Oracle9*i*AS Unified Messaging Technical White Paper

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EXECUTIVE OVERVIEW

Oracle9*i*AS now contains a full feature unified messaging solution. Oracle9*i*AS Unified Messaging is the most flexible system available today. With it, an IT department can consolidate their dispersed mail systems, replace their voice systems, extend the reach of their current e-mail clients, manage their appointments, and add web client access for their users.

Oracle9*i*AS Unified Messaging leverages all of the scale, reliability, and fault tolerance of the Oracle9*i* Database. Administration is simplified, and reliability and availability are increased.

The product provides a very high-level suite of development interfaces into the servers to mail enable any other Oracle applications easier and with more functionality.

This paper contains these topics:

- Unified Messaging Components
- Administration
- Reliability
- Integration and mail as a component of Oracle9*i*AS
- Other mail functions

INTRODUCTION

Oracle9*i*AS Unified Messaging manages electronic mail, voice mail, and facsimiles all together in one highly scaleable and reliable "inbox".

A brief review of electronic mail systems would reveal a fairly well-defined grammar for mail content and for routing mail messages anywhere in the world. The problem of proprietary mail systems only communicating with other systems from the same manufacturer has been solved by standards such as Multipurpose Internet Mail Extension (MIME) and Extended Simple Mail Transport Protocol (ESMTP). There are even standards delineating how mail clients cooperate with mail servers. The most important aspect of these standards is that they are supported by a wide range of vendors. Interoperability actually does work.

Voice mail systems are more monolithic, although standards are starting to emerge such as Internet Voice Messaging (IVM) for networking mail servers. There are fewer interoperability standards and fewer vendors that actually inter-operate. The emerging standards are inheriting and extending the standards for electronic mail systems. MIME is capable of storing an e-mail message, a voice message or a facsimile. This message can be routed over an SMTP or ESMTP network.

Mail is, and will continue to be, used for more and more purposes – beyond interpersonal communication and voice mail. It is a common medium for bearing workflow information, "front ending" applications, and even application-to-application communications.

Oracle9*i*AS Unified Messaging is a completely integrated component of the Oracle Internet Application Server. When combined with the Oracle9*i* Database, Oracle9*i*AS Unified Messaging provides a comprehensive solution for all of your e-mail, voice mail and fax mail requirements. No matter what type of mail or how the mail is used, Oracle9*i*AS Unified Messaging provides the best solution available today with capabilities that grow as your needs grow.

UNIFIED MESSAGING COMPONENTS

A complete unified messaging solution consists of:

- **One or more mail stores** – depending Upon the number of accounts and amount of mail messages to manage.
- **One or more standard client access servers (for access to the mail store)** – depending upon the number of concurrent clients accessing the store(s) during peak load.
- **One or more mail servers to support the routing of mail** – depending upon the numbers of messages sent and received over a period of time.
- **One or more mail clients** – unified messaging solutions usually support a minimum of two clients per user of the system (telephone access and traditional e-mail client), but could support a number of different clients depending upon the mobility and needs of each individual user.

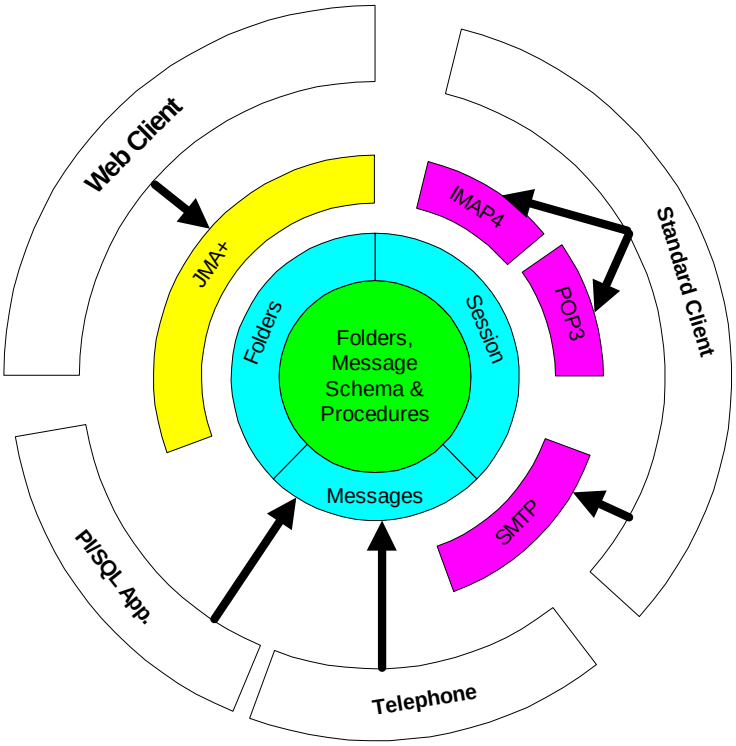
Oracle9*i*AS Unified Messaging turns an Oracle9*i* database into a high performance, scaleable unified messaging mail store, and turns an Oracle9*i*AS host into the rest of the complete unified messaging solution with Internet standard mail protocol services and web and telephone handset clients. These services can run on one host or scale across several, as required. Oracle9*i*AS Unified Messaging offers unprecedented flexibility in the numbers of accounts and messages, concurrent loads, utilization behavior, and the type of mail client used.

