SSCL-Preprint-288

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April 1993
Distribution Category: 400

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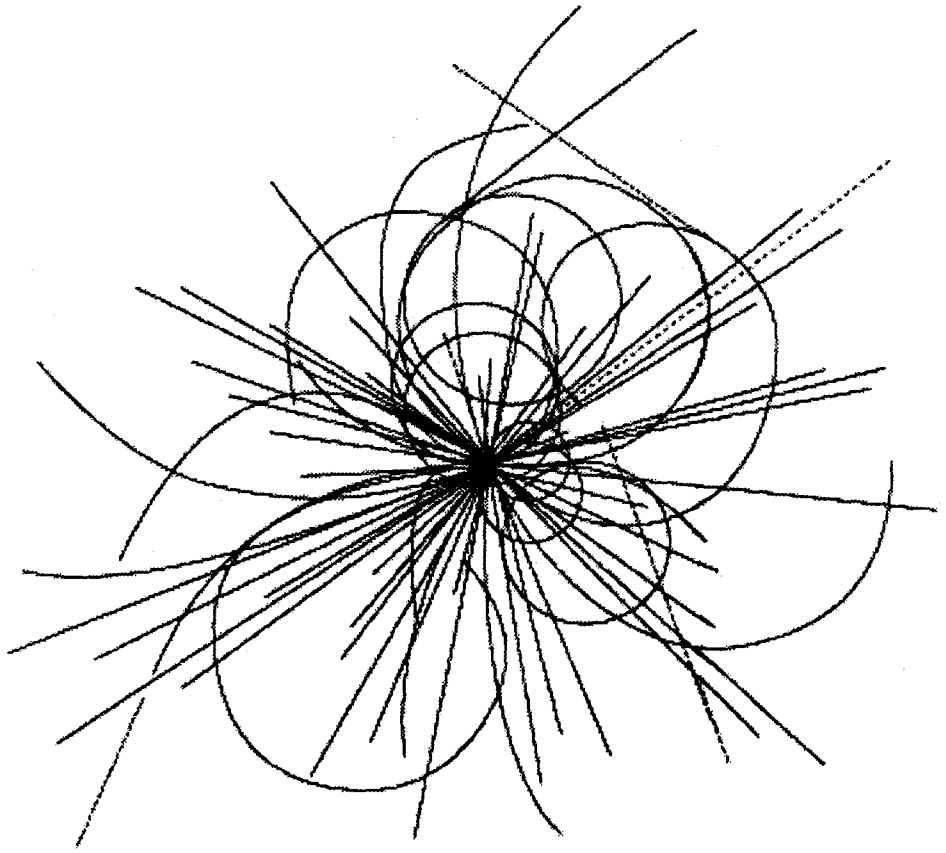

Superconducting Super Collider Laboratory

To be published in *Supercollider 5*

SSCL-Preprint-288

Building the Repositories to Serve*

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April 1993

*Presented at the Fifth Annual International Symposium on the Super Collider, May 6–8, 1993 San Francisco, CA.
†Operated by the Universities Research Association, Inc., for the U.S. Department of Energy under Contract No. DE-AC35-89ER40486.

BUILDING THE REPOSITORIES TO SERVE

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The project to design and build the Superconducting Super Collider (SSC) Laboratory also includes the exciting opportunity to implement client/server information systems. Lab technologists were eager to take advantage of the cost savings inherent in the open systems and a distributed, client server environment and, at the same time, conscious of the need to provide secure repositories for sensitive data as well as a schedule sensitive acquisition strategy for mission critical software.

During the first year of project activity, micro-based project management and business support systems were acquired and implemented to support a small study project of less than 400 people allocating contracts of less than $1 million. The transition to modern business systems capable of supporting more than 10,000 participants (world wide) who would be researching and developing the new technologies that would support the world's largest scientific instrument, a 42 Tevatron, superconducting, super collider became a mission critical event.

This paper will present the SSC Laboratory's strategy to balance our commitment to open systems, structured query language (SQL) standards and our success with acquiring commercial off the shelf software (COTS) to support our immediate goals. Included will be an outline of the vital roles played by other labs (Livermore, CERN, Brookhaven, Fermi and others) and a discussion of future collaboration potentials to leverage the information activities of all Department of Energy (DOE) funded labs.

INTRODUCTION

The Superconducting Super Collider (SSC) Laboratory was established to design, build, maintain, and operate the Superconducting Super Collider, a high energy subatomic particle accelerator to be used in basic scientific research to learn more about the fundamental nature of matter and energy. When completed in 1999, the Super Collider will be the most powerful subatomic particle accelerator in the world.

