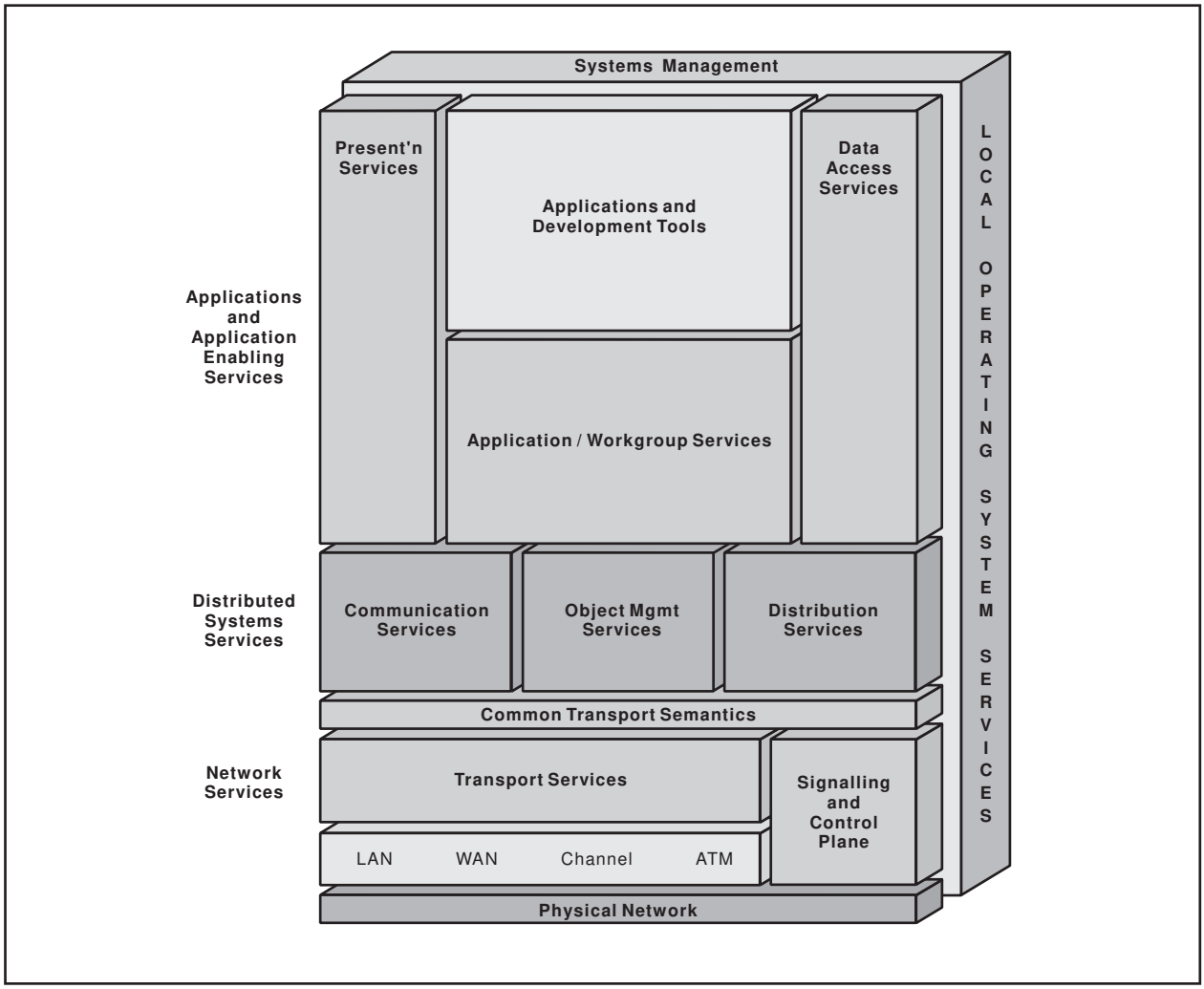
Open Blueprint

Mail Resource Manager



GC23-3919-01

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About This Paper

Open, distributed computing of all forms, including client/server and network computing, is the model that is driving the rapid evolution of information technology today. The Open Blueprint structure is IBM's industry-leading architectural framework for distributed computing in a multivendor, heterogeneous environment. This paper describes the Mail resource manager component of the Open Blueprint and its relationships with other Open Blueprint components.

The Open Blueprint structure continues to accommodate advances in technology and incorporate emerging standards and protocols as information technology needs and capabilities evolve. For example, the structure now incorporates digital library, object-oriented and mobile technologies, and support for internet-enabled applications. Thus, this document is a snapshot at a particular point in time. The Open Blueprint structure will continue to evolve as new technologies emerge.

This paper is one in a series of papers available in the *Open Blueprint Technical Reference Library* collection, SBOF-8702 (hardcopy) or SK2T-2478 (CD-ROM). The intent of this technical library is to provide detailed information about each Open Blueprint component. The authors of these papers are the developers and designers directly responsible for the components, so you might observe differences in style, scope, and format between this paper and others.

Readers who are less familiar with a particular component can refer to the referenced materials to gain basic background knowledge not included in the papers. For a general technical overview of the Open Blueprint, see the *Open Blueprint Technical Overview*, GC23-3808.

Who Should Read This Paper

This paper is intended for audiences requiring technical detail about the Mail Resource Manager in the Open Blueprint. These include:

- Customers who are planning technology or architecture investments
- Software vendors who are developing products to interoperate with other products that support the Open Blueprint
- Consultants and service providers who offer integration services to customers

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Summary of Changes

This revision describes:

- Mail resource manager use of the Collaboration resource manager document store.
- Additional interoperability support, in particular, the support of Internet mail.
- Advanced mail functions, including integrated and fourth generation messaging.

