

## PART VI

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## DATABASE ADMINISTRATION AND MAINTENANCE

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## CHAPTER 14

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# OVERVIEW OF ADMINISTRATION FUNCTIONS

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### CHAPTER OBJECTIVES

- Appreciate the importance of administering the database environment
- Study the goals and objectives of administration
- Distinguish between two aspects of administration—data and database
- Learn the major responsibilities of data and database administration
- Examine skills and training needed for the administration roles
- Ascertain the administration responsibilities throughout the database development life cycle

Think of an organization with a database system. When you consider any organization supported by a database system, you cannot imagine the system functioning without the services of a database administrator (DBA). Well, who is a DBA and what kind of specialized administration does he or she perform?

A database environment brings with it a set of new technologies and new functions. Many of these are specialized functions. The DBMS (database management system) that supports a database system is sophisticated software. You need special knowledge and skills to install and operate a DBMS. Designing the data structures, organizing them, and managing storage space for them call for special training. One or more specially trained personnel must be available to administer the database environment.

We will examine the evolution of the DBA role in database systems. You will study the objectives and responsibilities of the administrative role. The administrative role, in one form or another, continues to be necessary throughout the life cycle

of a database system. You will walk through the life cycle phases and observe the administrative tasks required in each phase.

This chapter is intended as an overview of all administration functions. The chapter will highlight the various responsibilities and tasks and the significance of administration functions. In a general way, we will explore the significance of administration and establish why it is indispensable for a database system. Then we will discuss the special skills and knowledge required for those responsible for administration functions. We will look at the specific tasks necessary for administration during every phase of database development, deployment, and even after deployment.

Among these responsibilities are a few that are of crucial importance. Although this chapter introduces database administration and provides you with a broad overview, we will cover the important functions more extensively in separate chapters. Database administration extends to maintaining the integrity of the database. The data content should be correct and consistent. Chapter 15 deals exclusively with data integrity. Chapter 16 covers database security. Safeguarding the database is a prime responsibility of administration. The issues of who gets data access privileges and to what extent must be carefully managed.

The administration functions do not cease when the database project is completed and the database system is up and running. Ongoing maintenance is a vital part of administration. You will learn about ongoing maintenance in Chapter 17, which is completely devoted to that topic.

## **SIGNIFICANCE OF ADMINISTRATION**

Many organizations made the transition to database systems from their file-oriented data systems in the 1970s and 1980s. Usage of database software, laying out the files, keeping the data consistent and correct, safeguarding the data content from unauthorized users, ensuring continued availability of the data system to users—these and many other tasks in the file-oriented environment were no match for those in the by far more sophisticated database environment.

Each user group owned, managed, and controlled its own data files. The advent of database systems changed the dispersed nature of control and management. The database system, because of its ability to share data among various user groups, prompted centralized coordination. The database moved control and administration functions from local units to the center of an organization. Someone, or some role, must exercise centralized control and coordination.

In the 1970s, we see the emergence of this new role for administration of the database system. Information technology professionals had to be specially trained for this new role and were entrusted with the administration of the database environment. As database management systems became more and more sophisticated, database vendors welcomed the emergence of the specially trained administrator. They needed people with special knowledge and skills within their client organizations with whom they could communicate on a technical level.

Although in earlier database implementations, organizations realized the need for the role for administration of the database system, specialists called DBAs did not appear right away. Initially, the systems programmer and the technical support

group took on the additional responsibility of administration of the database system. The need for special training and knowledge became more and more evident. Organizations began to train technical analysts and project leaders already in database projects. These professionals were given training in the particular DBMS and allocated additional responsibilities to carry out administration functions. As DBMSs and databases moved toward greater sophistication, the need for specialists with sole administration responsibilities became evident. Now most organizations with database systems have DBAs set apart for a distinct role. In many companies, the administration functions are split between data administration and database administration. Let us explore these administration functions further and cover wider ground.

### **Essential Need for Administration**

You now have a broad idea of how the role of DBA emerged and why it is necessary in a database environment. You understand that the database environment is more complex and more sophisticated than earlier file-oriented data systems and therefore needs someone or some group, properly trained, to manage and administer it. Given the intricacies of modern DBMSs, you appreciate why special training and knowledge have become necessary to understand these software systems.

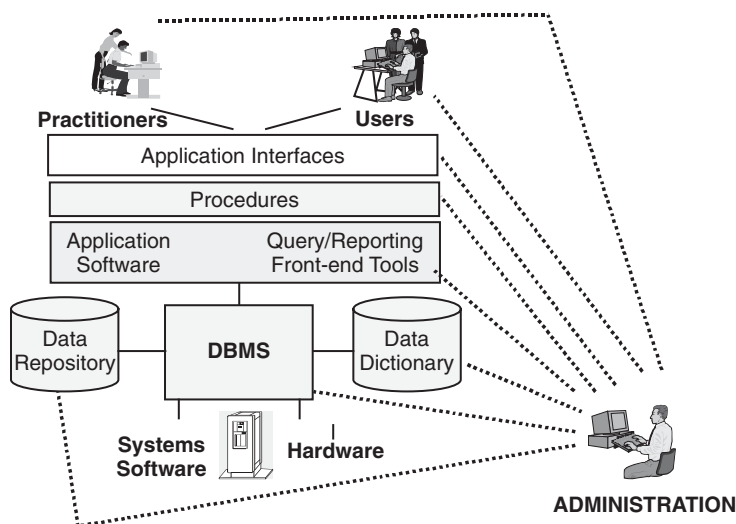
Let us get more specific and list the reasons why a specialized administration function is absolutely essential in a database environment. Reviewing these reasons will enable you to understand how the administration function continues throughout the life cycle of a database system. You will gain insight into the types of skills and training needed to strengthen data and database administration specialists for carrying out their responsibilities.

