COMPUTER SYSTEMS LABORATORY

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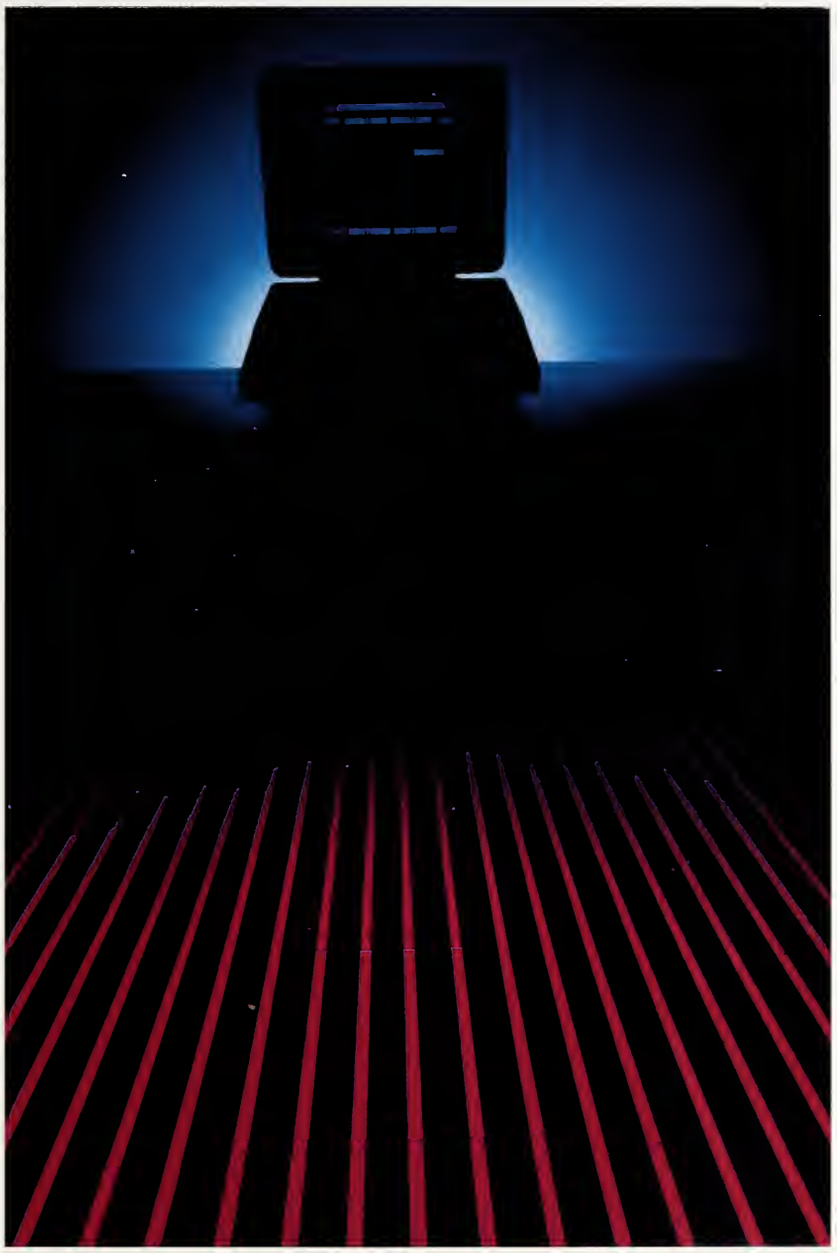

ANNUAL REPORT 1994

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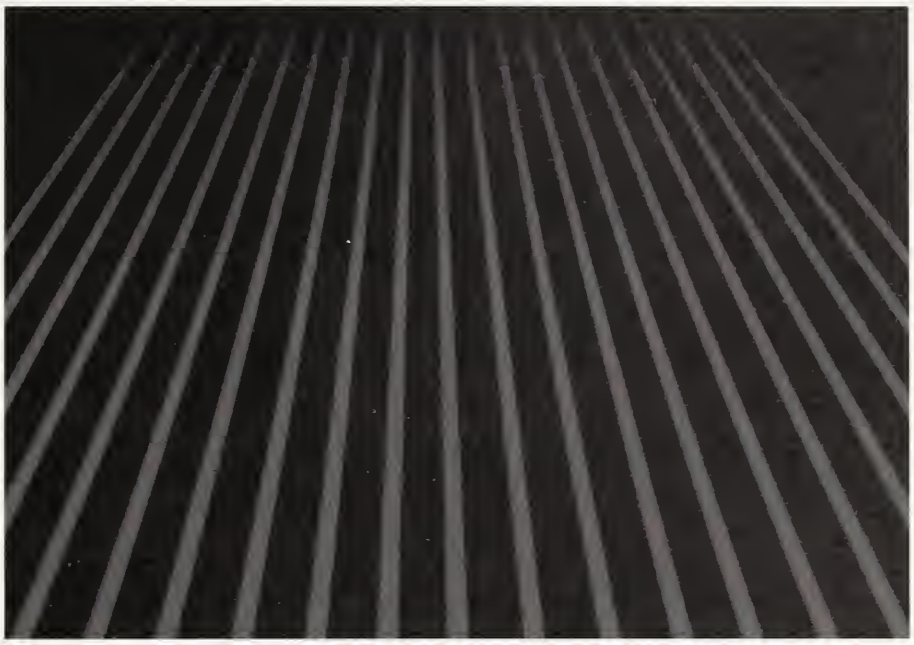
U.S. DEPARTMENT OF COMMERCE • Technology Administration • National Institute of Standards and Technology

COMPUTER SYSTEMS LABORATORY



ANNUAL REPORT 1994

NISTIR 5576

February 1995

U.S. DEPARTMENT OF COMMERCE
Ronald H. Brown, Secretary

Technology Administration
Mary L. Good, Under Secretary for Technology

National Institute of Standards and Technology
Arati Prabhakar, Director

Computer Systems Laboratory
James H. Burrows, Director

DIRECTOR'S FOREWORD

Information technology occupies a vital place in our daily lives and in our country's enterprises. Information technology stimulates new products, services, and economic growth, and is central to the development of an information infrastructure that will enable users to access information that they need, when and where they need it.

The centrality of information technology (IT) in our society has prompted NIST to examine how well it has been carrying out its mission in this area. NIST's mission to promote U.S. economic growth by working with industry to develop and apply technology, methods, measurements and standards will be strengthened in the coming year through the formation of a new organization, the Information Technology Laboratory (ITL). In 1995 the Computer Systems Laboratory (CSL) and the Computing and Applied Mathematics Laboratory (CAML) at NIST will merge to form the core of the new ITL. ITL's challenge will be to carry out activities that will have a major impact on the creation and use of information technology.

The new ITL will serve information technology suppliers, users, the research and development community, and NIST itself with infrastructural technologies that will support the development and use of reliable, interoperable IT products. ITL will work with partners in industry, government, and universities to promote interoperability, reliability, and ease of use of the information infrastructure.

CSL Activities in 1994

The foundation has been laid for ITL's new collaborative efforts through CSL's current activities which support national initiatives for the information infrastructure and for high performance computing and communications. CSL continues to work with users, industry, the research and development community, other governments, and national and international voluntary industry standards development organizations in a wide variety of technical projects.

This annual report details some selected technical activities, many of which are the result of collaborations with others. We have organized lectures and information exchanges to identify issues in areas of emerging technology; we have sponsored conferences, forums, and workshops to advance the effective use of information technology users and the implementation of standards in commercial products and services; we have supported the development of standards for open systems; we have produced reference data and reference materials that are used to improve the performance of commercial products; and we have produced measurement and test methods that contribute to efficient and interoperable products.

During the past year, some significant new collaborations were initiated. We organized the Center for Applied Information Technology (CAIT) to link industry, government, and academia for cooperation in a nationwide network of research and development. The center will seek information technology solutions to industry-defined problems for manufacturing, healthcare, electronic commerce, and education applications.

Another new effort is the Center for High Integrity Software Systems Assurance which will bring government, industry, and academia together to find solutions to industry-defined problems in the assurance of software-intensive systems. Society depends upon these systems for a host of essential functions such as banking, transportation, healthcare, manufacturing and education. The cooperative activities will focus on making these systems reliable, robust, and secure.

Yet other new partnerships include cooperative research and development agreements with the Software Engineering Institute to foster sound software methodology; with software industry organizations to advance capabilities to interchange electronic documents; and with Enterprise Integration Technologies to collaborate in developing advanced software for electronic commerce.

All of these alliances, as well as the many more detailed in this report, concentrate on developing the technical foundation for a modern information infrastructure that will support the efficient creation and diffusion of useful information. CSL contributed to the panels and working groups of the Information Infrastructure Task Force (IITF), an interagency group that is the focus of government efforts to work with the private and public sectors in setting priorities, policies, and programs for an information infrastructure for the future.

The IITF's Committee on Applications and Technology (CAT), chaired by NIST Director Arati Prabhakar, has been identifying potential applications and ways to remove the barriers to those applications. CSL assisted the Technology Policy Working Group, under the CAT, in examining the scalability and interoperability issues that will affect the National Information Infrastructure (NII), in developing possible architectures, and in identifying the standards, research, and technology requirements.

During the past year, two specific activities addressed the standards that will be key to the interoperability and openness of the information infrastructure. First, we completed a review of the government's requirements for its networks. The Federal Internetworking Requirements Panel, which was established in 1993 to recommend policies on the use of networking standards by the federal government, completed its report. Based on the Panel's recommendations, we have taken actions to modify existing standards and to encourage federal agencies to select standards that meet their interoperability needs, and that are supported in cost-effective, off-the-shelf commercial products.

Second, we started an assessment of the federal government's role in supporting the industry-driven standards development process. We cosponsored a workshop on Standards Development and the Information Infrastructure, in cooperation with the Science, Technology and Public Policy Program at Harvard University and with the Technology Policy Working Group. The workshop resulted in a collection of papers and discussions analyzing standards development issues and their impact on the use of information technology. This report is expected to provide the foundation for follow-up activities on standards and the standards process.

Also linked to standards requirements, we supported the formation of the Information Infrastructure Standard Panel (IISP) by the American National Standards Institute (ANSI). The IISP's goal is to accelerate the development of

standards critical to the implementation of national and global networks. The IISP includes representatives from the computer, communications, cable, software, cellular, satellite, and broadcast industries, and from government, standards developers, consortia, and other organizations.

Our Plans for 1995

We will continue to focus on information technology and its applications. Planned research and technical activities will develop methods for protecting information in distributed computer and telecommunications systems. We will develop and deploy computer performance measurement techniques, communications protocols, advanced software, and manufacturing applications.

We will continue to work with industry and other organizations to identify the standards and the research requirements for IT. We know that collective efforts will be needed to scale up current information technologies and services, to integrate information technologies with advanced voice and video communications, and to improve information storage and retrieval, ease of use, interoperability, and reliability.

In 1995, we are committed to strengthen our efforts in supporting industry and government in ways that will create new products and services, improve U.S. competitiveness, and help to lower the costs of government services. I invite your comments and suggestions on our activities.

James H. Burrows
Director
Computer Systems Laboratory

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OVERVIEW OF THE COMPUTER SYSTEMS LABORATORY

Director: James H. Burrows
Associate Director for Computer Security: F. Lynn McNulty
Associate Director for Program Implementation: R.J. Linn
Office of Enterprise Integration: Cita M. Furlani
Senior Management Advisor: Judith L. Lyons
Program Coordination and Support: Shirley M. Radack
Voluntary Standards Liaison: Michael D. Hogan

The linking of computer systems, networks, telecommunications services, and applications promises to open up new ways of doing things and change our lives. In areas such as electronic commerce, education, healthcare, and government services, information technology (IT) will deliver information, benefits, assistance, and other services more efficiently and cost-effectively to the nation's citizens. The value of IT will depend on the quality of the information itself; applications and software that allow users to access, manipulate, organize, and digest information; the network standards that facilitate seamless interconnection and interoperation between networks; and the controls that protect the confidentiality, integrity, and availability of sensitive information.

A major research component of the National Institute of Standards and Technology (NIST) of the U.S. Department of Commerce, the Computer Systems Laboratory (CSL) supports collaborative research and develops and demonstrates information technology, metrology and standards which enable industry to develop easy-to-use, reliable, and interoperable products. We foster the growth of the national economy through the development and commercialization of electronic commerce applications, enterprise integration, high-speed communications networks, and advanced software. CSL's programs and research activities are carried out under authority of the Brooks Act (Public Law 89-306), the Computer Security Act of 1987 (Public Law 100-235), and the Omnibus Trade and Competitiveness Act of 1988 (Public Law 100-418).

Partnership with Industry

CSL works in partnership with industry to strengthen the nation's technology base and to expand its economy. Through workshop activities and interactions with industry consortia, our laboratory gains a broad understanding of the requirements of U.S. computer and telecommunications organizations involved in the various components of the emerging information infrastructure. From a neutral vantage point and with unique expertise, CSL joins with industry in developing the needed advanced technologies and standards that support ease of use, interoperability, and security of the computers, communications, and applications which will form the nation's information infrastructure.

Enterprise Integration

This year NIST established a new Office of Enterprise Integration (OEI) within CSL to serve as a focal point for NIST efforts that provide technical underpinnings for applications of information technology in areas such as manufacturing, construction, healthcare, and government services. In addition, OEI supports and manages activities of the Committee on Applications and Technology (CAT) of the President's Information Infrastructure Task Force (IITF). The CAT, which is chaired by NIST Director Dr. Arati Prabhakar, is responsible for coordinating the Administration's efforts to develop, demonstrate, and promote the use of information technology in many application areas.

Collaborations

Often in collaboration with industry or other federal agencies, our laboratory-based research program develops technology, measurements, and standards for open, interoperable computer and telecommunications systems. CSL continues to develop test and measurement methods to evaluate conformance of products to standards. Working with industry in a timely and cost-effective manner brings benefits to the nation through enhanced U.S. productivity and an increasing share of business in the global marketplace.

Interactions with Industry and Consortia

An important mechanism for interactions with industry organizations and federal agencies is the Cooperative Research and Development Agreement (CRADA). In 1994, we collaborated with 34 government, industry, and academic institutions through CRADAs to pursue common goals. Our ongoing workshop efforts continued, including the Open System Environment (OSE) Implementors' Workshop (OIW), the Applications Portability Profile (APP)/OSE Users' Forum, and the North American Integrated Services Digital Network (ISDN) Users' Forum (NIUF), and the Federal Wireless Users' Forum (FWUF). Many other informal interactions with government and industry partners involved the sharing of equipment or expertise. These cooperative arrangements provide benefits to all participants through a better understanding of the advantages and barriers to the development and use of open systems.

CSL also sponsored two workshops with industry to examine the development of approaches to key escrow encryption for implementation in commercial, off-the-shelf (COTS) products. The workshop series encourages development of key escrow standards and products that are consistent with the Administration's key escrow policies, can be implemented in software, do not rely upon a classified algorithm, and can be exported. Representatives from approximately twenty-five computer manufacturers, software publishers, and security firms participated along with representatives of other government organizations.

Organizational Resources

Major technical units are: Information Systems Engineering Division, Systems and Software Technology Division, Computer Security Division, Systems and Network Architecture Division, and Advanced Systems Division, and the Office of Enterprise Integration. Our professional staff consists of computer scientists, computer specialists, electrical and electronics engineers, economists, policy analysts, operations research analysts, and mathematicians. Staffing resources in FY 1994 included 259 full-time-equivalent employees of which 75 percent were professional and technical staff and 25 percent were administrative support

personnel. In addition to CSL staff, about 62 research associates, guest scientists, and faculty appointments enhanced our research program.

Funding for CSL programs in FY 1994 consisted of $18.4 million from the NIST Congressional appropriation (STRS), including $1.0 million in NIST-supported competency funding; $1.3 million from the Advanced Technology Program intramural program; and $16.9 million in reimbursable funds, mostly from other federal agencies for direct technical assistance. About 40 organizations in government and industry received reimbursable technical support from CSL in FY 1994. See the Interactions and Accomplishments section of this report for a complete list of our collaborative interactions.

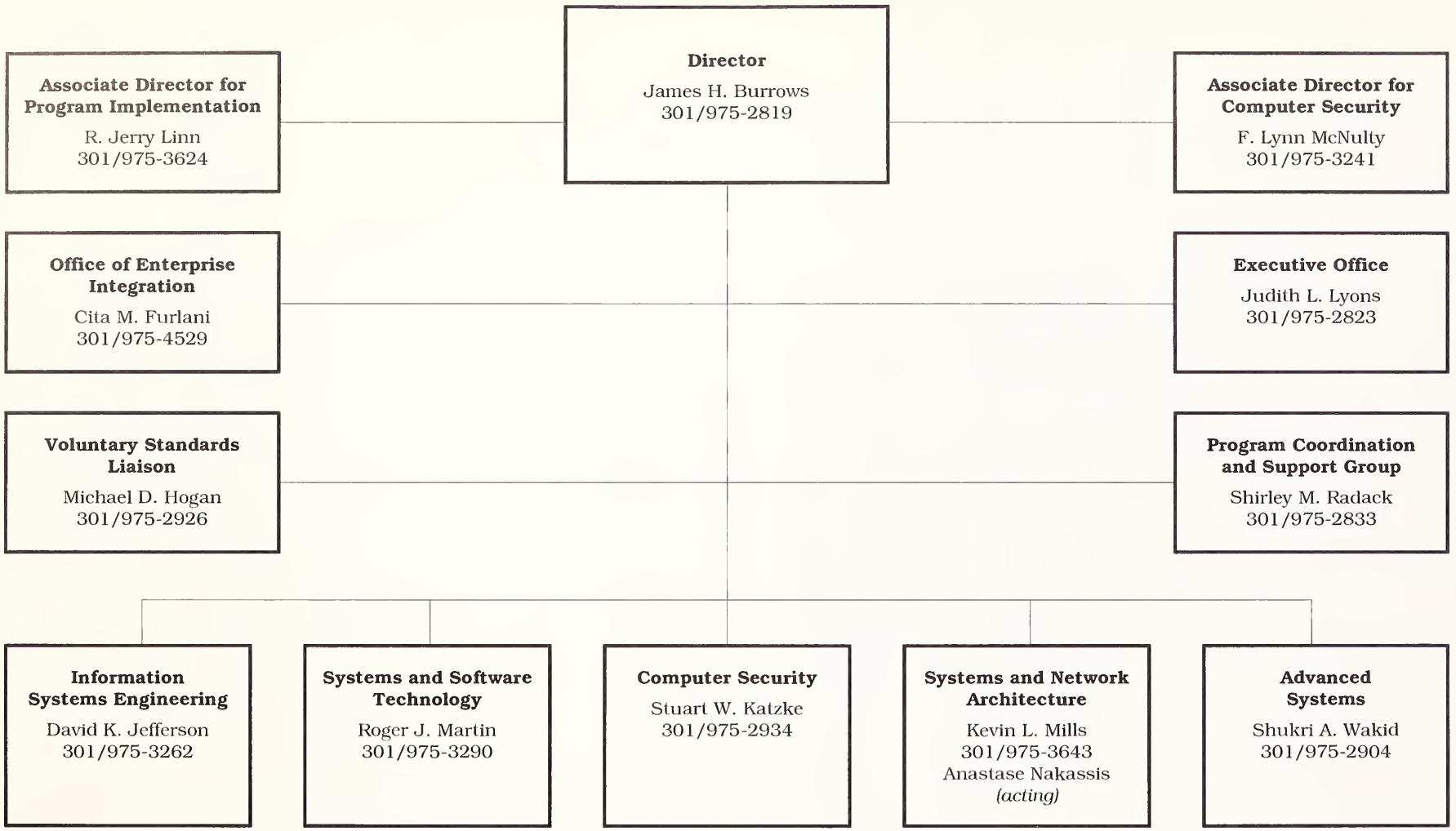
CSL's Information Resources

Through a variety of resources, we share information and technology with industry, government, academia, and the public. CSL publishes Federal Information Processing Standards (FIPS) and guidelines; special publications series focusing on computer systems, computer security, and ISDN; technical interagency reports on research and tests; a quarterly "CSL" newsletter; and a CSL bulletin series published about eight times a year on topics of interest to the information systems community. See the Interactions and Accomplishments section for a list of FIPS and other publications currently available for sale through the Government Printing Office (GPO) or the National Technical Information Service (NTIS). We also sponsor and host a variety of conferences and workshops throughout the year, and our staff members address many federal and private organizations.

Increasingly, we use information servers and electronic bulletin boards to disseminate information on our programs and information resources. Our Validated Products List is also available online. Access instructions for these resources appear in Interactions and Accomplishments.

Highlights of our major technical units follow.

COMPUTER SYSTEMS LABORATORY



- ❑ Database and Objectbase Management
- ❑ Data Administration
- ❑ Information Systems Architecture
- ❑ Software Standards Validation

- ❑ Open Systems Environment
- ❑ Software Quality and Assurance
- ❑ Integrated Software Engineering Environments
- ❑ Multimedia and Hypermedia
- ❑ Virtual Reality

- ❑ Security Management
- ❑ Cryptography and Authentication
- ❑ Network Security Architectures
- ❑ Evaluation and Validation Techniques

- ❑ Automated Protocol Methods
- ❑ Network Applications
- ❑ Network Management
- ❑ Network Protocols
- ❑ Network Architecture
- ❑ Electronic Commerce

- ❑ Visual Image Processing
- ❑ Spoken Natural Language Processing
- ❑ Written Natural Language Processing
- ❑ Parallel Processing
- ❑ High-Speed Networks
- ❑ Digital Signal Processing
- ❑ Display and Storage

December 31, 1994

OFFICE OF ENTERPRISE INTEGRATION

Technology advances help to promote new integrated applications such as electronic commerce, manufacturing, and delivery of government services and information. This year NIST established a new Office of Enterprise Integration (OEI) within CSL to serve as a focal point for efforts throughout the NIST laboratories that provide technical underpinnings for applications of information technology in areas such as manufacturing, construction, healthcare, and government services. The OEI provides an initial point of contact for policy makers and researchers in industry, academia, and government interested in learning more about NIST activities related to enterprise integration and electronic commerce.