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Open Blueprint Mail Resource Manager

Mail is an end user application for person-to-person messaging (from one person's out-basket to another person's in-basket), such as that performed by popular mail systems like Lotus Notes Mail, cc:Mail, and Microsoft Mail. In the Open Blueprint, person-to-person messaging, or mail, is also an application service that is used by other applications to deliver data in a network. Electronic mail can take two forms - one-to-one electronic messaging (mail between two people) or one-to-many (broadcast, news publishing, or mail to groups).

Mail is different from inter-process messaging, which refers to program-to-program communications. Activities such as the inter-process messaging and queuing-based communications services and replication are not mail. The term *message* or *messaging* therefore refers to the content or handling of a *mail* message. The term *mail* is also synonymous with *e-mail*.

The Mail resource manager client, which is usually installed on a client system, accepts mail from and delivers mail to application requesters. The Mail resource manager server routes and moves mail through the distributed network. The Mail resource manager uses the Collaboration resource manager document store for mail storage in both client and server systems.

Business Value

The growth in the use of electronic mail has resulted in electronic mail becoming strategic to organizations using it. For the Mail resource manager to be of value to a business, it must:

- Be **open**, so that customers can choose which mail service to use. The mail service must be based on published, industry standard APIs to enable an organization to mail-enable their line of business applications by using an open interface to the Mail resource manager.
- Operate in a **heterogeneous** environment. Virtually every major business has evolved to an environment in which multiple vendors' systems and networks reside, and in which mail is used to communicate among multiple enterprises. Therefore, a mail service that provides real value to a user must support the various protocols that are prevalent in the industry. This allows interoperability within a customer's heterogeneous environment, and with outside organizations (inter-enterprise).
- Operate in a **distributed** environment. The client/server and the store and forward models allow organizations the most configuration flexibility. This configuration flexibility enables organizations to support disconnected mobile users, and to send and receive mail objects using the World Wide Web.

Basics

Electronic mail is based on the store and forward (asynchronous) model. Under this model, an object is moved from one point to another along a number of intermediate points (server to server or post office to post office) until delivered to the ultimate recipient. Asynchronous connectivity is maintained because the message can be sent and received at different times. In addition, objects can be stored by the delivery service at the point of origin or at intermediate points in the network prior to reaching its final destination. This is analogous to a post office where mail is delivered to a mailbox where it awaits pickup, or where mail is routed through and stored at different post offices along the way until it is delivered to the recipient's mail box for pickup.

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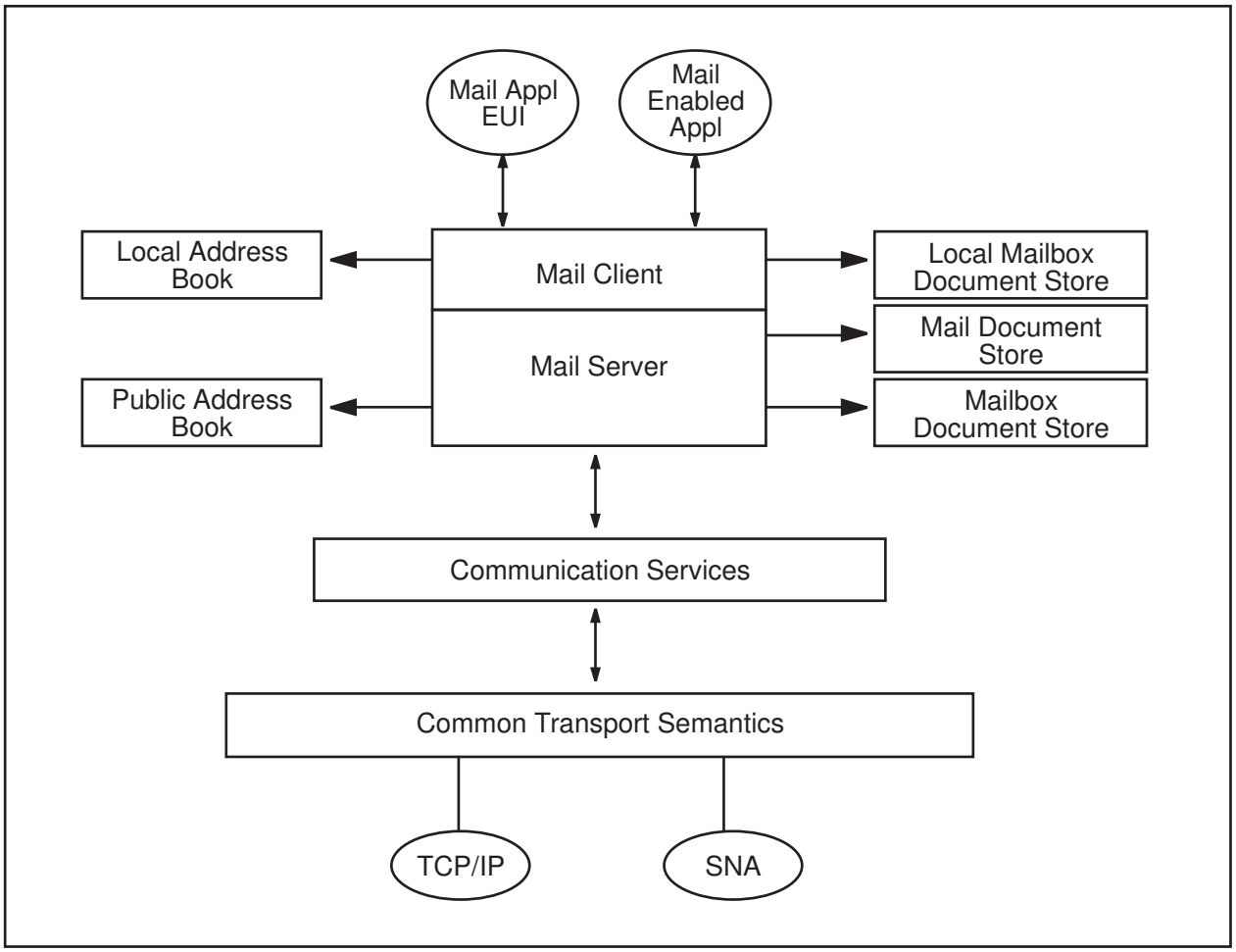

