TransLight / StarLight

NSF Cooperative Agreement OCI-0441094
www.startap.net/translight

QUARTERLY REPORT February 1, 2008 – April 30, 2008
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1. Participants

1.A. Primary Personnel

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

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	Professional staff	Yes
Laura Wolf	Professional staff	Yes
Steve Sander	Professional staff	Yes
Pat Hallihan	Professional staff	Yes
Lance Long	Professional staff	Yes
Linda Winkler	Professional staff	Yes
Rick Summerhill	Professional staff	Yes
Roberto Sabatino	Professional staff	Yes
Erik-Jan Bos	Professional staff	Yes
Kees Neggers	Other Senior Personnel	Yes
Joe Mambretti	Other Senior Personnel	Yes

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 26 National Research & Education Networks representing 30 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 Department of Energy 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 currently constructing a dedicated lightwave round-the-world, connecting scientific organizations in the US, Russia, China, Korea, Canada, the Netherlands and the Nordic countries. GLORIAD currently has 3x1Gbps VLANs on the TransLight/StarLight CHI/AMS link to NetherLight, where Russia has a 10Gbps link to Moscow. (This will soon change, and Russia will connect from Moscow to Stockholm, and then to Amsterdam via NORDUnet.)

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.

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 wants to encourage 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 NLR FrameNet use.

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

We have been working on the following activities during the first quarter of year 4 of the grant:

- Provisioning VLANs on TransLight/StarLight CHI/AMS for e-science applications (ongoing)
- Continue to represent 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 to identify and assist with developing production applications on both IRNC circuits.
- Update the TransLight/StarLight website <www.startap.net/translight> with information contained in 2007-2008 Annual Report
- Contribute to the GLIF Applications website <www.glif.is/apps>
- Begin preparations for GLIF and SC'08 international application demonstrations
- Facilitate, finalize and distribute the new GLIF 2008 network map

2.A.2. Infrastructure Topology

No updates to report.

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

PoP Connectivity and Peering – NYC/AMS

No updates to report.

Usage

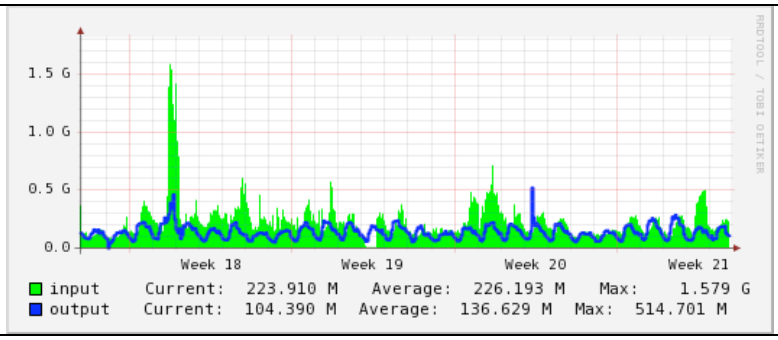
Currently, NYC/AMS Internet2 usage information appears on the TransLight/StarLight website <www.startap.net/translight/pages/measurement.html>.

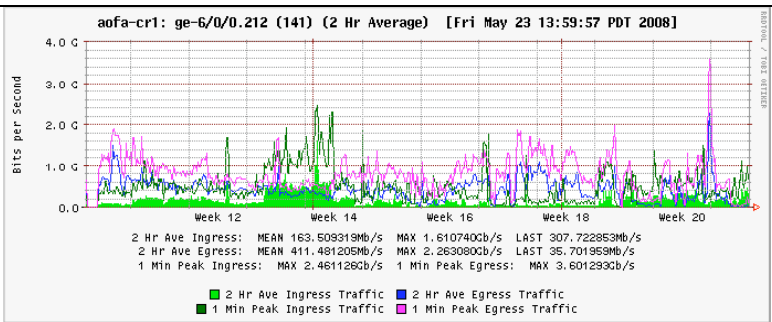
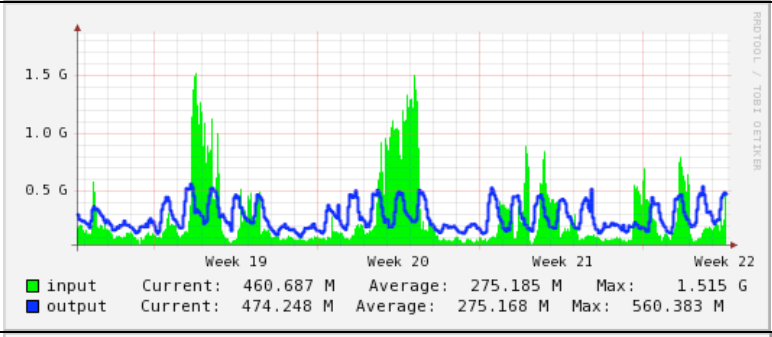
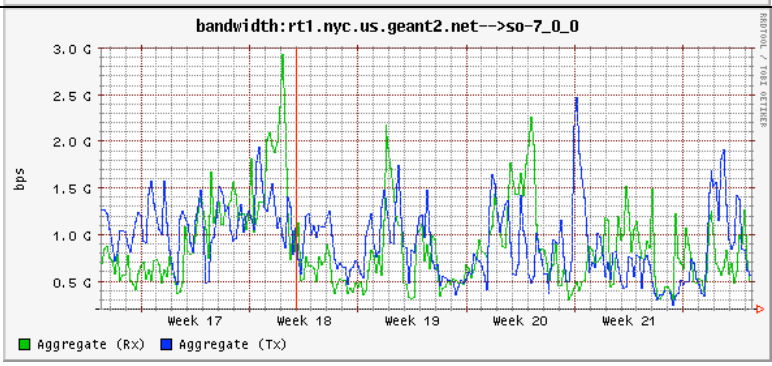
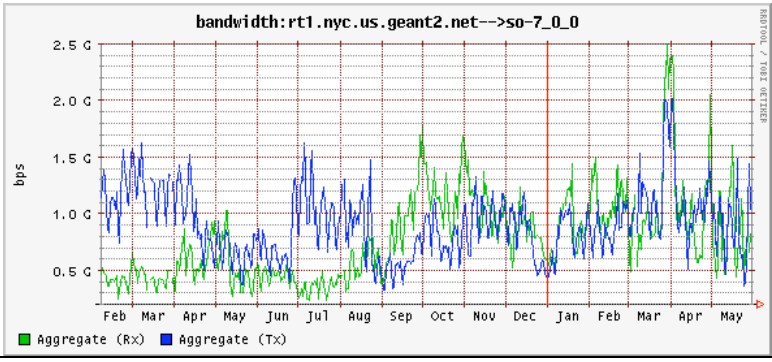
In preparing the 2006-2007 annual report, GÉANT2 provided us with a monthly utilization chart for February/March 2008 that showed a utilization of over 2.0Gbps on the link. Internet2 believed that the GÉANT2 chart showed the aggregate traffic of Internet2, ESnet and NLR PacketNet. ESnet and NLR have now provided public URLs for traffic stats from its networks to GÉANT2 over the IRNC link at MAN LAN. These URLs will soon be posted to the TransLight/StarLight website:

ESnet: <https://mrtg.es.net/geant/geant_mrtg_rtr-trfc_page_remote.cgi>.

NLR: <http://dc-snmp.wcc.grnoc.iu.edu/nlr/show-graph.cgi?title=newy.layer3.nlr.net--tengige0/5/0/4.211&rrdname=newy.layer3.nlr.net--tengige0_5_0_4.211.rrd>.

GÉANT2 does not make its statistics public, but provided the following monthly/yearly usage charts upon request.

Internet2 SNAPP traffic utilization chart over IRNC for the past month. Note that traffic peaks at ~1.5Gb.	

ESnet traffic over IRNC for the past two months. Note that traffic peaks at ~3.5Gb.	
NLR SNAPP traffic utilization chart over IRNC for the past month. Note that traffic peaks at ~1.5Gb.	
Monthly and yearly *aggregate* traffic utilization of the NYC/AMS TransLight/ StarLight link, as reported by GÉANT2.	 

