Interoperability and architecture for the life sciences industry

What it will take to gain industry consensus on interchange standards, and what organizations can do today to optimize their own information architectures

THE POWER TO KNOW®

Contents

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Toward a new model of collaboration and interchange

Does your organization have a unified repository of knowledge that spans scientific discovery, pre-clinical phases, clinical trials, manufacturing, marketing and compliance?

Can your labs, physician partners and contract research organizations exchange patient data in near real-time during clinical trials?

Do your scientists routinely view an aggregated archive of research and industry information related to their work?

Does your organization have automated, integrated information exchanges with external business partners and regulatory bodies?

If not, they soon might. Traditional boundaries between life sciences organizations are disappearing. Research is evolving from independent silos into collaborative communities—into connected ecosystems of internal and external partners and stakeholders.

This evolution will drive new efficiencies in how products are developed and product portfolios are managed. More effective business processes—made possible by broader distribution of deeper knowledge—should drive significant new progress in improving human health.

The new reality calls for new synergies among organizations and data platforms that previously didn't talk to each other much, if at all.

Information must flow seamlessly across the organization, between business partners and outside the industry. It must foster knowledge-sharing among scientists, information specialists, healthcare professionals and consumers. It must facilitate collaborative processes that connect contract research organizations, clinical labs, physicians' offices, biotechnology firms, academic and government institutions, manufacturers and suppliers.

The technologies are here, but challenges are at hand

For the first time since the introduction of information technology into clinical research, our technologies are actually up to the task. Computing and networking standards are maturing. Computer literacy is much more commonplace. Software and communications networks are becoming ubiquitous. Processing horsepower and storage space are more powerful and affordable than ever. In short, the life sciences industry can exploit information technology in ways that were unimaginable even a few years ago.

But there are still some significant barriers to gaining all the benefits of this technology. The convergence of life sciences firms with the broader healthcare ecosystem is already underway, but it is a gradual transformation, slowed by the conservative pace at which the healthcare sector has historically embraced information technology.

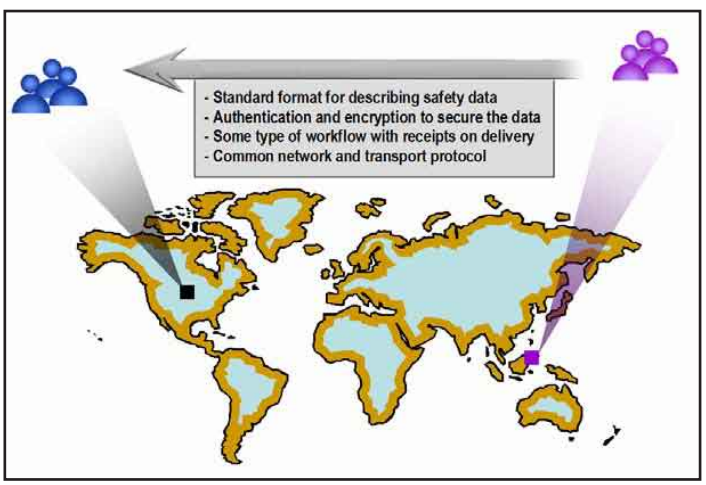
It is also slowed by issues of interoperability—industry consensus about how users and information systems should exchange information. Interoperability starts with data standards, and the industry has made great strides here, with such standards as Clinical Data Interchange Standards Consortium (CDISC) and Health Level 7 (HL7). However, true interoperability is much broader than data standards. Two or more parties or systems have to agree on many more details of the exchange. Let's take a look at three typical scenarios.

Interoperability scenario #1

Knowledge sharing among research teams in different geographies

Suppose a research team in southeast Asia wants copies of safety data collected in the U.S. on an almost real-time basis. How can the research site, located on the other side of the globe, deliver that data every hour of every day? What would these two sites need to agree on for this scenario to work?

