



# Reaping the Benefits of Integrated Business Intelligence: Introducing the SAS®9 Intelligence Platform

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# INTRODUCTION

Most companies today have made a significant investment in business intelligence (BI) covering many aspects of business performance. A typical installation has a mix of several custom built and packaged business intelligence applications accessing multiple data stores.

Typically, BI systems have been built independently of existing BI systems in the same organisation

Typically, BI systems have been individually funded by different business sponsors with the specific aim of measuring and analysing business performance in a single business area. Examples include campaign performance analysis, call centre sales analysis, cash flow analysis, supplier performance analysis, etc. Hence, many of these BI systems have been built and deployed in a fairly autonomous fashion using different development teams and with little or no co-ordination with other business area BI projects being developed in parallel. Furthermore, in large organisations, BI development within different divisions has often been undertaken using different data integration and BI tools, and deployed on different relational and multi-dimensional databases than those in other divisions. So it is fairly common to see a variety of BI applications across the enterprise deployed on a wide range of heterogeneous platforms with many different BI tools used to build reports, cubes, dashboards, scorecards and alerts. Typically, a number of analytical data stores exist, some holding substantial amounts of detailed historical data while others contain summary data that has been integrated and optimised for specific multi-dimensional analyses.

These BI systems are often deployed on a wide range of heterogeneous platforms with many different BI tools

The problem with this approach is that, over time, enterprises have created ‘silos’ of business intelligence and have accumulated a poorly integrated set BI tools and complex BI infrastructure technologies. In some cases there is also a duplication of technologies (such as ETL tools) used by IT developers in different divisions of the same company. Consequently, BI development skills are thinly spread across the proliferation of products. The total cost of ownership (TCO) of such a set-up is often much higher than it should be.

Companies have created ‘silos’ of business intelligence over time

Piecemeal BI development has resulted in unintentional data inconsistencies across BI systems and an overly complex BI infrastructure

Perhaps a bigger problem is that while this ‘piecemeal’ approach to BI development has resulted in rapid deployment with good return on investment in single business areas, the lack of co-ordination across projects has paradoxically resulted in unintentional data inconsistencies – in an environment that was set up to resolve this very problem! For example, inconsistent data naming and data definitions exist for the same data used in multiple BI applications and BI tools. In addition, metadata is fractured and not integrated such that there is little exploitation of common metadata across the multiple BI tools used in the same and different BI projects. If the same data is required in different BI data stores, that data may have been unintentionally extracted, transformed and integrated differently for different target BI systems. While these problems were never intended, they nevertheless represent reality in many organisations and contribute to a lack of quality information and user uncertainty when using BI to make decisions.

Business is under increasing pressure to be consistent and have commonly understood, auditable *trusted* metrics

Many companies are not yet leveraging BI in core business processes to maximise business benefit

Companies are looking to simplify and integrate business intelligence

BI platforms are being considered in order to standardise on a BI infrastructure from a single supplier

Meanwhile business pressure to leverage *trusted* consistent and commonly understood metrics has been mounting. Recent events such as major corporate failures and regulatory pressures brought about by legislation such as Basel II and Sarbanes Oxley have re-focused boardroom attention in many major companies on the problem of corporate governance, consistency and rock solid business performance management.

Many companies believe that they are not leveraging their existing BI investment well enough. Currently the vast majority of users of BI systems are business analyst power-users whose job it is to analyse data, produce intelligence and surface it to management, who then use that intelligence to make decisions. Power-user *information producers* are often not close enough to front line business operations to know how or when to best leverage BI in core business processes to deliver maximum business benefit.

As a result, companies are looking to do three main things with regards consolidation of their BI environment:

- Simplify their complex set-up that has arisen over years from ‘stand-alone’ BI developments by considering the use of a common BI platform of integrated tools from a single supplier for standardisation of all future BI development
- Integrate their BI and metadata ‘silos’ by repairing data naming, definition and data integration inconsistencies across BI systems.
- Integrating BI with operational applications to leverage BI for competitive advantage in every day business operations and all operational job functions as well as continuing with ‘traditional’ analysis and reporting.

A key part of doing this is in understanding the business benefits of making the leap from a BI environment consisting of best of breed technologies to one based on a common BI platform from a single supplier.

This paper defines what a BI platform is, looks at required BI platform components, and the benefits of standardising on such an option. In addition, it looks at how a BI platform can be used to integrate a heterogeneous BI environment and specifies requirements to migrate from a best of breed BI set-up. Finally, it looks at how a BI platform from one vendor, SAS, meets challenge of BI integration and outlines the benefits of such a single-vendor approach

# WHAT IS A BUSINESS INTELLIGENCE PLATFORM?

A BI platform is a complete suite of integrated tools and infrastructure components used to build, manage and integrate a BI system

A business intelligence platform is a complete suite of integrated tools and infrastructure components that share common metadata and that are used to design, build, manage, access and integrate a business intelligence system.

Custom built and packaged business intelligence applications sit on top of this platform and deliver personalised integrated actionable intelligence to internal and external users via a BI portal that may itself be integrated into an enterprise portal.

