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Environment, Safety, and Health Information Technology Systems Integration

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Environment, Safety, and Health Information Technology Systems Integration

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Abstract

The ES&H Information Systems department, motivated by the numerous isolated information technology systems under its control, undertook a significant integration effort. This effort was planned and executed over the course of several years and parts of it still continue today. The effect was to help move the ES&H Information Systems department toward integration with the corporate Information Solutions and Services center.

Contents

1 Introduction

Throughout Sandia there are numerous isolated information technology (IT) systems. They are often isolated from each other and the corporate IT infrastructure, leading to a lack of standardization, a redundant application of resources, and a lack of knowledge sharing. The ES&H Information Systems department, motivated by just such an isolated state, undertook a significant integration effort. This effort was planned and executed over the course of several years and parts of it still continue today. The effects of this effort are far reaching enough to reshape all current and future systems development within the department and to exert a positive influence on other groups in similar situations.

2 Systems Integration Objectives

2.1 Financial / Efficiency

Financial benefits and increased efficiency were central to what the Systems Integration project planed to accomplish. The goal was to minimize the number of software development tools and languages in the department's operating environment. This was to be accomplished by gradually moving away from non-standard environments and towards Integrated Information Services (IIS) approved platforms and tools. Standardizing technology would then translate to saving time and money by leveraging existing services and decreasing the skill sets required to maintain systems.

2.2 Customer

The customer was to benefit from systems integration through an overall increase in product performance and reliability. This would include improved data consistency and a common look and feel throughout ES&H applications.

2.3 Internal Business Processes

An improved computing strategy was to help assure greater ES&H Information Systems services to end users and bring these services in line with center strategic direction. Establishing authoritative systems for each major type of data was to reduce data redundancy and inconsistency between systems. In addition, a systematic and repeatable work approach for evaluating and comparing systems thought to be vital to this effort.

2.4 Learning and Growth

In addition to integrating ES&H information systems, improved collaboration and skill set improvement was planned into the Systems Integration effort. This effort was to work in conjunction with the plan to minimize the number of software development tools and languages. By keeping communication lines open and skills current with the new more standardized toolsets, programming efficiencies, including faster development time and increased programmer job satisfaction, were to be gained.

2.5 Prioritize Current Applications for Redevelopment

Current ES&H applications were to be prioritized in order to facilitate funding and resource allocation, thereby maximizing center return on investment. This return on investment includes improved ease of use, increased functionality and greater integration potential, along with the obvious fiscal benefits of using funds where they are need most.

3 Systems Integration Design

John A. Zachman, Zachman International, has published an approach to system development. An element of Zachman's "Framework" is diagrammed below.

