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Deploying Enterprise Solutions: The Business and Technical Issues Faced by SAS® Technologists

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ABSTRACT

With the advent of open environments, the web, and the emphasis on server based computing, the architecture of SAS applications has and will continue to evolve. This has presented both SAS Institute and SAS technologists who are involved in deploying SAS solutions with a number of issues and challenges that must be addressed in order to enable the successful deployment of an Enterprise Application. There are, of course, any number of technical challenges, in addition to a broad range of business issues that impact how to deploy SAS technology and how successful that deployment will be.

INTRODUCTION

This paper will address both the technical and business issues surrounding the deployment of SAS solutions. Case studies involving the SAS Performance Management Solution as well as the Integration Technologies product, including the SAS Portal will be used to illustrate these points.

Specifically this paper will address the following:

- Business vs. Technical Objectives
- Characteristics for an Enterprise-level Infrastructure for Data Warehousing and Business Intelligence
- The SAS System as a component of an Enterprise Infrastructure
- Selected Case Studies

BUSINESS VS. TECHNICAL OBJECTIVES

In addition to the varying mid-tier infrastructures that many typical SAS sites have supported in the past, the economy of recent years has seen the types of companies interested in SAS technology change in that many small and mid-tier businesses which have survived are now becoming interested in solutions, such as those provided by SAS Institute. The goal of both the traditional, and these new SAS clients, is to use these tools in ways to increase customer profitability. The core SAS analytics engine is one of the more proven approaches to accomplishing this.

Thus we have another dimension/complication in deploying SAS technology.

For established companies, they have their infrastructure set and in place and are hesitant to employ software tools requiring a change in that core architecture. For such organizations that have adopted a mid-tier infrastructure consistent with the requirements of SAS solutions, the issue can be as simple as installation and deployment into their existing framework. While this can be a significant amount of work, it pales in comparison to the effort involved for those organizations that have adopted a mid-tier infrastructure (e.g., MS based) that SAS is currently not targeting.

On the other hand, newer organizations have to start from scratch and so are more willing/interested in adopting the infrastructure

mandated/suggested by their solution provider (e.g., SAS Institute). These are companies that are just beginning to recognize the need and value of a robust warehousing environment to manage their data. Most of these companies (hitting the 5-10 year mark) are just beginning to realize that this is where they can uncover value. Yet at the same time they quickly realize that one can not jump into advanced analytics with out first standardizing business rules and objectives that can be applied to the data. Thus, there is also a cultural evolution in the business climate since in the first years of the business life cycle companies are more concerned with survival than data. If an issue or piece of information is not directly related to mission-critical activities, the issue takes a back seat. When the organization recognizes the value of data, especially historical data, we have to deal with all these problems as they emerge when we then try to create a customer centric data store that can feed the mining and analytic activities. As a result many companies initial forays into these solutions are met with unsatisfactory results. It is important to keep in mind these common objectives when designing and deploying these solutions.

AN EXAMPLE: A CRM IMPLEMENTATION

Consider the Business vs. IT objectives for a CRM solution. The primary business objectives would likely include:

- Enhanced contact data in order to provide more effective marketing and CRM Techniques.
- A customer segmentation and deployment process to improve Marketing and customer contact rates.
- Consistent customer and household Id's in order to facilitate external overlay data integration.
- Provide hooks in the data model for house-holding demographics when they become available.
- Improved ease of use and control of the systems that have access to customer data to provide a more complete view of the data.

While the primary IT objectives would likely include:

- Ability to leverage existing investments in software, hardware, and employees (especially IT staff)
- Ability to allow non-SAS tools to access the Data Warehouse to ease rollout of systems
- Knowledge Transfer and training for IT staff.
- Creation of a framework that provides a flexible architecture that will allow the inclusion of new products and services, as business needs change.

