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**SAP BusinessObjects Business  
Intelligence with SAP HANA**

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## Executive Summary

Even though it was only introduced in 2011, SAP's HANA in-memory database and computing platform is already playing a central role in the company's product portfolio and strategy. In this briefing we analyse how HANA and SAP's BusinessObjects suite of business intelligence products work together for improved decision making in organizations.

HANA is optimised for both transactional and analytical processing so enabling real-time analytics and applications. Its columnar structure, massively parallel processing functionality, and the way it stores data in main memory means it can process large amounts of data very quickly.

This leads to very fast response times for query and analysis. Existing BI tools and applications - but also new web-based and mobile analytical applications - can benefit from this capability.

SAP's broad offering of BI tools and applications provided in the "BI 4.1" suite is evolving to reflect the changing requirements now demanded by reporting, dashboarding and analysis applications. Such developments - supporting flexibility and independence of business users for Self Service BI (SSBI), visual analysis, predictive analysis or mobile devices for distributing and accessing BI content and tools - are benefiting from a high performance platform. One might say such developments couldn't be provided in a meaningful way without one.

BI tools and applications, such as BusinessObjects, interact with HANA in different ways. Whilst data in tables are accessed by standard SQL requests, more advanced platform features can be used with Extended SQL, SAP's own SQL extension. Applications, for example those developed in HTML5, can also use oDATA middleware to interact with the HANA application server (called XS Engine).

How BI is provided through BusinessObjects and HANA differs according to user functionality and how BI is being deployed in the company.

SAP's tools for reporting, dashboarding, analysis and planning can all access HANA, but in technically different ways. The Self Service BI product SAP Lumira is an example of how SAP is taking its first steps towards tighter integration between HANA and BusinessObjects BI tools. Lumira can publish a user's models and views to HANA to make them available to other users.

As well as this Self Service BI deployment scenario the combination of HANA and BusinessObjects becomes very interesting for operational BI. Support for this data from a SAP ERP system can be replicated by a HANA platform to make its high calculation and query performance available for time-intensive tasks and analytical applications.

Taking this further is the use of HANA as a database and computing platform for the SAP Business Suite. This powerful in-memory platform can supply operational data in real-time with views and information models providing the flexibility with which to define different views on the data. Additionally a package of pre-defined content and models called SAP HANA Live can speed up the implementation of operational BI especially with the Business Suite running on HANA.

For SAP customers the combination of BusinessObjects and HANA opens up many interesting new capabilities. For example, a new target architecture and tool landscape can now be defined to fit a company's BI strategy much more accurately. A roadmap considering business, organisational and technical implications of the new technologies can elevate an organisation to a new level of business intelligence.



## SAP BusinessObjects Overview

For more than 10 years SAP’s BI technology has been providing relevant decision-making information to a broad range of users. Its first solution - SAP NetWeaver Business Warehouse (BW) – was a packaged business intelligence solution designed to complement SAP ERP applications. BW integrates and processes transactional data and delivers it to front-end tools for display and analysis.

In 2008, SAP acquired BusinessObjects. The acquisition brought SAP a bevy of best-of-breed BI tools and applications. These front-end technologies replace the SAP Business Explorer (BEx) BI tools with a strategic tool suite that is continuously being developed (Table 1).

In 2011, two milestones followed: SAP launched its first major release following the acquisition of BusinessObjects – the SAP BusinessObjects BI 4.0 suite and, secondly, the company introduced a new in-memory platform - SAP HANA - optimised for both transactional and analytical processing so enabling real-time analytics and applications.

HANA’s columnar structure, its massive parallel processing functionality, and the way it stores data in main memory means it can process large amounts of data very quickly. This leads to very fast response times for query and analysis. But HANA is not just a database. It’s also a platform suited to new web-based and mobile analytical applications. The company’s Self Service BI product *SAP Lumira* is an example of how SAP is taking its first steps towards tighter integration between HANA and BusinessObjects BI tools.

### Overview of SAP BusinessObjects

SAP offers reporting, dashboarding and analysis tools in a BI suite for all categories and user roles (Table 1). Its central point of integration is a BI platform that supports tools administration - from assigning user rights to system configuration and performance optimisation. The BI Launchpad portal also provides a central publication platform for BI content and a central point of access for most tools which form part of the suite.

