SAP® IN-MEMORY COMPUTING TECHNOLOGY
CHANGING THE WAY BUSINESS INTELLIGENCE IS MANAGED
SAP In-Memory Computing technology enables real-time computing by bringing together online transaction processing applications and online analytical processing applications at a low total cost. Combining the advances in hardware technology with SAP In-Memory Computing empowers the entire business – from shop floor to boardroom – by giving real-time business processes instantaneous access to data. The alliance of these two technologies can eliminate today’s information lag for your business.
## CONTENT

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>About the Authors</td>
</tr>
<tr>
<td>4</td>
<td>Executive Summary</td>
</tr>
<tr>
<td>5</td>
<td>Introduction</td>
</tr>
<tr>
<td>5</td>
<td>Where Does In-Memory Come into the BI Picture?</td>
</tr>
<tr>
<td>5</td>
<td>Business Examples That Leverage In-Memory Computing</td>
</tr>
<tr>
<td>7</td>
<td>In-Memory Computing Technology</td>
</tr>
<tr>
<td>8</td>
<td>Business Intelligence</td>
</tr>
<tr>
<td>9</td>
<td>Project Portfolio Management</td>
</tr>
<tr>
<td>9</td>
<td>Cost Impact for Portfolio Management</td>
</tr>
<tr>
<td>10</td>
<td>Enterprise Architecture</td>
</tr>
<tr>
<td>10</td>
<td>A Clean, Spare Architecture</td>
</tr>
<tr>
<td>11</td>
<td>Cost-Effective Impact of Enterprise Architecture</td>
</tr>
<tr>
<td>12</td>
<td>The Potential of Metadata and Master Data</td>
</tr>
<tr>
<td>12</td>
<td>Cost Impact for Metadata and Master Data</td>
</tr>
<tr>
<td>13</td>
<td>Cost-Effective Deployment of In-Memory Computing</td>
</tr>
<tr>
<td>14</td>
<td>People, Processes, and Structures in Business and IT</td>
</tr>
<tr>
<td>14</td>
<td>BI Governance</td>
</tr>
<tr>
<td>15</td>
<td>Cost Impact for People, Processes, Structure, and Technology</td>
</tr>
<tr>
<td>16</td>
<td>BI Data Lifecycle Management</td>
</tr>
<tr>
<td>16</td>
<td>Cost Impact for BI Data Lifecycle Management</td>
</tr>
<tr>
<td>17</td>
<td>Comparing Architectures</td>
</tr>
<tr>
<td>18</td>
<td>Outlook</td>
</tr>
<tr>
<td>18</td>
<td>For More Information</td>
</tr>
</tbody>
</table>

### About the Authors

**Erich Schneider** is principal enterprise architect in the Business Transformation Services group of SAP® Consulting and has been implementing SAP solutions for over 20 years. He was chief architect in the internal SAP program to enable data and business intelligence (BI) architecture using SAP In-Memory Computing technology across all SAP AG lines of business worldwide.

**Raghav Jandhyala** is a solution expert in solution management for banking analytics. He is an SAP In-Memory Appliance (HANA) software champion for the Americas and provides guidance and support for HANA-related activities in financial services. As a development architect for banking and retail analytic applications at SAP, Jandhyala guided the integration of SAP BusinessObjects™ solutions with price optimization software and developed the BI strategy with respect to SAP In-Memory Computing.
With the revolution of in-memory computing already under way, the question isn’t if this revolution will impact businesses but when and, more importantly, how. Similar to the advance of enterprise resource planning (ERP) software in the 1990s, in-memory computing won’t be introduced because a company can afford the technology. It will be brought on board because a business cannot afford to allow its competitors to adopt the technology first.

This paper details how in-memory computing can change the way you manage business intelligence and the value your business can derive from the technology. For business and IT executives, the paper furnishes substantial information and business examples about what changes they can look forward to and how those changes can catalyze their strategic initiatives.

While non-SAP customers can integrate in-memory technology into their existing software environments, SAP customers can transform their businesses into real-time enterprises with game-changing potential without disrupting their existing IT landscapes. The Business Transformation Services group of SAP Consulting is available to help you assess the impact this technology can have on your IT environment and develop a strategy that leverages it specifically to differentiate your business.