In Chapter 2, we presented the components of the database environment in Figure 2-2. We will use that figure to place the administration function in the database environment and to observe how and where an administrator fits in. Figure 14-1 illustrates the role and place of administration in the database environment. Carefully note the various components of the database environment and notice how administration fits in and interacts with these components.

Now let us move on to the list of major reasons for the essential need to have a distinct administration role in the database environment.

**Centralized Coordination** Note the change in an organization with a database system. The database system promotes information sharing; it shares information with many departments and users. Pieces of corporate data are no longer owned or administered by individual departments. The shared resource belongs to the entire enterprise; it is not the property of a single group. This radical change in responsibility and ownership calls for centralized control and administration. A centralized administration role must be established to assume this responsibility.

**Data, a Vital Asset** Every organization now considers its database system to be highly important. Just like other assets of cash, inventory, or equipment, corporate data are regarded as a significant asset for an organization. The corporate controller manages and controls the company's finances. Similarly, there ought to be a custo-



**Figure 14-1** Administration in the database environment.

dian for corporate data. This custodian must develop procedures to manage and control the data asset of an organization. A specialized group or person must assume direct responsibility for the organization's data resource.

**Protection of Data** If data is a significant corporate asset, then they must be safeguarded from unauthorized access. Authorized users must be given the necessary access privileges to the applicable data elements. Only authorized users must be permitted to access the database. The organization must establish a clear and reliable security policy. The policy must be carefully reviewed and put into practice. In a large establishment, this is an extensive responsibility. Such a responsibility can be entrusted only to people with knowledge of the data needs of every user group in the organization.

**Uniform Standards** Consider the definitions and naming of data elements in an organization with a database system. Assume that there is a data element called *account* in a bank's database. Now this data element, being part of the database, is shared and used by the bank's staff in the various departments. What does the data element *account* mean? Does it refer to savings accounts, checking accounts, or loan accounts? Does it denote the balance amount in the account? If so, how large is the account field?

Because the data elements in a database are shared among various departments, it becomes all the more necessary to standardize data names, data definitions, and data types. You need someone responsible for instituting corporate-wide standards.

**Sophisticated DBMSs** The sophistication of commercial DBMSs continues to increase as the organization's database expands to serve new information needs. DBMS enables an organization to set up the database, to define the structures, to incorporate constraints and rules, to grant access privileges to authorized users, to

back up the data content, to safeguard the data from concurrent updates, and so on. Now, with the Internet, data warehousing, and analytical processing, the scope and usage of database systems have expanded tremendously.

How can organizations make use of the remarkable power and range of today's DBMSs? Only by having a group or an individual fully trained in particular DBMSs. The DBA in an organization must have expertise in the particular commercial DBMS that manages its database system.

**Data Integrity** A database is only as good as the integrity and correctness of the data it contains. If the data are incorrect or inconsistent, then the worth of the database is greatly diminished. For example, if the database in a large medical center shows the room numbers of the inpatients and if you do not find the patients in the room numbers shown by the database system, then the database is worthless as far as patient locations are concerned.

Data integrity in a database may be compromised in a number of ways. If proper edits are not instituted, incorrect data creep in. In a relational database, if entity integrity and referential integrity are not enforced, data may get out of line. When concurrent transactions attempt to update the same data elements simultaneously, without proper concurrency controls, the data elements may be left with incorrect values.

The administration role in a database environment has the serious responsibility of preserving data integrity. The administrator must accomplish this through proper edits, constraints, and concurrency controls. He or she needs special training and knowledge in data integrity methods.

**Data Availability** Modern enterprises depend on the information contained in their operational databases to run their day-to-day businesses. Profitability, competitive edge, and even the very survival of many businesses rest heavily on the strength of their database systems. Organizations need their database systems to be up and available all the time. 24/7 operation is especially critical for global organizations with user locations spread out worldwide.

Can you imagine an airline reservation system down even for a few minutes? What about the databases in banks and financial institutions? Can these be down for even short durations? Think of the databases supporting defense applications and government departments. Continuous availability of the corporate database is a critical requirement. Apart from scheduled downtime for maintenance, an organization's database must always be available to users in today's business environment.

What can go wrong, and why would database systems become unavailable? Many types of hardware and software malfunctions can interrupt availability. The organization has to recover quickly from such disruptions and make the database accessible again. We will consider database recovery in greater detail in Chapter 15. Right now, realize that recognizing malfunctions and taking suitable actions to recover the database are intricate functions. An organization needs specially trained professionals to perform such complicated functions.

**Resource Management** Many types of hardware and software resources work together to make the database system of an organization functional. You need

proper hardware infrastructure with powerful database servers. A robust operating system that can support parallel processing of data access requests must be present. Disk storage based on RAID technology has become the norm for storage of today's databases. Most companies also need data communications hardware and software for the database to be in operation. In addition, middleware to support remote operations is also in order for the database environment.

