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Oracle Net8 Configuration and Troubleshooting

By [Jonathan Gennick](#), [Hugo Toledo](#)

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Describes everything DBAs need to know to install configure, tune, and troubleshoot Net8, Oracle's networking technology. It covers the Oracle Internet Directory (OID), Oracle Names; the Multi-Threaded Server (MTS); and the Oracle Connection Manager, as well as the Oracle networking utilities (lsnctl, namesctl, cmctl, tnsping, Net8 Assistant, Net8 Easy Config, and Net8 Configuration Assistant). In addition, it provides networking troubleshooting techniques, commonly encountered Net8 configuration problems, and complete syntax for all networking files and commands.

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Preface

If you use an Oracle database, chances are that you also use Net8. Net8 is the fundamental networking technology that allows Oracle services and clients to communicate with each other over a network.

The primary purpose of Net8 is to allow clients to talk to database servers, but Net8 also enables communications between database servers, application servers, gateways to other database systems, and external procedures.

Net8 is a key part of any solution involving the use of Oracle technologies over a network. Net8 does not refer to one specific program or service, but rather to a varied collection of networking functions. We cover the full range of Oracle networking features and products in this book. Major topics include:

- Net8 architecture
- Configuration of Net8 client software
- Configuration of Net8 listeners
- Configuration of name resolution methods such as the Lightweight Directory Access Protocol (LDAP), Oracle Names, and local naming
- Configuration of advanced features such as Connection Manager, load balancing, and failover
- Common problems and troubleshooting techniques

As any observer of today's technology scene is keenly aware, connectivity is becoming all-important. Sun will tell you that "the network is the computer." Oracle will tell you that "the Internet changes everything." Clearly, if you are an Oracle database administrator or developer, you need to understand how to make Oracle a part of this new Internetworked world. Net8 is a key Oracle technology that will be around for the long-term. It's worth learning well.

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Audience

Oracle's networking features can be hard to understand and operate. We well remember the frustrations we encountered and the questions we had when we first learned to deal with Net8. Our goal in writing this book was to develop a comprehensive and focused resource to help others master this very important technology.

This book is primarily targeted at Oracle DBAs. It's the DBA who is usually charged with configuring Net8 listeners, LDAP, Oracle Names, and other aspects of Net8 on the server. In addition, DBAs are often called upon to specify the Net8 configuration for client PCs that access an Oracle database. When Oracle connectivity problems rear their ugly heads, it's again the DBA who is usually called upon to resolve them.

While DBAs represent the primary audience, we believe that developers, and possibly system administrators, will find parts of this book helpful. Developers are often involved with Net8 client configuration and troubleshooting. System administrators will often need to know how Net8 is configured, even though they may not be the ones directly responsible for doing that work.

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Which Platform and Version?

This book was written with Oracle8i in mind. For those of you who keep track of release numbers, that means the focus is on the 8.1.5, 8.1.6, and 8.1.7 releases of Oracle and Net8. This is not to say that we completely ignored Oracle8. Wherever possible, we point out differences between the Oracle8 and Oracle8i implementations of Net8.

Almost all the examples in this book were derived from Windows NT and Linux environments, but do note that Net8 is not a platform-specific technology. Net8's configuration and functionality are remarkably consistent across different hardware and software platforms.

Some of the information in this book will be applicable to earlier releases of Oracle, and we expect that almost all of it will apply to subsequent releases for some time to come. The basic architecture of Net8 was set in place several years ago when Oracle8 was released, and it has not changed significantly since then. Almost everything you read in the first few chapters of this book about client configuration, basic server configuration, and multi-threaded server configuration is applicable for both Oracle8 and Oracle8i. Much of it is even applicable to SQL*Net, the predecessor to Net8 that shipped with Oracle7.

With two Net8 components Oracle Names and Connection Manager the version issue is a bit more problematic. Oracle Names, in particular, has morphed significantly with each new release of Net8. (In fact, Oracle Names has changed so much over the years that we wonder if Oracle ever had a clear design for the product.) Consequently, in this book, coverage of Oracle Names and Connection Manager is very focused on the 8.1.x releases.

