Using the Java Gateway

Version 2018.1
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Ensemble Version 2018.1 2018-12-14

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Table of Contents

List of Figures

About This Book

This book explains how to enable easy interoperation between Ensemble and Java components. The Java Gateway can instantiate an external Java object and manipulate it as if it were a native object within Ensemble.

This book contains the following chapters:

- Introduction to the Java Gateway
- Using the Java Gateway in a Production
- Sample Code
- Mapping Specification

For a detailed outline, see the table of contents.

The following books provide related information:

- *Ensemble Best Practices* describes best practices for organizing and developing Ensemble productions.
- *Developing Ensemble Productions* explains how to perform the development tasks related to creating an Ensemble production.
- *Configuring Ensemble Productions* describes how to configure the settings for Ensemble productions, business hosts, and adapters. It provides details on settings not discussed in this book.

For general information, see the *InterSystems Documentation Guide*.

1

Introduction to the Java Gateway

This chapter introduces the Java Gateway, which provides an easy way for Ensemble to interoperate with Java components. It discusses the following topics:

- Prerequisites
- Starting and Stopping the Gateway
- Connecting and Disconnecting
- Java Gateway Modes

1.1 Prerequisites

The Java Gateway server runs within a JVM, which can be on the same machine as Ensemble or on a different machine. Complete the following setup steps on the machine on which the Java Gateway will run:

1. Install the Java Runtime Environment (for example, JRE 1.7.0_67).
2. Make a note of the location of the installation directory for JRE. This is the directory that *contains* the subdirectories bin and lib.

   This is the value that you would use for *JAVA_HOME* environment variable. For example: `c:\Program Files\Java\jre7`

   You use this information later when you configure your production.
3. Also make a note of the Java version. If you are uncertain about the Java version, open a DOS window, go to the bin subdirectory of your Java installation, and enter the following command:

   ```
   java.exe -version
   ```

   You should receive output like the following, depending on your platform:

   ```
   java version "1.7.0_67"
   Java(TM) SE Runtime Environment (build 1.7.0_67-b24)
   Java HotSpot(TM) 64-Bit Server VM (build 23.19-b22, mixed mode)
   ```

It is not necessary to set any environment variables. To access the JVM, Ensemble uses information contained in the production.

1.2 Starting and Stopping the Gateway

Start

Before you can use the Java Gateway, you must use some mechanism to start the Java Gateway server and tell Ensemble the name of the host on which the Java Gateway server is running. You can start the Java Gateway server in one of the following ways:

- *Automatically*, by adding a Java Gateway business service to the production. The Java Gateway server starts when the production starts.
- *Manually*, by calling the business service **StartGateway()** method.
- *Manually*, by entering a command at the Terminal command prompt.

Note: If you are using JMS on the Java side, you must start the Java Gateway server in JMS mode (the command is slightly different).

Stop

Once started, the Java Gateway server runs until it is explicitly shut down. You can stop the Java Gateway server in one of the following ways:

- *Automatically*, by adding a Java Gateway business service to the production. The Java Gateway server stops when the production stops.
- *Manually*, by calling the **StopGateway()** method of the business service.
- *Manually*, by calling the **%Shutdown()** method of the Java Gateway API (EnsLib.JavaGateway.JavaGateway).

When using the Java Gateway with an Ensemble production, it is a good practice to have the production start the Java Gateway server at production startup, and stop it at production shutdown. This happens automatically if you add a Java Gateway business service to the production.

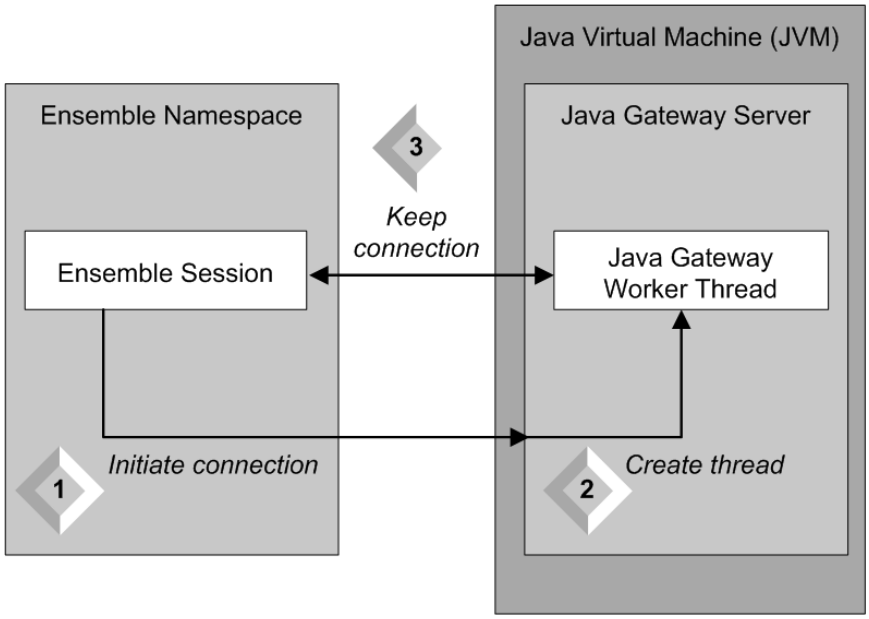
Note: If you make changes to your Java classes and want them available to the Java Gateway, you can stop and then restart the Java Gateway using any of these methods.

1.3 Connecting and Disconnecting

Once the Java Gateway server is running, each Ensemble session that needs to invoke Java class methods must create its own connection to the Java Gateway server. You can connect Ensemble with the Java Gateway server by calling the **ConnectGateway** method of the business service, or by calling the Java Gateway API **%Connect()** method.

The **Connect** command sets off the chain of sequential events (1), (2), and (3) shown in the following *Connecting to a Java Gateway Worker Thread* diagram:

Figure 1–1: Connecting to a Java Gateway Worker Thread



1. Caché Basic or ObjectScript code sends a connection request.
2. Upon receiving the request, the Java Gateway server starts a worker thread in which the Java class methods subsequently run.
3. The connection between this Java Gateway worker thread and the corresponding Ensemble session remains established until it is explicitly disconnected.

Caché Basic or ObjectScript code that establishes a worker thread must explicitly disconnect before exiting. Otherwise, the assigned port for the connection stays "in use" and is unavailable for use in other connections. Caché Basic or ObjectScript code can disconnect its thread by calling the Java Gateway API **%Disconnect()** method.

1.4 Java Gateway Modes

Java Gateway has two main modes of manipulation of Java objects:

- Proxy Object Mode — Allows you to statefully manipulate Java Objects from within Ensemble.
- Stateless Service Mode — Allows you to make simple calls to Java methods and return the results from within Ensemble.

1.4.1 Proxy Object Mode

Proxy Object Mode provides an easy way for Ensemble to interoperate with Java components. It allows Java Gateway to instantiate an external Java object and manipulate it as if it were a native object within Ensemble.