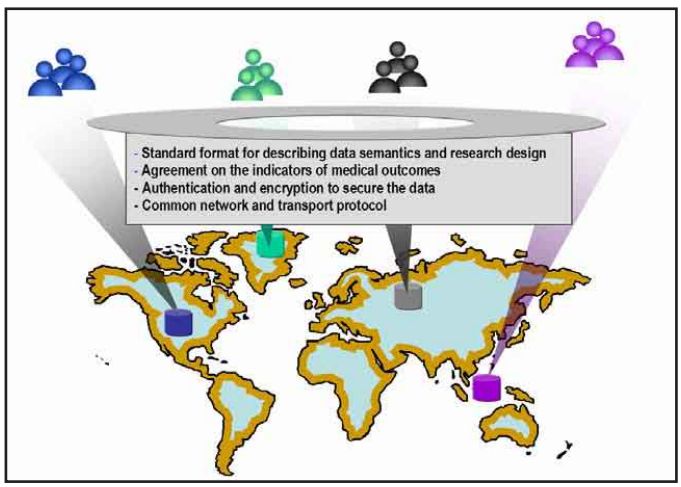
They would certainly need to agree on a standard format for the data—perhaps CDISC ODM, for example. But they would also need to agree on several other factors as well, such as how to ensure security and how to guarantee the data is delivered—considerations not addressed in present-day data standards.



Interoperability scenario #2

Knowledge sharing across diverse databases

In this scenario, four different research centers have databases containing research information related to influenza, and one of those centers needs to perform a meta-analysis that incorporates data from all four centers. (This scenario parallels the National Cancer Institute's caBIG initiative, which is designed to support this kind of analysis for oncology research and treatment.)



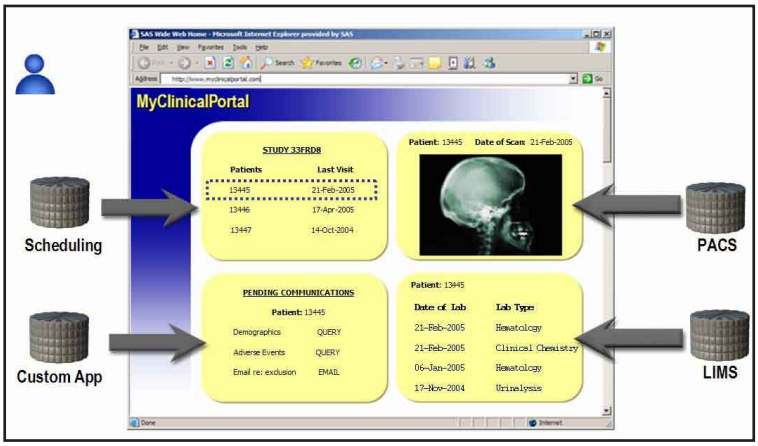
How would you create a shared environment that allows these centers to access each other's data for analysis? How would you do it without creating a giant data warehouse that everyone must use? Again, you would need to agree upon a data format, but you would also need agreement on other aspects of the exchange as well. For example, how do you attach the experimental conditions to any given data point, so a researcher unfamiliar with the study could get semantic context for the information?

Interoperability scenario #3

Knowledge sharing among diverse computing platforms

Suppose an information specialist is looking to assemble a Web portal that aggregates information related to a particular study. Each component of the portal is actually getting its information from a different back-end system. Maybe one component pulls from a scheduling system on a Microsoft Windows server, whereas another component pulls up lab or image data from Unix servers. Furthermore, when a user selects a patient in the first portal component, the remaining three portal components should automatically update to show just data related to that patient.

How would you easily deliver this capability, without building a large data warehouse that assembles the data for all four components?

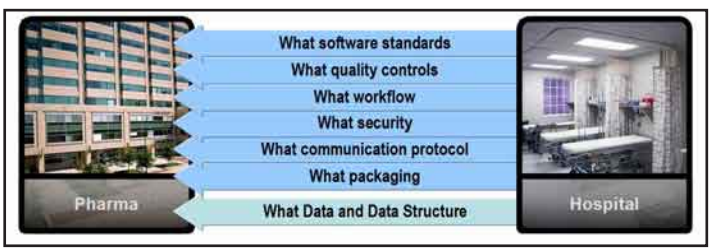


These examples point to four different types of interoperability:

- **Data interchange** – Agreement on the data structure.
- **Application integration** – Agreement on how to implement data interchange.
- **Application interoperability** – Agreement on how to combine software and user experiences.
- **Semantic interoperability** – Agreement on what the data means.

The life sciences industry is already addressing two of these four levels. For example, CDISC and HL7 are data interchange standards. The BRIDG initiative represents the beginnings of semantic interoperability. But the remaining two aspects of interoperability—how to implement data interchange consistently, and how to put that integration in the context of user interfaces like portals—are areas where the industry has not made as much progress.

What communication protocols would we use? How would each system understand the workflow of the other system? How could one system present its user interface in a way that the other systems could use? There are no consistent standards yet to address those considerations.



Standards must address technology and process.