The DBMS works with the operating systems and the communication systems. Specialists in database products need to work with systems programmers and technical support groups to manage the various resources in the database environment. You can therefore see the need for people specialized in resource management to carry out the necessary functions.

***Tuning for Efficiency*** Typically when a new database system is installed in an organization, usage of the database steadily expands. Usage patterns themselves change. New users come on board. More sophisticated applications are added. Over time, the efficiency of the database begins to slide and data access times start to rise. Transaction response times are crucial in most environments.

What must be done when the database slows down and the response becomes sluggish? The symptoms must be analyzed, the changes in the usage patterns must be reviewed, and the usage of resources must be examined. It is likely that new indexes are necessary and that some existing indexes may have to be dropped. The process of fine-tuning is a complex analytical task, and an organization needs specialists to perform this task.

## **Administration Objectives**

From the previous subsection you are now convinced that someone or some group, specially trained, must be responsible for the administration of the database environment in an organization. You have seen several reasons for this essential need. What are the major objectives of the administration function? What is this function intended to accomplish in the database environment?

Let us summarize the main goals and objectives:

***Enterprise information requirements.*** Analyze business needs and determine the information requirements to plan and conduct the organization's business.

***Data integration.*** Consolidate information requirements and define standards.

***Information framework.*** Plan for the database system; determine hardware and system software upgrades; select DBMS.

***Physical implementation.*** Assist in the logical design; perform physical design; implement and deploy database system.

***Data quality.*** Ensure correctness, validity, and consistency of the database system.

***Data security.*** Enable data access to authorized users; protect database system from unauthorized use.

**Data availability.** Ensure that data is available to users from the database system—whenever data are required, whatever data are required, and however data are required.

**Data system performance.** Ensure continued acceptable performance levels of the database system.

Examine the major goals listed. Think of the types of skills and training needed to perform the administration function. As you scrutinize the activities and tasks required to accomplish the goals and objectives, you will conclude that persons performing the administration function must have both managerial and technical skills.

For example, the tasks for determining enterprise information requirements involve a lot of coordination and organization. The tasks for establishing the information framework require more planning and coordination than working with highly technical details.

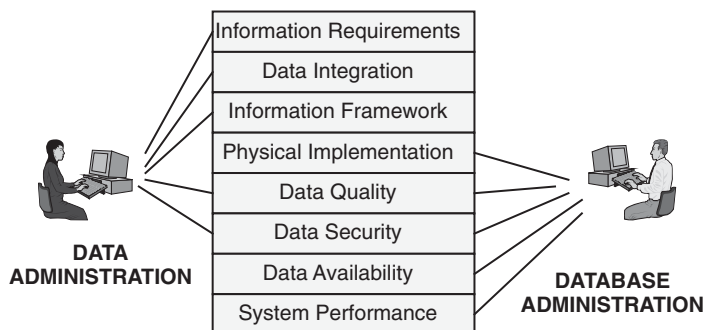
On the other hand, the tasks for physical implementation and ensuring system performance suggest more technical details than planning and coordination. Ensuring that the database system is quickly recovered from malfunctions and made available to users within a short time also involves more technical skills than managerial acumen.

Consider the goal of data security. Who gets authorized, for what purposes, and to access which data items—these are matters of planning and organization. But how to set up the authorization is more technical than managerial in nature.

On the basis of these considerations, many organizations realize that administration of a database system is not for a single group but needs two groups of specialists. So they are dividing up the administration function between two groups of professionals. One group, adopting the more managerial aspects, has come to be known as the data administration group; the other, taking on the more technical responsibilities, is known as the database administration group.

Figure 14-2 illustrates the division of responsibilities between data administration and database administration.

Although the bifurcation of responsibilities between data administration and database administration is gaining ground, not all organizations with databases have clear-cut divisions. Nor do most organizations have two distinct groups handling data administration and database administration tasks. Many small to medium-sized



**Figure 14-2** Data administration and database administration.



companies have only database administrators, who perform most of the data administration functions as well. Analysts and project leaders pitch in and perform any remaining data administration functions.

In the following subsections, we will explore the nature of data administration and database administration functions. For the rest of this chapter, even though we discuss these two functions separately, remember that in many organizations you will only find DBAs and no group designated as data administrators (DAs). Although in these organizations the functions are combined as the responsibility of DBAs, for the purpose of our discussions, it is worthwhile to consider the functions separately. In this way, our discussions will be complete.

### **Data Administration**

As already mentioned, data administration is more of a managerial function to manage and control the database environment. The DA practices all the key elements of management in his or her involvement in the database environment—planning, coordination, execution, control, and communication. The DA is generally responsible for policies and procedures. The DA is like a custodian of corporate data resource. He or she is intimately involved in planning the various aspects of the database environment.

In some large enterprises, a group of professionals form the data administration group. The group—not a single individual—assumes the data administration role. Nevertheless, whether a single individual or a group has the responsibility for data administration, the role is still the same and the same tasks are performed.