## Component Technologies That Make Up the BI Platform

The components of the BI platform are as follows and are shown in Figure 1:

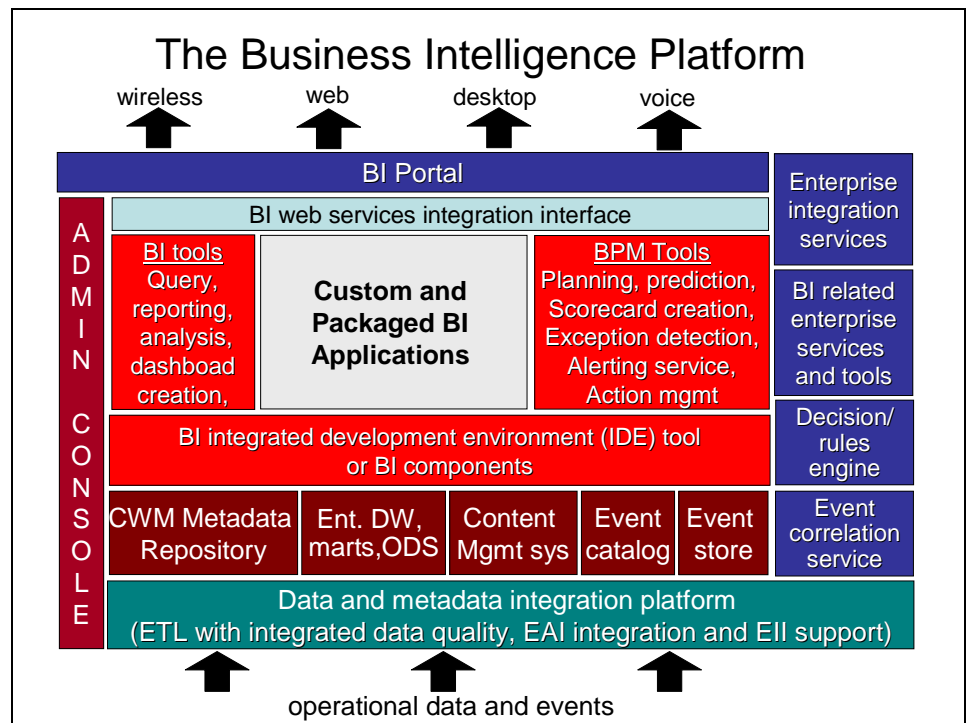


Figure 1

Data and metadata integration are critical components of the BI platform

- A data and metadata integration platform. The main role of the data integration component of this platform is to design and build target BI data stores. This may involve importing data models from other design tools. Batch and event-driven data is then extracted, transformed and loaded from one or more data sources into those target systems (the ETL process). Through this process of data integration, the organisation builds data warehouses, data marts, low latency event stores and operational data

Integrated data quality in the ETL process is imperative for ensuring accurate information

Event-driven data integration and enterprise information integration are key growth areas for new 'on-demand' applications

Metadata integration is critical to the creation of a shared business vocabulary

Centrally managed common metadata can be shared across all tools in the BI platform

stores that will provide integrated data on-demand to BI applications. Data quality profiling, data cleansing and matching capability should be integrated into the process to ensure that data is clean and consistent.

In the case of event-driven data, the tools must integrate with enterprise application integration (EAI) products such as application integration brokers to capture relevant events as soon as they happen. Data integration can also be used for enterprise information integration (EII) as well as for traditional ETL processing. The historical data warehouse adds context to the event and provides supporting information so that the event is not viewed in isolation. Support for EII as well as ETL allows data integration to leverage an EII federated query to easily supply subject-oriented data (such as product data, customer data and location data etc) to an ETL process. It can also be called as a service to supply integrated data 'on-demand' to other applications, analysis servers and portals from one or more BI and operational stores. For example, data in multiple BI systems may be integrated on-demand for automatic analysis and action taking to support business activity monitoring (BAM).

- The other key piece of this BI platform component is metadata integration. Metadata integration is critical in identifying and collecting disparate data definitions to build an asset registry of the disparate data used in different systems across and beyond the enterprise. Once collected, these disparate data definitions can be cross-referenced to a common shared business vocabulary consisting of common data names, definitions, structure and data integrity rules. The reason for doing this is to create common definitions that can be used and re-used across multiple BI (and operational) systems to improve data consistency, understanding and clarity. Metadata integration is required to fully understand disparate data and build a shared business vocabulary that can be used and re-used in modelling, data integration (EII and ETL), BI tool business views, and application integration.
- Data stores optimised for analysis and reporting. These data stores may make use of modern relational database management systems or they may be optimised for multi-dimensional analysis, reporting or predictive analytics. Different storage approaches may also be integrated to solve a particular business problem. For example, relational and multi-dimensional DBMSs may house detailed and summary data respectively but work together to support analysis and drill down for a specific business use.
- Centrally managed common metadata shared across multiple BI tools and applications is part of an integrated platform. This includes the ability for corporate performance management scorecard applications to make use of shared definitions of metrics in custom-built and packaged analytic applications when defining how to calculate key performance indicators

Industry standards for metadata interchange provide BI integration and platform extensibility

associated with strategic objectives. This metadata repository should be compliant with industry standards such as OMG Common Warehouse Metamodel (CWM) and XMI to facilitate open two-way exchange of metadata between heterogeneous tools as well as between the tools provided in the BI platform. This is critical because common definitions across all models, data stores and BI tool business views are necessary to integrate custom and packaged analytic applications built on top of the BI platform. Common definitions also provides consistency, trust, reliability and common understanding among business users, all of which contribute to more robust corporate governance and more reliable decision making.

BI IDE tools help developers build analytic applications

- The ability to extend applications to meet your unique business needs is an important element of an integrated BI platform. This can be achieved using an integrated development environment (IDE) tool for analytic application development and customisation of packaged analytic applications. Alternatively, the organisation could create a library of visual (such as charting) and non-visual BI analytical components. Such a component library can be used in an enterprise application IDE. Professional IT application developers use IDE tools to construct applications. They include Borland JBuilder, Oracle JDeveloper, Microsoft Visual Studio, IBM WebSphere Studio and BEA WebLogic Workplace.

An events catalog supports on-demand real-time analytics and business activity monitoring

- An events catalogue and an events correlation service. An events catalogue holds an inventory of events that allows users to select which events to watch for business activity monitoring (BAM). In conjunction with the catalogue, an event correlation service will help in the understanding of the relationship between multiple events and associate the presence of one event with another. This is in the context of events being captured by the data integration platform for business activity monitoring (BAM). Both event catalogues and correlation services will become a significant component of BI platforms over the next 12 months.

