

SAP Technology Vision

Leveraging Technology Innovation
to Reshape Your Business



the 1990s, the number of people in the UK who are employed in the public sector has increased from 10.5 million to 13.5 million, and the number of people in the public sector who are employed in health care has increased from 2.5 million to 3.5 million (Department of Health 2000).

There are a number of reasons for the increase in the number of people employed in the public sector. One reason is that the public sector has become a major employer in the UK. Another reason is that the public sector has become a major employer in the health care sector. A third reason is that the public sector has become a major employer in the education sector.

The increase in the number of people employed in the public sector has led to a number of changes in the way that the public sector is organized. One change is that the public sector has become more decentralized. Another change is that the public sector has become more competitive. A third change is that the public sector has become more customer-oriented.

The changes in the way that the public sector is organized have led to a number of challenges for the public sector. One challenge is that the public sector has become more complex. Another challenge is that the public sector has become more expensive. A third challenge is that the public sector has become more difficult to manage.

The challenges facing the public sector have led to a number of initiatives to improve the way that the public sector is organized. One initiative is that the public sector has become more efficient. Another initiative is that the public sector has become more effective. A third initiative is that the public sector has become more accountable.

The initiatives to improve the way that the public sector is organized have led to a number of benefits for the public sector. One benefit is that the public sector has become more cost-effective. Another benefit is that the public sector has become more customer-oriented. A third benefit is that the public sector has become more transparent.

The benefits of the initiatives to improve the way that the public sector is organized have led to a number of changes in the way that the public sector is perceived. One change is that the public sector has become more respected. Another change is that the public sector has become more trusted. A third change is that the public sector has become more valued.

The changes in the way that the public sector is perceived have led to a number of opportunities for the public sector. One opportunity is that the public sector has become more influential. Another opportunity is that the public sector has become more powerful. A third opportunity is that the public sector has become more successful.

The opportunities for the public sector have led to a number of achievements for the public sector. One achievement is that the public sector has become more innovative. Another achievement is that the public sector has become more dynamic. A third achievement is that the public sector has become more resilient.

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Foreword

SAP is a recognized leader in creating and delivering technology solutions to organizations of all sizes in virtually every country and in every sector of activity, enabling them to innovate, run better, and improve people's lives.

The purpose of this document is to share our technology vision with you, our customers and partners, and with other influencers of technology. This vision includes a look at the main forces reshaping today's technology landscape as well as strategic questions related to business and technology innovation that must be addressed to ensure continued success in a world that is changing at an accelerated pace.

Numerous forces are reshaping industry as a whole. However, we believe there are four that exert the greatest pressure: the emergence of new business models, the pace of innovation, the cost of doing business, and intensifying consumer influence.

The impact of these forces can be seen very clearly in our three focal points of innovation at SAP: in-memory computing, mobility, and cloud strategies.

In this technology age of breakthrough innovations, people expect perhaps nothing more than speed and agility delivered and enabled without disruption. To this end, our innovative in-memory computing strategy focuses on delivering breakthroughs in information provisioning and consumption while simplifying its management without disruption. This means your business operations can be investigated and decisions made based on the situation right now, rather than as it was last week. Our mobility strategy is directed at providing access to information, virtually anywhere and anytime, supporting seamless consumption of critical enterprise information resulting from consumer-driven demands and an increasingly mobile workforce. Our cloud strategy supports the provision of these services in a manner that grows and shrinks as needed.

A key aspect of our vision is the application of design principles to help ensure both functional and operational aspects of quality. One of the most important and overarching principles is timeless software: delivering innovation in technology and enterprise applications to our customers without any disruption to their business.

This technology vision paper will help you address key objectives and issues when thinking strategically about your investment in enterprise technology solutions. For example, how can mobility, cloud, and in-memory computing be employed to deliver new capabilities, expanding and even helping to create new markets? How will you be able to delight your customers with a superior user experience while remaining secure and accountable?

Ultimately, we want you to be able to employ our new technologies to drive business growth while positively impacting people's lives. We see consistent proof that technology solutions can be significant levers for business innovation and transformation, reaching beyond company walls to customers, suppliers, and the entire business network. I sincerely hope this document provides you with information and insights that will help your business innovate and run better.



Dr. Vishal Sikka
Chief Technology Officer
Member of the Executive Board, SAP AG

January 2012

Executive Summary

The speed of innovation in information technologies provides huge opportunities for organizations to improve the way they do business. To maximize the use of new innovation, though, it is imperative that organizations first consider their existing IT infrastructure. Oftentimes, legacy IT systems consist of heterogeneous and siloed system landscapes, which require constant maintenance and adaptation to keep up with new business models, compliance regulations, and other change-driving factors.

Just maintaining and adapting these existing systems is complex and costly and leads to a loss of agility and competitiveness over time. To efficiently and effectively transform these IT systems, organizations need to consider the latest developments and innovations while simultaneously figuring out how to leverage their existing investments. Any changes should be implemented at a pace appropriate to each individual organization to ensure they meet both budgetary and organizational goals.