The Intelligent Mail Store

The core of Oracle9*i*AS Unified Messaging is its "intelligent" mail store. If a message is destined for many accounts on that mail store, only one copy of the

message is stored and links to the message are sent to all recipients. Folders can be private, shared, or public. A single mail store can store mail for one domain or several different domains. If you have an extremely large domain, it is possible to have multiple nodes support a single domain.

Applications can make direct PL/SQL calls to act upon messages similar to the voice mail client, standard protocol servers and JMA+ libraries. Calls made to these stored procedures are executed in the message store.



The mail store loads stored procedures as that enable some extremely powerful features including:

- a high-level interface
- mail processing close to the physical location of the mail
- tertiary storage
- simple extensibility mechanisms

A High-Level Interface

The Oracle9*i*AS Unified Messaging mail store exposes a comprehensive and high-level PL/SQL interface. Clients make high-level calls to the Intelligent Mail Store. Because the logic takes place inside the mail store (an Oracle9*i* database), close to the actual data, mail transactions are greatly simplified and more reliable.

Unified Messaging, by definition, consists of multiple clients and client types, all accessing the same mail store. By having all clients enter through the same interface

and perform processing in the mail store, all clients achieve the same goals with the same behavior.

For example, a typical Oracle9*i*AS Unified Messaging installation allows a user to listen to voice mail messages from any one of three clients:

- a telephone handset client
- a standard IMAP4 mail client
- a web client

If a voice mail message has not been heard, the Message Waiting Indicator (MWI) light on the user's telephone is lit. If all voice mail messages have already been listened to, the light should be off. Because the MWI logic is placed inside the mail store and not in the web client, standard client, or telephone handset, the solution consistently and appropriately turns the light off irrespective of which client was used to "listen to" the voice mail messages.

Process Close to the Data

All of the scaleable protocol servers and access servers perform tasks within these stored procedures running within the mail store.

One can query an entire mail store with a simple request and the mail store will efficiently carry it out. This comprehensive high-level interface allows effective support for system-wide rules, individual rules, server side filters, SPAM control, etc., for a very large and very dynamic mail store without serious degradation. It also affords Oracle9*i*AS Unified Messaging the ability to query and update the mail store more efficiently than any other product on the market today.

Tertiary storage

Mailboxes are dynamic in nature. Mail is constantly entering the store, being processed, and removed. Users often store mail from when they first joined the company (just in case), never cleaning up their folders. The Oracle9*i*AS Unified Messaging Intelligent Mail Store housekeeping feature not only cleans up deleted messages, it moves mail messages that are old and not often referred to or acted upon to a "tertiary" tablespace, which can be located on a less expensive disk(s).

Extensible Store

The mail store can be extended by or integrated with other Oracle product capabilities. Filters can be applied (see "Filters" below) that automatically act upon all mail messages. These filters can either perform common mail tasks on a mail message, or they can pass the mail message to any external program.

For example, the Oracle Email Center product filters all mail messages sent to the abstract "Helpdesk" mail account of a company. Each message is broken down into it's main body and any attachments. Each part is then passed, individually, through the Oracle Text engine. The results can then be routed to the appropriate

support representative, who can choose from a list of possible responses to the specific request or create and log a new response.

Standard Client Access Servers

Oracle9*i*AS Scaleable Mail Protocol Servers offer Internet standard services for accessing and manipulating mail, leveraging the latest technology available on Oracle9*i*. This permits a wide variety of mail clients to natively act upon mail stored in an Oracle database. Oracle9*i*AS Unified Messaging offers two types of mail store access protocol servers depending upon the type of mail service you plan to offer.

