COMPUTER-SCIENCE GUEST-LECTURE SERIES AT LANGSTON UNIVERSITY SPONSORED BY THE U.S. GEOLOGICAL SURVEY: ABSTRACTS, 1992–93

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FOREWORD

Langston University, a Historically Black University located at Langston, Oklahoma, has a computing and information science program within the Langston University Division of Business. Since 1984, Langston University has participated in the Historically Black College and University program of the U.S. Department of the Interior, which provides education, training, and funding through a combined earth-science and computer-technology cooperative program with the U.S. Geological Survey (USGS).

USGS personnel have presented guest lectures at Langston University since 1984. Students have been enthusiastic about the lectures, and as a result of this program, 13 Langston University students have been hired by the USGS on a part-time basis while they continued their education at the University.

The USGS expanded the offering of guest lectures in 1992 by increasing the number of visits to Langston University, and by inviting participation of speakers from throughout the country.

The objectives of the guest-lecture series are to assist Langston University in offering state-of-the-art education in the computer sciences, to provide students with an opportunity to learn from and interact with skilled computer-science professionals, and to develop a pool of potential future employees for part-time and full-time employment.

This report includes abstracts for guest-lecture presentations during the 1992-93 school year.

ACKNOWLEDGEMENTS

The U.S. Geological Survey expresses its appreciation to the following people for making this program a success: the speakers, Langston University personnel, Dr. Calvin J. Hall, Director of the Division of Business, Dr. In H. Ro and Mr. Badrinath L. Krishnagiri, Instructors, and to the Langston students who worked with and for the U.S. Geological Survey during the lecture series.

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LOCAL AREA NETWORKS IN THE U.S. GEOLOGICAL SURVEY

By Daphne L. Chinn[1]

ABSTRACT

In the past the U.S. Geological Survey has communicated by computer through the use of the Prime minicomputers and a private network called GEONET[2]. Desk-top systems such as personnel computers and UNIX workstations worked only in a stand-alone mode but were connected to the world through a serial connection to the Prime. With the implementation of Local Area Networks (LAN's) at each site, connection was established at the desk-top level. This connection offers greater advantages and flexibility; it also brings with it greater responsibilities.

Choosing the correct LAN from the many available types is determined by many different factors such as physical layout of the site, type of equipment, the level of functionality desired, and cost.

The U.S. Geological Survey has implemented many different types of LAN's to fulfill each site's requirements. The only consistent feature has been that the LAN's are ethernet-based and that they use TCP/IP (Transmit Connect Protocol/Internet Protocol) as their main protocol. This lecture will describe some of the LAN's that are currently implemented within the U.S. Geological Survey as examples of the LAN technology.

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[1] U.S. Geological Survey, Reston, Va.

[2] Use of the GEONET name in this report is for identification purposes only and does not constitute endorsement by the U.S. Geological Survey.

TELECOMMUNICATIONS CONTINGENCY PLANNING— A UNITED STATES GEOLOGICAL SURVEY CASE STUDY

By Carol A. Lawson [1]

ABSTRACT

The 1990's have been identified by the United Nations as being the Decade of Natural Disaster Reduction. The potential for natural disasters such as tornadoes, hurricanes, landslides, earthquakes, floods, and volcanic eruptions is recognized as being significant throughout the world. Awareness of the potential for natural and man-induced disasters such as fire, power outages, and floods are significant to the business and government communities in terms of their effect on operations. Contingency planning is an important process that business and government must undergo in order to minimize the effect of natural and man-induced disasters.

On October 17, 1989, the U.S. Geological Survey (USGS), Western Region Headquarters in Menlo Park, Calif., experienced the damaging effects of the Loma Prieta earthquake. Without a formal contingency plan in place, many problems were encountered. The most significant problems identified were the loss of power and the corresponding disruption of communication services. These problems occurred because most of the systems were not properly supported by a backup power system. This disruption to the telecommunications systems not only affected the ability of USGS management to communicate among themselves, but also prevented scientists and managers from communicating with and transmitting data to external emergency response agencies and bureau management.

