



TransLight / StarLight

NSF Cooperative Agreement OCI-0441094

www.startap.net/translight

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Thomas A. DeFanti, Maxine Brown, Alan Verlo, Laura Wolf
Electronic Visualization Laboratory
University of Illinois at Chicago
851 S. Morgan St., Room 1120
Chicago, IL 60607-7053
tom@uic.edu

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1. Participants

1.A. Primary Personnel

Participant's Name(s)	Project Role(s)	>160 Hours/Yr
Thomas A. DeFanti (1)	Principal Investigator	Yes
Maxine Brown (2)	Co-Principal Investigator	Yes

- (1) Tom DeFanti, PI, focuses on managing the link procurement process, network engineering, budgets and accounts payable, interfacing with personnel from Internet2, ESnet, NLR and DANTE/GEANT2, coordinating project management and oversight activities with the NSF, and performing day-to-day project management. He participates in regularly scheduled IRNC phone calls and attends meetings as requested.
- (2) Maxine Brown, co-PI, focuses on managing documentation and education and outreach activities, and is responsible for TransLight/StarLight quarterly and annual reports, web pages and events planning. She also participates in regularly scheduled IRNC phone calls and attends meetings as requested.

1.B. Other Senior Personnel (Excluding PI and Co-PI)

Additional people who contribute greatly to the project are listed below. While some receive a salary from this grant, others provide in-kind services:

Participant's Name(s)	Project Role(s)	>160 Hours/Yr
Alan Verlo (3)	Professional staff	Yes
Laura Wolf (4)	Professional staff	Yes
Steve Sander (5)	Professional staff	Yes
Pat Hallihan (6)	Professional staff	Yes
Lance Long (7)	Professional staff	Yes
Linda Winkler (8)	Professional staff	Yes
Rick Summerhill (9)	Professional staff	Yes
Roberto Sabatino (10)	Professional staff	Yes
Erik-Jan Bos (11)	Professional staff	Yes
Kees Neggers (12)	Other Senior Personnel	Yes
Joe Mambretti (13)	Other Senior Personnel	Yes

- (3) Alan Verlo is the TransLight/StarLight network engineer, and is a member of the StarLight engineering team. For many years Verlo has also been a member of the SC conferences' SCinet committee, focusing on enabling international SC research demos that have network connections at StarLight in Chicago. He was also co-chair of the iGrid 2005 international cyberinfrastructure team, responsible for clusters and international networking. Verlo regularly participates in JET and GLIF GOLE meetings.
- (4) Laura Wolf is responsible for TransLight/StarLight technical writing and web documentation.
- (5) Steve Sander is the TransLight/StarLight budget, accounts payable and equipment procurement person.
- (6) Pat Hallihan reports to Alan Verlo and is technical support staff.
- (7) Lance Long reports to Alan Verlo and is technical support staff.
- (8) Linda Winkler of Argonne National Laboratory, while not compensated by the University of Illinois at Chicago, serves as part-time StarLight engineer with Alan Verlo, and assists with TransLight/StarLight. For many years, Winkler has been a member of the SCinet committee, helping enable international SC research demos with network connections at StarLight in Chicago. She was also co-chair of the iGrid 2005 international cyberinfrastructure team, responsible for clusters and international networking.
- (9) Rick Summerhill is the Internet2 Chief Technology Officer and, while not compensated by UIC, is one of the stewards of the TransLight/StarLight link that connects the Internet2 network at MAN LAN to the GEANT2 POP at the Amsterdam Internet Exchange.
- (10) Roberto Sabatino is the DANTE Chief Technology Officer and, while not compensated by UIC, is one of the stewards of the TransLight/StarLight link that connects the Internet2 network at MAN LAN to the GEANT2 POP at the Amsterdam Internet Exchange.
- (11) Erik-Jan Bos is a SURFnet Managing Director and, while not compensated by UIC, is one of the stewards of

the TransLight/StarLight link connecting StarLight in Chicago to NetherLight in Amsterdam.

- (12) Kees Neggers is a SURFnet Managing Director and a founder and current chair of GLIF. While not compensated by UIC, he does the tenders and procures both TransLight/StarLight links on UIC's behalf, and is one of the stewards of the TransLight/StarLight link connecting StarLight in Chicago to NetherLight in Amsterdam.
- (13) Joe Mambretti is the StarLight managing director and head of the International Center for Advanced Internet Research (iCAIR) at Northwestern University. While not compensated by UIC, he has been a strong supporter and advisor regarding our IRNC efforts. Mambretti has assisted with connectivity issues, not only at StarLight, but also at MAN LAN.

1.C. Other Organizations That Have Been Involved as Partners

Argonne National Laboratory

Argonne National Laboratory's Mathematics and Computer Science Division (MCS) <www.mcs.anl.gov> has been, and continues to be, a strong supporter of US international networking activities. Linda Winkler has facilitated STAR TAP/StarLight engineering since its inception, and is the lead engineer today; her salary comes from Argonne.

Northwestern University

Joe Mambretti, director of Northwestern's International Center for Advanced Internet Research (iCAIR) <www.icair.org>, also runs the StarLight facility <www.startup.net/starlight>, and assists with connectivity issues.

SURFnet

SURFnet, the national network for research and education in the Netherlands <www.surfnet.nl>, is a TransLight/StarLight "key institutional partner," responsible for negotiating, procuring and implementing the TransLight OC-192 circuit(s) between Open Exchanges in the US and in Europe, which UIC pays for upon receipt of an invoice from SURFnet, as has been our practice since our previous NSF HPIIS Euro-Link award.

1.D. Other Collaborators or Contacts

CANARIE

The Canadian Network for the Advancement of Research, Industry and Education (CANARIE) <www.canarie.ca> is Canada's advanced Internet development organization. It operates the CANARIE Network, a series of point-to-point optical wavelengths, most of which are provisioned at 10Gbps speeds, interconnecting Canada's provincial research networks with each other and international peer networks, and forming an innovative framework to support grids and e-Science.

DANTE

Owned by European NRENs, DANTE <www.dante.net> is an organization that plans, builds and operates pan-European networks for research and education. The GÉANT2 project is a collaboration among 30 National Research & Education Networks representing 34 countries across Europe, the European Commission, and DANTE. Its principal purpose is to develop the GÉANT2 network -- a multi-gigabit pan-European data communications network for research and education; see <www.geant2.net>. TransLight/StarLight funding provides a 10Gbps routed infrastructure to connect the Internet2 network, NLR PacketNet and DOE/ESnet with DANTE/GÉANT2. TransLight/StarLight also makes a 10Gbps switched infrastructure available for use.

ESnet

The Energy Sciences Network, (ESnet) <www.es.net> is funded by the DOE Office of Science to provide network and collaboration services in support of the agency's research missions, serving thousands of

DOE scientists and collaborators worldwide. ESnet provides direct connections to all major DOE sites with high-performance speeds, as well as fast interconnections to more than 100 other networks. TransLight/StarLight funding provides a 10Gbps routed infrastructure to connect the Internet2 network, NLR PacketNet and DOE/ESnet with DANTE/GÉANT2. TransLight/StarLight also makes a 10Gbps switched infrastructure available for use.