Post Office Protocol version 3 (POP3)

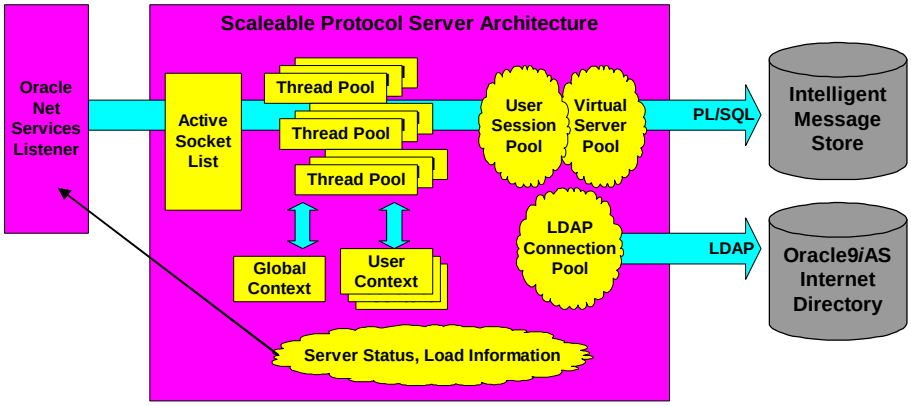
POP3 offers simple basic mail store access. Each user can connect to the message store, download messages, and optionally delete them from the server. This service offers only "Inbox" storage. There are no folder capabilities. Service Providers commonly offer this type of mail store access to provide basic mail features with little value add beyond the mail store.

Internet Messaging Access Protocol version 4 (IMAP4)

IMAP4 offers a rich set of mail storage services including folders, sub-folders and the ability for a disconnected client to re-synchronize with a mail store. Mail clients open a session with their mail store and manage mail items that are kept on the mail server.

Both mail store access servers are built on a multithreading, load balancing, and connection sharing architecture capable of supporting thousands of simultaneous logged-on users on inexpensive hardware. Both servers can work over a network, separating the processes that access mail from those of the intelligent message store. When running on a separate host, these servers can leverage all of the capabilities of Oracle Net Services including the many security features. For added security, these servers can listen on a secure SSL port. Neither server is mutually exclusive of the other. Support for IMAP4, POP3, IMAP4 SSL, POP3 SSL, or any combination is deployment specific.

All mail protocol servers listen on the well-known mail ports and route commands to the Intelligent Mail Stores or LDAP Server using pre-allocated connection pools for optimal efficiency and performance.



The Mail Routing Server

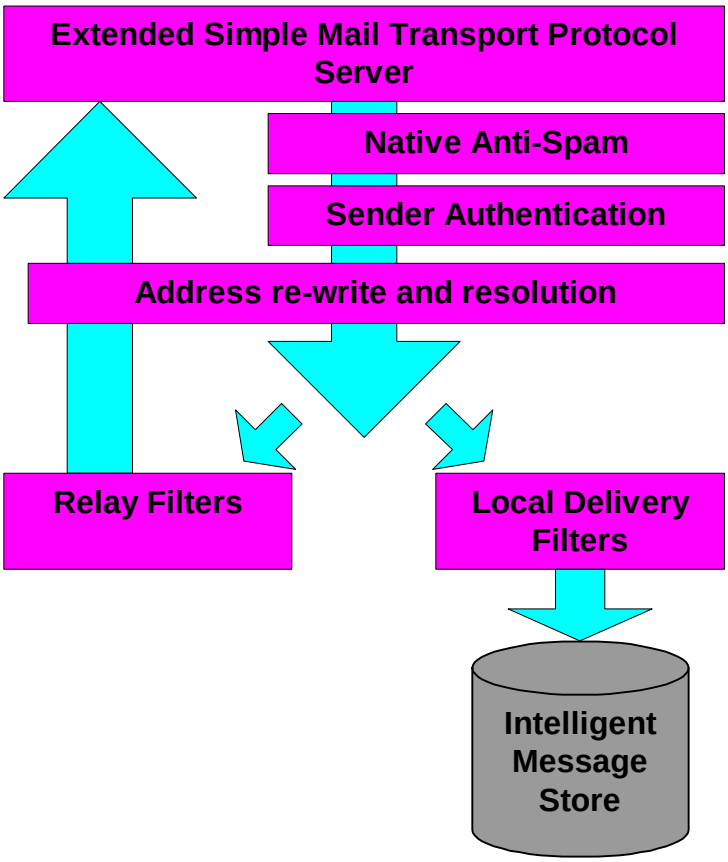
The Oracle9*i*AS Unified Messaging ESMTP server listens for incoming connections from standard clients, the web client, and other SMTP servers. Like the IMAP4 or POP3 protocol servers, it is built on a multithreading, load balancing, and connection sharing architecture. The ESMTP server can handle thousands of messages simultaneously.