BI tools are used to report on, analyse and *measure* business performance

- Business intelligence tools for:
  - Query,
  - Reporting,
  - Multi-dimensional analysis,
  - Dashboard creation and presentation.These tools are associated with applications that *measure* performance. There is also a demand for documents produced by these tools to be stored in a content management system.

BPM tools help users *manage* business performance

- Business performance management (BPM) tools for:
  - Planning,
  - Prediction (mining, forecasting, optimisation),
  - Scorecard creation,
  - Exception / state change detection,
  - Alerting,
  - Action management.

These tools are associated with applications that *manage* performance.

- A decision or rules engine service for automatic alerting, recommending and automated action taking. This is a key component that makes a business more responsive and able to consistently guide business operations. An example would be to make live recommendations in a call centre to assist staff in cross-selling to customers and prospects.
- A web-based business intelligence portal that acts as a secure integrated single web-based user interface to business intelligence and related unstructured content.

Web services facilitate a standard approach to integration with the BI platform

- An open industry standard BI web services interface for easy integration of any of the BI platform components with other applications and portals. This new wave of interoperability is an aspect of BI platforms that vendors would do well to incorporate during the early stages of development.
- A single BI system administration console to manage the BI environment. This aspect of the platform is important in attributing role-based security to the end-users within an organisation.

The BI platform should integrate with enterprise portals and enterprise application integration technologies

- BI platform integration with enterprise integration services including:
  - An enterprise portal - via publishing of BI portal portlets using industry standards such as web services for remote portals (WSRP) and JSR 168 portal-independent API. This can also be achieved via a proprietary portal integration kit to integrate the BI portal with a specific enterprise portal. This would also include exploitation of an enterprise portal personalisation service to target personalised BI at specific roles.
  - An enterprise application integration (EAI) service - via connectors to integrate BI tools and analytic applications with operational applications via an enterprise application integration technology and the BI web service integration interface.

The BI platform should leverage existing enterprise services

- BI platform integration with related enterprise services and tools including integration with:
  - A security service,
  - User directory services,
  - Content categorisation service to organise BI content such as reports, cubes etc.,
  - Collaboration tools to facilitate sharing and collaboration over BI content.
- Platform integration with a content management system to bring together structured BI and unstructured data and to store BI reports alongside related unstructured data in a managed environment.

### BI Platform Deployment Options

Options for deploying a business intelligence platform include:

1. Buy and integrate best-of-breed BI products from multiple vendors.
2. Buy a business intelligence platform from a single vendor, and integrate missing products as required.

Many companies are looking to standardise on a BI platform to reduce complexity and total cost of ownership

Option 2 is the most likely solution for many companies as they look to reduce the complexity and total cost of ownership of their heterogeneous BI environment.

### BI Applications Deployed On the BI Platform

While not the focus of this paper, most organisations are likely to have a mix of packaged and custom-built business intelligence applications. These applications include strategic performance management applications (scorecards, objectives and KPIs, resource planning) that sit on top of front office, middle office and back office analytics (sometimes called enterprise analytics) used for tactical analysis. Below the enterprise analytics layer, fits operational performance management with operational reports, business activity monitoring (BAM), on-demand BI and on-demand predictive analytics used to support operational decisions and guide operational staff. Figure 2 shows how these applications fit with the BI platform.

Both corporate performance management AND operational performance management are needed to manage a business

Strategic performance management on its own is not enough to manage a business. KPIs at the strategic level are often judged as the so-called corporate performance management (CPM) element. However, near real-time operational *analytics*, automatic analysis and automated action are also essential needed because people ‘on the ground’ working in day-to-day operations are not exposed to strategic KPIs. What they need is to be guided by alerts, live recommendations and automated application messages that are issued automatically by decision/rules engines that monitor actionable intelligence produced by automated analysis servers analysing business events as they happen.

So called ‘just in time analytics’ and business activity monitoring (BAM) are essential elements of business intelligence needed for managing day-to-day business operations.

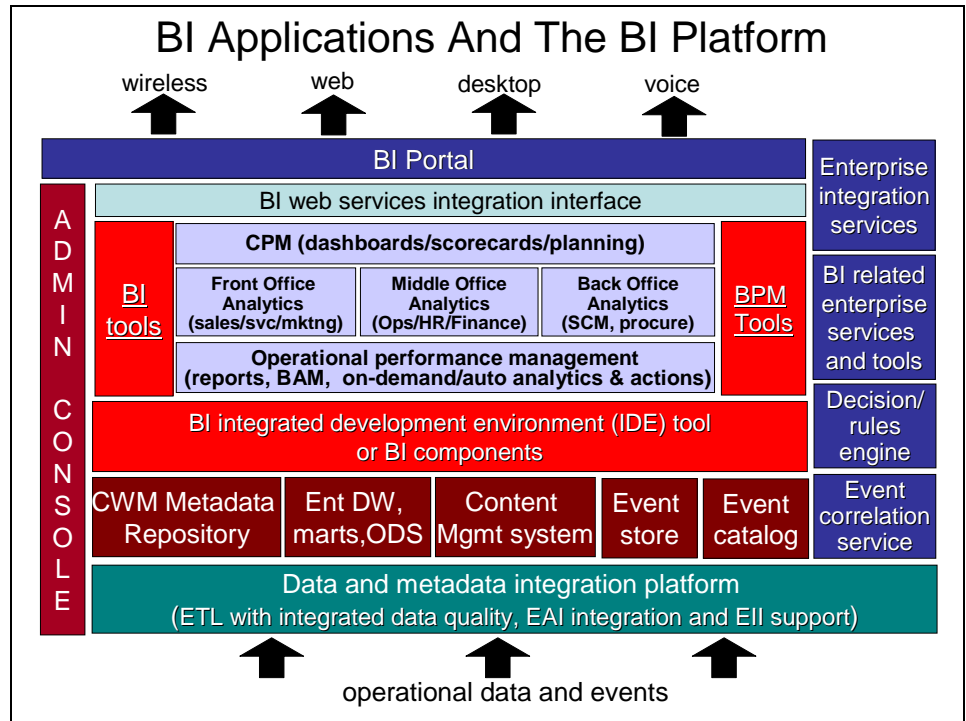


Figure 2

Perhaps a better term for this is *operational performance management*. Combining corporate performance management (scorecards, dashboards at the strategic planning level) with operational performance management (near-real time operational analytics at the operational decisions level) is important in *managing* a business. Enterprise analytics on the other hand is sandwiched between the operational and strategic performance management. Enterprise analytics is at the tactical analysis level and is used to *measure* business performance.