Thus when identifying the key requirements in most SAS Solution deployments, the first step is to develop a data store and accompanying reporting applications that will give the broad range of business users the power to act quickly on intelligent customer information, reduce customer churn, and increase customer

profitability. Typically, organizations implementing SAS technology and advanced analytics are working to create an "always-on", single view of the customer. When done correctly, this full cycle system should provide complete insight of both customer interactions and transactional events. This, in turn, provides a path for loop back from the business intelligence and analytical systems to the operational systems that are often the first line of contact with a customer. The analytical systems used to drive marketing and business decisions need to communicate and integrate with the many channels that a customer may interact with in today's organizations. Web Site, Call Center, and Loyalty Programs name but a few of these channels. Thus this initial solution should also support and provide a growth path to more advanced analytic and BI reporting.

CHARACTERISTICS FOR AN ENTERPRISE-LEVEL INFRASTRUCTURE FOR DATA WAREHOUSING AND BUSINESS INTELLIGENCE

There are a number of vendors and products that claim to be the best or the standard for Data Warehousing and/or Business Intelligence based solutions. Among the most widely recognized one might find (listed alphabetically):

- Business Objects SA, e.g., BusinessObjects, BusinessQuery, WebIntelligence, InfoView for Business Intelligence Reporting and Portals
- Cognos Corporation, e.g., Cognos PowerPlay, Cognos Impromptu, Cognos Query, Metrics Manager, etc. for Business Intelligence and Scorecarding.
- Informatica Corporation, e.g., Power Center for data warehouse and enterprise application integration (EAI) and Power Analyzer for business intelligence reporting.
- MicroStrategy, e.g., MicroStrategy 7i for Data Warehousing and Business Intelligence Reporting.

SAS has certainly positioned itself in the Data Warehousing space and is certainly the leader in Warehousing and Business Intelligence to support advanced analytics such as Data Mining, statistical analysis and methods. However, all of the above vendors and products (as well as others too numerous to list) are major players in the Warehousing and Business Intelligence space. By surveying the market the following characteristics can be identified for an Enterprise Infrastructure:

- Integration with Application Servers
- Deployable on a range of Operating Systems
- Integration with Database Servers
- Integration with Directory Servers
- Messaging and Data Integration
- Device Transparency
- Integration with third party applications

Each of these will be discussed in the following subsections.

INTEGRATION WITH APPLICATION SERVERS

Java has become a dominant player in this space and given SAS' focus on Java as a deployment platform, we will limit discussion to Java based application server environments.

A Data Warehouse/Business Intelligence architecture should include a J2EE application that can be deployed on the major Application Servers, e.g.:

- BEA Weblogic
- IBM WebSphere
- SUN ONE (formerly called iPlanet)

The benefits of integration with an Application Server are many and include:

- Proven scalability on both Unix and Windows
- Management of system resources
- Support for high availability and load balancing
- Leveraging the existing investment and infrastructure

In most enterprises there are a number of complimentary, as well as competing, applications that require enterprise infrastructure services. From both the IT and business perspective a single framework that can support the full range of business services is absolutely essential. Organizations cannot afford to support multiple enterprise infrastructures.

DEPLOYABLE ON A RANGE OF OPERATING SYSTEMS

It should go without saying that an enterprise infrastructure should support the major operating systems, e.g.:

- IBM AIX
- HP-UX
- SUN Solaris
- Windows NT/2000
- and perhaps LINUX

INTEGRATION WITH DATABASE SERVERS

Integration with the major databases is also a must, e.g.:

- DB2
- NCR Teradata
- Oracle 8i and 9i
- SQL Server
- Sybase
- as well as JDBC and ODBC access.

INTEGRATION WITH DIRECTORY SERVERS

Directory Servers can provide a number of essential services that have in the past been implemented at the application level. However when implemented at the application level, they have only addressed point solutions. Among the capabilities that a Directory Server can address, one could list:

- Identification of users, security and access.

By utilizing a central repository for this difficult problem

can be addressed, e.g., single sign-on.

- Centralized metadata management and access.

