

Oracle Net Services for Oracle10g

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INTRODUCTION

Oracle Database 10g is the first database designed for enterprise grid computing, the most flexible and cost-effective way to manage enterprise information. It cuts costs of management while providing the highest possible quality of service. In addition to providing numerous quality and performance enhancements, Oracle Database 10g significantly reduces the costs of managing the IT environment, with a simplified install, greatly reduced configuration and management requirements, and automatic performance diagnosis and SQL tuning. These and other automated management capabilities help improve DBA and developer productivity and efficiency.

Oracle Net Services, the primary communication foundation for Oracle Database 10g, provides enterprise wide connectivity solutions in distributed, heterogeneous computing environments. Additionally, it eases the complexities of network configuration and management, maximizes performance, and improves network security and diagnostic capabilities in the following areas:

- Connectivity
- Manageability
- Performance and Scalability
- Network Security

CONNECTIVITY

Oracle Net, a component of Oracle Net Services, enables a network session from a client application to an Oracle database server. Once a network session is established, Oracle Net acts as the data courier for both the client application and the database server. It is responsible for establishing and maintaining the connection between the client application and database server, as well as exchanging messages

between them. Oracle Net is able to perform these jobs because it is located on each computer in the network.

There are three types of connections using Oracle Net:

- Client/server application connections
- Web client application connections
- Web client connections without an application web server

Client/Server application connections

With client/server application connections, Oracle Net is a software component that resides on both the client and the database server. Oracle Net is layered on top of a network protocol – which determine how applications access the network and how data is subdivided into packets for transmission across the network. For example, Oracle Net communicates with the TCP/IP protocol to enable computer-level connectivity and data transfer between the client and the database server.

Specifically, Oracle Net is comprised of the Oracle Net foundation layer, which establishes and maintains connections, and Oracle protocol support, which maps the foundation layer's technology to industry-standard protocols.

Java client applications access an Oracle database through a Java Database Connectivity (JDBC) Driver, a standard Java interface for connecting from Java to a relational database. Oracle offers the following drivers:

- JDBC OCI Driver for client side use with an Oracle client installation
- JDBC Thin Driver for client side use without an Oracle installation, particularly with applets

These drivers use Oracle Net to enable connectivity between a client application and an Oracle database.

Web Client Application Connections

Internet connections from client Web browsers to an Oracle database server are similar to client/server applications.

Web Client Connections Without an Application Web Server

Web clients that do not require an application Web server to access applications can access the Oracle database directly, for example, by using a Java applet. In addition to regular connections, the database can be configured to accept HTTP protocol, FTP protocol, or WebDAV protocol connections. These protocols are used for connections to Oracle XML DB.

There is also a thin driver available, which uses a Java version of Oracle Net called JavaNet to communicate with the Oracle database server.

MANAGEABILITY

Oracle Net Services offers a number of manageability features that enable user to easily configure and manage networking components. These features are described in the following three areas:

1. Location Transparency

A company can have several databases, each representing a specific type of service for various client applications. For example, a company may have three databases, which it uses for sales, human resources, and marketing applications. Each database is represented by one or more services. A service is identified by a service name, for example, sales.acme.com. A client uses this service name to identify the database it needs to access. The information about the database service and its location in the network is transparent to the client because the information needed for a connection is stored in a repository.

Oracle Net Services offer several types of naming methods that support localized configuration on each client, or centralized configuration that can be accessed by all clients in the network. These naming methods are:

- Oracle Net Directory naming - The directory naming method stores connect identifiers in a centralized LDAP-compliant directory server to access Oracle database service.

- Local naming - The local naming method stores net service names and their connect descriptors in a localized configuration file, that is tnsnames.ora.
- Easy Connect Naming - The easy connect naming method enables Oracle10g Database clients to connect to an Oracle database server by using a TCP/IP connect string consisting of a host name and optional port and service name:

```
CONNECT username/password@host[:port] [/service_name]
```

The easy naming method requires no configuration.

