MINUTES
Advanced Scientific Computing Advisory Committee Meeting,
August 8-9, 2006, American Geophysical Union, Washington, D.C.

ASCAC members present:

Jill P. Dahlburg , Chair
John W. D. Connolly, Vice Chair
F. Ronald Bailey
Gordon Bell
Roscoe C. Giles
David Galas (Tuesday only)
James J. Hack
Thomas A. Manteuffel
Ellen B. Stechel
Virginia Torczon
Stephen Wolff

Also participating:

Melea Baker, Office of Advanced Scientific Computing Research, Office of Science, USDOE
Barbara Helland, Office of Advanced Scientific Computing Research, Office of Science, USDOE
Donald Batchelor, Fusion Energy Division, Oak Ridge National Laboratory
Daniel Hitchcock, Senior Technical Advisor, Office of Advanced Scientific Computing Research, Office of Science, USDOE
William Johnston, Manager, Energy Sciences Network (ESnet), Lawrence Berkeley National Laboratory
Frederick O'Hara, ASCAC Recording Secretary
Walter Polansky, Office of Advanced Scientific Computing Research, Office of Science, USDOE
Horst Simon, Associate Laboratory Director for Computing Sciences, Lawrence Berkeley National Laboratory
Rick Stevens, Director, Mathematics and Computer Science Division, Argonne National Laboratory
Michael R. Strayer, Associate Director, Office of Advanced Scientific Computing Research, Office of Science, USDOE
Chris Yetter, ASCAC Designated Federal Officer
Thomas Zacharia, Director, Center for Computational Sciences, Oak Ridge National Laboratory

About 45 others were in attendance in the course of the two-day meeting.

Tuesday, August 8, 2006

Preliminaries

Jill Dahlburg called the meeting to order at 8:38 a.m. and made safety and convenience announcements.

Update on SC and ASCR

Michael Strayer reported that Raymond Orbach was confirmed as Under Secretary for Science, and he will serve as a science and technology advisor to the Secretary of

Energy and will monitor all of the R&D programs of the DOE. He will identify cross-cutting research areas between Office of Science (SC) and DOE's applied programs, maintain the integrity of the basic and applied research programs, and improve the coupling between basic and applied research. The Office of Advanced Scientific Computing Research (ASCR) cosponsored a workshop on simulation and modeling for advanced nuclear energy systems in support of DOE's Global Nuclear Energy Partnership (GNEP) to learn the driving issues, vocabulary, and needs of the applications researchers and to communicate to the researchers their opportunities to migrate to relevant state-of-the-art computational practices.

ASCR's current-year budget is $235 million. The President's FY07 budget request was for $319 million, and this has been agreed to by the House and the Senate. It appears increasingly likely that DOE will be operating under a continuing resolution for part of FY07, which may affect the implementation of the American Competitiveness Initiative and Advanced Energy Initiative.

The second phase of Scientific Discovery Through Advanced Computing (SciDAC-2) will support projects in a broad variety of sciences with new hardware facilities at the centers for enabling technology (CETs), and it will forge new scientific applications partnerships. It will have 100-TF leadership computing at Argonne National Laboratory (ANL), 250-TF leadership computing at Oak Ridge National Laboratory (ORNL), 150-TF production computing at the National Energy Research Scientific Computing Center (NERSC), and a refined ESnet with fault-tolerant dual (40 and 10 Gbps) rings. NERSC-5 will be delivered in FY07. The Cray XT3 at ORNL will be upgraded to 250 TF by the end of 2007, and the Blue Gene/P at ANL will be upgraded to 500 TF by 2008. All of these upgrades are in the President's budget.

The program on Innovative and Novel Computational Impact on Theory and Experiment (INCITE) provides SC computing resources to a small number of large-scale computationally intensive research projects that can make high-impact scientific advances. In 2005, 6.5 million processor hours at NERSC were awarded to three projects. In 2006, INCITE was expanded to include resources at Pacific Northwest National Laboratory (PNNL), ORNL, and ANL in addition to those at NERSC, and 15 awards were made for more than 18.2 million processor hours. It will be further expanded in 2007 to include 80% of the resources at the leadership computing facilities (LCFs) in addition to 10% of NERSC and 5% of PNNL. Proposals are due September 15, 2006, and award announcements are expected in mid-December.

