Adding Mobile Capability to an Enterprise Application With Oracle Database Lite

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Table of Contents

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INTRODUCTION

In today's enterprises, managing data solely in a large data center is no longer sufficient. Business requires more flexibility in that accessing and uploading data dynamically is required by workers who are remote from the office. This may include the worker who is at a customer site gathering requirements. The ability for the worker to collect the data at the customer site, perform an analysis on his/her mobile device and then wirelessly upload it to the office enterprise database is very valuable in today's environment. Instant access to data both on the mobile device and at the office can prove invaluable in situations that are time critical. In addition, enabling the administrator to be able to manage and update the software on the worker's device remotely—without requiring him/her to bring in the device—allows the entire enterprise to run seamlessly and without interruption.

Examples for the types of workers can be delivery people, sales people or even hardware, such as hardware that monitors the inventory in vending machines or the performance statistics on automobiles. Any business that requires gathering, monitoring, or reacting to data that is at a site other than the main office can benefit from using Oracle Database Lite.

Mobile Business Challenges

In designing an enterprise system that includes the mobile capability, you may face the following business challenges:

- How do I provide my mobile workers with the latest data?
- How do I take the work my mobile workers have done and upload it to the main office enterprise system?
- How do I manage my devices to handle changes in the database table schema, application modifications, and software updates?
- How can I track and review what exists and who owns each mobile device in the enterprise?

Oracle Database Lite provides a solution for these challenges with the following features:

- Small, embedded, relational database for software or hardware solutions.

- Mobile options for synchronizing data between remote device and back-end Oracle database.
- Device management capability for the administrator.

The Evolution of Oracle Database Lite

When Oracle Database Lite was first implemented, it provided a small, relational database for small applications to use for storing, retrieving, and searching data on a Mobile device. Applications embed the Oracle Lite database as their relational database on small devices, such as a laptop or a PDA. Thus, the application can use SQL to manage data, rather than building and maintaining your own proprietary storage engine for managing data.

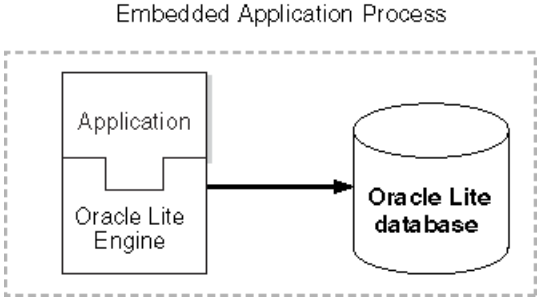
As mobile device usage increased, development added the mobile feature to synchronize data between any mobile device and a back-end server Oracle database. Now, multiple users can upload data to a single enterprise source. And the administrator can specify what information is downloaded to each user.

As the number of mobile device users grew, administrators found it increasingly difficult to manage the software updates for the devices and apply schema changes to the database on the device. Accordingly, development added device management to Oracle Database Lite, which provides the administrators the ability to manage all mobile devices from their desktop.

For your application—whether it needs an embeddable database or a mobile solution for an enterprise—you can use Oracle Database Lite. The following sections describe these options in more detail.

SMALL EMBEDDED DATABASE FOR APPLICATION SOLUTIONS

Often, a small, reliable database is necessary for independent applications or hardware. You can decrease the amount of development effort needed for your application by embedding an existing database in your application or hardware implementation. Oracle Database Lite contains a proven implementation of a small, reliable, relational database that provides many of the functions necessary to manage your data in a small application or on hardware. The following picture shows an application integrated with the Oracle Lite engine, and the Oracle Lite database in a single process:



- Embedded option—An application may need an independent small, relational database to exist solely for the application's need to store, search and retrieve application data. No synchronization of data with a back-end database is necessary. For example, if you have an individual accounting application or an address book, it may need a small embedded database to store the data.

  In addition, the software that supports a hardware unit may need an embedded database to facilitate gathering information, which can be retrieved by a service technician when the unit is serviced or brought in for service. Examples of this type of implementation may include any vending machine that tracks current inventory or software integrated into a car that monitors statistics on the automobile's performance.

