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Third Edition

Thoroughly Updated and Expanded, with Extensive New Coverage!

Sams **Teach Yourself**

SAP

in **24 Hours**

SAMS

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Introduction

Welcome, and thank you for picking up this latest edition of *Sams Teach Yourself SAP in 24 Hours*. Inside these pages you will find six newly renovated SAP parts and 24 hours of instruction refocused to better teach the SAP newcomer. My colleagues and I have spent a considerable amount of time aligning the content with what a person new to SAP needs to know up front, and we've done this from several different perspectives—the information technologist, the end user, the project manager, the wannabe SAP developer or programmer, and the business professional.

We have organized each hour (or chapter) around one of several common themes, beginning naturally with introductory materials useful in helping most anyone understand the underlying technology, business basics, and various SAP implementation roadmaps. Next, we cover SAP's products and components in detail, laying the groundwork for the next part of the book, which covers implementing SAP. By addressing SAP deployment from project management, business, and technology perspectives, we have strived to give our readers enough real-world breadth and depth to make the book a truly useful guide. Additional SAP technical considerations round out this breadth and depth, followed by a section focused on end users: how to log in, use the various SAP interfaces, customize the interface, and execute common business functions such as reports and queries. The final part of the book concludes with materials designed to help our readers land a job in SAP, including pointers to readily available Internet-based and other resources.

Though necessarily broad, our new approach accomplishes two things. First, it gives the new reader an opportunity to understand all that SAP comprises, particularly with regard to the many changes we've witnessed in the world of SAP since 2005. Second, the third edition makes for less jumping around from hour to hour, and is therefore an easier read. If your company has just announced it is deploying SAP, or you have just joined a company using SAP, you'll find it easy to navigate the book and quickly come up to speed. For example, end users may want to first read Parts I and IV before focusing their attention more fully on Part V, whereas technologists might prefer to focus their attention fully on Parts II and IV. Meanwhile, decision makers and project managers might find Parts II and III most useful, and SAP hopefuls might turn immediately to Part VI for advice aimed at breaking into the SAP workforce.

For you, our reader, picking up this book represents an assertive step forward. You are going with the market leader, the model of endurance, and the preeminent technology frontrunner and enterprise solution enabler. As a result, after about 24 hours of reading, you

will possess a solid foundation upon which to build greater capabilities or even a career in SAP. Your knowledge foundation will be broad, certainly, and in need of further bolstering before you're an expert in any sense of the word. But the great thing about your decision is simply that you'll know what you know and have a handle on what you still need to learn. You'll know where you want to go, and be smart enough about it to navigate a roadmap and career of your own choosing. That good sense alone will be enough to get you on the road toward making something new happen in your career, maybe even your life. And in the meantime, your 24 hours of investment may serve you well in your current employment position, too. Armed with insight, skills, understanding, and a broad sense of the big picture facing most every company in business today, you will no longer look at business applications and the technology solutions underpinning those applications in the same way again. You'll be wiser and more able to contribute to a greater extent than previously possible from several different perspectives, ranging from business and application expertise to technology, end-user, and project management insight. You'll be a "SAPling" in the broadest sense of the word.

SAP's Journey

SAP has come a long way since this first edition of this book was published in the heyday of R/3. In the last several years alone, we've witnessed an explosion in both technology and business applications, the frontlines of which SAP has arguably pushed harder than any other software company. Certainly, SAP's competitors and partners have provided great incentive to the developers and executives over in Walldorf, Germany. But with a revamped suite of core offerings surrounded by new products and new enabling technologies, SAP's stable of contemporary business solutions is unparalleled. And the company remains a model of both evolution and revolution. SAP may be found in 46,000 different firms around the world, ranging from multinational corporations to government entities, small/medium businesses, and everything in between. SAP has successfully engaged what is often termed the "mid market." That is, SAP is no longer only the best solution provider for big companies; it's also the best solution for the rest of the industry. Armed with state-of-the-art development tools, a focus on really delivering on the promises of Service-Oriented Architecture (SOA), and the willingness to reinvent how business does business in our new world, SAP is making it easier and easier to, well, do SAP.

What's New, and Who Should Read This Book?

Like its predecessors, this book is divided into 24 chapters, or "hours," that can each be completed in about an hour. This book covers everything you need to become well acquainted with the core SAP products and components that are often collectively referred to simply as SAP. The book is organized to provide visibility into key facets of SAP terminology, usage, configuration, deployment, administration, and more. As such, it is necessarily general at times rather than exceedingly detailed, although a certain amount of depth in much of the subject matter is purposely provided where deemed critical to further your understanding. The book serves as several intertwined roadmaps as well. In this structure may be found the book's true value—the content herein is broad enough to paint a picture most anyone can understand, yet deep enough to provide more than an introduction to the subject matter along several different paths or routes. And the flow of material moves along the same lines, from general to specific, from SAP products and components to post-implementation support and use, and from project management planning and preparation to project realization.