An important aspect of OEI's mission is supporting and managing activities of the Committee on Applications and Technology (CAT) of the President's Information Infrastructure Task Force (IITF). The CAT, which is chaired by NIST Director Dr. Arati Prabhakar, is responsible for coordinating the Administration's efforts to develop, demonstrate, and promote applications of information technology in manufacturing, education, healthcare, government services, libraries, environmental monitoring, electronic commerce, and other applications. OEI staff work with CAT participants in government agencies and with industry and academia to develop publications, conduct meetings and conferences, distribute both print and electronic information, and respond to queries about the National Information Infrastructure (NII).

Accomplishments of OEI this year include:

- ☐ preparing publications on NII applications:
  NIST Special Publication 857, *Putting the Information Infrastructure to Work*
  NIST Special Publication 868, *The Information Infrastructure: Reaching Society's Goals*

- ☐ conducting meetings of the Committee on Applications and Technology;

- ☐ development of an Applications Inventory of government NII-related projects;

- ☐ presentations on the National Information Infrastructure and applications at conferences and working groups;

- ☐ working with the private sector Council on Competitiveness to organize the successful "Breaking the Barriers to the National Information Infrastructure" conference;

- ☐ continuous interaction with NII-related working groups in both government and the private sector, including the Information Infrastructure Task Force, the Council on Competitiveness and the NII Awards Program; and

- ☐ electronic distribution of all publications, meeting minutes, and other documents. Information on electronic access to OEI and CAT publications can be obtained by sending electronic mail to cat_exec@nist.gov or by calling (301) 975-4529.

CSL continued to play an active role in the Continuous Acquisition and Life-Cycle Support (CALS) initiative through OEI support, serving as a worldwide focal point for government and industry questions and direction on the use of standards and technology. Working with geographically distributed CALS interest groups, the OEI also provided presentations on CALS as it relates to standards, other initiatives such as the NII and the Global Information Infrastructure (GII), and industrial opportunities for continued competitiveness. The OEI continued to collaborate with the Department of Defense and their supporting industrial base in implementing CALS standards and technology, providing the Department of Commerce delegate to the quarterly NATO CALS Management Board meetings, and contributing technical reports for adoption by the NATO CALS initiative.

In addition to continuing current activities, plans for 1995 include development of a "virtual library" on NII issues and a comprehensive inventory of NII applications-related standards activities. Related to its mission to champion NIST laboratory programs which support development and deployment of NII applications, OEI will be developing an inventory of laboratory programs and activities in support of NII technology and applications. OEI will be an easily identifiable point of contact between industry and NIST labs for information and industry guidance. Additionally, OEI will be working to develop assessments of the industrial and economic impacts of NIST laboratory programs in key NII applications areas. This activity will support NIST efforts to integrate the needs of U.S. NII technology and applications developers with NIST laboratory programs.

INFORMATION SYSTEMS ENGINEERING DIVISION

Chief: David K. Jefferson
Group Managers: Joseph C. Collica, Database & Graphics
Bruce K. Rosen, Data Administration
Mark W. Skall, Graphics Software
L. Arnold Johnson, Software Standards Validation
Shirley M. Hurwitz, Database Languages

Activities in the Information Systems Engineering Division focus on the development of technology, standards, demonstrations, and testbeds for information technology (IT) and applications to electronic commerce, manufacturing, and healthcare. The technologies include data management, data administration, domain analysis, computer graphics, multimedia, hypertext, hypermedia, and geographic information systems. The division also develops and performs validation tests to ensure that software products conform to standards.

Center for Applied Information Technology

The Center for Applied Information Technology (CAIT) has been established as a visionary, collaborative approach to reengineering the process of technology transfer through the use of information technology resources such as the NII. The CAIT, with industry participation, will develop a nationwide network of interconnected research, development, and technology transfer centers located at key government, industry, and university sites. The CAIT will identify, develop, and demonstrate critical new technologies and applications which can then be successfully commercialized by American industry.

The CAIT will pursue advanced electronic solutions to industry-defined problems in application areas such as manufacturing, collaborative engineering, healthcare, electronic commerce, nationwide multimedia libraries, education, environmental monitoring, and improved global communications.

Database Languages

Division researchers participated in the development and coordination of a substantial enhancement to Federal Information Processing Standard (FIPS) 127-1, *Database Language SQL*. Published as FIPS 127-2, the revised standard is for use in federal procurements of relational model database management systems. FIPS 127-2 adds significant new features for schema definition, diagnostics management, integrity constraints, and international character set support, as well as new data types, new table operations, and enhanced data manipulation expressions. A new Information Schema makes all schema data available to applications.

FIPS 127-2 provides for four separate levels of implementation: Entry SQL, Transitional SQL, Intermediate SQL, and Full SQL. Although only Entry SQL is required, initially, for conformance to FIPS 127-2, a higher conformance level may be specified by agencies to meet their specific requirements.

CSL continued to support the implementation of the SQL standard through its conformance testing program. Version 4.0 of the NIST SQL Test Suite became publicly available for general purchase in July 1993. Version 4.0 provides conformance tests for the Entry SQL level of FIPS 127-2. Version 4.0 provides 11 test suite types (interfaces) including Embedded and Module Language tests for Ada, C, COBOL, Fortran, and Pascal plus Interactive SQL tests. Eighteen SQL Test Suite licenses were added this fiscal year. Since the NIST SQL Test Suite was released, over 155 SQL Test Suite licenses have been purchased for all versions of the test suite. Additionally, Version 5.0 of the NIST SQL Test Suite for Transitional SQL is in beta testing. A Remote Database Access (RDA) Testbed has been established at NIST to promote connectivity and interoperability of conforming RDA/SQL products. An RDA conformance test suite for the SQL Specialization of the International Standard ISO/IEC 9579 is also being developed. A draft new FIPS for SQL Environments specifies profiles for accessing legacy or special-purpose databases through the SQL language.

Data Administration

CSL continued its support to the voluntary standards efforts concerning the Information Resource Dictionary System (IRDS) at the American National Standards Institute (ANSI) level. After the decision by the ANSI IRDS committee to seek to redirect its efforts at the international level into the development of a next-generation Portable Common Tool Environment (PCTE) standard, CSL generated needed committee positions and promoted those positions at the international level. In providing this support, CSL is helping to move forward an effort in the standards area that could be used to tie together the Data Administration community with the Software Engineering community. By redirecting standardization in the repository area in this manner, repository standards groups seek to provide a basis to better integrate the results produced through the use of Computer Aided Software Engineering (CASE) tools throughout an application system's life cycle.

CSL also completed the development of two new FIPS in the area of modeling technology. The specific modeling technology is called Integration Definition Language (IDEF). The completion of these FIPS was done in conjunction with the members of the IDEF Users Group, and the release of these standards has been commended by the members of the IDEF user community. This community consists of members from government, academia such as the University of Texas, and private industry organizations such as Boeing Corporation, General Electric Aircraft Engines, and Texas Instruments. CSL is currently seeking to tie together the IDEF modeling technology with the standards for CASE Data Interchange Format (CDIF). This linkage would expand the ability of organizations to integrate the results produced by their IDEF tools with the capabilities provided by other CASE tools based on differing methodologies.

CSL maintained continuing working agreements this year with the Environmental Protection Agency, the Internal Revenue Service, the U.S. Geological Survey, and the Department of Defense. These agreements cover topic areas such as tool integration, establishment of data administration policy for an organization, integration of modeling methodologies, and Geographic Information Systems. In all of this work, CSL seeks to ensure that the organizations involved

are directed in ways that take maximum advantage of standards that emphasize open systems environments and information interchange.

Computer Graphics

Much of the focus in the computer graphics area centered around conformance testing. Three separate testing services for the Computer Graphics Metafile (CGM) are currently in place. A CGM Interpreter Testing Service which determines conformance of CGM Interpreters to FIPS 128-1 and MIL-D-28003A began in FY 1994. This new testing service complements two existing CGM Testing Services--a CGM File Testing Service and a CGM Generator Testing Service. The validation of CGM files, generators, and interpreters ensures a complete and accurate exchange of graphical picture data. CSL is also working with the Airline Transport Association (ATA) to produce tests for the aerospace industry's CGM profile.

Conformance testing services continue to operate for the Programmers Hierarchical Interactive Graphics System (PHIGS) and the Graphical Kernel System (GKS). The PHIGS Validation Test Suite has recently been made available through the World Wide Web (WWW) via Mosaic. GKS testing takes place within a harmonized worldwide testing environment. NIST, the United Kingdom, Germany, and France form an international testing Control Board to maintain GKS tests and resolve disputes resulting from GKS testing. CSL has recently become the lead laboratory for GKS testing worldwide and the Secretariat of the Testing Control Board. CSL is now responsible for maintenance and distribution of the GKS Test Suite to testing laboratories in other countries.

An Initial Graphics Exchange Specification (IGES) Testing Service to test conformance of IGES preprocessors and postprocessors has recently been initiated. The IGES Test Service checks for conformance to FIPS 177, *IGES*. The test suite is currently being enhanced to test for a subset of the CALS IGES specification (MIL-D-28000).

CSL continues to hold leadership positions in the voluntary standards committees concerning graphics standards at both the American National Standards Institute (ANSI) level and the International Organization for Standardization (ISO) level. NIST representatives are very active within X3H3 (Computer Graphics) and serve as Rapporteurs of the Validation and Registration Working Groups within ISO/IEC JTC1/SC24.

In FY 1994, a Virtual Reality (VR) Laboratory was established. The VR Laboratory is being used to help determine the current limitations in VR technology which are preventing its effective use in scientific and technical areas and to investigate the utilization of computer graphics standards in overcoming these limitations. The division coordinates its research in VR technology with the Systems and Software Technology Division.

Software Standards Validation

Testing programming language compilers for conformance to FIPS continues to be an important service. CSL provides validation services for programming languages COBOL (FIPS 21-3), Fortran (FIPS 69-1), Pascal (FIPS 109), Ada (FIPS 119), MUMPS (FIPS 125), and C (FIPS 160). In FY 1994, CSL updated and released new programming language test suites for C, COBOL, and MUMPS.

During the past year, CSL received requests to validate 16 SQL implementations for conformance to the Entry Level SQL of the revised FIPS 127-2, *Database Language SQL*. Another 19 implementations were validated for conformance to FIPS 127-1. A total of 92 SQL implementations from 12 private-sector companies are currently listed as being validated.

During FY 1994, CSL provided programming language and database validation services to 32 private-sector companies for a total of 156 validations. The total number of programming and database language processors currently validated as of September 30, 1994, is 558.

The quarterly *Validated Products List (VPL)*, a collection of registers listing implementations of FIPS that have been tested for conformance to FIPS, again grew substantially during the past year. The VPL now lists over 1,200 implementations (products) covering FIPS conformance testing programs for programming languages, database, graphics, operating systems, open systems, and computer security. The publication is available through the National Technical Information Service on a single-issue or subscription basis or on-line via the Internet (see Accessing Information on Validated Products in the Interactions and Accomplishments section of this report).

CSL maintained a cooperative agreement with the Department of Veteran Affairs to update FIPS 125-1, *MUMPS* (ANSI/MDC 11.1-1990) to the proposed ANSI/MDC 11.1-199X. A test suite for FIPS 125-1 was released and is now available for use in validating MUMPS implementations for conformance to FIPS 125-1.

To facilitate the worldwide conformance testing effort, CSL sponsored the 6th International Workshop on Harmonizing Conformance Testing of Computer Language Standards. Experts from the United Kingdom, France (Institute of Defense Analysis), and the Department of Defense participated in the workshop. The attendees researched common areas of agreement among testing laboratories and certification authorities for harmonizing validation testing activities.

CSL maintained working agreements with the Department of Defense to advance software reuse technology for improving the production of reliable and affordable software. Focus areas in software reuse are domain analysis methods, software reuse terminology, software reuse metrics, and software reuse incentives. This work produced NISTIR 5390, *Context Analysis of Network Management Domain*, and NISTIR 5459, *Quality Characteristics and Metrics for Reusable Software (Preliminary Report)*. A "Glossary of Software Reuse Terms" was completed for publication as a NIST Special Publication. Several lectures and demonstrations were given on the results of CSL's work on the Domain Analysis Case Study. Lastly, CSL worked closely with the NIST Advanced Technology Program to establish a focused program on Information Infrastructure for Healthcare.

SYSTEMS AND SOFTWARE TECHNOLOGY DIVISION

Chief: Roger J. Martin
Group Managers: Tom Rhodes, Software Engineering
Lawrence A. Welsch, Office Systems Engineering
Fritz Schulz, Distributed Systems Engineering

The effective use of information technology (IT) requires the interoperability of distributed information systems, the portability of applications, advanced software technology, and standard formats for document interchange. The Systems and Software Technology Division works in all of these vital areas.

Advanced Software Technology

The engineering of basic software components to meet current and future business requirements is a challenge which the U.S. must meet to maintain industrial and software leadership. In February 1994, the CSL Director convened an invitational workshop on advanced software technology to address critical software problems and requirements facing U.S. industry and to identify major future applications, key technologies needed by these applications, and barriers to progress. The issues were considered in the context of the use of IT as a major driver in the application and advancement of software technologies. NISTIR 5500 presents workshop results. Future workshops are planned for 1995.

High Integrity Software System Assurance Project

Activities from all aspects of modern society require high integrity software, e.g., software which can be trusted to work dependably. High integrity software controls a wide range of essential activities including banking and commerce, manufacturing, education, transportation, healthcare, and entertainment. The tools and methodologies used to build and evolve these software systems must be able to ensure very high quality, reliability, security, and safety. The High Integrity Software System Assurance Project provides industry and government with advanced development, analysis, and testing techniques for assurance of software and systems and develops standards guidance in cooperation with industry and government.

CSL established a Center for High Integrity Software Systems Assurance (CHISSA) as a collaborative approach for government, industry, and academia to make available technology necessary for assuring high integrity software in a growing number of applications and to pursue visionary solutions to industry-defined problems in the assurance of software-intensive systems. CHISSA plans a demonstration laboratory for methods and tools that support high integrity software assurance. Over 35 organizations have expressed interest in participating in CHISSA activities.

Under an agreement with the Nuclear Regulatory Commission (NRC), CSL developed a framework of software assurance activities essential for high integrity software. NIST Special Publication 500-216 presents the proceedings of a nuclear safety workshop co-sponsored by CSL and NRC to identify key issues and potential solutions for digital technology related to software requirements, formal methods, testing, object-oriented technology, reliability and reuse of digital technology in nuclear power plants. CSL designed, for use by NRC auditors, a

prototype Computer-Aided Software Engineering tool, *unravel*, which uses a mathematical approach to program analysis called slicing to examine software features; the tool will be made available to the public in 1995.

To address software technology assessment and transition for improving the dependability of computer systems, CSL initiated a Memorandum of Understanding with the Naval Surface Warfare Center-Dahlgren Division. Researchers are exploring the use of object-oriented technology in high integrity software systems and examining the testability of object-oriented software. The recently published Software Engineering Encyclopedia includes a CSL article on "Verification and Validation." CSL also developed a preliminary set of metrics that may be useful in assessing quality of software for reuse; this work is presented in NISTIR 5459, *Quality Characteristics and Metrics for Reusable Software.*

The High Integrity Systems Lecture Series continued for the fourth year. Speakers addressed software metrics, fault tolerance and software safety, object-oriented programming and software reliability, software reuse, and the Ada programming language. In addition, CSL co-sponsored the Ninth Annual Conference on Computer Assurance, COMPASS '94, an annual event providing a forum for issues of software safety, process integrity, and computer security. A description of the presentations appeared in the November/December 1994 NIST Journal of Research.

Integrated Software Engineering Environments (ISEE)

The ISEE project focuses on the requirements, technology, and standards for open system ISEEs that provide software tool integration support, repositories for software components, and a distributed development environment. ISEE is defining a framework which identifies standards-compliant interfaces to a set of necessary services and a set of interchangeable tools. Researchers work closely with the European Computer Manufacturer's Association (ECMA), the Department of Defense and the Defense Information Systems Agency (DISA), the Navy's Next Generation Computer Resources (NGCR) program, the Software Engineering Institute (SEI), the Institute of Electrical and Electronics Engineers (IEEE), and industry toward this goal. Published documents include the NIST Special Publication 500-213, *Next Generation Computer Resources: Reference Model for Project Support Environments*, developed jointly with the NGCR Project Support Environment Standards Working Group (PSESWG).

The Software Engineering Environments Laboratory (SEEL) provides a testbed for investigating and demonstrating tool and repository integration, and provides guidance for developing tool interface standards. In collaboration with SEI at Carnegie Mellon University, CSL installed test applications using the Portable Common Tool Environment (PCTE) software for data integration experiments. Similar experiments were conducted using different software components to evaluate integration methods and performance. Future experiments will examine tool and software integration within distributed object-based systems.

CSL continued the ISEE workshops with government, industry, and academia, under the Open Systems Environment Implementors' Workshop, to develop profiles of compatible ISEE standards and interfaces. Using the Framework and PSE Reference Models, the laboratory is working with SEI to examine interfaces between various services and to investigate ISEE architectures. CSL is also looking at the information relationships between business process and underlying methods and automated components within automated environments, such as the NII, towards developing a multi-level model of Enterprise Information Systems. A report will be published on this work entitled the "Information Technology Engineering and Measurement (ITEM) Model."

Virtual Library

In collaboration with NIST's Office of Information Services, the division established the NIST Virtual Library Project. The NIST Virtual Library brings to the NIST staff member's desktop computer the information needed regardless of where it resides and in what form it appears. Current services include access to journal search and delivery service, CD-ROM data, and NIST documents in Adobe's Portable Document Format, the result of CSL's Cooperative Research and Development Agreement (CRADA) with Adobe Systems, Inc. Of particular interest has been the networked delivery of information to the heterogeneous computing environment of NIST researchers. This was accomplished using both text and graphically oriented information access tools. A Virtual Library Consortium of industry and academic participants has been established to pursue joint research and development activities related to virtual libraries.

In a related effort, researchers initiated a pilot project to use the Standard Generalized Markup Language (SGML) to mark up NIST documents for delivery to the NIST Virtual Library. The primary goal of the project is to adopt a mechanism that will impose some uniformity on document production so that the move from paper-based to electronic-based publication will be enhanced. Since most NIST publications are created using various word processing and page layout programs, converting the resulting electronic file to a viewable electronic format can be difficult and time- consuming. The American Association of Publishers (AAP) SGML tag set, an international standard, was selected to demonstrate the application of existing standards.

Virtual Reality

Sponsored by the Army Research Institute (ARI), the Open Virtual Reality Testbed (OVRT) facilitates the exploration and use of applied virtual environment (VE) technologies. Towards this goal, the OVRT collaborated with NIST's Manufacturing Engineering Laboratory (MEL) on work examining the use of VE in manufacturing. NISTIR 5343, *Applying Virtual Environments to Manufacturing*, illustrates a number of real-world VE applications being pursued by industry. Division efforts in this area are coordinated with those of the Advanced Systems Division, the Information Systems Engineering Division, the Systems and Network Architecture Division, and NIST's Computer and Applied Mathematics Laboratory. In FY 1995, division researchers, working closely with Information Systems Engineering Division staff, will collaborate with the Systems Integration for Manufacturing Applications (SIMA) project to fully integrate a VE with a manufacturing simulation.

A joint venture with ARI and Catholic University resulted in one of the few studies on the effect of immersion on spatial memory. Another major effort in the OVRT is the application of VE to information access. The paper "Approaches Using Virtual Environments with Mosaic" in the proceedings of WWW94, describes viable mechanisms to integrate VE with the information highway via the World Wide Web (WWW). The goal is to provide end-users with intuitive user interfaces to complex information.

Open System Environment

The semiannual APP/OSE Users' Forum provides users, vendors, and implementors with the opportunity to gain information about and respond to CSL proposals regarding the evaluation and adoption of an integrated set of standards to support the Application Portability Profile (APP) and the Open System Environment (OSE). These forums promote interchange on OSE developments within the federal government and provide guidance to federal agencies. The format has been expanded to include mini-workshops which focus on major topics such as OSE Procurement and Security in OSE. Additionally, an introductory tutorial on the OSE has been added to each forum in order to disseminate information on the fundamentals of the OSE.

The quarterly OSE Implementors' Workshop (OIW) is a public international technical forum for the development of implementation agreements (profiles) based on emerging international standards and publicly available specifications. This year, the OIW expanded further into OSE applications, such as electronic commerce, multimedia, and network and system management standards. Harmonization of OIW activities with those of other regional workshops continued.

NIST Special Publication 500-220, *Guide on Open System Environment (OSE) Procurements*, assists federal agencies in developing requests for proposals (RFP) based on acquiring and transitioning to an OSE. Also completed was a draft set of requirements needed in distributed integrated network, data, platform, and application system operations and administration. The OIW is investigating the development of profiles for incorporating these requirements through standard interfaces, data formats, and protocols.

Distributed System Engineering (DSE) Laboratory

The DSE Laboratory provides a testbed in which OSE-compliant distributed system technologies can be integrated, evaluated, and assessed in terms of their ability to support application software portability and interoperability. The laboratory provides an infrastructure to allow research and operation of distributed system software, distributed applications, and operation support tools. The laboratory plans to establish a testing and metrics capability to assist agencies in developing measures of interoperability and openness. These metrics and test results will be used as guides in making business decisions about the implementation of OSE.