The first product to leverage SAP In-Memory Computing technology is SAP In-Memory Appliance (SAP HANA™) software, which is currently in use at SAP and with SAP customers.

**EXECUTIVE SUMMARY**

**ENABLING REAL-TIME COMPUTING**

SAP® In-Memory Computing technology enables real-time computing by bringing together online transaction processing (OLTP) applications and online analytical processing (OLAP) applications at a low total cost. Combining the advances in hardware technology with SAP In-Memory Computing empowers the entire business – from shop floor to boardroom – by giving real-time business processes instantaneous access to data. The alliance of these two technologies can eliminate today’s information lag for your business.
In order to establish an effective business intelligence (BI) strategy, IT professionals must ask themselves which half of the money they spend on BI investments is working. Within the marketing organization, you probably use focus groups to determine what works and what does not. By using SAP BusinessObjects™ business intelligence (BI) solutions, you can get help from powerful statistics tools to focus your efforts quickly. Statistics can help you determine, for example, which 20% of the data in your data warehouse is used by 80% of your users. When you know this, you can focus 80% of your investment on that fraction of the data.

Our experience shows that BI statistics are a good starting point for optimizing BI spend. They can help you manage your BI graveyards – the reports and data that are simply never used – and maximize the usefulness of business intelligence that is in high demand. A great complementary tool for optimizing your BI investment is one or more BI focus groups that include end users.

Although using system statistics to manage BI spend is available to all customers, we find that some companies don’t perform even this basic step. As a result, they remain unaware of what BI is available to them through their software and don’t leverage it. They certainly are in no position to take full advantage of the new in-memory computing technology. Even the best technology will not help if you lack an effective BI strategy.

Where Does In-Memory Come into the BI Picture?

In 2010 SAP co-founder Hasso Plattner announced in his keynote speech at the SAPPHIRE® NOW conference that SAP In-Memory Computing technology was an IT revolution that was putting the “r” for “real time” back into enterprise resource planning solutions. SAP started its pursuit of real-time data processing with SAP R/2® and SAP R/3® software.

SAP co-CEO Bill McDermott suggests that the new technology will eliminate the BI middleman – the employee who reports data. The reason for this is there will no longer be any need to report up or down the key performance indicators (KPIs).

Here is just a sampling of what in-memory computing technology can do for you:

**Enable mixed workloads of analytics, operations, and performance management in a single software landscape**

**Support smarter business decisions by providing increased visibility of very large volumes of business information**

**Enable users to react to business events more quickly through real-time analysis and reporting of operational data**

**Provide greater flexibility by delivering innovative real-time analysis and reporting functions**

**Support the deployment of innovative new business applications**

**Help streamline the IT landscape and reduce total cost of ownership (TCO)**

Business Examples That Leverage In-Memory Computing

To show how compelling this technology can be, we have included a handful of examples showing how in-memory computing works in real-life, real-time situations to make business more responsive, more effective, and more successful.

In manufacturing enterprises, in-memory computing technology will connect the shop floor to the boardroom, and the shop floor associate will have instant access to the same data as the board member. The technology supports this by integrating on-premise, on-demand, and on-device architectures. Once the appropriate business processes are in place, empowered shop floor staff can take immediate action based on real-time data to make whatever adjustments on the shop floor are necessary. They will then see the results of their actions reflected immediately in the relevant KPIs. You could call this true 360-degree BI, as it eliminates the middleman as well as the need to create any reports other than whatever statutory or legal reports may be required.

SAP BusinessObjects Event Insight software is key. In what used to be called exception reporting, the software deals with huge amounts of real-time data to determine immediate and appropriate action for a real-time situation. Product managers will still look at inventory and point-of-sale data, but in the future they will also receive, for example, notifications when customers broadcast their dissatisfaction with a product to the masses over Twitter.
In order to establish an effective BI strategy, IT professionals must ask themselves which half of the money they spend on BI investments is working. Within the marketing organization, you probably use focus groups to determine what works and what does not. By using SAP BusinessObjects BI solutions, you can get help from powerful statistics tools to focus your efforts quickly.

