

isCOBOL Evolve: EIS

Enterprise Information System

Key Topics:

- The Service Bridge facility
- isCOBOL and AngularJS
- COBOL Servlet option (OOP)
- WebClient option
- Web Direct 2.0 option
- HTTPHandler class (com.iscobol.rts.HTTPHandler)
- HTTPClient class (com.iscobol.rts.HTTPClient)



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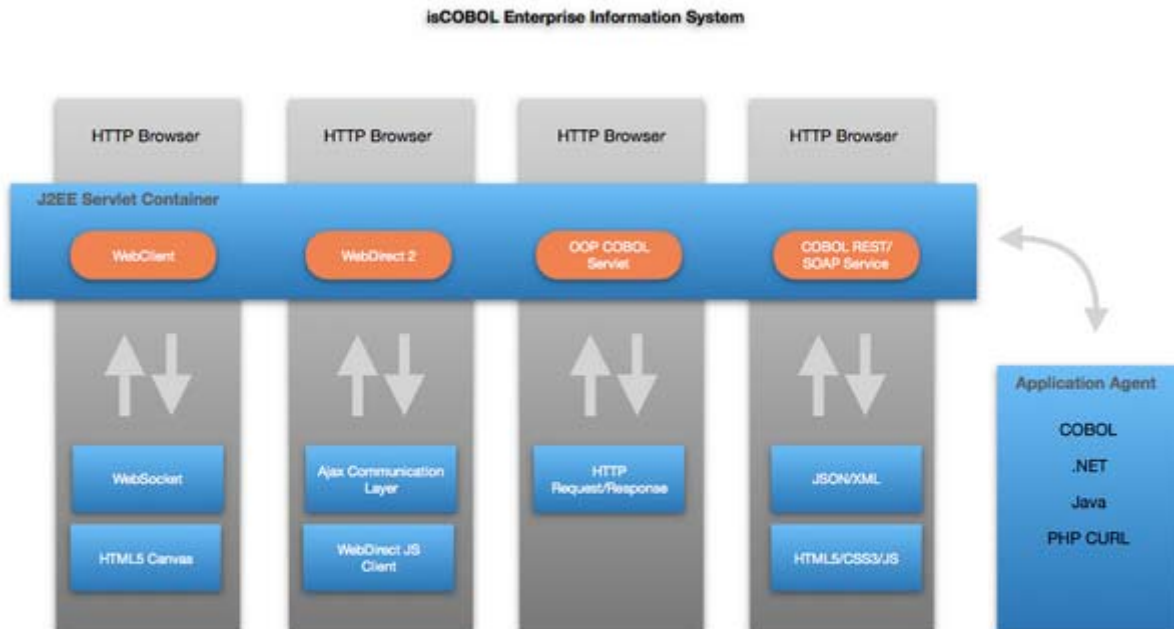
Chapter 1

Introduction

Overview

isCOBOL Enterprise Information System (EIS) is an umbrella of tools and features available in the isCOBOL Evolve Suite that allows development and execution of a web based application in a J2EE container. There are several options to deploy a web application based on EIS as shown in the figure below, isCOBOL Enterprise Information System Architecture, in order to provide the right option for every scenario.

isCOBOL Enterprise Information System Architecture



Getting Started

The setup of isCOBOL EIS environment requires the following steps:

1. [Download and install the Java Development Kit \(JDK\)](#)
2. [Download and install isCOBOL Evolve](#)
3. [Activate the License](#)

In order to activate your isCOBOL Evolve products, you will need the e-mail you received from Veryant containing your license key. Contact your Veryant representative for details.

Download and install the Java Development Kit (JDK)

JDK version 1.6 (or later) from Oracle must be installed on your machine in order to use isCOBOL products. For best results and performance, install the latest JDK version available for your platform.

1. Go to "<http://www.oracle.com/technetwork/java/javase/downloads/index.html>".
2. Click the first "Download" rounded square button below "Java SE Downloads"
3. Accept the license agreement and click on the appropriate filename to download the JDK installer. For example, for Windows 64-bit click on "jdk-8-windows-x64.exe".
4. Run the JDK installer or self-extracting binary. JDK installation instructions can be found at "<http://www.oracle.com/technetwork/java/javase/index-137561.html>".

After installation, verify that the PATH variable includes the JDK bin directory.

On Windows platforms, the JDK and JRE are installed in subdirectories of "C:\Program Files\Java". For example:

```
C:\Program Files\Java\jdk1.8.0
```

On UNIX and Linux platforms, the JDK and JRE may be installed in any directory. It is common to see "/opt/java" on Linux. For example:

```
/opt/java/jdk1.8.0
```

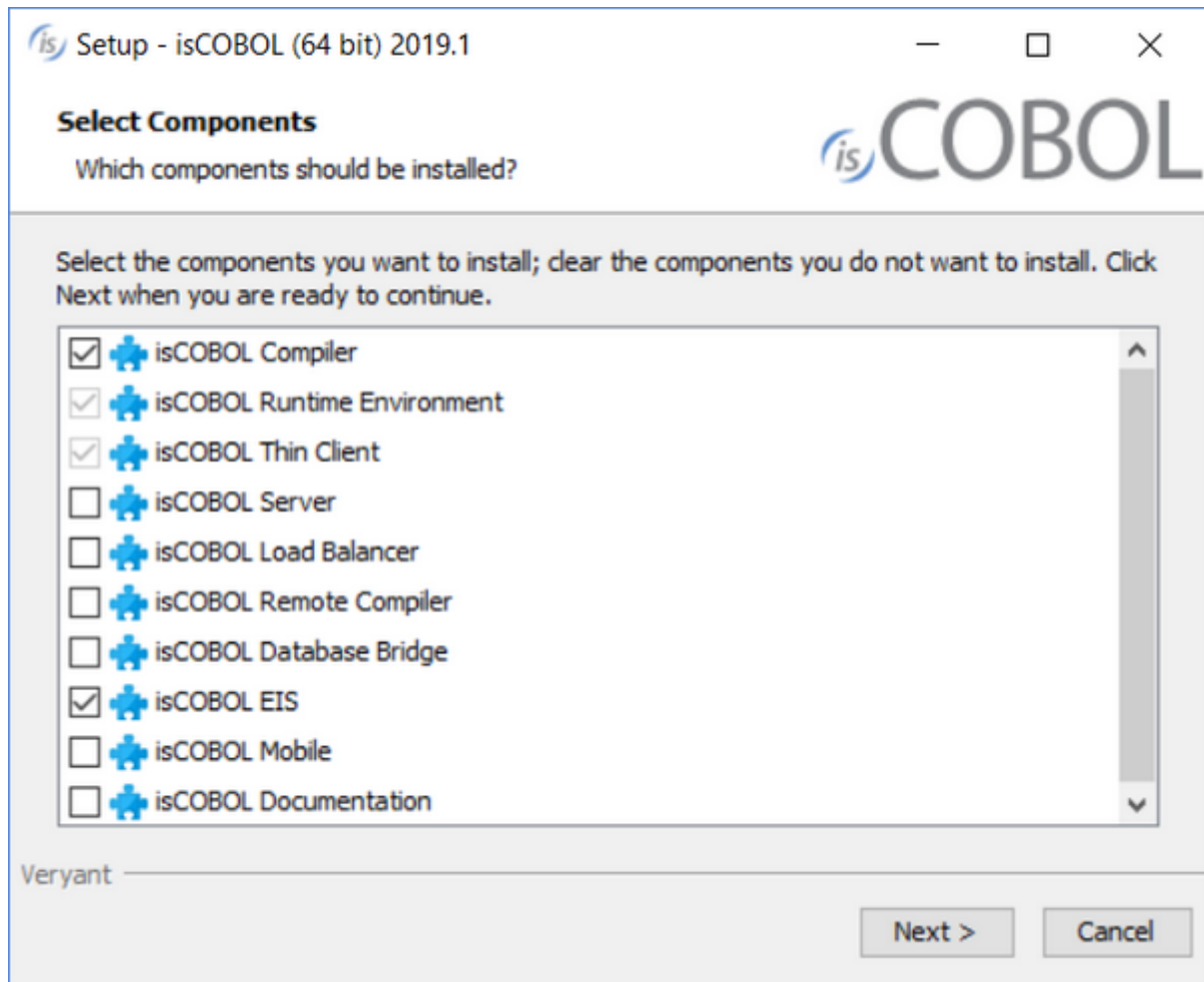
Note - Oracle doesn't provide Java for every UNIX platform. Some UNIX platforms provide their own Java environment. Refer to your UNIX documentation for details.

Download and install isCOBOL Evolve

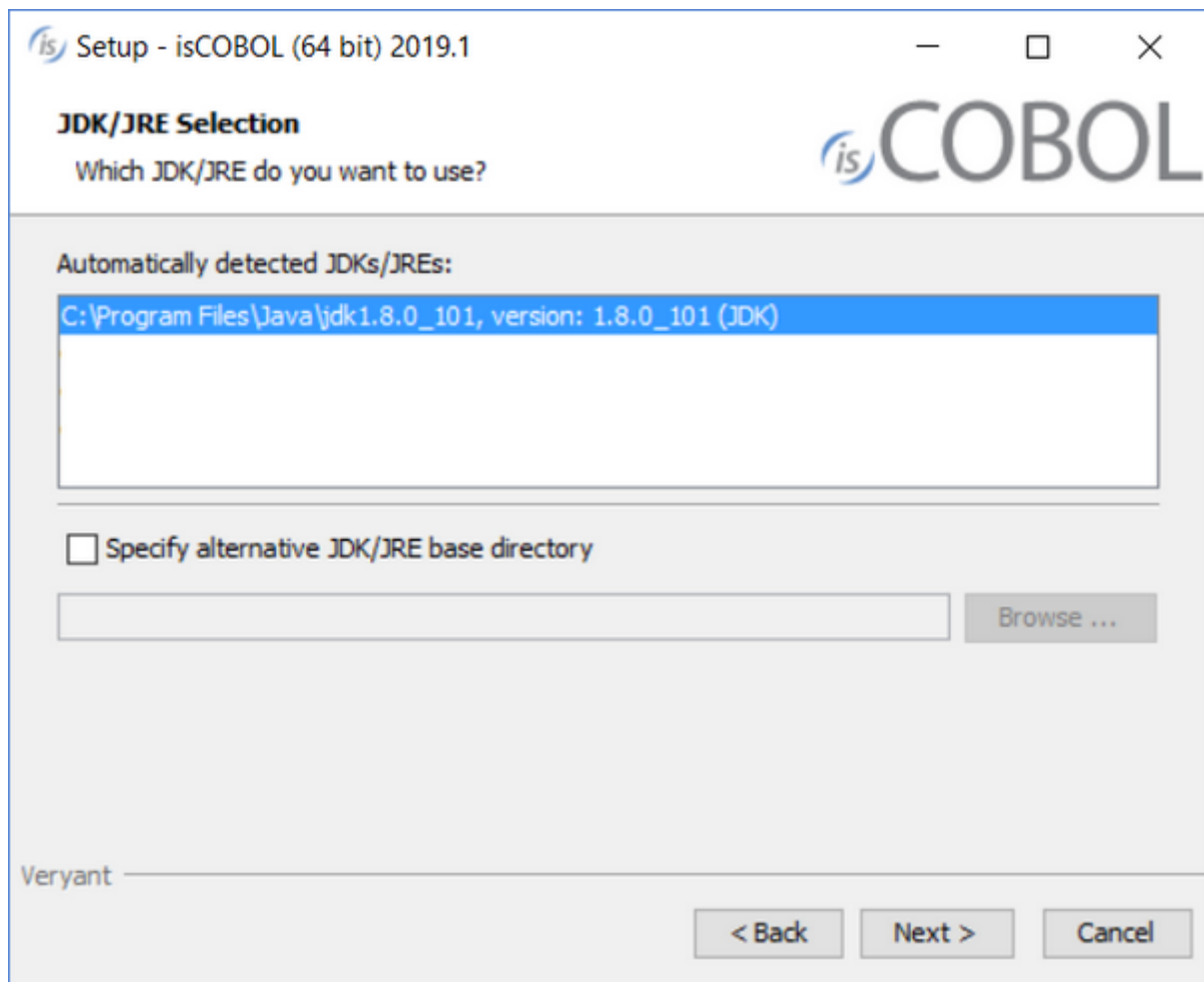
Windows

1. If you haven't already done so, [Download and install the Java Development Kit \(JDK\)](#) .
2. Go to "<http://www.veryant.com/support>".
3. Sign in with your User ID and Password.
4. Click on the "Download Software" link.
5. Scroll down to the list of files for Windows x64 64-bit or Windows x86 32-bit. Select isCOBOLyyyyR_n_Windowsarc.exe, where yyyy is the year, r is the release number, n is the build number and arc is the system architecture.
6. Run the downloaded installer to install the files.

7. Select "isCOBOL EIS" from the list of products when prompted.



8. Select your JDK when prompted



9. Follow the wizard procedure to the end. In the process you will be asked to provide the installation path ("C:\Program Files\Veryant" by default) and license keys. You can skip license activation and perform it later, as explained in [Activate the License](#).

UNIX/Linux

1. If you haven't already done so, [Download and install the Java Development Kit \(JDK\)](#).
2. Go to "<http://www.veryant.com/support>".
3. Sign in with your User ID and Password.
4. Click on the "Download Software" link.
5. Scroll down, and select the appropriate .tar.gz file for the product and platform you require.
6. Extract all contents of the archive. For example, on Linux 32-bit:

```
gunzip isCOBOL_2019_R1_*_Linux.32.i586.tar.gz
tar -xvf isCOBOL_2019_R1_*_Linux.32.i586.tar
```

7. Change to the "isCOBOL2019R1" folder and run "./setup" (if available), you will obtain the following output:

```
=====
                                isCOBOL EVOLVE Installation
                                For isCOBOL Release 2019R1
                                Copyright (c) 2005 - 2019 Veryant
                                =====

Install Components:

  [0] All products..... (no)
  [1] isCOBOL Compiler (includes [2] & [3])..... (yes)
  [2] isCOBOL Runtime Environment (includes [3])..... (no)
  [3] isCOBOL Thin Client..... (no)
  [4] isCOBOL Server..... (no)
  [5] isCOBOL Load Balancer..... (no)
  [6] isCOBOL Remote Compiler..... (no)
  [7] isCOBOL Database Bridge..... (no)
  [8] isCOBOL EIS..... (no)
  [9] isCOBOL Mobile..... (no)

Install Path:
  [P] isCOBOL parent directory: UserHome

JDK Path:
  [J] JDK install directory: JavaHome

[S] Start Install      [Q] Quit

=====
Please press [ 1 2 3 4 5 6 7 8 P J S Q ]
```

8. Type "8", then press Enter to select isCOBOL EIS.
9. (optional) Type "P", then press Enter to provide a custom installation path, if you don't want to keep the default one.
10. Type "S", then press Enter to start the installation.

Note - if the setup script is not available for your Unix platform or you don't want to use it, just extract the tgz content to the folder where you want isCOBOL to be installed.

isCOBOL Evolve for UNIX/Linux provides shell scripts in the isCOBOL "bin" directory for compiling, running, and debugging programs. These scripts make use of two environment variables, ISCOBOL to locate the isCOBOL installation directory and ISCOBOL_JDK_ROOT to locate the JDK installation directory. To use these scripts set these environment variables and add the isCOBOL "bin" directory to your PATH.

For example, if you install isCOBOL in "/opt/isCOBOL" and your JDK is in "/opt/java/jdk1.8.0":

```
export ISCOBOL=/opt/isCOBOL
export ISCOBOL_JDK_ROOT=/opt/java/jdk1.8.0
export PATH=$ISCOBOL/bin:$PATH
```

Distribution Files

For information on a specific distribution file, please see the README file installed with the product.

Activate the License

If you provided license keys during the installation, on Windows, you should skip reading this chapter.

isCOBOL EIS looks for the following configuration properties for the license keys at compile-time:

```
iscobol.compiler.license.2019=<license_key>  
iscobol.eis.license.2019=<license_key>
```

isCOBOL EIS looks for the following configuration property for the license key at run-time:

```
iscobol.license.2019=<license_key>
```

These keys should be stored in one of the following files (if they exist):

Windows

1. \etc\iscobol.properties in the drive where the working directory is
2. C:\Users\<username>\iscobol.properties (the setup wizard saves licenses here, if you don't skip activation)
3. iscobol.properties found in the Java Classpath
4. %ISCOBOL%\iscobol.properties
5. a custom configuration file passed on the command line

Unix/Linux

1. /etc/iscobol.properties
2. \$HOME/iscobol.properties
3. iscobol.properties found in the Java Classpath
4. \$ISCOBOL/iscobol.properties
5. a custom configuration file passed on the command line

NOTE - Files are listed in the order they're processed. If the license key appears in more than one of the above files, then the last occurrence is considered.

Chapter 2

Web Service option

Introduction

A Web Service is a software system designed to support interoperable machine-to-machine interaction over a network.

Many organizations use multiple software systems for management. Different software systems often need to exchange data with each other, and a web service is a method of communication that allows two software systems to exchange this data over the internet. The software system that requests data is called a service requester or consumer, whereas the software system that would process the request and provide the data is called a service provider or producer.

