

Analysis and Estimate for Statewide Voter Registration Enhancements



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Analysis and Estimate for Statewide Voter Registration Enhancements



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Introduction

The Oklahoma Election Management System (OEMS) was, and to this day, is one of the most functionally complete election systems in the United States. Unfortunately, the technological architecture that runs OEMS is becoming increasingly out-of-date. Recently the Help America Vote Act (HAVA) initiated some required functional modifications to OEMS. Outside of election equipment technology related requirements, the most significant HAVA modification required for OEMS is providing county election officials with online inquiry access to the statewide voter registration database. The current distributed county-based technical architecture does not easily lend itself to this requirement. As a result, significant modifications are required to meet this directive.

Several options exist to meet the requirement previously stated. An assessment of options document was created in December of 2004. A new approach was recently developed which moves a portion or all of the State OEMS functions to a new database and hardware platform. The amount of processing on the VAX 4000-300 would be greatly reduced. The current state hardware would essentially become a data conduit between the counties and the new platform. The options vary greatly in complexity and cost. Looking at the big picture, a byproduct of the required changes is the opportunity to develop a modern foundation or cornerstone for the successful conversion/upgrade of OEMS over the next several years.

The remainder of this document will focus on the State components of OEMS that could be moved to a new platform. Some potential benefits of this new approach include:

- Meets requirements of HAVA
- Meets voluntary guidelines of EAC
- Opportunity to review and improve design of OEMS
- Reduced risk of hardware failure
- Significantly greater processing power
- Greater functional capabilities
- Opportunity for significantly improved public access
- Improved "user-friendliness" for SEB employees
- Easier to maintain applications
- Updated and complete set of functional manuals
- Much more manageable project size than "modernizing" all of OEMS at once

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Enhancements

The primary driver of this project is providing an internet accessible voter registration database for county election officials. On the surface, this appears to be a relatively simple task. The interconnected nature of OEMS data and applications makes this task much more problematic. "Voter Registration" is much more than a single database that contains demographic information on each voter. Voter Registration is comprised of dozens of applications made up of hundreds of programs, processes, and reports. Maintaining two separate databases and applications (however small) for a short-term fix may be viable but is a poor long-range strategy. The entire Voter Registration application should be developed as the "core" modernization project.

Several additional State OEMS applications could also be converted to the new platform. VIRS, Ballot Ganging, Candidate Filing are just a few. Some of these applications would realize significant benefits from a new design and platform while others would only realize small or minimal benefits. All applications would benefit from economies of scale. The implementation effort for each application outside of the core application would be reduced by developing them all at once.

A front-end study should be incorporated into the preliminary system design if it is decided that several applications are to be developed at the same time. This study would consist of an extremely detailed review of each OEMS state function. Performing this step in advance will result in the most integrated and efficient design of an enterprise election application.

One application that we do not recommend moving to the new platform is EMS. This effort would be extremely complex and create significant risk. The uncertain future of election tallying devices further supports this approach.

Estimates for enhancements include the design, programming, installation, conversion of data and corresponding documentation. Documentation deliverables will include at a minimum preliminary system design, detailed design, user's manual and operator's handbook.

All proposed enhancements will be designed to meet the standards set forth in the "Proposed Voluntary Guidance on Implementation of Statewide Voter Lists" issued by the Election Assistance Commission on April 12, 2005.

Voter Registration

Moving the OEMS Voter Registration application from the VAX to a new technical architecture is the base component of the proposed changes in this document. As previously stated, the modifications to Voter Registration have been initiated by requirements of the Help America Vote Act (HAVA). The primary deficiency of OEMS is the inability for CEB election officials to access voter registration information on a statewide basis. The proposed modifications will meet the requirements of HAVA and provide many additional benefits that enhance the day-to-day operations of the State Election Board, thereby enhancing the election process for the State of Oklahoma.

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The following section will list the primary functions within Voter Registration that would be included in the new system.

