



Mid-Atlantic Crossroads

Advanced Regional Internetworking for
Higher Education and Research

Office: 8400 Baltimore Avenue
Suite 102
College Park, Maryland 20740
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July 31, 2007

Welcome

Welcome to the July 2007 edition of the MAX Newsletter. In these updates we highlight current technical activities and policy initiatives amongst our staff, our participants, and the Regional Optical Network and national networking communities. Please let us know your thoughts, and especially your suggestions.

Executive Director Message

While many this summer seem to be reading the newly released, and final, Harry Potter book, MAX staff are working on a myriad of facility details in preparation for the Phase 1 upgrade of our Movaz DWDM equipment across McLean, College Park, and Baltimore that has been in place since 2003. Phase 2 in late fall, will replace the Zhone/Luxn system from 2000 on the original DC ring providing us with a unified optical platform.

The Fujitsu purchase terms and order were successfully concluded and we are anticipating delivery the middle of August. Efforts are well underway to evaluate rack space needs, new fiber trays, power requirements, sparing plans, and specialized cable needs. Staff are going to balmy Richardson, Texas next week for four days of training. When the equipment arrives, the plan is to stage and configure it all in our lab prior to delivery to the McLean, College Park, and Baltimore PoPs. As we approach actual deployment, perform testing on the protect side, and finalize cutover dates in September, we will be developing regular communications with all of you.

Some of the Fujitsu technical strengths and key feature functionality that fit our requirements include the ability to have 40 channels of 10Gb/s waves to start with near term capability to upgrade to 40 40Gb/s waves when required, built in transponder optical switch protection, support for 8 degree ROADM (we need 5 degrees in College Park), full support for SNMP, fine SONET granularity at OC-3, ability to set up pass through waves without extra equipment, optical broadcast provisioning for Ethernet and IP multicast, easy operating system upgrades and quick reboot times, good scalability with shelves and smaller chassis, bundled training, and an excellent element manager client as part of their network management system (NMS). All these features can best be summarized by saying they will allow us greater flexibility across a range of high performance research and production networking services.

We're excited about this effort and the new service capabilities it will enable for all of you, our participants, this fall.
- Peter O'Neil



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U.S. Broadband Study

A well researched Brookings Institution study by researchers Robert Crandall, William Lehr, and Robert Litan, focuses on the economic effects of broadband deployment. While the report may read to some like an appeal to the FCC that "new regulatory policies not reduce investment incentives for these carriers," the issues it raises are worthy of consideration.

"The finding of the strong link between broadband use and state-level employment has important policy implications, both on the demand-side and the supply-side. In particular, these results suggest that all levels of government should follow policies that encourage broadband competition, which will lead to lower prices and hence greater use. It should be noted, however, that increased use will require an expansion of supply, specifically greater investment by service providers in broadband infrastructure, which already is facing capacity constraints as new applications, such as video streaming, become ever more popular."

<http://www3.brookings.edu/views/papers/crandall/200706litan.pdf>

Ohio Governor Establishes Broadband Network

Ohio Governor Ted Strickland has signed an executive order establishing the Ohio Broadband Council and the Broadband Ohio Network.

The order directs the Ohio Broadband Council to coordinate efforts to extend access to the Broadband Ohio Network to every county in Ohio. And the or-

der allows public and private entities to tap into the Broadband Ohio Network – all with a goal of expanding access to high-speed internet service in parts of the state that presently don't have such service. "Ohio's economic future relies on our ability to compete in a high-speed, high-tech global marketplace," Strickland said. "The Ohio Broadband Council will partner with the public and private sectors to help make sure that every Ohioan has viable access to affordable, high-speed internet service, regardless of where they live, work or learn."

The order directs state agencies to use the Broadband Ohio Network rather than the patchwork of public and private networks agencies presently use, allowing the state to realize cost savings and efficiencies. <http://www.governor.ohio.gov/News/July2007/News72707/tabid/335/Default.aspx>

CineGrid @ Holland Festival

San Francisco, CA, July 3, 2007 – On June 20, 2007, the first successful demonstration of trans-Atlantic streaming over photonic IP networks of 4K digital motion pictures and 5.1 surround sound was achieved by the international research consortium, CineGrid. This demonstration, part of the CineGrid @ Holland Festival 2007 project, was the latest in a series of ground-breaking CineGrid experiments using very high quality digital media running over very high speed digital networks.

