

NASA/GSFC's Key Accomplishments in CY05 and Future Plans as OptIPuter Partner

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January 12, 2006

Information for 17-18Jan06 OptIPuter AHM



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NASA/GSFC's Key Accomplishments in CY05 as OptIPuter Partner

Highlights (partial list)

- Completed 10-Gbps network connection from GSFC in Greenbelt, MD, to NLR (http://cisto.gsfc.nasa.gov/L-Netpdfs/L-Net_10G_DRAGON_v4.pdf)
 - Interconnected with NLR-based CAVEwave extended to McLean, VA (http://cisto.gsfc.nasa.gov/L-Netpdfs/nlr_diagram.pdf)
 - >5-Gbps “user payload” coast-to-coast single stream UDP/IPv4 (http://cisto.gsfc.nasa.gov/L-Netpdfs/Wash_Star_mrtg_073005.pdf); two 4.5-Gbps UDP/IPv4 flows filled both the NLR/WASH-STAR and DRAGON/channel49 lambdas to 90% of capacity (http://cisto.gsfc.nasa.gov/L-Netpdfs/L-Net_mrtg_collage_080505.pdf)
- Conducted Live Demonstration of 21st Century National-Scale Team Science for then NASA Associate Administrator of Science Alphonso Diaz (<http://www.calit2.net/newsroom/release.php?id=660>; http://cisto.gsfc.nasa.gov/L-Netpdfs/OPTIPUTER_demo_080805_collage.pdf)
- Demonstrated live 3D HDTV multi-Gbps real-time data streaming from GSFC to holographic display at iGrid2005 as the US130/Real-Time_True-3D_Visualization exhibitor (http://www.igrd2005.org/program/applications/vizservices_3dviz.html)
- Enabled e-VLBI real-time data flows from GGAO to MIT/Haystack during iGrid2005 for US122/Dynamic_Provisioning_&_VLBI exhibit (http://www.igrd2005.org/program/applications/lambdaservices_provisioning.html)

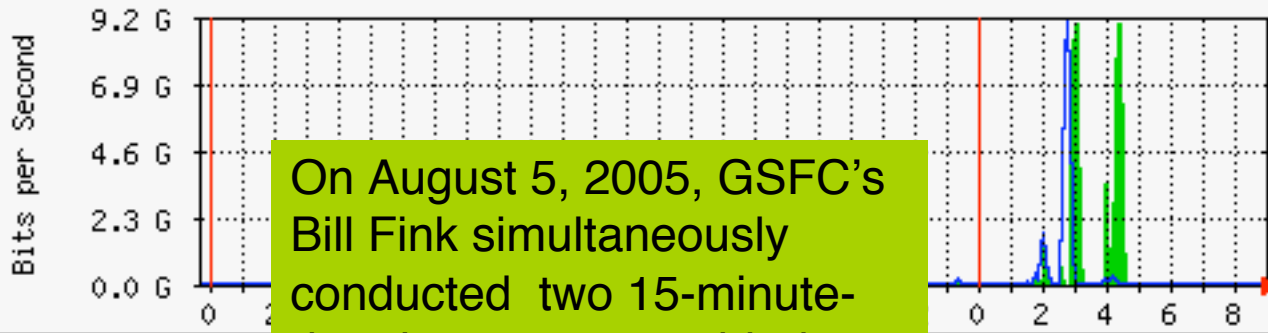


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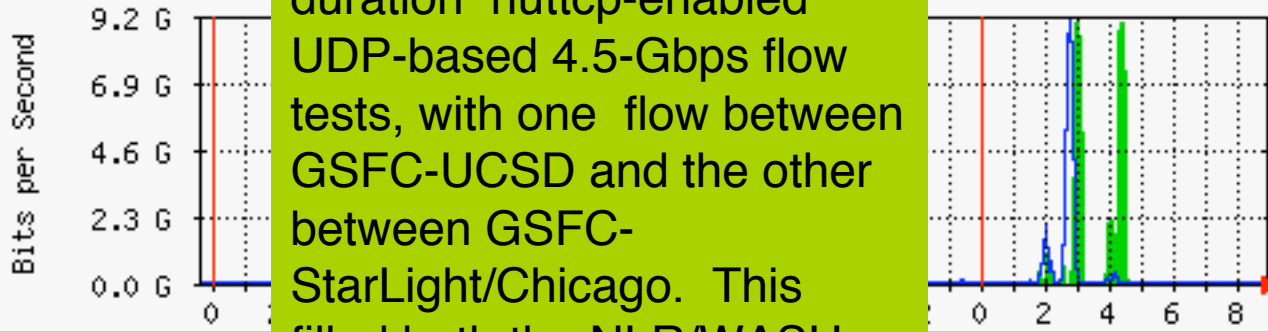
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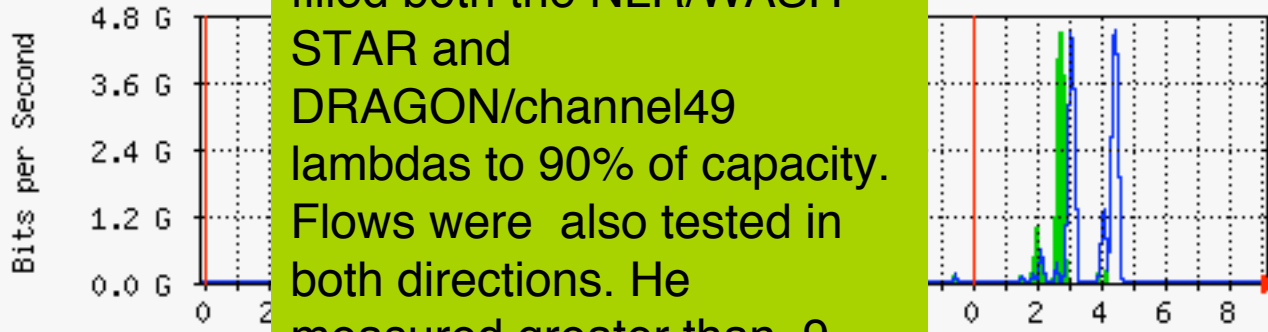


