Jumping on the NII Bandwagon

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Abstract

Many requests for proposals have been issued since the last issue of this column appeared six months ago. We first briefly touch upon some recent developments along the policy/legislation front concerning NSF, ARPA, and HPCC. We then recap the recent requests for proposals from ARPA, NSF, Air Force, NASA, and Army.

1 Budget Fights Continue

In June the House passed the Defense Spending Bill. The encouraging news is that ARPA's Computing Systems and Communications Technology program was granted US$426M—a 31% increase over 1994 and US$6M over the requested amounts! Other ARPA programs were also granted amounts equal to or greater than the requested amounts.

However, the House version of the Defense Spending Bill contained a US$900M reduction in university research funds—a 50% slash over the request. University research is spread throughout many program elements (some more than others) throughout the DoD. If the Senate does not come to rescue, the DoD will have to decide where to distribute the $900M cuts. Although the Senate is expected to partially rescind these cuts, a full restoration is unlikely, even in the best of circumstances. Even though this move is not necessarily aimed at university research, as Representative John Murtha, the chairman of the House appropriations subcommittee, puts it: "Because DoD officials are so interested in pure research, I wanted to send them a clear message". He also thinks that the overhead rates universities charge are much too high. For more details, I recommend the July issue of Computing Research Association Bulletin, which is located on WWW at http://cra/org/cra_b/.

The House also passed the NSF Spending Bill, which gives NSF a 3% increase in 1995—only half of the 6% increase the president had requested in February. In addition, the Bill gives NSF's HPCC program US$29M less than the Administration's $329M request, which amounts to a 12% increase over 1994. Moreover, US$45M more than requested is shifted into Academic Facilities, which translates into a 2.5% increase for research in 1995 over 1994.

The latest news from the Senate is more encouraging. The Senate Appropriations Subcommittee on VA, HUD, and Independent Agencies recommended boosting NSF spending in 1995 by 17%, $255M more than the president had requested, $349M more than the House appropriated, and $457M more than 1994. The biggest increase of $245M would go to Academic Facilities, while research gets $59M less than the request.

Even before US science agencies learn how much they'll be allowed to spend in 1995, the Administration has already told them what to ask for in 1996. A strategic planning memo from OSTP and OMB has laid out nine basic principles and six overall R&D goals for 1996, backing basic research at least with words, if not cash. The memo calls for "a measurable increase" in spending on peer-reviewed, academic research, which clearly indicates that agencies such as NIH and NSF are favored over others like DOE and NASA. Readers interested in US science policies can find more about the memo in the June 3 issue of Science.

2 R&D Agenda

The National Science Foundation's Computer and Information Science and Engineering (CISE) Advisory Committee met in May to discuss priorities in the future of NSF-funded computing research.

Among the many research areas mentioned as important were virtual reality, speech recognition, reduced energy consumption to increase portability, high density packaging, hand-off algorithms in cellular mobile communications, access technologies, wireless protocols, wireless security, interoperability, seamless access, distributed parallel processing, network information theory, architecture, operating system software, parallel algorithms, compilers, large knowledge repositories, querying large databases of multimedia information, compression, human interfaces, and information indexes.

In another event, a group of leading academic and industrial researchers released a report in June, recommending an NII R&D agenda containing 10 broad technological challenges. The report is titled "R&D for the NII: Technical Challenges" and can be found via WWW at http://cra.org/NIIReport/.

3 ARPA and Health Care

The US National Information Infrastructure plan, or NII, has undoubtedly become the focus of most recent requests for proposals.

In February ARPA issued a BAA on the health information infrastructure program, which can be browsed through the SIGMOD Information Server. The goal of the program is to develop "an intelligent, agent-based clinical associate software system (CLASS) and instrumented pilot demonstrations in: Ambulatory Care and Combat Casualty/Trauma Care. The program vision is to greatly improve the tools that support decision-making by clinical users and patients/consumers. The intent is to develop information processing technology for health care that grows and evolves. [...] Information processing techniques must focus on effective interoperability, increased human interaction capability, intelligent systems engineering capability, and extended information services utilizing the INTERNET.

