TransLight / StarLight

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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/GÉANT2, 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 GÉANT2 POP at the Amsterdam Internet Exchange. **Summerhill retired June 2009 and was replaced by Randall Frank**.

(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 GÉANT2 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.startap.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 second quarter of Year 5 of the grant:

- Preparing the 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)
- Continuing to update the TransLight/StarLight website <www.startap.net/translight> (ongoing)
- Continuing to contribute to the GLIF applications website <www.glif.is/apps>.
- Continuing preparations 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.startap.net/translight/pages/measurement.html>. This website also lists utilization for Internet2 and NLR.

Note: ESnet is currently transitioning from MRTG to an improved service, so specific graphs are not available, though utilization can be calculated.

IRNC aggregate traffic (~4Gbps) used by Internet2/ESnet/NLR for the period June 13-July 13, 2009.	

IRNC Internet2 traffic (>1Gbps) for the period June 13-July 13, 2009.	Device: rtr.newy32aoa.net.internet2.edu--ge-4/1/0.102 input Current: 204.202 Mbps Average: 440.402 Mbps Max: 1.062 Gbps output Current: 238.646 Mbps Average: 271.439 Mbps Max: 1.086 Gbps GEANT | AS:20965 (ge-4/1/0.102) Mon Jun 15 17:59:25 2009 UTC -- To -- Mon Jul 13 17:59:25 2009 UTC
IRNC NLR traffic (~1Gbps) for the period June 13-July 13, 2009.	Device: newy.layer3.nlr.net--tengige0/5/0/4.211 input Current: 299.688 Mbps Average: 195.037 Mbps Max: 720.310 Mbps output Current: 351.779 Mbps Average: 362.116 Mbps Max: 848.647 Mbps GEANT via MANLAN, AS20965 (TenGigE0/5/0/4.211) Mon Jun 15 18:01:17 2009 UTC -- To -- Mon Jul 13 18:01:17 2009 UTC

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

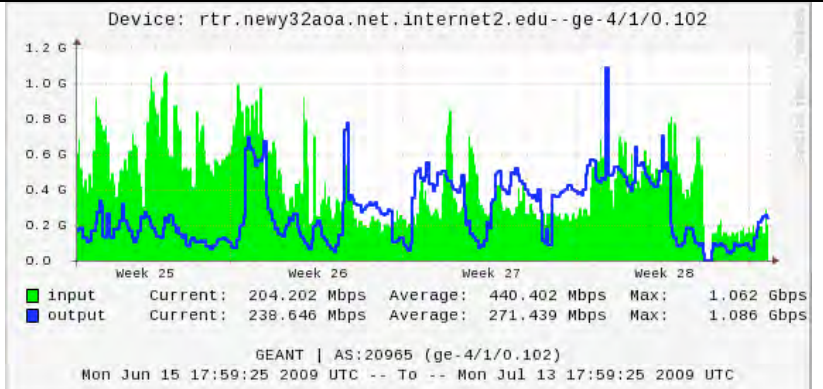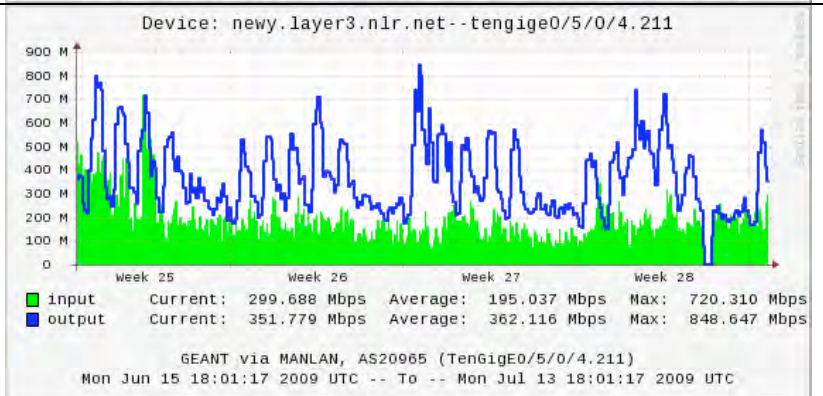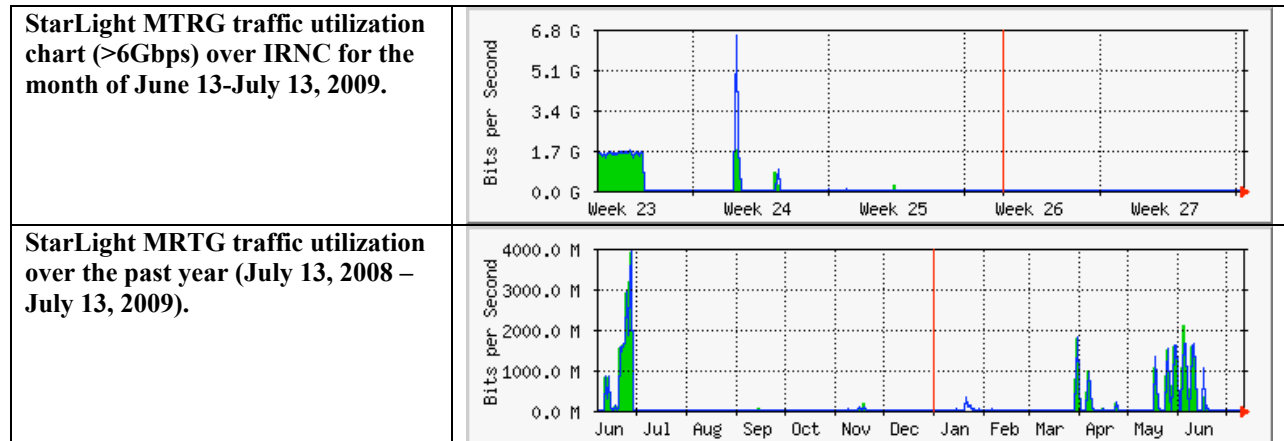MRTG traffic utilization information for the CHI/AMS TransLight/StarLight link can be accessed from