- External naming - The external naming method stores Oracle Net service names in a supported non-Oracle naming service. These supported third-party services include:
 - Network Information Service (NIS) External Naming
 - Distributed Computing Environment (DCE) Cell Directory Services (CDS)

Oracle Grid Control also provides easy-to-use graphical user interfaces to manage data stored using any of the naming methods.

2. Centralized Configuration and Management

To manage large networking environments, administrators have to be able to easily access a centralized repository to specify and modify the network configuration. For this reason, the Oracle Net Services configuration can be stored in an LDAP-compliant directory server such as Oracle Internet Directory.

Directory naming support is also provided with Microsoft Active Directory. However, there are some limitations with Microsoft Active Directory, such as Windows-only platform support, no multiple Oracle Contexts support, and lack of Oracle Net Service aliases support.

Support of LDAP-compliant directory servers provides a centralized vehicle for managing and configuring a distributed Oracle network. The directory can act as a central repository for all information on database network components, user and corporate policies, and user authentication and security, thus replacing client-side and server-side localized configuration files.

All computers on the heterogeneous network can refer to the directory for information. Figure 1 shows clients, other servers such as application

server and Oracle database servers connecting to a centralized directory server.

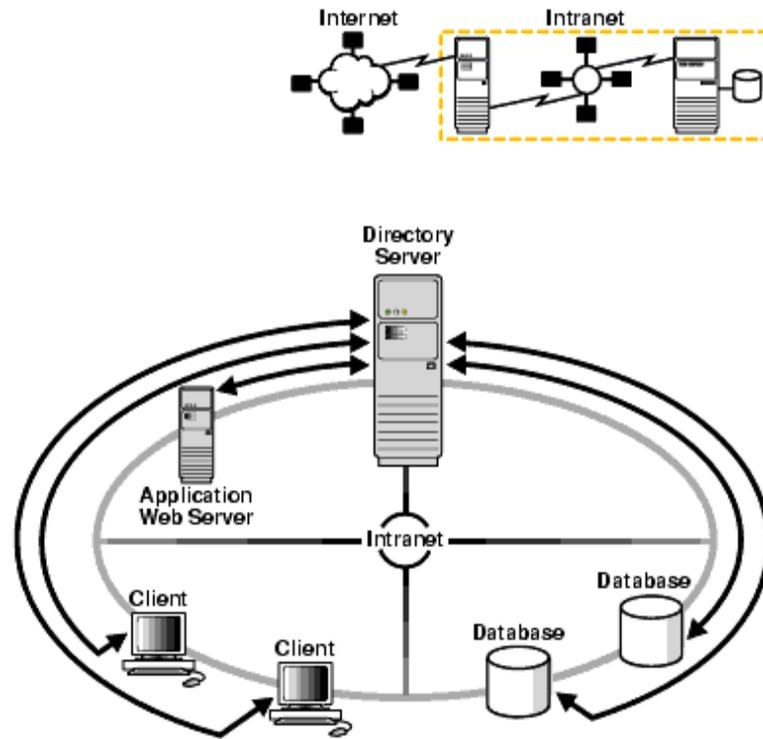


Figure 1 Centralized Storage of Network Configuration with a Directory Server

3. Quick Installation and Configuration

Oracle Net Services installs quickly and easily. Networking components for the Oracle database server and clients are pre-configured for most environments. Information about an Oracle database service is resolved in one or more naming methods. As a result, clients and servers are ready to immediately connect when installed.

PERFORMANCE AND SCALABILITY

Oracle Net provides scalability features that enable users to maximize system resources and improve performance. Feature such as shared server, which offers both connection pooling and session multiplexing (using Connection Manager), can increase the scalability of applications and the number of clients that can be simultaneously connected to the database. The shared server architecture also enables existing applications to scale up without making any changes to the application itself.

High Speed Network - InfiniBand

Oracle Net High Speed Interconnect Support improves network performance significantly by taking advantage of InfiniBand, an industry standard networking technology. InfiniBand provides large bandwidth and low latency, which allows sharing of the same physical link for communication between the nodes of a cluster, back end database servers and Network Area Storage. Thus, aggregating network pipe technology in the data center helps achieve a reduction in complexity and cost.