The DSE Laboratory program, in conjunction with other agencies and industry, is also developing a Core Distributed Platform Profile (DPP). This profile establishes a procurement and engineering baseline, identifying the minimum requirements for an application platform to qualify for inclusion in a distributed system.

NIST POSIX Conformance Testing

The NIST POSIX Testing Program issued over 50 certificates of validation for Federal Information Processing Standard (FIPS) 151-2, *Portable Operating System Interface (POSIX)-System Application Program Interface [C Language]* implementations. POSIX promotes the portability of applications software at the source-code level between computer systems from multiple vendors. Each validated product has been tested by an accredited testing laboratory using the NIST POSIX Conformance Test Suite (NIST-PCTS). CSL reviews test results and issues certificates of validation.

Plans for a testing program for implementations of FIPS 189, *Portable Operating System Interface (POSIX)-Part 2: Shell and Utilities*, are under development. FIPS 189 defines the command language interface for portable operating system environments and the utilities necessary to provide extensive support of user activities within the POSIX environment. Conformant products are listed in CSL's *Validated Products List (VPL).*

An information server also provides electronic access to APP/OSE Users' Forum and OSE Implementors' Workshop specifications, documents, and schedules, as well as other reports, publications, and draft standards. Services currently available include electronic mail, Internet ftp, Gopher, and World Wide Web (WWW) access, and working group forums for conducting technical work online.

NIST SGML Conformance Testing

The NIST SGML Conformance Testing Program tests SGML parsers to validate that parsers conform to FIPS 152, *Standard Generalized Markup Language (SGML).* SGML standardizes the application of the generic coding and generalized markup concepts. It provides a method for coding text, not the actual text but parts of it, so that the logical structure of the document remains consistent.

NIST has contracted with several laboratories to perform the actual testing. The test laboratories use the SGML Test Suite along with NIST test procedures to perform the test. CSL reviews the test results and issues certificates of validation.

Electronic DocumentInterchange Project

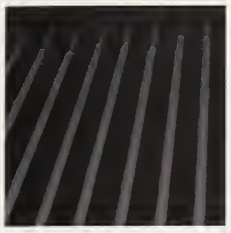
The document interchange project develops a mechanism for measuring and discussing the problems involved in the interchange of documents between document processing systems. Test methods and test suites are being developed to provide reasonable, practical assurance that the success of an interchange of documents between two document processing systems can be determined. Tests are being performed and results reviewed to evaluate problems encountered.

Telecommunications Security Analysis Center

To improve the security and integrity of the U. S. telecommunications infrastructure, CSL developed the Telecommunications Security Analysis Center (TSAC). The center enhances the security, integrity, and reliability of telecommunications throughout government by providing advanced analysis and testing techniques for assurance of security, integrity, and reliability in telecommunications systems and software. It also conducts evaluation of telecommunications systems and software, including switches and operations support systems that provision, test, administer, and maintain various network elements, and develops standards guidance in cooperation with industry. Several projects include research in formal methods, feature analysis, and program slicing. The National Security Agency will operate a joint Switch Evaluation Laboratory to conduct telephone switch security evaluations for government agencies.

Network Security on the Public Switched Network

The Public Switched Network (PSN) provides National Security and Emergency Preparedness (NS/EP) telecommunications. Service vendors, equipment manufacturers, and the federal government are concerned that vulnerabilities in the PSN could be exploited and result in disruptions or degradation of service. To address these threats, CSL assists the Office of the Manager, National Communications System (OMNCS), in computer and network security research and development. CSL investigates the vulnerabilities and related security issues resulting from the use of open systems platforms in the telecommunications industry, such as products based on open standards. The first result of this work is NIST Special Publication 800-7, *Security in Open Systems*.



COMPUTER SECURITY DIVISION

Chief: Stuart W. Katzke
Group Managers: Stuart W. Katzke (Acting), Computer Security Management & Evaluation
Miles E. Smid, Security Technology
Robert Rosenthal, Protocol Security
Robert Rosenthal (Acting), Computer Security Planning and Assistance

In areas such as electronic commerce, education, healthcare, and government services, information technology (IT) promises to deliver information, benefits, assistance, and other services more efficiently and cost-effectively to the nation's citizens. The Computer Security Division works to ensure the integrity of data, the availability of information systems, and the confidentiality of personal information processed by national and global networks.

Digital Signature Standard

The security of many IT applications will require the ability to electronically "sign" multimedia information, to ensure non-repudiation of the originator and receiver of the information, and to detect modifications to the information. Digital signatures are essential to conducting business electronically. Also needed will be the supporting infrastructure to distribute "certificates" to government and commercial users who wish to apply digital signature technology within electronic commerce interactions. Certificates contain unforgeable information that identifies the individual presenting the certificate and other components required for the digital signature function.

In May 1994, CSL issued FIPS 186, *Digital Signature Standard (DSS)*, to provide the capability to generate digital signatures that cannot be forged. This capability allows organizations to process electronic transactions based on a digital rather than a handwritten signature.

Discussions continue about a public key infrastructure (PKI) program to support the use of digital signatures and to ensure the integrity of electronic transactions over networks. CSL is working with other federal agencies and industry to plan an infrastructure that will distribute certificates to users in government and commercial sectors for their electronic commerce interactions. The PKI will manage the certification of public keys on a large-scale basis.

Other Cryptographic Standards

FIPS 185, Escrowed Encryption Standard (EES), was approved in FY 1994 for voluntary federal agency use. Affording a strong encryption algorithm for protecting unclassified information, FIPS 185 provides that the keys used in the encryption and decryption processes are escrowed to assist law enforcement and other government agencies, under the proper legal authority, in the collection and decryption of electronically transmitted information. CSL worked with the Department of Justice, the Federal Bureau of Investigation, the Department of the Treasury, and the National Security Agency to establish and operate a key escrow system which escrowed keys for approximately 30,000 encryption chips.

Also approved was FIPS 140-1, *Security Requirements for Cryptographic Modules*, which enables federal agencies to specify their security requirements for cryptographic modules which can be used to protect unclassified information in a variety of different applications. Developed by a joint government and industry working group, FIPS 140-1 specifies four levels of security which will give agencies flexibility in selecting appropriate and cost-effective security for the various kinds of sensitive information that they process and for different applications and environments. FIPS 46-2, *Data Encryption Standard (DES)*, was reaffirmed for five years. A draft FIPS on Cryptographic Service Calls was completed and circulated for review. In addition, CSL validated 12 vendor DES products as conforming to FIPS 46-2.

Electronic Commerce

CSL continued interactions with industry and other federal agencies in promoting the use of electronic commerce applications such as electronic funds transfer and electronic data interchange (EDI). NIST Special Publication 800-9, *Good Security Practices for Electronic Commerce Including Electronic Data Interchange*, presents security procedures and techniques, including internal controls and checks, that constitute good practice in the design, development, testing, and operation of electronic commerce systems. In addition, CSL co-sponsored, with the Office of Management and Budget, a seminar for federal managers on good security practices for electronic commerce. The division is also collaborating with the Systems and Network Architecture Division on a prototype secure e-mail prototype for the Electronic Commerce Integration Facility.

Advanced Authentication Technology

Authentication technology is a critical priority for the success of large-scale efforts. CSL has been helping organizations move away from reliance on passwords as the principal method for authenticating users to token-based and other authentication technologies.

Authentication requirements span international borders. As organizations automate more functions and communicate globally, they find that interoperability and security issues become more complex. Different authentication schemes are being adopted, but very few organizations are looking at authentication from a national or international perspective.

CSL held an Advanced Authentication Workshop with representatives of government and industry to develop a Common Authentication Architecture (CAA) for global networks. CSL sees a CAA as a viable foundation for achieving the requirements for authentication of users. Working with industry, standards committees, and others, CSL is developing a suite of standards for a wide range of authentication techniques and computing environments.

The CAA will pave the way for secure, reliable, cost-effective authentication of different users and systems. This will permit the use of different underlying algorithms, protocols, and devices. The ultimate goal is for a human user or any other entity in a computing system to be able to authenticate to any other entity, regardless of the second entity's location or computing environment.

To inform industry and federal computer users about authentication alternatives, CSL produced FIPS 190, *Guideline for the Use of Advanced Authentication Technology Alternatives.* FIPS 190 describes the primary alternative methods for verifying the identities of computer systems users, and provides recommendations on the acquisition and use of technology which supports these methods.

Security Criteria and Evaluation

Working with other North American and European government partners, CSL is participating in the development of a security evaluation approach that will ensure the commercial availability of secure, off-the-shelf products and systems for building, developing and implementing IT applications. The goal of this effort is a set of internationally accepted security criteria that can be used to specify the security functionality and assurance requirements of information technology products and systems. Also needed is a federal government capability to verify that the developer of the product or system has met both sets of requirements. Verification of the functional and assurance requirements of these products will aid in performing system security certification and accreditation before placing systems in operation.

CSL expects this work to develop a set of security criteria that meets not only the needs of the federal government but also the requirements of the global marketplace for mutually recognized, secure products and systems. Also produced will be an international registry of protection profiles which can be created against the security criteria, can be evaluated separately, and, once evaluated, can be internationally recognized and form the basis for the creation of conforming products and systems. The result will be a federal government security evaluation capability for assessing the security of commercially available products and systems that are created against the security criteria or protection profiles. This capability will be created in such a way as to ensure the mutual recognition of these evaluations, thus increasing their availability and use.

Network Security

Security incidents on larger networks such as the Internet have caused service disruptions and have harmed organizations' computing capabilities. Recurrence of these events often makes it cost-beneficial to develop a standing capability for quick discovery and response to such events.

FIPS 191, *Guideline for the Analysis of Local Area Network Security*, discusses threats and vulnerabilities to network security and discusses technical security services and security mechanisms. Industry organizations as well as federal agencies will find the guidance valuable. The May 1994 CSL Bulletin focused on *Reducing the Risks of Internet Connection and Use.* Another new document, NIST Special Publication 800-10, *Keeping Your Site Comfortably Secure: An Introduction to Internet Firewalls*, describes how firewalls work and outlines the steps necessary to implement firewalls. The document assists users in planning or purchasing a firewall.

Also approved was FIPS 188, *Standard Security Label for Information Transfer.* The standard defines syntactic constructs for conveying security label information when government sensitive but unclassified data is exchanged over computer networks. CSL continues its interactions with industry in testing security protocols for open systems environments.

Another new publication was NISTIR 5395, *Preliminary Functional Specifications of a Prototype Electronic Research Notebook for NIST*. The study focused on developing and securing electronic research notebooks (ERNs) for NIST scientists and researchers and proposes a system configuration where functional specifications for a basic ERN are defined.

Information Security Resources

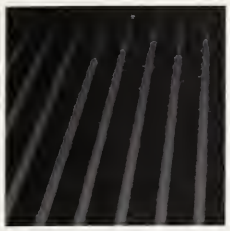
CSL continued to develop the draft *An Introduction to Computer Security: The NIST Handbook*. Providing a broad overview of the field of information security, the document assists managers in making informed decisions in selecting cost-effective, appropriate controls to protect systems in their own unique operating environments. Moreover, the document provides extensive references to materials and other publications that give detailed steps in developing and implementing sound information protection strategies. The handbook will serve both government and industry agencies.

Educating computer system users, at all levels, on their responsibilities in computer security and teaching them correct practices is one of the most important ways of improving information systems security. To this end, CSL developed and presented a one-day information systems security training course for federal managers who have responsibility for major information systems. The course addressed important security management issues and provided a toolkit of information that can be used as a reference guide for managers to implement sound and comprehensive information security protection programs.

Established by the Computer Security Act of 1987, the Computer System Security and Privacy Advisory Board met four times in 1994 to discuss significant computer security issues. CSL also hosted four meetings of the Federal Computer Security Program Managers Forum to share experiences and information on mutual problems and possible solutions, and sponsored the annual meeting of the Federal Information Systems Security Educators' Association (FISSEA) in February.

CSL and the National Security Agency co-sponsored the 17th National Computer Security Conference, in Baltimore, Maryland, in October 199, for about 2,000 participants from government, industry, and foreign countries. The conference theme was "Communicating our Discipline: Strategies for the Emerging Information Infrastructure."

This year, CSL's Computer Security Electronic Bulletin Board System was restructured and expanded into a Computer Security Resource Clearinghouse (CSRC) with improved access and additional information resources. (See the Interactions and Accomplishments section for electronic access instructions for the CSRC.) The mission of the clearinghouse is to serve as an agent to collect and promulgate computer security crisis information and computer security resources that will help users and managers better protect their data and systems. The clearinghouse addresses security problems including collection, analysis, and technical vulnerability assessments. CSL's involvement with the Forum of Incident Response and Security Teams (FIRST) corresponds with the clearinghouse activity. FIRST was born from the concept of a coalition of response teams--each with its own constituency, but working together to share information, provide alerts, and support each other in the response to incidents.



SYSTEMS AND NETWORK ARCHITECTURE DIVISION

Chief: Kevin L. Mills
Acting Chief: Anastase Nakassis
Group Managers: Anastase Nakassis (Acting), Distributed Applications Research and Technologies
Steven A. Trus, Electronic Commerce
Gerard F. Mulvenna, Network Applications
Fran Nielsen, Information Infrastructure Engineering

The successful use of information technology (IT) will require effective deployment of interoperable bitways capable of supporting enhanced services, on the development of enablers supporting common services, and on the development of applications based on integrable and interoperable components. The division is contributing in all three areas by focusing its efforts in the following critical sectors: new networking and subnetworking technologies, network management and security, integrated services, and electronic commerce (with current emphasis on streamlining federal procurement and on delivering services to the citizens electronically over integrated, secure networks, as mandated by the National Performance Review).

Electronic Commerce Integration Facility (ECIF)

To assist agencies in implementing a 1993 executive memorandum mandating the streamlining of procurement in federal agencies through electronic commerce, CSL initiated a demonstration project, as the initial application for the ECIF. The project is sponsored by the High Performance Computing and Communications (HPCC) project and the Departments of Health and Human Services, Agriculture, and Commerce.

The goals of the project are to serve as a technical resource for vendors and users; to demonstrate and promote interoperability between heterogeneous implementations of electronic commerce applications; and to assist in the removal of barriers preventing the deployment of electronic commerce applications. CSL's role in the project is to assist federal agencies with the deployment of electronic commerce technology in their procurement offices.

The development of an electronic commerce architecture for procurement, a key goal of the ECIF project, began with CSL's participation in the Federal Electronic Commerce Acquisition Team (ECAT) chaired by the Department of Defense and the General Services Administration. To complement the ECAT architecture which emphasized pressing and immediate concerns, CSL developed a long-term electronic commerce architecture. The ECIF is based on this concept, which is a superset of the ECAT architecture.

The development of an electronic commerce procurement application testbed involved identifying the software components required to implement electronic procurement, including a user interface to a procurement application, EDI translation software, database management software, security software, and communications software. Cooperative Research and Development Agreements (CRDAs) are being developed with over thirty vendors to provide the commercial, off-the-shelf (COTS) software components required to implement electronic

procurement. The vendors will install their software components in the ECIF and assist in integrating their components into electronic procurement applications, modifying their components as necessary.

By the end of FY 1994, several diverse COTS implementations had been installed in the ECIF and integrated to form electronic commerce procurement systems. Next year's efforts will focus on a variety of electronic commerce procurement systems, technical support to the Department of Commerce (DoC) and NIST procurement offices, the integration of standards-based security services, using the Digital Signature Standard (DSS) and the Data Encryption Standard (DES), and the dissemination of knowledge gained from the project.

CSL provides technical support and assistance to the DoC and NIST procurement offices in the deployment of an electronic commerce procurement system at the DoC and the agencies within the department. Guidance is provided in the design of the system, in the evaluation and selection of the system's components, and in the installation of the system.

CSL is also participating in the implementation of the CommerceNet electronic commerce procurement application. CommerceNet is a non-profit consortium funded under the Technology Reinvestment Program. The application incorporates intelligent agent technology with the previously identified software components (user interface, EDI translation software, database management software, security software, and communications software). Participating parties are connected via the Internet. This project is being jointly developed with the Information Systems Engineering Division.

Another joint venture, with the Computer Security Division, involved the development of a secure e-mail prototype for the ECIF. The prototype provides confidentiality and digital signature services using both public key and secret key cryptography and an implementation of the Simple Mail Transfer Protocol (SMTP). A simple User Agent was modified to access the security services using the Cryptographic Application Programmers Interface developed by CSL. The prototype incorporates the use of token-based cryptographic modules. Also being developed is a prototype Procurement Data Repository that enables agencies to use secure e-mail to post Requests For Quotations (RFQs) and Contract Awards (CAs) in standardized EDI formats. The public can search the posted material efficiently by using Mosaic and standardized query languages.

With CSL's Center for Applied Information Technology and NIST's Advanced Technology Program, the ECIF initiated a Lecture Series on Applied Information Technology in October 1994. Leaders in industry, academia, and government present monthly lectures on a variety of topics including electronic commerce, collaborative engineering, virtual enterprise, healthcare information infrastructure, manufacturing information infrastructure, nationwide multimedia libraries, and education.

Related activities included the publication of NIST Special Publication 500-218, *Analyzing Electronic Commerce*, which presents an overview of electronic commerce and examines key issues in its deployment. CSL also joined the Electronic Messaging Association and participates in their Electronic Commerce, Electronic Messaging, and Directories committees.

Electronic Data Interchange (EDI)

EDI standards define common data formats for business transactions, allowing existing or newly developed computer applications of business partners to exchange information. The implementation of EDI involves the use of encoding tools to translate data from an application's internal format into a format that is both suitable for electronic transmission and commonly understood; communication networks and protocols to transfer encoded information; tools which parse, verify, and decode the data received through communication media; and tools which map the decoded data into the receiving application's internal format.

Supporting industry and government by facilitating the implementation and use of EDI is a cost-effective approach for ensuring that new ideas and products become operational as quickly as possible. An example is CSL's EDI prototype tool, the Transaction Set Development System (TSDS), which eases the development of the federal government EDI conventions, assists federal agencies in effectively deploying EDI, and promotes EDI integration with existing computer systems.

The TSDS is a tool which allows a user to interactively design, develop, and test new transaction sets and to automatically produce working implementations. This accelerates the testing and subsequent standardization of those transaction sets. The TSDS consists of a Development Environment and an Operational Environment. The TSDS supports both X12 and UN/EDIFACT standards and provides parser-based translation and database mapping mechanisms.

The main goal of the TSDS was to provide a proof of concept, which encourages commercial EDI vendors to invest in better technology. Techniques similar to some of CSL's proposals, namely the database mapping techniques, are being incorporated into products announced by commercial vendors. The TSDS can also be used as a basis for developing testing tools for commercial EDI products developed by U.S. industry.

EDI Convention Harmonization

CSL has been tasked by the Federal Electronic Commerce Acquisition Team (ECAT) to coordinate the harmonization of conventions within the federal government. Initially, cooperating with the ECAT and the Office of Federal Procurement Policy of the Office of Management and Budget, CSL provided technical support for the harmonization effort and plans to coordinate and provide leadership for the resulting activities in this area.

During FY 1994, CSL developed, sponsored, and acquired the tools necessary to implement a successful harmonization of the EDI federal conventions. All required coordination processes were defined and started up by year's end.

Open Systems Specifications

In May 1994, CSL issued NIST Special Publication 500-217, *Industry/Government Open Systems Specification (IGOSS)*. The IGOSS, developed in conjunction with major U.S. industry groups and the Canadian Government, provides procurement and usage guidance for computer networking products that implement the Open Systems Interconnection (OSI) protocols.

The Federal Internetworking Requirements Panel (FIRP), an interagency group established by NIST in 1993 to study federal requirements for open systems networks, reviewed the problems that agencies were experiencing in using existing federal networking standards. The Panel concluded that agencies needed broader options to acquire and use networking products based on a variety of

open, voluntary standards. Such standards include those developed by the Internet Engineering Task Force (IETF), the International Telecommunications Union (ITU), and the International Organization for Standardization Open systems Interconnection (OSI) protocols. CSL proposed changes to the Federal Information Processing Standards (FIPS) for Government Open Systems Interconnection Profile (GOSIP) and the Government Network Management Profile (GNMP) to implement the Panel's recommendations.

Information Infrastructure Engineering

Division personnel participated in the development and selection process for the next generation Internet Protocol (Ipng) with emphasis on the network infrastructure, security, and network management. In the process the group staff authored or helped author five IETF requests for comments (RFCs) and five Internet drafts. Additional work focused on the development of integrated routing protocols, on the development of standards for key management, and on specifications of cross-translations between key OSI Common Management Information Protocol (CMIP) Management Information Bases and the corresponding Internet Protocol Suite (IPS) Simple Network Management Protocol (SNMP) ones.

In the area of network infrastructure concerning integrated routing protocols, staff members participated in the design, specification, and testing of the IETF Integrated Intermediate System to Intermediate System (I-ISIS) protocol. Integrated IS-IS is a routing protocol that supports both IP and Connectionless Layer Network Protocol (CLNP). CSL also conducted interoperability testing of emerging integrated IS-IS implementations. The results of this activity are documented in an Internet Draft (*Experience with the Integrated ISIS Protocol*, Gunner and Montgomery, July 1994).

In the area of key management and network security staff designed and prototyped an integrated security protocol that works both with CLNP (OSI) and with IP (Internet). This work is the basis of a collaborative agreement between CSL and NSA to develop a prototype that implements the IP Security protocol (IPSEC), currently under development in the IETF. A security association protocol module is also being developed to allow end systems to determine the security services and appropriate mechanisms that should be used between the systems in question.