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 – CHI/AMS

No updates to report.

Usage

Currently, usage of the CHI/AMS TransLight/StarLight (via VLANs) appears on the TransLight/StarLight website. StarLight's MRTG statistics 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 during the past quarter (Section 2.B.3). When we went to download the MRTG graphs for the past month and year to include in this section of the report, errors were detected in the Y-axes of the charts. StarLight network engineers have been notified and Linda Winkler is attempting to fix the MRTG program.*

Prior to November/December 2007, the TransLight/StarLight link terminated in Amsterdam into a UvA-owned Force10. It was then moved to a SURFnet-owned Nortel ERS8600R at NetherLight. Public monitoring of this Nortel switch is not yet available, though SURFnet is working on it. The TransLight/StarLight website needs to be updated to reflect this information.

Routing Policies

No updates to report.

Peering Policies

No updates to report.

Security

No updates to report.

Engineering: LightPath Services

The following 1Gbps VLANs on the TransLight/StarLight CHI/AMS were created this quarter:

- **Arecibo Radio Telescope in Puerto Rico…**A VLAN was created to connect Arecibo in Puerto Rico to JIVE in The Netherlands. A VLAN was created from AMPATH, where Arecibo connects, to AtlanticWave to CAVEwave (in Washington DC), and then from CAVEwave to Chicago, over TransLight/StarLight, to NetherLight. While put in place for a demonstration for the TERENA annual meeting, the radio astronomers would like to keep this VLAN permanent for Arecibo; science runs are done at 4-6 week intervals, for 24 hours periods.
- **HEPGrid (RNP/CLARA) and SPRace (Sao Paulo/ANSP)…**Two VLANs were created to connect Tier2 sites in Brazil to CERN (via WHREN-LILA to AMPATH, then over AtlanticWave to Washignton DC, to CAVEwave to Chicago, over TransLight/StarLight to Amsterdam, and then to CERN via SURFnet).

The following 1Gbps VLANs on the TransLight/StarLight CHI/AMS are pending:

- **i2CAT (Barcelona)…**has requested a VLAN to test 4K media streaming between Chicago and Barcelona, via Amsterdam. (i2CAT has a 10Gbps between Amsterdam and Barcelona.)

The following VLANs on the TransLight/StarLight CHI/AMS exist:

- GLORIAD (3Gbps)
- NOAA
- Teraflow Testbed
- OptIPuter/Global Lambda Visualization Facility (GLVF)
- Korea-NORDUnet Medical Imaging

NOC Operations

See <www.startap.net/starlight/ENGINEERING/network_operations.html>.

2.A.5. Meeting and Conference Participation

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

May 27, 2008. Minsun Lee of KISTI visited EVL. Lee is a networking expert in the e-science group at KISTI, which is an OptIPuter partner, an EVL collaborator, and a GLIF participant. This was her first visit to EVL, as she wanted to learn more about our latest developments.

May 27, 2008. Greg Wickham, AARNet e-Research Network expert, visited Calit2/UCSD to learn more about applications and OptIPortals. Luc Renambot of EVL was visiting Calit2/UCSD at the time, and met with him to explain how OptIPortals and SAGE 3.0 are being used over optical networks for collaborations with partners.

May 26, 2008. Maxine Brown used high-definition video teleconferencing to give the presentation "GLIF and the OptIPlanet Collaboratory" at the annual RNP Workshop <www.rnp.br/wrnp/2008/programacao.php> in Rio de Janeiro, Brazil. Also presenting (in person), were Rick Summerhill (Internet2), Bill St. Arnaud (CANARIE), and Guy Roberts (GÉANT2). The photo on the right was taken at the conference, to show the quality of the HD VTC. Chip Cox of the IRNC WHREN-LILA project attended.

May 21, 2008. Tom DeFanti organized CineGrid demonstrations for the "Future in Review" (FiRe) conference held at Calit2/UCSD. JPEG2000 content was streamed from Keio University (Japan), University of Amsterdam (The Netherlands), and StarLight. FiRe is organized by the Strategic News Service®, a technology newsletter, and attracts top officers from technology companies around the world.

May 19-22, 2008. The TERENA Networking Conference 2008 <http://tnc2008.terena.org> was held in Bruges, Belgium. Kees Neggers (SURFnet) and Heather Boyles (Internet2) attended.

May 21, 2008. Alan Verlo participated in the IRNC Measurement Group phone call.

May 20, 2008. Alan Verlo participated in the monthly JET meeting at NSF.

May 17-18, 2008. The CCIRN (Coordinating Committee for Intercontinental Research Networking) meeting was held in Bruges, Belgium. Kees Neggers (SURFnet) and Heather Boyles (Internet2), two of three CCIRN co-chairs, attended.

May 7-8, 2008. Alan Verlo attended the CyberSecurity Summit 2008 for NSF Large Research Facilities at the Sheraton Crystal City Hotel in Arlington, VA <www.educause.edu/cyb08>.

April 18, 2008. Chris Hancock, Chief Executive Officer of AARNet, visited Calit2 at UCSD; AARNet is actively involved in TransLight/PacificWave. Tom DeFanti met with him to discuss applications over optical networks, particularly the OptIPuter (OptIPortals and SAGE software). University of Melbourne constructed a 96 million-pixel OptIPortal, affectionately known as the "OzIPortal."

April 16, 2008. Alan Verlo participated in the IRNC Measurement Group phone call.

April 15, 2008. Alan Verlo participated in the monthly JET meeting at NSF.

March 26, 2008. Alan Verlo participated in the IRNC Measurement Group phone call.

March 18, 2008. Joe Mambretti participated in the monthly JET meeting at NSF.

March 12, 2008. Alan Verlo participated in the IRNC Measurement Group phone call.

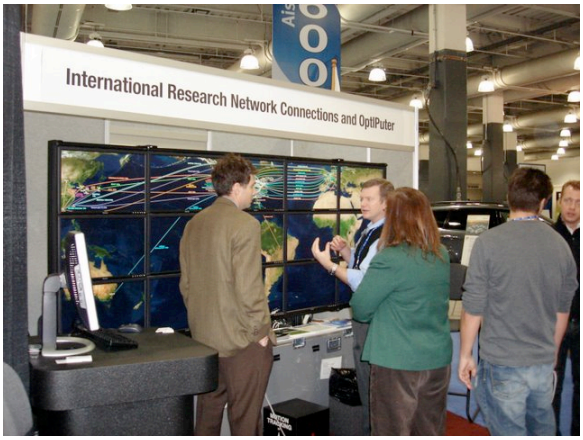
February 26, 2008. Tom DeFanti was invited to the NLR All Hands Meeting, held at the Georgia Tech Global Learning Center in Atlanta, to participate in a research session with other invited speakers to highlight project(s) that utilize the NLR infrastructure. DeFanti gave overviews of OptIPuter, CineGrid and CAMERA.

February 22, 2008. Tom DeFanti and Maxine Brown were co-organizers, with others, of the ON*VECTOR Terabit LAN Working Group. Attendees included DeFanti, Brown, Alan Verlo, Joe Mambretti, and Cees de Laat.

February 19-21, 2008. Tom DeFanti and Maxine Brown were co-organizers, with others, of the 7th Annual ON*VECTOR Photonics Workshop, sponsored by NTT, in San Diego. DeFanti, Brown and Alan Verlo attended. Several IRNC and national/international collaborators also attended and participated; notably: Cees de Laat, Joe Mambretti, Kees Neggers, John Silvester, Bill St. Arnaud (via VTC), and Tom West.

February 19, 2008. Alan Verlo participated in the monthly JET meeting at NSF.

February 14-18, 2008. UIC/EVL, in cooperation with Calit2, brought an OptIPortable (30-Megapixel shippable OptIPortal tiled display) to the AAAS conference in Boston and staffed it for demonstrations of OptIPuter and IRNC activities. The photo on the right shows the high-resolution GLIF 2008 map displayed on the OptIPortable.



2.B. Research Findings

2.B.1. IRNC Projects Interactions

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

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

SC 2008

In progress. Alan Verlo is a member of the SC'08 SCInet team.