Or they might be alerted to a negative product review released online that highlights some unpleasant product features requiring immediate action. From the other side, small businesses running real-time inventory reports will be able to announce to their Facebook and Twitter communities that a high-demand product is available, how to order it, and where to pick it up.

An excellent example comes from today’s entertainment companies. Conventionally, bad movies have been able to enjoy a great opening weekend before crashing the second weekend when negative word-of-mouth feedback has cooled off the initial enthusiasm. That week-long grace period is about to disappear for silver screen flops. In the future, consumer feedback won’t take a week, a day, or an hour. The very second showing of a movie could suffer from a noticeable falloff in attendance due to consumer criticism piped instantaneously through the new technologies. Since such rapid response is not possible with old-fashioned movie reels, changes in technology – both disruptive and accelerated – will surge through other industries besides IT.

Another example worth mentioning harks back to McDermott’s middleman: It will no longer be good enough to have the weekend numbers ready for executives on Monday morning. Executives will run their own reports on revenue, Twitter their reviews over the weekend, and by Monday morning have acted on their decisions.

Our final example is from the utilities industry: The most expensive energy that a utilities company provides is energy to meet unexpected demand during peak periods of consumption. In those cases, the provider may have to buy additional energy to support the power grid, which can get expensive. However, if the company could analyze trends in electrical power consumption based on real-time meter reading, it could offer its consumers – in real time – extra low rates for the week or month if they reduce their consumption during the following few hours. Consumers then have the option to save money by modifying their immediate consumption patterns, perhaps by switching off the power at their residence and going to a movie. By giving consumers an informed choice and an incentive, utilities companies have a chance to moderate peaks in energy consumption. This advantage will become much more dramatic when we switch to electric cars; predictably, those cars are going to be recharged the minute the owners return home from work, which could be within a very short period of time.
In-memory computing technology combines hardware and software technology innovations. Hardware innovations include blade servers and CPUs with multicore architecture and memory capacities measured in terabytes for massive parallel scaling. Software innovations include an in-memory database with highly compressible row and column storage specifically designed by SAP to maximize in-memory computing technology. Parallel processing takes place in the database layer rather than in the application layer as we know it from the client-server architecture. Total cost is expected to be 30% lower than traditional relational database technology due to:
- Leaner hardware and less system capacity required, as mixed workloads of analytics, operations, and performance management are handled within a single system, which also reduces redundant data storage
- Reduced extract, transform, and load (ETL) processes between systems and fewer prebuilt reports, reducing the support effort required to run the software

Replacing traditional databases in SAP applications with in-memory computing technology resulted in report runtime improvements of up to a factor of 1000 and compression rates of up to a factor of 10. Performance improvements are expected to be even higher in SAP applications natively developed for in-memory databases, with initial results showing a reduction of computing time from several hours to a few seconds. Currently SAP NetWeaver® Business Warehouse Accelerator (SAP NetWeaver BW Accelerator) software leverages in-memory computing technology. The accelerated version of SAP BusinessObjects Explorer™ software makes use of the technology for data provided by the SAP NetWeaver Business Warehouse (SAP NetWeaver BW) component and SAP BusinessObjects Data Services software. However, in-memory computing will not eliminate the need for data warehousing. A real-time reporting function will solve old challenges and create new opportunities, but new challenges will arise.

SAP HANA 1.0 software supports real-time database access to data from the SAP applications that support OLTP. In a parallel environment, updates of data in real time utilize database replication developed by Sybase. The first SAP application to run on an in-memory database is SAP NetWeaver BW 7.30 using SAP HANA 1.5. This advance has eliminated the need for separate hardware to run SAP NetWeaver BW Accelerator.

Both versions of the appliance software can be accessed with the SAP BusinessObjects Business Intelligence platform. The platform provides a shared semantic data layer for SAP BusinessObjects BI solutions and SAP BusinessObjects enterprise performance management (EPM) solutions. It allows optimized BI applications to take full advantage of the in-memory computing technology.