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Structure of This Book

When we designed this book, we tried to collect in one place all the essential information that you need to work with Net8. We've divided this information into four parts:

Part I, provides an introduction to Net8, its architecture, its functionality, and its major components. It includes the following chapters:

- **Chapter 1**, introduces Net8 and describes the various components that combine to implement Net8's functionality. **Chapter 1** also discusses stack communications and provides a brief overview of Net8's management utilities.
- **Chapter 2**, discusses name resolution, which is the process of taking a human-readable network address and correlating it with a specific network address that is meaningful to the underlying network protocol being used. Net8 supports several different naming methods, each useful in different situations.

Part II, comprises the major portion of the book. Here you'll find chapters showing how to configure Net8 on the server and on the client. You'll learn to configure advanced features such as load balancing and failover, and you'll learn about LDAP, Oracle Names, and Connection Manager. **Part II** includes the following chapters:

- **Chapter 3**, describes the process of configuring Net8 on clients that need to query an Oracle database across a network.
- **Chapter 4**, shows you how to configure Net8 on a server. Most of this chapter is focused on the task of getting a Net8 listener up and running.
- **Chapter 5**, describes MTS, the feature of Net8 that allows a server to support large numbers of client connections by sharing server processes among those connections.
- **Chapter 6**, presents Net8's increasing support for the Lightweight Directory Access Protocol (LDAP) as implemented by the Oracle Internet Directory (OID). LDAP is now the preferred name resolution method in cases where you want to centralize control over net service names.
- **Chapter 7**, shows how to implement name resolution via an Oracle Names server. Oracle Names is Oracle's proprietary name resolution software.
- **Chapter 8**, describes these two Net8 features, which are often used in Oracle Parallel Server (OPS) environments.
- **Chapter 9**, describes Net8's connection concentration and multi-protocol support features. These are implemented using an optional Net8 component known as Connection Manager.

Part III, will be useful when things go wrong with Net8. It includes the following chapters:

- [Chapter 10](#), shows how to use Net8's diagnostic and troubleshooting features. These include the `tnsping` utility, log files, and trace files.
- [Chapter 11](#), describes a number of commonly encountered problems and suggests ways of resolving them.

[Part IV](#), contains seven appendixes full of useful syntax reference information. You'll find references for `sqlnet.ora` parameters, `tnsnames.ora` parameters, `listener.ora` parameters, `names.ora` parameters, Net8-related registry and environment variables, and MTS initialization parameters and performance views.



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Conventions Used in This Book

The following typographical conventions are used in this book:

Italic

Used for filenames, directory names, and URLs. It is also used for emphasis and for the first use of a technical term.

Constant width

Used for examples and to show the contents of files and the output of commands.

Constant width bold

Indicates user input in examples showing an interaction (e.g., a Listener session).

UPPERCASE

In syntax descriptions, usually indicates keywords.

lowercase

In syntax descriptions, usually indicates user-defined items such as variables.

[]

In syntax descriptions, square brackets enclose optional items.

{ }

In syntax descriptions, curly brackets enclose a set of items from which you must choose only one.

|

In syntax descriptions, a vertical bar separates the items enclosed in curly brackets, as in {ON | OFF | YES | NO | TRUE | FALSE}.

...

In syntax descriptions, ellipses indicate repeating elements. In addition, since repetition is rarely mandatory, the second occurrence of a syntax element is enclosed within square brackets. The following syntax, for example, indicates that you can have a comma-delimited list of naming methods:

```
naming_method [,naming_method...]
```

Given this syntax, any of the following would be acceptable:

TNSNAMES

TNSNAMES, ONAMES

TNSNAMES, ONAMES, HOSTNAME



Indicates a tip, suggestion, or general note. For example, we'll tell you if a certain setting is version-specific.



Indicates a warning or caution. For example, we'll tell you if a certain setting has some kind of negative impact on the system.