Here is a typical list of functions of data administration:

- Establish corporate-wide data requirements.
- Ascertain future requirements.
- Communicate with users on data ownership and data control policies.
- Set up centralized control over the data resource.
- Play a leading role in planning for the database system—what data to collect, how to store data, and how to promote data usage.
- Plan for hardware and system software upgrades to support the new database system.
- Organize education for users on database technology and its great advantages.
- Establish realistic expectations and set guidelines to measure user satisfaction.
- Standardize data names, data types, and definitions for universal use.
- Establish standards and procedures for data integrity.
- Institute data security policy.
- Constantly communicate with IT management, corporate management, user departments, the DBA, and other IT professionals on plans, policies, and procedures.

### **Database Administration**

The database administration role comprises a different set of responsibilities. Although the DBA participates in database planning, coordination and planning

are not primary responsibilities. The DBA gets the technical work done. The DBA's role of getting down to technical details is evident throughout the development and implementation of the database system.

Typical functions for the database administration role are as follows:

- Participate in the selection of the DBMS.
- Define requirements for hardware and system software upgrades to accommodate the new database.
- Work with the DA on data standards to conform to the provisions in the target DBMS.
- Perform physical design of the database system.
- Liaise with the database vendor and install the DBMS.
- Set up data dictionary entries in coordination with the DA.
- Create user accounts and maintain data access authorizations.
- Manage database backup and recovery.
- Monitor and tune database performance.
- Coordinate with the database vendor and plan for upgrades.
- Provide DBMS-specific information to analysts and database designers.

## **SKILLS AND RESPONSIBILITIES**

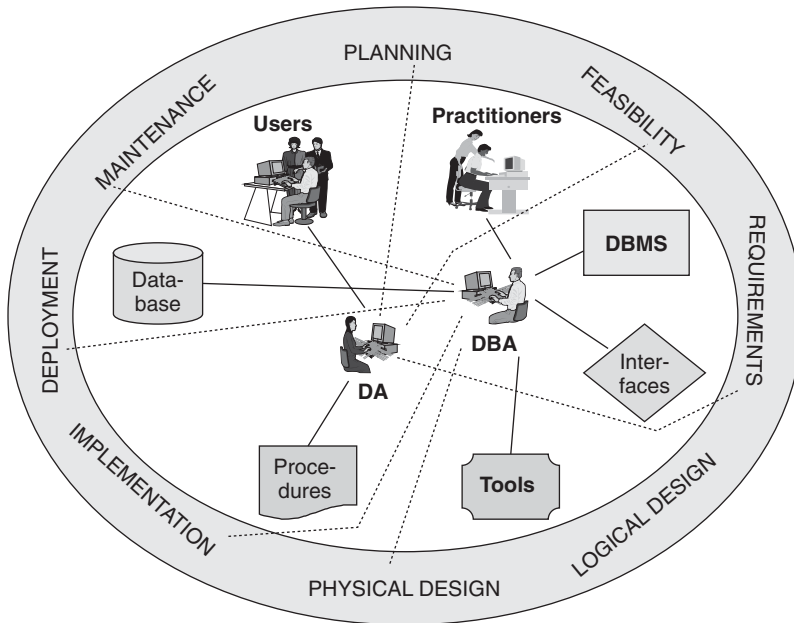
You have grasped the significance of the administration functions in a database environment. You have understood why these functions are absolutely essential not only to initiate a database system but also to keep it going in an organization. We reviewed the broad objectives of administration. You have also learned the essential difference between data administration and database administration. Because of the enormous importance of administration functions in a database environment, let us focus on these from slightly different perspectives.

You have noted the need for a DA and also for a DBA. How are they different, and why do you need both roles? What specific roles do these two types of administrators assume in a database environment? What major responsibilities do the DA and DBA fulfill?

By now you must assume that, given the significance and specialty of data administration and database administration functions, the DA and DBA have to be given specialized training and must acquire extraordinary skills. It is true that these professionals must possess specialized knowledge and have expertise in management and technical areas. We will elaborate on these as we proceed.

### **Administrative Roles**

As you must have understood by now, the administrative roles assumed by the DA are more pronounced in the earlier stages of the database development life cycle. The early phases need a corporate-wide view of the organization's data, more intense planning, and coordination among the various departments who intend to be benefited by the database. On the other hand, the administrative roles of the



**Figure 14-3** Administrative roles.

DBA begin their effect in later phases of the database development life cycle. Only in the later stages do you tend to get more and more technical.

Figure 14-3 depicts the administrative roles of the DA and those of the DBA.

Note the phases of the life cycle shown in the periphery of the figure. Also, observe the major components of a database environment. See how the administrative roles prove to be useful in the various phases and note how the DA and DBA play out these significant roles. It is important to observe how the DA and the DBA must work together in a highly cooperative manner.

Especially note the illustration of the following specific roles in the figure.

**Data administrator.** Planner, analyst, organizer, coordinator, communicator, liaison with users, controller.

**Database administrator.** Designer, technical expert, technical advisor, tester, security expert, database tuner.

### Areas of Responsibility

Let us now look at the DA and DBA from another angle. Consider the major areas of responsibilities. Who is primarily responsible for specific activities and areas? How are the two functions meshed together for effective design and development of the database system?

We list here the areas of responsibilities without tying them to particular phases of the database development life cycle. In a later section, we will enumerate the tasks of the DA and DBA in the development phases, one by one. At this point, let

us consider answers to broader questions. What are the responsibilities of the DA? What responsibilities fall under the DBA's jurisdiction? We will consider how the DA and DBA share the responsibilities for achieving the major goals of administration. For these major goals, let us demarcate the areas of responsibility.

