Expert Oracle Database 11*g* Administration

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CHAPTER 1

The Oracle DBA's World

There are many types of Oracle databases, and there are many types of Oracle database administrators (DBAs)—this chapter discusses the role of the Oracle DBA as well as the training that Oracle DBAs typically need to be successful. You'll look at the daily routine of a typical DBA, which will give you an idea of what to expect if you're new to the field. This chapter also covers ways you can improve your skill level as an Oracle DBA and prepare to keep the databases under your stewardship performing optimally. Toward the end of the chapter, you'll find a list of resources and organizations that will help you in your quest to become a top-notch DBA.

The Oracle DBA's Role

The main responsibility of a DBA is to make corporate data available to the end users and the decision makers of an organization. All other DBA tasks are subordinate to that single goal, and almost everything DBAs do on a day-to-day basis is aimed at meeting that single target. Without access to data, many companies and organizations would simply cease to function.

Note Imagine the chaos that would ensue if a company such as Amazon.com no longer had access to its customer database, even for a short time. The entire company could cease to function. At a minimum, it would lose perhaps thousands of online orders. As a DBA, your job is to ensure access to your organization's data. You are also responsible for protecting that data from unauthorized access—just think of the commotion caused by well-publicized security lapses at well-known consumer data–based organizations.

That's not to say that availability of data is the only thing DBAs have to worry about. DBAs are also responsible for other areas, including the following, all of which further the key goal of making data available to users:

- *Security*: Ensuring that the data and access to the data are secure
- *Backup*: Ensuring that the database can be restored in the event of either human or systems failure
- *Performance*: Ensuring that the database and its subsystems are optimized for performance
- *Design*: Ensuring that the design of the database meets the needs of the organization
- *Implementation*: Ensuring proper implementation of new database systems and applications

In a small organization, a DBA could be managing the entire information technology (IT) infrastructure, including the databases, whereas in a large organization there could be a number of DBAs, each charged with managing a particular area of the system.

You can put the tasks you'll perform as an Oracle DBA in the following three categories:

- Security
- System management
- Database design

I discuss each of these broad roles in more detail in the following sections, outlining what you could consider the bare minimum level of performance expected of a DBA. Although the lists in each section may seem long and daunting, the tasks are really not that difficult in practice if you follow certain guidelines. Proper planning and testing, as well as automating most of the routine tasks, keep the drudgery to a minimum. All you're left with to do on a daily basis are the really enjoyable things, such as performance tuning or whatever else may appeal to you.

The DBA's Security Role

As a DBA, you'll be involved in many different areas of system security, mainly focusing on the database and its data. Several potential security holes are possible when you implement a new Oracle system out of the box, and you need to know how to plug these security holes thoroughly before the databases go live in a production environment. In Chapter 12, which deals with user management, you'll find a fuller discussion of standard Oracle security guidelines and other Oracle security-related issues.

Protecting the Database

For an Oracle DBA, no task is more fundamental and critical than protecting the database itself. The Oracle DBA is the person the information departments entrust with safeguarding the organization's data, and this involves preventing unauthorized use of and access to the database. The DBA has several means to ensure the database's security, and based on the company's security guidelines, he or she needs to maintain the database security policy (and to create the policy if it doesn't already exist). A more complex issue is the authorization of users' actions within the database itself, after access has already been granted. I address this topic in depth in Chapter 12.

■ **Note** Some organizations don't have a general security policy in place. This is particularly true of smaller companies. In that case, it's usually up to the DBA to come up with the security policy and then enforce it within the database.

Creating and Managing Users

Every database has users, and it's the DBA's job to create them based on requests from the appropriate people. A DBA is expected to guide the users' use of the database and ensure the database's security by using proper authorization schemes, roles, and privileges. Of course, when users are locked out of the database because of password expiration and related issues, the DBA needs to take care of them. It's also the responsibility of the DBA to monitor the resource usage by individual users and to flag the heavy resource users.

The DBA's System Management Role

Another of the DBA's major roles is the day-to-day management of the database and its subsystems. This daily monitoring is not limited to the database itself. As a DBA, you need to be aware of how the system as a whole is performing. You need to monitor the performance of the servers that host the database and of the network that enables connections to the database. The following sections describe the various facets of the system management part of the Oracle DBA's job.

Troubleshooting

One of the Oracle DBA's main job responsibilities is troubleshooting the database to fix problems. *Troubleshooting* is a catchall term, and it can involve several of the tasks I discuss in the following sections. Two important aspects of troubleshooting are knowing how to get the right kind of help from Oracle support personnel, and how to use other Oracle resources to fix problems quickly.

Performance Tuning

Performance tuning is an omnipresent issue. It's a part of the design stage, the implementation stage, the testing stage, and the production stage of a database. In fact, performance tuning is an ongoing task that constantly requires the attention of a good Oracle DBA. Depending on the organizational setup, the DBA may need to perform database tuning, or application tuning, or both. Generally, the DBA performs the database tuning and assists in the testing and implementation stages of the application tuning performed by the application developers.