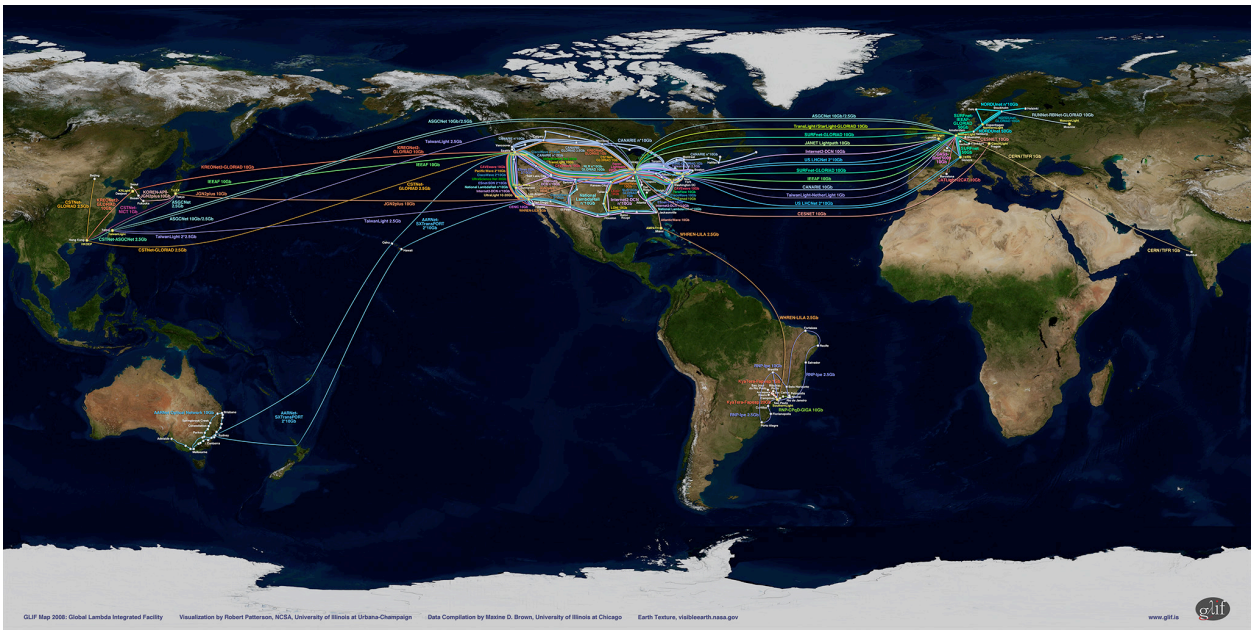
8th Annual Global LambdaGrid Workshop

The annual GLIF meeting will be held October 1-2, 2008 in Seattle, WA, and hosted by the University of Washington. Already "extreme" demonstrations using aggressive bandwidth are being planned, which will involve TransLight/StarLight and StarLight.

GLIF 2008 Map

TransLight/StarLight principals are leading organizers of GLIF <www.glif.is>. Maxine Brown, who serves as the GLIF Research & Applications (RAP) Working Group co-chair (with Larry Smarr), recently worked on creating a new GLIF 2008 world map, which is now available for downloading <www.glif.is/publications/maps/>. The press release, with details about the map, can be downloaded from <www.glif.is/publications/press/20080513.php>.

The visualization is courtesy of Robert Patterson of the Advanced Visualization Laboratory (AVL) of the National Center for Supercomputing Applications (NCSA) at the University of Illinois at Urbana-Champaign (UIUC); data compilation by Maxine Brown, Electronic Visualization Laboratory at the University of Illinois at Chicago (UIC). Funding was provided by GLIF, NCSA, and US National Science Foundation grants # SCI-04-38712 to NCSA/UIUC and # OCI-0441094 to EVL/UIC.



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

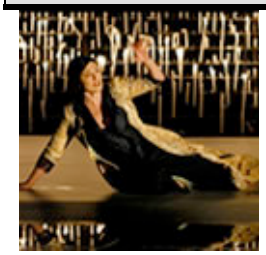
is a member of this group, representing TransLight/StarLight. This group has provided advice and support to several of the projects listed below.

- **NCO Optical Networking Testbed 4 (ONT-4) Workshop, now renamed Networking Research Challenges Workshop**, to be held September 28-30, 2008 in Seattle, prior to the GLIF meeting – Maxine Brown, Tom DeFanti, Joe Mambretti and Kees Neggers are members of the planning committee.
- **Cyberinfrastructure (CI) Days** <cidays.org> is an ongoing effort to educate campuses about what CI national-scale resources are available; it is organized by a consortium of CI providers, consisting of TeraGrid, Educause, Internet2, Open Science Grid, National LambdaRail and IRNC. Maxine Brown represents IRNC. During this quarter, CI Days were held in New Mexico (March 10-11) and at Clemson University (May 19-20, 2008). Russ Hobby, who organizes CI Days, gave the IRNC presentation.
- **Workshop on Driving eResearch Collaboration Across the Pacific (DeRCAP)** was held at the Australian Partnership for Advanced Computing (APAC) 2007 Conference in Perth, October 8-12, 2007; it was designed to stimulate e-science usage of AARNet links to the US <www.apac.edu.au/apac07/dercap/>. Organizers included John Silvester's TransLight/PacificWave Applications group, with Maxine Brown representing TransLight/StarLight, and John O'Callaghan, APAC Executive Director, and Chris Hancock, Chief Executive Officer of AARNet. It was so successful that there are plans to hold another DeRCAP Workshop later this year, potentially in collaboration with the 2008 Australasia E-Research Workshop.
- **The Chinese-American Network Symposium (CANS) 2008…** will take place October 20-22, 2008, in Indianapolis, IN <www.canscouncil.net/cans2008>. Maxine Brown is a member of the program committee.

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

While many international collaborations are ubiquitous and difficult to track, several major international collaboration projects 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>. For this quarter, below are some new international applications that are either supported by IRNC or by European transatlantic networks, thereby leveraging IRNC's investment.

US/European Applications 2008



CineGrid @ Holland Festival 2007

www.cinegrid.org
cenic08.cenic.org/news/FinalCENIC08Awards.pdf

The CineGrid @ Holland Festival, described in a previous TransLight/StarLight report, received the CENIC 2008 Innovations in Networking Award in Experimental/ Developmental Applications (tied with the UltraLight project) at CENIC's annual conference on March 11, 2008. *According to the CENIC press release: The international nonprofit CineGrid promotes research, development, and deployment of ultra-high performance digital media – sound and picture – over advanced networks, using grid computing technologies for networked collaboration. CineGrid has organized a number of experimental projects designed both to showcase what advanced networks can support in the world of digital media, and to test those same networks, pushing them as far as they can go in the pursuit of the most immersive possible experience. CineGrid @ Holland Festival 2007 certainly did that and more.*

On June 20-21, 2007 CineGrid recorded and streamed live 4K digital motion pictures with 5.1 surround sound of the operatic performance "Era la Notte" from the Holland Festival in Amsterdam over CalREN and partner IP networks to California. The 75-minute live performance was transmitted nearly 10,000 kilometers, in real time, to the University of California, San Diego where it was viewed in 4K on a large screen, with surround-sound, by an audience in the 200-seat auditorium of the California Institute for Telecommunications and Information Technology (Calit2). People in the audience in San Diego reported that they felt as if they were actually in the concert hall in Amsterdam.

This technical experiment was particularly interesting for many reasons but primarily because live performances require utterly reliable throughput and low-latency responsiveness. A less than perfect connection would be instantly noticed and may not be fixed later since, during a live performance of course, there is no "later." The CineGrid @ Holland Festival 2007, which is being recognized for the 2008 Experimental/Developmental Award, confirms that even these most demanding types of streaming media distribution can be done over high-performance fiber-optic infrastructure, such as CalREN, today.