In manufacturing enterprises, in-memory computing technology will connect the shop floor to the boardroom, and the shop floor associate will have instant access to the same data as the board member. The technology supports this by integrating on-premise, on-demand, and on-device architectures. Once the appropriate business processes are in place, empowered shop-floor staff can take immediate action based on real-time data to make whatever adjustments on the shop floor are necessary.
Business intelligence is more than fancy dashboards – at least most BI professionals agree with that. At first, computer-generated data was simply referred to as reports. Over time new terminology was introduced: executive information system (EIS) in the early 1990s, enterprise information management (EIM), and strategic information management (SIM, see Figure 1), to name a few.

Business intelligence can be complex and, depending on its definition, could be understood to cover functionality offered by SAP BusinessObjects EPM solutions. This would include financial planning and consolidation applications, strategy management and profitability software, and cost management simulation tools. Add to the BI category statistical applications that perform predictive analysis and SAP BusinessObjects Event Insight – which is based on information streams issuing from an event grid – and two things happen. It becomes almost impossible to agree on an industry-wide definition of business intelligence, and it becomes impossible to separate BI from other IT data processing.

For that reason, we do not focus on traditional BI definitions in this thought leadership paper. We focus our attention instead on analyzing the overall impact of in-memory computing technology.

Figure 1: Strategic Information Management
Our world is characterized by rapid changes, disruptive technologies, and strong competition. Clearly, no business can afford to waste its limited resources on duplicate efforts; on freewheeling short-term, throwaway development; or on shadow IT efforts – stopgap, maverick IT work performed outside the official corporate IT strategy. Nor will the biggest corporate spenders necessarily be tomorrow’s leaders. That role will go to the companies with IT strategies that enable their enterprise architects to align the IT infrastructure with business strategy across business units.

That is the reason why IT portfolio management is a top priority for companies today. However, to put that in place, you must understand your business strategy, then establish an IT portfolio that reinforces that strategy with every IT decision made (see Figure 2). In doing so, your IT can help align company priorities across lines of business and corporate support organizations, achieve business objectives, and keep lines of business profitable.

The objectives for IT portfolio management include:
- Establishing clear guidelines for gathering and prioritizing requirements, executing project work, and maintaining budget accountability
- Aligning existing and planned projects with these guidelines
- Prohibiting all IT and business initiatives not aligned with the guidelines of the IT portfolio

If a company intends to leverage in-memory computing technology, its IT portfolio management becomes even more important. We give two examples that illustrate this.

Formerly, operational reporting functionality was transferred from OLTP applications to a data warehouse. With in-memory computing technology, this functionality is integrated back into the transaction system. The consequence is that transaction processing functionality will have to be aligned much more closely with the integrated BI functionality.

SAP BusinessObjects Event Insight, which uses in-memory computing, requires a tightly woven network of data processes and data exploration to identify specific thresholds of performance measures. Reaching a threshold then triggers additional steps in one or more business processes. In order to implement an end-to-end business process with embedded BI, both business-process effort and IT effort must be carefully orchestrated.

### Cost Impact for Portfolio Management

The lion’s share of IT spend is tied up in operations and maintenance efforts, with less IT spend available for business innovation. If potential for innovation is to be significantly increased, organizations need mature portfolio management processes and capabilities to optimize spend without creating too many parallel developments, which could entail even higher IT support spend. For most companies this will mean new governance structures that span silos.

---

**Figure 2: Portfolio Management**
Enterprise architecture emerges where business requirements are formally and rigorously sustained by IT. In advanced enterprise architectural processes, no technology is implemented that has not been vetted and approved by the enterprise architecture office with regard to strategic viability and medium- to long-term benefit for the enterprise. However, those organizations wanting a head-start in in-memory computing must deploy at least one in-memory computing project as soon as possible to develop know-how, resources, and a feel for how the new technology will impact their unique situation.

Obviously, it will take some time before the first applications developed specifically to exploit in-memory computing affect the enterprise application architecture. Yet in-memory computing technology will have a major impact on BI and data warehouse application architecture as well as on OLTP applications. This is something enterprise architects should take stock of earlier rather than later. Real-time data access to BI information and the repurposing of data warehouses will be key to orchestrating their on-premise, on-device, and on-demand architecture successfully. And they will find that in-memory computing will open up new avenues and change the way they regard three-tier architecture for data processing.