Global Lambda Integrated Facility (GLIF)

GLIF <www.glif.is> is an international virtual organization of NRENs, consortia and institutions that promotes lambda networking. GLIF provides lambdas internationally as an integrated facility to support data-intensive scientific research, and supports middleware development for lambda networking. It brings together premier networking engineers to develop an international infrastructure by identifying equipment, connection requirements, and necessary engineering functions and services.

GLORIAD

GLORIAD, the Global Ring Network for Advanced Applications Development, <www.gloriad.org> is constructing a dedicated lightwave round-the-world connecting scientific organizations in the United States, Russia, China, Korea, Canada, the Netherlands and the Nordic countries. GLORIAD currently has 3x1Gbps VLANs on the TransLight/StarLight CHI/AMS link to NetherLight. Russia, a GLORIAD partner, connects to NetherLight in Amsterdam from Moscow via Stockholm.

Internet2

Internet2 <www.internet2.edu> is a consortium of leading US research universities working in partnership with industry and government to develop and deploy advanced network applications and technologies. In Spring 2007, the new Internet2 network <www.internet2.edu/network/>, a hybrid optical and packet network, designed in collaboration with Level 3 Communications, came online. TransLight/StarLight funding provides a 10Gbps routed infrastructure to connect the Internet2 network, NLR PacketNet and DOE/ESnet with DANTE/GÉANT2. TransLight/StarLight also makes a 10Gbps switched infrastructure available for use by the new Internet2-DCN (Dynamic Circuit Network).

National LambdaRail (NLR)

NLR <www.nlr.net> is a major initiative of US research universities and private sector technology companies to provide a national-scale infrastructure for research and experimentation in networking technologies and applications. TransLight/StarLight considers itself, in part, to be the international extension of NLR, and encourages data-intensive e-science drivers needing gigabits of bandwidth to use NLR FrameNet and international links for schedulable production services not available with “best effort” networks. TransLight/StarLight funding provides a 10Gbps routed infrastructure to connect the Internet2 network, NLR PacketNet and DOE/ESnet with DANTE/GÉANT2. TransLight/StarLight also makes a 10Gbps switched infrastructure available for use by NLR FrameNet.

TransLight/PacificWave

TransLight/PacificWave <www.pacificwave.net/participants/irnc> is developing a distributed exchange facility on the West Coast (currently in Seattle, Sunnyvale, and Los Angeles) to allow interconnection of international research and education networks with US research networks. TransLight/PacificWave is the sister project to TransLight/StarLight.

2. Activities and Findings

2.A. Research Activities

2.A.1. Accomplishments and Milestones

In Year 5, TransLight/StarLight continues to fund two international links, which were both delivered July 2005: an OC-192 routed connection between MAN LAN in New York City and NetherLight at the Amsterdam Internet Exchange (AMS-IE) connecting GÉANT2 to the US Internet2, NLR and ESnet networks, and an OC-192 switched connection between StarLight in Chicago and NetherLight (co-located at the AMS-IE facility) that is part of the GLIF fabric.

We have been working on the following activities during the first quarter of Year 5 of the grant:

- Preparing TransLight/StarLight quarterly report
- Provisioning VLANs on TransLight/StarLight CHI/AMS for e-science applications (ongoing)
- Representing TransLight/StarLight at major conferences and workshops (as members of the program committee and/or as participants); continuing to participate in network engineering JET and GLIF GOLE meetings; continuing to participate in the IRNC Measurement Group; and, continuing to learn/design cybersecurity best practices for IRNC (ongoing)
- Identifying and assisting applications on both IRNC circuits (ongoing)
- Updating the TransLight/StarLight website <www.startup.net/translight> (ongoing)
- Contributing to the GLIF applications website <www.glif.is/apps>.
- Preparing for GLIF and SC'09 international application demonstrations

2.A.2. Infrastructure Topology

No updates to report.

2.A.3. NYC/AMS Network Operations and Engineering

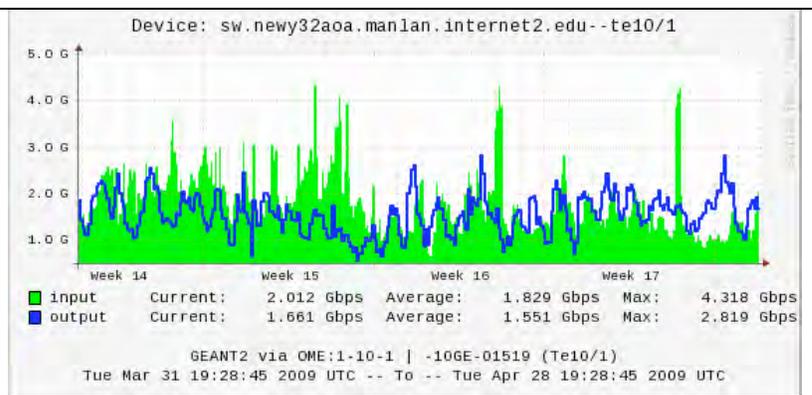
PoP Connectivity and Peering

No updates to report.

Usage

Aggregate traffic utilization information for Internet2, NLR and ESnet on TransLight/StarLight can be accessed from the TransLight/StarLight website <www.startup.net/translight/pages/measurement.html>, or directly from the Internet2 website: <http://dc-snmp.wcc.grnoc.iu.edu/manlan/show-graph.cgi?title=sw.newy32aoa.manlan.internet2.edu--te10/1&rrdname=sw.newy32aoa.manlan.internet2.edu--te10_1.rrd>

IRNC aggregate traffic (>4Gbps) used by Internet2/ESnet/NLR for the month of April 2009.



Routing Policies

No updates to report.

Peering Policies

No updates to report.

Security

No updates to report.

Engineering

No updates to report.

NOC Operations

No updates to report.

RENOG: Global NOC-NOC Communications

No updates to report.

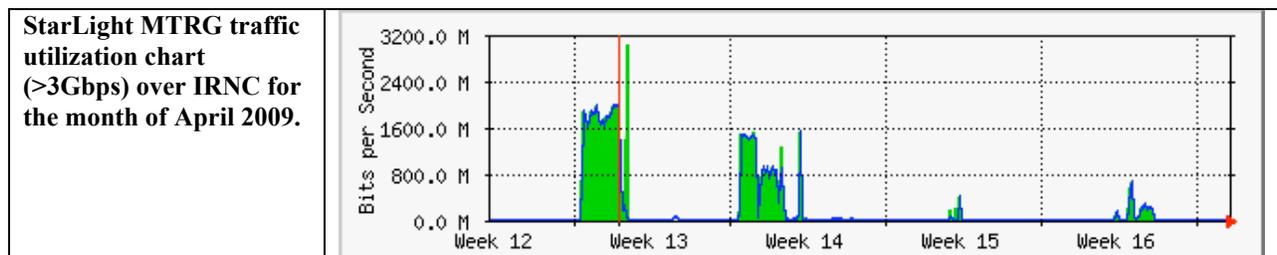
2.A.4. CHI/AMS Network Operations and Engineering

PoP Connectivity and Peering

No updates to report.