The ESMTP server provides the following array of functionality:

- The system's LDAP server can be queried to authenticate the sender
- Addresses can be rewritten based on very flexible rewriting rules
- Anti-spam filters can be applied
- Two different sets of filter paths can be applied. (See below the discussion of "Filters" in "Controlling Mail")

If the intended recipient (or recipients) is local, the message is placed in the local delivery queue. Local delivery picks up the message, applies any filters, and delivers it to the user's Inbox. If the intended recipient(s) is external to the system, the message is placed in a relay/submission queue. The server queries the DNS server, applies any filters, and sends the message out.

Extended Simple Mail Transport Protocol Server with two different filter rule sets depending on whether a mail message is destined for a local or remote mail store.



Unified Messaging Clients

Oracle9*i*AS Unified Messaging provides the following clients:

- web client
- voice mail telephone client
- facsimile telephone client

Web Client

Oracle9*i*AS Unified Messaging includes a web client that gives users a simple and fast means to access their e-mail through a basic web browser. A user points their browser to a predetermined URL to log in to their e-mail account. Their inbox is rendered dynamically. The logic to render a user's folders, messages, public directory and personal address book runs at the Oracle9*i*AS Web Server. The browser acts merely as a keyboard and screen. There is no processing or data storage on the desktop.

The web client provides a standard, "out of the box" web mail solution, as well as a toolkit with means by which one can extend and modify the standard solution.

The toolkit provides a framework for easy additions or modifications of simple functionality or presentation. For example, a deployment can replace the Oracle

logo with a different graphic. The toolkit can also enforce aspects of the application such as the availability of basic actions or functionality. This reduces the amount of development effort required to customize a solution for their needs.

Voice Mail Telephone Client

Oracle9*i*AS Unified Messaging includes a traditional telephone handset client that enables telephone interaction with the Unified Messaging system.

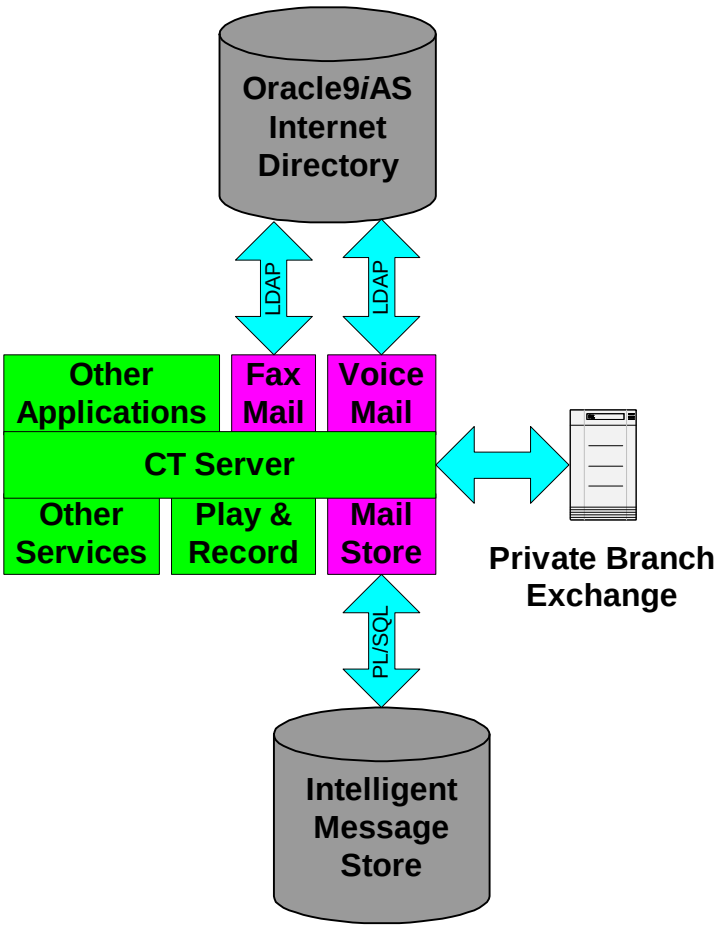
The client is based upon the architecture and approach defined by the Enterprise Computer Telephony Forum (ECTF). This will allow future releases to support enhancements to the solution such as Text To Speech (TTS) and Automatic Speech Recognition (ASR) in a vendor-independent manner.