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Comments and Questions

We have tested and verified the information in this book to the best of our ability, but you may find that features have changed or that we have made mistakes. If so, please notify us by writing to:

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<http://www.oreilly.com/catalog/net8trouble>

For more information about this book and others, see the O'Reilly web site:

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Acknowledgments

Quite a few people helped give birth to this book. To our editor, Deborah Russell, we express our heartfelt thanks for believing in this project and for applying her usual deft editing skills to the chapters we wrote.

Several people were instrumental to the success of this book because they took the time to answer questions, talk about how they were using Net8, and even supply some material. We owe Isobel Eckhardt a great debt for answering numerous questions about Oracle Names, reviewing an early draft of the chapter on Names, and supplying us with material explaining how regions and domains worked. John-Paul Navarro was instrumental in educating us about LDAP and also provided a great deal of aid when it came to figuring out just how to make Net8 and LDAP work together. Bill Pribyl, coauthor of Oracle PL/SQL Programming, was kind enough to review the section in [Chapter 4](#) that talks about configuring Net8 to support remote procedure calls.

We also have many excellent technical reviewers to thank. They took the time to read draft copies of this book, look for errors, and comment on areas where our coverage was thin or missing. Thanks to Edward (Lee) Murray, Stephen Andert, Michael Culp, Chris Gait, and Richard Eastham. These people have greatly contributed to the accuracy and relevance of the book that you are now reading. In addition, Howard Cohen and Harvey Eneman of Oracle Corporation were gracious enough to answer some questions regarding Connection Manager. Many thanks to the people at O'Reilly who helped produce this book, including: Caroline Senay, Debby's editorial assistant.

From Hugo

In the course of my work on Oracle's networking technologies, I've had the good fortune to be assisted by many at Oracle Corporation. In particular, I'd like to thank Mark Jarvis for his continued support of my efforts to evangelize Oracle's technologies. Likewise, I've always been afforded timely support by the various teams and individuals whose work is focused on the networking technologies, including Pierre Boudin and his group. Thank you all. I hope we have represented your craftsmanship well.

This book, however, would not be in your hands were it not for the remarkable efforts of Jonathan Gennick, who has taken my peculiar and often arcane interest in the minutiae of Oracle networking and made it particularly accessible to our readers. Thank you, Jonathan!

And finally, for the continually remarkable efforts of our editor, Debby Russell, by whom I was introduced to Jonathan and to whom I will always be grateful, my thanks and appreciation.

From Jonathan

Not only did John-Paul Navarro help with the LDAP chapter, he and his wife Debby put up with me at their house for two nights so that we could experiment with Net8 and the Oracle Internet Directory and take the screen shots that you see in [Chapter 6](#). I should also thank their two boys, John-Luke and Nicholas, for being such pleasant children and for diverting John-Paul and me from our work! John-Luke and Nicholas, also provided the inspiration for the net service names used in the LDAP examples.

My family, of course, had a part to play in the success of this book. My wife Donna has always been very supportive of my writing efforts, even though they mean many evenings and late nights holed up in my office away from the family. Thank you Donna! Finally, I want to thank my daughter Jenny and my son Jeff for their patience they suffer regularly from "missing daddy syndrome" when I'm working on books.

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Part I: How Net8 Works

This part of the book provides an introduction to Net8, its architecture, its functionality, and its major components. It includes the following chapters:

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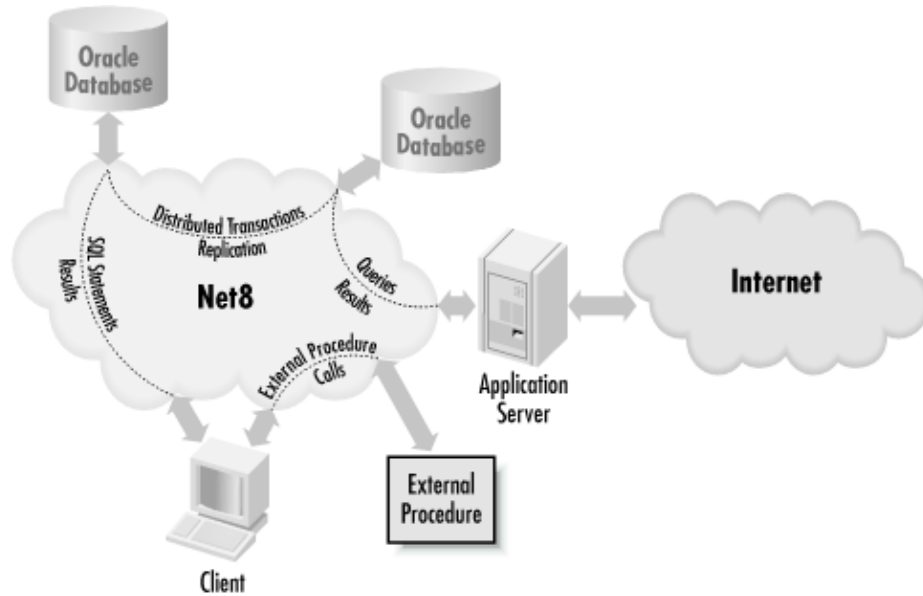
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Part I: How Net8 Works


Chapter 1. Oracle's Network Architecture and Products

Net8 is the fundamental networking technology that allows Oracle services and clients to communicate with each other over a network. The most common application for Net8 is to allow clients to talk to database servers, but Net8 also enables server-to-server and other types of communication, as shown in [Figure 1.1](#).

Figure 1.1. Net8 enables communication between many Oracle services and applications



In this chapter, you'll learn about Oracle's architectural goals for Net8. You'll also learn about the major components that make up Net8. Some of these components are behind-the-scenes in that they are only used by the Net8 communications stack. Others are management tools that you invoke directly.

 Net8 was originally named SQL*Net. When Oracle8 was released, Oracle changed the name to Net8.

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Chapter 1. Oracle's Network Architecture and Products

1.1 Goals of Net8

The overarching mission of Net8 is fairly obvious: to enable connectivity in an Oracle environment. Oracle wants to make it as easy and painless as possible for developers to connect client applications to an Oracle database. In support of that mission, Oracle has set these goals for Net8:

- Location transparency
- Platform independence
- Protocol transparency

By meeting these three goals, Oracle has made Net8 a very easy to use connectivity solution. Much of the complexity of dealing with various networking protocols and operating-system platforms has been hidden from the user. A developer or DBA working with Net8 only needs to understand how Net8 works. There's no need to have a detailed understanding of the underlying protocols or the underlying operating systems.

1.1.1 Location Transparency

Location transparency refers to the fact that an application does not need to know anything about the network location of the service to which it is connecting. Node names, IP addresses, and the like are transparent to the application. Net8 needs to know these details, but they are hidden from the application.

Net8 achieves location transparency by associating the network address of a server with a Net8 service name. You then use that Net8 service name in client applications in order to connect to the database server. If the address of the server changes, that change only needs to be made at the Net8 level. Client applications and database links that use the service name are completely unaffected.

1.1.2 Platform Independence

Platform independence refers to the fact that Net8 works the same way regardless of the specific hardware or software platform being used. An application that uses Net8 on Unix does not need to be modified in order to use Net8 on Windows NT or Windows 2000.

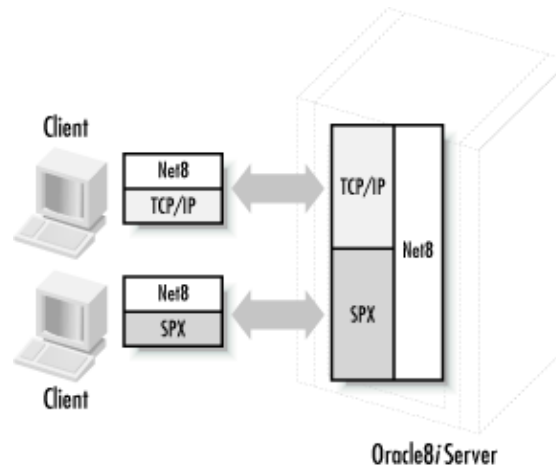
Net8 achieves platform independence by implementing common functionality and a common API on each platform that Oracle supports. Most applications, in fact, do not call Net8 directly. Instead, they make calls to the Oracle Call Interface (OCI). The OCI, in turn, interfaces with Net8. The result is that Oracle applications do not need to be aware of the specific hardware and software platform on which they are running.

