TATA CONSULTANCY SERVICES

NetScaler Application Delivery System
&
Oracle Applications E-Business Suite

Performance Report

April 2005

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1.0 Project Goals

Accelerating the performance of popular enterprise applications, such as the Oracle E-Business Suite, has emerged as a critical IT priority. Slow and unpredictable application response times directly impair the productivity of application users, including employees and business partners. In most cases, these application delivery problems are not the result of flaws in the application design, but are instead, the result of an underlying network infrastructure that was never designed to deliver complex modern applications.

To accelerate the delivery of these applications, IT buyers are looking beyond traditional L4-7 load balancing systems and deploying a new generation of devices – *Application Delivery Systems.* To completely understand the performance benefits of these solutions, IT professionals are increasingly seeking third-party validation of product capabilities.

To meet the need for accurate performance data in real world application environments, NetScaler commissioned Tata Consultancy Services (TCS) to complete a validation of the acceleration capabilities of its Application Delivery System. As one of the world's leading information technology consulting organizations, TCS applied its extensive experience in developing and implementing Oracle Applications to assess the real-world performance benefit to Oracle users conducting transactions common in Oracle Applications environments.

2.0 Performance Testing

To generate results representative of actual Oracle user experiences, TCS validated performance benefits using three different Oracle scenarios. Each test focused on a common Oracle Applications transaction contributing a disproportionate impact to overall application response time. Measuring application response performance for critical transactions highlights how overall application usability can be negatively affected by even a single user transaction request. The transactions tested are consistent with a normal Oracle use case.

User response times for each application transaction were measured and recorded with and without NetScaler acceleration enabled. All application and network variables were maintained constant to isolate the benefits of the NetScaler system. All Oracle functionality was validated prior to performance testing. Multiple test runs were performed for each transaction to ensure both consistency and repeatability.

The following Oracle application components and modules were used during the performance testing:

- Oracle iStore (web-based)
- Oracle Configurator (web-based)
- Oracle Order Management Module (Forms-based)

TCS conducted a thorough evaluation and validation of all aspects of the performance testing, including:

- Application Test Scenarios
- Test Methodology
- Test Bed Architecture
- Oracle Application Configuration
- NetScaler Device Configuration
- Performance Measurement
- Performance Results

3.0 Test Results

This section describes the three Oracle transactions tested and validated by TCS. For each transaction, an everyday scenario is given to illustrate how a typical user would execute the given Oracle transaction during the course of normal application usage. Additionally, an estimate of typical response times is provided, along with an identification of the root cause of poor application performance.

TCS-validated performance results are then presented for each tested transaction. Application response times experienced by end-users are presented with and without NetScaler acceleration.

Each transaction scenario utilized the following components:

- Oracle Applications version 11i, release 11.5.10
- Oracle 9i Database Server version 9.2.0
- Apache Web Server version 1.3.19
- Jserver release v9.2.0.5.0
- Oracle Forms Server v6.0.8.24.1
- Oracle Discoverer Server 4i 4.1.48.08.00

The scenarios selected and validated by TCS are common in typical real world environments running Oracle's E-Business Suite. Each test scenario measured delays in fetching large amounts of data to the browser via reports, forms, Discoverer or HTTP. It is these types of transactions which most significantly contribute to poor real world application performance.

The NetScaler system should yield similar acceleration benefits when deployed in equivalent Oracle environments implementing the same Oracle modules and servers.

3.1 Requesting Customer Sales Reports using Oracle iStore

3.1.1 Typical User Scenario

An enterprise organization has built an on-line purchasing portal for business partners using Oracle iStore. After logging into Oracle, the director of product management requests a sales report listing all purchases for all customer classes during a user-specified date range.

The report is generated on demand utilizing Oracle's Discoverer Report tool. The report lists customer order information, including the number of orders placed, total purchase amounts, percentage of orders placed by customer class, and more. (See Appendix A.1 for sample iStore report)

3.1.2 Application Response

Without application acceleration, Oracle users requesting report data from iStore may commonly experience delays ranging from 45 seconds to several minutes. Slow application responses are due to expensive database fetches and heavy processing by the Oracle Discoverer tool. Potentially large data sets and low-bandwidth client connections can further degrade application response times.

