SAS and Cloud Computing
Deployment and Service Model Options
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Executive Summary

Today’s economic climate – with rising customer expectations, an accelerated pace of business and fierce competition – requires organizations to make better use of their ever-increasing volumes of data for fact-based decision making. More and more enterprises are taking their data usage to new levels and applying business analytics to support rigorous, constant business experimentation that drives better decisions – whether it involves testing new products, developing better business models or transforming the customer experience. The challenge to provide more and better information faster is changing the traditional approach to information technology.

Cloud computing’s ability to provide elastic scalability, faster service delivery, greater IT efficiencies and a usage-based accounting model could break down many of the physical and financial barriers to aligning IT with evolving business goals. With its promise to deliver better business models and services quickly and cheaply, cloud computing could be the next major driver of business innovation across all industries. According to Gartner, Inc., a research and advisory firm, its 2011 Gartner Executive Programs worldwide survey of more than 2,000 CIOs identified cloud computing and virtualization as the top-two technology priorities for 2011.\(^1\)

The “cloud” itself is actually nothing more than a metaphor for various resources (software, hardware, storage and services) delivered via the Internet. While many vendors, analysts and authors attempt to define what cloud computing is and is not, SAS recognizes that this model of service consumption is still evolving – change is the only constant. The National Institute of Standards and Technology\(^2\) (NIST) provides a reference definition that many rely on: “Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service-provider interaction.”

This white paper provides a short summary of terms and concepts within the paradigm of cloud computing and “as-a-service” delivery models, focusing on different options and what SAS offers. Because virtualization enables the creation of flexible clouds with elastic computing resources, this paper presents a high-level overview of that technology. Other elements needed for successful cloud computing, such as security, data management, scalability and policy-based compliancy, are also addressed. Finally, the paper provides customer case studies that illustrate how the power of SAS\(^\circledast\) Analytics can be delivered using a variety of cloud environments and the benefits that have been achieved. While cloud computing provides great value to SAS customers today, SAS continues to explore additional options for enhanced alignment with cloud environments, including “platform-as-a-service” (PaaS) models and expanding its set of mobile and tablet-based interfaces (as the demand for accessing applications and information from cloud computing environments via mobile devices and the Internet increases).
Cloud Computing Service and Deployment Models

Computing clouds can be created in many shapes and sizes to serve different purposes. The market of consumers, providers and analysts often contrasts and compares cloud computing options based on variations of service and deployment models. There are two primary dimensions:

- **Service models include** (but are not limited to):
  - Software as a service (SaaS).
  - Platform as a service (PaaS).
  - Infrastructure as a service (IaaS).

- **Deployment models include**:
  - Public.
  - Private.
  - Community.
  - Hybrid.

**Common Cloud Service Models**

- **Software as a service (SaaS)**: The SaaS layer enables consumers to use a provider’s applications running on a cloud infrastructure. The applications can be accessed from various client devices through a thin-client interface such as a Web browser (for example, from Web-based email). The user does not manage or control the underlying cloud infrastructure or individual application capabilities, with the possible exception of limited user-specific application configuration settings.

- **Platform as a service (PaaS)**: The PaaS layer enables users to deploy their created or acquired applications using programming languages, frameworks and tools that are provided by the supplier. The consumer does not manage or control the underlying cloud infrastructure (networks, servers, operating systems and storage), but does have control over deployed applications and possibly the application-hosting configurations.

- **Infrastructure as a service (IaaS)**: The IaaS layer is considered the most basic “as-a-service” level where infrastructure equipment and resources are provided to clients. These can include storage, networks, processing and other general computing resources. The IaaS user is able to run software, has control over operating systems, applications and frameworks, and performs the general administrative functions, but does not manage or control the underlying infrastructure.
The following diagram describes the logical relationship between service layers in the common cloud environment, and the underlying resources required to support cloud service models.

**Figure 1:** Layers of the cloud computing environment build from the bottom with the top layers each a subset of what lies below. SAS’ focus thus far has been on the software-as-a-service model for delivering solutions to our customers. However, SAS has implemented an internal R&D and testing cloud environment based on the PaaS model that has resulted in many benefits. (See the Case Studies section of this paper.) As always, SAS continues to explore using additional methods and service models to offer our customers the SAS environment that best suits their needs.

