SAP Throws Down the Next-Generation Architecture Gauntlet With HANA

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SAP has begun to unveil details of its long-term application infrastructure strategy (originally announced in 2010) based on in-memory database management system (DBMS), mobility and cloud. This initiative is a bold attempt to effect a generational change for the company, and to allow it to compete with industry and thought-leading architectures. The vision is very ambitious, and, at the same time, consistent with users' aspirations. This research provides CIOs, CTOs, IT planners, enterprise technology architects, application managers and project leaders with an overview of the midterm and long-term implications of SAP's emerging technology strategy.

Key Findings

- SAP application infrastructure and architecture strategy, dubbed HANA Architecture, combines cloud and in-memory technologies in a progressive, and potentially disruptive, vision.

- The HANA Architecture will underpin SAP's software as a service (SaaS) and packaged business application strategy.

- The first manifestations of SAP's new vision are the HANA analytical appliance, the Business ByDesign software development kit (SDK) and the recently announced Project River application platform as a service (aPaaS) offerings.

- The HANA Architecture is a work in progress, and will undergo several significant changes before it is completed. This potentially exposes SAP users to challenges for migrating to, and integrating with, different technology generations.

- SAP's vision will force megavendor competitors to respond by clearly and openly articulating their cloud and in-memory computing strategies.

- In addition to addressing formidable technology and go-to-market challenges, SAP will have to introduce its highly innovative vision in a way that will be acceptable to the most-conservative part of its customer base.

Recommendations

- SAP users should plan for a migration of their NetWeaver-based applications to SAP's HANA Architecture within the next three to five years. At the same time, users must

determine if there are opportunities to improve their Advanced Business Application Programming (ABAP) applications with the new infrastructure.

- SAP clients and partners should consider that the HANA Architecture likely will have a significant industry impact, because it will be SAP's focus for its next-generation application strategy.

- Presently, users should adopt HANA technology, when available, primarily for high-return/fast ROI projects or for nonbusiness-critical applications, especially where complex analytics are crucial requirements.

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What You Need to Know

For more than a year, SAP has been in the process of rolling out a new vision for its application infrastructure. This vision is based on an entirely new platform designed to leverage advances in server technology, as well as to incorporate new in-memory data management and middleware capabilities and cloud computing. The architecture for which this new platform is being developed is informally known as the HANA Architecture, and the platform is often referred to as HANA or the HANA platform. This differs from the original definition of HANA, which referred specifically to the first product built on this platform, the already-available analytical appliance.

Although still a work in progress and not yet sustained by an officially communicated road map, the SAP strategy is a powerful and visionary combination of two key industry trends: in-memory computing and cloud. The power of HANA Architecture, coupled with SAP's ability to influence its loyal clients' and partners' IT strategic directions, will force megavendor competitors, such as IBM, Microsoft and especially Oracle, to respond by articulating their visions for the next-generation cloud and in-memory-enabled application platforms.

SAP's new application infrastructure strategy not only has long-term implications, but also is expected to impact users and SAP's partners with midterm incremental improvements to the current generation of the NetWeaver stack (7.3). Moreover some of the several manifestations of the platform as a service (PaaS) aspect of the HANA Architecture are already available in the form of the SAP Business ByDesign SDK, a feature of the SAP Business ByDesign business applications SaaS offering that enables the creation of add-on applications. Another HANA-powered, language-independent, albeit Java-based, high productivity-oriented aPaaS offering (referred to as Project River) was informally announced in September 2011 at SAP TechEd and will likely hit the market during 2012.

SAP users and partners should look at the HANA Architecture as the focus of SAP's next-generation, business-critical application investments. However, they should initially approach products based on the new architecture, when available, primarily for high-return/fast-ROI applications or for nonbusiness-critical projects, because of the immaturity of the technology.

