Oracle Email Server Overview and Scaling Demonstration

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INTRODUCTION

The rapid growth of the Internet, corporate intranets and extranets call for new scaling requirements while supporting a broad range of user types. Oracle's Email Server ™, comprised of scalable database servers and a distributed tier of protocol listeners, can help organizations achieve such scalability.

The solution to this demand for scalability is delivered by the most performant, fault tolerant, robust and flexible data storage mechanism in existence, Oracle 8*i*. With a linearly scalable tier of servers handling Internet protocol negotiations and by multiplexing the requests to an Oracle 8i database, Oracle's Email Server can scale from hundreds of thousands to millions of users.

This document outlines the advanced capabilities of Oracle's Email Server, its ability to easily integrate into existing applications, the hardware flexibility as a customer chooses to expand their system, and the reliability, security & manageability of storing messaging content in the Oracle 8*i* database server. In order to demonstrate the scalability of this system this paper includes an overview of an audited benchmark demonstrating 360,000 concurrent users on a single server.

THE INTERNET CHANGES EVERYTHING

The Internet has brought the world to a point in time where access to information from anywhere, at anytime, via any client, has become vital to a company's success. As our society is increasingly reliant upon information flows there has been an increase in the

- Demand for 'dialtone' reliability,
- Easier access mechanisms to the data, and
- Requirements to manage, build and **relate** data to external events and other information networks.

Oracle's Email Server handles these requirements by:

- Offering a centralized, reliable, fault tolerant server architecture that can cope with many users – Oracle 8*i*.
- Leveraging the features of a RDBMS, over the traditional flat file system, to store and relate nearly any type of information – Oracle 8*i*.
- An application server layer that is scalable, standards based and extensible
- Providing a powerful & flexible 'rules' engine. This rules engine can proactively handle custom designed events either from the messaging server itself or from other existing applications.

The Internet brings a convergence of more users and data onto fewer servers.[1] Paralleling the decline of each building having its own electric generator as the power grid developed, we have greater efficiency, reliability and manageability with centrally managed information networks. The real value of information density is the ability to relate the data and integrate with other applications. Oracle's Email Server provides a rules engine that can act on internal or external

[1] The proportion of Servers to Clients is shrinking. The total number of servers is growing with the Internet.

events. This coupled with a programmable PL/SQL interface allows for cohesive integration with other business processes

ORACLE'S Email Server:

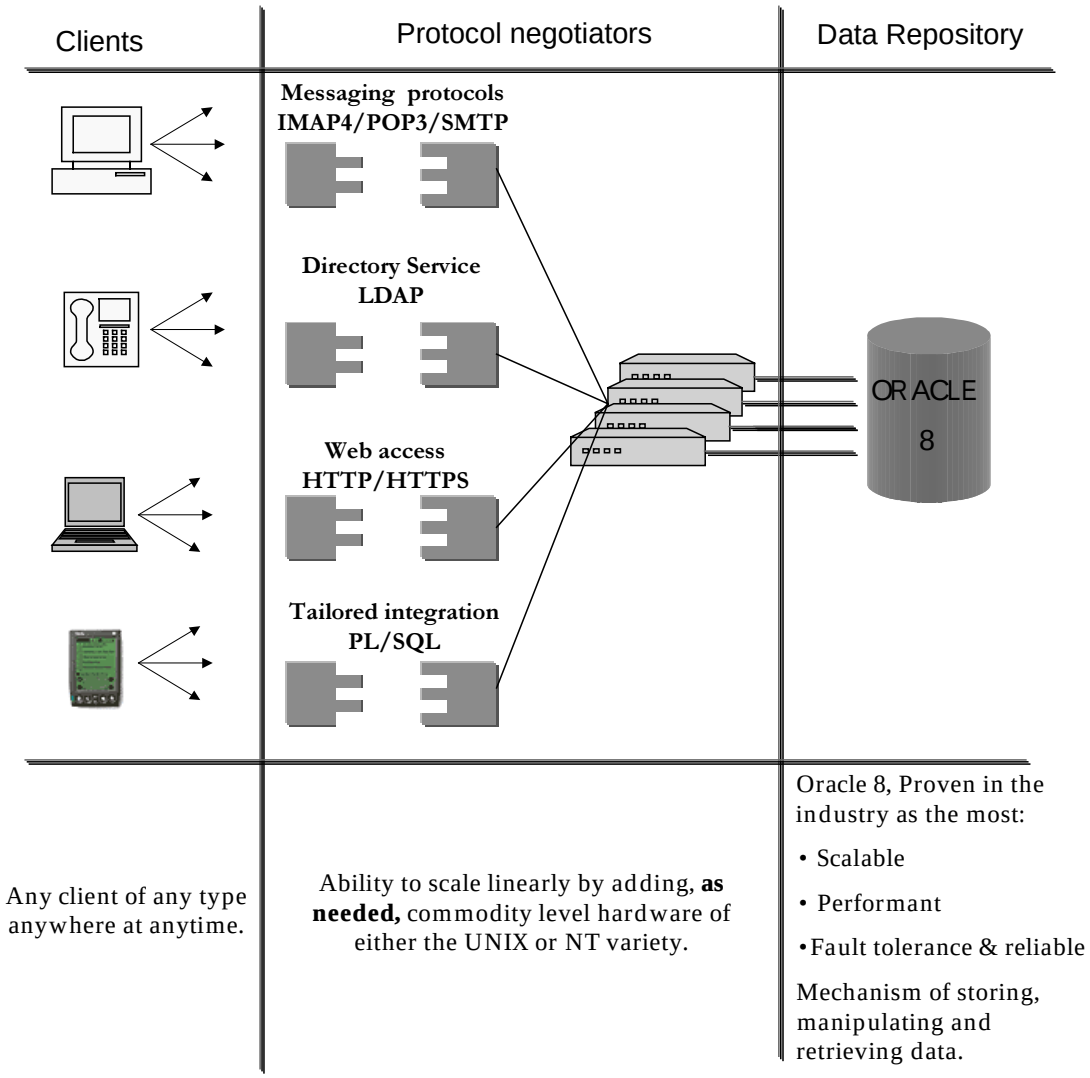


Figure 1

Oracle's email server partitions the workload into two distinct tiers. The front line tier acts as a protocol negotiator, allowing for the translation of HTTP, LDAP, IMAP4, POP3 & SMTP protocols into direct database queries. Each middle tier server multiplexes the Internet protocol requests over a relatively small number of database connections. This tier of protocol listeners work independently of each other and servers can be added as growth dictates. No data resides on this tier and the demands for nearly zero down time can be relaxed as surviving servers fill in for a failed node. Not requiring the five nines "99.999%" uptime for the individual middle tier servers reduces this tiers cost of ownership. The highlights of allowing a protocol tier to exist separate from the data repository are:

- **Less expensive.** Utilization of smaller commodity level hardware for 'data-less' tiers. More expensive hardware that has high availability componentry is dedicated to the tier holding the data.
- **Open**. Middle tier hardware types can be heterogeneous if desired.
- **Linear scalability.** Ability to add machines one at a time as demand grows.
- **Load balancing and failover.** Load from a failed server can be easily spread across the surviving protocol negotiators.

The data repository. Messaging built upon a database is an essential part of an integrated application for today's business environment. Oracle's superior database technology guarantees delivery of messages, documents and workflow information. In today's messaging environment where scalability, security, and mission critical reliability are key, database messaging provides the ideal solution to enterprises, service providers and developers while giving everyday application users the power typically reserved for high end applications.

This demonstration of scalability for a large user population complements other benchmarks of Oracle 8*i,* including industry recognized TPC Benchmarks™ TPC-C for OLTP throughput, and TPC-D for decision support power. The combination of these fully audited benchmarks is unmatched by any other database and demonstrates the unequaled power and scalability of Oracle 8*i.*

Integration. With Internet Computing, the database is the central point of integration, unifying operational and collaborative data to support the full range of business and consumer applications. By providing a programmable interface and a flexible rules engine the product works with other applications. Data does not want to be alone, and the value of data increases as cohesive relationships with other data and events grows. The majority of wealth being built on this planet is by creating, controlling and disseminating information. Email is one component of this data explosion and the best tool to integrate, leverage and provide a dynamic place for this information to live is in a database.