3.1.3. TCS-Validated Performance Results

To best evaluate real-world application performance, the test transaction was executed using both a LAN-based client (100 Mbps) and a WAN-simulated client (56 Kbps).

Maximum acceleration was achieved for clients accessing Oracle iStore over a corporate LAN as shown below in Figure 2. Acceleration results demonstrate the benefits of NetScaler features such as server offload, connection optimization, data compression and dynamic caching.

Performance Summary
When accelerating Oracle iStore transactions, user response times were reduced by 90% - resulting in approximately 10X acceleration.

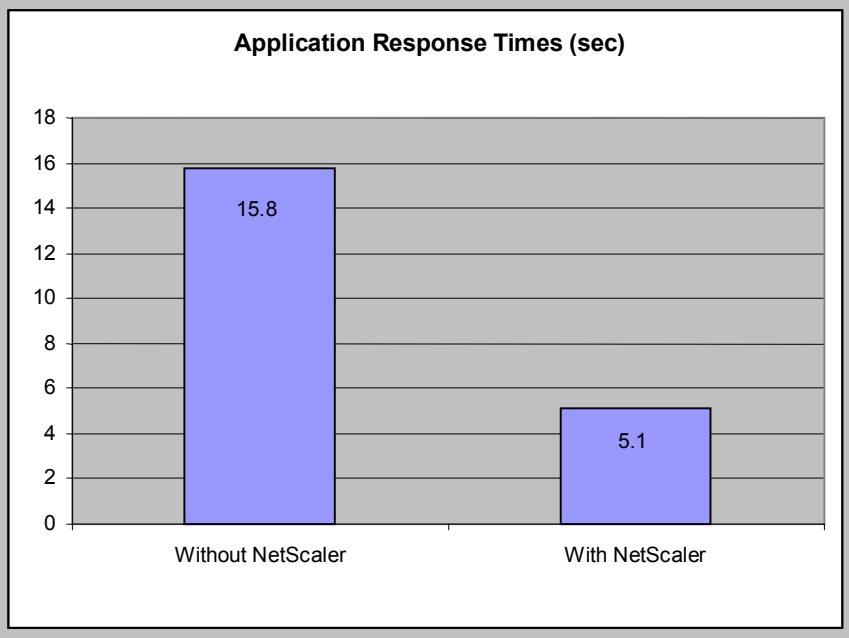


Figure 1 - Acceleration of iStore Report Generation and Delivery for WAN Clients

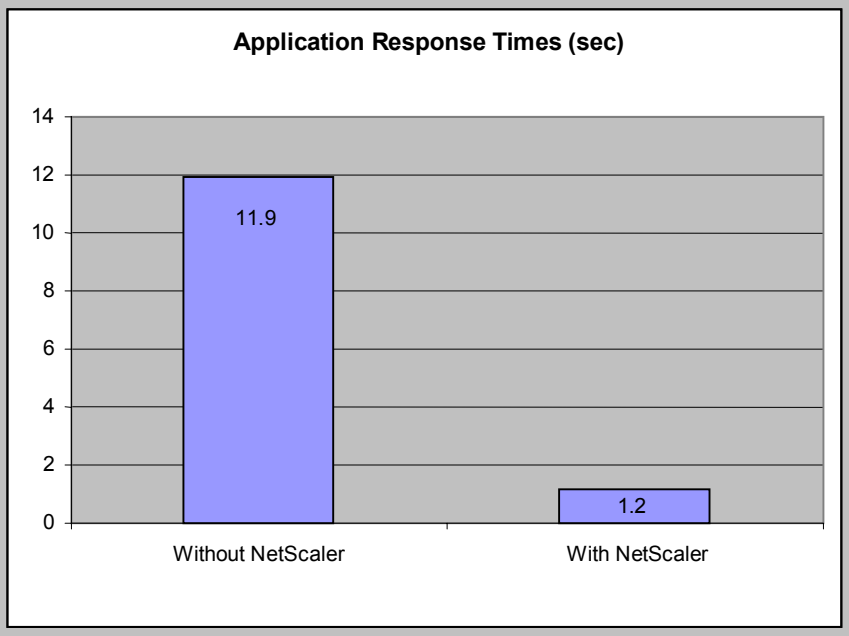


Figure 2 – Acceleration of iStore Report Generation and Delivery for LAN Clients

3.2 Viewing Pending Order Status using the Oracle Order Management Module

3.2.1 Typical User Scenario

After logging into Oracle, an inventory manager requests a report listing all RMA orders (i.e. "credit orders"). This is done by requesting a pre-generated "sales order report" from the Oracle Order Management Module.

The report provides a line item list of each RMA order, along with order information such as material quantity, expected material receipt date, RMA dollar value and more. (See Appendix A.2 for sample "sales order report")

3.2.2 Application Response