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# BENEFITS OF AN INTEGRATED BI PLATFORM

Why should an enterprise make a move away from the best-of-breed BI environment with tools from multiple vendors, to a standard BI platform from a single vendor? There are a number of benefits to adopting a standard BI platform strategy.

As the BI market consolidates to a smaller number of larger BI vendors, companies can reduce complexity of their existing BI environment by partnering with a single strategic supplier to standardise, simplify and reduce the total cost of ownership their end-to-end BI technology infrastructure.

Integrated tools with common metadata improve development productivity

In addition, the BI platform is an integrated suite of tools that share a common metadata repository such that each tool can leverage and reuse components and metadata created by other tools that are also part of the same platform. For example, metadata created by a BI platform data-modelling tool can be used by a data integration tool. In addition, business names defined in a data integration tool for target data can be reused to generate business views in front-end BI query, reporting and analysis tools. Also, administration consoles can display the workflows defined in data integration tools and report on data integration performance as ETL jobs execute. Other BI tools can reuse dimensions, dimension hierarchies and metrics as well as analytical applications that are part of the same integrated platform. This kind of interoperability and sharing of common metadata can contribute significantly to increased productivity and consistency.

Shared metadata across all tools in the BI platform may provide better integration than best-of-breed BI environments

A BI platform with a common repository and common industry standard based metadata interfaces can help to better integrate existing BI tools and facilitate migration from best-of-breed tools to a standard BI platform. Unwanted licences of best-of-breed vendors can be phased out as this migration occurs, thereby reducing total cost of ownership. In addition, the number of BI and metadata ‘silos’ can be reduced as metadata moves to being managed by a common repository shared by all tools.

A shared business vocabulary is difficult to achieve in best-of-breed BI environments

A BI platform with an extensive set of BI tools such as query, reporting, analysis and predictive tools can be used to develop and deploy a broad range of analytic applications. These analytical applications can all leverage and reuse data names and attribute data definitions, dimensions, measures, cubes, reports, queries and predictive models defined to the platform. This is very difficult to achieve in a best-of-breed BI environment where metadata integration and sharing is much more limited.

CPM scorecards can leverage metrics in underlying analytic applications to calculate KPIs

BI applications such as Corporate Performance Management (CPM) scorecards and dashboards can construct metrics trees by accessing other metrics already defined to the BI platform common metadata repository. Hence existing metrics used in other BI applications can be ‘rolled up’ and used in formulae to calculate key performance indicators (KPIs) used in CPM scorecards and strategy maps. This kind of re-use encourages deep integration between CPM applications and underlying BI applications developed using tools from the same BI platform.

BI development skills are becoming more focused on a single BI platform toolset

BI development skills that are thinly spread within an organisation can be focused around a single toolset; thereby increasing expertise and productivity rather than trying to support multiple different kinds of tools. This also reduces the costs of training, security management, user management, and other maintenance costs that are incurred when trying to maintain consistency across BI tools when changes occur to underlying BI systems.

The BI platform provides a common industry standard interface to integrate BI with all operational applications. This is a simpler option than struggling to integrate BI from multiple tools and analytic applications with operational applications using a number of interfaces some of which may be proprietary in nature. Additionally, a BI platform in general offers better integration across BI development, BI system management and BI system access tools. Finally software maintenance updates for all BI infrastructure software are from a single vendor which reduce complexity.

The longevity and financial stability of the BI platform supplier is also important

While these benefits are clear, the longevity, financial stability and track record of a BI platform supplier is important to customer confidence if strategic investments are to be made. Vendors must also ensure that their BI platforms are extensible by supporting metadata integration and metadata interoperability standards so that additional products can be integrated into the platform and managed by it.

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# BI PLATFORM INTEGRATION REQUIREMENTS

It is important that the component technologies of a BI platform work together to maximise development productivity and to integrate and manage BI applications deployed on top of it. The following is a list of requirements that BI platform components should meet to help maximise business benefits.

Shared metadata and interoperability between BI platform tools needs to be maximised

- All tools in the BI platform should share a common metadata repository or at the very least be able to interchange metadata.
- Data integration tools should support the importing of data models from other data modelling tools via metadata interchange standards.
- It should be possible to use metadata created via modelling and data integration tools to generate business views for all front-end BI tools rather than have to re-key the metadata into these products.
- Dimensions, dimension hierarchies and metrics defined or imported into the platform metadata repository should be available to BI, CPM and IDE tools within the platform. This will ensure that they can be re-used by these definition and data names for integration and consistency around a *shared business vocabulary*. As an example, a scorecard builder CPM tool should be able to access definitions of metrics used in BI tools and BI applications so as to re-use them to define the ‘roll-up’ formulae for key performance indicators (KPIs) used in scorecards.
- BI IDE tools should be able to re-use predictive models produced by power users in developed analytic applications.
- Predictive analytics tools such as data mining tools should be able to deploy scoring and predictive models in databases using industry standard Predictive Modelling Mark-up Language (PMML) so that operational applications can exploit them.

All tools in the BI platform should be able to integrate with the BI portal

- All BI tools and CPM tools in the BI platform should be able to integrate with the BI portal.
- Users producing documents with BI tools should be able to store these if required in a content management system.