County Access

A query only application will be developed that allows County Election Board personnel to view Voter Registration information for the entire state. The information available to the election personnel will be up-to-date and meet all of the requirements of HAVA. This information will only be accessible to designated election officials. This application will also be designed to improve communication between county election boards and the State Election Board. E-mail and web-site news are just two possible features to include in this function.

True Duplicates Processing

True Duplicates Processing is a resource intensive function in the current system. It currently takes over seven days to process true duplicates. True duplicate processing only occurs once a year due to resource related issues. Moving this application to a new platform will speed up the processing time substantially. The process could then be executed on a much more frequent basis. Additional selection criteria could be developed without slowing the process due to more robust processing power.

Potential Duplicates - Confirmation Mailing/Purge

The Potential Duplicates process "feeds" the Confirmation Mailing / Purge process. Like true duplicates this function takes over one week to process. Moving this application to a new platform will also speed up the processing time significantly. Additional selection criteria could be developed without slowing the process due to more robust processing power.

State Health Department Interface

The interface from the State Health Department (SHD) which provides a list of potentially deceased voters will be processed by the new application. Logic will be performed similarly to the current process, but must be moved since the voter information that must be matched against will no longer reside on the VAX.

Department of Public Safety (Surrendered Licenses)

The interface from the Department of Public Safety (DPS) which provides a list of Oklahoma drivers licenses surrendered in other states will be processed by the new application. Logic will be performed similarly to the current process, but must be moved since the voter information that must be matched against will no longer reside on the VAX.

Convicted Felons Processing

The current system can barely keep with the number of new felony convictions. Data transfer has been occasionally turned off due to the resource requirements of this function on a weekly basis. Reducing the number of criteria used for matching voters with felons is one of the options currently being considered at the SEB due to the processing problems. The proposed system will allow for expedited processing of felony convictions

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and the potential creation of additional criteria. This current application can be designed to integrate with any new interfaces with the department of corrections.

SEB Inquiry

In order to provide additional inquiry capabilities above and beyond that of the CEBs/public, SEB staff would have access to an application to allow detailed queries of voter registration data. This would also include the ability to mark voters for potential deletion due to state transfers. Additional search criteria not possible in OEMS on the VAX can be added to accommodate ad hoc queries.

Reporting

There are dozens of Voter Registration reports that currently reside in OEMS. The functionality of these reports will be created within the new system. Modern application development tools allow for a number of different ways to structure and present data. Review of the existing reports will probably result in the creation of many new reports that do not resemble the existing structure at all. An ad hoc reporting structure will be incorporated into the design allowing for state users to develop custom reports.

Voter Registration Improvements..... \$525,000 ¹

1 - Includes the conceptual design of the web interface for CEB/public use but not the development. If development is not performed by OSF, then additional costs may be incurred.

Data Transfer

Data Transfer is an essential ingredient of the existing OEMS as well as a key concern for the new extranet application. Currently, Data Transfer adequately provides for the transmission of required data to and from the SEB and the 77 CEBs. However, due to the slow data transmission speeds achievable by the current architecture combined with the long posting times, the SEB voter registration data files are usually about 3-7 days behind the CEBs. The transmission speed is a function of the hardware infrastructure and cannot be improved without a complete replacement, but that is not the bottleneck. In fact, we only run 2 of the 10 dynamic phone lines available for nightly data transfer to keep from clogging the VAX with posts. The lengthy posting times are partly due to the planned redundant posting of data to prevent lost records and partly due to the combination of a slow CPU, slow disk drives and a dated file management system (RMS). Redundant posting occurs because the extract process selects records from a range of dates which overlaps its first day of data with the last day of the next most recent extract.

