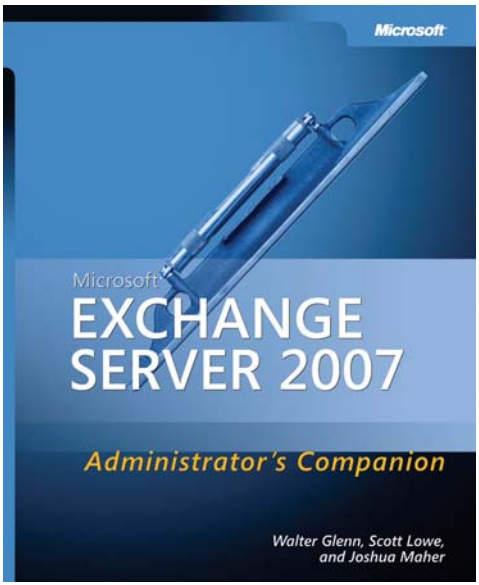

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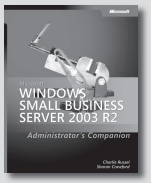

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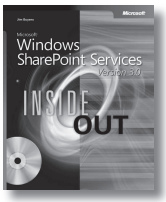

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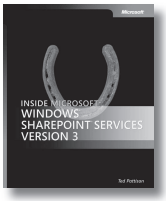

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Chapter 2

Active Directory for Exchange Administrators

In the Chapter 1, "Overview of Microsoft Exchange Server 2007," you learned about some of the basic components of an Exchange organization. This chapter builds on that knowledge by describing how Exchange Server 2007 integrates with Microsoft Windows Server 2003 and how it uses the services in Windows Server 2003 to its advantage. It begins with a brief overview of the Windows Server 2003 Active Directory service and finishes by describing how Exchange Server 2007 uses Active Directory and discussing some of the more important Internet information protocols.

Brief Overview of Active Directory

A full explanation of Active Directory is outside the scope of this book, but a brief overview is warranted. Because Exchange Server 2007 is heavily dependent on the underlying network operating system, it is important to have a basic understanding of Windows Server 2003 Active Directory.

More Info For a more thorough discussion of Active Directory and the other concepts discussed in this chapter, see *Microsoft Windows Server 2003 Administrator's Companion*, Second Edition, by Charlie Russel, Sharon Crawford, and Jason Gerend (Microsoft Press, 2006).

Directory Structure in Active Directory

Before beginning the discussion on what Active Directory is, you should first understand what a directory is. As an analogy, think of a generic file system. Perhaps in this file system, you have a C drive, and on that drive, you have a root folder named Memos. Under C:\Memos, you have a folder for each of the 12 months of the year, so you would find a folder in the structure named July. Under C:\Memos\July, you have a folder named Departments; the full pathname to Departments is C:\Memos\July\Departments. This is a hierarchy of folders in a file system.

A directory is no different from a folder list, except that the hierarchy consists not of folders but of objects. An *object* is an entity that is described by a distinct, named set of attributes. Instead of using Windows Explorer to search through this hierarchy of objects, you'll be using a protocol designed to search a directory, called the *Lightweight Directory Access Protocol* (LDAP).

Note The original protocol for accessing a directory was called Directory Access Protocol (DAP), but it had a high overhead and tended to be slow. *Lightweight Directory Access Protocol* (LDAP) is an improved version that is faster and requires less overhead.

With Active Directory, Microsoft has made significant improvements to the directory concept, such as dynamic DNS. The "Active" in Active Directory describes the flexibility and extensibility that have been built into Microsoft's directory service.

Logical Structure of Active Directory

The components that form the logical structure of Active Directory include domains, organizational units, trees, and forests.

Domains

A *domain* is the core unit in Active Directory and is made up of a collection of computers that share a common directory database. The computers that share this common directory database are called domain controllers. A *domain controller* is a Windows Server 2003 server that has Active Directory installed. It can authenticate users for its own domain. Each domain controller holds a complete replica of the domain naming partition for the domain to which it belongs and a complete replica of the configuration and schema naming partitions for the forest. Dcpromo.exe is the utility used to promote a Windows Server 2003 server to a domain controller. Partitions are discussed later in this chapter.

All Active Directory domain names are identified by a DNS name as well as by a NetBIOS name. The following is an example of the two types of names:

- DNS-style domain name: contoso.com
- NetBIOS name: CONTOSO

Generally, the NetBIOS name is the same as the first naming component in the DNS name. However, a NetBIOS name can be only 15 characters in length, whereas each name in the DNS naming convention can have up to 64 characters. During installation, both names can be configured to meet your needs. In the initial release of Windows Server 2003, Active Directory names could be changed. Although there are tools available that allow you to change a domain name, it is a complex undertaking. It is better to be careful when initially creating your naming scheme.

More Info To read more about and download the Windows Server 2003 Active Directory Domain Rename Tools, visit *http://www.microsoft.com/technet/downloads /winsrvr/domainrename.mspx*.