Different software might be built using different programming languages, and hence there is a need for a method of data exchange that doesn't depend upon a particular programming language. Most types of software can, however, interpret *XML* or *JSON* tags. Thus, web services can use *XML* or *JSON* files for data exchange.

Two predominant web services frameworks, *REST* and *SOAP*, are used in web site development.

REST (Representational State Transfer) and *SOAP* (Simple Object Access Protocol) provide mechanisms for requesting information from resources, *REST*, or from endpoints, *SOAP*. Perhaps the best way to think of these technologies is as a method of making a remote procedure call against a well-defined API. *SOAP* has a more formal definition mechanism called WSDL, Web Services Definition Language, and is more complex to implement. *REST* uses the standard *HTTP* request and response mechanism, simplifying implementation and providing for a more flexible, loose coupling of the client and server. Note that *REST* also supports the transfer of non-XML messages such as *JSON* (JavaScript Object Notation).

The Service Bridge facility

The creation of *SOAP* and *REST* Web Services is made easy by the isCOBOL Server Bridge facility. With this feature enabled, every time the Compiler compiles a legacy COBOL program with Linkage Section, it generates a bridge class that allows the program to be used as a Web Service.

The feature is activated and controlled through the [Library Routines and Utilities Configuration](#) entries that can be set either in the configuration file or directly in the source through the [SET Directive](#). isCOBOL IDE users instead can rely on the [isCOBOL Service Editor](#).

Let's consider the legacy COBOL program "SONGS.cbl" installed among isCOBOL samples. This program allows the user to manage an archive of songs. It has the following Linkage Section:

```
01  lnk-op-code          pic x.
    88 lnk-insert        value "I".
    88 lnk-update        value "U".
    88 lnk-read           value "R".
    88 lnk-read-next     value "N".
    88 lnk-read-previous value "P".
    88 lnk-delete        value "D".
    88 lnk-first         value "F".
    88 lnk-last          value "L".
01  lnk-song-data.
    05 lnk-sd-id          pic 9(5).
    05 lnk-sd-title       pic x(30).
    05 lnk-sd-length      pic x(5).
    05 lnk-sd-artist      pic x(20).
    05 lnk-sd-album       pic x(30).
    05 lnk-sd-genre       pic x(15).
    05 lnk-sd-label       pic x(30).
    05 lnk-sd-year        pic 9(4).
    05 lnk-sd-authors     occurs 5.
        10 lnk-sd-author  pic x(20).
01  lnk-return-status.
    05 lnk-status         pic x(2).
        88 lnk-ok         value "OK".
        88 lnk-ko         value "KO".
    05 lnk-file-status    pic x(2).
    05 lnk-status-message pic x(50).
```

In the next two chapters we'll see how to transform it in a Web Service through the Service Bridge facility, with and without isCOBOL IDE.

Web Service generation at command-line

The only action required in the source code is the mapping between Linkage Section data items and Web Service parameters. If no action is taken, the Compiler generates a Web Service parameter for each elementary COBOL data item and the parameter is assumed to be input/output. In this case instead we wish to define the first group item as input, the second as i/o, and the third as output, because the archive record buffer is shared between caller and callee, while the other two parameters are one-way.

This is achieved through [ELK Directives](#). The original Linkage Section code will change from

```
01 lnk-op-code          pic x.
   88 lnk-insert        value "I".
   88 lnk-update        value "U".
   88 lnk-read          value "R".
   88 lnk-read-next     value "N".
   88 lnk-read-previous value "P".
   88 lnk-delete        value "D".
   88 lnk-first         value "F".
   88 lnk-last          value "L".
01 lnk-song-data.
   05 lnk-sd-id         pic 9(5).
   05 lnk-sd-title      pic x(30).
   05 lnk-sd-length     pic x(5).
   05 lnk-sd-artist     pic x(20).
   05 lnk-sd-album      pic x(30).
   05 lnk-sd-genre      pic x(15).
   05 lnk-sd-label      pic x(30).
   05 lnk-sd-year       pic 9(4).
   05 lnk-sd-authors    occurs 5.
       10 lnk-sd-author pic x(20).
01 lnk-return-status.
   05 lnk-status        pic x(2).
       88 lnk-ok         value "OK".
       88 lnk-ko         value "KO".
   05 lnk-file-status   pic x(2).
   05 lnk-status-message pic x(50).
```

to

```
$elk input
01 lnk-op-code          pic x.
88 lnk-insert          value "I".
88 lnk-update          value "U".
88 lnk-read            value "R".
88 lnk-read-next       value "N".
88 lnk-read-previous   value "P".
88 lnk-delete          value "D".
88 lnk-first           value "F".
88 lnk-last            value "L".
01 lnk-song-data.
05 lnk-sd-id           pic 9(5).
05 lnk-sd-title        pic x(30).
05 lnk-sd-length       pic x(5).
05 lnk-sd-artist       pic x(20).
05 lnk-sd-album        pic x(30).
05 lnk-sd-genre        pic x(15).
05 lnk-sd-label        pic x(30).
05 lnk-sd-year         pic 9(4).
05 lnk-sd-authors      occurs 5.
    10 lnk-sd-author    pic x(20).
$elk output
01 lnk-return-status.
05 lnk-status          pic x(2).
88 lnk-ok              value "OK".
88 lnk-ko              value "KO".
05 lnk-file-status     pic x(2).
05 lnk-status-message  pic x(50).
```

After this quick modification, we can compile the program as follows:

```
iscc -c=compiler.properties SONGS.cbl
```

The file `compiler.properties` should include one or more [Library Routines and Utilities Configuration](#) entries. For the moment, we just activate the Service Bridge feature. It will generate a SOAP RPC Web Service. So, `compiler.properties` contains:

```
iscobol.compiler.servicebridge=1
```

At the end of the compilation process, you will find two additional files in your working directory:

- `soapSONGS.cbl` : the bridge program that allows our program to be called as Web Service, and
- `SONGS.wsdl` : the XML descriptor of the service

Refer to the installed sample README file for instructions about the deployment and testing of these items.

We've just demonstrated how to create a SOAP Web Service. With the next step, we're going to generate a REST Web Service instead. To achieve it, change `compiler.properties` as follows:

```
iscobol.compiler.servicebridge=1
iscobol.compiler.servicebridge.type=REST
```

Then compile again with the command:

```
iscc -c=compiler.properties SONGS.cbl
```

At the end of the compilation process, you will find one additional file in your working directory:

- *restSONGS.cbl*: the bridge program that allows our songs program to be called as REST Web Service.

Refer to the installed sample README file for instructions about the deployment and testing of these items.

An alternative way to activate the Service Bridge facility is to set the necessary properties directly in the source code, using the [SET Directive](#). For example:

```
$set "servicebridge" "1"  
$set "servicebridge.type" "REST"  
PROGRAM-ID. SONGS.
```

In this case, no specific configuration is required at compile time, so the compile command is just:

```
iscc SONGS.cbl
```

Web Service generation with isCOBOL IDE

In order to be able to easily test our Web Service at the end of the process, create a isCOBOL Project.

1. Click *File* in the menu bar
2. Select *New*
3. Choose *isCOBOL Project*

Once the new project is created

1. Copy the SONGS.cbl source file to the *source* folder of the project
2. Right click on SONGS.cbl
3. Select *Open With*
4. Choose *isCOBOL Service Editor*

The following editor will open

Service Settings

☐ Enable Service

Service Data Map

Type: SOAP

Decorations: Default

Settings:

Style: RPC

Prefix: soap

URL: http://localhost:8080

Namespace: http://tempuri.org

Namespace suffix:

Charset: UTF-8

☒ Generate Java-Bean

Prefix: bean

URL: http://localhost:8080/services

Package:

Entry Point	Operation
procedure	SONGS

1. Check the option *Enable Service*
If no action is taken, the Compiler generates a Web Service parameter for each elementary COBOL data item and the parameter is assumed to be input/output. In this case instead we wish to define the first group item as input, the second as i/o, and the third as output, because the archive record buffer is shared between caller and callee, while the other two parameters are one-way, so switch to the Data Map tab and
2. Delete *Ink-return-status* | *input* from the *Service Fields* list as we want this field only as output
3. Delete *Ink-op-code* | *output* from the *Service Fields* list as we want this field only as input

Service Settings

☒ Enable Service

Service Data Map

Linkage Section Fields

Data Item	Value
01 Ink-op-code pic x	
01 Ink-song-data	
01 Ink-return-status	

Service Fields

Data Item	Name	Direction	Type
Ink-op-code		input	string
Ink-song-data		input	string
Ink-song-data		output	string
Ink-return-status		output	string

As soon as you save modification in this editor, the SONGS.cbl source file is automatically updated as follows:

- the directive `$set "servicebridge" "1"` is added at the top of the source file
- the directive `$elk input` is added on top of the Ink-op-code group item
- the directive `$elk output` is added on top of the Ink-returns-status group item

At this point you can compile SONGS.cbl.

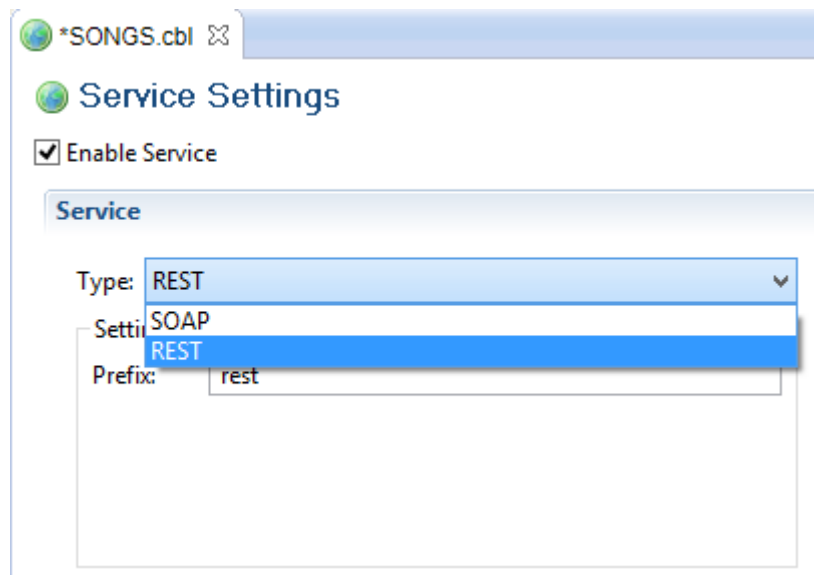
At the end of the compilation process, you will find two additional files in your project:

- `source/soapSONGS.cbl` : the bridge program that allows our program to be called as Web Service, and
- `output/SONGS.wsdl` : the XML descriptor of the service

You can start your Web Service with the following steps:

- Right click on the project name
- Select *Run As*
- Choose *isCOBOL EIS Servlet*

We've just demonstrated how to create a SOAP Web Service. With the next step, we're going to generate a REST Web Service instead. To achieve it, return to the Service Editor and change the field *Type* from SOAP to REST.



Note - By switching the Type value, the Settings frame content changes, allowing to set only the settings that are suitable for the selected service type.

After it, save modification and recompile SONGS.cbl to obtain the following new item in the project *source* folder:

- `restSONGS.cbl` : the bridge program that allows our songs program to be called as REST Web Service.

You can start your Web Service with the following steps:

- Right click on the project name
- Select *Run As*
- Choose *isCOBOL EIS Servlet*

Service Editor fields

In this section we map all the fields of the Service Editor with the corresponding Compiler property or directive that will be generated when you save modification.

Service Editor field	Corrponding Compiler property/directive
Decoration	DECORATION Directive
Direction	INPUT Directive OUTPUT Directive
Enable Service	iscobol.compiler.servicebridge (boolean)
Generate Java-Bean / Prefix	iscobol.compiler.servicebridge.bean.prefix
Generate Java-Bean / URL	iscobol.compiler.servicebridge.bean.url
Name	NAME Directive
Namespace	iscobol.compiler.servicebridge.soap.namespace
Operations	OPERATION Directive
Package	iscobol.compiler.servicebridge.bean.package
Settings / Prefix	iscobol.compiler.servicebridge.rest.prefix iscobol.compiler.servicebridge.soap.prefix
Settings / URL	iscobol.compiler.servicebridge.soap.url
Style	iscobol.compiler.servicebridge.soap.style
Type	iscobol.compiler.servicebridge.type
Use Group	USE GROUP Directive
Value	VALUE Directive

Customizing bridge programs through tagged areas

The SOAP and REST bridge program source files include tagged areas.

A tagged area is a block of code included between a start comment and an end comment, e.g.

```
*>start {iscobol}accept-http

    set request-method to comm-area:>getMethod()
    if request-method = "POST"
        comm-area:>acceptEx(request-varin)
    else
        comm-area:>accept(PAR-invar)
    end-if

*>end {iscobol}accept-http
```


Once the bridge program source file has been created, only the code inside tagged areas is regenerated by the Compiler.

If you need to add custom code to a bridge program, edit the bridge program source file and write your code outside of tagged areas, so before a start comment or after an end comment, e.g.

```
*>start {iscobol}accept-http

    set request-method to comm-area:>getMethod()
    if request-method = "POST"
        comm-area:>acceptEx(request-varin)
    else
        comm-area:>accept(PAR-invar)
    end-if

*>end {iscobol}accept-http
    < < your code here > >
*>start {iscobol}http-to-linkage
    move PAR-in to intPAR;;
```

SOAP runtime configuration

The following configuration is available for SOAP web services at run time.

WSDL Location

The download of the WSDL file can be achieved using a URL such as:

```
http://localhost:8080/test/servlet/SONGS?wsdl
```

where test is the webapp name and SONGS is the web service name. The download is requested via the ?wsdl parameter.

On the server the property `iscobol.soap.wsdl.location` controls the location of the wsdl file. It should point to a file system path where wsdl files are copies, ie:

```
iscobol.soap.wsdl.location=/opt/tomcat8/wsdl_files
```

The servlet appends the webservice name and ".wsdl" to this path to form a path name, which, if found, is then downloaded. If the file is not found or the property is not set, and http error 404 is returned.

Logging

Logging can be enabled globally and exceptions can be set on a per-method basis.

The following properties can be added to *iscobol.properties* to control SOAP services logging:

- `iscobol.soap.log=0/1` enables or disables logging on a global level
- `iscobol.soap.log.{methodname}=0/1` enables or disables logging for the SOAP service with the specified method name. This overrides the global settings specified above.
- `iscobol.soap.log.folder=` is used to configure the folder where log files should be generated. The file name is generated dynamically using the following pattern: *{methodname}-{SESSIONID}.log*.

For example: to enable logging for the SONGS web service add the following property:

```
iscobol.soap.log.songs=1
```

To enable logging for all SOAP web services except for the SONGS web service use the following:

```
iscobol.soap.log=1  
iscobol.soap.log.songs=0
```

The log includes a trace of the HTTP request and response. Both header and body are traced. If a runtime error occurs during the service activity, such error is traced in the log as well.

If a SOAP envelope cannot be successfully extracted from the request, an exception log is written on standard error (catalina.out if using Tomcat). In the log there will be the exception message and the HTTP request data.

REST runtime configuration

The following configuration is available for REST web services at run time.

Logging

Logging can be enabled globally and exceptions can be set on a per-method basis.

The following properties can be added to *iscobol.properties* to control REST services logging:

- `iscobol.rest.log=0/1` enables or disables logging on a global level
- `iscobol.rest.log.{methodname}=0/1` enables or disables logging for the REST service with the specified method name. This overrides the global settings specified above.
- `iscobol.rest.log.folder=` is used to configure the folder where log files should be generated. The file name is generated dynamically using the following pattern: *{methodname}-{SESSIONID}.log*.

For example: to enable logging for the SONGS web service add the following property:

```
iscobol.rest.log.songs=1
```

To enable logging for all REST web services except for the SONGS web service use the following:

```
iscobol.rest.log=1  
iscobol.rest.log.songs=0
```

The log includes a trace of the HTTP request and response. Both header and body are traced. If a runtime error occurs during the service activity, such error is traced in the log as well.

The request body is always logged as a string, so if the content is not in text format (e.g. content-type is "application/x-www-form-urlencoded"), then unreadable characters may appear in the log file.

Web Service Beans

The Service Bridge facility can also generate bean classes that can be used client side for test purposes.

Command-line usage

In order to enable this feature when compiling from the command-line, the configuration property `iscobol.compiler.servicebridge.bean` must be set to the same value as `iscobol.compiler.servicebridge.type`.

The following configuration entries demonstrate how to generate bean classes for a REST Web Service.:

```
iscobol.compiler.servicebridge=1
iscobol.compiler.servicebridge.type=REST
iscobol.compiler.servicebridge.bean=REST
```

With this kind of configuration, at the end of the compilation process, you will find four additional files in your working directory:

- `restSONGS.cbl`: the bridge program that allows our songs program to be called as REST Web Service.
- `beanSONGS.cbl`: the bean that allows to test the REST Web Service
- `beanSONGS.cpy`: copybook used by `beanSONGS.cbl`
- `beanSONGS.wrk`: copybook used by `beanSONGS.cbl`

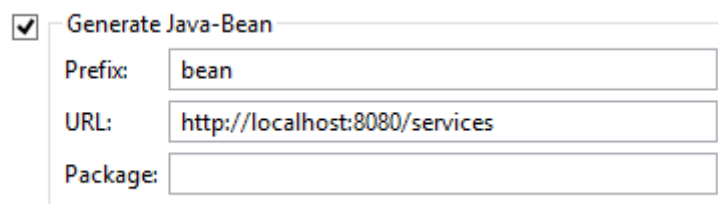
Refer to the installed sample README file for instructions about the deployment and testing of these items.