In the area of CMIP-SNMP coexistence, staff participated in the Network Management Forum's OMNIPoint-1 ISO IEC Management Coexistence (IIMC) project. The initial activity in the IIMC project has been the development of a series of specifications that provide cross-translations between key OSI Common Management Information Protocol (CMIP) and IPS Simple Network Management Protocol (SNMP).

The group plans to contribute to the further definition and evolution of the selected IPng proposal with emphasis on the fundamental design and development of the next generation Internet protocol, and on interoperability, security, and integration issues.

Network Consulting Services

Assisting industry and federal agencies in developing standards-based solutions for their networking requirements is an important part of the division's work. NISTIR 5485, *Videoconferencing Procurement and Usage Guide*, provides guidance to users in deciding whether to buy a videoconferencing system,

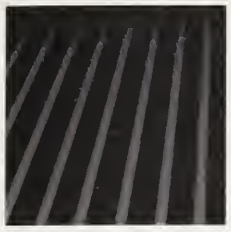
which system to buy, and, once acquired, how to use the videoconferencing system to its full advantage. Additional guides are planned on the procurement and use of Asynchronous Transfer Mode (ATM) technology and ISDN/LAN bridges.

The division provided tutorial and consulting services to the Internal Revenue Service and the Department of Agriculture Forest Service in developing network addressing plans. Assistance was also provided to DoD to ensure that their requirements for business-class messaging and upper- and lower-layer security protocols incorporated into the commercial standards.

Contributions in education and healthcare included a report on "Connecting K-12 Schools to the Internet" which highlights the benefits of using Internet technology in kindergarten through twelfth grade education and provides guidelines on how to connect school networks to the Internet. Also initiated were projects to develop a guideline document for the procurement of X.500 Directory Service implementations and to provide guidance to the Health Care Financing Administration in selecting the EDI standards to be used in their planned modernization of the Medicare Transaction System.

Automated Testing Tools

Another area of focus for CSL researchers is automated testing tools. A set of automated tools was developed which derive executable software testers from standard abstract test suites. The tools include a compiler for abstract test suites and a graphical runtime environment that is used to monitor and control the testers generated by the tools. These tools are being used to produce a distributed tester for the OSI Transaction Processing protocol.



ADVANCED SYSTEMS DIVISION

Chief: Shukri A. Wakid
Group Managers: Gordon E. Lyon, Parallel Processing
Oscar Farah, Display and Storage
Wayne McCoy, Digital Signal Processing
David S. Pallett, Spoken Natural Language Processing
Donna K. Harman, Written Natural Language Processing
Charles L. Wilson, Visual Image Processing
David H. Su, High Speed Networks

The Advanced Systems Division develops measurement and instrumentation methods for selected technologies that are likely to have a significant impact on promoting new large markets for U.S. industry. Areas of focus include high-speed networks, parallel processing, display and storage, spoken and written natural language processing, visual image processing, and digital signal processing.

High-Speed Networks

CSL provides leadership and expertise for the development of measurement techniques and conformance tests for broadband (B)-ISDN protocols. Staff members make contributions to the Asynchronous Transfer Mode (ATM) Forum through research projects which range from theoretical analysis of protocols to actual measurement of network performance.

A high-speed network testbed was installed using ATM technology. The network was instrumented by using the MultiKron measurement facility developed by CSL. Staff conduct performance analysis on ATM network protocols and applications. Also developed was an ATM network simulator which allows measurement of network performance without the expense of setting up a real network. This tool is used to study issues such as the effects of proposed network traffic management mechanism on the traffic delay, the behavior of Transmission Control Protocol/Internet Protocol (TCP/IP) traffic on an ATM network, and the characterization of traffic patterns at various network nodes. As a result of using this tool, the group presented many evaluation reports to the ATM Forum on traffic management mechanisms for the Internet-type traffic called Variable Bit Rate service. In addition, researchers developed Protocol Implementation Conformance Statements (PICS) for major B-ISDN protocols through national voluntary standards development groups and through the ITU-T. Staff also participate in the activities of the ATM Forum Testing Working Group to develop test suites for ATM conformance and interoperability tests.

Support for nationwide ISDN deployment is provided through sponsorship of the North American ISDN Users' Forum (NIUF). Through the forum, users of narrowband (N)-ISDN have the opportunity to work with implementors to assure that users' needs are met in the design of products and services. The forum develops applications requirements, implementation agreements, and conformance criteria which provide the detailed technical decisions necessary for interoperability. The NIUF met three times in 1994 with an average of 175 participants per meeting. The NIUF interacts with industry through Cooperative Research and Development Agreements (CRADAs). Currently, there are 28

CRADA signatories. The NIUF sponsored a multi-vendor interoperability event for various manufacturers demonstrating LAN bridges to a wide area ISDN link.

Parallel Processing

To promote the National Information Infrastructure (NII) and High Performance Computing and Communications (HPCC) initiatives, researchers pursue two areas in performance measurement: high-speed low-perturbation Very Large Scale Integration (VLSI) instrumentation hardware for multiple-instruction, multiple-data (MIMD) systems and novel portable software tools for sensitivity analyses of MIMD code. Both approaches, hardware for micromodeling and software for macromodeling, address difficulties inherent in using parallel MIMD systems. The goal of the work is to provide performance feedback to users and to improve MIMD system efficiency, thereby broadening the commercial viability of MIMD systems.

CSL continues working with the Advanced Research Projects Agency (ARPA) and its community on a new design for an advanced version of the MultiKron VLSI monitor chip. The new chip will greatly expand the set of state counters from the present 16 to several thousand. Considerable effort was expended to convert the design process to Cadence, which is widely accepted as a VLSI design vehicle in commercial manufacturing circles. Steps have been taken to promote the use of MultiKron. A toolkit (including interface board), which vastly simplifies system installation, is available for virtual memory extension (VME) systems. An Sbus version was also fabricated for future distribution.

In software, CSL devised a novel perturbation technique for quickly setting up and automatically testing parallel programs to explore their execution sensitivities. ARPA has encouraged focus upon a support environment tool that will relieve tedious bookkeeping inherent in the approach, which is based upon design-of-experiments. The first of three ARPA tool prototypes began running in FY 1994; it has graphical windowing and experiment library features that support ease of use. It has been tested for portability on both Sun and Silicon Graphics machines. Further research uncovered new applications for the technique; among these is a simple software scalability test that should have very high utility to parallel programmers.

Display and Storage

CSL supports industry in the areas of enabling technologies for the development of interface standards for flat panel displays, multimedia transmission, and digital video, the utilization of optical and other advanced high density/high bandwidth data storage technologies with data integrity studies, and the use of advanced technology for electronic information and image management. Technical support is provided to the Advanced Technology Program in data storage, network management, medical imaging, and healthcare.

To encourage standards for flat panel display interfaces, CSL sponsored a workshop in January 1994 for flat panel display manufacturers, computer systems manufacturers, and other interested parties to develop a coordinated plan for standards development. NIST Special Publication 500-219, *Report of the NIST Workshop on the Computer Interface to Flat Panel Displays*, reports workshop results. Related work included developing a flat panel display interface laboratory for research on interface techniques and demonstrations, researching interface

commonalties and differences, modeling proposed interface architectures, and exploring advanced interfacing techniques.

Another area of research is data integrity for optical disk and other high density/high bandwidth data storage information systems. CSL provided leadership in the development of national and international voluntary industry standards for data integrity in optical disk-based information systems. This included developing a laboratory to investigate data integrity of advanced data storage systems including media error monitoring techniques, statistical models for error distribution and error data visualization. The National Archives and Records Administration recently endorsed this work, recommending federal agencies to adopt an emerging industry standard for monitoring the data integrity of optical disks systems. CSL also collaborates with industry in developing optical disk media interoperability standards and media testing. Standard Reference Materials are provided to industry for several types of magnetic tape media, on a cost-reimbursable basis. Testing characteristics of CD-ROM and advanced CD recordable media is another research focus. During 1994, CSL participated in a round robin test of CD recordable media to analyze the performance and media characteristics of this data storage media.

Prototype systems were developed to study the use of advanced data storage technology in new applications. System performance and research interoperability problems for imaging on local area networks were measured. CSL also completed an experimental program on the care and handling of optical disks. Other areas of interest were data compression/decompression techniques, including the investigation of the performance of compression in the presence of media errors; the investigation of emerging techniques for data compression including entity reduction and error-resilient compression; image quality measurement; and workflow techniques for new imaging applications in government and industry.

Digital Signal Processing

Researchers are developing a system of tools, methodologies, metrics, measurement data, and source signals for impartial performance benchmarking of digital wireless systems and components. The purpose of the benchmarking program is to provide the wireless industry, user, and research communities with a comprehensive testbed for consistent evaluation of wireless devices, such as encoders. Activities include simulation of wireless components with correlated field test data, source reference signals (voice, data, images, etc.), and development of test and evaluation software for distribution to manufacturers and other interested parties. This work is being performed in collaboration with the National Telecommunications and Information Administration (NTIA) and industry partners, including members of the Telecommunications Industry Association (TIA).

In August, CSL and NTIA sponsored the first in a series of wireless performance benchmarking workshops, attended by 50 invited participants from industry, government, and academia, to gather technical information, develop requirements and frameworks, and determine work and schedules for benchmarking products. A second workshop is planned for FY 1995.

Another interaction with NTIA and other collaborative partners, funded by the National Communications System, focuses on ISDN over the Advanced Communications Technology Satellite (ACTS). Researchers evaluate the performance of ISDN and ATM commercial, off-the-shelf (COTS) applications over the ACTS system, in both quantitative and qualitative terms. Experiments focus on National Security/Emergency Preparedness (NS/EP) applications; results indicate how well COTS equipment designed for wireless technology can be employed in a "stressed" satellite situation (e.g., supplementing interrupted wireline services).

CSL, with the National Communications System, continued its sponsorship of the Federal Wireless Users Forum (FWUF), which met three times in FY 1994 with about 200 attendees at each meeting. The goals of the FWUF are to educate federal users about wireless telecommunications; identify the wireless telecommunications needs of federal users; facilitate information exchange with other relevant organizations; and promote interoperability of wireless technologies. Many telecommunications corporations participate in the FWUF.

Spoken Natural Language Processing

CSL advances the state of the art of spoken language processing (speech recognition and understanding) so that spoken language may serve as an alternative modality for the human-computer interface. Researchers provide reference materials (speech corpora) used by the research and development community, develop test procedures and coordinating community-wide benchmark tests, and build prototype systems. The benchmark tests serve to document progress in selected prototypical spoken language applications domains.

Researchers work closely with industry and other federal agencies to further the development of prototype systems that will permit access to information technology and large knowledge bases using spoken language. These prototype systems contribute to the development of technologies that will permit access to information services using spoken natural language technologies over the telecommunications network, without reliance on either keyboards or display screens.

CSL has worked with the ARPA spoken language community since 1984, filling a key role in the development and use of speech corpora (databases of speech, transcriptions, and related materials) by this research community. These reference corpora are used for system development and test purposes. Approximately 200 CD-ROMs have been produced by CSL to disseminate these speech corpora throughout the worldwide speech research community, including copies distributed through the National Technical Information Service (NTIS) and the University of Pennsylvania's Linguistic Data Consortium (LDC).

Benchmark tests, which have been implemented by CSL within this community since 1987, are used to track technology development for several speech technologies, including speech recognition and understanding, several spotting technologies, and most recently language identification. In FY 1994 and 1995, CSL implemented benchmark tests for the ARPA Human Language Technology Program and for the Department of Defense. These tests involved a number of "volunteers" -- research organizations not under contract to the sponsors. Participants included AT&T Bell Laboratories, BBN Systems and Technologies,

Boston University, Cambridge University Engineering Department (England), Carnegie Mellon University, Centre de Recherche Informatique de Montreal (Canada), Dragon Systems, IBM T.J. Watson Research Labs., International Computer Science Institute, ITT, Centre National de la Recherche Scientifique - Laboratoire d'Informatique pour la Mecanique et les Sciences de l'Inginieur (LIMSI) (France), MIT Lincoln Laboratory, MIT Laboratory for Computer Science, MITRE Corporation, New York University, Oregon Graduate Institute, Unisys, University of Karlsruhe, (Germany), Philips GmbH Research Laboratory (Germany), Sanders-Lockheed, and SRI International.

CSL also participated in software sharing efforts involving Cambridge University, MIT Laboratory for Computer Science, and SRI International. CSL's speech recognition test scoring software is widely used internationally. This approach to benchmark testing is being adopted for use in the European Union (EU)'s SQALE Program, a multilingual speech recognition project involving the TNO Institute for Perception in the Netherlands, Cambridge University, LIMSI, and Philips GmbH Research Laboratories.

In FY 1994, researchers initiated a new project to port ARPA-developed spoken language understanding technology for a new prototypical applications domain. CSL worked with Carnegie Mellon University in porting spoken language understanding technology and built a prototype system at NIST for this domain. The prototype system provides a spoken natural language interface to electronic libraries, as a specific example of spoken language interfaces to information services. Spoken language data collected in this effort will be made available to the research community.

Visual Image Processing

CSL supports the technology of image recognition in government and industry by developing new image recognition methods, evaluating existing techniques, and interchanging expertise with the commercial image recognition industry.

In cooperation with the Federal Bureau of Investigation (FBI), researchers developed the world's first neural network fingerprint classification system. The system achieves classification accuracy of 96.8 percent with 10 percent rejects and processes a fingerprint in less than three seconds on a massively parallel computer. To allow more detailed testing of fingerprint systems, CSL developed three large databases of fingerprint data. Special Database 9 (SD9) contained 27,000 images of fingerprints stored using a special image compression technique. SD10 contains 5000 images of fingerprints which have low natural frequency. SD14 contains 54,000 images of fingerprints compressed with the FBI's image compression algorithm. Since 27,000 images in SD9 and SD14 are of the same fingerprints, comparison of the results of the compression and the original images is possible for various applications.

CSL continues its development of a character recognition system. The system scans a structured form filled in with hand-print, isolates the entry fields on the form, segments and classifies the hand-printed characters, and returns the hand-printed information on the form as ASCII text. Efforts have been extended from digit recognition to recognition of alphabetic text at the word and phrase level. Three applications of this technology have been developed. The technology is being applied to recognition of 1990 Census industry and application

data, to the recognition of material on redesigned IRS 1040 forms, and to the recognition of unconstrained text with a limited lexicon using the constitution data from an earlier database.

Over the past five years, sponsored by the IRS and Census Bureau, researchers developed a wide variety of test and evaluation tools for form-based Optical Character Recognition (OCR). These tools are now accepted as the basis for testing OCR systems in government, as for example, in the IRS Document Processing System, and in industry, for testing applications such as check processing. Also developed were methods of analysis, databases, and software packages for documenting both performance assessment methods and advanced pattern classification techniques as applied to OCR systems. Loral adopted these methods and incorporates them in the development of their OCR products including automated form processing systems. NIST public domain OCR systems have been distributed to more than 320 organizations and are being incorporated into several commercial OCR systems.

In February 1994, CSL co-sponsored the second Census OCR Systems Conference which addressed recognition of complete fields from real 1990 Census Industry and Occupation data. This application is much more challenging than the isolated characters used in the first Census OCR Systems Conference held in May 1993. Of the 28 original participants, 21 continued their participation into the test phase of the conference. Initial results indicate that the gap between the best and worst systems is much larger than the previous conference but that the best systems will be good enough to provide OCR for future Census applications. NISTIR 5452, *The Second Census Optical Character Recognition Systems Conference*, reports conference results.

In FY 1994, two sets of image databases were produced. One contained images of faces for FBI applications and the other contained the images used in the second Census OCR Systems Conference. Also initiated was a joint project with Carnegie Mellon University on the recognition of visual information in scientific and technical documents.

Written Natural Language Processing

This work promotes the use of more effective and efficient techniques for manipulating unstructured textual information, especially the browsing, searching, and presentation of that information. Three of the projects in 1994 are continuations of previous work, and one new project was started.

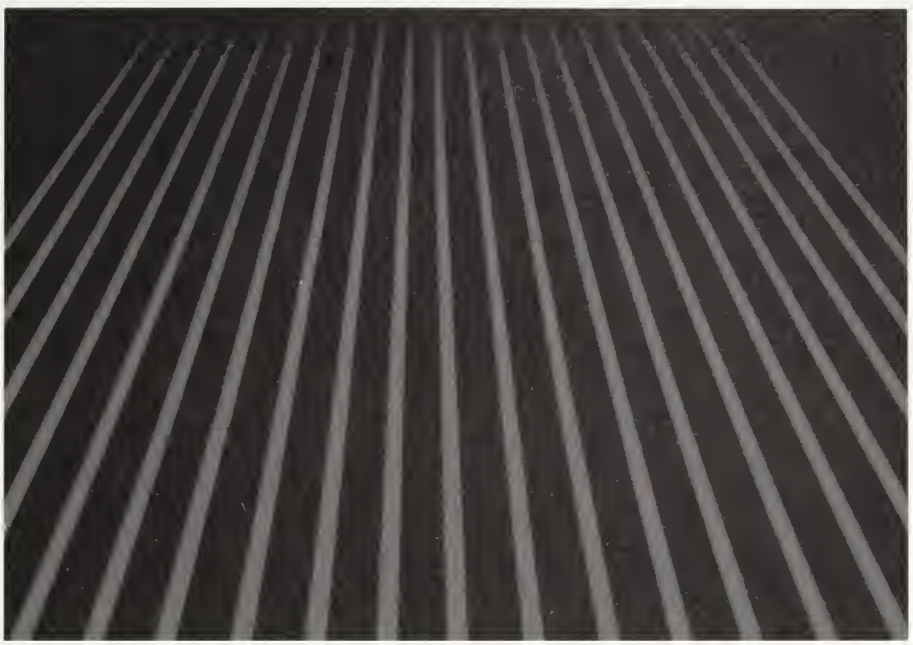
The first project is a continuation of the very successful Text REtrieval Conferences (TRECs), co-sponsored by CSL and ARPA. This conference attracts international participation from information retrieval researchers in industry, academia, and government. The conference has grown from 25 systems in 1992 to 33 systems in 1994, and serves as a major technology-transfer mechanism. Participating groups work with a large, CSL-built test collection, use the same evaluation procedures, and meet for a three-day workshop to compare techniques and results. In 1994, the proceedings from the second TREC were published as Special Publication 500-215, *The Second Text Retrieval Conference (TREC-2)*, and the third TREC was held. Additionally, new evaluation metrics and tools were developed and tested.

The second project is the continued development of the NIST prototype retrieval system (the PRISE system). This prototype is based on statistical ranking techniques and was initially developed to prove the effectiveness of these techniques in searching large collections of unstructured text. Research has continued in producing very efficient indexing and searching algorithms, efficient both in retrieval and indexing time, and in the amount of storage needed for indices. In 1994, researchers extended this prototype to include a UNIX client and server meeting the Z39.50-1994 standard. The goals of the work include increasing our understanding of the Z39.50 standard and our ability to influence and encourage its development and use; promoting the availability of information retrieval services by publishing source code for a working Z39.50 client/server; and providing an enhanced, user-friendly version of our PRISE application within a Z39.50 interface. This client/server is currently undergoing beta testing at several different academic and government sites.

The third project is the continued development of a system which automates the retrieval of employee wage records for the Social Security Administration (SSA). This system, first built by CSL in conjunction with SSA as a prototype to quickly search for names which are a "best-match" to a user query, received the "Federal Automation Medal of Excellence for Saving the Government Money" in March 1994. As part of SSA's Earnings Modernization project, the system is being installed at SSA for use with one year's worth of data (approximately 47 GB). This pilot effort will allow CSL to conduct major usability studies and performance evaluations.

Also in conjunction with SSA, CSL initiated research in the automatic linking of various types and sources of text. The goal of the project is to provide a method to identify programmatic help screens which need to change as a result of procedural manual changes. The work will involve the use of the PRISE system and the building of several different tools, including tools for automatically creating thesaurus.

COMPUTER SYSTEMS LABORATORY



INTERACTIONS AND ACCOMPLISHMENTS

SELECTED STAFF ACCOMPLISHMENTS
FY 1992 - FY 1994

Department of Commerce awards for major contributions to Department programs were presented to:

GOLD MEDAL

Miles E. Smid - 1994

SILVER MEDAL

F. Lynn McNulty - 1994

Shukri A. Wakid - 1992

BRONZE MEDAL

Lynne S. Rosenthal - 1994

Eugene F. Troy - 1994

Dolores R. Wallace - 1994

Natalie E. Willman - 1994

Wayne Jansen - 1993

Douglas C. Montgomery - 1993

Edward Roback - 1993

Dennis Steinaur - 1993

Donna F. Dodson - 1992

Elizabeth N. Fong - 1992

Michael Garris - 1992

Recognition from External Organizations

1994

Shukri A. Wakid received the Meritorious Executive Presidential Rank Award for 1994.

Robert E. Rountree received the 1994 ANSI's Edward Lohse Information Technology Medal for significant contributions to standardization by promoting the development of information technology standards both domestically and internationally and by providing leadership in the promulgation of such standards.

Michael D. Hogan was elected chair of the ANSI Information Systems Standards Board (ISSB) for the 1994-1995 term.

Shirley M. Radack received a Federal 100 Reader's Choice Award from Federal Computer Week in 1994.

Roger J. Martin was appointed to the Educational Products Advisory Board of the Software Engineering Institute in 1994.

Roy G. Saltman received an EDI Pioneer Award in 1994 from the EDI Group, publisher of *EDI Forum* magazine, for his contributions to the field of electronic data interchange.

