

MSIS: Modernized Student Information System

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Problem

Public schools, both before the recession and even more so now, have always faced the problem of budget cuts. While this problem affects the school system as a whole, one area in particular that gets radically less funding than it deserves is technology. In some cases, schools depend on older computer donations from other companies, such as TVA, where the computers are about 5 years behind current standards (1). As such, our schools are running on old technology because there simply isn't enough money to buy current computers.

In addition, schools are moving to an electronic database system. However, these databases are flawed/ As it stands now, most database systems in the public school system are either old and unreliable, or they are new and unreliable. Our product is meant to offer reliability and security, all at an economical price.

There are two categories of schools that will be interested in MSIS:

1. schools not using any electronic database system (or are using a very old one) due to budget constraints, and
2. school that are using a current electronic database system that doesn't meet their needs.

Other Solutions to the Problem

Horizon

The old system that the Tennessee Department of Education used. This system was DOS-based and is outdated by today's standards. This system was also not easy to use, as it was command-line based. However, it was custom designed for Tennessee's school system.

Cost: N/A
Ease of use: Hard (due to the command line interface)

StarBase School

The current system the Tennessee Department of Education (TDOE) is using. This system stores all data on various Oracle servers throughout the state of Tennessee. However, their system cannot handle the volume of requests. This results in denial of service errors. The system advertises that it is "web-based", but it is actually a Java application. This system is also filled with extensions and add-ons that are not needed by the schools here, but are still paid for.

Cost: \$8.7 Million per year (2)
Ease of use: Medium

- Reports of multiple points of data entry
- Files often don't port between StarBase systems
- Web based, but does not work with IE 7/8 or Firefox 2.2+

OpenSIS/FocusSIS

Database systems built on open-source software, much like MSIS. However, a hefty per-month fee is charged, based on the size of the student database. As such, this could get very expensive and possibly may not work well on the state-wide level (since it is designed for smaller scale operations).

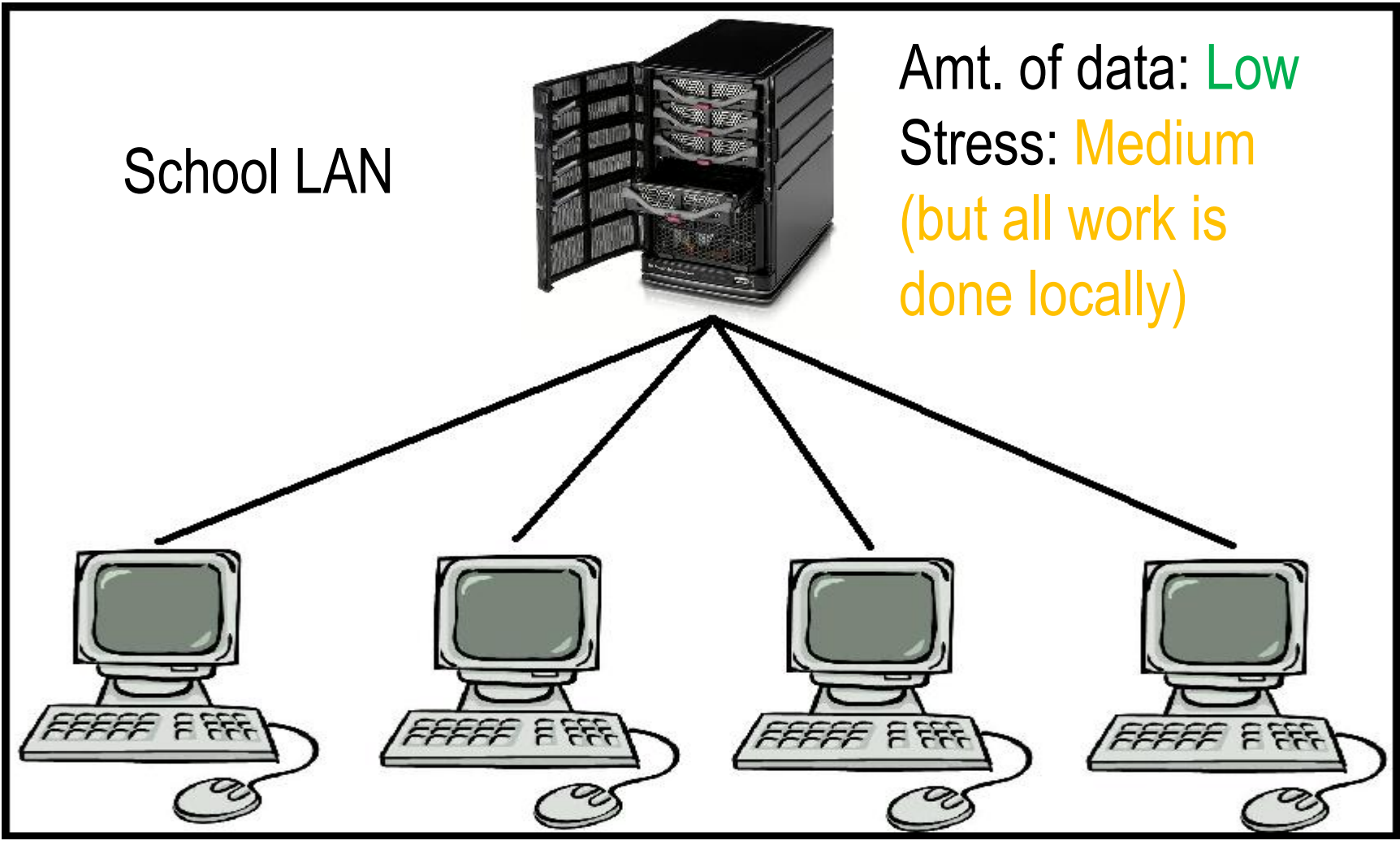
Cost: \$499/month per 2500 students, which is about \$2,185,000 per year
Ease of use: Easy