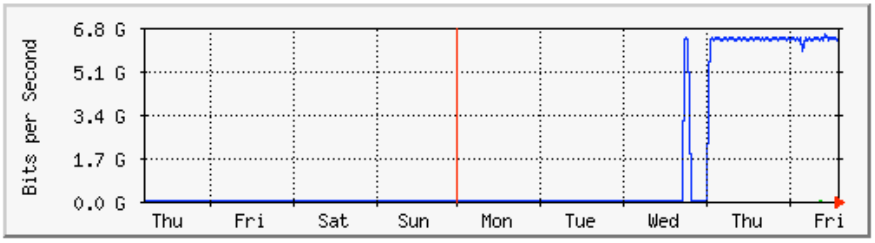
CineGrid: New Equipment Testing 2008

www.cinegrid.org

Collaborators:
- Keio University; JGN2plus; Japan
- StarLight; US
- SURFnet; The Netherlands

During last year's CineGrid Kyoto Prize 2007 demonstration, described in a previous TransLight/StarLight report, *NetherLight had a problem with their new Nortel network switch, apparently losing packets during the streaming of uncompressed 4K. On March 14, 2008, the Dutch and the Japanese had a debugging session to identify the network switch problem in Amsterdam, where they streamed uncompressed 4K streaming from Tokyo to Amsterdam over the TransLight/StarLight circuit. The following is a StarLight MRTG graph of this session.*

`Weekly' Graph (30 Minute Average)



Max In:105.0 Mb/s (1.1%) Average In:266.9 kb/s (0.0%) Current In:14.9 kb/s (0.0%)
Max Out:6556.0 Mb/s (65.6%) Average Out:1267.5 Mb/s (12.7%) Current Out:6395.5 Mb/s (64.0%)

CineGrid @ SURFnet Relatiedagen 20th Anniversary

www.cinegrid.org/news/SURFnet_may08.php
www.surfnet.nl

Collaborators:
- SURFnet; University of Amsterdam; The Netherlands
- Calit2/UCSD; EVL/UIC; NCSA/UIUC; CineGrid; StarLight; US

SURFnet holds a biannual conference for its connected institutions, to provide overviews of services, innovation and best practices, as well as an opportunity to meet each other face-to-face. This year's event, held May 14-15, 2008 in Noordwijkerhout, Holland, attracted 300 attendees representing Dutch institutions of higher education and research. CineGrid co-founder Laurin Herr delivered the keynote "Building a New User Community for Very High Quality Media Applications on Very High Speed Networks," during which CineGrid Exchange 4K content was streamed and JPEG 2000 decoded in real time for projection on a large screen with 5.1 surround sound in the auditorium. The highlight was the streaming of the new, never-before-seen 4K animation of the new GLIF 2008 map.

The GLIF map was visualized, animated and rendered in full-color at 4K by Robert Patterson of UIUC/NCSA. The rendered, uncompressed 4K frames were transferred over the Illinois I-WIRE from NCSA to StarLight in Chicago and then via CAVEwave to

UCSD/Calit2 in San Diego for JPEG 2000 compression and quality-assurance 4K screening in the Calit2 auditorium. The compressed files were then transferred back over CAVEwave from Calit2 to StarLight, and then over the SURFnet transatlantic link to servers at the University of Amsterdam in preparation for the CineGrid keynote at the SURFnet meeting. (Note: While this demonstration did not use TransLight/StarLight, it leveraged networking investments from The Netherlands for international transatlantic connectivity.)

Data Reservoir: The Gravitational Billion Body Problem 2008

http://data-reservoir.adm.s.u-tokyo.ac.jp
www.nao.ac.jp/E/

Collaborators:

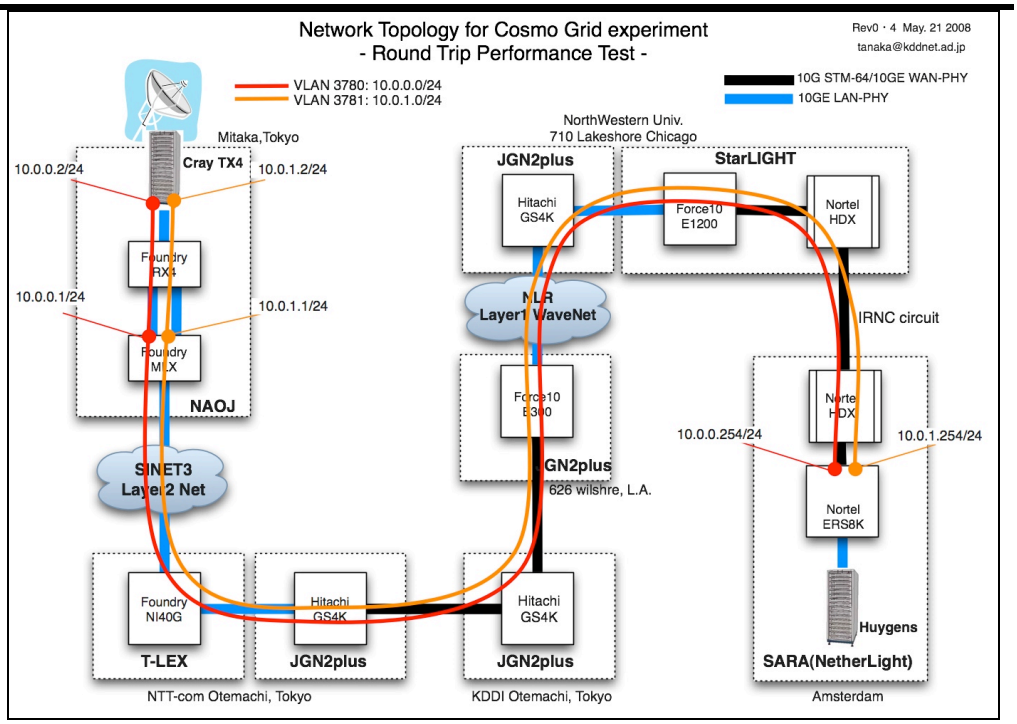
- StarLight; US
- University of Tokyo; National Astronomical Observatory of Japan (NAOJ); JGN2plus; SINET3; T-LEX; Japan
- University of Amsterdam (UvA); SURFnet; The Netherlands

U Tokyo and UvA are investigating an optimization method for TCP communication over Long Fat Networks (LFN). Dr. Kei Hiraki of U Tokyo previously established an optimization method for the single-server, single-TCP stream case; however, a single-server, multiple-TCP stream is more difficult than a single-TCP stream, and multiple servers and multiple TCP streams are even more difficult. They are studying a method to efficiently transfer data using multiple TCP streams, called "stream harmonizer," which stabilizes and balances multiple TCP streams.

An experiment proposed by Prof. Simon Portegies Zwart of UvA and Prof. Junichiro Makino of NAOJ uses cluster-to-supercomputer TCP communications, and requires a very good testbed on which to evaluate the method to stabilize and optimize multiple TCP streams. Their target is to fill more than 90% of the available bandwidth.

JGN2plus requested use of the 10Gbps CHI/AMS TransLight/StarLight circuit to support this experiment between Tokyo and Amsterdam. On May 29, a direct connection between NAOJ and UvA was created.

A test run is planned for June 10, and a subsequent test with network and all the computers in place about one month later (or maybe early September, if holidays interfere). The full simulation is scheduled to start sometime in September/October and will last about one month, though the network can be interrupted for other activities (code can be stopped and restarted). The total wall-clock time of the production simulation will be around 1 month.



eVLBI: EXPReS conducts first real-time e-VLBI observation with telescopes in Africa, Europe, North America and South America

www.expres-eu.org
www.expres-eu.org/TERENA08_networking.html
www.expres-eu.org/TERENA08_science.html

Collaborators:
- Arecibo; Puerto Rico
- StarLight; AtlanticWave; CAVEwave; AMPATH; MAX/NGIX; TransLight/StarLight; WHREN-LILA; US
- Transportable Integrated Geodetic Observatory (TIGO); Chile
- Effelsberg; Germany
- Medicina; Italy
- Westerbork; Joint Institute for VLBI in Europe (JIVE); SURFnet; The Netherlands
- Hartebeesthoek; South Africa
- Onsala; Sweden

On May 22, 2008, for the annual TERENA conference, members of the EXPReS (Express Production Real-time e-VLBI Service) project for the first time ever simultaneously linked telescopes in Africa, Europe, North America and South America to the central data correlator in the Netherlands, simulating a telescope almost 11,000 kilometers in diameter.