The major Directory Servers that should be supported by an enterprise-level DW/BI architecture should likely include:

- LDAP and Windows Directory servers
- Microsoft Active Directory 2K
- Novell
- Sun ONE
- WNT Domain Servers

MESSAGING AND DATA INTEGRATION

Messaging and data integration allow for applications to interact without the need to have specific customized adaptors for commonly used services (e.g., email integration). Among the services/applications that a DW/BI architecture should support one could include:

- Event based JMS (Java Message Service) functionality
- IBM MS/MQ

MS/MQ can be considered by some to be a legacy environment here. But it is still commonly used/deployed and so it is included in this list.

- Lotus Notes/Domino
- MS Exchange
- SMTP Compliant Mail Servers

DEVICE TRANSPARENCY

The Internet has changed all the rules and criteria for how applications are deployed and how results are delivered. In the past, it was possible for a platform and even an application to assume what device that the output would be viewed on (e.g., a 3270 display). That is no longer the case and so it becomes even more important to have transparent support for the deployment of standard reports to any device. By centralizing this function it relieves the application developer of the responsibility for customizing the content generated based on what device the end-user is utilizing to access their content.

The *same code* used to define/produce a report should support a range of target devices using a *write once, view anywhere* model.

The list of devices should include:

- Browsers, e.g.,
 - Internet Explorer
 - Netscape
- Mobile Devices, e.g.,:
 - Palms
 - Pocket PCs
 - RIM (i.e., Blackberry's)
 - WAP Devices

And voice based access is a capability that some might argue should become common in the not too distant future.

INTEGRATION WITH THIRD PARTY APPLICATIONS

Integration with other environments as well as third party applications adds significant value to any DW/BI environment. Among the most common environments and applications are:

- Custom web applications
- Enterprise Portals
- Excel
- Web Services, include services that leverage the leverage any/all of the following facilities/APIs:
 - HTTP
 - SOAP
 - WSDL
 - XML

Consider an example of a CRM based system. As we have mentioned, in today's business environment most CRM based system should strive to create a loop-back process from their analytical systems to the operational system that are the first line of contact with a customer. Examples of these systems include

- Inbound Call Center Systems
 - IVR
 - Switches
 - CSR Pop Screens
- Outbound Telemarketing Systems
 - Call list
 - Dialer integration
 - CSR Pop Screens
- Web based Customer Care Systems

THE SAS SYSTEM AS A COMPONENT OF AN ENTERPRISE INFRASTRUCTURE

The SAS System has a wide range of tools and products to build, develop and deploy Data Warehouse, Business Intelligence and Analytic applications. A wide range of SAS users and organizations have used these tools and products to build SAS based solutions to address business requirements.

In this section we will assess how the SAS System meet the criteria listed in the previous section for an enterprise application. In doing this assessment there are several points that the readers should keep in mind:

- Future capabilities planned for the SAS System or its components are not factored into this assessment. We only include those capabilities that are *here and now* and that have been available for sufficient time to make the assessment based on experience. If the customer has a current infrastructure, it needs to be supported now.
- This assessment is not directed to, nor is it relevant to, a *power user* who is running the SAS System on his/her PC. It is directed at the use of the SAS System as a back end server for enterprise applications.
- There is a distinction between whether a particular product or SAS solution supports a capability vs. whether the SAS System, and thus any application built with the SAS System supports it. Consider an example of the use of LDAP for single sign-on. The SAS Integration Technologies product supports LDAP, but it is not clear that the capability was automatically extended to other

parts of the SAS System (e.g., to provide slice level security control to an MDDB).

In the following subsections, the SAS System will be assessed using the criteria identified in the previous section.

INTEGRATION WITH APPLICATION SERVERS

Certain SAS products (e.g., Integration Technologies) do work with the major Application Servers. However, our experience indicates that many IT oriented customer's expect/demand a fuller and broader leveraging of these Application Server platforms.

DEPLOYABLE ON A RANGE OF OPERATING SYSTEMS

The SAS System has a long history of supported a broad range of operating systems. Thus, it has to be rated highly when it comes to support for a range of operating systems.

INTEGRATION WITH DATABASE SERVERS

Again, the SAS System has a long history, and an extensive list of SAS/ACCESS products that enable a SAS application to read and write to virtually any database on any platform. There are few, if any, other products that have the range of data access facilities that the SAS System does.