- Single point of data entry and web-based

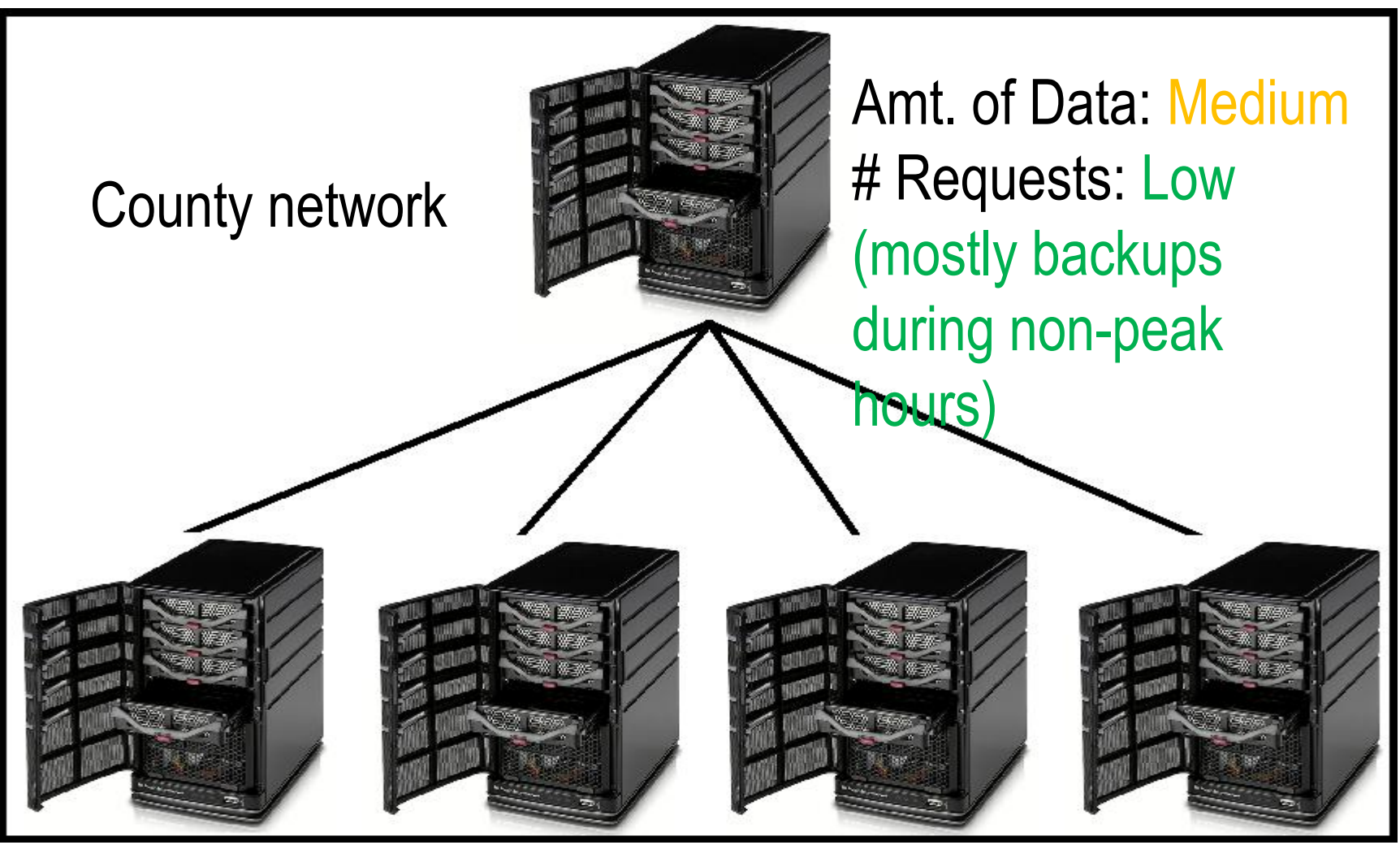
Our Solution to the Problem

Design

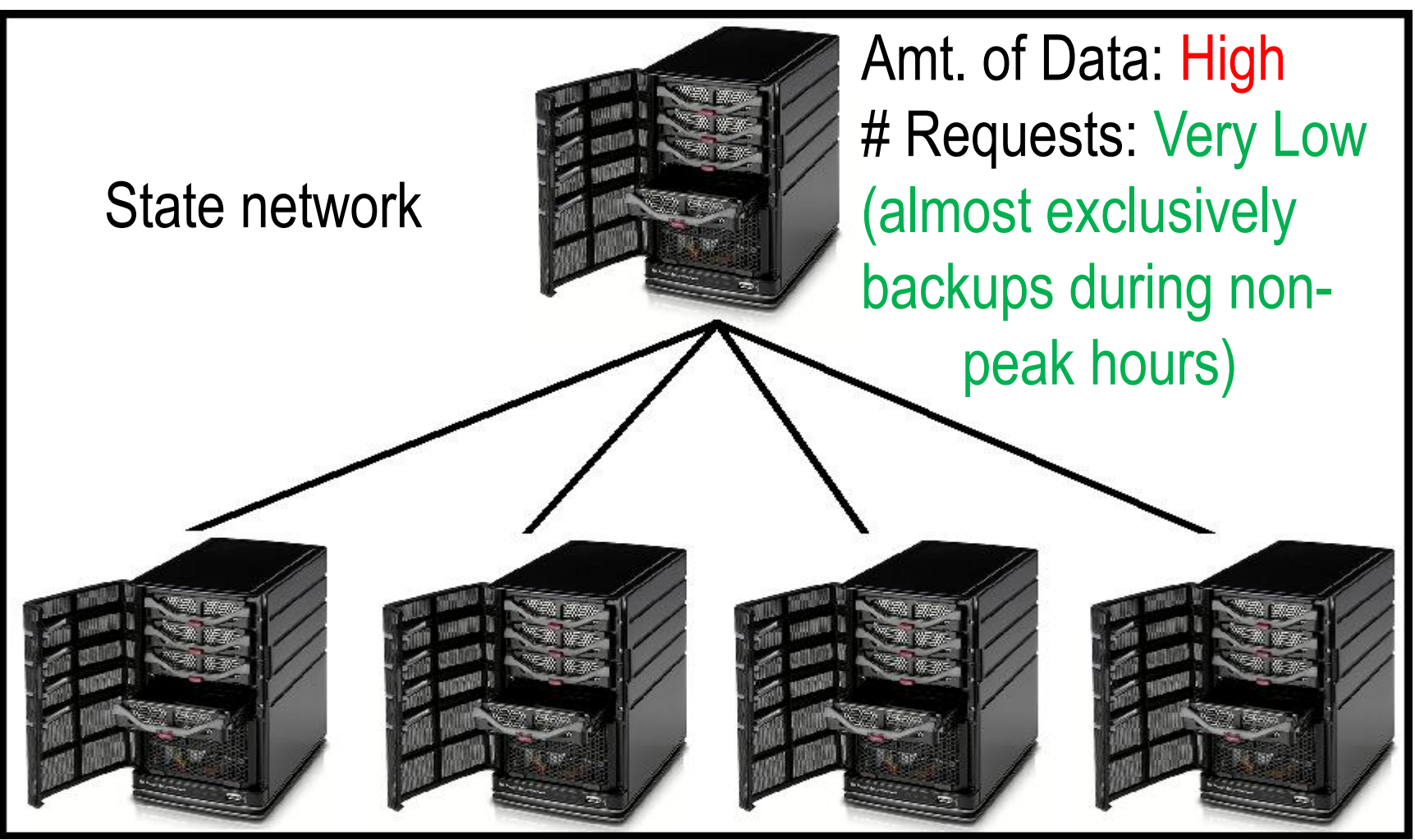
Our design is such that the vast majority of work on the system will be done locally (such as entering attendance and grades) on a school-wide level. Each school's server will be on that school's LAN, reducing page load time and data retrieval (and even allowing work to be done if the school's connection to the internet isn't functioning). This will also vastly improve the uptime and availability of each school's server. Also, maintenance can be performed locally, by each school's computer technician.



Schools will synchronize their data with the county level on a regular basis during non-peak hours, and counties will synchronize their data with the state level during non-peak times. The idea is that most data entry/retrieval is done locally where information is very limited (limited to that school's students and faculty). On the county level, much more information is stored, but it mainly serves as a backup center where very little data retrieval is performed – however, data retrieval is possible in the case that a student transfers schools intra-county.