**Table 1: Key BI front ends from SAP**

Product category	Key products
Dashboarding	SAP BusinessObjects Design Studio (Design Studio)
Formatted Reporting	SAP Crystal Reports
Ad-hoc Reporting	SAP BusinessObjects Web Intelligence (Web Intelligence)
Analysis (multidimensional)	SAP BusinessObjects Analysis (Analysis)
Analysis (free, explorative)	SAP Lumira (former SAP Visual Intelligence)
Analysis (advanced, statistical)	SAP Predictive Analysis

### How the BusinessObjects product portfolio is developing

For many years - first with BW and later through its BusinessObjects acquisition - SAP has delivered BI software which satisfies the typical requirements of processing, visualising and analysing data (core BI functionality). But these requirements have changed dramatically over the last few years.

Now users want to interact with their business systems in the same way they do with their personal applications and devices – user-friendly, web-based applications and intuitive-to-use mobile devices



which deliver data back to the user quickly and in a form, usually straightforwardly and visually, that is easy-to-understand and can be acted upon in seconds.

One of the biggest resulting trends in business intelligence is increasing the flexibility and independence of business users for Self Service BI (SSBI). Requirements in this category are manifold and range from creating reports independently (ad hoc) to local data integration and modelling. If BI tools are to be accepted by the business user community then it is important that SSBI is user friendly and offers intuitive functionality.

Visualising information is an important factor in usability – especially if you need to analyse large, possibly fast changing and poly-structured data sources effectively (Big Data Analysis). Visually appealing and meaningful charts, tables and diagrams help users understand complex issues.

Improved support for visual analyses has been introduced in Lumira (formerly SAP Visual Intelligence) - the first in a new line of Self Service BI tools introduced by SAP. Lumira increases independence and flexibility for an end user, e.g. through sophisticated data integration functionality and HANA optimisation. Support for advanced analyses such as predictive analysis and data mining can be found in Predictive Analysis.

Using mobile devices for distributing and accessing BI content and tools is also becoming very popular (mobile BI). The main objectives for this kind of functionality are to deliver current and relevant information and bring BI generally closer to the user. Information access becomes ubiquitous with mobile BI, enabling a decision maker to react promptly and independently from his/her current whereabouts. Now with the new product Design Studio, part of the BI 4.1 suite, you can start designing mobile applications which make the most of this kind of functionality.

## SAP HANA overview

SAP HANA is both a database and a data platform that leverages in-memory data processing as its core technology. It is designed to process large volumes of data in real-time and can source data from virtually any data source using standard data integration technology.

HANA is available as an appliance (pre-installed software on pre-configured hardware from SAP's certified hardware partners) to be used on premise/in-house or as a cloud solution provided by SAP.

HANA is used for both transactional and analytical processing. Using in-memory technology and combining a row- with a column-oriented database structure the platform can speed up processing in operational applications – such as ERP and CRM solutions - but it can also provide reporting, dashboarding and analysis capabilities with data in real-time directly from the transactional system. Here the reporting and analysis of data required in operational processes doesn't have to be transferred out of the transactional system, e.g. into a data warehouse. HANA provides one integrated data foundation for running real-time applications and providing operational BI with application data.

If data transformation is necessary - e.g. grouping it for analysis purposes - the necessary calculations can be performed 'on the fly' in HANA since the database provides the necessary performance.

## Integrating data within HANA

Typically, there are two ways to support decision making: Operational Business Intelligence supports decision making in processes, e.g. with a list report or a dashboard that helps to monitor specific processes and usually only shows data from a single process or a single transactional system. There is also a need for supporting tactical and strategic decision making with data warehouses that are invaluable for integrating data from multiple sources or transforming data in more complex ways. HANA supports both approaches in its three major deployment scenarios:



- 1) acting as a database for the Business Suite, HANA can address decision support so reports and analyses can run directly on the operational data;
- 2) it can also act as an additional database to existing systems that take in data and provide it to BI tools and applications;
- 3) or as a database for BW, the data warehouse management system from SAP that can manage a data warehouse data model instantiated in HANA.