An example of this technology is being currently used by Oracle's Customer Resource Management product. Figure 2 illustrates a brief overview of how this technology can be implemented to integrate with external systems and interrelate the data held within email.

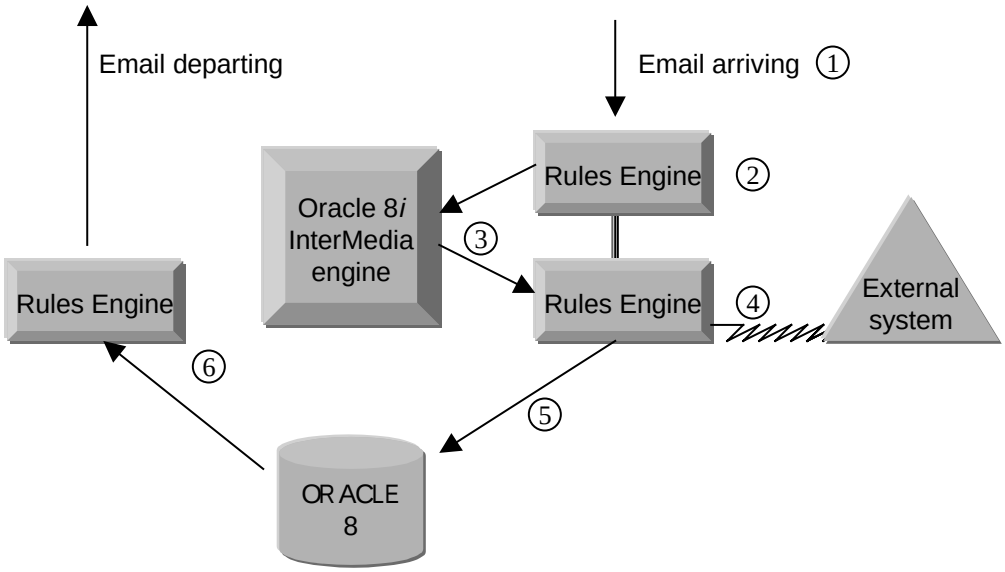


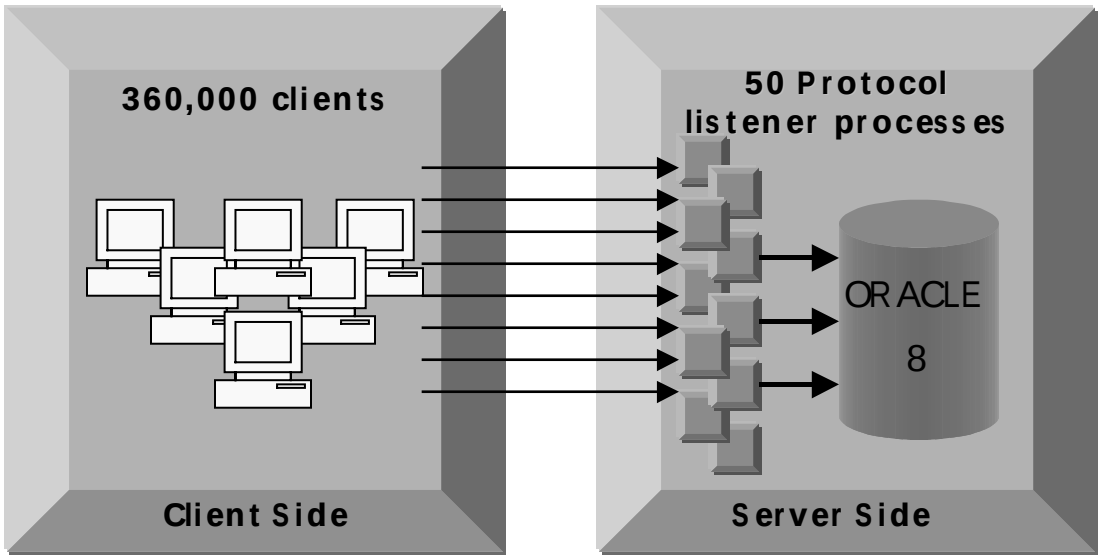
Figure 2
Steps:

1. Email arrives.
2. The rules engine checks if there are any actions to be taken depending upon the header, addressee, or addressor.
3. If the message satisfies one of the filtering conditions it is routed to the Oracle InterMedia text engine. The InterMedia engine processes the message analyzing content and creates themes and gists. The results are piped back to the rules engine.
4. The rules engine analyzes the results and determines if further actions are necessary. For example, if the I.M.T. engine determines the theme of the message was requesting more information on a particular book, an automated response sending out pertinent information on this item could be sent.
5. The message is routed to the desired recipient and stored in the database.
6. When a message is generated and sent out to the Internet. The rules engine checks the messages for any relevant rules. For example all messages going to a particular client could be blind carbon copied to an administrator.

Availability. As the demand for data rises so does the cost of having the data unavailable. The Oracle database has a wide range of options to insure data is available at all times, from the Oracle Parallel server option, to geographic disparate solutions with symmetric replication the Oracle database can be architected for any level of availability.

Scalability. The power of the Oracle database can grow both horizontally by clustering on either NT or UNIX hardware, and vertically by being able to effectively use UNIX platforms composed of dozens to hundreds of processors.

THE SCALABILITY DEMONSTRATION



THE APPLICATION

Client Application
The clients were a mixture of 350,000 POP3 and 10,000 IMAP4 simulated users. The POP3 users simulated two mail checks per hour, the IMAP4 clients simulated 4 mail checks per hour. The clients averaged sending 60,000 messages, each carbon copied to two users, an hour

averaging 5.4 Kb. This calculates out to over 13,000 ‘messaging operations’ per minute. The message size profile was designed to emulate real world scenarios with a wide range of message sizes and a portion of the messages containing embedded graphics and other rich content. To simulate this number of clients, an in house Java program emulated the exact calls of the Netscape 4.61 client.

Middle tier Processes:
For the purpose of this benchmark the database and protocol listeners were placed on a single Sun E6500. 50 IMAP processes and 50 POP3 processes were started up each with 10 connections to the database. SMTP connections were handled by a dynamic number of Sendmail processes that would be launched upon a incoming connection and then funneled into the database over 20 gateway processes, each with 1 static database connection.

Database:
The final tier was an Oracle 8 server running a single database. With a relatively small number of database connections serving a large user population the overhead of dynamically creating database connection for incoming users is eliminated. By using such features of the Oracle 8 server as serially reusable SQL and PL/SQL statements, the Cost Based Optimizer to find optimal execution plans, intimate shared memory and other performance features of the Oracle 8 database the messaging transaction rate at the imposed load was excellent.

THE HARDWARE

Server Platform

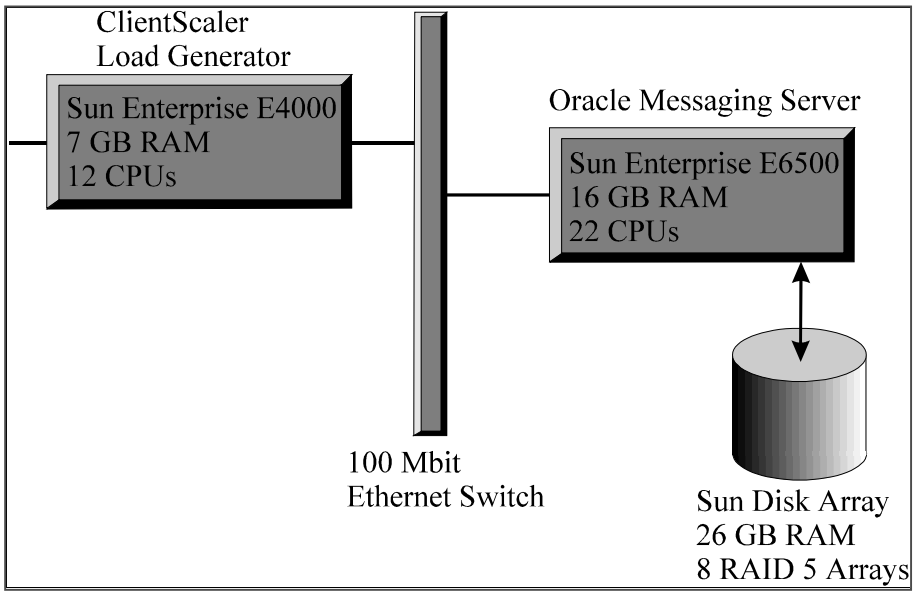
HARDWARE	**SUN ENTERPRISE E6500**
OPERATING SYSTEM	SUN SOLARIS 2.6
CPUs	22 @ 336 MHz
Memory	16 Gigabytes, 60 Ns, 16 –way interleaved factor
Hard Disk	26 Gigabytes Configured as 8 RAID 5 arrays of 34300 Megabytes each
Database Manager	Oracle 8 version 8.05
Messaging Application	Oracle Messaging Server version 4.2