1.1.3 Protocol Transparency

Protocol transparency refers to the fact that applications using Net8 do not need to be aware of the underlying network protocol being used. Net8 works the same over TCP/IP as it does over SPX or any other networking protocol. In fact, if you need to translate between protocols, the Oracle Connection Manager will do that for you, and it will be totally transparent to the applications involved.

Net8 achieves protocol transparency through the use of protocol adapters. Protocol adapters sit between Net8 and the underlying networking protocol being used. They allow Net8 packets to be transmitted and received using protocols such as TCP/IP or SPX. [Figure 1.2](#) shows how protocol adapters fit into the Net8 equation.

Figure 1.2. Net8 protocol adapters let Net8 function over any supported networking protocol



As [Figure 1.2](#) shows, Net8 can support multiple protocols simultaneously. When you define a service name to Net8, you also define the protocol (or protocols) that may be used to reach that service. The database service shown in [Figure 1.2](#) can be reached using either TCP/IP or SPX. Net8 will use whichever protocol is supported by the client machine that is making the connection.

Because the network protocol to use is known only to Net8, it can easily be changed without affecting client applications. All you have to do is make sure that the appropriate adapters are installed and that the Net8 service name definition specifies the protocol to use.

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Chapter 1. Oracle's Network Architecture and Products

1.2 Net8 Components

Just what do you get when you install Net8? What are the tangible components that you as the DBA need to know about and manage? The answers to these questions depend on the complexity of your environment and on the options that you choose or choose not to implement. The next few sections talk about the following Net8 configurations:

- Dedicated server
- Multi-threaded server (MTS)
- Oracle Internet Directory

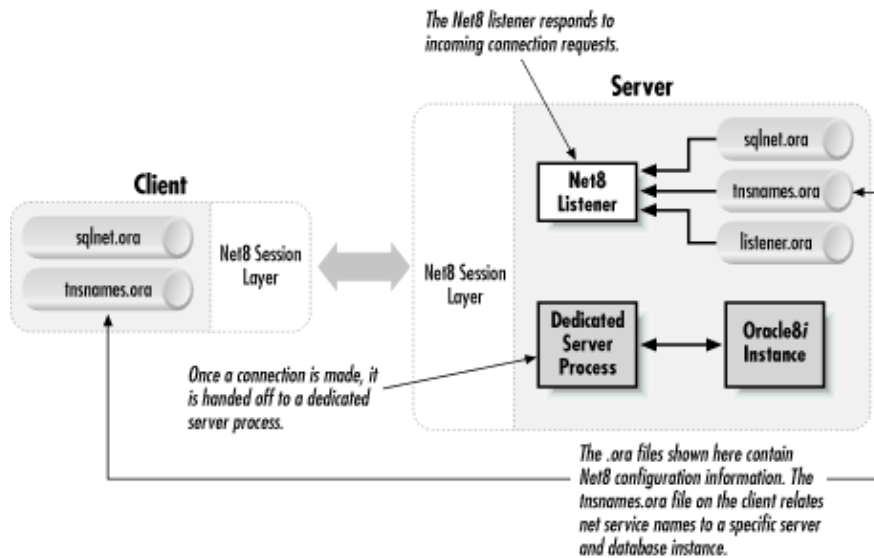
- Oracle Names
- Connection Manager

As you read these sections, bear in mind that these configurations are not mutually exclusive. They are presented separately to keep the diagrams simple and to keep the discussion focused. The simplest configuration, and the one you'll get by default when you do a fresh install of Oracle, is a dedicated server configuration that does not use any of the other components. However, it's entirely possible for a Net8 environment to use Oracle Internet Directory (or Oracle Names) and Connection Manager to implement the multi-threaded server option, and to still use dedicated server connections as well.