Sams Teach Yourself SAP in 24 Hours begins with the basics and terminology surrounding SAP, SAP NetWeaver, and what an SAP project looks like, and from there begins the process of carefully building on your newfound knowledge to piece together the complex world of SAP. The pace of the book is designed to provide a solid foundation such that you may grasp the more advanced topics covered later in the book. In this way, the novice may quickly realize what it means to plan for, deploy, and use SAP, in the process unleashing the power that comes with understanding how all the pieces of the puzzle come together to solve business problems. With this understanding also comes an appreciation of the role that SAP's various partners play with regard to an implementation project—how executive leadership, project management, business applications, technical deployment, and system end users all come together to create and use SAP end-to-end.

Organization of This Book

From the basics surrounding what SAP comprises and the technologies underneath it, to understanding and developing business and technology roadmaps, Part I, "Introduction to SAP," gives you a foundation. Part II, "SAP Products and Components," revolves around SAP's products and components, from the groundwork provided by SAP NetWeaver to SAP's

core ERP product, its Small/Medium Business (SMB) offerings, and finally SAP's full-featured SAP Business Suite. Part III, "Implementing SAP," then turns to implementation matters, providing project management, business, and technical roadmaps after setting the stage with SAP's development tools and methodologies and how SAP leverages SOA in the real world. The technical concentration in Part IV, "SAP Technical Considerations," brings together what we've been told over and over again by new technologists looking for an introductory SAP book—how to install SAP, how to integrate it with Microsoft's ubiquitous Office offerings, how to manage and maintain the system, and finally what it means to upgrade or enhance SAP once it's in production. Part V, "Using SAP," brings us to the world of using SAP, from logging in, to customizing SAP's display, printing, creating reports, and executing queries. Finally, Part VI, "Developing a Career in SAP," concludes as stated earlier with what it takes to develop a career in SAP.

All told, this latest edition of *Sams Teach Yourself SAP in 24 Hours* serves as an excellent launchpad for using and managing SAP in the real world of business and IT. To test and reinforce your knowledge, each hour concludes with a case study and related questions. The questions provide you an opportunity to put your newfound hours' knowledge and understanding to the test as well as into practice. And with the answers to the questions found in Appendix A, "Case Study Answers," it will be an easy matter to verify your newfound knowledge.

From all of us at Sams, we hope you enjoy and get a lot out of the third edition of *Sams Teach Yourself SAP in 24 Hours*!

Conventions Used in This Book

Each hour starts with "What You'll Learn in This Hour," which includes a brief list of bulleted points highlighting the hour's contents. A summary concluding each hour provides similar though more detailed insight reflecting what you as the reader should be walking away with. In each hour, any text that you type will appear as **`bold monospace`**, whereas text that appears on your screen is presented in `monospace` type.

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It will look like this to mimic the way text looks on your screen.
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Finally, the following icons are used to introduce other pertinent information used in this book.

By the Way presents interesting pieces of information related to the surrounding discussion.

Did You Know? offers advice or teaches an easier way to do something.

Watch Out! advises you about potential problems and helps you steer clear of disaster.

Each hour concludes with a case study germane to the hour's materials. By providing an hour-specific situation involving a fictional company called MNC Global Inc., the questions (and follow-on answers found in Appendix A) provide the reader with real-world reinforcement.

HOUR 4

Infrastructure Technology Basics: Hardware, Operating Systems, and Databases

What You'll Learn in This Hour:

- Hardware basics: server and disk subsystem infrastructure
- Partnering with your infrastructure providers
- Supported operating systems for SAP
- An introduction to database basics

With the business fundamentals covered in Hour 3, "Business Basics: Developing a Roadmap for Deploying SAP" behind us, it's now time to turn our attention to the infrastructure technologies that underpin SAP. In this hour, we take a closer look at the three broad infrastructure technologies that come into play when deploying SAP—hardware, operating systems, and databases. In later hours, we examine the SAP-specific application and integration technologies as well.

Why Is This Important?

Hardware, operating systems, and databases represent the underlying technologies that make up the lowest layers of an SAP business software solution. Called a *solution stack* or *technology stack*, these layers of enabling technology combine to create the basis of an SAP system. Similar to building a house or skyscraper, the underlying technology solution is like a foundation; it's the base layer of the building and arguably one of the most important aspects of an SAP system. An improperly built foundation weakens the ability of your

SAP system to weather storms, survive changing business needs, and meet the expectations of its occupants—your SAP end user community. Hour 4 covers the ins and outs of choosing these components wisely in order to build a firm, solid foundation, thus affording optimum system availability, longevity, and to some extent performance.

Hardware for SAP: An Introduction

Hardware, although often an afterthought in an SAP project, is an essential component of an SAP system. Hardware comprises the servers (think "data center computers"), disk storage systems, network gear (such as routers, network switches, and security firewalls), and tape backup units all working together to create the infrastructure or base layer of an SAP system. If any one piece is overlooked or skimped on, it creates a weak link or single point of failure that may cause something down the road as simple as a one-time nagging glitch or as major as a series of significant system outages, costing your company precious dollars. When hardware purchases are addressed late in an implementation, inevitable budget cuts (yes, implementing SAP tends to be more expensive than most companies estimate up front) often restrict purchasing what could have been a robust and highly available system. Advance planning will help you avoid this problem when designing the overall solution.