Knowledge about the basic particles and forces of nature has reached a critical point in the advance of science and civilization. Our understanding of the complexities of our universe has dramatically increased during the past 20 years, but puzzling questions still exist about how the universe is constructed and how it behaves and the relationship of matter to energy. The scientists of the Super Collider probe for answers to these questions and challenge our understanding of the fundamental particles and forces of nature.

The SSC Lab is being developed and managed for the U.S. Department of Energy by the Universities Research Associates, Inc., a non-profit institution established by 79 major research universities in the U.S. and Canada.

The project combines many elements of education on the grand scale: collaborationists from more than 100 colleges and universities, a strong commitment to improve American math and science education that includes talented primary and secondary teachers from all 50 states, and exciting programs to interest and challenge young (potential) scientists from all economic levels. Other important products of the project's advancements include new cancer treatment techniques and highly competitive commercial advancements in the use of massively parallel computing tools.

At the same time, an important scientific instrument design and a major construction project will dominate the culture of the Lab for the next few years and those projects require support and excellent management and control systems at every stage. One of the decisive events of the project has been its transition from the older, primarily desktop, platforms for business and project control systems to state-of-the-art, robust business platforms.

While dozens of magazine articles today tout the cost benefits/challenges of "downsizing," none counsel strategies and tactics for "upsizing," i.e. the establishment or retrofit of the repositories necessary to review

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and manage important tasks. In 1992, the Super Collider initiated its overhaul of its mission-critical management information systems.

ARCHITECTING THE FUTURE

In the initial project schedule, the Lab was to have replaced its early, small project management and business support systems acquired in 1991 to support its early feasibility studies. At that time, major systems design and testing was to begin, large equipment acquisition and installation development would be underway; in short: systems capable of supporting a $300 million/annum project would be required. Intensely conscious that the decisions made during the next few months would mark the project's information systems architecture for years, the selection teams of 1990 and 1991 evaluated many architectures: hierarchical, relational, object oriented. These early selection teams had a real desire to implement object oriented technologies. Unfortunately, the commercial application of object oriented database (OODB) was still immature: few commercial packages were available in 1991 to support mainstream business functions. Worse, many vendors in this area were new to the market, their stability and commercial viability characteristics unknown. Relational database systems and more traditional hierarchical systems were available but they would have to be carefully evaluated, and their integration strategies plotted and approved before they could be considered.

After months of thoughtful debate, the Lab agreed upon a mixed strategy of SQL-based, commercial-off-the-shelf-software (COTS) whenever possible. Selection teams and support groups were formed to support the Laboratory's diverse computing and network communications needs:

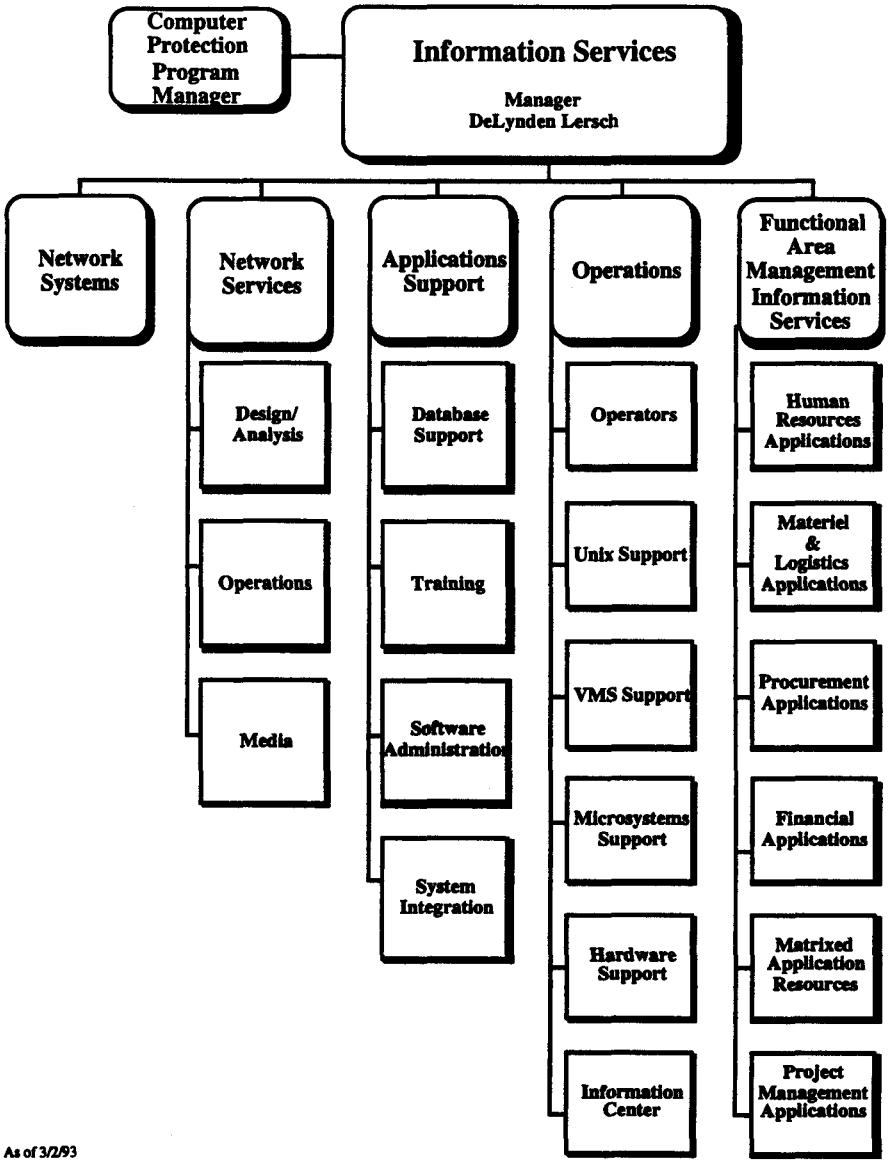

Figure 1. Organizational Chart of Information Services (3/2/93).

The first project undertaken was to establish the core of the major business systems. In the winter of 1991, the Superconducting Super Collider Lab began efforts to develop or obtain an on-line, highly integrated, laboratory procurement system that would handle the 15,000 purchase requisitions and 10,800 purchase orders that would be processed and placed among a pool of more than 10,000 vendors each year beginning in FY93. This mission critical upgrade effort turned into a project that would ultimately result in the overhaul of all the

Lab's basic business systems. This project became "P.A.R.I.S.," the Lab's Purchasing, Accounting, and Requisition Information System.

One initial thought was to attempt to integrate the newer system with the existing accounts payable (AP), general ledger (GL) inventory, and manufacturing resource planning systems and broaden support for receiving and encumbrance tracking functions. However, early analysis confirmed that the ramp-up in purchasing workload was, of course, MATCHED by a ramp up in accounts payable workload. Therefore, it became apparent during the initial analysis that in order to improve the entire acquisition process, the project should be expanded to include a new accounts payable software package.

The needs analysis also identified critical functional areas and users to represent those critical functional areas to be included on both the software selection and implementation committee. Active, sometimes full time, participation of these users turned out to be a major strength of the project.

Requests for Information (RFI's) were sent to over 25 software vendors. As the results from the RFI's were reviewed, it was apparent that replacement of the existing General Ledger systems should be included in the P.A.R.I.S. project. A General Ledger RFI was subsequently prepared and sent to the original vendors. In addition, twelve additional vendors were then invited to participate. Although the initial assumption within the Super Collider applications teams was that no one package would satisfy all three groups, it became apparent that a one vendor solution would help ensure integration.

The responses to a combined selection package of nearly 400 requirements clearly indicated that while many of the vendors had integrated Procurement, AP, and GL applications, few had incorporated government accounting and on-line procurement requirements into relational database systems. Procurement and Financial teams agreed on the value and priorities of requirements, most of which were met by several vendors. Finally, two requirements eliminated many of the contenders: the winning package would have both online procurement tracking and government fund accounting. Only one package claimed to meet all the other requirements and supported both online procurement tracking and government fund accounting: Oracle Government Financials.

LEAD, FOLLOW OR GET OUT OF THE WAY

Mission Critical is an overused phrase these days, but in this instance, it was accurate. The Lab had to migrate from the small, primarily PC-based systems that had served well during the early design and feasibility stages of the project onto systems that could manage, rapidly and accurately report the plans and progress of international scientific collaborations and a $350 Million a year major construction project. The Lab's new Integrated Planning and Scheduling System would be using Work Package Breakdown Structure (WBS) package identifications that that were 12 characters in length (the Lab's existing General Ledger package allowed only 6 characters). In addition, the ability to accurately track sources and uses of funds, types of costs and labor categories absolutely had to be in place for FY93 to drive the new Integrated Project Schedule and all the new DOE reporting requirements. That meant the SSC Lab had 10 months in which to do a 27 month job.

That was the bad news. The good news was nearly everyone on selection committees understood that and committed to get the job done.

Three key factors were necessary to support the schedule:

Organized DOE support
Prompt assistance from other laboratories
Experienced, professional contractor assistance.

OUTLINE THE PLAN

Fortunately, the Lab had kept its DOE reviewers briefed on all developments. Detailed plans for a fast track implementation were developed and approved. Eight contractors would be called in to give support in both the implementation of the new software and to maintain the existing systems in order to free permanent labor to train and supervise the implementation. Other laboratories supplied temporary database support and draft procedures.