The same result can be obtained by setting the necessary properties directly in the source code, using the [SET Directive](#). For example:

```
$set "servicebridge" "1"
$set "servicebridge.type" "REST"
$set "servicebridge.bean" "REST"
PROGRAM-ID. SONGS.
```

Usage in the IDE

In order to enable this feature within the isCOBOL Service Editor, just check the option *Generate Java-Bean*.



☒ Generate Java-Bean

Prefix:

URL:

Package:

Bean structure

The bean class exposes the following methods:

<code>get<parameter_name>()</code>	Returns the value of the given parameter. <i>parameter_name</i> doesn't necessarily match the COBOL data item. This name is affected by ELK Directives .
<code>set<parameter_name>()</code>	Sets the value of the given parameter. <i>parameter_name</i> doesn't necessarily match the COBOL data item. This name is affected by ELK Directives .

The above pair of methods is repeated for each Linkage Section item. Other methods exposed:

<code>get_url()</code>	Returns the URL to which the bean is going to connect
<code>run (<parameters>)</code>	Executes the call to the Web Service passing the received parameters. The number of parameters required matches with the number of Linkage Section items expected by the COBOL program server side.
<code>run()</code>	Executes the call to the Web Service passing the parameters that were previously set by invoking <code>set<parameter_name>()</code>
<code>set_url()</code>	Sets the URL to which the bean is going to connect

The bean source code also includes two copybooks that allow you to include custom code.

<code><beanPrefix><programName>.wrk</code>	Copybook that hosts custom data items.
<code><beanPrefix><programName>.cpy</code>	Copybook that hosts custom procedural code.

By relying on these copybooks you can invoke `set<parameter_name>()` to set the parameters for the Web Service and then invoke `run()`. In this way you obtain a stand alone COBOL program that can consume the Web Service.

COBOL approach using REST

In order to exchange data through a web service, you need to set up a server-side requestor, or 'producer' program, as well as a client-side provider, or 'consumer' program, as explained in the [Introduction](#). The REST-style architecture is stateless, with the client and server sides running separately. They communicate using HTTP protocol, and REST supports messages in JSON, XML, and other formats. The following chapters describe these two different types of COBOL programs.

COBOL REST producer

In order to develop a COBOL REST producer (server-side), to process requests and provide data, the COBOL program has to be transformed to be executed like a Web Service REST. This objective is achieved through the *HTTPHandler* class that allows communication with HTML pages through AJAX retrieving data and printing results.

In the isCOBOL sample folder you will find the folder `eis/webservices/rest` that contains an example of a COBOL REST producer (REST Web Service) and an example of a COBOL REST consumer to be used to test the service.

In the server folder there is a COBOL source program called "ISFUNCTIONS.cbl" that exposes two services: `ISFUNCTION_GETZIP` and `ISFUNCTION_GETCITY` that allow searching a US city name by zip code or by name.

This program has three entries:

- MAIN, the default entry where the values to be used are loaded from the JSON stream:

```
move "94101"      to a-zipcode(1).
move "San Francisco" to a-city(1).
move "San Francisco" to a-county(1).
move "California"  to a-state(1).

move "92123"      to a-zipcode(2).
move "San Diego"   to a-city(2).
move "San Diego"   to a-county(2).
move "California"  to a-state(2).

move "10001"       to a-zipcode(3).
move "New York"    to a-city(3).
move "New York"    to a-county(3).
move "New York"    to a-state(3).

move "89044"       to a-zipcode(4).
move "Las Vegas"   to a-city(4).
move "Clark"       to a-county(4).
move "Nevada"      to a-state(4).

move "Program Loaded" to ok-message;;
comm-area:>displayJSON (ok-page).
goback.
```

- ISFUNCTION_GETZIP, a COBOL entry point that receives into *isfunction-getZipCode* working storage structure, a name of a US city and returns the zip code into *isfunction-returnZipCode* as JSON stream using *displayJSON()* method:

```
entry "ISFUNCTION_GETZIP" using comm-area.

comm-area:>accept (isfunction-getZipCode).

move 1 to idx.
search array-data varying idx
  at end
    move "Zip code not Found" to returnZipCode
  when city-zipCode = a-city(idx)
    move a-zipcode(idx) to returnZipCode
end-search.

comm-area:>displayJSON (isfunction-returnZipCode).

goback.
```

where *isfunction-getZipCode* working storage structure is defined like:

```
01 isfunction-getZipCode identified by "".
03 identified by "get_Zip_Code".
05 city-zipCode pic x any length.
```

and *isfunction-returnZipCode* working storage structure is defined like:

```
01 isfunction-returnZipCode identified by "".
03 identified by "Zip_Code".
05 returnZipCode pic x any length.
```

- ISFUNCTION_GETCITY, a COBOL entry point that receives into *isfunction-getCity* working storage structure, a zip code of a US city and return the city name into *isfunction-receivedCity* variable as JSON stream using displayJSON() method:

```
entry "ISFUNCTION_GETCITY" using comm-area.

comm-area:>accept (isfunction-getCity).

move 1 to idx.
search array-data varying idx
  at end
    move "City not Found" to returnCity
  when zipCode-city(1:5) = a-zipcode(idx)
    move a-city(idx) to returnCity
end-search.

comm-area:>displayJSON (isfunction-receivedCity).

goback.
```

where *isfunction-getCity* working storage structure is defined like:

```
01 isfunction-getcity identified by "".
03 identified by "get_City".
05 zipCode-city pic x any length.
```

and *isfunction-receivedCity* working storage structure is defined like:

```
01 isfunction-receivedCity identified by "".
03 identified by "City".
05 returnCity pic x any length.
```

In order to have this ISFUNCTIONS.cbl working correctly, it should be deployed inside a Java Servlet container like Tomcat, JBOSS IBM WebSphere or BEA WebLogic.

COBOL REST consumer

In order to develop a COBOL REST consumer (client-side), to invoke REST Web Service, the COBOL program should take advantage of *HTTPClient* class that allows it to communicate with COBOL REST producer entry points through HTTP protocol. Also to allow the definition of HTTP parameters, an *HTTPData.Params* class is provided.

In the isCOBOL sample folder you will find the folder eis/webservices/rest/client that contains an example of COBOL client program called "CLIENTH.cbl" to communicate with the "ISFUNCTIONS.cbl" server service described on the previous page.

This program invokes ISFUNCTION_GETZIP service to return the zip code of San Diego, and the ISFUNCTION_GETCITY service to return the name of the city whose zip code is 89044.

This program shows how to do the following necessary steps:

- Include HTTPClient and HTTPData.Params classes in COBOL repository:

```
configuration section.  
repository.  
    class http-client as "com.iscobol.rts.HTTPClient"  
    class http-param  as "com.iscobol.rts.HTTPData.Params".
```

- Establish the connection with REST Web Service using doGet() method and checking the success of the operation using getResponseCode() method:

```
http:>doGet("http://127.0.0.1:8080/isfunctions/servlet/  
isCobol(ISFUNCTIONS)")  
http:>getResponseCode (response-code)
```

- Prepare the city name as parameter to be pass to the service

```
move "San Diego" to city-zipCode.  
set params = http-param:>new():>add("get_Zip_Code", city-zipCode).
```

- Invoke the ISFUNCTION_GETZIP with prepared parameter and getting back the zip code:

```
http:>doGet ("http://127.0.0.1:8080/isfunctions/"  
            "servlet/isCobol(ISFUNCTION_GETZIP)", params)  
  
http:>getResponseCode (response-code)  
if response-code = 200  
    http:>getResponseJSON (isfunction-recivedZipCode)
```

where isfunction-recivedZipCode working storage structure is defined like:

```
01 isfunction-recivedZipCode identified by "".  
    03 identified by "Zip_Code".  
        05 zipCode pic x any length.
```

and 92123 is the zip code of San Diego saved into zipCode COBOL variable.

A similar approach is followed to provide the city name and receive it's zip code.

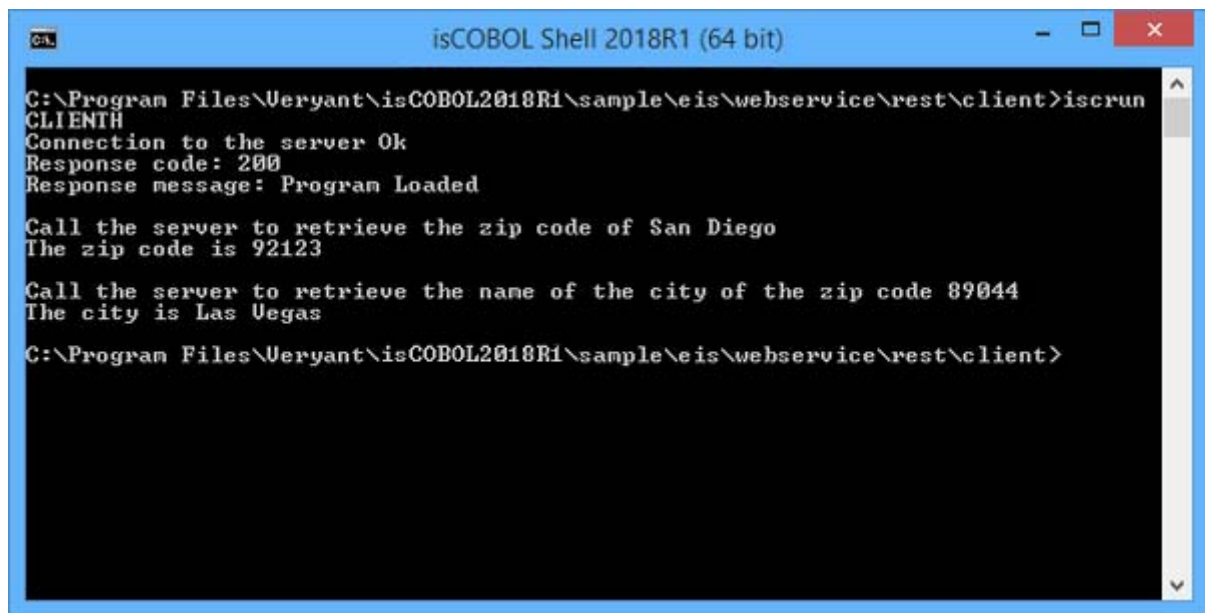
- Compile the program with the command:

```
iscc client.cbl
```

- and run it with the command:

```
iscrun CLIENTH
```

this is the result:

A screenshot of a Windows command prompt window titled "isCOBOL Shell 2018R1 (64 bit)". The window has a blue title bar and a black command area. The text in the command area is as follows:

```
C:\Program Files\Ueryant\isCOBOL2018R1\sample\eis\webservice\rest\client>isrun  
CLIENTH  
Connection to the server Ok  
Response code: 200  
Response message: Program Loaded  
  
Call the server to retrieve the zip code of San Diego  
The zip code is 92123  
  
Call the server to retrieve the name of the city of the zip code 89044  
The city is Las Vegas  
  
C:\Program Files\Ueryant\isCOBOL2018R1\sample\eis\webservice\rest\client>
```

COBOL approach using SOAP

EIS is provided as preliminary support to develop COBOL programs capable to consume SOAP Web Services based on XML.

COBOL SOAP consumer

In order to develop a COBOL SOAP consumer (client-side), to invoke a SOAP Web Service, the COBOL program should take advantage of *HTTPClient* class. This class contains several useful methods to work with SOAP Web Service.

In the isCOBOL sample folder you find the folder `eis/webservices/soap/client` that contains an example of COBOL client program called "IP2GEO.cbl" that shows how to use a SOAP Web Service available over the internet at <http://ws.cdyne.com/ip2geo/ip2geo.asmx> .

This service "Resolves IP addresses to Organization, Country, City, and State/Province, Latitude, Longitude. In most US cities it will also provide some extra information such as Area Code, and more."

A SOAP Web Service usually provides a way to inquire about the functionality available and the parameters that should be used.

The isCOBOL [STREAM2WRK](#) command line utility simplifies the creation of the working storage definitions needed to manage the XML envelope. STREAM2WRK reads the WSDL definition from a URL, with the ?WSDL appended to it. For example, <http://ws.cdyne.com/ip2geo/ip2geo.asmx?WSDL> was used to generate this working storage:

```
*> binding name=ResolveIP, style=document
01 soap-in-ResolveIP identified by 'soapenv:Envelope'.
03 identified by 'xmlns:soapenv' is attribute.
05 filler pic x(39) value 'http://www.w3.org/2003/05/soap-envelope'.
03 identified by 'xmlns:tns' is attribute.
05 filler pic x(20) value 'http://ws.cdyne.com/'.
03 identified by 'soapenv:Body'.
    06 identified by 'tns:ResolveIP'.
    07 identified by 'tns:ipAddress'.
    08 a-ipAddress pic x any length.
    07 identified by 'tns:licenseKey'.
    08 a-licenseKey pic x any length.

01 soap-out-ResolveIP identified by 'Envelope'
    namespace 'http://www.w3.org/2003/05/soap-envelope'.
03 identified by 'Body'.
    06 identified by 'ResolveIPResponse'
        namespace 'http://ws.cdyne.com/'.
    07 identified by 'ResolveIPResult'.
    08 identified by 'City'.
    09 a-City pic x any length.
    08 identified by 'StateProvince'.
    09 a-StateProvince pic x any length.
    08 identified by 'Country'.
    09 a-Country pic x any length.
    08 identified by 'Organization'.
    09 a-Organization pic x any length.
    08 identified by 'Latitude'.
    09 a-Latitude pic s9(16)v9(2).
    08 identified by 'Longitude'.
    09 a-Longitude pic s9(16)v9(2).
    08 identified by 'AreaCode'.
    09 a-AreaCode pic x any length.
    08 identified by 'TimeZone'.
    09 a-TimeZone pic x any length.
    08 identified by 'HasDaylightSavings'.
    09 a-HasDaylightSavings pic x any length.
    08 identified by 'Certainty'.
    09 a-Certainty pic s9(5).
    08 identified by 'RegionName'.
    09 a-RegionName pic x any length.
    08 identified by 'CountryCode'.
    09 a-CountryCode pic x any length.
```

The IP2GEO program will invoke the *ResolveIP* functionality providing the IP address and receiving some geographic information like City, State, Country, etc.

This program shows how to do the following necessary steps::

- Include HTTPClient class in COBOL repository:

```
configuration section.  
repository.  
    class http-client as "com.iscobol.rts.HTTPClient"
```

- Include the working storage definition to use XML envelope generated from WSDL by STREAM2WRK utility:

```
WORKING-STORAGE SECTION.  
copy "ip2geo.cpy".
```

- Provide the IP address to obtain information and call the ResolveIP service using doPostEx() method passing the URL of service, the SOAP media type and the input envelope generated from STREAM2WRK for ResolveIP service:

```
move "209.235.175.10" to a-ipAddress  
http:>doPostEx (  
    "http://ws.cdyne.com/ip2geo/ip2geo.asmx"  
    "text/xml; charset=utf-8"  
    soap-in-ResolveIP) .
```

Note - The type "text/xml; charset=utf-8" is suitable for SOAP v1.1. If the service is SOAP v1.2, use "application/soap+xml; charset=utf-8" instead.