To achieve the goal of "expedited" entry of local registration information into the statewide list (as mandated by HAVA), we must get the currency of the statewide voter registration list down significantly. This will be achieved by the following steps:

- Remove the voter registration files (RMS_VRMASTER, RMS_VRMAILAD, RMS_VRACTIV, RMS_VOTRHIST, RMS_STMASTER and RMS_STRMAST) from Nightly Data Transfer (the NGHT driver) as it exists today.
- Add a new data transfer driver to pull information from VR files. The new extract programs will be designed to use a time based redundancy factor (rather than date based) to greatly reduce the number of records processed. This will require a change to



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- RMS_VOTRHIST to either include SYSTIME on the record or write an RMS_ATVOTRHI audit trail for all transactions, not just deletes. In addition, these records will not be posted at all on the VAX. Instead they will just be copied to a holding area pending transfer to the RDBMS server.
- Create a transfer process that will concatenate the CEB files and move them to the RDBMS server for posting there. A statistical analysis has been performed to validate that average and maximum data volumes can be processed within a reasonable amount of time in this manner using a 38,400 baud connection (which is currently achievable).

These steps should allow us to realize a 1-2 day currency of data. This of course can be adversely affected by network issues (telephone outages, weather, hardware failures, etc) that are beyond our control.

Data Transfer Improvements..... \$75,000

Street Mapping/Polling Place Lookup

A new function would be developed that provides the general public with an option of identifying and locating their election day polling place by the simple entry of their address (or perhaps name/identifying information). The new application could be developed to provide several user options including detailed maps. Automatic directions to and from the registered voter's address to the polling place could be provided. This extranet application could be integrated with several other potential functions (i.e. county election board information, election results, etc.) to provide registered voters (or potential voters) with a valuable online tool.

Street Mapping/Polling Place Option \$25,000²

2 - Includes the conceptual design of the web interface for CEB/public use but not the development. If development is not performed by OSF, then additional costs may be incurred.

Voter Information Request System

As a standalone function, we have quite a bit of flexibility in how VIRS is handled. It could continue to receive data directly from the VAX or be configured to receive updates from the new VR database. In addition, it could be reconfigured as a component of the new system and then access data directly from the new database.

Should the VIRS application remain independent, then the only modifications required are those necessary to enable the host side to pass the proper input data. In this scenario, VIRS will continue to operate as it does currently.

If VIRS is made a part of the new system, then it will require some effort to update the database connectivity, SQL calls and menu hierarchy. This would eliminate the need to transfer voter information from the host to VIRS and ensure that all VIRS data is kept up to date. Also, additional VIRS functionality could be added to allow for online capture of requests with the potential for automated fulfillment and/or payment processing.



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VIRS Option 1 - Leave as separate application	\$5,000
VIRS Option 2 - Incorporate into new application	\$12,000
VIRS Option 3 - Add online request/payments	TBD

Candidate Filing

As a high profile and very visible function, Candidate Filing could significantly benefit from a technology upgrade. Along with results reporting and VIRS, Candidate Filing is one of the few faces of the election system that is actually available to the public and candidates for office. By moving this function off of the VAX we could achieve the following benefits:

- Provide a more attractive interface for candidate inquiries on the 5th floor
- Generate Internet reporting with additional functionality that is easier to read and use
- Automatically generate the List Book in a format that is ready to go to the printer
- Create media and other reports in a cleaner, easier to use format
- Save filings from previous years without resorting to tape backups and restores
- Allow for easy scalability for eventual use at the counties

Candidate Filing Option	\$85,000
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Ballot Ganging System

One of the SEB functional applications that would most benefit from a change in technical architecture is the Ballot Ganging System (BGS). The current system capabilities are significantly limited due to the processing power of the system, the limits of RMS, and the fragmented manner in which this application was developed over an eight-year period. The new BGS application would be designed with the following goals in mind: 1) reduced manual effort required to complete the ballot printing process for both the SEB and the vendor, 2) reduced SEB dependency on one printing vendor, and 3) more efficient "ganging" techniques. The projected benefits of the new system include:

- **Significant reduction in manual effort.** The proposed system will provide standardized electronic output of ballot quantities and ballot layout information. Currently, all ballot quantities and layout information are provided to Royal Printing in the form of paper reports. There is significant redundancy of manual entry effort in this process. Providing electronic output that can be loaded directly into the vendor's computers may improve this process by several days.
- **Standardized Output.** The new application would provide a standardized format of ballot quantities and layout information. The ballot layout information will be designed to download into the desktop printing software QuarkXPress. QuarkXPress is a standard, publishing software package used by the printing industry. Providing this capability should allow additional vendors to participate in the bidding process. Output will be generated using the ASCII based XPress Tags markup scheme.
- **Reduction of Errors.** Any thoroughly tested process that automates steps/procedures previously performed manually will reduce the number of data entry errors. This system would require only a single entry of race and candidate information.