Usage

MRTG traffic utilization information for the CHI/AMS TransLight/StarLight link can be accessed from the TransLight/StarLight website <www.startap.net/translight/pages/measurement.html>, or can be directly accessed at: <http://noc.startap.net/mrtg/206.220.240.222_tengigabitethernet_3_0.html>. *Note: Daily and weekly StarLight MRTG usage charts appear in this report to substantiate bandwidth for some of the heroic applications and experiments that took place over the past quarter (Section 2.B.4).*



Routing Policies

No updates to report.

Peering Policies

No updates to report.

Security

No updates to report.

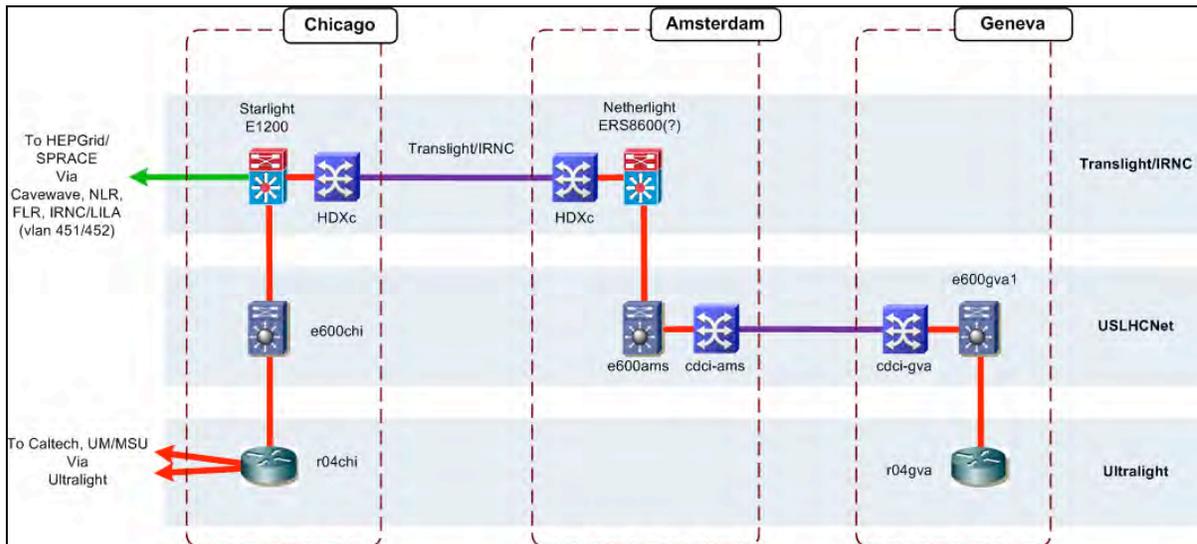
Engineering

No updates to report.

Engineering: LightPath Services

The following VLANs on the TransLight/StarLight CHI/AMS were recently put in place:

- ON*VECTOR...no bandwidth limits (See Section 2.B.3, “ON*VECTOR: Synchronized Multi-Lane Streaming Using NTT’s Terabit Network Interface Card (NIC)” description)
- CosmoGrid...no bandwidth limits (See Section 2.B.3, “CosmoGrid: The Gravitational Billion Body Problem 2009,” for intercontinental supercomputer experiment description)
- LHC/Tier2...3Gbps for Large Hadron Collider (LHC) data for US Tier2 sites, as illustrated below (note: TransLight/StarLight already carries LHC traffic between CERN and two Tier2 sites in Brazil). To complement DOE USLHCnet transatlantic bandwidth for US Tier1 sites, Harvey Newman and Artur Barczyk requested a connection between NetherLight and Starlight on the IRNC circuit (a USLHCnet-funded circuit would be used between CERN and NetherLight). This would enable US-based Tier2 sites to get data more efficiently, and not have to access it from Tier1 sites – whether Fermilab, Brookhaven or TRIUMF (in Canada), depending on the data required. From StarLight, lightpath connectivity to Tier2 physics labs at Caltech and University of Michigan is already in place, as both these sites are also part of the US UltraLight project, and have VLANs on USLHCnet. In the future, any UltraLight participant, as well as any other Tier2 site, could be connected to the IRNC TransLight/StarLight circuit via Abilene and/or NLR, as USLHCnet peers with both of them.



The following VLANs have been in place for awhile (see prior TransLight/StarLight reports):

- GLORIAD...3x1Gbps
- NOAA...1Gbps
- Teraflow Testbed...1Gbps
- OptIPuter...1Gbps
- Korea-NORDUnet Medical Imaging... 1Gbps *on the SURFnet AMS-CHI link (leveraging investments from SURFnet for international transatlantic network connectivity)*
- Arecibo Radio Telescope in Puerto Rico...1Gbps
- HEPGrid (RNP/CLARA) and SPRace (Sao Paulo/ANSP)...2x1Gbps
- i2CAT (Barcelona)...1Gbps

NOC Operations

No updates to report.

2.A.5. Meeting and Conference Participation

TransLight/StarLight principals have participated in the following meetings and conferences to promote IRNC:

April 21, 2009. Alan Verlo participated in a JET meeting.

April 6, 2009. Joe Mambretti represented TransLight/StarLight at the “Internet2 Meeting on NSF IRNC Program,” held at Georgetown University in Washington DC.

March 24, 2009. Larry Smarr and Tom DeFanti at Calit2/UCSD hosted the NLR All Hands Meeting.

March 20, 2009. Yul Edwards, technology advisor to Illinois’ Congressional representative Danny Davis, visited EVL to learn more about the technologies we use and deploy, including IRNC and StarLight.

March 17, 2009. Alan Verlo participated in a JET meeting.

March 17, 2009. Maxine Brown was selected as one of 15 “global visionaries” for the multi-media series “Chicago Matters: Beyond Burnham,” to explore how the Chicagoland region can thrive in a global era. Chicago Public Radio and PBS are producing this series. The goal was to feature StarLight, and Brown was chosen as a “co-creator and coordinator of the largest digital hub in North America.”

For the WTTW television interview, go to the following website, then scroll down to the end “Starlight” project and click VIEW CLIP:

<<http://www.wttw.com/main.taf?p=42,2,1,1&date=03172009&et=%20-%20Tuesday%2C%20March%2017%2C%202009>>

For the radio show, go to the following website, click on “Audio Slideshow” under Brown’s photo, then hit PLAY: <<http://www.chicagopublicradio.org/Content.aspx?audioID=32845>>

March 10-11, 2009. Mikhail Zhizhin, Head of the Grid laboratories at the Geophysical Center and the Space Research Institute in Moscow, is a long-time collaborator of UIC/EVL, and is involved with networked scientific applications for space physics, remote sensing and climatology with the World Data Centers System under research grants from the Russian Academy of Sciences, NOAA, NASA, EGEE, Microsoft, and the World Bank. He visited EVL and Adler Planetarium (where EVL has an installation in Adler’s Space Visualization Laboratory) to discuss future collaborations.

February 25, 2009. Tom DeFanti and Maxine Brown were co-organizers, with others, of the ON*VECTOR Terabit LAN Working Group. Participants included DeFanti, Brown, Alan Verlo and Joe Mambretti.