During FY06, staffing at ASCR increased from 10 government employees to 14, from 3 Intergovernmental Personnel Act detailees to 4, and from 3 detailees to 4. Program management at ASCR is expected to be brought under control by this increased staffing.

Discussion: There will be an increase in the resources to applied programs. The Office is currently understaffed, and this increase will exacerbate the situation. The development of tools for the applied programs will bolster the activity of SciDAC. Core research will be supported through the process of competitive awards, and SciDAC will be ideally suited to identify the best science. Most of NERSC will be devoted to programmatic research.

The Senate committee pointed out that ASCR and the National Nuclear Security Administration (NNSA) have strong collaborations that were not updated in the strategic plan. There were some areas in which ASCR's investment would not benefit NNSA in applied mathematics; there are other areas in which it would. That situation needs to be made clear to Congress. Congress would like to see more collaboration with other agencies, and ASCR fully endorses that concept.

SciDAC-2

Walter Polansky noted that the SciDAC-2 institutes will be required to be university-led centers of excellence that focus on major software issues through a range of collaborative interactions. The sole funding source will be the ASCR program. A multidisciplinary approach will be taken to the development of algorithms, methods, and libraries; program-development environments and tools; systems software for tera- to petascale simulations; and visualization and data-management systems. The goals of the selected science applications are to (1) achieve breakthrough scientific advances through computer simulation that are impossible using theoretical or experimental studies alone or (2) improve experimental science. The funding sources are typically SC, NNSA, and/or National Science Foundation (NSF) with ASCR.

Final preparations are under way to announce the SciDAC-2 portfolio. About 250 funding actions are being negotiated under different procedures for universities and laboratories, and multiple agencies are funding the research efforts. Many projects could start work as soon as mid-September 2006. A peer review was conducted of each proposal, and then a cross-cut panel advised on portfolio quality, breadth, and compatibility with SciDAC-2’s vision. The panel’s reports were provided to DOE program managers for their input, putting each recommendation in the perspective of the research portfolio.

A research center will be established to make SciDAC resources available to the entire research community involved in computational science. Each institute will have procedures for outreach to non-SciDAC research areas and will provide training. The institutes will help the CETs interface with applications, cooperate with each other, and develop management plans.

Discussion: To ensure computer science gets done, SciDAC communicates with centers and institutes and checks what they plan to do. A rigorous review of these centers will be conducted after a reasonable time. These centers are quite mature in providing tools to applications.

The proposals from national laboratories and universities were reviewed by the same individuals. Review criteria were the same for universities and national laboratories. For the final decisions, the cross-cut panel provided insightful comments that gave greater perspective and balance to the funding decisions. The reviews were very good. The NSF is contributing to the current awards, but its future plans are unknown.

To make SC more mission oriented, additional SciDAC solicitations can be put out to fill in gaps and to look at new applications. Regular reviews will make sure the right direction is always followed and allow the portfolio to be refreshed.

To make SciDAC widely available, research centers will introduce the outside research community to computing science and offer it training. The center’s staff would deal with inquiries about using high-performance computing (HPC) resources. Those activities will be the first interface between the broad research community and SciDAC.

A break was declared at 9:58 a.m. The meeting resumed at 10:30 a.m.

Networking Subcommittee Overview

Stephen Wolff said that the charge to the Subcommittee is to (1) review the organization, performance, expansion, and effectiveness of ESnet operations; (2) consider the appropriateness and comprehensiveness of the proposed ESnet evolution; and (3) make suggestions and recommendations on the appropriateness and comprehensiveness of the ASCR networking research programs. The Subcommittee's membership has been drawn up, but the subcommittee has not yet met. This is a small panel with many consultants. All members are conflicted in some way or other, but the membership is balanced.

Overlapping subgroups are looking at current operations, plans, and research. Each subgroup is drawing up an action plan. The purpose is to maximize the efficiency and effectiveness of this program in advancing science. External volunteer consultants are being contacted from industry, universities, etc. The Subcommittee is holding biweekly conference calls and regular Web conferences.

The investigation is expected to take seven months (September 2006 until March 2007). An additional seven months will be dedicated to writing the report (April 2007 until October 2007). The report is to be presented to ASCAC in November 2007.

