2012 NASCIO Recognition Award Nomination

Title: **Automatic Creation of Secure Functional Data Layers**

Category: **Fast Track Solutions**

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Project initiation and completion dates:

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Executive Summary

During the November, 2011, kickoff of the integrated Unemployment Insurance (iUS) project, its largest Information Technology development project in decades, the Idaho Department of Labor quickly recognized a fundamental problem with commercially available data access technologies: while they greatly ease access to data in a layered system architecture, they do so by simultaneously providing access to the underlying data tables – effectively creating a pervasive, system-wide data security weakness.

Unwilling to build what will become Labor's legacy systems upon a clearly exploitable flaw, Isaac Barrett, Data Architect, instead developed an ingeniously innovative method of automating the creation of functional data layers, using well-known, stable technologies.

Avoiding the data security risks inherent with products like Entity Framework, nHibernate, and others, Barrett's secure functional data layer has retained their ease of use and the ability to develop systems using abstract layers – freeing developers from tediously building numerous data access routines. Moreover, because data and its access frequently change, the secure functional data layer – like the commercial products – relieves developers from the never-ending task of updating countless input and output routines.

The secure functional data layer is a comprehensive solution which automatically generates stored procedures for every table in the database, allowing: reading, writing, updating, and deleting of data. When a data table is updated to include a new field, the system updates the stored procedure to support the new element in a matter of a few minutes.

Perhaps the most critically important feature of his solution is that it allows the restriction of data access to only the stored procedures. Of course, this prevents a host of security problems, including the potential of having staff or customers delete entire data tables using Microsoft Office applications.

To some, the secure functional data layer may appear too simple to be noteworthy. In fact, the solution is elegantly simple, yet powerful. Essentially, it is a self-designing data layer which intrinsically ensures that all data access is performed consistently, in a standards-compliant fashion – and nobody has to manually write or edit stored procedures for every table. It has and will yet save countless hours on every one of our projects.

Business Problem and Solution Description

The Problem:

The iUS project is being developed by an internal development team consisting of 5 software developers and one data architect. With limited development resources, it is critical to make optimal use of each developer's time, and minimize the amount of time spent on rote tasks. One of these rote tasks that must be minimized is writing the data access code to populate and persist data from the business objects to the physical data store.

The generally accepted solution to this problem is to use an Object Relational Mapping (ORM) tool. Examples of ORM tools include nHibernate and Entity Framework. These tools provide a standardized approach to accessing data in the physical database by automating the data layer code. Unfortunately, these tools share a common and fundamental flaw – they are not easily implemented in the most secure fashion using stored procedures. While many of the tools in this space purport to provide support for stored procedures, the use of these tools in conjunction with stored procedures is tedious and time-consuming. Many projects simply choose to sacrifice a little security and performance for the sake of optimized development; the iUS project is too critical to make fundamental security compromises.

Using stored procedures provides the optimal solution for data access for a variety of reasons, including: efficient data access, prevention of SQL injection attacks, and isolation of permissions to prevent direct access to data tables using tools such as Microsoft Office.

The Solution:

Given the problems of security, control, and efficiency, the team searched for an effective solution, but found nothing that met the criteria without requiring serious sacrifices. So Isaac Barrett, the iUS Data Architect, built a custom solution that solves our problems with no major sacrifices.

The secure functional data layer automation built by Barrett automatically builds standardized stored procedures for select, update and delete for each table in the iUS database. When new fields are added to a table, or fields are changed or removed from a table, the secure functional data layer automatically removes the obsolete stored procedures and generates new stored procedures that reflect the new table structures. Permissions are automatically created as well so the new procedures are fully ready for use.

The stored procedures are consumed by an automated .Net data access mechanism which accesses procedures for GetByID, GetByCustom, Update, and Delete. These

procedures are called by convention. Standardized naming conventions makes the use of the procedures simple, but still maintains full flexibility when needed simply by writing custom code to call customized stored procedures. Fortunately, the functional data layer includes robust functionality that rarely demands customized coding.