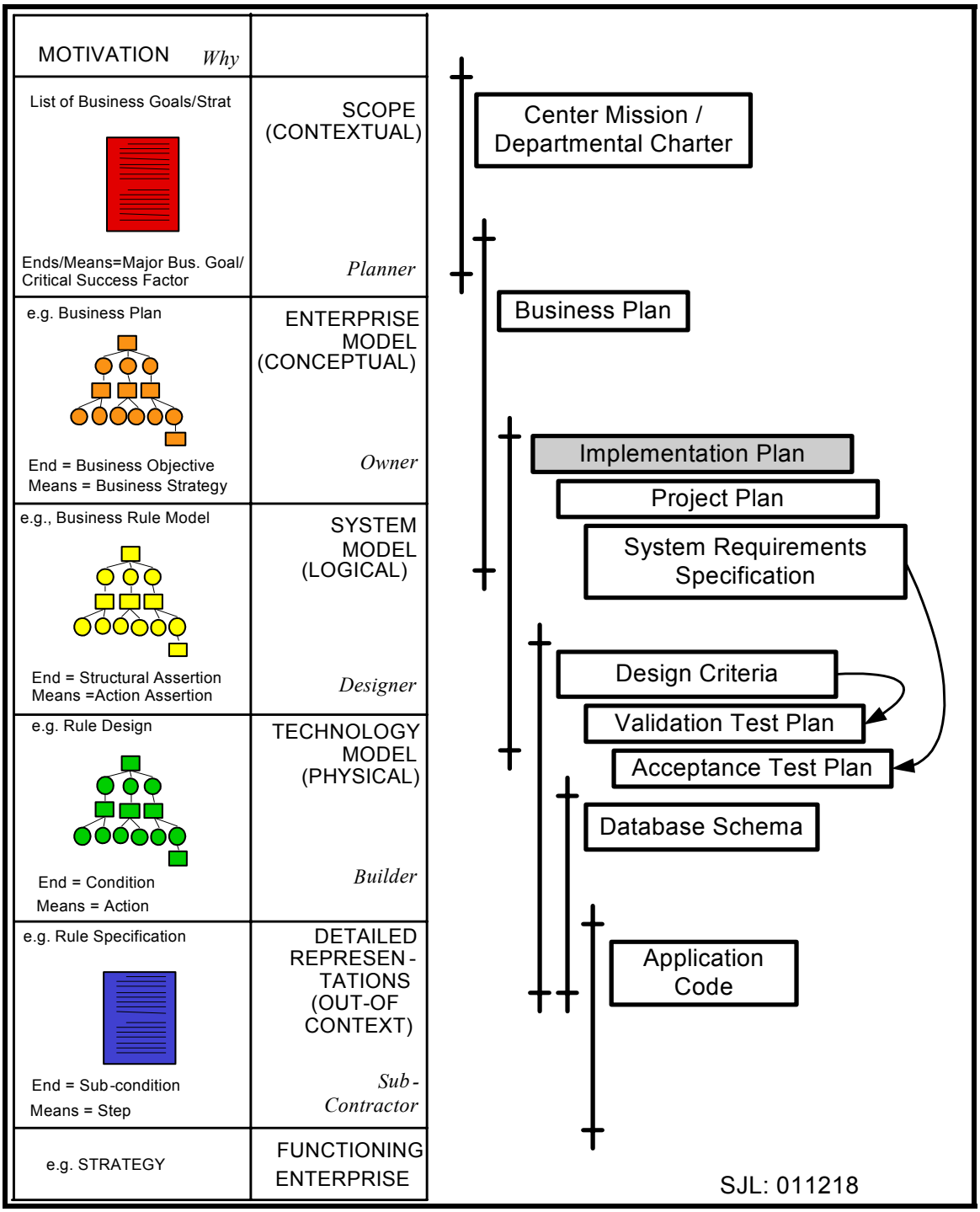

Figure 1. Original systems integration project documents at levels of the Zachman Framework for Enterprise Architecture. Only the Motivational ("Why") column of the Zachman Framework is shown.

3.1 Systems Characterization and Evaluation

ES&H Center data systems were evaluated, grouped, ranked, and then prioritized for redevelopment, to maximize return on investment. The interrelations between these systems was studied and used to identify authoritative data sources and to convey complicated system complexities.

3.1.1 Collected System Characteristics

In order to characterize and evaluate existing systems, it was necessary to gather both technical and human-factor metrics for each system. This was accomplished by a comparison of each system against the measures in the Priority Model and by identifying data and system dependencies.

3.1.1.1 Measures in the Priority Model (Scorecard)

A metric gathering methodology was developed that assessed various aspects of the state of ES&H information systems. The resulting model produced a quantitative representation of the effort, status, and priority using a common and consistent set of evaluation standards applicable to a diverse set of systems.

Multiple choice questions were used, according to the "S.M.A.R.T" criteria (specific, measurable, achievable, reasonable, and testable), to generate a set of contributor responses that were weighed as components of each of the three categories. These measures, in the Priority Model (see Appendix A), were used to obtain a health, ease of use, and impact baseline for each application.

A health baseline diagnosed the near-term survivability and long-term sustainability of the system. An ease of use baseline described the human factor capability of the system. An impact baseline detailed the financial and operational significance of the system.

3.1.1.2 System and Data Dependencies

Data exchange relationships between systems were gathered through a variety of methods. Process owners and subject matted experts were interviewed by the systems integration team. These meetings lead to the capture of often undocumented systems knowledge and fostered collaboration between experts to expose previously unknown dependencies.

3.1.2 Rank-order the Systems

A ranking system was developed based on the Priority Model to increase support for redevelopment efforts. Each of the categories and their associated weighted scores was taken into account when deriving the overall score for each system. This score was used to generate a

ranking which was accurate and quantitative. This lead to increased confidence among key stakeholders and helped justify redevelopment funding requests.

3.1.3 Evaluated Dependencies

Each application/system was evaluated via the creation and analysis of Galaxy Charts. These charts provided a visual representation of the data exchange relationships between applications and external data sources. These cross system dependencies demonstrated the complexity of the present state, and the rewards to be realized under a desired future state.

As a result, these visualization tools where used extensively in key presentations to stakeholders, in order to distil comprehensive systems analysis data into a form that could be easily communicated. The prioritization of redevelopment efforts was, and remains, a significant management challenge. These visualization tools impacted several important business decisions and further highlighted the benefit of this analysis.

3.2 Consensus-Building

In order to build support for and understanding of Systems Integration, emphasis was placed on building consensus among management, end users, Subject Matter Experts (SMEs), application owners, and developers. The systems characteristics gathered in section 3.1 were used to help build this support and demonstrate the value of integration.

3.2.1 Management Support

Management support is essential for any IT system to remain viable over time. This support is built through a combination of informative proposals, presentations, and generally well presented data. Often management is unaware of the complexities of a given system and therefore is resistant to the level of support required to keep the system viable.