The major players in the SAP hardware marketplace sell systems that fit all types of solution needs, from small/medium user platforms reflecting commodity solutions and low cost, to larger and highly resilient platforms capable of scaling on the fly to meet the changing or growing needs of thousands of users. Choosing a partner simply based on name recognition is a good place to start, to be sure. However, take care to investigate and compare hardware solutions from competitors that are truly apples-to-apples solutions. A million-dollar commodity hardware solution might support the same workload as a high-end proprietary system costing twice as much, but do they offer the same levels of availability, scalability, and flexibility your business needs to survive month-end closing? By the same token, will saving a few dollars on hardware (or database software, for that matter) require the IT department to spend more money every year on systems management, maintenance activities, and downtime for upgrades and patches?

Server Hardware

We view server hardware as coming in three main initial acquisition "cost" classes or performance categories: small or low, medium, and high (see Figure 4.1). Costs per server can range from a few thousand dollars to several million. Performance

can vary as well, depending on the number of CPUs, amount of RAM, internal server architecture factors, support for high-speed disk operations, and much more. Different hardware platforms are developed to support various operating systems and levels of system availability. They differ in terms of configuration flexibility and on-the-fly adaptability too.

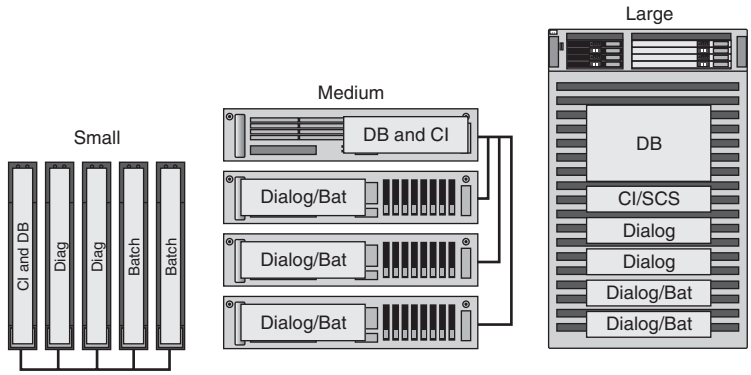

FIGURE 4.1 Servers for SAP come in a variety of sizes and configurations.

Interestingly, a single SAP solution may utilize servers from one, two, or all three categories. For instance, SAP solutions are commonly designed to leverage a high-end server for the database tier, a mid-tier server platform for the SAP central instance or applications servers, and perhaps very inexpensive servers to address web server needs, noncritical bolt-on solutions, and so on. Conversely, other SAP IT departments might choose to put all their SAP components on only a few high-end servers that can be carved up into partitions or virtual machines as necessary. And some small/medium businesses (SMBs) may choose to run SAP solely on low-cost servers (relying on SAP's built-in application server horizontal scalability to keep them out of trouble should their workload grow). In any case, overall system availability, a comprehensive total cost of ownership analysis (reflecting technology, people, and process costs over time as well as up front), and anticipated future business requirements should drive your hardware platform decision.

Several of the largest and certainly best-known hardware vendors use proprietary CPU chips in their servers and support a proprietary OS as well. IBM's PowerPC chip running AIX is a good example, as are HP's end-of-life PA-RISC and more contemporary Itanium2-based IA64 platforms running HP-UX. Be sure to investigate your platform's ability to host other operating systems as well; this can be beneficial down the road when you need to retire your SAP system and seek to redeploy it internally rather than toss it in the dumpster. HP's IA64 chips support Windows, Linux, and OpenVMS, for example, whereas Sun's latest offerings support Solaris, Windows, and Linux.

Clearly the trend of late is around deploying low-cost servers based on commodity CPU chips from Intel and AMD (often referred to generically as "x64" platforms). HP and Dell are the biggest players in this market, though Sun offers a bit of choice here as well. Interestingly, these platforms are growing more and more powerful each year, supplanting some of the bigger server platforms in the process. Commodity server form factors continue to expand and provide IT departments with choice—from dense blades to slim-line "pizza box" designs to more traditional big-box designs. Meanwhile, hardware vendors in this space continue to develop high-availability, virtualization, and other technologies and solutions that help put these servers on more of an equal footing with their proprietary counterparts. In all the excitement and hype surrounding these well-performing upstarts, though, take care not to overlook trade offs. Low cost up front doesn't always translate to low cost over a system's lifetime, for example.

When purchasing servers and associated hardware for SAP, consider investing in the high-availability features offered for the platform, even if an additional charge is involved. Most servers offer redundant power supplies, redundant memory, disk array (RAID) controllers capable of running even after a disk drive fails, and support for multiple network interfaces cards (NICs) to avoid failure of a network segment, network switch, or single card. Leveraging these technologies will certainly increase the overall uptime of your SAP solution, typically adding only incremental cost in the process.