February 23-24, 2009. Tom DeFanti and Maxine Brown were co-organizers, with others, of the 8th Annual ON*VECTOR Photonics Workshop, sponsored by NTT, and hosted by Calit2 at UCSD. DeFanti, Brown and Alan Verlo attended. Several IRNC national/international collaborators also attended and participated; notably: Joe Mambretti, Kees Negggers, John Silvester, Bill St. Arnaud (via VTC), and Dave Reese (NLR).

February 13-15, 2009. EVL participated in the AAAS 2009 conference (American Association for the Advancement of Science), which was held in Chicago. We were in the NSF booth and showcased the IRNC program, as well as several other NSF-funded projects. More specifically, EVL and Northwestern University coordinated the installation of a 1Gbps network between the NSF booth and StarLight, which NSF funded. For further information about the IRNC-related demonstrations, see Section 2.B.3, “AAAS 2009 International High-Definition Video Teleconferencing.”

February 9, 2009. Alan Verlo remotely attended the Collaborative Expedition Workshop #80: “Leveraging SOA: Advancing Cyberinfrastructure Capabilities for High-Performing Distributed Communities.” The GSA’s USA Services/Intergovernmental leads monthly Collaborative Expedition workshops to advance the quality of citizen-government dialogue and collaborations at the crossroads of

intergovernmental initiatives, Communities of Practice, Federal IT research and IT user agencies.

February 1-5, 2009. Alan Verlo attended the Winter '09 ESCC/Internet2 Joint Techs in College Station, TX. He participated in the JET meeting, held February 2. He also informally met with Matt Zekauskas and Julio Ibarra on IRNC measurement efforts.

2.B. Research Findings

2.B.1. IRNC Projects Interactions

Internet2/ESnet/NLR/GÉANT2 and StarLight/NetherLight Compatibilities

The TransLight/StarLight NYC-AMS routed network seamlessly connects Internet2, ESnet, NLR and GÉANT2, and the switched CHI-AMS switched circuit seamlessly connects StarLight and NetherLight, thereby assuring that international network services conform to those currently offered or planned by domestic research networks.

AAAS 2009

IRNC was successfully represented at the AAAS 2009 conference. This was the first time NSF's booth was networked at a AAAS meeting, so we were able to not only explain the NSF IRNC program, but to show it. NSF provided the additional funding necessary to install a temporary 1Gbps connection from the Hyatt Regency hotel (where AAAS was held) to the StarLight facility. Via high-definition video teleconferencing (VTC), we talked with colleagues from the US (Michigan), Brazil, Czech Republic, Korea, The Netherlands, and Russia. NSF director Arden Bement and former NSF director Rita Colwell happened to be in IRNC's section of the booth while we were talking with Petr Holub in the Czech Republic, and asked him questions about the very-high-resolution medical image shown on his tiled display.

The VTC demonstration was complemented by two high-performance networked demos by EVL collaborators Bob Grossman at UIC and Joe Mambretti at Northwestern University. Grossman and Mambretti also very much enjoyed seeing and talking with international colleagues via the VTC, many of whom they also collaborate with. (And, Mambretti was instrumental in working with AT&T to acquire its GigaMAN service between the hotel and StarLight.)

For a detailed description of AAAS 2009 demonstrations, see Section 2.B.3: "AAAS 2009: International High-Definition Video Teleconferencing."

9th Annual GLIF Global LambdaGrid Workshop

The annual GLIF meeting will be held October 27-28, 2009 in Daejeon, South Korea, and hosted by KISTI. Several international demonstrations are already being planned, some of which require TransLight/StarLight. <www.glif.is/meetings/2009/>

SC 2009

In progress. Alan Verlo is a member of the SC'09 SCInet team.

2.B.2. E-Science Application Identification and Support

Maxine Brown has been involved with the following organizations and conferences throughout the past year, whose goals are to find and encourage application and middleware development.

- **TransLight/PacificWave's Applications group (ongoing)**, organized by John Silvester, stimulates application development. This group meets occasionally via telephone and at conferences. Maxine Brown is a member of this group, representing TransLight/StarLight. This group has provided advice and support to several projects.
- **Cyberinfrastructure (CI) Days** <www.cidays.org> is an ongoing effort to educate campuses about what national-scale CI resources are available; it is organized by a consortium of CI providers, including TeraGrid, Educause, Internet2, Open Science Grid, National LambdaRail, SURA and IRNC. Maxine Brown represents IRNC. During the past quarter, a University of Texas Pan American CI Days was held (March 26-27). Russ Hobby, who heads up the group, gave the IRNC presentation.

2.B.3. E-Science Support (Quantified Science Drivers)

For many years, we documented international applications on the StarLight website <www.startap.net/starlight/APPLICATIONS> and, more specifically, US/European applications on the Euro-Link website <www.startap.net/euro-link/APPLICATIONS>. However, as international collaborations become more prevalent, as collaborations expand from two to three to four continents, and as more transoceanic links become operational, it is difficult to identify and document these applications – they are ubiquitous. Of more interest to us, is to identify and serve high-end applications – that is, data-intensive e-science applications requiring advanced networking capabilities – for they are the drivers for new networking tools and services to advance the state-of-the-art of production science.

Below is a list of recent applications (both routed and switched) that we are tracking; more are documented on the TransLight/StarLight website <www.startap.net/translight/pages/applications.html>. Applications utilizing GLIF links are publicized at <www.glif.is/apps>.

US/European Applications 2009



AAAS 2009: International High-Definition Video Teleconferencing

www.evl.uic.edu/core.php?mod=4&type=4&indi=627

Collaborators:

- UIC/EVL; UIC/National Center for Data Mining (NCDM); Northwestern University/International Center for Advanced Internet Research (iCAIR); University of Michigan; TransLight/StarLight; GLORIAD; WHREN-LILA; TransLight/Pacific Wave; StarLight; US
- SARA; The Netherlands
- Masaryk University; CESNET; Czech Republic
- RNP; Brazil
- KISTI; Korea
- Space Research Institute; Kurchatov Institute; GLORIAD; Russia

The transformative technology of high-performance networking in support of science was prominently featured at the 175th American Association for the Advancement of Science (AAAS) Annual Meeting held February 12-16, 2009, at the Hyatt Regency Chicago. NSF provided the funds to lease a 1Gbps AT&T GigaMAN connection between NSF's booth space at the conference and StarLight, enabling UIC and Northwestern University to showcase the IRNC program.

This network connection was used for H323 video teleconferences between EVL in the NSF booth and scientific institutions in the US, Russia, the Netherlands, Korea, the Czech Republic and Brazil. Attendees were able to watch live presentations and question the scientists appearing on a 65-inch LCD display, as if meeting face to face. *(This network connection also supported additional application demos by UIC National Center for Data Mining and Northwestern University.)*



UIC/NCDM director Bob Grossman and postdoc Yunhong Gu stand in front of their networked cloud computing demonstration in the NSF booth – with signage overhead that recognizes the IRNC TransLight/StarLight project, UIC and Northwestern University (home of StarLight). Note: while networked, this NCDM demo was not international in scope.



