

SAP System Architecture Overview

What Is mySAP.com?

To create a good IT infrastructure requires some awareness of the business functionality being addressed. The server, storage, and network infrastructure solutions presented in this book are focused on SAP® business application software. The choice and configuration of these software components plays an important role for the hardware configurations and ongoing IT operations needed. There are operating system, database, and server platform dependencies of these software solutions that may impact the performance (including sizing), availability, and total cost of ownership of the IT hardware infrastructure. Thus, some introduction to SAP's business software solutions is useful and is presented here as the foundation for the remainder of this book.

What This Chapter Is About

This chapter briefly introduces the SAP software products as they relate to the IT implementation and operations world. Both the high-level business functions as well as the SAP basis system architecture are described as they relate to the IT infrastructure.

This chapter is split into two parts. The first part covers the SAP business application components that are included in the mySAP.com® offering, including everything from the traditional SAP R/3® to SAP's new Customer Relationship Management solutions. The intention is to provide a brief overview of what these components are meant for, their underlying technology, and their IT hardware infrastructure requirements.

The second part of this chapter focuses on the essential elements of SAP's software architecture. SAP gives specific meanings to some widely known terms, which this section defines as a foundation for the rest of this book. Multi-tier architectures are introduced, as well as the SAP kernel and the concept of SAP Instances, Systems, and Landscapes. A detailed functional

description of SAP's business applications, including the well-known classic SAP R/3, however, is not discussed.

The mySAP.com World

SAP has been traditionally involved in helping customers modernize their back-office operations by integrating business processes, mostly with its standard Enterprise Resource Planning (ERP) software solution called SAP R/3. The traditional SAP R/3 ERP system offers transaction and reporting functionality in the areas of financial, logistics, and human resource applications, enabling the exchange of data between a company's various business units or divisions. The standard-business-process-fits-all approach of SAP R/3 often required business process re-engineering to meet the business needs. Because this could only address a limited portion of the market's needs, SAP began offering industry-specific solutions and extended ERP solutions, including managing supplier relationships with supply chain management (SCM) solutions, managing the distributors, resellers, and customers with customer relationship management (CRM) solutions, and managing the knowledge-assets with business intelligence (BI) solutions. In the traditional ERP world, companies first focused on getting their own in-house business processes under control and integrated. Business communication (such as placing orders or transferring financial data) within a company usually happened with SAP's Application Link Enabling[®] protocol (ALE). Business communication with outside partners usually happened with Electronic Data Interchange (EDI), or, in the worst case, per fax. This ALE or EDI communication was with known and established business partners, because these links had to be set up for each channel. In any case, these ERP systems were not as open to the outside world as the Internet has now enabled. Yet, they are the first implementation step needed before exposing the in-house business processes to the outside Internet world.

mySAP.com and the E-World Evolution

The evolving customer-centric Internet business world, with its HTTP and XML[®] communication protocols and need to do business anywhere and at any time, has enabled business collaboration to take place. Instead of communicating with known and established business partners (through EDI), now an entire electronic community (manufacturers, distributors, and customers) can perform business transactions among each other in electronic marketplace portals. In response, SAP introduced mySAP.com and the four main SAP Internet Strategy Elements:

- mySAP.com Marketplace[®]
- mySAP.com Workplace[®]
- mySAP.com Business Applications[®]
- mySAP.com Application Hosting[®]

The mySAP.com Marketplace is SAP's portal for e-communities. The mySAP.com Workplace is the personalized Internet desktop and middleware layer. The mySAP.com Business Applications are the core business processing components. The mySAP.com Application Hosting element allows organizations to create, test, implement, and host solutions online.

The mySAP.com electronic communities and marketplace portals will enable the evolution from traditional ERP to extended ERP, leading to what HP considers a Value Collaboration Network. Finding innovative ways to collaborate with partners is quickly becoming a business requirement for companies that want to stay competitive in the new Internet economy. By building the web-extended enterprise, businesses are able to achieve maximum value from their people and networks—by integrating processes with those of their partners and suppliers to better respond to customer needs.

The mySAP.com initiative is totally repositioning SAP AG and its business application products to establish a unique business software ecosystem for the interconnected world. The traditional SAP R/3 application software is now one of several business application components in the mySAP.com offering, along with the extended ERP application components, web-enabled marketplaces and workplaces. This new mySAP.com application components model results in increasing server, storage, and network infrastructure requirements, which is the primary focus of this book.

More complex business functionality leads to more, complex infrastructures.

To seamlessly access all of the services now available both internally and on the Internet, some middleware or glue is needed to tie everything together. The mySAP.com Workplace offers a personalized environment to help navigate across all the application functions and services needed to perform business tasks. Because the mySAP.com Workplace is such an essential element to the mySAP.com IT infrastructure, it is also addressed further in this book.

Beyond the electronic communities and marketplace portals lies the next paradigm shift, the world of e-services and pervasive computing. This enables business communication with anyone, including people, businesses, other services, or devices (mobile phones, Internet TVs, refrigerators, etc.). Several e-services, including those enabled by SAP applications, can be combined automatically to perform virtually any electronic task or transaction. This new world will also impact the IT department and infrastructure requirements as business services become more modular and can be outsourced more readily, including such things as processing power, data storage, and data mining. However, the tough work, the integration and compatibility of heterogeneous business applications via XML (or other protocol), still lies ahead. The Internet is simply the road or the highway infrastructure; more services and integration are needed for the paradigm shift to fully bloom. Although the mySAP.com Marketplace or the application hosting strategies will play an essential role in the e-services world, these topics are not discussed further.

The Business Application Components

The mySAP.com business applications consist of the following components (valid at the time this was written, however, more are planned to be added):

- **The ERP backbone**—SAP Financials (FI), Logistics (LO), Human Resources Management (HR), and Industry Solutions (IS)—the traditional SAP R/3;
- **Business Intelligence** solutions, such as Business Information Warehouse (BW), Knowledge Warehouse Management, Strategic Enterprise Management (SEM), and Corporate Finance Management (CFM);
- **Supply Chain Management** solutions, such as SAP Advanced Planner & Optimizer (APO), Logistics Execution System (LES), Business-to-Business Procurement (BBP), and Environment, Health & Safety (EHS);
- **Customer Relationship Management** solutions, such as Internet Sales Scenarios, Mobile and Field Sales and Service, the Customer Interaction Center, Employee Self Service (ESS), and others.

The traditional SAP R/3 ERP system is an online transaction processing system (OLTP). In the past, the SAP R/3 system was also used for functionality where the architecture of an OLTP system was not ideally suited. For example, reporting as well as logistic and production planning were considered the domain of ERP systems. Algorithms such as Material Requirements Planning (MRP) or Distribution Requirements Planning (DRP) were executed in SAP R/3. As the planning process was extended to the entire supply chain, relational database structures could not easily provide the performance required for planning across large, complex networks of plants, distribution centers, customers, and suppliers. The MRP run for one large company would load up the SAP R/3 system too much. Therefore, SAP developed extended ERP solutions called the Business Information Warehouse (BW) and the Advanced Planner & Optimizer (APO) for logistics and production planning. These are separate applications optimized for managing and analyzing huge amounts of data. Each can be a stand-alone application but still has tight integration to SAP R/3, one of their primary advantages. Although these products were introduced as part of SAP's New Dimensions initiative, they are now components of the larger mySAP.com business applications offering.

With the proliferation of mySAP.com, all these more or less separate products are repositioned from a functionality centric approach to a new, user role-based centric approach based on business scenarios. With this new approach, SAP implemented a new pricing model based on roles and business scenarios. The software packages are now delivered to address business scenarios. For example, if a data warehouse is required to fulfill analytic functions in a business scenario, SAP BW will be included as part of that scenario price. This is a big departure from SAP's previous user-based ERP model, allowing SAP to leverage its tight product integration.

From a technical standpoint, three different types of mySAP.com components can be distinguished:

- Spin-offs of the standard SAP R/3 system for special purposes like Strategic Enterprise and Corporate Finance Management, the various Industry Solutions and the mySAP.com Workplace Server. These components consist of a modified SAP kernel and a single relational database;
- Middleware components like Internet Transaction Server and Business Connector deploy a non-SAP kernel and have no database;
- Mixed components like Advanced Planner & Optimizer (APO) with an SAP R/3 based kernel, a relational database, and some specialized components, such as the SAP APO *live*-Cache.

