Messaging systems are an integral component of many enterprises. Over the years, they have evolved from providing basic functionality such as e-mail to encompassing rich collaboration features as well. Users’ messaging requirements have also changed significantly, from basic desktop e-mail access to remote collaboration available from multiple devices. In such an evolving environment, administering and maintaining messaging systems has become increasingly complex for IT administrators—and enterprise requirements for security, regulatory compliance, and availability only add to that complexity. Enterprises also face an enormous challenge when implementing a suitable messaging system that meets their targets for total cost of ownership and return on investment.

Microsoft Exchange Server 2007 incorporates features that enable enterprises to effectively meet these challenges without fundamentally altering the traditional methods used by end users to access e-mail. This article highlights some of these features, discussing the core architecture, mailbox data access, and secure deployment components of Exchange Server 2007.

Core architecture of Exchange Server 2007
Exchange Server 2007 introduces several architectural changes and other features designed to enhance its scalability and performance compared with Exchange Server 2003. Figure 1 summarizes the major differences between these two versions, which include key changes to server roles, memory use, and storage groups.

Server roles
Exchange Server 2007 includes five defined server roles—sets of functionality that administrators can deploy individually on servers or combined with other roles, with certain restrictions:

- **Mailbox:** Hosts user mailboxes, public folders, and calendar data
- **Client Access:** Provides functionality for Microsoft Office Outlook® Web Access (OWA), Microsoft Exchange ActiveSync® client access, Post Office Protocol 3/Internet Message Access Protocol 4 (POP3/IMAP4) client access, and Outlook Anywhere access—referred to in Exchange Server 2003 as Remote Procedure Call (RPC) over HTTP
- **Hub Transport:** Handles internal e-mail flow across Exchange components and user message delivery, along with functionality such as journaling, server-side rules, and an additional layer of antivirus and antispam security; this role is mandatory in Exchange Server 2007 deployments
- **Edge Transport:** Resides in the perimeter network and routes external Simple Mail Transport Protocol (SMTP) e-mail flow to and from the Internet, and provides...
antivirus and antispam security, filtering, and rule-based protection

- **Unified Messaging:** Integrates e-mail, voice mail, and faxes into user mailboxes and provides Outlook Voice Access functionality, which allows users to access e-mail, voice mail, faxes, calendars, contacts, and directory entries from a telephone.

These five server roles refine and add features to the traditional roles available with Exchange Server 2003. The mailbox and public folder functionality of Exchange Server 2003 back-end servers is provided by the Mailbox role in Exchange Server 2007. Some of the functionality of Exchange Server 2003 bridgehead servers is provided and enhanced by the Hub Transport role. Figure 2 illustrates the different server roles as part of an example Exchange Server 2007 infrastructure.

With the exception of the Edge Transport server role, all Exchange Server 2007 server roles are members of Microsoft Active Directory® domains. The Edge Transport role resides in the perimeter network, outside of Active Directory frameworks, using Active Directory Application Mode and EdgeSync to obtain the required Active Directory information. Because of its location, the Edge Transport role cannot be consolidated and deployed on a single-server system with other server roles. The other restriction on role consolidation is that when the Mailbox role is deployed in a highly available clustered configuration using single-copy clustering (SCC)
or cluster continuous replication (CCR) based on Microsoft Cluster Services, no other role can be consolidated with the Mailbox role on the same server.

Administrators should be sure to appropriately size the hardware for each server role for capacity and performance. High availability and scalability for server roles other than the Mailbox role can be achieved by deploying multiple server nodes hosting each role and using network load balancing. This flexibility to either consolidate roles or split them to different servers makes Exchange Server 2007 a highly scalable application: as an organization grows, administrators can choose to add servers to a particular role or split roles among additional servers.