### **Data Administrator**

*Information requirements.* Coordinate requirements gathering activities. Liaise with user departments to analyze business needs and determine the information requirements, current and future. Develop an enterprise-wide overall data model. Determine information types and content to be included in the database system.

*Data integration and design.* Identify and reduce data redundancy among various departments. Define data names, types, and formats; establish standards. Approve all modifications to data characteristics. Coordinate preparation for data dictionary entries. Estimate current and future data volumes. Review logical design and ensure that all requirements are included.

*Information framework.* Plan for database environment. Review feasibility studies. Coordinate determination of hardware and system software upgrades. Coordinate selection of any productivity software for administration, data definitions, data design, and performance monitoring. Participate in selection of DBMS.

*Physical implementation.* No direct responsibility for physical design or DBMS installation. Ensure that all of the original information requirements are included in the final database system. Oversee verification of file conversions for initial population of database. Coordinate user training.

*Data quality.* Establish data quality standards. Coordinate with users on quality assurance practices. Define data ownership and responsibilities of user departments. Determine edits and constraints to be included in database system.

*Data security.* Establish security policy and procedures. Ensure that legal security and privacy requirements are satisfied.

*Data availability.* Liaise with users on usage and requirements for database availability; work out details of scheduled database maintenance with users and get their cooperation.

*Data system performance.* Establish database performance levels based on user expectations.

### **Database Administrator**

*Information requirements.* No direct responsibility. Provide file layouts and data definitions from current data systems to DA and other interested professionals on the project team.

*Data integration and design.* No direct responsibility. Provide advice on possible data types and formats.

*Information framework.* Evaluate different DBMSs and participate in the final selection. Determine hardware and system software upgrades for the proposed database system; examine compatibility with selected DBMS. Evaluate productivity software from a technical viewpoint.

*Physical implementation.* Perform physical database design. Prepare disk storage and allocate space for database components. Install DBMS. Complete data dictionary entries in cooperation with DA. Load data from file conversions for initial population of database. Assist other IT professionals in project team in testing and verification of loaded data. Assist in user training.

*Data quality.* Incorporate edits and constraints through the facilities of the selected DBMS. Add all the necessary entity integrity and referential integrity constraints. Include proper controls such as locking mechanisms to eliminate problems from concurrent database updates.

*Data security.* Grant and revoke data access privileges to authorized users on the basis of established security policy. Monitor database access to detect unauthorized access.

*Data availability.* Back up database at regular intervals. Establish and test database recovery through the use of log files. Follow recommended maintenance schedule.

*Database system performance.* Monitor disk space usage and allocate additional space as and when necessary. Continuously monitor database usage; create or drop indexes according to changing access patterns. Perform DBMS upgrades. Recommend hardware and system software upgrades based on increased usage.

## **Skills, Knowledge, and Experience**

Having examined the roles and responsibilities of the DA and the DBA in a number of ways and from different perspectives, you must now have a reasonable idea of the types of skills and expertise required to perform these administration functions. Once again, be guided by the general focus of each function. The DA is more of a managerial type than a technician; the DBA is more of a technical expert than an overall manager. That does not, however, imply that the DA is devoid of any technical knowledge or that the DBA has no managerial tasks at all.

Let us summarize the types of skills, knowledge, and experience needed for the two administration functions.

**Data Administrator** Must be able to see the big picture and perceive the overall information requirements. Must have strong appreciation of the significance of information as a corporate asset. Should be able to communicate effectively with all levels of users and information technology professionals. Must possess good

people skills and be respected in the user community. Must have the ability to prepare short-term and long-term plans. Should be able to think through issues and establish policies and procedures for areas such as database usage, data ownership, data quality, and data security. Must be user-oriented rather than technology-oriented. Prior experience in managing application projects in a database environment could form a good foundation.

**Database Administrator** Must possess expertise in physical design of database systems. Expected to have prior experience as a DBA in a similar organization. Should possess thorough knowledge of database implementation and deployment. Must have intimate knowledge of the selected DBMS. Knowledge and background in systems programming and technical support are very helpful. Must have acute problem-solving and trouble-shooting skills. Should have the ability to share technical knowledge about database systems and the particular DBMS with other information technology professionals on the project team—required to be a good team player. Must be knowledgeable in issues of concurrency control and database recovery. Should be flexible and dedicated to work and resolve problems in emergency situations at odd hours.

### Interaction with Users and Practitioners

In the next sections, we will walk through the phases of the database development life cycle and summarize the tasks and responsibilities of the DA and DBA. This will provide a good conclusion to the discussion of the important topic of administration of the database environment.

Before proceeding to summarize the tasks and responsibilities, let us pause to observe the interaction of the DA and DBA with users and database practitioners. These administrators must interact with other people in a number of ways to carry out their responsibilities. Figure 14-4 highlights their interaction with users and information technology professionals. Note how the figure shows the various users at different levels and technology professionals by their job functions. Also, observe how the figure indicates the interaction with each group of people.

## DURING DEVELOPMENT

We will now summarize the tasks and responsibilities of the DA and DBA in each of the phases of the development and implementation of the database system. Chapter 4 covered the various phases of the database development life cycle. Please go back to that chapter and quickly review the activities and tasks in every phase.