Strategic Directions for the SAP Application Infrastructure

Although, recently, SAP has not been considered an application infrastructure innovator, the company has a long tradition in application platform technology (e.g., ABAP/Basis) and innovation in application architecture (e.g., SAP pioneered three-tier client/server computing in the SAP R/3 packaged application in the early 1990s). After a period of uncertainty, due to changes in management, and under the powerful thrust of one of its founders (Hasso Plattner), SAP has embarked on a massive, ambitious and visionary effort to refresh its technology platform. The objective of this initiative is to provide the foundation for the company's ambitions in cloud computing and to leapfrog its competition in packaged business applications through superior technology and breakthrough application architectures (e.g., combining transactional and analytical aspects).

The HANA Architecture strategy is built around an in-memory DBMS (see "What CIOs Need to Know About In-Memory Database Management Systems"). The technology is named SAP HANA Database, but sometimes is referred to as NewDB, the original project name. It combines a variety of DBMS techniques into a single integrated package, which, according to SAP, can result in tremendous improvements in query performance, especially for complex analytics. On top of the SAP HANA Database, SAP is layering innovative applications, high-productivity aPaaS

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offerings (Project River), SaaS offerings (e.g., Business ByDesign and the associated SDK feature) and cloud services (HANA Database [DB]-as-a-Service). An early manifestation of this strategy is the HANA analytical appliance (from which the architecture draws its tentative name), which includes hardware platforms (currently supported by SAP on x86-based servers from Cisco, Dell, Fujitsu, HP, IBM and Lenovo), specifically configured to optimally run the SAP HANA Database software to run analytical applications, including SAP Business Information Warehouse (SAP BW).

The HANA Architecture vision is in its early stages, is not yet fully articulated and will take many years to be fully delivered. However, SAP's publicly stated goal is to eventually base all its application offerings (new and established, SaaS and on-premises) on the HANA Architecture.

The HANA Architecture has midterm implications — that is, incremental improvements to the current generation of the NetWeaver platform, which will hit the market during the next 12 to 18 months — and will have a long-term strategic impact on SAP offerings development.

Midterm Road Map: Incremental NetWeaver Improvements

The follow-up version of the recently released SAP NetWeaver 7.3, likely to be called NetWeaver 7.3.1, will probably enter ramp-up mode in 4Q12 or 1Q13, and will incorporate some technologies that are part of the HANA Architecture vision.

In 7.3.1, NetWeaver Business Process Management (BPM) and NetWeaver Process Integration (PI) will be combined into a single package to provide a unified platform to support human-to-human and system-to-system workflow, as well as application integration requirements. The design/development environments of the two platforms will be unified in the Eclipse-based NetWeaver Developer Studio. The old cross-component BPM (ccBPM) feature of NetWeaver PI will be replaced with the NetWeaver BPM orchestration engine (although ccBPM will continue to be supported for backward compatibility). This will complete the planned NetWeaver PI transition toward a 100% Java code base started with NetWeaver PI 7.1.

The combined NetWeaver BPM/PI in 7.3.1 will incorporate a new business process simulation capability, the NetWeaver Business Rules Management, and a new business activity monitoring (BAM) capability based on the Sybase Complex Event Processing (CEP) engine (Aleri). The CEP engine will come bundled with the combined product, although the license will be restricted to only allow use as the runtime support for the BAM feature. Complementing the BPM/PI combo will be an improved version of the Gravity cloud-based process modeling capability.

NetWeaver 7.3.1 will also provide NetWeaver Gateway, a stand-alone product to help users generate lightweight RESTful service-oriented architecture (SOA) interfaces into SAP applications, primarily to support the development of user-facing applications. Gateway will play a crucial role in SAP's strategy, because it will be utilized in multiple SAP offerings, such as the new Duet Enterprise and SAP's mobile applications, and as the primary integration mechanism to link SAP on-premises packages with cloud-based applications.

In the post-7.3.1 version (sometimes referred to as NetWeaver 7.4), SAP plans to introduce a significantly re-engineered version of the Java-based NetWeaver Application Server (informally referred to as the New Generation Java Platform or the Lean Java Server), which implements an OSGi-based, modular "SOA inside" architecture (see "OSGi: Enabling an 'SOA-Inside' Approach to Application Infrastructure Middleware" [Note: This document has been archived; some of its content may not reflect current conditions.]). Due to the OSGi support, the New Generation Java Server will include, for example, the ability to "hot upgrade" the platform without stopping operations. The technology will also provide cloud-enabling capabilities (e.g., multitenancy and elastic scalability) that will be leveraged in a NetWeaver-based set of PaaS offerings (see "PaaS Road Map: A Continent Emerging"), including an aPaaS, and possibly an integration PaaS

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(iPaaS; see "Integration Platform as a Service: Moving Integration to the Cloud") capability based on the cloud-enabled BPM/PI engine. NetWeaver 7.4, in combination with the in-memory DBMS, will be at the core of the HANA Architecture.