### Cloud Deployment Models

- **Private clouds:** A private cloud is operated solely for a single enterprise. The physical and logical resources of a private cloud can be managed by the enterprise or a third party with the cloud environment located either on- or off-premise. SAS addresses this type of cloud deployment with SAS Grid Manager.

- **Public clouds:** Public clouds are open to the general public and cloud infrastructures are owned and managed by the cloud service provider. The consumer and service provider exist in separate enterprises. SAS addresses this type of deployment with SAS Solutions OnDemand.

- **Community clouds:** The community cloud infrastructure is shared by several predetermined organizations and supports a specific community with common concerns (for example, the same mission, security requirements or policy and compliance considerations). Community clouds can be managed by the organizations themselves or a third party and can be located on- or off-premise. SAS addresses this type of cloud deployment with SAS Solutions OnDemand.
• **Hybrid clouds**: Hybrid clouds are combinations of two or more clouds (private, public or community) that combine multiple elements of the different clouds through standardized integration technologies but remain as separate entities. Hybrid clouds are defined based on the interaction pattern between or within multiple private, public or community clouds. SAS is reviewing the technology requirements necessary to address this deployment model.

Organizations must evaluate these deployment options and strike a balance of demand for IT oversight, speed to implementation, service levels, risk exposure and corporate culture. To make the best decision possible, this white paper offers an in-depth look at the deployment options currently supported by SAS.

![Figure 2: A community cloud is a shared cloud environment with predetermined members, and can be located either on- or off-premise. SAS currently supports public, private and community deployment models.](image)

### What Characteristics Are Needed to Deliver Business Analytics via a Cloud?

Cloud computing fundamentally changes the way that IT services are delivered and consumed. Many perspectives define the benefits and characteristics of cloud computing, including business flexibility, operational efficiency and economies of IT and scale.

To move from a high-level abstraction of cloud benefits to a discussion of the benefits of using SAS in a cloud environment, we will focus on the factors that influence or provide those benefits. In particular, we will focus on cloud computing characteristics that have been identified as some of the most important for delivering business analytics via cloud models:

- Secure, shared and scalable.
- Service-based interfaces.
• Usage-based accounting model.

• Elastic within its limits.

• Policy-driven compliance.

• Accessible from a wide range of connected devices.

Secure, Shared and Scalable

Security is a huge cornerstone of cloud computing technology as it involves computer security, network security, data security and information security. It is up to the cloud provider to ensure that clients’ data and applications are protected. A broad set of policies, technologies and controls have been created and are used by cloud providers to protect consumers’ data, as well as the underlying applications and infrastructure.

A shared infrastructure – physically and logically – reduces the costs for computing resources. It increases agility in the use of resources but requires oversight and governance as to how the resources are used. With a shared infrastructure, you only use what you pay for, so in many cases, the costs of the infrastructure can be accounted for as an operational expense (OpEx), rather than as a capital expenditure (CapEx) to purchase hardware. With shared infrastructure and proper governance, there is huge opportunity to reduce CapEx spending.

Providing a scalable infrastructure is a big challenge for many organizations. With increasing amounts of data to deal with, it is important that hardware and networks are not the cause of bottlenecks that interrupt an application’s processing. With a private cloud and a grid infrastructure, applications are broken into subsets and each piece is processed where it is most efficient. This enables organizations to make the most of the resources they have. Organizations that look to public, community or hybrid cloud environments seek a cloud provider that can provide the scalability to dynamically meet fluctuating demands – especially when intensive processing requires the additional availability of computing power.

Service-Based Interfaces

The service-based aspect provides clear separation of concerns between the consumer and provider through well-defined interfaces. These interfaces serve the specific needs of consumers, helping them access integrated information on demand from the cloud when they need it. Even more importantly, users are able to focus on business issues rather than technology implementations.

Usage-Based Accounting Model

The cloud model builds on the notion of “pay for the computing capabilities that you use.” For the consumer, this characteristic of the cloud means that the user/organization is buying a service rather than an asset. A benefit is that organizations
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can limit situations where they own physical assets they have paid for but do not use.