We will list the tasks in each phase in which the DA and DBA assume key roles. First, consider their participation in each phase. Figure 14-5 provides a broad indication of their participation.

In each of the following sections, we have listed the significant tasks in which the DA and DBA assume substantial responsibilities. Against each task, the function that plays a significant role is indicated. Note each task and also who is more involved in that task.

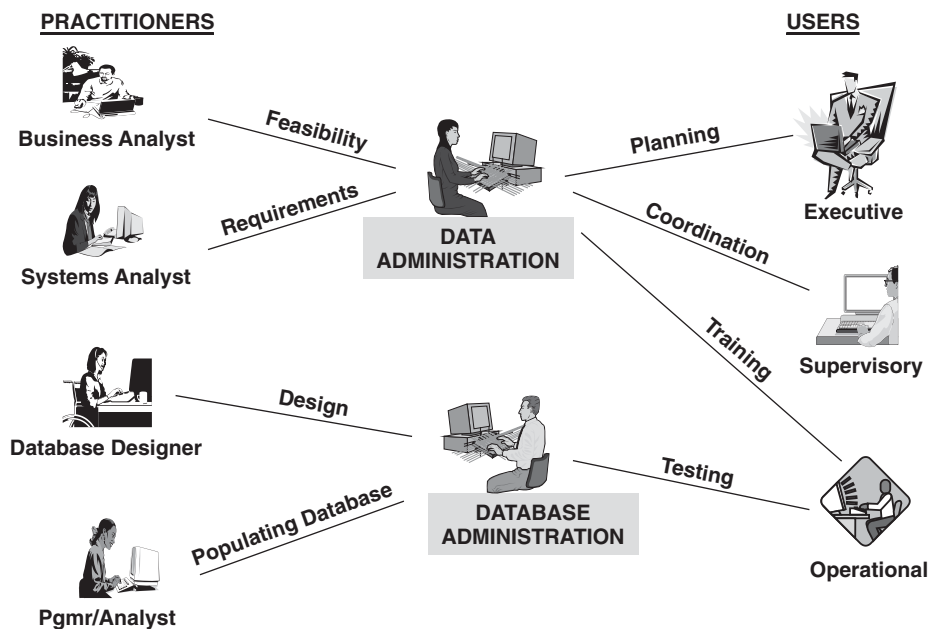


Figure 14-4 Interaction with users and practitioners.

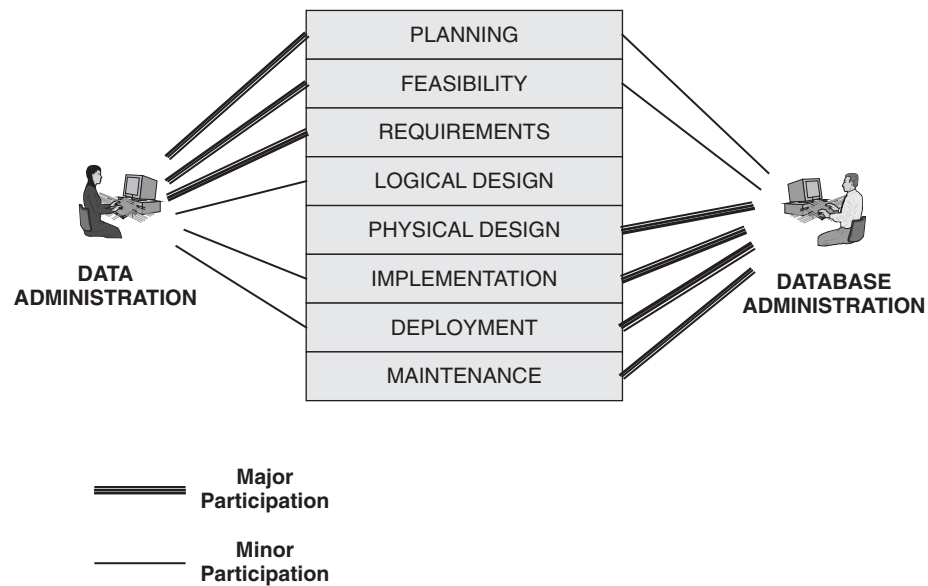


Figure 14-5 DDL phases: participation by DA and DBA.

### Planning and Feasibility Study

In these phases, the DA assumes a significant role. These phases set the tone for the entire project, and, therefore, as custodian of the organization's data, the DA is there to ensure that none of the overall data concerns are overlooked.

The DBA may sit in on the planning meetings as a technical advisor, but it is too early to define the needed DBMS features. In the feasibility study phase, the DBA assists in determining upgrades to the current infrastructure and calculation of costs.

<b>DA</b>	Understand business goals and objectives.
<b>DA</b>	Interpret organization's business plan for information requirements.
<b>DA</b>	Assess business opportunities and risks.
<b>DA</b>	Classify user groups for determination of data needs.
<b>DA</b>	Gauge user expectations.
<b>DA</b>	Determine data ownership issues.
<b>DA</b>	Develop enterprise information strategy and overall database environment.
<b>DA/DBA</b>	Make preliminary estimate of data volumes.
<b>DBA</b>	Assess the readiness of technological infrastructure and estimate costs for upgrade.
<b>DA/DBA</b>	Do preliminary skills review and estimate costs for training and additional personnel.
<b>DBA</b>	Establish criteria for DBMS selection.
<b>DA</b>	Match benefits against costs and prepare justification for database system.