More than 150 users, administrative support professionals, analysts, technicians and programmers worked days, nights and weekends through the summer and fall to set up the logic, check, electronically transfer and recheck and verify the information associated with older non-integrated systems. New procedures were written; teams and processes were integrated; and problems were identified and resolved. "The systems have been operational since late October and we are very pleased with the user support and acceptance," says Tony Reed one of the two PARIS project managers. Sharon Valenzula, the Oracle System Application Administrator adds, "We have over 450 active users at present, 200 of whom are usually on line."

P.A.R.I.S. IN THE FALL

The software was stable and the contractors who came to help were resourceful and very professional. The challenge for the conversion turned out to be the data itself: years of keeping separate lists of data, unintegrated, on small personal computers meant hundreds of exceptions among invoice numbers, purchase orders, old Work Breakdown Structures and new Work Breakdown Structures. All in all, the costs associated with more than $1.5 Billion and 75,000 data entries had to be converted, reviewed and confirmed. The effort took more than 100 days, with teams working holidays and weekends.

THE SSC LAB IN THE SPRING

The Lab has officially converted now to the new software. Not all functions and reports within the new system are running in production. (Budget data is still being collected and carried in the Integrated Project

Schedule. That data should be released for use by the new financial and procurement systems in April.) The conversion caused huge variances in all the monthly (in current period) Cost Performance Reports for the first quarter. More than 300 people worked on the project, most without overtime or any extraordinary compensation.

CURRENT STATUS

As of March 15, 1993, all software is functional (although the budgeting family of reports is awaiting approval of official budget data before reporting is instituted). All of the pre-FY93 data has been transferred, validated and integrated. Approximately 2 weeks of work remains to "catch up" with the data input neglected, by necessity, during the implementation. (Accounts Payable actions were conducted manually for much of the first 90 days of operation.) Requisition time from inception to buyer release has dropped from an average of 20 days to 10.

Most of the next few months will be spent developing commitment and financial reporting systems: our users have discovered a treasure trove of data is now available and have submitted more than 80 programs, primarily reports to be programmed.

Would we do it again, 100 hour work weeks and all? Yeeeeesssss, but...

LESSONS LEARNED

Not all policies and procedures governing laboratory business had been reviewed and approved and institutionalized prior to software acquisition and implementation. Some work groups, quite properly, seized upon the implementation of new software as an opportunity to also implement additional business control/integration. Procurement in particular had just finished a review of the purchasing practices of other laboratories and was able to bring in "best of breed" business practices as part of the implementation.

THE IMPORTANCE OF OTHER LABORATORIES/DOE PROJECTS

Special thanks must go to other institutes that shared knowledge, sent personnel and encouragement to the SSC Lab:

LLNL	– Jean Deir	NREL
– Bob Zanetel	– Gordon Jurgenson	– Paul Dragseth
– George Beck	– Eric Davies	– Mary Meinecke
– Rick Locatelli		
– Brad Calderon	Brookhaven National Lab	Wichita Airport Authority
– Mary Orr	– Ed Gallagher	– Karlis R. Otannkis

FUTURE COLLABORATIONS

This support has not waned with the successful implementation of the first Lab-wide business systems. At the time of the submission of this paper, we are currently reviewing the Environmental Health & Safety software developed by Fermi Lab and many of the logistics support packages used by CERN.

FUTURE PROJECT EFFORTS

These inter-Lab cooperative efforts encompass only a portion of the Lab projects during 1993 and 1994. During that time the Super Collider will be initiating/implementing whole families of applications:

- Overhaul of the Lab's Human Resources Information Systems
- Additions to the Lab's Financial, Procurement, Project Management Business Systems
  - Major Subcontract Tracking System
  - Fiscal Year Planning System
  - Laboratory Funds Management System
  - Directorate Executive Information Systems & Director-Net Project
  - Lab-wide Calendering Support
- Standardized Facilities Information Systems & Geographic Information Systems (interfacing with the Lab's existing CAD deliverables)
- Upgrades to the Lab's Electronic mail systems
- Upgrades to the Lab's Document Management
- Testing of Massively Parallel Systems
- Continued development of the challenging Geodesy Systems
- Upgrades to the Lab's Warehouse System
- Integration of many of the systems to support Equipment Installation
- Equipment Systems Support and Tracking
- Automated Data Processing Short Range Planning, Information Resource Management,
  - Enhancements to the Lab's Library Systems
  - Implementation of ES&H Systems

We hope many of you who offer solutions in these areas will contact us to discuss them, register for our bidder lists and help us implement the open architecture, distributed systems for the next 10 years.