Discussion: This investigation is being done by reading and talking to people. The Subcommittee will look at ESnet within the nexus it operates. Several members of other networks are on the panel.

Independent Review of Leadership-Class Facilities

Barbara Helland explained that the Office of Project Assessment (OPA) provides independent advice to the Director of SC on constructing and operating major research facilities. It also provides support to SC program offices. The independent review is a valuable tool in the management of HPC and LCF projects. It establishes a foundation for ASCR to manage the delivery of HPC and LCF resources within predetermined performance, and it reduces the risk associated with stated objectives. OPA reviews an LCF's site plan and establishes project baselines in accordance with Office of Management and Budget (OMB) reporting requirements. Reviews are scheduled for four phases of projects: (1) pre-acquisition activities, during which project plans; preliminary targets for costs, schedule, and performance; and requests for proposals are reviewed; (2 and 3) acquisition and acceptance activities, during which award contracts; refined costs, schedules, and performance; and delivery of hardware and system-support software are reviewed; and (4) transition activities, during which the acceptance tests, tests of the software environment, new libraries added to give support, and pioneer applications given access to the system are reviewed.

Typically, a charge is developed with the OPA in cooperation with the LCF, and a review is conducted by a representative panel for 1.5 days. That panel drills down into risk mitigation, scheduling, budgets, etc. It then writes a report with findings, comments, and recommendations. The recommendations generally consider whether the technical approach is reasonable to address SC scientific-computing needs and whether the major technical risks are addressed. Two reviews have been conducted at ORNL, and a follow-on was scheduled at ANL the week after the present meeting.

Discussion: The Program Execution Plan is the starting point; it has all the other documents in it.

Basic Research Integration with Applied Programs

Daniel Hitchcock noted that the Energy Policy Act (EPAct) of 2005 requires DOE to review periodically all of DOE's science and technology activities and to develop a plan to improve coordination and collaboration in research, development, demonstration, and commercial application. This plan has been written, cleared by OMB, and has been submitted to Congress. It covers integration activities and processes, significant cross-cutting scientific and technical issues, and strategies for implementation. It summarizes the scientific and technical issues and research questions that span more than one program or major DOE office. Cross-cutting technical issues include radiation-resistant materials; energy storage; advanced mathematics for optimization of complex systems, control theory, and risk assessment; and building synergies with work for others, laboratory-directed research and development, and university research.

In nuclear-test detection, ASCR research is investigating where to place sensors and how to process the data. In environmental management, it supports modeling, simulation, and scaling and predicts high-level waste-system performance to extreme time horizons. ASCR has also agreed to look at issues in carbon sequestration, the electric grid, nuclear power systems, and advanced combustion systems to investigate how to estimate risk, assess system stability, and model control systems. These programs all have many control points or interacting subsystems, stochastic loads or inputs, and complex interconnections. A workshop in December will further define opportunities and critical issues.

Discussion: As DOE goes on a more mission-oriented path, industry will become more involved. DOE has worked with industry for decades and is opening up its computer centers to them. Developing intellectual-property principles was painful, but those principles are now in place. If information is to be openly published, free access to facilities is granted. If information is to be proprietary, reimbursement is required. There are additional issues with cybersecurity and best practices. As to funding for all of this, FY08 is still under discussion. Opening up resources to the wider research community will have broad implications. It will progress slowly. Losing funding is always a risk. ASCR is negotiating with the Office of Basic Energy Sciences on sharing costs.

Once NNSA has classified a machine, it is very difficult to run unclassified programs on it. Little coupling with NNSA is expected.

Multi-scale work is continuing; a lot of scientific research for SC needs it.

The report will be e-mailed to the Committee.

A break was declared for lunch at 11:38 a.m.

Report on Subcommittee on Metrics

Gordon Bell noted that the charge to the Subcommittee had eight parts: (1) to review ASCR's approach to performance measurement and the assessment of its computing facilities, (2) to review the appropriateness and comprehensiveness of those measures, (3) to review the science accomplishments, (4) to review the effects of those accomplishments on the SC science programs, (5) to consider the roles of these facilities, (6) to assess the computational needs of the next 5 years, (7) to provide input for the OMB Program Assessment Rating Tool (PART), and (8) to comment on the observed strengths or deficiencies in the management of any component of the ASCR portfolio.