Today, an organization would have to build custom, proprietary solutions to address these issues. Custom development is cumbersome and costly—both to implement and manage—and often produces solutions that lack flexibility and resiliency. Furthermore, the company would probably not be able to reuse the solution in other business scenarios and contexts that might be similar.

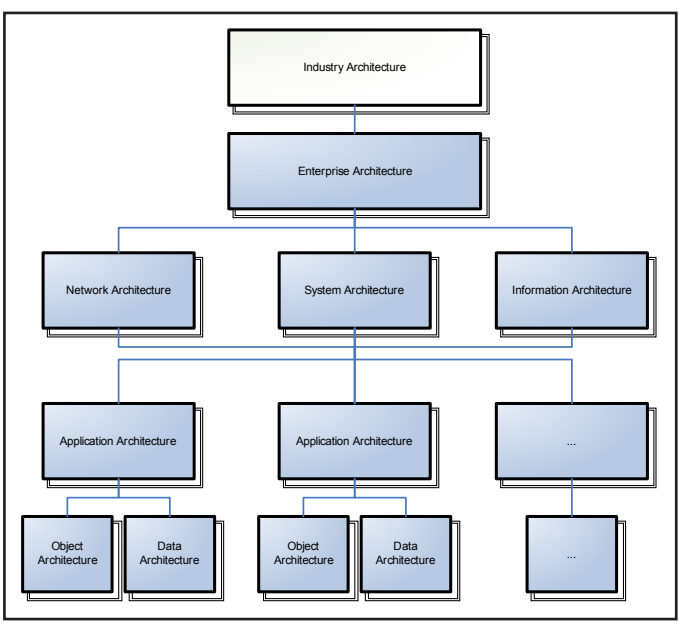
Fully formed interoperability standards for the life sciences industry would increase the consistency and robustness of industry software, while reducing the cost of sharing knowledge across organizational boundaries.

Moving toward a consistent industry architecture

Our world is moving increasingly toward higher levels of interoperability than simple data standards. For example:

- Consumers around the world can use debit and credit cards because standards for financial transactions—not just data—enable banks, ATM machines and retail stores to exchange information and conduct business processes in real time.
- Owners of Microsoft Xbox gaming consoles can play games in real time with users all over the world, thanks to a platform that allows game developers to extend their games across the Internet.
- Despite lagging their Asian counterparts in functionality and coverage, cellular phones are appearing in the US that can switch from their native tower signal coverage to PC wireless networking when it is available to the device.

These examples point both to the ubiquity of technology and the value of standards in supporting day-to-day processes, not just data.



Can this type of standardization take hold in life sciences? An industry architecture would offer life sciences firms predictable, reliable ways of connecting their enterprises—business processes, applications and people. The benefits are so compelling that it should be more a matter of when rather than if. But what will it take to get there?

Vendors will have to look beyond their own portfolios

The largest technology platform providers each have a strategy for deploying and using their technology products in the life sciences industry. However, without a coordinated effort to create standards across vendors, life sciences firms will still be left to connect their businesses as best as they can. Service-oriented design principles, coupled with existing standards, can help articulate vendor-agnostic technology strategies for interoperability.

The industry architecture cannot be overly restrictive

To be workable, an industry architecture would have to offer a fairly high level of abstraction. If standards for interoperability were too detailed or prescriptive, organizations would have to make changes to other architectures they use. Those forced changes might be too difficult or undesirable to implement. Any industry-standard architecture will have to strike a balance, delivering the components to satisfy interchange requirements without overly disrupting other architectures.

The industry architecture will embrace existing components & standards

By necessity, an industry-wide architecture would inherit components and standards from many of the other types of architectures found in organizations today. For example:

- The pharmaceutical industry has made great strides toward interoperability with the adoption of data standards CDISC and HL7.
- Software communications could rely on standards from organizations such as WS-I.
- Information payloads, envelopes and transport mechanisms can exploit standards already used in the broader IT community, such as HTTPS, SMTP, SOAP and EDI.
- A security framework could take advantage of work already underway with the SAFE (Secure Authentication for Everyone) initiative and related standards.

Industry leaders will have to agree on how to apply these standards

In an array of standards, the industry still needs consensus on common behaviors to operate across these types and standards. Consensus is a tricky business, especially when you're trying to align competitors in an industry where proprietary knowledge is the core asset. Getting industry powerhouses to agree on a data standard is simple, compared to getting agreement across the broader standards landscape.