Figure 1. The Mail Systems Model

This model is implemented through a combination of workstation and server software. Every user has a mail document store that resides on the user's mail server. The mail server is the server assigned to each user that is designated to hold the user's mail document store. When a user logs into his/her workstation, the server is connected to and the mail document store is checked for new mail. This checking occurs at regular intervals during the session and the user is notified of any new mail.

Each server and workstation has a mailbox document store. All outgoing messages are placed in the mailbox on the server. The server's mail router task periodically looks in the mailbox object store for new mail messages. It uses the server's public Name and Address Book to locate the addressee's domains and mail servers, verifies the addresses, and transfers the message from the mailbox to the addressee's mail document store. The workstation mailbox document store is used when the workstation is not connected to the server.

Communications Services and the Common Transport Semantics are used to support server to server communications between Mail resource manager servers over public (Internet) and private networks. The mail resource manager includes rich interoperability support (see “Internet Mail” on page 9).

Functions

There are four functions that are performed by the Mail resource manager. These include:

- **Receive Mail**
  - Accept delivery: Check the envelope to determine whether to forward or process for a local recipient.
  - Perform Transforms (if needed): Convert the message content to a format recognized by the receiver.
  - Perform security related functions: Decrypt the mail message or validate (or both) a digital signature.
  - Put into the mail document store: Retain the mail and associated information in a secure container.
  - Notify recipient(s): Inform recipients that mail has arrived.
- **Process Mail**
  - View mail: Access mail from the mail document store
  - Forward/Reply: Respond to mail by sending another message
  - Save/Delete mail: Either keep, copy or purge mail from the mail document store
  - Organize mail: Place mail into folders. Create, move, copy and delete folders in the mail document store.
- **Send Mail**
  - Resolve addresses: Expand any distribution lists and map recipient names to fully qualified destination addresses.
  - Create Envelope: Take the addresses and related delivery information and put them into an acceptable format.
  - Perform Transforms (if needed): Convert the message content to the format required by the receiver.
  - Apply security: Encrypt or add a digital signature (or both) to the mail.
  - Distribute: Invoke communications services to transfer mail to recipients.
- **Manage Mail**
  - Nondelivery: Handle error conditions to notify originator of nondelivery or other problems.
  - Accounting: Provide information needed for billing and audit activity.

Client Support

A set of open, industry-standard APIs provide the functional interface to the mail service for mail-enabled applications. These APIs consist of Vendor Independent Messaging (VIM), Messaging API (MAPI), and Common Messaging Call (CMC).

- **VIM** is a common client API that was developed by a consortium of companies, including IBM. It is intended to be a multi-platform standard that can be implemented by a variety of applications running in different environments.
- **MAPI**: MAPI is an additional client API for Windows. It was developed by Microsoft and has become a de facto standard due to its pervasive use in the industry. MAPI has two flavors, simple and

extended. Simple MAPI provides user applications an interface to the mail application. Extended MAPI is used for interaction between the client and the server, and is one way in which "mix and match" clients can be achieved. The Mail resource manager supports both simple and extended MAPI, but does not implement the Microsoft MAPI framework.

- **CMC**: CMC is an output of the X.400 API Association (XAPIA) and is intended to provide access to services by an application that supports any of the existing mail-enabled interfaces (such as VIM and MAPI). CMC 1.0 is a client API, but full CMC (2.0 and later) will include interfaces to distribution lists, gateways, and other mail functions.

As mail becomes more strategic to a company, the importance of standardizing the mail APIs increases. Because CMC represents the most "open" approach, and protects investments made in existing applications, both the Electronic Messaging Association (EMA) and XAPIA have endorsed it. Most major mail vendors have announced support for CMC.

A mail client has access to the public Name and Address Book to verify addresses and the mail document store to access mail.

Mobile users can use the mail client to make connections to a mail server to perform all tasks, such as routing mail, as if they were directly connected to the network. Mobile users can use mail in two ways:

- Access the mail server using a modem or as though they were LAN connected. This option is for mobile users who do not deal with a lot of mail and have access to reliable communication lines and fast modems.
- Using mail off-line by replicating the mail document store to the workstation and then performing the same functions with the local replica copy. New messages are posted to the local mailbox document store. The next time the workstation is connected to the server, the outgoing mail is transferred from the local mailbox to the mailbox on the server and processed as before. New mail is received by accessing the mail object store on the server or replicating it to the workstation.

Server Support

The mail server controls the networks, mail routing, exchange and delivery of mail. The mail server implements features such as blind copies, delivery confirmation, return receipts, encrypted mail and sender authentication and provides best-path routing analysis and fault tolerance. The mail server provides full integration with heterogeneous environments, including mail interoperability, directory interoperability, and integrated management. Conversion services provide mapping between different mail document stores.