MOBILE OPTIONS FOR THE SYNCHRONIZING DATA BETWEEN A MOBILE DEVICE AND THE ENTERPRISE

Business and personal access to data in remote locations in a timely fashion is now expected by users. Both businesses and individuals are using cell phones, PDAs, and laptops to collect, search and receive data out in the field. Users need to have a method to receive application data from the enterprise application that is specific to their needs and to be able to synchronize data collected back to the centralized database.

To facilitate user access to data, the following may need to occur:

- If there is data that exists on the centralized database that is needed by a certain worker out in the field, there should be a way to specify that the intended worker receives this data.
- When a worker collects data off-site, there should be a seamless way to synchronize data from the Mobile device to the server—whether the worker is at a remote site or back at the office.

It is no longer necessary for workers to be always connected to the enterprise. Instead, workers may be disconnected, but still enjoy the benefits of continuous data access—independent of connections to the enterprise.

Oracle Database Lite merges the enterprise infrastructure with every remote aspect of the organization. A mobile architecture contains the remote application, the remote data store, and the remote rules of the business. The Oracle Database Lite mobile infrastructure is responsible for connecting and synchronizing applications, associated data, and business rules with the applications, data store, and business rules of the enterprise.

- Oracle Database Lite enables efficient and effective remote data retrieval and collection from and to a centralized Oracle database.
- Oracle Database Lite provides a complete mobile infrastructure designed to run enterprise mobile and disconnected database applications.

- Oracle Database Lite provides the infrastructure that makes the enterprise application and data store available even when communications to the enterprise itself are not available or reliable.
- Oracle Database Lite is designed to extend and synchronize enterprise business applications and data to mobile workers

A mobile architecture with the proper design, security components, and implementation helps compress business processes and reduce operational costs.

In the past, your workers may have manually captured data on site and then, when back at the office, manually entered the data into the office database. With the proper design, your mobile application combines these steps into a single step of capturing the data at the remote location, which is then synchronized with the back-end Oracle database at the office. With mobile applications, you can take out the intermediate steps or interactions that are not necessary, which provides a cost savings and a reduction of errors within enterprises by reducing the latency and manual steps involved.

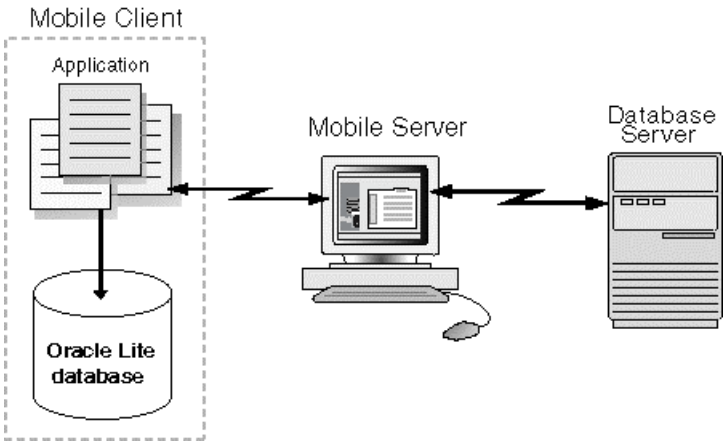
An application is created, where the worker enters data on a client Mobile device and the data is synchronized with a back-end Oracle database. For example, if you have a delivery service, each delivery person may have their own client Mobile device. As they travel around to their customers, they update and enter data when picking up or delivering packages to the customer. This data can be synchronized from the device either wired or wirelessly from the field or when returning to the office.

You have a choice for how it is best for the worker, also known as the user in Oracle Database Lite, to synchronize, as follows:

- Oracle Database Lite can be specified to wait on the user to manually initiate each synchronization. The manual synchronization can be initialized either within the program through an API call or by having the user initialize the synchronization executable.
- Oracle Database Lite provides an automatic service to synchronize the data between the Mobile Server and the Oracle server database. You can specify rules so that the data is automatically sent when certain conditions occur. With this ability to configure for an automatic synchronization, the data is always kept current between both the remote and server sites.