Server networks should be configured in a redundant fashion as well. In many IT data centers, the network represents a major—and avoidable—single point of failure. Dual switches and the use of the aforementioned redundant NICs can eliminate or mitigate what otherwise could be a major outage. Of course, these NICs and switches must be properly and professionally installed, cabled, and configured to actually work well; attention to high availability is just as important after the purchase as beforehand.

Disk Subsystem Hardware

Most server hardware vendors also sell disk subsystems, which are essentially enclosures for multiple disk drives used by SAP and other applications to house the application's database, its installation binaries or executables, and so on.

The most robust and well-performing disk subsystems today are in the form of storage area networks (SANs) and to a lesser extent network-attached storage (NAS) systems. Similar to how servers are marketed, vendors sell low-tier, mid-tier, and high-end SANs and NAS devices. At a minimum, the storage chosen for SAP should support redundant connectivity between the storage and the servers connected to it,

so as to avoid a single point of failure. RAID (Redundant Array of Inexpensive Disks) level 0, 1, 5, or 10 should be configured as well to protect against disk failures. As Table 4.1 suggests, different RAID levels provide various combinations of availability, cost, and performance.

TABLE 4.1 Disk Subsystem RAID Types, Advantages, and Disadvantages

RAID Level	Method of Availability	Advantages and Disadvantages
RAID 0	Disk striping	Spans multiple disks, all of which are available for storage. RAID 0 is great when maximum space is needed, and it provides excellent performance as well. However, no disk redundancy is afforded, and it's not viable for production systems.
RAID 1	Disk mirroring	Mirroring provides best-in-class performance and excellent redundancy, although it's costly (a 500GB database requires a terabyte of raw disk capacity at minimum).
RAID 5	Disk striping with parity	Stripes data with parity, making for wonderful disk read performance, though to some extent a disk write penalty; excellent redundancy balanced by best-in-class low cost.
RAID 10	Disk mirroring and striping	Data is both striped and mirrored; best performance and redundancy, although this is the most costly method of providing disk subsystem availability.

High-end SAN storage typically supports advanced replication technologies, too, which can be useful for disaster recovery purposes among other things. Be sure to look into such capabilities—the ability to copy data between remotely connected SANs or to create "snapshots" of SAP databases on the fly is useful in many different ways, from enabling rapid system backups, to allowing systems to be cloned for offline testing and training, to supporting disaster and business continuity requirements in the wake of a severe data center outage.

SAP-Supported Operating Systems

An operating system (OS) is software that allows applications to interface with a computer or server. The OS is the middleman, making a system's hardware accessible to an application sitting atop the OS while providing basic services to

applications (such as file sharing, support for network connections, and so on) in the process. Operating systems such as Microsoft Windows Server, Red Hat and SUSE Linux, and the many popular UNIX variants (HP-UX, AIX, and Solaris) are common in today's SAP environments. Even the occasional IBM iSeries or AS/400 (running the OS400 operating system) or mainframe (running z/OS) can be found supporting SAP today as well.

Figuring out which is the best for your solution can be a daunting task, however. More and more, the OS playing field is being leveled. Robust 64-bit technology in the commodity server market has many SAP shops rethinking their strategy. When choosing an OS, it all comes down to relationship, confidence, supportability, and particularly your in-house IT skill sets and personal biases. To this end, always take care to factor in your current in-house skill sets, comfort levels, and ability to be "retooled." The cost and time of retraining or hiring additional resources can weigh significantly on an IT department. And as with your hardware decisions, look for a company that has a solid relationship with SAP and verifiable satisfied client references.

In 2007, SAP announced it would generally only support 64-bit operating environments for new installations going forward. As SAP software evolves and low-cost 64-bit hardware becomes more prevalent, the need to run 32-bit servers and therefore 32-bit operating systems is falling by the wayside. Don't waste your time on such environments. Unless the company is already running an older version of SAP or has some odd bolt-on software only supported in 32-bit environments, there is simply no need to run a 32-bit server and OS in an SAP environment anymore.

Basic OS Features

Some of the features to look for in an OS are memory management, crash recovery, patch management, security, and advanced features such as clustering capabilities. Other things to consider when choosing an OS are support for third-party management utilities or the presence of built-in ones. Take a look at how the management and monitoring solutions in your IT environment today might fit with your prospective SAP solutions and the possible OS choices you face. Utilities such as monitoring applications, virus-scanning utilities, and backup software need to be validated to

make sure they will work with existing toolsets as well as with SAP. In some cases, new toolsets must be invested in, which may not be cost effective or consistent with your IT department's future vision.

SAP File Systems and the Role of the OS

SAP in relationship to an OS is a set of executables and libraries that allow users though various front ends to connect to application servers to submit and retrieve data to an SAP database. SAP starts multiple OS-level services and processes, thereby making efficient use of a server's available memory and CPU power. A UNIX or Linux OS containing an SAP instance has a directory named /usr/sap (or x:\usr\sap in the case of Windows) that contains several subdirectories with executables, log files, and profiles. In Windows, x:\usr\sap is shared as SAPMNT and is accessible as \\servername\sapmnt. On a Windows server with multiple instances of SAP and a single OS installation, all SAP instances must be installed to the same SAPMNT directory; there can be only one SAPMNT share. In UNIX, /sapmnt is mounted as an NFS (network file system) mount, whereas /usr/sap/<SID> is a local file system.