The major concepts and function supported by the server are:

- *Envelope:* The envelope is used to describe the electronic container for a message, and includes addressing and delivery information. The envelope is independent of its contents, which can be any size or type of data. While mail is best known for its capability of handling simple text for personal correspondence, the content of the envelope could just as well be a compound document that includes voice, image, graphics, or full motion video objects.
- *Message transfer protocol (MTP):* This is the server to server functional protocol. This protocol defines the format for the content of a mail message. For example, the message transfer protocol might identify that the first sixty-four characters of a message include the sender's id. It relies on having the same protocol at the receiving end, or on having a gateway that does a translation from one protocol to another. Examples of message transfer protocols are X.400, Simple Mail Transfer Protocol (SMTP) and Systems Network Architecture Distribution Services (SNADS).

- *Communications protocol:* This defines how mail messages are distributed, and is the protocol for transmissions between servers. For example, the communications protocol is the way in which an acknowledgment that a message was received is transmitted from the destination machine.
- *Message Transfer Agent (MTA)*: MTAs provide a method for handling a mail network in which multiple message transfer protocols are used. The MTA software provides a translation between two specific message transfer protocols; for example, between X.400 and SNADS. MTAs can be used in conjunction with a mail backbone, or implemented by multiple point-to-point connections. MTAs provide the gateway function between different MTPs.
- *Mail backbone:* This is a mechanism by which each server in the mail network connects to a common message transfer protocol. The backbone either transmits the message in its native message transfer protocol (such as X.400 or SMTP) or uses gateways to translate from one protocol to another.
- *Shared mail:* Shared mail enables single copies of mail messages to be stored in a central mail document store to which all recipients have access. Messages destined for multiple users on a mail server can optionally be stored in a shared mail document store and accessed from individual users' mail document stores using pointers. Shared mail uses a special mail document store that contains messages shared by one or more mail document stores on a single server. The mail server separates incoming messages into summary (message header) and non-summary (message body) data. Non-summary information uses most of the space in mail messages, and is identical in every copy of the message delivered by the router. Significant space savings can be made by storing a single instance of all non-summary information in this special mail document store and placing a transparent reference to that instance in the user's copy of the message stored in the user's mail document store. This is particularly useful for mail with large distribution lists.

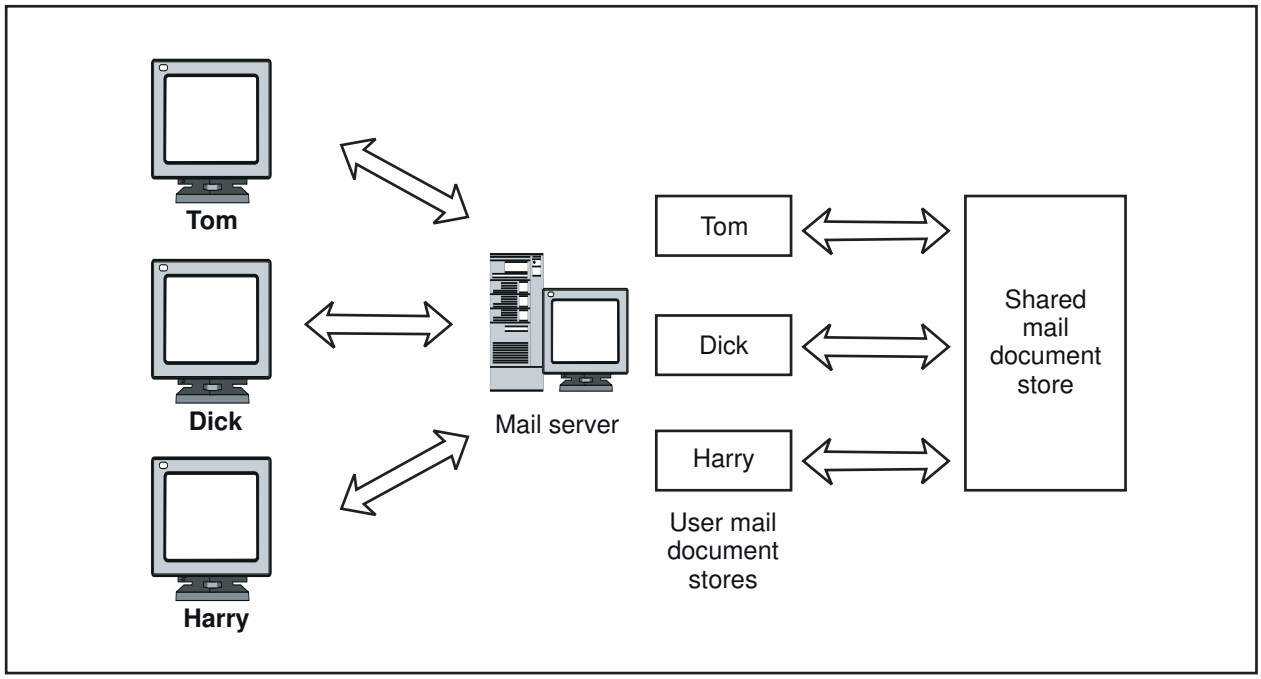

Figure 2. Shared Mail

- *Security:* The mail resource manager is concerned with protecting the mail message itself, either when held in the mail document store or in transit. This security includes the use of digital signatures and encryption. Digital signatures are a user-to-user form of authentication and guarantee that a given message is from who it says it's from. In addition, this technology enables a guarantee to its recipient that the message has neither been forged nor altered in transit. Encryption is used for individual messages for one or more intended recipients so that the message can be protected from

eavesdroppers. Because the mail document store is provided by the Collaboration resource manager, the definition of a mail message can specify that individual fields of the message are to be encrypted.