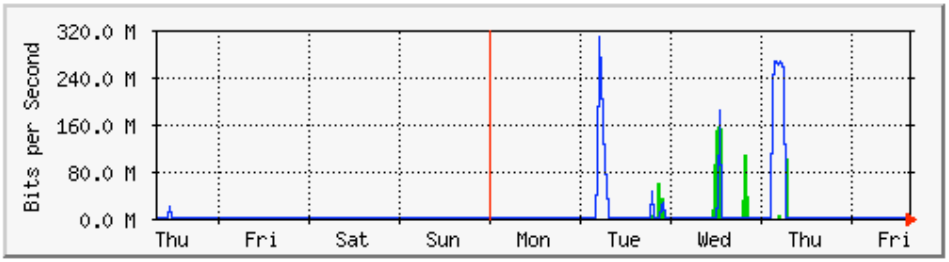
Telescopes in Chile, Germany, Italy, the Netherlands, Puerto Rico, South Africa and Sweden simultaneously observed quasar 3C454.3 and additional targets and streamed data to the JIVE in Dwingeloo, The Netherlands. There, the data was correlated in real time, and results were transmitted to Bruges, Belgium, as part of a live demonstration at the TERENA Networking Conference 2008.

Data from all seven telescopes was routed across numerous networks and exchanges, including: AtlanticWave, AMPATH, Centennial, DFN, GÉANT2, Internet2, SURFnet/NetherLight, NGIX, RedCLARA, Reuna, SANReN, StarLight and TENET. Data was transferred from Hartebeesthoek (South Africa) and TIGO (Chile) at 64Mbps, and at 256Mbps from all other stations, including Arecibo. For about 10 minutes, astronomers

observed one source from all 4 continents simultaneously.

Specifically, TransLight/StarLight was used to transmit data from Arecibo (Puerto Rico) to JIVE; below is an MRTG plot showing bandwidth utilization. A VLAN was created from Arecibo to AtlanticWave (in Miami) to CAVEwave (in Washington DC), and then from CAVEwave to Chicago, over TransLight/StarLight, to NetherLight. Note: TIGO connected via RedClara to GÉANT2 in Europe.

`Weekly' Graph (30 Minute Average)



Max In:158.3 Mb/s (1.6%) Average In:2552.1 kb/s (0.0%) Current In:728.0 b/s (0.0%)
Max Out:307.4 Mb/s (3.1%) Average Out:7777.4 kb/s (0.1%) Current Out:5072.0 b/s (0.0%)

Globus Alliance

www.globus.org

Globus Team:

- Argonne National Laboratory; University of Chicago; NCSA; Northern Illinois University; UnivaUD; University of Southern California, Information Sciences Institute; US
- Royal Institute of Technology; Sweden
- EPCC; University of Edinburgh; UK

Globus Academic Affiliates:

- Monash University; Australia
- Max Planck Institute for Gravitational Physics; Germany
- National Institute of Advanced Industrial Science and Technology, Grid Technology and Research Center; Tokyo Institute of Technology; Japan
- Poznan Supercomputing and Networking Center; Poland
- Umeå University; Sweden
- Indiana University; Lawrence Berkeley National Laboratory; Louisiana State University; NCSA; Northern Illinois University; SDSC; Texas Advanced Computing Center at the University of Texas; University of California at Santa Barbara; University of Wisconsin Condor group; US
- Imperial College; UK

The Globus Alliance is a community of organizations and individuals developing fundamental technologies behind the "Grid," which lets people share computing power, databases, instruments, and other on-line tools securely across corporate, institutional, and geographic boundaries without sacrificing local autonomy.

The Globus Toolkit is an open-source software toolkit used for building Grid systems and applications. It is being developed by the Globus Alliance and many others all over the world. A growing number of projects and companies use the Globus Toolkit to unlock the potential of grids for their cause.

International HapMap Project

www.hapmap.org

Collaborators:

- RIKEN and University of Tokyo; Health Sciences University of Hokkaido with Eubios Ethics Institute; Japan
- Wellcome Trust Sanger Institute; University of Oxford; University of Oxford/Wellcome Trust Centre for Human Genetics; UK
- McGill University and Génome Québec Innovation Centre; Canada
- The Chinese HapMap Consortium (Beijing Genomics Institute, Chinese National Human Genome Center at Beijing, University of Hong Kong, Hong Kong University of Science and Technology, The Chinese University of Hong Kong, Chinese National Human Genome Center at Shanghai); Beijing Normal University; Beijing Genomics Institute; China
- Illumina; Broad Institute of Harvard and MIT; Baylor College of Medicine with ParAllele Bioscience; University of California, San Francisco with Washington University in St. Louis; Perlegen Sciences; Johns Hopkins School of Medicine; University of Utah; Cold Spring Harbor Laboratory; US
- Howard University with University of Ibadan; Nigeria

The International HapMap Project is a partnership of scientists and funding agencies from Canada, China, Japan, Nigeria, UK and US to develop a public resource to help researchers find genes associated with human disease and find responses to pharmaceuticals. The Project's goal is to compare the genetic sequences of different individuals to identify chromosomal regions where genetic variants are shared. By making this information freely available, the Project will help biomedical researchers find genes involved in disease and responses to therapeutic drugs. In the initial Project phase, genetic data is being gathered from four populations with African, Asian, and European ancestry. Ongoing interactions with members of these populations are addressing potential ethical issues and providing valuable experience in conducting research with identified populations.

International Summer School on Grid Computing (ISSGC), 2007

www.isgtw.org/?pid=1001041
www.iceage-eu.org/v2/index.cfm v

Collaborators:

- University of Chicago, Medical Physics; OSG; US
- EGEE, International Collaboration to Extend and Advance Grid Education (ICEAGE); Europe

In 2007, with the aid of the Open Science Grid (OSG), U Chicago student Andrew Jamieson attended the International Summer School on Grid Computing in Sweden. Today, just over a year later, he is still involved in grid computing. His scientific background as a medical physicist researcher involves developing accurate computer-aided diagnosis (CAD) algorithms for breast mass lesions in X-ray mammography, ultrasound and MRI images. He and his colleagues want to use grid computing to push CAD and image analysis to a new level of exploratory power and scientific evaluation.

ISSGC'07 provided him the opportunity to meet and learn from a diverse and global set of intellects and opinions, experiences and perspectives. ISSGC incorporates students, investigators, enthusiasts and professionals from all over the world, who form a distributed and multi-platform network of nodes, separate yet linked by a common desire to achieve feats impossible to tackle alone.

International Wheat Genome Sequencing Consortium (IWGSC)

www.wheatgenome.org
www.isgtw.org/?pid=1000969

Coordinating Committee Members:

- Kansas State University; Kansas Wheat Commission; USDA-ARS; Michigan State University, Institute for Genomic Research; University of Georgia; University of California-Davis; Eversole Associates; Washington State University; North Dakota State University; Cornell University; Texas Agricultural Experiment Station; US
- Murdoch University; Australian Centre for Plant Functional Genomics; Australia
- Agriculture and Agri-Food Canada; Canada
- Key Lab of Crop Germplasm & Biotechnology, MOA, China/Institute of Crop Sciences, CAAS; China
- Institute of Experimental Botany; Czech Republic
- INRA; CNRGV-INRA; URGV-INRA; Cereales Vallee; BIOGEMMA; France
- Punjab Agricultural University; India
- CRA Genomic Research Centre; Department of Agroenvironmental Sciences and Technology; Italy
- Kihara Institute for Biological Research, Yokohama City University; Japan
- University of Zurich; Switzerland
- Sabanci University; Turkey
- John Innes Centre; UK

Bread wheat is grown on over 95% of the wheat-growing area and its sequence holds the key to genetic improvements that will allow growers to meet the increasing demands for high-quality food and feed produced in an environmentally sensitive, sustainable, and profitable manner. Further, because of its recent history, *hexaploid wheat* is a very good model to study *polyploidy*, a driving force for plant genome evolution.