Unquestionably, an industry architecture will require coordination among existing standards efforts. The good news is that there are some established alliances as a result of work on CDISC, HL7, BRIDG, IHE and other efforts. Productive dialogue among pharmaceutical firms and software vendors has already led to an effort within CDISC to define the business case for an industry architecture and what might be required to make it happen.

Benefits of an industry architecture

The implications for the life sciences industry are enormous. Interoperability standards would enable life sciences organizations to:

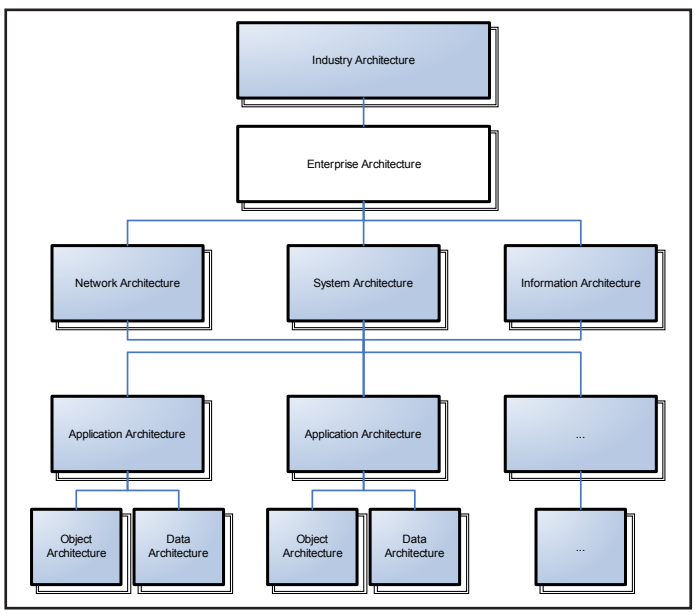
- **Integrate all types of data** – Organize disparate data from many internal and external sources into a unified research foundation that is compatible with existing systems and can manage various data types and formats.
- **Establish consistency** – Support the creation, execution and reuse of electronic business processes that reduce manual efforts of staff, improve data quality and enable business improvements through analyses of process performance and outcomes.
- **Disseminate meaningful findings** – Share information, analysis methods, and common success criteria across studies, laboratories or locations, to accelerate the discovery process and the success of clinical trials and marketing activities.

The challenge now is really a matter of agreeing that a full-fledged industry architecture is a next logical step, and to move forward in identifying the business cases, resources and high-priority scenarios that would kick-start the process.

The advantages of an industry architecture for your enterprise today

Optimizing the enterprise architecture

While work continues on developing a viable industry architecture, life sciences firms should be optimizing architectures one level down—at the enterprise level. Evolving your enterprise architecture is entirely within your control—and the technology exists today to help organizations of all sizes improve their use of information.



Enterprise architecture has been a topic of interest for IT leaders in life sciences for many years. Frameworks such as Zachman, TOGAF, and many others have presented both methodologies and "views" that organizations can use to capture enterprise architecture requirements and institute new governance models for technology decision-making.

No matter which framework you choose, an optimized enterprise architecture could be your most significant opportunity for managing these common concerns:

- **Too much data.** Over-abundant and redundant data overwhelm many of the people and tools used for data management, making it difficult to identify promising directions for further exploration.
- **Organizational "silos."** When departments work separately and linearly, on their own theses and time lines, everybody forfeits the value of collaboration.
- **Disparate data.** Vital knowledge is spread across channels in separate organizations and software applications. Historically, attempts to pool the information have been time-consuming and ineffective.

- **Inconsistent processes.** When many complex business processes are manual, it can be difficult to make effective decisions across units, and there are delays or pitfalls at every handoff from discovery to sales.

- **Lack of big-picture perspective.** Is the scientific discovery process effective? Contributing to business success? Would process improvements be productive?

Where is the required data? If you can find it, will it function in the application you need to use? Was it stored in a compatible format? Can meaningful new knowledge be distilled from the masses of raw research data? Is that information presented in a way that leads to new discoveries? Does the process reveal the answers to new questions that researchers might not have initially thought to ask?

You can imagine how powerful it would be to have strong answers to these questions. So it is no surprise that business intelligence (BI) is one of the top IT spending priorities for life sciences organizations this year. Business intelligence works across architectures to reveal new insights from multiple applications and their corresponding data.