Collaboration support facilitates joint decision making

- Users who want to share intelligence and collaborate with others to support joint decision-making should be able to make use of enterprise collaboration tools integrated with the BI platform. Collaboration tools include net meetings, instant messaging, threaded discussions, web chat

and e-mail. Discussions associated with BI can then be stored alongside the BI content in a content management system.

Integration with unstructured content enhances the information needed for decision making

- It should be possible to integrate unstructured content on the web and in content management systems with reports, dashboards, scorecards and applications developed via BI tools and IDE tools. All of this BI and unstructured content should be accessible via the BI portal.
- The data integration tool should be able to be invoked as a web service for on-demand data integration of operational and historical data for delivery to target applications supporting activities in a business process. In this context, data integration tool is providing EII to integrate BI, operational and unstructured data on-demand. The data integration tool should also be invoked as a web service for on-demand data integration of operational and historical data for delivery to target predictive analytics tools (such as data mining) for the purposes of business activity monitoring (BAM).

Data integration should be able to be invoked on-demand

The BI platform should support workflow for business activity monitoring (BAM)

- Workflow used in data integration should be able to include predictive analytics components, alerting, collaboration tools (such as e-mail or instant messaging), exception or state-change detection, decision or rules engine and other 3<sup>rd</sup> party web services as part of the workflow to support BAM and operational performance management. This transforms the data integration workflow into an “event driven BI workflow”. It should also be possible to publish these workflows as web services.

Publishing BI reports, queries, cubes and platform tools as web services facilitates enterprise integration

- One should also be able to publish cubes, reports, queries, models, BI tools, ETL tools, analytic applications and metadata services as web services to invite and support integration with other applications using industry standard web services interfaces and/or enterprise application integration technology. This can be achieved via the BI web services interface that is part of the BI platform.

BI should be organised into a portal taxonomy alongside other related content

- The BI platform should integrate with content categorisation service to *organise* BI and other related content into business topics in a portal taxonomy to help users easily find the content they are looking for. The BI portal should then be able to integrate with enterprise portals and enterprise security services via industry standard web service protocols.
- The BI platform administration console should be able to leverage enterprise security and user directory services for user management and security administration within the BI environment.

The following section looks at one example of a BI platform from SAS to see how it meets the needs of companies looking to standardise on BI infrastructure technology. It also shows how the SAS offering can integrate with other BI tools, operational applications and integrate existing BI and metadata silos.

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# PRODUCT EXAMPLE – THE SAS®9 INTELLIGENCE PLATFORM

Having discussed the BI platform at length, this section looks at a specific example of this technology suite from SAS.

## COMPANY OVERVIEW

SAS is a leading supplier in the BI marketplace

SAS is a recognised leader in providing enterprise business intelligence system solutions. Headquartered in Cary, North Carolina, SAS has been providing business intelligence and statistical analysis software since 1976.

SAS provides a BI platform and customisable packaged analytical solutions for various industries

SAS has over 38,500 customers worldwide, and its distribution channel spans 119 countries. SAS has strategic alliances and partnerships with leading hardware and software vendors, and regional and global solution delivery partners.

Key parts of the SAS product line, include its business intelligence platform and customisable horizontal and industry specific packaged solutions. Horizontal solutions include SAS® Customer Relationship Management, SAS® Financial Management, SAS® Supplier Relationship Management, SAS® Human Capital Management, and SAS® IT Management. Industry specific solutions include SAS® Process Intelligence for manufacturing, SAS® Banking Intelligence, SAS® Telecommunications Intelligence and SAS® Insurance Intelligence.

The SAS Intelligence Platform includes a number of integrated software components

The SAS® Intelligence Platform is a platform-independent suite of integrated software components that support the development and management of data warehousing and business intelligence systems. The SAS Intelligence Platform runs on a wide range of operating systems including Unix, IBM Z/OS, and Windows XP/200x/NT. The components of the SAS Intelligence Platform are shown in Figure 3 and include:

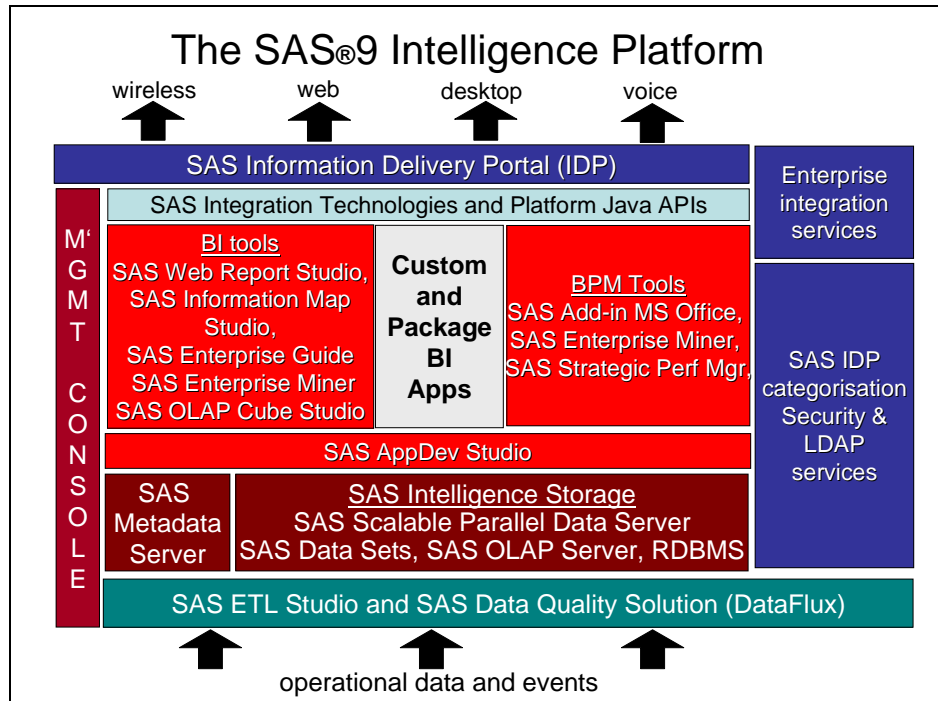


Figure 3

SAS ETL Studio supports integration with an extensive range of heterogeneous data sources as well as messaging middleware and XML sources

