SYBASE®
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Developer Guide: Windows and Windows Mobile Object API Applications

Sybase Unwired Platform 2.2 SP02

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Getting Started with Windows and Windows Mobile Development

Use advanced Sybase® Unwired Platform features to create applications for Windows and Windows Mobile devices. The audience is advanced developers who may be new to Sybase Unwired Platform.

This guide describes requirements for developing a device application for the platform, how to generate application code, and how to customize the generated code using the Client Object API. Also included are task flows for the development options, procedures for setting up the development environment, and Client Object API documentation.

Companion guides include:

- *Sybase Unwired WorkSpace - Mobile Business Object Development*
- *Supported Hardware and Software*
- *Tutorial: Windows Mobile Application Development*, where you create the SUP101 sample project referenced in this guide.

  Complete the tutorials to gain a better understanding of Unwired Platform components and the development process.
- *Troubleshooting*.
- A complete Client Object API reference is available in *SUP_HOME* `\MobileSDK22\ObjectAPI\apidoc\cs`
- *Fundamentals* contains high-level mobile computing concepts, and a description of how Sybase Unwired Platform implements the concepts in your enterprise.
- *Developer Guide: Migrating to Sybase Mobile SDK* contains information for developers who are migrating device applications to a newer software version, and changes to MBOs, projects, and the Unwired Server.

Object API Applications

Object API applications are customized, full-featured mobile applications that use mobile data model packages, either using mobile business objects (MBOs) or Data Orchestration Engine, to facilitate connection with a variety of enterprise systems and leverage synchronization to support offline capabilities.

The Object API application model enables developers to write custom code — C#, Java, or Objective-C, depending on the target device platform — to create device applications.

Development of Object API applications provides the most flexibility in terms of leveraging platform specific services, but each application must be provisioned individually after being compiled, even for minor changes or updates.

Development involves both server-side and client-side components. Unwired Server brokers data synchronization and transaction processing between the server and the client components.

- Server-side components address the interaction between the enterprise information system (EIS) data source and the data cache. EIS data subsets and business logic are encapsulated in artifacts, called mobile business object packages, that are deployed to the Unwired Server.
- Client-side components are built into the mobile application and address the interaction between the data cache and the mobile device data store. This can include synchronizing data with the server, offline data access capabilities, and data change notification.

These applications:

- Allow users to connect to data from a variety of EIS systems, including SAP® systems.
- Build in more complex data handling and logic.
- Leverage data synchronization to optimize and balance device response time and need for real-time data.
- Ensure secure and reliable transport of data.

Best Uses for Object API Applications

Synchronization applications provide operation replay between the mobile device, the middleware, and the back-end system. Custom native applications are designed and built to suit specific business scenarios from the ground up, or start with a bespoke application and be adapted with a large degree of customization.

Cache Synchronization

Cache synchronization allows mapping mobile data to SAP Remote Function Calls (RFCs) using Java Connector (JCO) and to other non-SAP data sources such as databases and Web services. When Sybase Unwired Platform is used in a stand-alone manner for data synchronization (without Data Orchestration Engine), it utilizes an efficient bulk transfer and data insertion technology between the middleware cache and the device database.

In an Unwired Platform standalone deployment, the mobile application is designed such that the developer specifies how to load data from the back end into the cache and then filters and downloads cache data using device-supplied parameters. The mobile content model and the mapping to the back end are directly integrated.

This style of coupling between device and back-end queries implies that the back end must be able to respond to requests from the middleware based on user-supplied parameters and serve up mobile data appropriately. Normally, some mobile-specific adaptation is required within SAP Business Application Programming Interfaces (BAPI). Because of the direct nature of application parameter mapping and RBS protocol efficiencies, Sybase Unwired Platform cache synchronization deployment is ideal:

- With large payloads to devices (may be due to mostly disconnected scenarios)
- Where ad hoc data downloads might be expected
- For SAP® or non-SAP back ends

Large payloads, for example, can occur in task worker (service) applications that must access large product catalogs, or where service occurs in remote locations and workers might synchronize once a day. While Sybase Unwired Platform synchronization does benefit from middleware caching, direct coupling requires the back end to support an adaptation where mobile user data can be determined.

Client Runtime Architecture

The goal of synchronization is to keep views (that is, the state) of data consistent among multiple tiers. The assumption is that if data changes on one tier (for example, the enterprise system of record), all other tiers interested in that data (mobile devices, intermediate staging areas/caches and so on) are eventually synchronized to have the same data/state on that system.

The Unwired Server synchronizes data between the device and the back-end by maintaining records of device synchronization activity in its cache database along with any cached data that may have been retrieved from the back-end or pushed from the device. The Unwired Server employs several components in the synchronization chain.

Mobile Channel Interfaces

Two main channel interfaces provide notifications and data transport to and from remote devices.

- The messaging channel serves as the abstraction to all device-side notifications (BlackBerry Enterprise Service, Apple Push Notification Service, and others) so that when changes to back-end data occur, devices can be notified of changes relevant for their application and configuration.

  The messaging channel sends these types of communications:
  - Application registration - the messaging channel is used for application registration before establishing a connection to the Unwired Server.
  - Change notifications - when the Unwired Server detects changes in the back-end EIS, the Unwired Server can send a notification to the device. By default, sending change notifications is disabled, but you can enable sending change notifications per synchronization group.

    To capture change notifications, you can register an `onSynchronize` callback. The synchronization context in the callback has a status you can retrieve.
  - Operation replay records - when synchronizing, these records are sent to the Unwired Server and the messaging channel sends a notification of `replayFinished`. The application must call another synchronize method to retrieve the result.
  - SAP Data Orchestration Engine (DOE) application synchronization - the messaging channel is used for synchronization for DOE applications.

- The synchronization channel sends data to keep the Unwired Server and client synchronized. The synchronization is bi-directional.

Mobile Middleware Services

Mobile middleware services (MMS) arbitrate and manage communications between device requests from the mobile channel interfaces in the form that is suitable for transformation to a common MBO service request and a canonical form of enterprise data supplied by the data services.

Data Services

Data services is the conduit to enterprise data and operations within the firewall or hosted in the cloud. Data services and mobile middleware services together manage the cache database (CDB) where data is cached as it is synchronized with client devices.

Once a mobile application model is designed, it can be deployed to the Unwired Server where it operates as part of a specialized container-managed package interfacing with the mobile middleware services and data services components. Cache data and messages persist in the databases in the data tier. Changes made on the device are passed to the mobile middleware services component as an operation replay and replayed against the data services interfaces with the EIS. Data that changes on the EIS as a result of device changes, or those originating elsewhere, are replicated to the device database.

Documentation Roadmap for Sybase Unwired Platform

Sybase Unwired Platform documents are available for administrative and mobile development user roles. Some administrative documents are also used in the development and test environment; some documents are used by all users.

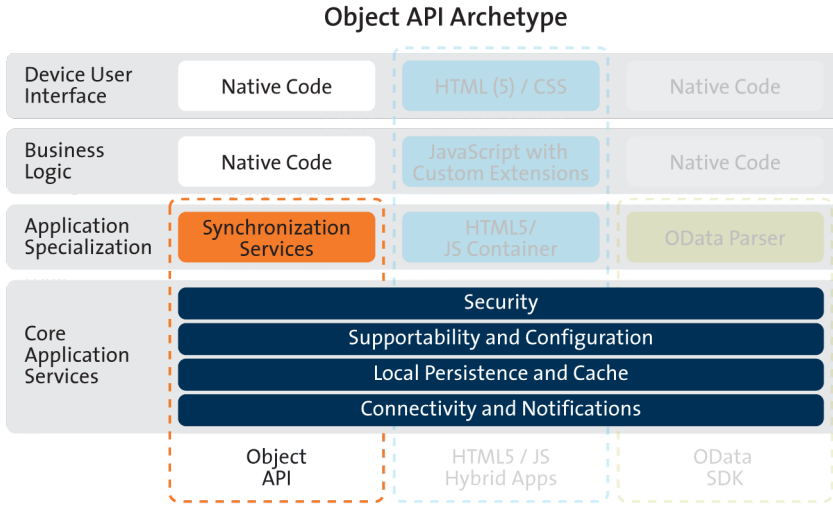
See *Documentation Roadmap* in *Fundamentals* for document descriptions by user role.

Check the Sybase® Product Documentation Web site regularly for updates: *http://sybooks.sybase.com/sybooks/sybooks.xhtml?id=1289&c=firsttab&a=0&p=categories* , then navigate to the most current version.

Development Task Flow for Object API Applications

Describes the overall development task flow for Object API applications, and provides information and procedures for setting up the development environment, and developing device applications.

This diagram illustrates how you can develop a device application directly from mobile business objects (MBOs), using the Object API and custom device application coding. This is how you create device applications with sophisticated UI interaction, validation, business logic, and performance.



The Object API provides the core application services described in the diagram.

The Authentication APIs provide security by authenticating the client to the Unwired Server.

The Synchronization APIs allow you to synchronize mobile business objects (MBOs) based on synchronization parameters, for individual MBOs, or as a group, based on the group's synchronization policy.

The Application and Connection APIs allow clients to register with and connect to the Unwired Server. The Callback Handler and Listener APIs, and the Target Change Notification APIs provide notifications to the client on operation success or failure, or changes in data.

With non-DOE-based applications, connectivity uses the MobiLink™ channel and notifications use the Messaging channel.

Installing the Windows Mobile Development Environment

Install and configure components required for Windows Mobile development.

Configuring Windows Mobile Device Center

Before using the Windows Mobile Device Emulator, you need to change the settings of Windows Mobile Device Center.

1. Open Windows Mobile Device Center.
2. Click **Mobile Device Settings**.
3. Click **Connection Settings**.
4. Click on the **Allow connections to one of the following** checkbox.
5. Select **DMA** in the combobox.
6. On the **This computer is connected to** combobox, select **The Internet** if you want to allow the Windows Mobile device to access the Internet using Pocket IE.
7. Start the Windows Mobile Device Emulator.

Enabling Network Access from the Windows Mobile Device Emulator

This task enables the emulator's connectivity.

You can start the Windows Mobile Device Emulator from Visual Studio or from the Device Emulator Manager.

1. To start the Emulator from Visual Studio 2008:
   a) Select **Tools > Device Emulator Manager**.
2. If a Device Emulator is not yet connected:
   a) Select a Device Emulator from the list and select **Connect**.
3. Right-click the current Emulator in Device Emulator Manager and select **Cradle**.

   ActiveSync starts. Once the connection is established, you should be able to access your PC and the Web from the Device Emulator.

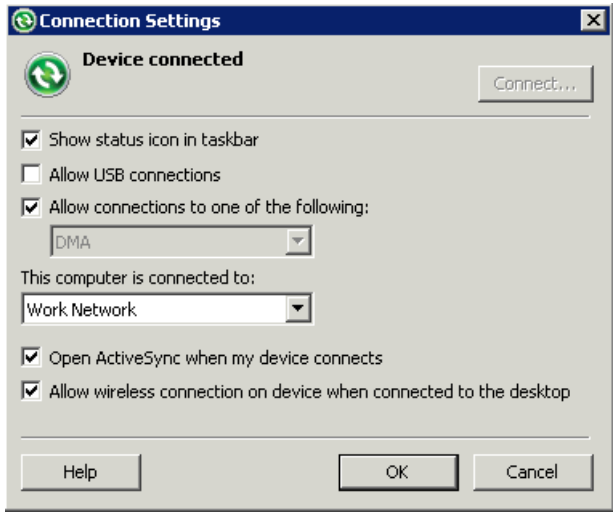
Installing Microsoft Synchronization Software

Install and configure Microsoft synchronization software so you can deploy and run a mobile application on a Windows Mobile emulator.

Note: Microsoft ActiveSync is for Windows XP. If you are using Windows Vista, Windows 7, or Windows 2008, install Virtual PC 2007 SP1 and Windows Mobile Device Center to manage synchronization settings. Download the Windows Mobile Device Center from *http://www.microsoft.com/windowsmobile/en-us/downloads/microsoft/device-center-download.mspx*.

1. Download Microsoft ActiveSync from *http://www.microsoft.com/windowsmobile/en-us/help/synchronize/device-synch.mspx*. Save it to your local machine. Windows XP requires ActiveSync version 4.5.
2. In Windows Explorer, double-click **setup.msi**.
3. When installation is complete, restart your machine.

   ActiveSync starts automatically, and its icon appears in the Windows toolbar.
4. Double-click the **ActiveSync** icon.
5. Select **File > Connection Settings**.
6. Select **Allow Connections to One of the Following**, then select **DMA**.
7. Under This Computer is Connected to, select **Work Network**.



8. Click **OK**.

Installing X.509 Certificates on Windows Mobile Devices and Emulators

Install the `.p12` certificate on the Windows Mobile device or emulator and select it during authentication. A certificate provides an additional level of secure access to an application, and may be required by an organization's security policy.

1. Launch the simulator or device.
2. Start the Windows synchronization software and cradle the device.
3. Use File Explorer to copy the `*.p12` certificate to the simulator or device.
4. Navigate to and double-click the certificate.
5. Enter the password at the prompt and click **Done**.

   An informational window indicates the certificate installed successfully.

Generating C# Object API Code

Generate object API code containing mobile business object (MBO) references, which allows you to use APIs to develop device applications for Windows or Windows Mobile devices. You can generate code either in Sybase Unwired WorkSpace, or by using a command line utility for generating code.

Generating C# Object API Code Using Sybase Unwired WorkSpace

Use Sybase Unwired WorkSpace to generate object API code containing mobile business object (MBO) references.

Prerequisites

Develop the MBOs that will be referenced in the device applications you are developing. A mobile application project must contain at least one non-online MBO. You must have an active connection to the datasources to which the MBOs are bound.

Task

Unwired Platform provides the Code Generation wizard for generating object API code. Code generation creates the business logic, attributes, and operations for your mobile business object.

1. Launch the **Code Generation** wizard.

From	Action
Mobile Application Diagram	Right-click within the Mobile Application Diagram and select **Generate Code**.
WorkSpace Navigator	Right-click the Mobile Application project folder that contains the mobile objects for which you are generating API code, and select **Generate Code**.

2. (Optional; this page of the code generation wizard is seen only if you are using the Advanced developer profile). Enter the information for these options, then click **Next**:

Option	Description
Code generation configuration	A table lists all existing named configurations plus the most recently used configuration. You can select any of these, click **Next**, and proceed. Additionally, you can: • Create new configuration – click **Add** and enter the **Name** and optional **Description** of the new configuration and click **OK** to save the configuration for future sessions. You can also select **Copy from** to copy an existing configuration which can then be modified. • Most recent configuration – if you click **Next** the first time you generate code without creating a configuration, the configuration is saved and displays as the chosen configuration the next time you invoke the code generation wizard. If the most recent configuration used is a named configuration, it is saved as the first item in the configuration table, and also "Most recent configuration", even though it is still listed as the original named configuration.

3. Click **Next**.
4. In Select Mobile Objects, select all the MBOs in the mobile application project or select MBOs under a specific synchronization group, whose references, metadata, and dependencies (referenced MBOs) are included in the generated device code.

   Dependent MBOs are automatically added (or removed) from the Dependencies section depending on your selections.

   Sybase Unwired WorkSpace automatically computes the default page size after you choose the MBOs based on total attribute size. If an MBO's accumulated attribute size is larger than the page size setting, a warning displays.
5. Enter the information for these configuration options:

Option	Description
Language	Select **C#**.

Platform	Select the platform (target device) for which the device client code is intended.
	• C#
	  • .NET Framework for Windows
	  • .NET Compact Framework 3.5 for Windows Mobile

Unwired Server	Specify a default Unwired Server connection profile to which the generated code connects at runtime.

Option	Description
Server domain	Choose the domain to which the generated code will connect. If you specified an Unwired Server to which you previously connected successfully, the first domain in the list is chosen by default. You can enter a different domain manually. **Note:** This field is only enabled when an Unwired Server is selected.
Page size	(Optional) Select the page size for the generated client code. If the page size is not set, the default page size is 4KB at runtime. The default is a proposed page size based on the selected MBO's attributes. The maximum page size is 16KB. The page size should be larger than the sum of all attribute lengths for any MBO that is included with all the MBOs selected, and must be valid for the database. If the page size is changed, but does not meet these guidelines, object queries that use string or binary attributes with a **WHERE** clause may fail. A binary length greater than 32767 is converted to a binary large object (BLOB), and is not included in the sum; a string greater than 8191 is converted to a character large object (CLOB), and is also not included). If an MBO attribute's length sum is greater than the page size, some attributes automatically convert to BLOB or CLOB, and therefore cannot be put into a **WHERE** clause. **Note:** This field is only enabled when an Unwired Server is selected.
Destination	Specify the destination of the generated device client files. Enter (or **Browse**) to either a **Project path** (Mobile Application project) location or **File system path** location. Select **Clean up destination before code generation** to clean up the destination folder before generating the device client files.

6. Select **Generate metadata classes** to generate metadata for the attributes and operations of each generated client object.

The **Including object manager classes** option is only available if you select **Generate metadata classes**.

7. Select **Including object manager classes** to generate both the metadata for the attributes and operations of each generated client object and an object manager for the generated metadata.

   The **Including object manager classes** option is enabled only for BlackBerry and C# if you select **Generate metadata classes**. The object manager allows you to retrieve the metadata of packages, MBOs, attributes, operations, and parameters during runtime using the name instead of the object instance.
8. Click **Finish**.
9. Examine the generated code location and contents.
10. Validate the generated code.

Generating Object API Code Using the Code Generation Utility

Use the Code Generation Utility to generate object API code containing mobile business object (MBO) references. This method of generating code allows you to automate the process of code generation, for example through the use of scripts.

Prerequisites

- Use Sybase Unwired WorkSpace to develop and package your mobile business objects. See *Sybase Unwired WorkSpace - Mobile Business Object Development* > *Develop* > *Developing a Mobile Business Object*.
- Deploy the package to the Unwired Server, creating files required for code generation from the command line. See *Sybase Unwired WorkSpace - Mobile Business Object Development* > *Develop* > *Packaging and Deploying Mobile Business Objects* > *Automated Deployment of Sybase Unwired WorkSpace Projects*.

Task

1. Locate `<domain name>_package.jar` in your mobile project folder. For the SUP101 example, the project is deployed to the default domain, and the deploy jar file is in the following location: `SUP101\Deployment\.pkg.profile \My_Unwired_server\default_package.jar`.
2. Make sure that the JAR file contains this file:
   - `deployment_unit.xml`
3. Use a utility to extract the `deployment_unit.xml` file to another location.
4. From *SUP_HOME*`\MobileSDK22\ObjectAPI\Utils\bin`, run the `codegen.bat` utility, specifying the following parameters:

```
codegen.bat -cs -client -ul deployment_unit.xml [-output
<output_dir>] [-doc]
```

- The `-output` parameter allows you to specify an output directory. If you omit this parameter, the output goes into the *SUP_HOME*`\MobileSDK22\ObjectAPI\Utils\genfiles` directory, assuming `codegen.bat` is run from the *SUP_HOME*`\MobileSDK22\ObjectAPI\Utils\genfiles` directory.
- The `-doc` parameter specifies that documentation is generated for the generated code.

Ignore these warnings:

```
log4j:WARN No appenders could be found for logger ...
log4j:WARN Please initialize the log4j system properly.
```

Generated Code Location and Contents

If you generated code in Sybase Unwired WorkSpace, generated object API code is stored by default in the "Destination" location you specified during code generation. If you generated code with the Code Generation Utility, generateed object API code is stored in the *SUP_HOME*`\MobileSDK22\ObjectAPI\Utils\genfiles` folder after you you generate code.

The contents of the folder is determined by the options you selected in the Generate Code wizard in Sybase Unwired WorkSpace, or specified in the Code Generation Utility. The contents include generated class (.cs) files that contain:

- MBO – class which handles persistence and operation replay of your MBOs.
- DatabaseClass – package level class that handles subscription, login, synchronization, and other operations for the package.
- Synchronization parameters – any synchronization parameters for the MBOs.
- Personalization parameters – personalization parameters used by the package.
- Metadata – Metadata class that allow you to query meta data including MBOs, their attributes, and operations, in a persistent table at runtime.

Validating Generated Code

Validation rules are enforced when generating client code. Define prefix names in the Mobile Business Object Preferences page of the Code Generation wizard to correct validation errors.

Sybase Unwired WorkSpace validates and enforces identifier rules and checks for keyword conflicts in generated code, for example, by displaying error messages in the Properties view or in the wizard. Other than the known name conversion rules (converting '.' to '_', removing white space from names, and so on), there is no other language-specific name conversion. For example, cust_id is not changed to custId.

You can specify the prefix string for mobile business object, attribute, parameter, or operation names from the Mobile Business Object Preferences page. This allows you to decide what prefix to use to correct any errors generated from the name validation.

1. Select **Window > Preferences**.
2. Expand **Sybase, Inc > Mobile Development**.

3. Select **Mobile Business Object**.
4. Add or modify the **Naming Prefix** settings as needed.

The defined prefixes are added to the names (object, attribute, operation, and parameter) whenever these are autogenerated, for example, when you drag and drop a data source onto the Mobile Application Diagram.

Creating a Project

Build a device application project.

Downloading the Latest Afaria Libraries

Afaria® provides provisioning of configuration data and certificates for your Sybase Unwired Platform client application. Afaria libraries are packaged with Sybase Unwired Platform, but may not be the latest software available. To ensure you have the latest Afaria libraries, download Afaria software.

1. Navigate to the Mobile Enterprise Technical Support website at *http://frontline.sybase.com/support/downloads.aspx*.
2. If not registered, register for an account.
3. Log into your account.
4. Select **Software Updates** and download the latest Static Link Libraries.
5. Extract the contents of the downloaded zip file.

Creating a Project in Visual Studio

Create a project for your Windows or Windows Mobile device application in Visual Studio.

1. From the Visual Studio main menu select **File** > **New** > **Project**.
2. Select:
   - Target platform:
     - Windows Mobile 6.0, 6.1, and 6.5 Professional
     - Windows
   - Library version – .NET version 3.5
   - Language – the language used in the resource DLLs, to be included in the generated project.

   Different sets of DLLs are included in the project based on your selections. The project contains all assemblies and runtime support DLLs required to access the Object API.
3. Click **OK** to generate the Visual Studio Project.
4. Build the Solution. From the Visual Studio main menu, select **Build** > **Build Solution**.

   The DLLs are copied to the target directory and the directory structure is flattened.

Once generated and built, you can write custom mobile applications based on your selections.

5. Develop the mobile business objects (MBOs) that implement the business logic.

   See these online help topics:

   - *Sybase Unwired WorkSpace - Mobile Business Object Development > Develop > Developing a Mobile Business Object*

6. Use the Code Generation wizard to generate the C# Object API code for the mobile business object.
7. Add the generated code to the new project you created from the template.

   For more information, see *Rebuilding the Generated Solution in Visual Studio*.

Rebuilding the Generated Solution in Visual Studio

After generating the C# Object API code for a Mobile Application project, you can modify the code in Visual Studio.

Prerequisites

Visual Studio must be installed.

Task

When you generate the Object API code for a Windows Mobile device using the Mobile Application project Code Generation wizard, the Visual Studio solution is saved to the folder you specified.

Note: If you generate 32-bit Windows code on a 64-bit machine, in the Visual Studio Configuration Manager for building and deploying the active solution, change the Active Solution Platform from "AnyCPU" to "x86" before deploying and running the application.

1. In Visual Studio, select **File > Open > Project/Solution**.
2. Browse to the solution file (`.sln`) you want to open and double-click the file.
3. In Solution Explorer, right-click the solution and select **Rebuild Solution**.
4. Select **File > Save**.
   You can now open the form for which you want to modify the code.

Generating Online Help for Visual Studio

You can generate online help for your mobile application project using the `.xml` file that is generated with the Object API code.

When you generate the C# Object API code for the mobile application project, an .xml file is generated for the mobile business objects. You can use the generated `.xml` file to build online help for the mobile application project in Visual Studio.

1. Use the Code Generation wizard to generate the C# Object API Code.
2. Build the generated solution in Visual Studio:
   a) In Visual Studio, select **File > Open > Project/Solution**.
   b) Browse to the solution file (`.sln`) you want to open and double-click the file.
   c) In Solution Explorer, right-click the solution and select **Rebuild Solution**.
   d) Select **File > Save**.
   The source `.xml` file for building online help is included with the generated project, which contains all assemblies and runtime support DLLs required to access the object API.
3. There are different tools available for building online help. This procedure uses the free tool called Sandcastle Help File Builder. You can download Sandcastle Help File Builder installer from *http://shfb.codeplex.com*.
4. Create a SandCastle Helpfile builder project (`.shfb`) in Sand Castle File Builder by specifying the assemblies and the generated `.xml` file as input.
5. Use the `.shfb` project file in the daily build script to build the document. For example:

```
<Target Name="Documentation">
  <Exec Command="$(SandCastleHelpBuilderPath)
Infrastructure.Core.shfb" />
</Target>
```

Integrating Help into a Project

When you generate MBOs or client applications for Windows Mobile from Sybase Unwired WorkSpace, an XML file is generated for the MBOs. The generated Visual Studio project for the forms can also generate a XML file. When you compile a project, an XML file is generated. You can use these XML files to generate online help.

To generate online help for Visual Studio 2008, you can use Sandcastle and Sandcastle Help File Builder. You can download and install Sandcastle and Sandcastle Help File Builder from these locations:

- *http://sandcastle.codeplex.com/Wikipage*
- *http://shfb.codeplex.com/releases*

To integrate help into your project build:

1. Add the /doc option in your project build, so that it can generate an XML file from the comments. You can also configure this option in the Visual Studio project properties. On the Build tab, select **XML documentation** and provide a file name.
2. Create a SandCastle Help File Builder project (`.shfb` file). Specify the assemblies and the XML file generated from the comments as input. You can also specify other help properties.
3. Use the `.shfb` project file in a script to build the document. For example:

```
<Target Name="Documentation">
   <Exec Command="$(SandCastleHelpBuilderPath) <shfb project
```

```
file>.shfb" />
</Target>
```

Client Application Dependencies

To build device clients, some files, which are provided in the Unwired Platform installation, are required in certain situations, such as when using a secure port for synchronization.

The client API assembly DLL dependencies are installed under the *SUP_HOME* `\MobileSDK22\ObjectAPI` directory. The contents of the directory are:

- **`WM and Win32`** – Binaries of the framework classes for .NET.
  - WM: files for use on Windows CE based systems such as Windows Mobile 6.
  - Win32: files for use on full Windows based systems like Windows XP.
- **`WM\Ultralite and Win32\Ultralite`** – .NET Data Persistence Library and client database (UltraLite®) assemblies. This is used for replication-based synchronization client applications on Windows Mobile or Windows.

The .NET assemblies listed above support Compact Framework 3.5+ on Visual Studio 2008. These project types are supported:

- Full .NET Framework 3.5+ Application
- Windows CE .NET CF 3.5+ Application
- Pocket PC .NET CF 3.5+ Application
- Smartphone .NET CF 3.5+ Application

If required, copy the following `.dll` files to the location used for referencing them in the Visual Studio application source project.

Platform	Location	Files	Notes
Windows Mobile Professional 6.0, 6.1, and 6.5	*SUP_HOME*`\MobileSDK22\ObjectAPI\WM`	• `sup-client.dll`	
	• *SUP_HOME* `\MobileSDK22\ObjectAPI\WM\PocketPC`, or • *SUP_HOME* `\MobileSDK22\ObjectAPI\WM\Smartphone`	`CMessagingClient.2.2.2.dll`	

Platform	Location	Files	Notes
	SUP_HOME\MobileSDK22\ObjectAPI\WM\Ultralite	• ulnet12.dll • ulnet-client12.dll • mlcrsa12.dll • mlczlib12.dll	The mlcrsa12.dll file is needed only if you are using a secure port (HTTPS) for synchronization.
	SUP_HOME\MobileSDK22\ObjectAPI\WM\Ultralite\<language>	iAnywhere.Data.UltraLite.resources.dll	Copy from the respective locale-specific folders.
Windows XP, Vista, Windows 7	*SUP_HOME*\MobileSDK22\ObjectAPI\Win32	• sup-client.dll • ECTrace.dll • CMessaging-Client.2.2.2.dll • Traveler-Lib.dll • zlib1.dll • libeay32.dll • ssleay32.dll	

Platform	Location	Files	Notes
	SUP_HOME\MobileSDK22\ObjectAPI\Win32\Ultralite	• iAnywhere.Data.UltraLite.dll • ulnet12.dll • mlcrsa12.dll • mlczlib12.dll	The mlcrsa12.dll file is required only if you are using a secure port (HTTPS) for synchronization.
	SUP_HOME\MobileSDK22\ObjectAPI\Win32\Ultralite\<language>	iAnywhere.Data.UltraLite.resources.dll	Copy from the respective locale-specific folders.

Adding References to a Mobile Application Project

This describes how to add the required libraries as references in the Visual Studio project.

You can use this method to add references to your client projects.

1. Add the following libraries for the appropriate device platform as references in the Visual Studio project:

   For Windows Mobile:
   - sup-client.dll – from *SUP_HOME*\MobileSDK22\ObjectAPI\WM.
   - iAnywhere.Data.UltraLite.dll – from *SUP_HOME*\MobileSDK22\ObjectAPI\WM\Ultralite.
   - iAnywhere.Data.UltraLite.resources.dll (several languages are supported) – from *SUP_HOME*\MobileSDK22\ObjectAPI\WM\Ultralite\<language>.

   For Windows:
   - sup-client.dll – from *SUP_HOME*\MobileSDK22\ObjectAPI\Win32.
   - iAnywhere.Data.UltraLite.dll – from *SUP_HOME*\MobileSDK22\ObjectAPI\Win32\Ultralite.
   - iAnywhere.Data.UltraLite.resources.dll (several languages are supported) – from *SUP_HOME*\MobileSDK22\ObjectAPI\Win32\Ultralite\<language>.

2. Add the following libraries for the appropriate device platform as items in the Visual Studio project. Set "Build Action" to "Content" and "Copy to Output Directory" to **Copy always**.