### Requirements Definition

The DA takes more active responsibilities in the requirements definition phase. The DBA's role in this phase is to be available as a technical advisor and database expert.

<b>DA</b>	Provide insight into overall business operations to analysts.
<b>DA</b>	Consolidate and integrate information requirements.
<b>DA</b>	Establish clear data definitions.
<b>DA</b>	Express business rules.
<b>DA</b>	Establish constraints and rules to validate data.
<b>DA/DBA</b>	Prepare data dictionary entries for data elements.
<b>DA</b>	Ascertain data usage patterns and access frequencies.
<b>DA</b>	Prepare list of users to be authorized and their data access requirements.
<b>DA</b>	Liaise with users to provide operational documents to analysts.
<b>DBA</b>	Provide layouts of current data files for analysts.
<b>DA/DBA</b>	Determine file conversions to switch over to new database system.
<b>DBA</b>	Estimate hardware storage space requirements.

### Logical Design

The data modelers and database designers are active in this phase. They perform almost all the tasks of modeling and logical design. The DA assumes the role of a



facilitator and establishes liaison with user groups. The DBA continues in the role of technical advisor to the project team on database concepts. Although not related to logical design, normally during this time frame, the DA and the DBA participate in finalizing the selection of the DBMS.

<b>DA</b>	Interpret and review data models with users.
<b>DA</b>	Ensure that logical data model is complete in terms of entities and relationships.
<b>DA</b>	Ensure that logical data model conforms to information requirements.
<b>DA</b>	Relate logical data model to individual user groups and establish user views.
<b>DBA</b>	Provide technical advice to data modelers and designers.
<b>DBA</b>	Install and maintain CASE tools needed for data modeling and design.
<b>DBA/DA</b>	Complete selection of DBMS.

### Physical Design

The DBA is almost exclusively responsible for this phase. Here and there, the DA is available to answer questions or clarify any user requirements. While listing the tasks for physical design, implementation, and deployment, we have assumed the implementation of a relational database system. However, the tasks for any other type of conventional database system will be similar to these.

<b>DBA</b>	Transform logical design into physical design.
<b>DBA</b>	Determine file organization for various tables.
<b>DBA</b>	Determine indexes and clustering of tables.
<b>DBA</b>	Map physical storage to files and set data blocks.
<b>DBA</b>	Establish storage management parameters.
<b>DBA</b>	Review user views.
<b>DBA</b>	Review entity and referential integrity constraints.
<b>DBA</b>	Review data edits and business rules to be implemented through DBMS.
<b>DBA/DA</b>	Review and complete list for data dictionary entries.

### Implementation and Deployment

All the database project members participate in final implementation and deployment. This is the culmination of all of the effort, and everyone has a stake in the success. Nevertheless, the DBA plays a key role in implementation and deployment. He or she is responsible for bringing the whole effort to a successful conclusion, and the significance of this role cannot be overemphasized. Review the following list and you will grasp the importance of the role.

<b>DBA</b>	Install selected DBMS.
<b>DBA</b>	Install application interfaces.
<b>DBA</b>	Define files for various tables.
<b>DBA</b>	Define indexes and clustering of tables.
<b>DBA</b>	Allocate physical storage to files and set data blocks.
<b>DBA</b>	Define storage management parameters.
<b>DBA/DA</b>	Define user views.
<b>DBA</b>	Define entity and referential integrity constraints.
<b>DBA</b>	Define data edits and business rules in data dictionary.
<b>DBA/DA</b>	Complete data dictionary entries for all definitions.
<b>DBA/DA</b>	Grant user privileges.
<b>DBA/DA</b>	Test backup and recovery.
<b>DBA</b>	Set concurrency control criteria.
<b>DBA/DA</b>	Complete final testing.
<b>DBA/DA</b>	Complete data conversions.
<b>DBA</b>	Perform initial data loads.
<b>DBA/DA</b>	Complete initial user training.
<b>DBA/DA</b>	Initiate initial user support.

## AFTER DEPLOYMENT

Administration tasks do not end with the deployment of the initial version of the database system. They continue in several ways. The DBA continues to have many responsibilities. He or she has to keep the database up and running with optimum efficiency. In the postdeployment phase, the DA mostly gets involved when new data requirements emerge or when the service levels decrease.

In each of the following sections, we have listed the significant tasks and indicated the involvement of the DBA and DA.

### Ongoing Functions

The DBA continues to perform many maintenance functions on an ongoing basis. These are mainly routine maintenance functions, and the DA is rarely involved in these activities.

<b>DBA</b>	Monitor database usage by gathering statistics.
<b>DBA</b>	Monitor usage by various user groups.
<b>DBA</b>	Police and detect unauthorized database access.
<b>DBA</b>	Watch space utilization and expand disk extents as data volume increases.
<b>DBA</b>	Organize and ensure periodic backups.
<b>DBA</b>	Create and maintain recovery log files.

- DBA** Conduct periodic database recovery tests.
- DBA** Reorganize files as and when necessary.
- DBA** Schedule regular database maintenance.
- DBA** Assist analysts and programmers in resolving database-related application problems.
- DBA** As necessary, import external data into the database system or export data from the database.
- DBA/DA** Grant and revoke access privileges as conditions change.