Oracle Net supports two types of high speed interconnect: Sockets Direct Protocol (SDP) and asynchronous I/O.

SDP is a standard wire protocol for InfiniBand protocol. The Oracle SDP protocol support enables the databases, application servers, and CPUs to operate more efficiently. The databases spend less time waiting for work, the application servers spend less time waiting for responses, and the CPUs have more cycles free for other work. As a result, with the addition of InfiniBand technology, customers see improved application performance from their existing servers (both database servers and application servers) without the cost of upgrading to expensive hardware.

The communication between clients, including Oracle Application Server or any other third-party middle-tier client, and an Oracle Database 10g database can take advantage of high-speed interconnect benefits. Oracle Application Server installs with Oracle TCP/IP support.

A driver installed on the Oracle Application Server transparently converts TCP/IP support to SDP support. The SDP requests are then sent to an InfiniBand switch that processes and forwards the requests from the Oracle Application Server to the database server. The SDP requests are then sent to an InfiniBand switch that processes and forwards the requests from the Oracle Application Server to the database server.

Connection Pooling

When thousands of clients are running interactive Web applications, many of these sessions may be idle at a given time. The connection pooling feature enables the database server to timeout an idle session and use the connection to service an active session. The idle logical session remains open, and the physical connection is automatically re-established when the next request comes from that session. Therefore, Web applications can allow larger numbers of concurrent users to be accommodated with existing hardware.

Connection pooling is only configurable with shared server.

Figure 2 shows how connection pooling works. In this example, the Oracle database server has been configured with 255 connections. One of the clients has been idle past a specified amount of time. Connection pooling makes this connection available to an incoming client connection, which is the 256th connection. When the idle client has more work to do, the connection is re-established for that client with another client's idle connection.

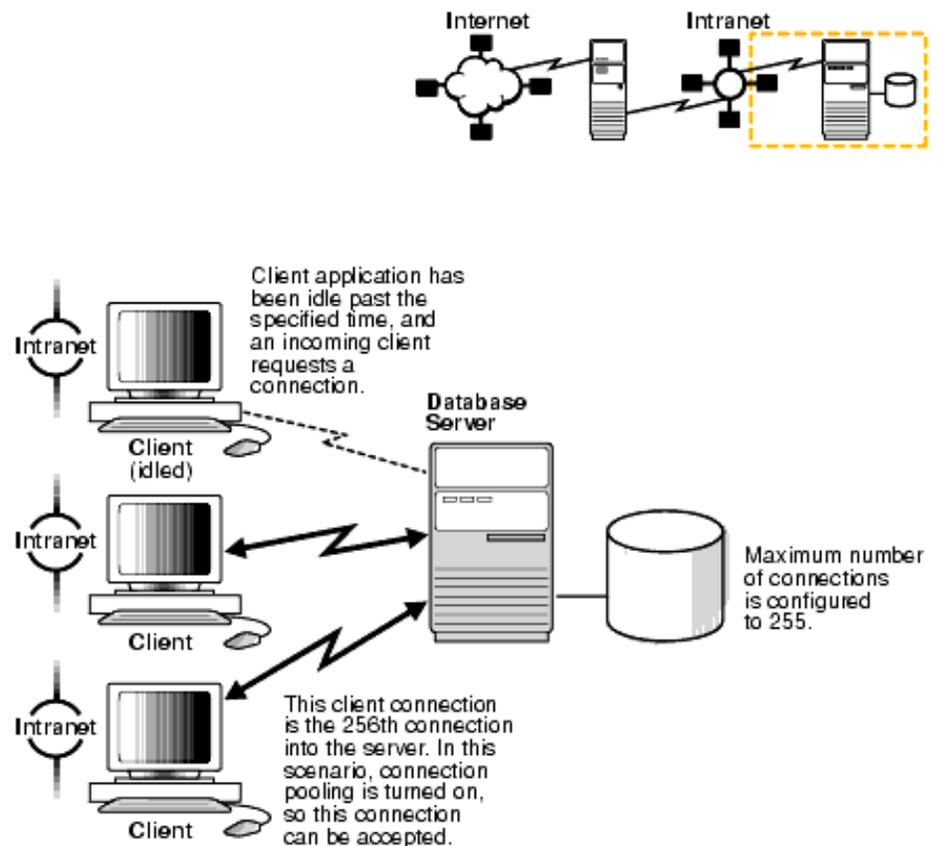


Figure 2 Connection Pooling

Session Multiplexing

Session Multiplexing is enabled by using both shared server and Connection Manager.

