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UPGRADING EXISTING DATABASES RECOMMENDATIONS FOR IRRIGATION DISTRICTS

Rio Grande Basin Initiative
Irrigation Technology Center
Texas Water Resources Institute
Texas AgriLife Extension Service

Upgrading Existing Databases

Recommendations for Irrigation Districts[1]

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Upgrading Existing Databases; Recommendations for Irrigation Districts

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Summary

With only a few exceptions, irrigation districts in the Texas border region have old, outdated database systems that need to be replaced. These old databases are costly to maintain, make accessing and analyzing data difficult, and limit a district's ability to implement certain important new technologies and software into district operations. Upgrading out-of-date databases should be a part of any program to renovate and modernize district facilities and to improve the operational efficiency of a district.

Modern databases allow easy integration with GIS and other software packages, facilitating the use of data in making management and operational decisions, and in the design of new facilities. Commercially available databases are also relatively easy to use, thereby reducing the need for external software consultants.

In this report, we discuss important issues and questions that should be considered when upgrading databases, and provide database and operating system recommendations. Estimated costs of the required software and hardware are also provided.

We recommend that districts move to one of the following two database systems:

Option 1: *Microsoft SQL Server 2000* running on *Microsoft Windows*; or

Option 2: *MySQL database* running on *Red Hat Linux*

We also recommend that districts team together in database upgrades so that the costs of reprogramming the client software can be shared.

Terms and Definitions

In order to make this report easier to understand, we first need to define several terms.

Database

A ***database*** is collection of data arranged in a structured format (think of a table with columns and rows). However, unlike a simple table, the information (or data) in a database is indexed and organized in a way that allows very fast data searching and retrieval.

Data

Data is factual information. As far as this report is concerned, the term ***data*** refers to account and water ordering information, order history, maintenance records and all other information contained within the database system.

Server and Database Software

The term ***server*** can mean two different things; it can refer to the physical hardware of the computer, or it can refer to the software on the computer which "servers out" information over a network. In this report, we use the term ***databases*** or ***database software*** to refer to the software and ***server*** to refer to the hardware (i.e., computer) that the software runs on. However, keep in mind that many computer and database experts use the term *"database server"* to refer to the database software running on the computer.

Client

Interfacing with the server and database is another software package referred to as the ***client***. The ***client*** is a software package that reads the information that the server is sharing over the network. In most of the districts, office personnel use a ***client*** to input water ordering and other account information, as well as to produce reports. The ***client*** allows persons with no database knowledge to enter and retrieve information from the database.

Problems with Existing Databases

With only a few exceptions, the database software being used by most districts is long past needing replacement. The majority of these databases are "flat-file" type database systems (or single-user systems) which are limited in the multi-user networked environment that most of us work in today. In other words, these tend to be on a single computer that only one person at a time can access and use.

Many irrigation districts have proprietary (non-standard) database software for which only certain individuals can work on. Likewise, the associated client software can only be programmed and changed by the same person, resulting in added costs and potential delays when changes are needed or different reports are needed.

Upgrading to modern databases will allow districts to take full advantage of the extensive data records they already have. These data records can be analyzed with various software packages, thereby aiding in management decisions, project design and future planning. Modern databases also facilitate the integration of modern GIS mapping systems into day-to-day operations of the districts.

Database Upgrade Considerations

Irrigation districts have data needs that differ from many other organizations. Important database considerations include the following:

What capabilities must the database have?
The new database must be able handle all of the district's accounting data and needs, and be able to accommodate as many simultaneous connections as needed by the district without faltering. The database must be capable of handling in-house water ordering, end-of-day and end of the season reporting, and have the capability of meeting future needs such as on-line, web-based water ordering and account access.

Who will update the client software?
Each district has a slightly different client (the program that handles the water ordering and reporting). Client software compatibility is the only significant problem when moving to a new database, as the only database that is compatible with current client is the existing database system, which should be replaced. The current client software will need to be reprogrammed in order to use with the new database.

How easy is the database software to manage?
This was a major consideration we used in developing our recommendations. With a little "familiarity" training with the database, a district employee should be able to take over general management of the database system. This should reduce the need for external software consultants.