Interoperability Support

Mail is a relatively mature application, and as a result, many users find themselves in an environment of multiple mail systems, all of which need to interoperate with one another. In addition to these local requirements, the Mail resource manager must also provide server-to-server communication. This need for interoperability (heterogeneity) is one of the top requirements for the Mail resource manager.

In this environment, the requirement to exploit a variety of wide area networking topologies is evident. The Mail resource manager must be independent of the underlying transport protocols, but able to take advantage of their capabilities. The Mail resource manager provides interoperability for the distribution of mail by using two techniques: tunneling and brokering.

Tunneling means that the mail message is encapsulated (wrapped), sent over a mail backbone, retrieved on the other side, and then unwrapped. No transform takes place. This is contrasted to the "least common denominator" approach where the message is transformed into a common format (which could be less functional), sent over the mail backbone, and then transformed on the other end. From the application's point of view, tunneling is no different than going over a network protocol (such as TCP/IP sockets); it is just slower. The concept of tunneling is illustrated in Figure 3.

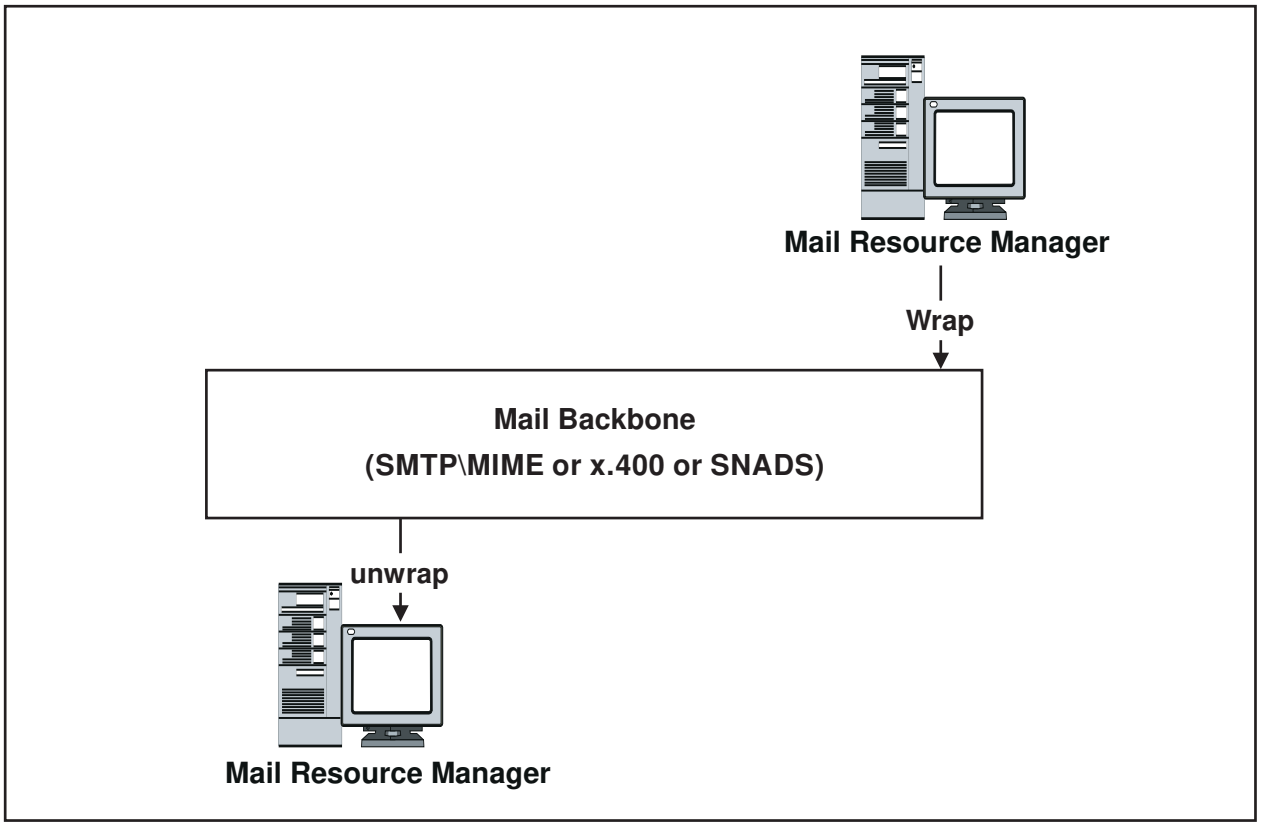

Figure 3. Example of Tunnelling

Brokering means taking a given message and formatting it in the way that the receiving system expects (the message can be made up of multiple parts). This type of delivery is important for message distribution, since the receiving program is a mail server that understands the message transfer protocol

(X.400, SMTP, and so on). Brokering alleviates the need for gateways. The brokering concept is illustrated in Figure 4.