- Check the response if successful and show results:

```
http:>getResponseCode (response-code).  
display "Response code: " response-code.  
if response-code = 200  
    http:>getResponseXML (soap-ResolveIP-output)  
    display "City=" a-city  
    display "StateProvince=" a-stateProvince  
    display "Country=" a-country  
    display "Organization=" a-Organization  
    display "Latitude=" a-latitude  
    display "Longitude=" a-longitude  
    display "AreaCode=" a-areaCode  
    display "TimeZone=" a-timeZone  
    display "Daylight savings=" a-HasDaylightSavings  
    display "Certainty=" a-certainty  
    display "RegionName=" a-regionName  
    display "CountryCode=" a-countryCode
```

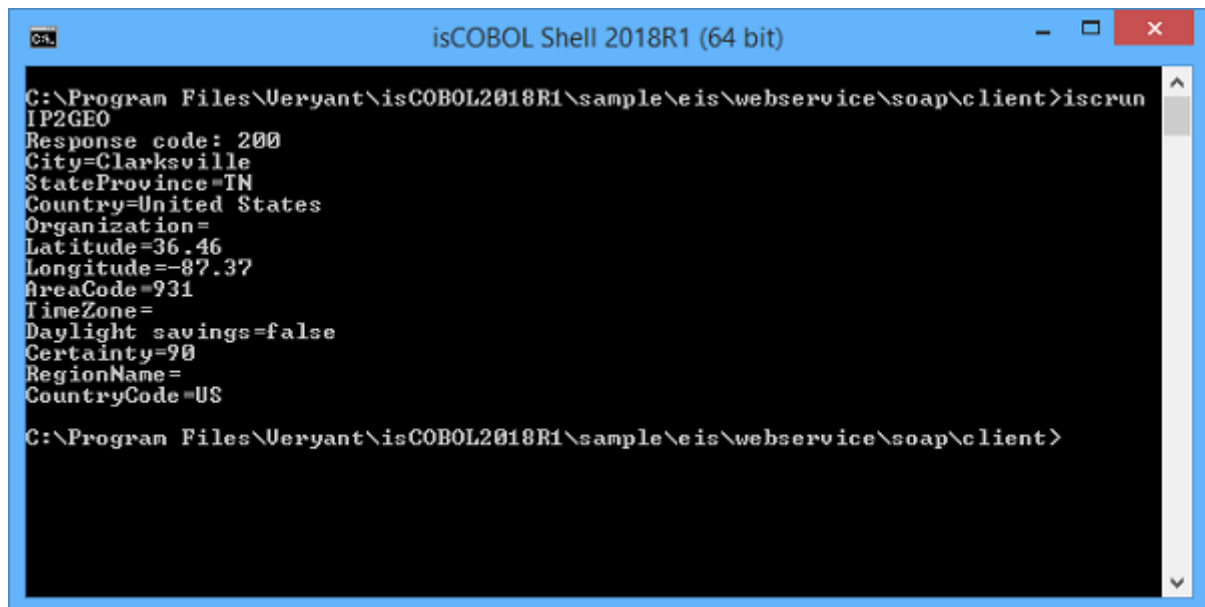
Compile the program with the command:

```
iscc IP2GEO.cbl
```

and run it with the command:

```
isrun IP2GEO
```

This is the result of execution of IP2GEO that consumes the ResolveIP SOAP Web Service:



```
isCOBOL Shell 2018R1 (64 bit)
C:\Program Files\Veryant\isCOBOL2018R1\sample\eis\webservice\soap\client>isrun
IP2GEO
Response code: 200
City=Clarksville
StateProvince=IN
Country=United States
Organization=
Latitude=36.46
Longitude=-87.37
AreaCode=931
TimeZone=
Daylight savings=false
Certainty=90
RegionName=
CountryCode=US
C:\Program Files\Veryant\isCOBOL2018R1\sample\eis\webservice\soap\client>
```

Chapter 3

Authentication and Authorization method

Introduction

You can obtain limited access to an HTTP Service taking advantage of existing Authentication and Authorizations providers like Google and Facebook based on OAuth 2.0 standard.

OAuth 2.0 is an open protocol to allow secure authorization in a simple and standard method from web, mobile and desktop applications. The request is to make a COBOL program accessible only by the logged users without checking for each single program.

Servlet Container Configuration

Servlet containers (e.g. Apache Tomcat) have fully configurable authentication systems, however they usually don't fit well with the authentication from another server, thus they are not used in this example.

You need to define a safe area where the isCOBOL application can be invoked only after a successful authentication. Since the isCOBOL applications are executed as if they belonged to the same session, you can set an environment property after the authentication process and then check for it each time an application runs. However it is not handy or safe to put a check in each program, thus you can define a filter that does this job.

The configuration file *web.xml* will therefore contain the following entries:

```
<filter>
  <filter-name>isCOBOL security</filter-name>
  <filter-class>SecurityFilter</filter-class>
</filter>
<filter-mapping>
  <filter-name>isCOBOL security</filter-name>
  <url-pattern>/servlet/*</url-pattern>
</filter-mapping>
```

In this way you specify a program to run before running any program located under the URL /servlet. This program could be the following isCOBOL class:

```
class-id. SecurityFilter as "SecurityFilter"
                                implements c-filter.
configuration section.
repository.
    class j-ioexception as "java.io.IOException"
    class c-filter as "javax.servlet.Filter"
    class c-filter-chain as "javax.servlet.FilterChain"
    class c-filter-config as "javax.servlet.FilterConfig"
    class c-ServletException as "javax.servlet.ServletException"
    class c-ServletRequest as "javax.servlet.ServletRequest"
    class c-ServletResponse as "javax.servlet.ServletResponse"
    class c-HttpServletResponse as
        "javax.servlet.http.HttpServletResponse"
    class c-HttpServletRequest as
        "javax.servlet.http.HttpServletRequest"
    .
id division.
object.
data division.
working-storage section.

procedure division.

id division.
method-id. init as "init".
linkage section.
77  cfg object reference c-filter-config.
procedure division using cfg raising c-ServletException.
main.
end method.

id division.
method-id. c-destroy as "destroy".
procedure division.
main.
end method.
```

```

id division.
method-id. doFilter as "doFilter".
working-storage section.
77 email pic x any length.
77 uri pic x any length.
77 http-response object reference c-HttpServletResponse.
linkage section.
77 request object reference c-ServletRequest.
77 response object reference c-ServletResponse.
77 f-chain object reference c-filter-chain.
procedure division using request response f-chain
                    raising c-ServletException j-IOException.
main.
    accept email from environment "openid.email".
    if email = space
        set http-response to response as c-HttpServletResponse
        http-response:>sendError
            (c-HttpServletResponse:>SC_FORBIDDEN)
    else
        f-chain:>doFilter (request response)
    end-if.
end method.
end object.

```

This program simply checks if the property "openid.email" has been set to a value different from space and in that case it forwards the execution to the next filter in the chain, otherwise it stops the execution with an error code.

This assures you that any program under the URL /servlet, the safe area, will be executed only if previously in the same session, some program has set the property.

You now need to write that program and define it outside the safe area.

Facebook Authentication

Here we show an example of how to implement a program in order to authenticate the access using the Facebook authentication. You can find Facebook's documentation at the address: <https://developers.facebook.com/docs/facebook-login/manually-build-a-login-flow/v2.0>.

This kind of authentication requires your program to redirect the login phase to the Facebook site and then performs some HTTP requests to the Facebook APIs. Your program will use the following classes:

```

configuration section.
repository.
    class web-area as "com.iscobol.rts.HTTPHandler"
    class http-client as "com.iscobol.rts.HTTPClient"
    class http-params as "com.iscobol.rts.HTTPData.Params"
    class j-bigint as "java.math.BigInteger"
    class j-securernd as "java.security.SecureRandom"
    .
working-storage section.
01 params object reference http-params.
01 http object reference http-client.

```

The classes j-bigint and j-securernd are used to create a secure random number whose purpose will be explained later.

In order to use the Facebook authentication, you need a Facebook App ID that you can create and retrieve on the App Dashboard (<https://developers.facebook.com/apps/>).

There you get a client ID and a client secret that are necessary in the authentication process.

Let's say that the URL of our program is "http://veryant.com/oauth/FBConnect", then the WORKING-STORAGE SECTION will contain:

```
78 client-id value "<client-id-by-Facebook>".
78 clsc value "<client-secret-by-Facebook>".
78 redir value "http://veryant.com/oauth/FBConnect".
78 realm value "http://veryant.com/oauth".
01 state pic x any length.
```

The login process can be divided in three stages:

- Request the authentication from Facebook through a redirection;
- Get the authentication data in order to be able to query Facebook APIs;
- Get the logged user data.

The program is called two times: the first time by the user in order to start the authentication process and the second time by a Facebook redirection.

The first phase is simply a redirection where you specify what URL must be called back.

You must protect the security of your users by preventing request forgery attacks. In order to be sure that this callback is performed by the URL you actually called, a random id (state token) must be supplied. According to Google documentation (<https://developers.google.com/accounts/docs/OAuth2Login>): "One good choice for a state token is a string of 30 or so characters constructed using a high-quality random-number generator". These tokens are often referred to as cross-site request forgery (CSRF) tokens.

You can create this secure random id using the classes j-securernd and j-bigint as in following code:

```
set state=j-bigint:>new(130 j-securernd:>new):>toString(32).
```

The code for redirection then will be:

```
phase-1-redirection.
    set state=j-bigint:>new(130 j-securernd:>new):>toString(32).
    set params = http-params:>new
        :>add ("client_id" client-id)
        :>add ("display" "popup")
        :>add ("response_type" "code")
        :>add ("scope" "email")
        :>add ("redirect_uri" redir)
        :>add ("state" state)

    comm-area:>redirect (
        "https://www.facebook.com/dialog/oauth" params).
```

The second phase begins when the same application is called back by Facebook, as specified by the `redir` variable. The program can easily tell if it is the first run or the second by the setting of the variables `state` and `http-state`: the former is set by phase 1 while the latter will be passed by Facebook in the redirection of the login. So the initial part of the program could be the following one:

```

linkage section.
01  comm-area object reference web-area.
procedure division using comm-area.
main.

    accept client-id from environment "app_id_by_fb"
    accept clsc   from environment "app_secret_by_fb".

    accept redir from environment "realdir_fb".

    if user-email = ""
        perform do-auth
    else
        perform run-first-program
    end-if.
    goback.

do-auth.
    initialize http-response.
    comm-area:>accept(http-response).
    if http-state = space
        perform phase-1-redirection
    else
        if http-state = state
            perform phase-2-get-auth-token
            perform phase-3-get-info
            perform set-first-program
            perform run-first-program
        else
            string  "Forged state! (" http-state ") (" state ")"
                into err-msg
            comm-area:>displayError(403 err-msg)
        end-if
    end-if.
end-if.

```

The parameters received by Facebook are described in the following variable:

```

01  http-response identified by "_".
03  identified by "state".
05  http-state   pic x any length.
03  identified by "code".
05  http-code    pic x any length.

```


The parameter code (stored in http-code) is the one you need in order to get the authorization to query the Facebook APIs, along with your client ID and client secret. The source code of the second phase could be the following:

```
phase-2-get-auth-token.  
  set http = http-client:>new  
  set params = http-params:>new  
    :>add ("code" http-code)  
    :>add ("client_id" client-id)  
    :>add ("client_secret" clsc)  
    :>add ("redirect_uri" redir)  
    :>add ("grant_type" "authorization_code")  
  try  
    http:>doPost (  
      "https://graph.facebook.com/oauth/access_token" params)  
    http:>getResponseCode (response-code)  
    if response-code = 200  
      http:>getResponseJSON (fb-token)  
    else  
      comm-area:>displayError(response-code "  
      goback  
    end-if  
  catch exception  
    comm-area:>displayError(500 exception-object:>toString)  
    goback  
  end-try.
```

The fb-token data item is defined as follows:

```
01 fb-token identified by "".  
03 access_token identified by "access_token".  
05 access_token-data pic x any length.  
03 token_type identified by "token_type".  
05 token_type-data pic x any length.  
03 expires_in identified by "expires_in".  
05 expires_in-data pic x any length.
```

If the request is successful, the program will receive in access-token-data a character string, called "access token", that allows you to call anything among the Facebook APIs. You still don't have any information about the person who is logged, so you need to get some basic information.

In the third phase you may choose to call the API "me": this API returns a JSON payload whose data is described in the following variable:

```
01 user-info identified by "".  
03 identified by "name".  
05 user-name pic x any length.  
03 identified by "email".  
05 user-email pic x any length.  
03 identified by "id".  
05 user-id pic x any length.
```

The source code could be the following:

```
phase-3-get-info.  
  string "https://graph.facebook.com/me?"  
    "fields=name,email&"  
    "access_token=" access_token-data  
  into authorization  
  set http = http-client:>new  
  try  
    http:>doGet (authorization)  
    http:>getResponseCode (response-code)  
    if response-code = 200  
      http:>getResponseJSON (user-info)  
    else  
      comm-area:>displayError(response-code "")  
      goback  
    end-if  
  catch exception  
    comm-area:>displayError(500 exception-object:>toString)  
    goback  
  end-try.
```

Note that this time there is a STRING command instead of passing the parameters in the usual way. This is because the access token must be passed as it is.

If the call is successful, then the only thing left to do is start the next program, i.e. the first program in the application, for example:

```
set-first-program.  
  set environment "openid.email" to user-email.  
  accept data-dir from environment "file.prefix"  
  string data-dir "/" user-email into data-dir  
  
  call "c$makedir" using data-dir  
  set environment "file.prefix" to data-dir.  
  
run-first-program.  
  comm-area:>redirect ("_index.html").
```

Google Authentication

Here we show an example about how to implement a program in order to authenticate the access using Google authentication. You can find Google's documentation at the address: <https://developers.google.com/accounts/docs/OAuth2Login>.

This kind of authentication requires your program to redirect the login phase on the Google site and then performs some HTTP requests to the Google APIs. Your program will use the following classes:

```
configuration section.  
repository.  
    class web-area      as "com.iscobol.rts.HTTPHandler"  
    class http-client   as "com.iscobol.rts.HTTPClient"  
    class http-params   as "com.iscobol.rts.HTTPData.Params"  
    class j-bigint      as "java.math.BigInteger"  
    class j-securernd   as "java.security.SecureRandom"  
    .  
working-storage section.  
  
01  params object reference http-params.  
01  http  object reference http-client
```

The classes *j-bigint* and *j-securernd* are used to create a secure random number whose purpose will be explained later.

According to Google's documentation "Before your application can use Google's OAuth 2.0 authentication system for user login, you must set up a project in the Google Developers Console (<https://console.developers.google.com/>) to obtain OAuth 2.0 credentials, set a redirect URI, and (optionally) customize the branding information that your users see on the user-consent screen. You can also use the Developers Console to create a service account, enable billing, set up filtering, and do other tasks. For more details, see the Google Developers Console Help (<https://developers.google.com/console/help/console>)"

There you get a client ID and a client secret that will be necessary in the authentication process.

Let's say that the URL of our program is <http://veryant.com/ismobile3/OpenIDConnect> then the WORKING-STORAGE SECTION will contain:

```
78  client-id value "<client-id-by-Google>".  
78  clsc value "<client-secret-by-Google>".  
78  redir value "http://veryant.com/oauth/GOOGLEConnect".  
78  realm value "http://veryant.com/oauth".  
01  state pic x any length.
```

The login process can be divided in three stages:

- Request the authentication from Google through a redirection;
- Get the authentication data in order to be able to query Google APIs;
- Get the data about the logged user.

The program will be called two times: the first time by the user in order to start the authentication process, the second time by a Google redirection.

The first phase is simply a redirection in which you must specify what URL must be called back.

You must protect the security of your users by preventing request forgery attacks. In order to be sure that this callback is performed by the URL you actually called, a random id (state token) must be supplied. According to Google documentation: "One good choice for a state token is a string of 30 or so characters constructed using a high-quality random-number generator". These tokens are often referred to as cross-site request forgery (CSRF) tokens.

You can create this secure random id using the classes j-securernd and j-bigint as in following code:

```
set state=j-bigint:>new(130 j-securernd:>new):>toString(32) .
```

The code for redirection then will be:

```
phase-1-redirection.  
  set state to  
    j-bigint:>new(130 j-securernd:>new):>toString(32) .  
  set params = http-params:>new  
    :>add ("client_id" client-id)  
    :>add ("response_type" "code")  
    :>add ("scope" "openid email")  
    :>add ("redirect_uri" redir)  
    :>add ("state" state)  
    :>add ("openid.realm" realm)  
  comm-area:>redirect ("https://accounts.google.com/o/oauth2/auth" params) .
```

Note that the SCOPE parameter has the value "openid email": if you do not include "email" then the logger will not share his email address with your application.

The second phase begins when the same application is called back by Google, as specified by the `redir` variable. The program can easily tell if it is the first run or the second by the setting of the variables `state` and `http-state`: the former is set by phase 1 while the latter will be passed back by Google in the redirection of the login. So the initial part of the program could be the following:

```
linkage section.
01 comm-area object reference web-area.
procedure division using comm-area.
main.

    accept client-id from environment "client_id_by_google"
    accept clsc from environment "client_secret_by_google".

    accept redir from environment "realdir".
    accept realm from environment "realm".

    if user-email = space
        perform do-auth
    else
        perform run-first-program
    end-if.
    goback.

do-auth.
    initialize http-response.
    comm-area:>accept (http-response) .
    if http-state = space
        perform phase-1-redirection
    else
        if http-state = state
            perform phase-2-get-auth-token
            perform phase-3-get-info
            perform set-first-program
            perform run-first-program
        else
            comm-area:>displayError(403 "Forged state!")
        end-if
    end-if.
```

The parameters received back by Google are described in the following variable:

```
01 http-response identified by "_".
03 identified by "state".
05 http-state pic x any length.
03 identified by "code".
05 http-code pic x any length.
```

The parameter code (stored in http-code) is the one you need in order to get the authorization to query the Google APIs, along with your client ID and client secret. The source code of the second phase could be the following:

```
phase-2-get-auth-token.  
  set http = http-client:>new  
  set params = http-params:>new  
    :>add ("code" http-code)  
    :>add ("client_id" client-id)  
    :>add ("client_secret" clsc)  
    :>add ("redirect_uri" redir)  
    :>add ("grant_type" "authorization_code")  
  try  
    http:>doPost (  
      "https://accounts.google.com/o/oauth2/token"  
      params)  
    http:>getResponseCode (response-code)  
    if response-code = 200  
      http:>getResponseJSON (google-auth)  
    else  
      comm-area:>displayError (response-code "")  
      goback  
    end-if  
  catch exception  
    comm-area:>displayError (500 exception-object:>toString)  
    goback  
  end-try.
```

If the request is successful, the program will receive a JSON payload, containing two strings of characters called "access_token" and "token_type" that allow you to call anything among the Google APIs. This is the isCOBOL description of the JSON:

```
01 google-auth identified by "_".  
  03 identified by "access_token".  
    05 access-token pic x any length.  
  03 identified by "token_type".  
    05 token-type pic x any length.  
  03 identified by "expires_in".  
    05 expires-in pic 9(9).  
  03 identified by "id_token".  
    05 id-token pic x any length.
```

In the third phase you may choose to call the API "userinfo": this API returns a JSON payload whose data are described in the following variable:

```
01 user-info identified by "_".
03 identified by "id".
05 user-id pic x any length.
03 identified by "email".
05 user-email pic x any length.
03 identified by "verified_email".
05 user-verified-email pic x any length.
03 identified by "name".
05 user-name pic x any length.
03 identified by "given_name".
05 user-given-name pic x any length.
03 identified by "family_name".
05 user-family-name pic x any length.
03 identified by "link".
05 user-link pic x any length.
03 identified by "picture".
05 user-picture pic x any length.
03 identified by "gender".
05 user-gender pic x any length.
```

You still don't have any information about the person who logged in, so you need to get some basic information.