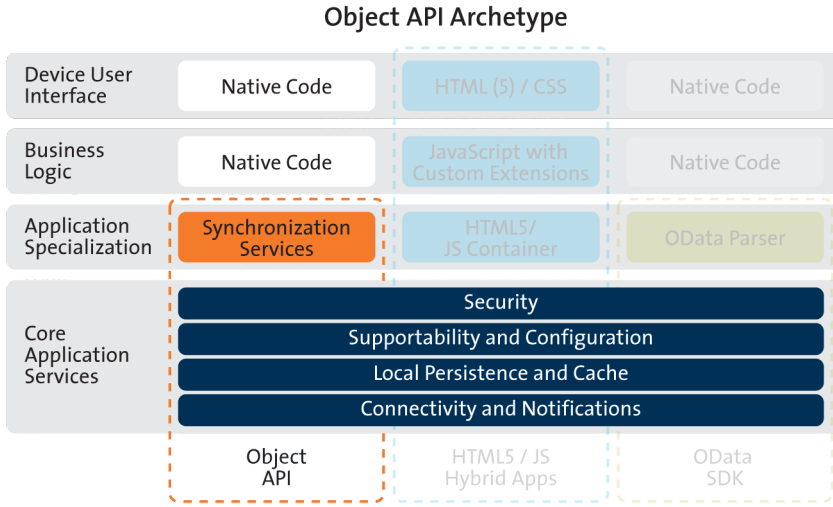
   For Windows Mobile:
   - `ulnet12.dll` – from *`SUP_HOME`*`\MobileSDK22\ObjectAPI\WM\Ultralite`.
   - `mlcrsa12.dll` (if HTTPS protocol is used) – from *`SUP_HOME`*`\MobileSDK22\ObjectAPI\WM\Ultralite`.
   - `mlczlib12.dll` (if HTTPS protocol is used) – from *`SUP_HOME`*`\MobileSDK22\ObjectAPI\WM\Ultralite`.
   - `CMessagingClient.2.2.2.dll` – from *`SUP_HOME`*`\MobileSDK22\ObjectAPI\WM\<DeviceType>`. <DeviceType> can be PocketPC or Smartphone as applicable.

   For Windows:
   - `ulnet12.dll` – from *`SUP_HOME`*`\MobileSDK22\ObjectAPI\Win32\Ultralite`.
   - `mlcrsa12.dll` (if HTTPS protocol is used) – from *`SUP_HOME`*`\MobileSDK\ObjectAPI\Win32\Ultralite`.
   - `mlczlib12.dll` (if using compression) - from *`SUP_HOME`*`\MobileSDK22\ObjectAPI\Win32\Ultralite`.
   - `CMessagingClient.2.2.2.dll` – from *`SUP_HOME`*`\MobileSDK22\ObjectAPI\Win32`.
   - `ECTrace.dll` – from *`SUP_HOME`*`\MobileSDK22\ObjectAPI\Win32`.
   - `TravelerLib.dll` – from *`SUP_HOME`*`\MobileSDK22\ObjectAPI\Win32`.
   - `zlib1.dll` – from *`SUP_HOME`*`\MobileSDK22\ObjectAPI\Win32`.
   - `libeay32.dll` – from *`SUP_HOME`*`\MobileSDK22\ObjectAPI\Win32`.
   - `ssleay32.dll` – from *`SUP_HOME`*`\MobileSDK22\ObjectAPI\Win32`.

Development Task Flow for DOE-based Object API Applications

Describes the overall development task flow for DOE-based native applications, and provides information and procedures for setting up the development environment, and developing DOE-based device applications.

This diagram illustrates how you can develop a device application directly from mobile business objects (MBOs), using the Object API and custom device application coding. This is how you create device applications with sophisticated UI interaction, validation, business logic, and performance.



The Object API provides the core application services described in the diagram.

The Authentication APIs provide security by authenticating the client to the Unwired Server.

The Synchronization APIs allow you to synchronize mobile business objects (MBOs) based on synchronization parameters, for individual MBOs, or as a group, based on the group's synchronization policy.

The Application and Connection APIs allow clients to register with and connect to the Unwired Server. The Callback Handler and Listener APIs, and the Target Change Notification APIs provide notifications to the client on operation success or failure, or changes in data.

With DOE-based applications, connectivity and notifications use the Messaging channel.

Installing the Windows Mobile Development Environment

Install and configure components required for Windows Mobile development.

Configuring Windows Mobile Device Center

Before using the Windows Mobile Device Emulator, you need to change the settings of Windows Mobile Device Center.

1. Open Windows Mobile Device Center.
2. Click **Mobile Device Settings**.
3. Click **Connection Settings**.
4. Click on the **Allow connections to one of the following** checkbox.
5. Select **DMA** in the combobox.
6. On the **This computer is connected to** combobox, select **The Internet** if you want to allow the Windows Mobile device to access the Internet using Pocket IE.
7. Start the Windows Mobile Device Emulator.

Enabling Network Access from the Windows Mobile Device Emulator

This task enables the emulator's connectivity.

You can start the Windows Mobile Device Emulator from Visual Studio or from the Device Emulator Manager.

1. To start the Emulator from Visual Studio 2008:
   a) Select **Tools > Device Emulator Manager**.
2. If a Device Emulator is not yet connected:
   a) Select a Device Emulator from the list and select **Connect**.
3. Right-click the current Emulator in Device Emulator Manager and select **Cradle**.

   ActiveSync starts. Once the connection is established, you should be able to access your PC and the Web from the Device Emulator.

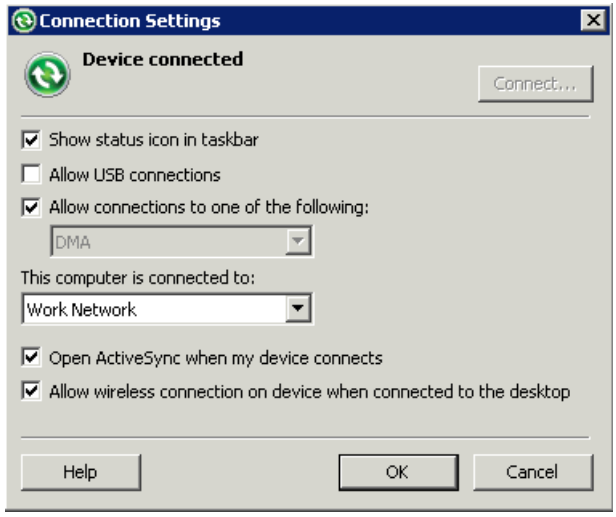
Installing Microsoft Synchronization Software

Install and configure Microsoft synchronization software so you can deploy and run a mobile application on a Windows Mobile emulator.

Note: Microsoft ActiveSync is for Windows XP. If you are using Windows Vista, Windows 7, or Windows 2008, install Virtual PC 2007 SP1 and Windows Mobile Device Center to manage synchronization settings. Download the Windows Mobile Device Center from *http://www.microsoft.com/windowsmobile/en-us/downloads/microsoft/device-center-download.mspx*.

1. Download Microsoft ActiveSync from *http://www.microsoft.com/windowsmobile/en-us/help/synchronize/device-synch.mspx*. Save it to your local machine. Windows XP requires ActiveSync version 4.5.
2. In Windows Explorer, double-click **setup.msi**.
3. When installation is complete, restart your machine.

   ActiveSync starts automatically, and its icon appears in the Windows toolbar.
4. Double-click the **ActiveSync** icon.
5. Select **File > Connection Settings**.
6. Select **Allow Connections to One of the Following**, then select **DMA**.
7. Under This Computer is Connected to, select **Work Network**.



8. Click **OK**.

Installing X.509 Certificates on Windows Mobile Devices and Emulators

Install the `.p12` certificate on the Windows Mobile device or emulator and select it during authentication. A certificate provides an additional level of secure access to an application, and may be required by an organization's security policy.

1. Launch the simulator or device.
2. Start the Windows synchronization software and cradle the device.
3. Use File Explorer to copy the `*.p12` certificate to the simulator or device.
4. Navigate to and double-click the certificate.
5. Enter the password at the prompt and click **Done**.

   An informational window indicates the certificate installed successfully.

Generating C# Object API Code

Use the Code Generation Utility to generate object API code, which allows you to use APIs to develop device applications for Windows or Windows Mobile devices.

Prerequisites

- Generate and download the ESDMA bundle for you application.
- Run the ESDMA Converter utility to turn your ESDMA into an Unwired Platform package.
- Deploy the package to the Unwired Server.

See *Create, Generate, and Download the ESDMA Bundle*, *Convert the ESDMA Bundle into an Unwired Platform Package*, and *Deploy the Unwired Platform Package* in *Mobile Data Models: Using Data Orchestration Engine*.

Task

1. Make sure that your *<ESDMA_dir>*\META-INF directory contains these three files:
   - afx-esdma.xml
   - ds-doe.xml
   - sup-db.xml
2. From *SUP_HOME*\MobileSDK22\ObjectAPI\Utils\bin, run the codegen.bat utility, specifying the following parameters:

   ```
   codegen -cs -client -doe -sqlite
   [-output <output_dir>] [-doc] <ESDMA_dir>\META-INF\sup-db.xml
   ```

   - The -output parameter allows you to specify an output directory. If you omit this parameter, the output goes into the *SUP_HOME*\MobileSDK22\ObjectAPI\Utils\genfiles directory, assuming codegen.bat is run from the *SUP_HOME*\MobileSDK22\ObjectAPI\Utils\bin directory.
   - The -doc parameter specifies that documentation is generated for the generated code.

   Ignore these warnings:

   ```
   log4j:WARN No appenders could be found for logger ...
   log4j:WARN Please initialize the log4j system properly.
   ```

Generated Code Location and Contents

The location of the generated Object API code is the location you specified when you generated the code using codegen.bat at the command line.

The contents of the folder is determined by the parameters you pass to codegen.bat in the command line, and include generated class (.cs) files that contain:

- DatabaseClass – package level class that handles subscription, login, synchronization, and other operations for the package.
- MBO – class which handles persistence and operation replay of your MBOs.
- Personalization parameters – personalization parameters used by the package.
- Metadata – Metadata class that allows you to query meta data including MBOs, their attributes, and operations, in a persistent table at runtime.

Creating a Project

Build a device application project.

Downloading the Latest Afaria Libraries

Afaria® provides provisioning of configuration data and certificates for your Sybase Unwired Platform client application. Afaria libraries are packaged with Sybase Unwired Platform, but may not be the latest software available. To ensure you have the latest Afaria libraries, download Afaria software.

1. Navigate to the Mobile Enterprise Technical Support website at *http://frontline.sybase.com/support/downloads.aspx*.
2. If not registered, register for an account.
3. Log into your account.
4. Select **Software Updates** and download the latest Static Link Libraries.
5. Extract the contents of the downloaded zip file.

Creating a Project in Visual Studio

Create a project for your Windows or Windows Mobile device application in Visual Studio.

1. From the Visual Studio main menu, select **File > New > Project**.
2. Select:
   - Target platform:
     - Windows Mobile 6.0, 6.1, and 6.5 Professional
     - Windows
   - Library version – .NET version 3.5
   - Language – the language used in the resource DLLs, to be included in the generated project.

   Different sets of DLLs are included in the project based on your selections. The project contains all assemblies and runtime support DLLs required to access the Object API.
3. Click **OK** to generate the Visual Studio Project.
4. Add all necessary dlls and assemblies:

a) Choose **Project > Add Reference** and add *SUP_HOME* `\MobileSDK22\ObjectAPI\DOE\WM\sup-client.dll` and *SUP_HOME* `\MobileSDK22\ObjectAPI\DOE\WM\System.Data.SQLite.dll`.
b) Choose **Project > Add Existing Item** and add *SUP_HOME* `\MobileSDK22\ObjectAPI\DOE\WM\SQLite.Interop.065.DLL` and *SUP_HOME*`\MobileSDK22\ObjectAPI\DOE\WM\PocketPC \CMessagingClient.2.2.2.dll`.
c) In the Solution window, open `SQLite.Interop.065.DLL` and change the property **Copy to Output Directory** to **Copy always**.
d) In the Solution window, open `CMessagingClient.2.2.2.dll` and change the property **Copy to Output Directory** to **Copy always**.

5. Build the Solution. From the Visual Studio main menu, select **Build > Build Solution**.

   The DLLs are copied to the target directory and the directory structure is flattened.

   Once generated and built, you can write custom mobile applications based on your selections.
6. Develop the mobile business objects (MBOs) that implement the business logic.

   See these online help topics:
   - *Sybase Unwired WorkSpace - Mobile Business Object Development> Develop > Developing a Mobile Business Object*
7. Use the Code Generation wizard to generate the C# Object API code for the mobile business object.
8. Add the generated code to the new project you created from the template.

   For more information, see *Rebuilding the Generated Solution in Visual Studio*.

Rebuilding the Generated Solution in Visual Studio

After generating the C# Object API code for a Mobile Application project, you can modify the code in Visual Studio.

Prerequisites

Visual Studio must be installed.

Task

When you generate the Object API code for a Windows Mobile device using the Mobile Application project Code Generation wizard, the Visual Studio solution is saved to the folder you specified.

Note: If you generate 32-bit Windows code on a 64-bit machine, in the Visual Studio Configuration Manager for building and deploying the active solution, change the Active Solution Platform from "AnyCPU" to "x86" before deploying and running the application.

1. In Visual Studio, select **File** > **Open** > **Project/Solution**.
2. Browse to the solution file (`.sln`) you want to open and double-click the file.
3. In Solution Explorer, right-click the solution and select **Rebuild Solution**.
4. Select **File** > **Save**.
   You can now open the form for which you want to modify the code.

Generating Online Help for Visual Studio

You can generate online help for your mobile application project using the `.xml` file that is generated with the Object API code.

When you generate the C# Object API code for the mobile application project, an .xml file is generated for the mobile business objects. You can use the generated `.xml` file to build online help for the mobile application project in Visual Studio.

1. Use the Code Generation wizard to generate the C# Object API Code.
2. Build the generated solution in Visual Studio:
   a) In Visual Studio, select **File** > **Open** > **Project/Solution**.
   b) Browse to the solution file (`.sln`) you want to open and double-click the file.
   c) In Solution Explorer, right-click the solution and select **Rebuild Solution**.
   d) Select **File** > **Save**.
      The source `.xml` file for building online help is included with the generated project, which contains all assemblies and runtime support DLLs required to access the object API.
3. There are different tools available for building online help. This procedure uses the free tool called Sandcastle Help File Builder. You can download Sandcastle Help File Builder installer from *http://shfb.codeplex.com*.
4. Create a SandCastle Helpfile builder project (`.shfb`) in Sand Castle File Builder by specifying the assemblies and the generated `.xml` file as input.
5. Use the `.shfb` project file in the daily build script to build the document. For example:

```
<Target Name="Documentation">
  <Exec Command="$(SandCastleHelpBuilderPath)
Infrastructure.Core.shfb" />
</Target>
```

Integrating Help into a Project

When you generate MBOs or client applications for Windows Mobile from Sybase Unwired WorkSpace, an XML file is generated for the MBOs. The generated Visual Studio project for the forms can also generate a XML file. When you compile a project, an XML file is generated. You can use these XML files to generate online help.

To generate online help for Visual Studio 2008, you can use Sandcastle and Sandcastle Help File Builder. You can download and install Sandcastle and Sandcastle Help File Builder from these locations:

- *http://sandcastle.codeplex.com/Wikipage*
- *http://shfb.codeplex.com/releases*

To integrate help into your project build:

1. Add the /doc option in your project build, so that it can generate an XML file from the comments. You can also configure this option in the Visual Studio project properties. On the Build tab, select **XML documentation** and provide a file name.
2. Create a SandCastle Help File Builder project (`.shfb` file). Specify the assemblies and the XML file generated from the comments as input. You can also specify other help properties.
3. Use the `.shfb` project file in a script to build the document. For example:

```
<Target Name="Documentation">
   <Exec Command="$(SandCastleHelpBuilderPath) <shfb project
file>.shfb" />
</Target>
```

Client Application Dependencies

To build device clients, some files, which are provided in the Sybase Unwired Platform installation, are required in certain situations, such as when using a secure port for synchronization.

The client API assembly DLL dependencies are installed under the *SUP_HOME* `\MobileSDK22\ObjecttAPI\DOE` directory. The contents of the directory are:

- **`WM and Win32`** – Binaries of the framework classes for .NET.
  - WM: files for use on Windows CE based systems such as Windows Mobile 6.
  - Win32: files for use on full Windows based systems like Windows XP.

The .NET assemblies listed above support Compact Framework 3.5+ on Visual Studio 2008. These project types are supported:

- Full .NET Framework 3.5+ Application
- Windows CE .NET CF 3.5+ Application
- Pocket PC .NET CF 3.5+ Application
- Smartphone .NET CF 3.5+ Application

If required, copy the following `.dll` files to the location used for referencing them in the Visual Studio application source project.

Platform	Location	Files	Notes
Windows Mobile Professional 6.0, 6.1, and 6.5	*SUP_HOME*\MobileSDK\ObjectAPI\DOE\WM	• sup-client.dll • SQLite.Interop.065.DLL (native DLL) • System.Data.SQLite.dll (assembly)	
	• *SUP_HOME*\MobileSDK22\ObjectAPI\DOE\WM\PocketPC, or • *SUP_HOME*\MobileSDK22\ObjectAPI\DOE\WM\Smartphone	CMessagingClient.2.2.2.dll	

Platform	Location	Files	Notes
Windows XP, Vista, Windows 7	*SUP_HOME*\MobileSDK22\ObjectAPI\DOE\Win32	• sup-client.dll • System.Data.SQLite.dll (assembly) • ECTrace.dll • CMessagingClient.2.2.2.dll • TravelerLib.dll • zlib1.dll • libeay32.dll • ssleay32.dll	

Adding References to a Mobile Application Project

This describes how to add the required libraries as references in the Visual Studio project.

You can use this method to add references to your client projects.

1. Add the following libraries for the appropriate device platform as references in the Visual Studio project. Set **Build Action** to **Content** and **Copy to Output Directory** to **Copy always**:

   For Windows Mobile:
   - `sup-client.dll` – from *SUP_HOME*`\MobileSDK22\ObjectAPI\WM`.
   - `CMessagingClient.2.2.2.dll` – from *SUP_HOME* `\MobileSDK22\ObjectAPI\DOE\WM\PocketPC` or *SUP_HOME* `\MobileSDK22\ObjectAPI\DOE\WM\Smartphone`.
   - `SQLite.Interop.065.dll` – from *SUP_HOME* `\MobileSDK22\ObjectAPI\DOE\WM\`.
   - `iAnywhere.Data.UltraLite.resources.dll` (several languages are supported) – from *SUP_HOME*`\MobileSDK22\ObjectAPI\DOE\WM \Ultralite\<language>`.

   For Windows:

- `sup-client.dll` – from *SUP_HOME*`\MobileSDK22\ObjectAPI\DOE\Win32`.
- `ECTrace.dll` – from *SUP_HOME*`\MobileSDK22\ObjectAPI\DOE\Win32`.
- `CMessagingClient.2.2.2.dll` – from *SUP_HOME*`\MobileSDK22\ObjectAPI\DOE\Win32`.
- `Traveler.dll` – from *SUP_HOME*`\MobileSDK22\ObjectAPI\DOE\Win32`.
- `zlib1.dll` – from *SUP_HOME*`\MobileSDK22\ObjectAPI\DOE\Win32`.
- `libeay32.dll` – from *SUP_HOME*`\MobileSDK22\ObjectAPI\Win32`.
- `ssleay32.dll` – from *SUP_HOME*`\MobileSDK22\ObjectAPI\Win32`.

2. Add the following libraries for the appropriate device platform as items in the Visual Studio project. Set "Build Action" to "Content" and "Copy to Output Directory" to **Copy always**.

   For Windows Mobile:
   - `ulnet12.dll` – from *SUP_HOME*`\MobileSDK22\ObjectAPI\DOE\WM\Ultralite`.
   - `ulnetclient12.dll` – from *SUP_HOME*`\MobileSDK22\ObjectAPI\DOE\WM\Ultralite`.
   - `mlcrsa12.dll` (if HTTPS protocol is used) – from *SUP_HOME*`\MobileSDK22\ObjectAPI\DOE\WM\Ultralite`.
   - `mlczlib12.dll` (if HTTPS protocol is used) – from *SUP_HOME*`\MobileSDK22\ObjectAPI\DOE\WM\Ultralite`.

   For Windows:
   - `ulnet12.dll` – from *SUP_HOME*`\MobileSDK22\ObjectAPI\DOE\Win32\Ultralite`.
   - `mlcrsa12.dll` (if HTTPS protocol is used) – from *SUP_HOME*`\MobileSDK22\ObjectAPI\DOE\Win32\Ultralite`.
   - `mlczlib12.dll` (if using compression) - from *SUP_HOME*`\MobileSDK22\ObjectAPI\DOE\Win32\Ultralite`.

Developing the Application Using the Object API

Use the Object API to develop the application. An application consists of building blocks which the developer uses to start the application, perform functions needed for the application, and shutdown and uninstall the application.

Initializing an Application

Initialize the application when it starts the first time and subsequently.

Initially Starting an Application

Starting an application the first time.

Setting Up Application Properties

The Application instance contains the information and authentication credentials needed to register and connect to the Unwired Server.

The following code illustrates how to set up the minimum required fields:

```
// Initialize Application settings
Application app = Application.GetInstance();

// The identifier has to match the application ID deployed to the SUP
server
app.ApplicationIdentifier = "SUP101";

// ConnectionProperties has the information needed to register
// and connect to SUP server
ConnectionProperties connProps = app.ConnectionProperties;
connProps.ServerName = "supserver.mycompany.com";
// if you are using relay server, then use the correct port number
for the relay server
// if connecting using http without a relay server, use the messaging
administration port, by default 5001.
// if connecting using https without a relay server, then use a new
port for https, for example 9001.
connProps.PortNumber = 5001;
// if connecting using https, set the network protocol
connProps.NetworkProtocol = "https";

// Set FarmId and UrlSuffix when connecting through the Relay
Server.

// Provide user credentials
LoginCredentials loginCred = new LoginCredentials("supAdmin",
```

```
"supPwd");
connProps.LoginCredentials = loginCred;

// Initialize generated package database class with this Application
instance
SUP101DB.SetApplication(app);
```

Registering an Application

Each device must register with the server before establishing a connection.

To register the device with the server during the initial application startup, use the `RegisterApplication` method in the `Sybase.Mobile.Application` class. You do not need to use the `RegisterApplication` method for subsequent application start-ups. The `RegisterApplication` method automatically starts the connection to complete the registration process.

Call the generated database's `SetApplication` method before starting the connection or registering the device.

The following code shows how to register the application and device.

```
// Initialize Application settings
Application app = Application.GetInstance();

// The identifier has to match the
// application ID deployed to the SUP server
app.ApplicationIdentifier = "SUP101";
IApplicationCallback appCallback = new MyApplicationCallback();
app.ApplicationCallback = appCallback;

// set connection properties, login credentials, etc
...

SUP101DB.SetApplication(app);

if (app.RegistrationStatus != RegistrationStatus.REGISTERED)
{
   // If the application has not been registered to the server,
   // register now
   app.RegisterApplication(<timeout_value>);
}
else
{
   // start the connection to server
   app.StartConnection(<timeout_value>);
}
```

Setting Up the Connection Profile

The Connection Profile stores information detailing where and how the local database is stored, including location and page size. The connection profile also contains UltraLite®J runtime tuning values.

Set up the connection profile before the first database access, and check if the database exists by calling the `DatabaseExists` method in the generated package database class. Any settings you establish after the connection has already been established will not go into effect.

The generated database class automatically contains all the default settings for the connection profile. You may add other settings if necessary. For example, you can set the database to be stored in an SD card or set the encryption key of the database.

Use the `Sybase.Persistence.ConnectionProfile` class to set up the locally generated database. Retrieve the connection profile object using the Sybase Unwired Platform database's `GetConnectionProfile` method.

```
// Initialize the device database connection profile (if needed)
ConnectionProfile connProfile = SUP101DB.GetConnectionProfile();

// encrypt the database
connProfile.SetEncryptionKey("your encryption key"); //Encryption
key can be of arbitary length, but generally the longer, the better.
// You can also automatically generate a encryption key and store it
inside a data vault.

// use 100K for cache size
connProfile.CacheSize = 102400;

// Store the database in a location other than the default location
connProfile.SetProperty("databaseFile", "SUP1011_0.udb");
```

An application can have multiple threads writing to the database during synchronization by enabling the connection profile property, `allowConcurrentWrite`. Setting the property to "true" allows multiple threads to perform create, read, update, or delete operations at the same time in a package database.

Note: Although multiple threads are allowed to write to the database at the same time, however, there will be errors when multiple threads write to the same MBO. Develop your application in such a way to avoid this situation.

Setting Up Connectivity

Store connection information to the Unwired Server data synchronization channel.

Setting Up the Synchronization Profile

You can set Unwired Server synchronization channel information by calling the synchronization profile's setter method. By default, this information includes the server host,

port, domain name, certificate and public key that are pushed by the message channel during the registration process.

Settings are automatically provisioned from the Unwired Server. The values of the settings are inherited from the application connection template used for the registration of the application connection (automatic or manual). You must make use of the connection and security settings that are automatically used by the Object API.

Typically, the application uses the settings as sent from the Unwired Server to connect to the Unwired Server for synchronization so that the administrator can set those at the application deployment time based on their deployment topology (for example, using relay server, using e2ee security, or a certificate used for the intermediary, such as a Relay Server Web server). See the *Applications* and *Application Connection Templates* topics in *System Administration*.

Set up a secured connection using the `ConnectionProfile` object.

1. Retrieve the synchronization profile object using the Sybase Unwired Platform database's `GetSynchronizationionProfile` method.

   ```
   ConnectionProfile cp = SUP101DB.GetSynchronizationProfile();
   ```

2. Set the connection fields in the `ConnectionProfile` object.

   ```
   cp.ServerName = "SUP_Host";
   cp.PortNumber = 2481;
   cp.StreamParams.Trusted_Certificates = "rsa_public_cert.crt";
   cp.NetworkProtocol = "https";
   ```

Creating and Deleting a Device's Local Database

There are methods in the generated package database class that allow programmers to delete or create a device's local database. A device local database is automatically created when needed by the Object API. The application can also create the database programatically by calling the `CreateDatabase` method. The device's local database should be deleted when uninstalling the application.

1. Connect to the generated database by calling the generated database instance's `OpenConnection` method.

   ```
   SUP101DB.OpenConnection();
   ```

   If the database does not already exist, the `OpenConnection` method creates it.

2. Optionally, you can include code in your application to check if an instance of the generated database exists by calling the generated database instance's `DatabaseExists` method.

   If an instance of the generated database does not exist, call the generated database instance's `CreateDatabase` method.

   ```
   if (!SUP101DB.DatabaseExists())
       {
   ```

```
        SUP101DB.CreateDatabase();
    }
```

3. When the local database is no longer needed, delete it by calling the generated database instance's `DeleteDatabase` method.

```
SUP101DB.DeleteDatabase();
```

Logging In

Use online authentication with the server.

Normally, the user is authenticated through the `RegisterApplication` and `StartConnection` methods in the `Application` class. Once this is done there is no need to authenticate again. However, the user can authenticate directly with the server at any time during the application's execution by calling the generated database instance's `OnlineLogin` method.

Use the `SynchronizationProfile` to store the username and password.

```
ConnectionProfile syncProfile =
SUP101DB.GetSynchronizationProfile();
syncProfile.UserName = "user";
syncProfile.Password = "password";
SUP101DB.OnlineLogin();
```

Check Network Connection Before Login

If a device does not establish a network connection, the login process does not return a result until after a long timeout occurs. To avoid this delay, check the network connection before performing a login.

Search for *Detect and Verify a Network Connection* on the .NET Framework Developer Center at *http://msdn.microsoft.com/en-us/netframework* for information on verifying connections to network resources required by an application.

Turn Off API Logger

In production environments, turn off the API logger to improve performance.

```
SUP101DB.GetLogger().SetLogLevel(LogLevel.OFF);
```

Setting Up Callbacks

When your application starts, it can register database and MBO callback listeners, as well as synchronization listeners.

Callback handler and listener interfaces are provided so your application can monitor changes and notifications from Sybase Unwired Platform:

- The `Sybase.Mobile.IApplicationCallback` class is used for monitoring changes to application settings, messaging connection status, and application registration status.
- The `Sybase.Persistence.ICallbackHandler` interface is used to monitor notifications and changes related to the database. To register callback handlers at the package level, use the `RegisterCallbackHandler` method in the generated

database class. To register for a particular MBO, use the `RegisterCallbackHandler` method in the generated MBO class.

- The `Sybase.Persistence.SyncStatusListener` class is used for debugging and performance measures when monitoring stages of a synchronization session, and can be used in the user interface to indicate synchronization progress.

Setting Up Callback Handlers

Use the callback handlers for event notifications.

Use the `Sybase.Persistence.ICallbackHandler` API for event notifications including login for synchronization and replay. If you do not register your own implementation of the `Sybase.Persistence.ICallbackHandler` interface, the generated code will register a new default callback handler.

1. The generated database class contains a method called `RegisterCallbackHandler`. Use this method to install your implementation of `ICallbackHandler`.
   For example:
   ```
   SUP101DB.RegisterCallbackHandler(new MyCallbackHandler());
   ```
2. Each generated MBO class also has the same method to register your implementation of the `ICallbackHandler` for that particular type. For example, if `Customer` is a generated MBO class, you can use the following code:
   ```
   Customer.RegisterCallbackHandler(new
   MyCustomerMBOCallbackHandler());
   ```

Asynchronous Operation Replay

Upload operation replay records asynchronously.

When an application calls `SubmitPending` on an MBO on which a create, update, or delete operation is performed, an operation replay record is created on the device local database.

When `Synchronize` is called, the operation replay records are uploaded to the server. The method returns without waiting for the backend to replay those records. The `Synchronize` method downloads all the latest data changes and the results of the previously uploaded operation replay records that the backend has finished replaying in the background. If you choose to disable asynchronous operation replay, each `Synchronize` call will wait for the backend to finish replaying all the current uploaded operation replay records.

When Sybase Unwired Platform does an `update` operation replay, if the primary key or foreign key of the MBO is generated by the EIS and the MBO has no primary key or foreign key, the Unwired Server loads the primary key or foreign key from the CDB to merge the incoming values with the CDB content so that a full row (graph) can be communicated to the EIS.

```
oneMBO mbo = new oneMBO();
mbo.SetXX(xx);
....
mbo.Create();
```

```
mbo.SubmitPending();
mbo.SetXX(yy);
....
mbo.Update();
mbo.SubmitPending();
DBClass.Synchronize()
```

This feature is enabled by default. You can enable or disable the feature by setting the `asyncReplay` property in the synchronization profile. The following code shows how to disable asynchronous replay:

```
SUP101DB.GetSynchronizationProfile().AsyncReplay = false;
```

When the application is connected (by `Application.StartConnection()` or `Application.RegisterApplication`), it may receive background notifications and trigger a synchronize or other database operation. If you try to delete the database, you may receive database exceptions.

