

Enterprise Resource Planning, Business Intelligence, Data Warehouses, and SAP BW

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This chapter provides a general overview and background to enterprise resource planning (ERP), SAP R/3, business intelligence, data warehousing, OLAP, and the SAP Business Information Warehouse (SAP BW), the main themes of this book.

The contents in this chapter are not explicitly tested on the exam, but provide important background information. This section will assist you in answering general-purpose questions on the exam related to these topics.

Enterprise Resource Planning

Enterprise Resource Planning Systems (ERP) are commercial software packages that facilitate the seamless integration of all the information flowing through a company—financial, accounting, human resources, supply chain, and customer information. ERP systems fundamentally integrate the different processes necessary in a business into a centralized pool that facilitates data sharing and eliminates redundancy. ERP provides information management and analysis to organizations.

The major benefits of ERP systems include:

- On-line/real-time information made available throughout all the functional areas of an organization
- Improved data standardization and accuracy across the enterprise
- “Best practices” included in the applications
- The efficiency gained throughout an organization
- The analysis and reporting made available for long-term planning

The major players in the ERP software industry are Baan, J. D. Edwards, Lawson, PeopleSoft, Oracle, and SAP. Examples of ERP modules are human resource management systems (HRMS), financials, manufacturing, distribution, and sales. Each ERP module offers different functionality for different industries.

SAP R/3

The German software company SAP AG is the market leader in the ERP arena. Systems, Application and Products in Data Processing (SAP) consists of highly integrated software modules that perform common business functions based on multinational leading practices.

SAP R/3 is the third generation of SAP software. SAP R/3 is based on a client/server architecture and uses a relational database to track all information related to a corporation. SAP R/3 runs on several operating systems, including UNIX, Windows NT, and AS/400, and can use different database management systems, including Oracle, DB2, Informix, and Microsoft SQL Server.

The SAP R/3 client/server system architecture is built around several modules or applications. A module is a set of transactions that deal with the same area of business functionality. The current modules of SAP R/3 include:

- FI—Finance
- CO—Controlling
- MM—Materials Management
- HR—Human Resources
- PM—Plant Management
- PP—Production Planning
- LO—Logistics
- SD—Sales and Distribution

One of the reasons for the success of SAP R/3 is the tight integration of the business applications. One event in one module, such as materials, automatically triggers response in the others, such as sales, finance, and plant maintenance. For instance, when a customer places an

order, a purchase order is created, an inventory is created, appropriate documents are created, and so on. This functionality is a major advantage compared to that offered by other vendors who simply package the business functionality in one box with limited integration.

Business Intelligence, Data Warehousing, and On-line Analytical Processing

Data Warehousing and Business Intelligence

The twenty-first century belongs to those who exploit information as a strategic enterprise resource. Today's decision makers urgently need accurate information on production, sales and markets, finance, and personnel to obtain a complete and up-to-date picture of their business and environment. As illustrated in Exhibit 1.1, that information is usually spread throughout the corporate IT structure, on a wide variety of platforms and in a wide range of applications. In other words, getting hold of vital facts and figures can be a complex and time-consuming task.

Exhibit 1.1 Business Intelligence Reality: Islands of Information



The technical concept for meeting this data challenge is known as *data warehousing*. A *data warehouse* is a separate application environment with a dedicated database drawing on diverse data sources and designed to support query and analysis.

“Business Intelligence is the process of transforming data into information and transforming that information into knowledge through discovery.”¹ Data warehousing and other business intelligence tools give meaning to all of that “useless” data. Using data warehousing and business intelligence functions, strategic decision makers can analyze, slice and dice, query, and generate reports. Closer integration of corporatewide data warehousing data with ERP data potentially enhances companies’ return on their ERP and data warehouse investments.