SAS data quality software is integrated into SAS ETL Studio

SAS supports BI data stores optimised for analysis as well as popular RDBMS platforms

- **SAS® ETL Studio** – This is data integration platform that can capture and/or extract, clean, transform and integrate data from a large number of heterogeneous, online transaction processing (OLTP), legacy and analytical data sources. This includes popular packaged application suites such as SAP and PeopleSoft as well as custom-built data stores. SAS ETL Studio also integrates with popular messaging products such as IBM WebSphereMQ and supports XML data sources to capture application events as they happen. Pre-defined transformations and integrated data quality routines are also provided.
- **SAS® Data Quality Solution** – This is a toolset for data profiling, data standardisation, data cleansing data matching, householding and augmentation to remove inconsistencies, anomalies and improve overall data quality. All of this contributes to better accuracy, confidence in trustworthy information when meeting regulatory requirements, and provides a more holistic view of customer data for potential competitive advantage. SAS Data Quality Solution includes the SAS DataFlux® dfPower Studio toolset and other components that can be integrated with SAS ETL Studio and SAS® Metadata Server to clean and match data during ETL processing. The combination of SAS Data Quality Solution, SAS ETL Studio and SAS Metadata Server is known as the SAS® Enterprise ETL Server.
- **SAS® Intelligence Storage** – SAS supports several options for BI data management to optimise storage for specific analytic activity. SAS® Intelligence Storage options include SAS Data Sets, SAS® Scalable Performance Data Server® and SAS® OLAP Server. SAS also supports the option of storing data in popular third-party relational database management systems.

The SAS Metadata Server is fully compliant with industry standards

The SAS Metadata Server supports a shared business vocabulary across all client tools in the SAS Intelligence Platform

Metadata interchange is possible between SAS and 3<sup>rd</sup> party tools using an industry standard mechanism

- SAS® Metadata Server – This is a metadata repository used to share and interchange technical, process and business metadata between all SAS Intelligence Platform tools and any other 3<sup>rd</sup> party tools. The SAS® Metadata Repository fully supports industry standards; specifically the OMG Common Warehouse Metamodel (CWM) standard and the XMI metadata interchange standards. Metadata interchange support is two-way via the XMI standard. SAS Intelligence Platform standards support is not purely for industry standard metadata interchange; SAS have gone much further by fully supporting the CWM standard to hold metadata within the SAS Intelligence Platform. This comprehensive support for standards protects customers from lock-in and makes it possible to migrate from best-of-breed products to the SAS Intelligence Platform. The SAS Metadata Server also supports a *shared business vocabulary* across all client tools in the SAS Intelligence Platform thereby allowing data in all data stores to be viewed using the SAS BI and BPM tools in a consistent common fashion. Shared metadata also means that SAS packaged applications and applications developed using SAS® Enterprise Guide® and SAS® AppDev Studio can have a shared business vocabulary. This is a very important feature because it allows SAS to deliver consistency and common understanding across all SAS BI tools that are used by different kinds of users (see figure 4 below).

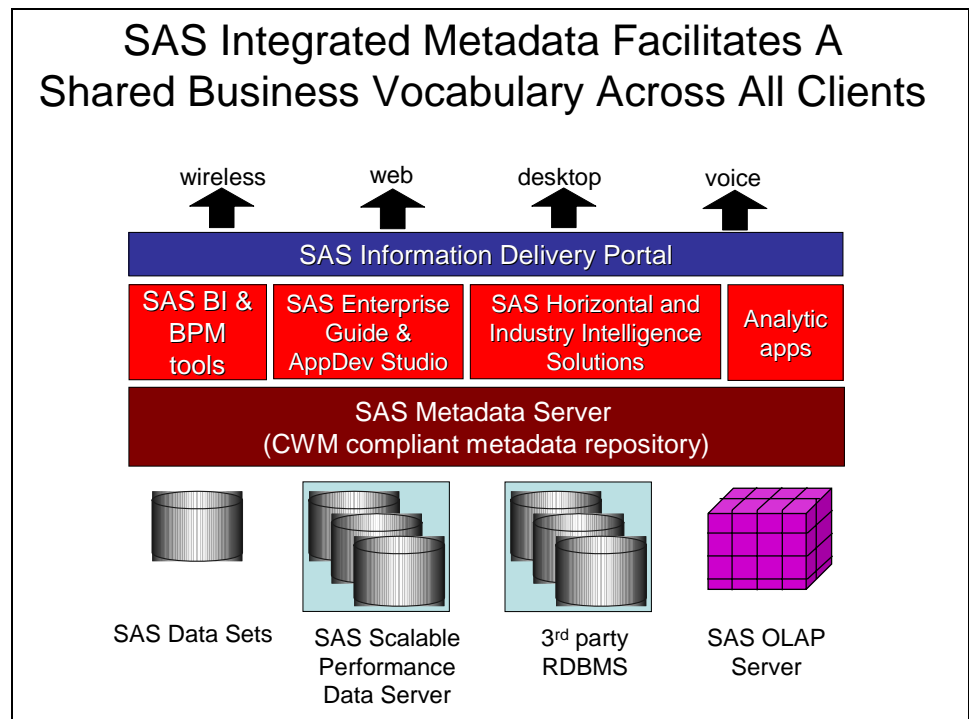


Figure 4

- SAS® Metadata Bridges - To open up the platform further to a wide range of 3<sup>rd</sup> party BI and other tools that do not support the CWM industry standards, the SAS Metadata Server also supports additional metadata integration bridges via a partnership with Metadata Integration Technologies Inc.(MITI).