The data and presentation tools provided by the systems integration project allowed these misunderstandings to be avoided more often. The systems integration Priority Model offered management a demonstration of system priority through a quantitative set of metrics. In addition, the systems integration Galaxy Charts offered a tool for the presentation of interrelationships between systems. These tools helped management to see the complexity of systems under their purview and allowed them to take this into account while making support and funding decisions.

3.2.2 Authoritative Data Sources

An authoritative data source is a data center that can be trusted to provide accurate and up-to-date information for a given subject area. These data centers can be subsets of systems, entire systems, or collections of systems that provide this trusted information. Establishing authoritative data sources prevents data duplication, inaccuracy, and staleness by ensuring that all subject area systems consistently use the same source of data.

The data from the evaluation of system dependencies was integral in establishing a consensus regarding authoritative data sources. As mentioned earlier, this data was presented via galaxy charts to system owners and key stake holders. It was then agreed upon that the data center with the most accurate and up-to-date information would be declared the authoritative data source for that subject area. These newly declared authoritative data sources were then utilized when redeveloping existing systems and designing new systems.

3.3 Integration and Standardization

Integration and Standardization were the major driving forces behind the Systems Integration project from the beginning. Although the needs that led to this project had been recognized, the characterization of these needs was essential for success. While the results of this process where at times unexpected, they led to changes within ES&H Information Systems that achieved the original goals of the project.

3.3.1 Need for Integration

Before this Systems Integration project began, ES&H Information Systems management recognized the need to integrate ES&H IT systems in order to improve data quality, reduce cost, and improve efficiency. The initial answer to this new objective was to develop a comprehensive set of documentation, which was to serve as a guideline on how ES&H systems should be integrated. This effort created the Systems Integration project.

The Systems Integration team worked to develop a business plan, implementation plan, system requirements specification, design criteria, etc (see Figure 1). They also developed the Priority Model and Galaxy Charts, which were of tremendous value in evaluating existing systems and building consensus throughout the center. As work continued, it started to become apparent that the efforts of this project were overlapping existing corporate integration standards. This initiated a natural progression away from developing a new set of guideline documents and toward integration with these IIS standards.

3.3.2 Improved Guidelines

While the Systems Integration effort was evolving, several positive effects of its original goals persisted. These effects helped to move ES&H Information Systems away from the "stovepiped" systems of the past and toward the authoritative data sources, shared infrastructure, and more web-based designs.

Difficulties encountered during the application of the Priority Model highlighted the "stovepiped" nature of several center systems. Many software development teams had recognized the need for cross-system sharing of data, consistencies in implementation, and standardization of development tools and technologies. The architecture of the existing systems often included specialized personnel maintaining redundant copies of the entire infrastructure required for the project. The systems integration team suggested a move away from these self-built systems. The hope was to move to centralized database and system administration, as well as standardized software development practices and methodologies.
An additional improvement that came out of the systems integration project was the recognition of thick client applications as less than ideal in our enterprise environment. With the advent of web application technology, reduced reliance on traditional client server and platform specific applications became a top priority.

Based on the decision to embrace existing IIS resources and standards as a major new goal for the Systems Integration project, many positive guideline changes where made within ES&H Information Systems. These changes emphasized migrating existing systems and new development to IIS supported tools and services.

4 Systems Integration Accomplishments

4.1 Accomplishments at the end of the Systems Integration project

The Systems Integration project directly accomplished several important tasks. These accomplishments then influenced the evolution of the ES&H Information Systems department and contributed to its current state of integration within IIS.

Unfortunately, no corporate guidance documents where available to direct the ES&H Information Systems department's path away from isolated "stove-piped" systems. The team published a set of guidance documents designed to standardize the integration efforts. These documents never became the accepted methodology they were designed to be, however the ideas from them were used in the integration effort that took place concurrently. Instead of diverting the department's efforts to support database management, server maintenance, and obscure development environments, its efforts would now be more focused than ever on its mission of providing high quality ES&H applications.

The system inventory and relationship information the project gathered was used to determine which application should be the authoritative data source for each major type of data. Some example authoritative data sources identified were: Hazardous Waste – WIMS, and Radiological Data – RadTrack. Also identified was the need to recognize authoritative corporate data sources, such as the "person table," which provided high quality data that was accurate throughout Sandia.

The Systems Integration team also exposed the need for extensive systems characterization. Knowing the status of systems targeted for integration and their relation to one another was found to be integral to any systems integration effort. Individual systems were inventoried for database and application specific information such as: owner, support, backup technology, size, number of users, classification, toolsets used, etc. The Priority Model technique was then developed to rank the "health," "ease of use," and "impact" of each system as objectively as possible and aid in making difficult redevelopment funding decisions. These efforts also lead to the development of progress models to help determine the effect of the systems integration effort and the related return-on-investment.

Initial efforts were made to standardize every project's change requests. A "Service Request Form" was developed to serve this purpose. Though eventually this solution was improved through the use of corporate change request management software, it helped move projects towards documenting change requests in an effective way.