These identified deficiencies led the USGS management to develop a management contingency plan, formulate the agency's involvement in a Bay Area Response Plan, and develop a telecommunications contingency plan to support both the management and scientific plans in the Menlo Park area. The telecommunications contingency plan employed risk- and impact-analysis techniques to identify deficiencies and vulnerabilities, and to establish minimally acceptable operational conditions. A series of backup and new systems were obtained and implemented. For example, among the items procured were backup generators to power critical communication systems and offices; supplemental telephones services for management and key scientists; hand-held radios for portable communications among managers and building coordinators; microwave telephones links to area codes outside of the disaster-affected area; and a satellite telephone system having minimal dependence on land-based operations. The microwave and satellite telephones were placed in a communications command center, servicing both the management and scientific needs of the USGS offices at Menlo Park.

Each contingency system was tested in the context of a simulated disaster, and procedural deficiencies were identified. These deficiencies continue to be corrected, and additional tests are being conducted as a part of the ongoing process of planning for disasters.

[1] U.S. Geological Survey, Menlo Park, Calif.

USE OF A GEOGRAPHIC INFORMATION SYSTEM FOR SPATIAL DATA ANALYSIS

By Tim D. Liebermann [1]

ABSTRACT

A spatial data base contains information that can be identified by reference to its physical location on the planet. A geographic information system (GIS) is an organized collection of computer hardware, software, and information designed to create, manage, utilize, and display spatial data. This data base may contain descriptive or numeric information, called attributes, for each geographic feature. In general, geographic features may be classified as points, lines, polygons, or pixels. The power of a GIS lies in its ability to analyze the spatial relations—such as proximity, connectivity, or containment—among different geographic features and their attributes.

Typical applications of spatial data with a GIS include: classifying of land use or irrigated acres from satellite imagery, keeping track of current land ownership and tax status, draping vegetation cover over an elevation surface for snowmelt modeling, determining optimum travel paths within a network, processing elevation data to derive stream channels and basin boundaries, determining acceptable locations for waste-disposal sites, investigating ground-water contamination, analyzing "viewsheds" to estimate the visual impact of changes to the landscape, and estimating the damage from potential earthquakes or landslide hazards.

Within a GIS, spatial data can be combined and manipulated for interpretation, for input into detailed mathematical models, and for display of information in two and three dimensions. High-quality maps can be produced for a variety of plotting or printing devices. Menu-driven applications can be developed for interactive display and query of a set of spatial data bases. GIS technology is changing rapidly to make use of advances in computer architecture, graphics display, and data-base design.

[1] U.S. Geological Survey, Carson City, Nev.

DATA-BASE MANAGEMENT
A UNITED STATES GEOLOGICAL SURVEY CASE STUDY

By Jayne E. May [1]

ABSTRACT

The National Water Information System (NWIS) data-base management in the Oklahoma District requires a full-time data-base administrator. The goal of the data-base administrator is to provide accurate data storage for projects (both completed and ongoing) and to provide access to data for District personnel, cooperators, and the general public. The NWIS data base continues to grow and requires sophisticated data-management techniques to obtain peak performance, because the data base is constantly being updated with new data.

The Oklahoma District has been recognized for "maintaining an extremely clean" NWIS data base. In July 1989, 70 percent of the records had severe errors. By April 1993, the number of sites with errors had been reduced to less than 7 percent. This improvement is the direct result of a revision of District policy on data-base management, the development and use of data-checking computer programs, and the conscientious effort of all District personnel to provide extensive and accurate information with new site entries into the data base.

[1] U.S. Geological Survey, Oklahoma City, Okla.

NEXT GENERATION WEATHER RADAR

By Richard L.Murnan[1]

ABSTRACT

A new type of Doppler weather radar, Next Generation Weather Radar (NEXRAD), has been developed to assist meteorologists in the early detection of severe weather, as part of the modernization of the National Weather Service. Over 130 NEXRAD systems are scheduled to be installed in the United States over the next 4 years. Oklahoma will play a key role in making these systems possible, as the NEXRAD program is headquartered in Norman, Okla., together with the local National Weather Service Forecast Office and the National Severe Storms Laboratory. In 1993 additional weather-related operational and research groups will join the present group in Norman. This will make Oklahoma the Nation's center for severe-weather research. These groups are dependent on computer technology, and will bring a number of computer- and engineering-related jobs to Oklahoma.

This lecture introduces students to the NEXRAD program, how this new Doppler system will improve accuracy of weather warnings across the country, and job opportunities available in the Federal Government, specifically the National Weather Service. Service.

[1] National Weather Service, Norman, Okla.