In both UNIX and Windows, the SAP system identified (SID) is at the next directory level. See Figures 4.2 and 4.3 for the SAP directory structures of a Windows and a UNIX system for SAP, respectively. In Windows, the service SAPOSCOL runs the OS collector and allows SAP to gather OS-related performance and other statistics such as CPU utilization, memory utilization, disk input/output (I/O) activity, and more. All SAP systems contain one instance of the OS collector, although this collector is not required for SAP system operation.

Another Windows service is SAPService<SID>, where <SID> is the system identifier of the SAP instance. One SAPService<SID> exists for each instance of SAP on a machine, and it is started using sapstartsrv.exe. The service is started by the SAP service account of the <SID>adm account, depending on SAP version. This service calls the SAP start profile, which tells the system how to start SAP and registers a number of environmental variables. Suffice it to say here that these matters can be fairly complex.

The term *SAP system* refers to a single system or collection of systems hosted by one database that uses one SID name (system identifier). For example, an SAP ERP production system named PRD may consist of one database (nearly always), one central instance, and perhaps two, eight, or sixty different application servers, depending on workload. This collection of multiple SAP instances and the database make up an SAP system. Thus, an SAP instance is synonymous with one installed component (or "installation") of SAP on a server (also called a "host"). One host can contain multiple SAP instances, too, which belong to different SAP systems.

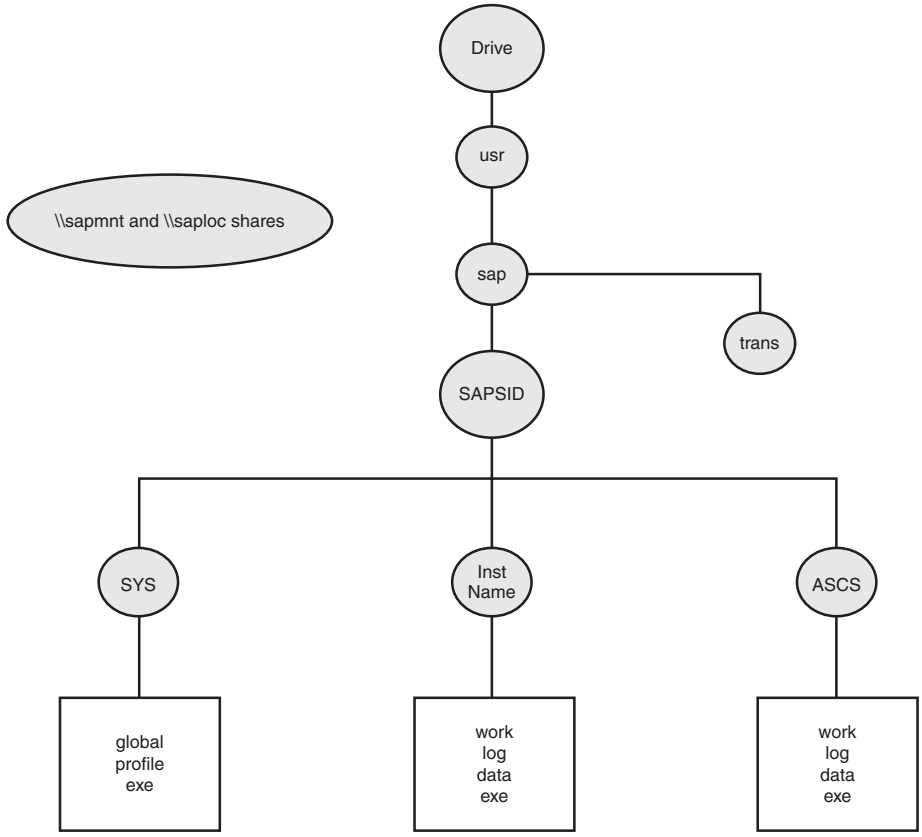

FIGURE 4.2 SAP file systems installed on Windows SAP systems.