Enterprises do not have to implement all mySAP.com components. Usually the components that are needed to describe a company's business processes are implemented first, before branching out to other more specialized solutions. The mySAP.com Workplace and the SAP R/3 system are mandatory, however, for any mySAP.com environment.

The mySAP.com Workplace

The mySAP.com Workplace provides an intranet portal that supplies users with role-based, personalized web access to all systems, functions, and services that they require to accomplish their tasks. For example, a user can enter a purchase order in SAP R/3's Materials Management and display a list from Business Information Warehouse without having to perform separate logons to each system. The security is managed by the mySAP.com Workplace system's Single Sign-On concept. The screen is adapted to the user's role in his or her company and at the workplace. These services and information may actually be provided by a number of different systems (SAP or others).

Users perform roles to participate in particular business scenarios (for example, create invoice) that are provided by numerous mySAP.com components and external systems. The mySAP.com Workplace provides the user with an integrated, personalized working environment that offers access to all the functions and information required accomplishing the tasks related to his or her specific role.

The role determines the visual appearance of a user's mySAP.com Workplace (Figure 1-1). It is used to structure the LaunchPad and the display of the Mini-Apps. A user's role determines the transactions, information, and services that he or she may access via the mySAP.com Workplace. The LaunchPad can contain more than one role (composite roles) for a given user.

To implement the mySAP.com Workplace, the desktop PCs need a compatible HTTP browser, and then at least one mySAP.com Workplace Server is needed, as well as the mySAP.com Workplace Middleware.

Workplace Server

The mySAP.com Workplace Server (WPS) provides user management for the entire mySAP.com environment. Additionally, it is used for administration purposes of all application

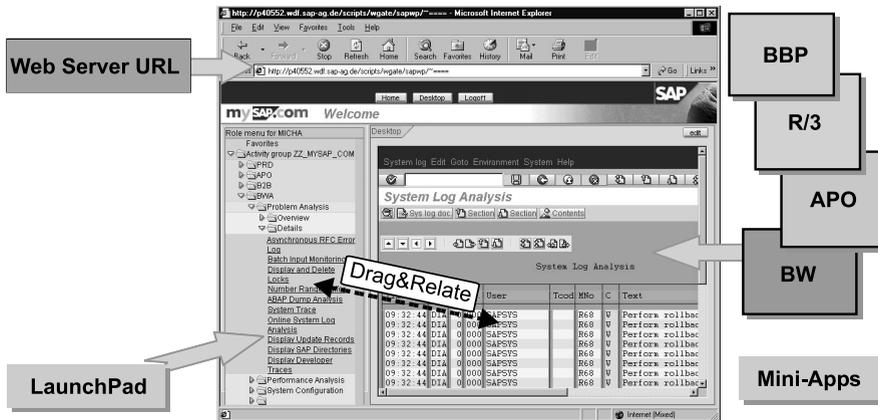


Figure 1-1 mySAP.com Workplace User Interface (Copyright by SAP AG)

component systems—it is the central user-management system. One of the primary usability features is Single Sign-On (SSO). With SSO, a user has access to all mySAP.com application components without repeatedly entering his or her user ID and password for authentication. The SSO environment in the mySAP.com Workplace is available based on user ID and password or using X.509 client certificates.

All of this information is passed via the mySAP.com Workplace Middleware to the browser, where it remains for the duration of the session (see Figure 1-2). The mySAP.com Workplace

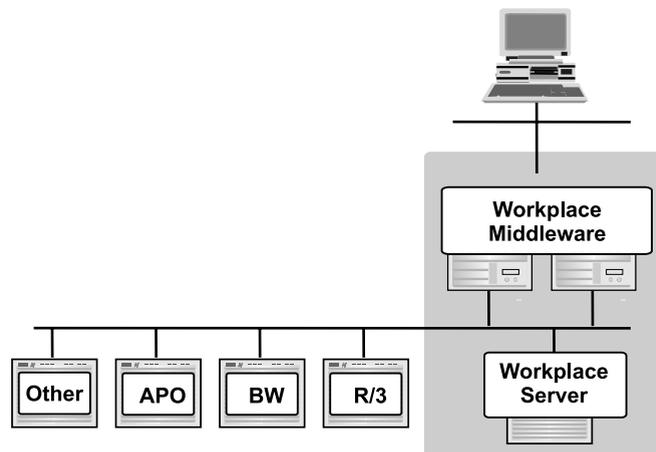


Figure 1-2 mySAP.com Workplace System Environment

Server is only accessed during user login to the mySAP.com environment and when updates are made (ex: favorites or Mini-Apps) in the LaunchPad. Thus, the load on a mySAP.com Workplace Server has a peak during initial logon of the employees (usually the morning hours). For the rest of the day, the mySAP.com Workplace Server will run with low utilization.

The mySAP.com Workplace Server is based on a standard SAP kernel with a database and special add-on functions required one time per mySAP.com environment. This mySAP.com Workplace Server supports the full client/server architecture, although a single server box central system configuration is most common. The Drag&Relate service is implemented as a plug-in. As a central component, the mySAP.com Workplace Server should be highly available. Although inconvenient and difficult for users to keep track of all their user names and passwords, direct logon to each mySAP.com application component is still possible if the mySAP.com Workplace Server is unavailable. However, an HA cluster configuration or multiple, replicated servers are strongly recommended.

Workplace Middleware

The mySAP.com Workplace Middleware provides a generic gateway between the common Internet protocol and the SAP protocol worlds. The middleware components consist of the Internet Transaction Server (ITS), the Business Connector (BC), and the DCOM Connector.

The Internet Transaction Server (ITS) is responsible for transforming SAPGUI screens into HTML[®] pages that can be displayed in a common web browser. SAP ITS is composed of the Application Gateway (AGate), the Web Gateway (WGate), and a common web server. One ITS instance per mySAP.com application component is required. The simplest ITS configuration is a single-host installation with the web server, WGate, and AGate installed on one computer. However, due to security issues, the components should be split between two computers (dual-host installation). The WGate is a small program that runs on the same system as the web server.

The SAP Business Connector (BC) converts the proprietary RFC format to the eXtensible Markup Language (XML), the de facto standard for Internet business community collaboration. The Business Connectors convert IDocs to the XML format, supporting BAPI[®] (SAP's Business Application Programming Interface) and ALE scenarios. SAP IDocs can be converted to structured documents with direct access to each single field. The SAP Business Connector Server contains the mySAP.com Portal Connector that enables bi-directional communication between SAP systems and the Marketplace portal(s). Vendors without an SAP R/3 system who want to sell over the mySAP.com Marketplace need to license the Business Connector from webMethods (www.webmethods.com). In general, the mySAP.com Marketplace is hosted and operated by SAP. However, organizations that want to implement their own need a dedicated mySAP.com Marketplace system.

The SAP DCOM Connector integrates SAP components written in ABAP with COM components written in Visual Basic, Visual C++, or Visual J++. The architectures of Internet Transaction Server, Business Connector, and DCOM Connector are further discussed in Chapter 12.

SAP R/3 System—The ERP Backbone

The SAP Enterprise Resource Planning (ERP) system, SAP R/3, is built as an integrated system where all functionality necessary to run an enterprise is provided by one system. The main benefits of this approach are the workflow and seamless integration of the different business processes within an enterprise. The integration is what ensures the consistency of the business information. The functionality within SAP R/3 is split into modules dedicated to the business functions in an enterprise. The core modules include hundreds of business processes to address the needs of an enterprise. They can be categorized under financials, logistics, and human resources management. Each of these, in turn, consists of multiple sub-modules. For instance, logistics includes general logistics, material management, plant maintenance, and production planning, among others. All modules are available on the installation media; customers are free to decide what modules should be implemented. The following section includes brief descriptions of the main modules.