Northwestern/iCAIR director Joe Mambretti sits in front of his HPDMnet demonstration in the NSF booth – with signage overhead that gives recognition to the IRNC program. (For more details on this international networked demonstration, see “HPDMnet @ AAAS 2009” in this report.)



Live teleconferencing between the NSF booth and collaborators from SARA, The Netherlands.



Live teleconferencing between the NSF booth and collaborators from RNP, Rio de Janeiro, Brazil.



Live teleconferencing with NSF director Arden Bement and former director Rita Colwell, in the NSF booth, and colleagues at Masaryk University, Czech Republic.



Live teleconferencing between the NSF booth and collaborators at KISTI, Korea.



Live teleconferencing between the NSF booth and collaborators at the Space Research Institute, Russia.



Live teleconferencing between the NSF booth and Dr. Vehlikov and others at the Kurchatov Institute, Russia.



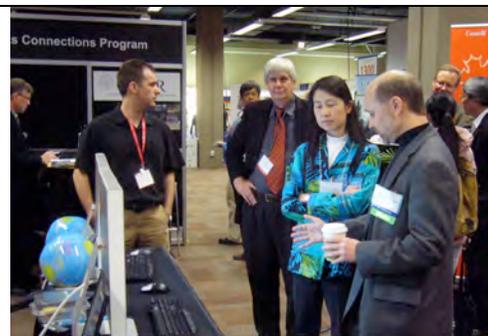
Live teleconferencing between the NSF booth and collaborators at University of Michigan. Note: While not international, it was networked.



Greg Cole participated in the NSF booth, gave presentations about GLORIAD, and showed his web-based traffic monitoring software.



NSF director Arden Bement and former director Rita Colwell, talk with Bob Grossman and Joe Mambretti in the NSF booth.



NSF CISE assistant director Jeanette Wing talks with Bob Grossman and Joe Mambretti in the NSF booth.



CosmoGrid: The Gravitational Billion Body Problem 2009

<http://modesta.science.uva.nl/Projects/2008/CosmoGrid/>
<http://wiki.2048x2048x2048.org/>

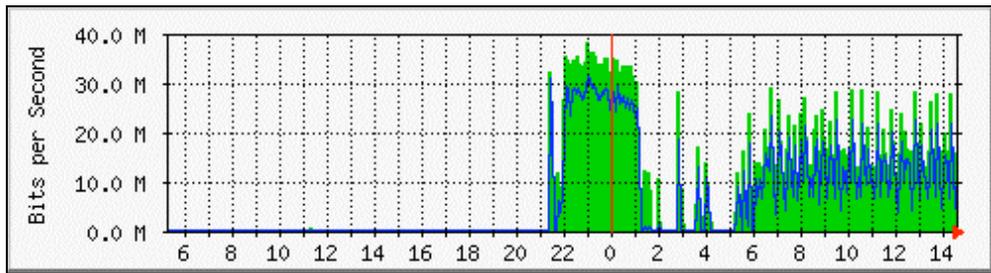
Collaborators:

- Drexel University; Vanderbilt University; StarLight; US
- CANARIE; Canada
- Univ. of Tokyo; National Astronomical Observatory of Japan (NAOJ)/Center for Computational Astrophysics; JGN2plus; SINET3; T-LEX; Japan
- University of Amsterdam (UvA); University of Leiden/Leiden Observatory (Sterrewacht Leiden); SARA; SURFnet; The Netherlands

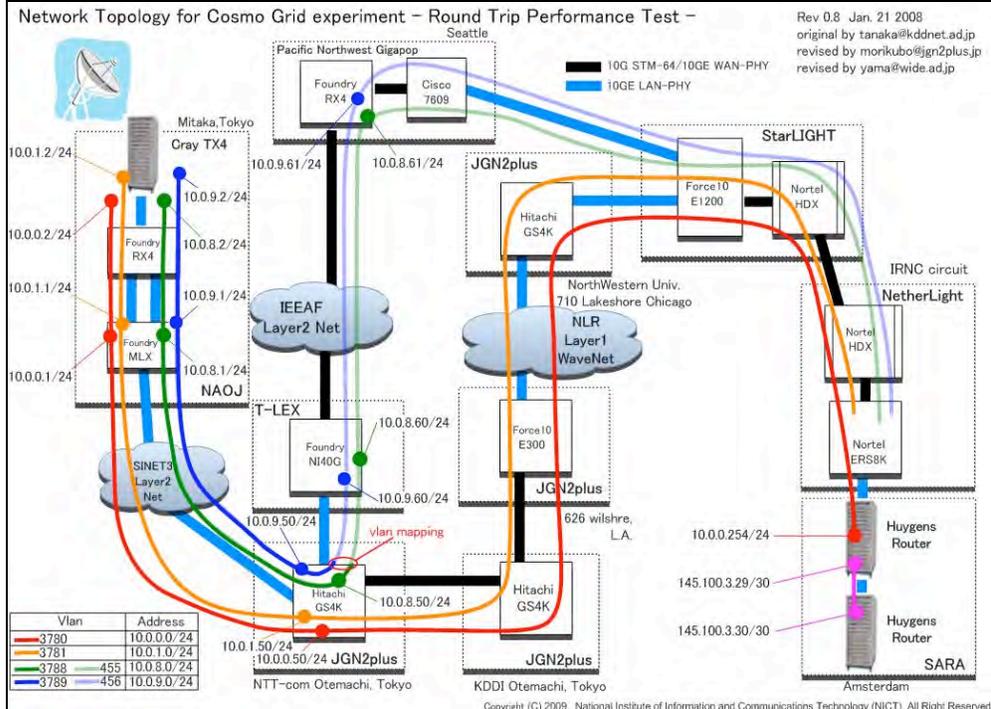
- University of Edinburgh/School of Mathematics; UK
- Ludwig-Maximilians Universität at München; Germany

Note: This collaboration started last year, and early progress was reported in previous TransLight/StarLight reports. Researchers in Tokyo and Amsterdam are building an intercontinental supercomputer grid to run cosmological N-body simulations of 10 billion particles. Updates for this year are given below.

Immediately following SC08, network engineers established a lightpath between NAOJ in Japan and SARA in The Netherlands for further network testing January 15-31, 2009. The scientists successfully ran a $2k^3$ simulation concurrently on the Cray in Tokyo and the Huygens supercomputer in Amsterdam. StarLight's MRTG traffic utilization graph for January 28, 2009, showed a sustained flow of 30-40Mbps, but overall, the traffic was bursty (with peaks over 500Mbps).

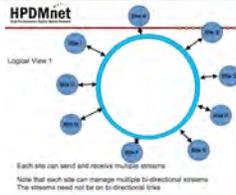


Note in the diagram below that the Tokyo to StarLight path went over the IEEAF link to Seattle, and then over the TransLight Cisco Research Wave to Chicago and then over TransLight/StarLight to Amsterdam.



As of April 14, 2009, the group reached $z=5.28$. Professor Zwart, who heads up this project, is now moving from UvA to the University of Leiden, where he accepted a position as full professor in Computational Astrophysics. There, he will perform

some mid-calculation analysis to see if all is right with the production run, and will also spend time optimizing the code for multi-platform (>2 supercomputers) calculations. At the Dutch Astronomical Conference, to be held May 13-15 in Rolduc in The Netherlands, he hopes to present a live demo and poster of the CosmoGrid project.