This road map is in line with the plans disclosed at SAP Sapphire 2010, held 17 through 19 May 2010 (see "SAP NetWeaver: The Past, Present and Future"), although slightly less aggressive than in the original schedule. It also makes significant steps in clarifying the future strategic role of NetWeaver in the light of SAP's ambitions regarding cloud computing.

Challenges for SAP include:

- Defining a realistic, inexpensive and as backward-compatible as possible migration path from 7.1/7.2 to 7.3.1 (and later 7.4) for current NetWeaver users, in particular those utilizing NetWeaver BPM and NetWeaver PI.

- Positioning NetWeaver Gateway against the SAP Enterprise Services (a broad set of Web services-based interfaces to SAP applications) in terms of providing users clear guidelines about when to use the predefined Enterprise Services interfaces and when to build specific RESTful interfaces via NetWeaver Gateway.

Impact on users:

Although SAP hasn't disclosed an availability date or specific details about NetWeaver 7.4, this version is likely to be made available in the 2013/2014 time frame. Therefore, users must:

- Plan for a transition of their NetWeaver-based applications to SAP's new, cloud-enabled application infrastructure within the next three to five years.

- Choose to either keep their NetWeaver-based applications (on an individual application basis) on-premises or migrate them to the future SAP NetWeaver-based PaaS, when available and proven.

Longer Term: In-Memory and PaaS

On the basis of the NetWeaver technology evolutions previously discussed, SAP is working on implementing the much broader HANA Architecture, a cloud-enabled application infrastructure derived from NetWeaver and based on the SAP HANA Database. One of the HANA Architecture manifestations will be in the form of a PaaS offering, which will include the already-announced HANA DB-as-a-service, currently in technical preview, and a choice of aPaaS, including a Java-based and an ABAP-based stack (see Figure 1).

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Figure 1. SAP's HANA Architecture for Cloud
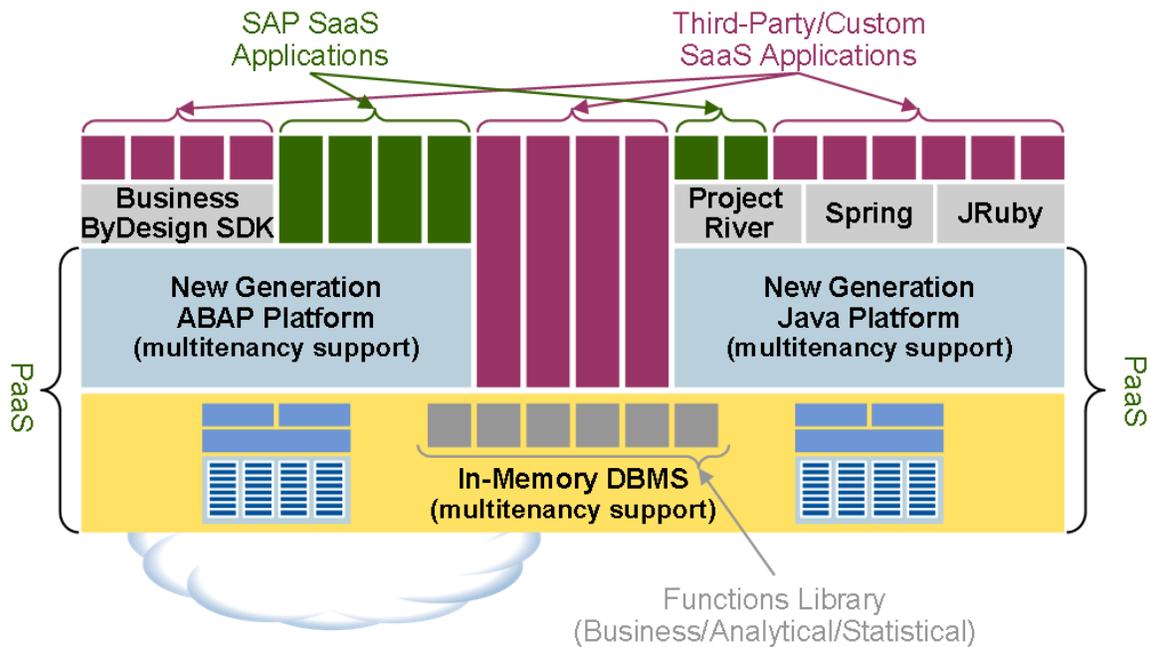
Source: Gartner (October 2011)