1.4.1.1 Proxy Object Mode Architecture

The external Java object is represented within Ensemble by a "wrapper" or "proxy" class. The proxy object appears and behaves just like any other Ensemble object, but it has the capability to issue method calls out to a Java virtual machine

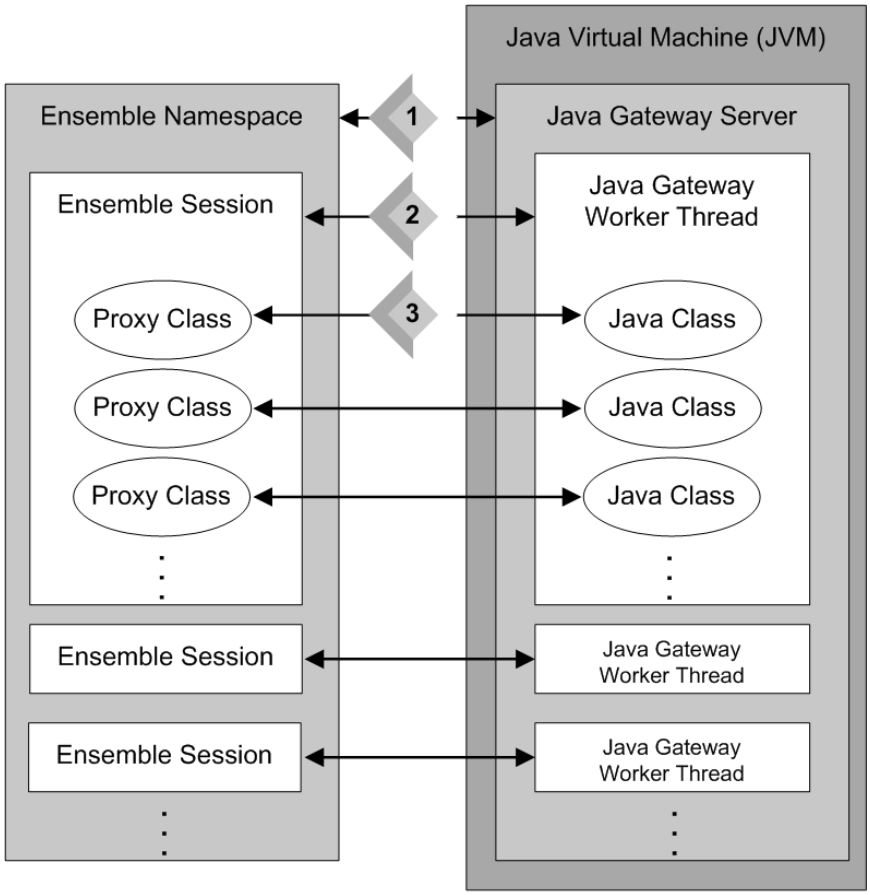
(JVM), either locally or remotely over a TCP/IP connection. Any method call on the proxy object triggers the appropriate class method inside the JVM.

You can use the Java Gateway to create proxy Caché classes for custom Java components. However, the most powerful feature of the Java Gateway is that it easily creates proxy mappings to entire Java interface specifications, such as the Java Database Connection (JDBC), Java Message Service (JMS), Enterprise Java Beans (EJB), Java Connector Architecture (JCA), etc. Ensemble can use this mapping to work with *any* implementation that is compliant with one of these specifications.

In general, the best approach to using the Java Gateway is to build a small wrapper class that exposes just the functionality you want and then create a proxy for this wrapper. This makes the API between Ensemble and Java very clean and eliminates many potential issues dealing with how to map more esoteric features to a proxy object.

The following diagram provides a conceptual view of Ensemble and the Java Gateway at runtime while using Proxy Object Mode.

Figure 1–2: Java Gateway Operational Model



The Java Gateway server runs in the JVM. Ensemble and the JVM may be running on the same machine or on different machines. The items (1), (2), and (3) in the preceding diagram represent the relationships established by the commands that set up this operational model:

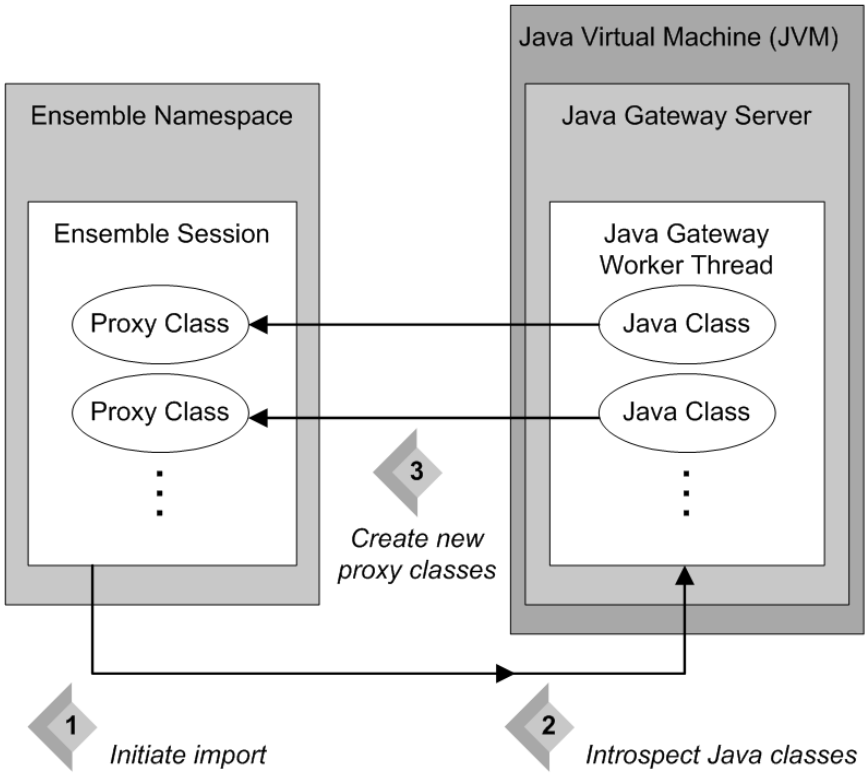
1. Start
2. Connect
3. Import

Later sections in this chapter explain how these commands work to set up Ensemble proxy classes for Java code, as well as how the proxies work once these relationships are set up; see "Proxy Call Sequence" for details.

1.4.1.2 Importing Java Classes

The Java Gateway API **%Import()** method sets off the chain of sequential events (1), (2), and (3) shown in the following diagram:

Figure 1–3: Importing Java Classes



1. The Ensemble session sends an import request.
2. Upon receiving the request, the Java Gateway worker thread introspects the indicated Java packages and classes.
3. If it finds any Java classes that are new or changed, or that have no proxy classes on the Ensemble side, the thread generates new proxy classes for them.

Important: The Java Gateway import only imports classes, methods, and fields marked as `public`.

1.4.1.3 Proxy Call Sequence

A call to any Ensemble proxy method initiates the following sequence of events:

1. All Ensemble proxy parameters are marshaled onto the wire. This is a very simple process in the vast majority of cases — parameters are simply written into the output TCP/IP buffer.
2. A message is sent over the TCP/IP connection to the Java Gateway worker thread. The message consists of the method name, marshaled parameters and, in some instances, other minor load.
3. The Java Gateway worker thread consumes the message, unmarshals the parameters, finds the appropriate method or constructor call, and invokes it using Java reflection. If the given method is an overloaded method, the gateway uses a method overload algorithm to find the right Java method version. For details, see "Overloaded Methods" in the chapter "Mapping Specification."

4. The results of the method invocation (if any) are marshaled onto the wire and sent back to the Ensemble side over the same TCP/IP channel.
5. The Ensemble proxy consumes the response; any return values are unmarshaled and the method call returns.