the TransLight/StarLight website <www.startap.net/translight/pages/measurement.html>. *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).*

StarLight MTRG traffic utilization chart (>6Gbps) over IRNC for the month of June 13-July 13, 2009.	
StarLight MRTG traffic utilization over the past year (July 13, 2008 – July 13, 2009).	

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 have been in place (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
- ON*VECTOR…no bandwidth limits
- CosmoGrid…no bandwidth limits
- LHC/Tier2…3Gbps

LHC/Tier2…We previously reported that 3Gbps were provisioned on TransLight/StarLight for LHC/Tier2 sites, to complement DOE USLHCnet transatlantic bandwidth for US Tier1 sites. This will 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 was already in place, as both these sites are 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 TransLight/StarLight circuit via Internet2 and/or NLR, as USLHCnet peers with both of them.

To further expedite access, on May 28, 2009, the DOE USLHCnet project selected NLR as a provider of 10Gbps circuits linking US institutions to the LHC. Specifically, NLR will provide two 10Gbps circuits between Chicago and New York, enabling LHC data access and exchange by the US Tier1 facilities under the leadership of Caltech in cooperation with the Fermilab near Chicago and Brookhaven National Laboratory near New York City. In addition, numerous smaller, Tier2 centers, where most of the data analysis will take place, will also be connected. The US LHC program roadmap calls for introduction of 40-100Gbps technologies when service and cost requirements are met. The full announcement can be found at <www.nlr.net/release.php?id=44>.

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:

July 29, 2009. Tom DeFanti hosted Dimitra Simeonidou, Chair of Optical Communications and Head of the Photonic Networks and Networked Media Groups at the University of Essex, UK. They discussed research infrastructure developments in the UK in the fields of networking and high-performance media, as well as the newly EU-funded GEYSER collaboration that will implement an IaaS framework over heterogeneous infrastructures (networks, data storage, media devices, content repositories, etc).

July 20, 2009. Alan Verlo participated in a JET meeting, held at the Joint Techs.

July 19-23, 2009. Alan Verlo attended the Summer '09 ESCC/Internet2 Joint Techs, held in Indianapolis, Indiana <http://events.internet2.edu/2009/jt-indy/index.cfm>.

June 16, 2009. Alan Verlo participated in a JET meeting.

June 15-20, 2009. Tom DeFanti visited Kees Neggers of SURFnet and Anwar Osseyran of SARA in The Netherlands to discuss IRNC TransLight StarLight. On June 19, he also participated in a one-day symposium "Networked Visualization for e-Science" organized by the University of Amsterdam, and gave the keynote "UCSD's Project GreenLight Computation, Visualization, and Networking" <http://staff.science.uva.nl/~delaat/symp-2009-06-19/>.

June 11-13, 2009. Tom DeFanti attended the International ACM Symposium on High Performance Distributed Computing (HPDC 2009) in Munich, Germany <www.lrz-muenchen.de/hpdc2009/index.php>, and gave the presentation "OptIPortals for 2015" as part of the panel "How to solve the power wall problem of supercomputing (in 2015)."