Similarly, the state level will hold much more information than one county, but even less data retrieval will be performed on that level.



Constraints on our Design

Cost

One of the biggest factors that we are taking into consideration when designing this system is the overall cost of the system. Since MSIS is designed for K-12 school, cost is a very sensitive and important constraint on our project. As it stands, the State of Tennessee pays millions of dollars per year on education software (3)(4). We believe that schools should be able to spend their money elsewhere, such as better textbooks for example, than to pay for a technology that can be built on open-source technology.

Our solution: Build our product using open-source technology, in particular Apache, PHP, and PostgreSQL. Using these products (as opposed to their proprietary competitors, Oracle for example) ensures that the cost of development and implementation are kept at a minimum.

Interoperability

Another constraint is the ability for schools to communicate with each other and transfer student records. MSIS is being designed with the whole Tennessee Department of Education in mind, not just one school.

Our solution: Design the database such that each school has the same table structure as the county and state levels above it but only contain the information local to that school or county. This includes a single point of data entry for each assignment, etc.

Privacy and Integrity

Because we are dealing with confidential information of minors, we must build in a system of checks and balances, such that only certain people can access student information (for example, a teacher shouldn't be able to access records of a student that isn't in his/her class currently). This also applies to record transfers inter-school - transfers must be encrypted and sent securely between schools.

Our solution: Use a login system with certain permissions and limit each account to only access certain information. There will be a variety of "Account types" available, for example: principals, system administrator, teacher, student, etc. Each account will be restricted to its own system, and even within that system, accounts are restricted to what information is accessible. More specifically,

- Students can only view their grades and attendance
- Teachers can only view and edit grades of classes they are teaching
- Principals can only view their school's grades
- Guidance counselors can only view grades for their school system, but may also request grades from the county/state level in the case of a transfer student
- System Administrators can only view information anonymously (that is, a student's name is not tied with their grade)

Our Prototype

Hardware

For the hardware, we are using an older Dell Precision as a server, with an Intel Pentium processor and 256 MB of RAM. We chose this computer because we want to demonstrate that our design is efficient and doesn't require a very powerful machine to operate. We also know that it is a strong possibility that machines in schools right now are running on hardware as old as this or just slightly newer.

Our Prototype (Continued)

Software

We have built MSIS on several well known open source software packages: Apache2, PHP, and PostgreSQL.

Apache2 is our web server. We have added support for URL rewriting, SSL, and PHP to the default installation. We use URL rewriting to force SSL connections and enable our REST PHP framework.

PHP is the scripting language in which MSIS is coded. MSIS is built on a custom built PHP framework to modularize the code and offer a RESTful web interface.

Finally, we are using PostgreSQL for our backend database. Currently, we are running our database on the same machine as our web server. While this will be true for our local "in school" servers, the higher tier MSIS servers will be segregated.

Our Mock Database

For our prototype, we generated a database of random students, teachers, grades, schools, and school systems. Our database is a smaller scale of what a school, county, and state would be, but for our prototype we feel this is adequate.

- Our prototype consists of 10 tables (format: "table – size – description")
- Systems – 3 – Number of counties
 - Schools – 21 - Gives each school an id and ties it to a county
 - Class – 6 - Different account types
 - Userinfo - 6,471 - Ties identifiable information to each username
 - Users – 6,471 - Holds passwords, last login, account type
 - Each password is stored as a SHA1 hex digest, much like the way UNIX stores passwords
 - Courses – 336 - Matches course name with a school and teacher
 - Schedule – 6,300 - Used to build a student's schedule
 - Assignments - 5,376 - Ties an assignment to a course
 - Grades – 100,800 - Ties a student to a course and a grade
 - Attendance – 6,300 - Records absences and if it was excused

MSIS's Future

To meet the requirements of the TDOE, MSIS will need to hold more information required by state and federal laws, such as addresses, parents' marital status, special needs status, etc. Also, our system will need to be in compliance with TDOE's Education Information System (EIS), which reports to the State Federal DoE and determines the amount of funding each school receives. We are confident that this functionality will be easy to implement once we have more specifics.

Seth fully intends to complete MSIS by adding EIS data and functionality in the coming months. He is also currently in negotiations with the Rutherford County School System to have MSIS beta tested along side StarBase for the Fall 2011/Spring 2012 school year.

Sources

- (1) Personal internship experience, Doug Tucker at TVA
- (2) Seth Elliott's Interview with Bob Mayes, Director of StarBase for Rutherford County Schools
- (3) <http://www.state.tn.us/finance/bud/bud0809/0809Document.pdf>
- (4) <http://blogs.knoxnews.com/humphrey/2011/01/proposed-budget-cuts-to-k-12-e.html>