### Maintenance of Service Levels

In a database environment, as the number of users increases and the patterns of data usage change, service levels tend to deteriorate. The database system becomes sluggish, and database transactions are apt to slow down. The DBA has the prime responsibility of maintaining and improving service levels.

- DBA** Gather statistics to monitor database performance.
- DBA** Add indexes and drop indexes based on changes in usage patterns.
- DBA** Perform other performance improvement techniques as necessary.
- DBA** Revise memory buffering as necessary.
- DBA** Verify concurrency control procedures and revise when needed.
- DBA** Work with application programmers to tune database access routines in application programs.
- DBA** Recommend and install productivity and efficiency software tools.

### Enhancements to Database System

This is a common feature of every database environment. Vendors continue to fix problems in the current version of the DBMS and also produce new versions with sustained regularity. The DBA interacts with the database vendor and assumes a primary role in enhancing the database system.

- DBA** Apply software patches and enhancements to existing DBMS version received from vendor.
- DBA** Install version upgrades to DBMS.
- DBA** Organize testing of DBMS version upgrades.
- DA** Liaise with users to test enhancements to database system.
- DBA** Recommend and test infrastructure upgrades and enhancements to storage system.

### Growth and Change

After deployment, the database grows in a few different ways. The data volume continues to increase as rows are added to the database tables. As business conditions change additional database tables become necessary. Even in existing tables, the

need arises to add more columns. Growth and change are basic realities in a database environment. The administration functions need to manage growth and change in the database environment. Both the DA and the DBA share responsibilities in managing growth and change.

<b>DA</b>	Review changes to business conditions and plan for growth.
<b>DA</b>	Institute change management procedures for routine enhancements to existing tables and indexes.
<b>DBA</b>	Make changes to existing tables according to change management procedures.
<b>DA/DBA</b>	Develop procedures to archive old data and set up the archival system.
<b>DBA</b>	Use data compression techniques to conserve disk storage space and data communication costs in a distributed database environment.
<b>DBA</b>	Benchmark and recommend infrastructure upgrades.
<b>DBA</b>	Examine and recommend newer technologies such as parallel processing or RAID for data storage.
<b>DBA</b>	Coordinate with technical support group to evaluate processor capacity at regular intervals.

## CHAPTER SUMMARY

- With the transition to more sophisticated database systems beginning in the 1970s, new roles for administration emerged.
- In a database environment, administration has become essential to have centralized coordination, protect the vital asset of data, adopt enterprise-wide uniform standards, understand and make use of sophisticated DBMSs, and make quality data available whenever, wherever, and however necessary.
- Administration in a database environment tends to be both managerial and technical—data administration is more managerial and database administration is more technical.
- The data administrator, as custodian of corporate data, is involved in planning, setting standards, coordinating and communicating with users, and establishing policies and procedures.
- The database administrator, as technical expert, implements and deploys the database system by providing data integrity, data security, and continued maintenance.
- Skills, training, and experience of the data administrator: ability to perceive the big picture, knowledge in methods for planning and coordination, capacity to communicate effectively, a user orientation rather than a technical one, and prior experience in managing application projects in a database environment.
- Skills, training, and experience of the database administrator: expertise in physical database design, deep knowledge of the selected DBMS, qualities of a team player, acute problem-solving and trouble-shooting skills, flexibility in being available, and prior experience or training as a database administrator.

- The data administrator assumes a major role in the earlier phases of the database development life cycle such as planning, feasibility study, and requirements definition.
- The database administrator assumes primary responsibilities in physical design, implementation, deployment of the database system, and ongoing maintenance.

## REVIEW QUESTIONS

1. Give any four reasons why data administration and database administration are essential in a database environment.
2. Why is data a vital asset to an organization? How do the administrators protect this vital asset?
3. “The sophistication of modern DBMSs makes the DBA role essential.” Explain.
4. Describe how the roles of the data administrator and database administrator are different.
5. List any five typical functions of data administration.
6. Name any five typical functions of database administration.
7. List four types each of skills needed by the data administrator and the database administrator.
8. List any four important functions of the data administrator in database planning and requirements definition phases.
9. Name any four significant functions of the database administrator in physical design and implementation phases.
10. List the major tasks of the data administrator and the database administrator after deployment of the database system.

## EXERCISES

1. Indicate whether true or false:
  - A. Every database environment must have both DA and DBA.
  - B. DA is responsible for uniform standards.
  - C. For data protection, DBA establishes policies and DA executes them.
  - D. Sophistication of the DBMS needs specially trained DBAs.
  - E. DA is responsible for managing physical resources such as disk storage.
  - F. DBA liaises with database vendor.
  - G. DA plays an important role in database planning.
  - H. DBA interprets and reviews logical data models with users.
  - I. DBA is responsible for backup and recovery of the database.
  - J. DA has absolutely no responsibilities after database deployment.

2. You are the project manager of a database project. Draft a note to the CIO of your organization listing the skills, knowledge, and experience to be considered in hiring a data administrator.
3. Describe the qualifications for a DBA position in a large manufacturing company. Indicate which qualifications are absolutely necessary, desirable, or good to have.
4. As a DBA in a medical center, briefly describe your major functions during development and after deployment of the database system.
5. “DA and DBA functions are not that different; they need not be separate in a database environment.” Do you agree or disagree? Support your assertion with reasons.