Successful transformation includes constant optimization of existing infrastructure and applications, paired with the introduction of new functionality based on innovations that may be evolutionary or disruptive. Examples of disruptive innovations include ubiquitous Internet access, which now enables an increasing number of cloud offerings; continuous availability of services through all kinds of devices; and the rise of social media and other social and business networks that increasingly influence the way we do business.

DRIVERS OF INNOVATION AND TECHNOLOGY

Four major trends are heavily influencing and driving the next wave of innovations and technologies, and it is imperative that IT organizations are equipped to support this fast-changing business environment.

More Data Is Available

Data volumes keep increasing. This new reality requires alternate ways of thinking if you want to turn data into valuable business information. Capturing and measuring our surroundings promises more transparency, and the data provided from all kinds of networks and sensors is extremely valuable. The constant stream of real-time data needs to be managed efficiently, and performance becomes the driving factor. To take full advantage of these data streams, data analysis becomes key, and the more this happens in or near real time, the higher the impact and the greater the benefits for the decision-making processes of organizations.

More Distribution and Consumption Channels Are Open

Information and processes become more distributed as businesses expand into new geographies, new partner networks, and new customer-facing channels. This development leads to information distribution across networks, data centers, business systems, marketplaces, and communities. As more and more mobile devices are used to access information and processes, IT solutions need to be ready to support all kinds of consumption channels. Companies need to keep pace with the unpredictable and very fast lifecycles of new devices with new features.

The IT Infrastructure Moves to the Cloud

With more than half the world's servers now virtualized or deployed on either an internal or public cloud platform, it is clear that cloud computing has become the deployment option of choice for new and renovated enterprise applications alike. The speed and ease of deployment afforded by cloud platforms, coupled with unprecedented scalability and attractive cost model, have convinced a large number of CIOs to develop a cloud strategy for their organization.

As issues of accountability, security, and data governance are progressively addressed by cloud platform providers, we expect more and more core enterprise applications to move to the cloud. The cloud in its hybrid public-private form will become the primary, and often the only, deployment environment for new applications. Enterprise applications that reside in the cloud will be enriched with unique functionalities only possible in the cloud, such as cross-organizational collaborative data analysis, simulation, or planning.

Consumers Lead the Enterprise

In the past few years, most technology trends have arisen within the consumer sector, with companies such as Apple and Google at the wheel. The advent of broadband mobile Internet and today's massive expansion of 4G networks have been influenced by the success of devices such as iPhones and iPads paired with Apple's joint market entry with AT&T. This development was further fueled by the availability of content – like music on iTunes and video content on YouTube.

Google's need to scale out its operation has driven and influenced many of the developments in cloud computing and big-data strategies. Amazon's monetization of surplus computing capacity has contributed to increase the maturity of virtualization technologies, bringing those into the mind of every CIO.

The innovation speed and force of consumer technology have become the key technology drivers in the enterprise space, and this innovation remains relatively unpredictable. Nobody knew that social networks would arise with such force or which of them would become market leaders.

Enterprise IT vastly benefits from innovation, but it is also challenged to develop strategies to adapt quickly to new trends and keep up with changing expectations of customers and employees. Gamification, devices with intuitive touch interfaces, tablet PCs, gestures, and social networking are just some examples of new trends making it into enterprise IT.

SAP TECHNOLOGY VISION

The IT industry has seen several fundamental changes in how companies run their business processes. One wave of innovation replaced mainframes with client-server architecture and offered the capability to run business processes in real time. Further waves introduced higher-level programming languages, Internet-scale application servers, and dynamic languages. With each wave, the level of abstraction moved up and commoditized technologies that were previously cutting edge.

Timeless Enterprise Applications

Today, information technology is once again at an inflection point. The trends we outlined are enabling new scales of cost and performance, but they are also increasing the heterogeneity of platforms and applications. As such, many infrastructure components considered as cutting edge today will become commodities in the same way application servers or operating systems did in the past.

Organizations will have to adapt to an increasingly faster pace of emerging IT trends while continuing to provide current service levels to the business without disruption. At the same time, they will be challenged to leverage IT advances to innovate their own processes and introduce new ways to operate and optimize their business.

Enterprise systems, however, tend to live for periods of time measured in decades during which they are exposed to constant pressure to interact with new, emerging technologies. However, at the same time, the technologies used to build the systems become obsolete. Enterprise applications developed well over a decade ago are still in use today and now need to communicate with twenty-first-century applications running on mobile devices or in the cloud and interact with social network platforms.

On the other hand, for some enterprise systems, technology advances clearly outpace the business need for change. These systems keep on delivering good business value, and there is no business justification to undergo a technology upgrade in the near future.

These two conflicting forces result in different parts of enterprise systems evolving at different speeds: some parts are required to evolve more quickly while others can continue to operate on an “outdated” technology stack.

Successful technology platforms will need to accommodate many different runtime, scalability, and deployment options. At the same time, the focus of these platforms will move to managing this heterogeneity with a homogeneous operating and development experience. This enables a platform to provide new levels of abstraction, so that companies can focus on optimizing their business rather than optimizing their IT landscape.

A TIMELESS PLATFORM FOR TIMELESS SOFTWARE¹

The overarching principles of timeless software, which SAP applies to its technology platform and all its enterprise applications, create stable interfaces that allow the renovation of core functionality and the consumption of technology innovation independently of each other.