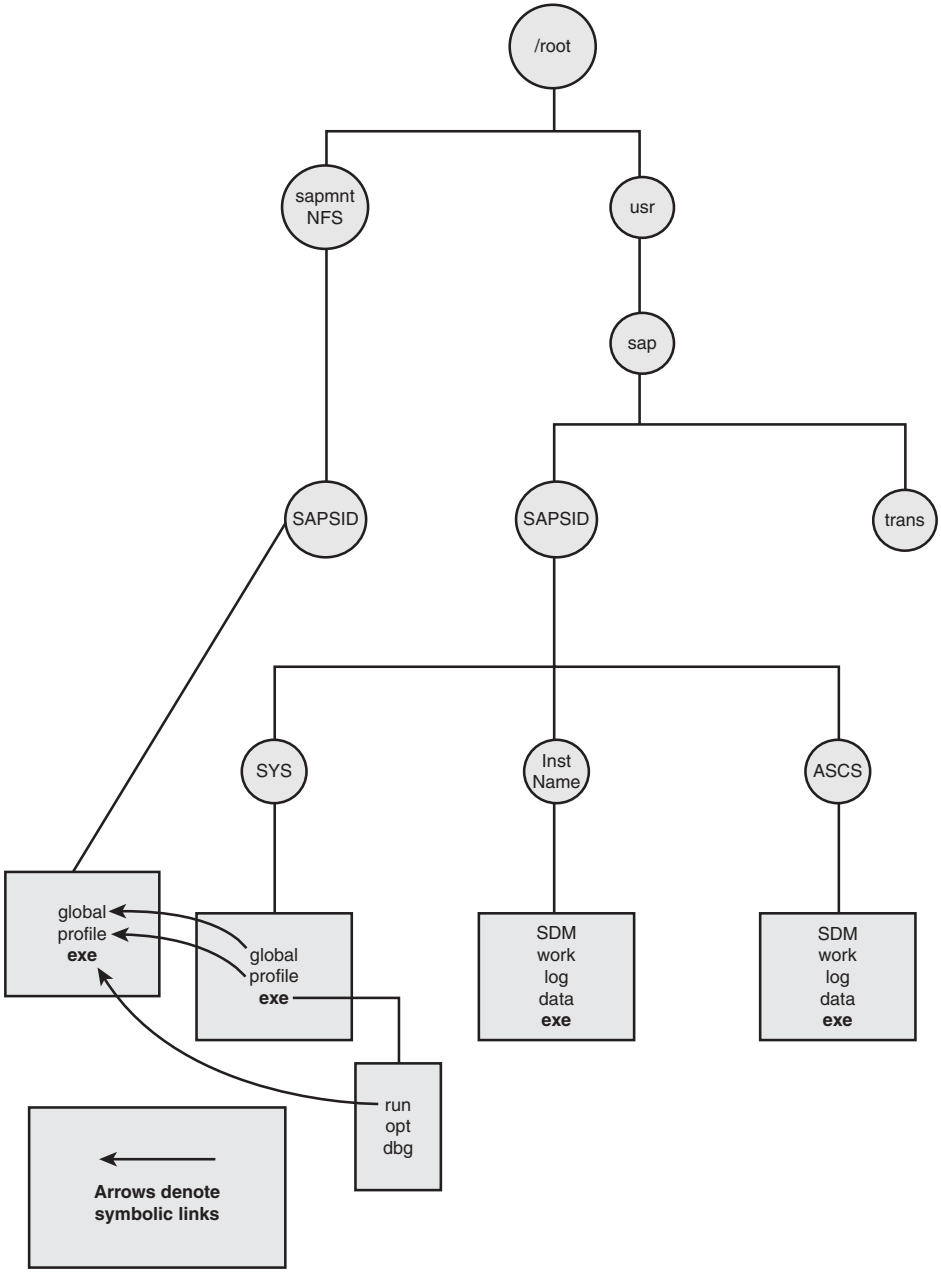

FIGURE 4.3
SAP file systems installed on UNIX-based SAP systems.

SAP OS-Level Work Processes

At an OS level, SAP has eight different work process types, as detailed in Table 4.2. Sometimes you will see them referenced as DVEBMSG. The *D* equates to dialog work processes, whereas the *V* references update work processes (differentiated by V1 and V2 priority types), *E* is enqueue, *B* is for background/batch jobs, *M* is the message service, *S* is used for print spooling, and *G* represents the SAP gateway. The instance profile of an SAP instance dictates how many of each type of process will start at system startup time. You can see which work processes your OS is running by running an applet or utility on the OS itself or using SAP's own transactions SM50 and SM66. Though we are getting ahead of ourselves, this ability to review the status of your SAP work processes is very important; beyond providing a view into the system's workload, it also reveals in real time the status of the system in terms of what each work process is performing on a particular SAP instance or group of instances. SM50 shows you only the work processes on the current application server you are logged in to, whereas SM66 gives you a global work process overview; SM66 is your window into what is happening with every active work process running across an entire SAP system.

TABLE 4.2 SAP Work Processes

Work Process Type	Description
Dialog	D: Processes real-time information in the foreground.
Background	B: Background processing for long-running processes, reports, and batch jobs.
Synchronous Update	V1: Processes immediate updates to the database.
Asynchronous Update	V2: Processes updates to the database on a lower priority than V1 (that is, when time permits).
Enqueue	E: Manages database locks.
Message	M: Manages communication between application servers.
Spool	S: Manages print jobs (the print spool).
Gateway	G: Communicates with other SAP and non-SAP systems.