The centers use dozens of wide-ranging "observed" and "control" metrics. One challenge is that all the machines are different in terms of hardware and configuration. The user bases of these machines have different learning curves. All code is portable and can very likely be improved for any specific machine. The scales of working code algorithms and machines vary by a factor of 10. This complexity leads to difficulty in selecting appropriate metrics.

The Subcommittee identified user satisfaction, scheduled availability, response time to solve problems, and support for high-capability work to be good control metrics. Individual codes, algorithms, software engineering, and experiment management are also important, but codes can vary by purpose, size, and need. An analysis of the relative speedup of algorithms over time shows that algorithms are beating Moore's law.

The Subcommittee assessed projects in terms of the teams and processes used, the scientific output produced, the resources input, and the code used and its scalability. It found that bibliographic measures, the people involved, the code and data sets used, technology transfer, the achievement of milestones on time, speedups in parallelism, and breakthroughs produced were suitable metrics for the support for scientific users.

The computational needs of SC programs for the next 3 to 5 years is well documented. The evolution of terascale computing (a 40× change) will be almost as challenging as the transition from shared memory to clusters. In regard to a PART metric, it is essential for every project to be able to track the performance and/or result-accuracy of code on a continual basis.

ASCR and the SC programs should be more tightly integrated. Project readiness should be peer reviewed, taking into account past achievements and potential for success. Computational scientists who can work on code scaling and code performance should be located at the centers. The SciDAC model of project integration should be extended to the larger projects at all three facilities. User training is essential. The number of jobs served should increase with improved performance and/or lower costs. Standard numbers for all centers would be helpful. Programs that can run on any system should not be run on the centers' machines. It would be helpful for user communities to adopt a common data set, as is done at the National Center for Atmospheric Research.

A break was declared at 3:07 p.m. The meeting was reconvened at 3:21 p.m.

Discussion: Each member was asked to comment on the report from the Performance-Metrics Subcommittee. The scheme for parsing the charge was deemed successful. Committee members difficulty in understanding the report and suggested that it needs to be condensed to be comprehensible. The specific methods recommended should be pulled out and put in one place. The terminology needs to be more specific. The report needs to be actionable. Opinion needs to be distinguished from recommendation.

This is an interim report. There are eight items in the charge, each subject to interpretation. The intent of the charge is to identify metrics that can be measured and used. This report brings out some important facts and distinctions that are helpful. A lot of what is in the report is broadly applicable, and some is focused on the petascale. This interim report would be improved if it were upgraded and put out for review by and feedback from the general community.

The Committee will have to be ready to vote on the final report in November. A vote on whether to accept the current report as an interim report or just consider it an informal presentation was deferred to the next day to allow time for Committee members to raise specific suggestions for improving it.

Predicting International Thermonuclear Reactor Experiment (ITER) Behavior

Donald Batchelor stated that Tokamaks are just about at breakeven between energy supplied and energy produced. ITER is being designed to break that barrier and to approach the regime of ignition. The next big steps will be (1) understanding the physics of burning fusion plasmas, where most of the plasma heating will be from internal fusion reactions rather than external sources, and (2) developing and demonstrating essential fusion technologies. ITER will take those next steps, producing about 500 MW with a plasma current of 15 MA, a magnetic field of 5 Teslas, a temperature of about 10 keV, and a confinement time of about 4 sec.

For a facility like ITER, simulation can have large consequences. Diagnostics of hot plasmas rely on the interpretation of radiation and particles that come out of the plasma. Many phenomena cannot be measured directly and must be inferred from diagnostics. These are expensive, complex experiments; shots are precious. Simulation is required to plan and design experiments.

