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Implementing Voting Systems: The Georgia Method

Sharing the experiences of the first statewide adoption of a computerized election process.

The history of elections and computers in Georgia is unique. DeKalb and Fulton counties in the metro-Atlanta area were the first jurisdictions in the U.S. to use computers to tally votes in a primary election in October 1964 [2]. Georgia was the first state to adopt a uniform, statewide direct-recording electronic (DRE) technology in 2002. (DRE systems are sometimes referred to as "computerized voting systems," or "touch-screen voting systems".) Georgians have been comfortable and confident in the use of technology to manage the state's election processes [1]. Georgia has a model system for the deployment and management of elections technology, which combines the resources of its Secretary of State (SOS), its University system, and its county election officials. This interlocking, multilevel approach helps ensure the accuracy and integrity of Georgia elections.

In the general election of 2000 the voters in Georgia voted on a variety of election devices. Two of the smallest counties used hand-counted paper ballots; 73 counties voted on mechanical lever machines; 17 counties voted on punch-card voting systems; and 67 counties voted on optical-scan voting systems. In 2000 there were no DRE voting systems in use in Georgia.

Due to the requirements of a secret ballot it is impossible to conduct an accurate study of voting patterns. However, the number of undervotes at the top of the ballot, in this case the presidential contest, is generally viewed as an indication of the performance of the voting system. Undervoted ballots are those ballots for which no vote was recorded for a particular office. In Georgia in November of 2000, over 93,991 voters (3.5%) failed to register a vote for president. These undervotes were spread evenly across all of the various types of voting systems. In the November 2002 election, using DRE technology, the undervote dropped to 0.86% [6].

Governor Roy Barnes and Secretary of State Cathy Cox considered the undervote in November 2000 unacceptable and initiated a study to determine ways to improve the state's voting systems. The 21st Century Voting Commission was formed

to investigate the relative merits of available voting systems and make a recommendation to the SOS. After extensive study and evaluation the committee recommended that Georgia adopt a statewide DRE voting system. Toward this goal, the 2001 Georgia State Legislature allocated funds for the purchase of a DRE voting system.

A Voting System Procurement Committee was formed, and bids were issued for a statewide implementation of a DRE voting system. In order to be considered for this procurement, a voting system had to have been issued a National Association of State Election Directors (NASED) Qualification Number and successfully pass a State Certification Evaluation [4]. Seven vendors qualified a system to bid. Bids were evaluated and an order was placed in May 2002 with the intent of using the system in the general election in November 2002.

The Center for Election Systems

Once the decision was made to convert the state to a DRE voting system, several challenges were identified. Georgia would be required to convert over 3,000 precincts from a collection of disparate lever-machine, optical-scan, and punch-card technologies to a single, uniform DRE technology. Approximately 3,000 poll managers, and 10,000 poll workers needed to be trained. The warehouse operations of the vendor had to be audited. DRE voting stations, election management servers, optical ballot scanners (for absentee ballots) and ancillaries had to be manufactured, configured, and delivered. Once delivered to the counties the hardware and software had to be tested, ballots built, and logic and accuracy tests performed on each precinct configuration.

Georgia has the largest land area of any state east of the Mississippi river, and with 159 counties—each functioning as a separate administrative unit—its infrastructure and transportation systems created additional deployment challenges. From the start of procurement until the November 2002 election, the state of Georgia had five months to orchestrate the largest deployment of voting technology in its history.

Faculty at Kennesaw State University (KSU) had conducted certification tests of computer-based voting systems for the state since 1988. Based on this expertise, the university proposed the formation of a center to support the installation and end-user training for the new voting system. The SOS authorized KSU to create a Center for Election Systems dedicated to assisting with the deployment of the DRE voting technology and providing ongoing support.

In April 2002, the KSU Center for Election Systems was created and charged with the responsibility of ensuring the integrity of voting systems in Georgia through training, research, auditing, and testing of voting systems. The Center maintains an arms-length working relationship with the SOS and the vendor, ensuring both independence and objectivity in its work. The Center has continued to evolve, adapting to the emerging issues associated with elections in general and DRE technology in particular.