Elastic Within Its Limits

One of the key benefits of cloud computing is its elastic nature. The elasticity provides the ability to automatically scale out and scale in based on fluctuating demand (for example, to accommodate year-end processing, seasonal rushes, etc.) and enables the consumer to dynamically meet growing or shrinking resource needs.

Policy-Driven Compliance

The policy-driven aspects of cloud computing, including automation, elasticity and governance, play an essential role in supporting business agility in a cloud environment because they represent high-level business objectives such as flexibility, consistency and accountability. For example, cloud computing can help IT eliminate the need for additional personnel to manage software updates or version compatibility with operating systems, databases and middleware.

Accessible via Many Devices

The world we live in is more connected than ever with access to information available through so many devices (laptops, desktops, smart phones, tablets and more). Providing easy Web-based access to computing resources through a variety of connected devices is increasingly important in today’s mobile business world.

Virtualization: A Key Enabler for Cloud Computing

Virtualization is one technology that enables the cloud computing model. In this paper, we are focusing on the virtualization of physical machines (i.e., the abstraction of logical resources away from their underlying physical resources). Using virtual machines (versus physical machines) as a building block improves agility and flexibility. For IT, virtualization technology reduces the costs of physical resources and management of those resources, decouples users from implementation issues and enables accounting chargebacks based on use.

In a cloud computing environment, virtualization enables a set of underutilized physical infrastructure components to be transformed into logical machines that are consolidated into a smaller number of better utilized devices. The common virtualization segments are application, presentation, server or hardware, storage and network.

In cloud computing environments, hardware/server, storage and network virtualizations are key enablers.
• **Hardware or server virtualization** is a technology that emulates a computer’s physical hardware, so that multiple operating systems and multiple applications can run on the same piece of hardware at the same time. Usually a software layer called a hypervisor is used to emulate the physical hardware. There are three common types of hypervisors: Type 1 (native), Type 2 (hosted) and Type 3 (containers or OS virtualization). Type 1 (native) hypervisors are the most common in today’s market. They are further classified into three subtypes – standalone (e.g., VMware ESX), hybrid (e.g., XenServer) and mixed (kernel virtualization).

• **Storage virtualization** is an abstraction that combines storage from multiple storage devices into a common storage pool. Often part of a storage area network (SAN), virtualized storage appears as one device to the server operating systems and can be centrally managed and provisioned from a single view.

• **Network virtualization** is the efficient utilization of network resources through the logical segmentation of a single physical network.

SAS directly supports both presentation and hardware/server virtualization, and indirectly supports storage and network virtualizations.

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**Cloud Deployment Options and SAS® Offerings**

**The Private Cloud with SAS® Grid Manager**

Working with the expectations that an IT organization desires tight controls over service levels and infrastructure, or has concerns over data privacy and security, many enterprises will opt for a private cloud deployment where applications remain on premise. Compliance concerns surrounding shared technology become a moot point with a private cloud. With this option, IT builds the private cloud, which is used only by its enterprise or portions thereof.

To enable private cloud computing for its customers, SAS has partnered with Platform Computing to offer SAS Grid Manager. SAS Grid Manager allows users to submit SAS jobs to a shared and highly available pool of resources (rather than to an individual server) to balance workloads, increase processing times and better manage their SAS environment. Computing-intensive programs can be allocated and managed to run in pieces across the grid, enabling IT organizations to optimize hardware capacity, improve performance and offer more flexibility. SAS Grid Manager provides the ability to scale business processes and accelerate decisions, giving organizations a significant competitive advantage.

Deploying SAS products and solutions with SAS Grid Manager to run in a private cloud has the following benefits:

• Centralizes management and reduces the complexity of your SAS environment.
• Creates a highly available environment to allow business continuity.
• Enhances performance of IT resources.
• Increases flexibility to scale out and meet fluctuating demands.

The key capabilities offered by SAS Grid Manager include enterprise job scheduling, workload balancing and the ability to segment large jobs and run the segments in parallel using a virtual pool of resources in a distributed environment.

• Enterprise job scheduling allows you to create and schedule SAS workflows over multiple distributed machines. SAS Grid Manager will automatically find and select the best available resource to execute each job within that flow.