Before deleting the database, stop the application connection (`Application.StopConnection()`).

You can specify an upload-only synchronization where the client sends its changes to the server, but does not download other changes from the server. This type of synchronization conserves device resources when receiving changes from the server.

```
public static void
BeginSynchronize(Sybase.Collections.GenericList<Sybase.Persistence.
ISynchronizationGroup> sgs,object context, bool uploadOnly)
```

When asynchronous replay is enabled and the replay is finished, the OnSynchronize callback method is invoked with a SynchronizationStatus value of `SynchronizationStatus.ASYNC_REPLAY_COMPLETED`. Use this callback method to invoke a synchronize call to pull in the results, as shown in the following callback handler.

```
public virtual SynchronizationAction OnSynchronize(
  Sybase.Collections.GenericList<ISynchronizationGroup> groups,
  SynchronizationContext context)
{
  switch(context.Status)
  {
    case SynchronizationStatus.ASYNC_REPLAY_UPLOADED:
      LogMessage("AsyncReplay uploaded");
      break;
    case SynchronizationStatus.ASYNC_REPLAY_COMPLETED:
      // operation replay finished
      if (busy)
      {
        // if busy, don't do synchronize now
        return SynchronizationAction.CANCEL;
      }
      break;
    default:
      break;
```

```
  }
            return SynchronizationAction.CONTINUE;
}
```

Synchronize Status Listener

Retrieve the synchronization status.

Synchronize Status Listener is mainly for debugging and performance measuring purposes to monitor stages of a synchronize session. It could also be used in UI for synchronization progress status. Below is a sample Synchronize Status Listener.

```
public class MySyncStatusListener : SyncStatusListener
  {
    long start;

    public MySyncStatusListener()
    {
      start = DateTime.Now.Ticks;
    }

    public virtual bool ObjectSyncStatus(ObjectSyncStatusData
statusData)
    {

      long now = DateTime.Now.Ticks;
      long interval = now - start;
      start = now;
      String infoMessage;

      SyncStatusState syncState = statusData.State;

      switch (syncState) {
        case SyncStatusState.SyncStarting:
          infoMessage = "START [" + interval + "]";
          break;
        case SyncStatusState.ApplicationDataUploading:
          infoMessage = "DATA UPLOADING [" + interval + "] " +
            statusData.CurrentMBO + ": (S>" +
            statusData.SentBytes + " R<" +
            statusData.ReceivedBytes + ")";
          break;
        case
SyncStatusState.ApplicationDataUploadingAcknowledgementReceived:
          infoMessage = "RECEIVING UPLOAD ACK [" + interval + "]";
          break;
        case SyncStatusState.ApplicationDataUploadingDone:
          infoMessage = "UPLOAD DONE [" + interval + "] " +
            statusData.CurrentMBO + ": (S>" +
            statusData.SentBytes + " R<" +
            statusData.ReceivedBytes + ")";
          break;
        case SyncStatusState.ApplicationDataDownloading:
          infoMessage = "DATA DOWNLOADING[" + interval + "] " +
            statusData.CurrentMBO + ": (S>" +
            statusData.SentBytes + " R<" +
```

```
            statusData.ReceivedBytes + ")";
          break;
        case SyncStatusState.ApplicationSyncDisconnecting:
          infoMessage = "DISCONNECTING [" + interval + "]";
          break;
        case SyncStatusState.ApplicationSyncCanceled:
          infoMessage = "SYNC CANCELED [" + interval + "]";
          break;
        case SyncStatusState.ApplicationDataDownloadingDone:
          infoMessage = "DATA DOWNLOADING DONE [" + interval + "]";
          break;
        case SyncStatusState.ApplicationSyncDone:
          infoMessage = "DONE [" + interval + "]";
          break;
        default:
          infoMessage = "STATE" + syncState + "[" + interval + "]";
          break;
    }
    LogMessage(infoMessage);
    return false;
  }
}
```

Connecting to the Device Database

Establish a connection to the database on the device.

After completing the device registration, call the generated database's `OpenConnection` method to connect to the UltraLite/UltraLiteJ database on the device. If no device database exists, the `OpenConnection` method creates one.

Synchronizing Applications

Synchronize package data between the device and the server.

The generated database provides you with synchronization methods that apply to either all synchronization groups in the package or a specified list of groups.

For information on synchronizing DOE-based applications, see *Message-Based Synchronization APIs*.

Configuring Data Synchronization Using SSL Encryption

Enable SSL encryption by configuring the synchronization HTTPS port.

1. In the left navigation pane of Sybase Control Center for Unwired Platform, expand the **Servers** node and click the server name.
2. Click **Server Configuration**.
3. In the right administration pane, click the **Replication** tab.
4. Select **Secure synchronization port** 2481 as the protocol used for synchronization, and configure the certificate properties. In the optional properties section, specify the security certificate file, the public security certificate file using the fully qualified path to the file, along with the password you entered during certificate creation.

Nonblocking Synchronization

An example that illustrates the basic code requirements for connecting to Unwired Server, updating mobile business object (MBO) data, and synchronizing the device application from a device application based on the Client Object API.

Subscribe to the package using synchronization APIs in the generated database class, specify the groups to be synchronized, and invoke the asynchronous synchronization method (`BeginSynchronize`).

1. Set the synchronization parameters if there are any.
2. Make a blocking synchronize call to Unwired Server to pull in all MBO data:

   ```
   SUP101DB.Synchronize();
   ```

3. List all customer MBO instances from the local database using an object query, such as `FindAll`, which is a predefined object query.

   ```
   GenericList<Customer> customers = Customer.FindAll();
   foreach (Customer customer in customers)
   {
     Console.WriteLine("customer: " + customer.Fname + " " +
   customer.Lname
       + " " + customer.Id  + customer.City);
   }
   ```

4. Find and update a particular MBO instance, and save it to the local database.

   ```
   Customer cust = Customer.FindByPrimaryKey(100);
   cust.Address = "1 Sybase Dr.";
   cust.Phone = "9252360000";
   cust.Save();//or cust.Update();
   ```

5. Submit the pending changes. The changes are ready for upload, but have not yet been uploaded to the Unwired Server.

   ```
   cust.SubmitPending();
   ```

6. Use non-blocking synchronize call to upload the pending changes to the Unwired Server. The previous replay results and new changes are downloaded to the client device in the download phase of the synchronization session.

   ```
   ISynchronizationGroup sg = SUP101DB.GetSynchronizationGroup("my-
   sychronization-group");
   GenericList<ISynchronizationGroup> syncGroups = new
   GenericList<ISynchronizationGroup>();
   syncGroups.Add(sg);
   SUP101DB.BeginSynchronize(syncGroups, "my-context");
   ```

Enabling Change Notifications

A synchronization group can enable or disable its change notifications.

By default, change notifications are disabled for synchronization groups. To enable change notifications, you must synchronize, then call the `SynchronizationGroup` object's `SetEnableSIS` method.

```
Sybase.Persistence.ISynchronizationGroup sg =
SUP101DB.GetSynchronizationGroup("PushEnabled");

if (!sg.EnableSIS)
{
  sg.EnableSIS = true;
  sg.Interval = 2; // 2 minutes
  sg.Save();
  SUP101DB.Synchronize("PushEnabled");
}
```

Specifying Personalization Parameters

Use personalization parameters to provide default values used with synchronization, connections with back-end systems, MBO attributes, or EIS arguments. The `PersonalizationParameters` class is within the generated code for your project.

1. To instantiate a `PersonalizationParameters` object, call the generated database instance's `GetPersonalizationParameters` method:

   ```
   PersonalizationParameters pp =
   SUP101DB.GetPersonalizationParameters();
   ```

2. Assign values to the `PersonalizationParameters` object:

   ```
   pp.PKCity = "New York";
   ```

3. Save the `PersonalizationParameters` value to the local database:

   ```
   pp.Save();
   ```

   Note: If you define a default value for a personalization key that value will not take effect, unless you call `pp.Save()`.

4. Synchronize the `PersonalizationParameters` value to the Unwired Server:

   ```
   SUP101DB.Synchronize();
   ```

Specifying Synchronization Parameters

Use synchronization parameters within the mobile application to download filtered MBO data.

Note: The `getSynchronizationParameters` method has been deprecated.

Assign the synchronization parameters of an MBO before a synchronization session. The next synchronize sends the updated synchronization parameters to the server.

Note: If you do not save the synchronization parameters, no data is downloaded to the device even if there are default values set for those synchronization parameters. Call the `Save` method for all synchronization parameters and for all MBOs when the application is first started. Do this after application registration and the first synchronization.

1. List all the synchronization parameters.

```
Sybase.Collections.GenericList<CustomerSubscription> r =
Customer.GetSubscriptions();
```

2. Add synchronization parameters.

```
CustomerSubscription sp = new CustomerSubscription();
sp.Name = "example";
Customer.AddSubscription(sp);
```

3. Save your changes by calling the synchronization parameters object's `Save` method:

```
sp.Save();
SUP101DB.Synchronize();
```

Subsequently Starting an Application

Subsequent start-ups are different from the first start-up.

Starting an application on subsequent occasions:

1. Use the `RegistrationStatus` API in the `Application` class to determine if the application has already been registered. if it has been registered, then only perform the following steps:
   a. Get the application instance.
   b. Set the `applicationIdentifier`. The `applicationIdentifier` must be the same as the one used for initial registration.
   c. Initialize the generated package database class with this application instance.

   Note: Once the application is registered, changes to any of the application connection properties do not take effect. To modify the connection properties, unregister the application, change the connection properties and then register again. Unregistering the application also removes the user from the server.
2. Set up the connection profile properties if needed for database location and tuning parameters.
3. Set up the synchronization profile properties if needed for SSL or a relay server.
4. Start the application connection to the server using the existing connection parameters and registration information.
5. Open the database connection.

You can open the database connection in parallel with starting the application connection to the server.

```
// Calls non-blocking StartConnection
// This call will return immediately.
application.StartConnection();

// Open the device database connection while establishing
// the messaging channel connection in the background
SUP101DB.OpenConnection();

// Once the device database connection has been opened, check
// whether the messaging channel is connected using the
// ApplicationCallback interface or the
Application.GetConnectionStatus() API
```

Accessing MBO Data

Use MBO object queries to retrieve lists of MBO instances, or use dynamic queries that return results sets or object lists.

Object Queries

Use the generated static methods in the MBO classes to retrieve MBO instances.

1. To find all instances of an MBO, invoke the static `findAll` method contained in that MBO. For example, an MBO named `Customer` contains a method such as `public static Sybase.Collections.GenericList<MBO> FindAll()`.
2. To find a particular instance of an MBO using the primary key, invoke `MBO.FindByPrimaryKey(...)`. For example, if a Customer has the primary key "id" as int, the Customer MBO would contain the `public static Customer FindByPrimaryKey(int id)` method, which performs the equivalent of `Select x.* from Customer x where x.id = :id`.

If the return type is a list, additional methods are generated for you to further process the result, for example, to use paging. For example, consider this method, which returns a list of MBOs containing the specified city name:
`Sybase.Collections.GenericList<SUP101.Customer> FindByCity(string city, int skip, int take);`. The `skip` parameter specifies the number of rows to skip, and the `take` parameter specifies the maximum number of rows to return.

Dynamic Queries

Build queries based on user input.

Use the `Sybase.Persistence.Query` class to retrieve a list of MBOs.

1. Specify the **where** condition used in the dynamic query.

```
Query query = new Query();

AttributeTest aTest = new AttributeTest();

aTest.Attribute = "state";
aTest.Value = "NY";
aTest.Operator  = AttributeTest.EQUAL;
query.TestCriteria = aTest;

SortCriteria sort = new SortCriteria();
sort.Add("lname", SortOrder.ASCENDING);
```

```
sort.Add("fname", SortOrder.ASCENDING);
query.SetSortCriteria(sort);
```

2. Use the `FindWithQuery` method in the MBO to dynamically retrieve a list of MBOs acccording to the specified attributes.

```
GenericList<MyMBO> mbos = MyMBO.FindWithQuery(query);
```

3. Use the generated database's `executeQuery` method to query multiple MBOs through the use of joins.

```
Query query = new Query();
query.Select("c.fname,c.lname,s.order_date,s.id");
query.From("Customer", "c");
query.Join("Sales_order", "s", "s.cust_id", "c.id");

AttributeTest ts = new AttributeTest();
ts.Attribute = "lname";
ts.Value = "Smith";
ts.Operator = AttributeTest.EQUAL;

query.TestCriteria = ts;

QueryResultSet qrs = SUP101DB.ExecuteQuery(query);

while (qrs.Next())
{
  string fname = qrs.GetString(1);
  string lname = qrs.GetString(2);
  int orderId = qrs.GetInt(4);
   // ...
}
```

MBOs with Complex Types

Mobile business objects are mapped to classes containing data and methods that support synchronization and data manipulation. You can develop complex types that support interactions with backend data sources such as SAP® and Web services. When you define an MBO with complex types, Sybase Unwired Platform generates one class for each complex type.

Using a complex type to create an MBO instance.

1. Suppose you have an MBO named `SimpleCaseList` and want to use a complex data type called `AuthenticationInfo` to its `Create` method's parameter. Begin by creating the complex datatype:

```
AuthenticationInfo authen = new AuthenticationInfo(); // Complex
structure
authen.UserName = "Demo";
```

2. Instantiate the MBO object:

```
SimpleCaseList newCase = new SimpleCaseList();
newCase.Case_Type = "Incident";
newCase.Category = "Networking";
newCase.Create_Time = System.DateTime.Now;
```

3. Call the `create` method of the SimpleCaseList MBO with the complex type parameter as well as other parameters, and call `submitPending()` to submit the `create` operation to the operation replay record. Subsequent synchronizations upload the operation replay record to the Unwired Server and get replayed.

```
newCase.Create (authen, "Other", "Other", "false", "work log");
newCase.SubmitPending();
```

Relationships

The Object API supports one-to-one, one-to-many, and many-to-one relationships.

Navigate between MBOs using relationships.

1. Suppose you have one MBO named `Customer` and another MBO named `SalesOrder`. This code illustrates how to navigate from the `Customer` object to its child `SalesOrder` objects:

```
Customer customer = Customer.FindById (101);
Sybase.Collections.GenericList<SalesOrder> orders =
customer.Orders;
```

2. To filter the returned child MBO's list data, use the `Query` class:

```
Query props = new Query();
// set query parameters
Sybase.Collections.GenericList<SalesOrder> orders =
customer.GetOrdersFilterBy(props);
```

3. For composite relationship, you can call the parent's `SubmitPending` method to submit the entire object tree of the parent and its children. Submitting the child MBO also submits the parent and the entire object tree. (If you have only one child instance, it would not make any difference. To be efficient and get one transaction for all child operations, it is recommened to submit the parent MBO once, instead of submitting every child).

   If the primary key for a parent is assigned by the EIS, you can use a multilevel insert cascade operation to create the parent and child objects in a single operation without synchronizing multiple times. The returned primary key for the parent's `create` operation populates the children prior to their own creation.

   The following example illustrates how to submit the parent MBO which also submits the child's operation:

```
Customer cust = Customer.FindById(101);
Sales_order order = new Sales_order();
order.Id = 1001;
order.Customer = cust;
order.Order_date = Date.ValueOf("1996-03-14");
order.Fin_code_id = "r1";
order.Region = "Eastern";
order.Sales_rep = 101;
order.Save(); // or order.create();
cust.Save();
cust.SubmitPending();
```

Manipulating Data

Create, update, and delete instances of generated MBO classes.

You can create a new instance of a generated MBO class, fill in the attributes, and call the `Create` method for that MBO instance.

You can modify an object loaded from the database by calling the `Update` method for that MBO instance.

You can load an MBO from the database and call the `Delete` method for that instance.

Creating, Updating, and Deleting MBO Records

Perform create, update, and delete operations on the MBO instances that you have created.

You can call the `Create`, `Update`, and `Delete` methods for MBO instances.

Note: For MBOs with custom create or update operations with parameters, you should use the custom operations, rather than the default and operations. See *MBOs with Complex Types*.

1. Suppose you have an MBO named `Customer`. To create an instance within the database, invoke its `Create` method, which causes the object to enter a pending state. Then call the MBO instance's `SubmitPending` method. Finally, synchronize with the generated database:

   ```
   Customer newcustomer = new Customer();
   //Set the required fields for the customer
   // …

   newcustomer.Create();
   newcustomer.SubmitPending();
   SUP101DB.Synchronize();
   ```

2. To update an existing MBO instance, retrieve the object instance through a query, update its attributes, and invoke its `Update` method, which causes the object to enter a pending state. Then call the MBO instance's `SubmitPending` method. Finally, synchronize with the generated database:

   ```
   Customer customer = Customer.FindByPrimary(myCustomerId) //find
   by primary key
   customer.City = "Dublin"; //update any field to a new value
   customer.Update();
   customer.SubmitPending();
   SUP101DB.Synchronize();
   ```

3. To delete an existing MBO instance, retrieve the object instance through a query and invoke its `Delete` method, which causes the object to enter a pending state. Then call the MBO instance's `SubmitPending` method. Finally, synchronize with the generated database:

```
Customer newcustomer = new Customer();
Customer customer = Customer.FindByPrimary(myCustomerId) //find
by primary key
customer.Delete();
customer.SubmitPending();
SUP101DB.Synchronize();
```

Other Operations

Use operations other than create, update, or delete.

In this example, a customized operator is used to perform a sum operation.

1. Suppose you have an MBO that has an operator that generates a customized sum. Begin by creating an object instance and assigning values to its attributes, specifying the `"Add"` operation:

   ```
   SUP101AddOperation op = new SUP101AddOperation(); //MBOName +
   OperationName + "Operation"

   op.Operand1 = 12;
   op.Operand2 = 23;
   op.Operator = "Add";
   op.Save();
   ```

2. Call the MBO instance's `SubmitPending` method and synchronize with the generated database:

   ```
   op.SubmitPending();
   SUP101DB.Synchronize();
   ```

Using SubmitPending and SubmitPendingOperations

You can submit a single pending MBO, all pending MBOs of a single type, or all pending MBOs in a package. Once those pending changes are submitted, the MBOs enter a replay pending state. The next synchronization will submit those changes to the EIS.

Note that **SubmitPendingOperations** APIs are expensive. Sybase recommends using the **SubmitPending** API with the MBO instance whenever possible.

Database Classes

Submit pending operations for all entities in the package or synchronization group, cancel all pending operations that have not been submitted to the server, and check if there are pending oprations for all entities in the package.

1. To submit pending operations for all pending entities in the package, invoke the generated database's `SubmitPendingOperations` method.

   Note that **SubmitPendingOperations** APIs are expensive. Sybase recommends using the **SubmitPending** API with the MBO instance whenever possible.

2. To submit pending operations for all pending entities in the specified synchronization group, invoke the generated database's `SubmitPendingOperations (string synchronizationGroup)` method.
3. To cancel all pending operations that have not been submitted to the server, invoke the generated database's `CancelPendingOperations` method.

Generated MBOs

Submit pending operations for all entities for a given MBO type or a single instance, and cancel all pending operations that have not been submitted to the server for the MBO type or a single entity.

1. To submit pending operations for all pending entities for a given MBO type, invoke the MBO class' static `SubmitPendingOperations` method.

   Note that **SubmitPendingOperations** APIs are expensive. Sybase recommends using the **SubmitPending** API with the MBO instance whenever possible.
2. To submit pending operations for a single MBO instance, invoke the MBO object's `SubmitPending` method.
3. To cancel all pending operations that have not been submitted to the server for the MBO type, invoke the MBO class' static `CancelPendingOperations` method.
4. To cancel all pending operations for a single MBO instance, invoke the MBO object's `CancelPending` method.
5. For a single MBO, you must call the `refresh()` method of the MBO instance before you use this instance again.

   ```
   customer.Create();
   customer.submitPending();
   // must call Refresh() here
   customer.Refresh();
   customer.Update();
   customer.SubmitPending();
   ```
6. For related MBOs, you must call the `refresh()` method of the MBO instance before you use this instance again, even if the MBO's child or parent has called `SubmitPending`.

Shutting Down the Application

Shut down an application and clean up connections.

Closing Connections

Clean up connections from the generated database instance prior to application shutdown.

1. To release an opened application connection, stop the messaging channel by invoking the application instance's `StopConnection` method.

   ```
   app.StopConnection(<timeout_value>);
   ```

2. Use the `CloseConnection` method to close all database connections for this package and release all resources allocated for those connections. This is recommended to be part of the application shutdown process.

Uninstalling the Application

Uninstall the application and clean up all package- and MBO-level data.

Deleting the Database and Unregistering the Application

Delete the package database, and unregister the application.

1. Unregister the application by invoking the `Application` instance's `UnregisterApplication` method.

   ```
   app.UnregisterApplication(<time out value>);
   ```

2. To delete the package database, call the generated database's `DeleteDatabase` method.

   ```
   SUP101DB.DeleteDatabase();
   ```

Testing Applications

Test native applications on a device or simulator.

Testing an Application Using a Simulator

Run and test the application on a simulator and verify that the application automatically registers to the Unwired Server using the default application connection template.

1. In Visual Studio, choose **Tools > Device Emulator Manager**.
2. Scroll down to the entry for **Windows Mobile 6 Professional**, right-click that entry and select **Connect**.
3. Right-click the entry for **Windows Mobile 6 Professional** again and select **Cradle**.
4. In the Solution Explorer of Visual Studio, right-click the C# project and select **Deploy**.
5. In the Windows Mobile emulator go to **Start > Programs > File Explorer**.
6. Navigate to the installed path by going in **Program Files** > > <***Application***>.
7. Start the application.
8. In Sybase Control Center, verify that the application connection was created in **Applications** > **Application Connections**.
   When the application has successfully registered, the application connection displays a value of zero in the Pending Items column.
9. Test the functionality of the application. Use debug tools as necessary, setting breakpoints at appropriate places in the application.

Client-Side Debugging

Identify and resolve client-side issues while debugging the application.

Problems on the device client side that may cause client application problems:

- Unwired Server connection failed - use your device browser to check the connectivity of your device to the server.
- Data does not appear on the client device - check if your synchronization and personalization parameters are set correctly. If you are using queries, check if your query conditions are correctly constructed and if the device data match your query conditions.
- Physical device problems, such as low memory - implement `ApplicationCallback.onDeviceConditionChanged` to be notified if device storage gets too low, or recovers from an error.

To find out more information on the device client side:

- If you have implemented debugging in your generated or custom code (which Sybase recommends), turn on debugging and review the debugging information. See the API Reference information about using the `Logger` class to add logs to the client log record and synchronize them to the server (viewable in Sybase Control Center).
- Check the log record on the device. Use the `DatabaseClass.GetLogRecords (Sybase.Persistence.Query)` or `Entity.GetLogRecords` methods.

  This is the log format

  ```
  level,code,eisCode,message,component,entityKey,operation,requestId,timestamp
  ```

  This log format generates output similar to:

  ```
  level code eisCode message component entityKey operation requestId timestamp
   5,500,'','java.lang.SecurityException:Authorization failed: Domain = default Package = end2end.rdb:1.0 mboName = simpleCustomer action = delete','simpleCustomer','100001','delete','100014','2010-05-11 14:45:59.710'
  ```

  - `level` – the log level currently set. Values include: 1 = TRACE, 2 = DEBUG, 3 = INFO, 4 = WARN, 5 = ERROR, 6 = FATAL, 7 = OFF.
  - `code` – Unwired Server administration codes.
    - Synchronization codes:
      - 200 – success.
      - 500 – failure.
  - `eisCode` – maps to HTTP error codes. If no mapping exists, defaults to error code 500 (an unexpected server failure).
  - `message` – the message content.
  - `component` – MBO name.
  - `entityKey` – MBO surrogate key, used to identify and track MBO instances and data.
  - `operation` – operation name.
  - `requestId` – operation replay request ID or messaging-based synchronization message request ID.
  - `timestamp` – message logged time, or operation execution time.
- If you have implemented `ApplicationCallback.OnConnectionStatusChanged` for synchronization in the `CallbackHandler`, the connection status between the Unwired Server and the device is reported on the device. See the `CallbackHandler` API reference information. The device connection status, device connection type, and connection error message are reported on the device:
  - 1 – current device connection status.

  - 2 – current device connection type.
  - 3 – connection error message.
- For other issues, you can turn on SQLTrace trace on the device side to trace Client Object API activity. To enable SQLTrace using the ConnectionProfile's enableTrace API:

```
/// To enable SQL trace with values also displayed
SUP101DB.GetConnectionProfile().EnableTrace(true, true);
```

Server-Side Debugging

Identify and resolve server-side issues while debugging the application.

Problems on the Unwired Server side may cause device client problems:

- The domain or package does not exist. If you create a new domain, with a default status of disabled, it is unavailable until enabled.
- Authentication failed for the application user credentials.
- The operation role check failed for the synchronizing user.
- Back-end authentication failed.
- An operation failed on the remote, replication database back end, for example, a table or foreign key does not exist.
- An operation failed on the Web Service, REST, or SAP® back end.

To find out more information on the Unwired Server side:

- Check the Unwired Server log files.
- For message-based synchronization mode, you can set the log level to DEBUG to obtain detailed information in the log files:
  1. Set the log level using Sybase Control Center. See *Sybase Control Center for Sybase Unwired Platform* > *Administer* > *Unwired Server* > *Server Log* > *Unwired Server Runtime Logging* > *Configuring Unwired Server Log Settings*.

  Note: Return to INFO mode as soon as possible, since DEBUG mode can affect system performance.
- Obtain DEBUG information for a specific device:
  - In the SCC administration console:
    1. Set the DEBUG level to a higher value for a specified device:
       a. In SCC, select **Application Connections**, then select **Properties... > Device Advanced**.
       b. Set the Debug Trace Level value.
    2. Set the TRACE file size to be greater than 50KB.
    3. View the trace file through SCC.

- Check the *SUP_HOME*\Servers\UnwiredServer\logs\ClientTrace directory to see the mobile device client log files for information about a specific device.

Note: Return to INFO mode as soon as possible, since DEBUG mode can affect system performance.

Localizing Applications

Localize a Windows Mobile application by generating resource files, adding a resource file template and strings, and localizing the application code.

Generating Resource Files

Generate resource files for localizing controls and captions for each locale.

1. In Visual Studio, select the Form you want to localize, and open it in View Designer.
2. In the Properties window, set the form's Localizable property to true.
3. Set the form's Language property to the language of the locale. For example, Chinese (Simplified).
4. Set the text for the form and the Text property for all buttons to the appropriate text for the locale.

   Note: You can resize a button to accommodate a longer string, if necessary. The button size is persisted in the resource file.
5. Repeat steps 3 and 4 to add more languages, as required.
6. Save and build the solution.
7. Expand `Customers.cs`.

   The resource files appear under Customers.cs. `Customers.resx` is the resource file for the default culture, which is built into the main assembly. Resource files for other locales include a language code, and, optionally, a country code. Language and country codes are specified in ISO-639 and ISO-3166, respectively.

   For example, `Customers.ch-CHS.resx` is the resource file for Chinese as spoken in Chinese (Simplified).

Adding a Resource File Template and String Variables

Add a resource file template to the project and then edit the template with the XML Designer to define localizable strings that appear in dialog boxes and error messages.

1. In the Project menu, select **Add New Item**.
2. In the Templates box, select the Resources File template. Enter the file name "SampleApp.resx" in the Name box.

   The resources file template contains resources that are accessed when the application cannot find resources appropriate to the user interface culture.

The file gets added to your project in Solution Explorer and automatically opens in the XML Designer in Data view.

3. In the Data pane, select an empty row and enter "strDatabaseDeleted" in the name column and "Database deleted" in the value column.
4. Add rows for other strings, as required.

   Note: You do not need to specify the type or mimetype for a string; strings are used for objects. The `type` specifier holds the data type of the object being saved. The `MIME type` specifier holds the base type (base64) of the binary information stored, if the object consists of binary data.
5. In the File menu, select **Save** SampleApp.resx.
6. Repeat this procedure to create resource files for the other languages.
   For example, we may create an additional resource file named "SampleApp.zh-CHS.resx". That file is to contain resources that are specific to Chinese as spoken in Chinese (Simplified).

Localizing the Application Code

Provide access to the manually added resources.

1. In the Code Editor, import the `System.Resources` namespace at the beginning of the code module.

   ```
   using System.Resources;
   ```
2. Add the following code at the beginning of the class. The ResourceManager constructor takes two arguments. The first is the root name of the resources — that is, the name of the resource file without the culture and `.resx` suffixes. The second argument is the main assembly.

   ```
   ResourceManager LocRM = new
   ResourceManager("SampleApp.SampleApp",
   typeof(Customer).Assembly);
   ```
3. Modify the code to use the ResourceManager `GetString()` method to replace hard-coded strings. For example, modify:

   ```
   AddString("Database deleted");
   ```

   to:

   ```
   AddString(LocRM.GetString("strDatabaseDeleted"));
   ```

   Note: By default, the ResourceManager object is case-sensitive. If you want to perform case-insensitive lookups you can set the resource manager's `IgnoreCase` property to true. However, for performance reasons, specify the correct case for your resource names.
4. Repeat the localization procedures for `CustomerDetails.cs`.

Validating the Localization Changes

Test that your changes appear in your application.

1. Launch the application on a device or emulator that supports the language for the locale.
2. Launch your application and verify that it is localized.
   The application appears with the appropriate user interface language for the operating system of the device or emulator.

Packaging Applications

Package applications according to your security or application distribution requirements.

You can package all libraries into one package. This packaging method provide more security since packaging the entire application as one unit reduces the risk of tampering of individual libraries.

You may package and install modules separately only if your application distribution strategy requires sharing libraries between Sybase Unwired Platform applications.

Signing

Code signing is required for applications to run on physical devices.

You can run unsigned modules, which will result in warnings.

Compiling an Application in Visual Studio

Deploy applications to a Device Emulator or connected device.

1. To deploy an application from Visual Studio, compile the project and deploy the application to the emulator or physical device.
2. If you are using a Device Emulator, define a shared folder and copy the file in that folder from your machine so the Emulator can access it.
3. Using Windows and a connected device, use the Virtual folder on your machine to copy the application's `.cab` file to the device or memory card.