Leslie A. Collica received a Government Computer News Award in 1994 for significant contributions to the U.S. telecommunications industry in the development of conformance testing for Integrated Services Digital Network (ISDN) standards.

Joan Sullivan received the 1994 Award for Technical Excellence from the Interagency Committee on Information Resources Management (IAC/IRM) for her technical leadership in internationalizing SQL testing and SQL conformance test suite development.

Joan Sullivan was appointed, in 1994, an Observer Member of the CTS5 SQL2 Project Management Board and Chair of the project's Test Method Control Board; both are activities of the European Commission for SQL testing.

Natalie Willman and **Laura Downey** were recognized for an information retrieval system prototype when CSL and the Social Security Administration jointly received the Federal Applications Medal of Excellence (FAME) for Information Technology Solutions Award given by National Trade Productions, Inc., *Government Computer News*, and Reed Exhibition Companies.

1993

James H. Burrows was named IRM Executive of the Year 1993 by the Federation of Government Information Processing Councils for his contributions to the IRM community in developing and advancing sound IRM standards that enhance the delivery of quality government IRM services to citizens.

Robert Rountree received an Extended Superior Service Award in 1993 from the International Organization for Standardization/International Electrotechnical Committee (ISO/IEC) Joint Technical Committee 1 on Information Technology.

Eugene F. Troy received a 1993 Federal 100 Award given by Federal Computer Week and FOSE '93 for key contributions in the NIST/NSA joint venture to document computer security requirements for the federal government.

Roger J. Martin was appointed, in 1993, to the X/Open User Council which provides strategic input to X/Open, an international consortium of major computer companies.

Mark Skall received the 1993 X3 Committee Management Award for his leadership as the former Vice Chair of X3H3, Computer Graphics, and the Document Editor and Rapporteur within JTC1/SC24/WG5, Validation and Registration, from the International Organization for Standardization/International Electrotechnical Committee (ISO/IEC) Joint Technical Committee 1 on Information Technology.

Mark Skall was appointed as the government representative to the National Computer Graphics Association Board of Directors for a three-year term beginning in January 1993.

Miles E. Smid received a 1993 Federal 100 Award given by Federal Computer Week and FOSE '93 for exceptional technical competence and leadership in developing solutions for protecting information systems in the federal government.

Kamie Roberts received a 1993 Award for Management/Administrative Excellence from the Interagency Committee on Information Resources Management (IAC/IRM) for technical leadership of the Transcontinental Integrated Services Digital Network (ISDN) Project (TRIP '92).

Leonard J. Gallagher received the 1993 X3 Committee Management Award for his national and international work on standards for Database Language SQL from the International Organization for Standardization/International Electrotechnical Committee (ISO/IEC) Joint Technical Committee 1 on Information Technology.

1992

A 1992 Federal Leadership Award was presented to CSL's Electronic Certification Project by *Federal Computer Week* and the Open Systems Conference Board. The project also received the 1993 Outstanding Security Technology Application award from Personal Identification News (PIN) Magazine.

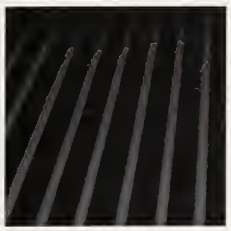
Roger J. Martin received the Institute of Electrical and Electronics Engineers (IEEE) Standards Medallion in 1992 for his contributions to the establishment of POSIX test methods as standards worldwide.

Kevin L. Mills was elected as a senior member in the Institute of Electrical and Electronics Engineers (IEEE) in 1992.

Robert Rosenthal was awarded the 1992 Award for Technical Excellence by the Interagency Committee on Information Resources Management for leadership in the field of local area networks and computer security.

Dennis D. Steinauer was elected chairman of the Forum of Incident Response and Security Teams (FIRST) for a one-year term beginning August 1992.

Judith Newton, accepting for NIST, received the 1992 Data Administration Management Association (DAMA) International Company Achievement Award for an outstanding contribution to the direction of the information resource industry.



PARTICIPATION IN VOLUNTARY STANDARDS ACTIVITIES

CSL staff members participate in more than 85 national and international voluntary standards activities, including the following:

American National Standards Institute (ANSI):
- Information Systems Standards Board (ISSB)
- Information Technology Consultative Committee (ITCC)
- USA Registration Authority Committee
- Information Infrastructure Standards Panel (IISP)

Accredited Standards Committee (ASC):
- T1, Telecommunications
- X3, Information Technology
- X9, Financial Services
- X12, Electronic Data Interchange (EDI)
- IT9, Physical Properties and Permanence of Imaging Media

Institute of Electrical and Electronics Engineers (IEEE):
- IEEE Standards Board and Committees
- IEEE Groups for:
  - Local Area Networks
  - Portable Operating System Interface (POSIX)
  - Graphical User Interface
  - Software Engineering
  - U.S. TAG for JTC 1 SC 7
  - U.S. TAG for JTC 1 SC 22 WG 15

International Organization for Standardization (ISO)/International Electrotechnical Commission (IEC)
Joint Technical Committee 1 (JTC 1) on Information Technology

U.S. Technical Advisory Group (TAG) for ISO/IEC JTC 1 (JTC 1 TAG)

International Telecommunications Union - Telecommunications Standardization (ITU-TS) Study Groups for:
- Switching and Signaling

U.S. National Committee for ITU-TS:
- Study Group B
- Study Group D

International Organization for Standardization (ISO) Technical Committees for:

Industrial Automation
Micrographics and Optical Memories for Document and Image Recording, Storage and Use

ASC X3 Subgroups for:

Audio/Picture Coding
Computer Graphics
Credit/Identification Cards
Database
Data Communications
Data Interchange
Data Representation
Geographic Information Systems
I/O Interface
Information Resource Dictionary System
Information Technology Security Techniques
Object Information Management
Open Systems Interconnection
Operational Management Committee (OMC)
Optical Digital Data Disks
Policy and Procedures Committee (PPC)
Text: Office and Publishing Systems
U.S. TAG for JTC 1 SC 21
U.S. TAG for JTC 1 SC 22

ASC X9 Subgroups for:

Data and Information Security
Public-Key Cryptography for Financial Institutions
Security for Financial Systems
Wholesale/Retail Banking

ASC X12 Subgroup for:

Security
EDIFACT Alignment

ASC T1 Technical Subcommittee for:

Services, Architecture and Signaling

JTC 1 TAG Subgroups for:

Functional Standards
Procedures

ISO/IEC JTC 1 Subcommittees or Groups for:

- Computer Graphics
- Data Element Principles
- Document Processing and Related Communication
- Functional Standardization
- Information Technology Security Techniques
- Interconnection of Information Technology Equipment
- Programming Languages
- Open Systems Interconnection, Data Management, and Open Distributed Processing
- Optical Disk Cartridges for Information Interchange
- POSIX
- Procedures
- Software Engineering
- Telecommunications and Information Exchange Between Systems

European Computer Manufacturers Association (ECMA) Technical Committees or Task Groups for:

- Object-Oriented Extensions, TC33/TGOO
- PCTE (Portable Common Tool Environment), TC33/TGEP
- Reference Model for Software Environments, TC33/TGRM
- Security Evaluation Criteria, TC36/TG1

European Workshop on Open Systems (EWOS)

- Expert Group on Open System Environment (OSE)

Association for Information and Image Management (AIIM)

ATM Forum

Canadian Committee on Geomatics

Corporation for Open Systems (COS)

Data Administration Management Association Standards and Procedures Subgroup

Federal Interagency Coordinating Committee on Digital Cartography

Federal Telecommunication Standards Committee

International Association for Identification

Internet Engineering Task Force (IETF)

National Association of State Information Resource Executives (NASIRE)

National Information Standards Organization (NISO)

Network Management Forum (NMF)

NIST Open System Environment Implementors' Workshop (OIW)

North American ISDN Users' Forum (NIUF)

North American Open Systems Testing & Certification Policy Council

Object Management Group (OMG)

Open Management Roadmap

U.S. Board on Geographic Names

X/Open Users Council

CSL LEADERSHIP

CSL staff members hold the following leadership positions in the above activities:

ANSI Information Systems Standards Board (ISSB)

Michael Hogan, Chairman

X3 and X3 Subgroups

Leonard Gallagher, Intl. Rep.	X3H2, Database
Susan Sherrick, Intl. Rep.	X3H3, Ad Hoc Group for Validation-Testing-Registration
Bruce Rosen, Intl. Rep.	X3H4, IRDS
Henry Tom, Chair	X3L1, Geographic Info. Systems
Roger Sies, Chair	X3V1.1, User Requirements M.S.T.

JTC 1 TAG Activities

Robert Rountree, Chair	JTC 1 TAG, U.S. Technical Advisory Group for ISO/IEC JTC1

JTC 1 Subcommittees

Dale Walters, Project Editor	JTC 1/SC 6 Transport and Network Layer Security Objects
Dale Walters, Project Editor	JTC 1/SC 6/WG 4 Transport Layer Security
Dale Walters, Project Editor	JTC 1/SC 6/WG 8 Upper Layer Security
Lawrence Welsch, Proj. Editor	JTC 1/SC 18/WG 1 MHMF
Dale Walters, Project Editor	JTC 1/SC 21 OSI Security Architecture

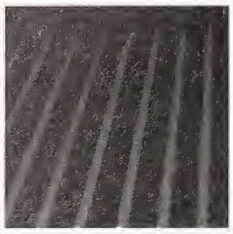
J.P. Favreau, Project Editor	JTC 1/SC 21/WG1 Formal Methods in Conformance Testing
Anastase Nakassis, Proj. Ed.	JTC 1/SC 21/WG 1 Confidentiality and Integrity Frameworks
David Jefferson, Rapporteur	JTC 1/SC 21/WG 3 Rapporteur Group on Reference Model of Data Management
Leonard Gallagher, Rapporteur	JTC 1/SC 21/WG 3 Rapporteur Group on Database Languages
Roger Martin, Rapporteur	JTC 1/SC 22/WG 15 Rapporteur Group on Conformance Testing
Fritz Schulz, Project Editor	JTC 1 SGFS, TR10003.3
Eugene Troy, Project Editor	JTC 1 27.16.1 General Model for Security Evaluations
Dolores Wallace, Representative	JTC 1/SC 7 Software Engineering

IEEE Standards Activities

Fritz Schulz, Editor	P1003.0, POSIX Guide
Roger Martin, Chair	P1003.3.1, POSIX.1 Test Methods
John Barkley, Editor	P1003.8, Transparent File Access
Tim Boland, Chair	P1238.1, OSI API
Anthony Cincotta, Editor	P2003, POSIX Test Method Specifications for PASC
Mike Rubinfeld, Chair	CDARCH, CD-ROM Architecture
Dolores Wallace, Co-Chair	IEEE P1012, Software Verification and Validation
Roger Martin, Chair	PASC Steering Cmte on Conformance Tests, Portable Applications Standards Cmte
Lawrence Welsch, Sponsor Chair	SCODMMP, Optical Disc and Multimedia Platforms

Others:

Tom Bagg, Vice Chair	Image Technology 9 Committee
Mike McCabe, Chair	Workshop on the Electronic Exchange of Fingerprint Images
Fran Nielsen, Secretary	Open Management Roadmap, User Advisory Council
Mike Rubinfeld, Chair	SIGCAT, SIG Standards
Leslie Collica, Chair	NIUF
Ted Landberg, Chair	OIW
Tish Antonishek, Secretariat	Federal Wireless Users' Forum
Joe Hungate, Chair	APP/OSE Users' Forum
Miles Smid, Chair	Key Escrow Working Group
Barbara Cuthill, Co-Chair	OIW ISEE SIG



INTERLABORATORY COLLABORATIONS

In FY 1993 and FY 1994, CSL collaborated with other NIST laboratories on the following projects:

Method for Faster Supercomputer Programs, Computing and Applied Mathematics Laboratory (CAML)

Statistical Optimization of Parallel Processing Programs (CAML)

ISDN Testing for Future Telecommunication Systems, Electronics and Electrical Engineering Laboratory (EEEL)

Development of a Computing Environment to Support the Manufacturing of Millimeter and Microwave Tubes (EEEL)

Video Processing to Support Advanced Video Technology (EEEL)

Interoperability of Product Data Exchange Standards to Support Advanced Manufacturing of Electronic Products (EEEL)

Testing Radiation Effects on Optoelectronic Devices, Physics Laboratory (PL)

INDUSTRY INTERACTIONS

Asynchronous Transfer Mode (ATM) Forum

The ATM Forum is an international non-profit organization which accelerates the use of ATM products and services through a rapid convergence of interoperability specifications. About 170 U.S. telecommunications corporations comprise the ATM Forum membership. Through the forum, CSL works with Bellcore, test equipment vendors such as Tekelec and Hewlett-Packard, and ATM switch vendors to develop interoperability test specifications and conformance test suites. CSL also participates in the Signalling and Traffic Management Working Group to develop ATM service protocols. David Su is the CSL principal.

Corporation for Open Systems (COS)

CSL participates in a variety of activities sponsored by COS. James Burrows serves as a member of the COS Board of Directors and the Executive Board. CSL staff members also participate in COS Executive Interest Groups (EIGs) in areas such as networking and telecommunications.

Electronic Messaging Association (EMA)

CSL participates in the permanent working committees and conference activities of this organization in three areas: electronic commerce, electronic mail, and directory services. EMA advances the deployment of these and other technologies throughout government and industry. Industry participants include the Exxon Corporation, MCI Communications Corporation, Hewlett-Packard, GE Information Services, American Express, Lotus Development Corporation, SETA Corporation, AT&T EasyLink Services, Bellcore, Bellsouth Advanced Networks, American Petroleum Institute, The Boeing Company, National Semiconductor, MITRE Corporation, Northern Telecom, Unisys Corporation, Control Data Systems, Inc., Digital Equipment Corporation, and many others. Steve Trus is the CSL contact.

IDEF Users Group

In developing the Integration Definition for Function Modeling (IDEFO, FIPS 183) and the Integration Definition for Information Modeling (IDEF1X, FIPS 184) standards, CSL worked closely with the IDEF Users Group, a non-profit association established to support users' requirements and provide capabilities of enterprise systems integration methods. The group provides a forum for the interchange of ideas and experiences in the use of integration modeling methods, related software tools and techniques, and the identification of potential solutions that add value and efficiency to business modernization initiatives. CSL will continue to work closely with industry to expand the coverage of the IDEF modeling technologies over a larger portion of the system development life cycle. Bruce Rosen is the CSL principal.

Internet Society

CSL is a member of the Internet Society, an international organization which promotes the exchange of information about the evolution and use of Internet technology, further growth of the global Internet and related private networks, and other activities of interest to its membership. The principal CSL contact is Anastase Nakassis. CSL contributes to the technical development of the Internet through its participation in the Internet Engineering Task Force (IETF). The IETF develops standards for internetwork technology and for evolving the Internet Protocol Next Generation (IPng). The principal contact for the IETF is Richard Colella. Additionally, Doug Montgomery chairs the IETF technical group working on integrated interdomain-system-to-interdomain-system (IS-IS) activities and Rob Glenn is the editor of the specification for Internet security.

Network Management Forum (NMF)

CSL works with industry consortia to ensure that the developing OMNI*Point* specifications, defined by the Open Management Roadmap partnership, address the full range of network management requirements. Released in Fall 1992, OMNI*Point* 1 is the first in a series of incremental specifications intended to provide a common approach to the integration and management of diverse technologies. To further this process, CSL continues to lead efforts in developing standards and implementors agreements for key areas of network management, including security, performance, and conformance. Fran Nielsen serves as Secretary of the User Advisory Council of the Open Management Roadmap and is the CSL participant in the NMF.

NII Testbed Consortium (NIIT)

NIST holds membership in the NIIT consortium, an industry, government, and academia collaboration to develop an advanced, nationwide information testbed that will deliver applications to solve real-world problems. Application Working Groups include Healthcare, Earth and Environmental Sciences, Electronic Commerce, Astrophysics, and Manufacturing. The NIST Concurrent Engineering project is a five-year project that will use currently available high performance computing and communication (HPCC) technologies to develop a platform capable of demonstrating the practical uses of HPCC technologies in concurrent engineering. CSL's participation in the consortium ensures that the NIST Concurrent Engineering project will be closely linked with industry efforts to focus on actual industry needs and to ensure maximum benefit from the NIST efforts. Shukri Wakid is the principal NIST participant.

Open Software Foundation (OSF)

The OSF is an international organization dedicated to the development and delivery of an open, portable software environment to which vendors and users have equal input and access. CSL has had a close but informal relationship with this organization over the last several years, attending and contributing to OSF forums. OSF efforts address the CSL program need for portability, interoperability, and scalability. The organization has made their Distributed Computing Environment (DCE) technology available for use in CSL's Distributed

Systems Engineering laboratory. Fritz Schulz is the principal CSL participant in interactions with the Open Software Foundation.

Society for Information Display (SID)

This worldwide professional society and forum is committed exclusively to the advancement of information display technologies. Membership in SID entitles CSL to participated in SID-sponsored symposia, seminars, and access to SID publications. Mark Williamson is the principal contact.

Software Engineering Institute (SEI)

Established by Congress in 1984, the SEI is a research and development center with a broad charter to address the transition of software engineering technology. CSL has established a memorandum of understanding (MOU) with SEI to work collaboratively on software engineering issues of mutual interest. Under this agreement, the Software Engineering Group of the Systems and Software Engineering Division and SEI are working together to address issues and develop standards for integrated software engineering environments. SEI is also participating with CSL in the formation of the Center for High Integrity Software Systems Assurance. Roger Martin, the principal CSL contact for the MOU, serves on SEI's Educational Products Advisory Board with representatives from Texas Instruments, AT&T, Carnegie Mellon University, Rochester Institute of Technology, and the Department of the Army.

Video Electronics Standards Association (VESA) Special Interest Group (SIG) on Flat Panel Displays

CSL's Workshop on the Computer Interface to Flat Panel Displays, held in San Jose, California, in January 1994, resulted in a consensus to form a VESA SIG to undertake the development of a standard or series of standards for the interface between a flat panel display and its controller. This interface standard will address both active and passive flat panel displays in integrated devices, and will cover both the electrical and the mechanical specifications. As a full member of VESA, CSL will participate in the technical development of standards and will also develop laboratory implementations of proposed interface architectures and by developing laboratory metrics. The CSL contact is Mark Williamson.

Virtual Library Consortium

CSL created a Virtual Library Consortium of industry and academic participants to pursue joint research and development activities related to virtual libraries. One hundred twenty-three interested parties responded to the virtual library consortium announcement in the Federal Register. Forty-three responses were from institutions or agencies that have done or continue to do research and development efforts related to virtual libraries. The other responses were requests to keep respondents informed of our progress. CSL will meet with all respondents by mid-1995 and determine the applicability of ongoing work in academia and industry to the NIST virtual library project. Lawrence Welsch is the principal contact.

X/OPEN

X/Open provides a forum for vendors to discuss and establish consensus on open system specifications. CSL has been a member of the X/OPEN User Council for several years. We have also worked closely with them in the development of conformance testing technology for information systems. Roger Martin is the principal most closely involved in this interaction.

COLLABORATION WITH GOVERNMENT, INDUSTRY, AND ACADEMIA

In FY 1994, CSL collaborated with many agencies and organizations in government, industry, and academia, some of which supported CSL research through funding or the loan of equipment or software.

Federal Agencies

Department of Defense
- Advanced Research Projects Agency
- Air Force Cryptologic Support Center
- Air Force, Scott Air Force Base
- Air Force, Wright Patterson Air Force Base
- Army Corps of Engineers
- Army, Ft. Belvoir, Virginia
- Army Research Institute
- Central Intelligence Agency
- Continuous Acquisition and Life-Cycle Support (CALS)
- Defense Finance Accounting Service
- Defense Information Systems Agency
- Defense Logistics Agency
- Department of the Air Force
- Department of the Army
- Department of the Navy
- National Security Agency
- Naval Command, Control and Ocean Surveillance Center
- Naval Research Laboratory
- Naval Surface Warfare Center, Dahlgren Division
- Navy, HRO CC
- Navy Next Generation Computer Resources
- Office of Naval Research
- Office of the Secretary of Defense

Department of Agriculture
Department of Commerce (DoC), Bureau of the Census
DoC National Telecommunications and Information Administration
DoC National Oceanic and Atmospheric Administration
DoC Office of Financial Management
DoC, U.S. & Foreign Commercial Service
Department of Education
Department of Health and Human Services
Department of Health and Human Services, Health Care Financing Administration
Department of Interior, U.S. Geological Survey
Department of Justice, Federal Bureau of Investigation
Department of State
Department of the Treasury
Department of the Treasury, Internal Revenue Service

Federal Agencies (continued)

Department of Veterans Affairs
Environmental Protection Agency
General Services Administration
National Aeronautics and Space Administration
National Archives and Records Administration
National Science Foundation
Nuclear Regulatory Commission
U.S. Postal Service

Industry

ADB, Inc.
Adobe
Aerospace Corporation
AHK & Associates
American Computer & Electronics Corporation
AT&T Bell Laboratories
AT&T Network Services
BBN
Bell Atlantic
Bellcore
Bell Northern INRS, Montreal, Canada
Boeing
Cadkey, Inc.
Computer Sciences Corporation
COMSAT Corporation
CTA, Inc.
DGM&S
Digital Equipment Corporation
Dragon Systems
Eastman Kodak Company
Electronic Data Systems Corporation
Enterprise Integration Technologies, Inc.
Fujitsu Networks Industry
Gandalf
General Datacomm, Inc.
General Electric
GTE
Harris Corporation
Hayes Microcomputer Products, Inc.
Hewlett-Packard
HFSI
Honeywell
IBM Corporation
Idacom Hewlett-Packard, Canada

Industry (continued)

Informix
InteCom, Inc.
Intel Corporation
Logicon
Loral Corporation
Loral Federal Systems
Lotus
Martin Marietta Corporation
McDonald Douglas
Microsoft
MITRE Corporation
Mobil Oil
Motorola
NCR
Network Communications Corporation
Northern Telecom, Inc.
NYNEX
Oracle
QUBA, Inc.
RLR Resources
Siemens Stromberg-Carlson
Silicon Graphics
Southwestern Bell Telephone Company
SRI International
Sun Microsystems
Sybase
Symbolic Systems, Inc.
Syscon, Inc.
TASC
Tekelec
Teleos Communications, Inc.
Texas Instruments
Union Switch & Signal
Unisys
U S WEST
X/Open Company, Ltd.