Key components of the CLASS include, but are not limited to:

1. The human computer interaction manager—an intelligent agent to manage the human computer interaction in such a way that users are presented with a consistently usable interface for all tasks.

2. The task/context manager—a set of intelligent agents that will model sequence of steps taken during tasks performed by the users. Because it will have access to patient data, physician input and current focus of activity, the task manager anticipates physicians' information needs. It uses knowledge of these steps to initiate activities of the information agent and/or the interaction manager for acquiring or presenting appropriate information. It will assist in scheduling physician activities and assist in efficient management of his scheduled activities. [...]

3. An information broker—an agent that will manage collections of mediators or other agents to support transparent access to data, information, and knowledge sources as required either by the user or the task manager."

4 ARPA Interests in NIE

There is another BAA from ARPA/CSTO on National-scale Information Enterprises (NIE). Although proposals are due before this column goes to press (07/18/94), it is still worthwhile to read the relevant sections of the BAA, which describe the target areas of research in this program, since there will doubtlessly be similar BAAs in the future.

"The National-scale Information Enterprises (NIE) program seeks to develop revolutionary computer systems technologies that can be used to constructively develop a scalable, modular, and robust service architecture for the National Information Infrastructure (NII). It has been observed that Internet end-user applications, like remote login, evolve into building blocks, like remote procedure call, from which more complex applications can be composed. A key goal is to develop scalable service building blocks from which new services and applications can be constructed rapidly. Within the context of a decade long NII program, it is expected that several successive generations of increasingly refined service architectures will evolve. This solicitation focuses on revolutionary prototype information infrastructure services and their pilot demonstration. It is expected that the developed technology will form the foundation for a generation of services beyond that which is already envisioned to exist within the next three years.

1. Information Infrastructure Services: These are the collection of service technologies available to application developers, built upon the high performance computing and communications (HPCC) developed bitways, that provide a ubiquitously available, network-aware, adaptive interface upon which to construct complex applications. These services include, but are not limited to, universal NII access points, made possible through network and operating system support for ubiquitous and mobile access; dynamic partitioning of applications logic among heterogeneous nodes based on their specialized capabilities or considerations of asymmetric and limited interconnection bandwidth; mechanisms for applications to negotiate for and adapt to the quality of service that is available or which they can afford; and mechanisms for a common authentication, authorization, accounting/banking, usage metering, and charging infrastructure for open networks like the Internet. [...]

2. Information Infrastructure Software Development Tools: Innovative mechanisms and development tools are needed to support the rapid development of new information infrastructure services and services-enabled applications composed from mod-

ular building blocks. Techniques of interest include, but are not limited to, self-describing service interfaces and modules that can negotiate with each other to reach a common communications protocol, mechanisms for real-time exchange of interoperable manipulable objects, new methods for encapsulating existing services for more dynamic and adaptive use, and mechanisms such as advanced Yellow Page services for resource registration and discovery of available services and service building blocks in a complex, internetworked environment. [...]

3. Information Infrastructure Applications Demonstrations: The NIE program seeks to demonstrate technology for fundamentally enabling applications, such as Digital Libraries and Electronic Commerce. These applications, in turn, enable other, larger scale applications that require extensive capabilities for large repositories of network-linked objects; adaptation to a dynamically changing resource environment; usage metering, accounting, and payment mechanisms; and privacy-enhanced, secure, and trusted processing on behalf of users and programs. [...]"

5 NSF Program on NII

The Directorate for Computer and Information Science and Engineering (CISE) of NSF has a program for group research on Information Infrastructure Technology and Applications (IITA). The proposal is due 08/15/94, and we quote below from the announcement, the full text of which can be browsed through the SIGMOD Information Server.