On-line Analytical Processing

One significant functional component of business intelligence is *on-line analytical processing (OLAP)*. The OLAP Council defines OLAP as a category of software technology that enables analysts, managers, and executives to gain insight into data through fast, consistent, interactive access to a wide variety of possible views of information that has been transformed from raw data to reflect the dimensionality of the enterprise as understood by the user.²

OLAP functionality is characterized by dynamic multidimensional analysis of consolidated enterprise data supporting end-user analytical and navigational activities, including:

- Calculations and modeling applied across dimensions, through hierarchies, and/or across members
- Trend analysis over sequential time periods
- Slicing subsets for on-screen viewing
- Drill-down to deeper levels of consolidation
- Reach-through to underlying detail data
- Rotation to new dimensional comparisons in the viewing area

While OLAP systems can answer “who and what” questions, it is their ability to answer “what, if, and why” questions that differentiates them from data warehouses. OLAP enables decision making about future actions. A typical OLAP calculation is more complex than simply summing data, for example, “What would be the effect on soft drink costs to distributors if syrup prices went up by \$.10/gallon and transportation costs went down by \$.05/mile?”

OLAP and data warehouses are complementary: A data warehouse stores and manages data. OLAP transforms data warehouse data into strategic information. OLAP ranges from basic navigation and browsing (often known as “slice-and-dice”), to calculations, to more serious analyses such as time series and complex modeling. As decision makers exercise more advanced OLAP capabilities, they move from data access to information to knowledge.

ERP Data Warehouses

The demand for data warehousing functionality for ERP systems has been growing exponentially as companies strive to gain and maintain a competitive advantage and executives are realizing that an ERP implementation alone does not provide the business intelligence edge that they need to take full advantage of emerging front-office applications such as supply chain management, sales force automation, and customer relationship management.

To improve the quality and accuracy of decision making in these areas, decision makers and business analysts need full integration and access to ERP and other source system data. However, some major hurdles prevent the flow of ERP data to business intelligence systems such as data warehouses. In response to these challenges, ERP vendors, data warehouseers, and third-party tool vendors developed numerous products and solutions to meet this demand.

Aside from building a data warehouse from scratch, the three basic categories of vendor-based data warehousing solutions include:

1. Solutions from third-party vendors that analyze data within ERP systems
2. ERP-based solutions that analyze data within ERP systems
3. ERP-based solutions that build data warehouses outside their ERP systems

An ERP-based data warehouse is a classical, external data warehouse or data mart built with tools offered by an ERP vendor. Oracle and SAP are currently the only major ERP vendors with such offerings. Sooner or later other ERP vendors such as PeopleSoft and Baan will enter the market.

Limitations of ERP Data Warehouses

There has been a lot of skepticism about ERP vendor offerings of data warehouses. Wayne Eckersen, vice president of the Data Warehouse Institute,³ stated that:

The promise of closed-loop decision support gives the ERP vendors an advantage in building next-generation data warehouses. But making the leap from transaction systems to analytic applications involves a radical shift in the way systems are designed, developed, and used. It's not self-evident that ERP vendors will master the art of building decision support tools or analytic applications, let alone linking the two together to create a closed-loop environment. This gives data warehousing vendors an opportunity to compete as the markets for ERP systems and data warehouses converge.

Data warehouse professionals are not the only skeptics of ERP-based data warehousing solutions. In an article entitled "ERP Users Face Data Warehouse Dilemma,"⁴ Frank Gillette, a Forrester, Inc. analyst, expressed doubt that ERP vendors are qualified to build data warehouses, saying, "You do not want to have data extraction and transformation going on in the same database that you run your transactions in."

The prime reason for this skepticism by the analysts in accepting ERP data warehouse initiatives can be traced back to the "cultural issues" as Naeem Hashmi, CTO of Information Frameworks, documented in his article "Mix It Up."⁵ This article explains what ERP data warehousing really means and identifies the traditional and ERP-centric data warehouse evolution and the cultural issues.

Three major limitations of ERP applications prevent the productive flow of data for business intelligence:

1. ERP applications are designed to support high-volume transaction-level activity using highly normalized data structures; they are not designed to support business intelligence functions such as ad-hoc querying, reporting, and analysis.

2. ERP applications do not store historical data that are needed for trend analysis.
3. Finally it is notoriously difficult to access and analyze data in ERP applications, especially in SAP. Therefore ERP's limitations cause considerable difficulty when linking business intelligence and ERP technologies.