The new programming model supporting timeless software focuses on capturing the essence of a business application. At its core is an extensible framework for capturing the business entities of an application and their interaction model, and keeping them separate from the assumptions of the underlying technology stack and free of technology-specific optimizations. This new programming model comprises a set of domain-specific languages that enable the applications to evolve free of the constraints of the runtime environment and to work with other applications regardless of their technology of choice. It is designed to be interoperable with many programming languages and runtime environments. The framework itself is extensible, thereby maintaining the “timelessness” of the approach and opening up the platform for future extensions without disruption to enterprise applications.

In this paper we focus on the strategic objectives that any organization should look at when trying to successfully turn challenges into opportunities. These objectives, together with SAP’s commitment to timeless software, are the foundation of SAP’s vision, driving and directing the development of new technology, products, and services.

Improve Your Business with Analytics and Mass-Data Technologies

More and more data is being produced, and more of it is relevant to your organization. Historically, when we talked about organizational data, we would usually think of data generated by and managed within the four walls of our own organization. Then we found that data was distributed across multiple systems – and sometimes across multiple organizations – resulting in the need for new systems to help consolidate it.

Fast-forwarding to today, organizations are seeing the value in all kinds of new data sources, from logs and machine-generated data to unstructured data such as e-mail and tweets. Leveraging these new sources of data gives rise to a whole host of new problems, such as a massive explosion in data volumes, data privacy issues, information governance policies and compliance, and the need for real-time responsiveness.

The good news is that this change is forcing a renewal of the technologies underpinning these data challenges. Hardware performance continues to improve at a rapid pace, while the cost of new hardware continues to fall, making the technology accessible to a wider audience.

Changes to the hardware stack are driving critical changes to the software stack, giving rise to new systems that can natively leverage the power unleashed by the new hardware. Perhaps the hardest hit component in the traditional software stack is the relational database, whose age is beginning to show. We are seeing new data platforms emerging, solving challenges ranging from streaming of data in real time to low-latency and high-scale problems.

GROWING EXPECTATIONS FOR SPEED AND USABILITY

The accomplishments of companies like Apple and Google have opened the eyes of consumers to see what is possible with new technology. Users' expectations from technology have skyrocketed, both for their use at home and in the office.

Despite the increase in volume and types of data that they want to access, users also have an insatiable appetite for faster and faster results, and they bring these same types of expectations to enterprise applications. Banks can do real-time risk management. Utility companies can analyze smart-meter data in real time. Across all industries, in-memory computing is simultaneously enabling new horizons and simplifying the existing layers of complexity without disruption.

IN-MEMORY COMPUTING SOLUTIONS THAT HELP BUSINESSES RUN BETTER

SAP is proud to be at the forefront of this software renewal, bringing the transformational power of in-memory computing to the enterprise and wiping out layers of complexity and latency in existing software architectures. This breakthrough in in-memory analytical functionality is empowering organizations to analyze massive volumes of data quickly enough to exploit time-critical business opportunities and avert threats.

Because software logic is "pushed down" to run right where the data resides, in-memory computing solutions designed by SAP enable all types of calculations to run at unparalleled speeds. It is no longer

necessary to pull data up and down through multiple software layers, creating performance challenges and data volume restrictions. You can trust delivered data; define, plan, and align performance goals and metrics; proactively balance risks and opportunities; respond instantly; take coordinated action on the best decision; and learn from best practices.

But beyond being a platform for enabling real-time analysis on big data, in-memory technology from SAP also serves as the foundation for a new class of applications that leverage the power of mass-data technologies.

BETTER BUSINESS DECISIONS THROUGH ANALYTICS

From long-range forecasting to operational reporting and decision making, advances being made with in-memory technology are changing the fundamental nature of analytics.

The boundary between the "transactional world" of online transaction processing (OLTP) and the "analytical world" of online analytical processing (OLAP) is being redefined. Historically, pushing analytics into separate systems introduced many compromises, such as the "freshness" of data for analysis, where data needed considerable time to go from the OLTP system into the OLAP system, or redundancy, with data replicated in at least one OLTP system and numerous times inside the OLAP system to enable faster reporting and analysis.

The promise of in-memory computing is to be able to run powerful analytics in place, directly on the raw data. This type of real-time decision making and decision support truly enables delivery of the closed-loop vision. For the first time, you could imagine scenarios such as a customer calling into a call center and the system immediately making real-time product recommendations after reviewing the customer's purchasing patterns, looking into current inventory on hand, and searching for ongoing specials.

FORWARD-LOOKING PREDICTIVE AND PRESCRIPTIVE ANALYTICS

Organizations are beginning to broadly adopt forward-looking analytics. They want to know what is coming their way, understand potential risks, and – perhaps the most difficult task of all – when the unexpected happens, analyze the situation and react in real time. Planning, forecasting, and simulation are critical

activities that were often relegated to specialized systems in the past and can now be brought to the forefront with in-memory technology.