The description of plasma is based on calculations with high dimensionality, extreme ranges of timescales, extreme range of spatial scales, extreme anisotropy, nonlinearity, and sensitivity to geometric details. Several subdisciplines in fusion physics have developed, each with related simulation codes. Radio frequency codes describe the fast-time-scale physics of high-power waves used to heat and control fusion plasmas. Microturbulence codes describe the small-scale fluctuations that presently dominate transport of matter and heat in fusion plasmas. Large-scale motions also occur in plasmas. They are modeled and studied with extended magnetohydrodynamic codes. Another set of codes treats the highly complex interface between the plasma and the material wall. Integrated modeling is required to understand how all these systems interact, even when time scales are well separated. This understanding is made possible by access to supercomputers and through collaborations with computer science and mathematics expertise in SciDAC. A roadmap for a fusion simulation project came out 5 years ago. Two pilot projects have been begun under SciDAC: a center for simulation of wave interactions with magnetohydrodynamics and a center for plasma-edge simulation. The United States has the advantage of having world-leading fusion-theory and simulation capabilities and also established, working partnerships with mathematics and computer science that no one else has. In addition, it has access to supercomputing resources. An integrated fusion-simulation activity would be a cost-effective way to ensure that the United States has a significant science role in ITER. In Batchelor’s opinion, nothing else the United States could do would have a greater impact on ITER than developing a comprehensive simulation capability.

Discussion: Simulations show some of the sudden transitions but not from first principles. The biggest computer being used is the Jaguar, and the project has a long history of use of NERSC. Jaguar and its successors seem to offer the best opportunity. ITER is a large device with many operating conditions, and simulation can cut down on the number of runs needed. One can get orders-of-magnitude improvements from the analysis of simulations.

Dahlburg asked for public comment; there was none. Yetter volunteered to receive and compile comments on the Metrics Subcommittee report. The meeting was adjourned for the day at 4:54 p.m.

Wednesday, August 9, 2006

Dahlburg called the meeting to order at 9:06 a.m. Yetter noted that a subcommittee may not include all the Committee members. Strayer noted that ASCAC is the only standing committee dealing with HPC, and the reports of this Committee are very important. The detail and consideration invested in those reports is appreciated.

ORNL Leadership Computing Facility

Thomas Zacharia reported that the award for the ORNL LCF was made in 2004, and steady progress has been made since then. The facility focuses on computationally intensive projects of large scale and high scientific impact. It recently upgraded to a 54-teraflop XT3 Jaguar, will upgrade again to a dual-core 100-teraflop system in 2006, and to 250 teraflops in late 2007.

The facility has a management structure in place and has developed a detailed risk-management plan. The major risks perceived are an operating system for multicore processor systems, a scalable file system for a 1-petaflop system, applications readiness, and market forces that could delay the delivery of parts. To date, the project has been delivered on time and within budget. The facility has more than 60 employees. Its Phoenix machine, an 18.5-teraflop Cray X1E, is the largest U.S. vector system and is used for simulations in astrophysics and combustion. The Jaguar is operating at 60% of peak and is expected to be taken to 90% of peak. Its upgrade was done safely. Uptime is very good for both the Jaguar and Phoenix systems, with more than 90% availability and about 80% utilization. The facility supports a broad spectrum of scientific domains; a balanced machine is needed to address all of those needs.

The 1000-teraflop Baker system will have a 1-petaflop peak, 23,936 multicore processors, 136 cabinets, liquid cooling, and 7 MW of power consumption. Supplying that power reliably requires intensive planning and special power facilities. An upgrade of the Baker system will install faster processors, more memory, and an improved RAS [reliability, availability, and serviceability] system but will reuse the Baker infrastructure.

Software systems are a huge challenge, so application teams are surrounded with experts. A user meeting was held in 2006 for the dozens of projects running at the Oak Ridge facility. Those research projects include investigations of next-generation recording media, efficient enzymes for cellulose degradation, molecular switches, fusion energy, and combustion.

Discussion: One goal is to maintain compatibility through all the upgrades in software, middleware, and operating systems.

Argonne's Leadership Computing Facility

Rick Stevens noted that DOE has a three-pronged, multivendor strategy for leadership computing: the Cray trajectory, the Blue Gene technology, and the PNNL technology. Multiple platforms were chosen to avoid risk. Blue Gene/L has a weekly failure rate of 0.89 with a mean time between failures of 7 days. This results in 0.004

failures per month per teraflop. These are very reliable machines. One can get high bandwidth, and collective networks make a big difference in scalability. Blue Gene is within a factor of 3 of the petaflop goal, has been remarkably reliable at scale, and has a power consumption that is 2 to 4 times better than that of other platforms. It is a very compact machine, taking up only 15 ft^2 of floor space for 13.9 teraflops.