4.2 IIS Integration

"Integrated Information Services (IIS) is a consortium of four centers, led by the CIO, which provides information services and information technology capabilities to all Sandia employees." "IIS organizations partner directly with other Strategic Management Units (SMUs) at Sandia to deliver information and technology services tailored specifically to the needs of these business units."[1]

As ES&H Information Systems moved toward becoming a part of IIS and the corporate Information Systems Development center, many difficult systems integration challenges had to be overcome. Isolated IT departments inherently face many challenges when trying to move towards integrating with a larger community. Tools, systems (development environments, databases, and servers), and methodologies all have to be changed to fit with those already accepted within the new community. Only after this difficult process is completed, can the many benefits of centrally directed and supported resources be realized.

ES&H Information Systems worked hard to meet these challenges. By raising awareness about the importance of systems integration, the department began to move away from the older fragmented and "stovepiped" environment and towards adapting more to working together with

[1] CIO Website About IIS, http://www-irn.sandia.gov/organization/div9000/ctr9400/aboutiis.htm

other systems and the IIS community. This is an extensive learning and migration process that continues today.

4.2.1 Used IIS Standardized Environments

4.2.1.1 Application Development

Within IIS, the wide variety of programming languages and tools used for Application Development has been reduced dramatically. Now, almost all new development projects use either ColdFusion or J2EE and thereby take advantage of existing corporate infrastructure.

4.2.1.2 Environment & Support

Enterprise Database Administration (EDA) now provides a wide variety of data/database related services to any Sandia organization. They offer both database infrastructure (hardware, software, procedures, monitoring, and automation) and database development/support services. EDA also provides a wealth of knowledge regarding data integration and access to corporate data sources. The project currently provides Database Administration services to many customers, both inside and outside of IIS, who build and maintain their own applications.

EDA services integrate directly with the IIS Systems Administration organizations. This partnership provides a complete infrastructure solution and is utilized for all database servers considered "corporate servers". Many Sandia projects also use these services to design, build, deploy, and maintain the application layer of their information systems.[2]

ES&H Information Systems is currently working to ensure that all of its systems are using the services EDA provides. This is a major step forward in the effort to eliminate locally supported ES&H IT systems and improve future integration opportunities.

4.2.2 Centralized Application Hosting and Support

4.2.2.1 Middleware

WebLogic is the IIS middleware solution for application hosting. WebLogic Server provides a robust Java 2 Enterprise Edition (J2EE) platform for the development, deployment, and management of application services. J2EE is an open application architectural standard on which to build applications for the future without having to continue to switch application development frameworks every 2-3 years. The WebLogic platform also provides the infrastructure for ColdFusion, which is heavily used by Sandia web application developers.[3]

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[2] Enterprise Database Administration, http://www-irn.sandia.gov/organization/div9000/ctr9600/dpt9618/services.html

[3] WebLogic Project Site, https://webprod.sandia.gov/middleware/

4.2.2.2 Workflow

The workflow project provides an infrastructure to support the development of production workflow applications. The need for identifying roles and role players within business processes, as well as the ability to delegate business process role authority is also provided by the Workflow team via the Roles and Delegation of Authority (R/DA) system. The lack of a simple "plug-and-play" solution has driven many workflow systems to write they own solutions rather than making use of the centralized product. A current pilot program hopes to change that by replacing the current antiquated IIS workflow engine with a J2EE solution which will integrate much more easily with applications currently under development and considering the use of a workflow engine.

4.2.2.3 Corporate Computing Help Desk (CCHD)

CCHD is Sandia's connection to service and support for all desktop and laptop computing needs, as well as any other computing-related service.[4] They not only provide support for commercial software, but also for custom built Sandia applications through Service Level Agreements (SLAs) with the application's development team. These agreements are then grouped into higher level department service level agreements, allowing faster response to service requests. This effectively integrates all computing support into one help desk and one corporately accessible hotline.

4.2.3 Systematic and Repeatable Work Approaches

4.2.3.1 Software Development Methodology

High quality software development requires a robust methodology to ensure that software is carefully planned, designed, and deployed. The development process must also be rigorously reviewed and tested based on a proven software development life cycle. This type of methodology ensures that all software systems using it meet a minimum level of quality and thereby improve their ability to integrate with one another.

Center 4500 has worked for the past few years to develop a software development methodology which follows the standards set forth by CMM. Its integrated approach to this challenge is the Software and Information Life Cycle (SILC). This process was developed in house (within 4500) and has recently been certified as CMM-Level 3 compliant. It provides a robust methodology which helps all software development projects within the center achieve a higher level of quality.

4.2.3.2 Version Control

Version control is an important part of any software development project. Having one corporate supported version management solution allows projects to get started quickly and easily, without sacrificing any of the benefits good version control software can provide.