Of particular note is that within the SAS environment it can be totally transparent to the user/developer what the underlying database is. It is, of course, true that you might often want to leverage specifics of an underlying database (e.g., for performance reasons). They key point is that using different databases, or switching to a new/different database server can be accomplished without a major burden.

As companies grow there are noted increased demands for faster data analysis and advanced analytics, such as data mining, and the applications that this type of data feeds. Storage needs also exploded as a result of this demand. While SQL Server may have been fine as a starting point the flexibility of the SAS System to ease in the transition to a new DBMS provides immediate value and ROI. When combining tools such as SAS Warehouse Administrator and the appropriate Access Engine, migration to a new DBMS is as simple as pointing and clicking to modify the metadata for the libname. The Access engines will handle the appropriate SQL translations then conversion can be as easy as changing a libname statement.

Database access has also become available from not only back-end applications, but web applications as well. SAS' increased support for JAVA has enhanced their capabilities for accessing databases via web-clients. Databases can be accessed via JDBC or ODBC and can utilize the native SAS/ACCESS Libname engines, or SQL Pass-thru capabilities.

INTEGRATION WITH DIRECTORY SERVERS

With the release of SAS Integration Technologies, directory servers have become a new data source accessible via the SAS System. Since many companies use a Directory Server to store users, access rights, and security, SAS now provides the capability to access this information directly, and use it for other purposes besides Application or Single Sign On. As mentioned above, in the Single-Sign-On example, although the LDAP integration does not automatically extend to provide slice level security control to an MDDB (referred to as ACL's), by having the capability to access the Directory Server directly, the data is now available for to other applications, and can be customized to be integrated directly with something like the SAS ACL's.

MESSAGING AND DATA INTEGRATION

Although the SAS System has provided it's users with interfaces that control the ETL process via metadata management, current products still are missing out on certain functionalities due to the thick client interface. This does not affect the data integration aspects, but more the ease of use of the tool.

Data Integration can currently be accomplished via the SAS/Warehouse Administrator, as well as tools such as SAS/Enterprise Guide. SAS Enterprise Guide utilizes the back-end data management capabilities of SAS, MEA and MVA, via a virtual-client interface.

With the support for Messaging, SAS has also provided clients with capabilities of interacting with applications that could have been cumbersome in the past. For example, creating a write-back loop to operation sources such as an SAP or Siebel can be accomplished in real-time through messaging. This can include, but is not limited to scoring data (such as customers) and writing the results back to Call Center applications for special treatment.

DEVICE TRANSPARENCY

The SAS System has an incredible breadth of tools that allow a user/developer to generate virtually any report in any format. However, with the exception of the capabilities of the ODS subsystem to generate reports in a number of formats (e.g., HTML, PDF, RTF), there is little if any functionality available in the SAS reporting tools to define a report once and have it automatically be rendered for different hardware devices.

The infrastructure exists in the SAS System to do this (e.g., ODS templates and mark-up). However, responsibility is left to the user/developer to build those facilities themselves. The SAS System does not natively support them. In fact, a number of SAS products produce HTML output that requires Internet Explorer in order to be viewed correctly.

SAS AppDev Studio also provides some capability for device transparency.

INTEGRATION WITH THIRD PARTY APPLICATIONS

Utilizing the core facilities of the SAS System a developer/user can write code that can likely enable integration with third party applications. Consider the following examples:

- HTTP
The SAS system has supported the URL access method for a number of years. That allows a user to read virtually any file available on the web using a custom code data step. However, there is limited support for SAS provided facilities to leverage those tools (e.g., a facility to load the contents of an HTML table into a SAS data set).
- XML
The SAS XML libname engine supports reading and writing SAS data using an XML tagset. However, there is little support at the application or solution level.

HOW DOES THE SAS SYSTEM SCORE AS PART OF AN ENTERPRISE-LEVEL INFRASTRUCTURE?

While the some of the capabilities can be perceived as limited in scope due to the legacy of the SAS System as an end-user analytical tool, the SAS System meets many of the criteria listed.