Performance requirements for a living database change constantly, and the DBA needs to continually monitor the database performance by applying the right indicators. For example, after migrating to a newer release of the Oracle database, I found that several large batch programs weren't completing within the allotted time. After much frustration, I realized that this was because some of the code was using cost-based optimizer hints that were no longer optimal under the new Oracle version. A quick revision of those hints improved the performance of the programs dramatically. The moral of the story: make sure you test all the code under the new Oracle version before you switch over to it.

You can say that all database tuning efforts can be grouped into two classes—proactive and reactive tuning. *Proactive tuning*, as the name indicates, means that the DBA heads off potential trouble by careful monitoring of necessary performance indices. As we all know, prevention is always better than any cure, so proactive tuning will always trump reactive tuning efforts. However, most Oracle DBAs in charge of production databases don't have the luxury of proactively tuning—they are too busy reacting to complaints about a slow-performing database or some similar problem. You are likely to encounter both kinds of database tuning efforts in your day-to-day life as an Oracle DBA.

Monitoring the System

Once a database is actually in production, the DBA is expected to monitor the system to ensure uninterrupted service. The tasks involved in monitoring the system include the following:

- Monitoring space in the database to ensure it is sufficient for the system
- Checking to ensure that batch jobs are finishing as expected
- Monitoring log files on a daily basis for evidence of unauthorized attempts to log in (something DBAs want to keep close tabs on)

Minimizing Downtime

Providing uninterrupted service by eliminating (or at least minimizing) downtime is an important criterion by which you can judge a DBA's performance. Of course, if the downtime is the result of a faulty disk, the company's service-level agreements (SLAs), if any, will determine how quickly the disk is replaced. DBAs may or may not have control over the maximum time for service provided in the SLAs. For their part, however, DBAs are expected to be proactive and prevent avoidable downtime (such as downtime due to a process running out of space).

Estimating Requirements

Only the DBA can estimate the operating system, disk, and memory requirements for a new project. The DBA is also responsible for coming up with growth estimates for the databases he or she is managing and the consequent increase in resource requirements. Although some of the decisions regarding physical equipment, such as the number of CPUs per machine and the type of UNIX server, may be made independently by system administrators and managers, the DBA can help during the process by providing good estimates of the database requirements.

In addition to estimating initial requirements, the DBA is responsible for planning for future growth and potential changes in the applications. This is known as *capacity planning*, and the DBA's estimates will be the basis for funding requests by department managers.

Developing Backup and Recovery Strategies

Adequate backups can prevent the catastrophic loss of an organization's vital business data. The Oracle DBA needs to come up with a proper backup strategy and test the backups for corruption. The DBA also needs to have recovery plans in place, and the best way to do this is to simulate several types of data loss. Proper testing of backup and recovery plans is sorely neglected in many companies, in spite of its critical importance for the company.

Loss of business data not only leads to immediate monetary damage in the form of lost revenue, but also costs customer goodwill in the long run. Unplanned database downtime reflects poorly on the firm's technical prowess and the competency of the management.

When disasters or technical malfunctions keep the database from functioning, the DBA can fall back on backed-up copies of the database to resume functioning at peak efficiency. The DBA is responsible for the formulation, implementation, and testing of fail-safe backup and restoration policies for the organization. In fact, no other facet of the DBA's job is as critical as the successful and speedy restoration of the company's database in an emergency. I've personally seen careers made or broken based on one backup- and recovery-related emergency; an emergency can test the true mettle of an Oracle DBA like no other job requirement can.

During those times when disaster strikes, the seasoned DBA is the one who is confident that he or she has the necessary technical skills and can remain calm in an emergency. This calmness is really the outcome of years of painstaking study and testing of the theoretical principles and the operational commands necessary to perform sensitive tasks, such as the restoration and recovery of damaged databases.

Loading Data

After the DBA has created database objects, schemas, and users, he or she needs to load the data, usually from older legacy systems or sometimes from a data warehouse. If the data loads need to be done on a periodic basis, the DBA needs to design, test, and implement the appropriate loading programs.

Overseeing Change Management

Every application goes through changes over time to improve features and fix bugs in the software. There is a constant cycle of development, testing, and implementation, and the DBA plays an important role in that cycle. *Change management* is the process of properly migrating new code, and the Oracle DBA needs to understand the process that's in place in his or her organization.

In addition to updating application code, the Oracle DBA is also responsible for ensuring that all the latest changes to the database software are also evaluated and adopted. These so-called software patches are usually made available through Oracle's MetaLink service. In fact, the latest Oracle Enterprise Manager (OEM) enables you to connect directly to MetaLink and download and apply software patches.

In Oracle Database 11*g*, you can use two new change management features, Database Replay and SQL Performance Analyzer, to find out ahead of time the impact of system changes, including a database or server upgrade, on SQL and database performance. I discuss both of these important features in Chapter 20.