A Clean, Spare Architecture

Adopting in-memory computing results in an uncluttered architecture based on a few, tightly aligned core systems enabled by service-oriented architecture (SOA) to provide harmonized, valid metadata and master data across business processes. Some of the most salient shifts and trends in future enterprise architectures will be:
- A shift to BI self-service application-like data exploration, instead of rolling out static report solutions for structured and unstructured data
- Full integration of planning business processes with instant BI provisioning from the source applications, replacing data warehouses for operational data and near-real-time data transfers
- Substitution of traditional ETL architecture and expansive data cleansing and harmonization processes with real-time data validation during all manual and automated data input processes
- Central metadata and master-data repositories that define the data architecture, allowing data stewards to work effectively across all business units and all architecture platforms
- Instantaneous analysis of real-time trending algorithms with direct impact on live execution of business processes
- Offline long-term historic trending that can impact future execution of business processes
- Construction of an event insight grid architecture combining live business applications across on-premise, on-device, and on-demand architectures for proactive use of BI instead of analyzing historic events after the fact

What specific changes are introduced to existing landscapes depend on how functional requirements, such as high availability or disaster recovery, were implemented. The technical specifications of the hardware making up the landscape also play a role. Another factor is whether a company’s data center is committed to a single vendor’s technology or is prepared to incorporate technology from a range of vendors.

It is most likely that future deployments of SAP NetWeaver BW will not require separate hardware to run SAP NetWeaver BW Accelerator. However, to what extent existing hardware components can be reused for SAP NetWeaver BW Accelerator will depend on how that hardware exploits the in-memory computing technology of the application.

Real-time in-memory computing technology will most probably cause a decline in sheer numbers of Structured Query Language (SQL) satellite databases. The purpose of those databases as flexible, ad hoc, more business-oriented, less IT-static tools might still be required, but their offline status will be too much of a disadvantage and will delay data updates. Some might argue that satellite systems equipped with in-memory computing technology will take over from satellite SQL databases. For limited sandbox purposes, that is a possibility. However, because in-memory computing technology can process massive quantities of real-time data to provide instantaneous results, traditional satellite architectures will always be at least one step behind. They are also likely to inherit undesired transformations made during the ETL process.
In-memory computing technology combines hardware and software technology innovations. Hardware innovations include blade servers and CPUs with multicore architecture and memory capacities measured in terabytes for massive parallel scaling. Software innovations include an in-memory database with highly compressible row and column storage specifically designed by SAP to maximize in-memory computing technology. Parallel processing takes place in the database layer rather than in the application layer.

Cost-Effective Impact of Enterprise Architecture

When enterprise architecture plays a role in setting up and maintaining BI projects, it helps reduce costs by considering the overall context of the project. It examines business needs, IT landscape, performance requirements, data model complexity, and the tools and software required to meet reporting demands. In seeing that these requirements are met, it helps establish a unified BI platform that supports administration, thereby significantly trimming the TCO for a BI project.

Analytics based on in-memory computing also contribute to lower TCO of both new and existing landscapes. Some huge cost benefits for IT include reduced hardware costs, higher performance and business agility, faster deployment, the opportunity to adopt incrementally, and compatibility with current and legacy landscapes. In-memory computing technology provides scaling and flexibility of hardware for higher performance. On-the-fly aggregations relieve IT staff from manual query tuning and data aggregation tasks. In cases where an enterprise data warehouse is not in place, SAP HANA provides instant access to real-time data via replication from ERP software from SAP with no need for complex ETL processes.

By contrast, in traditional data warehouse environments, ever higher performance and functional requirements lead to the acquisition of additional hardware, software, and performance-tuning tasks. In highly heterogeneous environments, multiple BI solution sets require additional independent lifecycle management, which adds to solution maintenance efforts.
THE POTENTIAL OF METADATA AND MASTER DATA
PROFITING FROM INTELLIGENT DATA

If a BI solution is to provide relevant information, high data quality is essential. But real-time analytics allow no time for data cleansing processes. To tackle this issue, it is sound strategy to establish the formal role of chief data officer in a company, as SAP has done. This step is an effective way to standardize data processes across the enterprise and achieve the highest possible data quality at the time the data is created.