GSFC Scientific and Engineering Network (SEN)
Mrtg-based 'Daily' Graph (5 Minute Average)
Bits per second In and Out
On Selected Interfaces

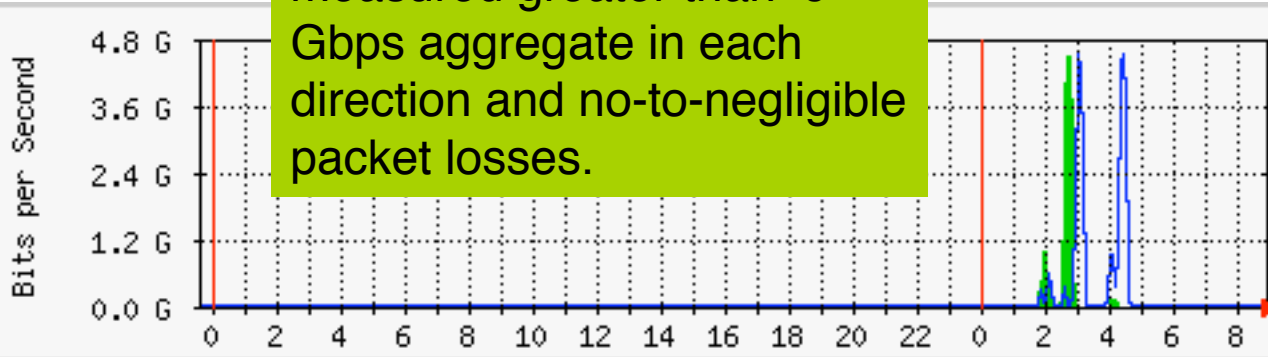
10 GigE from McLean to Chicago via OptIPuter Lambda
5 August 2005



DRAGON 10Gig DWDM XFP
5 August 2005

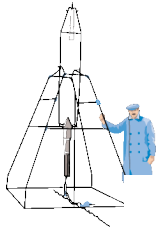


chance1 10Gig (eth1 Intel Pro/10GbE)
5 August 2005



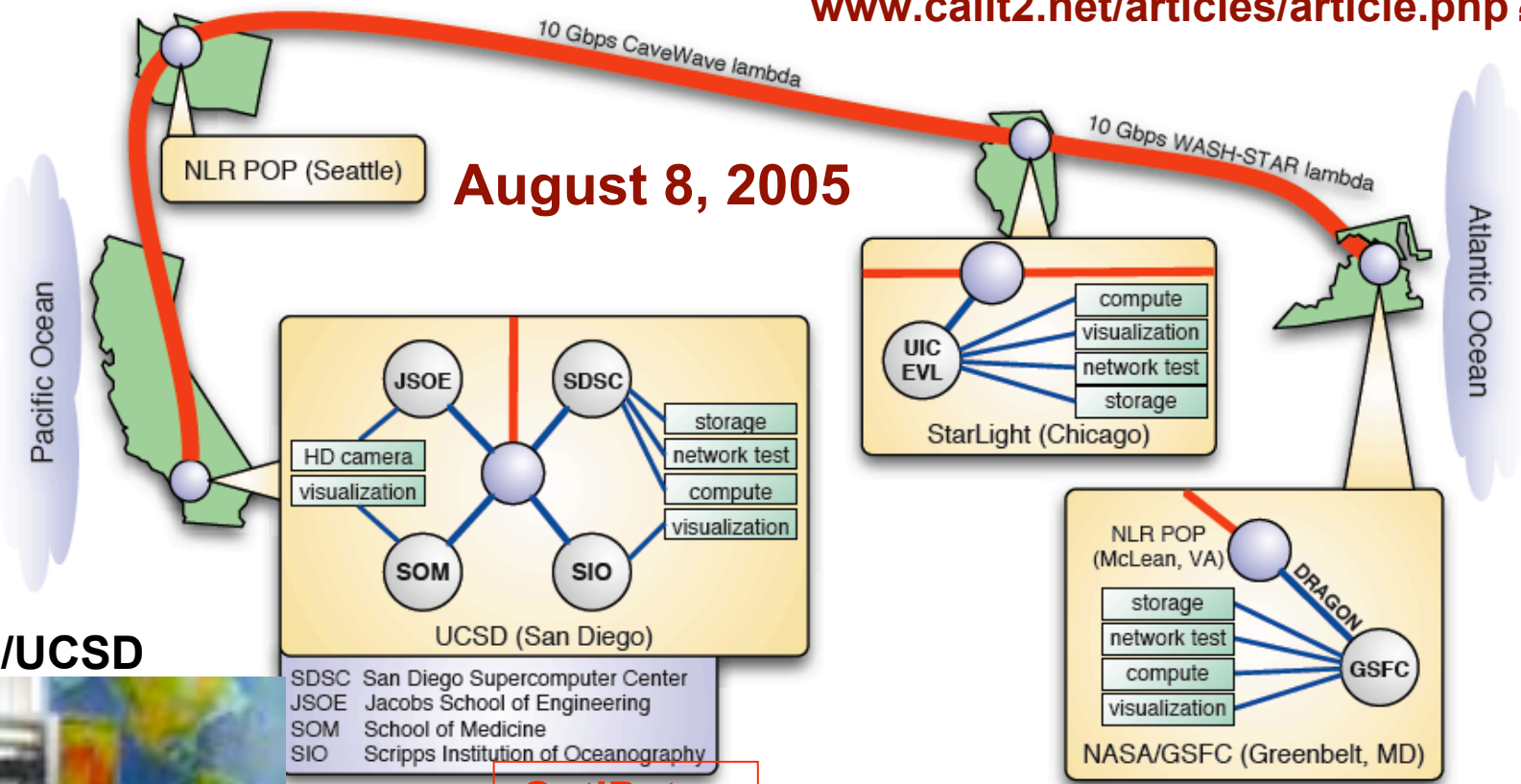
chance2 10Gig (eth1 Intel Pro/10GbE)
5 August 2005