The DBA's Database Design Role

Many Oracle DBAs spend at least part of their time helping design new databases. The DBA's role may include helping create entity-relationship diagrams and suggesting dependencies and candidates for primary keys. In fact, having the DBA actively involved in designing new databases will improve the performance of the databases down the road. It's a well-known fact that an improperly designed database thwarts all attempts to tune its performance.

Designing the Database

Although designing databases is probably not the first thing that comes to mind when you think of a DBA's responsibilities, design issues (whether concerning the initial design or design change) are a fundamental part of the Oracle DBA's job. Administrators who are particularly skilled in the logical design of databases can be crucial members of a team that's designing and building brand-new databases. A talented DBA can keep the design team from making poor choices during the design process.

Installing and Upgrading Software

The Oracle DBA plays an important role in evaluating the features of alternative products. The DBA is the person who installs the Oracle database server software in most organizations; the UNIX system administrator may also handle part of the installation process. Prior to actual installation, the DBA is responsible for listing all the memory and disk requirements so that the Oracle software and databases, as well as the system itself, can perform adequately. If the DBA wants the system administrator to reconfigure the UNIX kernel so it can support the Oracle installation, the DBA is responsible for providing the necessary information. Besides installing the Oracle database server software, the DBA is also called upon to install any middleware, such as the Oracle Application Server and Oracle client software on client machines.

Creating Databases

The DBA is responsible for the creation of databases. Initially he or she may create a test database and later, after satisfactory testing, move the database to a production version. The DBA plans the logical design of the database structures, such as tablespaces, and implements the design by creating the structures after the database is created. As the DBA plays a part in creating the new database, he or she needs to work with the application team closely to come up with proper estimates of the database objects, such as tables and indexes.

Creating Database Objects

An empty database doesn't do anyone a whole lot of good, so the DBA needs to create the various objects of the database, such as tables, indexes, and so on. Here, the developers and the DBA work together closely, with the developers providing the tables and indexes to be created and the DBA making sure that the objects are designed soundly. The DBA may also make suggestions and modifications to the objects to improve their performance. Through proper evaluation, the DBA can come up with alternative access methods for selecting data, which can improve performance.

■ **Note** As a DBA, you can contribute significantly to your organization by explaining the alternatives available to your application team in designing an efficient database. For example, if you explain to the application team the Oracle partitioning option, including the various partitioning schemes and strategies, the team can make smarter choices at the design stage. You can't expect the application team to know all the intricacies of many Oracle options and features.

Finally, remember that the organization will look to the DBA for many aspects of information management. The DBA may be called upon not only to assist in the design of the databases, but also to provide strategic guidance as to the right types of databases (OLTP, DSS, and so forth) and the appropriate architecture for implementing the organization's database-driven applications.

DBA Job Classifications

Given the diverse nature of business, a DBA's job description is not exactly the same in all organizations. There are several variations in the job's classification and duties across organizations. In a small firm, a single DBA might be the UNIX or Windows administrator and the network administrator as well as the Oracle DBA, with all job functions rolled into one. A large company might have a dozen or more Oracle DBAs, each in charge of a certain database or a certain set of tasks.

Sometimes you'll hear the terms "production DBA" and "development" (or "logical") DBA. *Production* DBA refers to database administrators in charge of production databases. Because a production database is already in production (meaning it is already serving the business functions), such DBAs aren't required to have design or other such developmental skills. DBAs who are involved in the preproduction design and development of databases are usually called *development* or *logical* DBAs. Ideally, you should strive to acquire the relevant skill sets for both development and production administration, but reality demands that you usually are doing more of one thing than the other at any given time. In general, large establishments usually have a number of DBAs and can afford to assign specialized tasks to their personnel. If you work for a small organization, chances are you'll be doing a little bit of everything.

Individual preference, the availability of financial and technical resources, and the necessary skill sets determine whether a DBA is doing production or development work. A DBA who comes up from the developer ranks or who's happiest coding is usually more likely to be a development or logical DBA. This same person also may not really want to carry a pager day and night and be woken up in the dead of night to perform a database recovery. On the other hand, a person who likes to do production work and to work with business analysts to understand their needs is less likely to enjoy programming in SQL or in any other language.

Although all of the preceding is true, both development and production DBAs are well advised to cross-train and learn aspects of the "other" side of Oracle database administration. Too often, people who characterize themselves as production DBAs do not do much beyond performing backups and restores and implementing the physical layout of databases. Similarly, development DBAs, due to their preference for the programming and design aspects of the job, may not be fully cognizant of the operational aspects of database management, such as storage and memory requirements.

Types of Databases

In many organizations, you will be working with different types of databases daily, and thus with different types of data and management requirements. You may find yourself working on simple SQL queries with users and simultaneously wrestling with decision-support systems for management.

Databases perform a variety of functions, but you can group all of those functions into two broad categories: online transaction processing (OLTP) and decision-support systems (DSSs; sometimes also called online analytical processing, or OLAP). Let's take a quick look at some of the basic classifications of Oracle databases.