Voice mail messages are stored and accessed directly in the Oracle9*i*AS Unified Messaging mail store. The concept of a Unified Messaging user is extended to support authentication that is client specific – when accessing mail over the handset, a user is able to authenticate with a telephone number and numeric personal identification number.

Facsimile Telephone Client

Oracle9*i*AS Unified Messaging includes a telephone client that allows users to directly receive a facsimile message. While anyone can call a user's extension, the telephone client can recognize an incoming G3 fax and convert it into a mail message. (The current offering supports inbound facsimiles only.)

Oracle9*i*AS Unified Messaging Voice Mail and Facsimile Mail clients authenticate against the common LDAP repository and act upon mail in the Intelligent Message Store. Users use the twelve key pad of the telephone to manage their information.



Calendar Server

Oracle9*i*AS Unified Messaging provides a full-featured web interface client for storing and managing appointments in a centralized calendar store. This approach gives users full calendar functionality from any web browser , and provides a single source of information for PDA synchronization.

The system supports personal appointments and group appointments. One can be a member of more than one group. Group meetings show up in the personal calendar of each member of the group. This feature is used for things like team meetings or company wide holidays.

A scheduling program is included to find free time of multiple attendees over multiple time zones. Attendees can accept or decline invitations.

Other basic functions include:

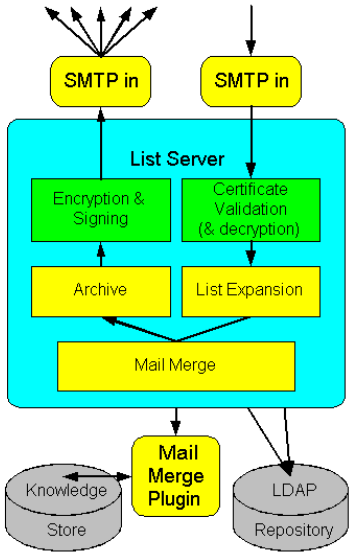
- Reoccurring appointments; daily, weekly, monthly (by day or date), and yearly
- Reminders and notifications over e-mail
- Private address books

- To-do lists
- Journals

List Server

Oracle9*i*AS Unified Messaging has a new list server. This provides a means of public list management as well as integration with other messaging services for applications.

Oracle9*i*AS Unified Messaging List Server can send S/MIME messages with bodies containing PL/SQL procedure tags. These tags are replaced with the values the procedure returns.



The Oracle9*i*AS Unified Messaging List Server allows users to own and administer public mailing lists. These lists can be set up as a means of distributing information to groups of people or as a discussion forum. For example, all members of a list could be people in a specific organization in a company, with the list managed by the vice president's administrative assistant. Another list could be made up of people who are interested in sailing. These list server lists can be set up with restricted membership, where users must be approved before becoming a member. For example, the vice president in the example above probably wants only people in her own organization to be on her list. List server lists can also be set up so that any messages sent out are moderated, where only certain members can send out messages. For example, the administrator of the sailing list may screen out advertisements.

APIs provided with the Oracle9*i*AS Unified Messaging List Server enable users to customize lists and messages sent out to a list. These Oracle9*i*AS Unified Messaging List Server features can be used for applications such as marketing campaigns where special non-transferable offers are sent to and readable only by the intended recipients. For example, a user can use the list server APIs to query a database of sales information to create a list of all customers who have made purchases in the past three months, then send coupons by e-mail to each of the customers with discounts based on the amount of their purchases.

A future version of the Oracle9*i*AS Unified Messaging List Server will be a secure list server. Messages sent to a secure list can be signed and encrypted so that they are readable only by the authorized recipients of the list. For example, a billing application could be integrated with the Oracle9*i*AS Unified Messaging List Server to send bills through e-mail. Because these bills contain personal information, e-mail bills can be signed by the billing company to assure the recipient that the e-mail is authentic, and encrypted so that only the intended recipient can read the contents of the message.

ADMINISTRATION

Oracle9*i*AS Unified Messaging provides complete administration capabilities from a single tool set built upon the Oracle Enterprise Manager. The solution includes the ability to delegate administration in hosted and larger deployments.

Oracle Enterprise Manager

Oracle Enterprise Manager is a single, integrated solution for administering and monitoring global e-Business enterprises. The Enterprise Manager with Oracle9*i*AS Version 2 provides tools to correlate computing performance to business service performance across all components of Oracle9*i*AS – host, database, web server, and applications; enabling identification and resolution of service performance problems from within a single framework.