In the third phase you may choose to call the API "userinfo": this API returns a JSON payload whose data are described in the following variable:

```
01 user-info identified by "_".
03 identified by "id".
05 user-id pic x any length.
03 identified by "email".
05 user-email pic x any length.
03 identified by "verified_email".
05 user-verified-email pic x any length.
03 identified by "name".
05 user-name pic x any length.
03 identified by "given_name".
05 user-given-name pic x any length.
03 identified by "family_name".
05 user-family-name pic x any length.
03 identified by "link".
05 user-link pic x any length.
03 identified by "picture".
05 user-picture pic x any length.
03 identified by "gender".
05 user-gender pic x any length.
```

In order to query the Google APIs you need to put an authorization property in the header of each request: the property key will be "Authorization" while the property value will be the concatenation of the "token_type" plus the "access_token" separated by a space character. The source code could be the following:

```
phase-3-get-info.  
    string token-type " " access-token into authorization  
    try  
        http:>setHeaderProperty ("Authorization" authorization)  
        http:>doGet (  
            "https://www.googleapis.com/oauth2/v2/userinfo")  
        http:>getResponseCode (response-code)  
        if response-code = 200  
            http:>getResponseJSON (user-info)  
        else  
            comm-area:>displayError (response-code " ")  
            goback  
        end-if  
    catch exception  
        comm-area:>displayError (500 exception-object:>toString)  
        goback  
    end-try.
```

If the call is successful, then the only thing left to do is start the next program, i.e. the first program in the application, for example:

```
set-first-program.  
    set environment "openid.email" to user-email.  
    accept data-dir from environment "file.prefix"  
    string data-dir "/" user-email into data-dir  
  
    call "c$makedir" using data-dir  
    set environment "file.prefix" to data-dir.  
  
run-first-program.  
    comm-area:>redirect ("_index.html").
```

For Complete examples of Facebook and Google authentications see the installed samples under sample\eis\other\oauth.

Twitter Authentication

If you need to implement a program in order to access some Twitter APIs using the application-only authentication, the following will explain how to do it. Also the example shows how to read some Twitts once connected. You can find Twitter's documentation at the address: <https://developer.twitter.com/en/docs/basics/authentication/overview/application-only>.

In order to use this kind of authentication you need to have a configured application on Twitter to get a "Consumer Key" (or "API Key") and a "Consumer secret" (or "API Secret").

These two strings are basically equivalent to a login name and a password to be used in an HTTP Basic Authentication.

Your COBOL program will define at least 2 classes: the class for doing an HTTP connection and the class for passing parameters in the HTTP requests, e.g.:

```
CONFIGURATION SECTION.  
REPOSITORY.  
    class http-client as "com.iscobol.rts.HTTPClient"  
    class http-params as "com.iscobol.rts.HTTPData.Params"  
    .  
  
WORKING-STORAGE SECTION.  
77 http object reference http-client.  
77 parms object reference http-params.
```

So the first HTTP request will be a typical POST request using the Basic authentication and supplying the parameter "grant_type" whose value will be "client_credentials".

```
set parms = http-params:>new  
    :>add ("grant_type", "client_credentials")  
  
set http = http-client:>new.  
http:>setAuth ("<Consumer-key-by-Twitter>"  
    "<Consumer-secret-by-Twitter>").  
try  
    http:>doPost (  
        "https://api.twitter.com/oauth2/token" parms)  
    http:>getResponseCode (response-code)
```

The response to this request will be a JSON-encoded payload: if the response code is different from 200 (OK), the JSON payload will be something like the following:

```
{ "errors": [  
    { "label": "authenticity_token_error", "code": 99, "message":  
        "Unable to verify your credentials" } ] }
```

while if the response will be 200 the JSON payload will be something like this:

```
{ "token_type": "bearer", "access_token":  
"AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA2FAAAAAAAAAAAAAAAAAAAAAA3DAAAAAAAAAAAAAAAAAAAAA  
AAAAAA AAAAAA" }
```

In order to get the data from this payload you can define the following structure in isCOBOL:

```
01 twitter-auth identified by "".  
03 identified by "token_type".  
    05 token-type pic x any length.  
03 identified by "access_token".  
    05 access-token pic x any length.
```

So you can get the two strings with something like:

```
if response-code = 200  
    http:>getResponseJSON (twitter-auth)
```

According to the official documentation, you must verify that the token type is "bearer" and then you can use the access token to call the APIs you need, allowed by this authentication method.

For example, you can implement the "user_timeline" API: in order to do this, we need to use the access token as "bearer" instead of the login/password used previously. The new method *setAuth* (*ICobolVar a*) of HTTPClient do exactly this. You can also pass all the supported parameters. See https://developer.twitter.com/en/docs/tweets/timelines/api-reference/get-statuses-user_timeline for the full documentation. E.g.:

```
if token-type = "bearer"
  http:>setAuth (access-token)
  set parms = http-params:>new
                :>add ("count", "20")
                :>add ("screen_name", "VeryantCOBOL");;
  http:>doGet ("https://api.twitter.com/1.1/statuses/user_timeline.json" parms)
```

In this case you perform the GET request according to the official documentation. This request will return two different JSON payloads depending on the success of the call, but, differently from what happened in the previous API, it seems that the response code is 200 in any case. This means that you cannot know which isCOBOL structure you must use in order to get the data from the payload.

The two formats returned by the above API are very different: when there is an error the format is very similar to the one already seen above when the authorization fails. If the operation return successfully, however, the payload will be an array of objects, whose length depends on the "count" parameter, each one including about 100 fields (see https://developer.twitter.com/en/docs/tweets/timelines/api-reference/get-statuses-user_timeline for a complete description).

In our example we are interested only in few fields, so we have defined a structure like the following:

```
01 twitter identified by space.
   03 array identified by space occurs dynamic
       capacity cnt.
       05 identified by "text".
         07 twittext pic x any length.
       05 identified by "user".
         07 identified by "screen_name".
           09 screen-name pic x any length.
```

The first 03 item is the data we need for our application.

This is the full program:

```
PROGRAM-ID. tweet.

CONFIGURATION SECTION.
REPOSITORY.
    class http-client as "com.iscobol.rts.HTTPClient"
    class http-params as "com.iscobol.rts.HTTPData.Params"
    .

WORKING-STORAGE SECTION.
77 http object reference http-client.
77 parms object reference http-params.
77 i int.
77 some-text pic x any length.
77 response-code pic 999.

77 api-key      pic x any length.
77 api-secret   pic x any length.

01 twitter-auth identified by "".
03 identified by "token_type".
05 token-type   pic x any length.
03 identified by "access_token".
05 access-token pic x any length.

01 twitter identified by space.
03 array identified by space occurs dynamic capacity cnt.
05 identified by "text".
07 twittext pic x any length.
05 identified by "user".
07 identified by "screen_name".
09 screen-name pic x any length.

PROCEDURE DIVISION.
MAIN.

    accept api-key from environment "api_key"
    accept api-secret from environment "api_secret"

    set parms = http-params:>new
        :>add ("grant_type", "client_credentials")
```

```

set http = http-client:>new.
http:>setAuth (api-key api-secret)
try
  http:>doPost (
    "https://api.twitter.com/oauth2/token" parms)
  http:>getResponseCode (response-code)
  if response-code = 200
    http:>getResponseJSON (twitter-auth)
    if token-type = "bearer"
      http:>setAuth (access-token)
      set parms = http-params:>new
        :>add ("count", "20")
        :>add ("screen_name", "VeryantCOBOL");;
      http:>doGet ("https://api.twitter.com/1.1"-
        "/statuses/user_timeline.json" parms)
      if response-code = 200
        display "Connection OK Response code="
          response-code;;
        http:>getResponseJSON (twitter)
        perform show-results
      else
        display "Response code=" response-code;;
        http:>getResponsePlain (some-text)
        display some-text
        goback
      end-if
    else
      display "wrong token-type=" token-type
    end-if
  else
    display "Connection problem. Response code="
      response-code;;
    http:>getResponsePlain (some-text)
    display some-text
    goback
  end-if
catch exception
  display exception-object:>toString
  goback
end-try.
goback.

show-results.
display "Total number of Tweets [" cnt "]"
perform varying i from 1 by 1 until i > cnt
  display "Tweet " i
  display "@" screen_name(i) ": " twittext (i)
end-perform.

```

where "api_key" and "api_secret" are the "Consumer Key" (or "API Key") and a "Consumer secret" (or "API Secret") are retrieved from the configuration file.

Chapter 4

HTML5/CSS3 JS and JSON

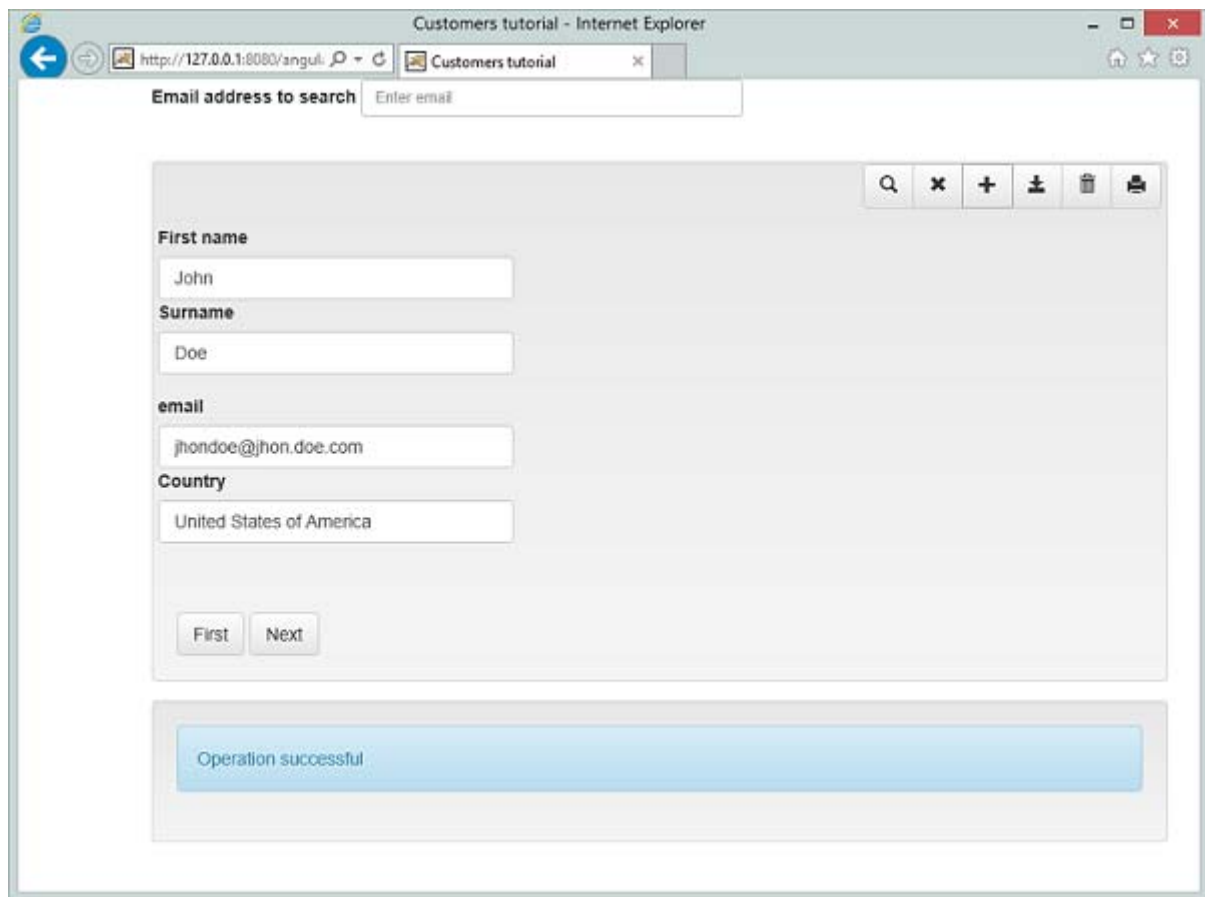
isCOBOL and AngularJS

With isCOBOL EIS taking advantage of COBOL REST producer and JSON COBOL integration, it is possible to write a Rich GUI Client Desktop application based on HTML5 and CSS3.

The client javascript library we recommend to work with is called AngularJS (<http://angularjs.org/>), and is developed and supported by Google.

This library, among other things, makes it easy to bind the data model coming from isCOBOL programs to the web page. An angular application is built on views and controllers. Each view (a page or part of a page) is handled by a controller, which fetches data from the isCOBOL servlet and binds it to the view's components.

The example page is described below and you'll find all sources on [sample/eis/other/angularjs](#).



First of all we need to include all relevant javascript and CSS files in the head of HTML page:

```
<link href="css/bootstrap.min.css" rel="stylesheet" media="screen"/>
<link href="css/bootstrap-theme.min.css" rel="stylesheet" media="screen"/>
<link href="css/customers.css" rel="stylesheet" media="screen"/>
<script type="text/javascript" src="js/jquery.js"></script>
<script type="text/javascript" src="js/angular.min.js"></script>
<script type="text/javascript" src="js/bootstrap.min.js"></script>
<script type="text/javascript" src="js/app.js"></script>
```

Then we should indicate the tag ng-app in the <html> declaration in order to load the library and process all directives in the page:

```
<html ng-app="appTutorial">
```

All code to manage the HTML application is contained in the file *app.js*.

Let's examine it:

- It contains the application declaration (*angular.module('appTutorial', []);*)
- It defines a controller CustomersCtrl which will handle a customer page

The controller includes a *\$scope* variable, which represents the current instance of the controller itself, and *\$http*, which is an object provided by the AngularJS library that supports http requests to servers.

We define our model using `$scope.customer={};`, which creates an empty JSON object that will be filled by the isCobol program:

```
$scope.customer={};
```

Also, the controller defines methods to handle the buttons placed in the form, used for data navigation and processing. For example, the `getNextCustomer` method calls a COBOL entry point called AWEBX-NEXT that fetches the next customer in the dataset:

```
$scope.getNextCustomer = function() {  
    $http.get("servlet/isCobol(AWEBX_NEXT)")  
        .then(function(response) {  
            if (response.data._comm_buffer._status=="OK")  
                $scope.customer = response.data._comm_buffer;  
        })  
}
```

Next, we need to bind the page, or a section of a page, to a controller. In this sample we bind the `CustomerCtrl` (Customer Controller) to a div, this means that each control inside the div will have access to the model and methods defined in the controller. The binding is done using the directive

```
<div class="container" ng-controller="CustomersCtrl">
```

inside the `<div...>` tag right after the body.

Inside the div we define an HTML form, which will be handled by the `CustomerCtrl` as well. This is done by specifying the directive `ng-action="performSearch()"` inside the form. Form submission will trigger the `PerformSearch` method of the controller:

```
<form ng-submit="performSearch()" class="form-inline" role="form">
```

Notice how each button in the form is bound to a method in the controller, meaning that the click will be handled by the method specified in the `ng-click` directive. Each INPUT tag in the form is bound to one of the data model defined in the controller. In this tutorial we only have one model: customer.

The structure of this model is defined in the AWEBX.cbl COBOL source code. Each time AWEBX.cbl is executed it returns the "response" record, which contains status about the performed operation and a customer record:

```
01 comm-buffer identified by "_comm_buffer".  
03 filler identified by "_status".  
05 response-status pic x(2).  
03 filler identified by "_message".  
05 response-message pic x any length.  
03 filler identified by "name".  
05 json-name pic x any length.  
03 filler identified by "surname".  
05 json-surname pic x any length.  
03 filler identified by "email".  
05 json-email pic x any length.  
03 filler identified by "country".  
05 json-country pic x any length.
```

Let's examine how the processing of a web request is done in an Angular controller:

Take a look at the getNextCustomer method:

```
$scope.getNextCustomer = function() {  
    $http.get("servlet/isCobol(AWEBX_NEXT)")  
        .then(function(response) {  
            if(response.data._comm_buffer._status=="OK")  
                $scope.customer = response.data._comm_buffer;  
        })  
    }  
}
```

It calls the isCOBOL program, using the entry point AWEBX_NEXT. This call is asynchronous, meaning that the javascript code will continue executing while the http object is fetching the data.