1.4.2 Stateless Service Mode

The Stateless Service Mode allows simple and efficient calls out to a particular Java service. A Java service is any implementation of the `com.intersys.gateway.Service` interface. Only the following method needs to be implemented:

```
public byte[] execute(byte[] args) throws Throwable;
```

This method takes a byte array, performs whatever service it needs to do, and produces a `byte[]` result. In order to invoke the above Java service method from Ensemble, call the following `%Net.Remote.Gateway` method:

```
Method %ServiceRequest(serviceName As %String, arguments As %String, ByRef response As %String) As
%Status
```

Where `serviceName` is the name of the implementing Java service class, `arguments` corresponds to the Java service `args` and

`response` corresponds to the Java service `result`. `arguments` and `result` are represented as `%Strings` on the Caché, and byte arrays on the Java side, meaning any values serialized as such will be accepted by the underlying engine.

The following static method to `%Net.Remote.Gateway` directly allows invocation of an external Java service:

```
ClassMethod %RemoteService(host As %String, port As %Integer, serviceName As %String, arguments As
%String, additionalClassPaths As %ListOfDataTypes = "") As %String;
```

Note: The implementation of Java service should never include a callback to Ensemble as this newly added component is not designed to be reentrant.

For a simple implementation using GSON please see Stateless Service Mode Example.

2

Using the Java Gateway in a Production

This chapter describes how to use the Java Gateway in a production. It discusses the following topics:

2.1 Adding the Java Gateway Business Service

While it is possible to start the Java Gateway server from the command prompt, the simplest way to use the Java Gateway with an Ensemble production is to add and configure the EnsLib.JavaGateway.Service class as a business service within the production. You can only do this if the Java Gateway server is on the local machine where you are running Ensemble.

Otherwise, you need to start the Java Gateway server from the command prompt. For details, see "Using the Command Prompt."

To add the EnsLib.JavaGateway.Service class as a business service in your production, use the **[Ensemble] > [Production Configuration]** page of the Management Portal. The following steps summarize the configuration procedure:

1. Click the add icon ( ) next to the **Services** column to start the Business Service Wizard.
2. Click the **All Services** tab, and choose EnsLib.JavaGateway.Service as the **Service Class**. You may accept the default values for the other settings.
3. Click **OK** to display the updated production diagram.
4. Click the new Java Gateway business service configuration item and then the **Settings** tab to configure it.

Unlike most business hosts in an Ensemble production, EnsLib.JavaGateway.Service does not handle any Ensemble messages.

2.2 Settings for the Java Gateway Business Service

The following settings specific to the Java Gateway service appear on the **Settings** tab. Hover the cursor over any setting name to display its help text as it appears in the *Class Reference* or click the setting name to display the help text in a separate pop-up window.

Address

IP address or name of the machine where the JVM to be used by the Java Gateway Server is located.

Port

Port number to which the Java Gateway connects. The default is 55555.

HeartbeatInterval

Number of seconds between each communication with the Java Gateway to check whether it is active. When enabled, the minimum value is 5 seconds and the maximum value is 3600 seconds (1 hour). The default is 10 seconds. A value of 0 disables this feature.

HeartbeatFailureTimeout

Number of seconds without responding to the heartbeat, to consider that the Java Gateway is in failure state. If this value is smaller than the HeartbeatInterval property, the gateway is in failure state every time the Java Gateway communication check fails. The maximum value is 86400 seconds (1 day). The default is 30 seconds.

HeartbeatFailureAction

Action to take if the Java Gateway goes into a failure state. Setting it to Restart (default) causes the Java Gateway to restart. Setting it to Alert generates an alert entry in the Event Log. This is independent of the **Alert on Error** setting.

HeartbeatFailureRetry

Time to wait before retrying the HeartbeatFailureAction if the Java Gateway server goes into failure state, and stays in failure state. The default is 300 seconds (5 minutes). A value of 0 disables this feature, meaning that once there is a failure that cannot be immediately recovered, there are no attempts at automatic recovery.

JavaHome

Location of the JVM; use the path you identified in "Prerequisites," in the previous chapter. (This is the value that you would use for *JAVA_HOME* environment variable). It is used to find the target JVM and assemble the command to start the Gateway.

If there is a default JVM on the machine that is usable without the need to specify its location, you can leave this setting blank.

ClassPath

Class path containing the files to be passed as an argument when starting the JVM. You must include any jar file that define classes you are importing via the Java Gateway. There is no need to include InterSystems' .jar files used by the Java Gateway. If you are specifying file paths containing spaces or multiple files, you should quote the classpath and supply the appropriate separators for your platform.

The following is an example semicolon-separated list of file paths for a Microsoft Windows platform:

```
C:\Library\Ensemble\mygateway.jar;"C:\Jar files\utilities.jar"
```

Note that additional paths for the classpath can be specified in business operations derived from EnsLib.JavaGateway.AbstractOperation. See the property AdditionalPaths in that class.

JVMArgs

Optional arguments to be passed to the Java Virtual Machine (JVM) to include when assembling the command to start the Java Gateway. For example, you can specify system properties: *Dsystemvar=value* or set the maximum heap size: *Xmx256m* and so on, as needed.

JDKVersion

Version of JDK used to select the intended version of the InterSystems .jar files. It is used to assemble the command to start the Java Gateway. For example: `Java 1.7`

Logfile

Fully qualified name of a file to log all communication between the Ensemble server and the Java Gateway. Usually this setting should be left blank, except when troubleshooting. These messages include acknowledgment of opening and closing connections to the server, as well as any difficulties encountered in mapping Java classes to Ensemble proxy classes.

JavaDebug

Allow a Java debugger (such as Eclipse or JSwat) to attach. If True, enables Java debugging via TCP. The default is False.

JavaDebugPort

Specify the port on which to listen. The default is 8000.

JavaDebugSuspend

If Yes, suspend the JVM on start to wait for the debugger to attach. The default is No.

Other settings are common to most Ensemble business services. See "Settings in All Business Services" in *Configuring Ensemble Productions*.

Once you have added and configured the Java Gateway business service, it automatically manages the Java Gateway as follows:

- When the production starts, the Java Gateway business service starts an instance of the Java Gateway server, using the settings that you specify on the configuration page.
- When the production receives a signal to stop, the Java Gateway business service attaches to the Java Gateway server and instructs it to stop, as well.

For more information, see EnsLib.JavaGateway.Service in the *Class Reference*.

2.3 Calling Business Service Methods

The Java Gateway business service provides methods that you can use to start, connect to, and stop the Java Gateway engine. You can call the following methods from Ensemble code after you have configured the Java Gateway business service as a member of the production:

- StartGateway()
- ConnectGateway()

- StopGateway()

See the EnsLib.JavaGateway.Service entry in the *Class Reference* for details on these methods.

2.3.1 StartGateway() Method

```
EnsLib.JavaGateway.Service:StartGateway(pJavaHome As %String,
     pClassPath As %String,
     pJVMArgs As %String,
     pPort As %String,
     pLogFile As %String = "",
     pDebug As %Boolean = 0,
     pJDKVersion As %String = "",
     ByRef pDevice As %String = "",
     pAddress As %String = "127.0.0.1",
     pCmdLine As %String = "")
```

This class method starts the Java Gateway server using the specified arguments. If *pDebug* is True, then the JVM is started such that a debugger can attach to it via TCP. If *pLogFile* specifies a valid file name, then messages regarding gateway activities are written to this file. These messages include acknowledgment of opening and closing connections to the server, and difficulties encountered (if any) in mapping Java classes to Ensemble proxy classes.