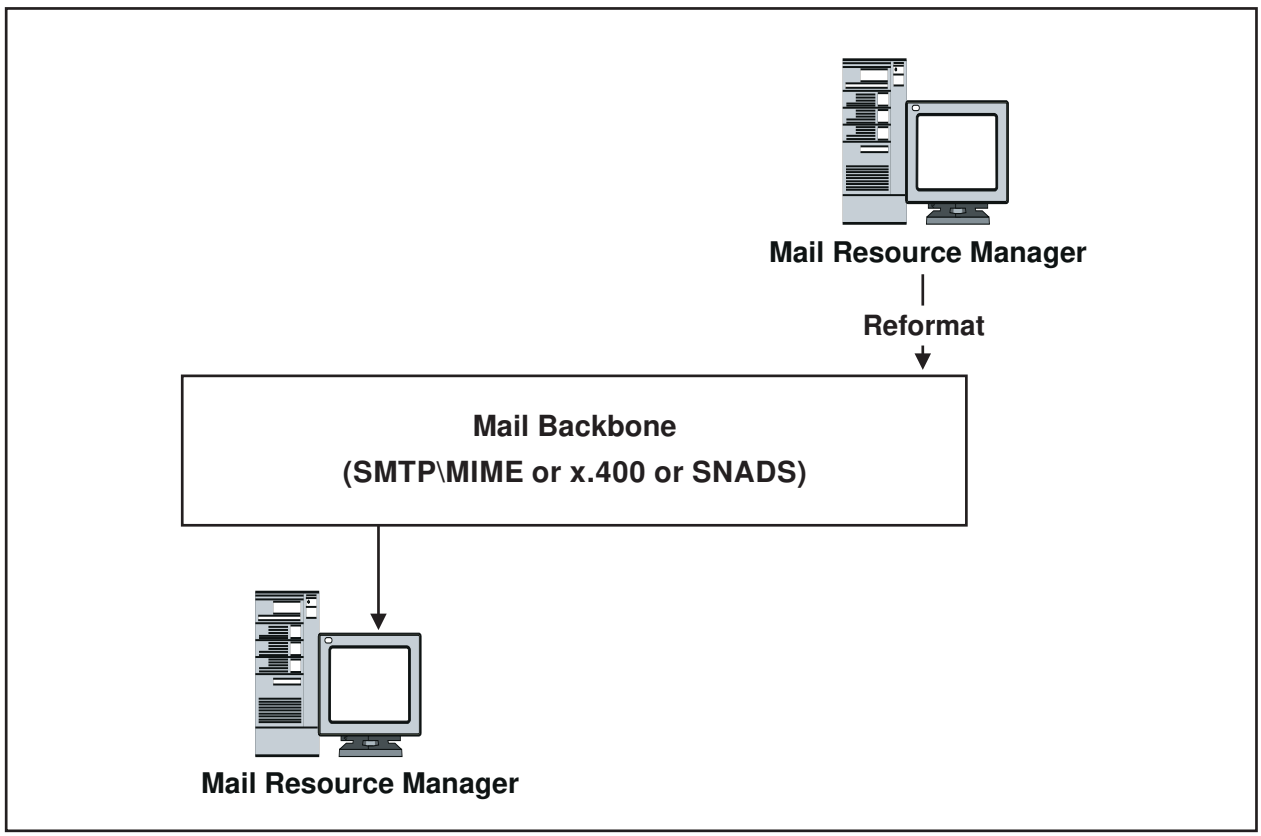

Figure 4. Example of Brokering

Internet Mail

The Mail resource manager supports the use of the Internet for mail messaging. The Internet has become the de facto network for global mail message transfer. Internet mail messaging is the process of sending an electronic message through the Internet and is the most popular application on the Internet. Simple Mail Transfer Protocol (SMTP) is the message transfer protocol used to transfer mail between computers on the Internet.

Enterprises connect to the Internet directly, through an ISP, or through a Public Network. An Internet Service Provider (ISP) is a company that offers different types of connections to the Internet. These connections range from simple dial-up connections to fully dedicated leased-line connections. Public Networks (PN) are services that provide a computing platform for use on public telecommunications networks. End users subscribe to the PN service through a network operator to establish inter-enterprise communications.

The connection can be made directly from a user workstation or from a server system supporting multiple user workstations. The Mail resource manager server function supports the connection.

A mail server can connect to another mail server over the Internet so that mail server tasks, such as mail routing, can be performed.

When sending mail messages, they are converted into plain text and any formatting information is appended as a MIME attachment. MIME stands for Multipurpose Internet Mail Extensions and is an evolving standard for the format of a multi-part message with both text and binary objects using existing text-only SMTP mail servers. Any original attachments are appended as additional MIME attachments as well.

If a MIME-capable mail application is being used, and a richer version of the document is present, the MIME mail application will display that version instead of the plain text version. MIME type support is built into the SMTP gateway. MIME types supported include BASE64 and UUencode.

The Mail resource manager can be used to access files using FTP. FTP files are accessed by sending an e-mail message to an auto-responder program designed to retrieve files from a site-specific database. These auto-responder programs are known as *listservs* or *infobots*. Some examples of listservs are the Internic's RFC server, info servers used by commercial organizations, document servers and mailing list archive servers. FTP files can also be accessed by sending an e-mail message to a mail server, such as the UNC or DEC mail servers, to request files from any site.

The Mail resource manager provides support for Post Office Protocol version 3 (POP3). POP3 is an MTP. Because POP3 is defined as a client protocol, outgoing messages to POP3 clients are translated to POP3 format. Incoming messages from POP3 clients are translated from POP3 format to the format being used in the mail server, stored in the mail document store and processed in the same way as other mail.

Advanced Server Features

Integrated messaging

Integrated messaging is a server based application that links a user's voice and e-mail boxes through administrator and user defined rules. Synchronization of the two mailboxes effectively consolidates incoming voice mail, e-mail, and fax messages so recipients can access them from their PC or telephone.