CineGrid @ Holland Festival 2007 recorded a performance of "Era la Notte" at the Holland Festival,



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featuring soprano Anna Caterina Antonacci performing works of Monteverdi, Strozzi and Giramo at the Muziekgebouw IJ concert hall in Amsterdam. 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 (at four times the resolution of HDTV) 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). Calit2 built the first CineGrid node in North America, fully equipped to handle networked digital media at this extremely high quality.

With the permission of the Holland Festival and the cooperation of the "Era la Notte" performers, CineGrid @ Holland Festival 2007 was able to deliver an audience experience of unprecedented quality across long distances using advanced networks. According to Tom DeFanti, Research Scientist in the UCSD division of Calit2, "the CineGrid combination of 4K streaming video and surround sound created an astounding sense of live presence in the auditorium, as if the audience in San Diego were actually sitting in the concert hall in Amsterdam, seeing, hearing and feeling the diva's beautiful performance very directly. Collectively, the CineGrid community learned a lot of useful lessons, both technically and creatively. The emerging global infrastructure of lambda-grids, networks of switchable/routable lightpaths, that is used by CineGrid opens all sorts of new approaches to media producers and consumers."

"The CineGrid @ Holland Festival 2007 demonstrations prove that live 4K production and networked

distribution of music concerts, opera, sports and various content genres beyond traditional theatrical-release feature movies is not only technically feasible but delivers a compelling new entertainment experience," said Laurin Herr, president of Pacific Interface and co-founder of CineGrid. "In networking terms, 'live' requires more reliable throughput and low-latency responsiveness. CineGrid @ Holland Festival 2007 confirms that even these most demanding types of streaming media distribution can be done over gigabit IP networks using lightpath infrastructure today." For additional information see http://www.cinegrid.org/news/2007_07_03_holland2007.php

New National Academy Reports

Toward a Safer and More Secure Cyberspace, from the National Research Council, examines the vulnerabilities of the Internet and offers a strategy for future research aimed at countering cyber attacks. The report also explores the nature of online threats and some of the reasons why past research for improving cybersecurity has had less impact than anticipated. http://www7.nationalacademies.org/cstb/pub_safercyberspace.html

Improving Disaster Management: The Role of IT in Mitigation, Preparedness, Response, and Recovery
The committee's report examines information technology's as-yet unrealized potential to improve how communities and the nation handle disasters. Payoffs for disaster management outlined by the committee include more robust and interoperable communications, improved situational awareness and decision



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support, greater organizational agility, and enhanced engagement of the public. The report's chapters (1) characterize disaster management, placing the use of information and communication technology in the broader human and organizational context and providing a framework for considering the range and nature of information and communication needs; (2) present the committee's vision of the potential for information and communication technology to improve disaster management; (3) examine structural, organizational, and other non-technical barriers to the acquisition, adoption, and effective use of IT in disaster management; and (4) provide an initial outline of the elements of a research program aimed at strengthening IT-enabled capabilities for disaster management.

http://www7.nationalacademies.org/cstb/pub_fema.html

NIH's NCRR Call for Input

The National Institute of Health's National Center for Research Resources (NCRR) is seeking your input as they develop a new Strategic Plan for 2009 - 2013. NCRR is a \$1 billion-a-year research center that enables NIH-funded researchers across the country to translate basic discoveries into improved patient care. To ensure that NCRR continues to meet the needs of biomedical investigators, your input on six questions is sought by August 24, 2007

http://www.ncrr.nih.gov/Strategic_Plan/spform.asp

History of the Internet DNS

For those curious about the origins and history of the Internet Domain Name Service (DNS), a timeline of the people and events involved can be viewed from <http://www.inaic.com/index.php?p=internet-dns-timeline>

Global LambdaGrid Workshop

GLIF, the Global Lambda Integrated Facility, internationally promotes the paradigm of lambda networking as an integrated facility to support data-intensive scientific research. The 7th annual meeting will be held in Prague September 17th - 18th.