One of the key advancements beyond predictive analytics is that of prescriptive analytics, where the system is able to not only make a prediction but actually make a recommendation to the decision maker on what the action should be, based upon a predicted outcome. For most types of forward-looking analytics, there is a saying that “more data beats better algorithms,” which is why advancements in in-memory computing provide such a critical platform on which this analysis can take place.

Despite the increase in complexity and sophistication in analytics, the demand for self-service analysis is increasing. People are demanding more and more control over their data and analytical models and often take matters into their own hands to ensure they have this freedom. To support the quest for data and

knowledge, we believe that applications need to be designed to work with and leverage organizations' existing IT investments while simultaneously empowering employees with the freedom and flexibility they need to run their business on a day-to-day basis. To achieve that goal, it is important to mask the underlying complexity of analytics with a simple and appealing user interface and to support new methods with which employees can interact with their data. This includes analyzing data on the go – through the Web and on mobile devices – while also supporting the collaborative nature of analytics: digging into the meaning of numbers, debating back and forth until there is agreement, and working out a future plan of attack. We believe this trend of disintermediation of data is excellent news, as it highlights the criticality of this information in decision-making processes, thereby reinforcing the need for powerful analytics to help businesses run better.



SAP is proud to be at the forefront of software renewal, bringing the transformational power of in-memory computing to the enterprise and wiping out layers of complexity and latency in existing software architectures.

Increase Competitiveness by Leveraging Cloud Computing and Virtualization

Decades ago, most organizations relied on their own power generators for electricity. Today, in most countries, they use the public grid, the same one that also serves individual consumers. Privately owned generating capacity is used as backup in case of outages or other emergencies. Relying on the public grid has proven to be more cost-efficient and good enough.

With the emergence of cloud computing and virtualization, companies are faced with a similar choice in IT. Should an application reside in the cloud or remain on premise? Cloud computing and virtualization are innovations that began as hyped topics and then matured into established concepts used for operating data centers and building new kinds of business software. Similar to other successful innovations, cloud computing benefits exponentially from the combination of several effects, two of which are the sharing of infrastructure resources (cloud infrastructure) and the coexistence of consumers of cloud software.

CLOUD INFRASTRUCTURE RESOURCES

From a technical standpoint, cloud infrastructures leverage virtualization for the purpose of better efficiency, which results

in lower costs. Virtualization allows for multitenancy on the infrastructure tier, which leads to better use of resources, such as CPUs, networks, and databases. At the same time, cloud computing allows applications to be offered, managed, and continuously evolved without involvement of the customer.

The advantages of cloud computing include effective deployment of solutions and scale of computing capacity. And because of this, cloud computing represents a paradigm shift in the way applications and IT services are developed, sold, deployed, maintained, and consumed. Based on centrally managed systems, cloud offerings can be consumed almost instantly and are highly elastic – allowing customers to start quickly, test in small settings, and, if required, scale globally with a few mouse clicks. If demand vanishes, customers can reduce their consumption and their associated costs.

This is possible through the central sharing of infrastructure and intelligent separation of concerns on the software layer, while keeping the whole system homogeneous and therefore easy to manage. With cloud computing, it is possible to leverage large pools of resources and communities for individual consumers. Cloud computing has enabled soft-

ware products like Google Maps, Facebook, and YouTube; has created entirely new categories of software; and enabled a plethora of new use cases.

From a business case standpoint, cloud computing gives participants and users direct or indirect access to information previously inaccessible or unknown. The use of shared resources between different customers or consumers allows the sharing of data with other parties within the cloud without the need for complex integration projects – given appropriate software design. Examples include collaborative supplier relationship management and sharing of social or business data within networks.

As a result, the benefit of accumulating critical masses of consumers in a software or application cloud gives the operator access to analytics, which enables achieving even higher-value use cases. One prominent example is Amazon's analytics of buyers' behavior, which allows Amazon to create highly tailored offerings to their customers, resulting in a more profitable business. Developing scenarios and creating software specifically designed to leverage these functions will become a main driver of success in the future. Higher-value use cases range from electronic data interchange (EDI)

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within business applications to connecting and identifying sales channels within social networks to leveraging communities to create content.

CONSIDERATIONS FOR DEVELOPING A CLOUD STRATEGY

Which key areas need to be considered when organizations work on their cloud strategies? Cloud adoptions are limited today by the availability of cloud-based offerings that are enterprise-ready. When evaluating cloud products for use in an enterprise environment, organizations should look into security, governance, performance, business continuity, and the laws and regulations. For a successful enterprise-wide adoption, trust in the cloud provider is a key prerequisite.

What are some key attributes that an organization should look for when reviewing its own cloud computing and virtualization strategy? You should look for vendors and partners who provide a comprehensive portfolio. This means the vendor should deliver solutions for each type of organization, from a complete on-demand suite for growing midsize companies to line-of-business solutions for well-established large enterprises

to technology and services to helping potential customers virtualize and manage their on-premise systems through the cloud.

Organizations should look for a vendor who offers hybrid, networked solutions. Your selected vendor should build or deliver networked solutions that offer seamless integration across all elements of an on-demand scenario (software, infrastructure, platform, and cloud services) as well as offer a full on-premise solution suite.