"IITA [...] will enable the integration of critical information systems and their application to National Challenge problems [...]. IITA will develop and demonstrate prototype solutions to National Challenge problems. [...] A major goal is to develop the common services, systems development, support environments, and intelligent user interfaces that are the foundation of a universally accessible national information infrastructure."

"Emphasis is placed on the support of research and educational activities relating to information infrastructure services, systems and support environment, and intelligent human interfaces to provide solutions to the following National Challenges: Health Care Delivery Systems, Advanced Manufacturing Technology, and Civil Infrastructure Systems. [...] innovative, collaborative approaches [are sought] in formulating solutions to these challenges within the IITA framework, focusing on the following:

- The development of basic tools and methodology in engineering and computer science that will support the overall IITA initiative and accelerate the infusion of HPCC technologies into the user communities;
- The development of the technology base underlying a universally accessible National Information Infrastructure (NII);
- The development and demonstration of prototype testbeds in collaboration with industry; and
- The development of ubiquitous information services, microelectronic and optical architectures, software tools and environments, and intelligent human interfaces integrated into solutions to the National Challenge problems."

"Examples of National Challenge problems which are appropriate for support include, but are not limited, to the following:

- High performance computational and simulation tools and sensing technologies for safe and reliable system control, material characterization, and processing, to support health-care delivery systems, civil infrastructure systems, and agile manufacturing and to achieve environmentally-benign manufacturing processes;
- Virtual reality and other visualization techniques for manufacturing product/process planning, civil infrastructure planning, medical education, telesurgery, and patient training for medical self-examination;
- Interactive information systems for patient accessible selection of health care services, delivery of medical information and educational materials, monitoring of civil infrastructure systems, and managing and control of manufacturing processes;
- Intelligent geographic information systems incorporating local material behavior data and codes for civil infrastructure analysis, design, and construction practice;
- Digital libraries of National Challenge-specific data sets, such as local material properties, to be used in conjunction with Geographic Information Systems, and the integration of these into civil infrastructure analysis, design, and construction practice;
- Operational strategies for manufacturing, healthcare, and civil infrastructure systems and integration of engineering with business functions, cooperative engineering education, and design;

- Computational algorithms, models, and techniques to support applications in the National Challenge areas; and,
- Low power, high-performance architectures for ubiquitous access to information systems that support solutions to the National Challenge problems."

6 NASA Invites Public Use of Data

NASA was soliciting proposals (due 05/09/94) for public use of earch and space science data over the Internet. In particular, proposals were sought from all sources "for

1. development of innovative applications of U. S. Earth and space science Remote Sensing DataBases via computer networks;
2. development of Digital Library technology focused on addressing the long-term scale-up requirements for the applications in 1); and
3. the establishment of a Remote Sensing Public Access Center for demonstrating, testing, and facilitating the first two activities."

"In the last few years, NASA has launched more science missions than in any similar period in recent history. [...] The Earth Observing System is an effort to study the Earth as a system while tracking long-term exchanges on a global scale. Earth observations are being made in a wide spectrum of wavelengths, sampling rates, and resolutions. Researchers are observing the universe from NASA Astronomical Great Observatories, sending instrumented spacecraft to every accessible solar system body, obtaining multispacecraft measurements of the generation and transport of solar energy and its interaction with the terrestrial environment. In the manned space program, sustained physical and biological experiments are conducted in the microgravity environment of space.

These science missions are obtaining massive volumes of new data with unprecedented temporal, spectral, and spatial resolution. New networking technologies will play a critical role in dealing with the massive volumes of data and distributing it to traditionally unserved communities, leading to gains in education, quality of life, and economic growth. These technologies will include digital libraries. [...]