<http://www.ces.net/glif2007/>

End-to-End Principle

Here's a link to a short paper by Noel Chiappa discussing the placement of state in the network as it relates to the end-to-end principle.

http://ana.lcs.mit.edu/~jnc//tech/end_end.html

NIST BGP Security Document

This document introduces the Border Gateway Protocol (BGP), explains its importance to the Internet, and provides a set of best practices that can help in protecting BGP. Best practices described here are intended to be implementable on nearly all currently available BGP routers. Potential attacks that threaten the security of BGP functions, the countermeasures that are available to thwart attacks, and their associ-



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ated costs and benefits are discussed in detail. The emphasis and recommendations focus on specific counter measures that can be applied without significant additions or changes to equipment. The report can be obtained from

<http://csrc.nist.gov/publications/nistpubs/800-54/SP800-54.pdf>

BGP Routing Table Visualization

The Netlantis team announced a new BGP routing tables visualization project called Routing Table Geoanalysis that represents various statistics based on the analysis of a providers BGP routing table.

The statistics analyzed include :

- The distribution across continents (or more precisely geo-political areas) of the total number of IP addresses announced
- The number of IP addresses announced for 100 inhabitants of these areas
- The number of routes, IP addresses and the average number of IP addresses per route
- The main upstream AS's share in the routing table (in number of IP) and the geographic distribution of IP addresses announced through or by them
- The distribution of AS path length by continent
- The prefix size distribution

<http://rtg.netlantis.org/>



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Member Spotlight

GAITHERSBURG, MD—Physicists at the Commerce Department’s National Institute of Standards and Technology (NIST) have induced thousands of atoms trapped by laser beams to swap “spins” with partners simultaneously. The repeated exchanges, like a quantum version of swinging your partner in a square dance but lasting a total of just 10 milliseconds, might someday carry out logic operations in quantum computers, which theoretically could quickly solve certain problems that today’s best supercomputers could not solve in years.

The atomic dance, described in the July 26 issue of *Nature*,* advances prospects for the use of neutral atoms as quantum bits (qubits) for storing and processing data in quantum computers. Thanks to the peculiarities of quantum mechanics, nature’s rule book for the smallest particles of matter and light, quantum computers might provide extraordinary power for applications such as breaking today’s most widely used encryption codes. Neutral atoms are among about a dozen systems being evaluated around the world as qubits; their weak interactions with the environment may help to reduce computing errors.

Led by Nobel Laureate William Phillips, the NIST group demonstrated the essential part of a so-called swap operation, in which atom partners exchange their internal spin states. (Spin can be visualized as a rotating top pointing up or down.) In the binary language of computers, the atoms swap values from 1 (“spin up”) to 0 (“spin down”), or vice versa. Unlike classical bits, which would either swap or not, quan-

tum bits can be simultaneously in an unusual state of having swapped and not swapped at the same time. Under these conditions, spin swapping has the effect of “entangling” the pairs, a quantum phenomenon that links the atoms’ properties even when they are physically separated. Entanglement is one of the features that make quantum computers potentially so powerful.

“This is the first time these spin-entangling interactions have been demonstrated between pairs of atoms in an optical lattice,” says Trey Porto, one of the authors. “Other research groups have entangled atoms in lattices as extended clusters. By isolating pairs, we can focus on the simplest units for quantum logic.”

The swapping process is a way of creating logical connections among data, crucial in any computer. A logic operation is the equivalent of an “if/then” statement, such as: If two qubits have opposite states, then they should exchange values. The logical connections in quantum computers are created using entanglement, which in effect allows for multiple simultaneous, correlated possibilities.