On August 5, 2005, GSFC's Bill Fink simultaneously conducted two 15-minute-duration nuttcp-enabled UDP-based 4.5-Gbps flow tests, with one flow between GSFC-UCSD and the other between GSFC-StarLight/Chicago. This filled both the NLR/WASH-STAR and DRAGON/channel49 lambdas to 90% of capacity. Flows were also tested in both directions. He measured greater than 9-Gbps aggregate in each direction and no-to-negligible packet losses.



Combining Telepresence with Remote Interactive Analysis of Data Over NLR

www.calit2.net/articles/article.php?id=660



August 8, 2005

SIO/UCSD

- SDSC San Diego Supercomputer Center
- JSOE Jacobs School of Engineering
- SOM School of Medicine
- SIO Scripps Institution of Oceanography

**OptIPuter
Visualized
Data**

**HDTV Over
Lambda**



**NASA
Goddard**



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21st Century National-Scale Team Science Demo

UCSD and GSFC linked using OptIPuter technologies over a 10-Gbps lambda across the NLR and DRAGON networks



Attendees at GSFC in Scientific Visualization Studio watching real-time HD broadcast of opening welcome by Larry Smarr and others from UCSD, displayed in lower left corner of the HyperWall.



Christa Peters-Lidard, a GSFC hydrologist, describes the Land Information System (LIS). Using the NLR, the HyperWall behind her displays LIS 1-kilometer data sets residing on an OptIPuter cluster at the University of California, San Diego.



Milt Halem (right) introducing the demo agenda to NASA Associate Administrator of Science Al Diaz (left), (in background) with live visualizations of every time-step from the NASA fvGCM forecast then running on Columbia at ARC.



~30 attendees at GSFC in Scientific Visualization Studio during the 21st Century National-Scale Team Science Demo.



Arlindo de Silva, a GSFC meteorologist, discusses high performance network-based use of GrADS-DODS for analyzing data sets prepared by the World Climate Research Program.



GrADS-DODS generated displays of MAP '05 hurricane data by GSFC information technologists Randall Jones (left) and Kevin Fisher (right).

iGrid 2005 Workshop, 26-29Sep05, UCSD/CalIT2

Accelerating the Use of Multi-10Gigabit per Second International and National Networks: www.igrid2005.org



GSFC's Ben Kobler (left) and POC's Sookwang Ro and Kirill Kolesnikov (right) work to set up POC's 35" x 35" holographic 3D HDTV video display system (center) prior to the start of iGrid 2005.

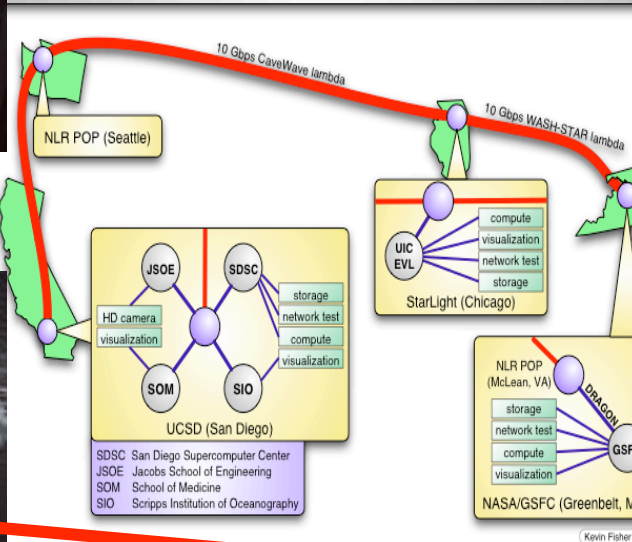


Only a non-stereo image of the True-3D display is captured in this photo of the real-time stereo-HDTV images transmitted from GSFC.

US130: Real-Time True-3D/HDTV (No Goggles) Visualization Over the National LambdaRail

NASA and Physical Optics Corporation demonstrate a holographic 3D HDTV video display system that does not require goggles or other special head gear, using a live cross-country video feed from NASA Goddard Space Flight Center to the iGrid 2005 site in San Diego. POC is a NASA SBIR Phase 1 awardee, and worked with NASA GSFC on this project.