Even though this sounds simple—assembling and analyzing information across the enterprise in a cohesive and consistent way—it has been a major challenge for life sciences firms. The traditional way has been to build or buy point applications targeting very specific business processes. When there was a need to cross the inevitable chasms between applications, a programmer created some manual "integrations" to fit the task. Over time, the integration efforts started to look like linguini, and were about as resilient to stressors. Many firms launched well-intentioned efforts to establish an enterprise architecture, only to see those initiatives gradually dissolve into a list of preferred vendors and software—good for portfolio simplification, but hardly an optimization strategy.

Real innovation needs to be powered by real architecture. Life sciences firms must shift their focus away from finding perfect niche applications, and start establishing a holistic information platform on which the business can grow and evolve.

Do you need a clinical trials management application, or do you need a business intelligence platform that can reveal best practices for clinical trials, explore clinical trial data to rapidly identify potential for adverse events, and exploit all that information to fast-track future development efforts?

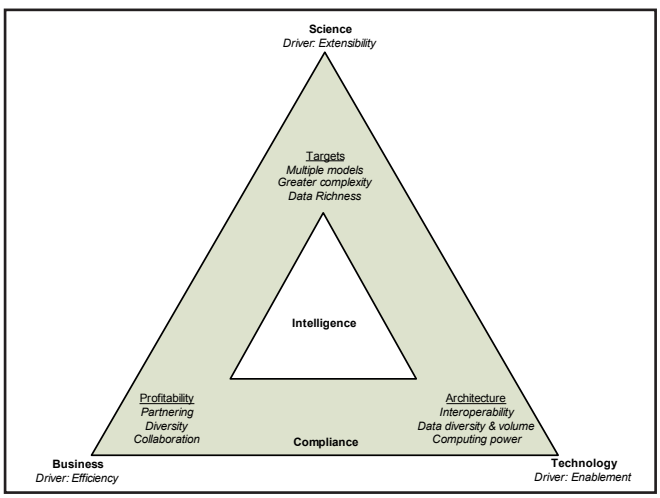
Should you integrate sales and marketing systems on an ad hoc basis, or should you have an integrated platform that uses sophisticated, near-real-time analytics to optimize marketing activities and interaction management across multiple channels?

Do you want your researchers to piece together niche components (and grapple with integration problems), or do you need a system that works with in-house, third-party, and legacy solutions and binds them into a comprehensive whole that spans the needs of the organization, not just specific users or functions?

No single application will bring you the whole future. An architecture focus offers a way to integrate those applications in a way that surpasses their individual merits. The whole is greater than the sum of the parts.

What attributes does an enterprise architecture require?

The science of our industry is growing. Chemical and biological models are adding power and complexity to the tasks of identifying and exploring new drug targets. The data generated from scientific endeavors hold richer detail than ever before—greater insights into drug performance and therapeutic outcomes. As scientists seek to leverage prior research by accessing external information sources, all scientific information must become more extensible. And in a business climate striving for efficiency, partnerships and collaborations that consume this information are increasingly valued.



An architecture for intelligence-sharing drives better science and better business.

The life sciences industry today demands a strong architecture that aggregates business and scientific intelligence while managing regulatory compliance. Such an architecture would have the following attributes:

- Computing power to manage huge volumes of diverse information.
- Interoperability in heterogeneous technology environments.
- Analytical power to derive new insights from scientific and business information.
- Query and reporting capabilities that make insights accessible and meaningful.

"A data integration and analysis solution that can … simultaneously integrate clinical, operational and financial data is critical to the ability to conduct adaptive clinical trials and enables life science companies to compete in a market growing ever more uncertain," says Senior Research Analyst Chris Connor, IDC Health Industry Insights.

An intelligently designed architecture enables organizations to reap the benefits of comprehensive views into their business and scientific information while managing regulatory requirements and risks.

With centralized and accessible information, teams can more proactively identify key disease mechanisms, promising drug leads and disease treatments, and optimal safety and efficacy characteristics. You can then filter out failures earlier in the process than ever before, focus resources on the most promising candidates, and improve the safety and success of clinical trials and healthcare treatments.

The SAS® architecture for life sciences

True business insight requires more than making smart technology investments in individual applications. That's why SAS developed an integrated platform for delivering enterprise intelligence. This enterprise-class architecture enables your organization to identify patterns and characteristics quickly and effortlessly from the hundreds of thousands of scientific results collected daily. Flexibility and customization features enable you to continually update and modify the system to meet the changing demands of research programs.

The SAS Enterprise Intelligence Platform for life sciences includes the following:

- **Data integration** – Prebuilt, high-performance capabilities for data connectivity, data quality, ETL (extract, transform and load), data migration, data synchronization and data federation. For research data, SAS provides a unified data repository and processes that establishes a consistent, validated foundation for cross-disciplinary analysis.