The IWGSC was established by a group of plant scientists, breeders, and growers dedicated to sequencing the wheat genome to enhance our knowledge of the structure and function of the wheat genome. By gaining increased understanding of the biology of *agronomically important traits* and deploying state-of-the-art molecular tools, plant scientists and breeders will be able to accelerate wheat improvement to meet the challenges of the 21st century. The Consortium is committed to ensuring that the sequence of the wheat genome and the resulting DNA-based tools are available for all to use without restriction.

Large Hadron Collider: Worldwide LHC Computing Grid (WLCG)

www.networkworld.com/news/2008/042208-large-hadron-collider.html?page=1
www.isgtw.org/?pid=1001047
http://lcg.web.cern.ch/LCG/
www.isgtw.org/?pid=1001103

Scientists are on the verge of opening the Large Hadron Collider (LHC), which will use ultra-powerful magnets to race proton beams around a 17-mile circular underground tunnel and smash them into each other 40-million times a second. These collisions will produce tiny particles not seen since just after the Big Bang and perhaps will enable scientists to find the elusive Higgs boson, which – if theories are correct – endows all objects with mass. The LHC may also help scientists figure out why all the matter in the universe wasn't destroyed by anti-matter, which would have been inconvenient for those who enjoy residing in a universe that isn't a great vacuum devoid of life.

The WLCG was set up to distribute the mountains of data produced by the seemingly infinite number of particle collisions. Data will be gathered from CERN and distributed to thousands of scientists throughout the world.

One writer described the grid as a "parallel Internet." Ruth Pordes, executive director of the

Open Science Grid (OSG), which oversees the US infrastructure for the LHC network, describes it as an "evolution of the Internet." New fiber-optic cables with special protocols will be used to move data from CERN to 11 Tier1 sites around the globe, which in turn use standard Internet technologies to transfer the data to more than 150 Tier2 centers.

The data is first produced in the collisions, which occur in caverns 100 meters underground. If all goes according to plan, the first proton beams will be injected into the LHC around mid-June, and will start smashing into each other about two months later. When proton beams collide and produce new particles, data will be read from 150-million sensors and sent to a counting room where signals are filtered to produce "raw data."

Raw data will be sent over dedicated 10Gbps optical networks to the CERN Computer Center, known as Tier0. Here, raw data will be sent to tape storage and also to a CPU farm, which will process information and generate "event summary data." Subsets of both the raw data and summaries will then be sent to the 11 Tier1 sites, including Brookhaven National Laboratory on Long Island, NY, and Fermilab in Illinois.

Each of the 11 Tier1 centers are connected to CERN via a dedicated 10Gbps link, and the Tier1 centers are connected to each other by a general-purpose research network. Each Tier1 center receives only certain subsets of information. Brookhaven, for example, is dedicated to ATLAS, one of several large detectors housed at the LHC, while Fermilab handles data from the CMS (Compact Muon Solenoid) detector.

Tier1 centers are responsible for reprocessing raw data, which is then kept on local disk and tape storage and distributed to Tier2 centers, which are located in most parts of the world. Tier2 centers are connected to Tier1 sites and to each other by general-purpose research networks, such as the US ESnet. Tier2s are located mainly in universities, where physicists will analyze LHC data. Ultimately, about 7,000 physicists will scrutinize LHC data for information about the origins and makeup of our Universe.

The LHC collisions will produce 10- to 15-Petabytes of data a year, says Michael Ernst of Brookhaven National Laboratory, where he directs of the program that will distribute data from the ATLAS detector. Brookhaven, a Tier1 site, will be responsible for filtering data so it can be easily readable by scientists located at the more numerous Tier2 facilities.

Worldwide, the LHC computing grid will be comprised of about 20,000 servers, primarily running the Linux operating system. Scientists at Tier2 sites can access these servers remotely when running complex experiments based on LHC data, Pordes says. If scientists need a million CPU hours to run an experiment overnight, the distributed nature of the grid allows them to access that computing power from any part of the worldwide network, she says. With the help of Tier1 sites, such as Brookhaven, the goal is to make using the grid just as easy for universities as using their own internal networks.

Common Computing Readiness Challenges

Jamie Shiers, responsible for overall coordination of the WLCG's practice runs, known as Common Computing Readiness Challenges, are doing "dress rehearsals" prior to LHC's debut. The first full rehearsal was held in February; the final one will be in May.

During each run, the LHC Computing Grid receives data from four main LHC experiments simultaneously, at loads predicted for a fully operational machine. After a quick cache, CERN/Tier0 sends data to Tier1 sites, which send it to Tier2 sites. Over 100 auxiliary Tier1 and Tier2 sites around the world aid in storage and processing.

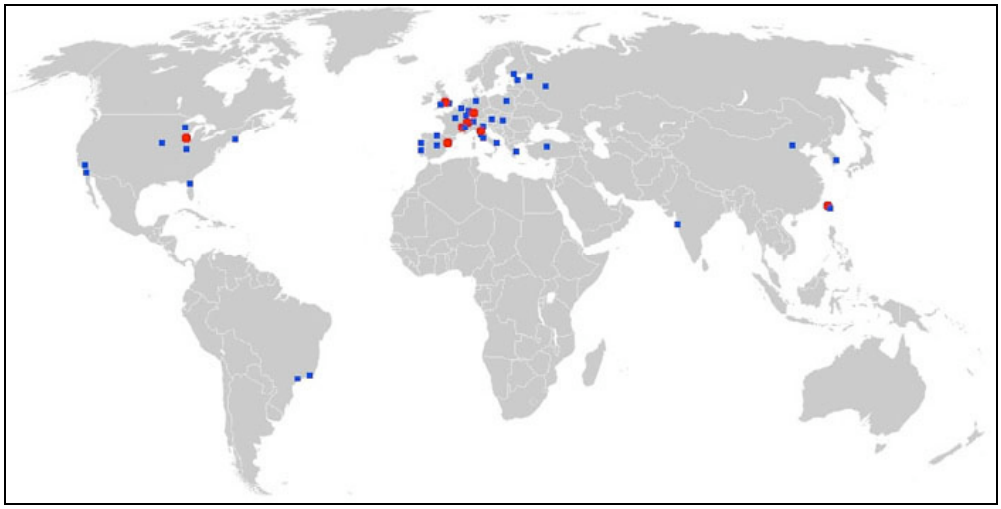
February's test yielded a middleware bug and a delay in storage configurations, but nothing crippling. May's tests will probably reveal more glitches; e.g., the grid may not be able to keep up with the scaling-up of computing volume. However, Shiers observes that the "LCG team" has grown adept at finding fixes or work-arounds.

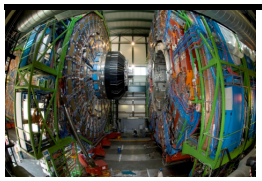
Compact Muon Solenoid (CMS) Readies Network Links for LHC Data

Transfer 300 thousand million bytes (300 Gigabytes) per day for 6 out of 7 consecutive days and move a total of 2.3 Terabytes during that same 7-day period – that's 2.3 million million bytes – these are the criteria that each major network link in the CMS's computing structure must satisfy when the LHC turns on this summer. Together they will transfer tens of Terabytes a day. The CMS computing structure comprises an internationally distributed system of services and resources that interact over the network through the WLCG.

Last July CMS assembled a task force to ready the inter- and intra-tier networks. The task force ran a set of simulated datasets up the computing chain to CERN, and ran workflows based on these datasets back down to the Tier1 and Tier2 centers. Thanks to a tool developed by Brian Bockelman of the University of Nebraska and CERN summer student Sander Sõnajalg, the team extracted transfer volume data from PheDEX, CMS's data transfer middleware, and applied the stringent commissioning criteria to it. The transfer tests in February 2008 more than doubled the throughput over all links seen in the 2007 CSA07 tests." said Letts. As of May 2008, all the Tier1 sites are stable and about two-thirds of the Tier1 to Tier2 connections have been commissioned.

Below is an illustration of Tier1 (red) and Tier2 (blue) sites worldwide in CMS. (Image courtesy of James Lett <www.isgtw.org/images/CMSFig2L.jpg>.