The Center works closely with the Elections Division of the SOS, the Georgia county election superintendents, and the vendor to facilitate successful elections. The Center's staff includes a Director responsible for the day-to-day operations of the Center; a Technology Coordinator responsible for overseeing testing protocols and implementation; a Training Coordinator responsible for developing and implementing training programs for county election officials; and an Elections Coordinator responsible for assisting counties and municipalities in the construction of ballots. The Center employs graduate and undergraduate students who work in its call center and provide some of the personnel for its testing activities. All employees of the Center must complete a preemployment background check and an orientation program that includes election law and ethics.

The 2002 Election

Deployment of the DRE technology in the summer of 2002 was characterized by the conviction of the SOS that Georgia should eliminate technological barriers to voting, such as undervotes or spoiled ballots. Unlike most IT rollouts in which the project managers can compromise functionality, scope or schedule as a means of meeting project goals, this system had to be fully deployed, fully functional, and ready to use, a minimum of 30 days prior to the November election. With enormous logistical issues and little margin for error, the project began in earnest on May 1, 2002.

One of the first activities of the KSU Center for Election Systems was to develop an audit program to monitor the vendor's warehousing and shipping procedures. This audit included a report of the condition of the warehouse, correctness and completeness of bills of lading and shipping records, and spot checks on the quality of units leaving the assembly and integration production lines at the warehouse. Reports were provided to the SOS's Election Division as well as the vendor's management to assist them in fine-tuning their own quality control processes.

Once the DRE units, servers, optical scanner, memory cards, and encoders were delivered to a county, the Center's staff performed an Acceptance Test on the equipment. Georgia Election Code

requires that all equipment used in elections must pass a rigorous unit test before use in the state. This required the Center to test 23,000 DRE units (several large counties placed their own orders for additional units, beyond the 19,000 purchased by the state), 8,000 encoders, 400 optical scanners, 161 servers, and other peripheral devices. The acceptance testing process also enabled the Center's staff to inspect the storage facilities of the equipment and to make subsequent recommendations for improvement at the county level. In the course of the three month acceptance testing process, the Center failed over 1,000 pieces of equipment for a variety of reasons, including screen freezes, incorrect time and date settings, incorrect software versions, incorrect serial numbers, defective cases, bad batteries, and various hardware failures. Failed units were removed from the county and replaced, with subsequent testing of the replacement units. County election superintendents were provided detailed reports of the status of their election equipment inventories, including a failed-unit report.

Acceptance testing was completed in mid-September of 2002. The Center then shifted its focus to the training of poll managers and poll workers for the upcoming election. On Election Day the Center's staff was deployed to the counties to provide assistance at the precinct level throughout the state.

Ensuring the Integrity of Elections in Georgia

The security of election technologies and the integrity of the election process is a shared responsibility. The Georgia Constitution invests the SOS with the stewardship of elections, but the integrity of elections depends upon the joint efforts of the SOS Elections Division, county election superintendents, the Center for Election Systems, vendors, poll managers, poll workers, and ultimately the voting citizens themselves.

Training. The training issues in election technologies are unique. The process is heavily dependent upon personnel that are both volunteer and infrequent users of the systems. The processes are a combination of manual and computerized operations that are the result of state and federal election law, state election rules, election tradition, and functional requirements of the election technologies. The processes are dynamic and change in varying degrees from election to election, requiring a constant vigilance of training objectives, materials, and curriculum. The KSU Center is responsible for working with the vendor and state and county officials in the development and maintenance of training programs.

In 2003, the State of Georgia enacted legislation that requires all election superintendents to successfully complete 64 hours of training. This training includes election law, ethics, and election procedures, including those unique to the current DRE technology used in Georgia. This training helps ensure that appropriate security procedures are understood and implemented at the county and precinct level [5].

Technology Support. The KSU Center provides technology support to counties and the SOS Elections Division. This support includes the evaluation of new technologies, troubleshooting, and call center support for end users. The Center evaluates existing and proposed technology innovations to the existing configuration and provides feedback to the SOS Election Division and the DRE vendor. At the forefront of the Center's evaluation of every proposed technology change is the need for: compliance with EAC voting systems standards; compliance with Georgia election code; robustness of the system to emerging threats; and concern for the public's perception of the integrity of the election process.