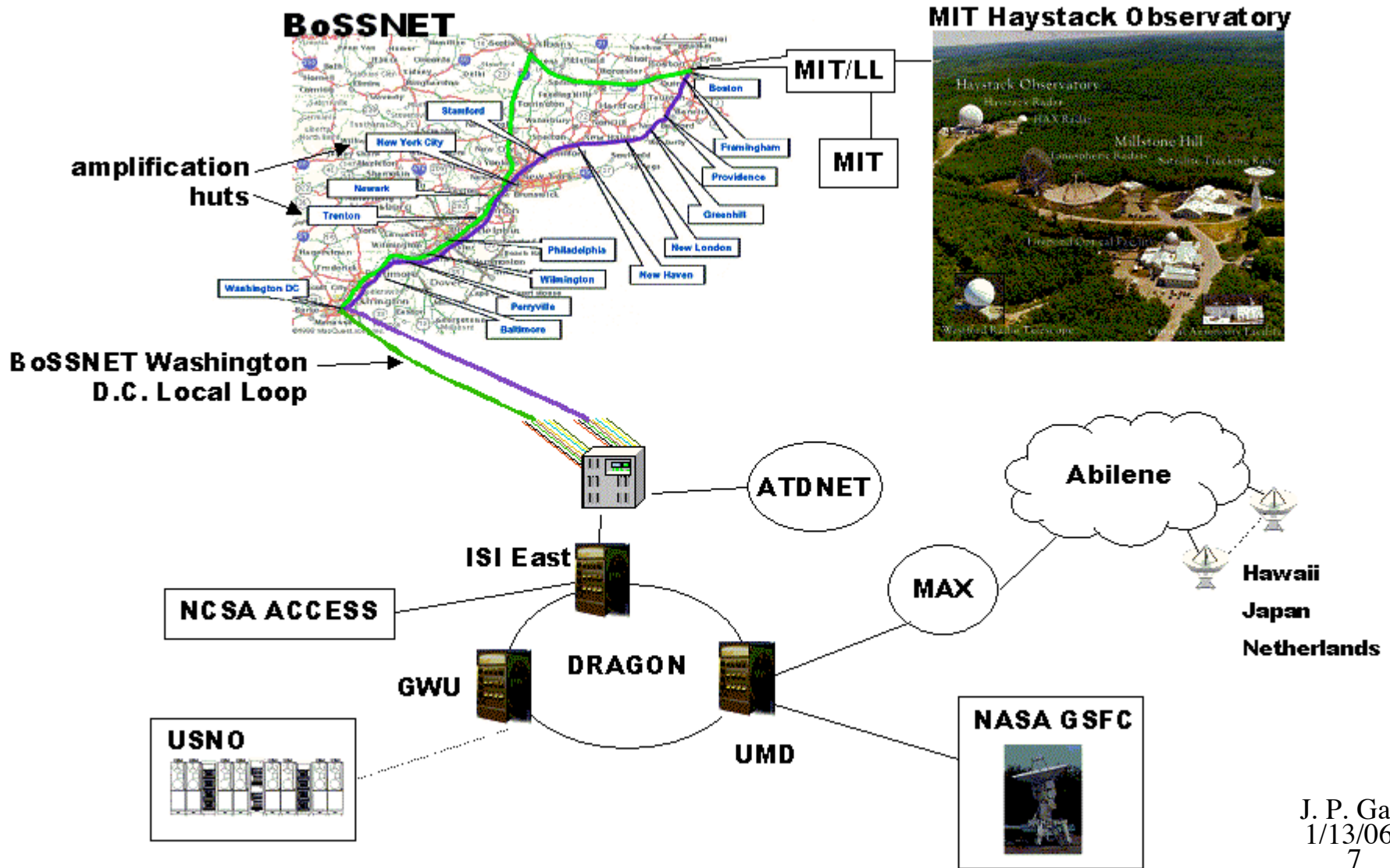
www.poc.com/emerging_products/3d_display/default.asp



3D HDTV Over Lambda

Stereoscopically-aligned Sony HDV 1080i HDR-FX1HDTV cameras and the viewed targets at GSFC.

DRAGON eVLBI Experiment Configuration

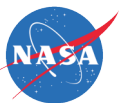




NASA/GSFC's Key Accomplishments in CY05 as OptIPuter Partner

Highlights (partial list continued)

- Supported HOPI/DRAGON demonstrations in Internet2 exhibit (booth 2435) at SC|05 (<https://mail.internet2.edu/wws/arc/i2-news/2005-11/msg00006.html>)
 - Enabled e-VLBI real-time data flows from GGAO to MIT/Haystack (<http://web.haystack.mit.edu/e-vlbi/evlbi.html>)
- Supported the NASA exhibit (booth 1810) at the SC|05
 - Enabled hurricane data sets exchanges between ARC's Project Columbia supercomputer and GSFC's supercomputer facilities across the recently-upgraded-to-1-Gbps NREN path across the NLR
 - Supported Shujia Zhou (Northrop Grumman)'s demonstration of a prototype of ESMF-based cross-organization coupling of climate models over a high speed network (http://cisto.gsfc.nasa.gov/L-Netpdfs/sc05_esmf_demo_v5.pdf)
- S. Zhou et al., "High-Speed Network and Grid Computing for High-End Computation: Application in Geodynamics Ensemble Simulations", CompFrame 2005 Workshop, Atlanta, Jun. 2005 (http://cisto.gsfc.nasa.gov/L-Netpdfs/compframe05_april26.pdf)
- P. Gary et al., "New 10-Gbps Networks Facilitating Grid-related Development Activities", NASA GSFC Grid Workshop, Jun. 2005 (<http://romulus.gsfc.nasa.gov/msst/gridws/P19%20Gary.pdf>)
- S. Zhou, et al., "Grid Computing in Distributed High-End Computing Applications: Coupled Climate Models and Geodynamics Ensemble Simulations", ESMF on the GRID Workshop, July, 2005 (http://www.esmf.ucar.edu/esmf_presentations/pres_0507_shujiazhougrid.ppt)