The petascale system will have a service-node cluster, front-end nodes, and infrastructure-support nodes feeding into a 1-petaflop BG/P, a 10-Gb/s switch complex, 176 file servers/data movers, 66 analytic servers, and tape servers. There will be 176 channels into the I/O system, a large SAN [storage area networking] array.

The IBM operating-system chips have reduced services, which are offloaded to specialized chips. This affects scaling. One also has to optimize code for the configuration. More than 120 applications covering a broad spectrum of topics have been ported to Blue Gene/L. The Blue Gene system provides a unique opportunity for the computer science community to test ideas for next-generation operating systems and scalable systems software. The facility will permit testbed users to try new operating systems and filesystems.

About 20 teams are at full production with about 200 people, consuming about 90% of the available cycles. Computer-science testbed teams are scaling up the next generation of systems software and numerical algorithms. Proposals are solicited and selected jointly with the DOE computer-science program manager. About five teams are at full production with 25 people consuming about 5% of the available cycles. Development teams are scaling up the next generation of science codes.

Discussion: The Blue Gene offers a wider choice for applications. Groups that think they have a shot at getting an allocation go for it if they think that they can use the architecture. Platforms (or conversion algorithms) need to be provided so people have a place to go, and there needs to be a policy in place to help them find the right path.

Algorithm efficiency is very good for the hardware, but they are not good code. There is a tradeoff between efficiency and the capabilities of architectures. It is sometimes better to run inefficient code on a highly competent architecture. A spark needs to be instilled in graduate students to inspire them, and the Program Office needs to get mathematics back into the mix.

People are not fully envisioning what they could do with 100 petaflops yet. One could turn it around by asking what problems they are solving and what size machine they are willing to build to solve that problem. It takes a long time to make the community believe it will actually happen.

NERSC Update

Horst Simon reported that NERSC scientist-users recommended that, in the next 5 years, NERSC expand HPC resources; configure the systems to minimize the time to completion of large jobs; and actively support the continued development of algorithms, software, and database technology for improved performance on parallel platforms. The NERSC 5-year plan identifies three trends that need to be addressed: a widening gap between application performance and peak performance of high-end computing systems; the emergence of large, multidisciplinary computational science teams; and a flood of scientific data from both simulations and experiments.

During the past year, a new, 722-processor cluster, Jacquard, was established; and an IBM Bassi with 122 IBM p5-575 nodes, 1.9 GHz POWER 5 nodes, and a 7.6 Gflop/sec peak processing speed was accepted and installed in record time. A global filesystem was also installed, spanning five platforms, three architectures, and four vendors. Cumulative storage is increasing exponentially, and the number of files stored is expected to accelerate in the future. The number of delivered hours almost doubled in 2006. NERSC serves a large spectrum of users in fusion, astrophysics, chemistry, and other disciplines. In 2005, more than 1200 papers were based wholly or partly on work done at NERSC.

The next step is NERSC-5, which is being acquired through a nationally coordinated procurement process, with application and kernel benchmarks (representative of the workload) jointly set with the Department of Defense and NSF. The NERSC-5 goals were 7.5 to 10 sustained teraflops per second; a system balanced among the aggregate memory, global usable disk storage, and the NERSC global filesystem; and full impact in allocation year 2008. All bids were for multi-core chips, hybrid systems with proprietary interconnects, and high processor counts. NERSC's performance-cost predictions were accurate, not increasing that much. The contract was to be signed within days of the present meeting. NERSC will have a small test system this summer, Phase 1 will be completed in the fall, and Phase 2 will be completed in winter 2007. NERSC-5 promises to be a significant increase in production capability with a sustained performance of 16 teraflops; it will be called Franklin.

Discussion: Under EPAct, NERSC will reach out to DOE users who are currently one step removed from HPC. If INCITE is open to the world, all the centers will have to be integrated, and their resources will have to be broadly available. Collaboration on some issues has started; the centers have monthly calls and are talking of a joint user group. Users are now coming in with a good knowledge of clusters, and NERSC is holding scaling workshops. Concern was expressed by the Committee that the effort to help users get on the machine has lost its impact and funding. NERSC is often the first use of HPC; ASCR should consider that. This is an important service that should be provided at all the centers.

A break was declared at 11:09 a.m. The meeting resumed at 11:17 a.m.