Client Platform

HARDWARE	**SUN ENTERPRISE E4000**
OPERATING SYSTEM	SUN SOLARIS 2.6
CPUs	12 @ 336 MHz
MEMORY	7 GIGABYTES, 60 NS, 4 –WAY INTERLEAVED FACTOR
Load Generator Application utility)	ClientScaler-0.6 (Oracle in-house developed JAVA

Network

Switch	100 Mbit Ethernet switched network with no other traffic than benchmark transactions



THE RESULTS

During the timed, steady state portion of the test (63 minutes), ClientScaler, the test utility, simulated a load of approximately 10,000 IMAP users and 350,000 POP3 users. The simulated users generated a total of 721,818 POP3 get new mail cycles and 40,252 IMAP4 check and fetch cycles. Additionally, 61,367 SMTP messages were sent with each message carbon copied to two users.

Based on these measurements, the Oracle Messaging Server sustained 360,000 concurrent users with an average rate of over 13,700 messaging transactions per minute, and a response time of less that 1 second for a typical user sequence of sending or checking/retrieving mail.

The response time of each transaction was measured. Table 1 correlates the transaction response rates to corresponding user response time for a typical sequence of sending or checking/retrieving mail. User response time naturally varies depending on the size and number of messages sent or retrieved. Therefore, Table 1 lists three response ranges depending on the message file size being sent or retrieved. These results illustrate that Oracle's messaging server provides excellent response times for a very large user population and range of message file sizes.

Protocol	File Size (Kbytes)	Response (sec)	File Size (Kbytes)	Response (sec)	File Size (Kbytes)	Response (sec)
SMTP	1	.35	Up to 35	.37	141	.4
POP3	1	.57	Up to 5	.6	141	1.1
IMAP4	1	.86	Up to 5	.88	141	1.3

Table 1 User response time (seconds) by sequence of mail operations and file size.

WHAT THE RESULTS MEAN

Scalability

Utilizing the Oracle 8*i* database to intelligently manage the storage and retrieval of messaging content while leveraging commodity level hardware to handle protocol negotiations is an efficient and scalable solution. Key characteristics of this system beyond scalability include high availability and resiliency of using a database with integrated transactional durability and system management, including integrated backup and recovery. This technology being demonstrated is a radical departure from the past where scalable applications had to be hand crafted using the most expensive software and hardware systems. Now with Oracle 8*i* and Internet Messaging rapid development of scalable solutions that integrate into even the largest existing information infrastructure, is feasible.

The fully audited report is available independently from Shiloh Associates.

CONCLUSION

The best place to store, manage, analyze and interrelate data is in a database. The most performant database in existence is Oracle *8i.* Email began as a limited tool to exchange small and discrete units of information to a limited community. The sophistication of this burgeoning nervous system was limited. Today Email can be accessed from anywhere, the information it contains comes in many multimedia forms and the number of relationships the data holds to external events and information is growing. Email has become the principal building block to a complex nervous system within the Internet.

With this rise in importance and nearly universal use grows a parallel demand for reliable, manageable and scalable messaging solutions. With a linearly scalable tier of protocol negotiators coupled with proven database technology, Oracle 8*i* and Universal Messaging can deliver scalable and integrated solutions to the largest information networks in existence, today.

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