2.3.2 ConnectGateway() Method

```
EnsLib.JavaGateway.Service:ConnectGateway(pEndpoint As %String,
     ByRef pGateway As EnsLib.JavaGateway.JavaGateway,
     pDebug As %Boolean = 0,
     pTimeout As %Integer = 5,
     pAdditionalPaths As %String = "")
```

This class method connects to the Java Gateway server at the specified *pEndpoint* (hostname:port:namespace) and returns an instance of the EnsLib.JavaGateway.JavaGateway class. If *pDebug* is true, then the connection uses a much longer timeout to allow for a Java debugger (such as Eclipse or JSwat) to attach.

2.3.3 StopGateway() Method

```
EnsLib.JavaGateway.Service:StopGateway(pPort As %String,
     pAddress As %String = "127.0.0.1",
     pTimeout As %Integer = 5)
```

This class method connects to the Java Gateway server and shuts it down.

2.4 Creating a Business Operation

An abstract business operation is available as a base for building Java Gateway oriented business operations for Ensemble productions. You can simply subclass the abstract class EnsLib.JavaGateway.AbstractOperation and implement the appropriate message handlers.

Call the **GetConnection()** method to verify the connection and always access the Java Gateway connection object via the gateway connection object returned by the **GetConnection()** method. For example:

```
 Set tSC = ..GetConnection(.tJavaGateway)
     If $$$ISOK(tSC)
     {
        // Now, start using the tJavaGateway instance ...
     }
```

This method returns a private gateway connection object to be used with the proxy classes.

You can configure the Java Gateway IP address and port in the business operation settings when you add the business operation to the production. Note that the connection to the Java Gateway instance is made during **OnInit()** and closed in **OnTearDown()**. You must override these methods in the business operation class to implement your own setup and tear down procedures.

See the EnsLib.JavaGateway.AbstractOperation entry in the *Class Reference* for details on these methods and also the AdditionalPaths, Address, ConnectTimeout, and Port properties.

2.5 Calling API Methods

In addition to using connect, disconnect, and stop from the business service, the following methods are also available in the EnsLib.JavaGateway.JavaGateway class. You can use them when the business service model is not appropriate for your situation:

The EnsLib.JavaGateway.JavaGateway class provides the following types of methods:

- API methods that let you %Connect() to the Java Gateway server, %Disconnect() from it, and %Shutdown() the Java Gateway server.
- The %Import() method, which imports Java classes or packages from the JVM and generates all the necessary proxy classes for the Ensemble side.
- The %ExpressImport() method, which combines calls to **%Connect()**, **%Import()**, and **%Disconnect()**.
- The utility methods %ClassForName() and %GetAllClasses().

2.5.1 %Connect() Method

```
Method %Connect(host As %String,
                port As %Integer,
                namespace As %String,
                timeout As %Numeric = 5,
                additionalClassPaths As %ListOfDataTypes = "")
     As %Status [ Final ]
```

The **%Connect()** method establishes a connection with the Java Gateway engine. It accepts the following arguments:

Argument	Description
host	Identifies the machine on which the Java Gateway server is running.
port	Port number over which the proxy classes communicate with the Java classes.
namespace	Ensemble namespace.
timeout	Number of seconds to wait before timing out, the default is 5.
additionalClassPaths	Optional — use this argument to supply additional class paths; the paths are added to the system class loader and are available until the session terminates.

2.5.2 %Disconnect() Method

```
Method %Disconnect() As %Status [ Final ]
```

The **%Disconnect()** method closes a connection to the Java Gateway engine.

2.5.3 %Shutdown() Method

```
Method %Shutdown() As %Status [ Final ]
```

The **%Shutdown()** method shuts down the Java Gateway engine.

2.5.4 %Import() Method

```
Method %Import(javaClass As %String,
               ByRef imported As %ListOfDataTypes,
               additionalClassPaths As %ListOfDataTypes = "",
               exclusions As %ListOfDataTypes = "")
    As %Status [ Final ]
```

The **%Import()** method imports the given *javaClass* and all its dependencies by creating and compiling all the necessary proxy classes. The **%Import()** method returns, by reference, a list (*imported*) of generated Ensemble proxy classes. For details of how Java class definitions are mapped to Ensemble proxy classes, see the "Mapping Specification" chapter.

%Import() is a onetime, startup operation. You only need to call it the first time you wish to generate the Ensemble proxy classes. It is necessary again only if you recompile your Java code and wish to regenerate the proxies.

Note: Though it was necessary in earlier versions, **%Import()** does not need to be called at runtime every time you connect.

The following sections provide more details about the **%Import()** method:

- Import Arguments
- Import Dependencies and Exclusions

2.5.4.1 %Import() Arguments

Before you invoke **%Import()**, prepare the %ListOfDataTypes arguments *additionalClassPaths* and *exclusions*. That is, for each argument, create a new %ListOfDataTypes object and call its **Insert()** method to fill the list.

You can use the optional *additionalClassPaths* argument to supply additional *CLASSPATH* arguments, such as the name of the jar file that contains the classes you are importing via the Java Gateway. List elements should correspond to individual additional class path entries, which require one of the following formats:

```
"rootdirectory\..."
"rootdir\...\myjarfile.jar"
```

The additional paths are added to the system class loader and are available until the session terminates. Wildcards are not accepted in *CLASSPATH* arguments; you must use a full name.

Note: While the examples in this topic use Windows pathname conventions, other supported Ensemble platforms work also.

2.5.4.2 Import Dependencies and Exclusions

While mapping a Java class into an Ensemble proxy class and importing it into Ensemble, the Java Gateway loops over all class dependencies discovered in the given Java class including all classes referenced as properties and in argument lists. In other words, the Java Gateway collects a list of all class dependencies that would be needed for a successful import of the given class, then walks that dependency list and generates all necessary proxy classes.

Important: The Java Gateway import only imports classes, methods, and fields marked as `public`.

You can control this process by specifying a list of package and class name prefixes that you would like to exclude from this process. While this situation is rare, it does give you some flexibility to control what classes get imported. The Java Gateway automatically excludes a small subset of packages such as sun.*, COM.rsa.*, and most com.sun.* packages.

In previous releases, the Java Gateway disallowed import of all com.sun.* classes, as some of them are Java internals. However, subsequent releases have relaxed this so that you can import additional com.sun.* classes (including com.sun.tools.javac.Main and com.sun.messaging).

2.5.5 %ExpressImport() Method

```
ClassMethod %ExpressImport(name As %String,
                           port As %Integer,
                           host As %String = "127.0.0.1",
                           silent As %Boolean = 0,
                           additionalClassPaths As %ListOfDataTypes = "",
                           exclusions As %ListOfDataTypes = "")
     As %ListOfDataTypes
```

%ExpressImport() is a one-step convenience class method that combines calls to **%Connect()**, **%Import()**, and **%Disconnect()**. It returns a list of generated proxies. It also logs that list, if you set the *silent* argument to `0`. The *name* argument is a semicolon-delimited list of classes or jar files.

2.5.6 %ClassForName() Method

```
Method %ClassForName(className As %String)
     As %Status [ Final ]
```

If you need your Caché Basic or ObjectScript code to call the Java method `Class.forName` to load a Java class, use the Java Gateway API method **%ClassForName()** to make the call. Its argument is the name of the class. Use the Ensemble proxy class name as the argument, rather than the Java class name.