The domain is also a security boundary in Active Directory. Administrators in a domain have the permissions and rights to perform administrative functions in that domain. However, because each domain has its own security, administrators must be given explicit permissions to perform administrative tasks in other domains. Members of the Enterprise Admins group have rights to perform administrative tasks in all domains across the forest. Hence, you can have domain administrators and a higher level of administration from the Enterprise administrators.

A Windows Server 2003 Active Directory domain can be in either mixed mode or native mode. The default installation is mixed mode. In mixed mode, a Windows Server 2003 domain controller acts like a Microsoft Windows NT 4 domain controller. Active Directory domains in mixed mode have the same limitations on the security accounts database as Windows NT 4 domain controllers. For example, in mixed mode, the size of the directory is limited to 40,000 objects, the same restriction imposed by Windows NT 4. These limitations allow Windows NT 4 backup domain controllers to exist on the network and connect to and synchronize with the Windows Server 2003 domain controllers.

Note Exchange Server 2007 requires that an Active Directory be in native mode prior to installation. You'll learn more about that in Chapter 6, "Installing Exchange Server 2007."

The PDC Emulator is one of the five Flexible Single Master Operation (FSMO) roles that make Windows Server 2003 look like a Windows NT 4 PDC. Only one Windows Server 2003 domain controller can act as the PDC Emulator. By default, the PDC Emulator role, like all other FSMO roles, is installed on one domain controller in each domain — by default, on the first domain controller of each domain. (FSMO roles are discussed in a moment.) To run Windows Server 2003 in native mode, you must not have any reason or desire to connect to a Windows NT 4 backup domain controller. In other words, when you decide to run Windows Server 2003 in native mode, you won't be able to use a Windows NT backup domain controller again on your network, and no applications running on your network will be able to use Windows NT to operate. The switch to native mode is a one-time, one-way switch and is irreversible. Native mode allows your Windows Server 2003 domain controllers to have millions of objects per domain. In addition, native mode allows the nesting of groups, something that is advantageous if you anticipate large distribution groups in Exchange Server 2007.

A Windows Server 2003 network running in native mode can accommodate Windows NT 4 stand-alone and member servers. Windows NT 4 workstations must be upgraded to Windows 2000 Professional, Windows XP Professional, or Windows Vista to participate in Active Directory, or you must install the Directory Service Client. Windows Server 2003 implements Active Directory in a multimaster model because objects in Active Directory can be modified on any domain controller, which accounts for the emphasis on directory replication between domain controllers. However, some roles are either too sensitive to security issues or too impractical to perform in a multimaster model because of potential conflicts that could arise from the replication traffic. An understanding of these roles is important: if a domain controller that is performing a particular role becomes unavailable, the function it performs is not available in Active Directory. These roles are schema master, domain naming master, relative identifier master, PDC emulator, and infrastructure master.

Schema Master

The *schema* is the set of object classes (such as users and groups) and their attributes (such as full name and phone number) that form Active Directory. The schema master controls all aspects of updates and modifications to the schema. To update the schema, you must have access to the schema master. There can be only one schema master in the forest at any given time.

Domain Naming Master

The domain naming master controls the addition and removal of domains in the forest. This is the only domain controller from which you can create or delete a domain. There can be only one domain naming master in the forest at any given time.

Relative Identifier Master

The relative identifier (RID) master allocates sequences of RIDs to each of the domain controllers in its domain. Whereas the schema master and domain naming master perform forestwide functions, one RID master is assigned per domain. Because each domain controller can create objects in Active Directory, the RID master allocates to each domain controller a pool of 500 RIDs from which to draw when creating the object. When a domain controller has used more than 400 RIDs, the RID master gives it another batch of 500 RIDs.

Whenever a new user, group, or computer object is created, the object inherits the security identifier (SID) of the domain.The RID is appended to the end of the of the domain SID to make up a unique SID for the object. In addition, when an object is moved from one domain to another, its SID changes, because it receives a new SID (made up of both the domain SID and the RID) in the destination domain. By allowing only the RID master to move objects between domains, Windows Server 2003 ensures SID uniqueness, even across domains. Objects maintain a SID history for security access to resources.

PDC Emulator

Each domain in the forest must have one domain controller that acts as the PDC emulator. If Active Directory is running in mixed mode with Windows NT 4 domain controllers on the same network, the PDC emulator is responsible for synchronizing password changes and security account updates between the Windows NT 4 servers and the Windows Server 2003 servers. Moreover, the PDC emulator appears to downlevel clients, such as Windows 95, Windows 98, and Windows NT 4, as the PDC of the domain. It functions as the domain master browser, is responsible for replication services to the BDCs, and performs directory writes to the Windows NT 4 domain security database.

In native mode, the PDC emulator receives the urgent updates to the Active Directory security accounts database, such as password changes and account lockout modifications. These urgent changes to user accounts are immediately replicated to the PDC emulator, no matter where they are changed in the domain. If a logon authentication fails at a domain controller, the credentials are first passed to the PDC emulator for authentication before the logon request is rejected.