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- **Reduction in Costs.** Creating the new application could reduce the bottom line several different ways. The increased processing power of the PC combined with more sophisticated application development tools will allow for more efficient “ganging” of ballot styles. The file system (RMS), application development tool (PowerHouse), and operating system now limit processing performed by the current application. Due to timesaving on the manual steps, fewer “runs” will have to be performed. The more styles included in a run, the more efficient the ganging will be. Vendor competition could also reduce overall costs.
- **Better Design.** The PC application will be easier and faster to use because of the improved interface of modern GUI based systems. Additionally, lessons learned over the last ten years will be incorporated to improve the application.

The base BGS application will include the following functional components:

Base System

The base system will include the following functional components:

- All current BGS functionality will be included in the new application. The application will be redesigned for efficiency.
- Ballot Layout information will be included in the new application.
- Electronic output of all information will be available.
- All reports will be viewable online.

There are additional options that could be added to this application. Further review would be required to determine the total estimated effort. These options include:

1. Creation of QuarkXPress templates.
2. Provide online ballot style proofing capabilities.
3. Develop election summary reports and historical information.
4. Create functionality that incorporates historical voter turnout information in determining required quantities. This function would be designed as optional for each election.

Ballot Ganging Option \$125,000
Additional Options TBD

Motor License Agents

The Motor License maintenance and payment application would greatly benefit by transferring the functionality to a new platform. The existing application already includes an inefficient interface with the Office of State Finance (OSF). Each quarter the SEB receives a large vendor file from the OSF. This file is broken into four smaller files on a PC and then transferred to the VAX (the file is broken into four smaller files to allow transfer to the VAX). This information is used to create a MLA cross-reference for the payment process. Once this information is downloaded and processed, the payment process is executed and the resulting payment file is then transferred back to the PC. The payment file is then sent to the OSF. Having the functionality reside on the PC to begin with will eliminate the parsing of the vendor file, the transfer of vendor information to the VAX, and the transfer of payment information from the VAX back to the PC.

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Motor License Agent Option \$20,000

Election Preparation

The Election Preparation application at the SEB primarily consists of creating state and/or federal related elections that are passed through data transfer to the counties. The Election Preparation functionality at the State Election Board (and the County Election Board for that matter) could be greatly enhanced from its existing capabilities. The design concept of "Election Templates" could be incorporated to greatly reduce the amount of manual effort required to create elections. This concept could be created on the VAX platform as well as a new platform but large enhancements to OEMS at this time are probably not very cost effective.

Election Preparation Option \$45,000

Election Results Reporting

The State Election Board currently creates several election result reports following each federal election. These reports come from three different subsystems in OEMS (VSES, VSET, and VSRS). The overall design of this application is considerably fragmented. The VSRS application still uses UDMS data to create its reports. Three sets of result related RMS files are currently in use. They are comprised of roughly the same data with different structures. In addition, there is a custom application that has to be recreated each election season for straight party voting. A new application would greatly improve this function. A single database design would incorporate the needs of all result reporting. Modern report writing application development tools allow the creation of many different types of reports that can incorporate dynamic parameters. In OEMS, nine VSRS reports were created because of the unknown number of potential candidates for an election and the unknown number of characters in their name. A new application would only need one report.

Election Results Reporting Option \$45,000

County Election Board Management

The County Election Board Management system is a small application at the State. The primary function of this application is to inquire on and modify county election board location and personnel information. No significant benefit would be realized by moving the current functionality to the new platform other than the minor benefits of economies of scale (more efficient to develop multiple applications at once than one at a time). Some of the information contained in this application could be easily added to an Internet application that enhances the information available to registered voters. For instance, a registered voter could go online and determine the location of their county election board office and receive such information as phone number, etc. They could also automatically map directions from any location to the office (or MLA for that matter).