Online Transaction Processing and Decision-Support System Databases

Online transaction processing databases are the bread and butter of most consumer- and supplier-oriented databases. This category includes order entry, billing, customer, supplier, and supply-chain databases. These databases are characterized by heavy transaction volume and a need to be online continuously, which today (given the use of the Internet to access such systems) means 24/7/365 availability, short maintenance intervals, and low tolerance for breakdowns in the system.

Decision-support systems range from small databases to large data warehouses. These are typically not 24/7 operations, and they can easily manage with regularly scheduled downtime and maintenance windows. The extremely large size of some of these data warehouses necessitates the use of special techniques both to load and to use the data.

There isn't a whole lot of difference between the administration of a DSS-oriented data warehouse and a transaction-oriented OLTP system from the DBA's perspective. The backup and recovery methodology is essentially the same, and database security and other related issues are also very similar. The big difference between the two types of databases occurs at the design and implementation stages. DSS systems usually involve a different optimization strategy for queries and different physical storage strategies. Oracle Database 11*g* provides you with the choice of implementing an OLTP database or a DSS database using the same database server software.

Performance design considerations that may work well with one type of database may be entirely inappropriate for another type of database. For example, a large number of indexes can help you query a typical data warehouse efficiently while you are getting some reports out of that database. If you have the same number of indexes on a live OLTP system with a large number of concurrent users, you may see a substantial slowing down of the database, because the many updates, inserts, and deletes on the OLTP system require more work on the part of the database.

Development, Test, and Production Databases

Applications are developed, tested, and then put into production. A firm usually has development, test, and production versions of the same database in use at any given time, although for smaller companies the test and development versions of the database may be integrated in one database.

Development databases are usually owned by the development team, which has full privileges to access and modify data and objects in those databases. The *test databases* are designed to simulate actual production databases and are used to test the functionality of code after it comes out of the development databases. No new code is usually implemented in the "real" *production databases* of the company unless it has been successfully tested in the test databases.

When a new application is developed, tested, and put into actual business use (production), the development and production cycle does not end. Application software is always being modified for two reasons: to fix bugs and to improve the functionality of the application. Although most applications go through several layers of testing before they move into production, coding errors and the pressure to meet deadlines contribute to actual errors in software, which are sometimes not caught

until the application is already in use. In addition, users continually request (or, more appropriately, *demand*) modifications in the software to improve the application's functionality. Consequently, application code does not remain static; rather, developers and testers are always working on it.

Training and Certification

Your strength as an Oracle DBA is directly related to the amount of effort you put into understanding the conceptual underpinnings of Oracle Database 11*g*. As you're assimilating the database concepts, it's vital that you implement the various techniques to see if they work as advertised and whether a particular technique is suitable for your organization.

■ **Tip** There's no substitute for hands-on playing with the database. Download the most recent Oracle Database 11*g* server software, install it, buy some good Oracle DBA books, access the Oracle manuals on Internet sites, and just start experimenting. Create your own small test databases. Destroy them, bring them back to life, but above all have fun. I had great trainers who lived and breathed databases; they made it fun to learn and always had the time to show me new techniques and correct my errors. You'll find database experts willing to share knowledge and skills freely both in the workplace and on the Internet.

In this section, I discuss the help and services that professional organizations and other resources can provide to enhance your credentials.

Training

There's no ideal background for an Oracle DBA, but it's highly desirable that one have a real interest in the hardware side of databases, and also have a decent knowledge of operating systems, UNIX and NT servers, and disk and memory issues. It also helps tremendously to have a programming or development background, because you'll be working with developers frequently. The most common operating system for the Oracle database is UNIX, with the Hewlett-Packard (HP) and Sun Microsystems (Sun) versions being the ones commonly adopted. IBM supplies the AIX variant of the UNIX operating system, but it has its own proprietary database, the DB2 Universal Database.

If you want to study to become a full-fledged Oracle Database 11*g* DBA, you need to take these two classes from Oracle or another provider:

- Oracle Database 11*g*: Administration Workshop I
- Oracle Database 11*g*: Administration Workshop II

There are three levels of Oracle certification for DBAs. You must start with the Oracle Certified Associate (OCA) certification first, followed by the Oracle Certified Professional (OCP) certification, which is the most common certification sought by Oracle professionals. The final certification level is the Oracle Certified Master (OCM) certification, which involves a lengthy practical exam over two days. All Oracle Database 11*g* DBA certification candidates are required to take one in-class or online class from an approved list of courses, in order to meet the new hands-on course requirement. If your firm uses Oracle Real Application Clusters (RAC) or distributed databases, you need to take additional, specialized courses. If your firm uses the UNIX operating system and you don't have experience using it, you may be better off taking a basic class in UNIX (or Linux) from HP, Sun, Red Hat, or another vendor. You don't need to take such a course for Oracle DBA certification purposes, but it sure will help you if you're new to the UNIX or Linux environment. Oracle itself provides several courses in Linux administration and even a certification path for managing Oracle under Linux, under the Oracle Certified Expert Program. Of course, if your databases are going to use the Windows environment, you may get away with not taking a long and formal course in managing

Windows, assuming you are relatively familiar with the Windows operating system, unless you also happen to be a Windows system administrator.