As part of this framework, Oracle9*i*AS Unified Messaging administration can leverage all of the advanced features, including process administration, tuning, change management, capacity planning, system monitoring, real-time monitoring, event-based notifications, and system target discovery. The framework provides the same web-based look-and-feel for Oracle9*i*AS Unified Messaging administration as other Oracle products. The framework is Internet standard based with all displays using HTML, and all connections made via HTTP. A simple web browser is all that is required as a single administrative point to manage the system and view monitoring data. .

Delegated Administration

Oracle9*i*AS Unified Messaging can be administered on different levels. A system administrator can manage the entire Oracle9*i*AS system, including all hosts,

processes and programs associated with Oracle9*i*AS Unified Messaging. Large installations and hosted deployments can also delegate basic user administration, such as adding and removing users, resetting passwords, and managing domain-level system parameters, within a domain. A single mail node can store mail for two or more companies, with each company securely administering their own name service.

Oracle9*i*AS Unified Messaging exposes several administrative capabilities to the end user as well, available as self service from the web client. End users can change their own passwords, create server side filters, and activate or inactivate filters.

RELIABILITY

The value of a company's mail differs from company to company ranging from superficial use of mail to mail messages containing the basis of million dollar deals. Many of today's companies expose mail accounts so that their customers can obtain support, receive important notices, or purchase goods and services through the electronic mail system. Oracle9*i*AS Unified Messaging, built on the Oracle9*i* database, offers as highly available, or fault tolerant, a unified messaging solution as is required.

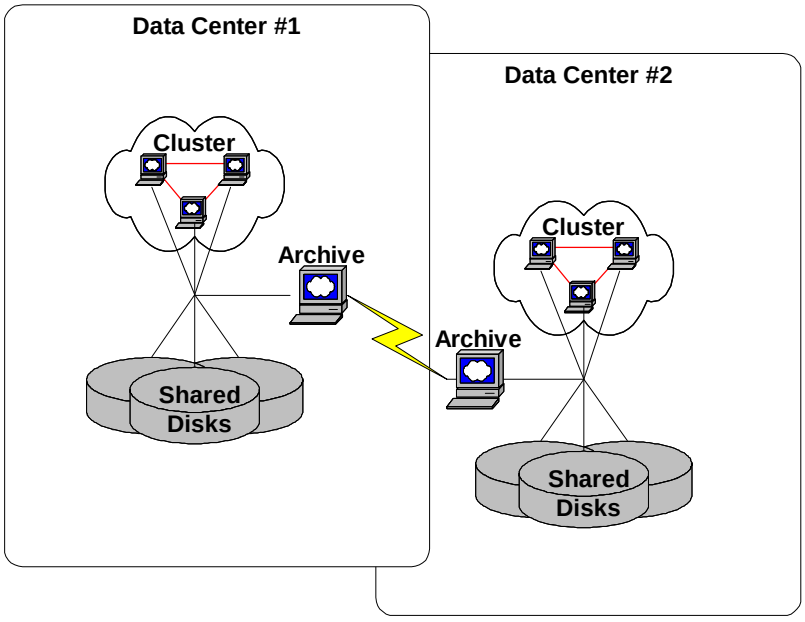
Unified Messaging on Reliable Application Clusters

By creating an Oracle9*i*AS Unified Messaging mail store on a Reliable Application Cluster (RAC), one can actually increase availability and scale at the same time. Users enjoy uninterrupted service. Additional hardware servers add scale. A larger number of smaller systems can actually increase performance and reliability at a reduced cost.

Disaster Proof Unified Messaging

Some mail systems must be disaster proof. In cases where the uses warrant an investment to make everything redundant in multiple locations, Oracle has the solution. Even a catastrophic failure of your data center will only cost a few minutes of downtime.

Each deployment can store mail on a standard Oracle9*i* database, a Oracle9*i* Reliable Application Cluster database, or a fully redundant backup data center.