Client Object API Usage

The Sybase Unwired Platform Client Object API consists of generated business object classes that represent mobile business objects (MBOs) that are designed and built in the Sybase Unwired WorkSpace development environment. Device applications use the Client Object API to retrieve data and invoke mobile business object operations.

Refer to these sections for more information on using the APIs described in *Developer Guide: Windows and Windows Mobile Object API Applications* > *Developing the Application Using the Object API*.

Client Object API Reference

Use the Sybase Client Object APIC# docs as a Client Object API reference.

Review the reference details in the Client Object API documentation, located in *SUP_HOME* `\MobileSDK22\ObjectAPI\apidoc`.

There is a subdirectory for `cs`.

Application APIs

The `Application` class, in the `Sybase.Mobile` namespace, manages mobile application registrations, connections and context.

Note: Sybase recommends that you use the Application API operations with no `timeout` parameter, and register an `ApplicationCallback` to handle completion of these operations.

Application

Methods or properties in the `Application` class.

GetInstance

Retrieves the `Application` instance for the current mobile application.

Syntax

```
public static Application GetInstance()
```

Returns

`GetInstance` returns a singleton `Application` object.

Examples

- **Get the Application Instance**

```
Application app = Application.GetInstance();
```

GetInstance (String)

Return a named `Application` instance for the current mobile application. Named application instances are intended to support performance tests, where multiple instances of an application are running simultaneously as separate processes on the same computer. This operation is currently only provided for Windows C# applications

Syntax

```
public static Application GetInstance(string instanceID)
```

Returns

`GetInstance` returns a singleton `Application` object.

Examples

- **Get the Application Instance**

```
Application app = Application.GetInstance(123);
```

ApplicationIdentifier Property

Identifier for the current application. The property must be set before calling startConnection, registerApplication or unregisterApplication.

Syntax

```
public string ApplicationIdentifier { get; set; }
```

Examples

- **Get the Status**

```
application.ApplicationIdentifier = "SUP101";
```

RegistrationStatus property

Retrieves the current status of the mobile application registration.

Syntax

```
public int RegistrationStatus { get; set; }
```

Returns

`RegistrationStatus` returns one of the values defined in the `RegistrationStatus` class.

```
public class RegistrationStatus {

public static final int REGISTERED = 203;
public static final int REGISTERING = 202;
public static final int REGISTRATION_ERROR = 201;
public static final int UNREGISTERED = 205;
public static final int UNREGISTERING = 204;
}
```

Examples

- **Get the Registration Status –** Registers the application if it is not already registered.

```
if (app.RegistrationStatus != RegistrationStatus.REGISTERED)
{
   // If the application has not been registered to the server,
   // register now
   app.RegisterApplication();
}
else
{
   // start the connection to server
   app.StartConnection();
}
```

RegisterApplication

Creates the registration for this application and starts the connection. This method is equivalent to calling `RegisterApplication(0)`.

Syntax

```
public void RegisterApplication()
```

Parameters

None.

Examples

- **Register an Application –** Start registering the application and return at once.

```
app.RegisterApplication();
```

Usage

You must set up the `ConnectionProperties` and `ApplicationIdentifier` before you can invoke `registerApplication`.

```
Application app = Application.GetInstance();

// set Application ID - need to match as the server side Application
ID
app.ApplicationIdentifier = "SUP101";
ConnectionProperties props = app.ConnectionProperties;
props.ServerName = "supserver.mycompany.com";
props.PortNumber = 5001;
LoginCredentials loginCred = new LoginCredentials("supAdmin",
"supPwd");
props.LoginCredentials = loginCred;

SUP101DB.SetApplication(app);

if (app.RegistrationStatus != RegistrationStatus.REGISTERED)
{
// If the application has not been registered to the server,
// register now
app.RegisterApplication();
}
```

RegisterApplication (int timeout)

Creates the registration for this application and starts the connection. An `ApplicationTimeoutException` is thrown if the method does not succeed within the number of seconds specified by the timeout.

If a callback handler is registered and network connectivity is available, the sequence of callbacks as a result of calling `RegisterApplication` is:

```
OnRegistrationStatusChanged(RegistrationStatus.REGISTERING, 0, "")
OnConnectionStatusChanged(ConnectionStatus.CONNECTING, 0, "")
OnConnectionStatusChanged(ConnectionStatus.CONNECTED, 0, "")
OnRegistrationStatusChanged(RegistrationStatus.REGISTERED, 0, "")
```

When the connectionStatus of CONNECTED has been reached and the application's applicationSettings have been received from the server, the application is now in a suitable state for database subscriptions and/or synchronization. If a callback handler is registered and network connectivity is unavailable, the sequence of callbacks as a result of calling registerApplication is:

```
OnRegistrationStatusChanged(RegistrationStatus.REGISTERING, 0, "")
OnRegistrationStatusChanged(RegistrationStatus.REGISTRATION_ERROR,
code, message)
```

In such a case, the registration process has permanently failed and will not continue in the background. If a callback handler is registered and network connectivity is available for the start of registration but becomes unavailable before the connection is established, the sequence of callbacks as a result of calling registerApplication is:

```
OnRegistrationStatusChanged(RegistrationStatus.REGISTERING, 0, "")
OnConnectionStatusChanged(ConnectionStatus.CONNECTING, 0, "")
OnConnectionStatusChanged(ConnectionStatus.CONNECTION_ERROR, code,
message)
```

In such a case, the registration process has temporarily failed and will continue in the background when network connectivity is restored.

Syntax

```
public void RegisterApplication(int timeout)
```

Parameters

- **timeout –** Number of seconds to wait until the registration is created. If the the timeout is greater than zero and the registration is not created within the timeout period, an `ApplicationTimeoutException` is thrown (the operation might still be completing in a background thread). If the timeout value is less than or equal to 0, then this method returns immediately without waiting for the registration to finish (a non-blocking call). If the timeout value is less than or equal to 0, then this method returns immediately without waiting for the registration to finish (a non-blocking call).

Examples

- **Register an Application –** Registers the application with a one minute waiting period.
  ```
  app.RegisterApplication(60);
  ```

Usage

You must set up the `ConnectionProperties` and `ApplicationIdentifier` before you can invoke `registerApplication`.

```
Application app = Application.GetInstance();
// set Application ID - need to match as the server side Application
ID
app.ApplicationIdentifier = "MyPackage";
app.ApplicationCallback = new MyApplicationCallbackHandler();
ConnectionProperties props = app.ConnectionProperties;
props.ServerName = "supserver.mycompany.com";
props.PortNumber = 5001;
LoginCredentials loginCred = new LoginCredentials("supAdmin",
"supPwd");
props.LoginCredentials = loginCred;

MyPackageDB.SetApplication(app);

if (app.RegistrationStatus != RegistrationStatus.REGISTERED)
{
app.RegisterApplication(60);
}
```

ApplicationCallback Property

Callback for the current application. It is optional (but recommended) to set a callback, so that the application can respond to changes of connection status, registration status and application settings.

For information on the `IApplicationCallback` class, see *Developer Guide: Windows and Windows Mobile Object API Applications* > *Client Object API Usage* > *Callback and Listener APIs* > *IApplicationCallback API*.

Syntax

```
public IApplicationCallback ApplicationCallback { get; set; }
```

Examples

- **Get the current ApplicationCallback handler**

  ```
  application.ApplicationCallback = new MyApplicationCallback();
  ```

StartConnection

Starts the connection for this application. This method is equivalent to calling `StartConnection(0)`, but is a non-blocking call which returns immediately. Use `getConnectionStatus` or the `ApplicationCallback` to retrieve the connection status.

Syntax

```
public void StartConnection()
```

Returns

None.

Examples

- **Start the Application**

  ```
  StartConnection()
  ```

Usage

If you delete an application from Sybase Control Center, when the client application calls `startConnection()`, the following callback is triggered inside the `ApplicationCallback` handler:

```
void onConnectionStatusChanged(int connectionStatus, int errorCode,
String errorMessage);
errorCode = 580
```

```
errorMessage = "Error: 580 Message: 'TM
Error:InvalidAuthenticationParameters'"
```

To continue using the application, call `unregisterApplication()` to clean up the client state, and re-register using `registerApplication()`. You lose the previous subscription on the server side. Delete the client database and perform another initial synchronization.

StartConnection (int timeout)

Starts the connection for this application. If the connection was previously started, then this operation has no effect. You must set the appropriate `connectionProperties` before calling this operation. An `ApplicationTimeoutException` is thrown if the method does not succeed within the number of seconds specified by the timeout.

If connection properties are improperly set, a `ConnectionPropertyException` is thrown. You can set the `applicationCallback` before calling this operation to receive asynchronous notification of connection status changes. If a callback handler is registered and network connectivity is available, the sequence of callbacks as a result of calling `StartConnection` is:

```
onConnectionStatusChanged(ConnectionStatus.CONNECTING, 0, "")
 onConnectionStatusChanged(ConnectionStatus.CONNECTED, 0, "")
```

If a callback handler is registered and network connectivity is unavailable, the sequence of callbacks as a result of calling `StartConnection` is:

```
onConnectionStatusChanged(ConnectionStatus.CONNECTING, 0, null)
 onConnectionStatusChanged(ConnectionStatus.CONNECTION_ERROR, code,
message)
```

After a connection is successfully established, it can transition at any later time to CONNECTION_ERROR status or NOTIFICATION_WAIT status and subsequently back to CONNECTING and CONNECTED when connectivity resumes.

Note: The application must have already been registered for the connection to be established. See *registerApplication* for details.

Syntax

```
public void StartConnection(int timeout)
```

Parameters

- **timeout –** The number of seconds to wait until the connection is started. If the timeout is greater than zero and the connection is not started within the timeout period, an `ApplicationTimeoutException` is thrown (the operation may still be completing in a background thread). If the timeout value is less than or equal to 0, then this method returns immediately without waiting for the registration to finish (a non-blocking call).

Returns

None.

Examples

- **Start the Application**

```
StartConnection(timeout)
```

ConnectionStatus Property

This property represents the current status of the mobile application connection, one of the `ConnectionStatus` class values.

Syntax

```
public int ConnectionStatus { get; set; }
```

Returns

`ConnectionStatus` has the following possible values:

- **ConnectionStatus.CONNECTED –** The connection has been successfully started.
- **ConnectionStatus.CONNECTING –** The connection is currently being started.
- **ConnectionStatus.CONNECTION_ERROR –** The connection could not be started, or was previously started and subsequently an error occurred. Use `onConnectionStatusChanged` to capture the associated `errorCode` and `errorMessage`.
- **ConnectionStatus.DISCONNECTED –** The connection been sucessfully stopped, or there was no previous connection.
- **ConnectionStatus.DISCONNECTING –** The connection is currently being stopped.
- **ConnectionStatus.NOTIFICATION_WAIT –** The connection has been suspended and is awaiting a notification from the server. This is a normal situation for those platforms which can keep connections closed when there is no activity, since the server can reawaken the connection as needed with a notification.

Examples

- **Get the Status**

```
if (app.ConnectionStatus != ConnectionStatus.CONNECTED)
{
  // start the connection to server
  app.StartConnection(100);
}
```

GetConnectionProperties

Retrieves the connection parameters from the application's connection properties instance. You must set connection properties before calling `StartConnection`, `RegisterApplication` or `UnregisterApplication`.

Syntax

```
public ConnectionProperties ConnectionProperties
```

Parameters

None.

Returns

Returns the connection properties instance.

ApplicationSettings Property

Return application settings that have been received from the Unwired Server after application registration and connection.

Syntax

```
Sybase.Mobile.ApplicationSettings ApplicationSettings { get; set; }
```

Returns

Application settings that have been received from the Unwired Server.

Examples

- **Get the Application Settings**

  ```
  Sybase.Mobile.ApplicationSettings applicationSettings =
  Application.GetInstance().ApplicationSettings
  ```

beginDownloadCustomizationBundle (System.IOStream writer)

Starts downloading the default resource bundle associated with the application, and saves it into the output stream that you provide.

The resource bundle is saved into the output stream that you provide. An application can only have one default resource bundle.

Syntax

```
public void beginDownloadCustomizationBundle (System.IO.Stream
writer)
```

Parameters

- **writer –** A writer stream that you provide.

Returns

None.

Examples

- **Download the default resource bundle**

```
string file = "Example1.zip";
Stream writer = new FileStream(file, FileMode.OpenOrCreate,
FileAccess.ReadWrite);
Application.GetInstance().BeginDownloadCustomizationBundle(writer
);
```

beginDownloadCustomizationBundle (string customizationBundleID System.IO.Stream writer)

Start downloading the specified resource bundle into the output stream.

The resource bundle is saved into the output stream that you provide.

Syntax

```
public void beginDownloadCustomizationBundle (String
customizationBundleID System.IO.Stream writer)
```

Parameters

- **customizationBundleID –** The resource bundle name.
- **writer –** A writer stream that you provide.

Returns

None.

Examples

- **Download the specified resource bundle**

```
string file = "Example2.zip";
Stream writer = new FileStream(file, FileMode.OpenOrCreate,
FileAccess.ReadWrite);
Application.GetInstance().BeginDownloadCustomizationBundle("Examp
le:2.0", writer);
```

StopConnection

Stops the connection for this application. This method is equivalent to calling StopConnection(0).

Syntax

```
public void StopConnection()
```

Returns

None.

Examples

- **Stop the Connection for the Application**

  ```
  StopConnection();
  ```

StopConnection (int timeout)

Stop the connection for this application. An `ApplicationTimeoutException` is thrown if the method does not succeed within the number of seconds specified by the timeout.

If no connection was previously stopped, then this operation has no effect. You can set the applicationCallback before calling this operation to receive asynchronous notification of connection status changes.

If a callback handler is registered, the sequence of callbacks as a result of calling StopConnection is:

- OnConnectionStatusChanged(ConnectionStatus.DISCONNECTING, 0, "")
- OnConnectionStatusChanged(ConnectionStatus.DISCONNECTED, 0, "")

Syntax

```
public void StopConnection(int timeout)
```

Parameters

- **timeout –** The number of seconds to wait until the connection is stopped. If the timeout value is less than or equal to 0, then this method returns immediately without waiting for the registration to finish (a non-blocking call).

Returns

None.

Examples

- **Stop the Application**

```
StopConnection(60)
```

UnregisterApplication

Delete the registration for this application, and stop the connection. If no registration was previously created, or a previous registration was already deleted, then this operation has no effect. This method is equivalent to calling `UnregisterApplication(0)`, but is a non-blocking call which returns immediately. You can set the applicationCallback before calling this operation to receive asynchronous notification of registration status changes.

Make sure the synchronization process has ended before calling this method.

Syntax

```
UnregisterApplication()
```

Parameters

None.

Examples

- **Unregister an Application –** Unregisters the application.

```
app.UnregisterApplication();
```

UnregisterApplication(int timeout)

Delete the registration for this application, and stop the connection. If no registration was previously created, or a previous registration was already deleted, then this operation has no effect. You must set the appropriate connectionProperties before calling this operation. You can set the applicationCallback before calling this operation to receive asynchronous notification of registration status changes.

If a callback handler is registered and network connectivity is available, the sequence of callbacks as a result of calling unregisterApplication should be:

- OnConnectionStatusChanged(ConnectionStatus.DISCONNECTING, 0, "")
- OnConnectionStatusChanged(ConnectionStatus.DISCONNECTED, 0, "")
- OnRegistrationStatusChanged(RegistrationStatus.UNREGISTERING, 0, "")
- OnRegistrationStatusChanged(RegistrationStatus.UNREGISTERED, 0, "")

If a callback handler is registered and network connectivity is unavailable, the sequence of callbacks as a result of calling unregisterApplication should be:

- OnConnectionStatusChanged(ConnectionStatus.DISCONNECTING, 0, "")
- OnConnectionStatusChanged(ConnectionStatus.DISCONNECTED, 0, "")

- OnRegistrationStatusChanged(RegistrationStatus.UNREGISTERING, 0, "")
- OnRegistrationStatusChanged(RegistrationStatus.REGISTRATION_ERROR, code, message)

Syntax

```
UnregisterApplication(int timeout)
```

Parameters

- **timeout –** Number of seconds to wait until the application is unregistered. If the timeout value is less than or equal to 0, then this method returns immediately without waiting for the registration to finish (a non-blocking call).

Examples

- **Unregister an Application –** Unregisters the application with a one minute waiting period.

  ```
  app.UnregisterApplication(60);
  ```

ConnectionProperties

A class that supports the configuration of properties to enable application registrations and connections.

NetworkProtocol

Retrieves or sets the network protocol for the server connection URL, which is also known as the URL scheme. Defaults to HTTP.

Syntax

```
public string NetworkProtocol
```

Parameters

None.

Returns

Returns the network protocol for the server connection URL.

LoginCertificate

Retrieve the login certificate, or set this property to enable authentication by a digital certificate.

Syntax

```
public LoginCertificate LoginCertificate
```

Parameters

None.

Returns

Returns the login certificate.

LoginCredentials

Retrieve the login credentials, or set this property to enable authentication by username and password..

Syntax

```
public LoginCredentials LoginCredentials
```

Parameters

None.

Returns

Returns the login credentials.

PortNumber

Retrieve or set the port number for the server connection URL.

Syntax

```
public int PortNumber
```

Parameters

None.

Returns

Returns the port number.

ServerName

Retrieve or set the server name for the server connection URL.

Syntax

```
public string ServerName
```

Parameters
None.

Returns

Returns the server name.

SecurityConfiguration
Retrieve or set the security configuration for the connection profile. If not specified, the server selects the correct security configuration by matching an application connection template with the `applicationIdentifier`. If you have two application connection templates with the same application ID but different security configurations, you must set the security configuration. Otherwise, a 'template not found' exception will be thrown.

Syntax
```
public string SecurityConfiguration
```

Parameters
None.

Returns

Returns the security configuration.

UrlSuffix
Retrieve or set the URL suffix for the server connection URL. This optional property is only used when connecting through a proxy server or Relay Server.

If the URL Suffix is left blank, then the client will attempt to discover the correct URL using default Relay Server URLs. If a valid `UrlSuffix` is discovered, the value will be saved and used exclusively.

Note: If an incorrect URL is configured, it must be cleared or corrected before the client is able to connect.

Syntax
```
public string UrlSuffix
```

Parameters
None.

Returns

Returns the URL suffix.

Usage
The suffix "`/%cid%/tm`" is appended if the URL does not already end in "`/tm`". If the URL ends in "`/`", then only "`%cid%/tm`" is appended.

You can optionally code a Content-ID (CID) into the URL.

For example, if the CID is "XYZ" then any of these URL suffixes:

- /ias_relay_server/client/rs_client.dll
- /ias_relay_server/client/rs_client.dll/
- /ias_relay_server/client/rs_client.dll/%cid%/tm
- /ias_relay_server/client/rs_client.dll/XYZ/tm

result in the following URL suffix:

- /ias_relay_server/client/rs_client.dll/XYX/tm

FarmId
Retrieve or set the Farm ID for the server connection URL. This optional property is used in the URL discovery process when connecting through a proxy server or Relay Server. The `FarmId` is substituted into the default URL templates for Relay Server on into a configured `UrlSuffix`. The `FarmId` is used only until a connection is successfully made and the permanent `UrlSuffix` is stored.

Syntax
```
public string FarmId
```

Parameters
None.

Returns

Returns the Farm ID.

HttpHeaders
Retrieve or set any custom headers for HTTP network communications with a proxy server or Relay Server.

Syntax
```
public StringProperties HttpHeaders
```

Parameters
None.

Returns

Returns the HTTP headers.

HttpCookies

Retrieve or set any custom HTTP cookies for network communications with a proxy server or Relay Server.

Syntax

```
public StringProperties HttpCookies
```

Parameters

None.

Returns

Returns the HTTP cookies.

HttpCredentials

Retrieve or set the credentials for HTTP basic authentication with a proxy server or Relay Server.

Syntax

```
public LoginCredentials HTTPCredentials
```

Parameters

None.

Returns

Returns credentials for HTTP basic authentication with a proxy server or Relay Server.

ApplicationSettings

Methods or properties in the `ApplicationSettings` class.

IsApplicationSettingsAvailable

Checks whether the application settings are available from the Unwired Server.

Syntax

```
public bool IsApplicationSettingsAvailable()
```

Parameters
None.

Returns
Returns true if the application settings are available.

Examples

- **Check if application settings are available**

```
bool isSettingsAvailable  =
Sybase.Mobile.Application.GetInstance().ApplicationSettings.IsApp
licationSettingsAvailable();
```

GetStringProperty
Retrieves a string property from the `applicationSettings`.

Syntax
```
public String GetStringProperty(ConnectionPropertyType type)
```

Parameters

- **type –** Type of ConnectionPropertyType.

Returns

Returns a string property value.

Examples

- **Get string property**

```
string user_name =
appSettings.GetStringProperty(ConnectionPropertyType.UserName);
```

GetIntegerProperty
Retrieves an integer property from the `applicationSettings`.

Syntax
```
public int? GetIntegerProperty(ConnectionPropertyType type)
```

Parameters

- **type –** Type of ConnectionPropertyType.

Returns
Returns an integer property value.

Examples

- **Get integer property**

```
int? min_length =
appSettings.GetIntegerProperty(ConnectionPropertyType.PwdPolicy_L
ength);
```

GetBooleanProperty

Retrieves a boolean property from the `applicationSettings`.

Syntax

```
public bool? GetBooleanProperty(ConnectionPropertyType type)
```

Parameters

- **type –** Type of ConnectionPropertyType.

Returns

Returns a boolean property value.

Examples

- **Get boolean property**

```
bool? pwdpolicy_enabled =
appSettings.GetBooleanProperty(ConnectionPropertyType.PwdPolicy_E
nabled);
```

Custom1

A custom application setting for use by the application code.

Syntax

```
public String Custom1
```

Parameters

None.

Returns

Returns a custom application setting.

Custom2
A custom application setting for use by the application code.

Syntax
```
public String Custom2
```

Parameters
None.

Returns
Returns a custom application setting.

Custom3
A custom application setting for use by the application code.

Syntax
```
public String Custom3
```

Parameters
None.

Returns
Returns a custom application setting.

Custom4
A custom application setting for use by the application code.

Syntax
```
public String Custom4
```

Parameters
None.

Returns
Returns a custom application setting.

DomainName

Syntax

```
public String DomainName
```

Parameters

None.

Returns

Returns the domain name.

ConnectionId

Syntax

```
public String ConnectionId
```

Parameters

None.

Returns

Returns a Connection ID for this application setting.

ConnectionPropertyType

Methods or properties in the `ConnectionPropertyType` class.

PwdPolicy_Enabled

Indicates whether the password policy is enabled.

Syntax

```
ConnectionPropertyType PwdPolicy_Enabled
```

Parameters

None.

Returns

Examples

- **PwdPolicy_Enabled**

```
bool? pwdpolicy_enabled =
appSettings.GetBooleanProperty(ConnectionPropertyType.PwdPolicy_E
nabled);
```

PwdPolicy_Default_Password_Allowed

Indicates whether the client application is allowed to use the default password for the data vault.

Syntax

```
ConnectionPropertyType PwdPolicy_Default_Password_Allowed
```

Parameters

None.

Returns

None.

Examples

- **PwdPolicy_Default_Password_Allowed**

```
bool? default_password_allowed =
appSettings.GetBooleanProperty(ConnectionPropertyType.PwdPolicy_D
efault_Password_Allowed);
```

PwdPolicy_Length

Defines the minimum length for a password.

Syntax

```
ConnectionPropertyType PwdPolicy_Length
```

Parameters

None.

Returns

Returns an integer value for the minimum length for a password.

Examples

- **PwdPolicy_Length**

```
int? min_length =
appSettings.GetIntegerProperty(ConnectionPropertyType.PwdPolicy_L
ength);
```

PwdPolicy_Has_Digits

Indicates if the password must contain digits.

Syntax

```
ConnectionPropertyType PwdPolicy_Has_Digits
```

Parameters

None.

Returns

Returns true if the password must contain digits.

Examples

- **PwdPolicy_Has_Digits**

```
bool? has_digits =
appSettings.GetBooleanProperty(ConnectionPropertyType.PwdPolicy_H
as_Digits);
```

PwdPolicy_Has_Upper

Indicates if the password must contain at least one upper case character.

Syntax

```
ConnectionPropertyType PwdPolicy_Has_Upper
```

Parameters

None.

Returns

Returns true if the password must contain at least one upper case character.

Examples

- **PwdPolicy_Has_Upper**

```
bool? has_upper =
appSettings.GetBooleanProperty(ConnectionPropertyType.PwdPolicy_H
as_Upper);
```

PwdPolicy_Has_Lower

Indicates if the password must contain at least one lower case character.

Syntax

```
ConnectionPropertyType PwdPolicy_Has_Lower
```

Parameters

None.

Returns

Returns true if the password contains at least one lower case character.

Examples

- **PwdPolicy_Has_Lower**

```
bool? has_lower =
appSettings.GetBooleanProperty(ConnectionPropertyType.PwdPolicy_H
as_Lower);
```

PwdPolicy_Has_Special

Indicates if the password must contain at least one special character. A special character is a character in the set "~!@#$%^&*()-+".

Syntax

```
ConnectionPropertyType PwdPolicy_Has_Special
```

Parameters

None.

Returns

Returns true if the password must contain at least one special character.

Examples

- **PwdPolicy_Has_Special**

```
bool? has_special =
appSettings.getBooleanProperty(ConnectionPropertyType.PwdPolicy_H
as_Special);
```

PwdPolicy_Expires_In_N_Days

Specifies the number of days in which the password expires from the date of setting the password.

Syntax

```
ConnectionPropertyType PwdPolicy_Expires_In_N_Days
```

Parameters

None.

Returns

Returns an integer value for the number of days in which the password expires.

Examples

- **PwdPolicy_Expires_In_N_Days**

```
int? expires_in_n_days =
appSettings.getIntegerProperty(ConnectionPropertyType.PwdPolicy_E
xpires_In_N_Days);
```

PwdPolicy_Min_Unique_Chars

Specifies the minimum number of unique characters in the password.

Syntax

```
ConnectionPropertyType PwdPolicy_Min_Unique_Chars
```

Parameters

None.

Returns

An integer specifying the minimum number of unique characters in the password.

Examples

- **PwdPolicy_Min_Unique_Characters**

```
int? min_unique_characters =
appSettings.getIntegerProperty(ConnectionPropertyType.PwdPolicy_M
in_Unique_Chars);
```

PwdPolicy_Lock_Timeout

Specifies the timeout value (in seconds) after which the vault is locked from the unlock time. A value of 0 indicates no timeout.

Syntax

```
ConnectionPropertyType PwdPolicy_Lock_Timeout
```

Parameters

None.

Returns

An integer specifying the timeout value.

Examples

- **PwdPolicy_Lock_Timeout**

```
int? lock_timeout =
appSettings.getIntegerProperty(ConnectionPropertyType.PwdPolicy_L
ock_Timeout);
```

PwdPolicy_Retry_Limit

Specifies the number of failed unlock attempts after which the data vault is deleted. A value of 0 indicates no retry limit.

Syntax

```
ConnectionPropertyType PwdPolicy_Retry_Limit
```

Parameters

None.

Returns

An integer specifying the number of failed unlock attempts after which the data vault is deleted.

Examples

- **PwdPolicy_Retry_Limit**

```
int? retry_limit =
appSettings.GetIntegerProperty(ConnectionPropertyType.PwdPolicy_R
etry_Limit);
```

Connection APIs

The Connection APIs contain methods for managing local database information, establishing a connection with the Unwired Server, and authenticating.

ConnectionProfile

The `ConnectionProfile` class manages local database information. Set its properties, including the encryption key, during application initialization, and before creating or accessing the local client database.

By default, the database class name is generated as "packageName"+"DB".

```
ConnectionProfile cp = SUP101DB.GetConnectionProfile();
cp.PageSize = 4*1024;
cp.EncryptionKey = "Your encryption key"; //Encryption key could be
of arbitrary length. Generally the longer, the better.
cp.Save();
```

Note: If you set the page size to a negative value, the framework uses a default value of 4K as the page size.

You can also generate an encryption key by calling the generated database's `GenerateEncryptionKey` method, and then store the key inside a `DataVault` object. The `GenerateEncryptionKey` method automatically sets the encryption key in the connection profile.

You can use the `cacheSize` connection property to control the size of the memory cache used by the database.

```
public int CacheSize {get; set; }
```

Managing Device Database Connections

Use the `OpenConnection()` and `CloseConnection()` methods generated in the package database class to manage device database connections.

Note: Any database operation triggers the establishment of the database connection. You do not need to explicitly call the `openConnection` API.

The `OpenConnection()` method checks that the package database exists, creates it if it does not, and establishes a connection to the database. This method is useful when first starting the application: since it takes a few seconds to open the database when creating the first

connection, if the application starts up with a login screen and a background thread that performs the `OpenConnection()` method, after logging in, the connection is most likely already established and is immediately available to the user.

All `ConnectionProfile` properties should be set before the first access to database, otherwise they will not take effect.

The `CloseConnection()` method closes all database connections for this package and releases all resources allocated for those connections. This is recommended to be part of the application shutdown process.

Improving Device Application Performance with One Writer Thread and Multiple Database Access Threads

The `maxDbConnections` property improves device application performance by allowing multiple threads to access data concurrently from the same local database.

Connection management allows you to have at most one writer thread concurrent with multiple reader threads. There can be other reader threads at the same time that the writer thread is writing to the database. The total number of threads are controlled by the `maxDbConnections` property.

In a typical device application such as Sybase Mobile CRM, a list view lists all the entities of a selected type. When pagination is used, background threads load subsequent pages. When the device application user selects an entry from the list, the detail view of that entry appears, and loads the details for that entry.

Prior to the implementation of `maxDbConnections`, access to the package on the local database was serialized. That is, an MBO database operation, such as, create, read, update, or delete (CRUD) operation waited for any previous operation to finish before the next was allowed to proceed. In the list view to detail view example, when the background thread is loading the entire list, and a user selects the details of one entry for display, the loading of details for that entry must wait until the entire list is loaded, which can be a long while, depending on the size of the list.

You can specify the number of total threads using `maxDbConnections`.