2.5.7 %GetAllClasses() Method

```
Method %GetAllClasses(jarFileOrDirectoryName As %String,
                      ByRef allClasses As %ListOfDataTypes)
     As %Status
```

This method returns, in the ByRef argument *allClasses*, a list of all public classes available in the jar file or directory specified by the first argument, *jarFileOrDirectoryName*.

2.6 Using the Command Prompt

Usually you start and stop the Java Gateway server automatically, by configuring the EnsLib.JavaGateway.Service business service as a member of the production. Once this is done, the Java Gateway server starts and stops automatically with the production. The **StartGateway()** class method is also available to manually start the Java Gateway server.

However, during development or debugging, or when Ensemble and the Java Gateway server run on different machines, you may find it useful to start the Java Gateway server from a command prompt. Do this by entering the following command (all on one line). Within this command, the service name has a length limit of 255 characters:

`java -classpath` *classpath* `com.intersys.gateway.JavaGateway` *port logfile*

Argument	Description
classpath	Consists of a semicolon-separated list of paths of the files required to be passed as an argument when starting the JVM, including the jar file that contains the classes you are importing via the Java Gateway. If any path includes space characters, that path should be enclosed within double quotes. Be sure to use pathnames of the appropriate format for you platform.
port	Port number on which to listen for the incoming requests.
logfile	*Optional* — If specified, the command procedure creates a log file of that name. You must specify the full pathname in the string.

The command line for starting the Java Gateway in JMS mode is similar to the one for starting the Java Gateway, replacing `JavaGateway` with `JMSGateway` in the command (all on one line). Within this command, the service name has a length limit of 255 characters:

`java -classpath` *classpath* `com.intersys.gateway.JMSGateway` *port logfile*

You only need to start the JMS Gateway if you are using the Java Gateway with JMS. Otherwise you can just start the Java Gateway.

2.7 Using the Java Gateway Wizard

You can import a Java class or an entire .jar file using the Java Gateway wizard built into Studio. To start the wizard:

1. Start Studio.
2. From the **Tools** menu, point to and click **Add-Ins**.
3. Click **Java Gateway Wizard** to start the Java Gateway Wizard dialog.
4. Click **Jar File** and either enter the path name or click **Browse** to find the appropriate .jar file. For example, the following is the name of a sample jar file included with Ensemble, where MyEnsemble is the name of the install directory:

   ```
   C:\MyEnsemble\dev\java\samples\remote\test\javagatewaysamples.jar
   ```

   or

   Click **Class Name** and either enter the full path name or click **Browse** to find the appropriate Java class file. For example, the following is the name of a sample Java class included with Ensemble, where MyEnsemble is the name of the install directory:

   ```
   C:\MyEnsemble\dev\java\samples\remote\test\Address.class
   ```

5. Enter the **Host** and **Port** for the Java Gateway server.
6. Enter **Classpaths** and **Exclusions** as instructed in the dialog.
7. If you select a **Jar File** in Step 4, you can click **View** to see a list of the classes in the jar file.

   or

   If you enter a **Class Name** in Step 4, continue to the next step.
8. Click **Import** to generate Ensemble proxy classes. The wizard displays the class name as it generates each proxy class.
9. When the import operation is complete, click **Finish** to exit the wizard.

2.8 Error Checking

The Java Gateway provides error checking as follows:

- When an error occurs while executing Ensemble proxy methods, the error is, in most cases, a Java exception, coming either from the original Java method itself, or from the Java Gateway engine. When this happens, a <ZJGTW> error is trapped.
- Java Gateway API methods like **%Import()** or **%Connect()** return a typical Ensemble %Status variable.

In both cases, Ensemble records the last error value returned from a Java class (which in many cases is the actual Java exception thrown) in the local variable *%objlasterror*.

You can retrieve the complete text of the error message by calling **$system.OBJ.DisplayError()**, as follows:

```
Do $system.OBJ.DisplayError(%objlasterror)
```

2.9 Troubleshooting

When you encounter problems using the Java Gateway, it is always beneficial to turn on logging. This facilitates InterSystems staff to help you troubleshoot problems. To activate logging, simply identify a log file when you start the Java Gateway. You can do this whether you start from the command line, by configuring the business service, or using the **StartGateway()** business service method.

Sometimes, while using the Java Gateway in a debugging or test situation, you may encounter problems with a Terminal session becoming unusable, or with write errors in the Terminal window. It is possible that a Java Gateway connection terminated without properly disconnecting. In this case, the port used for that connection may be left open.

If you suspect this is the case, to close the port, enter the following command at the Terminal prompt:

```
Close "|TCP|port"
```

Where *port* is the port number to close.

3

Sample Code

You can find sample Java Gateway code in Ensemble installations in the EnsLib.JavaGateway.Test class. These samples demonstrate how to generate and use Ensemble proxy classes. They are presented in the following example sections:

- Setting Up Java Gateway Examples
- Running Plain Java Examples
- Running JDBC Examples
- Running EJB Gateway Examples
- Running JMS Gateway Examples
- Stateless Service Mode Example

For each method described in this chapter, the *port* argument is the port number over which the proxy classes communicate with the Java classes, and *host* identifies the machine on which the Java Gateway server is running. The *port* argument is required; *host* is optional and defaults to `"127.0.0.1"` (the local machine) if not provided.

3.1 Setting Up Java Gateway Examples

To prepare to run sample code, in each of the examples described in this chapter, you must complete the following steps:

1. Start the Java Gateway server (for JMS, start the JMS Gateway server).
2. Start a Terminal session and change to an Ensemble namespace (for JMS examples you need two Terminal sessions).
3. Make sure to run Import code if this is the first time you are running the sample code or if you have modified or recompiled your Java classes.

To prepare to run any of the sample code located under EnsLib.JavaGateway.Test — either for the first time, or after you update or recompile your Java code — you must run the corresponding Import methods found under EnsLib.JavaGateway.InterfaceEnabler. This imports the necessary Java classes. The specific sample Import method depends on the type of example you are running. For example:

- To import the sample Java classes provided with Ensemble:

```
Do ##class(EnsLib.JavaGateway.InterfaceEnabler).ImportJGSamples(port,host)
```

- To import the JDBC interface:

```
Do ##class(EnsLib.JavaGateway.InterfaceEnabler).ImportJDBC(port,host)
```

- To import the InterSystems JBoss Person EJBs, enter the following command (all on one line):

```
Do ##class(EnsLib.JavaGateway.InterfaceEnabler).ImportPersonJBoss(PersonEJBJar,
j2eeJarFile,port,host)
```

  Where *PersonEJBJar* points to the `PersonEJB.jar` file (as generated by the InterSystems EJB Boss projection) and *j2eeJarFile* points to the J2EE jar file on your system, for example:

  `c:/myj2ee/j2ee.jar`

- To import SonicMQ ConnectionFactory (Queue and Topic), allowing connectivity to the SonicMQ JMS Server, enter the following command (all on one line):

```
Do ##class(EnsLib.JavaGateway.InterfaceEnabler).ImportSonicJMS(sonicBrokerJar,
sonicContextJar,port,host)
```

  Where *sonicBrokerJar* points to the Sonic `broker.jar` file, for example:

  `C:/Program Files/SonicSoftware/SonicMQ/lib/broker.jar`

  And *sonicContextJar* points to the Sonic `mfcontext.jar` file, for example:

  `C:/Program Files/SonicSoftware/SonicMQ/lib/mfcontext.jar`

- To import all J2EE interfaces (EJB, JCA, JTA, Java XML, JTA, etc.), enter the following command (all on one line):

```
Do ##class(EnsLib.JavaGateway.InterfaceEnabler).ImportJ2EE(j2eeJarFile,
port,host)
```

  Where *j2eeJarFile* points to the J2EE jar file on your system, for example:

  `c:/myj2ee/j2ee.jar`

In addition to these Import methods, the EnsLib.JavaGateway.InterfaceEnabler class provides a convenience method that, given a jar file or a directory name, displays all available classes in that jar file or directory:

```
Do ##class(EnsLib.JavaGateway.InterfaceEnabler).Browse(jarName,port,host)
```

3.2 Running Plain Java Examples

The **Test()** method shows how to use the sample basic classes delivered with Ensemble. To run it, first set up the example, using **ImportJGSamples()** if you need to import. Then enter:

```
Do ##class(EnsLib.JavaGateway.Test).Test(port,host)
```

The **TestArrays()** method shows how to use arrays. To run it, first set up the example, using **ImportJGSamples()** if you need to import. Then enter:

```
Do ##class(EnsLib.JavaGateway.Test).TestArrays(port,host)
```

3.3 Running JDBC Examples

The following example establishes a connection with Caché JDBC driver, then executes some standard JDBC code. To run it, first set up the example, using **ImportJDBC()** if you need to import. Then enter:

```
Do ##class(EnsLib.JavaGateway.Test).JDBC(port,host,jdbcPort,jdbcHost)
```

This sample code should work against any database that has a compliant JDBC driver. Simply replace the connection parameters (JDBC driver class name, URL, username, and password) with appropriate values. See the *Class Reference* entry for the **JDBC** method for details.

Note: The value of *jdbcPort* defaults to 1972; in many cases, this is not correct for your Ensemble instance.

3.4 Running EJB Gateway Examples

The following example shows how Caché Basic or ObjectScript code can access a sample Entity Bean (generated by Caché EJB projections) using JBoss version 4.0.1. To run it, first set up the example, using **ImportPersonJBoss()** if you need to import. Then enter:

```
Do ##class(EnsLib.JavaGateway.Test).PersonJBoss(JBossRoot,port, host)
```

Where *JBossRoot* points to your JBoss root, for example:

```
c:/jboss-4.0.1sp1
```

You can easily modify this example to work against *any* application server. Simply set the *CLASSPATH* accordingly and use appropriate connection and context parameters.

3.5 Running JMS Gateway Examples

The following examples show how to use Pub/Sub (Topic) and P2P (Queue) JMS Gateways against the SonicMQ JMS Server. The sample Topic/Queue shipped with SonicMQ is used throughout the examples.

Important: To use the JMS Gateway you must have the `java.jms.*` libraries which are included in the J2EE SDK j2ee.jar file.

The examples below can be modified to work against *any* JMS Server. Simply set the *CLASSPATH* accordingly and use appropriate Queue/Topic Connection factories. You must also modify the **ImportSonicJMS()** method to import corresponding connection factories, and you need to use appropriate sample Topics/Queues.

- JMS Point-to-Point (P2P) Example
- JMS Publish/Subscribe (Pub/Sub) Example
- Java Naming and Directory Interface (JNDI) Example

3.5.1 JMS Point-to-Point (P2P) Example

The following example shows how to generate a JMS-based Queue message sender and receiver and control them from an Ensemble session. To run the example, first set it up, using **ImportSonicJMS()** if you need to import. Then:

1. In one Terminal session, type:

   ```
   Do ##class(EnsLib.JavaGateway.Test).JMSQueueReceiver(sonicBrokerJar,port,host)
   ```

   Where *sonicBrokerJar* points to the Sonic `broker.jar` file, for example:

   ```
   C:/Program Files/SonicSoftware/SonicMQ/lib/broker.jar
   ```

The example connects to the SonicMQ JMS Server using the sample queue that SonicMQ provides. After that, it waits for incoming messages and displays any received messages on the Terminal screen.

2. In the other Terminal session, type:

```
Do ##class(EnsLib.JavaGateway.Test).JMSQueueSender(sonicBrokerJar,port,host)
```

   The example connects to the SonicMQ JMS Server using the sample queue that SonicMQ provides. After that, it sits in a loop, prompting the user to type a message.

3. On the Sender side, you are prompted to type a message.
4. Type a message and press **Enter**.
5. The message appears on the Receiver side.
6. The example runs until you close both Terminal sessions, or until you enter `QUIT` as the message text.

3.5.2 JMS Publish/Subscribe (Pub/Sub) Example

The following example shows how Caché Basic or ObjectScript code can generate a JMS-based Topic Publisher and Subscriber and use them to send messages. To run it, first set up the example, using **ImportSonicJMS()** if you need to import. Then:

1. In one Terminal session, run:

```
Do ##class(EnsLib.JavaGateway.Test).JMSSubscriber(sonicBrokerJar,port,host)
```

   Where *sonicBrokerJar* points to the Sonic `broker.jar` file, for example:

```
C:/Program Files/SonicSoftware/SonicMQ/lib/broker.jar
```

   The example connects to the SonicMQ JMS Server using the sample topic that SonicMQ provides. After that, it establishes a topic connection and waits to receive a single message.

2. In the other Terminal session, run:

```
Do ##class(EnsLib.JavaGateway.Test).JMSPublisher(sonicBrokerJar,port,host)
```

   The example connects to the SonicMQ JMS Server using the sample topic that SonicMQ provides. After that, it establishes a topic connection and creates and sends a single message.

3. The publisher sends one message to the subscriber ("Hello JMS!") and both quit.

3.5.3 Java Naming and Directory Interface (JNDI) Example

This example is exactly the same as the JMS Pub/Sub example, except that the **JNDIPublisher()** method establishes a connection by looking up a *TopicConnectionFactory* object in the JNDI registry, whereas **JMSPublisher()** actually creates the connection. If **JNDIPublisher()** does not find the object, it tries to (re)bind the object, then return and try to look it up.

Note: The JMS with JNDI example is customized for JMS. However, you can use JNDI to obtain a factory object in other contexts, such as with Enterprise Java Beans (EJB).

To run the example, first set it up, using **ImportSonicJMS()** if you need to import. Then:

1. In one Terminal session, type:

```
Do ##class(EnsLib.JavaGateway.Test).JMSSubscriber(sonicBrokerJar,port,host)
```

   Where *sonicBrokerJar* points to the Sonic `broker.jar` file, for example:

```
C:/Program Files/SonicSoftware/SonicMQ/lib/broker.jar
```

2. In the other Terminal session, type (all on one line):

```
Do ##class(EnsLib.JavaGateway.Test).JNDIPublisher(sonicBrokerJar,
sonicContextJar,port,host)
```

   Where *sonicContextJar* points to the Sonic `mfcontext.jar` file, for example:

```
C:/Program Files/SonicSoftware/SonicMQ/lib/mfcontext.jar
```

3. The publisher sends one message to the subscriber ("Hello JMS!") and both exit.

3.6 Stateless Service Mode Example

Here is a simple implementation using GSON which gets the Google directions between two cities and sends them back to Caché in JSON format. For more info on GSON go to: https://code.google.com/p/google-gson/.