The purpose of this [solicitation] is to focus on developing pilot end-user Remote Sensing DataBase applications and applying new Digital Library technologies that can enable and demonstrate the application and accessibility of Earth and space science databases. To demonstrate, test and facilitate these activities, a Remote Sensing Public Access Center (RSPAC) will be established. Remote Sensing DataBase applications potential areas of interest include: atmospheric, oceanic, and land monitoring; publishing; agriculture; forestry; transportation; agriculture; mineral exploration; land-use planning; libraries; cartography; education (especially K-12); entertainment; environmental hazards monitoring; and space science data applications. Potential Digital Library technologies include: innovative user interfaces; direct public access to satellite imagery; heterogeneous databases; information retrieval; advanced search and browse techniques; data structures; use of data and image compression; distributed database systems; accounting and data security; file storage management systems; and resource discovery. The purpose of the RSPAC will be to support the integration of Digital Library technologies with Remote Sensing DataBase applications and to serve as a demonstration/testing center and technology-transfer focal point. Potential testbed facility goals are to make some datasets readily available to end users, to give on-line help for Remote Sensing DataBase applications, to demonstrate the performance of new Digital Library technologies, and to test and evaluate Remote Sensing DataBase applications."

7 Rome Lab Solicitation

Rome Lab in interested in white papers "for studies, experiments and demonstrations involving innovative approaches for creating a distributed information environment that has high potential for dual-use by both the military and civilian communities."

"Candidate areas of research in support of a distributed information environment should investigate advances to the state of the art to include, but not limited to, the following:

1. High Speed Networks—the creation, security, management, and control of very high speed/high capacity networks,
2. Distributed Computing Environments—the system level software resident on the computing elements of the network nodes, which integrates all of the processing resources into a seamless processing environment,
3. Information Services—the teleconferencing, collaborative workspace support, and application execution control services residing on the distributed information backbone and supporting the use of dis-

tributed databases containing text, graphics, video, audio, and imagery,

4. Multi Cluster Domain Support — mechanisms within the distributed information environment which optimize the performance across combinations of WANs and LANs where the required service level is not uniform and the applications may have natural service domain characteristics (distributed database management and file systems)."

For more information, consult the SIGMOD Information Server or call Mr. Alan J. Akins at (315)330-7751 regarding BAA 93-11-PKRD.

8 US Army Announcement

A recent BAA from Army Research Laboratory has identified two research areas that are particularly relevant. The BAA is open for two years, although full proposals for fiscal 95 funding is due 11/15/94. However, "due to significant Government budget cuts, no dollars have been reserved for awards under this BAA. Therefore, [...] submission of a brief outline or 'White Paper' [...] before the submission of a formal proposal is STRONGLY suggested."

One area is in general database technology, with an emphasis on heterogeneous databases. In particular, proposals are sought which

- "explore ideas and prototype tools for advanced data management concepts, including: schema integration in a standardized data environment, transparent access to multiple heterogeneous databases, automated SQL query formulation strategies using data element thesaurus capabilities, integration of data encyclopedia tools with data and process modeling tools, and automated intelligent support for electronic records management (RM) and digital signature";
- "implement and experiment with simultaneously and transparently accessing and manipulating data from many different databases"; and
- "investigate new ideas, design, implement, and evaluate prototype data management tools that support the Army Information Architecture and Army modernization efforts."

Technical Point of Contact is Mr. Glenn Racine at (404)894-3110.

Another area is in distributed hypermedia applications. Proposals are requested "to identify research projects/applications to take advantage of the currently expanding global hypermedia information space on the Internet. [...] Some Areas of Interest include: Query/Maintaining Distributed Hypermedia DBMSs" involving

- Network performance,
- Access to heterogeneous DBMSs containing multimedia information,
- Fault tolerance (Failover and Recovering),
- Security (distributed database administration, controlling site access).

Technical Point of Contact is Dr. James Gantt at (404)894-3104.

9 ARPA TRP Program

In late May ARPA announced an RFP jointly with NSF, DOE, NASA, NIST, etc. for the TRP program. The RFP contains several focus areas that are of interest to the database community:

- High density data storage systems,
- Object technology for rapid software development and delivery, and
- Interoperability testbeds for the national information infrastructure.

You can browse the program announcement on-line through the SIGMOD Information Server for further details of the focus areas.