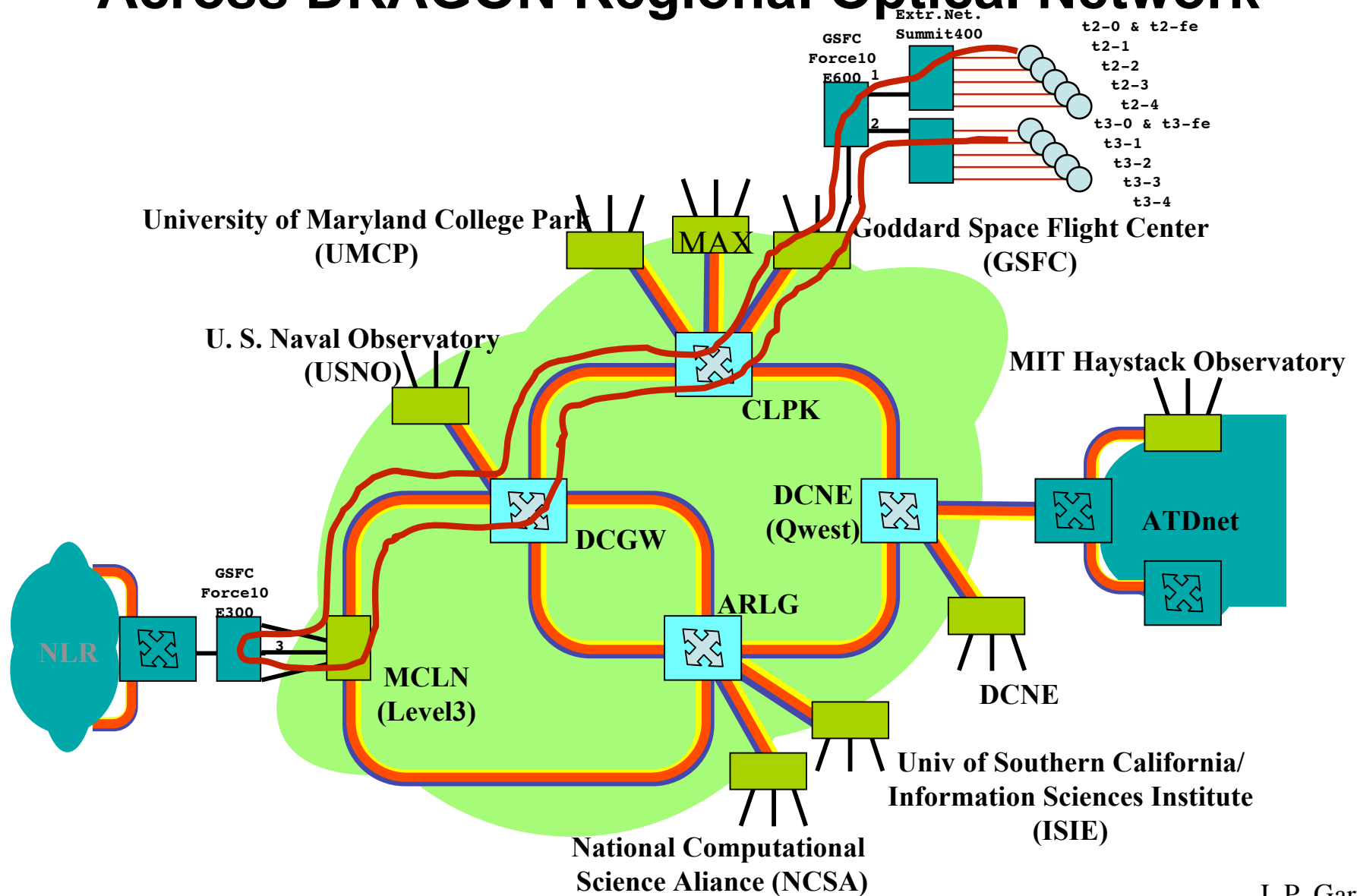
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Thunder2-Thunder3 Looped Data Flows Across DRAGON Regional Optical Network





NASA/GSFC's Future Plans as OptIPuter Partner

Future Plans (partial list)

- Support new 10-Gbps connection with NREN's NLR lambda once available
 - 20Jan06: NLR to release 10-Gbps Sunnyvale-McLean lambda & NASA to start testing GSFC-Sunnyvale-GSFC
 - mid-Feb06: NASA to start testing GSFC-ARC end-to-end
- Leverage 12Jan06-completed 10-GE GSFC(McLean)-NGC(Colshire) connection & ~Apr06 NGC(Colshire) and UMBC new DWDM connections to DRAGON
- Leverage existing DRAGON-provided 10-Gbps connection with Internet2's NLR/HOPI lambda
- Support plans identified in NASA NRA Proposals
 - "MAP Core Integration LambdaGrid Infrastructure" by Smarr (UCSD) et al to NASA's MAP NRA
 - "Brokering and Chaining Distributed Services and Data Using OptIPuter and the National Lambda Rail" by Ramapriyan (GSFC) et al to NASA's ROSES NRA
 - "Enabling NASA Applications Across Heterogeneous High Performance Networks" by Habib (CUNY) et al to NASA NNH05ZDA001N-Applied Information Systems Research (a.k.a. ROSES:D3)
- Extend GSFC's existing 10 Gbps L-Net to additional GSFC buildings, computers, and users; increase the number and type of GSFC science/exploration research projects that benefit from the increased throughput performance that multi-wavelength optical networking can provide