Infrastructure Master

The infrastructure master is responsible for tracking group-to-user references whenever the user and the group are not members of the same domain. The object that resides in the remote domain is referenced by its GUID and SID. If an object is moved from one domain to another, it receives a new SID, and the infrastructure master replicates these changes to other infrastructure masters in other domains.

Organizational Units

An *organizational unit* (OU) is a container object that is used to organize other objects within a domain. An OU can contain user accounts, printers, groups, computers, and other OUs.

> **More Info** The design of Active Directory is based on the X.500 standard, which can be procured from *www.itu.org*. The standard is rather short—around 29 pages—but reading it will give you a great background for understanding Active Directory and, for that matter, Novell Directory Services.

OUs are strictly for administrative purposes and convenience. They are transparent to the user and have no bearing on the user's ability to access network resources. OUs can be used to create departmental or geographical boundaries. They can also be used to delegate administrative authority to users for particular tasks. For example, you can create an OU for all of your printers and then assign full control over the printers to your printer administrator.

OUs can also be used to limit administrative control. For example, you can give your help desk support personnel the permission to change the password on all user objects in an OU without giving them permissions to modify any other attributes of the user object, such as group membership or names.

Because an Active Directory domain can hold millions of objects, upgrading to Windows Server 2003 allows companies to convert from a multiple-domain model to a single-domain model and then use organizational units to delegate administrative control over resources.

Trees and Forests

The first Windows Server 2003 domain that you create is the root domain, which contains the configuration and schema for the forest. You add domains to the root domain to form the tree. As Figure 2-1 illustrates, a *tree* is a hierarchical grouping of Windows Server 2003 domains that share a contiguous namespace. A *contiguous namespace* is one that uses the same root name when naming additional domains in the tree.

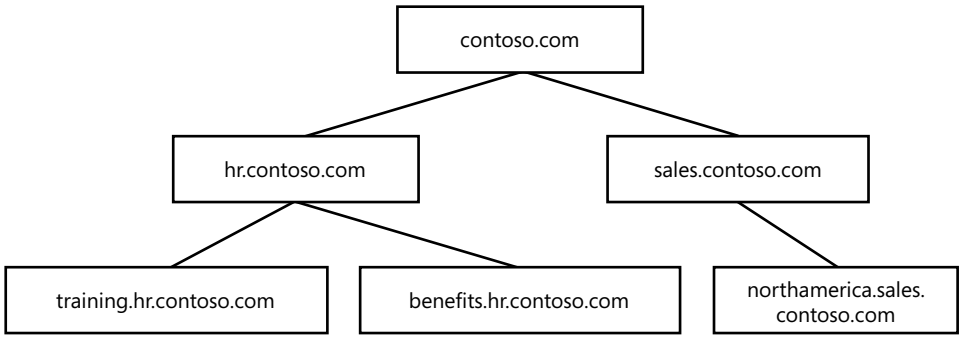

Figure 2-1 Fictitious tree of contoso.com

A collection of trees that does not share a contiguous namespace can be placed in the same forest. They then share a common configuration, schema, and Global Catalog (GC). By default, the name of the root domain becomes the name of the forest, even though other trees will not share the same name as the root domain.

Even though they don't share the same name, transitive trust relationships are automatically established between the root domain servers in each tree, as long as they are members of the same forest. Figure 2-2 shows two trees—contoso.com and litwareinc.com—in the same forest.

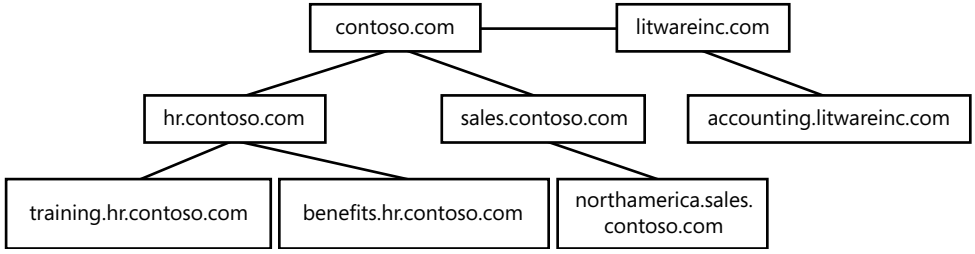

Figure 2-2 Forest consisting of contoso.com and litwareinc.com

The schema and configuration partitions for Active Directory are replicated to all domain controllers in each domain. Whereas a domain represents a boundary for security and the logical grouping of objects, a forest represents the boundary for Active Directory and the Exchange Server 2007 organization.

In addition, other domain names cannot be represented above the first domain name. For example, if your root domain name is sales.contoso.com, you can never install a domain named contoso.com in the same forest. You can join other domain names to the forest, such as litwareinc.com, as long as they are in a different namespace.