1.2.1 Dedicated Server

A dedicated server environment is one in which each database session communicates with a corresponding server process that has been dedicated to it. [Figure 1.3](#) shows an example of this environment. The term refers to the dedicated server processes that are started for each client connection to the Oracle database.

Figure 1.3. A Net8 dedicated server configuration



The following list describes the major components that you'll need to deal with in a simple dedicated server configuration such as that shown in [Figure 1.3](#).

Net8 listener

A process that runs on the server and monitors the network for incoming connection requests. When a connection is made, the listener starts up a dedicated server process and hands off the connection to that process. The listener does not stay involved in the connection after that point.

Net8 session layer

The low-level software that enables Net8 communication over a network. The session layer consists of a generic network interface; a routing, naming, and authentication layer; and the Transparent Network Substrate (TNS). You'll read more about these later in this chapter in [Section 1.3](#).

sqlnet.ora file

A text file that exists on both the client and the server machines. It contains settings that control various aspects of Net8's operation.

tnsnames.ora file

A text file that translates net service names to specific server addresses and instance names.
listener.ora file

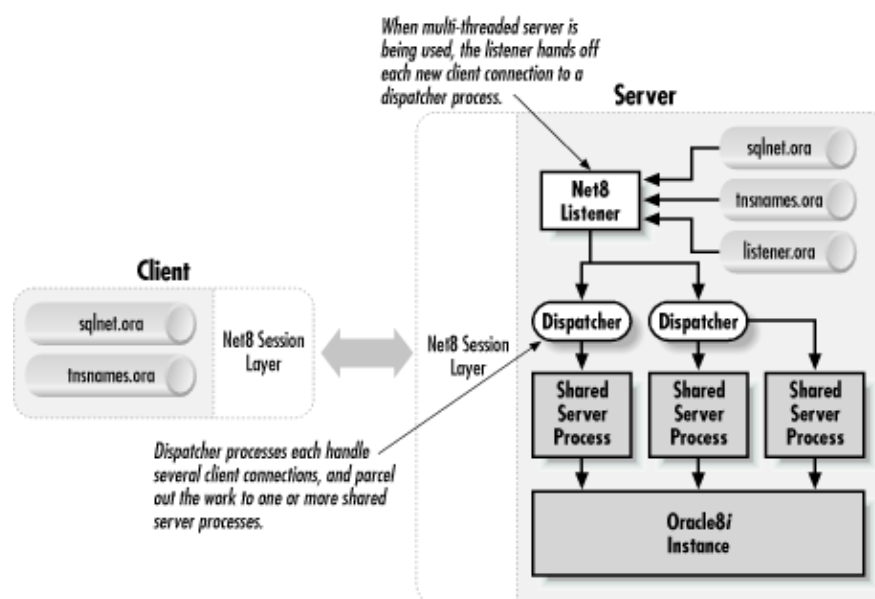
A text file containing settings that control the operation of the Net8 listener.

Although [Figure 1.3](#) only shows one listener, it is possible to configure Net8 to use multiple listener processes on one machine. When you configure multiple listeners, you still have only one *listener.ora* file. All the parameters for all the listeners are in that one file. See [Chapter 4](#), for details on configuring Net8 listeners.

1.2.2 Multi-Threaded Server

A multi-threaded server environment is one in which the client connections share access to a pool of shared server processes. In a dedicated server environment, as the number of client connections to an Oracle database increases, the resulting dedicated server processes can quickly eat away at the available CPU and memory resources on the server. This has an adverse impact on scalability; you won't be able to support as many users as you might like. If you expect to have a large number of client connections to your database, you may be able to improve scalability by using Net8's multi-threaded server (MTS) option. The MTS option, illustrated in [Figure 1.4](#), allows one server process to handle more than one client connection.