Academia

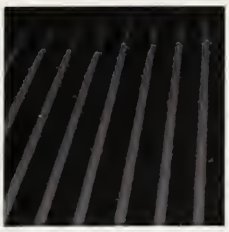
Boston University
California Institute of Technology, Jet Propulsion Laboratory
Carnegie-Mellon University
Carnegie-Mellon University, Software Engineering Institute
Catholic University
Cornell University

Academia (continued)

George Mason University
George Washington University
Johns Hopkins University
Massachusetts Institute of Technology
Mississippi State University
Michigan State University
Rutgers University
University of Greenwich
University of Leeds, U.K.
University of Maryland
University of Pennsylvania, Linguistic Data Consortium
University of Southern California, Information Sciences Institute
University of Texas
University of Virginia
West Virginia University

Other

Airline Transport Association
Canadian Government
CCTA, UK Government
Computer Logic R&D, Greece
Ecole Nationale Superieure de Telecommunication
Electronics and Telecommunications Research Institute, South Korea
Institut National de Telecommunication
Institute for Genomic Research
INTAP, Japanese Government Agency
Istituto Italiano del Marchio, Italy
Korea Telecommunications Research Laboratories, South Korea
National Computing Center, UK
Open GIS Foundation
Open System Foundation
Taiwan



COOPERATIVE RESEARCH & DEVELOPMENT AGREEMENTS (CRDAs)

FY 1994

RESEARCH PARTNER	*PROJECT*
Integrated Services Digital Network (ISDN)	
AHK & Associates	North American ISDN Users' Forum (NIUF)
American Computer & Electronics Corporation	NIUF
Ameritech Services	NIUF
AT&T Bell Laboratories	NIUF
Bell Atlantic	NIUF
Bell Communications Research	NIUF
Chase Research	NIUF
Defense Communication Agency	NIUF
Department of the Navy	NIUF
Electronic Data Systems Corporation	NIUF
Fujitsu Networks Industry, Inc.	NIUF
General DataComm, Inc.	NIUF
Hayes Microcomputer Products, Inc.	NIUF
InteCom, Inc.	NIUF
International Business Machines Corporation	NIUF
National Aeronautics and Space Administration (NASA)	NIUF
Network Communications Corporation	NIUF
North Carolina State University	NIUF
Northern Telecom, Inc.	NIUF
NYNEX	NIUF
RLR Resources	NIUF
Siemens Stromberg-Carlson	NIUF
Southwestern Bell Telephone Company	NIUF
TASC (The Analytical Sciences Corporation)	NIUF
U.S. Air Force, Technology Integration Center	NIUF
U S WEST	NIUF
Unisys Corporation	NIUF
West Virginia University	NIUF
COMSAT Corporation	Test and Demonstrate ISDN Protocols and Services

Enterprise Integration	
Enterprise Integration Technologies Corp.	Develop Software and Services for Electronic Commerce on the Internet
Database	
Innovative Technology & Engineering Corp.	Test and Evaluation of "Object Database" Features
Software Standards Validation	
Washington Software Technologies, Inc.	Basic Test Suite
Document Interchange	
Adobe Systems Incorporated	Postscript Language, PDF Format and Acrobat Software Review
Speech Recognition Research	
Linguistic Data Consortium	Corpora to Support Human Language Technology Research

GUEST RESEARCHERS
FY 1994

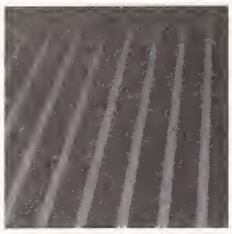
Guest Scientists and Research Associates **52**

Organizations represented include:

Armament Development Authority, Rafael, Israel
Bellcore, Livingston, New Jersey
Centre de Recherche en Informatique de Nancy, France
Ecole Normale Superieure, France
Electronics and Telecommunications Research Institute, Korea
Environmental Protection Agency
George Washington University, Washington, D.C.
Imperial College of Science and Technology, United Kingdom
Institute of Geology, Beijing, People's Republic of China
Institut National des Telecommunications, France
Institut Universitaire de Technologies of Metz, France
Ministry of Communications, Taiwan
National Science Foundation, Washington, D.C.
Northeast University of Technology, People's Republic of China
Quality One Softworks Corporation, Annandale, Virginia
Space Science and Technology Center, People's Republic of China
Syracuse University, Syracuse, New York
Telecom, Paris, France
University of Manchester, United Kingdom
University of Maryland, Baltimore, Maryland
University of Southern California
University of Twente, The Netherlands

Faculty Appointments **10**

Iowa State University
University of the District of Columbia
University of Maryland
University of Pittsburgh



PATENTS
FY 1994

Pending

Optical Faust Memory, Charles Wilson

Optical Image Feature Extraction, Charles Wilson and James Blue

Topological Optimization of Neural Networks, Charles Wilson

Serial/Parallel Correlator for Words or Phrases, Jon Geist

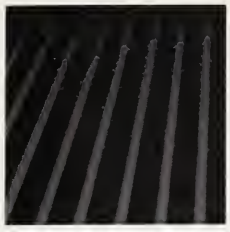
(CURL) Correlated Run Length Method for Detecting Form Structure Within Digitized Documents, Michael Garris

Multiple Memory Self-Organizing Pattern Recognition Network, Charles Wilson

Grayscale Correlated Run Length Method For Detecting Form Structure Within Digitized Documents, Michael Garris

Active Issued Patents

Object/Anti-Object Neural Network Segmentation, Charles Wilson, Michael Garris, and R. Wilkinson, issued September 14, 1993.



NIST PUBLICATIONS

NIST COMPUTER SYSTEMS TECHNOLOGY SERIES

FY 1992 - FY 1994

NIST SPEC. PUB. TITLE

500-192 Government Open Systems Interconnection Profile Users' Guide, Version 2
By Tim Boland
October 1991 SN003-003-03119-4 $9.50

500-193 Software Reengineering: A Case Study and Lessons Learned
By Mary K. Ruhl and Mary T. Gunn
September 1991 SN003-003-03100-3 $2.25

500-194 ISDN Conformance Testing, Layer 1--Physical Layer, Part 1--Basic Rate S/T Interface, User Side
Shukri A. Wakid and Kathleen M. Roberts, Editors
September 1991 PB92-102201 $19.00

500-195 North American ISDN Users' Forum Agreements on Integrated Services Digital Network
Shukri A. Wakid and Kathleen M. Roberts, Editors
September 1991 PB92-102219 $26.00

500-196 Guidelines for the Evaluation of File Transfer, Access and Management Implementations
By Paul Markovitz, Steven A. Trus, and Curtis Royster
October 1991 PB92-126580 $19.50

500-197 Guide to Schema and Schema Extensibility
Bruce K. Rosen and Isabella des Fontaines
November 1991 PB92-126556 $17.00

500-198 Monitoring and Reporting Techniques for Error Rate and Error Distribution in Optical Disk Systems
By Fernando L. Podio
October 1991 PB92-123124 $19.50

500-199 The 3480 Type Tape Cartridge: Potential Data Storage Risks, and Care and Handling Procedures to Minimize Risks
By Mark Williamson
November 1991 PB92-126549 $19.50

500-200 Development of a Testing Methodology to Predict Optical Disk Life Expectancy Values
By Fernando L. Podio
December 1991 PB92-137538 $19.50

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PB numbers - stocked by NTIS

NIST SPEC. PUB	TITLE		
500-201	Reference Model for Frameworks of Software Engineering Environments Prepared Jointly by NIST and the European Computer Manufacturers Association (ECMA) December 1991	PB92-158328	$26.00
500-202	Stable Implementation Agreements for Open Systems Interconnection Protocols, Version 5, Edition 1, December 1991 December 1991	PB92-164508	$147.00
500-203	Conformance Test Specifications for COBOL Intrinsic Function Module By Carmelo Montanez-Rivera and L. Arnold Johnson July 1992	PB92-229178	$27.00
500-204	High Integrity Software Standards and Guidelines By Dolores R. Wallace, Laura M. Ippolito, and D. Richard Kuhn September 1992	PB93-114619	$27.00
500-205	Guidelines for the Evaluation of Virtual Terminal Implementations By Carol A. Edgar November 1992	PB93-139053	$19.50
500-206	Stable Implementation Agreements for Open Systems Interconnection Protocols, Version 6, Edition 1, December 1992 (superseded by SP 500-214) Tim Boland, Workshop Chairman; Brenda Gray, Workshop Editor December 1992	PB93-166809	$147.00
500-207	The First Text Retrieval Conference (TREC-1) By Donna K. Harman November 1992	PB93-191641	$61.00
500-208	Manual for Data Administration Judith J. Newton and Daniel C. Wahl, Editors March 1993	PB93-182053	$27.00
500-209	Software Error Analysis By Wendy W. Peng and Dolores R. Wallace March 1993	PB93-200871	$27.00
500-210	Application Portability Profile, The U.S. Government's Open System Environment Profile OSE/1 Version 2.0 June 1993	PB93-216943	$27.00

SN numbers - stocked by GPO
PB numbers - stocked by NTIS

NIST SPEC. PUB	TITLE		
500-211	Reference Model for Frameworks of Software Engineering Environments (supersedes SP 500-201) Prepared jointly by NIST and the European Computer Manufacturers Association (ECMA) August 1993	PB94-112497	$27.00
500-212	Planning for the Fiber Distributed Data Interface (FDDI) By William E. Burr October 1993	PB94-135761	$27.00
500-213	Next Generation Computer Resources: Reference Model for Project Support Environments (Version 2.0) (CMU/SEI-93-TR-23) Alan Brown, David Carney, Patricia Oberndorf, and Marvin Zelkowitz, Editors November 1993	PB94-143401	$27.00
500-214	Stable Implementation Agreements for Open Systems Interconnection Protocols, Version 7, Edition 1, December 1993 (supersedes NIST SP 500-206) Albert Landberg, Workshop Chairman; Brenda Gray, Workshop Editor December 1993	Available on CD-ROM at (202) 371-1013.	
500-215	The Second Text Retrieval Conference (TREC-2) D. K. Harman, Editor March 1994	PB94-178407	$52.00
500-216	Proceedings of the Digital Systems Reliability and Nuclear Safety Workshop (NUREG/CP-0136) D.R. Wallace, B.B. Cuthill, L.M. Ippolito, and L. Beltracchi, Editors March 1994	SN003-003-03254-9	$23.00
500-217	IGOSS-Industry/Government Open Systems Specifications, Version 1 Gerard Mulvenna, Editor May 1994	SN003-003-03269-7	$8.00
500-218	Analyzing Electronic Commerce By Len Gebase and Steve Trus June 1994	SN003-003-03270-1	$3.00
500-219	Report of the NIST Workshop on the Computer Interface to Flat Panel Displays By M.P. Williamson, W.E. Burr, and J.W. Roberts August 1994	SN003-003-03289-1	$14.00
500-220	Guide on Open System Environment (OSE) Procurements By Gary Fisher October 1994	SN003-003-03302-2	$11.00

SN numbers - stocked by GPO
PB numbers - stocked by NTIS

NIST COMPUTER SECURITY SERIES

FY 1991 - 1994

NIST SPEC. PUB. TITLE

800-1 Computer Security in the 1980s: Selected Bibliography
Rein Turn, Compiler, and Lawrence E. Bassham, Editor
December 1990 PB91-148486 $36.50

800-2 Public-Key Cryptography
By James Nechvatal
April 1991 PB91-187864 $27.00

800-3 Establishing a Computer Security Incident Response Capability (CSIRC)
By John P. Wack
November 1991 PB92-123140 $17.00

800-4 Computer Security Considerations in Federal Procurements: A Guide for Procurement Initiators, Contracting Officers, and Computer Security Officials
By Barbara Guttman
March 1992 SN003-003-03147-0 $6.00

800-5 A Guide to the Selection of Anti-Virus Tools and Techniques
By W. Timothy Polk and Lawrence E. Bassham
December 1992 PB93-152049 $17.50

800-6 Automated Tools for Testing Computer System Vulnerability
By W. Timothy Polk
December 1992 SN003-003-03187-9 $3.25

800-7 Security in Open Systems
By R. Bagwill, J. Barkley, L. Carnahan, S. Chang, R. Kuhn, P. Markovitz, A. Nakassis, K. Olsen, M. Ransom, and J. Wack; John Barkley, Editor
July 1994 SN003-003-03276-0 $19.00

800-8 Security Issues in the Database Language SQL
By W. Timothy Polk and Lawrence E. Bassham
August 1993 SN003-003-03225-5 $3.25

800-9 Good Security Practices for Electronic Commerce Including Electronic Data Interchange
Roy G. Saltman, Editor
December 1993 SN003-003-03243-3 $4.50

SN numbers - stocked by GPO
PB numbers - stocked by NTIS

NIST INTEGRATED SERVICES DIGITAL NETWORK TECHNOLOGY SERIES

FY 1992 - FY 1994

NIST SPEC. PUB. TITLE

823-1 Overview of Integrated Services Digital Network Conformance Testing
Leslie A. Collica, Kathleen M. Roberts, and David Su
March 1992 PB92-181015 $17.50

823-2 Integrated Services Digital Network Conformance Testing, Layer 1 -- Physical Layer, Part 2 -- Basic Rate U Interface, User Side
Daniel P. Stokesberry and Kathleen M. Roberts, Editors
March 1992 PB92-181114 $19.50

823-3 North American Integrated Services Digital Network Users' Forum Agreements on ISDN
Daniel P. Stokesberry, Kathleen M. Roberts, and Tish Antonishek, Editors
January 1993 PB93-173391 $36.50

823-4 Integrated Services Digital Network Conformance Testing, Layer 2--Data Link Layer (LAPD), Part 1--Basic Rate Interface, User Side
Daniel P. Stokesberry, Leslie Collica, and Kathleen M. Roberts, Editors
September 1993 PB94-162559 $44.50

823-5 North American ISDN Users' Forum Agreements on Integrated Services Digital Network
Daniel P. Stokesberry and Tish A. Antonishek, Editors
March 1994 SN003-003-03248-4 $23.00

823-6 ISDN Conformance Testing Guidelines - Guidelines for Implementors of ISDN Customers Premise Equipment to Conform to Both National ISDN-1 and North American ISDN Users' Forum; Layer 3, Basic Rate Interface, Basic Call Control; Abstract Test Suites
Leslie A. Collica and Dawn Hoffman, Editors
July 1994 SN003-003-03278-6 $2.50

SN numbers - stocked by GPO
PB numbers - stocked by NTIS

NIST SPECIAL PUBLICATIONS

NIST SPEC. PUB. TITLE

857 Putting the Information Infrastructure to Work: Report of the Information Infrastructure Task Force Committee on Applications and Technology
Office of the Director, NIST; Kathleen Roberts, Editor
May 1994 SN003-003-03267-1 $7.00

868 The Information Infrastructure: Reaching Society's Goals
Office of the Director, NIST; Kathleen Roberts, Editor
September 1994 SN003-003-03283-2 $11.00

SN numbers - stocked by GPO
PB numbers - stocked by NTIS

CURRENT CSL BULLETINS

Wack, J; Kurzban, S.; **Computer Virus Attacks**. August 1990

Roback, E.; **Computer Security Roles of NIST and NSA**. February 1991

Saltman, R.; **Security Issues in the Use of Electronic Data Interchange**. June 1991

Boland, T.; **File Transfer, Access and Management**. July 1991

Lennon, E.; **The NIST POSIX Testing Program**. October 1991

Dray, J.; **Advanced Authentication Technology**. November 1991

Wack, J.; **Establishing a Computer Security Incident Response Capability**. February 1992

Branstad, D.; **An Introduction to Secure Telephone Terminals**. Mar 1992

Roback, E.; **Disposition of Sensitive Automated Information**. Oct 1992

Roback, E.; **Sensitivity of Information**. November 1992

Radack, S.; **Using Information Technology Standards in Federal Acquisitions**. December 1992

Radack, S.; **Guidance on the Legality of Keystroke Monitoring**. Mar 1993

Skall, M.; Rosenthal, L.; **The NIST Graphics Testing Program**. Apr 1993

Roback, E.; Guttman, B.; **Security Issues in Public Access Systems**. May 1993

Wack, J.; **Connecting to the Internet: Security Considerations**. July 1993

Guttman, B.; Roback, E.; **Security Program Management**. August 1993

Roback, E.; Guttman, B.; **People: An Important Asset in Computer Security**. October 1993

Roback, E.; Guttman, B.; **Computer Security Policy: Setting the Stage for Success**. January 1994

Guttman, B.; Roback, E.; Lennon, E.; **Threats to Computer Systems: An Overview**. March 1994

Barkley, John F.; **Reducing the Risks of Internet Connection and Use**. May 1994

Dodson, D.; Roback, E.; Lennon, E.; **Digital Signature Standard**. November 1994

OTHER NIST PUBLICATIONS

FY 1992 - FY 1994

PUB. NUMBER	TITLE
NISTIR 4681	On the Interchangeability of SGML and ODA By Charles K. Nicholas and Lawrence A. Welsch January 1992 PB92-149830 $17.00
NISTIR 4688	Prototyping the IRDS: An Airport Application By Anthony P. Sani and Henry Tom October 1991 PB92-112580 $26.00
NISTIR 4703	Technology Integration Workshop: Selected Papers Henry Tom, Editor October 1991 PB92-158278 $26.00
NISTIR 4734	Foundations of a Security Policy for Use of the National Research and Educational Network By Arthur E. Oldehoeft February 1992 PB92-172030 $19.00
NISTIR 4737	Operating Principles of MULTIKRON Performance Instrumentation for MIMD Computers By Alan Mink and Robert J. Carpenter March 1992 PB92-181072 $17.00
NISTIR 4739	Validated Processor List 1992, No. 1 (supersedes NISTIR 4690) Judy B. Kailey, Editor January 1992 PB92-937301 $19.00
NISTIR 4743	Requirements and Recommendations for STEP Conformance Testing Sharon J. Kemmerer, Editor Revised June 1992 PB92-213503 $19.00
NISTIR 4749	Sample Statements of Work for Federal Computer Security Services: For Use In-House or Contracting Out Dennis M. Gilbert, Project Leader Nickilyn Lynch, Editor December 1991 PB92-148261 $19.00
NISTIR 4750	Massively Parallel Implementation of Character Recognition Systems By M.D. Garris, C.L. Wilson, J.L. Blue, G.T. Candela, P. Grother, S. Janet, and R.A. Wilkinson January 1992 PB92-149863 $17.00

SN numbers - stocked by GPO
PB numbers - stocked by NTIS

NIST SPEC. PUB	TITLE
NISTIR 4759	Annual Report 1991 Computer Systems Laboratory Elizabeth B. Lennon, Shirley M. Radack, and Ramona Roach December 1991 PB92-172709 $19.00
NISTIR 4766	Optimization of Neural Network Topology and Information Content Using Boltzmann Methods By Charles L. Wilson and Omid M. Omidvar February 1992 PB92-205418 $17.00
NISTIR 4774	A Review of U.S. and European Security Evaluation Criteria By Charles R. Dinkel March 1992 PB92-172022 $17.00
NISTIR 4775	Incorporating CALS Requirements into the CGM Standard and the CALS Application Profile - MIL-D-28003 By Daniel R. Benigni February 1992 PB93-118123 $44.50
NISTIR 4776	Training Feed Forward Neural Networks Using Conjugate Gradients By J.L. Blue and P.J. Grother February 1992 PB92-171990 $17.00
NISTIR 4780	Guide for Specifying and Building CITIS with Data Management Standards Leonard J. Gallagher, Joan M. Sullivan, and Joseph C. Collica February 1992 PB92-172725 $17.00
NISTIR 4792	A Formal Description of the SDNS Security Protocol at Layer 4 (SP4) By Wayne A. Jansen March 1992 PB92-172816 $26.00
NISTIR 4800	An Overview of the Document Style Semantics and Specification Language and the MIL-M-28001A Output Specification By Ronald B. Wilson March 1992 PB92-181122 $17.00
NISTIR 4805	FAUST: A Vision-Based Neural Network Multi-Map Pattern Recognition Architecture By Charles L. Wilson March 1992 PB92-181064 $17.00
NISTIR 4806	Procedures Manual for Testing CGM Generator Products That Claim Conformance to FIPS 128 and MIL-D-28003 Daniel R. Benigni, Editor March 1992 PB92-181155 $26.00

SN numbers - stocked by GPO
PB numbers - stocked by NTIS

NIST SPEC. PUB	TITLE		
NISTIR 4816	PBX Administrator's Security Standards, Developed by the Federal Deposit Insurance Corporation Edward Roback, NIST Coordinator April 1992	PB92-187152	$17.00
NISTIR 4820	Validated Products List 1992 No. 2 (supersedes NISTIR 4739) Judy B. Kailey, Editor April 1992	PB92-937302	$26.00
NISTIR 4824	Karhunen Loeve Feature Extraction for Neural Handwritten Character Recognition By Patrick J. Grother April 1992	PB92-187111	$17.00
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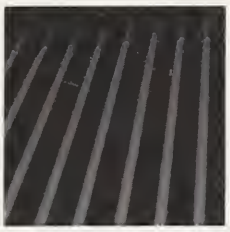

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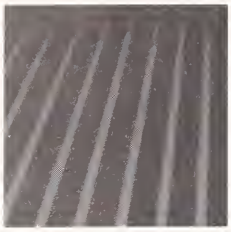


CONFERENCES AND WORKSHOPS

October 1993 - December 1994

1993

October 18-22 — North American ISDN Users' Forum (NIUF) - Meeting three times a year, this forum of ISDN users and implementors was attended by 175 industry and government organizations.