The `ConnectionProfile` class in the persistence package includes the `maxDbConnections` property, which you set before performing any operation in the application. The default value (maximum number of concurrent read threads) is 2.

```
ConnectionProfile connectionProfile =
SUP101DB.GetConnectionProfile();
```

To allow 6 concurrent threads, set the `maxDbConnections` property to 6 in `ConnectionProfile` before accessing the package database at the beginning of the application.

```
    connectionProfile.MaxDbConnections = 6;
```

Set Database File Property

You can use `setProperty` to specify the database file name on the device, such as the directory of the running program, a specific directory path, or a secure digital (SD) card.

```
ConnectionProfile cp = SUP101DB.GetConnectionProfile();
cp.SetProperty("databaseFile", "sup101.udb");
cp.Save();
```

Examples

The *databaseFile* is created in the `/Temp` directory of the Windows Mobile device:

```
/Temp/mydb.udb
```

The *databaseFile* is created on an SD card:

```
"/Storage Card/mydb.udb"
```

Note: For the database file path and name, the forward slash (/) is required as the path delimiter, for example `/smartcard/supprj.db`.

Usage

- Be sure to call this API before the database is created..
- The database is UltraLite; use a database file name like `mydb.udb`.
- For DOE applications, the database is SQLite; use a database file name like `mydb.db`.
- If the device client user changes the file name, he or she must make sure the input file name is a valid name and path on the client side.

Note: Sybase recommends using industrial grade SD cards using Single Level Cell (SLC) technology. SD cards that use SLC technology are generally more reliable and faster than MLC cards, although they may be more limited in size and more expensive per unit of storage. Not all SD cards perform equally, and it is advised that customers evaluate the benchmarks available from different suppliers.

Synchronization Profile

The Synchronization Profile contains information for establishing a connection with the Unwired Server's data synchronization channel where the server package has been deployed. The `Sybase.Persistence.ConnectionProfile` class manages that information. By default, this information includes the server host, port, domain name, certificate and public key that are pushed by the message channel during the registration process.

Settings are automatically provisioned from the Unwired Server. The values of the settings are inherited from the application connection template used for the registration of the application connection (automatic or manual). You must make use of the connection and security settings that are automatically used by the Object API.

Typically, the application uses the settings as sent from the Unwired Server to connect to the Unwired Server for synchronization so that the administrator can set those at the application deployment time based on their deployment topology (for example, using relay server, using e2ee security, or a certificate used for the intermediary, such as a Relay Server Web server). See the *Applications* and *Application Connection Templates* topics in *System Administration*.

```
ConnectionProfile profile = SUP101DB.GetSynchronizationProfile();
profile.DomainName = "default";
profile.ServerName = "host-name";
profile.PortNumber = 2481;
profile.NetworkProtocol = "https";
profile.StreamParams.Trusted_Certificates = "rsa_public_cert.crt";
```

You can allow clients to compress traffic as they communicate with the Unwired Server by including "compression=zlib" into the sync parameters:

```
NetworkStreamParams streamParams =
MyDatabase.GetSynchronizationProfile().StreamParams;
streamParams.Compression= "zlib";
streamParams.Zlib_Upload_Window_Size= 12;
streamParams.Zlib_Download_Window_Size= 12;
```

By default, compression is disabled.

You can allow clients to authenticate with a proxy server by including a username and password in the sync parameters. This feature supports Basic and Digest authentication as described in RFC 2617. With Basic authentication, passwords are included in HTTP headers in clear text; however, you can use HTTPS to encrypt the headers and protect the password. With Digest authentication, headers are not sent in clear text but are hashed.

```
SUP101DB.GetSynchronizationProfile().NetworkStreamParams +=
";http_userid=supAdmin;http_password=supPwd";
```

Connect the Data Synchronization Channel Through a Relay Server

To enable your client application to connect through a Relay Server, you can enter the related configuration in the application connection template through Sybase Control Center, and/or setup the configuration properties in the synchronization profile using the object API.

Edit SUP101DB by modifying the values of the Relay Server properties for your Relay Server environment.

```
ConnectionProfile syncProfile =
SUP101DB.GetSynchronizationProfile();
syncProfile.ServerName = "examplexp-vm1";
syncProfile.PortNumber = 80;
syncProfile.NetworkProtocol = "http";
NetworkStreamParams streamParams =
GetSynchronizationProfile().StreamParams;
streamParams.Url_Suffix = "/cli/iarelayserver/<FarmName>";
GetSynchronizationProfile().DomainName = "default";
```

To update properties for a Relay Server installed on Internet Information Services (IIS) on Microsoft Windows:

```
ConnectionProfile syncProfile =
SUP101DB.GetSynchronizationProfile();
syncProfile.ServerName = "examplexp-vm1";
syncProfile.PortNumber = 80;
syncProfile.NetworkProtocol = "http";
NetworkStreamParams streamParams =
GetSynchronizationProfile().StreamParams;
streamParams.Url_Suffix = "/ias_relay_server/client/rs_client.dll/
<FarmName>";
GetSynchronizationProfile().DomainName = "default";
```

For more information on relay server configuration, see *System Administration* and *Sybase Control Center for Sybase Unwired Platform*.

Asynchronous Operation Replay

When an application calls `submitPending` on an MBO on which a create, update, or delete operation is performed, an operation replay record is created on the device local database

When `synchronize` is called, the operation replay records are uploaded to the server. The method returns without waiting for the backend to replay those records. The `synchronize` method downloads all the latest data changes and the results of the previously uploaded operation replay records that the backend has finished replaying. If you choose to disable asynchronous operation replay, each `synchronize` call will wait for the backend to finish replaying all the current uploaded operation replay records.

By default, synchronization will not wait for the operations to be replayed on the backend. When the replay is finished, the onSynchronize callback method will be called with this status code in the SynchronizeContext:

```
SynchronizationStatus.ASYNC_REPLAY_COMPLETED
```

The application can set the following property in the synchronization profile to use the previous Synchronous Operation Replay behavior.

```
SUP101DB.getSynchronizationProfile().setAsyncReplay(false);
```

Authentication APIs

You can log in to the Unwired Server with your user name and credentials and use the X.509 certificate you installed in the task flow for single sign-on.

Logging In

The generated package database class provides a default synchronization connection profile according to the Unwired Server connection profile and server domain selected during code generation. You can log in to the Unwired Server with your user name and credentials.

The package database class provides methods for logging in to the Unwired Server:

- **`OnlineLogin()`** – authenticates credentials against the Unwired Server.

Sample Code

Illustrates importing the certificate and setting up login credentials, as well as other APIs related to certificate handling:

```
// SUP101DB is a generated database class
// First install certificates on your emulator, for example
"Sybase101.p12"

//Getting certificate from certificate store
CertificateStore myStore =
CertificateStore.GetDefault();
string filter1 = "Sybase";
StringList labels = myStore.CertificateLabels(filter1, null);
string aLabel = labels.Item(0);
LoginCertificate lc = myStore.GetSignedCertificate(aLabel,
"password");

// Save the login certificate to your synchronization profile
SUP101DB.GetSynchronizationProfile().Certificate = lc;

//Perform synchronization
SUP101DB.Synchronize();

// Save the login certificate to your data vault
DataVault vault = null;
if (!DataVault.VaultExists("myVault"))
{
  vault = DataVault.CreateVault("myVault", "password", "salt");
}
else
{
  vault = DataVault.GetVault("myVault");
}
vault.Unlock("password", "salt");
lc.Save("myLabel", vault);

// Get certificate that was previously loaded from the data vault
LoginCertificate newLc = LoginCertificate.Load("myLabel", vault);

// Delete the certificate from the data vault
LoginCertificate.Delete("myLabel", vault);
```

Single Sign-On With X.509 Certificate Related Object API

Use these classes and attributes when developing mobile applications that require X.509 certificate authentication.

- `CertificateStore` class - wraps platform-specific key/certificate store class, or file directory
- `LoginCertificate` class - wraps platform-specific X.509 distinguished name and signed certificate
- `ConnectionProfile` class - includes the certificate attribute used for Unwired Server synchronization.

Refer to the API Reference for implementation details.

Importing a Certificate into the Data Vault

Obtain a certificate reference and store it in a password-protected data vault to use for X.509 certificate authentication.

The difference between importing a certificate from a system store or a file directory is determined by how you obtain the `CertificateStore` object. In either case, only a label and password are required to import a certificate blob, which is a digitally signed copy of the public X.509 certificate.

```
//Obtain a reference to the certificate store
CertificateStore myStore = CertificateStore.GetDefault();

//List all certificate labels from the certificate store
StringList labels = myStore.CertificateLabels();

//List the certificate labels filtered by subject
String filter1 = "Sybase";
labels = myStore.CertificateLabels(filter1, null);

//Get a LoginCertificate from the certificate store
string aLabel = ... //ask user to select a label
string password = ... //prompt user for password
LoginCertificate lc = myStore.GetSignedCertificate(aLabel,
password);

//Save/Load/Delete...LoginCertificate
//Create or lookup a data vault
DataVault vault = null;
if (!DataVault.VaultExists("myVault"))
{
    vault = DataVault.CreateVault("myVault", "password", "salt");
}
else
{
    vault = DataVault.GetVault("myVault");
}
```

Selecting a Certificate for Unwired Server Connections

Select the X.509 certificate from the data vault for Unwired Server authentication.

```
//Unlock the vault before using it
vault.Unlock("password", "salt");
//Save the certificate with specified label
lc.Save("myLabel", vault);
//load the certificate from data vault by label
LoginCertificate newLc = LoginCertificate.Load("myLabel", vault);
//Delete the certificate from the data vault
LoginCertificate.Delete("myLabel", vault);
```

Connecting to Unwired Server with a Certificate

Once the certificate property is set, use the `LoginToSync` or `OnlineLogin` API with no parameters to connect to the Unwired Server with the login certificate.

```
//connect to Unwired Server with the login certificate
SUP101DB.GetSynchronizationProfile().Certificate = lc;
SUP101DB.OnlineLogin();
```

Personalization APIs

Personalization keys allow the application to define certain input parameter values that are personalized for each mobile user. Personalization parameters provide default values for synchronization parameters when the synchronization key of the object is mapped to the personalization key while developing a mobile business object. The Personalization APIs allow you to manage personalization keys, and get and set personalization key values.

Type of Personalization Keys

There are three types of personalization keys: client, server, and transient (or session). Client personalization keys are persisted in the local database. Server personalization keys are persisted on the Unwired Server. Session personalization keys are not persisted and are lost when the device application terminates.

A personalization parameter can be a primitive or complex type.

A personalization key is metadata that enables users to store their search preferences on the client, the server, or by session. The preferences narrow the focus of data retrieved by the mobile device (also known as the filtering of data between the client and the Unwired Server). Often personalization keys are used to hold backend system credentials, so that they can be propagated to the EIS. To use a personalization key for filtering, it must be mapped to a synchronization parameter. The developer can also define personalization keys for the application, and can use built-in personalization keys available in the Unwired Server. Two built-in (session) personalization keys — username and password — can be used to perform single sign-on from the device application to the Unwired Server, authentication and

authorization on the Unwired Server, as well as connecting to the back-end EIS using the same set of credentials. The password is never saved on the server.

Getting and Setting Personalization Key Values

The `PersonalizationParameters` class is generated automatically for managing personalization keys. When a personalization parameter value is changed, the call to `save` automatically propagates the change to the server.

An operation can have a parameter that is one of the Sybase Unwired Platform list types (such as `IntList`, `StringList`, or `ObjectList`). This code shows how to set a personalization key, and pass an array of values and an array of objects:

```
PersonalizationParameters pp =
SUP101DB.GetPersonalizationParameters();
pp.MyIntPK = 10002;
pp.Save();
Sybase.Collections.IntList il = new Sybase.Collections.IntList();
il.Add(10001);
il.Add(10002);
pp.MyIntListPK = il;
pp.Save();
Sybase.Collections.GenericList<MyData> dl = new
Sybase.Collections.GenericList<MyData>(); //MyData is a structure
type defined in tooling
MyData md = new MyData();
md.IntMember = 123;
md.StringMember = "abc";
dl.Add(md);
pp.MyDataListPK = dl;
pp.Save();
```

If a synchronization parameter is personalized, you can overwrite the value of that parameter with the personalization value.

Synchronization APIs

You can synchronize mobile business objects (MBOs) based on synchronization parameters, for individual MBOs, or as a group, based on the group's synchronization policy.

Note: The `LoginToSync` API is now deprecated. Call `Synchronize` or `BeginSynchronize` before saving synchronization parameters. After saving the synchronization parameters, call `Synchronize` or `BeginSynchronize` again to retrieve the new values filtered by those parameters.

Managing Synchronization Parameters

Synchronization parameters let an application change the parameters that retrieve data from an MBO during a synchronization session.

The primary purpose of synchronization parameters is to partition data. Change the synchronization parameters to affect the data you are working with (including searches), and synchronization.

To add a synchronization parameter:

```
CustomerSubscription sp = new CustomerSubscription();
sp.Name = "example";
Customer.AddSubscription(sp);
```

To list all synchronization parameters:

```
Sybase.Collections.GenericList<CustomerSubscription> r =
Customer.GetSubscriptions();
```

To remove a synchronization parameter:

```
Sybase.Collections.GenericList<CustomerSubscription> r =
Customer.GetSubscriptions();
CustomerSubscription sub = r.Item(0);
Customer.RemoveSubscription(sub);
```

Performing Mobile Business Object Synchronization

A synchronization group is a group of related MBOs. A mobile application can have predefined synchronization groups. An implicit default synchronization group includes all the MBOs that are not in any other synchronization group.

This code synchronizes an MBO package using a specified connection:

```
SUP101DB.Synchronize (string synchronizationGroup)
```

The package database class includes two synchronization methods. You can synchronize a specified group of MBOs using the synchronization group name:

```
SUP101DB.Synchronize("my-sync-group");
```

Or, you can synchronize all synchronization groups:

```
SUP101DB.Synchronize();
```

There is a default synchronization group within every package. The default synchronization group includes all MBOs except those already included by other synchronization groups. To synchronize a default synchronization group call:
`SUP101DB.BeginSynchronize("default");` or
`SUP101DB.Synchronize("default");`

If there is no other synchronization group, call `SUP101DB.BeginSynchronize();` or `SUP101DB.Synchronize();`

To synchronize a synchronization group asynchronously:

```
GenericList<SynchronizationGroup> syncGroups = new
GenericList<SynchronizationGroup>();
syncGroups.add(SUP101DB.GetSynchronizationGroup("my-sync-group"));
SUP101DB.BeginSynchronize(syncGroups, "");
```

When an application uses a create, update, or delete operation in an MBO and calls the `SubmitPending` metod, an `OperationReplay` object is created for that change. The application must invoke either the `Synchronize` or `BeginSynchronize` method to upload the `OperationReplay` object to the server to replay the change on the backend data source. The `IsReplayQueueEmpty` API is used to check if there are unsent operation replay objects and decide whether a synchronize call is needed.

Message-Based Synchronization APIs

The message-based synchronization APIs enable a user application to subscribe to a server package, to remove an existing subscription from the Unwired Server, to suspend or resume requests to the Unwired Server, and to recover data related to the package from the server.

Note: The `BeginOnlineLogin`, `SuspendSubscription`, `ResumeSubscription`, and `VacuumDatabase` methods are for use with DOE-based applications only.

BeginOnlineLogin

Sends a login message to the Unwired Server with the username and password.

Typically, the generated package database class already has a valid synchronization connection profile and you can log in to the Unwired Server with your username and credentials.

beginOnlineLogin sends a message to the Unwired Server with the username and password. The Unwired Server responds with a message to the client with the login success or failure.

When the login succeeds, the `OnLoginSuccess` method of the ICallbackHandler is invoked. When the login fails, the `OnLoginFailure` method of the ICallbackHandler is invoked.

Syntax

```
public static void BeginOnlineLogin(string username, string
password)
```

Parameters

- **userName –** the user name.
- **password –** the password.

Returns

None.

Examples

- **Begin an Online Login –** Start logging in with "supAdminID" for the user name and "supPass" for the password.

```
SUP101DB.BeginOnlineLogin("supAdminID", "supPass");
```

Subscribe

Subscribes to a server package. A subscription message is sent to the Unwired Server and the application receives a subscription request result notification from the the Unwired Server. If the subscription succeeds, the `OnSubscribeSuccess` method of the `ICallbackHandler` is invoked. If the subscription fails, the `OnSubscribeFailure` method of the `ICallbackHandler` is invoked.

Prerequisites for using **subscribe**:

- The mobile application is compiled with the client framework and deployed to a mobile device, together with the Sybase Unwired Platform client process.
- The device application has already configured Unwired Server connection information.

Syntax

```
public static void Subscribe()
```

Parameters

- **None – subscribe** has no parameters.

Returns

None.

Examples

- **Subscribe to a Sample Application –** Subscribe to SUP101DB.

```
SUP101DB.Subscribe();
```

Unsubscribe

Removes an existing subscription to a server package. An unsubscription message is sent to the Unwired Server and the application receives a subscription request result notification from the Unwired Server as a notification. The data on the local database is cleaned. If the unsubscribe succeeds, the `OnSubscribeSuccess` method of the ICallbackHandler is invoked. If it fails, the `OnSubscribeFailure` method of the ICallbackHandler is invoked.

The device application must already have a subscription with the server.

Syntax

```
public static void Unsubscribe()
```

Parameters

- **None – unsubscribe** has no parameters.

Returns

None.

Examples

- **Unsubscribe from a Sample Application –** Unsubscribe from SUP101DB.

  ```
  SUP101DB.Unsubscribe();
  ```

SuspendSubscription

Sends a suspend request to the Unwired Server to notify the server to stop delivering data changes. A suspend subscription message is sent to the Unwired Server and the application receives a suspend subscription request result notification from the Unwired Server as a notification. If the suspend succeeds, the `OnSuspendSubscriptionSuccess` method of the ICallbackHandler is invoked. If the suspend fails, the `OnSuspendSubscriptionFailure` method of the ICallbackHandler is invoked.

Syntax

```
public static void SuspendScription()
```

Parameters

- **None – suspendSubscription** has no parameters.

Returns

None.

Examples

- **Suspend a Subscription –** Suspend the subscription to SUP101DB.

  ```
  SUP101DB.SuspendScription();
  ```

BeginSynchronize

Sends a message to the Unwired Server to synchronize data between the client and the server. There are two different beginSynchronize APIs, one with no parameters that synchronizes all the groups, and one that takes a list of groups.

The synchronization completes in the background through an asynchronous message exchange with the server. If application code needs to know when the synchronization is complete, a callback handler that implements the `onSynchronize` method must be registered with the database class.

Syntax

```
public static void BeginSynchronize

public static void
BeginSynchronize(Sybase.Collections.GenericList<Sybase.Persistence.
ISynchronizationGroup> synchronizationGroups, string context)
```

Parameters

- **synchronizationGroups –** specifies a list of a list of `SynchronizationGroupISynchronizationGroup` objects representing the groups to be synchronized. If omitted, begin synchronizing data for all groups.

  Note: This parameter is not relevant for DOE packages; pass a null value to this parameter.

Returns

None.

Examples

- **Synchronize Data between Client and Server –** Synchronize data for SampleAppDB for SUP101DB group.

  ```
  SUP101DB.BeginSynchronize(null, "your context");
  ```

ResumeSubscription

Sends a resume request to the Unwired Server.

The resume request notifies the Unwired Server to resume sending data changes for the subscription that had been suspended. On success, **onResumeSubscriptionSuccess** callback handler method is called. On failure, **onResumeSubscriptionFailure** callback handler is called.

Syntax

```
public static void ResumeSubscription()
```

Parameters

- **None – resumeSubscription** has no parameters.

Returns

None.

Examples

- **Resume a Subscription –** Resume the subscription to SUP101DB.

```
SUP101DB.ResumeScription();
```

VacuumDatabase

Reclaims unused database space left when records are deleted, reducing the size of the database file.

When a large amount of data is deleted from the database file it leaves behind empty space, or "free" database pages. Running `VacuumDatabase` to rebuild the database reclaims this space. The size of the database file is reduced by the amount of space reclaimed.

Syntax

```
public static void VacuumDatabase()
```

Parameters

- **None – VacuumDatabase** has no parameters.

Returns

None.

Examples

- **Reclaim Empty Space in Database –** Reclaim empty space in SUP101DB database.

```
SUP101DB.VacuumDatabase();
```

Push Synchronization Applications

Clients receive device notifications when a data change is detected for any of the MBOs in the synchronization group to which they are subscribed.

Sybase Unwired Platform uses a messaging channel to send change notifications from the server to the client device. By default, change notification is disabled. You can enable the change notification of a synchronization group: If you see that setInterval is set to 0, then change detection is disabled, and notifications will not be delivered. Enable change detection and notification delivery by setting an appropriate value. For recommendations, see

Configuring Synchronization Groups in *Sybase Control Center for Sybase Unwired Platform*.

```
ISynchronizationGroup sg =
SUP101DB.GetSynchronizationGroup("TCNEnabled");

if (!sg.EnableSIS)
{
  sg.EnableSIS = true;
  sg.Interval = 2;
  sg.Save();
  SUP101DB.Synchronize("TCNEnabled");
}
```

When the server detects changes in an MBO affecting a client device, and the synchronization group of the MBO has change detection enabled, the server will send a notification to client device through messaging channel. By default, a background synchronization downloads the changes for that synchronization group. The application can implement the onSynchronize callback method to monitor this condition, and either allow or disallow background synchronization.

```
public int OnSynchronize(GenericList<ISynchronizationGroup> groups,
SynchronizationContext context)
{
  int status = context.Status;
  if (status == SynchronizationStatus.STARTING_ON_NOTIFICATION)
  {
    // There is changes on the synchronization group
    if (busy)
    {
      return SynchronizationAction.CANCEL;
    }
    else
    {
      return SynchronizationAction.CONTINUE;
    }
  }

  // return CONTINUE for all other status
  return SynchronizationAction.CONTINUE;
}
```

Retrieving Information about Synchronization Groups

The package database class provides the following two methods for querying the synchronized state and the last synchronization time of a certain synchronization group.

```
/// Determines if the synchronization group was synchronized
public static bool IsSynchronized(string synchronizationGroup)

/// Retrieves the last synchronization time of the synchronization
group
public static System.DateTime GetLastSynchronizationTime(string
synchronizationGroup)
```

Log Record APIs

The Log Record APIs allow you to customize aspects of logging.

- Writing and retrieving log records (successful operations are not logged).
- Configuring log levels for messages reported to the console.
- Enabling the printing of server message headers and message contents, database exceptions, and `LogRecord` objects written for each import.
- Viewing detailed trace information on database calls.

Log records are automatically created when an operation replay fails in the Unwired Server. If an operation replay succeeds, there is no `LogRecord` created by default (note that an SAP default result checker may write a log record even when the SAP operation succeeds). To get the confirmation when an operation replay succeeds, register a CallbackHandler and implement the `CallbackHandler.onReplaySuccess` method.

See *Developer Guide: Windows and Windows Mobile Object API Applications* > *Client Object API Usage* > *Callback and Listener APIs*.

LogRecord API

`LogRecord` stores two types of logs.

- Operation logs on the Unwired Server. These logs can be downloaded to the device.
- Client logs. These logs can be uploaded to the Unwired Server.

`SUP101DB.GetLogger` – gets the log API. The client can write its own records using the log API. For example:

```
ILogger logger = SUP101DB.GetLogger();
    logger.Debug("Write this string to the log records table");
    SUP101DB.SubmitLogRecords();
```

`SUP101DB.GetLogRecords` – gets the log records received from the server. For example:

```
Query query = new Query();
query.TestCriteria =
Sybase.Persistence.AttributeTest.Equal("component", "Customer");
Sybase.Persistence.SortCriteria sortCriteria = new
Sybase.Persistence.SortCriteria();
sortCriteria.Add("requestId",
Sybase.Persistence.SortOrder.DESCENDING);
query.SortCriteria = sortCriteria;

GenericList<ILogRecord> loglist = SUP101DB.GetLogRecords(query);
```

This sample code shows how to find the corresponding MBO with the LogRecord and to delete the log record when a record is processed.

```
private void processLogRecords()
  {
```

```
    Query query = new Query();
    GenericList<ILogRecord> logRecords =
SUP101DB.GetLogRecords(query);
    bool callSync = false;
    foreach (ILogRecord log in logRecords)
    {
      // log warning message
      BenchmarkUtils.AddInfo("log " + log.Component + ":"
        + log.EntityKey
    + " code:" + log.Code
        + " msg:" + log.Message);

      if (log.Component.Equals("Customer"))
      {
        long surrogateKey = Convert.ToInt64(log.EntityKey);
    Customer c = Customer.Find(surrogateKey);
    if (c.IsPending)
    {
      c.CancelPending();
    }

    log.Delete();
    log.SubmitPending();
    callSync = true;
      }
    }

      if (callSync)
      {
       SUP101DB.BeginSynchronize(null, null);
      }
  }
```

Logger APIs

Use the `Logger` API to set the log level and create log records on the client.

Each package has a `Logger`. To obtain the package logger, use the `GetLogger` method in the generated database class.

```
Logger logger = SUP101DB.GetLogger();

// set log level to debug
logger.LogLevel = LogLevel.DEBUG;

// create a log record with ERROR level and the error message.
logger.Error("Some error message");
```

Change Log API

The change log allows a client to retrieve entity changes from the back end. If a client application already has a list view constructed, it simply needs to add, modify, or delete entries in the list according to the change logs.

A single `ChangeLog` is generated for each changed entity. If the changed entity is a child of a composite relationship, there is also a `ChangeLog` for its parent root entity.

EntityType

Returns the entity type.

Syntax

```
int EntityType
```

Parameters

None.

Returns

Returns the entity type. The entity type values are defined in the generated C# class EntityType.cs for the package.

Examples

- **Get the Entity Type**

  ```
  EntityType
  ```

OperationType

Returns the operation type of the MBO.

Syntax

```
char OperationType
```

Parameters

None.

Returns

The operation type of the MBO. Possible values are 'U' for update and insert, and 'D' for delete.

Examples

- **Get the Operation Type**

```
OperationType
```

RootEntityType

Returns the name of the root parent entity type.

Syntax

```
int RootEntityType
```

Parameters

None.

Returns

Returns the root entity type which is the root of the object graph.

Examples

- **Get the Root Entity Type**

```
RootEntityType
```

RootSurrogateKey

Returns the surrogate key of the root parent entity.

Syntax

```
long RootSurrogateKey
```

Parameters

None.

Returns

The surrogateKey of the root entity.

Examples

- **Get the Root Surrogate Key**

```
RootSurrogateKey
```

SurrogateKey

Returns the surrogate key of the entity.

Syntax

```
long SurrogateKey
```

Parameters

None.

Returns

The surrogate key of the affected entity. Note that the change log contains all affected entities, including children of the object graph.

Examples

- **Get the Surrogate Key**

  ```
  SurrogateKey
  ```

Methods in the Generated Database Class

You can use generated methods in the package database class to manage change logs.

EnableChangeLog

By default, Change Log is disabled. To enable the change log, invoke the `EnableChangeLog` API in the generated database class. The next synchronization will have change logs sent to the client.

Syntax

```
EnableChangeLog();
```

Returns

None.

Examples

- **Enable Change Log**

  ```
  SUP101DB.EnableChangeLog();
  ```

GetChangeLogs

Retrieve a list of change logs.

Syntax

```
GetChangeLogs();
```

Returns

Returns a GenericList of type <Change Log>.

Examples

- **Get Change Logs**

  ```
  SUP101DB.GetChangeLogs();
  ```

DeleteChangeLogs

You are recommended to delete all change logs after the application has completed processing them. Use the `DeleteChangeLogs` API in the generated database class to delete all change logs on the device.

Syntax

```
DeleteChangeLogs();
```

Returns

None.

Examples

- **Delete Change Logs**

  ```
  SUP101DB.DeleteChangeLogs();
  ```

Usage

Ensure that when calling `DeleteChangeLogs()`, there are no change logs created from a background synchronization that are not part of the original change log list returned by a specific query:

```
GenericList<IChangeLog> changes = SUP101DB.GetChangeLogs(myQuery);
```

You should only call `DeleteChangeLogs()` in the `OnSynchronize()` callback where there are no multiple synchronizations occurring simultaneously.

DisableChangeLog

Creating change logs consumes some processing time, which can impact application performance. The application may can disable the change log using the DisableChangeLog API.

Syntax

```
DisableChangeLog();
```

Returns

None.

Examples

- **Disable Change Log**

```
SUP101DB.DisableChangeLog();
```

Code Samples

Enable the change log and list all changes, or only the change logs for a particular entity, Customer.

```
SUP101DB.EnableChangeLog();
SUP101DB.Synchronize();

// Retrieve all change logs
GenericList<IChangeLog> logs = SUP101DB.GetChangeLogs(new Query());
Console.WriteLine("There are " + logs.Count + " change logs");
foreach (IChangeLog log in logs)
{
Console.WriteLine(log.EntityType
+ "(" + log.SurrogateKey
+ "): " + log.OperationType);
}

// Retrieve only the change logs for Customer:
Query query = new Query();
AttributeTest at = new AttributeTest("entityType",
SUP101.EntityType.Customer,
AttributeTest.EQUAL);
query.TestCriteria = at;
logs = SUP101DB.GetChangeLogs(query);
Console.WriteLine("There are " + logs.size() + " change logs for
Customer");
foreach (IChangeLog log in logs)
{
Console.WriteLine(log.EntityType
+ "(" + log.SurrogateKey
+ "): " + log.OperationType);
}
```

Security APIs

The security APIs allow you to customize some aspects of connection and database security.

Encrypt the Database

You can set the encryption key of a local database. Set the key during application initialization, and before creating or accessing the client database.

The length of the encyption key cannot be fewer than 16 characters.

The encryption key must follow the rules applicable to DBKEY in UltraLite:

- Any leading or trailing spaces in parameter values are ignored.
- The value cannot include leading single quotes, leading double quotes, or semicolons.

```
ConnectionProfile profile = SUP101DB.GetConnectionProfile();
profile.EncryptionKey = "Your encryption key"; //Encryption key can
be of arbitrary length. Generally the longer, the better.
```

You can use the `generateEncryptionKey()` method to encrypt the local database with a random encryption key.

```
SUP101DB.GenerateEncryptionKey();
// store the encryption key at somewhere for reuse later
ConnectionProfile profile = SUP101DB.GetConnectionProfile();
String key = profile.EncryptionKey;
...
SUP101DB.CreateDatabase();
```

End to End Encryption and Compression Support APIs

Use encryption communication parameters to ensure end to end encryption and eliminate any WAP gap security problems.

You can use the Client Object API to set up end to end encryption, supported by Ultralite, and HTTPS items in the synchronization profile. Encryption is not enabled by default, but must be explicitly set.