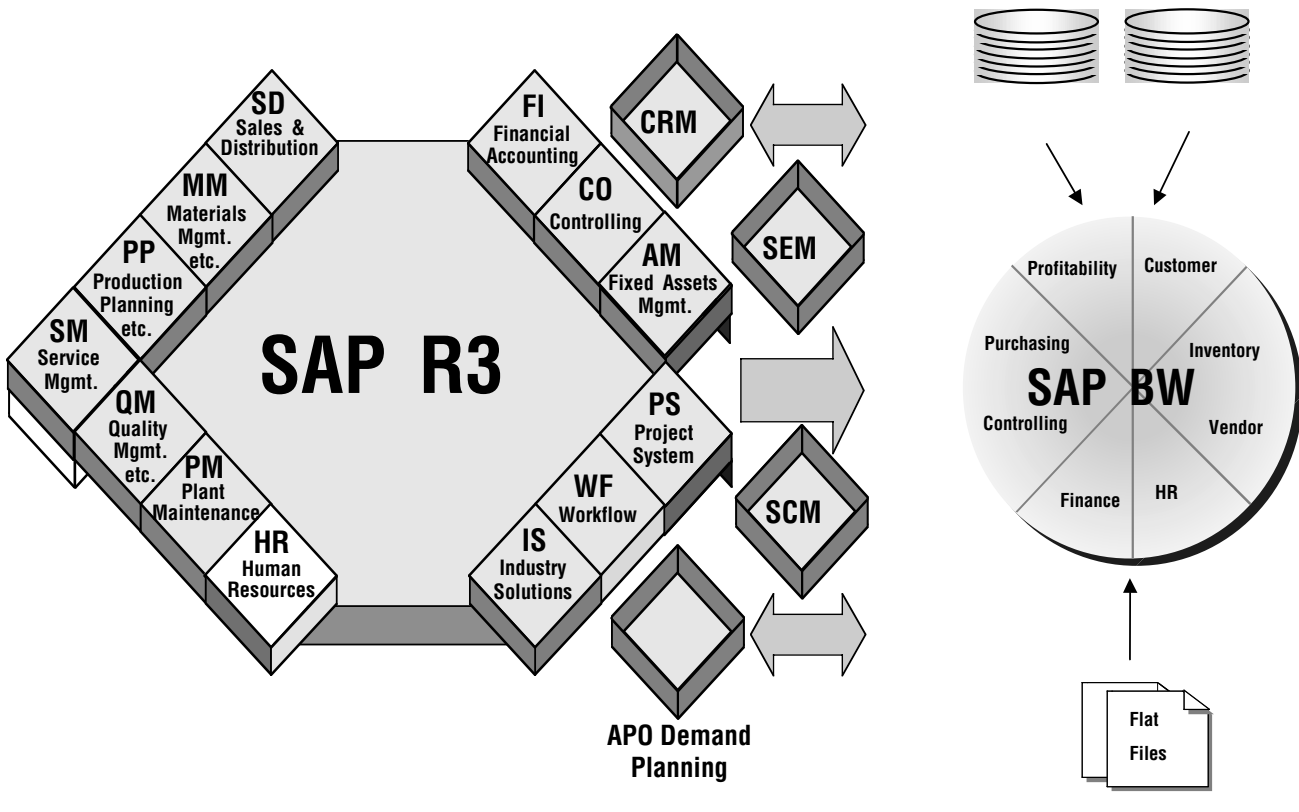
SAP Business Information Warehouse (SAP BW)

The SAP Business Information Warehouse (SAP BW) is a state-of-the-art, end-to-end data warehouse solution developed by SAP. As pictured in Exhibit 1.2, SAP BW provides knowledge workers and decision makers with rapid access to data from SAP R/3 systems, other enterprise applications, and external sources, such as Nielsen.