County Election Board Management Option \$25,000

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Election Equipment Management

The Election Equipment Management application at the SEB is a completely standalone function. This application inventories election equipment and election equipment parts. Maintenance of equipment and parts and election usage is also processed and tracked. The current functionality is very limited based on the existing OEMS technology. A technology upgrade would greatly enhance this application. It is one of the applications where several new functions would be the byproduct of a platform transfer. It is relatively easy to determine the total effort required to simply transfer the existing functionality. However, we are confident that after detailed analysis new functions might be identified that would be beneficial but require additional costs.

Election Equipment Management Option \$75,000

Interfaces

Interagency interfaces are required as part of HAVA. Having the Voter Registration application residing on a new platform will greatly enhance the interface effort when it is required and being implemented. The total amount of effort for the Department of Public Safety interface will not be known until more meetings with the appropriate agencies have been conducted. Since Department of Corrections (Federal and State) are not currently being processed, no estimate will be provided at this time, but can be if desired. Possible additional interagency interfaces include:

Department of Public Safety (ID Verification)

Oklahoma Department of Corrections

Federal Department of Corrections

Inventory Management

The Inventory Management application that resides at the SEB is not currently used. The development of a new application is not anticipated nor recommended.

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Technical Architecture

The technical architecture choice is vital to the future success of this endeavor. It is guaranteed that substantial performance gains will be achieved over the current VAX configuration. However, we should still take care to ensure that desired performance goals can be met not only in the short-term, but also for years to come. We can assure these goals are met by first selecting hardware and software sized to fulfill current capacity requirements. Next, we must also verify that they are scalable to meet future usage needs that may be driven by growth in registration, increasing use by internal or external clients or migration of new applications.

Desired Attributes

All components of the selected architecture must be selected to achieve the following goals:

Reliability

The measuring points of reliability are dependability and consistency. From database to network any broken link of the chain disrupts the end user's ability to access required functions. Each component should be ready when needed and should function exactly the same way each time it is used.

Availability

Availability may seem to overlap with reliability, but it can go a step further. A fully functional system may be unavailable due to backups, higher than anticipated transaction volume, maintenance and myriad other concerns. The ideal solution would be able to provide full system availability to users during all predictable events. The realistic solution must achieve a balance between cost and desired availability percentage.

Scalability

It is all well and good for a system to meet the needs of today, but if it can't also meet tomorrow's requirements (or allow for expansion to meet them), then it is destined for failure. The selected platform should be designed with expansion in mind. It should be able to handle an increase in data volume (i.e. increased registration) or additional functionality with only minor configuration changes required.

Security

The proper level of security will be a negotiated balance of cost to the level of protection required. Basic protections will be standard in any market leading operating system, relational database management system (RDBMS) or utility. Enhanced protections may be added at additional expense. These extended security measures may or may not be desirable depending on the assessed level of risk versus the cost of implementation.

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Server

There are more server vendors, configurations and options than can possibly be mentioned in this document. There are a number of highly respected vendors such as Dell, HP, IBM and Sun that just about anyone would recognize. In addition, there are a great many more fringe players. To keep this section manageable we will recommend only a few key features and then conclude with an example configuration and its listed costs.

At a minimum one server will be required to host the relational database. Depending on options selected for the hosting of web applications, e-mail and other services an additional server (or servers) may be desired. If web services are outsourced, then likely only the one server will be required.

Recommended Server Attributes

- x86 compatible with either the Intel Xeon (32 or 64 bit) or Intel Itanium (64 bit) processor.
- Minimum of two processors with scalability to minimum of four.
- Minimum 2 GB of main memory
- Not proprietary to a single (or restricted number of) operating system(s).
- Capable of RAID Level 1
- Capable of redundant power supplies
- On-site service available

Example Server - Dell PowerEdge 6650 (\$15,710.95) ¹

- Dual 2.7 GHz/2MB Cache Xeon Processors ²
- Rack Chassis
- 2 GB SDRAM
- Four 36 GB 10K RPM Ultra 320 SCSI Drives ³
- RAID Level 1
- 1.44 Diskette Drive
- CD-RW/DVD ROM
- Windows Server 2003 with 25 Client Licenses
- Veritas Backup Exec Database Server Protection Suite
- 3 Yr Gold Support, 4 Hr Onsite,

1 - Options listed for the server represent only one possible configuration. Prices were taken from Dell's website on 4/7/05 and are purported to be the going rate for Oklahoma State Government purchases.