Groups

In Windows Server 2003, groups are used to reduce administrative effort and to enable the management of many user accounts simultaneously. Windows Server 2003 uses groups to reduce the number of objects that require direct administration.

There are basically two kinds of groups in Windows Server 2003. Each has its own advantages and restrictions that you must take into account when using them. Exchange Server 2007 uses both kinds of groups from Windows Server 2003:

- **Security groups** Security groups host security principles within Active Directory. They are used to group users or computers for the purpose of reducing the points of administration and providing permissions to network resources.
- **Distribution groups** Distribution groups are meant to perform distribution functions. You cannot use them to assign permissions to network resources.

Global Groups

Global groups, in mixed mode, can contain users only from the domain in which they are hosted. In native mode, they can contain users and global groups from the local domain in which they were created. However, they can be used to assign permissions to resources in any domain. Global groups can contain users, computers, and global groups from the local domain. They can be members of any other type of group.

Typically, you'll use global groups for administering user membership that has permissions to a network resource. The group itself is replicated as part of the Global Catalog, but its membership is not. This restriction means that adding user accounts to or removing user accounts from a global group does not trigger a new replication of the Global Catalog. Global groups can be converted to universal groups (discussed shortly) as long as the global groups do not contain other global groups and the domain is in native mode.

Domain Local Groups

Domain local groups in native mode can contain other domain local groups, users, global groups, and universal groups from any domain in the forest, but they can be granted permissions only in the domain in which they reside. In mixed mode, they can contain only user and global group accounts.

You grant permissions to domain local groups only for objects in the local domain. The existence of the domain local group is replicated to the Global Catalog server, but its membership is not replicated. Domain local groups are flexible in that you can use any other security principle inside the domain local group (when running in native mode) to reduce administrative effort. You can convert a domain local group to a universal group in native mode as long as it does not contain other domain local groups.

Universal Groups

Universal groups can contain users, global groups, and other universal groups from any Windows Server 2003 domain in the forest. The domain must be operating in native mode to create security groups with universal scope. You can grant permissions to resources anywhere in the forest to a universal group.

Universal group membership must be determined at the time of logon. Because the scope of the universal group is universal, this group is propagated through the Global Catalog. Hence, not only is the group itself propagated in the Global Catalog, but its membership is propagated as well. A universal group with a large membership generates additional replication overhead if the membership changes. Universal groups as security groups are available only in native mode. Table 2-1 summarizes group membership rules.

Table 2-1 Comparison of Various Types of Groups

Group scope	In mixed mode can contain	In native mode can contain	Can be a member of	Can be granted permissions for
Domain local	User accounts and global groups from any domain	User accounts, global groups, and universal groups from any domain in the forest, and domain local groups from the same domain	Domain local groups in the same domain	The domain in which the domain local group exists
Global	User accounts	User accounts and global groups from the same domain	Universal and domain local groups in any domain and global groups in the same domain	All domains in the forest
Universal	Not applicable	User accounts, global groups, and other universal groups from any domain in the forest	Domain local and universal groups in any domain	All domains in the forest

Other Active Directory Components

Active Directory is a complex system that includes far more than the basic logical structure just described. This section highlights several other components that play a critical role within Active Directory.

Naming Partitions

You can think of Active Directory as being divided into three distinct directories, or partitions: the domain partition, the configuration partition, and the schema partition. Each

partition is a self-contained section of Active Directory that can have its own properties, such as replication configuration and permissions structure. A Windows Server 2003 domain controller always holds three naming partitions in its database file (Ntds.dit). These are the default LDAP paths for these partitions:

- Configuration: cn=configuration,dc=sales,dc=contoso,dc=com
- Schema: cn=schema,cn=configuration,dc=sales,dc=contoso,dc=com
- Domain: dc=sales,dc=contoso,dc=com

In a multidomain structure, domain controllers belong to different domains. These servers share a common configuration and schema naming partition but have a unique domain naming partition. Exchange Server 2007 stores most of its information in the configuration naming partition, which is replicated throughout the forest.

Sites

A *site* within Active Directory is a collection of Internet protocol (IP) subnets that enjoy permanent, high-bandwidth connectivity. Active Directory assumes that all computers in the same site have permanent, high-speed connectivity with one another. Sites tend to map to the physical structure of your network: slow WAN links will be considered outside your sites, and high-speed links will form your sites.

Site and domain topologies are not dependent upon each other; a single domain can span multiple sites, or multiple domains can be located in a single site. Because the bandwidth between sites is assumed to be slow or unreliable, it stands to reason that some type of connector is needed to connect the sites. That connector is called a *site link*.

Site links are built manually by the administrator and form the physical topology of the network. To create replication paths between domain controllers across the site links (as well as between domain controllers within the same site), Windows Server 2003 employs the knowledge consistency checker (KCC), which runs automatically but can be configured manually, if necessary. The KCC creates *connection objects* on each domain controller in the configuration naming partition; these connection objects form the overall replication topology over which Active Directory information can be replicated. The KCC is a service that runs on each domain controller to create the connection objects for that domain controller.