SAP Financials

Every company must care about and manage money to survive. Therefore, most enterprises start their SAP implementation with SAP Financial Accounting (FI) and SAP Controlling (CO), the fundamental bookkeeping modules. SAP financial modules give enterprises the whole array of accounting functionality with extensive reporting support, especially with the controlling module. An important aspect of the financial accounting system is the real-time generation of the current balance. The needs of globalization are addressed with support for multiple currencies, units, and languages, as well as national tax and legal regulations (R/3 can address US-GAAP, German HGB, IAS, and other accounting standards). The related modules are SAP Enterprise Controlling (EC) providing an executive management system (EIS), as well as financial consolidation for subsidiaries in countries with different legal regulations, and the SAP Treasury (TR) module. Documents generated by the financial modules have a relatively low performance impact on the SAP system.

SAP Logistics

Logistics and production is the most extensive area of SAP R/3 and contains the largest number of modules. The logistic modules manage all processes involved in the internal supply chain, from raw material procurement to final customer delivery and billing. These functions interact with virtually every SAP R/3 module, from financial to human resources (considered workflow). The main logistic-related modules are Sales & Distribution (SD), Production Planning (PP), and Materials Management (MM).

SAP Sales & Distribution (SD) is the second most deployed module. SD covers the complete sales cycle from ordering and quotations over shipping and transportation to billing and customer payment processing. SD supports EDI, fax, mail, and so on. Other useful features include immediate product availability and delivery schedule information by integration with MM and PP. Due to seamless integration with FI and CO (and connections with bank accounts), receivables

and revenues are immediately updated. SD generates a much higher load than FI because of the many steps to process a business case and the data exchange necessary with other modules. Depending on the functionality in use, high performance load can quickly arise. Prominent examples of such performance hot spots are online availability check and online price finding. To help keep the response times on the remaining application servers acceptable, it is possible to set up a dedicated server to perform the availability to promise (ATP) calculation within the standard SAP R/3 system.

SAP Material Management (MM) comprises all activities related with material acquisitions (purchasing) and control (inventory, warehousing). The warehouse management (LE-WM) module manages complex warehouse structures, storage areas, and transportation routes. Stock is always controlled because every material movement is immediately recorded.

SAP Production Planning (PP) provides a whole palette of production methods ranging from make-to-order production to repetitive manufacturing/mass production for discrete, batch-oriented, and continuous production. This business area is a very complex part of SAP R/3, extensively integrated with SD and MM. The capacity requirements planning (CRP) and material requirements planning (MRP) batch processing runs create a significant load on the system (hot spots). Related modules are Plant Maintenance (PM), Quality Management (QM), and the Project System (PS).

SAP Human Resources

The SAP human resources (HR) area includes business processes for personnel administration (applicant screening, payroll accounting, travel expenses, etc.) and personnel development (workforce planning, seminar management, etc.). The business processes associated with the HR modules are very country-specific to adhere to national laws concerning employment, tax, benefits, and so forth. Because these laws are subject to change frequently, many enterprises deploy a dedicated HR system separate from the other systems to restrict the downtime necessary when implementing legal patches to the HR department.

Other Functions

Cross-application modules provide general-purpose functionality independent of specific modules. Applications include, among others, business workflow automation, EDI support, document management system (DMS) with an archive link and product data management (PDM) including CAD integration. However, the most essential functionality is Application Link Enabling (ALE). ALE automates the data exchange between independent systems (R/3, R/2®, or external). This way, ALE provides the ability to synchronize the databases of distributed SAP systems. Reflecting the customer business needs, the scenarios reach from systems distributed around the globe to physical consolidation in one or a few data centers. ALE is the technological basis for the coupling of mySAP.com components discussed later in this chapter. ALE also can be used for replicating a system to another location. ALE has an impact on the CPU and memory utilization, so it must be accounted for on the server(s) that is sending documents.

The SAP Computing Center Management System (CCMS) is a built-in management system. CCMS is delivered with the installation CDs free of charge (no other ERP vendor has a similar solution). However, CCMS is restricted to the SAP and database system management. To manage the complete infrastructure including clients and networks, a management system like HP OpenView is recommended.

mySAP.com Industry Solutions

SAP also offers a multitude of industry-specific solutions for a wide range of industries such as banking, healthcare, retail, and utilities. The mySAP.com Industry Solutions (IS) consists of modified and extended standard SAP R/3 modules, providing industry-specific business processing functionality. The technical architecture of IS configurations is identical to standard SAP R/3 systems.

Because of these modifications, Industry Solutions are incompatible to each other and to the standard SAP R/3 system in most cases. Developed by dedicated expert groups within SAP, every IS has its own release schedule. Due to the modifications, standard maintenance (hot) packages are not always possible to apply to an IS system. Therefore, a separate setup is often recommended for each Industry Solution, interconnected by ALE to a standard SAP R/3 or other system. However, these systems can be consolidated onto the same physical server, as discussed in Chapter 2.

A noteworthy Industry Solution example is mySAP.com for Retail. The business process modeled is the collection of daily sales data from the stores into a company's central headquarters system, called the point-of-sales (POS) upload. Then a replenishment planning calculation (batch process) is made, which generates resupply orders and delivery notes for trucks for stocking up the depleted store inventory. The POS upload and replenishment planning are very intense processes that require special care in the hardware-sizing estimate for the SAP system.

SAP R/2 to SAP R/3 Migrations

Currently, there are still several hundred customers worldwide with SAP's first ERP solution, called R/2. R/2 support has been scheduled to disappear soon, so SAP is encouraging R/2 customers to migrate to SAP R/3 as soon as possible. SAP R/3 4.6C is the last release supported for such a migration, and each migration project can take up to a year.

Multi-Language Support

With globalization comes rapid growth of international markets. Nevertheless, even a global business world is still made of nations using different rules, laws, and special characters in their written languages. The variety of languages within a global company, including business partners, is a challenge to a company's organization or IT structure. For example, Germany is blessed with a complex legal system as well as additional unique characters, the famous umlauts ä, ö, ü, ß. As a German company, SAP understands well that each country has unique attributes.

Based on a multi-lingual architecture, the country-specific software is designed around an international core. SAP installations can be found in more than 50 countries, supporting more than 35 native languages including Kanji, Mandarin, and Thai.

The different legal aspects are addressed by country versions. Some country-specific functionality is already included in standard SAP R/3, initialized by the country installation program and activated by customizing. These versions are compatible and can be used simultaneously; multiple country versions can be consolidated onto a single system. More country-specific functions are covered as add-on or modification solutions provided by local SAP subsidiaries or even by partners. Add-ons are compatible with the standard country version.

The different native languages are addressed by language versions. A multinational enterprise may expect that all employees communicate in English. However, customers expect their name and address to be written with the correct character set. A phonetic transliteration (i.e., Missbach instead of the correct German Mißbach) is not always desired. SAP delivers the translation for user interfaces (screens, menus, messages, online help, etc.) on the installation media. However, the translation of the master data, customer developments, printouts, and so on is the responsibility of the customer.

Special considerations have to be taken into account when different languages are combined on an SAP system. Each language may require a special character set, represented in so-called codepages. Improper use of codepage settings can lead to corrupt data imported into the database (e.g., batch input, RFC, EDI, ALE, etc.). SAP supports any language combination without limitation as long as the required languages belong to one codepage (see Figure 1-3).

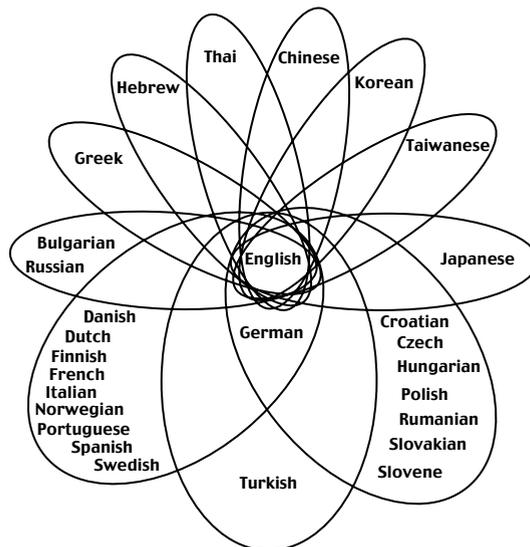


Figure 1-3 Standard Codepage Language Combinations (Copyright by SAP AG)

All languages listed in one ellipse can be combined within a standard codepage SAP system. Unfortunately, it is most likely that a language combination required is not supported by a standard ISO codepage. In order to enhance the language coverage per system, SAP provides additional codepages blended from parts of standard ISO codepages (see Table 1-1).