Election Support. On Election Day, the Center becomes a comprehensive call center for election issues. Incoming calls and faxes are assessed and directed to the vendor's support staff, the SOS Elections Division and the Center's staff for resolution. Call logs are analyzed and used as a basis for improved communication, training, documentation, and technology upgrades.

Ballot Building. One benefit of using a uniform technology throughout the state is that many ballot-building procedures can be centralized. This enables better error detection and correction as well as efficiency in the production of redundant ballot content (federal and statewide races). Ballots can be reviewed for compliance with state law as well as proper district and precinct information. Ballot images are created at the KSU Center with multiple levels of review. Then the ballots are delivered to the counties for final review and acceptance.

Assurance. A primary function of the KSU Center for Election Systems is to maintain the accuracy and continuously improve the security of the voting system. This is a dynamic activity that continuously evaluates the voting system and implements policies, procedures, and system modifications to improve the system. The components of this process are directed toward assuring the system is correctly installed (Qualification Testing, Certification Testing, and Acceptance Testing), assuring the system is functioning properly (Logic and Accuracy Testing), and assuring the system has not been compromised (Integrity Testing).

Qualification Testing: ITA. Georgia was one of the first states to adopt the Election Assistance Commission (EAC) Voting System Standard in its entirety (formerly these standards were referred to as Federal Elections Commission (FEC) standards) [3]. The first step in this process is Qualification by a NASED Independent Testing Agency (ITA). Before any voting system can be considered for use in an election in the state it must successfully pass ITA testing for compliance with the AEC Voting System Standards and be issued a NASED Qualification Number. This testing is designed to establish the functionality, accuracy, security, reliability, and maintainability of the system.

Certification Testing: Center for Election Systems. The second step in the EAC Standards program is state-level certification testing. The KSU Center for Election Systems conducts Certification Tests to ensure the system complies with the State Election Code, The Rules of the State Board of Elections, and The Rules of the Secretary of State. During these tests the system is examined for usability and affordability. In addition, tests designed by the KSU Center for Information Security, Education, and Awareness are conducted to detect extraneous or fraudulent code. To maintain the audit integrity of the system, the KSU Center receives the software directly from the ITA, thus ensuring that the software tested is identical to the software qualified by the ITA.

The present state voting system was subjected to six weeks of testing that included processing over 250,000 ballots in both primary and general election formats. If the system fails State Certification Testing for any reason, the fault is corrected by the vendor and the revised system is returned to the ITA for Qualification Testing. When the system successfully completes State Certification Testing, the KSU Center archives the tested software and this archived software is used as the basis for subsequent signature analysis to validate the software used in the counties.

Acceptance Testing: Center for Election Systems. The final step in the EAC Standards program is Acceptance Testing. After the system is delivered to a county, a team from the KSU Center goes to the county and conduct tests to ensure that the system, as delivered, is identical to the system that passed Qualification Testing and Certification Testing. In addition to tests to verify the correctness of the software, these tests verify that the hardware components are working properly.

Logic and Accuracy Testing: County Election Officials. Prior to each election, county election officials conduct Logic and Accuracy Tests to ensure the election has been properly programmed, the ballots are correct, and the system is accurately tabulating the votes. These tests are open to the public and must be advertised in the county's official publication.

Integrity Testing: Center for Election Systems. Integrity Testing is conducted at periodic and at random times to ensure the voting system in use has not been altered. The last step in the Certification Tests described here is to compute an electronic signature of the tested system to be used to compare with the signature of systems in the counties. This signature is based on FIPS 180-2 and is estimated to detect any modification to the system with a probability of 1/10,000,000,000 [4]. This comparison can be conducted immediately before and after an election to verify that the system was correct prior to the election and did not change during the election. It can also be used after any random event (for example, a nearby lightning strike or power failure) to verify that the system was not altered.

Conclusion

The most cited measurement of election system integrity is the undervote. It is generally accepted in the elections community that high undervote rates indicate problems with the voting system. Georgia has progressed from an undervote rate of 4.4% across a variety of election technologies in the November 2000 election to an undervote rate of less than 1% using DRE technology in the November 2002 election. This increase in the integrity of the elections system is attributed to the comprehensive deployment and management program put into place by the Secretary of State and implemented by the SOS Elections Division, the KSU Center for Election Systems, and the county election officials in the state of Georgia. C

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