Location Service Providers

In Windows Server 2003, DNS provides the role of server service locator, helping the client find the services it needs on the network. Dynamic DNS is supplied with Windows Server 2003 and is a standard part of the Active Directory installation. With dynamic

DNS, clients query DNS service (SRV) records to locate services on the network and can also update the DNS records if their own location changes.

Global Catalog Servers

In a multidomain environment, it is reasonable to assume that some users will need access to objects outside of their own domains. For example, a user in domain A might need access to a color printer located in domain B. Because domain controllers maintain only a replica of objects in their own domain, a special service is needed in the forest to gain access to objects located in remote domains. The Global Catalog server performs this function. This server holds a replica of all objects in the forest, with a limited set of attributes for those objects. The schema defines which attributes are listed for each object in the Global Catalog. The Global Catalog is not a separate file; it is instead held inside the NTDS.DIT file. The GC will be roughly 40 percent of the size of your active directory, or the size of the NTDS.DIT file on a non-GC domain controller.

Note By default, there is only one Global Catalog server in the entire forest, and that is the first domain controller installed in the first domain of the first tree. All other Global Catalog servers need to be configured manually. You can do this by opening the Active Directory Sites And Services snap-in, navigating to the NTDS settings on the server on which you want to install this service, right-clicking NTDS Settings, choosing Properties, and selecting the Global Catalog Server check box.

In addition to users needing access to services outside their domain, some applications need access to a forestwide listing of objects. Exchange Server 2007 is one of those applications. For example, a user might want to browse the Global Address List, which is generated by the Global Catalog server. The Global Catalog server gathers each mail-enabled object into a list and returns this list to the user inside the address book interface.

Even in a single-domain environment, Exchange clients are referred to the Global Catalog server for address book lookups. In this scenario, the default is to refer all those lookups to the root domain controller. You should plan for an increase in network traffic between Global Catalogs and Exchange Server 2007 servers. This increase may be sizeable if you are taking full advantage of all the new features and roles in Exchange Server 2007.

It is helpful to note that a Global Catalog server passes back different attributes depending on the TCP port used for the query. For example, a query to port 389 (the default LDAP port) allows a client to search for objects only within the home domain, with the full set of attributes for the object being returned. In contrast, a query over port 3268 allows a client to search for domain objects from all domains in the forest, including the home domain of the Global Catalog server. However, a query over this port returns only

a subset of the attributes available, even if the object is in the home domain of the Global Catalog server.

Client Authentication

When a client attempts to log on to the domain, it queries DNS SRV records to locate a domain controller. DNS attempts to match the client's IP address to an Active Directory site and then returns a list of domain controllers that can authenticate the client. The client chooses a domain controller at random from the list and then pings it before sending the logon request. In native mode, the authenticating domain controller passes the client's credentials to the local Global Catalog server so that the Global Catalog can enumerate universal security group access.

Active Directory Names

Both users and applications are affected by the naming conventions that a directory uses. To locate a network resource, you need to know its name or one of its properties. Active Directory supports many naming schemes for the different formats that can access Active Directory.

Distinguished Name

Each object in the directory has a *distinguished name* (DN) that identifies where the object resides in the overall object hierarchy. For example:

cn=dhall,cn=users,dc=contoso,dc=com

This example indicates that the user object dhall is in the Users container that is located in the contoso.com domain. If the dhall object is moved to another container, its DN changes to reflect its new position in the hierarchy. Distinguished names are guaranteed to be unique in the forest. You cannot have two objects with the same distinguished name.

Relative Distinguished Name

The *relative distinguished name* of an object is the part of the distinguished name that is an attribute of the object. In the former example, the relative distinguished name of the dhall object is dhall. The relative distinguished name of the parent organizational unit is Users. Active Directory does not allow two objects with the same relative distinguished name under the same parent container.

User Principal Name

The *user principal name* that is generated for each object is in the form username@DNS-domainname. Users can log on with their user principal name, and an administrator can define suffixes for user principal names if desired. User principal names are required to

be unique, but Active Directory does not enforce this requirement. It's best, however, to formulate a naming convention that avoids duplicate user principal names.

Globally Unique Identifier

Some applications require that an object be referred to by an identifier that remains constant. This is achieved by adding an attribute called the *globally unique identifier* (GUID), a 128-bit number that is guaranteed to be unique. A GUID is assigned to an object when it is created, and it never changes, even if the object is moved between containers in the same domain.