Depending upon how it's used, HANA is able to accommodate both real-time data integration (replication/synchronisation) or the batch oriented extraction, transformation and loading of data (ETL). These two and other possible approaches to data integration are provided with additional tools - such as SAP Landscape Transformation Replication Server (SLT) - for replicating data in real-time. SAP Data Integrator (part of SAP Data Services) extracts and transforms data from many possible systems and loads it into HANA.

As a modelling tool SAP HANA Studio can be used to set up and control the tables that store the data in a HANA database. 'Information Models' provide views on to this data. Views can be set up flexibly so that data can be supplied to users in a way that helps them to understand it.

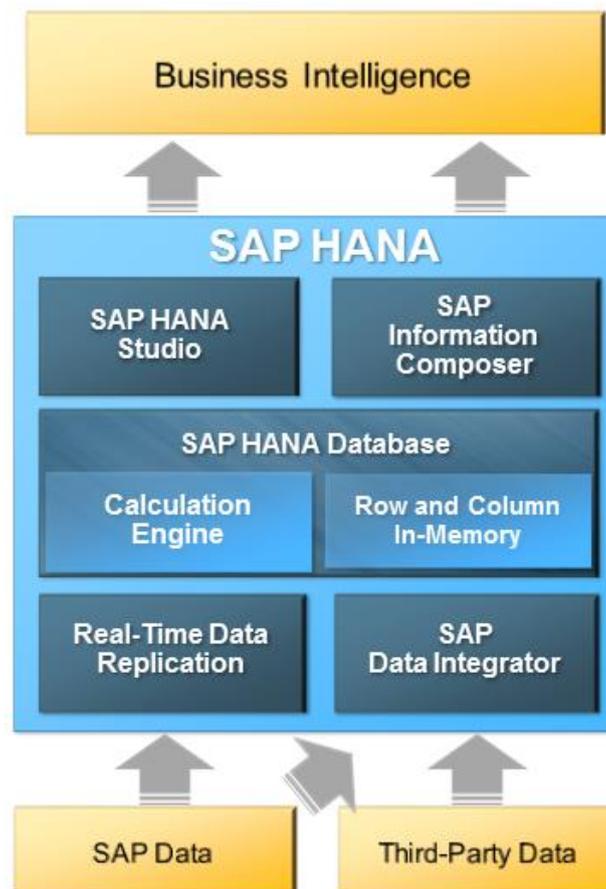


Figure 1: HANA overview: From source system data to business intelligence applications.

### HANA interfaces to retrieve and write back data

On the one hand, HANA is a row and column-oriented relational database that can be accessed using several data interfaces. On the other, HANA operates as an application server (XS engine) which can be used to support web-based applications (e.g. HTML5).

There are three ways of interacting with HANA:



- 1) HANA provides physical **data tables** stored in-memory. These tables can be accessed with tools and applications. To extract and write back data from and to the HANA database several HANA data interfaces can be used. Standard ANSI/ISO SQL is supported by HANA.
- 2) **Views** on tables and more comprehensive ‘information models’ (a collection of views and HANA artefacts such as variables and hierarchies) can be accessed using “Extended SQL”, the HANA SQL dialect.
- 3) As an application server **XS Engine** can be accessed via oData, HTTP or by other means.

All of the interfaces internally trigger the various HANA engines in different ways. Developers of client tools can decide which interface provides the best option for leveraging HANA’s client architecture and how deep their interaction with the data in HANA has to be.