DATA-BASE APPLICATIONS IN THE WATER RESOURCES DIVISION OF THE U.S. GEOLOGICAL SURVEY

By Darcy Person [1]

ABSTRACT

The U.S. Geological Survey, Water Resources Division (WRD), has had a historic emphasis on data-base applications. Computer storage of scientific and other data is of strategic importance to the WRD. Data-base application software are used to facilitate data entry, to manage data storage, to insure data integrity, and to provide information to meet a wide variety of needs. One of the most important data-base systems is the National Water Information System (NWIS), which includes the Ground-Water Site Inventory data storage and retrieval system; a water-quality data base, the Automated Data Processing System, which stores real-time surface-water data; and the National Water-Use Data System.

The NWIS was originally implemented utilizing Fortran programs and keyed data files. WRD personnel are currently implementing NWIS-II, using a relational data-base-management system in the UNIX operating system environment. Structured Query Language (SQL) is being used to improve portability of the application. A fourth-generation language is being used to develop an easy-to-use interface to the NWIS-II data base based on a graphics windowing system.

The WRD requires superior tools to handle the storage of large amounts of water data efficiently. These data have been collected for over 100 years in some locations and currently are being collected in support of programs throughout the country. Water data are critical to the management of the Nation's water resources.

[1] U.S. Geological Survey, Albuquerque, N. Mex.

SOFTWARE QUALITY-ASSURANCE PLANNING, DESIGN, DEVELOPMENT, DOCUMENTATION, AND TESTING AND REVIEW

By John E. Terry[1]

ABSTRACT

What is meant by "Software Quality Assurance?" Is it just a modifier for the word "Plan," as in "Software Quality Assurance Plan"? Is it a process in it's own right with a specific definition? How does it relate to "Software Quality Assurance Policy"? Does the concept "Software Quality Assurance" mean the same thing to all computer programmers? Does it mean the same thing to the software-user community as it does to those writing software code? Just how important is "Software Quality Assurance?"

As might be expected, there are many different answers to each of these questions. The importance of "Software Quality Assurance" is the focus of an excerpt from a recent article in one of the popular information-management newspapers, which notes that software bugs, at their worst, can be fatal. The article describes one incident in which three people were injured and one killed as a result of X-ray overexposure caused by a software bug. Obviously, the quality of software can be very important.

The key word is "quality." Empty assurances are of no value to anyone and, in fact, can do great harm. An individual programmer, a member of corporate staff devoted to software development, or one involved in writing code for an industry or government agency as a mission-support activity, must strive to produce bug-free efficient code as quickly as possible in order to stay competitive, and to insure data-processing integrity and cost effectiveness. It is imperative that software producers have a well-defined plan for producing good-quality software. A well-defined plan must include five basic phases: planning, design, development, documentation, and testing and review. In order to assure software users that the code is of good quality, software producers should have a standard policy, a "Software Quality Assurance Policy," requiring adherence to a "Software Quality Assurance Plan."

[1] U.S. Geological Survey, Little Rock, Ark.

ARCTIC DATA INTERACTIVE—AN ELECTRONIC SCIENCE JOURNAL

By Denise A. Wiltshire[1]

ABSTRACT

Multimedia computer technology offers exciting new possibilities for communicating complex scientific processes. Through the use of computer graphics, satellite imagery, and animation, data and information can be visually depicted in ways to enhance analysis of earth-science phenomenon, such as sea-floor spreading, plate tectonics, and sea-ice concentrations.

In 1990, the U.S. Geological Survey and several other Federal agencies agreed to use multimedia technology to promote access to data and information on global environmental change. Effective data management is one of the goals of the global change research community. To meet this goal, a project was established to design and implement a prototype of an electronic-science journal. The objective of the project, known as the Arctic Data InterActive (ADI), was to integrate a variety of scientific information, including complete texts of scientific papers, numeric and spatial data sets, and related software for data analysis. The Arctic was selected as the theme of this data-management study because it is one of the first geographic regions to respond to changing climate.

The design of ADI is based on hypertext technology. Hypertext, also known as hypermedia, is defined in the computer and information science literature as a software environment for developing non-sequential data-base-management systems. Hypertext techniques provide the capability to create associative links between structured and unstructured information that may include data, text, graphics, imagery, and sound. A hypertext link, which is conceptually similar to a footnote or a parenthetical phrase, directs the reader to related points or topics for further research.

Hypertext technology allows easy access to a mix of information through the use of a graphical user interface. The use of icons for representing different system functions allows readers to browse through information by following associative links between bibliographies, numeric data, textual information, and spatial imagery.

[1] U.S. Geological Survey, Reston, Va.