Exchange Server 2007 and Active Directory

Exchange Server 2007 is tightly integrated with the Windows Server 2003 Active Directory service. Integration with Windows Server 2003 provides several benefits, including the following:

- **Centralized object management** Administration is unified for Exchange Server 2007 and Windows Server 2003. Directory objects can be managed from one location, with one management tool, and by one team.
- **Simplified security management** Exchange Server 2007 uses the security features of Windows Server 2003, such as the discretionary access control list (DACL). Changes to security principles (such as user or group accounts) apply to data stored in both Exchange Server 2007 and Windows Server 2003 file shares.
- **Simplified creation of distribution lists** Exchange Server 2007 automatically uses Windows Server 2003 security groups as distribution lists, eliminating the need to create a security group for each department and a corresponding distribution group for the same department. Distribution groups can be created in those instances when e-mail distribution is the only desired function of the group.
- **Easier access to directory information** LDAP is the native access protocol for directory information.

Exchange Server 2007 and Active Directory Site Topology

In Exchange 2000 Server and Exchange Server 2003, Exchange requires the configuration of routing groups to govern how messages and other Exchange-related traffic are routed throughout an organization. Exchange Server 2007 no longer uses routing groups, instead relying on the routing technology built into Active Directory site topology.

All computers within a single Active Directory site are considered well connected, with a high-speed, reliable network connection. By default, when you first deploy Active Directory on a network, it creates a single site named (by default) *Default-First-Site-Name*. All server and client computers in the forest are made members of this first site. When you define more than one site, you must define the network subnets that are present on the network and associate each of those subnets with Active Directory sites.

In Active Directory, *IP site links* define the relationship between sites. An IP site link connects two or more Active Directory sites. Each IP site link is associated with a cost that helps dictate how Active Directory should consider using that link in relation to the costs of other available site links. You (or the Active Directory administrator) assign the cost to a link based on relative network speed and available bandwidth compared to other available connections.

Exchange Server 2007 uses the cost assignment for an IP site link to determine the lowest cost route for traffic to follow when multiple paths exist to a destination. The cost of the route is determined by aggregating the cost of all site links in the path. For example, assume that a computer in Site A must communicate with a computer in Site C. Site A is connected by an IP site link with a cost of 10 to Site B. Site B is connected by an IP site link to Site C with a cost of 5. The cost of the full route from Site A to Site C would be 15.

Active Directory clients assume site membership by matching their assigned IP address to a subnet associated with a particular site.

Because Exchange Server 2007 is now a site-aware application, it can determine its own Active Directory site membership and the Active Directory site membership of other servers. All Exchange Server 2007 server roles use site membership to determine which domain controllers and Global Catalog servers to use for processing Active Directory queries. In addition, Exchange Server 2007 also tries first to retrieve information about recipients from directory servers that are in the same site as the Exchange Server 2007 server.

The Exchange Server 2007 server roles use Active Directory site membership information as follows:

- The Mailbox server role uses Active Directory site membership information to determine which Hub Transport servers are located in the same Active Directory site as the Mailbox servers. The Mailbox server submits messages for routing and transport to a Hub Transport server that has the same Active Directory site membership as the Mailbox server. The Hub Transport server performs recipient resolution and queries Active Directory to match an e-mail address to a recipient account. The Hub Transport server delivers the message to the Mailbox server within its same Active Directory site, or it relays the message to another Hub Transport server for delivery to a Mailbox server that is outside the Active Directory site. If there are

no Hub Transport servers in the same Active Directory site as a Mailbox server, mail can't flow to that Mailbox server.

- Active Directory site membership and IP site link information is used to prioritize the list of servers that are used for public folder referrals. Users are directed first to the default public folder database for their mailbox database. If a replica of the public folder being accessed does not exist in the default public folder database, the Mailbox store where the default public folder database resides provides a prioritized referral list of Mailbox servers that hold a replica to the client. Public folder databases that are in the same Active Directory site as the default public folder database are listed first, and additional referral locations are prioritized based on Active Directory site proximity.
- The Unified Messaging (UM) server role uses Active Directory site membership information to determine which Hub Transport servers are located in the same Active Directory site as the Unified Messaging server. The Unified Messaging server submits messages for routing and transport to a Hub Transport server that has the same Active Directory site membership as the Unified Messaging server. The Hub Transport server delivers the message to a Mailbox server within its same Active Directory site, or it relays the message to another Hub Transport server for delivery to a Mailbox server that is outside the Active Directory Site.
- When the Client Access server role receives a user connection request, it queries Active Directory to determine which Mailbox server is hosting the user's mailbox. The Client Access server then retrieves the Active Directory site membership of that Mailbox server. If the Client Access server that received the initial user connection is not located in the same site as the user's Mailbox server, the connection is redirected to a Client Access server in the same site as the Mailbox server.
- Exchange Server 2007 Hub Transport servers retrieve information from Active Directory to determine how mail should be routed inside the organization. If the recipient's mailbox is located on a Mailbox server in the same Active Directory site as the Hub Transport server, the message is delivered directly to that mailbox. If the recipient's mailbox is located on a Mailbox server in a different Active Directory site, the message is relayed to a Hub Transport server in that site and then delivered to the Mailbox server.