• Workload balancing is essential for optimizing the workloads of multiple users submitting multiple types of jobs to a shared pool of resources. SAS Grid Manager provides queuing of jobs, policies for different types of workloads to deliver the desired service levels and prioritization of workloads to meet the needs of different business units as well as the entire organization.

• Large SAS applications or programs can be broken into segments that can be run in parallel using SAS Grid Manager. Huge performance gains can be realized when you have workloads that can be broken into independent subtasks and run across distributed resources in a grid environment.

When considering SAS Grid Manager for a private cloud deployment, organizations should also recognize the additional value and IT benefits the product provides:

• A shared, centrally managed SAS platform. A single location to manage policies ensures maximum throughput and efficient use of IT infrastructure across the organization.
• **Availability and resiliency.** Software must be available whenever customers want and need to use it. A fault-tolerant and resilient infrastructure, designed to be self-healing, ensures that users can continue to operate and applications will complete their processing regardless of what happens at the technology resource layer.

• **Growth.** The ability to easily provide additional resources and incrementally grow the grid as the number of users and size of data increases over time future-proofs the IT infrastructure.

• **Flexibility.** SAS Grid Manager facilitates dynamic resource reallocation to meet peak demands. Ongoing maintenance is made easier by allowing machines to be taken offline with no disruption to the business.

• **Chargeback.** Implementation of equitable sharing and recovery of cloud computing costs can be achieved by charging departments or organizational entities for the IT resources they consume.

• **Service levels.** Visibility of performance metrics are provided for comparative analysis with service-level objectives to each line of business.

• **Oversight.** Web-based monitoring of all users, job activity and resource consumption across the grid as well as alerting and optimized grid configurations enables ongoing management of the grid operation.

**Cloud Computing with SAS® Solutions OnDemand**

A perennial problem for IT has been its ability to deliver new solutions at the speed demanded by the business. Working with the expectations of greater cost savings and speed-to-use as primary drivers, organizations can gain an advantage using public or community cloud deployments. To support the successful deployment of public and community cloud computing, SAS Solutions OnDemand was established with a state-of-the-art facility, managed by SAS experts, for the use of SAS applications and services.

**Public Clouds**

While IT can be reluctant to relinquish control over infrastructure and service levels, benefits can range from improved engagement with constituents, an improved focus on core operational solutions and faster innovation for the organization overall. There are internal challenges for IT, including shifting service models, realigning personnel and adapting business processes, but the benefits of faster deployments make it worth consideration. Other drivers that support the use of public cloud deployments include:

• **Labor.** IT budgets are constrained by the rising cost of personnel required to install and maintain software. SAS Solutions OnDemand, staffed by SAS experts, reduces the need for IT to add to its headcount.
• **Energy.** Costs for power and cooling continue to rise, and increased focus on sustainability initiatives can make looking elsewhere for resources an attractive proposition for IT organizations.

• **Innovation.** Fast implementations and the ability to use new dynamic applications can improve time to market, market expansions and customer satisfaction.

**Community Clouds**

In addition to some of the drivers for a public cloud model, several organizations with similar requirements may seek to share infrastructure to realize common goals. They will discover that a community cloud facilitates the necessary collaboration. While it is a widely accepted practice within the field of academia, commercial and governmental organizations are slowly augmenting their IT strategies with community cloud deployments. In the case of commercial organizations, the use and resources of a neutral third-party best supports the common mission, security requirements, and policy and compliance considerations of multiple organizations.

Consider the process of new drug development where a pharmaceutical company commonly engages with an outside clinical research organization (CRO) during early stages of a clinical trial. Completion of an FDA submission with voluminous patient data can be mired in compliance and legal requirements when both parties find it too foreboding to grant mutual access to each other’s corporate network. A community cloud environment could solve their issues.

The creation of a joint venture (JV) is another example where community cloud computing can ensure that all parties minimize risk and up-front investment while capitalizing on speed to market and a shared environment with equal benefits. In circumstances where parties end the relationship, there are fewer IT assets to divide.