HPDMnet @ AAAS 2009

www.hpdmnet.org

Collaborators:

- CANARIE; Communications Research Centre (CRC); Inocybe; Nortel; Canada
- i2CAT; Barcelona
- StarLight; Northwestern University/International Center for Advanced Internet Research (iCAIR); US
- NetherLight; SARA; SURFnet; University of Amsterdam; The Netherlands

Northwestern University's iCAIR demonstrated its High-Performance Digital Media Network (HPDMnet) by streaming high-resolution digital content from servers in Spain, Canada, the Netherlands and StarLight to displays in the NSF booth at the AAAS 2009 conference, held February 12-16 in Chicago.

HPDMnet is an advanced digital media service that is being designed and developed by an international consortium that has created unique technologies that allow high-performance networks to stream exceptionally high-quality digital media from any source, including cameras, servers, scientific instruments and data repositories. HPDMnet, which is based on a global optical networking facility, can support high-volume digital media streams including individual streams thousands of times larger than those on the "best-effort" Internet.

Below, NSF CISE assistant director Jeanette Wing talks with Joe Mambretti in the NSF booth at AAAS 2009.





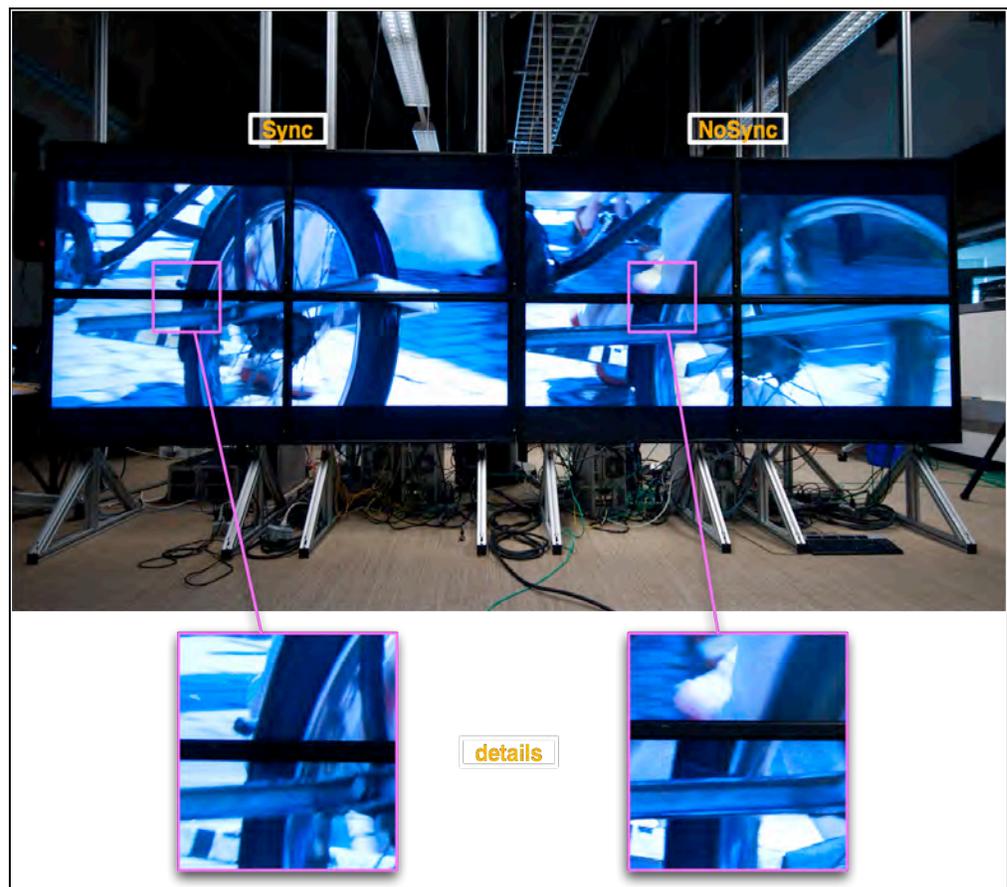
ON*VECTOR: Synchronized Multi-Lane Streaming Using NTT's Terabit Network Interface Card (NIC)

Collaborators:

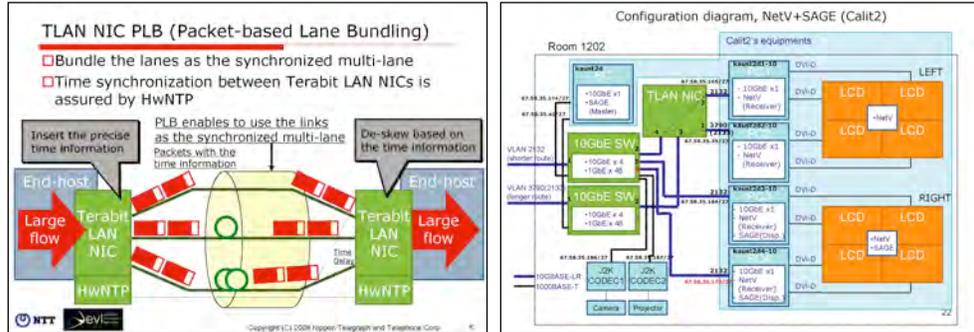
- NTT Network Innovation Laboratories; Keio University/Institute for Digital Media and Content; Japan
- UIC/EVL; Calit2/UCSD; StarLight; IEEAF; US
- CzechLight; CESNET; Czech Republic
- NetherLight; SURFnet; The Netherlands

*ON*VECTOR (Optical Networked Virtual Environments for Collaborative Trans-Oceanic Research) is a joint project of NTT Network Innovation Laboratories, Keio University's Institute for Digital Media and Content (DMC), the University of Tokyo's Morikawa Laboratory, the University of Illinois at Chicago's (UIC) Electronic Visualization Laboratory (EVL), and the California Institute for Telecommunications and Information Technology (Calit2) at the University of California, San Diego (UCSD), and managed by Pacific Interface Inc (PII).*