Considering the number of data fields in SAP Business Suite software, it would be a herculean task to define processes and standards for them all. Since the functionality in SAP Business Suite is designed to take care of this, there is no need to. This is not the case in a heterogeneous environment that brings together legacy systems from different vendors, systems inherited from mergers and acquisitions, and business processes reflecting different levels of maturity. For such environments, strict data governance must be in place to maintain the high quality of real-time data based on company-wide data standards and controls. If current data management processes are insufficient, in-memory computing technology will only make existing issues worse.

Cost Impact for Metadata and Master Data

Reporting in real time based on in-memory computing requires reading directly from analytics data pools in the original source system. Because the data is consumed before traditional data cleansing processes can be performed, data validation must be performed upstream. From a TCO perspective, that might sound like more effort than conventional reporting methods require. We would like to suggest that every dollar a company spends on data quality upstream eliminates two dollars spent downstream.

In-memory computing technology provides scaling and flexibility of hardware for higher performance. On-the-fly aggregations relieve IT staff from manual query tuning and data aggregation tasks. In cases where an enterprise data warehouse is not in place, SAP HANA provides instant access to real-time data via replication from ERP software from SAP with no need for complex ETL processes.

Negative Business Impact from Poorly Managed Master Data

<table>
<thead>
<tr>
<th>Line of business</th>
<th>Financials</th>
<th>IT</th>
<th>Sales</th>
<th>Supply chain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chief financial officer</td>
<td>Chief information officer</td>
<td>Head of sales and marketing</td>
<td>Head of supply chain or manufacturing</td>
<td></td>
</tr>
</tbody>
</table>

Challenges

**Compliance**
- Manual efforts to update financial master data in local financial systems
- Slow group closes
- Risk of not complying with International Financial Reporting Standards or the Sarbanes-Oxley Act

**TCO and Flexibility**
- High master-data maintenance costs
- Need for multiple systems to manage master data in different domains
- Lack of flexibility in dynamic business environments

**Opportunities**
- Lack of consolidated view of customer data across all channels
- Compromise of customer transactions due to limited view of the facts

**Optimization**
- Lack of transparency relating to suppliers and products
- Unused benefits from discounts, conditions, and central contracts
- Limited availability of up-to-date master data in business network
Most companies spend a significant amount of time and effort manually cleansing master data after transactions have been created in OLTP applications. Excessive effort mounts for other reasons: Data validation must be developed in the ETL processes. Multiple sources of truth must be harmonized for multiple BI applications. Meetings must be held in which staff members discuss which data is the right data. Often, these meetings kick off another round of data validation efforts. By contrast, in-memory computing technology provides support for improved data storage, search, and analysis to enhance data consistency.

Cost-Effective Deployment of In-Memory Computing
To deploy in-memory computing cost-effectively, it is critical to link data-quality tools such as SAP BusinessObjects Data Services software directly to both manual and automatic data entry (see Figures 3 and 4). These tools help curb invalid data coming from OLTP applications into the data warehouse through traditional ETL processes or as periodic batch processes. Other ways to reduce TCO include identifying the right data sources with proper data governance processes and choosing the right integration platform, such as SAP BusinessObjects Data Services.
To fully enable BI governance, support of business processes end to end is required. The SAP Business Process Management service offers this kind of support based on a business process-centric approach. On the IT side, a process information owner is responsible for an entire business process. From the business side, a business process owner is given responsibility for the business process.

An example from forecasting – a typical cross-function business process – illustrates how this works. The parties involved could be marketing, sales, and the finance and controlling function. Depending on the type of industry, a delivery business unit like manufacturing or mining or a supply chain unit could be involved. From the business side, the business process owner of forecasting is responsible for aligning the forecasting processes across business units. How well this is done can be measured in process performance indicators (PPIs). The business process owner also serves as the central point of contact between business and IT and is explicitly invested by the board with decision power. (It should be noted that the business process owner is not responsible for getting actual revenue to meet the forecast data. Instead, the business process owner’s role is to control, optimize, or reinforce the process.)