The session multiplexing feature reduces the demand on resources needed to maintain multiple network sessions between two processes by enabling the server to use fewer network connection endpoints for incoming requests. This enables you to increase the total number of network sessions that a server can handle. One Oracle Connection

Manager with multiple gateways enables thousands of concurrent users to connect to a server.

Figure 3 shows how session multiplexing can be used in a Web architecture. When Oracle Connection Manager is run on the same computer as an application Web server, the application Web server can route multiple client sessions through Oracle Connection Manager to ensure that those sessions have continuous access to an Oracle database server. This functionality is especially useful for Web applications where session availability and response time are major concerns.

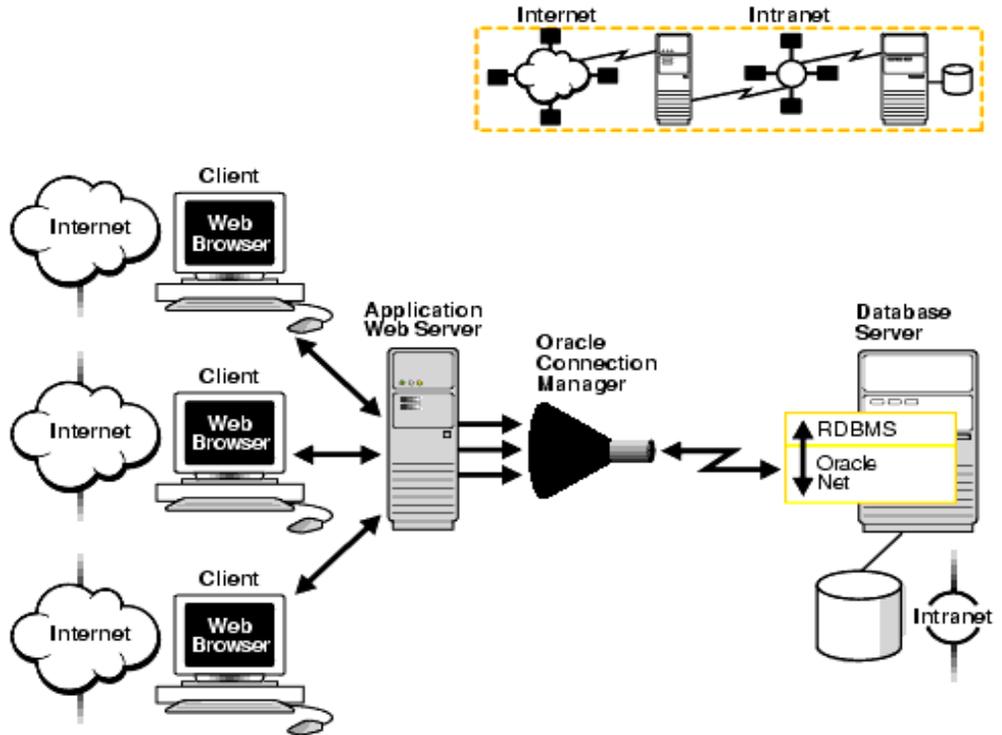


Figure 3 Session Multiplexing

NETWORK SECURITY

Data access and secure transfer of data are important considerations when deploying Oracle. Granting and denying access to a database are crucial for a secure network environment. Oracle Net Services enable database access control using features described in the following topics:

- Firewall Access Control
- Protocol Access Control

Firewall Access Control with Connection Manager

Oracle Connection Manager is a software component that resides on its own computer, separate from a client or an Oracle database server. It proxies and screens requests for the database server.