June 3, 2009. UIC/EVL hosted several visitors from IMC in Vietnam who were visiting UIC's Department of Earth and Environmental Sciences to discuss collaborations. IMC is the Institute for Technology Development, Media and Community Assistance, a division of VUSTA, the Vietnamese Union of Science and Technology, both Vietnamese ministerial level entities. Delegates were: Nguyen Duy Ngoc (IMC director), Nguyen Hoang (IMC deputy director), Bui Viet Duc (Head of IMC Education Exchange Division) and Dao Dang Toan (IMC communications assistant).

June 1-5, 2009. Alan Verlo attended a SCInet meeting in Portland, OR.

May 19, 2009. Alan Verlo participated in a JET meeting.

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.

9th Annual GLIF Global LambdaGrid Workshop

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

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, no CI Days events were held.

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>.
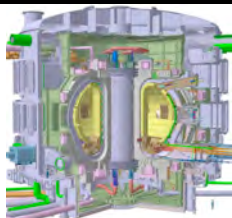
EVO Powers Communication for Global Collaborations

www.isgtw.org/?pid=1001833
http://evo.caltech.edu/

Collaborators:
The Enabling Virtual Organizations (EVO)"grid" consists of 52 servers deployed at key network locations in 22 countries. Network locations include institutions linked by education and research networks such as JANET in the UK and RENATER in France, and at large laboratories such as CERN in Switzerland and Brookhaven National Laboratory in the US. EVO uses the grid monitoring service MonALISA (Monitoring Agents using a Large Integrated Services Architecture), developed at Caltech, to connect users to the best available server and provide load balancing for the entire system.

EVO, a worldwide network designed for institutions participating in the LHC experiments and other high-energy physics collaborative programs, makes international collaboration easier by providing a reliable and secure system for real-time virtual meetings.

EVO, developed by Caltech, was a winner of the 2009 Internet2 IDEA award for applied advanced networking "at its best." In 2008 it hosted more than 9,100 virtual LHC collaboration meetings with a total of over 4,200 users. The combined time each user spent in EVO LHC meetings last year totals more than 86,300 hours. Unlike commercial networks, EVO poses no restriction on the number of participants in a meeting. On September 10, 2008, about 1,250 sites around the world participated via EVO in the LHC startup event, with up to 250 sites connected at any given time.

ITER Long-Distance Data-Transfer Experiments 2009
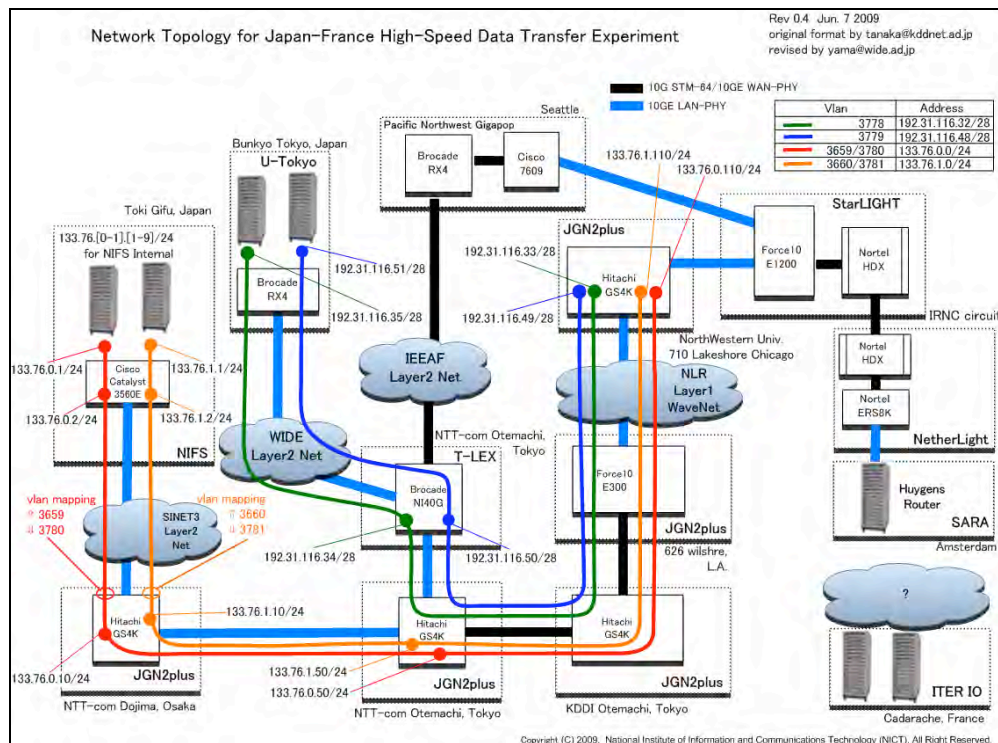
www.iter.org