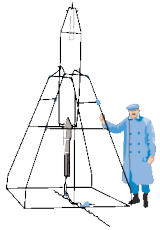


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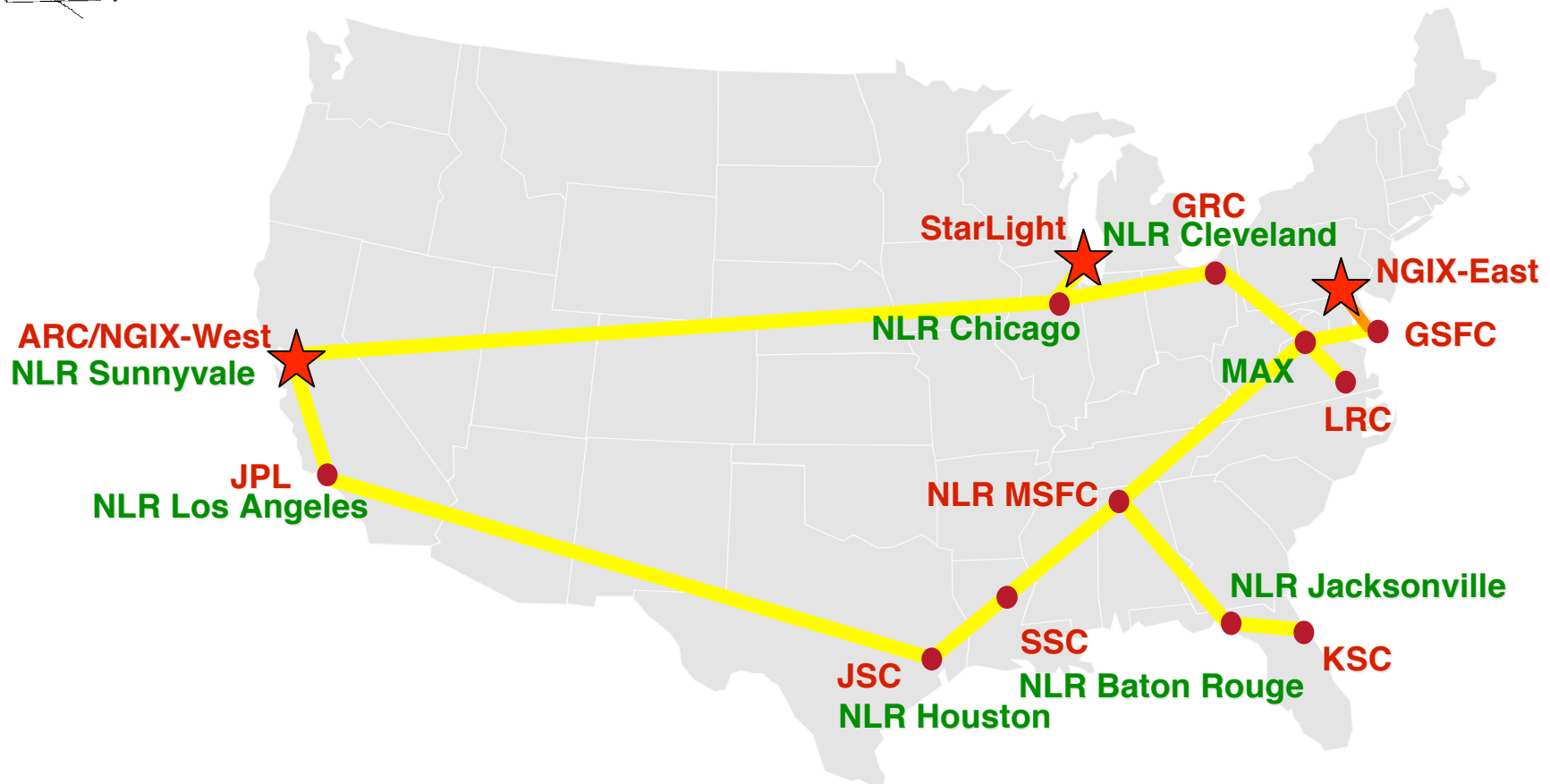
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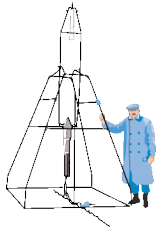


Future NREN Over NLR

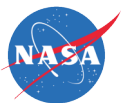
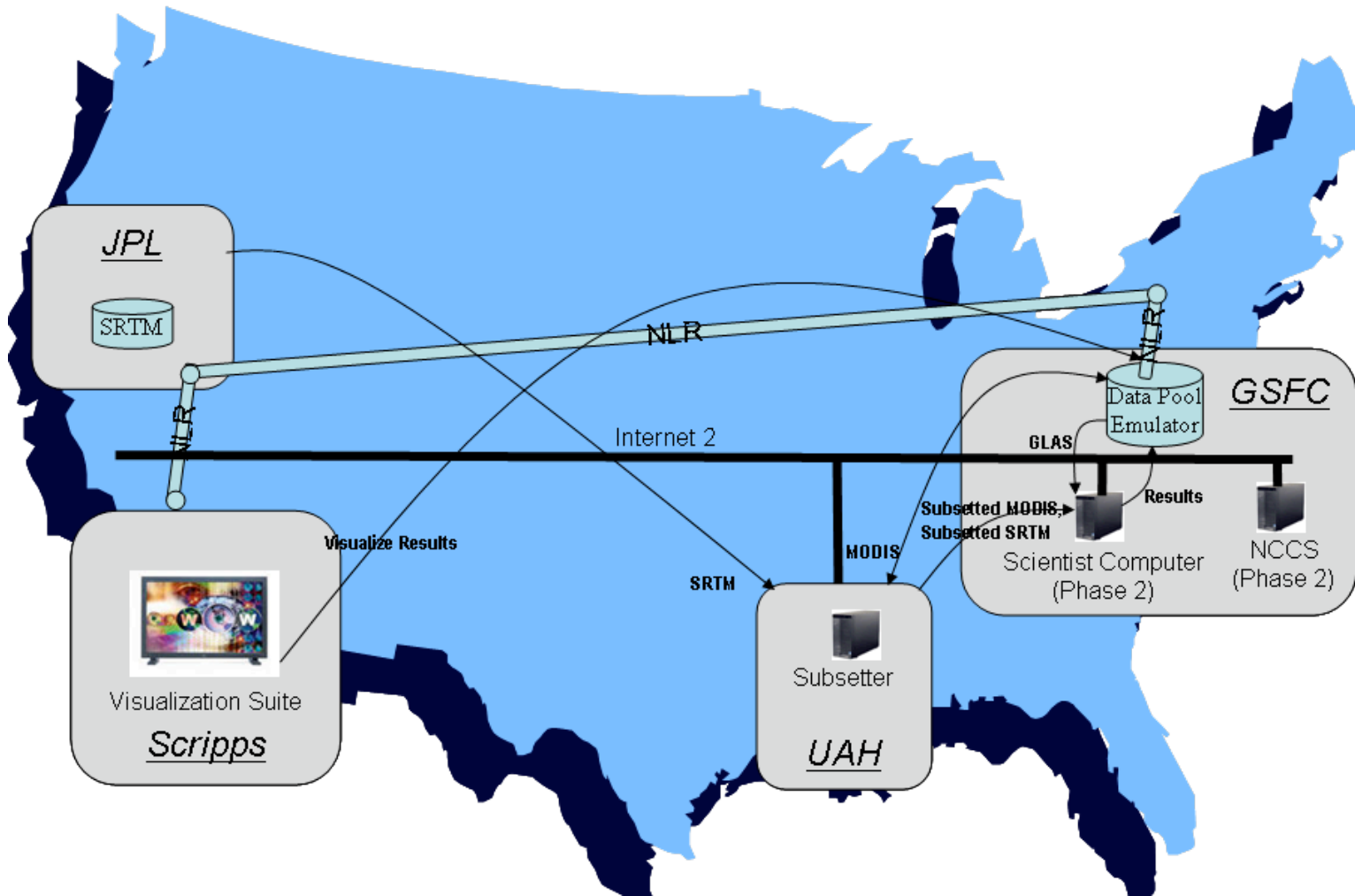