Without application acceleration, users of Oracle's Order Management Module may commonly experience delays of 60 seconds or more when viewing reports. Slow response times are due to large report file sizes, as well as the inherent latency and packet loss common across low-bandwidth WAN links.

3.2.3 TCS-Validated Performance Results

This test was conducted via a 56 Kbps connection simulating client access over a WAN. As shown in Figure 3 below, NetScaler reduced application response times by 93.8%, resulting in acceleration of **more than 16x**.

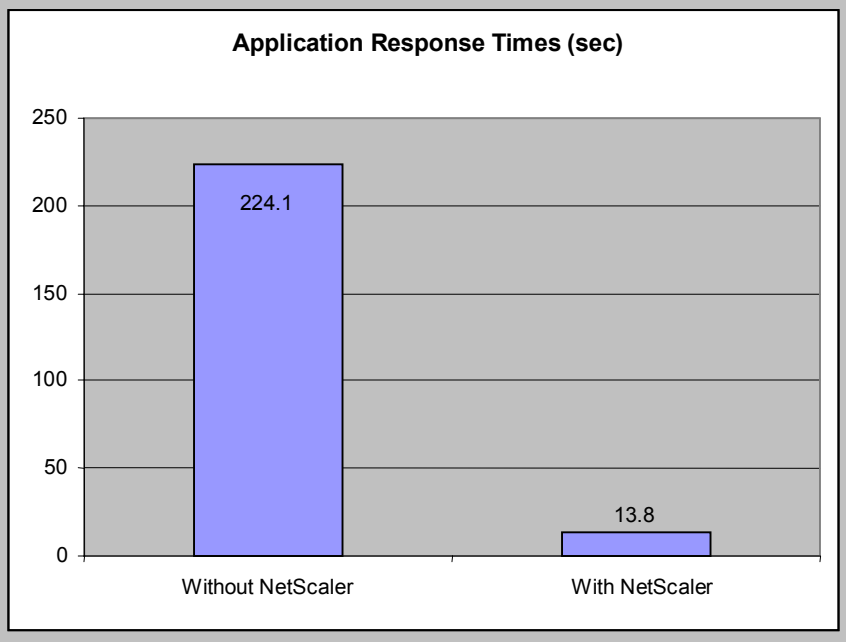


Figure 3 – Acceleration of Report Delivery for Oracle Order Management

3.3 Viewing Customer Order Details Using Oracle Order Management Module

3.3.1 Typical User Scenario

A customer service representative accesses the Oracle Order Management Module to view all orders for a specific customer. Customer order information includes the order number, order entry date, order type and customer number, and is presented to the user in the window of a thin client that shares a similar look-and-feel to the users browser interface. (See Appendix A.3 for sample order detail report)

3.3.2 Application Response

In scenarios like this, Oracle users on a WAN connection may commonly experience delays of between 10 and 30 seconds when viewing customer order details. Response times are delayed due to expensive database fetches and processing of the Oracle Forms server. Clients viewing order details over low-bandwidth WAN connections will experience an even greater deterioration in application performance.