October 29 — Lecture Series on High Integrity Systems - Regular lecture series attended by 100 industry and government representatives.

November 1-5 — Second International Conference on Information and Knowledge Management (CIKM-93) - Annual conference attended by 200 academic and industry participants.

November 16-17 — Applications Portability Profile/Open Systems Environment (APP/OSE) Users' Forum - Semi-annual workshop attended by 150 government and industry users.

November 30 — Computer Security Day - Computer security awareness events presented to 2,600 NIST staff members.

December 6-10 — OSE Implementors' Workshop (OIW) (cosponsored by the IEEE Computer Society) - Quarterly forum attended by 190 industry and government representatives.

December 16 — Lecture Series on High Integrity Systems - Regular lecture series attended by 100 industry and government representatives.

1994

January 11 — Lecture Series on High Integrity Systems - Regular lecture series attended by 100 industry and government representatives.

January 12-13 — NIST Workshop on the Computer Interface to Flat Panel Displays - Workshop attended by 60 flat panel display manufacturers, vendors, industry and government users to ascertain need for standards.

January 18-20 — Federal Wireless Users' Forum (FWUF) (cosponsored by National Communications System) - An ongoing forum held three times per year which attracts about 250 federal and industry wireless users.

February 1 — Advanced Software Technology Requirements - A CSL-sponsored workshop for software industry executives to discuss technologies needed for the National Information Infrastructure.

February 7-11 — NIUF - Meeting three times a year, this forum of ISDN users and implementors was attended by 214 industry and government organizations.

February 22-23 Federal Information Systems Security Educators' Association (FISSEA) Conference - The annual meeting of this educators group attracts about 150 people from government, industry, and academia.

March 8 Lecture Series on High Integrity Systems - Regular lecture series attended by 100 industry and government representatives.

March 14-18 OIW (cosponsored by the IEEE Computer Society) - Quarterly forum attended by 190 industry and government representatives.

March 15-16 International Workshop on Harmonizing Conformance Testing for Programming Language and Graphics Standards - Seventh in a series of international workshops on harmonizing validation procedures attended by representatives of the United Kingdom, France, and the U.S.

May 10 Lecture Series on High Integrity Systems - Regular lecture series attended by 100 industry and government representatives.

May 11-12 APP/OSE Users' Forum - Semi-annual workshop attended by 150 government and industry users.

May 17-18 7th Annual Data Administration Management Association (DAMA) Symposium - Annual symposium for about 180 industry and government data administrators.

June 1 Good Security Practices for Electronic Commerce, Including Electronic Data Interchange (cosponsored by Office of Management and Budget) - A one-day seminar for 160 representatives of the federal electronic commerce community.

June 7-9 FWUF (cosponsored by National Communication System) - An ongoing forum held three times per year which attracts about 250 federal and industry wireless users.

June 13-17 OIW (cosponsored by the IEEE Computer Society) - Quarterly forum attended by 160 industry and government representatives.

June 15-16 Workshop on Standards Development and the National Information Infrastructure (cosponsored by Harvard University and the Information Infrastructure Task Force) - An invitational workshop on standards development and the planned National Information Infrastructure.

June 16-17 International Invitational Workshop on Developmental Assurance (cosponsored by National Security Agency and the European Commission & Communications Security Establishment) - Attended by 98 invited participants representing users, vendors, evaluators, and integrators of computer security products.

June 20-24 NIUF - Meeting three times a year, this forum of ISDN users and implementors was attended by 168 industry and government organizations.

June 27-July 1	COMPASS '94 (cosponsored by IEEE Aerospace and Electronic Systems Society and IEEE National Capital Area Council)
July 19-21	International Risk Management Workshop - Sixth in a series of international workshops dedicated to improving risk analysis and risk management techniques, this workshop attracted 27 participants from six countries.
August 2-3	Second Common Authentication Architecture (CAA) Workshop - Annual meeting of 30 industry and federal participants working to develop a CAA.
August 17	Key Escrow Workshop - Second in a series of workshops on key escrow issues, this workshop attracted 65 participants from industry and government.
August 25-26	Information Systems Security...and You - A one-day training course, given on two consecutive days, attended by 40 federal managers and contractors.
September 12-16	OIW (cosponsored by IEEE Computer Society) - Quarterly forum attended by 140 industry and government representatives.
October 4-7	NIUF - Meeting three times a year, this forum of ISDN users and implementors was attended by 117 industry and government organizations.
October 5-7	FWUF (cosponsored by National Communications System) - An ongoing forum held three times per year and attracting about 250 federal and industry wireless users.
October 11-14	17th National Computer Security Conference (cosponsored by National Computer Security Center [NCSC]) - A major international conference attended by 2,000 industry and government representatives.
October 14	Healthcare Forum CRADA - An information seminar attended by 85 federal and industry healthcare professionals.
October 17	Lecture Series on High Integrity Systems - Regular lecture series attended by 100 industry and government representatives.
October 28	Connecting to the Internet - Training on Internet security for 75 federal employees.
October 31	Lecture Series on Applied Information Technology (cosponsored by Advanced Technology Program) - Regular lecture series on applied information technology topics attended by about 100 federal and industry representatives.
November 2-4	Third Text Retrieval Conference (TREC-3) (cosponsored by Advanced Research Projects Agency) - Forum for researchers in information retrieval attended by 140 industry representatives.
November 14	Lecture Series on High Integrity Systems - Regular lecture series attended by 100 industry and government representatives.

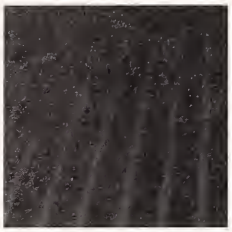
November 15	Connecting to the Internet - Training on Internet security for 75 federal employees.
November 15-16	APP/OSE Users' Forum - Semi-annual workshop attended by 150 government and industry users.
Nov 29-Dec 2	Third International Conference on Information and Knowledge Management (CIKM-94) - Annual conference attended by 200 industry and government participants.
November 30	Computer Security Day - Computer security awareness events presented to 2,600 NIST staff members.
December 12-16	OIW (cosponsored by IEEE Computer Society) - Quarterly forum attended by 100 industry and government representatives.
December 20	Lecture Series on Applied Information Technology (cosponsored by Advanced Technology Program) - Regular lecture series on applied information technology topics attended by about 100 federal and industry representatives.

PLANNED CONFERENCES AND WORKSHOPS

1995

January 9	Lecture Series on High Integrity Systems
January 24-26	FWUF (cosponsored by National Communications System)
January 27	Lecture Series on Applied Information Technology (cosponsored by Advanced Technology Program)
February 15-16	FISSEA
February 22	Lecture Series on Applied Information Technology (cosponsored by Advanced Technology Program)
Feb 28-March 3	NIUF
March 13-17	OIW (cosponsored by IEEE Computer Society)
March 22	Lecture Series on Applied Information Technology (cosponsored by Advanced Technology Program)
April 17	Lecture Series on High Integrity Systems
April 21	Lecture Series on Applied Information Technology (cosponsored by Advanced Technology Program)
May 9-11	APP/OSE Users' Forum
May 16-17	Eighth Annual DAMA Symposium
May 18	Lecture Series on Applied Information Technology (cosponsored by Advanced Technology Program)
May 22	Lecture Series on High Integrity Systems
May 23-25	FWUF (cosponsored by National Communications System)
June 5-9	NIUF
June 12-16	OIW (cosponsored by IEEE Computer Society)
June 21	Lecture Series on Applied Information Technology (cosponsored by Advanced Technology Program)
June 26-30	COMPASS '95 (cosponsored by IEEE Aerospace and Electronic Systems Society and IEEE National Capital Area Council)
July 20	Lecture Series on Applied Information Technology (cosponsored by Advanced Technology Program)

August 30	Lecture Series on Applied Information Technology (cosponsored by Advanced Technology Program)
September 11-15	OIW (cosponsored by IEEE Computer Society)
September 20	Lecture Series on Applied Information Technology (cosponsored by Advanced Technology Program)
October 10	Lecture Series on High Integrity Systems
October 11-14	18th National Computer Security Conference (cosponsored by NCSC)
October 24-26	FWUF (cosponsored by National Communications System)
November 1-3	Fourth Text Retrieval Conference (TREC-4) (cosponsored by Advanced Research Projects Agency)
November 7-8	APP/OSE Users' Forum
November 13-17	NIUF
November 28	Lecture Series on High Integrity Systems
December 11-15	OIW (cosponsored by IEEE Computer Society)



TALKS

During the past year, CSL staff members presented papers and gave talks to a large number of external organizations, including the following:

Advanced Research Projects Agency (ARPA)
Aerospace Industry Association
American Bankers Association
American Bar Association
American Electronics Association
American National Standards Institute (ANSI)
American Society for Industrial Security
America's Telecommunications Standards Symposium
Armed Forces Communications and Electronics Association (AFCEA)
Association for Computing Machinery (ACM)

Bell Atlantic

Cadkey Incorporated
Canadian Communications Security Establishment
Canadian Government Telecommunications Agency (GTA)
Canadian Interest Group for Open Systems (CIGOS)
COMPASS '94
Computer Integrated Manufacturing Conference
Continuous Acquisition and Life-Cycle Support (CALS) EXPO '94
Computer and Business Equipment Manufacturers Association (CBEMA)

Data Administration Management Association (DAMA)
Data Interchange Standards Association
Defense Information Systems Agency (DISA)
Department of Agriculture
Department of Defense
Department of Energy
Department of Health and Human Services
Department of Justice
Digital Sound Corporation
DI and Government Computer News Conference

EDP Auditors Association
Electronic Data Interchange National Conference
European ISDN Users' Forum
Eurosec '94 5th European Forum and IT Quality and Security

Federal Bureau of Investigation
Federal Government Industry Policy Council
Federal Government Mosaic Consortium
Federal Information Systems Security Educators' Association (FISSEA)
Federal Networking Council

Federal Wireless Users' Forum (FWUF)
Federation of Government Information Processing Councils
Fingerprint Image Analysis Workshop

Geographic Information & Spatial Data Exposition (GISDEX)
George Mason University
George Washington University
Goethe University Medical Center, Frankfurt on Main, Germany
Government Users' ISDN Security Conference

Harvard Law School
Hewlett-Packard

Independent Telephone Pioneer Association
Information Systems Security Association
Institute of Supercomputing Research of Japan
Institute of Electrical and Electronics Engineers (IEEE)
Integration Definition (IDEF) Language Users' Group
Intel
Intergovernmental Council of Information Processors
Internal Revenue Service (IRS)
International Data Administration Symposium
International Information Integrity Institute
International Security Symposium
International Security Systems Symposium

Johns Hopkins University

Library of Congress

MITRE Corporation

National Aeronautics and Space Administration
National Communications System
National Computer Security Conference
National Engineering Consortium
National Library of Medicine, Bethesda
NATO Conference on Affordable Communications and Information Systems Security
NCR Corporation
North American ISDN Users' Forum (NIUF)
Northeastern University
Nuclear Regulatory Commission

Office of Technology Assessment
Open Systems Environment (OSE) Implementors' Workshop (OIW)
Overseas Security Advisory Council

Patent and Trademark Office (PTO)

Research Institute of Telecommunications Transmission, China
RSA, Incorporated

Santa Barbara Industrial Association (SBIA)
SIGCAT '94
Social Security Administration (SSA)
Society of Logistics Engineers
Society of Naval Engineers
Software Engineering Institute
Smithsonian Seminar on Scientific Imaging
School of Engineering Institute National des Telecommunications, Evry, Cedex, France.
SQL Access Group
Symposium on Military Communication Networks

United States Customs Service
United States Postal Service
University of Hamburg, Germany
University of London
University of Maryland
University of Pittsburgh
University of New Castle

Weizmann Institute, Israel
Washington Area ISDN User Group

X/OPEN
XTRA '94 Federal Aviation Administration

ELECTRONIC PRODUCTS

Standard Reference Databases Developed by CSL

NIST Special Databases

NIST Binary Images of Printed Digits, Alphas, and Text	$ 895
NIST Structured Forms Reference Set of Binary Images (SFRS)	$ 250
NIST Binary Images of Handwritten Segmented Characters	$ 895
NIST 8-Bit Gray Scale Images of Fingerprint Image Groups	$ 250
NIST Structured Forms Reference Set of Binary Images II	$ 250
NIST Test Data 1: Binary Images of Handprinted Segmented Characters (TSTI)	$1000
NIST Machine-Print Database of Gray Scale and Binary Images (MPDB)	$1895
NIST Mated Fingerprint Card Pairs (Volumes 1-5)	each $ 750
NIST Supplemental Fingerprint Card Data (SFCD)	$ 750
NIST Mated Fingerprint Card Pairs 2 (MFCP2)	$ 750

NIST Special Software

NIST Scoring Package Release 1.0	$1150

To order, call the NIST Standard Reference Data office at (301) 975-2208.

Standard Reference Materials Developed by CSL

SRM Number	Description	Cost
3200	Magnetic Tape Cartridge	$1202
3201	Magnetic Tape Cartridge	$1172
3202	Magnetic Tape Cartridge	$ 897
3203	Magnetic Tape Cartridge	$1059
3204	Magnetic Tape Cartridge	$1100
3217	Magnetic Tape Cartridge	$1362
9529	Flexible Disk 90	$1262

To order, call the NIST Standard Reference Materials office at (301) 975-6776.

CD-ROMs and Optical Discs Developed by CSL

TITLE	NTIS ORDER NO.	PRICE
Darpa Air Travel Information System (ATISO) Read Versions of Spontaneous Data and Adaption Data	PB91-505362CCM	$ 600
Darpa Air Travel Information System (ATISO) Speaker-Dependent Training Data	PB91-505370CCM	$1400
Darpa Air Travel Information System (ATISO) Spontaneous Speech Pilot Corpus and Relational Database	PB91-505354CCM	$ 600
Darpa Resource Management Continuous Speech Database Speaker-Dependent Training Data	PB89-226666CCM	$ 400
Darpa Extended Resource Management Continuous Speech Speaker-Dependent Corpus (RM2)	PB90-501776CCM	$ 600
Darpa Timit Acoustic-Phonetic Continuous Speech Corpus	PB91-505065CCM	$ 100
NTIMIT Telephone Network Acoustic-Phonetic Continuous Speech Corpus	PB92-502087CCM	$ 250
Road Rally Conversational Speech Corpora	PB91-509802CCM	$ 500
TI 46-Word Speaker-Dependent Isolated Work Corpus, CD 7-1.1	PB91-509810CCM	$ 125

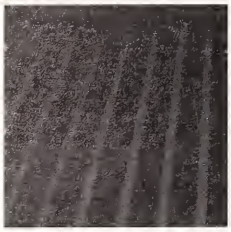
To order, call the National Technical Information Service (NTIS) at (703) 487-4650.

ARPA Continuous Speech Recognition Pilot Corpus (WSJ0)	NIST Speech Discs 11-1.1-11.12.1 (12 discs)	$2000
ARPA Multi-Site air Travel Information System (ATIS3) Corpora	NIST Speech Discs 17-1.1-17.3.1 (3 discs)	$5000
ARPA Air Traffic Control Corpus (ATC0)	NIST Speech Discs 16-1.1-16-8.1 (8 discs)	$5000
OGI Multi-Language Corpus	1 disc	$ 200
SPIDRE Speaker Identification Corpus	2 discs	$2500

To order, call the Linguistic Data consortium, University of Pennsylvania, at (215) 898-0464.

TITLE	NTIS ORDER NO.	PRICE
NIST Special Publication 500-214, Stable Implementation Agreements for Open Systems Interconnection Protocols	NIST SP 500-214	$ 15

To order, call the IEEE Computer Society at (202) 371-1013.



ELECTRONIC BULLETIN BOARDS

CSL operates three electronic bulletin boards for information exchange:

Computer Security Resource Clearinghouse (CSRC) (301) 948-5717

or type: ftp csrc.ncsl.nist.gov or 129.6.54.11
gopher csrc.ncsl.nist.gov or 129.6.54.11

To access the clearinghouse via an http client, such as Mosaic, use the following Uniform Resource Locator (URL):

http://csrc.ncsl.nist.gov/

To download CSRC files, Internet users can use ftp as follows:

Type ftp csrc.ncsl.nist.gov or ftp 129.6.54.11
Login to account anonymous, use Internet ID as password
CSRC files are located in directory pub

Information about data management (301) 948-2048
activities and applications and 948-2059

Information about the North American Integrated Services Digital Network (ISDN) Users' Forum (NIUF) (301) 869-7281

or telnet 129.6.53.11 on the Internet.

Dial Access

Users can reach the bulletin boards by dialing the numbers listed above. Terminals should have the following capabilities:

ASCII, 300, 1200, or 2400 baud, 8 bits with no parity or 7 bits with even parity, 1 stop bit.

If a connection is not established at the end of two rings or if the line is busy, hang up and try again.

After "CONNECT," strike the carriage return twice and the system will be accessed. The system will now guide you through the bulletin board by asking key questions and providing helpful menus.

ACCESSING INFORMATION ON VALIDATED PRODUCTS

CSL publishes a *Validated Products List* (VPL), a collection of registers describing 1,200 implementations of Federal Information Processing Standards (FIPS) that have been validated for conformance to FIPS. Updated quarterly, the list also contains information about the organizations, test methods, and procedures that support the validation programs.

The VPL contains conformance testing information for the following information technology standards: Programming Languages COBOL, Fortran, Ada, Pascal, C, and MUMPS; Database Language SQL; Graphics; GOSIP; POSIX; and Computer Security. Entries in the printed VPL are contained in WordPerfect, Version 5.1 files.

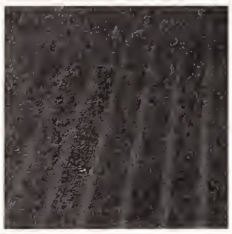
To access the VPL via the Internet:

Type: **ftp speckle.ncsl.nist.gov** (internet address is 129.6.59.2)
Login as user **ftp**
Type your e-mail address preceded by a dash (-) as the password
Type: **cd vpl**
Type: **binary**
Type: **get** and the name of the file you want, e.g. **language**

These entries are also available as DOS text files, through the World Wide Web using MOSAIC. Use one of the following instructions:

1. Open the file called: "http://speckle.ncsl.nist.gov/~kailey/intro.htm"

2. Open the file called: "ftp://speckle.ncsl.nist.gov/vpl/html/intro.htm"



USER GROUPS SPONSORED BY CSL

The **Open System Environment (OSE) Implementors' Workshop (OIW)**, co-sponsored by the IEEE Computer Society, meets four times a year to discuss detailed implementation specifications for OSE standards.

CONTACT: Albert Landberg
B-266 Technology Building
National Institute of Standards and Technology
Gaithersburg, MD 20899-0001
Telephone: (301) 975-2245
E-mail: landberg@micf.nist.gov

The joint **ISDN Users' Workshop and ISDN Implementors' Workshop of the North American ISDN Users' Forum (NIUF)** meets three times a year to address application requirements and to develop application profiles for ISDN products and services.

CONTACT: Sara Caswell
B-364 Materials Building
National Institute of Standards and Technology
Gaithersburg, MD 20899-0001
Telephone: (301) 975-2937
E-mail: sara@isdn.ncsl.nist.gov

The **Applications Portability Profile/Open System Environment (APP/OSE) Users' Forum** meets twice a year to identify federal requirements and to discuss the development of an architectural approach to applications portability in an open system environment.

CONTACT: Joe Hungate
B-266 Technology Building
National Institute of Standards and Technology
Gaithersburg, MD 20899-0001
Telephone: (301) 975-3368
E-mail: hungate@sst.ncsl.nist.gov

The **Federal Wireless Users' Forum**, co-sponsored by the National Communications System, meets three a year to provide information on wireless technology and capabilities, to identify the needs of federal users, and to address wireless communications issues.