Oracle Connection Manager can be configured to grant or deny client access to a particular database service or a computer. By specifying filtering rules, users can allow or restrict specific client access to a server, based on the following criteria:

- Source host names or IP addresses for clients
- Destination host names or IP addresses for servers
- Destination database service names
- Client use of Oracle Advanced Security

Figure 4 shows an Oracle Connection Manager positioned between three Web clients and an Oracle database server. Oracle Connection Manager is configured to allow access to the first two Web clients and to deny access to the third. In order for this configuration to work, clients require the JDBC Thin driver.

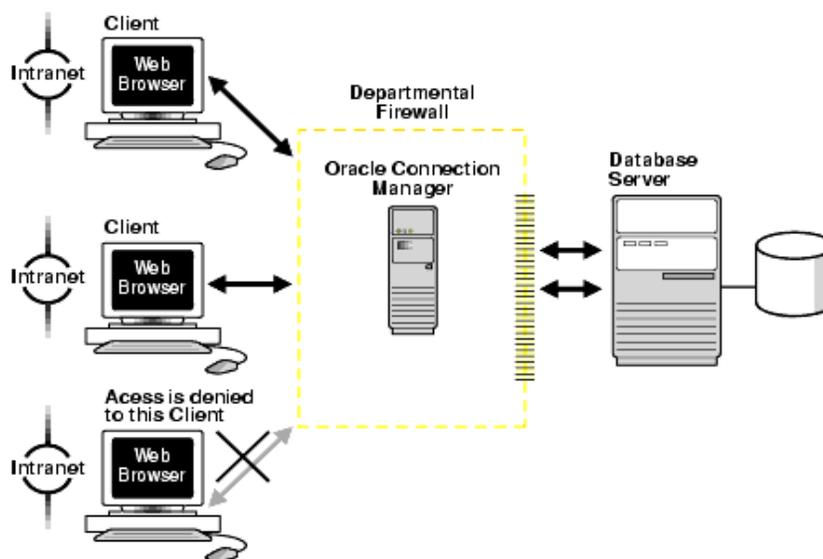


Figure 4 Intranet Network Access Control with Oracle Connection Manager

Although Oracle Connection Manager cannot currently be integrated with third-party firewall products, vendors can package it with their

own products in a way that enables this product mix to serve as an application gateway.

Protocol Access Control

The database server can be configured with access control parameters in the `sqlnet.ora` configuration file. These parameters specify whether clients are allowed or denied access based on the protocol.

CONNECTION MANAGER AND ITS NEW ARCHITECTURE

In Oracle10g Database, Connection Manager has a new scalable architecture, which provides significant performance improvement and is capable of handling thousands of client connections. In addition, it also allows dynamic configuration during runtime and additional support for access control.

Oracle Connection Manager is a router through which a client connection request is sent either to its next hop or directly to the database server. Clients who route connection requests through an Oracle Connection Manager can take advantage of the session multiplexing and access control features configured on that Oracle Connection Manager.

Oracle Connection Manager consists of three components:

- Listener
- CMGW (Connection Manager gateway)
- CMADMIN (Connection Manager Administration)

The listener receives client connections and evaluates them against a set of rules to determine whether to deny or allow access. If it allows access, the listener forwards a request to a gateway process, selecting the one with the fewest connections. The CMGW process, in turn, forwards the request to another Oracle Connection Manager or directly to the database server, relaying data until the connection terminates. If a connection to the server already exists, the gateway multiplexes, or funnels, its connections through the existing connection. CMADMIN monitors the health of the gateway processes and the listener, shutting down or starting up processes as needed. In addition, it registers the location and load of the gateway processes with the listener, and it answers requests from the Oracle Connection Manager Control utility.

In Figure 5, the listener screens connection requests. A gateway process registers with the CMADMIN process. And the CMADMIN process registers with the listener. Finally, the listener forwards the connection requests to the gateway process. Notice that the listener has denied

access to the fourth client. After receiving the three valid client connections, the gateway process multiplexes them through a single network protocol connection to the database.