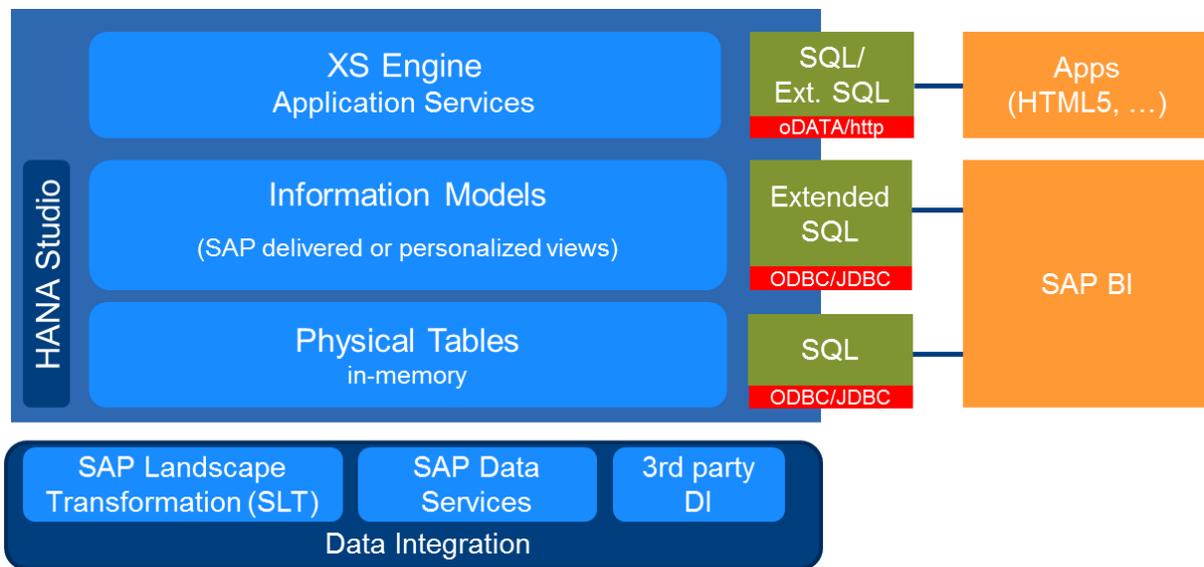


Figure 2: HANA layers and interfaces

HANA’s three interfaces are based on open standards: SQL, MDX and oData. They make sure client tools can work with HANA models in a relational manner, in a multi-dimensional representation and in a format which is suited for HTTP or HTML5 based requests. Currently, the MDX interface is not widely used or supported. The SQL interface provides extensions for SAP BI client tools which can make full use of the HANA information models (HANA information models can contain much more functionality than a typical relational object which cannot be expressed in plain SQL). Currently Crystal Reports, Web Intelligence, Lumira and Predictive Analysis use SQL Extensions to access HANA functions and specifics such as parameters, variables, or units of measures.

HANA also provides you with a way of interacting with data in-memory using lower level function calls - such as the Computation Engine (CE) functions, and other languages such as the R statistics and predictive programming language. Such calls to lower level functions can be embedded in a scripting language. SAP’s BI Consumer Services (BICS) technology is used to consume CE functions with SAP BI clients such as Analysis and Design Studio. Predictive algorithms in Predictive Analysis can leverage the R language in HANA. Detailed information on the integration of SAP BI tools with SAP HANA can be found in the paper “Connecting BI4.0 Client Tools to SAP HANA” available on the SAP Community Network.



Non-SAP client tools can access HANA data using the ODBC/JDBC middleware and SQL as a language. Certification for several BI tool vendors is on the way, but we recommend to test any use of a non-SAP tool with HANA in a proof of concept.

## How HANA is developing

Even though it was only introduced in 2011, HANA is already playing a central role in SAP's product portfolio and strategy. After introducing HANA in "side-by-side" scenarios where data is replicated from the SAP ERP system to the database for faster calculation and analysis, it is now being offered as a database for BW and Business Suite applications. In addition, HANA is available for those companies without any SAP application and who are looking for a data mart solution to address the need for real-time insight into their business.

As this relatively young technology matures development efforts are becoming focused on supporting more and more processes and applications. Also integrating semi-structured data, such as text documents is a new feature to broaden the possibilities to use HANA in Big Data scenarios. Also by using the new near-line storage option for BW on HANA that uses a SAP Sybase IQ database for storing data on disk that is not very frequently accessed means you can cut costs, making sure expensive computer memory is used just for priority applications with other data stored on less expensive disk drives.

Another important development is being able to use HANA's performance to speed up processes in SAP applications. The latest BW release benefits from faster data load processes when running on HANA. This solves the problem we hear about so regularly – that data load times exceed the time limits that are available for them. Executing calculation-intensive tasks can also be performed significantly faster when the ERP system is running on HANA, opening up operational processes. This porting of application logic in to the HANA system will take place over many years but early examples of this being done are showing that the technology has enormous potential.