Java code:

```
package jsonservice;
import java.io.BufferedReader;
import java.io.ByteArrayInputStream;
import java.io.InputStreamReader;
import java.net.URL;

import com.google.gson.JsonElement;
import com.google.gson.JsonObject;
import com.google.gson.JsonParser;

public class Directions implements com.intersys.gateway.Service {

 public byte[] execute(byte[] args) throws Throwable {
  JsonElement inputJSON = new JsonParser().parse(new
    BufferedReader(new InputStreamReader(new ByteArrayInputStream(args), "UTF-8")));
  JsonObject jsonObject = inputJSON.getAsJsonObject();
  String origin = jsonObject.get("origin").toString();
  String destination = jsonObject.get("destination").toString();

  URL URLsource = new URL("http://maps.googleapis.com/maps/api/directions/json?
    origin="+origin+"&destination="+destination+"&sensor=false");
  BufferedReader in = new BufferedReader(new  InputStreamReader(URLsource.openStream(),"UTF-8"));
  JsonElement outputJSON = new JsonParser().parse(in);
  in.close();
  jsonObject = outputJSON.getAsJsonObject();
  String response = jsonObject.toString();
  return response.getBytes();
 }
}
```

To invoke the above service from Caché/Ensemble, simply do:

```
Set classPath=##class(%ListOfDataTypes).%New()
// add GSON to the classpath
Do classPath.Insert("c:/service/gson-1.4.jar")
// add the location of the above Service to the classpath
Do classPath.Insert("c:/service/")
// invoke the service
Write  ##class(%Net.Remote.Gateway).%RemoteService("127.0.0.1",55555,"jsonservice.Directions","{""origin""
 :
   ""philadelphia"", ""destination"" : ""boston""}",classPath)
```

Note: The JSON parsing tool (GSON) is not strictly necessary in this simple example.

4

Mapping Specification

This chapter describes the mapping between Java objects and the Ensemble proxy classes that represent the Java objects.

Important: Only classes, methods, and fields marked as `public` are imported.

This chapter describes mappings of the following types:

- Package and Class Names
- Primitives
- Date and Time
- Properties
- Methods
- Constructors
- Constants
- Java Classes
- Restrictions

4.1 Package and Class Names

Package and class names are preserved when imported, except that each underscore (_) in an original Java class name is replaced with the character u and each dollar sign ($) is replaced with the character d in the Ensemble proxy class name. Both the u and the d are case-sensitive (lowercase).

4.2 Primitives

Primitive types and primitive wrappers map from Java to Ensemble as shown in the following table.

Java	Ensemble
boolean	%Library.Boolean
byte	%Library.Integer

Java	Ensemble
char	%Library.String
double	%Library.Numeric
float	%Library.Float
int	%Library.Integer
long	%Library.Integer
short	%Library.SmallInt
java.lang.Boolean	%Library.Boolean
java.lang.Double	%Library.Numeric
java.lang.Float	%Library.Float
java.lang.Integer	%Library.Integer
java.lang.Long	%Library.Integer
java.lang.Short	%Library.SmallInt
java.lang.String	%Library.String

Primitive Java type wrappers are mapped by default to their corresponding Ensemble data types for performance reasons. It is recommended that you always use data types whenever you are passing an argument whose type is a primitive wrapper. For example, you can call the following Java method:

```
public Long getOrderNumber(Integer id, Float rate)
```

as follows in Ensemble:

```
Set id=5
Set rate=10.0
// order is a local Ensemble variable
Set order=test.getOrderNumber(id,rate)
```

However, you are also free to import primitive wrapper types as is, then use them that way from your Ensemble code, for example:

```
Set id=##class(java.lang.Integer).%New(gateway,5)
Set rate=##class(java.lang.Float).%New(gateway,10.0)
// order is of java.lang.Long type
Set order=test.getOrderNumber(id,rate)
```

4.3 Date and Time

Date and time types map from Java to Ensemble as follows:

Java	Ensemble
java.sql.Date	%Library.Date
java.sql.Time	%Library.Time
java.sql.Timestamp	%Library.TimeStamp

4.4 Properties

The result of importing a Java class is an ObjectScript abstract class. For each Java property that does not already have corresponding getter and setter methods (imported as is), the Java Gateway engine generates corresponding ObjectScript getter and setter methods. It generates setters as set*XXX*, and getters as get*XXX*, where *XXX* is the property name. For example, importing a Java string property called Name results in a getter method **getName()** and a setter method **setName(%Library.String)**. The gateway also generates set and get class methods for all static members.

4.5 Methods

After you perform the Java Gateway import operation, all methods in the resulting Ensemble proxy class have the same name as their Java counterparts, subject to the limitations described in the Method Names section. They also have the same number of arguments. The type for all the Ensemble proxy argument methods is %Library.ObjectHandle; the Java Gateway engine resolves types at runtime.

For example, the Java method **test()**:

```
public boolean checkAddress(Person person, Address address)
```

is imported as:

```
Method checkAddress(p0 As %Library.ObjectHandle,
                    p1 As %Library.ObjectHandle) As %Library.ObjectHandle
```

4.5.1 Overloaded Methods

While Caché Basic and ObjectScript do not support overloading, you can still map overloaded Java methods to Ensemble proxy classes. This is supported through a combination of largest method cardinality and default arguments. For example, if you are importing an overloaded Java method whose different versions take two, four, and five arguments, there is only one corresponding method on the Ensemble side; that method takes five arguments, all of %ObjectHandle type. You can then invoke the method on the Ensemble side with two, four, or five arguments. The Java Gateway engine then tries to dispatch to the right version of the corresponding Java method.

While this scheme works reasonably well, avoid using overloaded methods with the same number of arguments of similar types. For example, the Java Gateway has no problems resolving the following methods:

```
test(int i, String s, float f)
test(Person p)
test(Person p, String s, float f)
test(int i)
```

However, avoid the following:

```
test(int i)
test(float f)
test(boolean b)
test(Object o)
```

Tip: For better results using the Java Gateway, use overloaded Java methods only when absolutely necessary.

4.5.2 Method Names

Ensemble has a limit of 31 characters for method names. Ensure your Java method names are not longer than 31 characters. If the name length is over the limit, the corresponding Ensemble proxy method name contains only the first 31 characters of your Java method name. For example, if you have the following methods in Java:

```
thisJavaMethodHasAVeryVeryLongName(int i)       // 34 characters long
thisJavaMethodHasAVeryVeryLongNameLength(int i) // 40 characters long
```

Ensemble imports only one method with the following name:

```
thisJavaMethodHasAVeryVeryLongN                 // 31 characters long
```

The Java reflection engine imports the first one it encounters. To find out which method is imported, you can check the Ensemble proxy class code. Better yet, ensure that logging is turned on before the import operation. The Java Gateway log file contains warnings of all method names that were truncated or not imported for any reason.

Each underscore (_) in an original method name is replaced with the character u and each dollar sign ($) is replaced with the character d. Both the u and the d are case-sensitive (lowercase). If these conventions cause an unintended overlap with another method name that already exists on the Ensemble side, the method is not imported.

Finally, Ensemble class code is not case-sensitive. So, if two Java method names differ only in case, Ensemble only imports one of the methods and writes the appropriate warnings in the log file.