From the Business and IT perspective, the lack of integrated SAS based environment that can integrate with other tools and products is a potential serious limitation, but also potentially a misconceived notion. By utilizing the open-ness of SAS and industry standards, the majority of the concerns can be addressed by the implementation team. Some of the most common objections the authors have encountered include:

- SAS having its own portal, instead of easily integrating with industry standard portals (e.g., Plumtree)
- Warehouse Administrator as a "stand-alone" product instead of being *integratable* with application servers.

- Lack of thin-client administration tools
- Ability to integrate metadata from various applications (e.g. Reporting and Data Management).
- Licensing issues surrounding getting additional software.

SELECTED CASE STUDIES

Three case studies will be used to illustrate both the strengths and weaknesses of either the SAS System or component solution/products at the enterprise-level. Each of these were examples involving one or more of the authors as either (or both) the lead architect or project manager:

- An Industry-Specific Scorecard Template Solution
- The SAS Portal
- SAS Business Intelligence Platform

AN INDUSTRY-SPECIFIC SCORECARD TEMPLATE SOLUTION

The SAS Strategic Performance Management (SPM) solution (note that at the time of the project, this solution was known as SAS Strategic Vision) was identified by two of the authors as the core of an industry-specific solution. The concept included a set of template or starter metrics could be identified and included in a template solution built on top of the SPM product.

The goal of this effort was a packaged offering that leveraged domain expertise as well as the SAS Strategic Performance Management product. The approach was to align and focus core business and support processes, linking business strategies to the actions occurring at the operational and support levels including: implementation, innovation and learning. Through the process of formally defining the measures set, this linkage is made explicit throughout the organization, forcing the execution and monitoring of actions that are aligned with the business strategies. By having a core starter set of metrics and defined processes that can be modified during an initial assessment or scoping project, and by using the Strategic Performance Management Mapping tool to modify the scorecard structure and deliver published versions of it to the client, it was expected that we would have a unique offering since the SPM product provides an excellent framework to work with a client on developing a scorecard framework. SPM creates a data structure corresponding to the scorecard that can be immediately used to define a back-end warehouse framework to populate the Scorecard, providing many advantages over the iterative process that many practitioners follow to define the metrics.

The template solution incorporated tools to address the business processes surrounding the definition of the analytics to be used, as well as tools to integrate the reporting environment with back-end data sources:

- A core starter set of analytics/metrics and defined processes that can be modified during an initial assessment/scoping project
- SAS Strategic Performance Management to modify the scorecard structure and meet the specific customer's needs.
- A collaborative environment to discuss, track, monitor and document the discussions surrounding the definition of the analytics/metrics.

From both a technology and business perspective, it appeared that we had a solid infrastructure for a template solution. However, when addressing some concerns raised by the targeted deployment teams

(as well as comments from the initial customers) it became clear that the solution would not be as easy to deploy as initially expected. The following two issues were sufficient to cause significant concern on the part of management:

- Lack of support for a client device other than Internet Explorer (the first two customer prospects were Netscape shops).
- An updated release of SAS Strategic Vision (as it was known at the time) required that it be integrated with a back end JSP server. However, there was limited support from SAS Institute for specific JSP servers and their integration with SAS Strategic Vision.

These relatively minor issues (from a technical perspective) for the first two potential customers were able to derail the project (from a business perspective) long enough so that it lost momentum.

Note: The above experience in no way impedes the authors' enthusiasm for the SAS Strategic Performance Management solution. In the right environment it has the potential to be an outstanding enterprise-level solution. And once SAS addresses the issues identified above, it should have even broader appeal.

THE SAS PORTAL

The SAS Portal was identified as a solution that could provide the client with one interface to access all their company-wide information and reports. The concept was the one-stop shop for report, data, and channel notifications.

The goal of this project was to create a web-based reporting application that provided both application and data level security to different types of users. The user breakout was as follows:

- Financial Analysts
- IT Data Administrators
- Finance Business Users

In terms of the Financial Analysts, they needed the capability to analyze the data and generate reports through an easy to use interface, and distribute them to Business Users that had the authority to view the particular reports. The business users had no SAS knowledge, but understood analytics. The report generation and analysis was performed via SAS Enterprise Guide (a virtual client interface to the SAS System), and published to Channels created in the Portal for different Business Users. Analysts also utilized the portal to gain access to the data and metadata created from the SAS/Warehouse Administrator, via the portal for further ad-hoc analysis. This information was available to all users listed above based off their inclusion in the appropriate LDAP Groups.