Significance

In Idaho, over 100,000 Unemployment Insurance claimants receive benefits from the Idaho Department of Labor each year. Claimants depend on this vital source of income to keep their families afloat during difficult times of unemployment. It is critical that Idaho's Unemployment Insurance systems operate efficiently, and that they are always available when needed. Active claimants must file certifications each week to continue receiving benefits, so the weekly filing process must be particularly efficient.

The iUS project has roots in a multi-state consortium which included Arizona, Wyoming, Idaho and North Dakota. This consortium developed requirements that are now being used by all four states to plan and build new Unemployment Insurance systems. The iUS project is taking the work started by this consortium to the next level and efficiently rebuilding Idaho's core Unemployment Insurance systems.

Rapid and efficient completion of the iUS project directly benefits all Unemployment Insurance claimants in the State of Idaho. Similar projects undertaken by other states or groups of states have been funded with amounts from $30 million to $90 million. The iUS project is being completed with a small project team and an estimated budget of $10 million. These dramatic savings are possible because of innovative uses of technology exemplified by the secure functional data layer.

Future software development projects at the Idaho Department of Labor will also use the secure functional data layer to expedite software development, saving money and providing better solutions for Idaho's taxpayers faster and for less money.

Currently, Idaho's Unemployment Insurance systems are mainframe systems running COBOL code that is 25-40 years old. This venerable technology is well past its prime, and must be replaced to have a viable, supportable, and flexible system for the coming decades. The mainframe where the systems currently run is scheduled to be turned off by the end of 2014, so an expeditious solution is absolutely required. Idaho does not have time to spend on ineffective efforts, and the secure functional data layer ensures the developers can spend their time on the most productive tasks.

The Idaho Department of Labor is an active participant in Idaho's state enterprise. Idaho's Governor, C.L. "Butch" Otter has identified three key priorities, which are directly supported by the iUS project and the implementation of a secure functional data layer:

1. *Enhancing Economic Opportunity*: Idaho's Unemployment Insurance system is a valuable tool to enhance economic opportunity for all Idahoans by ensuring that valuable, well-trained workers are able to remain in their communities during short periods of unemployment. The iUS project and the secure functional data layer will ensure that the Unemployment Insurance system remains viable and efficient, even during challenging economic times and lean budget years.
2. *Empowering Idahoans*: The iUS project will empower Idaho's Unemployment Insurance claimants by enabling them to efficiently file initial and weekly certifications when and where they need to. The secure functional data layer expedites development of iUS Phase I, speeding up the timelines for implementing Phase II improvements such as initial and weekly continued claims.
3. *Promoting Responsible Government:* This key goal is supported very clearly by the iUS project and the secure functional data layer. The iUS project will cost tens-of-millions less than comparable efforts, and will take less time as well. The innovative and effective use of technologies is keeping costs down and ensuring quick delivery of valuable solutions.

Benefits of the Project

There are many benefits of the secure functional data layer, but two are truly critical: Security and Cost Control.

Security

The secure functional data layer allows the iUS project to implement an automated data layer without making sacrifices to the iUS security model. With a large amount of data that absolutely must be confidential, security must be our top concern. The secure functional data layer allows efficient development in a secure platform.

Cost Control

The secure functional data layer component generates and maintains hundreds of stored procedures – over 800 at last count. To manually build these stored procedures would take countless hours, and the quality would be lower, requiring additional testing. Table changes occur many times per day in the early stages of a development project. Each time these changes happen, an hour or more is saved by not needing to manually modify, test, and save the stored procedure.

The secure functional data layer is one of the key components that allow the iUS project to complete work that costs most states much more. Together these innovative technology solutions and practices are expected to save an estimated $10 million when compared with Unemployment Insurance modernization efforts in other states. Development has been expedited, risk has been reduced, and a viable solution will be deployed more quickly.