- **Intelligence storage** – Efficient storage and dissemination of information for business intelligence and analytic requirements, offering relational and OLAP storage options from the same foundational inputs.

- **Advanced analytics** – An integrated environment for predictive and descriptive modeling, forecasting, optimization, simulation, experimental design and more—to reveal new insights and opportunities from data.

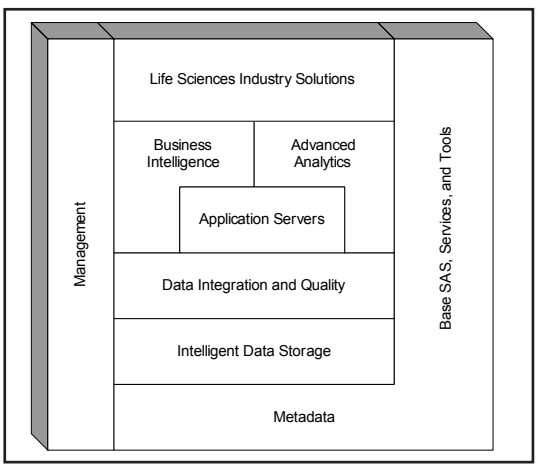
  Industry-specific applications and solutions provide a controlled, centralized platform for transforming, analyzing and submitting clinical research data in accordance with industry best practices and regulatory requirements.

  Optional modules for specific discovery niches—such as microarray, proteomic or genetic marker research—provide analysis and visualization methods targeted to those disciplines, yet integrated with the solution as a whole.

- **Business intelligence** enables different types of users to surface meaningful intelligence from consistent, company-wide data. Data- and text-mining tools enable in-depth exploration of data sets and unstructured sources (documents and images) to reveal patterns of significance. Intelligence can flow across processes for discovery, development, manufacturing and marketing.

These components and services are managed from a single point, reducing the administrative effort for maintenance of applications, users and security. Data consistency is assured because metadata is stored in a single metadata repository and shared across all SAS technologies and solutions. Supporting a wide range of open standards, the SAS Enterprise Intelligence Platform integrates well with existing IT infrastructures.

Each element of the SAS Enterprise Intelligence Platform—from data integration, to storage, to analytics and reporting—adds incremental value to the organization. But you gain the most value when these elements are individually optimized and integrated in an enterprisewide strategy.



In an enterprisewide strategy, architecture elements are individually optimized and integrated.

Let's take a look at how the SAS Enterprise Intelligence Architecture provides the essential attributes needed by life sciences companies: computing power, interoperability, analytical power and the means to share information with diverse types of users.

SAS® Enterprise Intelligence Architecture – computing power

SAS® 9, the foundation for the SAS Enterprise Intelligence Architecture, provides a multi-threaded, multi-dimensional, scalable, and open database framework that quickly processes very large amounts of data. Grid computing applies the resources from multiple computers in a network, and harnesses their collective computing power for a single project. A high-speed, scalable data server uses parallel storage technologies and hardware to reduce transaction overhead and rapidly deliver subsets of information from huge databases.

SAS® computing power in action

One customer reported that four-hour jobs with massive data sets were trimmed by two hours simply by switching to SAS® 9, with no code changes. With fine-tuning, runtime was further reduced to less than 30 minutes. Smaller tasks that previously took 30 minutes are now done in five minutes.

A pharmaceutical company applied grid computing to a complex optimization job that previously took 24 hours to run on an NT server, or 15 hours on a large UNIX server—and reduced job runtime to two hours on a grid of laptop computers that had been considered obsolete.

Academic researchers and pharmaceutical scientists leverage SAS grid computing to rapidly perform highly complex and time-consuming analyses, such as clinical trial simulations and genomic searches. As a result, processing time has been cut significantly, enabling research to move forward more quickly.

SAS® Enterprise Intelligence Architecture – interoperability

For many years, SAS has been a strong supporter of standards that enable interoperability among platforms in the life sciences industry. When developing the SAS platform, we determined that the architecture absolutely had to support interoperability at many levels:

Support industry standards and methodologies

SAS is strongly committed to industry standard protocols, programming languages, models, and communication interfaces. Our products speak the languages of the IT industry at large, such as XML, WS-I, J2EE, OMG's CWM, LDAP and more.