NREN Site	●
Peering Points	★
1 GE	—
10 GE	—





"Brokering and Chaining Distributed Services and Data Using OptIPuter and the National Lambda Rail" by Ramapriyan (GSFC) et al to NASA's ROSES NRA





“Enabling NASA Applications Across Heterogeneous High Performance Networks” by Habib (CUNY) et al to NASA NNH05ZDA001N-Applied Information Systems Research (a.k.a. ROSES:D3)

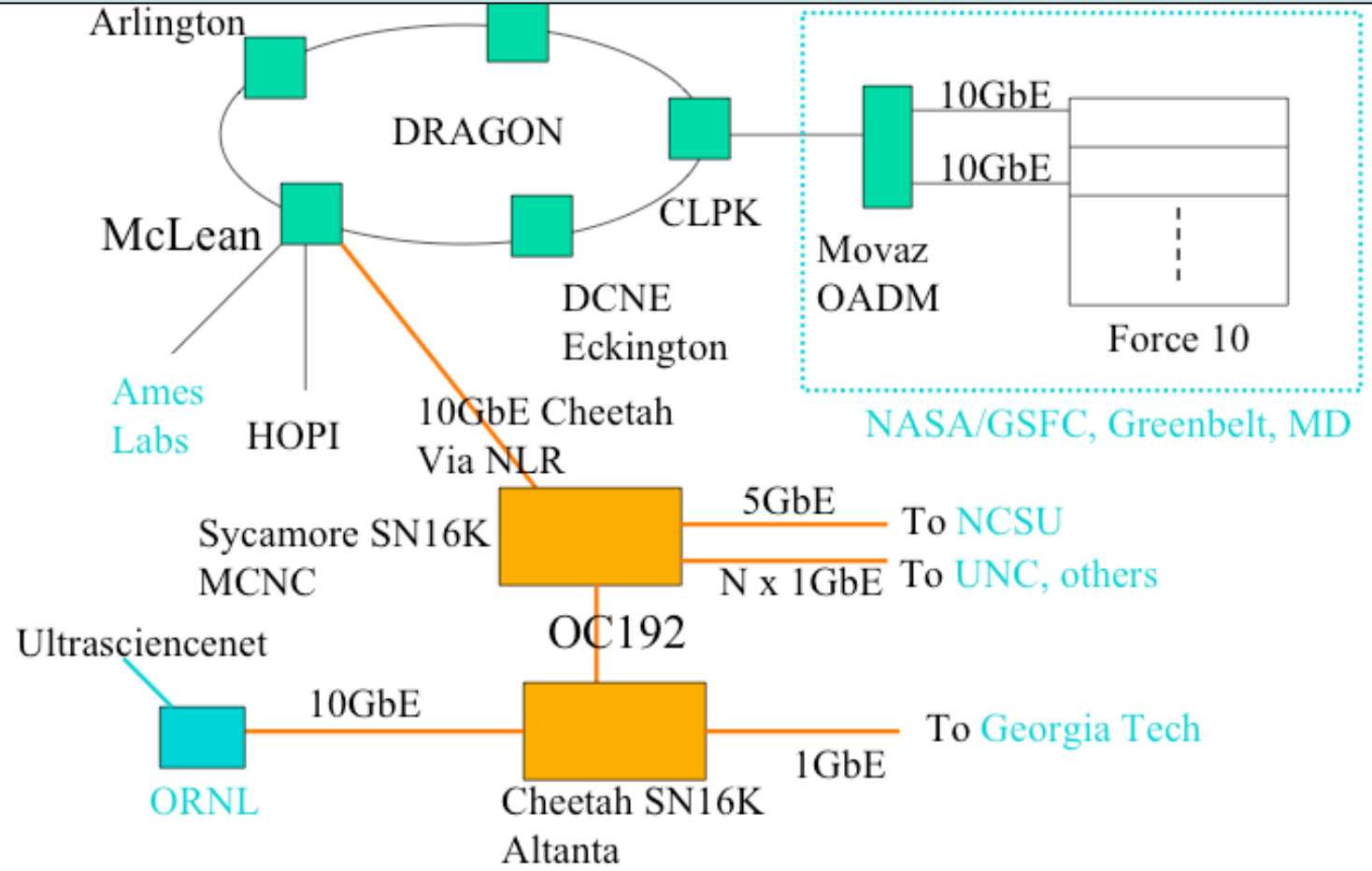
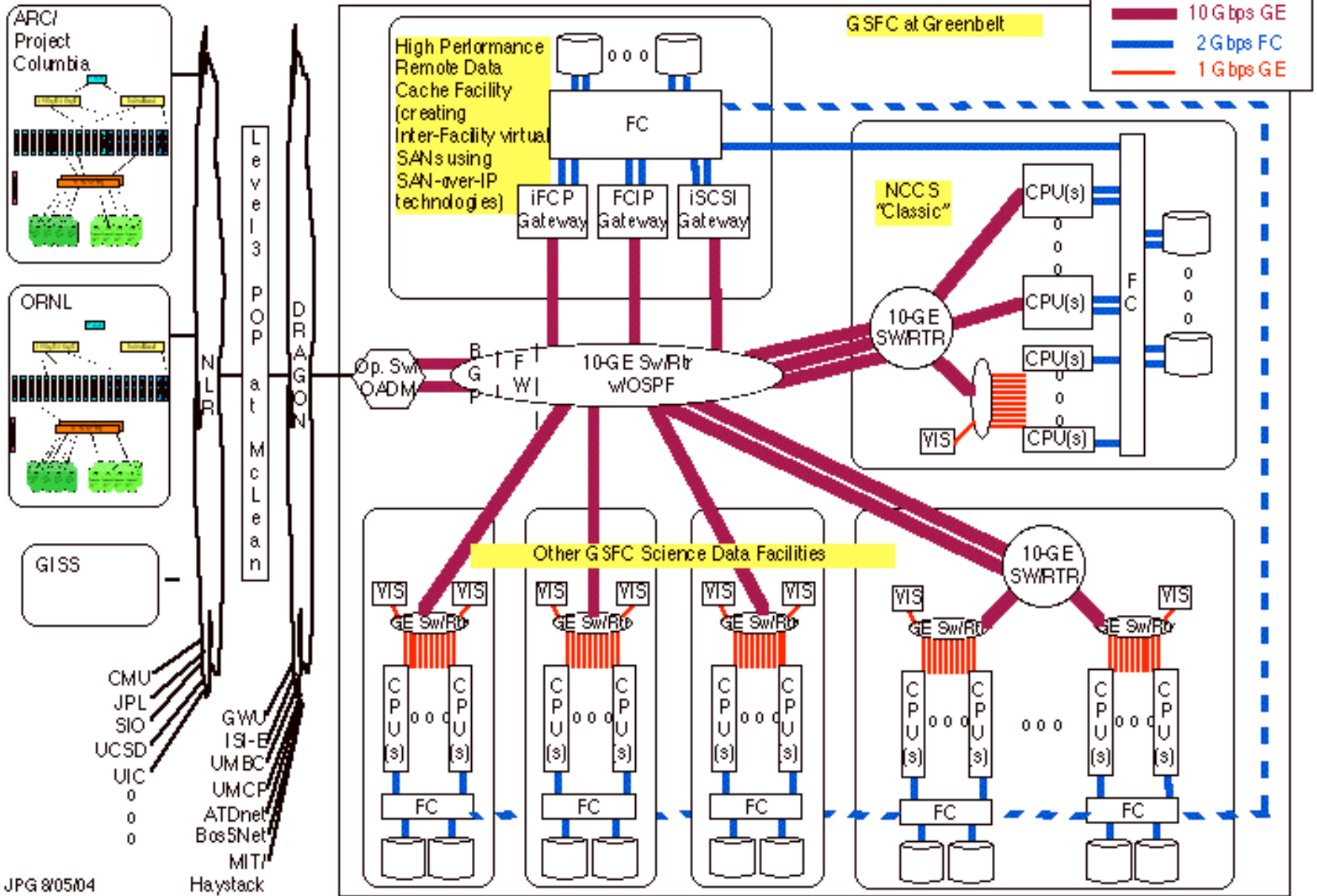


Fig. 1: Overall Proposed Network Connectivity to Cheatah



High Performance Networking and Remote Data Access GSFC L-Net for NCCS and Science Buildings





Science-Enabling Network Technology Highlights of GSFC's 10-Gbps Lambda Network Project

GSFC Lambda Network Project Website

- http://cisto.gsfc.nasa.gov/IRAD_Lambda.html
- **Designs**
 - GSFC Local Network Part (i.e., within GSFC)
 - Regional Network Part (i.e., between GSFC in Greenbelt, MD, & Level3 POP in McLean, VA, typically involving the DRAGON optical network)
 - Transcontinental Network Part (i.e., use of NLR, GSFC 10-GE switch & workstations in the Level3 POP in McLean, VA, & remote end users/sites)
- **Implementation Status**
 - GSFC Local Network Part
 - Regional Network Part
 - Transcontinental Network Part
- **Presentations/Events in the News**
 - Eg: P. Gary's 18Feb05 presentation at GSFC's FY04 IRAD Colloquium <<http://cisto.gsfc.nasa.gov/L-Netpdfs/FY04IRADGARY.pdf>>
 - Live Demonstration of 21st Century National-Scale Team Science <<http://www.calit2.net/articles/article.php?id=660>>
- **Related Links (e.g., DRAGON, HOPI, NLR, OptIPuter, ...)**