SAP OS-Level Profiles

SAP contains three profiles: the default, start, and instance profiles. Profiles are essentially text files that, for the purposes of version control, are imported into and maintained by the SAP database. The default profile contains information common to all instances of SAP in an SAP system. For example, PRD may have a database, central instance, and three application servers; these would all use the same default

profile. The start profile calls the executables to start SAP. Finally, the instance profile contains detailed information for each SAP instance in a system that makes up a common <SID>. This detailed information reflects specific memory configuration parameters, defines how buffers and work processes are defined and utilized, and a myriad of other information as well. Use SAP transaction RZ10 to change and maintain all these profiles, and to access a handy list of all available profile parameters.

Database Basics for SAP

With hardware and operating system details behind us, it is now time to turn our attention to the role of the database underneath an SAP business application. The same care that goes into choosing a hardware platform and OS should be used when choosing a database. Depending on your platform and SAP version, you may be restricted to only a few database choices (which underscores the importance of looking at your SAP infrastructure holistically). SAP tends to support most mainstream databases such as Microsoft SQL Server, IBM DB2, and Oracle's ubiquitous database offerings. SAP also supports its very own database called MaxDB, which has an interesting history of acquisitions and continues to grow in popularity. More common for SAP-on-Linux platforms, MaxDB is an interesting and low-cost alternative to the other primary SAP-supported database offerings. Indeed, it is serving to level the playing field in the same way that commodity hardware and OS solutions are leveling the hardware and operating system playing fields.

Most IT departments choose a database based on what their current database administrators (DBAs) are familiar with or know. In the past, it has been a daunting task to retrain DBAs for a new database platform, particularly one associated with mission critical applications such as SAP. Today, though, low-overhead database offerings from Microsoft and IBM are making this transition easier.

Relative to selecting a database platform for SAP, you need to base your decision in part on the advanced functionality of database software you may need to meet your business user's response-time and availability requirements. Microsoft SQL Server and Oracle both support log shipping and clustering technologies for increasing the availability of SAP systems. Log shipping allows you to maintain a secondary copy of your SAP (or any) database on another system to fail over to in case of a disaster situation. Sometimes log shipping is called "poor man's DR." Regardless, it is a robust and widely used technology for SAP as much as any other business application.

A Database Primer

Whichever database you choose, enterprise applications such as SAP are essentially made up of programs along with the data that is both used by and created by those

programs. The data is organized in a meaningful way within a database, making it easy for the programs to access and find the data necessary to do something useful like run a financial report or create a sales order. In the case of an SAP component or product such as ERP, the programs and data reside together in the same database. Each component generally has its own database (although exceptions exist)—a production system landscape composed of SAP ERP, SAP NetWeaver Portal (EP), and SAP Customer Relationship Management (CRM) consists of three production databases, for example.

A database is essentially an electronic filing system that houses a collection of information organized in such a way that it allows a computer program to quickly find desired pieces of data. In the simplest form, a database is composed of tables, columns (called fields), and rows (called *records* or *data*). The basic structure of a database is quite similar to the well-known Microsoft Excel spreadsheet, where columns (fields) store row after row of records (data). The biggest difference between a database and a spreadsheet is simply that databases can contain multiple (and extremely large) tables that are connected to one another through relationships. Thus, a database can be thought of as a much more complex, and ultimately much more useful, spreadsheet. The database plays a key role in each SAP system because it houses all the data used by that particular SAP component or application.

Tables, Indexes, and Structure

The SAP database contains literally thousands of tables that store information. Some products, such as ERP, comprise greater than 30,000 tables, whereas less complex offerings such as SAP NetWeaver Process Integration (PI) might have fewer than 10,000. It is noteworthy to know that in most SAP systems, 10% of the tables house 90% of the data, so some tables can get quite large and be subject to constant change, whereas others tend to remain very small and relatively static. Regardless of the number, though, these various tables are all tied to each other through established relationships. It is precisely this series of connected multiple tables that creates what is known as a *relational database management system (RDBMS)*.

Databases are made up of indexes, too; whereas tables house the data, indexes are used to speed up the retrieval of data from those tables. An index might best be described as a copy of a database table reduced to only the key fields. The data in this reduced copy is sorted according to some predefined criteria, enabling rapid access to the data. Not all fields from the copied table exist in the index, and the index contains a pointer to the associated record of the actual table. You might be surprised to know that indexes make up approximately 50% of the overall size of an SAP database!

SAP uses another concept called *transparent tables*, which are SAP database tables that only contain data at runtime. A transparent table is automatically created in the database when a table is activated in the ABAP/4 Data Dictionary. This transparent table contains the same name as your database table in the ABAP/4 Dictionary. Each of its fields also contains the same names as their database counterparts, although the sequence of the fields might change. The varying field sequence makes it possible to insert new fields into the table without having to convert it, all of which allows for more rapid access to data during runtime.

Database structure is another technical term that you really do not need to concern yourself with too much, but it's important nonetheless. Simply remember that database structures are a group of internal fields that logically belong together. Structures are activated and defined in the ABAP/4 Data Dictionary and only contain data temporarily—during the execution of a program. Structures are differentiated from database tables based on the following three criteria:

- A structure does not contain or reflect an associated ABAP/4 Data Dictionary table.
- A structure does not contain a primary key.
- A structure does not have any technical properties such as class, size, category, or buffering specifications.