SAS has been actively engaged in developing and supporting CDISC models through active participation in CDISC working groups, advisory boards and the board of directors. SAS is also a long-standing CDISC Registered Solution Provider. The SAS platform supports CDISC functionality in a controlled, traceable environment and leverages this standardized data for more efficient and effective cross-protocol data analysis, review and utilization.

SAS is also involved with emerging standards such as ADaM, BRIDG (Biomedical Research Integrated Domain Group), Janus, the Protocol Representation Model for clinical trial processes, and the increasingly important HL7 standards that enable health records to flow easily into the clinical research process. Common metadata (data about how data is managed) will accelerate the evolution of standardized business processes.

Integrate data from any computing platform

Data can be integrated from diverse formats, platforms and interfaces—such as ORACLE, TERADATA, DB2, ODBC and SQL… from desktops to mainframes… from electronic data capture (EDC) systems, in-house clinical data management systems (CDMS), labs and contract research organizations (CROs).

An intelligent storage platform assembles this information in a way that is targeted for analytic and business intelligence, efficiently processes massive tables containing millions of rows, and disseminates a unified view to many different types of third-party clients across the organization.

SAS® 9 offers the unique ability to integrate multiple, disparate data sources and applications across the enterprise through common "metadata" (information about how data elements are derived and managed). Consistent metadata enables diverse applications to contribute to shared intelligence that transcends functional and organizational boundaries—and to deliver it to the right people, at the right time, in the format they can best use. With integrated metadata and data cleansing capabilities, decision-makers can be confident that the information they rely on is consistent, high quality, and reflects a single version of the truth.

Provide a cohesive platform, not just niche applications

In the past, SAS was perceived as a programming language to serve discrete analysis projects. Today, SAS provides a cohesive platform to support integrated, enterprise-wide applications.

The platform includes components for data management, intelligent storage, business intelligence and advanced analytics. Information flow can transcend functional silos, organizational boundaries, computing platforms and specialized tools. The SAS platform creates a collaborative domain that links previously isolated specialists in business, research, healthcare, marketing and manufacturing.

Organizations that have adopted IBM's service-oriented architecture (SOA) will appreciate that SAS is a member of IBM's SOA Specialty program. Through Web services and message-oriented middleware, the SAS Enterprise Intelligence Platform can easily integrate with a service-oriented architecture to add value and performance to any SOA fabric. SAS programs can be deployed as Web services, and the platform can consume third-party Web services as well.

SAS® Enterprise Intelligence Architecture – advanced analytics

What many software vendors call "business intelligence" is simply query-and-reporting software with a thin veneer of so-called "analytics"—using simple and limited calculations, such as basic sorting, filtering and ranking. Such systems can help a company understand where they've been, but not point the way to future directions.

SAS delivers the industry's widest portfolio of analytics, algorithms, mathematical data manipulation and modeling capabilities. SAS advanced analytics enable you to predict future outcomes, explore and understand complex relationships in structured data and text, and model behavior, systems and processes.

SAS takes the mystery out of these high-end statistical techniques by coupling them with a wide range of user interfaces and graphics. There are industrial-strength analytic toolsets for quantitative analysts, as well as packaged applications that make high-end analytics accessible to business users. Medical professionals, research analysts, and statisticians each have an analysis workspace that is appropriate to their roles—and find it easy to interact with their data, model business scenarios, and send the output to hundreds of different devices.

SAS® analytics in action

Moving away from hindsight views of research, many organizations are now tapping into the power of predictive analytics to improve medical outcomes. For example, one health insurer uses artificial intelligence neural network predictive models to profile patients at medical risk.

Analytic capabilities can be applied to business problems as well. A medical device company saved more than $6 million by adopting a SAS forecasting solution for inventory management.

SAS® Enterprise Intelligence Architecture – business intelligence

In the past, SAS had a reputation for being the province of technical programmers and statistical analysts. That was then. SAS®9, released in 2004, reinvented the way people interact with SAS software and made SAS analytical power accessible to users who have little or no statistical background.

SAS advanced analytic capabilities

- Predictive modeling
- Descriptive modeling
- Forecasting
- Optimization
- Data and text mining
- Experimental design

Empower users to distill knowledge from data, without help from IT

There are new, browser-based, self-service interfaces to suit all types of users across the organization—from statistical "power users" who need behind-the-scenes control of underlying logic, to clinical researchers who need on-demand answers to medical questions and "what-if" scenarios, to executives who need a high-level view of performance metrics and the ability to drill into any detail.