When the server returns with data (or an error), the .then() method will be called.

The .then method expects as a parameter a function which receives a response object as its own parameter. The response.data field contains the response model defined in the AWEBX.cbl file.

The function needs to check if the fetch operation was successful:

```
if (response.data._comm_buffer._status=="OK")
```

and, if so, it will extract the customer model and make it available in the controller:

```
$scope.customer = response.data._comm_buffer;
```

This will automatically display the model data in the input tags of the form. Each input has an ng-model directive, which holds the field that will be bound to the edit field:

```
<input type="text" class="form-control" ng-  
model="customer.name" id="edFirstname" style="width:280px" />
```

As the user modifies the content of the input field, the model in the controller is automatically updated.

So, all we need to do in order to save the changes is to post the model to the isCOBOL program.

This is done in the saveCustomer (or newCustomer) method of the controller. All we need to do is call the isCOBOL program, using the right entry point, AWEBX_UPDATE (AWEBX_INSERT), and pass it the customer model:

```
$scope.saveCustomer = function() {  
    callServerWithJson("AWEBX_UPDATE",  
$scope.customer, $scope.onSuccess, $scope.onError);  
}
```

The *callServerWithJson* utility method accepts the entry point to call, a model to pass to the isCOBOL program, and 2 callbacks, that specify the function to execute if the http request is successful *onSuccess*, or if it fails *onError*.

Notice that the *onSuccess* will be called even if the isCOBOL program generates an error (duplicated key, record locked, and so on). This is because the HTTP request was carried out successfully, but a logical program error occurred. So the *onSuccess* method needs to check the response object and handle it appropriately.

The *onError* callback will be invoked only if the http request fails (network error, server error,...).

Chapter 5

COBOL Servlet option (OOP)

Introduction

One of the initial purposes of the Java language was to enable programmers to make Web pages more interactive by embedding programs called applets. When a browser loads a Web page containing an applet, the browser downloads the applet byte code and executes it on the client machine. However, because of client compatibility, bandwidth, security and other issues, businesses needed an alternative solution where Web pages could be made to interact with server-side instead of client-side Java programs.

Server-side Java programming solves problems associated with applets. A servlet can be thought of as a server-side applet. However, when the code is executed on the server-side, there are no issues with browser compatibility or download times. The servlet byte code runs entirely on the server and only sends information to the client in a form that the client can understand.

Similar to a CGI program, a servlet takes requests from a client such as a Web browser, accesses data, applies business logic, and returns the results.

The servlet is loaded and executed by the Web server, and the client communicates with the servlet through the Web server using HTTP requests. This means that if your Web server is behind a firewall, your servlet is secure.

Servlet technology was developed to improve upon and replace CGI programs. Servlet technology is superior to CGI but uses the same HTML code. So you can switch from CGI programs to servlets on the back-end without having to change the programming on the front-end. Servlets use the CGI protocol.

In addition to Java technology's platform independence and promise of write once, run anywhere, servlets have other advantages over CGI programs:

- Servlets are persistent. They are loaded only once by the Web server and can maintain services such as database connections between requests.
- Servlets are fast. They need to be loaded only once by the Web server. They handle concurrent requests on multiple threads rather than in multiple processes. Thus, applications with servlets perform better and are more scalable than the same applications using CGI programs.
- Servlets are platform and Web server independent.
- Servlets can be used with a variety of clients, not just Web browsers.
- Servlets can be used with a variety of client-side and server-side Web programming techniques and languages.

The isCOBOL EIS introduces a new way to develop COBOL programs that acts like java servlet using *HTTPHandler* class functionality.

One of the most remarkable differences between COBOL servlets and CGI programs is that Web servers automatically maintain user session state for servlets. This means that the COBOL servlet can store user-session specific information in a user session object and retrieve that information on a subsequent call.

The isCOBOL EIS Framework uses this feature to associate the user session with a COBOL thread context. This makes sure that the same instances of COBOL programs get used each time they are called during a particular user session. In other words, COBOL programs called during a particular user session retain their file states and working-storage data between requests from that user session. If desired, the programmer can cancel the program at any time with the CANCEL statement. In fact, at first it will be necessary to cancel old CGI programs because they were written to assume that they have been cancelled between calls. Later, the CANCEL statement can be removed as the old CGI programs are updated to make use of the Stateful nature of COBOL servlets.

COBOL Servlet Programming

Following you will find an explanation about how to develop a simple COBOL servlet that builds an HTML page using a header.htm page and a footer.htm page, filling them with the correct message and sending a text string between them, the string is "Hello world from isCOBOL!".

The Web Servlet container used for this example is Tomcat 7.

This program needs to take the following steps:

- Create a folder called doctest with the following structure:

```
doctest/  
  WEB-INF/  
    classes  
    lib
```

- Create a file called *web.xml* in doctest/WEB-INF folder with the following content:

```
<?xml version="1.0" encoding="UTF-8"?>  
<web-app xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://  
java.sun.com/xml/ns/javaee" xmlns:web="http://java.sun.com/xml/ns/javaee/web-  
app 2.5.xsd" xsi:schemaLocation="http://java.sun.com/xml/ns/javaee http://  
java.sun.com/xml/ns/javaee/web-app 2.5.xsd" id="WebApp_ID" version="2.5">  
  <display-name>isCOBOL EIS</display-name>  
  <welcome-file-list>  
    <welcome-file>Hello.htm</welcome-file>  
  </welcome-file-list>  
  <filter>  
    <filter-name>isCOBOL filter</filter-name>  
    <filter-class>com.iscobol.web.IscobolFilter</filter-class>  
  </filter>  
  <filter-mapping>  
    <filter-name>isCOBOL filter</filter-name>  
    <url-pattern>/servlet/*</url-pattern>  
  </filter-mapping>  
  <servlet>  
    <servlet-name>isCobol</servlet-name>  
    <servlet-class>com.iscobol.web.IscobolServletCall</servlet-class>  
  </servlet>  
  <servlet-mapping>  
    <servlet-name>isCobol</servlet-name>  
    <url-pattern>/servlet/*</url-pattern>  
  </servlet-mapping>  
  <listener>  
    <listener-class>com.iscobol.web.IscobolSessionListener</listener-class>  
  </listener>  
</web-app>
```

- Create a *Hello.htm* web form to call a COBOL servlet called HELLO:

```
<HTML><HEAD><TITLE>isCOBOL Example</TITLE></HEAD>  
<BODY>  
<H2>isCOBOL Example.</H2>  
<H3>This example shows how easily you can compose an HTML page with an isCOBOL program  
running on the web server. The HTML page is composed of two parts; a header and a  
footer. The isCOBOL program will insert a message to the header and footer, as well as  
inserting the text "Hello world from isCOBOL" between the header and footer.</H3>  
<HR size="2">  
<FORM method="post" action="/servlet/isCobol(HELLO)">  
  <p><input type="submit" value="Invoke isCOBOL HELLO program" /></p>  
</FORM>
```

Note that in POST method of HTML form there is the call of the COBOL Servlet called HELLO.

- Create a *Header.htm* as follow:

```
<HTML>
<HEAD><TITLE>CGI Header</TITLE></HEAD>
<BODY>
<CENTER>
<H1>This is the header HTML page of the isCOBOL Example</H1>
<H2>This is the message sent by the isCOBOL program: %%opening-message%%</H2>
<HR>
```

Note that this form displays the top of the HTML page that the program HELLO.cbl will build; as we can see, the <HTML>, <BODY> and <CENTER> tags are not closed, and there is the string %%opening-message%% that will be managed and replaced by the COBOL servlet program.

- Create a *Footer.htm* web form as follow:

```
</CENTER>
<BR>
<HR>
This is the footer HTML page of the isCOBOL Example.
<H2>This is the message sent by the isCOBOL program: %%closing-message%%</H2>
</BODY></HTML>
```

Note that this form displays the bottom of the HTML page that the program HELLO.cbl will build. Here the tags <HTML>, <BODY> and <CENTER> are closed and there is the string %%closing-message%% that will be managed and replaced by the COBOL servlet program.

- Create a *HELLO.cbl* COBOL Servlet program as follows:

```
PROGRAM-ID. HELLO initial.
CONFIGURATION SECTION.
REPOSITORY.
class web-area as "com.iscobol.rts.HTTPHandler"
.
WORKING-STORAGE SECTION.
01 hello-buffer pic x(40) value "Hello World from isCOBOL!".
01 rc pic 9.
01 html-header-form identified by "Header".
    05 identified by "opening-message".
    10 opening-message pic x(40).
01 html-footer-form identified by "Footer".
    05 identified by "closing-message".
    10 closing-message pic x(40).

LINKAGE SECTION.
01 comm-area object reference web-area.
PROCEDURE DIVISION using comm-area.
MAIN-LOGIC.
    move "This is the header" to opening-message
    set rc = comm-area:>processHtmlFile (html-header-form).
    comm-area:>displayText (hello-buffer).
    move "Bye Bye by isCOBOL" to closing-message
    set rc = comm-area:>processHtmlFile (html-footer-form).
    goback.
```

Note that the COBOL servlet does the following steps:

- Move the value "This is the header" to the variable opening-message of the structure prepared for Header.htm
- Add to the HTML page source (that currently is empty) the Header.htm form replacing the string %%opening-message%% by the opening-message variable value
- Add to the HTML page the text "Hello world from isCOBOL!"
- Move the value "Bye Bye by isCOBOL" to the variable closing-message of the structure prepared for Footer.htm
- Add to the HTML page source the Footer.htm form replacing the string %%closing-message%% by the closing-message variable value

at the exit of the program, the page HTML will be sent to the Web Server.

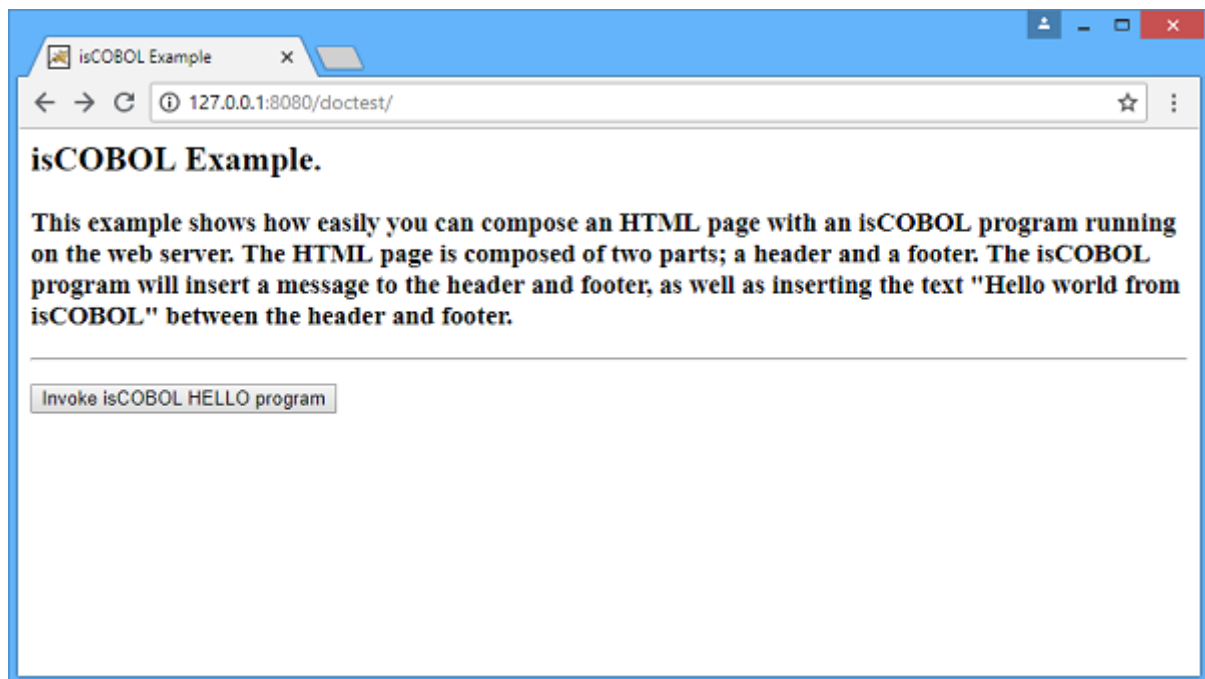
- Compile HELLO.cbl without any specific options and copy HELLO.class under doctest/WEB-IF/classes folder
- Create a iscobol.properties file under doctest/WEB-IF/classes folder with a property to inform isCOBOL EIS framework of the path of all HTML useful files:

```
iscobol.http.html_template_prefix=webapps/doctest
```

- Copy the isCOBOL runtime library (iscobol.jar) to the doctest/WEB-IF/lib folder.
- Create a war file to be deployed in Tomcat called doctest.war that includes all files of doctest folder. It can be done with the following command:

```
jar -cfv doctest.war *
```

Once doctest.war file is deployed correctly in Tomcat servlet container, we can try it using http://127.0.0.1:8080/doctest, assuming Tomcat is running on the localhost and using the default port, 8080.



By pressing the "Invoke isCOBOL Hello program" button, the result is:



COBOL Servlet Programming with AJAX and XML

AJAX (Asynchronous JavaScript and XML) is a group of interrelated Web development techniques used on the client side to create asynchronous Web Applications. With Ajax, Web applications can send data to, and retrieve data from, a server asynchronously (in the background) without interfering with the display and behavior of the existing page.

Extensible Markup Language (XML) is a text format derived from Standard Generalized Markup Language (SGML). Compared to SGML, XML is simple. HyperText Markup Language (HTML), by comparison, is even simpler. Even so, a good reference book on HTML is an inch thick. This is because the formatting and structuring of documents is a complicated business.

Most of the excitement about XML is related to a new role as an interchangeable data serialization format. XML provides two enormous advantages as a data representation language:

- It is text-based
- It is position-independent

The scope of this paragraph is to show how to develop a simple web application that uses XML stream to communicate data from COBOL servlet to a Web form.

The following example called HELLO.cbl, is located in sample/eis/http/xml folder. The README.txt file explains how it works and how to deploy it.

This example needs to take the following steps:

- Create an HTML file called index.html that is able to establish an AJAX communication to receive an XML stream from COBOL servlet program:

In *index.html* there is included a Javascript code based on JQUERY to be able to call some COBOL servlet entry points making a GET request type (default) and receiving XML data stream:

```
function callServer (cobolProg) {  
    var url = "servlet/isCobol(" + cobolProg + ")";  
    jQuery.ajax(url, {  
        success: handleSuccess,  
        error: handleError  
    });  
    return false;  
}
```

- Load all COBOL Servlets using the following statement:

```
window.onload = callServer('HELLO');
```

Note that when HELLO COBOL Servlet is loaded the following code executed:

```
move "Hello World from isCOBOL!" to xml-hellotext.  
lnk-area:>displayXML (hello-buffer).
```

And XML stream is returned to the Web form with the displayXML() command.

When running this example the result is the following:



COBOL Servlet Programming with AJAX and JSON

JSON or JavaScript Object Notation, is an open standard format that uses text easy to understand to transmit data objects consisting of attribute-value pairs. It is used primarily to transmit data between a server and web application, as an alternative to XML.

Although originally derived from the JavaScript scripting language, JSON is an independent data format, and code for parsing and generating JSON data is readily available in a large variety of programming languages.

Here we will show how to develop a simple web application of data file management that uses JSON stream to communicate data from COBOL servlet to HTML pages.

The following example is located in sample/eis/http/json folder. The README.txt file explains how it works and how to deploy it.