■ **Note** Remember that Oracle Corporation is not the only source of Oracle classes. Although Oracle University is a large entity with fine courses, other private vendors offer courses that are just as good or better than those that Oracle University offers. As is true of all courses, the quality of the teaching depends directly on the teacher's experience and communication skills. And remember that you really don't have to go anywhere to take a class; you can purchase self-study CD-ROMs and learn by yourself, at a fraction (one-fifth) of the cost for the instructor-led in-class training.

An even better strategy might be to subscribe to Oracle's online learning program, known as Oracle iLearning (`http://ilearning.oracle.com`). It's cheaper than buying the DVDs, and you get access to hundreds of Oracle University courses. If you're planning to take the Oracle courses, make sure you're also working on a server with an actual database. Oracle supplies very well-designed sample schemas that you can use to sharpen your SQL skills, whether your database is a development version on a UNIX server or a free downloaded Windows version of Oracle Database 11*g* Enterprise Edition on your desktop computer. You'll go further in a shorter time with this approach.

Once you get started as an Oracle Database 11*g* DBA, you will find that the real world of Oracle databases is much wider and a lot more complex than that shown to you in the various courses you attend. As each new facet of the database is revealed, you may find that you are digging more and more into the heart of the software, why it works, and sometimes why it doesn't work. It is at that point that you will learn the most about the database and the software used to manage it. If you really have read everything that Oracle and other private parties have to offer, do not worry—there are always new versions coming out, with new features and new approaches, practically guaranteeing an endless supply of interesting new information.

After the first year or two of your DBA journey, you'll know enough to competently administrate the databases and troubleshoot typical problems that occur. If you've also worked on your programming skills during this time (mainly UNIX shell scripting and PL/SQL), you should be able to write sophisticated scripts to monitor and tune your databases. At this stage, if you dig deeper, you'll find out a lot more about your database software that can enhance your knowledge and thereby your contribution to your organization.

Oracle is constantly coming up with new features that you can adopt to improve the performance of your production databases. Although the developers, testers, and administrators are also striving mightily in the organization's cause, it is you, the Oracle DBA, who will ultimately lead the way to new and efficient uses of the new features of the database.

Certification

In many IT fields, certification by approved authorities is a required credential for advancement and sometimes even for initial hiring. Oracle has had the Oracle Certification Program in effect for a number of years now. The OCP is divided into three levels: Associate, Professional, and Master (the Master level requires a lab test in addition to the other requirements). Traditionally, certification was not a big issue with most organizations, especially in the face of the severe shortages of certified DBAs in the field for many years. In today's environment, though, that certification will help tremendously in underlining your qualifications for the job.

Oracle provides DBA certification at the following levels—Oracle Database 11*g* Administrator Certified Associate, Oracle Database 11*g* Administrator Certified Professional, and Oracle Database 11*g* Administrator Certified Master (OCM). Oracle provides the following descriptions of their certification programs:

- *OCA*: The Oracle Certification Program begins with the Associate level. At this apprentice skill level, Oracle Associates have a foundation knowledge that will allow them to act as junior team members working with database administrators or application developers. The two exams you are required to take expect knowledge of basic database administration tasks and an understanding of the Oracle database architecture and how its components work and interact with one another. The OCA is also a prerequisite to becoming an OCP.
- *OCP*: The exam ensures that the OCP with the 11*g* credential can competently address critical database functions, such as manageability, performance, reliability, security, and availability using the latest Oracle technology. The OCP is a prerequisite to becoming an Oracle Certified Master.

■ **Note** New Oracle Database 11*g* OCP candidates who wish to obtain the Oracle Database 11*g* DBA OCP credential must attend one instructor-led course, either in-class or online, from the approved list of Oracle University courses.

- *OCM*: The Oracle Database 11 OCM credential is for the Oracle database guru—the senior database professional with both classroom and on-the-job experience. The prerequisites are that candidates earn an Oracle Database 11*g* OCP credential and complete advanced-level coursework. The final stage requires that candidates prove their skills through an intensive two-day hands-on practical examination.

My views on certification are really very practical. Preparing for certification will force you to learn all the little details that you've been ignoring for some reason or another, and it will clarify your thinking regarding many concepts. Also, the need to certify will compel you to learn some aspects of database administration that you either don't like for some reason or currently don't use in your organization. So if you're not already certified, by all means start on that path. You can get all the information you need by going to Oracle's certification web site at `http://www.oracle.com/education/certification`. Believe me, that certificate does look nice hanging in your cubicle, and it's a symbol of the vast amount of knowledge you've acquired in the field over time. You can rightfully take pride in obtaining OCP-certified DBA status!