Refer to the following APIs when setting up end to end encryption and compression support:

- `Sybase.Persistence.ConnectionProfile.StreamParams`
- `Sybase.Persistence.NetworkStreamParams.E2ee_Public_Key`
- `Sybase.Persistence.NetworkStreamParams.E2ee_Type`
- `Sybase.Persistence.NetworkStreamParams.Tls_Type`
- `Sybase.Persistence.NetworkStreamParams.Trusted_Certificates`
- `Sybase.Persistence.NetworkStreamParams.Trusted_Certificates`
- `Sybase.Persistence.NetworkStreamParams.Url_Suffix`
- `Sybase.Persistence.NetworkStreamParams.Zlib_Download_Window_Size`

- `Sybase.Persistence.NetworkStreamParams.Zlib_Upload_Window_Size`

The following code example shows how to set SUP101:

```
ConnectionProfile conn=SUP101DB.GetSynchronizationProfile();
conn.NetworkProtocol = "HTTP";
conn.PortNumber = 2480;
conn.StreamParams().E2ee_Type = "rsa";
conn.StreamParams().E2ee_Public_Key = "e2ee_public_key.key";
conn.Save();
```

DataVault

The `DataVault` class provides encrypted storage of occasionally used, small pieces of data. All exceptions thrown by `DataVault` methods are of type `DataVaultException`.

If you have installed the utility files `DataVault.cs` and `DataVaultException.cs` into your application, you can use the `DataVault` class for on-device persistent storage of certificates, database encryption keys, passwords, and other sensitive items. Use this class to:

- Create a vault
- Set a vault's properties
- Store objects in a vault
- Retrieve objects from a vault
- Change the password used to access a vault

The contents of the data vault are strongly encrypted using AES-256. The `DataVault` class allows you create a named vault, and specify a password and salt used to unlock it. The password can be of arbitrary length and can include any characters. The password and salt together generate the AES key. If the user enters the same password when unlocking, the contents are decrypted. If the user enters an incorrect password, exceptions occur. If the user enters an incorrect password a configurable number of times, the vault is deleted and any data stored within it becomes unrecoverable. The vault can also relock itself after a configurable amount of time.

Typical usage of the `DataVault` is to implement an application login screen. Upon application start, the user is prompted for a password, which unlocks the vault. If the unlock attempt is successful, the user is allowed into the rest of the application. User credentials for synchronization can also be extracted from the vault so the user need not reenter passwords.

CreateVault

Creates a new secure store (a vault).

A unique name is assigned, and after creation, the vault is referenced and accessed by that name. This method also assigns a password and salt value to the vault. If a vault with the same name already exists, this method throws an exception. A newly created vault is in the unlocked state.

Syntax

```
public static DataVault CreateVault(
   string sDataVaultID,
   string sPassword,
   string sSalt
)
```

Parameters

- **sDataVaultID –** an arbitrary name for a `DataVault` instance on this device. This name is effectively the primary key for looking up `DataVault` instances on the device, so it cannot use the same name as any existing instance. If it does, this method throws an exception with error code INVALID_ARG. The name also cannot be empty or null.
- **sPassword –** the initial encryption password for this DataVault. This is the password needed for unlocking the vault. If null is passed, a default password is computed and used.
- **sSalt –** the encryption salt value for this DataVault. This value, combined with the password, creates the actual encryption key that protects the data in the vault. If null is passed, a default salt is computed and used.

Returns

Returns the newly created instance of the DataVault with the provided ID. The returned DataVault is in the unlocked state with default configuration values. To change the default configuration values, you can immediately call the "set" methods for the values you want to change.

If a vault already exists with the same name, a `DataVaultException` is thrown with the reason `ALREADY_EXISTS`.

Examples

- **Create a data vault –** creates a new data vault called `myVault`.

```
DataVault vault = null;
if (!DataVault.VaultExists("myVault"))
{
   vault = DataVault.CreateVault("myVault", "password", "salt");
}
else
{
   vault = DataVault.GetVault("myVault");
}
```

VaultExists

Tests whether the specified vault exists.

Syntax

```
public static bool VaultExists(string sDataVaultID)
```

Parameters

- **sDataVaultID –** the vault name.

Returns

Returns true if the vault exists; otherwise returns false.

Examples

- **Check if a data vault exists –** checks if a data vault called `myVault` exists, and if so, deletes it.

```
if (DataVault.VaultExists("myVault"))
{
   DataVault.DeleteVault("myVault");
}
```

GetVault

Retrieves a vault.

Syntax

```
public static DataVault GetVault(string sDataVaultID)
```

Parameters

- **sDataVaultID –** the vault name.

Returns

GetVault returns a `DataVault` instance.

If the vault does not exist, a `DataVaultException` is thrown.

DeleteVault

Deletes the specified vault from on-device storage.

If the vault does not exist, this method throws an exception. The vault need not be in the unlocked state, and can be deleted even if the password is unknown.

Syntax

```
public static void DeleteVault(string sDataVaultID)
```

Parameters

- **sDataVaultID –** the vault name.

Examples

- **Delete a data vault –** deletes a data vault called `myVault`.

```
if (DataVault.VaultExists("myVault"))
{
   DataVault.DeleteVault("myVault");
}
```

GetDataNames

Retrieves information about the data names stored in the vault.

The application can pass the data names to `GetValue` or `GetString` to retrieve the data values.

Syntax

```
public byte[] GetValue(string sName)
```

Parameters

None.

Returns

Returns a `DVPasswordPolicy` object, as an array of `DVDataName` structure objects.

Examples

- **Get data names**

```
// Call getDataNames to retrieve all stored element names from our
data vault.
DataVault.DVDataName[] dataNameArray = oDataVault.GetDataNames();
for ( int i = 0; i < dataNameArray.GetLength( 0 ); i++ )
{
 if ( dataNameArray[ i ].type == DataVault.DVDataType.String )
  {
    String thisStringValue =
oDataVault.GetString( dataNameArray[ i ].name );
  }
  else if ( dataNameArray[ i ].type ==
DataVault.DVDataType.Binary )
  {
    byte[] thisBinaryValue =
oDataVault.GetValue( dataNameArray[ i ].name );
  }
}
```

SetPasswordPolicy

Stores the password policy and applies it when `ChangePassword` is called, or when validating the password in the `Unlock` method.

If the application has not set a password policy using this method, the data vault does not validate the password in the `CreateVault` or `ChangePassword` methods. An exception is thrown if there is any invalid (negative) value in the `passwordPolicy` object.

Syntax

```
public void SetPasswordPolicy(DataVault.PasswordPolicy oPolicy)
```

Parameters

- **oPolicy –** the password policy constraints.

Examples

- **Set a password policy**

```
// SetPasswordPolicy() will always lock the vault to ensure the
old password
// conforms to the new password policy settings.
oDataVault.SetPasswordPolicy( oPasswordPolicy );
```

Password Policy Structure

A structure defines the policy used to generate the password.

Table 1. Password Policy Structure

Name	Type	Description
defaultPasswordAllowed	Boolean	Indicates if client application is allowed to use default password for the data Vault. If this is set to TRUE and if client application uses default password then minLength, hasDigits, hasUpper, hasLower and hasSpecial parameters in the policy are ignored.
minimumLength	Integer	The minimum length of the password.
hasDigits	Boolean	Indicates if the password must contain digits.

Name	Type	Description
hasUpper	Boolean	Indicates if the password must contain uppercase characters.
hasLower	Boolean	Indicates if the password must contain lowercase characters.
hasSpecial	Boolean	Indicates if the password must contain special characters. The set of special characters is: “~!@#$%^&*()-+”.
expirationDays	Integer	Specifies password expiry days from the date of setting the password. 0 indicates no expiry.
minUniqueChars	Integer	The minimum number of unique characters in the password. For example, if length is 5 and minUniqueChars is 4 then “aaate” or “ababa” would be invalid passwords. Instead, “aaord” would be a valid password.
lockTimeout	Integer	The timeout value (in seconds) after which the vault will be locked from the unlock time. 0 indicates no timeout. This value overrides the value set by `setLockTimeout` method.
retryLimit	Integer	The number of failed unlock attempts after which data vault is deleted. 0 indicates no retry limit. This value overrides the value set by the `setRetryLimit` method.

Settings for Password Policy

The client applications uses these settings to fill the PasswordPolicy structure. The default values are used by the data vault when no policy is configured. The defaults are also used in Sybase Control Center in the default template. The Sybase Unwired Platform administrator can modify these settings through Sybase Control Center. The application must set the password policy for the data vault with the administrative (or alternative) settings.

Note: Setting the password policy locks the vault. The password policy is enforced when `unlock` is called (because the password is not saved, calling `unlock` is the only time that the policy can be evaluated).

- **PROP_DEF_PWDPOLICY_ENABLED –** Boolean property with a default value of false. Indicates if a password policy is enabled by the administrator.
- **PROP_DEF_PWDPOLICY_DEFAULT_PASSWORD_ALLOWED –** Boolean property with a default value of false. Indicates if the client application is allowed to use the default password for the data vault.
- **PROP_DEF_PWDPOLICY_MIN_LENGTH –** Integer property with a default value of 0. Defines the minimum length for the password.
- **PROP_DEF_PWDPOLICY_HAS_DIGITS –** Boolean property with a default value of false. Indicates if the password must contain digits.
- **PROP_DEF_PWDPOLICY_HAS_UPPER –** Boolean property with a default value of false. Indicates if the password must contain at least one uppercase character.
- **PROP_DEF_PWDPOLICY_HAS_LOWER –** Boolean property with a default value of false. Indicates if the password must contain at least one lowercase character.
- **PROP_DEF_PWDPOLICY_HAS_SPECIAL –** Boolean property with a default value of false. Indicates if the password must contain at least one special character. A special character is a character in this set “~!@#$%^&*()-+”.
- **PROP_DEF_PWDPOLICY_EXPIRATION_DAYS –** Integer property with a default value of 0. Specifies the number of days in which password will expire from the date of setting the password. Password expiration is checked only when the vault is unlocked.
- **PROP_DEF_PWDPOLICY_MIN_UNIQUE_CHARS –** Integer property with a default value of 0. Specifies minimum number of unique characters in the password. For example, if minimum length is 5 and minUniqueChars is 4 then “aaate” or “ababa” would be invalid passwords. Instead, “aaord” would be a valid password.
- **PROP_DEF_PWDPOLICY_LOCK_TIMEOUT –** Integer property with a default value of 0. Specifies timeout value (in seconds) after which the vault is locked from the unlock time. 0 indicates no timeout.
- **PROP_DEF_PWDPOLICY_RETRY_LIMIT –** Integer property with a default value of 0. Specifies the number of failed unlock attempts after which data vault is deleted. 0 indicates no retry limit.

Password Errors

Password policy violations cause exceptions to be thrown.

Table 2. Password Errors

Name	Value	Description
PASSWORD_REQUIRED	50	Indicates that a blank or null password was used when the password policy does not allow default password.
PASSWORD_UNDER_MIN_LENGTH	51	Indicates that the password length is less than the required minimum.
PASSWORD_REQUIRES_DIGIT	52	Indicates that the password does not contain digits.
PASSWORD_REQUIRES_UPPER	53	Indicates that the password does not contain upper case characters.
PASSWORD_REQUIRES_LOWER	54	Indicates that the password does not contain lower case characters.
PASSWORD_REQUIRES_SPECIAL	55	Indicates that the password does not contain one of these special characters: ~!@#$%^&*()-+.
PASSWORD_UNDER_MIN_UNIQUE	56	Indicates that the password contains fewer than the minimum required number of unique characters.
PASSWORD_EXPIRED	57	Indicates that the password has been in use longer than the number of configured expiration days.

GetPasswordPolicy

Retrieves the password policy set by `SetPasswordPolicy`.

Use this method once the DataVault is unlocked.

Syntax

```
public DataVault.PasswordPolicy GetPasswordPolicy()
```

Parameters
None.

Returns

Returns a `PasswordPolicy` structure that contains the policy set by `SetPasswordPolicy`.

Returns a `DVPasswordPolicy` object with the default values if no password policy is set.

Examples

- **Get the current password policy**

```
// Call getPasswordPolicy() to return the current password policy
settings.
         DataVault.PasswordPolicy oCurrentPolicy =
oDataVault.GetPasswordPolicy();
```

IsDefaultPasswordUsed
Checks whether the default password is used by the vault.

Use this method once the DataVault is unlocked.

Syntax

```
public bool IsDefaultPasswordUsed()
```

Returns

Returns	Indicates
true	Both the default password and the default salt are used to encrypt the vault.
false	Either the default password or the default salt are not used to encrypt the vault.

Examples

- **Check if default password used**

```
// Call isDefaultPasswordused() to see if we are using an
automatically
// generated password (which we are).
bool isDefaultPasswordUsed = oDataVault.IsDefaultPasswordUsed();
```

This code example lacks exception handling. For a code example that includes exception handling, see *Developer Guide: Windows and Windows Mobile Object API Applications> Client Object API Usage > Security APIs > DataVault > Code Sample*.

Lock
Locks the vault.

Once a vault is locked, you must unlock it before changing the vault's properties or storing anything in it. If the vault is already locked, `lock` has no effect.

Syntax
```
public void Lock()
```

Examples

- **Locks the data vault –** prevents changing the vaults properties or stored content.
  ```
  vault.Lock();
  ```

IsLocked
Checks whether the vault is locked.

Syntax
```
public bool IsLocked()
```

Returns

Returns	Indicates
true	The vault is locked.
false	The vault is unlocked.

Unlock
Unlocks the vault.

Unlock the vault before changing the its properties or storing anything in it. If the incorrect password or salt is used, this method throws an exception. If the number of unsuccessful attempts exceeds the retry limit, the vault is deleted.

The password is validated against the password policy if it has been set using `SetPasswordPolicy`. If the password is not compatible with the password policy, an `IncompatiblePassword` exception is thrown. In that case, call `ChangePassword` to set a new password that is compatible with the password policy.

Syntax
```
public void Unlock(string sPassword, string sSalt)
```

Parameters

- **sPassword –** the encryption password for this DataVault. If null is passed, a default password is computed and used.
- **sSalt –** the encryption salt value for this DataVault. This value, combined with the password, creates the actual encryption key that protects the data in the vault. This value may be an application-specific constant. If null is passed, a default salt is computed and used.

Returns

If an incorrect password or salt is used, a `DataVaultException` is thrown with the reason `INVALID_PASSWORD`.

Examples

- **Unlocks the data vault –** once the vault is unlocked, you can change its properties and stored content.

```
if (vault.IsLocked())
{
   vault.Unlock("password", "salt");
}
```

SetString

Stores a string object in the vault.

An exception is thrown if the vault is locked when this method is called.

Syntax

```
public void SetString(
   string sName,
   string sValue
)
```

Parameters

- **sName –** the name associated with the string object to be stored.
- **sValue –** the string object to store in the vault.

Examples

- **Set a string value –** creates a test string, unlocks the vault, and sets a string value associated with the name `"testString"` in the vault. The `finally` clause in the `try/catch` block ensures that the vault ends in a secure state even if an exception occurs.

```
string teststring = "ABCDEFabcdef";
try
```

```
{
   vault.Unlock("password", "salt");
   vault.SetString("testString", teststring);
}
catch (DataVaultException e)
{
   Console.WriteLine("Exception: " + e.ToString());
}
finally
{
   vault.Lock();
}
```

GetString

Retrieves a string value from the vault.

An exception is thrown if the vault is locked when this method is called.

Syntax

```
public string GetString(string sName)
```

Parameters

- **sName –** the name associated with the string object to be retrieved.

Returns

Returns a string data value, associated with the specified name, from the vault.

Examples

- **Get a string value –** unlocks the vault and retrieves a string value associated with the name `"testString"` in the vault. The `finally` clause in the `try/catch` block ensures that the vault ends in a secure state even if an exception occurs.

```
try
{
   vault.Unlock("password", "salt");
   String retrievedstring = vault.GetString("testString");
}
catch (DataVaultException e)
{
   Console.WriteLine("Exception: " + e.ToString());
}
finally
{
   vault.Lock();
}
```

SetValue

Stores a binary object in the vault.

An exception is thrown if the vault is locked when this method is called.

Syntax

```
public void SetValue(
   string sName,
   byte[] baValue
)
```

Parameters

- **sName –** the name associated with the binary object to be stored.
- **baValue –** the binary object to store in the vault.

Examples

- **Set a binary value –** unlocks the vault and stores a binary value associated with the name `"testValue"` in the vault. The `finally` clause in the `try/catch` block ensures that the vault ends in a secure state even if an exception occurs.

```
try
{
   vault.Unlock("password", "salt");
   vault.SetValue("testValue", new byte[] { 1, 2, 3, 4, 5});
}
catch (DataVaultException e)
{
   Console.WriteLine("Exception: " + e.ToString());
}
finally
{
   vault.Lock();
}
```

GetValue

Retrieves a binary object from the vault.

An exception is thrown if the vault is locked when this method is called.

Syntax

```
public byte[] GetValue(string sName)
```

Parameters

- **sName –** the name associated with the binary object to be retrieved.

Returns

Returns a binary data value, associated with the specified name, from the vault.

Examples

- **Get a binary value –** unlocks the vault and retrieves a binary value associated with the name `"testValue"` in the vault. The `finally` clause in the `try/catch` block ensures that the vault ends in a secure state even if an exception occurs.

```
try
{
   vault.Unlock("password", "salt");
   byte[] retrievedvalue = vault.GetValue("testValue");
}
catch (DataVaultException e)
{
   Console.WriteLine("Exception: " + e.ToString());
}
finally
{
   vault.Lock();
}
```

DeleteValue

Deletes the specified value.

Syntax

```
public static void DeleteValue(string sName)
```

Parameters

- **sName –** the name of the value to be deleted.

Examples

- **Delete a value –** deletes a value called `myValue`.

```
DataVault.DeleteValue("myValue");
```

ChangePassword (two parameters)

Changes the password for the vault. Use this method when the vault is unlocked.

Modifies all name/value pairs in the vault to be encrypted with a new password/salt. If the vault is locked or the new password is empty, an exception is thrown.

Syntax

```
public void ChangePassword(
   string sPassword,
```

```
   string sSalt
)
```

Parameters

- **sPassword –** the new password.
- **sSalt –** the new encryption salt value.

Examples

- **Change the password for a data vault –** changes the password to "`newPassword`". The `finally` clause in the `try/catch` block ensures that the vault ends in a secure state even if an exception occurs.

```
try
{
   vault.Unlock("password", "salt");
   vault.ChangePassword("newPassword", "newSalt");
}
catch (DataVaultException e)
{
   Console.WriteLine("Exception: " + e.ToString());
}
finally
{
   vault.Lock();
}
```

ChangePassword (four parameters)

Changes the password for the vault. Use this method when the vault is locked

This overloaded method ensures the new password is compatible with the password policy, uses the current password to unlock the vault, and changes the password of the vault to a new password. If the current password is not valid an `InvalidPassword` exception is thrown. If the new password is not compatible with the password policy set in `setPasswordPolicy` then an `IncompatiblePassword` exception is thrown.

Syntax

```
public void ChangePassword(
    string sOldPassword,
    string sOldSalt,
    string sNewPassword,
    string sNewSalt
)
```

Parameters

- **sOldPassword –** the current encryption password for this data vault. If a null value is passed, a default password is computed and used.

- **sOldSalt –** the current encryption salt value for this data vault. If a null value is passed, a default password is computed and used.
- **sNewPassword –** the new encryption password for this data vault. If a null value is passed, a default password is computed and used.
- **sNewSalt –** the new encryption salt value for this data vault. This value, combined with the password, creates the actual encryption key that protects the data in the vault. This value may be an application-specific constant. If a null value is passed, a default password is computed and used.

Examples

- **Change the password for a data vault**

```
// Call changePassword with four parameters, even if the vault is
locked.
// Pass null for oldSalt and oldPassword if the defaults were
used.
oDataVault.ChangePassword( null, null, "password!1A",
"saltD#ddg#k05%gnd[!1A" );
```

Code Sample

Create a data vault for encrypted storage of application data.

```
 public void DataVaultSampleCode()
   {
      try
      {
         DataVault oDataVault = null;

        // If this dataVault already exists, then get it by calling
getVault()
         // Else create this new dataVault by calling createVault()
         if ( DataVault.VaultExists( "DataVaultExample" ) )
            oDataVault = DataVault.GetVault( "DataVaultExample" );
         else
            oDataVault = DataVault.CreateVault( "DataVaultExample",
"password!1A", "saltD#ddg#k05%gnd[!1A" );

        // Call setLockTimeout(). This allows you to set the timeout
of the vault in seconds
         oDataVault.SetLockTimeout( 1500 );
         int iTimeout = oDataVault.GetLockTimeout();

       // Call setRetryLimit(). This allows you to set the number of
retries before the vault is destroyed
         oDataVault.SetRetryLimit( 10 );
         int iRetryLimit = oDataVault.GetRetryLimit();

       // Call setPasswordPolicy(). The passwordPolicy also includes
the retryLimit and LockTimeout that we set above.
         DataVault.PasswordPolicy oPasswordPolicy = new
DataVault.PasswordPolicy();
         oPasswordPolicy.defaultPasswordAllowed = true;
```

```
         oPasswordPolicy.minimumLength = 4;
         oPasswordPolicy.hasDigits = true;
         oPasswordPolicy.hasUpper = true;
         oPasswordPolicy.hasLower = true;
         oPasswordPolicy.hasSpecial = true;
         oPasswordPolicy.expirationDays = 20;
         oPasswordPolicy.minUniqueChars = 3;
         oPasswordPolicy.lockTimeout = 1600;
         oPasswordPolicy.retryLimit = 20;

        // SetPasswordPolicy() will always lock the vault to ensure
the old password
         // conforms to the new password policy settings.
         oDataVault.SetPasswordPolicy( oPasswordPolicy );

        // We are now locked and need to unlock before we can access
the vault.
        oDataVault.Unlock( "password!1A", "saltD#ddg#k05%gnd[!1A" );

         // Call getPasswordPolicy() to return the current password
policy settings.
         DataVault.PasswordPolicy oCurrentPolicy =
oDataVault.GetPasswordPolicy();

       // Call setString() by giving it a name:value pair to encrypt
and persist
         // a string data type within your dataVault.
         oDataVault.SetString( "stringName", "stringValue" );

       // Call getString to retrieve the string we just stored in our
data vault!
         String storedStringValue =
oDataVault.GetString( "stringName" );

        // Call setValue() by giving it a name:value pair to encrypt
and persist
         // a binary data type within your dataVault.
         byte[] binaryValue = { 1, 2, 3, 4, 5, 6, 7 };
         oDataVault.SetValue( "binaryName", binaryValue );

       // Call getValue to retrieve the binary we just stored in our
data vault!
         byte[] storedBinaryValue =
oDataVault.GetValue( "binaryName" );

         // Call getDataNames to retrieve all stored element names
from our data vault.
         DataVault.DVDataName[] dataNameArray =
oDataVault.GetDataNames();
         for ( int i = 0; i < dataNameArray.GetLength( 0 ); i++ )
         {
            if ( dataNameArray[ i ].type ==
DataVault.DVDataType.String )
            {
               String thisStringValue =
oDataVault.GetString( dataNameArray[ i ].name );
```

```
            }
            else if ( dataNameArray[ i ].type ==
DataVault.DVDataType.Binary )
            {
               byte[] thisBinaryValue =
oDataVault.GetValue( dataNameArray[ i ].name );
            }
         }

         // Call changePassword with 2 parameters. Vault must be
unlocked.
        // If you pass null parameters as your new password or your
new salt,
         // it will generate a default password or default salt,
respectively.
         oDataVault.ChangePassword( null, null );

         // Call isDefaultPasswordused() to see if we are using an
automatically
         // generated password (which we are).
         bool isDefaultPasswordUsed =
oDataVault.IsDefaultPasswordUsed();

         // Lock the vault.
         oDataVault.Lock();

       // Call changePassword with 4 parameters even if the vault is
locked.
         // Here, we pass null for oldSalt and oldPassword because
defaults were used.
         oDataVault.ChangePassword( null, null, "password!1A",
"saltD#ddg#k05%gnd[!1A" );

         // Call isDefaultPasswordused() and we will see that the
default password is NOT used anymore.
         isDefaultPasswordUsed = oDataVault.IsDefaultPasswordUsed();
      }
      catch ( DataVaultException dvex )
      {
         // Handle datavault exception.
      }
      catch ( Exception ex )
      {
         // Handle exception.
      }
      finally
      {
        // Because this is a test example, we will delete our vault at
the end.
        // This means we will forever lose all data we persisted in
our data vault.
         if ( DataVault.VaultExists( "DataVaultExample" ) )
            DataVault.DeleteVault( "DataVaultExample" );
    }
  }
```

Callback and Listener APIs

The callback and listener APIs allow you to optionally register a callback handler and listen for device events, application connection events, and package synchronize and replay events.

ICallbackHandler API

The ICallbackHandler interface is invoked when any database event occurs. A default callback handler is provided, which basically does nothing. You should implement a custom `CallbackHandler` to register important events. The callback is invoked on the thread that is processing the event. To receive callbacks for database changes, you must register a `CallBackHandler` with the generated database class, the entity class, or both. You can create a handler by extending the `DefaultCallbackHandler` class or by implementing the `Sybase.Persistence.ICallbackHandler` interface.

To allow the CallbackHandler to be called, you must use asynchronous synchronization, for example by calling `BeginSynchronize()` instead of `Synchronize()`.

In your handler, override the particular callback that you are interested in (for example, `void OnReplayFailure(Object entity)`). The callback is executed in the thread that is performing the action (for example, replay). When you receive the callback, the particular activity is already complete.

Table 3. Callbacks in the `ICallbackHandler` Interface

Callback	Description
`void OnImport(Object entity)`	This method is invoked when an import message is successfully applied to the local database. However, it is not committed. One message from server may have multiple import entities and they would be committed in one transaction for the whole message. **Note:** 1. Stale data may be read from the database at this time before commit of the whole message. Developers are encouraged to wait until the next `OnTransactionCommit()` is invoked, then to read from the database to obtain the updated data. 2. Both CallbackHandlers registered for the MBO class of the entity and Package DB will be invoked. **Parameters**: • **entity** – the Mobile Business Object that was just imported.
`void OnLoginFailure()`	This method will be invoked when login failed for a `beginOnlineLogin` call. **Note:** Only the `CallbackHandler` registered for package DB will be invoked.
`void OnLoginSuccess()`	This method is invoked when login succeeds for a `beginOnlineLogin` call. **Note:** Only the CallbackHandler registered for package DB is invoked.

Callback	Description
`void OnReplayFailure(Object entity)`	This method is invoked when a replay request fails. **Note:** CallbackHandlers registered for both the MBO class of the entity and the Package DB are invoked. **Parameters**: • **entity** – the Mobile Business Object to replay.
`void OnReplaySuccess(Object entity)`	This method is invoked when a replay request succeeds. `OnReplaySuccess` is an MBO object instance that contains the data prior to the synchronization. You can use the Change Log API to find records that occur after the synchronization. **Note:** CallbackHandlers registered for both the MBO class of the entity and the Package DB are invoked. **Parameters**: • **entity** – the Mobile Business Object to replay.
`void OnSearchFailure(Object entity)`	This method is invoked when a back-end search fails. **Note:** CallbackHandlers registered for both the MBO class of the entity and the Package DB are invoked. **Parameters**: • **entity** – the back-end search object.
`void OnSearchSuccess(Object entity)`	This method is invoked when a back end search succeeds. **Note:** CallbackHandlers registered for both the MBO class of the entity and the Package DB are invoked. **Parameters**: • **entity** – the back-end search object.

Callback	Description
`void OnSubscribeFailure()`	This method is invoked when subscribe fails. **Note:** CallbackHandlers registered for both the MBO class of the entity and the Package DB are invoked.
`void OnSubscribeSuccess()`	This method is invoked when subscribe succeeds. **Note:** Only the CallbackHandler registered for the Package DB is invoked.
`SynchronizationAction On-Synchronize( Generic-List<IsynchronizationGroup> groups, SynchronizationCon-text context)`	This method is invoked at different stages of the synchronization. This method is called by the database class `Synchronize` or `Begin-Synchronize` methods when the client initiates a synchronization, and is called again when the server responds to the client that synchronization has finished, or that synchronization failed. The status of the synchronization context, `con-text.Status`, specifies the stage of the synchronization. **Parameters**: • **groups** – a list of synchronization groups. • **context** – the synchronization context. **Returns**: Either `SynchronizationAc-tion.CONTINUE` or `Synchroniza-tion.CANCEL`. If `SynchronizatioonAction.CANCEL` is returned, the synchronize is cancelled if the status of the synchronization context is one of the following. • `SynchronizationSta-tus.STARTING` • `SynchronizationSta-tus.ASYNC_REPLAY_COMPLETED` • `SynchronizationSta-tus.STARTING_ON_NOTIFICA-TION` The return value has no effect if the status is not in the above list.

Callback	Description
`void OnSuspendSubscription-Failure()`	This method is invoked when suspend subscription fails. **Note:** Only the CallbackHandler registered for the Package DB is invoked.
`void OnSuspendSubscription-Success()`	This method is invoked when suspend subscription succeeds. **Note:** Only the CallbackHandler registered for the Package DB is invoked.
`void OnResumeSubscriptionFailure()`	This method is invoked when resume subscription fails. **Note:** Only the CallbackHandler registered for the Package DB is invoked.
`void OnResumeSubscriptionSuccess()`	This method is invoked when resume subscription succeeds. **Note:** Only the CallbackHandler registered for the Package DB is invoked.
`void OnUnsubscribeFailure()`	This method is invoked when unsubscribe fails. **Note:** Only the CallbackHandler registered for the Package DB is invoked.
`void OnUnsubscribeSuccess()`	This method is invoked when unsubscribe succeeds. **Note:** Only the CallbackHandler registered for the Package DB is invoked.

Callback	Description
`void OnMessageException(Exception ex)`	This method is invoked when an exception occurs in the processing of a message. **Note:** In DefaultCallbackHandlers, `onMessageException` re-throws the Exception so that the messaging layer can retry the message. The application developer has the option to implement a custom CallbackHandler that does not re-throw the exception, based on exception types or other conditions, so that the message is not retried. **Parameters**: • **ex** – the exception thrown when processing a message.
`void OnTransactionCommit()`	This method is invoked after a message is processed and committed. **Note:** Only the CallbackHandler registered for the Package DB is invoked.
`void OnTransactionRollback()`	This method is invoked after a message is rolled back. It only happens when an Exception was thrown when processing the message, or from a custom Callback method. **Note:** Only the CallbackHandler registered for the Package DB is invoked.
`void OnResetSuccess()`	This method is invoked when all data is cleared by the reset. **Note:** Only the CallbackHandler registered for the Package DB is invoked.
`void OnRecoverSuccess()`	This method is invoked when recover succeeds. **Note:** Only the CallbackHandler registered for the Package DB is invoked.
`void OnRecoverFailure()`	This method is invoked when recover fails. **Note:** Only the CallbackHandler registered for the Package DB is invoked.