This example needs to take the following steps:

- Create an HTML file that is able to establish an AJAX communication using JSON stream to a COBOL servlet program:

In *awebx.htm* there is included a Javascript code based on JQUERY to be able to call some COBOL servlet entry point making a GET request type (default) and receiving JSON data stream:

```
function callServer (cobolProg) {  
    var url = "servlet/isCobol(" + cobolProg + ")";  
    var parm = $("form").serialize();  
    $.ajax(url, {  
        success: handleSuccess,  
        error: handleError,  
        data: parm  
    });  
    return false;  
}
```

- Load all COBOL Servlet entry points using the following statement:

```
callServer("AWEBX"); // program initialization
```

Note the once AWEBX COBOL Servlet is loaded the INIT paragraph is executed:

```
INIT.  
    set declaratives-off to true.  
    move low-values to r-awebx-email.  
    open i-o awebxfile.  
    set declaratives-on to true.  
    if file-status > "0z" and file-status not = "41"  
        open output awebxfile  
        close awebxfile  
        open i-o awebxfile.  
    comm-area:>displayJSON (ok-page).  
    goback.
```

Code is included that associates each AWEBX entry point to an HTML button, to be executed when the button is clicked:

```
<input type="submit" value="Insert" onclick="return callServer('AWEBX_INSERT');">  
<input type="submit" value="Search" onclick="return callServer('AWEBX_SEARCH');">  
<input type="submit" value="Next" onclick="return callServer('AWEBX_NEXT');">  
<input type="submit" value="Update" onclick="return callServer('AWEBX_UPDATE');">  
<input type="submit" value="Delete" onclick="return callServer('AWEBX_DELETE');">
```

Note that the above HTML is able to call the following COBOL servlet entry-point:

```
INSERT-VALUES.  
    entry "AWEBX_INSERT" using comm-area.  
    ...  
    goback.  
  
SEARCH-VALUES.  
    entry "AWEBX_SEARCH" using comm-area.  
    ...  
    goback.  
  
NEXT-VALUES.  
    entry "AWEBX_NEXT" using comm-area.  
    ...  
    goback.  
  
UPDATE-VALUES.  
    entry "AWEBX_UPDATE" using comm-area.  
    ...  
    goback.
```

- Define some fields in HTML to input data suitable for data management, such as name, surname, email, country etc:

```
<input type="text" name="name" size="25" placeholder="Name"/><br/>  
<input type="text" name="surname" size="25" placeholder="Surname"/><br/>  
<input type="text" name="email" size="25" placeholder="E-mail"/><br/>  
<select name="country" placeholder="Country">  
  <option value="" selected="selected" disabled="disabled">Country</option>  
  <option value="us">US</option>  
  <option value="it">Italy</option>  
  <option value="fi">Finland</option>  
  <option value="nl">The Netherlands</option>  
  <option value="de">Germany</option>  
  <option value="fr">France</option>  
  <option value="sp">Spain</option>  
  <option value="uk">United Kingdom</option>  
</select><br/>
```

- In COBOL Servlet create a working storage structure that matches the field name of previous HTML. It can be done with identified by clause:

```
01 comm-buffer identified by "_comm_buffer".  
03 filler identified by "_status".  
05 response-status pic x(2).  
03 filler identified by "_message".  
05 response-message pic x any length.  
03 filler identified by "name".  
05 json-name pic x any length.  
03 filler identified by "surname".  
05 json-surname pic x any length.  
03 filler identified by "email".  
05 json-email pic x any length.  
03 filler identified by "country".  
05 json-country pic x any length.
```

- In COBOL Servlet manage GET request by accept() answering with a JSON stream by displayJSON(). For example if "insert" is submitted the following entry point is invoked:

```

INSERT-VALUES.
    entry "AWEBX_INSERT" using comm-area.
    comm-area:>accept(comm-buffer).
    move spaces to error-status.
    perform check-values.
    if error-status = spaces
        move json-name      to r-awebx-name
        move json-surname   to r-awebx-surname
        move json-email     to r-awebx-email
        move json-country   to r-awebx-country
        write rec-awebxfile
        move "Operation successful" to ok-message;;
        comm-area:>displayJSON (ok-page)
    else
        comm-area:>displayJSON (error-page).
    goback.

```

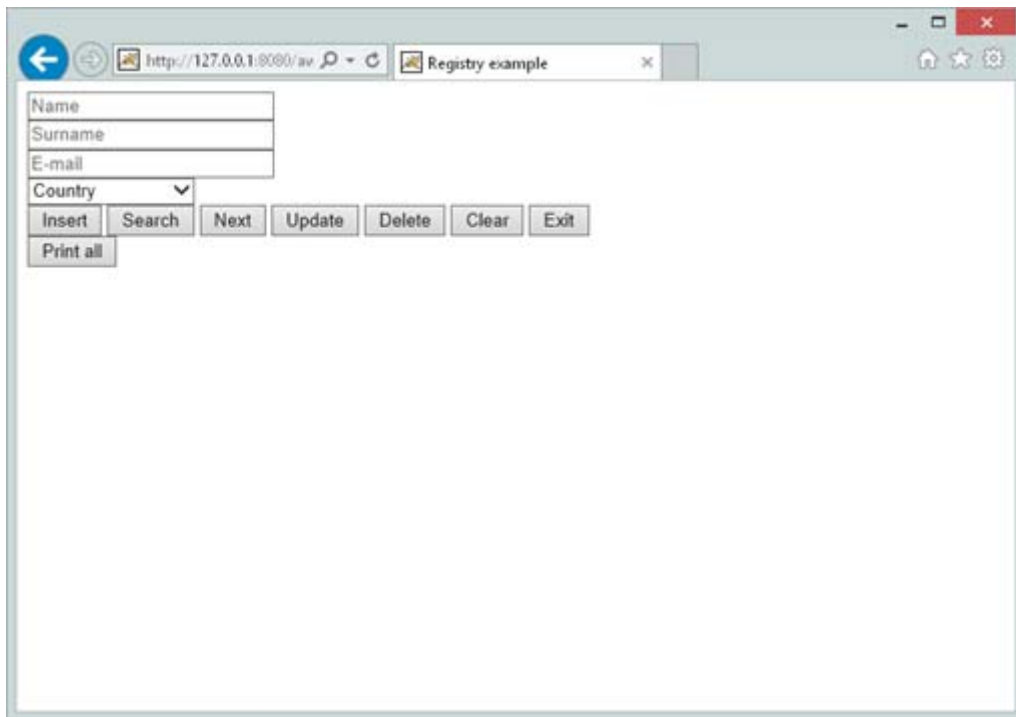
- In a similar way when a "next" command is submitted, the records are returned back as JSON stream with the displayJSON() command:

```

NEXT-VALUES.
    entry "AWEBX_NEXT" using comm-area.
    read awebxfile next
    move r-awebx-name      to json-name
    move r-awebx-surname   to json-surname
    move r-awebx-email     to json-email
    move r-awebx-country   to json-country
    move "OK" to response-status
    move "" to response-message;;
    comm-area:>displayJSON (comm-buffer).
    goback.

```

This is the output form of awebx.htm used in this example:



COBOL Servlet Programming to replace CGI COBOL programming

This page will show you how to migrate older CGI COBOL programs to isCOBOL Servlets in order to take advantage of useful features of the HTTPHandler class. Usually only a few changes are required; most of your source code will remain unchanged.

Conversion of the ACUCOBOL-GT Oscars sample

The following example is located in sample/eis/http/getpost/acucgi2is folder. The README.txt file explains how it works and how to deploy it.

This example needs to take the following steps:

- A POST form action invoking the COBOL program acting as a servlet to replace the CGI program:

```
<FORM method="post" action="servlet/isCobol(OSCARS)">
```

This HTML document, called 'oscars.htm' will also include these controls:

```
<input type=checkbox name=y1996 value=1996> 1996
<input type=checkbox name=y1995 value=1995> 1995
<input type=checkbox name=y1994 value=1994> 1994
<input type=checkbox name=y1993 value=1993> 1993
<P>
<input type=checkbox name=y1992 value=1992> 1992
<input type=checkbox name=y1991 value=1991> 1991
<input type=checkbox name=y1990 value=1990> 1990
<input type=checkbox name=y1989 value=1989> 1989
<P>
<input type=checkbox name=y1988 value=1988> 1988
<input type=checkbox name=y1987 value=1987> 1987
<input type=checkbox name=y1986 value=1986> 1986
<input type=checkbox name=y1985 value=1985> 1985
<P>
<input type="submit" value="Submit Query" >
```

When checking one or more years and pressing the 'Submit query' button, the OSCARS COBOL servlet program is called.

The OSCARS COBOL program needs to be compiled with the following options:

```
-ca -smat
```

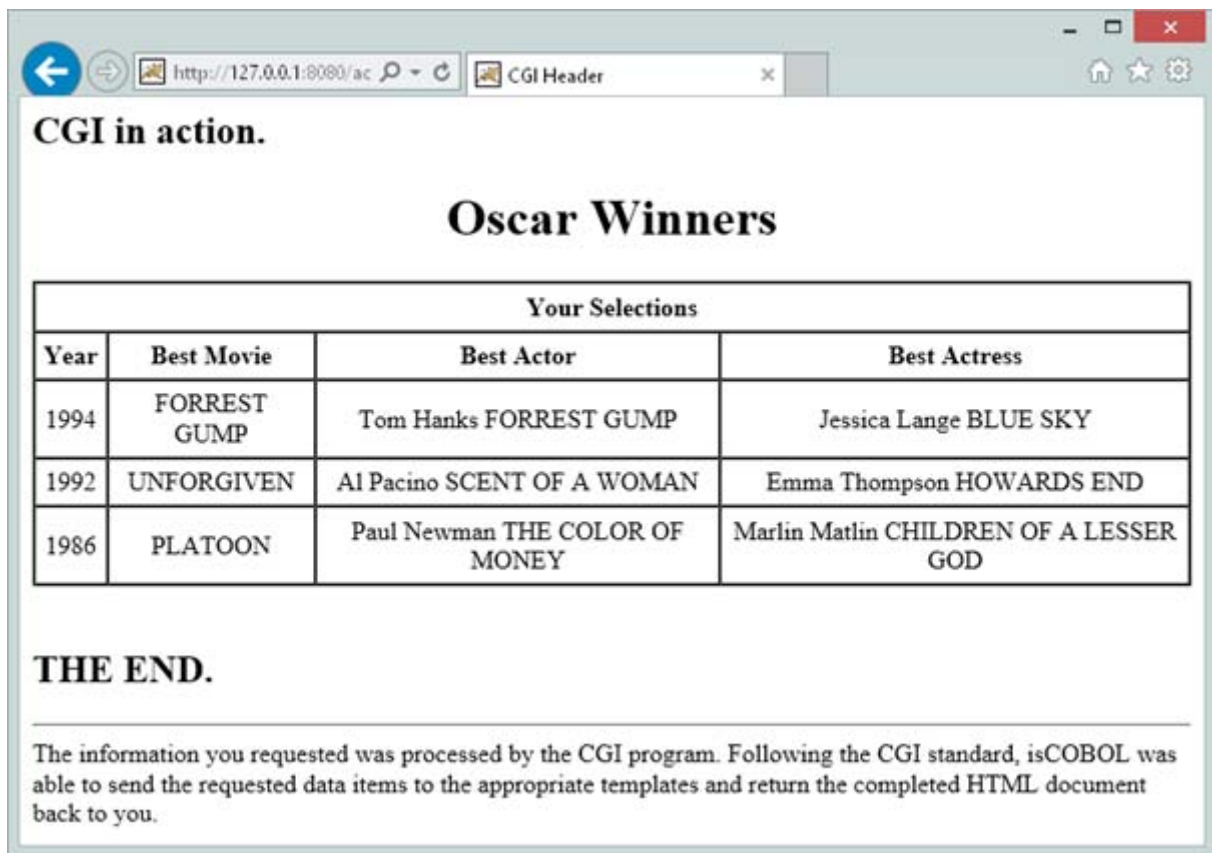
having the following regexp in the Compiler configuration:

```
iscobol.compiler.regexp="( ?i) (STOP) \\s+ (RUN) " "GOBACK"
```

and the following setting in the Runtime configuration:

```
iscobol.http.stateless=true
```

The result choosing 1994, 1992 and 1986 is the following:



Conversion of the Micro Focus sample

Using the above approach is also possible to migrate a Micro Focus COBOL CGI program to COBOL Servlet.

Under sample/eis/http/getpost/ mfcgi2is folder you find an example of a Micro Focus Cobol CGI program rewritten to run with the HTTP option of isCOBOL EIS.

The README.txt file explains how it works and how to deploy it.

This example needs to take the following steps:

- A POST form action invoking the COBOL program acting as a servlet to replace the CGI program:

```
<BODY><FORM id=form1 name=form1 action="servlet/isCobol (WEBDEMO) " method=post >
```

This HTML document, called 'WebDemo.htm', will also include these controls:

```
<INPUT id=checkbox1 type=checkbox value=on name=checkbox1>Vanilla
<INPUT id=checkbox2 type=checkbox value=on name=checkbox2>Chocolate
<INPUT id=checkbox3 type=checkbox value=on name=checkbox3>Marble

<INPUT id=radiobutton1 type=radio value=White name=radio>White
<INPUT id=radiobutton2 type=radio value=Chocolate name=radio>Chocolate
<INPUT id=radiobutton3 type=radio value=Blue name=radio>Blue

<SELECT id=select1 name=select1> <OPTION
selected>Cash<OPTION>Visa<OPTION>Check<OPTION>Mac</OPTION></SELECT>
```

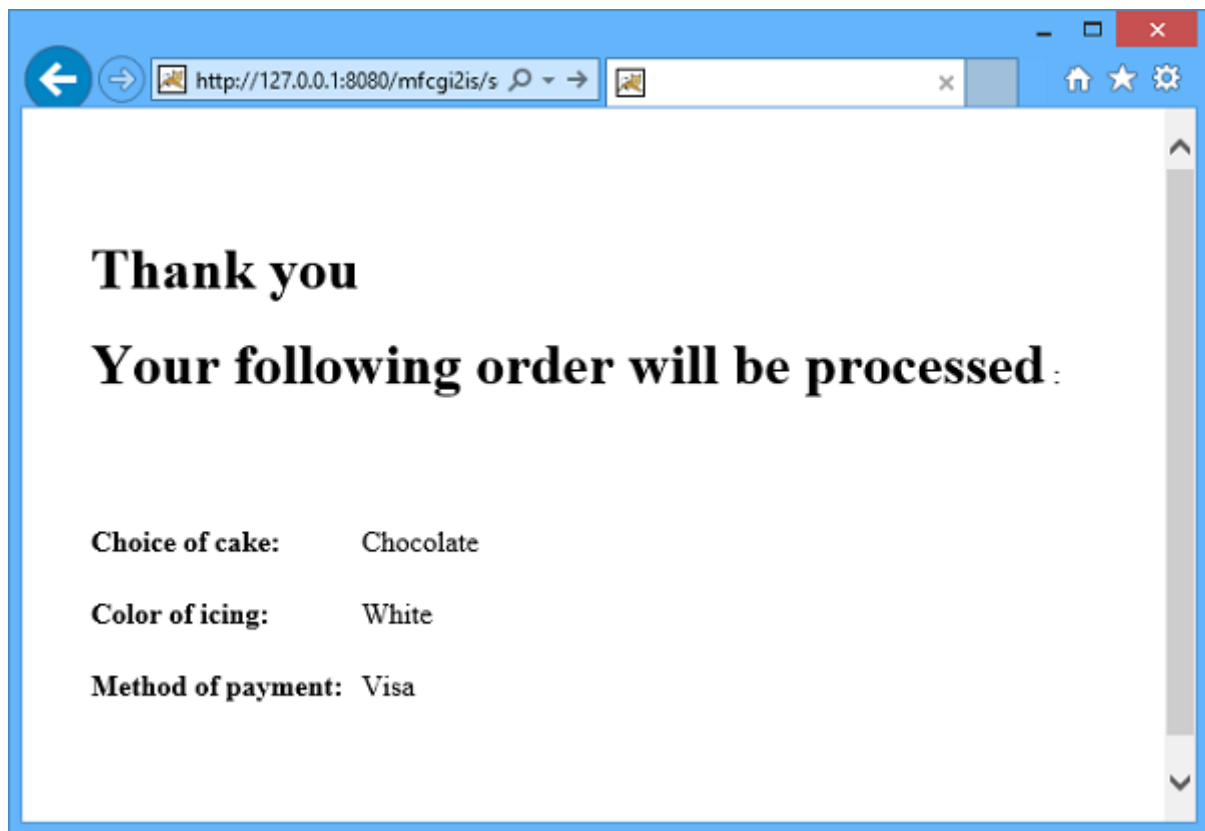
The WEBDEMO COBOL program needs to be compiled with the following options:

```
-sa -exec=html
```

having the following regexp in the Compiler configuration:

```
iscobol.compiler.regexp="( ?i) (STOP)\\s+(RUN) " "GOBACK" \
    "( ?i) (local-storage)\\s+(section.) " "|local-storage section." \
    "call-convention" "|call-convention" \
    "( ?i) (\\(length ) " "(length of " \
    "( ?i) ( length ) " "length of " \
    "( ?i) (CALL)\\s+(LLNK) " "CALL"
```

The result choosing Chocolate cake, White icing and Visa payment is the following:



Chapter 6

Web Direct 2.0 option

Introduction

With isCOBOL EIS Web Direct 2 option your organization can leverage existing COBOL syntax to develop and deploy a universally accessible, zero client, rich Internet applications (RIA) using standard COBOL screen sections and existing program procedure flow. No knowledge of object-oriented programming, JavaScript, HTML, or other Web languages is required.

isCOBOL EIS Web Direct 2.0 (EIS WD2) is a Java framework for presenting a graphical user interface, composed of elements such as windows, dialogs, menus, text fields and buttons, inside a Web Browser. This technology uses AJAX (asynchronous JavaScript and XML) techniques and the Comet web application model. The web application is deployed as a Servlet and therefore requires a Java-enabled web server, one that implements the Java Servlet specification from Sun Microsystems

isCOBOL EIS Web Direct 2.0 takes advantage of ZK libraries, installed with the product. ZK is an event-driven, component-based framework to enable rich user interfaces for Web applications. ZK includes an AJAX-based event-driven engine, a rich component set of XUL and XHTML and a markup language called ZUML (ZK User Interface Markup Language).