SAP's Project River-Based PaaS

The Java side of the strategy, at times referred to as Project River, is currently based on the NetWeaver 7.3.1 Java application server, and later will incorporate the OSGi-enabled New Generation Java Server at the core of NetWeaver 7.4. Project River will support multitenancy and elasticity and will also expose a number of programming environments in addition to Java, including the River Description Language, a model-driven development environment supporting the implementation of front-end Web/Ajax-based applications. Project River-based applications can consume SAP (typically exposed via NetWeaver Gateway) and non-SAP application resources, whether on-premises or in the cloud. River Description Language developers can also implement back-end business logic using server-side JavaScript programming hosted in the SAP cloud. Project River will support other programming frameworks, including Spring (for Java programming) and Rails (for JRuby developments) and will include collaborative features derived from the current SAP StreamWork offering. At TechEd 2011 in Las Vegas (September 2011), SAP announced that Project River will enter private beta in 4Q11, with ramp-up scheduled for 1H12.

Project River will provide the cloud foundation services for other, future PaaS capabilities. These will likely include a cloud-enabled evolution of the combined NetWever BPM/PI part of NetWeaver 7.3.1. However, SAP has not yet clarified whether this capability (basically a combination of iPaaS and BPM PaaS) will be released as a stand-alone offering or only used as a feature in SAP's cloud-based offerings. Project River is intended to be used by SAP clients and partners to develop custom or packaged cloud applications and SaaS offerings, typically front-ending SAP SaaS and on-premises applications. SAP also plans to develop several SaaS applications on Project River for non-SAP clients, who may likely be reluctant to consider adopting cloud services built on SAP's proprietary ABAP-based application platform. SAP Carbon Impact and SAP Recall Genie are already available examples of such applications.

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SAP's ABAP-Based PaaS

The HANA Architecture also includes an ABAP-based stack, which SAP will use to implement SaaS offerings primarily addressing the company's customer base. The first manifestation of this strategy is in the SAP Business ByDesign suite of business applications (ERP, CRM, supply chain management [SCM], etc.), which also provides the SAP Business ByDesign SDK. This is an aPaaS feature of Business ByDesign to enable users and service providers to extend and customize the SaaS offerings' core application functionality. The Business ByDesign SDK leverages a Silverlight-based, model-view-controller development environment. Back-end business logic can be implemented by using SAP's proprietary scripting language combining elements of C# and PHP.

Project River and the ABAP aPaaS will be natively integrated with HANA DB-as-a-service, thus allowing developers to offload certain application components in the in-memory DBMS runtime environment. Project River and ABAP PaaS-based applications will have access to the underlying SAP HANA Database through a variety of APIs (including SQL scripts) and can trigger common, shared application, statistical and analytical functions hosted in the SAP HANA Database runtime environment. At least initially, users and partners will not be provided with the development tools needed to implement these DB-hosted functions, which, therefore, only SAP will provide as part of the HANA DB-as-a-service offering.

It is possible that elements of SAP's PaaS vision will also be released as software products that user organizations and service providers will be able to deploy in their own data centers to offer as a service to internal users or clients. Some initial elements of the product rendition of the SAP PaaS technology are likely to be included in NetWeaver 7.4.