Memory use
Exchange Server 2003 is a 32-bit application, and is limited to 4 GB of addressable memory: it can utilize roughly 3 GB of user-mode virtual memory, with the remaining 1 GB required for the kernel. Because Exchange Server 2003 does not support using Address Windowing Extensions (AWE), it cannot access physical memory above 4 GB made available through Physical Address Extension (PAE) on supported Microsoft Windows® OS–based systems, requiring the application to rely highly on disk subsystems and perform a large number of I/O operations. Beyond the physical memory limitation, the kernel running Exchange Server 2003 is also under constant stress because of the limited kernel-mode memory available for user connections and other processing.

Exchange Server 2007 overcomes these memory limitations by providing support as a 64-bit application capable of running on supported Microsoft Windows Server® 2003 x64 Editions platforms, which make approximately 8 TB of addressable memory available for user-mode and kernel-mode applications. Windows Server 2003 Enterprise x64 Edition supports up to 1 TB of physical RAM. Both the application and kernel can have sufficient memory for operations, allowing the Exchange Server 2007 Extensible Storage Engine to utilize additional memory to buffer data pages and thereby helping reduce the number of required I/Os (specifically read operations) to the disk subsystem.

Storage groups
Exchange Server 2007 provides support for up to 50 storage groups to host mailbox stores or databases, a significant increase from the 4 storage groups supported in Exchange Server 2003. This support enables administrators to split mailboxes across multiple storage groups and helps simplify administrative operations such as backup and restore. Splitting mailboxes across multiple storage groups also increases the checkpoint depth available for user data operations. In certain situations, dirty data pages—those that have not yet been written to disk—can be optimized to reside in memory for additional time to help reduce the number of required I/O write operations to the disk subsystem. Exchange Server 2007 also increases the data page size from 4 KB to 8 KB, which allows it to optimize I/O in some situations by containing large messages and internal data structures within a single page.

Mailbox data access in Exchange Server 2007
Exchange Server 2007 enables users to access their mailbox data in multiple ways using computers, telephones, and handheld devices. The main capabilities of this access are enabled by back-end functions, including mobile messaging, Web-based messaging, and the Unified Messaging feature. In addition to these three key capabilities, Exchange Server 2007 works closely with Outlook 2007 to provide rich features such as the scheduling assistant, which can automatically find appropriate meeting times based on free and busy data for each participant. Outlook 2007 also provides features for organizing different message types, such as e-mail, voice mail, and faxes.

Mobile messaging
Mobile messaging is enabled by Exchange ActiveSync, which allows users to access data on different supported mobile devices through low-latency wireless data networks. The Direct Push feature helps keep Outlook mobile client devices up-to-date by providing new item notifications, and many mobile devices provide the ability to read and edit attachments that use common Microsoft Office file formats. Exchange Server 2007 ActiveSync also supports HTML messages, enhanced message flagging, server-side searching for items not stored locally, and access to Microsoft Windows SharePoint® Services and Windows file shares. The Exchange Server 2007 Client Access server role hosts the services required for ActiveSync functionality, allowing Client Access servers to communicate with mobile clients that can connect to the Internet through high-speed mobile data networks.

Web-based messaging
Web-based messaging is enabled by OWA and the Outlook Anywhere feature. OWA provides Web browser–based access to mailbox data, and Exchange Server 2007 provides enhanced browser-based functionality that includes access to Unified Messaging data, HTML data conversion, and reduced local client data storage to enhance security. OWA also provides access to Windows SharePoint Services and Windows file shares. This feature requires Internet connectivity through a Web browser, but not an Outlook client.

The Outlook Anywhere feature provides Outlook client connectivity to Exchange Server 2007 through the Internet, without requiring a connection to an internal enterprise network; in Exchange Server 2003, similar functionality was referred to as RPC over HTTP. The Client Access server role hosts the services and functionality required for OWA and Outlook Anywhere support, and facilitates the access of OWA Web browser clients and remote Outlook clients to data hosted on Exchange Server 2007 Mailbox servers.