Table 1-1 SAP Custom-Blended Codepages

SAP Codepage	Supported Languages
Eurojapan	English, German, French, Italian, Danish, Dutch, Finnish, Norwegian, Portuguese, Spanish, Swedish, Japanese ^a
Nagamasa	English, Japanese ^a , Thai
Silk Road	English, Japanese ^a , Greek
Trans Siberian	English, Japanese ^a , Russian
Asian Unification C	English, Japanese ^a , Chinese
Asian Unification K	English, Japanese ^a , Korean
Asian Unification T	English, Japanese ^a , Taiwanese
Asian Unification ^b	English, Japanese ^a , Chinese, Korean, Taiwanese
Diocletian ^b	English, German, French, Italian, Danish, Dutch, Finnish, Norwegian, Portuguese, Spanish, Swedish, Greek
SAP Unification ^b	English, German, French, Italian, Danish, Dutch, Finnish, Norwegian, Portuguese, Spanish, Swedish, Czech, Hungarian, Polish, Slovakian, Rumanian, Slovene, Croatian, Turkish, Greek, Japanese ^a

^aSingle Byte Katakana is not supported.

^bThese codepages are ambiguous (several characters have been assigned to a single common code point) and need special care when used.

The use of SAP-specific blended codepages does not differ from the use of an ISO standard codepage regarding the SAP R/3 system itself. However, the character sets used within the blended codepage must also be available in the peripherals (terminals, printers, etc.).

In cooperation with operating system and database vendors, SAP has been preparing for Unicode support for a while. Unicode promises a single codepage for all characters (www.unicode.org). One of the primary reasons Unicode hasn't become commonly available so quickly is because of the lack of peripheral device support.

The SAP system does not use the codepage of the operating system. Therefore, several SAP systems supporting different codepages can be consolidated onto a single server (with the exception of the AS400). However, SAP reads the locales from the operating system. Locales are operating system interfaces for country/cultural conven-

tion aware programming, including things like date, time, and currency format. They are responsible for country-specific sorting order and rules for case conversion essential for match code. There are different locales for the USA and Britain, for example. On HP-UX, the most essential locales are installed by default; other operating systems may need a manual installation of the appropriate locales.

In business cases where a mandatory combination of languages is not available as standard or blended codepage, Multi-Display Single Process (MDSP) and Multi-Display Multi-Process (MDMP) installations allow the usage of multiple codepages within a single SAP system. In an MDSP system, the DB server and all application servers run in the same codepage, the front-end changes codepages dynamically. User data input needs to be restricted to the application server's codepage or a subset of it. In an MDMP system, the front-end and the application server both change codepages dynamically. However, the database is created in one particular codepage. A user logged in in another language will get a somewhat strange presentation of this data. The same situation occurs when SAP systems with different codepages exchange master data by ALE. There is a potential risk of corrupting data if users are not well trained to handle this situation. Therefore, SAP supports such systems only on a project by project basis.

TIP **Golden Rules for Multi-Language Scenarios**

Users must restrict data entry to the native characters of the logon language. Use transliteration if necessary (i.e., converting to phonetic rendition using English letters). Do not update data owned by someone else, inform them of the error so they can correct the data AND the procedures. Key fields should only contain characters from the core character set (US-ASCII)—this is the only way to really share data globally!

Business Intelligence

The Business Intelligence application area gathers the business application components related to knowledge and corporate finance management to support decision-making processes with the Business Information Warehouse (BW) as the core component.

Business Information Warehouse (BW)

Today's extended usage of IT systems in the enterprise generates a tremendous flood of information. To leverage the information assets for competitive advantages, visions of the future must be distilled from historical trends, requiring data to be consolidated and analyzed for correlation. SAP developed Business Information Warehouse (BW) as the mySAP.com business application specialized for online analytical processing (OLAP). SAP BW is thus positioned as the data warehouse backbone in the mySAP.com environment.

In an online transactional processing (OLTP) system like SAP R/3, all data is stored in a normalized form for consistency. Related data (sums, averages, etc.) are calculated on demand. However, there is one major drawback for the analysis of large data sets—all of the data must be accessed for each analysis or report, even when only certain sums are necessary. This causes a

heavy performance load on the OLTP system, especially the database server and its I/O system. Therefore, OLAP systems such as mySAP.com BW deploy so-called Infocubes to provide a multi-dimensional view of data (see Figure 1-4). Infocubes are special data structures where related numbers are calculated in advance to help improve performance. Because the data is no longer in a normalized form, the redundancy causes the SAP BW database size to become very large.

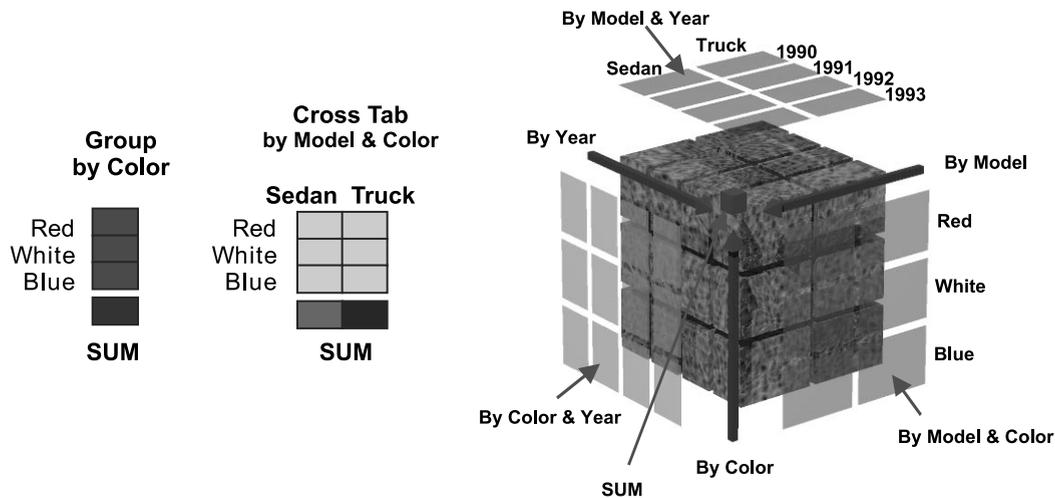


Figure 1-4 Example of a Three-Dimensional Infocube

In the traditional SAP R/3 system, all tables containing cost accounting data have to be accessed for monthly financial reports with the CO module. These tables can have millions of records, each which must be independently read. This can take several hours for month-end closing processing. Within this timeframe, online response time degrades due to the massive resource consumption. Reporting with SAP BW is an alternative to offload the job from the core SAP R/3 system. Therefore, SAP BW is the first choice for reporting in a mySAP.com environment.

Because the SAP BW system offers so much value, it is often the next business application implemented after the initial SAP R/3 system. Here are some of the primary reasons for implementing an SAP BW system:

- It provides useful information that is otherwise hidden in SAP R/3—the typical benefit of a data warehouse.
- Those reports that cause performance problems in the SAP R/3 OLTP systems can be offloaded (on average, 50–60% of the SAP R/3 system resources are used for reporting).
- It is time consuming and expensive to create new reports within SAP R/3. Once the data is in SAP BW, creating reports is easier and more intuitive.
- Reporting tools for different SAP R/3 modules look quite different. SAP BW offers a unified approach to reporting. When reporting requirements exist for different systems, data

can be consolidated in SAP BW so that it can provide information in a unified and consistent way.

- For new (future) business processes, there will be no additional SAP R/3 reports delivered by SAP. The SAP BW Business Content, on the other hand, will be enhanced on a regular basis.

SAP BW is not only positioned as a reporting tool but as a real data warehouse with all the powerful features normally possible. SAP BW provides predefined queries and key performance indicators (KPIs) for benchmarking; business content specific to industries including consumer, retail, and media; and business scenarios addressing areas such as supply chain and business-to-business procurement. SAP BW Reporting Agent runs queries in the background to push information onto a personalized mySAP.com workplace, to monitor exceptions and trigger follow-up actions. The geographic information system (GIS) combines the SAP BW data analyses with geographic visualization to identify relationships between spatial information.