SAS BI tool user interfaces are targeted at different types of users

- SAS BI tools – there are a number of BI tools whose user interfaces are targeted at different user roles to open up SAS BI to a wide spectrum of users. The tools include SAS® Web Report Studio, SAS® Add-in for Microsoft Office, SAS® Enterprise Miner, SAS® OLAP Cube Studio, SAS® Information Map Studio, SAS® XML Mapper, as well as other SAS tools for statistical analysis.

The following table shows how SAS have targeted BI tools at different roles. All of these tools also integrate with the SAS® Information Delivery Portal to personalise BI to the role of the user.

Role	BI Tool
Information consumer	SAS Web Report Studio, SAS Information Delivery Portal
Decision maker	SAS Web Report Studio, SAS Information Delivery Portal, SAS Add-in for Microsoft Office
Power user	SAS Web Report Studio, SAS Add-in for Microsoft Office, SAS Enterprise Guide
Business Analyst	SAS Enterprise Guide, SAS Add-in for Microsoft Office, SAS Enterprise Miner, SAS OLAP Cube Studio, SAS Statistical tools
IT Developer	SAS Information Map Studio, SAS XML Mapper, SAS AppDev Studio (see later)

- SAS® Web Report Studio - is an easy-to-use web-based reporting tool mainly for information consumers and decision makers who need simple self-service report viewing and creation. This product also offers wizard-driven report creation.
- SAS® Add-in for Microsoft Office - offers some investigative capability from within Microsoft Office products like Word and Excel.
- SAS® OLAP Cube Studio - is a client for business analysts doing multi-dimensional analysis on data managed in the SAS OLAP server.
- SAS® Enterprise Guide - is an analytic application development tool aimed at business analysts who wish to build their own applications.
- SAS® Information Map Studio - this is used to build easy to understand business views (maps) of the data for use in other SAS BI tools.
- SAS® Enterprise Miner - this is a modern, distributed system that streamlines the data mining process by supporting all necessary tasks for data mining within one solution, while providing the flexibility for broad workgroups to collaborate on data mining projects. The system offers extensive integration and configuration opportunities that support a variety of business requirements, eliminating the need for niche solutions. Predictive models built with SAS Enterprise Miner can be deployed in numerous real-time or

Data mining can be used for automatic analysis to automatically identify problems and opportunities

SAS Enterprise Miner can be invoked from within a SAS ETL Studio workflow to automatically analyse integrated data

batch environments within SAS, on the Web or directly in databases such as IBM's DB2 (using PMML). Once deployed, SAS predictive analytics models can run in parallel to leverage the power of large multiple CPU systems. The models can also be integrated with SAS AppDev Studio-developed applications or other applications and portals to efficiently disseminate the results of predictive analytics to a much wider audience in an organization. A Java-based API (or SQL- queries for models deployed in a DBMS) also allows predictive models to also be invoked on-demand from other applications and portals to score customers and flag problems or opportunities. The advantage here is that predictive models can be triggered to automatically analyze events and other data captured via SAS ETL Studio from within a single ETL Studio workflow. In addition, business analysts can generate rules using SAS Enterprise Miner C\*Score and J\*Score for incorporation into C or Java based rule servers and applications. These SAS generated rules can drive alerts, recommendations and transactional messages when conditions in the rule are met. This capability allows SAS to support event driven data integration and automatic analysis and generate rules which are all key requirements for business activity monitoring (BAM).

SAS Interaction Management can detect changes in state and trigger actions as a result

- SAS® Interaction Management – this is an event and state change detection based decision engine that can be used to trigger alerting, automatic actions and personalisation
- SAS® AppDev Studio – this is a stand-alone development environment , that includes a professional IT developer BI integrated development environment (IDE) tool Java IDE called SAS® webAF, that can be used to build BI and predictive analytic applications and for customising SAS packaged analytic applications.

The SAS Intelligence Platform can be managed from a single console

- SAS® Management Console for administering the platform - this is a standardized management tool that enables enterprises to support technologies across the platform from a single point of administration. By enabling repeatable processes, the console enables organizations to uphold standard operating procedures and minimize manual work.
- SAS® Integration Technologies (IT) and SAS Intelligence Platform Java APIs – these ensure integration of on-demand BI and on-demand SAS Intelligence platform services with other applications and portals. Note that web services can be created to get SAS data via JDBC or ODBC. Alternatively they can invoke SAS analytical stored processes via SAS IT application programming interfaces (APIs) or the new SAS Java based APIs. In addition, SAS stored processes can also be published as web services and then invoked from desktop and web applications via industry standard SOAP (simple object access protocol) XML messages. Advances in portal technology standards<sup>1</sup> also mean that remote SAS analytical web services can

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<sup>1</sup> OASIS Web Services Remote Portlets (WSRP) and JSR 168

be easily integrated into third party enterprise portal products to deliver personalised BI to internal and external users on any device.

A portal is a single, secure and personalised web based user interface to information, applications and collaborative tools

- SAS® Information Delivery Portal – this is a Java-based BI portal that provides a single, secure and personalised web based user interface to SAS tools, SAS BI, SAS analytic web services and SAS analytic applications. Users interact with the portal using an HTTP browser. The portal technology offers a common way to support personalised delivery of BI to internal and external users and uses a role-based security model to limit information. To save time and prevent administration problems, user profile information can automatically be inherited from standard LDAP enabled enterprise directory servers.

The multi-threaded SAS Information Delivery Portal processes requests for BI and analytical services to retrieve data on any SAS data warehouse platform in the enterprise including Windows NT/2000, UNIX and OS/390. A portal cache is also used to boost performance.