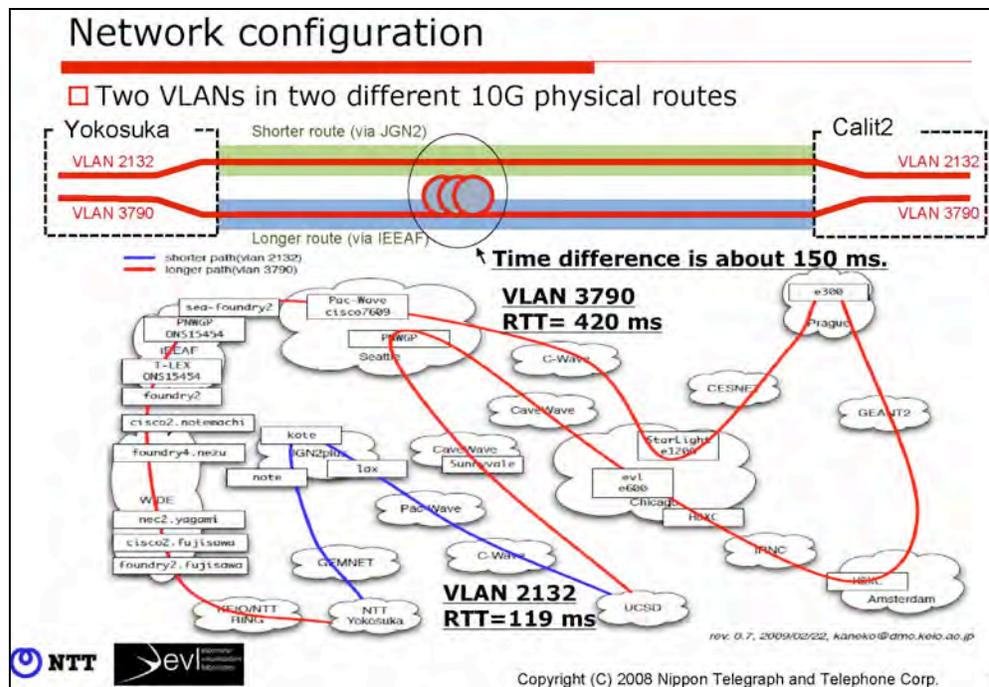
On February 24, 2009, members of the ON*VECTOR team did an experiment that required a diverse 10Gbps path from Japan to San Diego via Europe, which included the IRNC TransLight/StarLight link (network diagram appears below). The goal was to demonstrate NTT research hardware, a Terabit Local Area Network (TLAN) NIC, which synchronizes tiled display animations so that the frames display correctly, regardless of the network paths taken.



NTT's TLAN NIC Packet-based Lane Bundling (PLB) and EVL's SAGE and NetV (MultiRail-aware networked video) were used to stream tiled images in parallel over two transpacific 10Gbps routes. The photo above shows the same 2x2 animations being sent simultaneously – the 2x2 animation on the left used the TLAN NIC PLB to compensate for a 150ms propagation delay difference; the 2x2 animation on the right did not use it. Below is an illustration of the overall experiment, followed by a schematic of how the equipment was put together.



For the demonstration at the annual ON*VECTOR Photonics Workshop, two 10Gbps paths were used (a short path, shown in BLUE, and a long path, in RED).

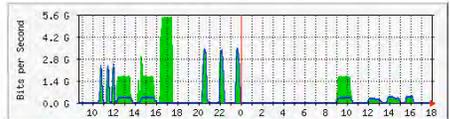


The following MRTG graphs are from February 26.

System: SL-E1200 in
 Maintainer:
 Description: TenGigabitEthernet-2/2 CiscoWave 6506 at 750/iCair
 ifType: ethernetCsmacd (6)
 ifName: TenGigabitEthernet 2/2
 Max Speed: 1250.0 MBytes/s

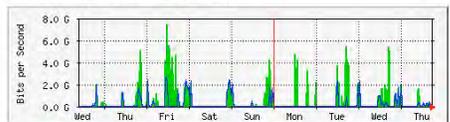
The statistics were last updated **Thursday, 26 February 2009 at 18:04**, at which time 'SL-E1200' had been up for **133 days, 13:37:05**.

'Daily' Graph (5 Minute Average)



Max In: 5536.5 Mb/s (55.4%) Average In: 565.6 Mb/s (5.7%) Current In: 16.6 kb/s (0.0%)
 Max Out: 3482.2 Mb/s (34.8%) Average Out: 227.1 Mb/s (2.3%) Current Out: 2384.0 b/s (0.0%)

'Weekly' Graph (30 Minute Average)



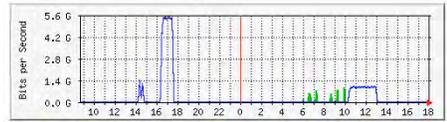
Max In: 7548.6 Mb/s (75.5%) Average In: 593.1 Mb/s (5.9%) Current In: 16.4 kb/s (0.0%)
 Max Out: 2689.0 Mb/s (26.9%) Average Out: 211.4 Mb/s (2.1%) Current Out: 2520.0 b/s (0.0%)

Bandwidth usage from Pacific Wave in Seattle to StarLight over "TransLight," the Cisco Research Wave that is deployed on NLR

System: SL-E1200 in
 Maintainer:
 Description: TenGigabitEthernet-10/2 CESNET
 ifType: ethernetCsmacd (6)
 ifName: TenGigabitEthernet 10/2
 Max Speed: 1250.0 MBytes/s

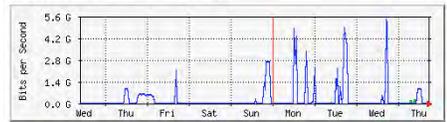
The statistics were last updated **Thursday, 26 February 2009 at 18:04**, at which time 'SL-E1200' had been up for **133 days, 13:37:06**.

'Daily' Graph (5 Minute Average)



Max In: 963.6 Mb/s (9.6%) Average In: 23.2 Mb/s (0.2%) Current In: 2792.0 b/s (0.0%)
 Max Out: 5540.8 Mb/s (55.4%) Average Out: 275.3 Mb/s (2.8%) Current Out: 304.5 kb/s (0.0%)

'Weekly' Graph (30 Minute Average)



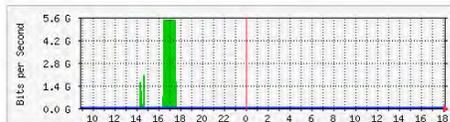
Max In: 333.4 Mb/s (3.3%) Average In: 4032.3 kb/s (0.0%) Current In: 2960.0 b/s (0.0%)
 Max Out: 5441.8 Mb/s (54.4%) Average Out: 276.6 Mb/s (2.8%) Current Out: 308.2 kb/s (0.0%)

Bandwidth from StarLight to Prague over CESNET

System: evl-e600 in
 Maintainer:
 Description: TenGigabitEthernet-2/3 TransLight/StarLight IRNC
 ifType: ethernetCsmacd (6)
 ifName: TenGigabitEthernet 2/3
 Max Speed: 10.0 Gbits/s

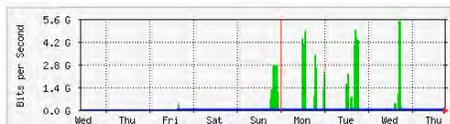
The statistics were last updated **Thursday, 26 February 2009 at 18:10**, at which time 'evl-e600' had been up for **148 days, 19:36:39**.