2 - Number of processors can affect the purchase price of RDBMS significantly; therefore our recommendation is to use fewer, faster processors instead of more, slower ones.

3 - Additional storage can be added in the form of internal or external drives at relatively low costs.

Operating System (OS)

There are several server operating systems on the market that would adequately fulfill the SEB's basic requirements. However, when considering long-term objectives many lose their

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attractiveness. Much as the VMS OS used by the VAX currently is no longer a prominent player in the server OS market, other operating systems that may seem acceptable now, might not be good choices 10 years from now. We will recommend some options for OS, but will not include those that:

- Do not have sufficient market share to legitimize their staying power
- Are proprietary to certain hardware solutions
- Do not have strong support infrastructures in place
- Are not supported by a wide variety of software selections (such as RDBMS's)

Microsoft Windows Server 2000/2003

As an industry leader, Microsoft certainly has the staying power, support network, resources and the rest necessary to keep their server OS in the field for the foreseeable future. With over 90% of the desktop market share and over 50% of the server market share, Microsoft is the global leader in OS install base. However, due to its successes, Microsoft also has become the target of every virus, Trojan horse and disgruntled user that walks the Earth.

There are a number of compelling reasons to recommend Windows Server:

- Highest server market share
- Runs on most major server hardware brands
- Ease of use and familiarity (same code base as Windows XP)
- Supported by almost all major software applications
- Large pool of resources for support and maintenance

There are also some reasons not to:

- History of security/stability problems
- Doesn't scale well to the largest server configurations (high number of processors)
- Updates/patches are released infrequently (may be a pro or con depending on your position)

Linux (Red Hat, SUSE, etc.)

With Open Source software becoming more and more mainstream, Linux is becoming a viable option for many IT departments. What started out as a spare time project among a community of un-paid "developers" has become the fastest growing OS available. There are completely free versions of Linux available as well as cheap, supported versions available from numerous suppliers.

Reasons for a Linux OS:

- Very low cost
- Excellent track record for security/stability
- High growth rate
- Sophisticated administrators can achieve a high degree of flexibility because of Open Source (access to source code, quick turnarounds on patches, etc.)

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Reasons against a Linux OS:

- Fewer (but growing) number of supported applications
- Numerous suppliers/versions can lead to compatibility issues
- Not the support infrastructure that exists for other operating systems
- It is not easy to maintain and administer for unsophisticated users

UNIX (HP-UX, IBM AIX, Sun Solaris)

As Linux was based on UNIX, it is not surprising that UNIX also exists in a wide variety of formats and is offered by numerous vendors. For the most part, we would only recommend UNIX if a hardware server solution is selected that requires it. Otherwise, we would recommend Windows or Linux in its place. We will do further research in this area if requested, but do not anticipate that it will be necessary.

Our bottom line recommendation is a Windows approach. It represents a safe and practical alternative that doesn't require a steep learning curve. However, we wouldn't oppose the selection of the other listed options. There are other OS options available, but we would need some persuasion to get to the point of recommending any of them.

Relational Database Management System (RDBMS)

The selected Relational Database Management System (RDBMS) will be the heart of the statewide voter list application. It will contain all of the voter information as well as the supporting data used to provide the desired functionality. An RDBMS is an order of magnitude improvement over the indexed and flat file RMS based data storage system used by OEMS on the VAX. The Sybase SQL Anywhere Studio product used by the new VIRS application is an entry level RDBMS on a desktop PC and already significantly outperforms the VAX.