SYSTEM ADMINISTRATION AND THE ORACLE DBA

There's a clear and vital connection between the Oracle DBA's functions and those of the UNIX (or Windows) administrator in your organization. Your database and the database software will be running on a physical UNIX (or Windows or Linux) server and a UNIX (or Windows or Linux) operating system. Depending on the size of your organization and your role within it, you may need anything from a basic to a thorough understanding of operating system administration. In small firms where there's no separate UNIX system administrator position, you may need to know how to configure the UNIX server itself before you actually install and manage an Oracle server and the data on it. Fortunately, this situation is very rare, and most organizations have one or more UNIX administrators in charge of managing the UNIX servers and the data storage systems. Some small entities adopt Windows as an operating system, as it isn't quite as complex to manage as the UNIX operating system.

Although the system administrators usually are very helpful, it's in your best interest to acquire as much skill in this field as you can. This will help you in more ways than you can imagine. It will help you in working effectively with the UNIX administrator, because you can both speak the same language when it comes to fancy topics such as the logical volume manager and subnet masks. More important, a good understanding of the UNIX disk structure will help you make the proper choice of disks when you design the physical layout of your database. By understanding concepts such as UNIX disk volumes and the usage of system memory, you can improve the performance of your databases and avoid bottlenecks that slow databases down. You can also write excellent monitoring scripts by being well steeped in the UNIX shell scripting and the related awk and sed programming languages.

You'll find that UNIX is a fun operating system, with interesting commands and scripting languages that can contribute to your being a highly effective Oracle DBA. One of the marks of an accomplished Oracle DBA is his or her expertise in the way the operating system works. By acquiring system administration skills, you'll become a well-rounded professional who can contribute significantly to your organization's IT needs. There are several web UNIX (and Linux) shell accounts available. Get one of these free accounts and start practicing common UNIX commands, if you think you need to practice your skills in this area.

Resources and Organizations for Oracle DBAs

As you progress in your career as an Oracle DBA, you'll need to refer to various sources for trouble-shooting information and general Oracle and database knowledge. I have a couple of recommendations for organizations you may want to make a part of your professional DBA practice:

- The Oracle Technology Network (OTN) at `http://otn.oracle.com` or `http://technet.oracle.com` is highly useful for DBAs and Oracle developers, and even better, it's free! You'll find everything from online documentation to copies of all Oracle software available freely for download on the OTN. The site offers a complete set of Oracle documentation.
- The International Oracle Users Group (IOUG), which you can find on the Web at `http://www.ioug.org/`. Membership to this organization will set you back $125 currently, an expenditure that most organizations will reimburse their DBAs for. The IOUG holds annual conventions where practitioners in the field present literally hundreds of extremely useful papers. IOUG makes these articles available to its members, and the organization also publishes a monthly magazine. In addition to the international group, there are several regional Oracle user groups, where users meet in their hometowns and discuss relevant DBA topics. For example, the group located in Dallas, Texas, is known as the Dallas Oracle Users Group (`http://www.doug.org/`). Oracle Corporation also holds an annual Oracle OpenWorld conference, where several interesting and useful papers are presented. You can find session papers from recent OpenWorld conferences by going to the Oracle OpenWorld Archives web site at `http://www.oracle.com/openworld/archive`.

There are also dozens of sites on the Web today where you can find all kinds of useful information and scripts for managing your databases, as well as help in certifying yourself as an OCP DBA. Just go to your favorite search engine, type in the relevant keywords, and you'll be amazed at the amount of help you can get online in seconds. Before the proliferation of DBA-related web sites, DBAs had to rely on printed materials or telephone conversations with experts for resolving several day-to-day issues, but that's not the case anymore.

A great way to enhance your knowledge is to maintain a network of other practicing Oracle DBAs. It's amazing how useful these contacts can be in the long run, as they provide a good way to compare notes on new releases and difficult troubleshooting issues that crop up from time to time. There's really no need to reinvent the wheel every time you encounter a problem, and chances are that most of the problems you face have already been fixed by someone else. Especially when you're starting out, your friendly Oracle DBA contacts will help you avoid disasters and get you (and your databases) out of harm's way.