The NIST experiment was performed with about 60,000 rubidium atoms in a Bose-Einstein condensate (BEC), a special state of matter in which all atoms are in the same quantum state. They were trapped within a three-dimensional grid of light formed by three pairs of infrared laser beams. The lasers were arranged to create two horizontal lattices overlapping like two mesh screens, one twice as fine



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as the other in one dimension. This created many pairs of energy “wells” for trapping atoms. The scientists attempted to place a single atom in each well, with one atom spin up (or 1) and the other down (or 0). Then, they merged all double wells to force each pair of atoms into the same well, where they could interact with each other. When two such identical atoms are forced into the same physical location, quantum mechanics imposes a specific type of symmetry (only two of four seemingly possible combinations of quantum states are allowed). Due to this restriction, the merged atoms oscillate between the condition in which one atom is 1 and the other is 0, to the opposite condition. This behavior is unique to identical particles.

As they swap spins, the atoms pass in and out of entanglement. At the “half-swap” points the spin of each atom is uncertain and, if measured, might turn out to be either up or down. But whatever the result, a measurement on the other atom, equally uncertain before the measurement, would be sure to be the opposite. This entanglement is the key feature that enables quantum computation. According to Porto, the work reported in *Nature* is the first time that quantum mechanical symmetry (“exchange symmetry”) has been used to perform such an entangling operation with atoms.

The current set-up is not directly scalable to an arbitrary computer architecture, Porto says, since it performs the same spin-swap in parallel for all pairs of atoms. Researchers are developing ways to address and manipulate any pair of atoms in the lattice, which should allow for scalable architectures. Fur-

thermore, not all atoms participated in the swap process, primarily because of imperfect initial loading of the atoms in the lattice. (Some double-wells contained only one atom and had no partner to exchange with.) The scientists estimate that the swap worked for at least 65 percent of the double wells.

The NIST group is continuing to work on improving the reliability of each step and on completing the logic operation by separating atoms after they interact. The research was funded in part by the Disruptive Technology Office, the Office of Naval Research and the National Aeronautics and Space Administration. The authors are affiliated with the Joint Quantum Institute, a collaboration of NIST and the University of Maryland.

Background on quantum computing is available at http://www.nist.gov/public_affairs/quantum/quantum_info_index.html

*M. Anderlini, P.J. Lee, B.L. Brown, J. Sebby-Strabley, W.D. Phillips, and J.V. Porto. 2007. Controlled exchange interaction between pairs of neutral atoms in an optical lattice. *Nature*. July 26. A link to view the “quantum square dance” http://www.nist.gov/public_affairs/releases/quantum_gate.html



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Federal Labs and Agencies:

- ATDnet - NRL, LTS, DISA
- D.C. Government
- Energy Sciences Network (ESNet)
- Laboratory for Telecommunications Sciences
- Library of Congress
- NASA / GSFC
- National Archives and Records Administration (NARA)
- National Institutes of Health (NIH)
- National Institute of Standards and Technology
- National Library of Medicine (NLM)
- National Oceanic and Atmospheric Administration (NOAA)
- National Science Foundation (NSF)
- U.S. Census
- USDA, Beltsville Agricultural Research Center
- U.S. Department of Health and Human Services
- U.S. Department of State (through GWU)
- U.S. Geological Survey
- U.S. Holocaust Memorial Museum

Higher Education:

- Baltimore Education & Research Network
- Catholic University
- GEANT
- Georgetown University
- George Mason University
- George Washington University
- Johns Hopkins University

- Johns Hopkins University - Applied Physics Laboratory (JHU-APL)
- Montgomery College
- National Consortium for Supercomputing Applications / ACCESS
- Network Virginia
- Smithsonian Institution
- Southern Universities Research Association (SURA)
- University of California, D.C. campus
- University Consortium for Advanced Internet Development (UCAID / Internet2)
- University of Maryland, College Park
- University of Maryland, Baltimore
- University of Maryland, Baltimore Co.
- Univ. System of Maryland Network
- University of Southern California, Information Sciences Institute / East
- Washington Research Library Consortium

Corporate and Non-profit:

- Columbia Telecommunications Corporation (CTC)
- Howard Hughes Med. Institute
- Fujitsu Labs of America
- Inter-American Development Bank (IADB)
- Northrop Grumman Corporation
- The Institute for Genomic Research
- Windber Professional Services, Inc.
- World Bank
- The Venter Institute