## Providing Business Intelligence with HANA

The HANA analytical database can be used in many Business Intelligence scenarios from operational reporting to predictive analysis and operational BI to self-service BI. How BI is provided also differs in the way HANA is deployed, as a database for the Business Suite, BW or stand-alone.

### The BI perspective: Selecting the right approach for different implementations of BI with BusinessObjects and HANA

Analytical databases in general and especially HANA as a database and application platform can support a multitude of analytical applications. Users can make the most of the good query performance and additional platform functionality such as built-in analytical algorithms in different tools and applications. Using BusinessObjects tools together with HANA offers some advantages.

We will therefore look at the different uses for the technology from a functional and a BI deployment point of view:

#### Functional BI use cases

Table 1 above provides an overview of SAP's key BI tools. They can all access HANA, but in different ways.

**Reporting:** Crystal Reports and Web Intelligence are tools that are best suited to building up and deploying reports. Both use SQL to access data sources including HANA. Web Intelligence especially uses a semantic layer concept ('universes') as an intermediary layer between data sources and end users. Views and information models in HANA can serve the same purpose, forcing the system



architect to decide whether HANA information models, BusinessObjects universes, or both should act as a semantic layer.

**Dashboarding:** The main tool in the future for developing dashboards will be Design Studio which accesses HANA via the BICS (BI consumer services) interface (that is also used to access BW from Design Studio). In contrast to pure SQL access this interface offers extended capabilities to call up HANA functions in support of application features such as currency conversions, using variables, etc. Dashboards can be published as a web application or on mobile devices.

**Analysis:** The Analysis products support dimensional (cross table) analyses of data in Excel and on the web, and access HANA via BICS. Lumira is going further by addressing the visual analysis of data. Predictive Analysis enhances Lumira with additional functionality for advanced analysis and also supports the data mining language “R”. Some data mining algorithms will be available directly in HANA; additionally the “R” library can be used as an add-on to HANA. Both Lumira and Predictive Analysis offer the tightest HANA integration of all BI tools offering a unique way of writing back built-up models to HANA so they can be re-used as views by other users.

**Planning, forecasting, simulation:** The two tools SAP Business Planning and Consolidation (BPC) and BW Integrated Planning (BW IP) in combination with Analysis for Excel can support planning, forecasting and simulation scenarios with data stored in HANA. The Planning Application Kit (PAK) takes BW IP further by pushing down the processing of planning models from the application layer into the HANA database and calculation engine. This leads to better planning performance for BW IP models running on HANA.

#### BI deployment view

The two key BI deployment scenarios that are especially well supported by HANA are operational BI and self-service BI scenarios.

#### Operational BI:

Some BI 4.1 tools are closely integrated with the Business Suite so users can visualise and analyse transactional data as embedded features (“Embedded Analytics”). Standard content is provided directly within the SAP system so there is no need to use a separate BI system alongside an ERP solution.

Embedded Analytics contains predefined Dashboards and Crystal Reports which provide “out-of-the-box” content based on SAP’s best practice examples. This content can be adapted to various user requirements. All content is available integrated in the ERP system referring to operational processes that are handled in that system. More details can be found in the BARC Research Note “SAP BusinessObjects BI Solutions for SAP Applications”.

With the availability of HANA as a high-performance platform the usability of operational BI within the Business Suite is increasing. Embedded Analytics for the Business Suite on HANA is available with the new package HANA Live. It contains pre-defined, unified virtual data models that are easy to understand and tailored to analytical applications as well as pre-defined BI content matched to the HANA database and platform. Crystal Reports, Analysis workbooks, Design Studio applications and Lumira documents are available. This output is available within the transactional SAP system without you needing to leave the application, and the data is reported in real-time, directly from the transactional data. The data models and pre-defined BI content can be used as they are but they can also be modified.

All customers with requirements that are not matched by HANA Live content can build up their own views and information models with the transactional data from the Business Suite. Data modelling is performed in HANA Studio. BI 4.1 tools can access these views and models and provide the capabilities to report and analyse them. New applications that use the transactional data can also be developed, potentially using the HANA XS engine features. SAP also started to deliver a new



generation of applications aimed at extending the Business Suite functionality in combining new working models with consumer-grade, multi-channel user experience. These applications are called “SAP Smart Business”.