FILTERS

A filter is an action taken based upon a set of conditions being met by a mail message, at a particular event point in that mail message's life span. A condition can be set on any information in the mail header, the envelope, and the message size. Examples of conditions are:

- All messages from this user
- Messages from this domain
- All messages that have the word "urgent" in the subject
- All messages with an attachment with the extension ".exe"

The life span of a message begins when it is created. It is then sent to one or more recipients, used by the recipients, and eventually deleted and removed from the system. Oracle9*i*AS Unified Messaging defines the following event control points:

- Sending a message out of the mail system
- Receiving a message into the system
- Receiving a message into an inbox
- Deleting a message

At any particular event control point, messages are queried to see if a particular condition or set of conditions are met. This combination of conditions at an event control point make the filter. Each event control point can have as many filters as needed. Each filter, if it is true for a message, will execute an action. Actions are extensible. You can write a PL/SQL procedure action to do anything you want. Oracle9*i*AS Unified Messaging comes with several common actions that do not require programming, including:

- Deleting a message
- Forwarding a message to an address
- Suspending the receipt of a message
- Suspending the sending of a message
- Replying to a message
- Moving or copying a message to a folder

Oracle9*i*AS Unified Messaging supports two types of filters: system filters and individual filters. System filters are managed by an administrator and are often hidden from the users. Individual filters are self service managed by individual users.

While filters are often available through many vendor's e-mail clients, these client side filters work only when the client is checking e-mail using that particular client on the computer on which the user created the filter. Oracle9*i*AS Unified Messaging filters execute on the servers and not on the clients, which makes them extremely powerful. These filters run on all messages, regardless of when, where, or which client is used to access the system. It is through these filtering mechanisms that Oracle9*i*AS Unified Messaging offers additional control over the service, including virus protection and spam filtering.

Virus Protection

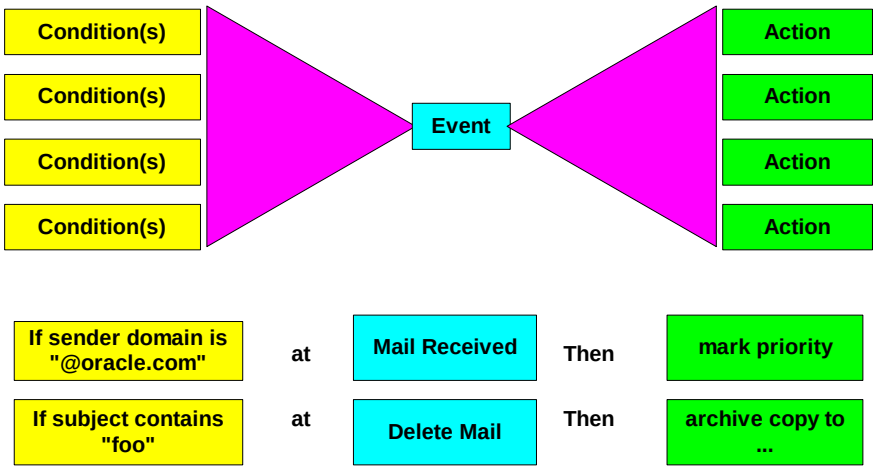
System filters at the inbound event control point offer an inexpensive means by which one can filter out many viruses. For example, all messages passing through the inbound SMTP server that contain "I love you" in the subject and have an .exe attachment should be put into the suspension queue. Filters can also be used for more expensive and thorough third party virus scans; for example, all inbound messages, no matter what, pass to a third party virus scanner.

You want to keep your mail system open to everyone. New mail-born viruses are created and evolve all the time. There is a lag in time between the virus 'creation and when it is found and understood. Often a new virus will already be in your mail store before your virus scanning software or inbound filters recognize it and can check for it. With Oracle9*i*AS Unified Messaging, this is not as much of a concern as many other mail systems. First, Oracle9*i*AS Unified Messaging scales, so there are fewer mail stores you need to scrub. Second, the mail store is an Oracle database, which is the most effective place to have your information if you need to quickly query it to find these new viruses. Oracle9*i*AS Unified Messaging can apply the same concepts as filters. It can check a complete mail store for all instances of a message that meets a particular virus fingerprint and remove it from the store.

Spam Control

Filters are also useful in the control of spam. The site administrator can filter out all messages from known spam addresses. End users can filter out spam on an individual basis as well.

At each event control point, each mail item is interrogated for condition sets and, if conditions are met, an action is execute d.



MAIL IN THE BIGGER PICTURE

Oracle9*i*AS Unified Messaging is a component of Oracle9*i*AS and benefits from being fully integrated. The product is tightly integrated in the installation process for Oracle9*i*AS and into the Oracle9*i*AS Infrastructure LDAP server. The web client is tightly integrated into the Oracle9*i*AS Infrastructure Single Sign-On server. As a component of Oracle9*i*AS, Unified Messaging and other Oracle9*i*AS components are easier to integrate and simpler to administer. They run on a common technology stack under a common architecture.