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[4] Corporate Computing Help Desk (CCHD) Website-Home Page, http://www-irn.sandia.gov/cchdhome.html

Sandia's corporate solution is Serena® ChangeMan® Version Manager™. It organizes, manages and protects software assets across many distributed development teams and is centrally managed and supported by Sandia's Software Configuration Management (SCM) team. This software is a complete solution for any Sandia Software development team and eliminates the need for teams to purchase, set up, and maintain their own version management solutions.

[5]

This solution is a significant improvement over the diverse version control solutions used by ES&H Information Systems in the past. Use of these legacy solutions, such as SourceSafe (locally managed and largely unsupported software) and even less secure local file repositories, is contrary to the goals of systems integration. ES&H Information Systems has embraced the corporate solution and now requires all systems to use it.

4.2.3.3 Change Request Management

The corporate Change Request Management (CRM) solution has been the Serena Tracker software for several years. This solution, though no longer on the cutting-edge, is still a marked improvement over older ES&H Information Systems solutions. These custom paper-based solutions did not provide as much control or rigor. As the corporate environment moves towards newer solutions, the benefit gained by integrating will only increase.

Sandia's newest integrated solution for CRM is another Serena product. Serena® TeamTrack® is a secure and highly configurable process & issue management solution. It provides control, insight and predictability in the application lifecycle and business process management, by creating repeatable, enforceable, auditable, predictable processes.

TeamTrack® is also centrally managed and supported by Sandia's Software Configuration Management (SCM) team, eliminating the need for teams to purchase, set up, and maintain their own change request management solutions.[6]

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[5] Version Control Software Serena Version Manager - PVCS Version Control Software Source Control and Code Management, http://www.serena.com/Products/professional/vm/home.asp

[6] Serena TeamTrack - Business IT Process Management Software - Issue Management - Application Lifecycle Software Solution, http://www.serena.com/Products/teamtrack/home.asp

4.2.3.4 Automated Job Control

BMC Software's Dynamic Batch Scheduling Management solution, allows Sandia to orchestrate and optimize enterprise-wide batch processes. This CONTROL-M solution enables projects to manage dependencies and the impact of workflows at a business service level, so problems can be resoled quickly, before customers are affected.

Critical batch processes need to be managed and monitored strategically from a business data integration perspective. BMC's CONTROL-M software supports this approach, while helping to solve problems quickly, reduce manual errors, predict and prevent problems, and maximize resources.[7]

4.2.4 Easily Accessible Data

4.2.4.1 Authoritative Corporate Data Sources

One of Sandia's most well known authoritative corporate data sources is the "Person table." The metadata captured within this directory has created a central store of user information for each employee, contractor, or visitor. This information is used by almost every application to deliver accurate and up-to-date user specific information.

In addition to this directory, Sandia has also succeeded in integrating corporate hierarchies, organizational structures, and location specific information into authoritative corporate data sources. These data sources make it possible for many of Sandia's IT projects to accomplish their missions.

4.2.4.2 Data Warehousing

A data warehouse provides Sandia with the infrastructure necessary to make rich use of our data and propel us to the forefront of the state of the art in data management. Providing better data faster: data quality is improved, made consistent across sources and divisions, and integrated into one location. A data warehouse is accessible from the desktop with reporting, statistical analysis, and data and text mining tools. The results are better data that is available faster and new types of analyses are now possible.

Data warehousing ensures clean and integrated data from multiple sources which, for example, include location, person, project/task, and organization data, as well as providing historical views of this data.

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[7] BMC Software Dynamic Batch Scheduling Management Solutions, http://www.bmc.com/products/products_services_detail/0,,0_0_0_2,00.html

4.2.5 Application Assessment

4.2.5.1 Function Point Analysis Worksheet

Performance, cost, and schedule are critical components of an application assessment and estimation process. An estimation process is a phrase used generically which includes approximation, estimation, and actual counting processes. An example of an actual counting process is the Function Point Analysis Worksheet (FPAW).

The purpose of using Function Point Analysis processes, implemented primarily through worksheets, is to provide the project team with confirmation and increased confidence in project planning and tracking. Approximations from the Quick-and-Dirty Estimation (QDE) worksheet are based on historical organizational productivity, cost, and cycle time measures. Size approximations from the FPAW are based on limited knowledge of the product using customer notions of files and their associated CRUD (Create, Read, Update, and Delete) functions. The resulting values from the worksheets replace traditional "gut feel" approaches to software sizing and resource needs with a documented process that draws on quantitative measures that are calibrated as we measure released products and resources throughout the lifecycle.

An application assessment ensures uniformity and consistency among estimating approaches. It reduces variation in project performance, and using this approach improves a team's estimation capability over time.[8]

ES&H Information Systems has incorporated this tool into its project planning and estimation efforts. This has lead to more metric based estimation and reduced error over time.

5 Systems Integration Remaining Challenges

Despite great strides and progress made with systems integration, there are still several challenges to be overcome. These challenges are not localized to one area, but rather highlight particularly difficult topics for any systems integration effort. ES&H Information Systems has made varying degrees of progress on each of these issues and continues to work actively to overcome them.