Management Shell

You can use the `Set-AdSiteLink` cmdlet in the Exchange Management Shell to configure an Exchange-specific cost to an Active Directory IP site link. The Exchange-specific cost is a separate attribute that is used instead of the Active

Directory-assigned cost to determine the Exchange routing path. This configuration is useful when the Active Directory IP site link costs do not result in an optimal Exchange message routing topology.

Storing Exchange Server 2007 Data in Active Directory

It was mentioned earlier that Active Directory is divided into three naming partitions: configuration, schema, and domain. This section discusses how Exchange Server 2007 uses each of these partitions and which kind of data is stored in them.

Domain Naming Partition

In the domain naming partition, all domain objects for Exchange Server 2007 are stored and replicated to every domain controller in the domain. Recipient objects, including users, contacts, and groups, are stored in this partition. Exchange Server 2007 exploits Active Directory by adding attributes to user, group, and contact objects for messaging purposes.

Designing a Group Implementation Strategy

Exchange Server 2007 uses distribution groups to send the same message to a large number of recipients. Any user accounts that are placed inside the distribution group will receive the message. In Windows Server 2003 native mode, groups can be nested inside of other groups, effectively creating a multitiered distribution list. The two types of groups you will use most often for large distribution of a message are global and universal.

The largest downside to universal groups is that membership is fully replicated to each Global Catalog server, which means that replication traffic occurs whenever a Universal Group's membership changes. Therefore, it is best to populate a universal group with other global groups so that when membership changes in the global group, the universal group is not changed and traffic is not replicated.

Global groups can also be mail-enabled for message distribution. If you choose not to use universal groups, you can mail-enable global groups. Membership for a global group is not promoted to the Global Catalog server, which presents some issues to consider when working in a multidomain environment.

When a message is sent to a global group in a remote domain, the expansion server must connect to a domain controller in the group's home domain and retrieve the membership list. In addition, the expansion server must have IP connectivity to a domain controller in the group's home domain. If bandwidth between the two domains is slow or unreliable, retrieving membership from a remote domain might take time and slow down message delivery, which affects overall performance. It is best if Exchange Server 2007 is in the remote domain. Then you can set the expansion server to be the remote Exchange Server

2007 server instead of retrieving the membership remotely and expanding the group membership locally.

When deciding which group type to select, consider the following implications:

- **Are you using a single-domain or multiple-domain environment?** If you have a single domain, you don't need to use universal groups, because all of the domain objects are local. When you have multiple domains, use universal groups if the membership is fairly static (that is, global groups as opposed to individual users), and remember that users might not have access to all object attributes from other domains in universal groups.
- **Is direct IP connectivity possible between all domains?** If you have IP connectivity, use global groups when membership changes frequently or you have Exchange servers in each domain that can act as expansion servers. Otherwise, use universal groups, because membership is static, and the local expansion server can expand the list.
- **Will membership change frequently?** If membership changes often, use global groups. If membership changes infrequently, use universal groups.

Microsoft Outlook users will not be able to view the user memberships of a group that has been created in a remote domain. They can view membership only in global groups and domain local groups that have been created in their home domain.

An Expansion server, which has been mentioned several times, requires some explanation. When a message is sent to a mail-enabled group, the message needs to be expanded and individually addressed to each member of the group. By default, the local server performs the expansion and uses LDAP to contact the Global Catalog server to deliver the message to each member of the group. If the message is intended for a local group in the domain, the local Global Catalog server is contacted. If the local server is not available for expansion, another server in the site is used.

You can select a specific server in an organization to be an expansion server. The advantage of doing this is that you can offload the sometimes resource-intensive process of expanding large distribution groups to a dedicated server, removing the load from the mailbox server. The disadvantage of specifying an expansion server is that if that expansion server is not available, messages to the distribution group are not delivered, as Exchange does not try another server. For this reason, if you choose to designate an expansion server, take steps to ensure high availability for that server.

Configuration Naming Partition

The configuration partition of Active Directory stores information regarding how your Exchange Server 2007 system is organized. Because this information is replicated to all

domain controllers in the forest, the Exchange Server 2007 configuration is also replicated throughout the forest. The configuration information includes the Exchange Server 2007 topology, connectors, protocols, and service settings.

Schema Naming Partition

The schema partition contains all object types and their attributes that can be created in Active Directory. This information is replicated to all domain controllers in the forest. During the first installation of Exchange Server 2007 in the forest, the Active Directory schema is extended to include new object classes and attributes that are specific to Exchange Server 2007. These new classes start with "msExch" or "ms-Exch" and are derived from the LDAP Data Interchange Format (LDIF) information in the Exchange Server 2007 installation files.

Given that these extensions represent more than 1000 changes to the schema and that these changes are replicated to all the domain controllers in your forest, you should prepare the forest for Exchange Server 2007 at the beginning of a period of time when you anticipate that network activity will be relatively light—for example, on a Friday night. This schedule gives the domain controllers time to replicate all the schema changes into their own databases.