Unlike the late 80's when DEC VAX VMS was selected as the platform of choice for OEMS (thereby limiting database options to RMS and RDB), there are now a number of good RDBMS choices available for just about any OS/server combination. We will list several of the key players in the RDBMS field that all provide solutions that would meet or exceed the needs of the SEB. Primary discussion will focus on Oracle and Sybase Adaptive Server Enterprise (ASE). This is because Oracle is widely held to be the leader in database technology and because we are already familiar with Sybase products.

Server RDBMS are typically priced either per user or per CPU. If our database is accessed directly to serve web based access, then we must use the CPU licensing model. If through some type of hosting arrangement our database only feeds the hosting agency/company's database, then we could possibly use the user license model (which would be much less expensive).

Oracle

Oracle is the undisputed market share leader in global server RDBMS installations. In fact, Oracle now claims a 41.3% share of the RDBMS market (based on a 2004 study by IDC). Their most recent version, Oracle 10g, has been on the market for over a year now. Oracle includes or can be tailored to include any function that could be reasonably expected from a database. It has excellent performance ratings and is certainly a safe choice. The only downside of Oracle is the cost.

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The Oracle 10g Enterprise Edition has a purchase price of \$40,000/CPU (\$800/Named User) with software updates costing \$6,000/CPU/year (\$120/Named User/year) and product support costing \$2,800/CPU/year (\$56/Named User/year). The Enterprise Edition is designed for over 1000 users and is scalable to any number of processors. It has advanced security and data mining options available as well, although they cost an additional \$10,000/CPU (\$200/Named User) and \$20,000/CPU (\$400/Named User) respectively. However, Enterprise is probably more than the SEB needs right now, and it could be upgraded to if necessary.

Oracle 10g Standard Edition has a purchase price of \$15,000/CPU (\$300/Named User) with software updates costing \$2,250/CPU/year (\$45/Named User/year) and product support costing \$1,050/CPU/year (\$21/Named User/year). The Enterprise Edition is designed for 400-1000 users and is limited to a maximum of four processors. It does not have the advanced security and data mining options. If Oracle is selected and web requests directly access our database, then this is probably the correct version to install. The only real differences in Standard and Enterprise is their marketing, allowable scalability and options.

If all web based queries are being served by the hosting service, then Oracle 10g Standard Edition One is also an attractive low cost option. With a purchase price of \$4,995/CPU (\$149/Named User) with software updates costing \$749/CPU/year (\$22/Named User/year) and product support costing \$350/CPU/year (\$10/Named User/year). The Standard Edition One is designed for 1-400 users and is limited to a maximum of two processors. It also does not have the advanced security and data mining options.

All Oracle prices are taken from their E-Business Global Price List.

Sybase Adaptive Server Enterprise (ASE)

Sybase is the fourth leading provider of RDBMS installations. Maxim Consulting has implemented Sybase RDBMS solutions for three separate clients, including the Oklahoma County Election Board and the SEB (VIRS). Sybase products are easy to use, work well with the PowerBuilder application development tool and are cost effective.

Adaptive Server Enterprise (ASE) has a purchase price of \$24,995/CPU (\$2,995/Server and \$595/Networked Seat) with extended support costing \$5,499/CPU/year (unknown for networked seat option). ASE is designed for over 256 concurrent connections and is scalable to up to 64 processors. It also supports enterprise class options for distributed computing and high availability.

ASE Small Business Edition (ASE SBE) has a purchase price of \$4,995/CPU (\$1,495/Server and \$195/Networked Seat) with extended support costing \$1,099/CPU/year (unknown for networked seat option). ASE is designed for 1-256 concurrent connections and is scalable to up to four processors. It does not include the security, disaster recovery and high availability options that are allowed by ASE.

If all web based queries are being served by the hosting service, then it is also possible that SQL Anywhere Studio is a valid choice. It is already licensed by the SEB for use in VIRS and could easily be expanded to host additional functions. Additional 5 user

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license packs can be purchased for only \$595. There are also no processor limits that affect scalability. Because it is self-administering there are fewer tuning requirements (but also few options for enhancing performance).

Sybase prices were partially provided by a sales representative and partially taken from online purchasing options at Sybase.com.