**Feeling Secure with SAS® Solutions OnDemand for Your Cloud Environment**

SAS Solutions OnDemand was established in 2000 and serves users in more than 70 countries, representing academic, government and commercial sectors. State-of-the-art outsourced applications are provided to consumers along with subject-matter expertise to manage and implement them. SAS Solutions OnDemand operates facilities around the globe, including a new 38,000-square-foot cloud-computing facility at SAS headquarters in Cary, North Carolina, which will provide the additional data handling capacity needed to manage the expanding portfolio of SAS offerings.

SAS Solutions OnDemand handles a wide variety of customer data in a highly secured manner and in compliance with data privacy requirements that vary with country and customer specifics across all continents. Below are some of the data
types that SAS Solutions OnDemand handles on a day-to-day basis:

- State court cases, juvenile and criminal data.
- Workers’ compensation, welfare and childcare benefit claims.
- Student data and test scores.
- Product warranty claims.
- Credit card transactions.
- Medicare and Medicaid claims.
- Patient data.
- Clinical trial data.
- Retail and commercial banking activity.
- Retail transaction history and product SKUs.
- Hotel and gaming activity.
- Protected health information (PHI).
- Personal information.
- Public information.
- Highly sensitive types of information.

**Security and Compliance**

Proving the commitment to safe and secure public cloud deployments, SAS has completed the following certifications and audits widely seen as standard for third-party delivery.

- **SAS 70 Type II Audit.** This is the recognized auditing standard developed by the American Institute of Certified Public Accountants (AICPA). A service auditor’s examination performed in accordance with SAS No. 70 (also commonly referred to as a “SAS 70 Audit”) is widely recognized because it indicates that a service organization has been through an in-depth audit of its control objectives and control activities, which often include controls over information technology and related processes.
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- **SysTrust.** Trust Services (comprised of the SysTrust and WebTrust programs) are defined as a set of professional assurance and advisory services based on a common set of principles and criteria that address the risks and opportunities of information technology. Trust Services’ principles and criteria are issued by the Assurance Services Executive Committee of the American Institute of Certified Public Accountants and the services can only be delivered by a licensed Certified Public Accounting firm.

- **Safe Harbor.** The process was developed by the US Department of Commerce in consultation with the European Union (EU). US-EU Safe Harbor is a streamlined process for US companies to comply with the EU Directive 95/46/EC on the protection of personal data. Intended for organizations within the EU or US that store customer data, the Safe Harbor Principles are designed to prevent accidental information disclosure or loss. SAS has worked with TRUSTe to certify adherence by SAS Solutions OnDemand to the seven principles outlined in the directive.

- **Penetration testing.** SAS Solutions OnDemand routinely performs vulnerability testing and application scans, and hires third parties to perform manual penetration testing.

- **Security.** With stringent security measures in place, customers can trust their data to SAS. Additionally, SAS strongly believes security is not just about the technology. It’s also about the processes in place to ensure the different levels of security. SAS’ SaaS solutions provide a variety of industry-leading security features ranging from protection of data both in motion and at rest, transport-level security, message-level security, encryption of the networks, strong password authentication, Identity and Access Management (IAM), cryptography, Public Key Infrastructure (PKI) and threat detection and mitigation. Across the board, SAS’ SaaS solutions support and utilize the key industry standard technologies to ensure customer data is always protected.

- **EU Data Privacy and Compliance.** SAS Solutions OnDemand manages and protects the privacy and security of global customer data that it processes on behalf of our customers, including personal data concerning EU residents.

**Practices, Policies and Capabilities**

Leading the industry in both the investments and best practices related to service, security and availability, SAS has implemented numerous systems to ease concerns of the most demanding domestic and international IT clientele. The following represent just a few of the policies and practices used to ensure availability and enforce logical, physical and personnel security.
• **Facilities.** The SAS Solutions OnDemand infrastructure is hosted in a high tech and physically secure environment within the SAS data centers. The data center operations personnel are responsible for authorizing physical access to the SAS data centers. The SAS security department controls physical access to the environment by enforcing badge access rules and monitoring, and by using several layers of physical security. Security becomes even more stringent closer to the source of data.

• **Staff.** Detailed SAS security policies document the security guidelines for staff members who work in the SAS Solutions OnDemand facility. All personnel are subject to employment reference checks, a criminal background check and drug screening. All staff members receive training for implementing security policies on an annual basis.

