

Networking Overview

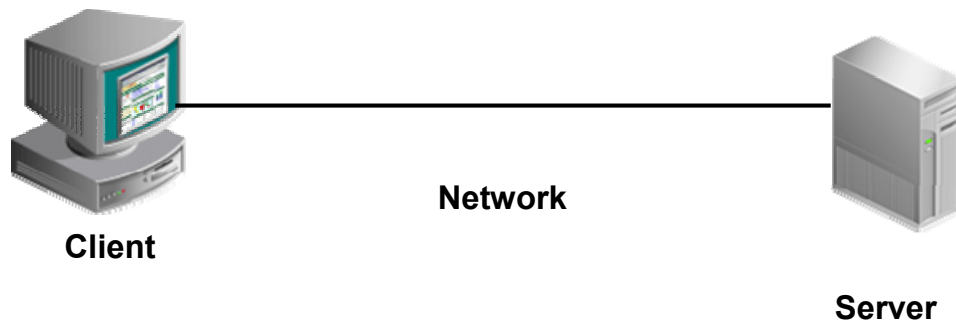
Date: 05.10.2007

Instructor: Drd. Ing. Ciprian Mihai Dobre



Database Administration I © All rights reserved

Simple Network: Two-Tier



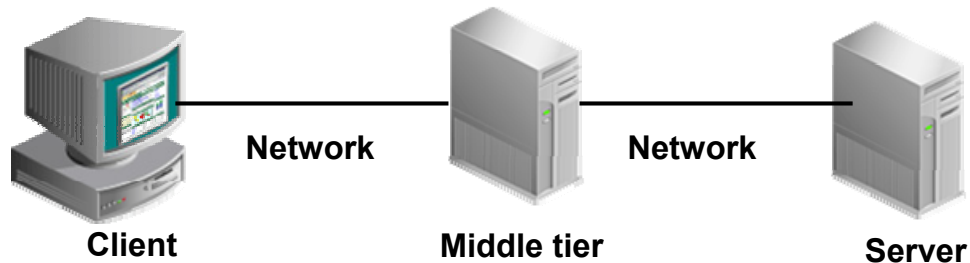
- **Network connects client and server**
- **Client and server speak the same language or protocol**

Two-Tier Networks

In a two-tier network, a client communicates directly with a server. This is also known as a client-server architecture. A client-server network is an architecture that involves client processes that request services from server processes. The client and server communicate over a network using a given protocol, which must be installed on both the client and the server.

A common error in client-server network development is to prototype an application in a small, two-tier environment and then scale up by adding more users to the server. This approach can result in an ineffective system, as the server becomes overburdened. To properly scale to hundreds or thousands of users, it may be necessary to implement an N-tier architecture, which introduces one or more servers or agents between the client and the server.

Simple to Complex Network: N-Tier



- **Client can be a thin client or a PC**
- **Middle tier can contain applications and services**
- **Server holds actual data**

N-Tier Networks

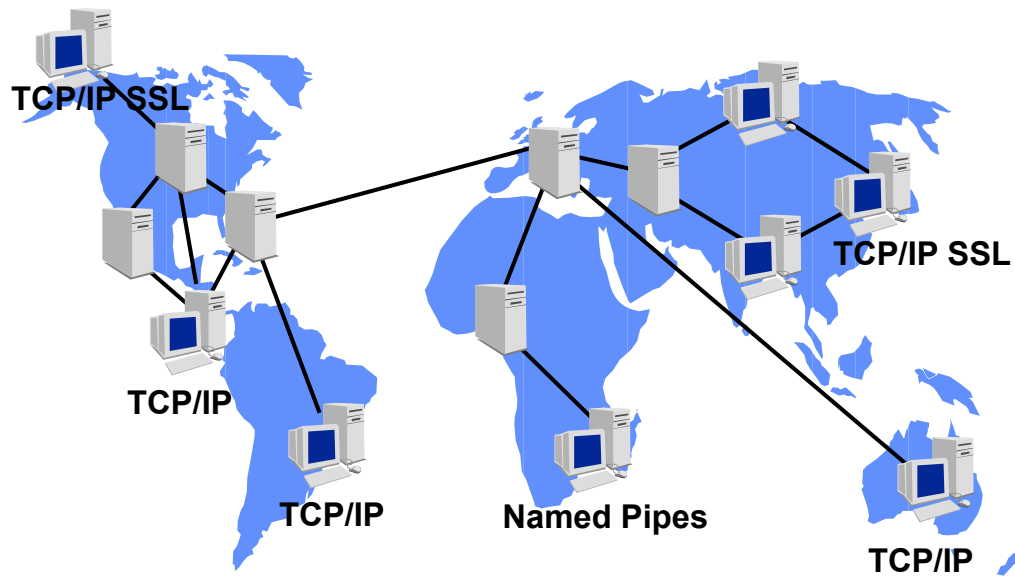
In an N-tier architecture, the middle-tier agent can provide:

Translation services (as in adapting a legacy application on a mainframe to a client-server environment or acting as a bridge between protocols)

Scalability services (as in acting as a transaction-processing monitor to balance the load of requests between servers)

Network agent services (as in mapping a request to a number of different servers, collating the results, and returning a single response to the client)

Complex Network



Complex Network Issues

Networks should improve communication rather than impede distributed operations. In a more complex network environment, several issues must be addressed:

- Different hardware platforms that run different operating systems
- Multiple protocols used on these platforms
- Different syntax between different but connected applications
- Different geographical locations in which the connected applications reside

A well-designed complex network can support a large-scale distributed system.

Oracle9i Networking Solutions

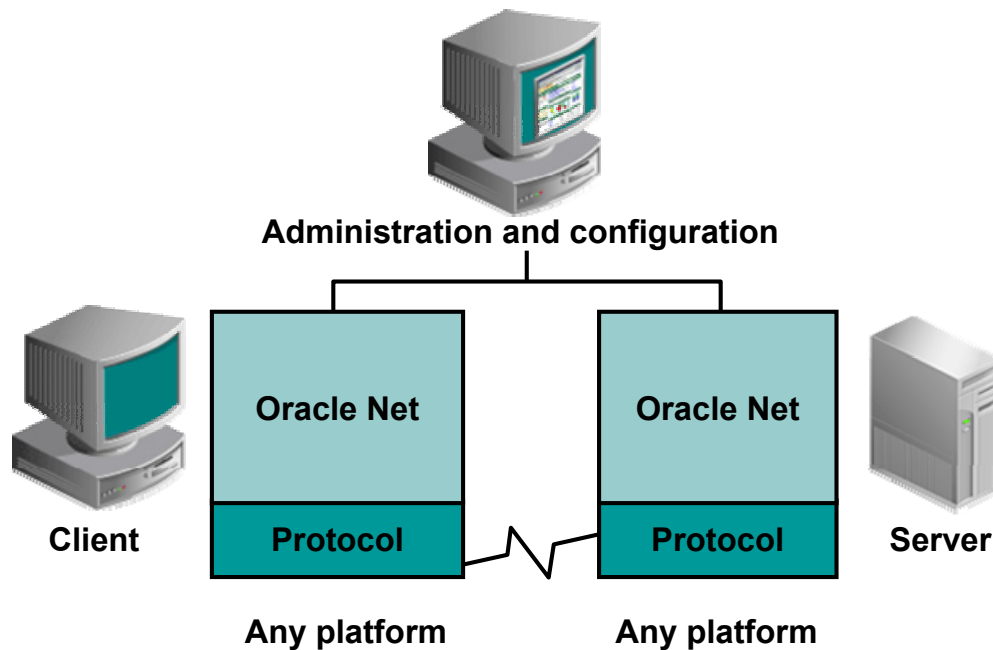
- **Connectivity**
- **Directory Services**
- **Scalability**
- **Security**
- **Accessibility**



Oracle Network Solutions

Oracle provides a full suite of products and tools to address almost any networking need. Connectivity issues are addressed by a wide range of protocols that are supported by Oracle Net Services. Oracle Internet Directory (OID) is tightly integrated with Oracle9i. OID is a Lightweight Directory Access Protocol (LDAP), Version 3 compliant directory service and fulfills requests for everything from net service names to user credentials to policies. You can use Oracle Connection Manager and Oracle Shared Server, to enable Oracle to support huge user demands. Security needs are addressed by Oracle's support of third-party encryption and data integrity products and authentication adapters. Oracle supports industry or de facto standard security products rather than proprietary products. Oracle also supports the integration of non-Oracle databases through Oracle Heterogeneous Services.

Connectivity: Oracle Net Services



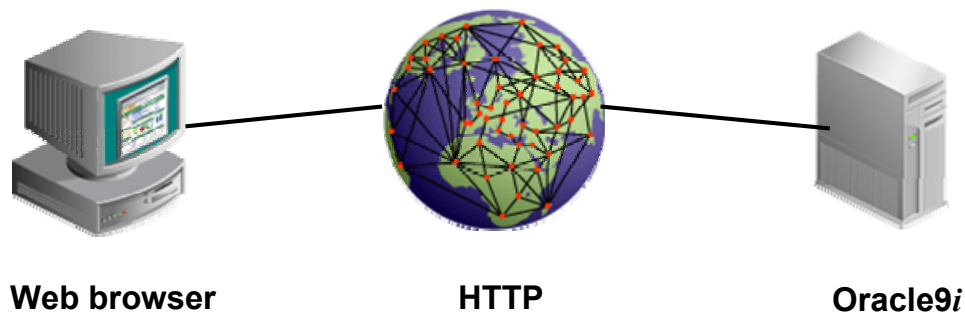
Oracle Net Services

Oracle Net Services provides the industry's broadest support for network transport protocols, including TCP/IP, TCP/IP with Secure Sockets Layer (SSL), and Named Pipes. All data conversion using Oracle Net Services is transparent to the user and the application. This enables Oracle Net Services to operate across different types of computers, operating systems, and networks to transparently connect any combination of PC, UNIX, legacy, and other systems without expensive changes to the existing infrastructure.