You can find many excellent resources on the Internet to help you when you're stuck or when you need to learn about new features and new concepts. The Oracle DBA community has always been a very helpful and cooperative group, and you'll probably learn over time that you can resolve many troublesome issues by getting on the Internet and visiting DBA-related sites. You can find hundreds of useful scripts on the Internet, and you're invited to use them. The following is a brief list of excellent sites for Oracle DBAs. Of course, any omissions from this list are purely unintentional—my sincere apologies to any other great sites that I either don't know about yet or have just plain forgotten about. These sites just happen to be some of the ones that I visit often:

- *Hotsos* (`http://www.hotsos.com/`): The redoubtable Cary Millsap, well-known creator of the Optimal Flexible Architecture (OFA) guidelines and the main author of the best-selling Oracle performance book *Optimizing Oracle Performance* (O'Reilly, 2003), is the person behind the Hotsos site. Visit this site for sophisticated, cutting-edge discussions of performance tuning and other issues.
- *Oracle-Base* (`http://oracle-base.com/`): This site contains extremely useful and very well written Oracle DBA articles. The site provides free help for preparing for the Oracle DBA certification exams.
- *Ixora* (`http://www.ixora.com.au`): Oracle internals expert Steve Adams is the main force behind this site. Ixora offers first-rate discussions about many Oracle and UNIX performance issues, although not much new material has been put up on this web site in recent years.
- *OraPub* (`http://www.orapub.com/`): This is another top-notch site led by an ex-Oracle employee. It provides consistently high-grade white papers on key database administration topics.
- *DBAsupport.com* (`http://www.dbasupport.com/`): This is another useful site that offers many scripts and a "how-to" series of articles on a variety of topics.
- *Burleson Consulting* (`http://www.dba-oracle.com/`): Popular Oracle writer and editor Don Burleson runs this web site (and well-known author Mike Ault is a regular contributor). This site is packed with terrific articles covering a broad range of DBA topics.
- *Oracle FAQ* (`http://www.orafaq.com/`): The Oracle FAQ site, run by Frank Naude of South Africa, provides a lot of question-and-answer–type discussions of relevant topics.

There are several other sites that are useful, including dbazine.com (`http://dbazine.com/`), Mark Rittman's Oracle Weblog (`http://rittman.net/`), and Database Journal (`http://www.databasejournal.com`), whose authors, Steve Callum, Jim Czuprinski, and James Koopmann, present solid articles on various Oracle features. Also, Tom Kyte, the well-known Oracle expert, maintains an extremely popular web site at `http://asktom.oracle.com`.

Oracle by Example

Oracle Corporation has been providing a highly useful (and absolutely free) set of step-by-step implementations for many of the important features of the Oracle server software. I'm referring to the Oracle Corporation's Oracle by Example (OBE) series (`http://www.oracle.com/technology/obe/start/index.html`), which provides authoritative hands-on experience with many features of the Oracle database, including installation. I strongly recommend that you go through the OBE series carefully and save yourself quite a bit of frustration when installing and using the database software. Check it out!

Oracle Database Two-Day DBA Course

One of the most useful, if not the most useful, of the Oracle manuals for a beginning DBA is *Oracle Database 2 Day DBA* (Oracle, 2008). The *Oracle Database 2 Day DBA* book is designed to provide new DBAs with sufficient information to manage small to medium-sized databases. So, you if ever wanted an online, self-paced, complete DBA program that's free, you don't have to look any further!

Oracle By Example has a complete series dedicated to the *Oracle Database 2 Day DBA* book. You can go right from the installation of the database to performance turning using the Enterprise Manager rather than the command line as the administrative interface. The Oracle by Example series covering the course content of the *Oracle Database 2 Day DBA* manual, providing an unsurpassed introduction to DBA hands-on tasks. In fact, Oracle refers to the *Oracle Database 2 Day DBA* manual as "actionable documentation" because of its emphasis on practice rather than concepts and theory.

Oracle MetaLink

When you buy the Oracle server software and licenses from Oracle, you can choose from various levels of service support. Support that requires a quick response and round-the-clock attention costs more. Years ago, the only way to get Oracle to help you was by calling and talking to an analyst by phone. Once an analyst was assigned to your technical assistance request (TAR), you and the analyst would try to resolve the issue over the phone. If the analyst couldn't fix the problem right away, there would be a delay until the analyst found a solution to the problem.

For the last several years, Oracle has emphasized the use of a Web-based service called MetaLink to help resolve TARs from customers. The MetaLink service is of enormous importance to the working DBA, as it not only facilitates the exchange of important files and other troubleshooting information through the File Transfer Protocol (FTP), but it also provides access to the actual database of previous customer issues and the solutions provided by Oracle for similar problems. Thus, in many cases, when you are dealing with problems of a small to medium degree of complexity, you can just log onto the MetaLink web site (`http://metalink.oracle.com/`) and resolve your problem in minutes by typing in keywords or the Oracle error number.

If you have a real problem and need Oracle troubleshooters to help you out, MetaLink is the usual way to get that help. In most cases, the Oracle troubleshooters will ask you to upload several files that'll help diagnose the problem. In some cases, they may ask you to send in quite a lot of information using a tool they call the RDA (remote diagnostic assistant), which helps the professionals understand your system well. All this, of course, saves a bundle of money for Oracle, but more important from the DBA's point of view, it saves a tremendous amount of time that the DBA would otherwise have to spend resolving garden-variety troubleshooting issues.

Oracle Web Conference

Oracle Web Conference (OWC), the latest means of support from Oracle, provides for collaboration between you and Oracle Support. OWC allows the Oracle Support engineers to monitor the issues and problems within your own environment using both telephone and the Web to troubleshoot. You can download the archives of the web conference afterward.