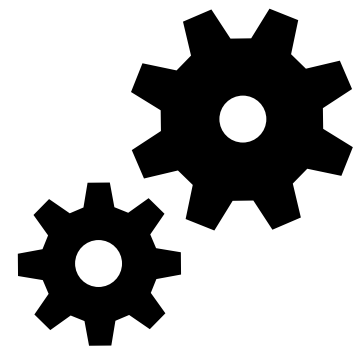
Lastly, the right vendor should be able to provide an open, global platform and ecosystem. The vendor should bring global scale and reach to customers and partners alike and provide an on-demand platform that is open to a broad ecosystem of partners to drive greater innovation.

SAP helps ensure that the cloud delivers maximum value to its customers.

The SAP® technology platform is evolving to support flexible deployment models that leverage cloud-operation and cloud-scale models. We are also extending development tools and programming models to efficiently include cloud requirements in the core design of the software, enabling customers to easily leverage both cloud computing and

existing cloud services. SAP is creating and offering services that will leverage the cloud to provide value-add to our customers and their customers. We help our customers understand how to integrate on-premise and cloud functionality so that they work together and support end-to-end business processes. In addition, we assess which IT functions should stay on premise and which should move to the cloud today and tomorrow.

We help our customers understand how to integrate on-premise, cloud, and mobile functionality in a secure way so that they have an agile and adaptable approach to mitigating risks as they are continuously identified and assessed.



Build Better Connections to Your Customers and Partners Through Networks

Today's enterprises operate within a complex network of relationships. Some of these relationships are collaborative; others are competitive. Some are stable and long-lived, while others are transitory. Some relationships are implemented via automated processes, while others are facilitated via human collaboration.

Unfortunately, today's enterprise software only partially captures this network of relationships. When an enterprise application maintains information about business relationships, it typically does so from a very narrow focus, usually pertaining to a single business function. As a result, an enterprise rarely has visibility into its full range of business relationships. Consequently, it is unable to identify preexisting relationships or establish new ones easily. Apart from leading to missed business opportunities, this lack of visibility can also hide significant business risks, such as a shared dependence on a single upstream supplier.

THE BUSINESS NETWORK OF THE FUTURE

State-of-the-art business network technology aims to overcome this deficiency by creating a common foundation that can represent all types of business rela-

tionships and the various business networks they support. Enterprises will join the business network once, discover their existing business relationships or create new ones, and self-organize into multiple short-term or long-term process-specific collaborative networks. A given enterprise may play multiple roles in these networks and will always have control over what is shared with other members of the networks.

Business network technology promises to power a new class of applications that require many-to-many connections between companies and support multi-party collaboration or multitier visibility. Examples of these include supplier collaboration, marketing collaboration, product traceability, and supplier sustainability. Business networks will enable customers, partners, and other third parties to build many such applications, all of which reinforce one another synergistically because they run on a common business network foundation.

This technology would not be possible without the key technology drivers: ubiquitous Internet access, cloud services, and large-scale in-memory computing. Although these services have been available for a while, enterprises have begun to overcome their initial wariness toward cloud-based solutions relatively recently.

In addition to the technology drivers, security and data privacy are key topics in business networks where competing companies are participants.

TIMING IS RIGHT – SAP TECHNOLOGY IS READY

SAP technology provides a set of cloud-based foundational services used to construct business network solutions that are accessible via standard Web-based application programming interfaces (APIs). Business network solutions may be built on any platform best suited to them, provided they represent their networks using the foundation. Foundational services include all that is necessary to capture and manage networks of business relationships, including registration, business directories, authorizations, and relationship management. In addition, services for facilitating the construction of collaborative business services are essential, such as data sharing, process integration, user collaboration, network analytics, metering, rating, and feedback.

A key benefit of providing a common set of services across these functions is that it allows business networks to provide value-added functionality that cuts across all applications. For example, using a common data-sharing or

process-integration service enables insights to be gained by examining data across a set of applications (subject to visibility controls, of course). In return, this enhances the value of business networks, enticing more and more applications to be constructed on it, thus creating a virtuous cycle.

SAP technology enables the construction of a powerful class of business network applications that support multi-party collaboration or multitier visibility, giving organizations the ability to easily create, manage, and have visibility into their complex network of business relationships. At the same time, the technol-

ogy also allows existing applications to be extended with business network functionality so that organizations can take advantage of business network opportunities from within their existing applications. Built on a common network foundation, SAP applications synergistically reinforce one another by allowing value to be gained across the applications as well as from the applications themselves, thus giving customers value beyond what they would obtain from an isolated set of applications.

SAP is building a strong business network foundation by developing additional business network technologies and addi-

tional services. The business network solutions being built on this foundation enable organizations to create instant value by leveraging their existing business relationships and increase competitiveness by forging new ones. Business network functionality will not only be provided as part of new applications but will also be built into existing SAP applications, thus preserving IT investments. You can take advantage of new business network opportunities incrementally, first from within your existing applications and then gradually adopting new network-based applications.

A flexible technology platform becomes the essential enabler. It can help to run existing systems more efficiently, while at the same time offering agility to respond to current and future business challenges and new technology trends.