IMPORTANT NOTE

When using applications such as Oracle's Order Management Module to view customer detail information, it is important to note that even though the user experience has the look-and-feel of a web browser, downloaded data is transported behind the scenes over non-HTTP protocols. As a result, common methods of accelerating web traffic, such as HTTP compression, will not speed up application performance or improve the user experience. For this test, we activated NetScaler's ability to compress data for non-HTTP based protocols.

3.3.3 TCS-Validated Performance Results

This test was conducted via a 56 Kbps connection simulating client access over a WAN. NetScaler's ability to compress and accelerate all TCP-based application traffic response times by an average of 47% - approximately **2x faster** than without NetScaler.

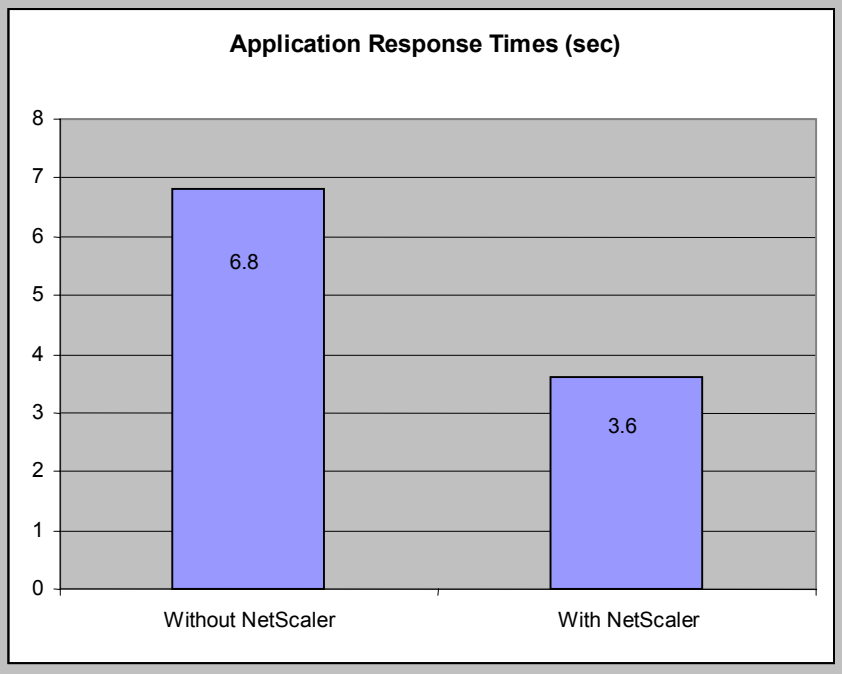


Figure 4 – Acceleration of Order Details Viewing Using Order Management

4.0 Test Configuration

4.1 Test Equipment

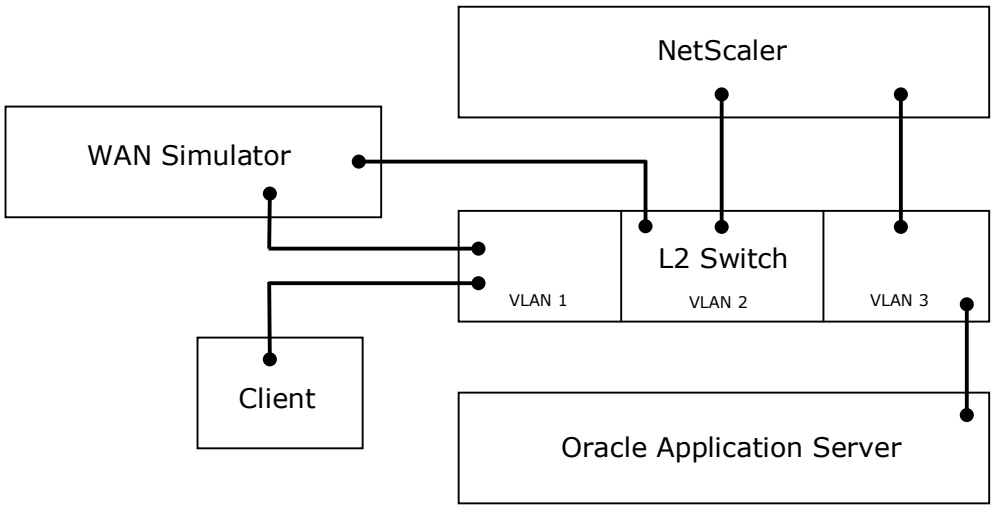
All test results were generated using a test bed comprised of the following components:

Software
- Oracle Applications version 11i, release 11.5.10
- Oracle 9i Database Server version 9.2.0
- Apache Web Server version 1.3.19
- Jserver release 9.2.0.5.0
- Oracle Forms Server 6.0.8.24.1
- Oracle Discoverer 4i 4.1.48.08.00
- WAN Simulation: Black Widow (56k throttle with 300ms of RTT)

Hardware
- NetScaler Application Delivery System: Model 9950 with v6.0.47.7
- Layer 2 Switch: Cisco 3500
- Oracle Database Server + Oracle Application Server (single physical server):
    - Dual 3.04 GHz CPU
    - 2 GB RAM
    - 160 GB HD

4.2 System Deployment

The test bed illustrated below was used to measure application performance for all three test cases described in this document.



4.3 Test Conditions

WAN emulation was utilized to simulate real-world WAN conditions. Tested WAN links were throttled to 56 kbps with 300 ms round trip latencies introduced.

4.4 Test Measurements

Three test runs were executed for each Oracle transaction, with the average used for reporting purposes (shown in section 3). All measurements were based on a single user executing the specfied transaction. Response times were measured from initiation of user request until the complete response was received.

5.0 Conclusion

The NetScaler Application Delivery System accelerated all three Oracle transactions between 2X and 15X (as measured by average application response times).

The NetScaler system accelerated Oracle transactions by leveraging multiple acceleration capabilities, including the following:

- TCP Multiplexing
- TCP Buffering
- TCP Fast Ramp
- Dynamic Content Caching
- Data Compression over HTTP
- Data Compression over non-HTTP protocols

The scenarios selected and validated by TCS are common in typical real world environments running the Oracle E-Business Suite. Each test scenario measured delays in fetching large amounts of data to the browser via reports, forms, Discoverer or HTTP. Experience in many enterprise application deployments has shown that transactions like these are the ones that most significantly contribute to poor real world application performance.

The NetScaler system should yield similar acceleration benefits when deployed in equivalent Oracle environments implementing the same Oracle modules and servers.

APPENDIX A – Sample Oracle Transaction Results

A.1. Sample result from transaction test 3.1 "Customer Sales Report using Oracle iStore"

Customer Sales Report
29-MAR-2005 03.45.28 PM
Begin Date : '01-JAN-2003' , End Date : '01-JAN-2006' , Customer Class : 'All' , Currency Code : 'USD' , Sort By : 'Average Sales Amount'

Page 1 25 rows per page

	Customer Class	Customer Name	Number of Orders	Percent of Total Number of Orders	Sales Amount	Percent of Total Sales Amount	Average Sales Amount
1	Other	Computer Service and Rentals	1	1.12%	3,677.70	2.65%	3,677.70
2	Other	United Parcel Service	1	1.12%	3,260.66	2.35%	3,260.66
3	Unassigned	Jack Phillips	1	1.12%	3,038.10	2.19%	3,038.10
4	Unassigned	Nicole Aron	2	2.25%	5,668.65	4.08%	2,834.32
5	Telecom	AT&T Universal Card	4	4.49%	10,236.26	7.37%	2,559.06
6	Unassigned	Wendy Suter	2	2.25%	4,795.59	3.45%	2,397.80
7	Unassigned	Annie Lai	1	1.12%	2,279.05	1.64%	2,279.05
8	Unassigned	Richard Lee	1	1.12%	1,870.55	1.35%	1,870.55
9	Unassigned	Robert Pike	1	1.12%	1,870.55	1.35%	1,870.55
10	High Technology	Business World	33	37.08%	51,684.71	37.19%	1,566.20
11	Unassigned	Gillian Chung	1	1.12%	1,519.05	1.09%	1,519.05
12	Unassigned	Michelle Wald	1	1.12%	1,519.05	1.09%	1,519.05
13	Utilities	CDS, Inc	1	1.12%	1,519.05	1.09%	1,519.05
14	Unassigned	Alliance Systems	6	6.74%	8,878.25	6.39%	1,479.71
15	Telecom	American Telephone and Telegraph	5	5.62%	7,261.83	5.23%	1,452.37
16	Unassigned	Joe Warner	14	15.73%	19,095.47	13.74%	1,363.96
17	High Technology	General Technologies	1	1.12%	1,279.20	0.92%	1,279.20
18	Unassigned	Edward Combs	3	3.37%	3,389.61	2.44%	1,129.87
19	Unassigned	Anne Barnhart	2	2.25%	1,756.55	1.26%	878.28
20	High Technology	Imaging Innovations, Inc.	1	1.12%	722.00	0.52%	722.00
21	Unassigned	Richard Cohen	3	3.37%	2,041.54	1.47%	680.51
22	Unassigned	Sangita Rele	2	2.25%	1,140.00	0.82%	570.00
23	Unassigned	David Crane	1	1.12%	237.49	0.17%	237.49
24	Unassigned	Annabelle Canlas	1	1.12%	237.49	0.17%	237.49
25	Grand Total		89	100.00%	138,978.40	100.00%	1,561.56