To maximize the effect of the business process owner’s efforts, the company should designate an IT counterpart: a single point of contact responsible for supporting the forecasting business process from the IT side. To realize this, IT must be able to adjust its opera-
tions to provide single-person, end-to-end process support, thus eliminating the need to hand off IT responsibilities from one IT group to another for a single business process. This dramatically increases the likelihood of handling business processes effectively.

We saw a case where a number of IT teams were assigned to perform different stages in handing off an external data load-interface task to the SAP ERP Central Component component. One team was responsible for the ETL stage from SAP ERP Central Component to the data warehouse, data harmonization, and data validation. Another team took over data modeling in the data warehouse. A third team was responsible for the BI front-end applications. Other IT teams supported SQL satellite data warehouses for other BI front-end applications. Although splitting up support resources this way is cumbersome and costly, we are aware of cases where seven or more handovers occurred between IT groups, at times across continents.

In-memory computing technology provides a major opportunity for IT to realign itself as a business process-centric organization based on orchestration of an on-premise, on-demand, on-device architecture. This would do away with a fragmented support model, which only intensifies shadow IT efforts by the business. As the organization changes, so will the people. The more tech-savvy business users become and the easier BI products are to use, the less business will have to rely on IT to produce reports and dashboards. Similarly, as IT personnel become more business savvy, they can provide ever better support for business processes end to end.

**Cost Impact for People, Processes, Structure, and Technology**

At the start of a BI implementation project, implementation teams may be presented with thousands of legacy reports they are to rebuild in the new environment. It is not uncommon, however, that once the teams have rebuilt those reports and after the new software goes live, they are inundated with new report requests because nobody in the user community used the old reports. Unfortunately, this is precisely the time in the project when the IT group members must focus on stabilizing the new environment. Their tasks may include fine-tuning the data warehouse design, preparing and deploying prebuilt reports running on predefined aggregates, or defining processes to warm up limited memory caches. With valuable IT resources tied up with overhead functions, the business cannot wait for its new reports, so it starts building SQL databases. This situation presents a tremendous opportunity to reduce capital and operational expenditures while increasing user experience.
We all know that the amount of data packing this planet is growing. Just reflecting on how much information from social media networks we sift through every day can make us feel slightly ill at ease about it. We also feel quite keenly that the rate at which that data is accumulating is increasing. What’s worse, we neither can nor should ignore it.

Companies are in a far worse quandary: their business depends on it. One day unstructured data might render traditional forecast methods obsolete. Product reviews posted on the Internet may have greater impact on forecasts, sales pipelines, profit margins, and product lifecycles than actual sales from point-of-sale data. It is no mystery why more SAP customers spend as much money and time analyzing unstructured data as they do analyzing traditional structured BI data.

Analysis of unstructured data may become essential in determining product lifecycles by giving companies answers to such questions as: Why keep pushing marketing dollars for a product version when its reviews are under par? Should we accelerate the release of a new version and start promotions to push the old product out of the retail shelves and out of the Internet warehouses instead of replacing the inventory? There’s a very real possibility that unstructured data might render traditional forecasting methods obsolete.

**Cost Impact for BI Data Lifecycle Management**

The majority of databases and data marts could be consolidated into a single, integrated enterprise data warehouse, and it would make sense to do so. Most of the data in data warehouses is hardly used, with only a fraction accessed on a daily basis. Data volume maintenance is one of the major recurring costs and activities of IT. To minimize these costs, infrequently used data should be off-loaded to “cold” hardware and database spaces. Only high-demand data should be stored in the “hot” spaces. “Hot” refers to storing data in a dynamic state, which allows frequent data loads for high availability and split-second response time despite access by many users. “Cold” refers to the storage of nonoperational static data infrequently accessed and causing no additional data loads. Data for long-term analytics or multiyear trending is an example of cold data.

Today, SAP NetWeaver BW can store high-demand data using SAP NetWeaver BW accelerator, medium-demand data with relational database management systems, and low-demand data with near-line storage solutions on optical discs. These different storage strategies remain invisible to users. Using in-memory computing, the database can manage cold, lukewarm, and hot spaces and move data automatically between the areas based on parameter values.