'Daily' Graph (5 Minute Average)



Max In: 5462.0 Mb/s (54.6%) Average In: 195.5 Mb/s (2.0%) Current In: 2208.0 b/s (0.0%)
 Out: 8712.0 b/s (0.0%) Average Out: 3816.0 b/s (0.0%) Current Out: 3680.0 b/s (0.0%)

'Weekly' Graph (30 Minute Average)



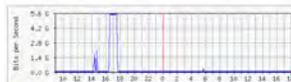
Max In: 5443.8 Mb/s (54.4%) Average In: 287.0 Mb/s (2.9%) Current In: 2384.0 b/s (0.0%)
 Out: 15.8 Mb/s (0.2%) Average Out: 85.5 kb/s (0.0%) Current Out: 3608.0 b/s (0.0%)

Bandwidth from NetherLight in Amsterdam to StarLight over the TransLight/StarLight IRNC circuit

System: evl-e600 in
 Maintainer:
 Description: TenGigabitEthernet-1/0 CAVEwave to UCSD (NLR-STAR-SEAT-10GE-6 and NLR-SEAT-SAND-10GE-7)
 ifType: ethernetCsmacd (6)
 ifName: TenGigabitEthernet 1/0
 Max Speed: 10.0 Gbits/s

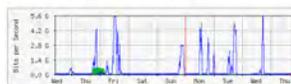
The statistics were last updated **Thursday, 26 February 2009 at 18:10**, at which time 'evl-e600' had been up for **148 days, 19:36:39**.

'Daily' Graph (5 Minute Average)



Max In: 209.8 Mb/s (2.1%) Average In: 531.8 kb/s (0.0%) Current In: 6792.0 b/s (0.0%)
 Out: 5482.0 Mb/s (54.0%) Average Out: 196.0 Mb/s (2.0%) Current Out: 3248.0 b/s (0.0%)

'Weekly' Graph (30 Minute Average)



Max In: 457.5 Mb/s (4.6%) Average In: 32.2 Mb/s (0.3%) Current In: 6976.0 b/s (0.0%)
 Out: 5446.9 Mb/s (54.5%) Average Out: 381.8 Mb/s (3.8%) Current Out: 3280.0 b/s (0.0%)

Bandwidth from StarLight to UCSD over CAVEwave

2.B.4. Plans for the Coming Quarter (Quarterly Reports Only)

TransLight/StarLight plans for May 1 – July 31, 2009, include:

- Continue provisioning VLANs on TransLight/StarLight CHI/AMS for e-science applications (ongoing)
- Continue representing TransLight/StarLight at major conferences and workshops (as members of the program committee and/or as participants); continue to participate in network engineering JET and GOLE meetings; continue to participate in the IRNC Measurement Group; and, continue to learn/design cybersecurity best practices for IRNC
- Continue identifying and developing production applications on both IRNC circuits.
- Continue updating the TransLight/StarLight website.
- Continue to contribute to the GLIF applications website.
- Continue preparations for GLIF 2009 and SC'09 international demonstrations

2.C. Research Training

National Research & Education Network (NREN) management and engineers from Internet2, ESnet, NLR and DANTE work closely with IRNC management and engineers at UIC and SURFnet, as well as at MAN LAN, StarLight, and NetherLight, to facilitate connectivity and greater advances in global networking than a single-investigator effort can afford. In addition, numerous researchers, middleware developers, network engineers and international NRENs are involved as users of TransLight/StarLight. This global, dedicated community has elected to work together, on a persistent basis, to further the goals of international e-science collaboration.

2.D. Education/Outreach

TransLight/StarLight's primary education and outreach activities include web documentation, journal articles, and conference presentations and demonstrations. We also provide PowerPoint presentations and other teaching materials to collaborators to give presentations at many conferences, government briefings, etc.

Since 1986, EVL has partnered with NCSA, ANL, and, since 1994 with NU/iCAIR, and since 2000 with Calit2/UCSD, in ongoing efforts to develop national/international collaborations at major professional conferences, notably ACM/IEEE Supercomputing (SC), IEEE High Performance Distributed Computing (HPDC), and Internet2 and GLIF meetings. We have participated in European conferences, NORDUnet annual meetings and a UKERNA seminar on optical networking. Our success has been in the development of teams, tools, hardware, system software, and human interface models on an accelerated schedule to enable multi-site collaborations for complex problem solving.

We participate in the annual GLIF and SC conferences, and have participated in AAAS 2008 and 2009, to promote the goals of IRNC and TransLight/StarLight. We also organized the iGrid 2005 in San Diego in September 2005 to showcase international advanced applications and middleware developments.

3. Publications and Products

3.A. Journals/Papers

None.

3.B. Books/Publications

None.

3.C. Internet Dissemination

www.startup.net/translight

3.D. Other Specific Products

Other than the information reported here, we have not developed any other specific product of significance.

4. Contributions

4.A. Contributions within Discipline

TransLight/StarLight, by its very nature, is interdisciplinary. There is clearly a fine team of computer scientists, computational scientists and networking engineers involved with TransLight/StarLight, facilitating greater advances in global networking than single-investigator efforts can afford.

TransLight/StarLight developed its management team in the Chicago area (UIC/EVL), and leverages the efforts of its IRNC partners (particularly TransLight/PacificWave, GLORIAD and WHREN-LILA), and technical and administrative contacts at national NRENs (Internet2, ESnet and NLR) and foreign NRENs (DANTE and SURFnet).

4.B. Contributions to Other Disciplines

Within the Computational Science and the Computer Science communities, TransLight/StarLight efforts help lead 21st century discipline science and computer science innovation. TransLight/StarLight's 10Gbps routed circuit among the Internet2 network, NLR, ESnet and GÉANT2 provides greater transatlantic connectivity, and the 10Gbps switched circuit between StarLight and NetherLight provides long-distance, high-bandwidth capability for demanding data-intensive e-science applications.

4.C. Contributions to Human Resource Development

We promote TransLight/StarLight through web documentation, journal articles, demonstrations and presentations at major networking conferences (e.g., SC, HPDC, Internet2), workshops (GLIF, PFLDNeT), scientific conferences (AAAS), as well as PowerPoint presentations and other instructional material. We teach the infrastructure, the grid advancements, the technological innovations and the application advancements that global connectivity enables. In fact, thanks to previous NSF funding of STAR TAP, StarLight and Euro-Link, we have a mailing list of ~1,000 <stars@startup.net> individuals, from academia, government and industry, interested in information about international advanced networking developments.

4.D. Contributions to Resources for Research and Education

TransLight/StarLight is a necessary and integral part of application advances and technological innovations for the US Computational Science and Computer Science research and education communities, as well as of major interest to network engineers. In particular, the TransLight/StarLight L2 circuit between StarLight and NetherLight is part of the GLIF LambdaGrid fabric and represents a major resource for science and technology.

4.E. Contributions Beyond Science and Engineering

Because of TransLight/StarLight's interest in advanced applications and lightpath provisioning, we often get inquiries from network equipment manufacturers and telecommunication providers about partnering with us to create and showcase a marketplace for wavelength-based network services and products. We look forward to working with these companies and introducing them to the Nation's foremost university and Federal laboratory networking engineers, computer programmers and applications scientists, who are developing and using today's evolving grid technologies. Our users expect us to grow in capacity and sophistication, and we look forward to the engineering challenges ahead.

5. Special Requirements

5.A. Objectives and Scope

A brief summary of the work to be performed during the next year of support if changed from the original proposal.

Our scope of work has not changed.

5.B. Special Reporting Requirements

Do special terms and conditions of your award require you to report any specific information that you have not yet reported?

No.

5.C. Animals, Biohazards, Human Subjects

Has there been any significant change in animal care and use, biohazards, or use of human subjects from what was originally approved (or approved later)?

No.