Page 1 25 rows per page

A.2. Sample result from transaction test 3.2 "Viewing Pending Order Status using the Oracle Order Management Module"

Vision Operations (USA) Credit Order Summary Report Report Date: 23-MAR-2005 13:17
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Currency: USD

Sort By: Customer Name Item Display: Description Credit Order Type: Return Only
Customer Name: American Telephone and Customer No: 1001 Open: No
Credit Order Number: 54054 Date: 01-OCT-02

Line Item	Expected Receipt Date	Warehouse	Authorized Quantity	Authorized Amount	Received Quantity	Receipt Days	Return Line Days	Line Type	Open
1.1 Item Not Found	01-OCT-02	Dallas Manufacturing	11	2,199.8	11	904	904	Return	No
Credit Order Number 54054 Totals:			11	2,199.8	11	904	904		

Sort By: Customer Name Item Display: Description Credit Order Type: Return Only
Customer Name: American Telephone and Customer No: 1001 Open: No
Credit Order Number: 54211 Date: 28-OCT-02

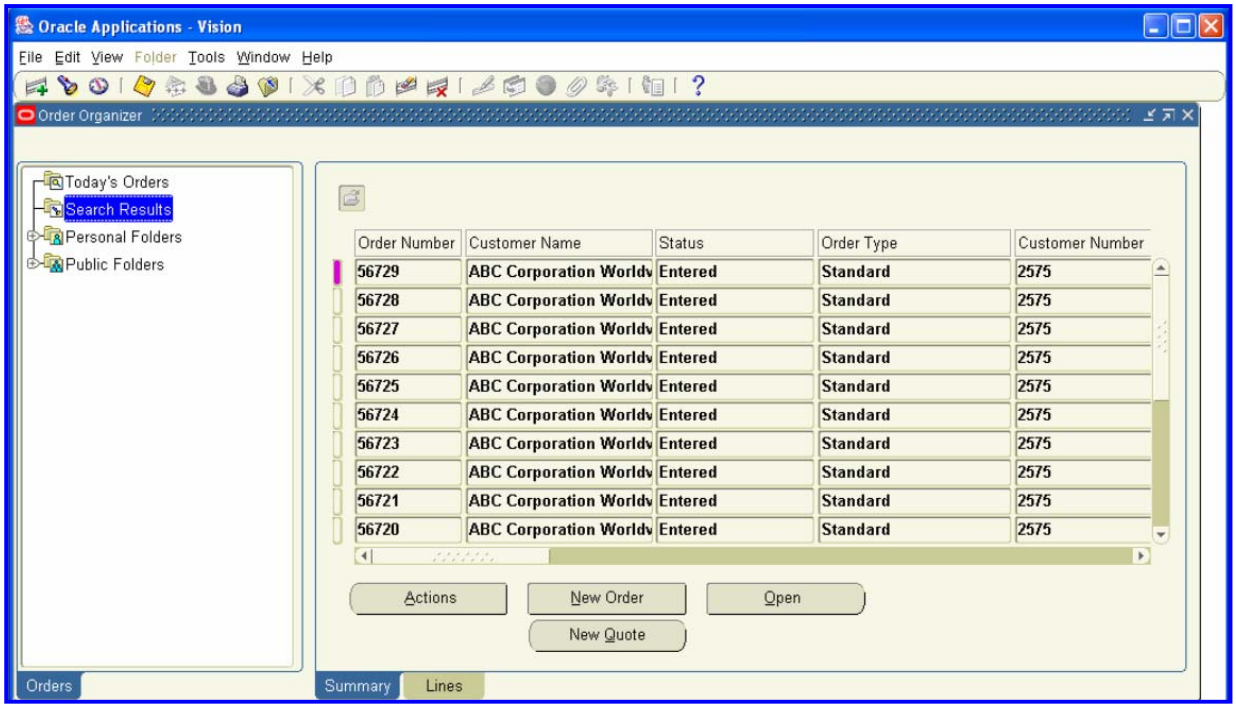
Line Item	Expected Receipt Date	Warehouse	Authorized Quantity	Authorized Amount	Received Quantity	Receipt Days	Return Line Days	Line Type	Open
1.1 Item Not Found	28-OCT-02	Dallas Manufacturing	11	2,199.8	11	877	877	Return	No
Credit Order Number 54211 Totals:			11	2,199.8	11	877	877		