To implement integrated messaging, the system administrator installs the software on a collaboration server and then uses forms to specify information about the organization's messaging servers and the features available to each user. Once all parameters are established, integrated messaging begins linking mailboxes and handling their contents in the ways specified by the organization. Using the Telephony resource manager, users can access all types of messages by PC or telephone. Flexibility is provided via user-specified rules. Once implemented, the user will see a list of message headers in the order they were received, regardless of whether they are voice-mail messages, e-mail messages, or faxes which can be reviewed, selected and responded to. If a sound equipped PC is being used, telephone messages can be played back. Users can also choose the messaging strategy that best meets the needs of their current situation, whether they are in the office, working remotely, or on the road.

Fourth Generation Messaging

Historically, mail has undergone four generations of development.

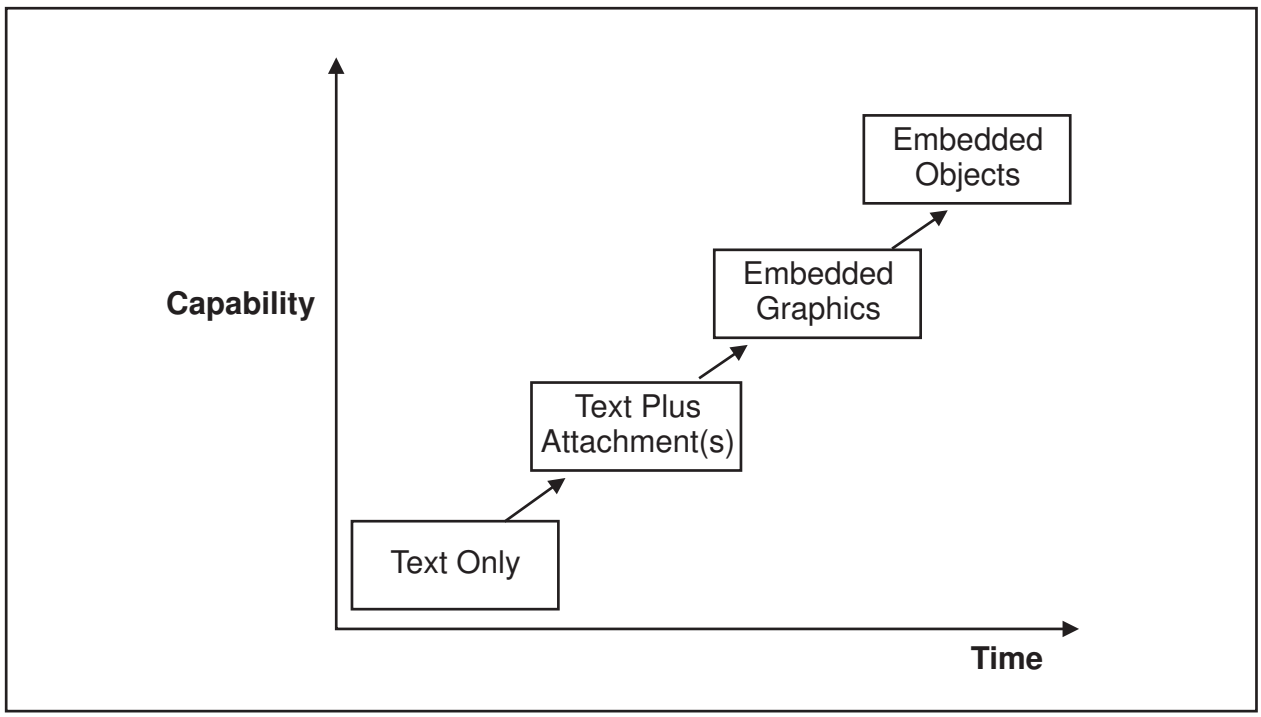

Figure 5. Four Generations of Messaging

- Simple text messages.
- Capability to attach binary documents to simple text messages.
- Support for a new type of field within a document that allows a greater variety and amount of text such as color, multiple fonts and different character sizes. Embedded objects in the message body itself is also supported, as well as in binary attachments.
- Additional support for graphics, images, audio and video directly within a document; also support for the inclusion of live data from other applications using compound document technologies. Links to documents in common document stores are maintained during the routing process.