Collaborators:
- University of Tokyo/Data Reservoir project; National Institute of Fusion Science; Japan
- StarLight; US
- ITER Institute; Cadarache, France
- *Note: The 7 members of the international ITER project are the People's Republic of China, the European Atomic Energy Community (via EURATOM), the Republic of India, Japan, the Republic of Korea, the Russian Federation and the US. Collectively, they represent over half of the world's population.*

ITER is a large-scale scientific experiment intended to prove the viability of fusion as an energy source, and to collect the data necessary for the design and subsequent operation of the first electricity-producing fusion power plant. Site preparation at Cadarache in Southern France began in January 2007, representing an important first milestone in the 10-year construction process to build ITER.

Beginning June 2009, University of Tokyo's Data Reservoir project and the National Institute of Fusion Science (NIFS) in Japan started performing long-distance data transfer experiments between Japan and the ITER Institute in

Cadarache, France. This is the first of the series of experiments to establish dedicated network technology for the coming ITER fusion system. Currently they are using 1Gbps; in September/October, they hope to use 10Gbps.

On June 11, 2009, an experiment took place using 1Gbps bandwidth (from Japan to Cadarache via SINET3 to Internet2 to GÉANT2 to RENATER); possible routes were discussed among the various network engineers, as illustrated below. Actual bandwidth used was up to 800Mbps, though there was packet loss and the Tokyo/ITER route was not symmetric. After much debugging, errors were fixed.

For upcoming 10Gbps trials, the tentative path is RENATER from Cadarache to Paris, where the data will be carried by SURFnet and GÉANT2+ to NetherLight, then over IRNC TransLight/StarLight to Chicago, and then JGN2+ to Japan. (By August, GÉANT2+ will have a 10Gbps connection at NetherLight, but until then, SURFnet will carry the data to the GÉANT2+ cloud. Once GÉANT2+ peers at NetherLight, it will just be a simple migration.)

Large Hadron Collider: Worldwide LHC Computing Grid: STEP'09

www.hpcwire.com/industry/academia/STEP09-Demonstrates-LHC-Readiness-49631242.html
http://press.web.cern.ch/press/PressReleases/Releases2009/PR11.09E.html
http://lcg.web.cern.ch/LCG/

Collaborators:
WLCG combines the IT power of more than 140 computer centers, the result of collaborations among 33 countries.

On July 1, 2009, in preparation for the restart of the Large Hadron Collider (LHC), the Worldwide LHC Computing Grid (WLCG) was used in its first production demonstration involving all key elements – from data taking to analysis. Records of

all sorts were established: data taking throughput, data import and export rates between the various Grid sites, as well as huge numbers of analysis, simulation and reprocessing jobs – ATLAS alone running close to 1M analysis jobs and achieved 6GB/s of Grid traffic, the equivalent of a DVD worth of data a second, sustained over long periods.

This result is particularly timely as it coincides with the transition of grids into long-term sustainable e-infrastructures, clearly of fundamental importance to projects of the lifetime of the LHC. With the restart of the LHC only months away, one can expect a large increase in the number of grid users: from several hundred users today to several thousand when data taking and analysis commences. This can only happen through the significant streamlining of operations and simplification of end-users' interactions with the grid. *Scale Testing for the Experiment Programme '09 (STEP'09)* included massive-scale testing of end-user analysis scenarios, including "community-support" infrastructures, whereby the community is trained and largely self-supporting, backed by a core group of grid and application experts.

SAGE Visualcasting: Total Solar Eclipse July 22, 2009

www.astronomy2009.org
http://eclipse.gsfc.nasa.gov/SEmono/TSE2009/TSE2009.html
http://en.wikipedia.org/wiki/Solar_eclipse_of_July_22,_2009

Collaborators:
- UIC/EVL; University of Michigan; StarLight; US
- Keio University; JGN2plus; Japan
- SARA; The Netherlands

The total solar eclipse that took place on Wednesday, July 22, 2009 was visible from a narrow corridor through northern India, eastern Nepal, northern Bangladesh, Bhutan, the northern tip of Myanmar, central China and the Pacific Ocean, including the Ryukyu Islands, Marshall Islands and Kiribati.