Provide Information Anywhere, Anytime, on Any Device

Mobility is the new frontier of human-machine interaction. The global adoption of mobile computing devices has outpaced the adoption of any other technology in the history of mankind. The advancement in wireless technologies, phenomenal innovation in mobile device technologies, and the adoption of software consumption and development standards have fueled an ecosystem of accelerated innovation and adoption. The presence of mobile devices with various functionalities (from standard mobile phones to smartphones to tablets) across all strata of society is already a reality, and a majority of people will use smartphone devices in the foreseeable future.

In the consumer world, people are handling more and more tasks with their mobile devices, going back to their personal computers only when mobile devices don't meet their needs. This change in behavior is affecting users' expectations of business-grade applications, raising them significantly. To meet these new expectations, organizations need to make more data and processes available on all kinds of devices so that people can accomplish their tasks with the device of their choice – anywhere, anytime. As a result, when developing business applications, IT organizations will focus on provisioning data and processes to accomplish certain tasks rather than on the design of a single user interface. This will lead to the availability of business applications in multiple forms on multiple devices. To achieve this, though, IT organizations need to take into account some key considerations.

TRENDS AFFECTING APPLICATION DEVELOPMENT FOR MOBILE DEVICES

First, there is a fundamental distinction between applications for desktops and apps for mobile devices. A mobile app provides information to achieve one specific task and has a predefined flow. Desktop applications focus on solving business problems or understanding a bigger picture and, therefore, have no predefined flow in the user interface; all information a user might need has to be discoverable. This means that the functionality of a desktop application on a personal computer is represented by many task-specific apps on mobile devices. In addition, these apps need to interact with the native functions of a specific mobile device, such as available location services.

Second, we are seeing more organizations allowing employees to use their own personal mobile devices within their company. IT organizations will have to adapt to the fact that they cannot control the deployment and management of mobile devices and apps as they did for desktop applications. Users will install the apps they need themselves on their devices. This lack of control needs to be balanced with the concerns of corporate CIOs with respect to data integrity, security, maintainability, policies, governance and compliance, and connectivity to diverse business systems in order to achieve an acceptable total cost of ownership and total cost of development.

In the future, the heterogeneity of devices that our customers have to support will result in an extremely high number of apps created and respective

versions in use. To manage devices, apps, and their versions, including support for the above-mentioned IT qualities, a platform and a strategic approach to mobility in general are essential. Such platforms will deploy into the cloud and will be based on open standards, especially on HTML, enabling end-to-end delivery of mobile applications through stores or other means for a large community.

THE RIGHT MOBILE APP EVERY TIME

The opportunity for SAP, our customers, our partners, and the entire ecosystem to produce numerous, yet specific, apps is huge. To make that happen, it is necessary for the technology platform to provision data with an easy-to-consume, standardized interface, so that developers can identify and expose the right data for their own apps. As the functionality of business applications is often very rich and highly configurable, the necessary information for consumption on a mobile device should be served ready-made for a specific task.

Each SAP customer has a unique combination of system environment, user base, and security requirements, resulting in unique needs against a mobile strategy. SAP technology, on the one hand, helps open up existing business applications and bundle information for consumption; on the other hand, it helps develop mobile applications across all SAP software for a multitude of devices. This unique combination of front-end and back-end technologies enables our customers to implement a best-fit mobile strategy every time.

To meet our customers' current and future business needs, SAP is developing an adaptable, extensible, and open enterprise platform and infrastructure that delivers current and complete information at any time for any device – and with low total cost of ownership.



Offer the Right User Experiences

An effective user experience is key for better business performance of organizations. It allows users to work intuitively with software solutions no matter where they are, thereby minimizing errors, reducing the need for user training, and, in general, helping to achieve higher levels of productivity.

Creating an effective user experience is a challenge for every software company. Expectations for the look and behavior of software are changing with each generation of users and also with new technologies and devices. Guidelines, patterns, and frameworks valid today may be outdated, or even wrong, tomorrow.

A NEW GENERATION DEMANDS A NEW EXPERIENCE

Today, we see two fundamental changes in user experience expectations. On the one hand, mobility has begun to outpace the desktop experience. On the other hand, the Facebook generation has come into the workforce, and the generation raised on AOL Instant Messenger (AIM),

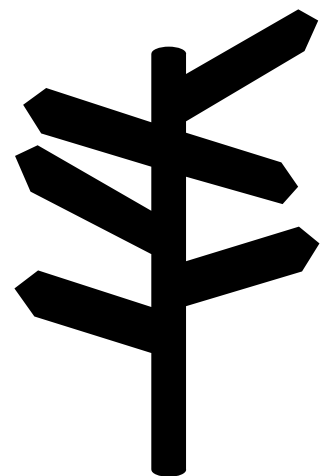
Yahoo, and Amazon is now taking corporate management positions. The acceleration of information access provided by the Internet has taught both of these generations to problem solve and make decisions in real time.