Partnering with Your Infrastructure Providers

As you have seen, there is much to consider when developing an infrastructure design or plan for SAP. Choosing an infrastructure provider or network of providers is therefore serious business. Do not just automatically choose a hardware, OS, or database vendor your company is already familiar with in the context of desktop PCs or laptop purchases. Look to your data center standards first, to get a sense of whom you might already be comfortable with. And then look at competitors. It is certainly a fine strategy to choose a hardware partner you know and trust, for example, but too much is at stake to not conduct a more thorough assessment.

Be sure to investigate any prospective infrastructure providers in light of their relationship with SAP. Do they have a long history of partnering with SAP? Are they "certified" for SAP, or do they hold SAP's Global Technology Partner status? Check with potential providers for SAP-specific customer references, and follow up by talking with these references over the phone or via an onsite visit if possible. After all, it

is helpful to see and hear from other customers; their experiences with SAP and your other likely infrastructure partners can really shed some light on whether your proposed infrastructure solution will provide the foundation the company needs. References in a similar industry or reflecting SAP components and products hosting similar workloads or scope are even more valuable.

Attending an SAP tradeshow such as SAP TechEd, ASUG, or any number of SAP Insider conferences is a great place to meet other SAP customers as well as potential infrastructure providers. SAP is generally happy to make these introductions, but don't fear striking out on your own. This process is akin to peer support, similar to what is seen in the open-systems arena. Many SAP customers have peer contacts with other companies, sometimes even their own competitors, which can be leveraged to share various experiences and technical challenges as well as answer questions related to how well the provider supports and maintains its customers *after* money changes hands.

Bottom line: It is not advisable to bet your SAP environment's viability on a whim, on a relationship that has not been vetted over time or shown to be fruitful by others, or on a little-used technology. Save your cutting-edge IT decisions for something less critical and less essential to the company's financial well-being. Finally, do your homework, and do it early—before all the SAP project's budget money is spent on consultants!

Summary

In Hour 4, we covered the key components of SAP infrastructure: hardware, operating systems, and databases. And we looked at what it means to choose and partner with the vendors that will ultimately work together to create your infrastructure platform for SAP. A new SAP implementation requires a solid, well-thought-out foundation. Leverage the information presented here when researching the best alternatives for your company, keeping in mind the following:

- Does my current hardware provider have solutions for SAP?
- Does my current hardware provider have a relationship with SAP?
- What are the current in-house skill sets at my company that may be called upon to support the SAP solution?

Ask the same types of questions in relationship to your operating system and database providers, and then perform an apples-to-apples cost and capabilities analysis to really vet out the right fit for your company and its SAP environment.

Case Study: Hour 4

In light of your newfound hardware, operating system, and database knowledge, consider this hour's case study and answer the questions that follow. Answers may be found in Appendix A, "Case Study Answers."

Situation

MNC Global recently acquired a company in the process of upgrading to a new release of SAP ERP 6.0. Currently, the acquisition runs SAP R/3 4.6C hosted by IBM on older 32-bit hardware, running AIX 5.x and an older release of Oracle (8.1.7), all connected to a best-in-class third party storage system. The $6M annual price tag associated with hosting is greater than MNC wishes to spend in the future, though. Fortunately, the outsourcing contract is coming to a close in the next 12 months. Thus, the combined company has made a strategic decision to in-source its new SAP environment in an effort to provide greater flexibility to its business while hopefully cutting IT costs in the process. The current SAP R/3 database is 500GB in size and supports about 1000 users.

MNC has several options as they see it. First, they can buy new IBM AIX-supported equipment and move the database to MNC's local datacenter. In this way, they can stay on the same platform, making the technical transition fairly straightforward. Once the system is hosted in-house, the upcoming SAP technical upgrade could then be performed. Neither MNC nor the firm being acquired has IBM AIX expertise in house, but both are strong when it comes to Oracle administration and support.

Another option put forth by MNC's IT department is to buy less-expensive commodity hardware and move SAP to a new platform. MNC IT has grown comfortable with supporting Microsoft Windows and both Oracle and SQL Server over the last several years, and is anxious to apply their knowledge to SAP. Such a transition or "replatforming" to a Windows platform would cost $500K in consulting and migration services and another $2M annually in hardware, OS, and database licenses, acquisition, and ongoing maintenance costs. The technical upgrade could then be performed afterwards. While MNC Global has the skill-sets in the datacenter to host the new platform, the acquired company has very little SAP Basis knowledge and MNC has only begun to develop its own in-house SAP expertise.

Questions

1. For each hardware/OS/database platform choice outlined above, list several advantages.
2. What are the disadvantages or potential challenges for each platform?
3. In your estimation, is there a clear option or path that MNC Global should choose?
4. Is there another potentially good alternative that might need to be explored?
5. What new performance enhancing technology is available to MNC Global when the move is made to a new platform and upgrade is performed?

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