A Common Installation

During installation, all middle tier mail processes and servers register themselves with the Infrastructure LDAP server. They become visible to each other and to the Enterprise Manager based framework. By simply providing access to the Oracle9*i*AS LDAP server, each middle tier inherits connection information from all other processes, services, and mail stores already known to the installation.

A Common Oracle User

Oracle9*i*AS products share common directory schema standards for users as well as for applications. User management and provisioning are shared. Oracle9*i*AS Unified Messaging manages the mail of a “common” Oracle user. The administrator does not have to create a mail user for the mail system, a human resources user for the HR system, and a portal user for the portal system, because a single user is created who is capable of using the mail, HR, and portal systems.

Oracle9*i*AS Unified Messaging offers several different entry points for different mail clients. Some mail clients are part of a larger solution. An example is the Oracle9*i*AS Unified Messaging web mail client behind an enterprise portal. Mixing the capabilities of these types of deployments can be difficult. Oracle makes it easy through the Oracle9*i*AS Single Sign-On server.

Oracle9*i*AS Unified Messaging mail access servers support third party clients. These clients log directly into the mail server; authenticate with a user name and password; and support mail capabilities. At the same time, an Enterprise Portal can accept a user name and password to enter a personal desktop with mail and other applications. Once a user logs into their portal, they do not want to log into their mail system a second time. Oracle products support Oracle9*i*AS Single Sign-On, which uses the Oracle9*i*AS Infrastructure LDAP as its repository of users. Oracle9*i*AS Unified Messaging uses the same Oracle9*i*AS Infrastructure LDAP and common user as its repository. Everything works seamlessly, no matter what the entry point or what modifications take place. An administrator creates or removes one user for everything. A user changes one password, and that password is used for all their clients.

Programming to Unified Messaging

Mail and mail systems are increasingly used as a common format and medium for performing an ever-broader set of tasks. List servers inexpensively keep employees and customers informed of important events. Programs intercommunicate over mail. E-mail forms are common. In this environment, the developer quickly realizes that sending a message can be easy, but receiving and understanding a message is not so trivial. Oracle9*i*AS Unified Messaging offers a broad range of programmatic interfaces to help the developer mail enable applications or use the mail system to do work.

Oracle9*i*AS Unified Messaging supports the following interfaces:

- Java
- PL/SQL

Java Interface

Java is another premier technology. It is commonly used as the engine of choice for developing dynamic web pages such as those that render the Oracle Webmail client. Java has a common API for accessing and manipulating mail in a mail store called the Java Mail API (JMA) and a common API for the directory repository called Java Naming and Directory Interface (JNDI). Oracle9*i*AS Unified Messaging has extended these interfaces to leverage the intelligence of the Oracle mail store and the functionality of the Oracle database and other Oracle products including the following:

- **Shared Folders** – Find out if a folder is shared and manage access control information such as adding or removing a grantee from the access list or get the grantees list.
- **Authenticated sending** - Authenticate with the Oracle9*i*AS Unified Messaging ESMTP services.
- **S/MIME support** – Encrypt, sign decrypt or verify an S/MIME mail message.
- **Oracle Text support** – Get themes or highlights of a message.
- **Server Side Sorting** - Sort mail in a folder in the Intelligent Mail Store, rather than in the Java client or web client middle tier. This has a dramatically positive affect on increasing the performance while lowering the middle tier resource requirements.

Furthermore, the Oracle9*i*AS Unified Messaging JMA directly communicates with one or more Intelligent Mail Stores, permitting unparalleled scale.

PL/SQL Interface

Applications such as order processing, bill payment, and marketing systems rely on e-mail as a mechanism for customer interaction. Since most of these applications already have a database back-end, and in most cases the database is an Oracle database, applications can benefit greatly by having a PL/SQL SDK for messaging operations.

The Oracle9*i*AS Unified Messaging SDK is complete in the sense that it has all of the functionality needed to develop an e-mail client. It exposes an easy to use, object based interface for all e-mail functions. The developer should be knowledgeable about the basics of the RFC822 and MIME standards, enough to understand the meaning of various headers and message structure, but is not expected to know details like encoding/decoding algorithms, character set conversions and so on. All the data returned by the functions is in decoded format and the character set is converted to the client character set for the developer. The interface includes batch fetching and updates for reducing round trips and increasing performance; support for multiple sessions, multiple simultaneous fetches, and composing; and other e-mail tasks.

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