ESnet4

William Johnston said that ESnet's primary mission is to enable large-scale science and to support thousands of collaborators world-wide. The evolving footprint includes the university community and a major international component. ESnet, Internet 2/Abilene, and the National Lambda Rail (NLR) provide most of the nation's transit networking for basic science, ESnet for the DOE laboratories and Abilene for most of the U.S. universities. NLR provides various science-specific and network R&D circuits. GÉANT plays a role in Europe similar to that of Abilene and ESnet in the United States. ESnet's backbone is connected directly to the other networks at a large number of points and has put the big science laboratories on local-area rings. ESnet is a highly reliable infrastructure with many sites enjoying an availability of 99.999% and everyone enjoying at least 99.9% availability

Planning for a new network, a configurable optical infrastructure, is being done by considering the data characteristics of instruments and facilities that will be connected over the next 5 to 10 years, examining how science will be conducted, and studying the historical use of the network. The Large Hadron Collider (LHC) will generate the most data in the world except Google, 5 to 7 petabytes per year. In the future, science will need remote control and file sharing, which have different network demands. Today’s bandwidth of 10 Gbps will increase to 100 Gbps. Other new demands on the network will be increased capacity, high network reliability, and new network services with bandwidth guarantees.

Traffic has grown exponentially since 2000. ESnet is now moving 100 to 200 petabytes per month. ESnet traffic has increased by a factor of 10 every 47 months. In 4 years, one can expect an order-of-magnitude increase in traffic over current levels without the addition of production LHC traffic. Bandwidth trends drive the requirements for a new network architecture. Peak traffic is declining, and the data flow is smearing out. A lot of systems are passing huge amounts of data, the result of grids. Large data transfers by parallel/grid data movers are the most significant traffic pattern change in the history of ESnet. This has implications for the network architecture that favor path multiplicity and route diversity (which will also enhance reliability).

The new network will have a new architecture and services, featuring a science data network core and multiple sets of rings. The ESnet team has regular meetings with its European counterparts to ensure compatibility. A major baseline review was held of the first-level engineering plan; it produced a resounding endorsement of past performance and future plans. Building this new network is now in the SC budget, and the contracts for constructing it should be completed in a matter of weeks.

Discussion: The Grid traffic comes from High Energy Physics, Nuclear Physics, and Fusion Energy Sciences; it is largely LHC traffic, though. LHC scientists generate synthetic traffic to test their systems. The new network will not have any optical switches (they are not reliable yet), but other elements will be optical on dedicated fiber.

Dahlburg called for public comment. There was none.

Discussion of the Performance Metrics Subcommittee Report

There are two parts to the charge: the analysis of performance measures and the assessment of the needs of ASCR’s facilities. There is also a section related to PART ratings, which was split off from the purview of the Subcommittee. Manteuffel has agreed to take on the multiscale PART metric, and Torczon has agreed to take on Genomes to Life Project (GTL) and PART metrics. There are also recommendations needed for the next 3 to 5 years. A draft should be delivered to the Committee weeks before the November Committee meeting.

Item 2 (appropriateness of the measures) was interpreted very broadly as, “are users ready to use the codes?” That can be strengthened or weakened. Whether customers’ expectations and needs are being met could be asked. The other offices in SC should be asked if ASCR is meeting their needs and expectations. The facilities currently measure the number of publications, lines of code, etc. This item is the most important part of the charge. A code-readiness checklist should be put in place. That is as far as the Committee should go in that direction.

What more is necessary in addition to the definitions already available in GTL? What exists is a long-term measure of performance done in collaboration with the Office of Biological and Environmental Research (BER) to understand how well GTL is doing.

This Subcommittee is being asked for a grade, a one-word report, and an explanation of why that grade was given.

A vote was taken on whether to take up consideration of the interim report or just consider it an informal document of the Subcommittee? There were three votes for considering it an informal document and five for considering it a formal intermediate report. The draft report will be cleaned up, reorganized, and restructured. Public comment will not be solicited, but this is a public activity, and there may be comments submitted. The chair proposed accepting this document as an interim report. The Committee voted unanimously in favor of the proposal, and the meeting was adjourned at 1:05 p.m.

Respectfully submitted,
Frederick M. O'Hara, Jr.
Recording Secretary
Sept. 11, 2006