• **Data transfer.** SAS Solutions OnDemand maintains a secure file transfer infrastructure that requires data encryption for transmission using industry standard encryption methods. All data transferred to SAS Solutions OnDemand hosting services must meet these encryption standards. Access is via site-to-site VPN.

• **Advanced Analytics Lab.** The Advanced Analytics Lab at SAS specifically develops innovative analytical processes and techniques for cloud deployments using SAS software. Clients obtain the optimal hardware environment and implementation or knowledge transfer for predictive and descriptive modeling, data mining, text analytics, forecasting, optimization, simulation, experimental design and more.

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**Case Studies**

**ISO: Private Cloud with SAS® Grid Manager**

ISO Innovative Analytics (IIA), a unit of ISO, supplies data, analytics and decision-support services to property/casualty insurance, mortgage lending, health care and other markets. IIA exploits new technologies and new mathematical solutions to create advanced models for risk-based insurance pricing, claims fraud and other applications that ISO provides to its customers.

As the innovation engine for the entire organization, the IIA unit is keenly aware of the impact of inadequate technology on its ability to execute its mission. “Lack of scalability is an innovation killer,” said Marty Ellingsworth, head of IIA. The organization found that its SMP servers running Base SAS and SAS/STAT® had several performance problems related to data provisioning, I/O and sequential job flows. These shortcomings led not only to analyst frustration, but also to slowdowns in the time to bring new products and services to market. In addition, because IIA was a new venture within ISO, there was a potential for damage to internal creditability, and strained relationships with internal groups and business development staff.

IIA analysts can now run up to 70 concurrent jobs on the grid-based solution. The grid is located in ISO’s New Jersey headquarters facility but the grid-based virtual machines are accessed from many US locations.
IIA was able to achieve substantial improvements after recently moving SAS® Enterprise Miner™ and SAS® Enterprise Guide® to a grid system with a cluster backbone using SAS Grid Manager. For example, IIA analysts can now run up to 70 concurrent jobs on the grid-based solution. This parallel processing capability, combined with 5-8 times great sort speeds and a 3-4 times acceleration of complex math runs, promises to dramatically boost analyst productivity.

Half-a-dozen models can now be tested within two hours to see which works best. And it is now feasible to create and run more granular, higher-resolution models that incorporate key statistical areas that had to be omitted before, such as ultraviolet-based paint fading and roof cracks in the property insurance domain. In addition to performance and scalability gains, IIA was also able to consolidate disparate modeling algorithms into one sharable, collaborative environment.

The new grid-based SAS Analytics solutions, which IIA calls “The Advanced Analytic Platform,” arrived none too soon. Due to increased demand, the unit plans to add more analysts soon. The grid-based solution has improved analyst productivity by changing the typical process from single job, serial number crunching and resultant waiting cycles to a “fire and forget” method, whereby an analyst can start a computational job and immediately advance to the next project. The grid is located in ISO’s New Jersey headquarters facility but the grid-based virtual machines are accessed from many US locations.

**McKesson: Winning Big with SAS®**

McKesson – a health care company that distributes pharmaceuticals and medical supplies and sells health care information technologies – is winning big with SAS. Stephen Buck, Vice President of Analytics Services, heads analytics in McKesson’s Pharmaceutical Division. Buck works with a team of 10 analytics professionals on marketing analysis, clinical analysis and industry analytics involving all types of reporting functions. By introducing SAS Solutions OnDemand, Analytics Services has increased productivity and creativity.

Analytic Services used to operate in silos, with team members doing individual analytics, data pulls and manipulations in a decentralized manner. The staff would spend months preparing data extracts and prepping for analytics instead of actually performing the analytics necessary to keep the business moving forward.

McKesson turned to SAS to help resolve that dilemma. By eliminating silos and putting data in a centralized place – housed securely at SAS – the necessary basics of getting started are taken care of and staff members are both more productive and focused on attacking issues and preventing problems rather than preparing for them. Analytic Services used to spend months working through cross-business units. With the SAS solution, the team spends minutes or hours doing the same type of work.

McKesson’s Analytic Services team develops analysis to quantify a variety of insights. One example is the impact multiple enrollments in marketing and sales programs have on overall loyalty to McKesson. Without a master database to show particular

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“There is no doubt that the solution provided by SAS Solutions OnDemand was the missing element in accelerating analytics at McKesson. SAS had us up and running in less than two months, compared to a 12- to 18-month time frame if we did this on our own.”