**Figure 5: Business Challenges of Unstructured Data**

<table>
<thead>
<tr>
<th>Unstructured enterprise content...</th>
<th>...is changing in two fundamental ways...</th>
<th>...creating strategic business challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper/Physical; Graphics; Video; E-mail</td>
<td>Growth of data and documents accelerates while regulatory oversight continually increases</td>
<td>Business process inefficiency</td>
</tr>
<tr>
<td>Corporate documents</td>
<td></td>
<td>• Breakdown of ad hoc processes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Lost productivity searching for content</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Emergence of siloed solutions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Regulatory risk exposure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Legal requirement of storing complete record of processes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Unmanaged content “lost in the haystack”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Longer-than-necessary retention of content</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Growth of e-discovery costs</td>
</tr>
</tbody>
</table>

1990 2000 2010

SOX HIPPA GLBA OSHA EUROP A EC 1085 S-296 FISMA UCC-1 RCRA EEO EC 2003

SAP Thought Leadership – SAP In-Memory Computing Technology
## Comparing Architectures
### Traditional Versus In-Memory Computing

<table>
<thead>
<tr>
<th>Feature</th>
<th>Traditional Architecture</th>
<th>In-Memory Computing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Portfolio management</strong></td>
<td>Parallel programs to address process and analytical requirements in separate projects</td>
<td>Overarching portfolio management for redundant data and business intelligence (BI) efforts</td>
</tr>
<tr>
<td><strong>Enterprise architecture</strong></td>
<td>- Layered approach: transactional system layer, enterprise data warehouse layer, and regional and business satellite data warehouse layers</td>
<td>- Streamlined IT landscape with analytics, operations, and performance management combined in one system</td>
</tr>
<tr>
<td></td>
<td>- BI based on 24-hour-old data</td>
<td>- Real-time enterprise</td>
</tr>
<tr>
<td><strong>Metadata and master-data support</strong></td>
<td>- Fragmented data governance</td>
<td>- Enterprise-wide data governance</td>
</tr>
<tr>
<td></td>
<td>- Downstream data management, such as harmonization and validation</td>
<td>- Upstream data validation, with data consumption occurring before data management processes can be performed</td>
</tr>
<tr>
<td><strong>People, processes, and structures in business and IT</strong></td>
<td>- High dependence of business on IT</td>
<td>- High degree of BI self-service</td>
</tr>
<tr>
<td></td>
<td>- Shadow IT in competition with enterprise IT</td>
<td>- Enterprise-wide governance, with business process owners crossing business units in partnership with process-centric IT</td>
</tr>
<tr>
<td></td>
<td>- Business silos</td>
<td></td>
</tr>
<tr>
<td><strong>BI data lifecycle management</strong></td>
<td>- Focus on structured data</td>
<td>- Structured and unstructured data</td>
</tr>
<tr>
<td></td>
<td>- Growing data volume is not proactively managed by actual usage and only segregated by multiple online and offline solutions</td>
<td>- Growing data volume distributed across different storage media determined by user needs and managed by a single database</td>
</tr>
</tbody>
</table>

SAP Thought Leadership – SAP In-Memory Computing Technology
We do not proclaim to know the future and cannot know for certain where the in-memory computing revolution will lead us. What we can say is that the revolution is under way, and for a business to succeed, it must consider the possibilities opening up and prepare for the transformation now.

In-memory computing technology will alter existing IT processes more quickly than ever before. At the same time, business is pursuing disruptive business ideas at an unprecedented rate. In-memory computing will be able to connect the dots between existing application platforms, new mobile community technologies, and nascent technologies.

Although some of the business examples provided in this paper might not relate to your unique situation, we trust we have provided you with some ideas on how you can shape your business opportunities with SAP In-Memory Computing. The Business Transformation Services group from SAP Consulting is skilled at bringing business and IT into alignment. The SAP experts can work with you to create a strategy to leverage technology, deliver value, and differentiate your business in the marketplace.

For More Information

To learn more about the software and tools that can help you manage TCO for BI, call an SAP representative today or go to www.sap.com. For more information on the Business Transformation Services group, see www.sap.com/usa/services/consulting/bts/index.epx. For the latest information on the SAP product road map and release information, visit the SAP Developer Network site at www.sdn.sap.com.