Unified Messaging
Traditionally, e-mail, voice mail, and fax data have been maintained in separate systems. Exchange Server 2007 Unified Messaging enables these three types of data to be routed
to Outlook in-boxes, allowing the in-boxes to serve as consolidated repositories for messaging data. Users can access this data using Outlook clients on a computer or mobile device, or through OWA using a Web browser. Voice mail messages and incoming faxes appear as e-mail attachments with unique identification flags; voice mail can be played on computer or device speakers. Unified Messaging also provides telephone access to the messaging data through Outlook Voice Access: users can dial in from their office extension or an external telephone and access their e-mail, voice mail, faxes, calendar, contacts, and directory entries.

The Exchange Server 2007 Unified Messaging server role hosts the services and functionality required to implement Unified Messaging. Unified Messaging servers use voice over IP (VoIP) protocols, enabling them to receive voice mail and fax messages from existing private branch exchange (PBX) telephony systems and store these messages in user mailboxes hosted by Exchange Server 2007 Mailbox servers. Through their connection with the telephony system, Unified Messaging servers also provide the interface for voice access to Outlook data. A VoIP gateway device may be needed to translate between Unified Messaging servers and the PBX system; it is critical that this gateway meet the requirements for Unified Messaging server integration.

Secure enterprise deployments for Exchange Server 2007

Exchange Server 2007 introduces several features designed to enhance security, compliance and archiving, and backup and recovery functionality.

Security

Exchange Server 2007 provides enhanced built-in antivirus and antispam security features, including filtering based on IP address, content and attachments, and sender ID, as well as message stamping to identify scanned messages in the system. Edge Transport servers provide these features in perimeter networks and can filter potential threats before they enter internal networks. Administrators can also configure Hub Transport servers with antivirus and anti-spam functionality when these servers have been set up to relay external messages directly without utilizing Edge Transport servers.

Compliance and archiving

Exchange Server 2007 includes features designed to help organizations effectively meet their regulatory compliance and archiving requirements. Administrators can configure transport rules for Hub Transport servers that enforce restrictions on internal and external communications based on the users involved or the message content. Messaging records management features provide managed folders—Outlook user folders that can be centrally managed by administrators. Journaling features have been enhanced to include journaling at the mailbox, distribution list, or mailbox database level, and messages included in journaling can be sent to a third-party SMTP server, an Exchange mailbox, or a Microsoft Office SharePoint Server folder for archiving. User-wide mailbox scan and search functionalities are included to help meet compliance and retention requirements.

Backup and recovery

Exchange Server 2007 supports backups of database copies when using local continuous replication (LCR) or CCR. Backing up copies, rather than active production databases, helps increase performance by reducing the load on production servers and e-mail clients and enables administrators to remove time restrictions on backup and maintenance windows. The database portability feature allows other servers to host a failed server's user mailboxes, enabling users to continue sending and receiving messages while the backup mailbox data is being recovered.

Enhanced Exchange Server 2007 architecture and features

Microsoft Exchange Server 2007 introduces multiple features and enhancements designed to meet ever-growing enterprise messaging needs. Dell™ PowerEdge™ servers and Dell PowerVault™ and Dell/EMC storage provide a standard hardware platform for deploying Exchange Server 2007 messaging solutions, and Dell Services can provide assessments, designs, and implementations tailored for those messaging deployments. Dell also offers end-to-end Exchange messaging solutions that include partner offerings for security, archiving, and backup and recovery. Enterprises can take advantage of these services when planning to upgrade to or deploy Exchange Server 2007 in their data centers.

Ananda Sankaran is a lead engineer in the Dell End-to-End Solutions team. His interests include databases, application consulting, performance engineering, and sizing, and he led the release of the Dell SQL Server 2005 Advisor and Dell Exchange 2007 Advisor tools. Ananda has a master’s degree in Computer Science from Texas A&M University.

Suman Kumar Singh is a lead systems engineer on the Dell End-to-End Solutions team. He specializes in messaging systems architecture and sizing, and led the release of the Dell Exchange 2003 Advisor tool. His other interests include storage area networks, virtualization, and security, and he has published and presented several papers at industry conferences. Suman has a master’s degree from the University of Texas at El Paso.