Based on proven SAP R/3 client/server technology and exploiting SAP's acknowledged business expertise, SAP BW combines state-of-the-art data warehousing technologies with SAP AG's expertise to create an end-to-end solution. It includes all the components required for installation, use, ongoing changes, and maintenance of a data warehouse.

The content-rich SAP BW sets a precedent for speed and ease of implementation and maintenance because it is preconfigured with intelligence about a company's business

Exhibit 1.2 SAP BW Integrates Data from SAP R/3 and Other Enterprise Applications



processes, providing a faster return on information. This new-generation solution provides users with a comprehensive view of data across an organization, including SAP R/3-based data as well as data from other systems.

SAP BW Drivers

When the ERP environment is SAP, the majority of the users face multiple problems in accessing, analyzing, and reporting of data. These problems prevent end users from easily accessing both current and historical data for better decision making.

It is difficult to extract customized reports from SAP R/3 and access enterprisewide analytical data while users are provided with a limited set of options:

- Build custom programs for each new reporting requirement.
- Use SAP's predefined reports—if you know where to find them.
- Do without the data.

Custom SAP reports can be written using Advance Business Application Programming (ABAP), a proprietary SAP coding language. ABAP reports, while costly, do not solve the problem because:

- *They are static.* They do not support ad-hoc querying capability.
- *They are expensive to maintain.* All changes have to be manually incorporated by ABAP programmers.
- They negatively impact the performance of the transaction system.

Integration of SAP and non-SAP data is difficult because data extraction from SAP is a difficult task and requires knowledge of SAP data structure and contents. As a consequence, flexible access to enterprisewide information becomes very difficult. Many organizations have tried to solve this problem by building data warehouses taking data feeds from SAP and non-SAP systems.

Alternative solutions exist but lack flexibility and ease of use. These attributes are essential if the data are to be exploited profitably. None of the available approaches optimally address key aspects of a desirable solution:

- *SAP R/3 ERP information systems.* While the SAP Logistics Information Systems are quite flexible in permitting multidimensional querying, significant issues remain:
 - ◆ All the data that compose the multidimensional cubes have to be available in SAP R/3 whereas most organizations have a significant amount of enterprisewide data in non-SAP transaction processing systems.
 - ◆ Use of the Logistics Information System (LIS) requires significant training, and end users need knowledge of SAP data before LIS cubes can be customized.
 - ◆ The execution of queries to LIS has a negative impact on SAP/R3 transaction processing performance.
- *Third-party solutions.* Third-party solution products are available to extract data out of SAP from multiple vendors. These products are components of a business intelligence solution rather than being an end-to-end solution.
- *Custom data warehouse solutions.* The creation of custom data warehouses taking data feeds from SAP and non-SAP systems is usually an expensive project that takes years to implement and usually has limited success due to the following issues:

- ◆ If the Metadata in the data warehouse are not synchronized with SAP/R3, the data warehouses can quickly lose relevance.
- ◆ Extracting data from SAP R/3 to obtain the data feeds has traditionally been a difficult task, because it relies on the underlying data model and data definitions.
- ◆ The integration effort is often plagued with difficulties, because different OLTP systems utilize disparate data.

SAP BW Features and Functionality

SAP BW is an end-to-end data warehousing solution with multiple features and functionality:



- The SAP BW server includes an OLAP engine and a metadata repository, both of which are preconfigured with business content, saving the time and money that would be necessary to build a data warehouse from scratch. The SAP BW server is designed to provide fast retrieval, interpretation, and preparation of the information stored in its data stores.
- The Business Explorer provides customers with a new easy-to-use multidimensional data access interface. The Business Explorer's navigation capability allows customers to build a personal catalog of reports for ongoing or recurring queries and reports displaying data using Microsoft Excel.
 - ◆ In addition to Business Explorer, the latest version of SAP BW 3.0 also includes a new Web-based multidimensional analysis environment to develop and publish analytical applications for the Internet community.
- Automated data extraction and loading capabilities supply the SAP BW server with data from SAP R/3 applications, SAP R/2 applications, and non-SAP applications and external sources using flat files or using certified third-party extraction tools for any other data source.
- The Administrator Workbench, another feature of SAP BW, provides a single point of control for creating, monitoring, and easily maintaining the complete data warehouse environment, reducing the total cost of ownership to customers.
- SAP BW embodies all the advantages of leading-edge SAP R/3 BASIS technology with its multitier architecture: security, integrity, scalability, high availability, and interoperability within a uniform environment.
- Desirable reporting architecture and features:
 - ◆ SAP BW includes a proven, consistent enterprise data model for the application of business rules to data. This builds on the enterprise model of SAP R/3 and greatly facilitates data warehouse implementation and management.
 - ◆ Preconfigured information models and reporting templates help users generate reports quickly and simply.
 - ◆ SAP BW supports predefined standard reports and ad-hoc analysis; both allow drill-down and multidimensional views.
 - ◆ Users can define their own collections of favorite reports, enabling them to access relevant information at the "touch of a button."
 - ◆ SAP BW is built for high performance. It resides on its own dedicated server. OLTP and reporting activities are therefore separated, and OLTP system performance is not compromised. Report caching mechanisms have also been carefully designed to maintain high performance.

Benefits of SAP BW

SAP BW remains open to different source systems and it will also come as a pleasant surprise for its ease of introduction and maintenance. SAP BW includes a broad range of predefined reporting templates geared to the specific needs of particular industries and user types, such as production planners, financial controllers, or human resources directors.

When implementing the Business Information Warehouse (SAP BW), customers obtain the following benefits:

- *Fast business intelligence solution.* As a business component of SAP R/3 Business Framework, SAP BW can be implemented quickly, especially when compared to a custom data warehouse solution.
- *Data access.* SAP BW significantly reduces the data load time, thereby providing global access to data on a timely basis and significantly lower maintenance and overhead costs.
- *Increased performance on the R/3 OLTP system.* The integration of decision support functionality into the existing business applications environment does not compromise the performance of the OLTP systems; on the contrary, it takes the reporting load away from the OLTPs.
 - ◆ *Open solution.* SAP BW is not limited to sourcing data from SAP R/3 and interfaces with third-party extract, transform, and load (ETL) tools and other systems through flat files.
 - ◆ *Function-rich solution.* SAP BW offers a wide range of powerful reporting and analysis features for effective exploration and interpretation of data.
 - ◆ *Adaptable solution.* SAP BW is designed to adapt to changes made to the business processes or IT environment. In addition, the Administrator Workbench provides effective support for easy maintenance of SAP BW and quick implementation of changes.
 - ◆ *Robust, business-driven solution.* Based on proven SAP expertise in SAP R/3 technology and business processes, SAP BW is built to answer the specific information needs of decision makers in all industries reliably and effectively.

Limitations of SAP BW

SAP BW was first introduced to the market by SAP AG in 1998 with version 1.0A. By all reasonable criteria, SAP BW is still a relatively new product and still in development as of this writing; SAP is providing functional updates every two weeks. As such, initial versions of SAP BW have been criticized for some of their limitations.

In 1999, William Inmon, the “founding father of data warehousing,” criticized the architecture of the current SAP BW release (1.2) in his white paper, “SAP and Data Warehousing.”⁶ He noted the limitations of SAP BW as a true data warehouse solution, including:

- The redundancy in data movement and storage
- SAP’s “open” interface is somewhat constraining in use and applicability.
- The SAP BW metadata repository only imports directly from SAP R/3 sources; non-SAP R/3 sources require manual managing of metadata.
- SAP BW requires an underlying star schema.
- Each cube is limited to 16 dimensions, three of which are reserved.

- The end-user interface of choice in SAP BW is Microsoft Excel extended through Visual Basic for Applications (VBA) macros.
- The lack of a true operational data store (in the data warehousing sense)
- The lack of accessibility by non-SAP tools to the data in the staging area
- The complexity of the creation and maintenance of the interfaces between SAP R/3 and the InfoCubes.

The most critical shortcomings noted above have already been addressed by SAP in later releases of the product. For instance, SAP has improved the architecture of SAP BW, and the Operational Data Store in SAP BW 2.0 is now a *true* Operational Data Store. Other limitations are being addressed as SAP is adding new features and functionality with every new release.