[8] Estimating Process, http://www-irn.sandia.gov/cmm/4500/SQA/estitool.htm

5.1 Systems Outside of Our Control

There are many IT systems around Sandia that are outside the scope of ES&H Information Systems and the IIS. These systems may or may not be undertaking similar systems integration efforts. As such, it is beyond the scope of this effort to analyze or improve the integration related status of those systems.

In addition to the systems completely outside of the scope of this effort, there are also some systems which fail to follow these integration guidelines for various other reasons. Many times this is caused by an especially urgent or localized business need. Unfortunately, sometimes these "temporary" systems become permanent and more widely adopted. This situation presents a challenge to migrate the given system to fit within accepted IIS standards. These types of migration efforts will hopefully befit from what was learned in this systems integration effort.

5.2 Diversity of Tools

A system developer can choose from any number of tools. Unfortunately, the tools chosen may or may not be supported by the corporate infrastructure. A developer who makes use of a unique tool will find it challenging to leverage help or assistance on developing a system when compared to the same situation with a corporate adopted tool set. This isolation makes it difficult to achieve the goals of systems integration.

A continuing challenge is to communicate the availability of corporate tools sets. The goal is to convince others to utilize available corporate tools, thereby reducing the diversity of unique tool sets.

5.3 Data Issues

An issue that permeates systems at Sandia is data compatibility. This is indirectly addressed in systems integration, but even if all systems were utilizing the corporate infrastructure, some data compatibility issues would remain.

5.3.1 Incompatible Data Formats

Work continues on reducing problems such as leading zeros on both Social Security and organization numbers, incompatible date formats, and differences in storing large objects. While this issue will probably never be completely resolved, minimizing it is an important component of systems integration

5.3.2 Data Duplication

Another important concern is the duplication of data. Data accuracy relies on all sources of a given piece of data being synchronized and up-to-date. This task becomes increasingly difficult and often impossible when dealing with many copies of the same data. Ideally, data is stored in one authoritative location, eliminating many of the problems associated with data duplication. While duplication issues certainly still exist, ES&H Information Systems has been working to make such authoritative data sources a reality.

5.3.3 Lack of Referential Integrity

Whenever systems make an effort to communicate and share data (as suggested in the last section), referential integrity is an important requirement. Referential integrity ensures that unique identification of a given record is possible across one or more systems. The challenge surrounding this issue become apparent when working with systems developed without database best-practices in mind. These systems often require transformation to establish referential integrity before they can become authoritative sources of data.

5.4 Legacy Platforms

Many Sandia systems have the challenge of dealing with legacy components. These can range from older databases and software to obsolete physical hardware and operating systems. The continuing challenge here is to migrate these legacy components to the new corporate infrastructure in a cost effective way.

5.5 Centrally Document Authoritative Data Sources

Despite the fact that there are now many authoritative data sources established within ES&H Information Systems and the IIS, the ability to identify and make use of these resources still remains a challenge. There is a continuing need to document these resources and disseminate this information to the current and future systems that could benefit from them the most.

6 Conclusions

The challenges associated with the isolated IT systems present throughout Sandia are not going away anytime soon. The benefits of integrating these systems have been clearly established, and a successful systems integration project has been undertaken. This effort has demonstrated a method of integrating a group of isolated systems that is representative of many other groups at Sandia. The goals, challenges, and accomplishments of this project will challenge others to learn from it and undertake similar efforts. Only with sustained effort and cooperation will systems integration continue to improve the state of IT systems throughout the laboratory.

7 Appendix A: Priority Model

7.1 Weighting Factors under the "Ease of Use" and "Impact" Model

Contributor	EASE Gradational Score (G_E)	Weighting toward EASE Aspect (W_E)	IMPACT Gradational Score (G_I)	Weighting toward IMPACT Aspect (W_I)	Improvement Metric? (Before / After)	Relevant BP/BS Measure(s)/ Ind[ex|ices]
Who **controls the code**?		1	n/a	0	No	
Dept PL	10		n/a			
Center SME	7		n/a			
Out-of-Center SME	4		n/a			
IIS	2		n/a			
Commercial vendor	1		n/a			
Information not applicable/available	0		n/a			
What is the degree of **rigor of control on the code**?		1		0.5	Δ	Protection, Tools
Uses IIS code-management tool (SourceSafe, PVCS, etc.)	10		1			
Uses other code-management tool	6		8			
Uses no code-management tool	1		10			
Information not applicable/available	0		0			
What is the progression of **development environments** used for code maintenance and enhancement?		0.5		0.5	Δ	Development
Development to Quality to Production	10		2			
Development to Production	6		6			
Development done directly in Production Environment	2		10			
Information not applicable/available	0		0			
Who **controls the database**?		1	n/a	0	No	