The IT Data Administrators needed to be able to view utilization reports, as well as exception reporting notifications during the data build. The SAS Portal relies on the infrastructure used by SAS Integration Technologies. This provides users with the publish/subscribe functionality, and not only allows the analysts to publish to channels, but also automated processes to publish to channels set up for IT via the portal, email, or other wireless devices in case of job failure, etc.

In terms of the Business Users needs, they consisted of one location for all their information, a customizable interface for Document Management, and the ability to view their scorecard metrics. Each user was included in one or many groups created in the LDAP server that controlled report and application access. They wanted the capability to select only the reports from the list available to them, to present in their portal.

Enterprise Guide, the SAS Portal, and the accompanying infrastructure (SAS Integration Technologies), were a viable solution to address all of the requirements and objectives for the project.

Some of the issues that arose during the implementation were:

- The need to maintain the many different components making up the SAS Portal.
- The need to customize the SAS Portal to provide the client with a Document Management System.
- Cross-Portal integration (e.g. integrating widgets from other portals with SAS and vice-versa)

These issues were not enough to derail the project, and in fact turned out to show some of the flexibility of the SAS System by:

- Providing the capability of adding customizable widgets directly into the SAS Portal with knowledge of LDAP and its API.
- Providing direct integration from SAS' Data Management Facilities (SAS/Warehouse Administrator), and Reporting Facilities (SAS/Enterprise Guide) with the Portal via the LDAP Server and Publish/Subscribe.

SAS BUSINESS INTELLIGENCE PLATFORM

The SAS Business Intelligence Platform was identified as a solution to provide the client with a robust and flexible web-based reporting application. This platform allows the customer to view their billing data across all data centers. This data was to be secured so a customer could only have access to data for their Line of Business.

The current application is not very intuitive or flexible and requires many customizations to create specific user-defined reports.

SAS OLAP Server, SAS/Warehouse Administrator, AppDev Studio, SPDS, and Enterprise Integration Technologies were the main components used to address the project requirements.

The issues that were uncovered throughout the project were easily addressed through customization of the technology. These issues consisted of:

- Lack of infrastructure for Decision Support Reporting
- Large volumes of data that needed to be processed in a short time frame, and SAS' lack of parallel processing.
- Learning curve for the technologies.
- Too many different product offerings
- OLAP Java classes have limited flexibility.

All of the technology-based issues were easily addressed. SPDS Server was used for the data processing and increased performance drastically. The software listed above was installed and configured for optimum reporting and back-end performance. Customized reporting capability was generated via Bookmarks, which eliminated users requests for customized reports, by allowing them to create their own.

In terms of the product offerings, an audit was done to analyze what the client currently had, and what would be needed for the implementation as well as future initiatives. This software was evaluated by the client, and then implemented. The infrastructure audit provided them with the capability to determine what software

will fit their needs today and in the future.

The most difficult issue to address was the client's learning curve regarding OLAP and Multidimensional Reporting. This was a new concept for them, and was overcome by constant knowledge transfer throughout the project lifecycle and customized training after the project was put into production.

CONCLUSION

The SAS System has been, and will continue to be, successfully used to build and deploy applications, including enterprise applications. It is a robust platform that can meet many business and IT requirements. However, the market has changed and evolved and SAS still has work to do before it can be truly considered as a complete Enterprise Application Development environment.

The SAS System is clearly moving in the right direction. Given there are competitive products, it is important from both a business and IT perspective that they continue to focus on the flexibility needed at the enterprise-level in order to facilitate an organization choosing SAS over those competitive products.

REFERENCES

Information about SAS products was obtained from the SAS website:

<http://www.sas.com>

as well as published documentation.

Information about other products was obtained from the vendor's web sites.

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