Large Hadron Collider: UltraLight Data Analysis Tools, 2007

cenic08.cenic.org/news/FinalCENIC08Awards.pdf

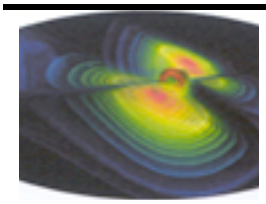
Collaborators:

- CERN; Switzerland
- Caltech; Stanford Linear Accelerator Center (SLAC); Fermilab; Brookhaven National Laboratory; U Florida; U Michigan; Vanderbilt U; Cisco Systems; US
- Korea Institute of Science and Technology Information (KISTI); Kyungpook National U; Korea
- U Manchester; UK
- Universidade do Estado do Rio de Janeiro (UERJ); Universidade Estadual Paulista (UNESP)/Universidade de São Paulo (USP); Brazil
- National Institute of Information Technology; Pakistan
- Polytechnica U; Romania

The UltraLight SC07 demonstration, described in a previous TransLight/StarLight report, received the CENIC 2008 Innovations in Networking Award in Experimental/ Developmental Applications (tied with the CineGrid project) at CENIC's annual conference on March 11, 2008. *According to the CENIC press release: The UltraLight collaboration is comprised of an international team of researchers working on advanced*

global systems and networks to meet the needs of experiments due to begin at CERN's Large Hadron Collider in 2008. In a demonstration at the SuperComputing 07 conference held last November in Reno, NV, seven individual 10-Gigabit fiber paths (six provided by CENIC and one by Internet2) were used bi-directionally at high efficiency to move vast files of scientific data at blinding transfer rates of 80 Gigabits per second of bi-directional transfer. This is the equivalent of twelve full-length Hollywood movie DVDs in one second!

This achievement relied in part on one of the CENIC 2006 Innovations in Networking Award Winners, MonALISA. MonALISA, developed over the last six years by Caltech and its partners at CERN and the Universitatea Politehnica Bucharest, is a globally scalable framework of services to monitor and help manage and optimize the operational performance of computing grids, networks, and running applications in real time. This framework is ideal for creating and dynamically managing dispersed collaborative environments over Internet networks.



LIGO: Laser Interferometer Gravitational-Wave Observatory

www.ligo.org
www.ligo.caltech.edu
www.ligo.mit.edu

Scientific Collaboration (LSC) Council – Members and Observers:

- Caltech; Eastern Michigan University; LIGO Hanford Observatory; LIGO Livingston Observatory; Louisiana State University; MIT; National Science Foundation; Northwestern University; Penn State University; Stanford University; Syracuse University; University of Colorado Boulder; University of Florida; University of Michigan; University of Oregon Eugene; University of Wisconsin; US
- Observatoire de Paris-Meudon; IN2P3; France
- Max Planck Institut fur Quantenoptik – Garching; Germany
- TAMA Project National Astronomical Observatory; Japan
- Moscow State University; Russia
- University of Glasgow; UK

Albert Einstein predicted the existence of gravitational waves in 1916 as part of the theory of general relativity. LIGO will detect ripples in space-time by using a device called a laser interferometer, in which the time it takes light to travel between suspended mirrors is measured with high precision using controlled laser light. Two mirrors hang far apart, forming one "arm" of the interferometer, and two more mirrors make a second arm perpendicular to the first. Viewed from above, the two arms form an L shape. Laser light enters the arms through a beam splitter located at the corner of the L, dividing the light between the arms. The light is allowed to bounce between the mirrors repeatedly before it returns to the beam splitter. If the two arms have identical lengths, then interference between the light beams returning to the beam splitter will direct all of the light back toward the laser. But if there is any difference between the lengths of the two arms, some light will travel to where it can be recorded by a photo-detector.

The space-time ripples cause the distance measured by a light beam to change as the gravitational wave passes by, and the amount of light falling on the photo-detector to vary. The photo-detector then produces a signal defining how the light falling on it changes over time. The laser interferometer is like a microphone that converts gravitational waves into electrical signals. Three interferometers of this kind were built for LlGO – two near Richland, Washington, and the other near Baton Rouge, Louisiana. LlGO requires at least two widely separated detectors, operated in unison, to rule out false signals and confirm that a gravitational wave has passed through the Earth.

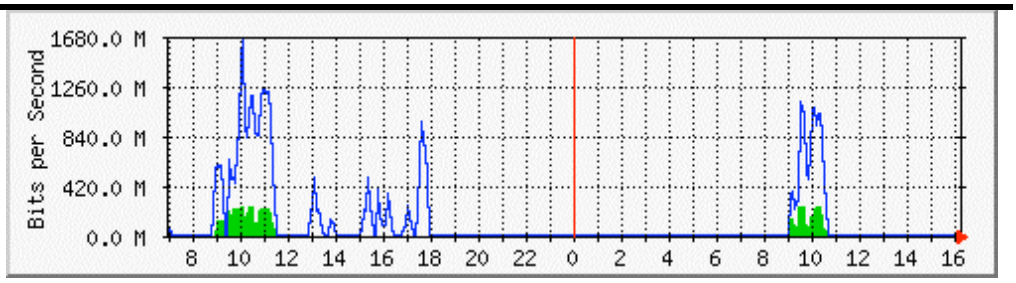
OptIPuter: SAGE Visualcasting with HD Teleconferencing 2008

www.evl.uic.edu/cavern/sage
www.optiputer.net

Collaborators:
- UIC, EVL; University of Michigan, School of Information; US
- SARA; The Netherlands
- Gwangju Institute of Science and Technology (GIST); Korea Institute of Science and Technology Information (KISTI); Korea

In fulfillment of his PhD dissertation "SAGE Visualcasting," EVL student Byungil Jeong used SAGE Visualcasting to broadcast high-definition (HD) teleconferences among 5 sites. SAGE Visualcasting distributes HD video and ultra-high-resolution visualizations in real time to multiple sites. It is a scalable, real-time image broadcasting service enabling multi-point collaborative work sessions that are a*pplications-centric* – i.e., the users decide who participates and when. It does not require *multicast,* a network-centric technology that requires network engineering at all sites prior to working. Visualcasting uses commodity clusters (SAGE Bridges) to broadcast real-time ultra-high-resolution content to multiple sites. To scale up the resolution or number of sites, one must increase number of cluster nodes. The following image shows the view from EVL; while EVL is not projected on the tiled display (but reflected), one sees connections to U Michigan, SARA, GIST and KISTI.

Two 10Gb SAGE Bridge cluster nodes located at StarLight were used. EVL connects to StarLight via I-WIRE. U Michigan connects to StarLight via Michigan LightRail (MiLR). GIST and KISTI connect via KREONet2/CANARIE. SARA connects via TransLight/ StarLight. In this example, SARA sent video from its facility to SAGE Bridge at StarLight, and received video from EVL and Michigan. The following MTRG chart shows that 1.7Gbps was being streamed over TransLight/StarLight to/from SARA (~600Mb per video stream).



Square Kilometer Array (SKA): International radio telescope for the 21st century

www.skatelescope.org

Collaborators:

- SKA; Argentina
- Consortium (Australian Square Kilometre Consortium, CSIRO Australia Telescope National Facility, University of Sydney, Swinburne SKA Simulation and Radio Interferometry Group); Australia
- National Research Council of Canada; Canada
- Five-hundred-metre Aperture Spherical Telescope (FAST); China
- SKA Design Studies on Aperture Array Tiles (SKADS); Europe
- Istituto di Radioastronomia SKA group; Italy
- ASTRON; Netherlands
- Jodrell Bank Observatory; UK
- SKA Indian Consortium (SKAIC); India
- Centre for Radiophysics and Space Research; New Zealand
- SKA; South Africa
- US SKA consortium; US

An international consortium representing more than 15 countries, including sites in Europe, the US, Australia, Canada, China, India and South Africa, is building the SKA, to be online in ~2012. This telescope will provide two orders of magnitude increase in sensitivity over existing facilities. To achieve this goal will require a telescope with one square kilometer of collecting area – one hundred times more collecting area than the Very Large Array (VLA).