Contributor	EASE Gradational Score (G_E)	Weighting toward EASE Aspect (W_E)	IMPACT Gradational Score (G_I)	Weighting toward IMPACT Aspect (W_I)	Improvement Metric? (Before / After)	Relevant BP/BS Measure(s)/ Ind[ex|ices]
IIS dba	10		n/a			
Dept dba	5		n/a			
Dept developer	4		n/a			
Non-Dept developer	1		n/a			
Information not applicable/available	0		n/a			
What is the degree of **rigor of control on the database**?		1		0.5	Δ	Protection, Resilience
IIS rules	10		1			
IIS platform, non-IIS rules	5		4			
Non-IIS enterprise platform	2		8			
"Desktop" platform	1		10			
Information not applicable/available	0		0			
What is the availability of **personnel skilled/knowledgeable** vis-à-vis development of this application?		1		0.5	Δ	Tools, Skills Currency
Active in Dept	10		1			
Matrixed to Dept	8		2			
Contractor (incl vendor) to Dept	6		4			
Active in another department, outside Dept WBS	4		6			
At SNL, but reassigned	2		8			
No longer available	1		10			
Information not applicable/available	0		0			
What is the highest level of **documentation of the data model**?		1		0.5	Δ	Documentation, Data Model
Entity relationship diagram	10		1			
Data dictionary	7		6			
Annotations in code	4		8			
Human memory	1		10			
Information not	0		0			

Contributor	EASE Gradational Score (G_E)	Weighting toward EASE Aspect (W_E)	IMPACT Gradational Score (G_I)	Weighting toward IMPACT Aspect (W_I)	Improvement Metric? (Before / After)	Relevant BP/BS Measure(s)/ Ind[ex|ices]
applicable/available						
What is this application's **current state in its lifecycle**?		1	n/a	0	No	Development, Product Currency
Undergoing development/redevelopment	10		n/a			
Stable (active maintenance and enhancements)	6		n/a			
Scheduled for redevelopment and/or replacement	2		n/a			
Information not applicable/available	0		n/a			
From how many other corporate sources/systems does this application need authoritative data?	**10-[actual number]**	0.5	**[actual number]**	1	Δ(#implemented / #needed)	Data source, Redundancy
Information not applicable/available	0		0			
From how many other non-corporate sources/systems does this application need authoritative data?	**10-[actual number]**	1	**[actual number]**	1	Δ(#implemented / #needed)	Data source, Redundancy
Information not applicable/available	0		0			
How many other corporate sources/systems need authoritative data from this application?	n/a	0	**[actual number]**	1	Δ(#implemented / #needed)	Data source, Redundancy
Information not applicable/available	n/a		0			
How many other non-corporate sources/systems need authoritative data from this application?	n/a	0	**[actual number]**	1	Δ(#implemented / #needed)	Data source, Redundancy
Information not applicable/available	n/a		0			

Contributor	EASE Gradational Score (G_E)	Weighting toward EASE Aspect (W_E)	IMPACT Gradational Score (G_I)	Weighting toward IMPACT Aspect (W_I)	Improvement Metric? (Before / After)	Relevant BP/BS Measure(s)/ Ind[ex|ices]
What is the **highest level of configuration management** of this application?		1		0.5	Δ	Requirements, Rules, Service Request, Support, User Group
System requirements specification on original production code, with continuous record of service requests	10		1			
Original production code, with continuous record of service requests	5		6			
Original production code, with demonstrably continuous record of timestamped programmer's accounts of incremental changes	2		8			
No apparent configuration management	1		10			
Information not applicable/available	0		0			
What is the **highest level of data sensitivity** and control?		1		1	Δ	Protection
Unrestricted	10		1			
Restrictions discretionary with data owner	7		2			
UCI	4		4			
Classified	1		10			
Information not applicable/available	0		0			

Contributor	EASE Gradational Score (G_E)	Weighting toward EASE Aspect (W_E)	IMPACT Gradational Score (G_I)	Weighting toward IMPACT Aspect (W_I)	Improvement Metric? (Before / After)	Relevant BP/BS Measure(s)/ Ind[ex|ices]
How do **budget limitations constrain development** of this application?		2	n/a	0	No	
Systems integration work could be covered within Dept WBS	10		n/a			
Systems integration work could be covered within Dept WBS for the application, but would displace other development and maintenance work	5		n/a			
Systems integration work could not be covered within any Dept WBS	1		n/a			
Information not applicable/available	0		n/a			
How many users directly interact with this application?	n/a	0		2	No	Value
>500	n/a		10			
50-500	n/a		7			
20-50	n/a		4			
<20	n/a		1			
Information not applicable/available	n/a		0			
What is the **broadest organizational impact of an audit finding** requiring corrective action in this application?	n/a	0		2	No	Value
Lab-wide	n/a		10			
Topical programs/projects	n/a		6			
Selected organization(s)	n/a		2			
Minimal	n/a		1			
Information not applicable/available	n/a		0			