Within the context of the International Year of Astronomy 2009, researchers at Keio University in Japan coordinated groups to capture the total solar eclipse. HD video (motion-picture XD-CAM) was captured and transmitted in real time from Wuhan and Shanghai, in China, and from Amami, Japan (southern islands), back to Keio University in Tokyo. High-resolution still images were also recorded and transmitted in real time from each location (Nikon D3 with fish-eye lens).

From Keio, HD video was streamed using SAGE streaming software to a SAGE Bridge cluster at StarLight in Chicago (Keio selected and switched the various input streams). SAGE Visualcasting then replicated the HD video streams for viewing at UIC/EVL in Chicago, University of Michigan in Ann Arbor, and SARA in Amsterdam. Uncompressed YUV422 video at ~ 20 fps, with audio, requires a sustained bandwidth of 800Mbps.

In addition, digital still images were sent to a SAGE Bridge cluster at UIC/EVL using Keio's virtual file-system cache, which uses Fuse, where Visualcasting was then used to replicate the still images to displays at UIC/EVL, Michigan and SARA. Images were backed up on EVL's storage system. Uncompressed RGB images at ~1 fps requires a sustained bandwidth of 500Mbps.
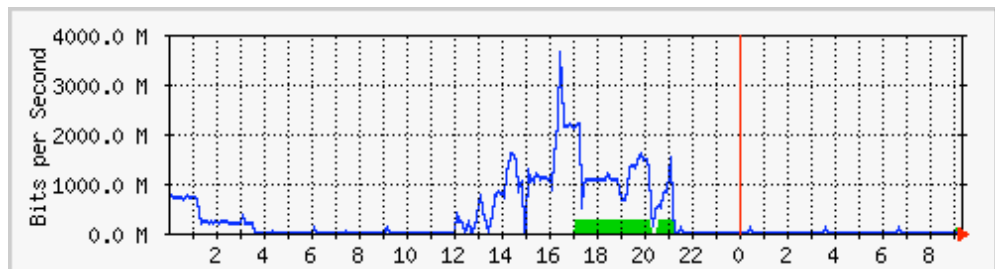
Keio also arranged to have the event shown on several dome theaters in Japan and
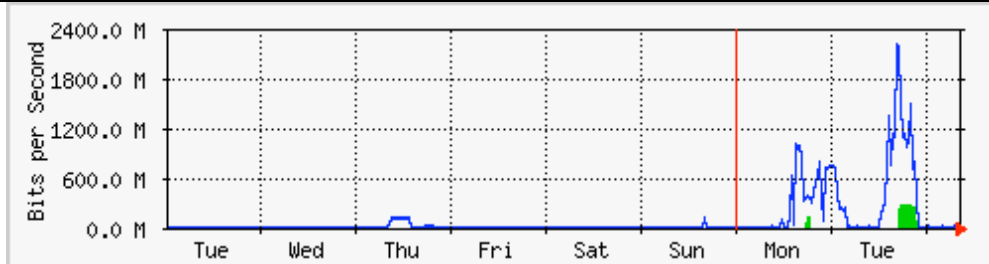
to transmit an Internet video stream as well.

Above is a picture of UIC/EVL's tiled display wall. The fish-eye lens photos sent from Tokyo are displayed in the upper left. The HD video streamed from Tokyo to StarLight, where it is replicated and forwarded to EVL, appears in the lower left. Video feedback of people at SARA viewing the photos and video, being streamed to EVL from Amsterdam in real time, appears in the upper right. (Feedback from Michigan was displayed on a Lifesize teleconferencing system elsewhere in the EVL laboratory.) The following day, Paul Wielinga of SARA sent email stating: "We enjoyed a fantastic eclipse-night with our audience last Wednesday morning…It is always amazing to realize that we are able to view, live, high-resolution images from the other side of the earth as if it is next door…We will get used to this idea, but it still seems a miracle, certainly for most of the people who attended the show."

The TransLight/StarLight CHI/AMS MRTG, for transmitting HD video and still images to SARA in Amsterdam, on the evening of July 21, 2009:

TransLight/StarLight CHI/AMS MRTG for the week of July 15-22, 2009:

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

TransLight/StarLight plans for August 1 – October 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.
- Provide appropriate support for successful networked demonstrations at GLIF 2009
- Continue preparations for 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, articles, and conference presentations and demonstrations. We also provide PowerPoint presentations and other teaching materials to collaborators to give presentations at conferences, government briefings, etc.

EVL has partnered with NCSA and ANL since 1986, with NU/iCAIR since 1994, and with Calit2/UCSD since 2000, 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.startap.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 connecting Internet2, 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, 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@startap.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. Conference Proceedings

None.

6. Special Requirements

6.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.

6.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.

6.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.