From a technical point of view, SAP BW uses the same client/server approach as SAP R/3 (leveraging the SAP kernel and database approach). For smaller installations, SAP BW may be executed together with the database on a single server. Larger installations consist of a dedicated database server and one or more application servers.

TIP
SAP BW—A Fast Data Warehouse Implementation

On the SAP R/3 system, a special plug-in is used to extract data into the SAP BW system. Traditional data warehouse projects spend a lot of effort on designing the data extractors for the source system, which is already done for standard reports in the SAP BW and SAP R/3 case. Consequently, an SAP BW implementation can show useful results very quickly. This data extractor interface can then be enhanced if more complex data sets are required, which is one of the reasons why implementing an SAP BW data warehouse is an ongoing process and not a one-time project.

Knowledge Warehouse Management

The SAP Knowledge Warehouse Management component provides a central repository for online documentation, training courses, and project-specific documentation. SAP includes the contents of its standard training courses. SAP Knowledge Warehouse Management consists of an SAP R/3 system, one or more Content Servers, and the associated Cache Servers. The SAP R/3 system contains the structures that define each piece of content, the necessary control data, and the associated user authorizations. The Content Servers contain the actual physical files, such as slides, text, sound, and video files. When a user requests a piece of content, it checks the user's authorization and sends the content structure to the user's PC. The actual content is then automatically loaded from the Content Server and stored on the Cache Server for improved local access speed, useful for remote sites across a WAN. This architecture provides significant performance benefits in that communication with the SAP R/3 system (which can be located anywhere) requires only minimal bandwidth, while the data-intensive loading of the content takes place locally.

Strategic Enterprise Management

SAP Strategic Enterprise Management (SEM) is an analytical solution providing a Management Cockpit® with Balanced Scorecards and Key Performance Indicators (KPIs). In addition, SAP SEM® provides tools for business planning and simulation, stakeholder relationship management, business information collection, as well as business consolidation for legally required consolidation (US-GAAP, IAS, German-HGB, etc.).

The SAP SEM system is based on the SAP R/3 kernel and can be integrated with SAP BW, which stores the metadata and application data for all SAP SEM components. However, it comes with an integrated database (SAPDB) to be utilized in case no SAP BW system is available. You can have a centralized or decentralized installation (several SAP SEM systems linked together). There are three different technical installation scenarios for SAP SEM configurations:

1. As a stand-alone application. The SAP BW technology necessary to operate it is included, and data can be extracted or consolidated from one or more SAP R/3 systems.
2. As a data mart linked with an existing data warehouse (SAP BW or a third-party solution). In this case, the data from various SAP R/3 systems is already consolidated on the SAP BW system, so SEM extractors for SAP R/3 are not required.
3. Executed as an application on top of SAP BW using the same hardware and software basis. The data basis is created in the enterprise's SAP BW. Thus, SEP SEM extractors for SAP R/3 are not required.

Corporate Finance Management

SAP Corporate Finance Management (CFM) supports the demands of modern finance management. SAP CFM® provides a virtual in-house bank that allows companies to optimize their intergroup payment transactions. In addition, there are analyzers for portfolio performance, market and credit risks together, as well as tools for processing financial transactions and liquidity planning.

Supply Chain Management

The Supply Chain Management (SCM) solution application area consists of the SAP APO, SAP BBP, and SAP LES components.

Advanced Planner and Optimizer (APO)

The SAP Advanced Planner and Optimizer (APO) combines sophisticated planning algorithms, object-oriented data structures, and memory-resident optimization databases for solving complex planning problems. SAP APO production planning (MRP runs) and shop floor scheduling support the generation of feasible production plans across multiple plants using dynamic pegging and optimization techniques. (In contrast, production planning [MRP] in SAP R/3 is limited to only the data in that SAP R/3 system with fewer optimization techniques.) Distribution and transportation planning considers warehouse and transportation constraints, creates optimal truckloads, allocates inventory and vendor managed inventory (VMI), and so on. Global availability to promise (ATP) provides a multi-level, rule-based availability checking that considers allocations, production, transportation capacities, and costs in a global environment. The Supply

Chain Cockpit provides a configurable, graphical user interface for maintenance of extended supply chain models (plants, distribution centers, etc.), factory layout (machines, storage locations, etc.), schedules, exceptions, and so forth.

The technical infrastructure for SAP APO is based on the SAP R/3 architecture (an SAP kernel, specialized modules, and a database) with two additional components: *liveCache* server and optimizer servers.

To provide the planning or ATP functions using a database with its data primarily on disk drives is not sufficient when huge amounts of data must be analyzed. In addition to an object-oriented data model, extremely fast access to data is necessary to enable complex real-time scheduling calculations. Therefore, SAP developed a memory-based data structure optimized for SAP APO, called *liveCache*. Use of *liveCache* memory resident computing technology enables forecasting, planning, and optimization functions to be executed in real time. The technology basis for *liveCache* is SAPDB (formerly ADABAS®). This approach grants sufficient performance and avoids slow disk access. SAP APO's *liveCache*, made feasible by the current availability of high-capacity main memory (RAM) at low prices, almost completely eliminates the need to copy data back and forth between hard disk and main memory during transaction processing (except for high availability).

A large SAP APO system consists of one or more application servers, a database server, one separate server for *liveCache*, and multiple optimizer servers executing the optimization algorithms (see Figure 1-5). For smaller installations, database and application can be consolidated to one server and the optimizer software can be executed at the front-end PCs. For the *liveCache*, however, a separate server is recommended due to the large memory demand. The biggest challenge for the SAP APO solution is using a *liveCache* server that can address enough memory with some level of fault-tolerance.

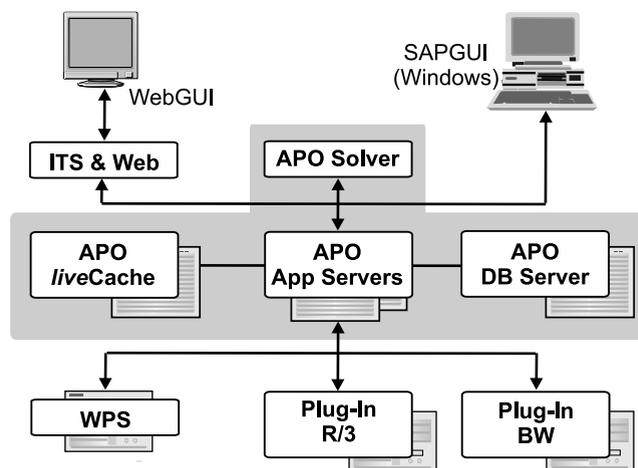


Figure 1-5 Advanced Planner and Optimizer (APO) Infrastructure

Business to Business Procurement

The objective of SAP Business to Business Procurement (BBP) is the cost-saving procurement of high-volume, low dollar transactions for C-material or MRO; equipment parts and supplies; as well as services, such as temporary help. BBP enables end users to handle the complete procurement process, from creating a requirement to approving the invoice, all through a web front-end. However, expenditure control is ensured by flexible approval routing and tracking features. This way, purchasing personnel are free to focus on strategic sourcing and agreement negotiations. The SAP Catalog is bundled into BBP together with interfaces to other online catalog systems and external content aggregators, such as Aspect, Harbinger, and Commerce One.

SAP BBP is based on an SAP R/3 nucleus executed on a dedicated BBP server. An Internet Transaction Server (ITS) is mandatory, a catalog server is optional. Large installations may include multiple ITS servers, one or more SAP BBP application servers, and a dedicated database server. The BBP Mobile Edition, introduced on HP's Jornada handheld PC, provides the possibility to hold a selected part of the catalog, to enter any order, and to transmit the requisition later to the system via the web.

An SAP E-Commerce Starter Pack is available as a bundle with the necessary components to quickly have an Internet presence. These include the SAP ITS, mySAP.com Workplace Server, SAP BBP, and a Catalog, plus the SAP Online Store (a web interface to the back-end SAP R/3 SD module). Although these can all be combined on one server for testing, production use would require some segregation for security reasons.