Challenges for SAP include:

- During the next 12 to 18 months, SAP will have to decide whether to use the cloud-enabled NetWeaver only as an internal foundation for its SaaS offerings or turn it into a full PaaS offering.

- Competitive pressure (in particular from Microsoft, IBM and Oracle, as well as from VMware, Dell-Boomi, Informatica, Tibco and Software AG) and the degree of success of SAP's SaaS and aPaaS initiatives will determine the company's strategy in this area. However, like many other SaaS vendors, SAP will feel users' pressure to complement its SaaS application offering with a set of rich PaaS, in particular iPaaS, capabilities.

Impact for users and SAP partners:

The HANA Architecture shows that SAP has an advanced and progressive vision regarding cloud computing and the role that in-memory computing will play in this context. Therefore, SAP clients and partners should:

- Look at the HANA Architecture (whether in the PaaS or on-premises rendition) as one of the potential key offerings in the next-generation application infrastructure.

- Adopt HANA Architecture when available, primarily for the implementation of high-return/fast ROI projects or nonbusiness-critical, situational to maximize benefits and minimize risks associated with the use of a new technology.

A Double Wake Up Call for SAP's Competitors

Although still rough around the edges and incomplete, SAP's strategy is likely to shake up the application infrastructure market and put extraordinary competitive pressure on the megavendors,

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including IBM, Microsoft and Oracle, as well as on application infrastructure specialists, such as Red Hat-JBoss, Tibco Software, Software AG and VMware.

Although largely ancillary to SAP's packaged applications and SaaS strategies, the HANA Architecture vision will compel competitors to respond on two fronts: in-memory computing and PaaS.

In-Memory Computing: The Next Frontier

Whereas there is a general recognition among the major application infrastructure vendors that some support to in-memory computing architectures is critical — e.g., all the vendors listed above have an in-memory data grid product in their portfolios (see "Taxonomy, Definitions and Vendor Landscape for Application Platform Products") and some also have an in-memory DBMS. However no vendor has articulated a comprehensive vision such as SAP's, linking in-memory technology, application platforms and cloud architecture. Although many vendors will try to ridicule SAP's strategy — which implies holding in-memory the database of records for business applications — as unrealistic, industry trends (e.g., 64-bit and multicore processors, dramatic drop in DRAM and flash memory cost and growing miniaturization) decidedly point in this direction. In-memory DBMS and in-memory data grid technologies are well-known and largely mature technologies. SaaS providers, such as Workday, have demonstrated that an in-memory database of record approach can support large-scale business-critical applications. The validation of this notion by a powerful and influential vendor like SAP will force other vendors to respond by coming out with in-memory computing visions within the next 12 to 18 months.

PaaS: Evolution or Revolution?

To date, the main application infrastructure vendors — with the notable exception of Microsoft (see "Windows Azure AppFabric: A Strategic Core of Microsoft's Cloud Platform") — have adopted an evolutionary approach to the PaaS market. In most cases, their visions are based on moving the current products in the cloud, rather than on engineering a natively cloud technology supporting fine-grained elasticity, advanced multitenancy (see "Gartner Reference Architecture for Multitenancy"), cloud transaction processing infrastructure (see "From OLTP to Cloud TP: The Third Era of Transaction Processing Aims to the Cloud") and diversified high-productivity and high-control-oriented programming models (see "Productivity vs. Control: Cloud Application Platforms Must Split to Win").

The approach of engineering a natively cloud application platform has been adopted thus far primarily by newcomers to this market, such as Cordys, GigaSpaces, Gnubila and salesforce.com. Among the established vendors, only Microsoft and Software AG are developing natively cloud application platforms. Natively cloud application platforms are proving technically superior to the previous generation of technologies, at least when it comes to supporting large-scale, global-reach applications, such as SaaS. Many successful SaaS vendors have developed proprietary natively cloud application platforms, often based on in-memory computing architectures.

SAP's PaaS strategy positions the company in this second revolutionary natively cloud application camp, because of the in-memory-centric architecture and the layering of high-productivity frameworks (River Description Language, Business ByDesign SDK) on top of high control, cloud-enabled foundations.