CONTACT: Tish Antonishek
A-216 Technology Building
National Institute of Standards and Technology
Gaithersburg, MD 20899-0001
Telephone: (301) 975-2922
E-mail: tish@dsys.ncsl.nist.gov

FIPS PUBLICATIONS LIST BY FIPS NUMBER

1994 December

FIPS NO.	CATEGORY	TITLE-DATE	CHANGE NOTICES
0		"WITHDRAWN"	
1-2	(2&3)S	Code for Information Interchg., Its Representations, Subsets, and Extension (ANSI X3.4-1986/R1992, X3.32-1990, X3.41-1990) 84 Nov 14	1
2-1	(2)S]	Perforated Tape Code for Information Interchg. (ANSI X3.6-1965/R1983 & R1991) 84 Nov 14	
3-1	(2)S	"WITHDRAWN"	
4-1	(4)S	Representation for Calendar Date and Ordinal Date for Information Interchg. (ANSI X3.30-1985/R1991) 88 Jan 27	
5-2	(4)S	Codes for the Identification of the States, the District of Columbia and the Outlying Areas of the United States, and Associated Areas 87 May 28	1
6-4	(4)S	Counties and Equivalent Entities of the United States, Its Possessions, and Associated Areas 90 Aug 31	2
7		"WITHDRAWN"	
8-5	(4)S	Metropolitan Statistical Areas (MSAs) (Including CMSAs, PMSAs, and NECMAs) 84 Oct 31	6
9-1	(4)S	Congressional Districts of the U.S. 90 Nov 30	

***Approved in 1994**

Category Key: **(1)** General Publications **(2)** Hardware Standards/guidelines **(3)** Software Standards/guidelines **(4)** Data Standards/guidelines **(5)** Computer Security Standards/guidelines **(6)** ADP Operations Standards/guidelines **(7)** Telecommunications Standards

S-Standard **G**-Guideline **P**-Program Information Document

FIPS NO.	CATEGORY	TITLE-DATE	CHANGE NOTICES
10-3	(4)S	Countries, Dependencies, Areas of Special Sovereignty, and their Principal Admin. Divs. 84 Feb 9	15
11-3	(3)G	Guideline: American National Dictionary for Inform. Systems (ANSI X3.172-1990 & X3.172a-1992) 91 Feb 1	1
12-2		"WITHDRAWN"	
13	(2)S	Rectangular Holes in Twelve-Row Punched Cards (ANSI X3.21-1967/R1980 & R1991) 71 Oct 1	
14-1	(2)S	Hollerith Punched Card Code (ANSI X3.26-1980/R1991) 80 Dec 24	
15		"WITHDRAWN"	
16-1	(7)S	Bit Sequencing of Code for Information Interchg. in Serial-By-Bit Data Transmission (ANSI X3.15-1976/R1983 & R1990) 77 Sept 1	
17-1	(7)S	Character Structure and Char. Parity Sense for Serial-By-Bit Data Communication in the Code for Inform. Interchg. (ANSI X3.16-1976/R1983 & R1990) 77 Sept 01	
18-1		"WITHDRAWN"	
19-2	(4)G	Catalog of Widely Used Code Sets 92 July 1	
20		"WITHDRAWN"	
21-3	(3)S	COBOL (ANSI X3.23-1985 & X3.23A-1989) 90 Jan 12	2

***Approved in 1994**

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S-Standard **G**-Guideline **P**-Program Information Document

FIPS NO.	CATEGORY	TITLE-DATE	CHANGE NOTICES
22-1	(7)S	Synchronous Signaling Rates Between Data Terminal and Data Communication Equip. (ANSI X3.1-1976) 77 Sept 1	
23		"WITHDRAWN"	
24		"WITHDRAWN"	
25		"WITHDRAWN"	
26	(2)S	One-Inch Perforated Paper Tape for Information Interchg. (ANSI X3.18-1967/R1974, R1982, & R1990) 73 June 30	
27	(2)S	Take-Up Reels for One-Inch Perforated Tape for Information Interchg. (ANSI X3.20-1967/R1982 & R1990) 73 June 30	
28		"WITHDRAWN"	
29-3	(1&3)P	Interpretation Procedures for Federal Information Processing Standards for Software 92 Oct 29	
30		"WITHDRAWN"	
31	(5)G	Guidelines for Automatic Data Processing Physical Security and Risk Management 74 June --	
32-1	(2)S	Character Sets for Optical Char. Recognition (OCR) (ANSI X3.2-1970/R1976, X3.17-1981/R1989, X3.49-1975/R1982 & R1989) 82 June 25	
33-1	(2)S	Character Set for Handprinting (ANSI X3.45-1982/R1989) 84 Nov 5	

***Approved in 1994**

Category Key: **(1)** General Publications **(2)** Hardware Standards/guidelines **(3)** Software Standards/guidelines **(4)** Data Standards/guidelines **(5)** Computer Security Standards/guidelines **(6)** ADP Operations Standards/guidelines **(7)** Telecommunications Standards

S-Standard **G**-Guideline **P**-Program Information Document

FIPS NO.	CATEGORY	TITLE-DATE	CHANGE NOTICES
34	(1)P	Guide for the Use of International System of Units (SI) in Federal Information Processing Standards Publications 75 Jan 1	
35		"WITHDRAWN"	
36		"WITHDRAWN"	
37		"WITHDRAWN"	
38	(3)G	Guidelines for Documentation of Computer Programs and Automated Data Systems 76 Feb 15	
39		"WITHDRAWN"	
40	(2)G	Guideline for Optical Character Recognition Forms 76 May 1	
41	(5)G	Computer Security Guidelines for Implementing the Privacy Act of 1974 75 May 30	
42-1	(6)G	Guidelines for Benchmarking ADP Systems in the Competitive Procurement Environment 77 May 15	
43		"WITHDRAWN"	
44		"WITHDRAWN"	
45	(4)G	Guide for the Development, Implementation & Maintenance of Standards for the Representation of Computer Processed Data Elements 76 Sept 30	
46-2	(5)S	Data Encryption Standard 93 Dec 30	
47		"WITHDRAWN"	

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FIPS NO.	CATEGORY	TITLE-DATE	CHANGE NOTICES
48	(5)G	Guidelines on Evaluation of Techniques for Automated Personal Identification 77 Apr 1	
49	(6)G	Guideline on Computer Performance Management: An Introduction 77 May 1	
50		"WITHDRAWN"	
51		"WITHDRAWN"	
52		"WITHDRAWN"	
53		"WITHDRAWN"	
54-1	(2)S	Computer Output Microform (COM) Formats and Reduction Ratios, 16 mm and 105 mm (ANSI/AIIM MS5-1991 & MS14-1988) 91 Jan 15	
55DC-4	(4)G	Guideline: Codes for Named Populated Places, Primary County Divisions, and Other Locational Entities of the United States and Outlying Areas 87 Jan 16	1
55-2	(4)G	Same as 55DC except without codes 87 Feb 3	1
56	(6)G	Guideline for Managing Multivendor Plug-Compatible ADP Systems 78 Sept 15	
57	(6)G	Guidelines for the Measurement of Interactive Computer Service Response Time and Turnaround Time 78 Aug 1	

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FIPS NO.	CATEGORY	TITLE-DATE	CHANGE NOTICES
58-1	(4)S	Representations of Local Time of the Day for Information Interchg. (ANSI X3.43-1986) 88 Jan 27	
59	(4)S	Representations of Universal Time, Local Time Differentials, and United States Time Zone References for Information Interchg. (ANSI X3.51-1975) 79 Feb 1	
60-2		"WITHDRAWN"	
61-1		"WITHDRAWN"	
62		"WITHDRAWN"	
63-1		"WITHDRAWN"	
63-1 SUPPLEMENT		"WITHDRAWN"	
64	(3)G	Guidelines for Documentation of Computer Programs and Automated Data Systems for the Initiation Phase 79 Aug 1	
65	(5)G	Guideline for Automatic Data Processing Risk Analysis 79 Aug 1	
66	(4)S	Standard Industrial Classification (SIC) Codes 79 Aug 15	2
67	(2)G	Guideline for Selection of Data Entry Equipment 79 Sept 30	
68-2	(3)S	BASIC (ANSI X3.113-1987) 87 Aug 28	
69-1	(3)S	FORTRAN (ANSI X3.9-1978/R1989) 85 Dec 24	

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FIPS NO.	CATEGORY	TITLE-DATE	CHANGE NOTICES
70-1	(4)S	Representation of Geographic Point Locations for Information Interchg. (ANSI X3.61-1986) 86 Nov 14	
71		"WITHDRAWN"	
72	(6)G	Guidelines for Measurement of Remote Batch Computer Service 80 May 1	
73	(5)G	Guidelines for Security of Computer Applications 80 June 30	
74	(5)G	Guidelines for Implementing and Using the NBS Data Encryption Standard 81 Apr 1	
75	(6)G	Guideline on Constructing Benchmarks for ADP System Acquisitions 80 Sept 18	
76	(3)G	Guideline for Planning and Using a Data Dictionary System 80 Aug 20	
77	(3)G	Guideline for Planning and Management of Database Applications 80 Sept 1	
78		"WITHDRAWN"	
79		"WITHDRAWN"	
80		"WITHDRAWN"	
81	(5)S	DES Modes of Operation 80 Dec 2	1

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FIPS NO.	CATEGORY	TITLE-DATE	CHANGE NOTICES
82	(2)G	Guideline for Inspection and Quality Control for Alphanumeric Computer-Output Microforms (ANSI/AIIM MSI-1980) 80 Sept 26	
83	(5)G	Guideline on User Authentication Techniques for Computer Network Access Control 80 Sept 29	
84	(2)S	Microfilm Readers (ANSI/AIIM (NMA) MS20-1979) 80 Oct 31	
85	(2)S	Optical Character Recognition (OCR) Inks (ANSI X3.86-1980/R1993) 80 Nov 7	
86	(2)S	Additional Controls for Use with Amer. Natl. Std. Code for Information Interchg. (ANSI X3.64-1979/R1990) 81 Jan 29	2
87	(5)G	Guidelines for ADP Contingency Planning 81 Mar 27	
88	(3)G	Guideline on Integrity Assurance and Control in Database Administration 81 Aug 14	
89	(2)S	Optical Character Recognition (OCR) Character Positioning (ANSI X3.93M-1981/R1989) 81 Sept 4	
90	(2)G	Guideline for Optical Character Recognition (OCR) Print Quality (ANSI X3.99/R1983/R1991) 83 Sept 29	
91		"WITHDRAWN"	

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FIPS NO.	CATEGORY	TITLE-DATE	CHANGE NOTICES
92	(4)G	Guideline for Standard Occupational Classification (SOC) Codes 83 Feb 24	
93		"WITHDRAWN"	
94	(2)G	Guideline on Electrical Power for ADP Installations 83 Sept 21	
95-1	(4)S	Codes for the Identification of Federal and Federally Assisted Organizations 93 Jan 4	
96	(6)G	Guideline for Developing and Implementing a Charging System for Data Processing Services 82 Dec 6	
97		"WITHDRAWN"	
98		"WITHDRAWN"	
99	(3)G	Guideline: A Framework for the Evaluation and Comparison of Software Development Tools 83 Mar 31	
100-1	(7)S	Interface Between Data Terminal Equipment (DTE) and Data Circuit-Terminating Equipment (DCE) for Operation with Packet-Switched Data Networks (PSDN), or Between Two DTEs, by Dedicated Circuit (ANSI X3.100-1989) 91 Mar 20	
101	(3)G	Guideline for Lifecycle Validation, Verification, and Testing of Computer Software 83 June 6	
102	(5)G	Guideline for Computer Security Certification and Accreditation 83 Sept 27	

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FIPS NO.	CATEGORY	TITLE-DATE	CHANGE NOTICES
103	(4)S	Codes for the Identification of Hydrologic Units in the United States and the Caribbean Outlying Areas (USGS/CIRCULAR #878-A & ANSI X3.145-1986) 83 Nov 15	1
104-1	(4)S	ANS Codes for the Representation of Names of Countries, Dependencies, and Areas of Special Sovereignty for Information Interchg. 86 May 12	1
105	(3)G	Guideline for Software Documentation Management 84 June 6	
106	(3)G	Guideline on Software Maintenance 84 June 15	
107	(2&3)S	Local Area Networks: Baseband Carrier Sense Multiple Access with Collision Detection Access Method and Physical Layer Specifications and Link Layer Protocol (ANSI/IEEE 802.2 & 802.3) 84 Oct 31	
108	(2)S	Alphanumeric Computer Output Microform Quality Test Slide (AIIM MS28-1983) 84 Nov 5	
109	(3)S	Pascal (ANSI/IEEE 770X3.97-1983/R1990) 85 Jan 16	
110	(3)G	Guideline for Choosing a Data Management Approach 84 Dec 11	
111		"WITHDRAWN"	
112	(5)S	Password Usage 85 May 30	
113	(5)S	Computer Data Authentication 85 May 30	

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FIPS NO.	CATEGORY	TITLE-DATE	CHANGE NOTICES
114		"WITHDRAWN"	
115		"WITHDRAWN"	
116		"WITHDRAWN"	
117		"WITHDRAWN"	
118		"WITHDRAWN"	
119	(3)S	Ada (ANSI/MIL-STD-1815A-1983) 85 Nov 8	
120-1	(3)S	Graphical Kernel System (GKS) (ANSI X3.124-1985(R1991), X3.124.1-1985(R1991), X3.124.2-1988(R1994), X3.124.3-1989 and ISO/IEC 8651-4: 1991) 91 Jan 8	1
121	(2&3)S	Videotext/Teletext Presentation Level Protocol Syntax (North American PLPS) (ANSI X3.110-1983(R1991)/CS T500-1983) 86 May 6	
122		"WITHDRAWN"	
123	(3)S	Specification for a Data Descriptive File for Information Interchg. (DDF) (ANSI/ISO 8211-1985/R1992) 86 Sept 19	
124	(3)G	Guideline on Functional Specifications for Database Management Systems 86 Sept 30	
125-1	(3)S	MUMPS (ANSI/MDC X11.1-1990) 93 June 10	
126	(3)S	Database Language NDL (ANSI X3.133-1986) 87 Mar 10	

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FIPS NO.	CATEGORY	TITLE-DATE	CHANGE NOTICES
127-2	(3)S	Database Language SQL (ANSI X3.135-1992) 93 June 2	1
128-1	(3)S	Computer Graphics Metafile (CGM) (ANSI/ISO 8632.1-4:1992 & MIL-D-28003A) 93 May 11	
129	(2)S	Optical Character Recognition (OCR) - Dot Matrix Character Sets for OCR-MA (ANSI X3.111-1986) 87 May 06	
130		"WITHDRAWN"	
131		"WITHDRAWN"	
132	(3)G	Guideline for Software Verification and Validation Plans (ANSI/IEEE 1012-1986) 87 Nov 19	
133		"WITHDRAWN"	
134-1		"WITHDRAWN"	
135		"WITHDRAWN"	
136		"WITHDRAWN"	
137	(7)S	Analog to Digital Conversion of Voice by 2,400 Bit/Second Linear Predictive Coding 84 Nov 28	
138	(7)S	Electrical Characteristics of Balanced Voltage Digital Interface Circuits 75 Sept 24	
139	(7)S	Interoperability and Security Requirements for Use of the Data Encryption Standard in the Physical Layer of Data Communications 83 Aug 3	

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FIPS NO.	CATEGORY	TITLE-DATE	CHANGE NOTICES
*140-1	(5)S	Security Requirements for Cryptographic Modules 94 Jan 11	
141	(7)S	Interoperability and Security Requirements for Use of the Data Encryption Standard with CCITT Group 3 Facsimile Equipment 85 Apr 4	
142	(7)S	Electrical Characteristics of Unbalanced Voltage Digital Interface Circuits 80 Jan 31	
143	(7)S	General Purpose 37-Position and 9-Position Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment (EIA-RS-449) 85 June 10	
144	(7)S	Data Communication Systems and Services User-Oriented Performance Parameters (ANSI X3.102-1983/R1990) 85 May 28	
145		"WITHDRAWN"	
146-1	(2&3)S	Government Open Systems Interconnection Profile (GOSIP) 91 Apr 3	1
147	(7)S	Group 3 Facsimile Apparatus for Document Transmission 81 Aug 19	
148	(7)S	Procedures for Document Facsimile Transmission (EIA-RS-466) 82 Apr 14	
149	(7)S	General Aspects of Group 4 Facsimile Apparatus (EIA-536-1988) 88 Nov 4	

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FIPS NO.	CATEGORY	TITLE-DATE	CHANGE NOTICES
150	(7)S	Facsimile Coding Schemes and Coding Control Functions for Group 4 Facsimile Apparatus (EIA-538-1988) 88 Nov 4	
151-2	(3)S	Portable Operating System Interface (POSIX)- - System Application Program Interface [C Language] (ISO/IEC 9945-1:1990) 93 May 12	
152	(3)S	Standard Generalized Markup Language (SGML) (ISO 8879-1986) 88 Sept 26	
153	(3)S	Programmer's Hierarchical Interactive Graphics System (PHIGS) (ANSI/ISO 9592.1,2,3:1989, ISO/IEC 9593.1:1990; ANSI/ISO 9593.3-1990 and 9593.4:1991) 88 Oct 142	
154	(7)S	High Speed 25-Position Interface for Data Terminal Equipment and Data Circuit-Terminating Equipment (EIA-530-1987) 88 Nov 4	
155	(7)S	Data Communication Systems and Services User-Oriented Performance Measurement Methods (ANSI X3.141-1987) 88 Nov 4	
156	(3)S	Information Resource Dictionary System (IRDS) (ANSI X3.138-1988X3.138A--1991) 89 Apr 5	1
157	(2)G	Guideline for Quality Control of Image Scanners (ANSI/AIIM MS44-1988) 89 Sept 13	

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FIPS NO.	CATEGORY	TITLE-DATE	CHANGE NOTICES
158-1	(3)S	The User Interface Component of the Applications Portability Profile (MIT X Version 11, Release (5) 93 Oct 8	
159	(7)S	Detail Specification for 62.5um Core Diameter/ 125-um Cladding Diameter Class Ia Multimode, Graded\Index Optical Waveguide Fibers (ANSI/EIA/TIA-492AAAA-1989) 90 Dec 27	
160	(3)S	C (ANSI/ISO 9899:1992) 91 Mar 13	1
161-1	(3)S	Electronic Data Interchg. (EDI) 93 Apr 19	
162	(7)S	1,200 Bits Per Second Two-wire Duplex Modems for Data Communications Use on Telephone-Type Circuits 92 Apr 2 (Supersedes FIPS PUB 136/Former Federal Standard 1008)	
163	(7)S	2,400 Bits Per Second Two-Wire Duplex Modems for Data Communications Use on Telephone-Type Circuits 92 Apr 2 (Supersedes FIPS PUB 133/Former Federal Standard 1005A)	
164	(7)S	2,400 Bits Per Second Four-Wire Duplex and Two-Wire Half-Duplex Modems for Data Communications Use on Telephone-Type Circuits 92 Apr 2 (Supersedes FIPS PUB 133/Former Federal Standard 1005A)	

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FIPS NO.	CATEGORY	TITLE-DATE	CHANGE NOTICES
165	(7)S	4,800 Bits Per Second Four-Wire Duplex and Two-Wire Half-Duplex Modems for Data Communications Use on Telephone-Type Circuits 92 Apr 2 (Supersedes FIPS PUB 134-1/Former Federal Standard 1006A)	
166	(7)S	4,800 and 9,600 Bits Per Second Two-wire Duplex Modems for Data Communications Use on Telephone-Type Circuits 92 Apr 2 (Supersedes FIPS PUB 134-1/Former Federal Standard 1006A)	
167	(7)S	9,600 Bits Per Second Four-Wire Duplex Modems for Data Communications Use on Telephone-Type Circuits 92 Apr 2 (Supersedes FIPS PUB 135/Former Federal Standard 1007)	
168	(7)S	12,000 and 14,400 Bits Per Second Four-Wire Duplex Modems for Data Communications Use on Telephone-Type Circuits 92 Apr 2	
169	(7)S	Error Correction in Modems Employing Asynchronous-To-Synchronous Conversion 92 Apr 2	
170	(7)S	Data Compression in Modems Employing CCITT Recommendation V.42 Error Correction 92 Apr 2	
171	(5)S	Key Management Using ANSI X9.17 (ANSI X9.17-1985) 92 Apr 27	

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FIPS NO.	CATEGORY	TITLE-DATE	CHANGE NOTICES
172	(3)S	VHSIC Hardware Description Language (VHDL) (ANSI/IEEE 1076-1987) 92 June 29	
*173-1	(3)S	Spatial Data Transfer Standard (SDTS) (DOI/USGS Specs.) 94 June 10	
174	(7)S	Federal Building Telecommunications Wiring Standard (ANSI/EIA/TIA-568-1991) 92 August 21	
175	(7)S	Federal Building Standard for Telecommunications Pathways and Spaces (ANSI/EIA/TIA-569-1990) 92 Aug 21	
176	(7)S	Residential and Light Commercial Telecommunications Wiring Standard (ANSI/EIA/TIA-570-1991) 92 Aug 21	
177	(3)S	Initial Graphics Exchange Specification (IGES) (ASME/ANSI Y14.26M-1989) 92 Dec 21	
178	(7)S	Video Teleconferencing Services at 56 to 1,920 kb/s (ITU-T Recommendations H.221;230;242;261;320 - 1993) 92 Dec 21	
179	(2&3)S	Government Network Management Profile (GNMP) 92 Dec 14	
180	(5)S	Secure Hash Standard (SHS) 93 May 11	
181	(5)S	Automated Password Generator (APG) 93 Oct 5	

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FIPS NO.	CATEGORY	TITLE-DATE	CHANGE NOTICES
182	(7)S	Integrated Services Digital Network (ISDN) 93 Oct 5	
183	(3)S	Integration Definition for Function Modeling (IDEFO) 93 Dec 21	
184	(3)S	Integration Definition for Information Modeling (IDEF1X) 93 Dec 21	
*185	(5)S	Escrowed Encryption Standard (EES) 94 Feb 9	
*186	(5)S	Digital Signature Standard (DSS) 94 May 19	
*187	(7)S	Administration Standard for the Telecommunications Infrastructure of Federal Buildings (ANSI/EIA-606-1993) 94 August 11	
*188	(5)S	Standard Security Label for Information Transfer 94 September 6	
*189	(3)S	Portable Operating System Interface (POSIX) -- Part 2: Shell and Utilities (ISO/IEC 9945-2:1993) 94 October 11	
*190	(5)G	Guideline for the Use of Advanced Authentication Technology Alternatives 94 September 28	
*191	(5)G	Guideline for the Analysis of Local Area Network Security 94 November 9	
*192	(3)S	Application Profile for the Government Information Locator Service (GILS) 94 December 7	

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