Environment, Health & Safety

The SAP Environment, Health & Safety (EH&S) component supports all processes required for manufacturing and distributing dangerous goods with regard to international and national legislation. As the transport and shipping of dangerous goods crosses the boundaries of countries and continents, regulations have been synchronized on an international level.

EH&S supports the automatic setup of a hazardous substance log according to the German Hazardous Substance Ordinance and provides incident/accident management and the generation of risk assessments, site inspection plans, and standard operating procedures. In addition, EH&S offers functionality for product safety, industrial hygiene, and occupational health, observing the various regulations, laws, and guidelines (Occupational Safety and Health Act 1970). It allows management of all data concerning the properties and composition of pure substances, mixtures, and dangerous goods and substances.

Customer Relationship Management

SAP Customer Relationship Management (CRM) supports a wide range of customer contact scenarios, including via the Internet, call centers, or mobile sales representatives (see Figure 1-6). Therefore, the SAP CRM architecture deploys a multitude of specialized components executed on dedicated servers. The core of the infrastructure is the SAP CRM server, built on the SAP kernel. The SAP CRM middleware controls the data exchange between CRM front office

components and other mySAP.com business application components like SAP R/3, SAP BW, SAP APO, or legacy systems. SAP BW is used as a data source for SAP CRM, while data is also delivered to SAP BW for consolidation and analysis. SAP APO provides integration to Supply Chain Management and executes Available-to-Promise (ATP) checks. The mySAP.com Workplace Server stores user profiles and provides Single Sign-On. However, depending on actual business requirements, not all mySAP.com application components need to be installed.

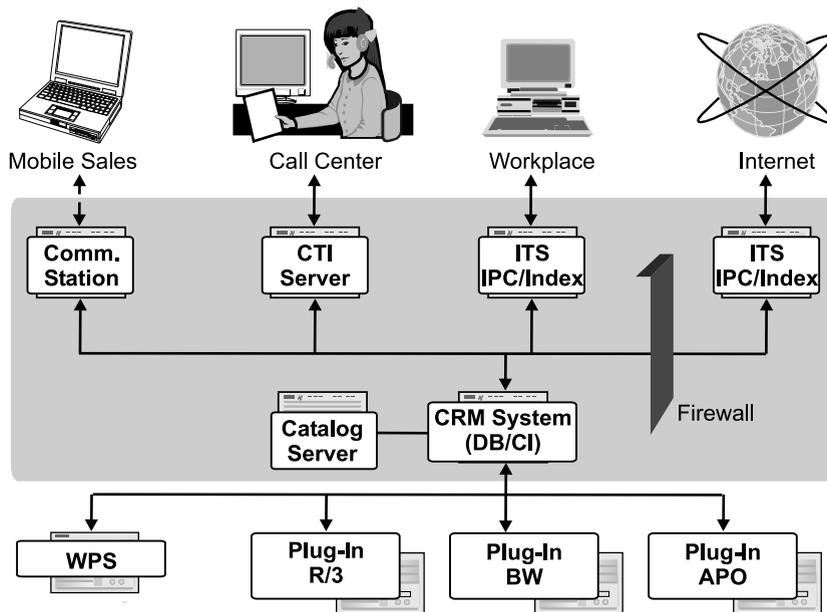


Figure 1-6 SAP's CRM System—Major Components

Internet Sales Scenarios

The Internet sales component supports Business to Customer (B2C), Business to Business (B2B), and Business to Retailer (B2R) scenarios as well as Employee Self Service (ESS). Customers can configure and order products or services from catalogs via the Internet using the Internet Pricing & Configurator (IPC) component. IPC is designed as a separate component to ensure high access performance. The data is downloaded from the SAP R/3 system to the database of the IPC. Product catalogs are exported to the index-server component for faster browsing and searching of the catalog data. Multimedia data attached to catalogs are stored in the SAP Knowledge Provider (KPro) component. The ITS is mandatory for Internet sales scenarios. The IPC, as well as the index-server component, can be executed on ITS or on separate servers for scalability reasons.

Field Sales and Service Support

The CRM Field Sales and Service solutions supports sales representatives and service engineers in the field. A replication mechanism ensures actuality of the local database installed on their laptops or other pervasive devices, such as HP's Jornada product family. The connection is established via a Communication Station (transforming the Microsoft® proprietary DCOM calls into SAP's proprietary RFC calls). In addition, the Communication Station can host the CRM Administration Console, used to administer sales data distribution. The CRM Server provides a central data storage and distribution unit.

The CRM Mobile Application Workbench provides tools to customize the mobile client software. The Workbench is installed on separate workstations as part of the development environment. Customization information is stored in the CRM repository database to be called by the mobile client.

Customer Interaction Center

Customers may use the telephone, fax, or email to reach the sales or service representatives. The SAP Customer Interaction Center (CIC) provides SAP standard APIs, SAPConnect, and SAPPhone. The SAPConnect interface in conjunction with SAP workflow routes emails from the enterprise mail server to SAPOffice depending on the receiver's address. SAPPhone interfaces to a Computer Telephony Integration (CTI) server connected to the private branch exchange (PBX) to provide call center functions. SAPPhone supports various telephony control functions such as initiating and transferring calls, processing incoming call information, and predictive dialing and Interactive Voice Response (IVR). CIC provides interfaces to other call center solutions, extending its functionality with session management, automatic call distribution (ACD), and smart dialing features.

Employee Self Service

SAP Employee Self Service (ESS) is a set of easy-to-use components that empower employees to view, create, and maintain their data in an SAP R/3 system via the intranet. SAP ESS services extend SAP R/3 functionality to all employees in an organization. SAP ESS enables employees to care about and update their own master data, including name, address, telephone number, and other changes. SAP ESS primarily includes human resources capabilities but also offers logistical, financial, and office functionality.

Other mySAP.com Application Components

In addition to the business application components, one noteworthy component applies across the mySAP.com environment.

SAP R/3 Plug-Ins

Plug-In is the general term SAP has introduced for the interfaces between the mySAP.com business applications (e.g., SAP APO, SAP CRM, SAP BBP, etc.) and the standard SAP R/3 system. They are add-ons, like hot packages, to the standard SAP R/3 system to provide extrac-

tors for transaction and master data and are essential to enable the tight integration needed. For example, the SAP APO Plug-In, also known as CoreInterFace (CIF), extracts from SAP R/3's complex data set only those objects that are needed in SAP APO's data structures for individual planning and optimization processes. In addition to initial data provision, the SAP R/3 Plug-In also guarantees an incremental supply of relevant data changes to SAP APO. A similar situation applies to the SAP BW Plug-In, which enables the extraction of data from SAP R/3 to build the Infocubes in an efficient manner.

The SAP R/3 Plug-Ins are constantly enhanced to ensure that the integration between a given SAP R/3 standard release and the latest version of mySAP.com application components works also for the new functionality.

TIP
Impact of Extractors

From an IT infrastructure perspective, the important impacts to consider when using SAP R/3 Plug-Ins are the administration and the performance of the source system. SAP's general claim is that any SAP R/3 Plug-In performance impact due to data transfers is offset by reduced reporting requirements. This may not always apply to all systems or operational timeframes, however.

SAP System Technology

The first section of this chapter introduced the business application components of the mySAP .com environment, as well as the mySAP.com Workplace system. These components are implemented using SAP's software technology. The focus of this section is to introduce the SAP's software architecture and to define some commonly used terms. This is an important foundation for the rest of this book on IT infrastructure solutions.

Technology Implementation Map

The SAP Business Technology Map (<http://service.sap.com>) illustrates how SAP Business Technology effectively and comprehensively covers the ERP system's life cycle. It provides best practice support for companies of any size and direction. Its goal is to get customers to focus on lowest cost of ownership while providing the openness and flexibility needed. The sections in the Business Technology Map that are addressed (in part) in this book include sizing, manageability, performance, availability, security, and scalability.

Multi-Tier Computing Architecture

The SAP R/3 system is structured in a three-tier client/server architecture from a software perspective, with each tier having a distinct function (see Figure 1-7). In this architecture, the presentation tier provides the interface to the user, the application tier processes the business logic,

and the database tier stores the business data. The SAP system architecture supports heterogeneous environments and provides a high degree of system scalability and flexibility. With the introduction of the Internet middleware, SAP systems are now considered to be structured in a multi-tier architecture.