During the next two to three years, users and third parties are likely to favor the adoption of the evolutionary approach, because it will allow them to easily move their established Java Platform, Enterprise Edition (Java EE)/Spring/Ruby, etc., applications in the cloud. To a certain extent, the Project River technology will enable SAP to articulate offerings to satisfy this need by providing a Java EE/Spring development capability in the cloud.

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However, longer term, Microsoft, SAP, salesforce.com and smaller players in the revolutionary camp will put pressure on the most conservative vendors. The primary reason will not be the technical superiority of the natively cloud applications, but will be due to the proven ability of some of these revolutionary players, chiefly SAP and Microsoft, to influence their customer bases' and partner ecosystems' strategies. This pressure will likely force the most conservative vendors to move toward natively cloud-based platforms within the next three to four years.

New natively cloud PaaS platforms are likely to introduce incompatibilities and discontinuities with the first-generation evolutionary PaaS, because of the necessary changes in the programming models required to natively support cloud attributes or to provide high-productivity environments. These discontinuities will force vendors to offer long-term support for the evolutionary and the revolutionary versions of their PaaS, or will require users and partners to significantly re-engineer their evolutionary PaaS-based applications. In either case, vendors in the revolutionary PaaS camp, including SAP (if the company delivers on its HANA Architecture vision), will find themselves in a favorable competitive position, because their costs will be lower (they will have to support only one PaaS offering) and because their clients will not need to go through a painful migration process.

Will SAP's Clients Endorse the HANA Vision?

The HANA Architecture vision is potentially disruptive for the SAP packaged application business, because it dramatically changes some of the technology assumptions on which the SAP Business Suite has developed over the past two decades. However, SAP is pledging that the SAP Business Suite will be re-engineered to take advantage of the HANA Architecture with minimal disruption for users. SAP also expects that by rehosting its packaged applications on top of the SAP HANA Database, it will be possible to drastically simplify the SAP Business Suite by reducing the amount of batch processing, and by narrowing down the necessity of moving data from module to module. At the same time, SAP expects to utilize the HANA Architecture and the approach to embedded analytics to implement new, innovative SaaS and packaged application offerings targeting not only the SAP installed base, but also new markets.

Implementation of the HANA Architecture, the HANA enablement of the SAP Business Suite and the development of the new offerings are daunting efforts, even for a powerful and capable vendor like SAP. It is likely to keep the company's R&D department very busy for a good part of the next decade, and will pose challenging issues from marketing and sales perspectives as well.

SAP has established a powerful grip on its client base, which is typically quite willing to follow SAP's strategic directions. Therefore, it is likely that SAP clientele will be willing to endorse the HANA Architecture, as long as SAP is able to demonstrate business value through innovation on the application offering front. On the other hand, the SAP installed base is, in part, quite conservative and reluctant to adopt new, unproven technologies. These customers are even more reluctant to go through a disruptive transition to adopt dramatically innovative versions of the SAP Business Suite, if not justified by a solid business case.

Key challenges for the success of HANA Architecture will be for SAP to:

- Deliver on the technical vision before its competitors can articulate a response and catch up

- Win support from its large partners' ecosystems and have them convert their established solutions and develop new added values on top of the HANA Architecture

- Deliver innovative HANA-enabled applications (SaaS or on-premises)

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- Provide a smooth, nondisruptive and incremental, but dramatically innovative, migration path for the current SAP Business Suite users toward the new HANA-enabled suite of business applications

RECOMMENDED READING

Some documents may not be available as part of your current Gartner subscription.

"What CIOs Need to Know About In-Memory Database Management Systems"

"OSGi: Enabling an 'SOA-Inside' Approach to Application Infrastructure Middleware"

"PaaS Road Map: A Continent Emerging"

"Integration Platform as a Service: Moving Integration to the Cloud"

"SAP NetWeaver: The Past, Present and Future"

"Taxonomy, Definitions and Vendor Landscape for Application Platform Products"

"Gartner Reference Architecture for Multitenancy"

"From OLTP to Cloud TP: The Third Era of Transaction Processing Aims to the Cloud"

"Productivity vs. Control: Cloud Application Platforms Must Split to Win"

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