The new generation of employees is familiar with receiving information through feeds, discovering content through arbitrary search, and collaborating instantly by tagging, sharing, and pushing. People are now accustomed to use many different sources of information, which often occurs in real time, like on Twitter or Facebook. They are used to a constant overflow of information, which they try to filter and prioritize. The attention span to finish a task is very short. If a task cannot be accomplished in an intuitive way, the user will move on to a different task. Voice, gesture, and natural language have become part of daily life and are expected by users, such as in-route guidance systems in cars. In addition, people are now used to instantly sharing even the most private information with a large audience and spontaneously collaborating with or forming short-lived workgroups.

What are the implications of this change in user behavior and user expectations for business software? Does it mean that financial accounting will be as easy as Facebook or Amazon activities? How can organizations transform the existing user experience of their applications toward newer and more effective paradigms?

This consumerization of IT has characteristics that directly translate into IT systems requirements, which, if not met, can lead to rejection of enterprise user interfaces. These requirements include usability that meets the quality of top Web and desktop products, just-in-time information, on-demand information in context with users' current tasks, combined analytic and transactional information in the same user interface, bridging the gap between information explosion and limited human ability to handle large amounts of data, social media functionality appropriate for the business environment for enhanced teamwork, and the ability to consume information on a variety of different devices and form factors.

Organizations must adapt to IT trends while continuing to provide service to the business without disruption. At the same time, they must leverage IT advances to innovate their processes and introduce new ways to operate and optimize their business.



The user experience on a mobile device needs to be much simpler and easier than the desktop business application. While mobile applications are geared toward achieving a specific task and therefore adopt a simple, task-driven approach, the “professional” user interface of applications will focus on problem solving. In addition, a user’s expectation of how an application should look and feel on a specific mobile device is an important aspect of mobility. For example, it is not only the user experience that is important but also the way information is structured on an iPad versus a BlackBerry or a desktop computer. When using an application for a desktop computer, you can work with tabs to structure your information. On an iPad, people use the swipe gesture for the same purpose. On a small device, you always try to create specific applications for specific, small tasks that you can handle with just a few taps and clicks.

On the other hand, many professional enterprise users will always need a fully featured user interface, one that exposes all functionality on large-display devices, such as personal computers and laptops. Applications are typically delivered within a browser or a native user interface, with a focus on solving problems and understanding a bigger picture, rather than achieving a specific task quickly with optimized usability.

SAP’S STRATEGIES TO IMPROVE THE USER EXPERIENCE

Many user paradigms in business software are derived from technical shortcomings of the past. The distinction between analytical and transactional content, single-source user interfaces, and static screens are artificial constructs that are not valid anymore.

A modern technology platform has to support the transformation in user experience within the following two different areas.

- **Improve existing applications –**

The technology platform has to offer generic functionality and frameworks that apply to all existing applications. These improvements provide access to integrated analytics, social collaboration, feeds, and information that is relevant for a specific context, like location, user, role, and social connectivity. The distinction between data source and information type is not relevant anymore, as the focus is on the context of a specific task. That leads to integration of relevant data and information no matter where that data and information come from.

- **Create new applications –**

Fully endorsing a task-driven nature and problem-solving attitude requires new and creative user interfaces that need to be built completely differently than the interfaces of existing applications. To ensure an effective user experience, it is necessary to establish new user experience guidelines and design patterns. The technology platform helps ensure that new applications behave consistently and predictably by providing libraries, frameworks, and development tools.

Providing the right user experience for each device and task means balancing consistency with the expectations of a user for a specific context. This means that regardless of the native user experience of a specific device, there is always one natural way to accomplish a specific task.

SAP continues to innovate and to improve the user experience of SAP applications. In addition, SAP continues to provide transformation strategies for customers who need to improve the user experience of existing applications.

Secure Your Data

In the past, the responsibility of the IT security officer was to manage the development and implementation of the corporate security policy and standards. In addition, the officer had to ensure ongoing operation and maintenance of a company's IT resources, including incident-response planning as well as the investigation of security breaches within the boundaries of the corporate network. With the rise of trends like cloud and mobile computing, these boundaries become increasingly blurred.

The traditional office environment, guarded behind the corporate firewall, is a relic of the past. The nomadic worker, armed with a smartphone or tablet, can communicate and collaborate from virtually anywhere and at any time, using social platforms and applications that are operated in the corporate data center, at a partner's site, or in the cloud. This rapidly changing environment, paired with the pace at which new applications and devices are implemented and deployed to the workforce, requires IT security officers to rethink enterprise security.

THE NEED FOR POWERFUL SECURITY FRAMEWORKS

A key area that is most affected by this new type of networked solution is identity management, because users are no longer constrained by the boundaries of the corporate network. Most businesses today rely on automated processes for granting and revoking access to their mission-critical applications, and provision identities across their user stores to reduce operational complexity. Leading organizations adopting a hybrid approach to cloud computing are now

facing the challenges of integrating their existing on-premise identity and access management infrastructure with new applications operated behind the corporate firewall in the cloud or on devices owned by their employees. To keep pace with new innovations in cloud and mobile computing, the ability to extend the reach of existing identity and access management processes within these highly interconnected business networks is a key function of any application platform and security infrastructure.