The SKA will probe the gaseous component of the early universe, addressing fundamental questions on the origin and evolution of the universe. The SKA will complement planned facilities at other wavelengths, such as the ALMA and James Webb Space Telescope (JWST). HI, CO and continuum radiation would be observed from the interstellar medium of most of the galaxies the JWST will discover in the infrared at large redshifts.

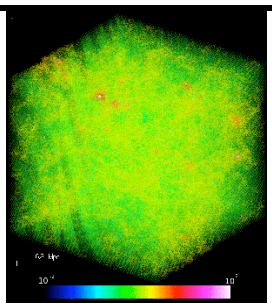
The SKA will be an interferometric array of individual antenna stations, synthesizing an aperture with a diameter of up to several 1000 kilometers. A number of configurations are under consideration to distribute the 1 million square meters of collecting area. These include 30 stations each with the collecting area equivalent to a 200-meter diameter telescope, and 150 stations each with the collecting area of a 90-meter telescope.

Following proposals for and the analysis of potential locations, and the advice of the International SKA Site Advisory Committee, the International SKA Steering Committee (ISSC) decided that the short-list of acceptable sites are Australia and Southern Africa. Additional studies of the characteristics of the short-listed sites will be carried out in 2007 and 2008. A final decision of the location of the SKA is expected thereafter.

Numerical Simulations to Optimize the SKI Design

www.isgtw.org/?pid=1000976

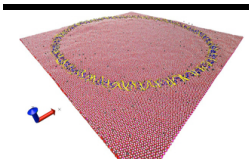
Towards the end of these Dark Ages, the Universe entered a new phase—the Epoch of Reionization—when UV and X-ray emissions from stars and quasars began to reionize the



newly formed neutral atoms.

"We have very few ways to gather observational information about the epoch of reionization, because the photons emitted by stars and quasars are absorbed by the intergalactic medium before they reach us," explains Benoit Semelin, an astrophysicist at the *Paris Observatory* in France. But, there is one kind of radiation to which the universe is transparent, even during the epoch of reionization: the 21-cm emission of neutral hydrogen. To detect these emissions, the world is building the international SKA radio telescope.

"To optimize the design of this instrument we need to have the best possible models of the 21-cm emission," says Semelin. "This is achieved by numerical simulations." Semelin and his team are using their grid-enabled LICORICE code to run Monte Carlo simulations of the radiative transfer of photons, including up to 109 virtual photons per simulation. These simulations are scheduled to run on EGEE grid.



TeraGrid: UK Molecular Dynamics

www.isgtw.org/?pid=1001017
http://ccs.chem.ucl.ac.uk/

Collaborators:
- TeraGrid; US
- University College London (UCL); National Grid Service; UK

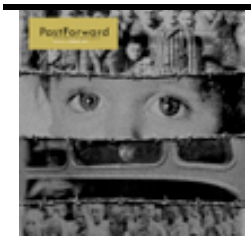
The National Grid Service in the UK and the TeraGrid in the US have joined forces to help University College London scientists shed light on how life on earth may have originated. Deep ocean hydrothermal vents have long been suggested as possible sources of biological molecules, such as RNA and DNA, but it was unclear how they could survive the high temperatures and pressures that occur round these vents.

Peter Coveney and colleagues at the UCL Centre for Computational Science used computer simulation to provide insight into the structure and stability of DNA while inserted into layered minerals. Coveney's simulations reproduced the high temperatures and pressures that occur around hydrothermal vents, showing that the structure of DNA inserted into layered minerals becomes stabilized at these conditions and therefore protected from catalytic and thermal degradation. Their results were recently published in the Journal of the American Chemical Society.

Thyveetil, M.-A.; Coveney, P.V.; Greenwell, H.C.; Suter, J.L., "Computer Simulation Study of the Structural Stability and Materials Properties of DNA-Intercalated Layered Double Hydroxides," J. Am. Chem. Soc.; (Article); 2008; 130(14); 4742-4756.

"Computational grids are only now being made easy to use for scientists, enabling simulations of sufficient size to model these large biomolecule and mineral systems," Coveney explains.

Note: This research used UKLight, leveraging NSF's TransLight/StarLight's investment in transatlantic international connectivity.



USC Shoah Foundation Institute for Visual History and Education

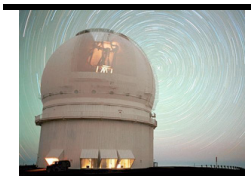
http://college.usc.edu/vhi/

Collaborators (location of cached arhives):
- University of Southern California (USC); University of Michigan at Ann Arbor; Rice University; University of North Carolina at Chapel Hill/RENCI; Duke University; North Carolina State University; Florida Atlantic University; University of Minnesota; UCSD; Syracuse University; Brown University; Columbia University; US Holocaust Memorial Museum; US

- Monash University; Australia
- Freie Universität Berlin; Germany

The USC Shoah Foundation Institute for Visual History and Education has an archive of nearly 52,000 videotaped testimonies from Holocaust survivors and other witnesses. The Institute works with a global network of partners to provide an array of valuable educational services that reach educators, students, and the general public around the world.

The Institute a 200TB database at USC. Other caches are set up that have a subset of the entire database (right now the most any other cache has is 20 TBs or 10% of the archive). End users make their request and if the video is available locally, it plays right away. If not, the server requests a transfer of the data from USC. A typical interview (or testimony) is 4 GB per record. Typical users request more than one interview, so there are multiples requested at the same time. Performance to end sites have varied widely.



ZEN – Zoom sur l'Energie Noire (Zoom on Dark Energy)

www.isgtw.org/?pid=1000992

Collaborators:
- Marseilles Centre for Particle Physics; France
- Canada-France-Hawaii Telescope (CFHT), a joint facility of National Research Council of Canada, Centre National de la Recherche Scientifique of France, and University of Hawaii, US
- NASA Wilkinson Microwave Anisotropy Probe Mission; Sloan Digital Sky Survey; US

ZEN is a computer model designed to enable new estimates about the nature of dark energy. "Dark energy has a very surprising property: it acts like negative pressure," says ZEN project leader Andre Tilquin of the Marseilles Centre for Particle Physics in France. "This means the expansion of our universe is accelerating; before we thought the expansion of the universe was decelerating due to its own mass." Tilquin's goal is to calculate the dynamics of this force with new accuracy, using ZEN.

The ZEN model combines observations from different experiments within a framework of interdependent cosmological and astrophysical parameters – new information about one force will affect what we know about all other forces. The tool allows researchers to analyze new data quickly and coherently.

Part of EGEE's Earth Science Research virtual organization, using DataGrid, ZEN currently uses input from three astronomical experiments: CFHT Legacy Supernova Survey, cosmological microwave background from NASA's Wilkinson Microwave Anisotropy Probe mission and baryonic acoustic oscillations from the Sloan Digital Sky Survey.

Tilquin and his colleagues are focused on the dynamics of dark energy: Is its strength constant? Or does it evolve with time? If constant, we will have evidence for Einstein's proposed "cosmological constant." "If we discover that this parameter is not constant in time," says Tilquin, "then we have to think about a new particle, and researchers will then try to discover it with accelerators, such as the Tevatron or Large Hadron Collider."

On 7 March 2008, NASA's Wilkinson Microwave Anisotropy Probe mission published results suggesting that the cosmological constant is still the best explanation of dark energy.

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

TransLight/StarLight plans for May 1 – July 31, 2008, include:

- Maintain TransLight/StarLight NYC/AMS until Internet2 and GÉANT2 convert to network switches, which is our preference.
- 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 to update the TransLight/StarLight website.
- Continue preparations for GLIF and SC'08 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 NRNs 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, 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, 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, more recently, WHREN-LILA), national networking groups (Internet2, ESnet and NLR) and foreign NRN (DANTE and SURFnet) technical and administrative contacts.

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 10Gb routed circuit among the Internet2 network, NLR, ESnet and GÉANT2 provides greater transatlantic connectivity, and the 10Gb switched circuit between StarLight and NetherLight provides long-distance, high-bandwidth capability for demanding data-instensive 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., Supercomputing, HPDC, Internet2), workshops (GLIF), 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. 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.