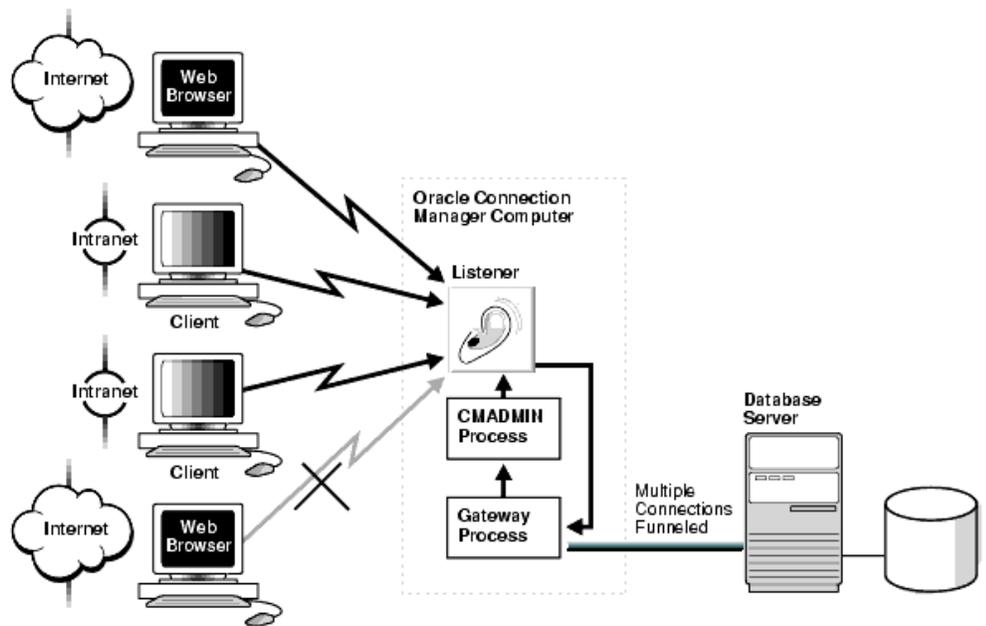


Figure 5 Oracle Connection Manager Architecture

NETWORKING TOOLS FOR CONFIGURATION AND ADMINISTRATION

Oracle Net Services provides user interface tools and command-line utilities that enable users to easily configure, manage, and monitor the network.

- **Oracle Net Configuration Assistant** is a tool that enables user to configure listeners and naming methods.
- **Oracle Enterprise Manager** combines configuration functionality across multiple file systems, along with listener administrative control to provide an integrated environment for configuring and managing Oracle Net Services.
- **Oracle Net Manager** provides configuration functionality for an Oracle home on a local client or server host. With Oracle Enterprise Manager or Oracle Net Manager, users can fine-tune the listener and naming method configuration created with Oracle Net Configuration Assistant. In addition, Oracle Enterprise Manager and Oracle Net Manager offers built-in wizards and utilities that enable users to test connectivity, migrate data from one naming method to another, and create additional network components.

- **Oracle Net Trace Assistant**, a diagnostic and performance analysis tool, provides detailed information about the source and context of problems as they arise. This information is generated and stored in log and trace files. The process of logging and tracing error information will help users to diagnose and resolve network problems.
- The command-line control utilities enable users to configure, administer, and monitor network components, including listeners and Oracle Connection Managers.

CONCLUSION

Oracle Net Services is a critical part of the Oracle Database communication infrastructure. It offers reliable and scalable networks. It works with many different industry standards, such as LDAP and InfiniBand. Oracle Net Services components can be easily managed and configured through Oracle Enterprise Manager tools. Moreover, for network security, it provides both protocol, and firewall access control through the new scalable architecture of Connection Manager. Additional security features are also available with Oracle Advanced Security.

In today's rapidly changing business environment, the networking infrastructure needs not only best quality of service, it also requires flexibility and cost-effectiveness. Oracle Net Services has helped many Oracle customers to achieve these goals.



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