Targeted user interfaces are "fit to task," designed and tailored to the varying skill levels and usage patterns of clinical researchers, doctors, technologists, regulators and executives. An intuitive, wizard-driven, query-and-reporting application makes it easy for researchers to view, author and share reports on the Web, or via customized portals, e-mail and wireless devices. Users can even work with the power of high-end SAS analytics within the comfort of Microsoft Office products such as Word and Excel. Meanwhile, IT retains control over the integrity of source data.

- The SAS platform creates a collaborative domain that links previously isolated specialists in business, research, marketing and manufacturing—and gives the whole user community access to company-standard analytical routines, cleansed data, and user-appropriate presentation interfaces.

Ensure the integrity and compliance of research intelligence

Life sciences data must be handled in accordance with good industry practices, sound business practices and Title 21 of the Code of Federal Regulations (21 CFR Part 11).

The SAS architecture automatically documents data management activities and users' interactions with the data. Integrated processes provide versioning, audit trails and electronic signatures, as well as fully describing the relationships between process inputs, transformations, analyses and results. This degree of transparency and documentation of clinical information processes ensures ongoing quality control and quality assurance, but moreover, makes it easy to confidently address inquiries from regulatory agencies.

Cross the life sciences and healthcare ecosystems

Traditional lines within the industry are blurring. With the emerging role of biomarkers, discovery and development sciences are converging. With the trend toward personalized medicine (and growing concerns about patient safety and treatment efficacy), the healthcare and life sciences environments are converging.

SAS encourages these promising trends by enabling the free flow of information among these previously separate ecosystems. For instance, SAS has demonstrated how data can flow directly from electronic patient records or electronic health records (EHR) systems into clinical trial systems—accelerating the speed at which researchers can assess progress. Information can flow directly from specialized systems for microarray, proteomics or genetic marker research—leading to more effective clinical trial designs and more compelling submissions to regulatory agencies.

Life sciences organizations that adopt a SAS architecture will be well-positioned for the convergence of discovery, development and healthcare ecosystems.

SAS® business intelligence in action

Organizations of all sizes are implementing research methods where many different information sources and systems—globally distributed and with mixed heritages—contribute to medical research. More than 20 organizations are evolving their business practices using SAS Drug Development and other SAS technologies, enabling data managers to spend more time collaborating with statisticians and clinicians, and less time resolving data discrepancies.

In describing one pharmaceutical company's use of SAS, *Bio-IT World* Best Practices states, "Collecting data from around the world and deriving usable answers to queries once took months; now it can be accomplished in a week. The key to expediting and globalizing the drug development process is in successful sharing of data."

Closing thoughts

An industry architecture will bring untold benefits in easing the cost and complexity of information interchange across organizational boundaries and technologies. Imagine the benefits of easily sharing information with research partners, contract research organizations, physicians, and other stakeholders and contributors. The technology is available today to dramatically redefine the way the industry operates.

An industry architecture is still years away, but life sciences organizations can work proactively now to optimize their enterprise architectures—and start reaping the benefits. Unlike a traditional focus on function-specific solutions, the new enterprise architecture model focuses on cohesion and unification. It brings order to muddled infrastructures and aligns IT with the strategic objectives of the enterprise—all while leveraging existing legacy systems and processes.

The SAS Enterprise Intelligence Platform empowers your IT organization to:

- **Deliver a rational enterprisewide intelligence strategy**, providing actionable intelligence that supports the changing needs of the enterprise, business units and departments.
- **Reduce costs for system implementation, maintenance and training** through integrated components and processes that support business units' needs.
- **Optimize your current infrastructure while extending the value of previous investments** with applications that are written once and can run anywhere.

- **Maintain flexibility for future IT evolution** with an open, modular, platform-independent, standards-compliant architecture.
- **Roll out methodologies consistently** across all your global operations.

The life sciences industry has yet to tap some of the tremendous potential available in current-generation software. An industry architecture, when it happens, will bring dramatic improvements. An enterprise architecture is achievable today.

SAS – a leader in business intelligence for life sciences

For nearly 30 years, SAS solutions have provided accurate, consistent and reliable analysis of large volumes of information across all major industries. SAS is globally recognized as the industry leader in analytics, the de facto standard for clinical data analysis, and an FDA standard for electronic submissions. SAS solutions are used at more than 40,000 sites—including the U.S. Food and Drug Administration (FDA) and 100 percent of the Fortune 500 pharmaceutical companies.

For three decades, SAS has been giving customers around the world THE POWER TO KNOW®. To find out more about SAS solutions for the life sciences industry, visit **www.sas.com**.

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