials responsible for university research funding initiatives. Serra and Sebastia Sallent run the i2CAT program <http://www.i2-cat.net>, a university/commercial/government initiative that focuses on funding collaborative projects requiring advanced networking. Serra has been closely monitoring Kees Neggers' efforts to lead the optical Internet in Europe. People that Brown met with include:

- Jordi Domingo-Pascual, Computer Architecture Department (runs the GigaPoP), UPC
- Pere Brunet, Industrial Design Department (runs a CAVE-like facility, funded by Volkswagen), UPC
- Montserrat Meya I Llopart, Catalunya Government (University research)
- Josep Blat, Escola Superior Politecnica

May 11, 2001. Tom DeFanti and Maxine Brown met with Bob Grossman of UIC's National Center for Data Mining about his placing a data warehouse at StarLight and at SARA in Amsterdam to stress-test the optical links once they are in place.

May 8, 2001. Anne Richeson of Qwest and representatives of QwestLink (the local company) visited the StarLight facility at 710 and then visited EVL to discuss opportunities in advanced networking with Tom DeFanti, Maxine Brown and Joe Mambretti.

May 3, 2001. Lazaros Efraimoglou, president of the Foundation for the Hellenic Worlds (FHW) in Athens, Greece, visited EVL with his wife to learn more about future virtual-reality and networking research activities. EVL graduate Maria Roussou works for the FHW, where she is responsible for their virtual-reality activities (they have a CAVE-like display and an ImmersaDesk, and develop cultural heritage applications of Greek temple ruins for educational purposes). FHW participated in iGrid 2000 in Yokohama that EVL organized. Tom DeFanti and Maxine Brown impressed upon Efraimoglou the importance of high-speed interconnectivity for remote collaboration.

C.2. Publications

No new publications to report.

C.3. Software Releases

No new software upgrades or releases.

D. Collaboration Activities

EVL's Dan Sandin is organizing a large, shared VR environment for the Ars Electronica Festival, September 1-6, 2001, in Austria. Participants include artists from Hungary's C3 [http://www.c3.hu/], The Netherlands' V2 [http://www.v2.nl/], The Interactive Institute of Sweden [http://www.interactiveinstitute.se/], and the United States (UIC, Chicago and SUNY, Buffalo).

Working with SARA in The Netherlands to do network performance studies over long, fat networks using various transmission techniques (TCP, UDP, FEC, RUDP).

EVL is working with CERN on RUDP tests. EVL is talking to CERN about DiffServ tests.