Microsoft SQL Server

SQL Server is second to Oracle in market share and is the only other top 5 RDBMS besides Oracle whose market share is growing. Microsoft doesn't have the long history of an Oracle, Sybase or IBM in server databases, but has made huge strides in recent years with the trend towards the x86 based server. SQL Server also has the appearance of being very cost effective. It includes many features that are higher priced options for Oracle or Sybase. The one drawback is that you must be using a Microsoft Windows server OS.

SQL Server Enterprise Edition has a purchase price of \$24,999/CPU (\$13,499/Server with 25 client access licenses - CALs) with 5 years of support included. Also, service packs and patches are free. If version updates are desired a software assurance plan is available, but I could not determine prices. Enterprise edition supports an unlimited number of processors and an unlimited amount of RAM. It includes advanced security and data mining at no additional cost.

SQL Server Standard Edition has a purchase price of \$5,999/CPU (\$2,799/Server with 10 CALs) with 5 years of support included. Service packs and patches are free, just like for the enterprise version and the software assurance plan is available as well. Standard edition supports up to 4 processors and an unlimited amount of RAM. It also includes advanced security and data mining (standard not advanced) at no additional cost.

All prices for Microsoft SQL Server are retail prices obtained from their web site Microsoft.com. Listed prices are for SQL Server 2005. If the previous release, SQL Server 2000 is desired, prices are somewhat lower.

IBM DB2

IBM DB2 is the third largest market share RDBMS. It is available on a variety of platforms, but is most commonly deployed on IBM mainframes or servers. Unless an IBM hardware solution is desired, we will not spend any additional time investigating DB2.

We would recommend any of the first three RDBMS products (Oracle, Sybase or SQL Server) without reservation. Each should satisfy the technical requirements, but each has a drawback that must be considered. SQL Server runs only on a Windows OS and a long-term commitment to Windows would be a prerequisite. Sybase is the lowest market share holder of the three and therefore has the most risk (although not particularly high in my opinion) of losing support. Oracle's drawback is its cost compared to the others, particularly if it is scaled upwards and/or additional options are required. The SEB must decide which of those three factors is the least problematic.

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Development Tools

Although there are numerous application development tools on the market, we recommend using PowerBuilder for all client/server application development at the SEB. It is a robust tool that supports all of the major RDBMS and OS products. We recommend it for the following reasons:

- Maxim Consulting has significant experience in designing, developing, installing and supporting PowerBuilder applications in private industry and government (including the SEB and Oklahoma CEB).
- The current VIRS application was developed and implemented using PowerBuilder.
- Along with Visual Basic, its one of the market leaders in client/server development.
- As a 4GL, it allows for rapid application development and quick turnaround times.

It is our understanding that the SEB intends to use OSF to develop and host the web pages that will provide CEBs and the public access to voter registration data. If this is later determined to be untrue and we are asked to develop said functions, then we would need to evaluate whether to use PowerBuilder for web development or use another tool. PowerBuilder supports web based development, but we have not used it in that capacity and cannot directly vouch for its capabilities. The current trend for web based application building lies in the arena of Java and .NET.

Backup

The choice of software and hardware for backups of the server must be specific to the selected server/OS/RDBMS combination. Therefore any analysis and recommendations in this area will need to come along at a later time.

Network/Desktops

As the State of Oklahoma has statewide contracts in place to support networking and desktop procurement, we will abstain from addressing these areas that others would be better suited to deliver.

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Summary Estimate

Enhancements

Required Base Components

Voter Registration	\$525,000
Data Transfer	\$75,000
Total Base	<u>\$600,000</u>

Optional

Street Mapping/Polling Place	\$25,000
VIRS Option 2 (\$5000 if Option 1 selected)	\$12,000
Candidate Filing	\$85,000
Ballot Ganging	\$125,000
Motor License Agents	\$20,000
Election Preparation	\$45,000
Election Results Reporting	\$45,000
County Election Board Management	\$25,000
Election Equipment Management	\$75,000
Total Options	<u>\$457,000</u>