Note You can install Exchange Server 2007 using the */prepare AD* switch, which writes the new Exchange object classes and attributes to the schema but does not install Exchange itself. Plan on this activity taking anywhere from 30 to 90 minutes, depending on the speed and capacity of your hardware. Also, generally, the earlier in an Active Directory deployment that you extend schema, the better, because as domain controllers are added to the forest, they inherit the extended schema, thus reducing replication traffic when */prepare AD* is run. For more information on installing Exchange Server 2007, consult Chapter 6.

Exchange Server 2007 and Forest Boundaries

Because Exchange Server 2007 stores much of its information in the configuration naming partition, an Exchange Server 2007 organization cannot be extended past the boundaries of the forest. This is one area in which your Active Directory structure directly influences your Exchange topology. Having multiple forests in a company incurs the following limitations:

- You have separate Exchange organizations to administer.
- You have separate Global Address Lists, with no automatic directory replication between them.
- All e-mail system features are not available between forests.

Cross-Forest authentication is available, however. See Chapter 21, "Messaging Security," for a discussion about this topic.

Although using a single forest is the recommended way to set up an Exchange Server 2007 organization, if you want to synchronize directory information among multiple forests, you can use one of two scenarios:

- **Resource forest** In this scenario, one forest is dedicated to running Exchange Server 2007 and hosting mailboxes. User accounts associated with those mailboxes are contained in separate forests. The disadvantage of using this scenario is higher cost associated with configuring the additional forest, domain controllers, and Exchange servers. You must also ensure that when objects are created in one forest, corresponding placeholder objects are created in the other forests.
- **Cross-forest** Exchange Server 2007 runs in multiple forests, and e-mail functionality is configured between forests. The primary disadvantage of this scenario is reduced e-mail functionality between forests.

Configuration Partition and Directory Data

The two Active Directory services that an Exchange server uses most often are the Global Catalog server for address book lookups and the configuration naming partition for routing information. It is possible that two different domain controllers will be referenced, depending on the type of request being made by the Exchange server.

When an Exchange server starts up, it establishes a number of LDAP connections to domain controllers and Global Catalog servers. If it needs routing information to route a message, it can contact any domain controller to obtain this information, because each domain controller in the forest has a full copy of the configuration naming partition. If the Exchange server needs to obtain the Global Address List, it contacts the closest Global Catalog server. Best practice is to place a Global Catalog server near the Exchange server and make sure that they are in the same site and domain.

DNS Configuration

On the Internet (or on any TCP/IP network, for that matter), every device is represented by an IP address—using a four-part dotted-decimal notation, such as 192.168.0.1. A device with a TCP/IP address is called a *host* and is assigned a host name, which is a character-based name that is easier for humans to recognize and remember than its numeric IP address. The format of the host name is *hostname.domain.com*. When a host name identifies a resource on a TCP/IP network, computers must translate that host name into an IP

address because computers communicate using only IP addresses. This translation is called *name resolution*.

Two basic methods exist for resolving host names to IP addresses on a TCP/IP network. The first involves using a Hosts file. The Hosts file is a single, flat file that simply lists hosts on a network and each host's IP address. To use the SMTP with a Hosts file, enter into that file the domain name and IP address of the hosts to which the IMS might need to transfer messages. As you might imagine, this process can be time consuming.

The second method of resolving names is more efficient. It involves the Domain Name System (DNS), a hierarchical, distributed database of host names and IP addresses. In order to run Exchange Server 2007, you must have already installed Windows Server 2003 Active Directory and DNS services on your network. Although host files are still available in Windows Server 2003, given the dynamic nature of the new implementation of DNS, there are few times when you'll want to use them.

You are likely to want outside SMTP hosts to be able to transfer messages to your SMTP service. To enable this capability, create two records in the DNS database so that those outside hosts can resolve your server's IP address. The first record you must create is an address record, or a record for your Exchange server. This can be registered dynamically with DNS in Windows Server 2003. The second record is a mail exchanger record, or MX record, which is a standard DNS record type used to designate one or more hosts that process mail for an organization or site. This record must be entered manually in your DNS tables.

More Info This chapter provides a simple discussion of configuring TCP/IP and DNS, but these topics actually encompass a monstrous amount of material. If you need more information about using TCP/IP and DNS in the Windows Server 2003 environment, see *Microsoft Windows Server 2003 Administrator's Companion*, Second Edition, by Charlie Russel, Sharon Crawford, and Jason Gerend (Microsoft Press, 2006).

Summary

This chapter described the ways in which Exchange Server 2007 is integrated with Windows Server 2003. It gave an overview of how Active Directory is structured and described how Exchange Server 2007 works with Active Directory. It also discussed the Internet information protocols installed with Windows Server 2003 as well as services available in Exchange Server 2007, such as Outlook Web Access. In the Chapter 3, "Exchange Server 2007 Architecture," you learn more about the Exchange Server 2007 architecture.