Sort By: Customer Name Item Display: Description Credit Order Type: Return Only
Customer Name: American Telephone and Customer No: 1001 Open: No
Credit Order Number: 54212 Date: 28-OCT-02

Line Item	Expected Receipt Date	Warehouse	Authorized Quantity	Authorized Amount	Received Quantity	Receipt Days	Return Line Days	Line Type	Open
1.1 Item Not Found	28-OCT-02	Dallas Manufacturing	32	6,399.6	32	877	877	Return	No
Credit Order Number 54212 Totals:			32	6,399.6	32	877	877		

Sort By: Customer Name Item Display: Description Credit Order Type: Return Only
Customer Name: American Telephone and Customer No: 1001 Open: No
Credit Order Number: 54281 Date: 06-NOV-02

A.3. Sample result from transaction test 3.3 "Viewing Customer Order Details Using Oracle Order Management Module"



APPENDIX B – Corporate Overviews

B.1. About NetScaler

NetScaler is the leading provider of networking systems that accelerate the secure delivery of critical business applications to any user in any location. The NetScaler solution tightly integrates best-in-class load balancing and content switching with industry-leading acceleration and security functionality, enabling customers to improve the performance of both web and non-web applications by 5x or more. With five of the top five e-businesses in the world as customers, an estimated 75 percent of all Internet users interact with a NetScaler system at least once in any given day. NetScaler also boasts more than 400 enterprise customers across all industry sectors, including some of the world's largest Global 2000 companies.

NetScaler headquarters are in San Jose, Calif. For more information, visit: http://www.netscaler.com.

B.2. About Tata Consultancy Services

Tata Consultancy Services (TCS) is a leading global IT services provider and was the first billion-dollar Indian IT services organization by annual revenues. Since its inception in 1968, TCS has pioneered many of the significant developments in the Indian IT services industry, including the offshore delivery model for IT services.

TCS is a global organization with offices in 32 countries and development centers in 10 countries. TCS offers a comprehensive range of IT services to its clients in diverse industries such as banking and financial services, insurance, manufacturing, telecommunications, retail and transportation. TCS' clients comprise of some of the world's largest and well-known organizations. TCS has developed extensive experience in providing end-to-end IT services, integrating multiple technologies and delivering solutions in multiple geographies for its global clients. It is the largest Indian IT services organization in terms of revenues as well as profits.

TCS is part of the Tata Group, which has a heritage of over 135 years as one of India's leading corporate groups. The Tata Group has interests in a diverse range of industries, and had combined sales of approximately Rs. 654 billion (US$14.25 billion) in fiscal 2004.