Callback	Description
`void OnSubscriptionEnd()`	This method is invoked when a subscription is re-registered or unsubscribed. This method deletes all MBO data on the device. **Note:** Only the CallbackHandler registered for the Package DB is invoked.
`void OnImportSuccess()`	This method is invoked when all data has been successfully imported. **Note:** Only the CallbackHandler registered for the Package DB is invoked.
`void BeforeImport(Object entity)`	This method is invoked before importing the specified entity. **Note:** Only the CallbackHandler registered for the Package DB is invoked. **Parameters**: • **entity** – the Mobile Business Object to be imported.

This code shows how to create and register a handler to receive callbacks:

```
public class MyCallbackHandler : DefaultCallbackHandler
{
    // implementation
}

MyCallbackHandler handler = new MyCallbackHandler();
MyPackageDB.RegisterCallbackHandler(handler);
```

IApplicationCallback API

This callback interface is invoked by events of interest to a mobile application.

You must register an `IApplicationCallback` implementation to your Sybase.Mobile.Application instance to receive these callbacks.

Table 4. Callbacks in the `IApplicationCallback` Interface

Callback	Description
`void OnApplicationSettingsChanged(Sybase.Collections.StringList names)`	Invoked when one or more application settings have been changed by the server administration.

Callback	Description
`void OnConnectionStatusChanged(int connectionStatus, int errorCode, string errorMessage)`	Invoked when the connection status changes. The possible connection status values are defined in the `ConnectionStatus` class. **Note:** Some of the connection status codes are not returned on certain client platforms due to platform operating system limitations.
`void OnDeviceConditionChanged(int deviceCondition)`	Invoked when a condition is detected on the mobile device that may be of interest to the application or the application user. The possible device condition values are defined in the `DeviceCondition` class.
`void OnRegistrationStatusChanged(int registrationStatus, int errorCode, string errorMessage)`	Invoked when the registration status changes. The possible registration status values are defined in the `RegistrationStatus` class.
`void OnHttpCommunicationError(int errorCode, string errorMessage, Sybase.Collections.StringProperties responseHeaders);`	Invoked when an HTTP communication server rejects HTTP communication with an error code. • **errorCode –** Error code returned by the HTTP server. For example: code 401 for authentication failure, code 403 for authorization failure. • **errorMessage –** Error message returned by the HTTP server. • **responseHeaders –** Response headers returned by the HTTP server.

Callback	Description

`void OnCustomizationBundleDownloadComplete(string customizationBundleID, int errorCode, string errorMessage);`	Invoked when the download of a resource bundle is complete.
	• **errorCode –** If download succeeds, returns 0. If download fails, returns an error code.
	• **errorMessage –** If download succeeds, returns "". If download fails, returns an error message.
	  • RESOURCE_BUNDLE_NOTFOUND = 20000
	  • DOWNLOAD_RESOURCE_BUNDLE_STREAM_IS_NULL = 20001
	  • DOWNLOAD_RESOURCE_BUNDLE_FAILURE = 20002
	• **customizationBundleID –** The name of the resource bundle. If null, the default application resource bundle is downloaded.

`int OnPushNotification (Hashtable notification);`	Invoked if a push notification arrives. You can add logic here to handle the notification. This callback is not called when a notification arrives when the application is not online. An integer to indicate if the notification has been handled.
	• **int –** An integer to indicate if the notification has been handled. The return value is for future use. You are recommended to return NOTIFICATION_CONTINUE.
	  • 0: NOTIFICATION_CONTINUE if the notification was not handled by the callback method.
	  • 1: NOTIFICATION_CANCEL if the notification has already been handled by the callback method.

SyncStatusListener API

You can implement a synchronization status listener to track synchronization progress.

Note: This topic is not applicable for DOE-based applications.

Create a listener that implements the `SyncStatusListener` interface.

```
public interface SyncStatusListener
{
    bool ObjectSyncStatus(ObjectSyncStatusData statusData);
}

public class MySyncListener : SyncStatusListener
{
// implementation
}
```

Pass an instance of the listener to the synchronize methods.

```
MySyncListener listener = new MySyncListener();
SUP101DB.synchronize("sync_group", listener);
// or SUP101DB.synchronize(listener); if we want to synchronize all
// synchronization groups
```

As the application synchronization progresses, the `ObjectSyncStatus` method defined by the `SyncStatusListener` interface is called and is passed an `ObjectSyncStatusData` object. The `ObjectSyncStatusData` object contains information about the MBO being synchronized, the connection to which it is related, and the current state of the synchronization process. By testing the `State` property of the `ObjectSyncStatusData` object and comparing it to the possible values in the `SyncStatusState` enumeration, the application can react accordingly to the state of the synchronization.

The method returns `false` to allow synchronization to continue. If the method returns true, the synchronization is aborted.

Possible uses of `ObjectSyncStatus` method include changing form elements on the client screen to show synchronization progress, such as a green image when the synchronization is in progress, a red image if the synchronization fails, and a gray image when the synchronization has completed successfully and disconnected from the server.

Note: The `ObjectSyncStatus` method of `SyncStatusListener` is called and executed in the data synchronization thread. If a client runs synchronizations in a thread other than the primary user interface thread, the client cannot update its screen as the status changes. The client must instruct the primary user interface thread to update the screen regarding the current synchronization status.

This is an example of `SyncStatusListener` implementation:

```
public class SyncListener : SyncStatusListener
{
  public bool ObjectSyncStatus(ObjectSyncStatusData data)
  {
    switch (data.SyncStatusState) {
    case SyncStatusState.ApplicationSyncDone:
      //implement your own UI indicator bar
      break;
    case SyncStatusState.ApplicationSyncError:
      //implement your own UI indicator bar
```

```
      break;
    case SyncStatusState.SyncDone:
      //implement your own UI indicator bar
      break;
    case SyncStatusState.SyncStarting:
      //implement your own UI indicator bar
      break;
    ...
    }
    return false;
  }
}
```

Query APIs

The Query API allows you to retrieve data from mobile business objects, to page data, and to retrieve a query result by filtering. You can also use the Query API to filter children MBOs of a parent MBO in a one to many relationship.

Retrieving Data from Mobile Business Objects

You can retrieve data from mobile business objects through a variety of queries, including object queries, arbitrary find, and through filtering query result sets.

Object Queries

To retrieve data from a local database, use one of the static Object Query methods in the `MBO` class.

Object Query methods are generated based on the object queries defined by the modeler in Sybase Unwired WorkSpace. Object Query methods carry query names, parameters, and return types defined in Sybase Unwired WorkSpace. Object Query methods return either an object, or a collection of objects that match the specified search criteria.

The following examples demonstrate how to use the Object Query methods of the Customer MBO to retrieve data.

This method retrieves all customers:

```
public static Sybase.Collections.GenericList<Customer> FindAll()

Sybase.Collections.GenericList<Customer> customers =
Customer.FindAll();
```

This method retrieves all customers in a certain page:

```
public static Sybase.Collections.GenericList<Customer> FindAll(int
skip, int take)

Sybase.Collections.GenericList<Customer> customers =
Customer.FindAll(10, 5);
```

Suppose the modeler defined the following Object Query for the Customer MBO in Sybase Unwired WorkSpace:

- **name –** FindByFirstName
- **parameter –** String firstName
- **query definition –** SELECT x.* FROM Customer x WHERE x.fname = :firstName
- **return type –** Sybase.Collections.GenericList

```
public static Sybase.Collections.GenericList<Customer>
FindByFirstName(string firstName)

Sybase.Collections.GenericList<Customer> customers =
Customer.FindByFirstName("fname");
```

Query and Related Classes

The following classes define arbitrary search methods and filter conditions, and provide methods for combining test criteria and dynamically querying result sets.

Table 5. Query and Related Classes

Class	Description
Query	Defines arbitrary search methods and can be composed of search conditions, object/row state filter conditions, and data ordering information.
AttributeTest	Defines filter conditions for MBO attributes.
CompositeTest	Contains a method to combine test criteria using the logical operators AND, OR, and NOT to create a compound filter.
QueryResultSet	Provides for querying a result set for the dynamic query API.
SelectItem	Defines the entry of a select query. For example, "select x.attr1 from MBO x", where "X.attr1" represents one SelectItem.
Column	Used in a subquery to reference the outer query's attribute.

In addition queries support **select**, **where**, and **join** statements.

Arbitrary Find

The arbitrary find method lets custom device applications dynamically build queries based on user input. The `Query.DISTINCT` property lets you exclude duplicate entries from the result set.

The arbitrary find method also lets the user specify a desired ordering of the results and object state criteria. A `Query` class is included in the client object API. The `Query` class is the single

object passed to the arbitrary search methods and consists of search conditions, object/row state filter conditions, and data ordering information.

Define these conditions by setting properties in a query:

- **TestCriteria –** criteria used to filter returned data.
- **SortCriteria –** criteria used to order returned data.
- **Skip –** an integer specifying how many rows to skip. Used for paging.
- **Take –** an integer specifying the maximum number of rows to return. Used for paging.

Set the `Query.Distinct` property to `true` to exclude duplicate entries from the result set. The default value is `false` for entity types, and its usage is optional for all other types.

```
Query query1 = new Query();
query1.Distinct = true;
```

`TestCriteria` can be an `AttributeTest` or a `CompositeTest`.

TestCriteria

You can construct a query SQL statement to query data from a local database. You can create a `TestCriteria` object (in this example, `AttributeTest`) to filter results. You can also query across multiple tables (MBOs) when using the `ExecuteQuery` API.

```
Query query2 = new Query();
query2.Select("c.fname,c.lname,s.order_date,s.region");
query2.From("Customer", "c");
//
// Convenience method for adding a join to the query
// Detailed construction of the join criteria
query2.Join("Sales_order", "s", "c.id", "s.cust_id");
AttributeTest ts = new AttributeTest();
ts.Attribute = ("fname");
ts.TestValue = "Beth";
query2.Where(ts);
QueryResultSet resultSet = SUP101DB.ExecuteQuery(query2);
```

AttributeTest

An `AttributeTest` defines a filter condition using an MBO attribute, and supports multiple conditions.

- IS_NULL
- NOT_NULL
- EQUAL
- NOT_EQUAL
- LIKE
- NOT_LIKE
- LESS_THAN
- LESS_EQUAL

- GREATER_THAN
- GREATER_EQUAL
- CONTAINS
- STARTS_WITH
- ENDS_WITH
- NOT_START_WITH
- NOT_END_WITH
- NOT_CONTAIN
- IN
- NOT_IN
- EXISTS
- NOT_EXISTS

For example, the C# .NET code shown below is equivalent to this SQL query:

```
SELECT * from A where id in [1,2,3]
```

```
Query query = new Query();
  AttributeTest test = new AttributeTest();
  test.Attribute = "id";
  Sybase.Collections.ObjectList v = new
Sybase.Collections.ObjectList();
    v.Add("1");
    v.Add("2");
    v.Add("3");

  test.Value = v;
  test.Operator = AttributeTest.IN;
  query.Where(test);
```

When using EXISTS and NOT_EXISTS, the attribute name is not required in the `AttributeTest`. The query can reference an attribute value via its alias in the outer scope. The C# .NET code shown below is equivalent to this SQL query:

```
SELECT a.id from AllType a where exists (select b.id from AllType b
where b.id = a.id)
```

```
Sybase.Persistence.Query query = new Sybase.Persistence.Query();
query.Select("a.id");
query.From("AllType", "a");
Sybase.Persistence.AttributeTest test = new
Sybase.Persistence.AttributeTest();
Sybase.Persistence.Query existQuery = new
Sybase.Persistence.Query();
existQuery.Select("b.id");
existQuery.From("AllType", "b");
Sybase.Persistence.Column cl = new Sybase.Persistence.Column();
cl.Alias = "a";
cl.Attribute = "id";
Sybase.Persistence.AttributeTest test1 = new
Sybase.Persistence.AttributeTest();
test1.Attribute = "b.id";
test1.Value = cl;
```

```
test1.Operator = Sybase.Persistence.AttributeTest.EQUAL;
existQuery.Where(test1);
test.Value = existQuery;
test.SetOperator(Sybase.Persistence.AttributeTest.EXISTS);
query.Where(test);
Sybase.Persistence.QueryResultSet qs = SUP101DB.ExecuteQuery(query);
```

SortCriteria

`SortCriteria` defines a `SortOrder`, which contains an attribute name and an order type (ASCENDING or DESCENDING).

For example,

```
Query query = new Query();

query.Select("c.lname, c.fname");
query.From("Customer", "c");

AttributeTest aTest = new AttributeTest();
aTest.Attribute = "state";
aTest.TestValue = "CA" ;
aTest.TestType = AttributeTest.EQUAL;
query.TestCriteria = aTest;

SortCriteria sort = new SortCriteria();
sort.Add("lname", SortOrderType.ASCENDING);
sort.Add("fname", SortOrderType.ASCENDING);
query.SortCriteria = sort;
```

Paging Data

On low-memory devices, retrieving up to 30,000 records from the database may cause the custom client to fail and throw an `OutOfMemoryException.`

Consider using the Query object to limit the result set:

```
Query props = new Query();
props.Skip =10;
props.Take = 5;

GenericList<Customer> customers = Customer.FindWithQuery(props);
```

Aggregate Functions

You can use aggregate functions in dynamic queries.

When using the `Query.Select(String)` method, you can use any of these aggregate functions:

Aggregate Function	Supported Datatypes
`COUNT`	integer
`MAX`	string, binary, char, byte, short, int, long, integer, decimal, float, double, date, time, dateTime

Aggregate Function	Supported Datatypes
MIN	string, binary, char, byte, short, int, long, integer, decimal, float, double, date, time, dateTime
SUM	byte, short, int, long, integer, decimal, float, double
AVG	byte, short, int, long, integer, decimal, float, double

If you use an unsupported type, a `PersistenceException` is thrown.

```
Query query1 = new Query();
query1.Select("MAX(c.id), MIN(c.name) as minName");
```

Grouping Results

Apply grouping criteria to your results.

To group your results according to specific attributes, use the `Query.GroupBy(String groupByItem)` method. For example, to group your results by ID and name, use:

```
String groupByItem = ("c.id, c.name");
Query query1 = new Query();

//other code for query1

query1.GroupBy(groupByItem);
```

Filtering Results

Specify test criteria for group queries.

You can specify how your results are filtered by using the `Query.having(com.sybase.persistence.TestCriteria)` method for queries using `GroupBy`. For example, limit your AllType MBO's results to `c.id` attribute values that are greater than or equal to 0 using:

```
Query query2 = new Query();
query2.Select("c.id, SUM(c.id)");
query2.From("AllType", "c");
ts = new AttributeTest();
ts.Attribute = "c.id";
ts.TestValue = "0";
ts.Operator = AttributeTest.GREATER_EQUAL;
query2.Where(ts);
query2.GroupBy("c.id");

ts2 = new AttributeTest();
ts2.Attribute = "c.id";
ts2.TestValue = "0";
ts2.Operator = AttributeTest.GREATER_EQUAL;
query2.Having(ts2);
```

Concatenating Queries

Concatenate two queries having the same selected items.

The `Query` class methods for concatenating queries are:

- `Union(Query)`
- `UnionAll(Query)`
- `Except(Query)`
- `Intersect(Query)`

This example obtains the results from one query except for those results appearing in a second query:

```
Query query1 = new Query();
... ... //other code for query1

Query query2 = new Query();
... ... //other code for query 2

Query query3 = query1.Except(query2);
SUP101DB.ExecuteQuery(query3);
```

Subqueries

Execute subqueries using clauses, selected items, and attribute test values.

You can execute subqueries using the `Query.From(Query query, String alias)` method. For example, the C# .NET code shown below is equivalent to this SQL query:

```
SELECT a.id FROM (SELECT b.id FROM AllType b) AS a WHERE a.id = 1
```

Use this C# .NET code:

```
Query query1 = new Query();
query1.Select("b.id");
query1.From("AllType", "b");
Query query2 = new Query();
query2.Select("a.id");
query2.From(query1, "a");
AttributeTest ts = new AttributeTest();
ts.Attribute = "a.id";
ts.Value = 1;
query2.Where(ts);
Sybase.Persistence.QueryResultSet qs =
SUP101DB.ExecuteQuery(query2);
```

You can use a subquery as the selected item of a query. Use the `SelectItem` to set selected items directly. For example, the C# .NET code shown below is equivalent to this SQL query:

```
SELECT (SELECT count(1) FROM AllType c WHERE c.id >= d.id) AS cn, id
FROM AllType d
```

Use this C# .NET code:

```
Query selQuery = new Query();
selQuery.Select("count(1)");
```

```
selQuery.From("AllType", "c");
AttributeTest ttt = new AttributeTest();
ttt.Attribute = "c.id";
ttt.Operator = AttributeTest.GREATER_EQUAL;
Column cl = new Column();
cl.Alias = "d";
cl.Attribute = "id";
ttt.Value = cl;
selQuery.Where(ttt);

Sybase.Collections.GenericList<Sybase.Persistence.SelectItem>
selectItems = new
Sybase.Collections.GenericList<Sybase.Persistence.SelectItem>();
SelectItem item = new SelectItem();
item.Query = selQuery;
item.AsAlias = "cn";
selectItems.Add(item);
item = new SelectItem();
item.Attribute = "id";
item.Alias = "d";
selectItems.Add(item);
Query subQuery2 = new Query();
subQuery2.SelectItems = selectItems;
subQuery2.From("AllType", "d");
Sybase.Persistence.QueryResultSet qs =
SUP101DB.ExecuteQuery(subQuery2);
```

CompositeTest

A `CompositeTest` combines multiple `TestCriteria` using the logical operators AND, OR, and NOT to create a compound filter.

Complex Example

This example shows the usage of `CompositeTest`, `SortCriteria`, and `Query` to locate all customer objects based on particular criteria.

- FirstName = John AND LastName = Doe AND (State = CA OR State = NY)
- Customer is New OR Updated
- Ordered by LastName ASC, FirstName ASC, Credit DESC
- Skip the first 10 and take 5

```
Query props = new Query();
  //define the attribute based conditions
  //Users can pass in a string if they know the attribute name. R1
column name = attribute name.
  CompositeTest innerCompTest = new CompositeTest();
  innerCompTest.Operator = CompositeTest.OR;
  innerCompTest.Add(new AttributeTest("state", "CA",
AttributeTest.EQUAL));
  innerCompTest.Add(new AttributeTest("state", "NY",
AttributeTest.EQUAL));
  CompositeTest outerCompTest = new CompositeTest();
  outerCompTest.Operator = CompositeTest.OR;
  outerCompTest.Add(new AttributeTest("fname", "Jane",
```

```
AttributeTest.EQUAL));
  outerCompTest.Add(new AttributeTest("lname", "Doe",
AttributeTest.EQUAL));
  outerCompTest.Add(innerCompTest);
  //define the ordering
  SortCriteria sort = new SortCriteria();

  sort.Add("fname", SortOrder.ASCENDING);
  sort.Add("lname", SortOrder.ASCENDING);
  //set the Query object
  props.TestCriteria = outerCompTest;
  props.SortCriteria = sort;
  props.Skip = 10;
  props.Take = 5;
  Sybase.Collections.GenericList<Customer> customers2 =
Customer.FindWithQuery(props);
```

Note: "Order By" is not supported for a long varchar field.

QueryResultSet

The `QueryResultSet` class provides for querying a result set from the dynamic query API. `QueryResultSet` is returned as a result of executing a query.

The following example shows how to filter a result set and get values by taking data from two mobile business objects, creating a `Query`, filling in the criteria for the query, and filtering the query results:

```
Sybase.Persistence.Query query = new Sybase.Persistence.Query();
  query.Select("c.fname,c.lname,s.order_date,s.region");
  query.From("Customer ", "c");
  query.Join("SalesOrder ", "s", " s.cust_id ", "c.id");
  AttributeTest at = new AttributeTest();
  at.Attribute = "lname";
  at.TestValue = "Devlin";
  query.TestCriteria = at;
  QueryResultSet qrs = SUP101DB.ExecuteQuery(query);
  while(qrs.Next())
  {
    Console.Write(qrs.GetString(1));
    Console.Write(",");
    Console.WriteLine(qrs.GetStringByName("c.fname"));

    Console.Write(qrs.GetString(2));
    Console.Write(",");
    Console.WriteLine(qrs.GetStringByName("c.lname"));

    Console.Write(qrs.GetString(3));
    Console.Write(",");
    Console.WriteLine(qrs.GetStringByName("s.order_date"));

    Console.Write(qrs.GetString(4));
    Console.Write(",");
    Console.WriteLine(qrs.GetStringByName("s.region"));
  }
```

Retrieving Relationship Data

A relationship between two MBOs allows the parent MBO to access the associated MBO. A bidirectional relationship also allows the child MBO to access the associated parent MBO.

Assume there are two MBOs defined in Unwired Server. One MBO is called Customer and contains a list of customer data records. The second MBO is called SalesOrder and contains order information. Additionally, assume there is an association between Customers and Orders on the customer ID column. The Orders application is parameterized to return order information for the customer ID.

```
Customer customer = Customer.FindByPrimaryKey(101);
            Sybase.Collections.GenericList<SalesOrder> orders =
customer.Orders;
```

```
Query props = new Query();
… // set query parameters
Sybase.Collections.GenericList<SalesOrder> orders =
customer.GetOrdersFilterBy(props);
```

Persistence APIs

The persistence APIs include operations and object state APIs.

Operations APIs

Mobile business object operations are performed on an MBO instance. Operations in the model that are marked as create, update, or delete (CUD) operations create non-static instances of operations in the generated client-side objects.

Any parameters in the create, update, or delete operation that are mapped to the object's attributes are handled internally by the client object API, and are not exposed. Any parameters not mapped to the object's attributes are left as parameters in the generated object API. The code examples for create, update, and delete operations are based on the **fill from attribute** being set. Different MBO settings affect the operation methods.

Note: If the Sybase Unwired Platform object model defines one instance of a create operation and one instance of an update operation, and all operation parameters are mapped to the object's attributes, then a `Save` method can be automatically generated which, when called internally, determines whether to insert or update data to the local client-side database. In other situations, where there are multiple instances of create or update operations, methods such as `Save` cannot be automatically generated.

Create Operation

The `Create` operation allows the client to create a new record in the local database. To execute a create operation on an MBO, create a new MBO instance, and set the MBO

attributes, then call the `Save()` or `Create()` operation. To propagate the changes to the server, call `SubmitPending`.

```
Customer cust = new Customer();
cust.Fname  =  "supAdmin" ;
cust.Company_name =   "Sybase";
cust.Phone = "777-8888";
cust.Create();// or cust.Save();
cust.SubmitPending();
```

Update Operation

The `Update` operation updates a record in the local database on the device. To execute update operations on an MBO, get an instance of the MBO, set the MBO attributes, then call either the `Save()` or `Update()` operation. To propagate the changes to the server, call `SubmitPending`.

```
Customer cust = Customer.FindByPrimaryKey(101);
cust.Fname = "supAdmin";
cust.Company_name = "Sybase";
cust.Phone = "777-8888";
cust.Update();// or cust.Save();
cust.SubmitPending();
```

To update multiple MBOs in a relationship, if the relationship is a composite, call `submitPending()` on the parent MBO. If the relationship is not a composite, call `submitPending()` on each MBO within the relationship:

```
Customer cust = Customer.FindByPrimaryKey(101);
Sybase.Collections.GenericList<SalesOrder> orders = cust.Orders;
SalesOrder order = orders[0];
order.Order_date = DateTime.Now;
order.Save();
cust.SubmitPending();
```

Delete Operation

The `Delete` operation allows the client to delete a new record in the local database. To execute delete operations on an MBO, get an instance of the MBO, set the MBO attributes, then call the `Delete` operation. To propagate the changes to the server, call `SubmitPending`.

```
Customer cust = Customer.FindByPrimaryKey(101);
cust.Delete();
```

For MBOs in a relationship, perform a delete as follows:

```
Customer cust = Customer.FindById(101);
Sybase.Collections.GenericList<SalesOrder> orders = cust.Orders;
SalesOrder order = orders[0];
order.Delete();
cust.SubmitPending();
```

Save Operation

The `Save` operation saves a record to the local database. In the case of an existing record, a `Save` operation calls the `Update` operation. If a record does not exist, the `Save` operation creates a new record.

```
//Update an existing customer
Customer cust = Customer.FindById(101);
cust.Save();

//Insert a new customer
Customer cust = new Customer();
cust.Save();
```

Other Operation

Operations other than `Create`, `Update`, or `Delete` operations are called "other" operations. An `Other` operation class is generated for each operation in the MBO that is not a `Create`, `Update`, or `Delete` operation.

Suppose the Customer MBO has an Other operation "other", with parameters "p1" (string), "p2" (int), and "p3" (date). This results in a `CustomerOtherOperation` class being generated, with "p1", "p2" and "p3" as its attributes.

To invoke the Other operation, create an instance of `CustomerOtherOperation`, and set the correct operation parameters for its attributes. This code provides an example:

```
CustomerOtherOperation other = new CustomerOtherOperation();
other.P1 = "somevalue";
other.P2 = 2;
other.P3 = System.DateTime.Now;
other.Save();
other.SubmitPending();
```

Cascade Operations

Composite relationships are cascaded. Cascade operations allow a single synchronization to execute a chain of related CUD operations. Multi-level insert is a special case for cascade operations. Multilevel insert allows a single synchronization to execute a chain of related insert operations, creating parent and children objects.

Multilevel Insert

Consider creating a Customer and a new SalesOrder at the same time on the client side, where the SalesOrder has a reference to the new Customer identifier. The following example demonstrates a multilevel insert:

```
Customer customer = new Customer();
customer.Fname = “firstName”;
customer.Lname = “lastName”;
customer.Phone = “777-8888”;
customer.Save();
SalesOrder order = new SalesOrder();
```

```
order.Customer = customer;
order.Order_date = DateTime.Now;
order.Region = "Eastern";
order.Sales_rep = 102;
customer.Orders.Add(order);
//Only the parent MBO needs to call Save()
customer.Save();
//Must submit parent
customer.SubmitPending();
```

To insert an order for an existing customer, first find the customer, then create a sales order with the customer ID retrieved:

```
Customer customer = Customer.FindByPrimaryKey(102);
SalesOrder order = new SalesOrder();
order.Customer = customer;
order.Order_date = DateTime.UtcNow;
order.Region = "Eastern";
order.Sales_rep = 102;
customer.Orders.Add(order);
order.Save();
customer.SubmitPending();
```

See the Sybase Unwired Platform online documentation for information on defining relationships that support cascading (composite) operations, and for specific multilevel insert requirements.

Pending Operation

You can manage the pending state.

You can group multiple operations into a single transaction for improved performance:

```
// load the customer MBO with customer ID 100
Customer customer = Customer.FindByPrimaryKey(100);

// Change phone number of that customer
customer.Phone = "8005551212";

// use one transaction to do save and submitPending
Sybase.Persistence.LocalTransaction tx =
SUP101DB.BeginTransaction();
try
{
  customer.Save();
  customer.SubmitPending();
  tx.Commit();
}
catch (Exception e)
{
  tx.Rollback();
}
```

- **SubmitPending –** submits the operation so that it can be replayed on the Unwired Server. A request is sent to the Unwired Server during a synchronization.

- **CancelPending –** cancels the previous create, update, or delete operations on the MBO. It cannot cancel submitted operations.
- **SubmitPendingOperations –** submits all the pending records for the entity to the Unwired Server. This method internally invokes the `SubmitPending` method on each of the pending records.
- **CancelPendingOperations –** cancels all the pending records for the entity. This method internally invokes the `CancelPending` method on each of the pending records.

Note: Use the `SubmitPendingOperations` and `CancelPendingOperations` methods only when there are multiple pending entities on the same MBO type. Otherwise, use the MBO instance's `SubmitPending` or `CancelPending` methods, which are more efficient if the MBO instance is already available in memory.

```
Customer customer = Customer.FindByPrimaryKey(101);
if(errorHappened)
{
  Customer.CancelPending();
}
else
{
  customer.SubmitPending();
}
```

Object State APIs

The object state APIs provide methods for returning information about the state of an entity in an application.

Entity State Management

The object state APIs provide methods for returning information about entities in the database.

All entities that support pending state have the following attributes:

Name	Type	Description
`IsNew`	`bool`	Returns true if this entity is new, but has not yet been created in the client database.

Name	Type	Description
`IsCreated`	`bool`	Returns true if this entity has been newly created in the client database, and one of the following is true: • The entity has not yet been submitted to the server with a replay request. • The entity has been submitted to the server, but the server has not finished processing the request. • The server rejected the replay request (`replayFailure` message received).
`IsDirty`	`bool`	Returns true if this entity has been changed in memory, but the change has not yet been saved to the client database.
`IsDeleted`	`bool`	Returns true if this entity was loaded from the database and subsequently deleted.
`IsUpdated`	`bool`	Returns true if this entity has been updated or changed in the database, and one of the following is true: • The entity has not yet been submitted to the server with a replay request. • The entity has been submitted to the server, but the server has not finished processing the request. • The server rejected the replay request (`replayFailure` message received).
`Pending`	`bool`	Returns true for any row that represents a pending `create`, `update`, or `delete` operation, or a row that has cascading children with a pending operation.
`PendingChange`	char	If pending is true, this attribute's value is 'C' (create), 'U' (update), 'D' (delete), or 'P' (to indicate that this MBO is a parent in a cascading relationship for one or more pending child objects, but this MBO itself has no pending create, update or delete operations). If pending is false, this attribute's value is 'N'.
`ReplayCounter`	long	Returns a `long` value that is updated each time a row is created or modified by the client. This value is a unique value obtained from `KeyGenerator.GenerateID` method. Note that the value increases every time it is retrieved.

Name	Type	Description
`ReplayPending`	long	Returns a `long` value. When a pending row is submitted to the server, the value of `ReplayCounter` is copied to `ReplayPending`. This allows the client code to detect if a row has been changed since it was submitted to the server (that is, if the value of `ReplayCounter` is greater than `ReplayPending`).
`ReplayFailure`	long	Returns a `long` value. When the server responds with a `ReplayFailure` message for a row that was submitted to the server, the value of `ReplayCounter` is copied to `ReplayFailure`, and `ReplayPending` is set to 0.