Figure 1.4. A Net8 multi-threaded server configuration



Using the MTS option adds one component to the Net8 environment—the dispatcher process. Whereas in a dedicated server environment each new connection is handed off to a dedicated server process, in an MTS environment, each new connection is handed off to a dispatcher process. Each dispatcher process can handle a large number of client connections. When a client sends a SQL statement to the database to be executed, the dispatcher routes that SQL statement to an available shared server process. The shared server process is analogous to a dedicated server process, except that it is shared by more than one connection. The shared server process takes care of executing the SQL statement, and then returns the results back to the client.

The multi-threaded server option is only beneficial in cases where your client connections sporadically use the database. The idea is that while one connection is sitting idle, another connection can be serviced. Clients with little or no idle time should be connected to dedicated server processes. You can learn more about the MTS option in [Chapter 4](#).

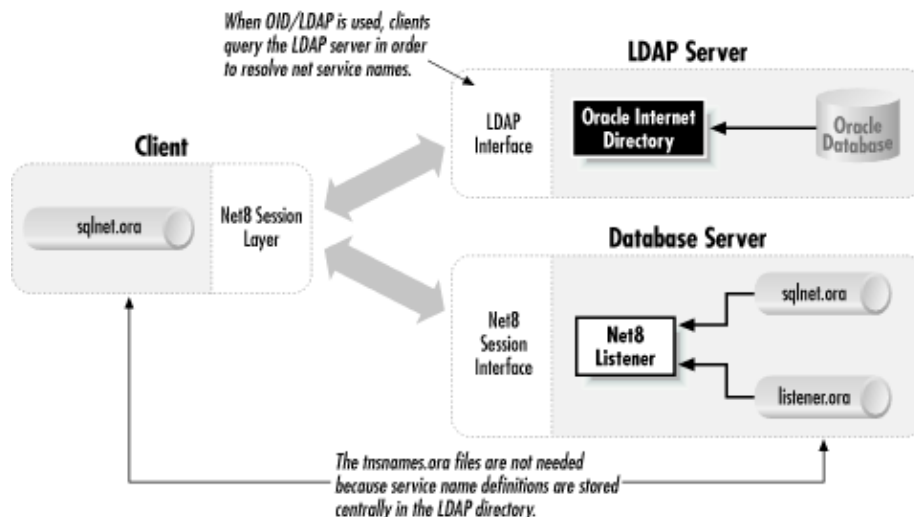
1.2.3 Oracle Internet Directory

Oracle Internet Directory (OID) is not, strictly speaking, a Net8 component. It's an implementation of a standards-based Lightweight Directory Access Protocol (LDAP) directory server. An LDAP directory server such as OID can be used to maintain a central repository of net service names that can be referenced by all clients.

When you connect to an Oracle database, you specify the database in question by supplying a net service name. Somehow, Net8 needs to resolve that service name into a specific Oracle instance on a specific server. One way to do that is through the use of *tnsnames.ora* files. These are text files that sit on each client machine, and also on the servers, and that contain the information needed to resolve each net service name.

Because they must reside on each machine, *tnsnames.ora* files do not represent a very scalable solution to the problem of resolving net service names. Every time changes are made, the *tnsnames.ora* files on all your machines need to be refreshed. You can imagine how burdensome and error-prone that task becomes as the number of machines increases. OID, shown in [Figure 1.5](#), allows you to define net service names in one central repository.

Figure 1.5. A Net8 environment using OID



OID is shipped with the Enterprise Edition of the Oracle database software. Currently, if you are licensed for the Enterprise Edition, that confers a license to use OID for the purposes of net service name resolution. Read [Chapter 6](#), for more information on using LDAP with Net8.

1.2.4 Oracle Names

Oracle Names is a soon-to-be obsolete Net8 component that allows net service names to be defined centrally. It functions in much the same manner as the OID. To resolve a net service name, clients contact an Oracle Names server. The Names server sends back the definition for the name, and the client uses that definition to connect to a database service.

Using Oracle Names allows you to dispense with the *tnsnames.ora* files, and adds the following two components to your Net8 environment:

Oracle Names

Software that maintains a central repository of net service name definitions