■ **Note** You can also look into Oracle Advanced Customer Services, which focuses on providing continual operational improvement of the Oracle environment in your organization.

The Daily Routine of a Typical Oracle DBA

Many of the daily tasks DBAs perform on a database involve monitoring for problems. This can mean running monitoring scripts or using the Oracle built-in tools, such as Enterprise Manager, to keep track of what's actually happening with the database.

A good example of something you'll want to monitor closely is space in the database. If you run out of space on a disk where a database table resides, you can't insert any more new data into the table, and the transactions will fail. Of course, you can fix the problem by adding the requisite amount of space and rerunning the transaction. But if you were properly monitoring the database, you would have been alerted through a page or an e-mail that the particular table was in danger of running out of space, and you could have easily avoided the subsequent Oracle errors.

You'll normally check the reports generated by your monitoring scripts on a daily basis to make sure no problems are developing with regard to disk space, memory allocation, or disk input and output. Enterprise Manager is a handy tool for getting a quick, visual idea about various issues, such as memory allocation and other resource usage. The monitoring scripts, on the other hand, can provide

summarized information over a lengthy period of time; for example, they can provide interval-based information for an entire night.

It's also worthwhile to study the *alert log* (the log that Oracle databases maintain to capture significant information about database activity) on a regular basis to see if it's trapping any errors reported by Oracle. You may do this alert log monitoring directly, by perusing the log itself, or you could put a script in place that monitors and reports any errors soon after their occurrence in the alert log.

You will need to take some action to fix the Oracle errors reported in the alert log. Based on the nature of the error, you may change some parameters, add some space, or perform an administrative task to fix the problem. If the problem has no fix that you are aware of, you may search the MetaLink database and then open a new TAR with Oracle to get help as soon as you can.

Oracle, like every other software company, is constantly improving its software by releasing upgraded versions, which usually have newer and more sophisticated features. It's your responsibility as a DBA to be on top of these changes and to plan the appropriate time for switching over to new versions. Some of these switches might be to completely upgraded versions of software and may require changes in both the applications and the DBA's configuration parameters. Again, the right approach is to allow plenty of time for testing the new software to avoid major interruptions in serving your customers.

Some General Advice

As you progress in your journey as an Oracle DBA, you'll have many satisfying experiences as well as some very frustrating and nerve-racking moments. In the following sections, I make three important suggestions that will help you when you are going through the latter.

Know When You Need Help

Although it's always nice to figure out how to improve performance or recover an almost lost production database on your own, know when to call for help. It doesn't matter how much experience you gain, there will always be times when you're better off seeking advice and help from someone else. I've seen people lose data as well as prolong their service disruption when they didn't know what they didn't know. You can't successfully manage production databases by basing your decisions on incomplete knowledge or insufficient information.

Remember You Are Not Alone

I don't mean this in any philosophical way—I just want to remind you that as an Oracle DBA, you're but one of the people who have the responsibility for supporting the applications that run on your databases. You usually work within a group that may consist of UNIX and Windows administrators, network administrators, storage experts, and application developers. Sometimes the solution to a problem may lie in your domain, and other times it may not. You can't take all the credit for your application running well, just as you don't deserve all the blame every time database performance tanks. Today's enterprises use very sophisticated servers, storage systems, and networks, and you need the help of experts in all these areas to make your database deliver the goods. Oracle isn't always the cause of your problems—sometimes the system administrator or the network expert can fix your problems in a hurry for you.

Think Outside the Box

Good DBAs constantly seek ways to improve performance, especially when users perceive that the database response may be slow. Sometimes tinkering with your initialization parameters won't help you, no matter how long you try. You have to step back at times like this and ask yourself the following question: Am I trying to fix today's problems with yesterday's solutions? There's no guarantee that things that worked well for you once upon a time will serve you equally well now. Databases aren't static—data changes over time, users' expectations change, load factors increase with time, and so on. As a DBA, it pays not to rest on your laurels when things are going fine; rather, you should always be looking at new database features that you can take advantage of. You can't constantly increase memory or CPU in order to fix a performance problem. For example, you may have a situation where memory usage is very high, response times are slow, and the user count is going up steadily. Maybe you should rethink your architectural strategies at times like this—how about replacing the dedicated server approach with the Oracle multithreaded server? It's a big switch in terms of the way clients connect to your database, but if the new strategy has great potential, the effort will pay off big.

Primum Non Nocere

The ancient medical admonition *primum non nocere* (first, do no harm) could also serve for us DBAs, when we are confronted with a database that needs recovery or some such critical operation.

In critical situations, it's better to gather vital facts and clarify the conceptual basis of your impending changes before actually typing commands in a hurry. Your goal is to resolve the issue at hand, of course, but at a minimum, you shouldn't do any further harm! Slow down, make sure you really understand what's at stake, and then proceed further or call for additional help.