Note: This section describes using the mobile option for software-based applications. You can also expand the embedded option described in the previous section by enabling automatic synchronization. For example, if you enable automatic synchronization for hardware implementation in a vending machine, then it can communicate to the back-end Oracle database over a wireless connection to update current inventory and prompt a service call when inventory is low.

Oracle Database Lite provides a complete mobile infrastructure suitable for almost any enterprise demands using the following:



- The Mobile repository resides in the back-end enterprise database, which links the enterprise data with the mobile data.
- The Mobile Server is a Web-based tier that integrates with OracleAS and executes on top of the Oracle Containers for J2EE (OC4J). OC4J is Oracle's J2EE implementation for accessing remote locations through wireless or wired connectivity. Oracle Database Lite uses OC4J to facilitate synchronization, application management, device management, and so on.
- The Mobile client uses a client database, called the Oracle Lite database, and the means for deploying applications developed using the most popular languages. These clients can be executed on most any device from a cell phone, to a personal digital assistant (PDA), Tablet PC, Laptop, Linux platform and so on.

Database Creation During Synchronization

The first time a user synchronizes on the Mobile client, an Oracle Lite database is automatically created on the mobile device. Data is downloaded from the enterprise database and stored in the Oracle Lite database on the mobile device. SQL queries, which may contain bind variables, are used to determine what data is downloaded to the mobile device. By varying the values of these bind variables, users receive data sets based upon what they need as defined by the administrator or developer. The data is stored in snapshot tables in the Oracle Lite database. Snapshot tables are similar to tables in a relational database, with the added ability to track data changes made to the table. A later synchronization sends these changes to the Mobile Server, where they are applied to the enterprise database.

Automatic or Manual Synchronization

As the user executes the application, changes made to Oracle Database Lite are captured. In addition, any modifications that occur on the back-end Oracle database are captured. The process of synchronization is where the modifications

on the client are uploaded to the server; any modifications that are designated for this particular user are downloaded from the server to the client.

Synchronization is an event that can occur either manually or automatically.

- Manual synchronization occurs when the user initiates the synchronization through one of the synchronization executables, depending on the platform.
- Automatic synchronization is configured by the developer and/or the administrator to occur seamlessly when a connection is available and when certain conditions are present.

REMOTE MOBILE DEVICE MANAGEMENT

Since the mobile device environment is exploding, administrators are managing enterprises with hundreds—and sometimes thousands—of distributed devices. This creates the question of how to manage modifications for the devices—whether it is software updates, changing users who own the device or modifying the database schema for the application. Oracle Database Lite provides administrators the means to send commands remotely to mobile devices based upon users, applications or groups. As described in this section, the administrator can send commands to Mobile devices to inspect or modify what is currently installed or configured, start synchronization, validate the database, install and upgrade software, as well as deactivate a unit if the user is no longer allowed to access the database or if the device was lost.

When you install your Mobile client software, the Mobile device manager client software is automatically installed. The device management software enables your administrator to manage each device.

Automatically Update Software on Mobile Client

The administrator can configure each mobile device to automatically receive new software updates when each comes available—either for the Mobile client software or for any applications installed on the client.

Send Commands to Manage Mobile Device

The administrator can send commands to remote devices from the Oracle Database Lite management application—the Mobile Manager. The next time that the device is available—either through wireless connection or synchronization—the command that you requested executes on the mobile device.

The following sections describe what you can do with the commands you can send to the device.

Reset Password

If a user has forgotten their password, use this command to remotely reset the password on the device.

Modify Configuration

Modify configuration settings in the client-side POLITE.INI or ODBC.INI configuration files.

Synchronization Commands

The following commands either starts synchronization or retrieves information about a previously executed synchronization:

- Retrieve synchronization log—If the administrator needs to understand why a synchronization may not be successful for a certain device, then he/she can retrieve the data synchronization log from the client. The retrieved information can be viewed in the Mobile Manager.
- Synchronize databases—If, for some reason, the administrator needs all updates in the server at a certain time, then the administrator can issue this command to synchronize all the Mobile client databases that are able to be synchronized. For example, the administrator may want all available updates to be applied before the weekly backup.
- Synchronize and delete databases—If a mobile device has been lost or stolen, then the administrator may need to retrieve the last updates from a mobile device and then delete all databases from that device.