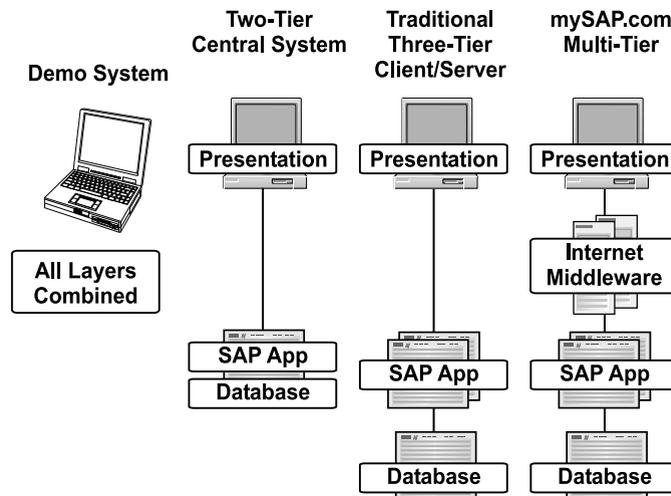


Figure 1-7 The Multiple Software Tiers (Layers) of SAP Systems

The presentation tier, typically installed on a PC, provides the SAP Graphical User Interface (SAPGUI). The interface is also available through a web browser. In this case, an additional middleware tier transforms the SAPGUI DIAG protocol into HTTP. The access is via TCP/IP and consumes very little network bandwidth. Essential for WAN links, SAP has the lowest network bandwidth demand of all ERP solutions.

The application tier executes the business logic, responsible for processing client transactions, print jobs, running reports, coordinating access to the database, and interfacing with other applications—the heart of the SAP R/3 system. Because the application logic can be executed in parallel, the workload can be distributed between multiple servers if the system load exceeds the capacity of a single machine.

The database stores both the business-generated data and also the SAP application programs, which are loaded into the SAP application servers from the database at runtime. SAP supports several database platforms, so the customer is free to determine the vendor. The database license is part of the SAP contract, although price differences exist between each database. The database software is delivered with the SAP installation media. In general, each SAP system can deploy only one database instance. All business and application data associated with a single SAP system is located in one database. Therefore, the server executing the database is the component with the highest demands on reliability, availability, and performance and ultimately determines

the scalability of the entire SAP system. (In theoretical terms, the SAP R/3 system is considered a single server queuing network model.)

Depending on system workload and available computing power, the software tiers are executed on separate servers or consolidated onto fewer ones. The presentation tier is always considered distributed to the user's workplace. Development and test systems, as well as small production systems, commonly consolidate database and application instances onto one server (central system or two-tier). Large productive installations typically deploy a separate database server and multiple application instances on separate servers for increased scalability. For demo purposes, however, it is possible to combine all of the SAP software tiers onto one laptop computer.

The SAP Kernel Architecture

There are two important terms to differentiate for SAP systems: kernels and releases. The SAP release is the collection of business programs, usually written in ABAP® (SAP's own business programming language), that are stored in the relational database. These ABAP programs are the business and functional logic of the relevant SAP system. They are independent of the underlying operating system and server platform.

SAP Kernel, Instance, and Work Processes

The SAP kernel, on the other hand, is a collection of executables and tools that enable the SAP system to process the business logic. The sum of SAP kernel processes started or stopped as a whole is called an SAP instance. Each SAP system can deploy multiple instances, typically one instance per server box. There are several situations, however, where it makes sense to run multiple instances per single server box.

Each SAP instance consists of one dispatcher and multiple work processes. The dispatcher distributes requests to free work processes. There are different kinds of work processes, dedicated to specific tasks (see Figure 1-8):

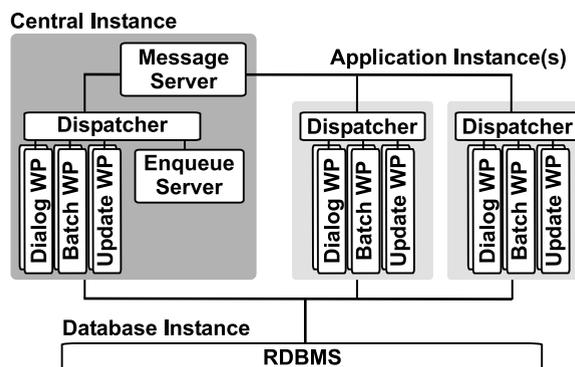


Figure 1-8 SAP R/3 Work Processes and Instances (Spool & Gateway processes purposely not shown)

- Dialog work processes (D) are responsible for carrying out the online user transaction load. A dialog process can handle the requests of several users. However, a sufficient number of dialog processes must be available to prevent user requests from waiting for a free dialog process. At least two dialog work processes are required for each SAP R/3 instance.
- Batch work processes (B) carry out background tasks that don't require an online response, for example, data loading from a file.
- Update work processes (V) perform the actual updates to the database, asynchronously to the dialog and batch processes.
- Spool work processes (S) support print spooling. More than one spool process is supported per SAP R/3 instance with SAP R/3 release 4.0 and above.
- The gateway work process (G) provides communication between applications on the same or on an external system (for example, between an SAP R/3 and an R/2 system). Only one gateway process is needed per SAP R/3 instance.

The work processes described belong to the SAP application instance, of which there can be many in one single SAP system. There are two additional processes, however, that are unique to each SAP system:

- The enqueue server (E) and the enqueue table help to manage the locks on database updates to guarantee data consistency as seen from the business process level, even across database transactions.
- The message process (M) is responsible for communication between the various application servers. Users logging on to the system are assigned (by the message process) to the application server with the lowest load. However, this load distribution mechanism is at logon time only. If an application server goes down, the message process routes the new logon requests to the remaining application servers, providing a basic level of availability.

The instance running the enqueue and message work processes (along with dialog, batch, and the others) is called the Central Instance (CI). A configuration with a single central instance executed together with the database on one single machine is called a central system (i.e., two-tier system). All of the application instances require the proper functioning of the Central Instance. Because there is only one CI possible per SAP system, it is a single point of failure, and is therefore subject to high-availability solutions described later in this book.

Note

If an application server is running more than one SAP instance, there is one dispatcher for every instance but still only one message and enqueue server with the central instance. If the server is running more than one central instance (i.e., multiple SAP systems), there is a dispatcher for every instance together with a message and enqueue server for each central instance.

The SAP System Architecture

From SAP's point of view, the three software tiers of database, application, and presentation are parts of one unit. In practice, only the application and database servers typically located in the data center are considered the SAP system. The presentation server, typically an SAPGUI application running on the user's workstation or PC, is often mislabeled as "client" or assumed equivalent to a "user."

The easiest configuration is a Central System where both the database and the SAP application tier are executed on one single server. The network and SAP R/3 profile configuration management becomes relatively easy in this scenario. A central system needs fewer resources compared with a distributed system due to the reduction of network communication.

When the SAP R/3 application logic runs on a separate application server, or sets of servers, this configuration is called the distributed (client/server) model. There are many combinations of software configurations possible, with three common ones listed here:

- **Standard**—The database server executes the database management software, plus the SAP R/3 central instance, along with update processes, and some dialog and batch. The update work processes represent a significant load on the database host, so this is only appropriate for smaller transaction loads.
- **Tuned**—The update processes are moved off from the database server, distributed onto multiple application servers. The distribution is required primarily for redundancy but also has a potential performance benefit. In this case, the enqueue and message work processes represent less than 10% additional load, typically.
- **High-End**—When every ounce of processing power must be dedicated to the database, even the Central Instance can be moved off onto an SAP R/3 application server.

The initial intention of most enterprises is to deploy one single central SAP system for the entire organization. However, as time goes by, a multitude of independent SAP systems sprouts because different business units deploy different business processes and have different maintenance, geographical, and legal considerations, for example. In most cases, a separate human resources HR system is the first spin-off. Communication between these different systems is via the standard ALE and RFC interfaces provided by SAP.

The Database Server

Although SAP software is generally independent of any one particular relational database management system (RDBMS), there are some important software architecture concepts that apply to each database.