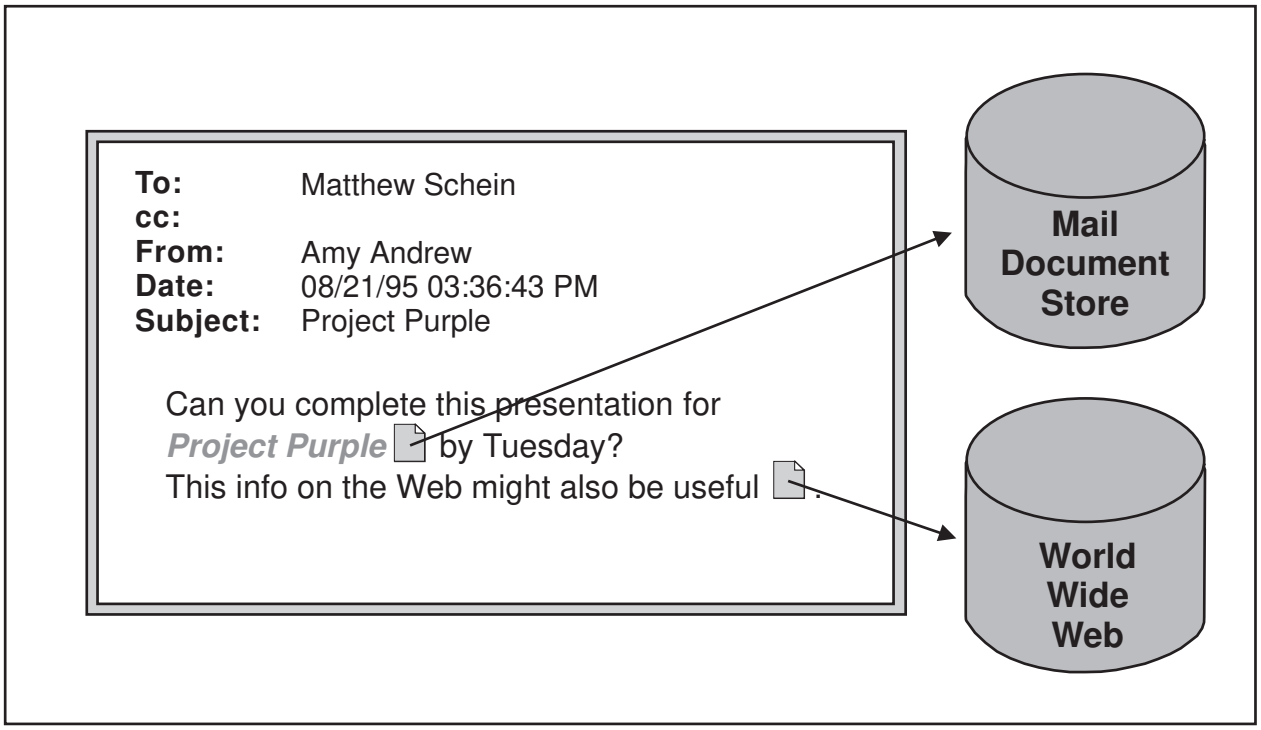

Figure 6. Fourth Generation Messaging (Example based on Lotus Notes)

In earlier generations of mail, objects such as graphics, or spreadsheets were embedded in the mail object as binary attachments. In fourth generation mail, a mail object can contain hypertext links or pointers to these objects. Figure 6 illustrates how these pointers can be used to transfer:

- Objects that contain tasks to be performed, such as graphics and spreadsheets.
- External sources of information for that task, such as rich text, graphics, images, audio and video.

In the example, the task is to complete a presentation, so the pointer would point to a presentation. Activating the pointer would enable the associated graphics application so that the presentation can be edited and run. The additional information to help in this task would be held on a Web site, so activating the pointer would bring down the Web page.

Because the objects are no longer embedded in the mail object itself, the latest versions of the objects are seen when the pointers are activated. However, although all links to documents in common object stores are maintained during the routing process, they must be able to be activated by both the sender and the recipients at any time.

Relationship to Other Resource Managers

The Mail resource manager has close affinity to several other resource managers. They are Collaboration, Directory, Identification and Authentication, Access Control, Compound Document and Telephony.

The Collaboration resource manager provides mail and mailbox document store capability.

Mail works with the Directory resource manager to locate servers or other resources in the network. The Mail resource manager places its server entries into the directory, and depends upon that directory to locate other servers. The Name and Address Book service within the Open Blueprint Federated directory is used to identify people by name, address, role, title, responsibility or any other attribute needed by the

mail application. (For more information about the Open Blueprint federated directory, see the Directory resource manager component description paper.)

The Mail resource manager also participates with the Open Blueprint Identification and Authentication and Access Control resource managers, to identify and authenticate users, to obtain their access privileges, and to support a single sign-on.

The Compound Document resource manager is used to support creation of and access to mail message attachments.

The Telephony resource manager supports integrated messaging.

Performance

A large site can be managed by dedicating specific servers as mail servers to avoid overloading. No matter where a user's mail document store resides, the size of the mail document store needs to be monitored. Mail document stores can grow large and consume considerable server resources if they are not carefully monitored and maintained.

Systems Management

Systems management is carried out by the following entities:

- **Public Name and Address Book:** The public Name and Address Book is the centralized server mail management tool. The public Name and Address Book provides a directory of mail servers, users, remote users and groups. It contains documents that manage mail-server-to-mail-server communication and mail server programs, such as routing, and mail server tasks such as event reporting. These documents provide server and network information and scenarios for mobile users who might be using different mechanisms and IDs to dial into servers. Any changes to the mail network configuration must to be made in the public Name and Address Book.
- **System Configuration Parameters**: These parameters control how the mail server runs. They are defined and stored in the mail system configuration file. Parameters include such things as logging levels, delivery of priority messages, maximum number of concurrent threads and whether shared mail is allowed on that particular mail server.
- **Systems Management Applications:** These are activated from the mail server console or the user interface. They are used to show status of particular tasks such as routing, ports or schedules for server mail related tasks or run specific server programs, such as forcing routing to a specific server overriding routes specified in the public Name and Address Book. Mail tracing is run from the user interface and is used to test mail routing or new mail connections by sending out a trace and reporting on the success or failure of the trace.
- **Shared Mail:** If shared mail is the chosen mail system for a particular server, then shared mail document stores, their sizes, and the number of users accessing them are managed. Other tasks include backup and restore, and linking or unlinking of those shared mail document stores from shared mail.
- **Mail Box:** The mail box document store holds pending mail for delivery, including dead mail in the event of delivery failure. The mailbox document store is regularly reorganized to recover internal space and monitored for growth. Mail box document stores can be created or deleted.
- **Event Logging:** Logging is used to check for server crashes, corrupted mail document stores, modem problems, dial-up problems and connection problems. Information shown includes modem I/O messages, corrupted documents and messages and calls made to and received by the mail server.

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