How easy and expensive will it be to upgrade the system to keep it up-to-date?
This is an important consideration over the long term. Both the database and the operating system should be easy and cost effective to upgrade in order to stay up with new technologies. The new database should also have excellent compatibility with other commercially available software in order to avoid becoming obsolete.

What operating system should the database run on?
Currently, districts are using three different computer operating systems: *UNIX*, *Novell*, and *Windows*. In addition, there is a relatively new operating system available named *Linux*. Each operating system has its advantages and disadvantages as follows:

- *UNIX* is known for it stability and robustness. However, for a district with a small office staff, it has two major limitations.
  (1) *UNIX* is a complex operating system which makes it difficult to manage without special *UNIX* training, thereby requiring the hiring of consultant.
  (2) *UNIX* system hardware and software is very expensive.

- *Novell* has good stability. However, since it is designed to be used only in server applications, it does not have good software compatibility and requires specific training for management.

- *Windows Server* is the server version of the *Windows* desktop operating system that most people have on their personal computer. *Windows Server* has a good reputation as an easy to manage operating system with great software compatibility. *Windows Server* does have several shortcomings in stability and performance when compared to *UNIX* and *Linux*; however it makes up for those shortcomings in ease of use.

- *Linux* is a relative newcomer to the operating system market. With its low cost, rock solid stability and excellent performance, *Linux* is great choice for replacing a system using *UNIX*. However, it requires advanced *UNIX* system administration training.

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Database Upgrade Recommendations

Based on the requirements discussed above, we have two recommendations for replacement existing database systems.

Option 1: *Microsoft SQL Server 2000* running on *Microsoft Windows*.
Microsoft SQL Server is a robust, high-performance database capable of handling the needs of irrigation districts with ease. *SQL Server* offers several advantages over other databases, and is a vast improvement over the existing database systems in most districts.

- *SQL Server* is a solid database easily capable of handling all of a district's needs.

- *SQL Server* is fully compatible with almost all commercial software packages that run on *Windows*.

- With its graphical user interface, very complete management packages for database tables and information, and *Windows*-like user friendliness, *SQL Server* is probably one of the easiest databases to manage.

- *Microsoft* provides excellent product support, and the software is easy to upgrade. The upgrade can often be done by persons with little technical expertise, making it easy for districts to keep their systems up to date.

Option 2: *MySQL* database running on *Red Hat Linux*.
MySQL is also a robust, proven, open-source database system that may well be the fastest database system available. *MySQL /Linux* offers several advantages over the *Microsoft* option discussed above.

- *MySQL* and *Red Hat Linux* paired together offer an extremely reliable, robust, and fast database solution. Also, both *MySQL* and *Red Hat* are "open source" software and are available free of charge. Being free does not undermine the value of the software; in fact open source software represent the world's best cutting edge software development.

- *MySQL* is fully ODBC complaint ("Open Database Connectivity:" allowing for integration with all windows software) and offers excellent software and technical support through the web.

- Several graphical management interfaces are available for *MySQL*, offering an extremely easy way to manage the databases, tables and information within.

- *Red Hat* provides excellent product support, and has an easily automated support system that downloads and installs all necessary product patches and upgrades. System upgrades are also relatively easy using the *Red Hat* installer.

Other major commercially available database systems were considered, including *Oracle* and *IBM's DB2*. Both *Oracle* and *DB2* are powerful database systems; however, they were not selected because they offer features beyond the requirements of the irrigation districts and are very expensive.

Hardware Requirements and Costs

A dedicated server is the best option for a complete database upgrade. One dedicated *Intel*-based server costing about $5000 will meet the needs of most districts. Some of the district offices that are currently running *Windows* or *Novell* may be able to avoid this cost if the existing server is less than three years old.

Software Requirements and Costs

Microsoft software and licenses must be purchased while the *Linux* software is free. The price of the *Microsoft* option varies depending on server configuration, but a rough estimate is $2500 for both *Microsoft Windows Server* and *Microsoft SQL Server*. This should be a one time charge; however *Microsoft* is continually restructuring its licensing policies so it is difficult to say what the ownership costs will be in the future.

There also will be the cost of reprogramming the existing client software (the program that currently handles the water ordering and reporting) to make it compatible with the new database system. The cost to reprogram the client will vary from district to district depending on the costs of the districts' consultant. We suggest that districts team together, thereby sharing the costs of programming the new client.

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