Stephen Buck, Vice President of Analytic Services, McKesson
pharmaceutical customers in all areas where McKesson does business, the analysis could not be done. With SAS, McKesson has taken sales data and combined it with all of its program enrollment information to give management a clear picture of which programs, products and services are keys in driving customer loyalty. As McKesson seeks even more insight about customer loyalty, SAS provides the means to make the data ready and waiting.

“There is no doubt that the solution provided by SAS Solutions OnDemand was the missing element in accelerating analytics at McKesson,” Buck says. “SAS had us up and running in less than two months, compared to a 12- to 18-month time frame if we did this on our own.”

The team is also analyzing drug and medical conditions to determine the right type of pharmacy-based interventions pharmacists can perform. Without the SAS platform’s ability to hold and analyze this data, McKesson would not be able to develop cutting-edge medical practices and clinical protocols. Mohammed Mahbouba, MD, Director of Analytic Services at McKesson, puts it this way: “Our SAS centralized analytic platform empowered efficient, accurate and consistent analytics. It did so by providing everyone on the team access to the same clean, de-normalized, reliable, consistent and up-to-date data sources.”

When the team starts projects with new manufacturers or new payers, SAS provides a ready, accessible platform to store the data. “SAS has eliminated and streamlined so much for us that it makes us confident in talking with a payer or manufacturer to say, ‘No problem. If you want to send us data or we need to get data, we have a place where we can store it, protect it and organize it,” Buck says.4

**North Carolina Office of the State Controller: Getting Tougher with Crime**

Increased data volume, archaic information systems, shrinking budgets and constrained resources can hinder law enforcement and criminal justice agencies from effectively coordinating information and proactively maintaining public safety. Public safety agencies need reliable, timely and accurate data to strategically and tactically reduce crime and victimization, enhance public safety and optimize the allocation of finite resources. Challenged with obtaining a comprehensive view of individuals with prior criminal records, including potentially dangerous offenders, law enforcement and criminal justice officials in the state of North Carolina needed an efficient, integrated application to provide quick access to accurate offender information.

To replace the manual process of integrating historical criminal data from multiple systems, reduce the risk of overlooking critical data and improve the information needs of law enforcement agencies, the state of North Carolina’s Office of the State Controller worked with SAS to develop the Criminal Justice Law Enforcement Automated Services (CJLEADS) application.
CJLEADS is an on-demand, Web-based application hosted by SAS. It integrates criminal offender data to provide courts, law enforcement, and probation and parole agencies with a complete view of a criminal offender. The system also includes a watch list that allows officials to monitor the change of any offender’s status, such as arrests, future court appearances or a release from custody.

“CJLEADS is a tool to support criminal justice officials with making quicker and more effective decisions,” says Kay Meyer, Project Director, NC Office of the State Controller. “CJLEADS brings together disparate criminal justice data to help create a more rounded profile of offenders – including court, warrant, probation, parole and local jail information – which agencies can access securely via the Web.”

With the new system, authorized criminal justice professionals can log in to the application through a secure, Web-based interface to perform searches. Search results on individuals are displayed as summaries, which can be clicked on to view more detailed data. In addition, automated messages can be requested to monitor an individual’s legal status changes.

“Because SAS hosts CJLEADS, the state was able to focus on design and business requirements, rather than procurement and installation of a technical infrastructure,” explains Meyer. “With shrinking state budgets, leveraging existing computing capabilities and technical support resources was an economical and efficient way to establish the new application environment. CJLEADS is highly scalable. Initially supporting 3,000 users, it will grow to support some 33,000 criminal justice professionals. Based on improved access to information, the state estimates a savings of $7 million annually. SAS’ expertise in data integration and analytics, as well as strong security controls of the technical environment, application access and authentication, was critical due to the complexity and sensitivity of the data.”