Oracle Net Services provides mechanisms which reduce the need for configuration in simple environments. Configuration utilities provide access to the full spectrum of Oracle Net Services functionality. For simple environments, Oracle Net Services' default settings provide a transparent name resolution adapter. This eliminates the need for generating configuration files. For more complicated environments, Oracle Net Services employs the Oracle Internet Directory to store connection information in a centralized repository.

Oracle Net Services addresses Internet connectivity through integration of standard solutions such as Remote Authentication Dial-In User Service (RADIUS) and Lightweight Directory Access Protocol (LDAP) with legacy systems.

Connectivity: Database Connectivity with HTTP



Database Connectivity with HTTP

Connections to the Oracle server are not limited to Oracle Net Services alone; clients can establish connections by using Internet protocols such as Hypertext Transfer Protocol (HTTP). Using these Internet protocols, you can run applications from within a Web browser to connect directly to an Oracle9i database. Internet technologies such as Internet File System, Enterprise JavaBeans (EJB), and the Internet standard Secure Sockets Layer (SSL) protocol provide added security to network connections.

Directory Services: Directory Naming

- **Process of resolving a network alias using an LDAP-compliant directory server**
- **Clients must be configured to use the LDAP compliant server**

Directory Naming

LDAP is an Internet standard for directory services. LDAP has emerged as a critical infrastructure component for network security and as a vital platform for enabling integration among applications and services on the network. It simplifies management of directory information considerably by providing the following:

A well-defined standard interface to a single, extensible directory service, such as the Oracle Internet Directory

Rapid development and deployment of directory-enabled applications

An array of programmatic interfaces that enables seamless deployment of Internet-ready applications

Directory Services: Oracle Internet Directory

- Oracle's LDAP compliant directory service
- Provides the following features:
 - Integrates tightly with Oracle9i
 - Simplifies network administration
 - Provides a secure and reliable directory structure



Oracle Internet Directory

The Oracle Internet Directory (OID) complies with LDAP, Version 3. It provides the following features:

Integrates with Oracle8i and Oracle9i databases, making it easy for you to administer users and systems

Provides a scalable, cross-platform directory structure for reliable, secure Internet computing

Enables OID-based directories to stay synchronized even when distributed

Integrates existing public key certificates, wallets, and access privileges

Maintains routing policies, system management objects, and quality of service issues

Enables service resellers that lease lines from carrier-class providers to segregate directories with customer information from their providers while sharing the infrastructure information required to provide quality service

Note: Configuration of Oracle Internet Directory is discussed in the *Oracle Net Services: Advanced Administration* course.

Scalability: Oracle Shared Server

- **Enables a large number of users to connect to a database simultaneously**
- **Database resources are shared resulting in efficient memory and processing usage**
- **Connections are routed via a dispatcher**
- **Server processes are not dedicated to each client**
- **Server processes serve client processes as needed**



Oracle Shared Server

The Oracle Shared Server architecture has been designed for user scalability. By enabling efficient server-side resource sharing, the Oracle Shared Server allows a large number of users to connect simultaneously to a database server.

Dispatcher

The dispatcher is a process that handles the management of the connections to the valuable server processes. A dispatcher can support multiple client connections concurrently.

Server processes

Shared servers handle the retrieving and saving of data to the database and any other CPU processing that the application needs.

The Result

This task distribution in the Oracle Shared Server is very efficient and enables large user scalability. It also leads to very good connection time and throughput.

Note: Oracle Shared Server was known as Oracle Multithreaded Server (MTS) in versions before Oracle9i.

Scalability: Oracle Connection Manager

Oracle Connection Manager offers:

- **Multiplexing of connections**
- **Cross-protocol connectivity**
- **Network access control**



Oracle Connection Manager

Oracle Connection Manager is a gateway process and control program that is configured and installed on a middle tier. Oracle Connection Manager can be configured for the following features:

Multiplexing

Oracle Connection Manager can handle several incoming connections and transmit them simultaneously over a single outgoing connection. You can use multiplexing to provide access to the server to more users. The configuration is offered only in a TCP/IP environment.