Entity State Example

Shows how the values of the entities that support pending state change at different stages during the MBO update process. The values that change between different states appear in bold.

Note these entity behaviors:

- The `IsDirty` flag is set if the entity changes in memory but is not yet written to the database. Once you save the MBO, this flag clears.
- The `ReplayCounter` value that gets sent to the Unwired Server is the value in the database before you call `SubmitPending`. After a successful replay, that value is imported from the Unwired Server.
- The last two entries in the table are two possible results from the operation; only one of these results can occur for a replay request.

Description	Flags/Values
After reading from the database, before any changes are made.	IsNew=false IsCreated=false IsDirty=false IsDeleted=false IsUpdated=false Pending=false PendingChange='N' ReplayCounter=33422977 ReplayPending=0 ReplayFailure=0
One or more attributes are changed, but changes not saved.	IsNew=false IsCreated=false IsDirty=**true** IsDeleted=false IsUpdated=false Pending=false PendingChange='N' ReplayCounter=33422977 ReplayPending=0 ReplayFailure=0

Description	Flags/Values
After `entity.Save()[entity save]` or `entity.Update()[entity update]` is called.	IsNew=false IsCreated=false IsDirty=**false** IsDeleted=false IsUpdated=**true** Pending=**true** PendingChange=**'U'** ReplayCounter=**33424979** ReplayPending=0 ReplayFailure=0
After `entity.SubmitPending()[entity submitPending]` is called to submit the MBO to the server.	IsNew=false IsCreated=false IsDirty=false IsDeleted=false IsUpdated=true Pending=true PendingChange='U' ReplayCounter=33424981 ReplayPending=**33424981** ReplayFailure=0

Description	Flags/Values
Possible result: the Unwired Server accepts the update, sends an import and a `ReplayResult` for the entity, and then refreshes the entity from the database.	IsNew=false IsCreated=false IsDirty=false IsDeleted=false IsUpdated=**false** Pending=**false** PendingChange='**N**' ReplayCounter=**33422977** replayPending=**0** ReplayFailure=0
Possible result: The Unwired Server rejects the update, sends a `ReplayFailure` for the entity, and refreshes the entity from the database	IsNew=false IsCreated=false IsDirty=false IsDeleted=false IsUpdated=true Pending=true PendingChange='U' ReplayCounter=33424981 ReplayPending=**0** ReplayFailure=**33424981**

Pending State Pattern

When a `create`, `update`, `delete`, or `save` operation is called on an entity in an application, the requested change becomes pending. To apply the pending change, call `SubmitPending` on the entity, or `SubmitPendingOperations` on the MBO class:

```
Customer e = new Customer();
e.Name = "Fred";
e.Address = "123 Four St.";
e.Create(); // create as pending
e.SubmitPending(); // submit to server

Customer.SubmitPendingOperations(); // submit all pending Customer
rows to server
```

`SubmitPendingOperations` submits all the pending records for the entity to the Unwired Server. This method internally invokes the `SubmitPending` method on each of the pending records.

For message-based sychronization, the call to `SubmitPending` causes a JSON message to be sent to the Unwired Server with the `Replay` method, containing the data for the rows to be created, updated, or deleted. The Unwired Server processes the message and responds with a JSON message with the `ReplayResult` method (the Unwired Server accepts the requested operation) or the `ReplayFailure` method (the server rejects the requested operation).

If the Unwired Server accepts the requested change, it also sends one or more `Import` messages to the client, containing data for any created, updated, or deleted row that has changed on the Unwired Server as a result of the `Replay` request. These changes are written to the client database and marked as rows that are not pending. When the `ReplayResult` message is received, the pending row is removed, and the row remaining in the client database now contains data that has been imported from and validated by the Unwired Server. The Unwired Server may optionally send a log record to the client indicating a successful operation.

If the Unwired Server rejects the requested change, the client receives a `ReplayFailed` message, and the entity remains in the pending state, with its `ReplayFailed` attribute set to indicate that the change was rejected.

The call to `SubmitPending` creates a replay record in local database. When the `SUP101DB.Synchronize()` method is called, the replay records are uploaded to the Unwired Server. The Unwired Server processes the replay records one by one and either accepts or rejects it.

At the end of the synchronization, the replay results are downloaded to client along with any created, updated or deleted rows that have changed on the Unwired Server as a result of the Replay requests. These changes are written to the client database and marked as rows that are not pending.

When the operation is successful, the pending row is removed, and the row remaining in the client database now contains data that has been imported from and validated by the Unwired Server. If the Unwired Server rejects the requested change, the entity remains in the pending state, with its ReplayFailed attribute set to indicate that the change was rejected. The Unwired Server may optionally send a log record to the client.

The `LogRecord` interface has the following getter methods to access information about the log record:

Method Name	Type	Description
Component	`string`	Name of the MBO for the row for which this log record was written.

Method Name	Type	Description
EntityKey	`string`	String representation of the primary key of the row for which this log record was written.
Code	`int`	One of several possible HTTP error codes: • 200 indicates success. • 401 indicates that the client request had invalid credentials, or that authentication failed for some other reason. • 403 indicates that the client request had valid credentials, but that the user does not have permission to access the requested resource (package, MBO, or operation). • 404 indicates that the client tried to access a nonexistent package or MBO. • 405 indicates that there is no valid license to check out for the client. • 500 indicates an unexpected (unspecified) server failure.
Message	`string`	Descriptive message from the server with the reason for the log record.
Operation	`string`	The operation (create, update, or delete) that caused the log record to be written.
RequestId	`string`	The ID of the replay message sent by the client that caused this log record to be written.
Timestamp	`System.DateTime`	Date and time of the log record.

If a rejection is received, the application can use the entity method `GetLogRecords` to access the log records and get the reason:

```
Sybase.Collections.GenericList<Sybase.Persistence.ILogRecord> logs =
e.GetLogRecords();
for(int i=0; i<logs.Size(); i++)
{
Console.WriteLine("Entity has a log record:");
Console.WriteLine("Code = {0}",logs[i].Code);
Console.WriteLine("Component = {0}",logs[i].Component);
Console.WriteLine("EntityKey = {0}",logs[i].EntityKey);
Console.WriteLine("Level = {0}",logs[i].Level);
Console.WriteLine("Message = {0}",logs[i].Message);
Console.WriteLine("Operation = {0}",logs[i].Operation);
Console.WriteLine("RequestId = {0}",logs[i].RequestId);
Console.WriteLine("Timestamp = {0}",logs[i].Timestamp);
}
```

`CancelPendingOperations` cancels all the pending records for an entity. This method internally invokes the `CancelPending` method on each of the pending records.

Refresh Operation

The refresh operation of an MBO allows you to refresh the MBO state from the client database.

For example:

```
Customer cust = Customer.FindByPrimaryKey(101);
cust.Fname = "newName";
cust.Refresh();// newName is discarded
```

Generated Package Database APIs

The generated package database APIs include methods that exist in each generated package database.

Client Database APIs

The generated package database class provides methods for managing the client database.

```
public static void CreateDatabase()
public static void DeleteDatabase()
public static bool DatabaseExists()
```

Typically, `CreateDatabase` does not need to be called since it is called internally when necessary. An application may use `DeleteDatabase` when uninstalling the application.

Use the transaction API to group several transactions together for better performance.

```
public static Sybase.Persistence.LocalTransaction BeginTransaction()
```

```
Customer customer = Customer.FindByPrimaryKey(101);
   // Use one transaction to save and submit pending
   LocalTransaction tx = SUP101DB.BeginTransaction();
   // modify customer information
   customer.Save();
   customer.SubmitPending();
   tx.Commit();
```

Large Attribute APIs

Use large string and binary attributes.

You can import large messages containing binary objects (BLOBs) to the client, send new or changed large objects to the server, and efficiently handle large attributes on the client.

The large attribute APIs allow clients to import large messages from the server or send a replay message without using excessive memory and possibly throwing exceptions. Clients can also access or modify a large attribute without reading the entire attribute into memory. In addition, clients can execute queries without having large attribute valuies automatically filled in the returned MBO lists or result sets.

BigBinary

An object that allows access to a persistent binary value that may be too large to fit in available memory. A streaming API is provided to allow the value to be accessed in chunks.

Close

Closes the value stream.

Closes the value stream. Any buffered writes are automatically flushed. Throws a `StreamNotOpenException` if the stream is not open.

Syntax

```
public void Close()
```

Examples

- **Close the value stream –** Writes a binary book cover image and closes the image file. In the following example, `book` is the instance of an MBO and `cover` is a BigBinary attribute

```
Book book = Book.FindByPrimaryKey(bookID);
Sybase.Persistence.BigBinary image = book.Cover;
image.OpenForWrite(256);
// ...
image.Close();
```

CopyFromFile

Overwrites this `BigBinary` object with data from the specified file.

Any previous contents of the file will be discarded. Throws an `ObjectNotSavedException` if this `BigBinary` object is an attribute of an entity that has not yet been created in the database. Throws a `StreamNotClosedException` if the object is not closed.

Syntax

```
public void CopyFromFile(string filepath)
```

Parameters

- **filepath –** The file containing the data to be copied.

CopyToFile

Overwrites the specified file with the contents of this `BigBinary` object.

Any previous contents of the file are discarded. Throws an `ObjectNotSavedException` if this `BigBinary` object is an attribute of an entity that has not yet been created in the database. Throws a `StreamNotClosedException` if the object is not closed.

Syntax

```
public void CopyToFile(string filepath)
```

Parameters

- **filepath –** The file to be overwritten.

Flush

Flushes any buffered writes.

Flushes any buffered writes to the database. Throws a `StreamNotOpenException` if the stream is not open.

Syntax

```
public void Flush()
```

OpenForRead

Opens the value stream for reading.

Has no effect if the stream was already open for reading. If the stream was already open for writing, it is flushed before being reopened for reading. Throws an `ObjectNotSavedException` if this `BigBinary` object is an attribute of an entity that has not yet been created in the database. Throws an `ObjectNotFoundException` if this object is null.

Syntax

```
public void OpenForRead()
```

Examples

- **Open for reading –** Opens a binary book image for reading.

```
Book book = Book.FindByPrimaryKey(bookID);
Sybase.Persistence.BigBinary image = book.Cover;
image.OpenForRead();
```

OpenForWrite

Opens the value stream for writing.

Any previous contents of the value will be discarded. Throws an `ObjectNotSavedException` if this `BigBinary` object is an attribute of an entity that has not yet been created in the database.

Syntax

```
public void OpenForWrite(long newLength)
```

Parameters

- **newLength –** The new value length in bytes. Some platforms may allow this parameter to be specified as 0, with the actual length to be determined later, depending on the amount of data written to the stream. Other platforms require the total amount of data written to the stream to match the specified value.

Examples

- **Open for writing –** Opens a binary book image for writing.

```
Book book = Book.FindByPrimaryKey(bookID);
Sybase.Persistence.BigBinary image = book.Cover;
image.OpenForWrite(256);
```

Read

Reads a chunk of data from the stream.

Reads and returns the specified number of bytes, or fewer if the end of stream is reached. Throws a `StreamNotOpenException` if the stream is not open for reading.

Syntax

```
public byte[] Read(long length)
```

Parameters

- **length –** The maximum number of bytes to be read into the chunk.

Returns

`Read` returns a chunk of binary data read from the stream, or a null value if the end of the stream has been reached.

Examples

- **Read –** Reads in a binary book image.

```
Book book = Book.FindByPrimaryKey(bookID);
Sybase.Persistence.BigBinary image = book.Cover;
image.OpenForRead();
byte[] binary = image.Read(bufferLength);
while (binary != null)
{
    binary = image.Read(bufferLength);
}
image.Close();
```

ReadByte

Reads a single byte from the stream.

Throws a `StreamNotOpenException` if the stream is not open for reading.

Syntax

```
public int ReadByte()
```

Returns

`ReadByte` returns a byte of data read from the stream, or -1 if the end of the stream has been reached.

Seek

Changes the stream position.

Throws a `StreamNotOpenException` if the stream is not open for reading.

Syntax

```
public void Seek(long newPosition)
```

Parameters

- **newPosition –** The new stream position in bytes. Zero represents the beginning of the value stream.

Write

Writes a chunk of data to the stream.

Writes data to the stream, beginning at the current position. The stream may be buffered, so use `Flush` or `Close` to be certain that any buffered changes have been applied. Throws a

`StreamNotOpenException` if the stream is not open for writing. Throws a `WriteAppendOnlyException` if the platform only supports appending to the end of a value and the current stream position precedes the end of the value. Throws a `WriteOverLengthException` if the platform requires the length to be predetermined before writing and this write would exceed the predetermined length.

Syntax

```
public void Write(byte[] data)
```

Parameters

- **data –** The data chunk to be written to the stream.

Examples

- **Write data –** Opens a binary book image for writing.

```
Book book = Book.FindByPrimaryKey(bookID);
Sybase.Persistence.BigBinary image = book.Cover;
image.OpenForWrite(256);
byte[] binary = new byte[] { 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 };
image.Write(binary);
image.Close();
book.SubmitPending();
```

WriteByte

Writes a single byte to the stream.

Writes a byte of data to the stream, beginning at the current position. The stream may be buffered, so use `Flush` or `Close` to be certain that any buffered changes have been applied. Throws a `StreamNotOpenException` if the stream is not open for writing. Throws a `WriteAppendOnlyException` if the platform only supports appending to the end of a value and the current stream position precedes the end of the value. Throws a `WriteOverLengthException` if the platform requires the length to be predetermined before writing and this write would exceed the predetermined length.

Syntax

```
public void WriteByte(byte data)
```

Parameters

- **data –** The byte value to be written to the stream.

BigString

An object that allows access to a persistent string value that might be too large to fit in available memory. A streaming API is provided to allow the value to be accessed in chunks.

Close

Closes the value stream.

Closes the value stream. Any buffered writes are automatically flushed. Throws a `StreamNotOpenException` if the stream is not open.

Syntax

```
public void Close()
```

Examples

- **Close the value stream –** Writes to the biography file, and closes the file.

```
Author author = Author.FindByPrimaryKey(authorID);
BigString text = author.Biography;
text.OpenForWrite(256);
text.Write("something");
text.Close();
```

CopyFromFile

Overwrites this `BigString` object with data from the specified file.

Any previous contents of the value will be discarded. Throws an `ObjectNotSavedException` if this `BigString` object is an attribute of an entity that has not yet been created in the database. Throws a `StreamNotClosedException` if the object is not closed.

Syntax

```
public void CopyFromFile(string filepath)
```

Parameters

- **filepath –** The file containing the data to be copied.

CopyToFile

Overwrites the specified file with the contents of this `BigString` object.

Any previous contents of the file are discarded. Throws an `ObjectNotSavedException` if this `BigString` object is an attribute of an entity that has not yet been created in the database. Throws a `StreamNotClosedException` if the object is not closed.

Syntax

```
public void CopyToFile(string filepath)
```

Parameters

- **filepath –** The file to be overwritten.

Flush

Flushes any buffered writes.

Flushes any buffered writes to the database. Throws a `StreamNotOpenException` if the stream is not open.

Syntax

```
public void Flush()
```

OpenForRead

Opens the value stream for reading.

Has no effect if the stream was already open for reading. If the stream was already open for writing, it is flushed before being reopened for reading. Throws an `ObjectNotSavedException` if this `BigString` object is an attribute of an entity that has not yet been created in the database.

Syntax

```
public void OpenForRead()
```

Examples

- **Open for reading –** Opens the biography file for reading.

```
Author author = Author.FindByPrimaryKey(authorID);
BigString text = author.Biography;
text.OpenForRead();
```

OpenForWrite

Opens the value stream for writing.

Any previous contents of the value will be discarded. Throws an `ObjectNotSavedException` if this `BigString` object is an attribute of an entity that has not yet been created in the database.

Syntax

```
public void OpenForWrite(long newLength)
```

Parameters

- **newLength –** The new value length in bytes. Some platforms may allow this parameter to be specified as 0, with the actual length to be determined later, depending on the amount of

data written to the stream. Other platforms require the total amount of data written to the stream to match the specified value.

Examples

- **Open for writing –** Opens the biography file for writing.

```
Author author = Author.FindByPrimaryKey(authorID);
BigString text = author.Biography;
text.OpenForWrite(256);
```

Read

Reads a chunk of data from the stream.

Reads and returns the specified number of characters, or fewer if the end of stream is reached. Throws a `StreamNotOpenException` if the stream is not open for reading.

Syntax

```
public byte[] Read(long length)
```

Parameters

- **length –** The maximum number of characters to be read into the chunk.

Returns

`Read` returns a chunk of string data read from the stream, or a null value if the end of the stream has been reached.

Examples

- **Read –** Reads in the biography file.

```
Author author = Author.FindByPrimaryKey(authorID);
BigString text = author.Biography;
text.OpenForRead();
int bufferLength = 1024;

string something = text.Read(bufferLength); //null if EOF
while (something != null)
{
    something = text.Read(bufferLength);
}
text.Close();
```

ReadChar

Reads a single character from the stream.

Throws a `StreamNotOpenException` if the stream is not open for reading.

Syntax

```
public int ReadChar()
```

Returns

`ReadChar` returns a single character read from the stream, or -1 if the end of the stream has been reached.

Seek
Changes the stream position.

Throws a `StreamNotOpenException` if the stream is not open for reading.

Syntax

```
public void Seek(long newPosition)
```

Parameters

- **newPosition –** The new stream position in characters. Zero represents the beginning of the value stream.

Write
Writes a chunk of data to the stream.

Writes data to the stream, beginning at the current position. The stream may be buffered, so use `Flush` or `Close` to be certain that any buffered changes have been applied. Throws a `StreamNotOpenException` if the stream is not open for writing. Throws a `WriteAppendOnlyException` if the platform only supports appending to the end of a value and the current stream position precedes the end of the value. Throws a `WriteOverLengthException` if the platform requires the length to be predetermined before writing and this write would exceed the predetermined length.

Syntax

```
public void Write(string data)
```

Parameters

- **data –** The data chunk to be written to the stream.

Examples

- **Write data –** Writes to the biography file, and closes the file.

```
Author author = Author.FindByPrimaryKey(authorID);
BigString text = author.Biography;
text.OpenForWrite(256);
text.Write("something");
```

```
text.Close();
author.SubmitPending();
```

WriteChar

Writes a single character to the stream.

Writes a character of data to the stream, beginning at the current position. The stream may be buffered, so use `Flush` or `Close` to be certain that any buffered changes have been applied. Throws a `StreamNotOpenException` if the stream is not open for writing. Throws a `WriteAppendOnlyException` if the platform only supports appending to the end of a value and the current stream position precedes the end of the value. Throws a `WriteOverLengthException` if the platform requires the length to be predetermined before writing and this write would exceed the predetermined length.

Syntax

```
public void WriteChar(char data)
```

Parameters

- **data –** The character value to be written to the stream.

MetaData API

You can access metadata for database, classes, entities, attributes, operations, and parameters using the MetaData API.

MetaData API

Some applications or frameworks can operate against MBOs generically by invoking MBO operations without prior knowledge of MBO classes. This can be achieved by using the MetaData API.

These APIs allow retrieving the metadata of packages, MBOs, attributes, operations, and parameters during runtime.

You can generate metadata classes using the `-md` code generation option. You can also generate metadata classes by selecting the option **Generate metadata classes** in the code generation wizard in the mobile application project.

DatabaseMetaData

The `DatabaseMetaData` class holds package-level metadata. You can use it to retrieve data such as synchronization groups, the default database file, and MBO metadata.

Any entity for which "allow dynamic queries" is enabled generates attribute metadata. Depending on the options selected in the Eclipse IDE, metadata for attributes and operations may be generated for all classes and entities.

```
DatabaseMetaData dmd = SUP101DB.Metadata;
  foreach (String syncGroup in dmd.SynchronizationGroups)
  {
    Console.WriteLine(syncGroup);
  }
```

ClassMetaData

The class holds metadata for the MBO, including attributes and operations.

```
AttributeMetaData lname = customerMetaData.GetAttribute("lname");
OperationMetaData save = customerMetaData.GetOperation("save");
...
```

EntityMetaData

The `EntityMetaData` class holds metadata for the MBO, including attributes and operations.

```
EntityMetaData customerMetaData = Customer.GetMetaData();
    AttributeMetaData lname =
customerMetaData.GetAttribute("lname");
    OperationMetaData save = customerMetaData.GetOperation("save");
```

AttributeMetaData

The `AttributeMetaData` class holds metadata for an attribute such as attribute name, column name, type, and maxlength.

```
Console.WriteLine(lname.Name);
Console.WriteLine(lname.Column);
Console.WriteLine(lname.MaxLength);
```

Exceptions

Reviewing exceptions allows you to identify where an error has occurred during application execution.

Exception Handling

An exception represents an unexpected condition hindering a method from completion. In some cases, the exception is transient and you can retry it at a later time. In most cases, you must resolve the underlying cause of the exception to allow the API to complete successfully. In rare cases, the exception encountered corrupts the application state and may require you to terminate and restart the application.

To use the localization features in exception handling:

- Register an exception message service implementation through the `ServiceRegistry`.

Base Exceptions

A base exception class is defined as the super class for all external exceptions. Specific exceptions always inherit from the base exception. To enable you, the Object API developer, to write a standard exception handler, all external exceptions have an error code and a single error message. Furthermore, the exception may contain another exception as the cause.

You can use the `getLocalizeMessage (Locale locale)` method to retrieve an error message for a specified locale.

Exception Message Service

You can implement an exception message service for resolving localized messages using error codes. The exception class uses the exception message service to load resource bundles and look up error messages based on an error code. You can use a default message provider, `ExceptionMessageServiceImpl`, or create a custom provider by implementing your own `ExceptionMessageService`.

To resolve localized messages, implement the `IExceptionMessageService` interface.

```
class CustomExceptionMessageService : IExceptionMessageService
{
  public string GetMessage(int errorCode)
  {
    string msg = null;

    msg = "GetMessage(" + errorCode + ")";

    return msg;
  }

  public string GetMessage(int errorCode, string localeName)
  {
    string msg = null;

    msg = "GetMessage(" + errorCode + "," + localeName + ")";

    return msg;
  }
}
```

A default implementation, `ExceptionMessageServiceImpl` allows the default English resource to look up an error message using an error code. You can follow these steps to add other localized resources without implementing a custom message service.

1. Get the default file "SUPErrorMessage.en.txt" (included in the `resources` folder in the Mobile SDK for the Windows and Windows Mobile platform) and localize it to another language file such as "SUPErrorMessage.de.txt"
2. Use "resgen.exe" to generate its resource file like "SUPErrorMessage.de.resources":

   ```
   >>resgen SUPErrorMessage.de.txt
   ```
3. Register the default implementation "ExceptionMessageServiceImpl" in the application code:

```
ServiceRegistry.GetInstance().RegisterService(typeof(IExceptionMe
ssageService),
      ExceptionMessageServiceImpl.GetInstance());
```

4. Put the generated resource file into the same folder of the application execution file.
5. The application uses the localized error message automatically.
6. You can unregister the exception message service to cancel the use of the localized error message:

```
ServiceRegistry.GetInstance().UnregisterService<IExceptionMessage
Service>(typeof(IExceptionMessageService));
```

Service Registry

You can register objects that implement the `IExceptionMessageService` interface using the `ServiceRegister` interface's `RegisterService` and `UnregisterService` methods.

```
ServiceRegistry.GetInstance().RegisterService(typeof(Sybase.Mobile.
Framework.IExceptionMessageService), new
CustomExceptionMessageService());
...
ServiceRegistry.GetInstance().UnregisterService<Sybase.Mobile.Frame
work.IExceptionMessageService>(typeof(Sybase.Mobile.Framework.IExce
ptionMessageService));
```

Example Code for Handling Exceptions

An example of registering your interface.

```
// Register ExceptionMessageServiceImpl
ServiceRegistry.GetInstance().RegisterService(typeof(Sybase.Mobile.
Framework.IExceptionMessageService),
ExceptionMessageServiceImpl.GetInstance());
try
{
  // throw Sybase.Persistence.ObjectNotFoundException
}
catch (ObjectNotFoundException e)
{
  if (e.ErrorCode == ObjectNotFoundException.VALUE_IS_NULL)
  {
    string msg = e.Message;
    msg = e.GetLocalizedMessage("fr");
    msg = e.GetLocalizedMessage("es");
    msg = e.GetLocalizedMessage("de");
  }
}

// Register CustomExceptionMessageService
ServiceRegistry.GetInstance().RegisterService(typeof(Sybase.Mobile.
Framework.IExceptionMessageService), new
CustomExceptionMessageService());
try
{
  // throw Sybase.Persistence.ObjectNotFoundException
}
```

```
catch (ObjectNotFoundException e)
{
  if (e.ErrorCode == ObjectNotFoundException.VALUE_IS_NULL)
  {
    string msg = e.Message;
    msg = e.GetLocalizedMessage("fr");
    msg = e.GetLocalizedMessage("es");
    msg = e.GetLocalizedMessage("de");
  }
}
finally
{
  // Unregister CustomExceptionMessageService

ServiceRegistry.GetInstance().UnregisterService<Sybase.Mobile.Frame
work.IExceptionMessageService>(typeof(Sybase.Mobile.Framework.IExce
ptionMessageService));
}
```

Server-Side Exceptions

A server-side exception occurs when a client tries to update or create a record and the Unwired Server throws an exception.

A server-side exception results in a stack trace in the server log, and a log record (`LogRecordImpl`) imported to the client with information on the problem.

Client-Side Exceptions

Device applications are responsible for catching and handling exceptions thrown by the client object API.

Note: See *Callback Handlers*.

Exception Classes

The Client Object API supports exception classes for queries and for the messaging client.

- **Sybase.Mobile.ApplicationRuntimeException –** thrown when a call to start the connection, register the application, or unregister the application cannot be completed due to an error.
- **Sybase.Mobile.ConnectionPropertyException –** thrown when a call to start the connection, register the application, or unregister the application cannot be completed due to an error in a connection property value or application identifier
- **Sybase.Mobile.ApplicationTimeoutException –** thrown when a call to start the connection, register the application, or unregister the application times out.
- **Sybase.Persistence.LoginRequiredException –** thrown when the client application does not login to the server.
- **Sybase.Persistence.NoSuchOperationException –** thrown when trying to access operation metadata that does not exist in class metadata.

- **Sybase.Persistence.NoSuchAttributeException –** thrown when trying to access an attribute that does not exist in class or entity metadata and thrown by a dynamic query method (such as ExecuteQuery) if the Query passed in selects for an attribute that does not exist in the MBO queried.
- **Sybase.Persistence.ObjectNotFoundException –** thrown when trying to load an MBO that is not inside the local database.
- **Sybase.Persistence.ObjectNotSavedException –** thrown when a BigBinary or BigString method is called that requires the object to already exist in the database.
- **Sybase.Persistence.PersistenceException –** thrown when trying to access the local database.
- **Sybase.Persistence.ProtocolException –** thrown when an exception occurs during protocol version mismatch.
- **Sybase.Persistence.StreamNotOpenException –** thrown when a BigBinary or BigString method is called that requires the object to be open.
- **Sybase.Persistence.StreamNotClosedException –** thrown when a BigBinary or BigString method is called that requires the object to not be open.
- **Sybase.Persistence.SynchronizeException –** thrown when an error occurs during synchronization.
- **Sybase.Persistence.SynchronizeRequiredException –** thrown when synchronization is needed.
- **Sybase.Persistence.WriteAppendOnlyException –** thrown if a BigBinary or BigString method is called that writes to the middle of a value where only appending is allowed by the underlying database.
- **Sybase.Persistence.WriteOverLengthException –** thrown if the platform requires the length to be predetermined before write and a BigBinary or BigString method is called that writes past the predetermined length.

Error Codes

Codes for errors occuring during application execution.

HTTP Error Codes

The Unwired Server examines the EIS code received in a server response message and maps it to a logical HTTP error code, if a corresponding error code exists. If no corresponding code exists, the 500 code is assigned to signify either a Sybase Unwired Platform internal error, or an unrecognized EIS error.

The EIS code and HTTP error code values are stored in log records (`ILogRecord.EisCode`, and `ILogRecord.Code`, respectively).

These tables list recoverable and unrecoverable error codes. All error codes that are not explicitly considered recoverable are considered unrecoverable.

Table 6. Recoverable Error Codes

Error Code	Probable Cause
409	Backend EIS is deadlocked.
503	Backend EIS is down, or the connection is terminated.

Table 7. Unrecoverable Error Codes

Error Code	Probable Cause	Manual Recovery Action
401	Backend EIS credentials wrong.	Change the connection information, or backend user password.
403	User authorization failed on the Unwired Server due to role constraints (applicable only for MBS).	N/A
404	Resource (table/Web service/BAPI) not found on backend EIS.	Restore the EIS configuration.
405	Invalid license for the client (applicable only for MBS).	N/A
412	Backend EIS threw a constraint exception.	Delete the conflicting entry in the EIS.
500	Sybase Unwired Platform internal error in modifying the CDB cache.	N/A

Error code 401 is not treated as a simple recoverable error. If the `SupThrowCredentialRequestOn401Error` context variable is set to true (the default), error code 401 throws a `CredentialRequestException`, which sends a credential request notification to the user's inbox. You can change this behavior by modifying the value of the `SupThrowCredentialRequestOn401Error` context variable in Sybase Control Center. If `SupThrowCredentialRequestOn401Error` is set to false, error code 401 is treated as a normal recoverable exception.

Mapping of EIS Codes to Logical HTTP Error Codes

A list of SAP® error codes mapped to HTTP error codes. By default, SAP error codes that are not listed map to HTTP error code 500.

Note: These JCO error codes are not applicable for DOE-based applications.

Table 8. Mapping of SAP Error Codes to HTTP Error Codes

Constant	Description	HTTP Error Code
JCO_ERROR_COMMUNICATION	Exception caused by network problems, such as connection breakdowns, gateway problems, or unavailability of the remote SAP system.	503
JCO_ERROR_LOGON_FAILURE	Authorization failures during login. Usually caused by unknown user name, wrong password, or invalid certificates.	401
JCO_ERROR_RESOURCE	Indicates that JCO has run out of resources such as connections in a connection pool.	503
JCO_ERROR_STATE_BUSY	The remote SAP system is busy. Try again later.	503

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