SAS: Internal Private Cloud with PaaS Deployment

SAS has been delivering dynamic, on-demand computing resources to its sales force, customer instructors and internal trainers since 2004 through the remote access computing environment, known internally as the RACE cloud. Using resources in the RACE cloud enables the global R&D development, testing and delivery teams to build, test and deliver software and solutions to market – with the quality that customers expect – in a shorter time frame because these teams can quickly set up the computing resources needed for each phase of the process.

The RACE cloud is a development and test cloud environment that provides an IaaS and PaaS service model for more than 11,500 employees globally. The Scheduling and Image Management System (SIMS) is the provisioning platform that orchestrates...
the construction and deployment of servers within the cloud. The cloud architecture uses network appliance storage accessible via SAN as the foundation of the cloud for near-instantaneous cloning of disk images. The combination of thin provisioning and the centralized storage and management of data in the cloud facilitates reuse of data and eliminates redundancy. Therefore, SAS has been able to reduce the data footprint of its code image library by 50 percent.

For computing resources, the RACE cloud uses VMware ESX for Intel x86-based systems such as Windows and Linux. Solaris zones and containers are used to support SPARC-based systems, and workload partitioning is used for AIX systems. Through the use of these virtualization technologies, the ability to scale the RACE cloud becomes a simple matter of introducing new resources and updating the SIMS application to recognize those resources. Management of the cloud is made easier by the level of abstraction between the bare metal equipment and the servers configured in the cloud. As an example, older IBM hosts within the RACE cloud were swapped out for newer Dell hosts supporting more CPU and RAM without a major outage, disruption of service or cloud reconfiguration. After the upgrade, the SIMS application was updated to allow servers with larger memory and CPU requirements to be constructed and deployed on the new hardware. The RACE cloud supports three main technologies to enable accessibility to a server once it is deployed: console access through Windows Remote Desktop Client (RDC), CVPN connectivity through a Juniper-supported Web portal and application-level access through Citrix.

SAS requires such a dynamic environment because supporting many platform hosts for its finished products is a core requirement. SAS supports provisioning of Windows, Solaris, AIX and several variants of Linux operating systems on finished images, which is abstracted from the person choosing the image to run.

In addition, making code images available in multiple languages is a requirement for SAS with developers in countries around the world. Images are rated, much like titles at an online movie rental site, to help developers quickly find what they need. Images in the RACE cloud are indexed, which is another significant benefit that drives efficiency. Prior to the RACE cloud, finding a server with the software needed for testing or development was very time-consuming. Developers and testers often had to sit down to discuss how a machine was configured and what software products it contained. That process now is simplified with the interface used to select the images. A quick check of the index tells when the image was created, who created it and what software the image contains.

SAS is currently provisioning 1,700 environments on a daily basis with an expectation to triple that figure by the end of 2011. It’s no wonder that InformationWeek included the SAS RACE cloud in its “20 Great Ideas To Steal.”
Conclusion: SAS as Your Cloud Partner

Cloud computing not only represents a wave of change in the way organizations expect software to be delivered, but how the IT departments deliver diverse value to support their organizations. With cloud computing, IT departments can reap a number of benefits:

- **Infrastructure.** Reduce spending by sharing infrastructure and other resources, saving procurement cycles and money.

- **Scalability.** Improve processing or store more data than with private computer systems and expand/contract needs within the cycle of business.

- **Automation.** Forego the need for additional IT personnel to manage software updates or version compatibility with different operational systems, databases and middleware.

- **Mobility.** Access information wherever and whenever via Web browser. This improves productivity for the growing mobile workforce.

- **Collaboration.** Organizations under different ownership structures find it pragmatic and expedient to share documents and solutions in the cloud, thereby solving legal or governance issues related to access of each other's network.

- **Subscription.** Traditionally software vendors have offered only an outright product purchase, thereby imposing higher financial strains and risks on the purchasing organization. Alternatively, ongoing subscription licensing reduces the up-front expense and provides organizations with an opportunity to use operational budgets rather than capital expenditures.

The capabilities and benefits shown above prove SAS is a trusted partner that can be counted on to help transform IT organizations with cloud computing, whether:

- Within an enterprise as a private cloud model.

- Outside your enterprise as a public cloud model.

- Outside your enterprise with a software-as-a-service model.

- Integrated from an enterprise business process to SAS Solutions OnDemand as a hybrid cloud model.
References


2. www.nist.gov