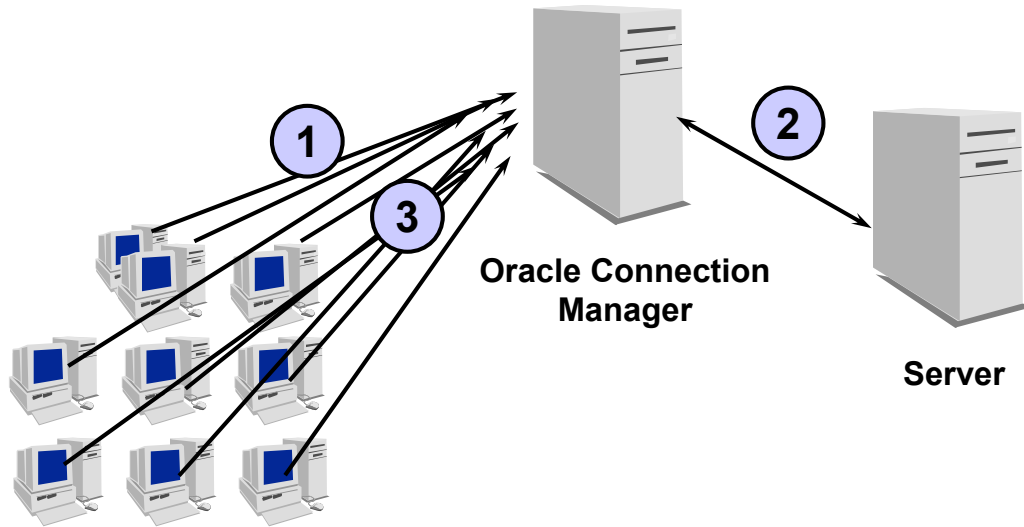
Cross-protocol Connectivity

Using this feature, a client and a server can communicate with different network protocols.

Network Access Control

Using Oracle Connection Manager, designated clients can connect to certain servers in a network based on the TCP/IP protocol.

Scalability: Oracle Connection Manager



Connection Multiplexing

The example in the slide shows how Oracle Connection Manager acts as a multiplexer to funnel data from many clients to one server.

1. The initial connection from a client to a server is established by connecting to Oracle Connection Manager.
2. Oracle Connection Manager establishes the connection to the server.
3. When additional clients request connections to the server through Oracle Connection Manager, they use the same connection that Oracle Connection Manager used for the initial connection.

Security: Advanced Security

- **Encryption**
 - Encodes between network nodes
 - DES, RSA, 3DES
- **Authentication**
 - Authenticates users through third-party services and Secure Sockets Layer (SSL)
 - Kerberos, Radius, CyberSafe
- **Data Integrity**
 - Ensures data integrity during transmission
 - MD5, SHA



Oracle Advanced Security

Oracle Advanced Security provides data privacy, integrity, authentication, and single sign-on.

Authentication ensures that users are authenticated appropriately.

Encryption ensures that the data transmitted between nodes remains private.

Data Integrity ensures that data is not modified or tampered with during transmission.

Single sign-on enables users to authenticate to multiple servers using a single username/password combination.

Note: Oracle Advanced Security is a product that is licensed separately.

Accessibility: Heterogeneous Services

- Enables access of legacy data as if it resides in a single, local relational database
- Enables Oracle procedure calls to access non-Oracle systems, services, or APIs



Computer Science
& Engineering
Department

Database Administration I © All rights reserved

Heterogeneous Services

Heterogeneous Services provide seamless integration between the Oracle server and environments other than Oracle. Heterogeneous Services enable you to do the following:

Use Oracle SQL to transparently access data stored in non-Oracle data-stores like Informix, DB2, SQL Server, and Sybase

Use Oracle procedure calls to transparently access non-Oracle systems, services, or application programming interfaces (APIs), from your Oracle distributed environment

A Heterogeneous Service agent is required to access a particular non-Oracle system.

Benefit

Heterogeneous Services enable integration with foreign data sources.

Note: Configuration of Heterogeneous Services is discussed in the *Oracle Net Services: Advanced Administration* course.

Accessibility: External Procedures

- **Functions written in a 3GL language that can be called from PL/SQL**
- **Allows the developer more flexibility than SQL or PL/SQL provide**
- **Listener can listen for external procedure calls**
- **Connections to external procedure can be configured during or after server installation**



Computer Science
& Engineering
Department

Database Administration I © All rights reserved

External Procedures

Oracle support of external procedures allows the developer more development choices than standard SQL or PL/SQL provide. The listener can be configured to listen for external procedure calls. When a PL/SQL or SQL application calls an external procedure, the listener launches a network session-specific process called `extproc`. Through the listener service, PL/SQL passes the following information to `extproc`:

Shared library name

External procedure name

Parameters (if necessary)

The `extproc` program then loads the shared library and invokes the external procedure.