For instance, in release 3.0, SAP BW provides:

- Closed-loop analytical applications
- Open standards in heterogeneous environments
- Platform for e-business solutions
- Hub-and-spoke capability as an option in BW 3.0B



For further details on enhancements available with SAP BW 3.0, refer to “Development News for SAP Business Information Warehouse” (www.service.sap.com) and to Appendix D.

SAP BW's Competitors

Competition for SAP BW comes from ERP and data warehousing vendors, including:

- Other ERP vendors
 - ◆ Oracle
 - ◆ PeopleSoft
- Data warehouse tool vendors
 - ◆ Extraction tool vendors—extraction from legacy to SAP BW
 - ACTA
 - Informatica
 - ◆ Front-end tool vendors (can integrate with SAP BW)
 - Cognos
 - Business Objects
 - ◆ OLAP vendors—coupled with *many* analytical application vendors
 - Essbase/Hyperion
 - Microsoft SQL Server—Data Warehouse Consortium
 - ◆ Partnerships of these vendors
- Internally developed data warehouses

Future of SAP BW

There should be an explosion in the demand for SAP BW. First, demand from end-user companies needing expertise in the integration of ERP data into corporatewide data warehouses is growing exponentially. This trend is due to several business and technology drivers:

- Acquisitions and mergers lead to the requirement of consolidated data from disparate systems to perform decision support activities.

- *Integration of disparate systems.* To develop a comprehensive Business Intelligence solution, a data warehouse can incorporate data from all the systems.
- Companies demand better information about their customers and marketplace.
- Today's technology can support the promise of data warehousing:
 - ◆ Parallel computing technologies have made very large databases a reality.
 - ◆ Competition has significantly lowered computing and storage costs.
 - ◆ Tools are becoming more versatile and user friendly.
- Analytical applications such as strategic enterprise management (SEM) support the processes to provide the return on investment that companies are trying to achieve.

Second, end users and consulting companies alike are increasingly seeking data warehousing solutions for prepackaged ERP data warehouse implementations, especially for SAP's Business Information Warehouse.

The strategic direction for SAP AG is to move all reporting and analysis functionality away from SAP R/3 and into SAP BW. For instance, reporting for the new SAP products such as Advanced Planning Optimizer (APO) and Customer Relationship Management (CRM) is provided in SAP BW. Therefore, most companies with SAP R/3 implementations will be implementing SAP BW in the near future.

Finally, SAP will probably want to expand the current market of SAP BW to go beyond that of SAP-centric organizations. In the future SAP will certainly try to create more robust interfaces and technologies to incorporate non-SAP source systems and data access tools.

Summary

This chapter introduced the basic concepts behind the key topics of this book: ERP and SAP R/3, business intelligence, data warehousing, OLAP, and SAP BW. It also provided a general overview of SAP BW, its drivers, features and functionalities, benefits, limitations and future.

In the next chapter, you will learn more about the SAP BW certification exam, including the benefits of the certification, examination process, prerequisites and resources, preparation for the exam, certification requirements, scoring for the exam, exam retakes, and logistics. The content/weighting discussion provides the exam content and assists you in prioritizing your efforts in preparing for the exam.

Need to Know More?

Published Resources

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- William Inmon, Claudia Imhoff, and Ryan Sousa. *Corporate Information Factory*. New York: John Wiley & Sons, Inc., 1998.
- Alan R. Simon. *Data Warehousing for Dummies*. New York: John Wiley & Sons, Inc., 1997.

On-line Resources

- Naeem Hashmi. "Mix It Up." *Intelligent Enterprise*. Intelligent ERP—feature, July 2000. <http://www.intelligenterp.com/feature/hashmi.shtml>.
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Endnotes

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2. "OLAP Council White Paper," The OLAP Council, 1997, <http://www.olapcouncil.org/research/whitepaper.htm>.
3. Wayne Eckersen, "Analyzing ERP Data," The Data Warehouse Institute, 1999.
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