### Self Service BI:

In Self Service BI scenarios HANA can act as a central platform to store and provide analyses and data models as views for many users. They can use tools with self-service capabilities such as Analysis or Lumira to work with these data views and change them if necessary. Lumira also has a unique way of writing back new models as views to HANA. Using HANA as a common platform for Self Service BI applications for business users became even easier with the availability of HANA in the cloud since users do not have to wait for a physical implementation of the system in the company.

### The HANA perspective: Providing BI in different HANA deployment scenarios

HANA can be deployed in many different scenarios. We describe how BI is provided in three of them: by using HANA as a stand-alone data mart, BW powered by HANA and HANA being used as an application platform for the Business Suite and other applications.

#### HANA used as a stand-alone data mart

HANA can be used independently from SAP applications such as BW or the Business Suite as an analytical database that provides data to BI front-end tools or custom applications (Figure 3)



Figure 3: Providing BI with HANA as stand-alone data mart

The HANA architecture (Figure 2) supports this by offering

- flexible data integration possibilities from many source systems and databases with SAP Data Services and other tools;
- accessibility of data via the HANA data interfaces for queries (see paragraph “HANA interfaces to retrieve and write back data” above); and
- data accessibility via the XS engine for customised and other applications.

Some SAP BI tools offer a deeper support for specific HANA features than other SAP and non-SAP BI tools (see chapter “The BI Perspective: Selecting the right approach for different BI use cases with BO and HANA” above).

Dashboard applications can be developed with Design Studio and other individual applications, e.g. HTML5 can use the XS application engine.



## BW powered by HANA

BW, the packaged Data Warehouse solution designed to complement ERP applications contains connectors to ERP modules, a data warehouse for storing source data, subject-oriented data marts, and pre-defined content. As a data warehouse management solution it used to manage data that was stored in standard relational databases.

With the availability of HANA the BW application can now also manage data that is stored in HANA. There are two benefits to this approach: 1) the in-memory database has a much better query performance than standard relational databases (this is especially true when the BW Accelerator – basically, a similar technology to HANA – is not used with BW); and 2) some processing is pushed down from the BW application to HANA to provide much faster processing - e.g. some parts of the data integration process run significantly faster in HANA compared to the BW application server.

These changes in the technical (back-end) system architecture do not change the way BI tool interact with BW. Front-end tools and BI applications continue to access the BW application and are not directly querying the database, so a change in the database and some application processing features do not affect the way BW interacts with BI front-ends (Figure 4). They continue to access BW using interfaces such as BICS, BAPI, etc. with their respective available features.

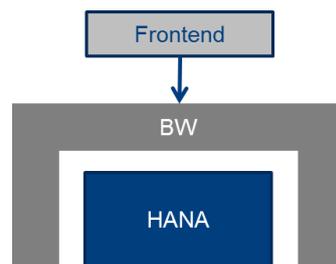


Figure 4: Providing BI with BW powered by HANA

## HANA used as an application platform (for the Business Suite and other applications)

The HANA in-memory technology can process mass quantities of real-time data in the main server memory to provide immediate results from analyses and transactions. This capability can be used to increase massively the performance of both transactional (OLTP) and analytical (OLAP) processing.

Consequently, the latest release of the Business Suite is also supporting HANA as a database and application platform.

An easy to implement solution is the side-by-side scenario where HANA is used additionally to the Business Suite. Specific parts of the application data is replicated to the additional HANA platform where it can be processed quickly for analytical queries. The most popular side-by-side solution is the CO-PA accelerator that calculates e.g. cost allocations.