4.5.3 Static Methods

Java static methods are projected as class methods in the Ensemble proxy classes. To invoke them from ObjectScript, use the following syntax:

```
// calls static Java method staticMethodName(par1,par2,...)
Do ##class(className).staticMethodName(gateway,par1,par2,)
```

4.6 Constructors

You invoke Java constructors by calling **%New()**. The signature of **%New()** is exactly the same as the signature of the corresponding Java constructor, with the addition of one argument in position one: an instance of the Java Gateway. The first thing **%New()** does is to associate the proxy instance with the provided gateway instance. It then calls the corresponding Java constructor. For example:

```
// calls Student(int id, String name) Java constructor
Set Student=##class(javagateway.Student).%New(Gateway,29,"John Doe")
```

4.7 Constants

The Java Gateway projects and imports Java static final variables (constants) as Final Parameters. The names are preserved when imported, except that each underscore (_) is replaced with the character u and each dollar sign ($) is replaced with the character d. Both the u and the d are case-sensitive (lowercase).

For example, the following static final variable:

```
public   static   final   int   JAVA_CONSTANT   =  1;
```

is mapped in ObjectScript as:

```
Parameter JAVAuCONSTANT  As INTEGER = 1;
```

From ObjectScript, access the parameter as:

```
##class(MyJavaClass).%GetParameter("JAVAuCONSTANT"))
```

4.8 Java Classes

The following sections describe the particulars of using the Ensemble Java Gateway with specific types of Java classes:

- Java Object Superclass (java.lang.Object)
- Java Arrays
- Java Collections Framework
- Recasting
- Java Standard Output Redirection

4.8.1 Java Object Superclass (java.lang.Object)

Earlier versions of the Java Gateway did not allow the use of java.lang.Object. This release maps java.lang.Object as is. When using java.lang.Object, consider the following:

- Primitive wrapper classes in Java, which are subclasses of java.lang.Object in Java, are mapped to Ensemble data types and are thus not subclasses of java.lang.Object in Ensemble. For details, see the Java Arrays section.
- Although using java.lang.Object in Java provides great flexibility, it often requires much (re)casting. ObjectScript has only limited support for casting and recasting. When using java.lang.Object to point to its subclass, use the cast operation in ObjectScript to execute the methods of the subclass. Here is an example from the EJB Gateway:

```
Set jndiContext=##class(javax.naming.InitialContext).%New(gateway)
Set jndiName="PersonEJB_Sample_EJBPerson"
Set refPerson=jndiContext.lookup(jndiName)
Set personHomeClass=##class(java.lang.Class).forName(gateway,
    Sample.EJBPersonHome)
Set homePerson=##class(javax.rmi.PortableRemoteObject).narrow(gateway,
   refPerson,personHomeClass)
// here homePerson is java.lang.Object, and in Java, we would simply
// recast it to EJBPersonHome by saying:
//    homePerson = (EJBPersonHome) homePerson

// In ObjectScript, you will need to 'recast' the method call:
Set remotePerson=##class(Sample.EJBPersonHome)homePerson.findById(1)
```

Using java.lang.Object works as long as you remember you cannot recast an object *per se*. However, since Ensemble proxy classes are abstract classes, method invocation recasting is sufficient for most purposes.

4.8.2 Java Arrays

Arrays of primitive types, wrappers, data and time types, and Class types are mapped as %Library.ListOfDataTypes. Arrays of object types are mapped as %Library.ListOfObjects. Only one level of subscripts is supported.

Java byte arrays (byte[]) are projected as %Library.GlobalBinaryStream. Similarly, Java char arrays (char[]) are projected as %Library.GlobalCharacterStream. This allows for a more efficient handling of byte and character arrays.

As an only exception to the general rule of pass-by-value-only semantics in the Java Gateway, you can pass byte and stream arrays either by value or by reference. Passing by reference allows changes to the byte/char stream on the Java side visible on the Ensemble side as well. A good example is the **java.io.InputStream** read method:

```
int read(byte ba[], int maxLen
```

which reads up to *maxLen* bytes into the ba byte array. For example, in Java:

```
byte[] ba = new byte[maxLen];
int bytesRead = inputStream.read(ba,maxLen);
```

The equivalent code in ObjectScript:

```
 Set readStream=##class(%GlobalBinaryStream).%New()
 // reserve a number of bytes since we are passing the stream by reference
 For i=1:1:50 Do readStream.Write("0")
 Set bytesRead=test.read(.readStream,50)
```

The following example passes a character stream by value, meaning that any changes to the corresponding Java char[] are not reflected on the Ensemble side:

```
 Set charStream=##class(%GlobalCharacterStream).%New()
 Do charStream.Write("Global character stream")
 Do test.setCharArray(charStream)
```

4.8.3 Java Collections Framework

Previous versions of the Java Gateway provided special treatment when importing java.util.List (and its subclasses), java.util.Map (and its subclasses) and java.util.Class. The Java Gateway imported the first two as either %Library.ListOfDataTypes or %Library.ListOfObjects and java.util.Class as %Library.String.

This release now imports all of the above classes "as is." You now can use the entire Java Collections Framework "as is" in Ensemble. You can also take advantage of java.lang.Class methods. The following is a **HashMap** example using ObjectScript:

```
 Set grades=##class(java.util.HashMap).%New(gateway)
 Set x=grades.put("Biology",3.8)

 Set x=grades.put("Spanish",2.75)
 Do student.mySetGrades(grades)

 Set grades=student.myGetGrades()
 Set it=grades.keySet().iterator()
 While (it.hasNext()) {
     Set key=it.next()
     Set value=grades.get(key)
     Write " ",key," ",value,!
 }
```

The following example uses Class.forName and java.utilArrayList:

```
 Set arrayListCls=##class(java.lang.Class).forName(gateway,"java.util.ArrayList")
 Set sports=arrayListCls.newInstance()
 Do sports.add("Basketball")

 Do sports.add("Swimming")

 Set list=student.myGetFavoriteSports()
     For i=0:1:list.size()-1 {
     Write " "_list.get(i),!
 }
```

4.8.4 Recasting

ObjectScript has limited support for recasting; namely, you can recast only at a point of a method invocation. However, since all Ensemble proxies are abstract classes, this should be quite sufficient. For an example of how to recast, see the Java Object Superclass section.

4.8.5 Java Standard Output Redirection

The Java Gateway automatically redirects any standard Java output in the corresponding Java code to the calling Ensemble session. It collects any calls to System.out in your Java method calls and sends them to Ensemble to display in the same format as you would expect to see if you ran your code from Java. To disable this behavior and direct your output to the standard output device as designated by your Java code (in most cases that would be the console), set the following global reference in your Ensemble-enabled namespace:

```
Set ^%SYS("Gateway","Remote","DisableOutputRedirect") = 1
```

4.9 Restrictions

Important: Rather than aborting import, the Java Gateway engine silently skips over all the members it is unable to generate. If you repeat the import step with logging turned on, Ensemble records all skipped members (along with the reason why they were skipped) in the `WARNING` section of the log file.

The Java Gateway engine always makes an attempt to preserve package and method names, parameter types, etc. That way, calling an Ensemble proxy method is almost identical to calling the corresponding method in Java. It is therefore important to keep in mind Caché Basic and ObjectScript restrictions and limits while writing your Java code. In a vast majority of cases, there should be no issues at all. You might run into some Caché Basic or ObjectScript limits if, for example:

- Your Java method names are longer than 30 characters.
- You have 100 or more arguments.
- You are trying to pass String objects longer than 32K.
- You rely on the fact that Java is case-sensitive when you choose your method names.
- You are trying to import a static method that overrides an instance method.

Check with the latest Caché Basic and ObjectScript documentation regarding any limits or restrictions. The books are:

- *Using Caché Basic*
- *Caché Basic Reference*
- *Using Caché ObjectScript*
- *Caché ObjectScript Reference*