Retrieve and View Device Information

You can retrieve and view device information, such as the following:

- Device information, such as the following:
    - The operating system, its version and the latest service pack applied. In addition, you can view the host name and last known IP address for the Mobile device.
    - How much memory you have on the device, which includes how much virtual or physical memory is on the device, and how much of that memory is still available.
    - The type of device and processor. Organizations may have rolled out several types of devices over the lifetime of a mobile deployment. With this functionality, you can determine exactly which users require device upgrades.
    - For Windows-based devices only, the version of the JDK that you have installed and where it is installed. You no longer have to ask your users to check which version of JDK that they have installed. In addition, this section describes the CLASSPATH for the Mobile client environment.
    - The amount of storage space that exists and is currently available on each drive.

- Database information for the Oracle Lite database that is installed on the Mobile client, such as the following:
  - The ODBC driver name and full path to the DLL implementing the driver, so that you can know which version that is installed on your client.
  - The user client databases for each application.
  - The exact contents of the Mobile client POLITE.INI configuration file.
- Installed Oracle Database Lite software on the Mobile device, which lists each application, its version, setup time, and location details.

Retrieve a file from the device

This command forces the device to upload a designated file, which enables the administrator to see any configuration file on the device. This can be particularly useful in diagnosing problems with the device.

Install Application

If you need the device to install a new application, then this command forces the device to install an application.

Manage the Oracle Lite Database

- Validate Database—Validates the client database and uploads the results to the Mobile Server.
- De-install Oracle Database Lite—If the device is lost or stolen, then the administrator can de-install the Oracle Database Lite client remotely. This also may be useful if it is easier to de-install the previous and install a new version of Oracle Database Lite, rather than upgrade.

Device Management Security

The device management commands are powerful and provide an administrator a great deal of control over the mobile device population. It is important that malicious users cannot send potentially harmful commands to a user's device. Oracle Database Lite uses state of the art public/private key encryption algorithms to verify the originator and the integrity of the commands.

BUILDING MOBILE APPLICATIONS ON ORACLE DATABASE LITE

A Mobile application is one that can execute on Mobile devices without requiring constant connectivity to the server. An Oracle Database Lite application places a local database on the Mobile device, whose content is a subset of data that is stored in the enterprise data server. Modifications made to the local database by the application are reconciled with the server data on the Oracle database. The technology used for reconciling modifications between the Mobile database and the enterprise database is known as data synchronization.

In order to make it easy for you to develop applications for Oracle Database Lite, a variety of mobile devices and development APIs for the major languages are supported. In addition, Oracle Database Lite facilitates the deployment and management of applications for a large number of Mobile users.

Supported Platforms

You can develop your own custom application to execute on one or more separate Mobile platforms—such as a Windows laptop, Windows CE, Linux, or Symbian platforms.

Supported Development Languages

You can use the following languages in developing your Oracle Database Lite applications:

- Native Development: The most common way is to develop native applications using C, C++. C#, Visual Basic, Visual Basic.Net or Java for specific Mobile platforms, as follows:
    - C and C++ applications access the database through the ODBC API.
    - C# and Visual Basic .Net applications access the database through the ADO.Net API.
    - Java based applications access the database through the JDBC API, where Oracle Database Lite provides both a type-2 and a type-4 driver.

  Applications can be developed using popular IDEs like Oracle's Jdeveloper or Microsoft Visual Studio.
- Web applications: You can build Mobile, Web-based, database applications using Mobile Client for Web-to-Go. This client stack includes a standalone Web server, which is installed on the mobile device. You can build applications with the Servlet, Java Sever Pages (JSP), applet, HTML, and JDBC technologies.

CONCLUSION

This paper introduces how you can use Oracle Database Lite for your mobile workers to access the enterprise data seamlessly. Each user can only access and modify data that is assigned to them by the administrator. In addition, the administrator is able to seamlessly manage multiple devices—without interrupting the productivity of the worker.

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Oracle Corporation
World Headquarters
500 Oracle Parkway
Redwood Shores, CA 94065
U.S.A.

Worldwide Inquiries:
Phone: +1.650.506.7000
Fax: +1.650.506.7200
oracle.com

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