Personalised real-time access to on-demand analytics

Portal users can also get personalised real-time access to dynamic reports, interactive query processes and OLAP cubes by invoking on-demand analytical services. The SAS Information Delivery Portal also supports the retention and presentation of unstructured content including word processing documents and audio/video clips within the portal. All relevant information that a user needs can therefore be made available to support decision-making.

Unstructured content can also be viewed via the portal

The portal directory tracks all reports, queries, cubes and other information across the enterprise

Users can share information with others by publishing BI reports, analyses and mining models into the portal directory so that others can see them. The portal directory categorises and keeps track of BI reports, queries, cubes, SAS analytical processes etc. Published content can be manually assigned to one or more categories within the portal directory taxonomy. Other users can then search for or navigate the hierarchies and categories in the portal directory to discover what BI services (queries, reports, and SAS analytical models) exist and then select the BI service to view the required intelligence. Alternatively they can subscribe to receive this information on a regular basis. In order to cater for the needs of multiple users, the SAS Information Delivery Portal exploits the SAS Publishing Framework to deliver information directly to a user via the browser or (if requested) to a user list via e-mail. Delivery to a message queue, to a channel for delivery to subscribers, or to an archive is also possible.

Information can be delivered in multiple formats

SAS intend to integrate the SAS Information Delivery Portal with collaboration tools and enterprise portals

In order to facilitate collaboration over content managed by the portal, it is a SAS direction to integrate the SAS Information Delivery Portal with collaborative offerings from popular infrastructure providers, such as IBM Lotus and Microsoft, as well as leading information vendors in the content management and knowledge management marketplace. SAS also intends to integrate its BI content, and BI services with popular 3rd party portal products. SAS is already involved in supporting and creation of portlet standards such JSR168 and WSRP.

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# INTEGRATING BI WITH THE SAS®9 INTELLIGENCE PLATFORM

Having described the SAS Intelligence Platform, this section looks at how the platform helps to integrate a business intelligence environment within the enterprise.

SAS Metadata Server support for 2-way CWM standard metadata interchange allows the SAS Intelligence Platform to integrate with existing CWM compliant tools

The SAS Intelligence Platform runs on most hardware platforms and operating systems and therefore allows companies to exploit existing server capacity allocated to BI systems and keep total cost of ownership to a minimum.

This allows a shared business vocabulary to be implemented across the enterprise in SAS and 3<sup>rd</sup> party products

The SAS Metadata Server can provide common metadata to other BI tools in the enterprise via industry standard CWM XMI metadata export to drive a shared business vocabulary across all BI tools in the enterprise using an industry standard mechanism. It can also import metadata from multiple ETL tools, BI tools and DBMSs via CWM XMI and/or proprietary metadata bridges. This means that all tools, scorecards and SAS developed analytic applications can re-use data definitions defined in other products and leverage data transformations already created in other ETL tools.

SAS ETL Studio can provide data to all SAS built and non-SAS BI data stores

SAS ETL Studio can extract, clean, transform and load data into existing or SAS-built detailed data stores and then supply integrated and clean data from there to existing BI systems, SAS OLAP Server cubes, SAS Enterprise Miner-based analytical models and SAS® Strategic Performance Management scorecards when the same data is needed in all these places. This guarantees consistent supply of data to both in-house non-SAS based BI systems as well as SAS BI systems.

SAS BI tools can access and integrate with existing BI data stores

SAS BI tools can access any RDBMS BI data store in the enterprise via the ETL Server mentioned previously. SAS OLAP Server can leverage this connectivity by creating virtual cubes. Virtual cubes can sit on top of existing dimensional models since data on distributed servers can be integrated into a single virtual cube using the proxy-MDDB facility. In this way, existing dimensions and measures can be mixed and matched with those in the SAS OLAP cubes to leverage the existing investment. Users can also drill into existing dimensional models from the SAS OLAP Server.

SAS Information Delivery Portal integrates with enterprise security

The SAS Information Delivery Portal can use enterprise LDAP-compliant user directories and security services to inherit user and security profiles. In addition, third party BI tools with web services interfaces can be integrated into the SAS Information Delivery Portal customized code to be written in order to determine the reports and the categories. The SAS Management Console can be used to manage data integration to supply the necessary data to all RDBMS servers in the enterprise and metadata integration across all CWM compliant tools in the enterprise.

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# MIGRATING TO THE SAS®9 INTELLIGENCE PLATFORM

Industry standard metadata interchange and additional metadata bridges makes migration easier

Companies can migrate to the SAS Intelligence Platform, from a best-of-breed BI tool set-up by exploiting the SAS Metadata Server CWM compliant import facility and/or the specific metadata bridges provided via SAS's partnership with Metadata Integration Technologies Inc. (MITI). Using this functionality, metadata can be exported from existing ETL tools and imported into the SAS Intelligence Platform for use in SAS ETL Studio. Along with SAS professional services, SAS ETL Studio can then be tested and if necessary adjusted to take over the ETL processing.

In addition, metadata can be exported from other BI tools and imported into the SAS Intelligence platform for use in SAS BI tools and other analytic applications. As an example, cubes in other OLAP servers can be migrated to the SAS platform by exporting cube metadata (via CWM XMI) and importing these definitions into SAS OLAP Server via the SAS Metadata Server. Data from non-SAS cubes can then be exported and used to populate SAS OLAP server using SAS ETL Studio.

## Conclusions

The newly developed SAS Intelligence Platform provides an integrated framework for BI system development. Comprehensive support for industry standard metadata interchange, industry standard metadata storage, role-based BI clients and integration APIs make it a strong candidate for enterprise-wide BI deployment.

### **About Intelligent Business Strategies**

Today, successful companies are those that can absorb new information technologies and use them effectively in their businesses. But faced with so many new technology developments, how can IT and business users possibly keep up? Intelligent Business Strategies is a research and consulting company whose goal is to help companies understand and exploit new developments in business intelligence, analytical processing and enterprise business integration. Together, these technologies help an organization become an *intelligent business*.



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