Just like SAP software, each RDBMS has a kernel, or a set of executables that enable the database application to run. These kernel files are compiled specifically for each server OS platform. The actual data stored in the database is logically stored as rows within relational tables.

Physically, however, the data is stored in data files on disks, configured with a file system or as raw disks (discussed further in Chapter 4).

Changes to the data are tracked by a log writer process and stored in log files. At some point, the changes stored in the log files are flushed out to the database data files by the database writer process.

Transactions that are being processed but not yet committed as final are stored in the database rollback (or equivalent) tables or table areas (spaces). If a transaction aborts for any reason, the database can then be rolled back to a consistent state. Data needed for temporary use, such as for table joins, are written onto the disks in temporary storage. To access data quickly, index tables are used to reference the actual data. Often, logs, roll, temp, index, and data areas are each kept on separate disks for performance reasons. More information about the database architecture and its impact on disk systems is covered in Chapter 4.

Because the database server stores all the business data, it is the most critical system (including its disks) in any one SAP system. It needs protection from failure, from disasters, and needs to be scalable to avoid performance problems when processing activity increases.

The SAP System Landscape

Every SAP implementation project goes through deployment phases of some sort. There are several types of systems used to implement a project. These should at least be dedicated software deployment layers, if not on physically separate servers:

- **Training, Evaluation, and Sandbox Systems**—used for user training, gaining experience in mySAP.com and playground for feasibility studies for customer-specific requirements; usually small systems with small databases.
- **Development System (DEV)**—for customization of the mySAP.com systems and development of new components and functionality; usually small systems with small databases. It can be on different OS and HW platform, however, similar OS ease the management.
- **Test and Quality Assurance System (Test/QA)**—enables extended testing of upgrades/ transports prior to implementation in the production system. These tests can cover OS upgrades, SAP upgrades and patches, new system drivers, interface setups, and so on. These are smaller than the production system but in a ratio that allows forecasting the performance impact. The data used is a copy of the production system to run tests with real, large quantities of data.
- **Production System (PROD)**—system with live data for production use.

The Change and Transport System (CTS) transports configuration changes as well as upgrades, patches, and newly developed components in a controlled manner between the layers of the system landscape (i.e., from DEV to Test/QA to PROD). This requires a file share available to all of the systems within the SAP landscape.

Figure 1-9 shows the typical SAP system landscape. The normal SAP project starts with a development system to set up, configure, and sometimes customize SAP software for a particular

company's business processes. A test system is used to verify the development code before going into production. In some cases, a separate integration system is used to consolidate the changes of multiple development teams. Most of the mySAP.com application components (SAP BW, SAP APO, etc.) use development, test, and production systems in the complete landscape.

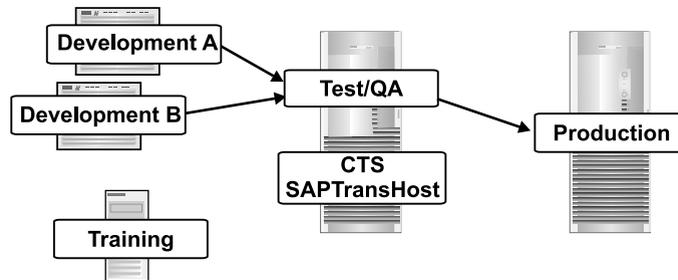


Figure 1-9 Typical SAP R/3 System Landscape (including CTS—Transport Host)

The minimum recommended configuration is a three-system landscape. However, due to budgetary reasons sometimes a different setup can be chosen. Development and Test/QA systems can be combined on one server. This is the case for the preconfigured Ready-To-Run packages from SAP, which are more cost sensitive. In any case, it is still useful to have a minimum of three logically separate systems, although there may be fewer physical servers.

Figure 1-10 shows a sample landscape with a few mySAP.com application components and two separate SAP R/3 systems. Not all Development and Test/QA systems possible are shown, however. The main point is that there are potentially many different server boxes (and storage) required to support a full mySAP.com environment.

TIP **System Consolidation for mySAP.com**

Scalability is one of the major benefits of the SAP architecture. With increased system load caused by a growing number of users, the number of application servers per component can be extended accordingly. Separate servers need to be added for SAP APO (*liveCache*) and ITS (AGate, WGate) due to architectural and security reasons. Together with the demand for separate development systems for each component, the result is a proliferation of servers, which increases the management effort as well as investments in data center environment (floor space, cooling, electric power, etc.).

In the past, it was generally not recommended to run more than one production SAP system per server due to performance issues. Newer, high-performance servers are allowing the consolidation of multiple SAP systems and mySAP.com components onto one single box without impacting the system performance scaling or throughput. This has the potential to reduce the overall hardware management and environmental costs. Several consolidation approaches are described in Chapter 2.

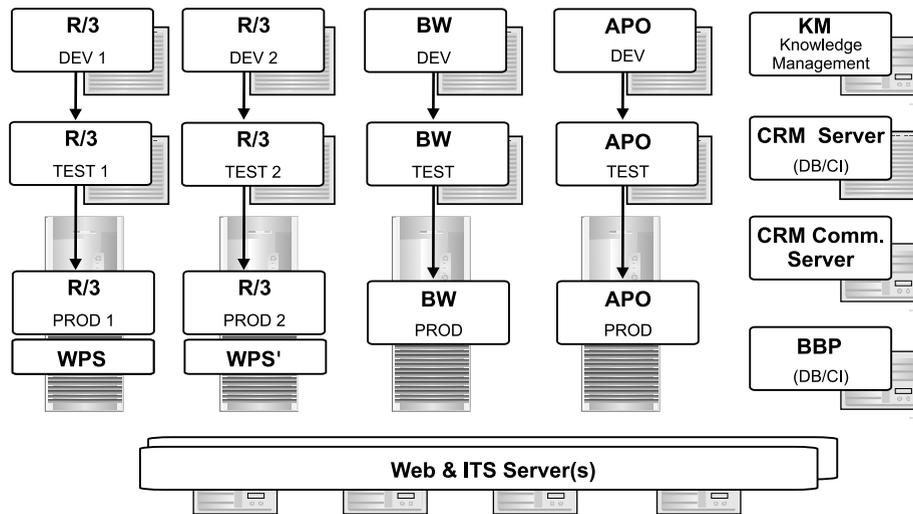
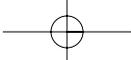


Figure 1-10 mySAP.com System Landscape—A Few Application Components

Summary

To implement the IT infrastructure, it is useful to know something about the business applications being implemented. The business applications determine the important data processing requirements, from a performance, availability, and total cost of ownership view. SAP introduced many new business applications as part of the mySAP.com initiative. The first part of this chapter provided a brief introduction of the major mySAP.com business application components. The terms defined are referenced in the remaining chapters in this book. Here are some of the important points in this chapter:

- There are many business application components in the mySAP.com solution offering. However, a mySAP.com Workplace system and an SAP R/3 system are the minimum required.
- Application Link Enabling (ALE) provides the ability to synchronize the databases of distributed SAP systems. ALE is the technological basis for the coupling of mySAP.com business applications.
- SAP supports multiple national languages. However, some language combinations cause additional administrative effort.
- The SAP architecture is based on distinct tiers for user interface (presentation), business logic execution (application), and business data storage (database). An additional tier (middleware) is mandatory for browser access to mySAP.com business applications.
- Because the application logic in any one system can be executed in parallel, the workload can be distributed between multiple application servers. Each system only has one database server, so it is critical for all operations.



Summary

29

- Depending on system workload, application and database tiers can be consolidated onto a central system, executed on a single server.
- Multiple SAP application components can be executed in parallel on one server. Multiple SAP application and database instances can be executed on a single server box, if needed for consolidation purposes.
- The message and the enqueue work processes are unique in each SAP system. The instance running the enqueue and message work processes is the Central Instance (CI). There's only one CI possible per SAP system.
- A typical SAP System Landscape includes at least a development system, a test system, and the production system. This applies to most of the mySAP.com components.
- Many of the mySAP.com components are based on an SAP basis kernel and a single database instance. Middleware components like Internet Transaction Server and Business Connector deploy a different kernel and have no database.