Contributor	EASE Gradational Score (G_E)	Weighting toward EASE Aspect (W_E)	IMPACT Gradational Score (G_I)	Weighting toward IMPACT Aspect (W_I)	Improvement Metric? (Before / After)	Relevant BP/BS Measure(s)/ Ind[ex|ices]
What is the **highest level of authority specifying the function** (automated or not) that this application performs?	n/a	0		1	No	Rules
Legal/regulatory (Federal, State, local…)	n/a		10			
DOE order	n/a		8			
SNL CPRs, manuals, etc.	n/a		6			
Good business practice	n/a		2			
Information not applicable/available	n/a		0			
What best describes the **set of tools used to develop** this application?		1		1	Δ	Tools
IIS-specified, for use with Common Operating Environment	10		1			
Not within IIS specifications, for use with COE	6		8			
Source-code compilation into proprietary executable client deployed to individual workstations	2		10			
Information not applicable/available	0		0			

7.2 Weighting Factors under the "Health" Model

Contributor	HEALTH Gradational Score (G_H)	Weighting toward HEALTH (W_H)	Improvement Metric? (Before / After)	Relevant BP/BS Measure(s)/ Ind[ex|ices]
Who **controls the code**?		1	No	
IIS	10			
Dept PL	7			
Center SME	4			
Out-of-Center SME	2			
Commercial vendor	1			
Information not applicable/available	0			
What is the degree of **rigor of control on the code**?		2	Δ	Protection, Tools
Uses IIS code-management tool (SourceSafe, PVCS, etc.)	10			
Uses other code-management tool	6			
Uses no code-management tool	1			
Information not applicable/available	0			
What is the progression of **development environments** used for code maintenance and enhancement?		2	Δ	Development
Development to Quality to Production	10			
Development to Production	6			
Development done directly in Production Environment	2			
Information not applicable/available	0			
Who **controls the database**?		1	No	
IIS dba	10			
Dept dba	5			
Dept developer	4			
Non-Dept developer	1			
Information not applicable/available	0			
What is the degree of **rigor of control on the database**?		2	Δ	Protection, Resilience
IIS rules	10			
IIS platform, non-IIS rules	5			
Non-IIS enterprise platform	2			
"Desktop" platform	1			
Information not applicable/available	0			

Contributor	HEALTH Gradational Score (G_H)	Weighting toward HEALTH (W_H)	Improvement Metric? (Before / After)	Relevant BP/BS Measure(s)/ Ind[ex|ices]
What is the availability of **personnel skilled/knowledgeable** vis-à-vis development of this application?		2	Δ	Tools, Skills Currency
Active in Dept	10			
Matrixed to Dept	8			
Contractor (incl vendor) to Dept	6			
Active in another department, outside Dept WBS	4			
At SNL, but reassigned	2			
No longer available	1			
Information not applicable/available	0			
What is the highest level of **documentation of the data model**?		2	Δ	Documentation, Data Model
Entity relationship diagram	10			
Data dictionary	7			
Annotations in code	4			
Human memory	1			
Information not applicable/available	0			
What is this application's **current state in its lifecycle**?		1	No	Development, Product Currency
Stable (active maintenance and enhancements)	10			
Undergoing development/redevelopment	6			
Scheduled for redevelopment and/or replacement	2			
Information not applicable/available	0			
From how many other corporate sources/systems does this application need authoritative data?	**10*[Has]/ [Needs]**	1	Δ(#implement-ed / #needed)	Data source, Redundancy
Information not applicable/available	0			
From how many other non-corporate sources/systems does this application need authoritative data?	**10*[Has]/ [Needs]**	1	Δ(#implement-ed / #needed)	Data source, Redundancy
Information not applicable/available	0			

Contributor	HEALTH Gradational Score (G_H)	Weighting toward HEALTH (W_H)	Improvement Metric? (Before / After)	Relevant BP/BS Measure(s)/ Ind[ex|ices]
What is the **highest level of configuration management** of this application?		2	Δ	Requirements, Rules, Service Request, Support, User Group
System requirements specification on original production code, with continuous record of service requests	10			
Original production code, with continuous record of service requests	5			
Original production code, with demonstrably continuous record of timestamped programmer's accounts of incremental changes	2			
No apparent configuration management	1			
Information not applicable/available	0			
How do **budget limitations constrain development** of this application?		1	No	
Systems integration work could be covered within Dept WBS	10			
Systems integration work could be covered within Dept WBS for the application, but would displace other development and maintenance work	5			
Systems integration work could not be covered within any Dept WBS	1			
Information not applicable/available	0			
What best describes the **set of tools used to develop** this application?		2	Δ	Tools
IIS-specified, for use with Common Operating Environment	10			
Not within IIS specifications, for use with COE	6			
Source-code compilation into proprietary executable client deployed to individual workstations	2			
Information not applicable/available	0			

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