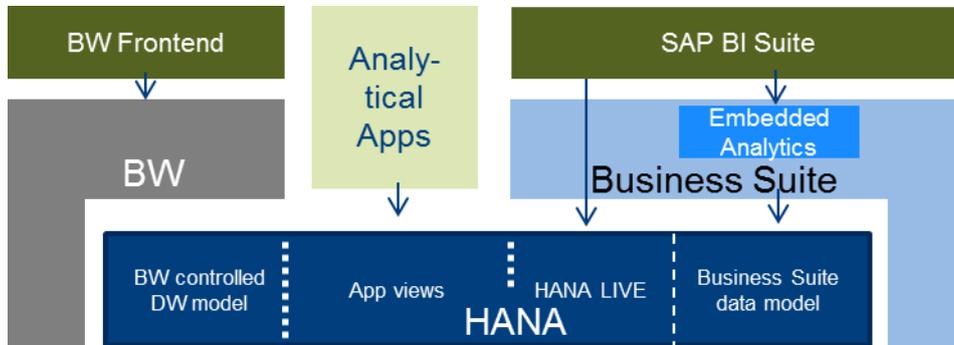
Similar to these approaches it is always possible to use HANA as a platform for individually developed analytical applications that use their own data or data from SAP applications.

Additional capabilities are available once the Business Suite is deployed directly on HANA. Some application areas that are already “optimised” for HANA (meaning that HANA is not only used as a database but that also application processing logic is running in HANA) are Financial Accounting, Financial Risk Management, Receivables Management and Access Risk Management.

HANA Live provides pre-defined content and models to deploy operational BI directly (in real-time) on operational data. Using HANA Studio the HANA Live content can be extended and changed. As well as using HANA Live as a starting point and template for operational BI applications you can also build up applications from scratch that utilise existing SAP data in HANA views or information models. SAP



has already published 30 of such applications that can serve as examples a sales pipeline analysis that mixes SAP ERP and CRM data.



**Figure 5: Providing BI with HANA as an application platform**

In effect, you can envision a centralised HANA resource in a company that supports a multitude of SAP and custom developed applications (Figure 5). The key application here is the Business Suite that provides the transactional data. HANA Live offers some pre-defined content for operational BI on this data. Custom built applications and also BI tools extend this with access to built-up views and information models. Additionally BW can be used to manage a data warehouse model in HANA providing aggregated, historic and integrated data from the Business Suite and other data sources.



## Step-by-step guidelines on how to define a roadmap for BusinessObjects BI with HANA

As a SAP customer or someone interested in deploying BI with HANA, you should evaluate your current and future BI strategies in the light of these new developments both in BusinessObjects BI as well as HANA.

To ensure a successful architecture and roadmap your company should

- **Define your BI strategy first.** Using a project-by-project approach without an overall BI strategy is one of the main reasons why companies do not achieve the desired level of success in their projects or obtain optimal benefits from their BI systems. This strategy should cover technical, business as well as organisational aspects in the light of company requirements and recent technical developments supporting mobility and Self Service BI.
- **Evaluate business benefit of high performance computing.** HANA is a powerful technology that delivers high performance in the way it calculates and supplies data. It is important to be clear about the benefits such a new technology can bring to the business. Improving query speed or calculation times can be a benefit in itself but it's usually more interesting to evaluate the effect of such improvements on business processes. It may even be possible to invent new processes, products or business models around the capabilities that a new generation of analytical database and application platform such as HANA brings to the business.
- **Define a target architecture and tool landscape.** It is important to define the goal of subsequent changes to the data management and BI tool landscape with an architecture that spans all layers of an analytical infrastructure from data integration to BI tools and applications to show
  - which BI tools and applications continue to be used or will be introduced to the company and which BI user applications and user groups they should serve;
  - which HANA deployment scenarios should be employed and how HANA applications complement or replace existing applications;
  - the effects of new capabilities for real-time reporting of data directly from the SAP Business Suite; and
  - how data is transferred physically between systems and where views (semantic models) of data are used to present data to users.
- **Create a roadmap.** Taking a step by step approach to deploying BI with HANA in different user scenarios and approaches as outlined in this document will be the most useful way forward for most companies. A roadmap brings all the necessary steps into chronological order and defines what should be achieved when. There are
  - business implications (e.g. when new capabilities in BI and analytics are desired or necessary);
  - organisational implications (e.g. how changes to applications are implemented and how skill development and user training is organised); as well as
  - technical implications (e.g. for deploying SAP applications on HANA the applications need to be upgraded to recent releases (BW 7.3, ERP6.0 EhP6).



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