A new level of flexibility and agility is also required for core security functions, such as authentication and authorization, to provide users, devices, and systems with access to the data they require at any time, from any technology, in any location. For example, businesses will have to accept the fact that the authority for identifying and verifying their employees is not always a central corporate directory or identity provider hosted on premise. Instead, identity data will be provided by many sources outside the enterprise IT network perimeter. Enhancing traditional role-based access control with attribute- and relationship-based mechanisms will be a key concept for a highly secure yet positive user experience when working in these open, massively distributed computing environments. Being aware of the situational context, next-generation business applications will take into account the increasingly quickly changing environment of the user or mobile device and automatically adapt security and privacy levels, such as authorization rights, accordingly. The underlying platform will provide a contextual analysis that, for instance, uses the reputation of an externally authenticated user or an application as

a parameter for establishing a trust relationship to another system in the extended business network.

Secure application development is imperative as well as a natural evolution. Powerful security frameworks and simple-to-use APIs will drive adoption of these enhanced security models in existing and new applications. They will enable developers who are not experts in cryptographic functions and protocols to easily secure their applications without requiring understanding of the underlying complexity. A common set of security-industry standards will be applied consistently across all platforms and applications deployed on premise, on demand, and on device, to ensure tight integration and seamless access between all components and full interoperability in heterogeneous landscapes.

Intrusion detection and prevention are of utmost importance in this more flexible environment. More than ever, the increasing openness, dynamics, and interconnectedness of these business networks require faster and more effective responses to new attacks. Information security management systems established today will have to move from reactive to much more proactive and predictive security controls. What does it take to make the real-time intrusion prevention system a reality for business networks that span across on-premise, on-demand, and on-device solutions? Consider, for example, the ability to predict and to prepare for the unknown or the combination of advanced techniques, such as the systematic and continuous measurement of a new application's attack surface, with high-performance analytic functionality introduced by in-memory computing.

SAP'S PROACTIVE AND HOLISTIC APPROACH TO SECURITY

SAP consistently helps customers implement a secure hybrid cloud and mobile strategy by keeping up with the highest possible security standards for their business-critical applications and data. At SAP, we do everything possible to help our customers run their business processes securely, while enabling them to concentrate on the success of their business activities.

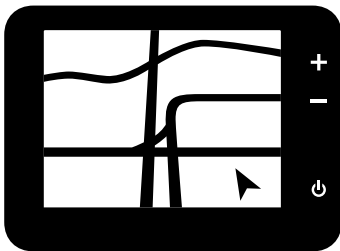
Maintaining security requires a holistic approach. The SAP® technology platform supports state-of-the-art identity management solutions that enable our customers to build secure, collaborative

business processes and services. Our solutions run in the cloud and on-premise and can be consumed from anywhere on mobile devices. SAP is also using a very rigorous, secure software development process to make sure that SAP systems are protected against current and future security threats. We are extending our secure software development processes and security technologies to efficiently include new cloud and mobile security requirements into the core design of the software. This enables an end-to-end holistic security approach for cloud and mobile applications that are connected with on-premise systems.

As security solutions evolve and become more sophisticated, we believe they should intersect and integrate more

seamlessly and synergistically. By integrating otherwise siloed security tools, an organization can gain greater insight and visibility to potential threats and attacks before and as they unfold. Our integrated portfolio, which includes both identity management and risk and compliance solutions, provides exactly this framework.

We are marching toward a proactive and holistic security model. We help our customers understand how to integrate on-premise, cloud, and mobile capabilities in a secure way so that they have an agile and adaptable approach to mitigating risks as they are identified and assessed.



New technologies need to be integrated with existing applications, and devices need to become seamlessly connected and assimilated into business processes.

Conclusion

In this paper, we have examined the main trends of innovation in information technology. But what does all of this mean for SAP customers?

Processes and applications need to be transformed toward the new reality in the IT industry. New technologies need to be integrated with existing applications, and devices need to become seamlessly connected and assimilated into business processes. But how can existing systems evolve to incorporate all these innovations without disrupting the current business? And how can organizations plan for the necessary transformation to take place at the pace they can accommodate and choose?

This is where SAP innovations provide huge benefits for organizations. A flexible technology platform becomes the essential enabler. It can help run existing systems more efficiently, while at the same time offering agility to respond to current and future business challenges and new technology trends.

To meet our customers' current and future business needs, SAP is developing

an adaptable, extensible, and open enterprise platform and infrastructure that delivers current and complete information at any time for any device – and with a low total cost of ownership.

Listening to our customers and understanding their needs is a first step; innovation and execution are the next. SAP has a proven track record of being a leader in innovation for more than three decades. A very large amount of SAP's revenue continues to be invested in research and development for the benefit of all customers.

As a result, organizations will continue to see solutions coming from SAP that offer superior functionality and unmatched business value – solutions that help our customers stay ahead of the competition. In addition, SAP will help customers leverage their investment in SAP products by providing the right strategies and services to transform them, step-by-step, into a new generation of solutions. Look to SAP as your partner when it comes to leveraging innovation for the benefit of your business.

LEARN MORE

To find out more, visit us online at www.sdn.sap.com/irj/sdn/sap-technology-innovation.

FOOTNOTES

1. For more information, see the Timeless Software blog series by Vishal Sikka at <http://bit.ly/v7rMEy>.

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