Current version of ZK is:

- ZK 8.5

Technical Notes

EIS WD2 on the client side is a JavaScript application running inside a web browser. This environment has many limitations in comparison with a full GUI environment, e.g. only a few events are generated. JavaScript is a script language so its performance is not as good as compiled languages, although latest generation browsers are improving performance by the use of JIT (Just In Time) compilers.

EIS WD2 was not developed from scratch; it uses a library, ZK, that hides the JavaScript implementation and exposes a Java API. Veryant interfaces our set of GUI controls with the ones implemented in ZK. As a result, because our controls are similar to those provided by ZK, future updates will require less effort and provide more stable releases interfacing with ZK GUI controls. Alternatively, controls completely different from the ZK controls will require more development and testing time.

The client/server communication is performed through the HTTP protocol; since this protocol is very limited in functionality, a special technique (called "COMET") has been used in order to get the needed functionality. This technology is the up-to-date best technology in this area. However its performance is not as good as native protocols. Just as an example, it uses XML protocols, so it creates bigger messages and it requires considerable computation resources for marshalling.

Installation Environment

In order to deploy and run programs using Web Direct 2.0, the programs' environment must be set up in a servlet container such as Apache Tomcat.

Veryant recommends using Apache Software Foundation Tomcat version 7 for running EIS WD2 Application.

The Apache Tomcat main page is <http://tomcat.apache.org/>

isCOBOL EIS Web Direct 2.0 is expected to work also on the following containers:

- IBM WebSphere
- BEA WebLogic
- JBoss
- Oracle OC4J and Oracle OPMN Release 3
- Liferay
- Pluto
- Jetty
- Resin

Servlet container and Web Browser Requirements

Web Direct 2.0 runs on any web server that supports Servlet 2.3+ and JVM 1.5+.

The web browser must be able to run JavaScript and support Ajax (namely the XMLHttpRequest object). The following browsers are certified for ZK 8:

- Internet Explorer 8+
- Edge
- Firefox
- Chrome
- Safari
- iOS Safari
- Android Browser
- Opera

Getting Started

The jar libraries must be copied into the proper directory in order to be available to the web application. If you're using Tomcat, you must copy these libraries in the "lib" folder of your web application.

Web Direct 2.0 is composed of:

Name	Description	Location
iscobol.css	Web Direct 2.0 stylesheet	resources/css
iscobol.properties	Configuration file for the web application	WEB-INF/classes
iscobol.jar	isCOBOL Runtime Framework	WEB-INF/lib
iswd2.jar	isCOBOL Web Direct 2.0 Implementation	WEB-INF/lib

Name	Description	Location
commons-codec-1.9.jar commons-collections4-4.1.jar commons-logging.jar javassist.jar itext-2.1.7v3.jar xmlbeans-2.6.0.jar poi-3.17.jar poi-ooxml-3.17.jar poi-ooxml-schemas-3.17.jar	additional isCOBOL libraries	WEB-INF/lib
bsh.jar commons-codec.jar commons-collections.jar commons-fileupload.jar commons-io.jar commons-logging.jar Filters.jar flashchart.jar gmaps.jar gson.jar jackson-annotations.jar jackson-core.jar jackson-databind.jar sapphire.jar silvertail.jar slf4j-api.jar slf4j-jdk14.jar timelinez.jar timeplotz.jar zcommon.jar zel.jar zhtml.jar zk-bootstrap.jar zk.jar zkbind.jar zkex.jar zkmax.jar zkplus.jar zml.jar zsoup.jar zul.jar zweb.jar	ZK Framework and its dependences	WEB-INF/lib
portlet.xml	ZK loader for ZUML pages	WEB-INF
web.xml	Deployment Descriptor. To configure servlets, listeners and an optional filter	WEB-INF
zk.xml	configuration descriptor of ZK. This file is optional. If you need to configure ZK differently from the default, you could provide a file called zk.xml under the WEB-INF directory.	WEB-INF

All the above files are installed in \$ISCOBOL/eis/wd2.

Running the sample application

Web Direct 2.0 comes with a sample web application. This chapter explains how to deploy and run the sample application.

1. Build the war

1. Change to the wd2 folder of isCOBOL samples
Windows

```
cd %ISCOBOL%\sample\eis\wd2\widget
```

Linux/Unix

```
cd $ISCOBOL/sample/eis/wd2/widget
```

2. Add zk.jar, zul.jar and zcommons.jar to the CLASSPATH
Windows

```
set  
CLASSPATH=%CLASSPATH%;..\..\..\..\eis\wd2\lib\zk.jar;..\..\..\..\eis\wd2\lib\zul.jar;..  
..\..\..\..\eis\wd2\lib\zcommon.jar
```

Linux/Unix

```
export CLASSPATH=$CLASSPATH:../../../../../eis/wd2/lib/zk.jar:../../../../../eis/wd2/lib/  
zul.jar:../../../../../eis/wd2/lib/zcommon.jar
```

3. Compile the programs
Windows

```
iscc -sp=../../../../../isdef;copylib -wd2 *.cbl
```

Linux/Unix

```
iscc -sp=../../../../../isdef:copylib -wd2 *.cbl
```

4. Create the "wd2" webapp folder structure as follows:
Windows

```
mkdir wd2  
mkdir wd2\arc  
mkdir wd2\excel  
mkdir wd2\pdf  
mkdir wd2\upload  
mkdir wd2\resources  
mkdir wd2\resources\css  
mkdir wd2\WEB-INF  
mkdir wd2\WEB-INF\classes  
mkdir wd2\WEB-INF\lib  
mkdir wd2\WEB-INF\programs
```

Linux/Unix

```
mkdir wd2
mkdir wd2/arc
mkdir wd2/excel
mkdir wd2/pdf
mkdir wd2/upload
mkdir wd2/resources
mkdir wd2/resources/css
mkdir wd2/WEB-INF
mkdir wd2/WEB-INF/classes
mkdir wd2/WEB-INF/lib
mkdir wd2/WEB-INF/programs
```

5. Copy the compiled programs and the sample files to the webapp folder as follows:

Windows

```
copy %ISCOBOL%\sample\eis\wd2\widget\css\custom.css wd2\resources\css
copy %ISCOBOL%\sample\eis\wd2\widget\images\* wd2\WEB-INF\programs
copy %ISCOBOL%\sample\eis\wd2\widget\snippet\* wd2\arc
copy %ISCOBOL%\sample\eis\wd2\widget\index.html wd2
copy %ISCOBOL%\sample\eis\wd2\widget\iscobol.properties wd2\WEB-INF\classes
copy %ISCOBOL%\sample\eis\wd2\widget\*.class wd2\WEB-INF\programs
```

Linux/Unix

```
cp $ISCOBOL/sample/eis/wd2/widget/css/custom.css wd2/resources/css
cp $ISCOBOL/sample/eis/wd2/widget/images/* wd2/WEB-INF/programs
cp $ISCOBOL/sample/eis/wd2/widget/snippet/* wd2/arc
cp $ISCOBOL/sample/eis/wd2/widget/index.html wd2
cp $ISCOBOL/sample/eis/wd2/widget/iscobol.properties wd2/WEB-INF/classes
cp $ISCOBOL/sample/eis/wd2/widget/*.class wd2/WEB-INF/programs
```

6. Copy the isCOBOL runtime and WD2 libraries to the webapp lib folder as follows:

Windows

```
copy %ISCOBOL%\eis\wd2\lib\*.jar wd2\WEB-INF\lib
copy %ISCOBOL%\lib\commons-logging.jar wd2\WEB-INF\lib
copy %ISCOBOL%\lib\commons-codec-1.9.jar wd2\WEB-INF\lib
copy %ISCOBOL%\lib\javassist.jar wd2\WEB-INF\lib
copy %ISCOBOL%\lib\iscobol.jar wd2\WEB-INF\lib
copy %ISCOBOL%\lib\poi-*.jar wd2\WEB-INF\lib
copy %ISCOBOL%\lib\xmlbeans-2.6.0.jar wd2\WEB-INF\lib
copy %ISCOBOL%\eis\wd2\lib\iswd2.jar wd2\WEB-INF\lib
copy %ISCOBOL%\lib\itext-2.1.7v3.jar wd2\WEB-INF\lib
```

Linux/Unix

```
cp $ISCOBOL/eis/wd2/lib/*.jar wd2/WEB-INF/lib
cp $ISCOBOL/lib/commons-logging.jar wd2/WEB-INF/lib
cp $ISCOBOL/lib/commons-codec-1.9.jar wd2/WEB-INF/lib
cp $ISCOBOL/lib/javassist.jar wd2/WEB-INF/lib
cp $ISCOBOL/lib/iscobol.jar wd2/WEB-INF/lib
cp $ISCOBOL/lib/poi-*.jar wd2/WEB-INF/lib
cp $ISCOBOL/lib/xmlbeans-2.6.0.jar wd2/WEB-INF/lib
cp $ISCOBOL/eis/wd2/lib/iswd2.jar wd2/WEB-INF/lib
cp $ISCOBOL/lib/itext-2.1.7v3.jar wd2/WEB-INF/lib
```

7. Copy deployment descriptors and the standard css file from the isCOBOL distribution to the webapp folders as follows:

Windows

```
copy %ISCOBOL%\eis\wd2\css\iscobol.css wd2\resources\css
copy %ISCOBOL%\eis\wd2\xml\*.xml wd2\WEB-INF
```

Linux/Unix

```
cp $ISCOBOL/eis/wd2/css/iscobol.css wd2/resources/css
cp $ISCOBOL/eis/wd2/xml/*.xml wd2/WEB-INF
```

8. Create the "wd2.war" with the following commands:

```
cd wd2
jar -cf wd2.war *
```

2. Deploy the war

The following instructions are applicable to Apache Tomcat. However, your webapp can also be executed by other servlet containers.

Download Tomcat from <http://tomcat.apache.org/> and install it, if you haven't installed it yet. Start the Tomcat service.

Note: if you're running Tomcat on Unix/Linux, ensure that the working directory is the Tomcat home directory. If you start the process from another directory (e.g. the Tomcat bin directory), then relative paths in the sample will not work.

When Tomcat service is started, open a browser and navigate to "http://127.0.0.1:8080/" . The browser displays something like:



Select *Tomcat Manager* link in order to application administration pages. You will be prompted for username and password. By default Tomcat has the user "admin" with no password. You can refer to *tomcat-users.xml*.

Using the Tomcat Web Application Manager, scroll down to the Deploy dialog and use the *Browse* button to select the Web Application Archive file (wd2.war)

Deploy

Deploy directory or WAR file located on server

Context Path (required):

XML Configuration file URL:

WAR or Directory URL:

WAR file to deploy

Select WAR file to upload

Diagnostics

Check to see if a web application has caused a memory leak on stop, reload or undeploy

This diagnostic check will trigger a full garbage collection. Use it with extreme caution on production systems.

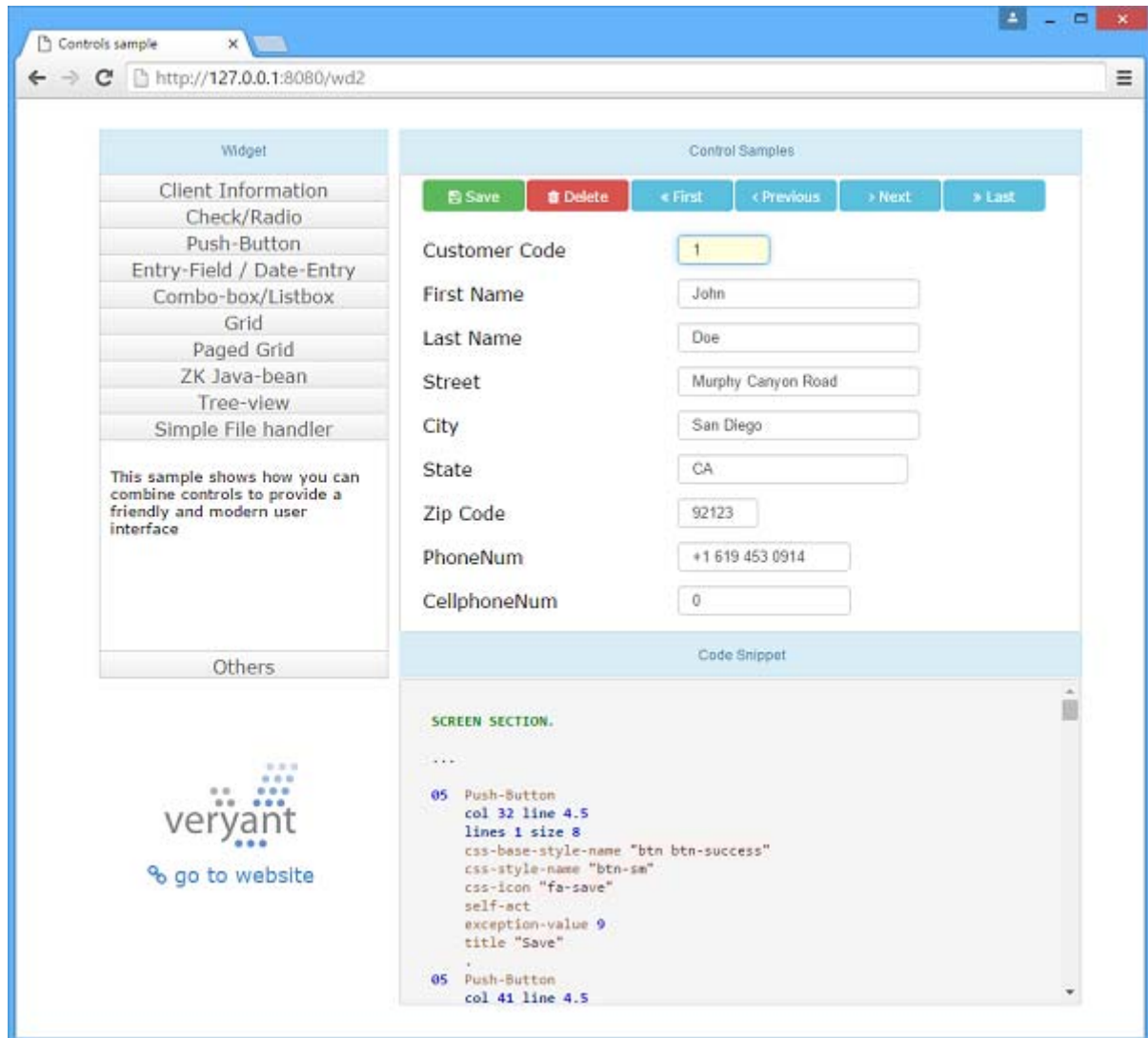
Server Information							
Tomcat Version	JVM Version	JVM Vendor	OS Name	OS Version	OS Architecture	Hostname	IP Address
Apache Tomcat/7.0.37	1.7.0_10-b18	Oracle Corporation	Windows 8	6.2	amd64	Luciano-Veryant	192.168.0.213

An item called "wd2" will be added to the Applications list.

Edit the file `iscobol.properties` in `classes'` folder to insert valid license codes. The following licenses are required:

- isCOBOL Runtime license (`iscobol.license.2019`)
- isCOBOL EIS license (`iscobol.eis.license.2019`)

To run the sample, open a browser and navigate to "`http://127.0.0.1:8080/wd2`".



Guidelines for writing a web application

Web Direct 2.0 allows you to bring GUI COBOL programs into the web without major modifications.

Each COBOL program with a Screen Section containing graphical controls can run as a web application with Web Direct 2.0.

However, not all GUI features are supported by Web Direct. If you plan to bring an existing COBOL application into the web it is strongly suggested you compile all sources with the `-wd2` option. When using this option, the isCOBOL Compiler will alert you with warning messages if an unsupported feature is being used. For example, the following Frame definition

```
03 fr frame
   line 2, col 2
   lines 10 size 30
   height-in-cells
   width-in-cells
   full-height
   fill-color 2, fill-percent 50
```

Will produce the following warning at compile time:

```
--W: #179 WD2: Unsupported   FULL-HEIGHT in FRAME control;
--W: #179 WD2: Unsupported   FILL-PERCENT in FRAME control;
```

More details about the unsupported features are provided in [Known limitations and differences between Swing and Web Direct 2.0](#).

In order to produce a fast web application, it is strongly suggested you:

- Reduce the number of controls in the screen
- Avoid using embedded and event procedures if not necessary

It's very important to avoid using the STOP RUN statement if you plan to run your programs as a web application. STOP RUN causes the whole JVM to exit and it would result in the shutdown of the whole servlet container. We suggest you use GOBACK instead.

Known limitations and differences between Swing and Web Direct 2.0

This chapter lists the features that are currently not supported by Web Direct 2.0 as well as behaviors that are different between running as a standard COBOL application and running as a web application.

The list is updated to the date this document has been written.

Please consider that the number of unsupported features decreases as the product becomes more mature.

Most of the unsupported features will just be ignored and the application will behave as if they were not specified in the source code. In some rare cases, an unsupported feature may cause an error.

BAR

In the BAR control the following styles are not supported: DOTTED, DASHED and DOT-DASH.

BITMAP

In the BITMAP control BITMAP-START, BITMAP-END and BITMAP-TIMER properties are not supported and the following mouse events are not returned: MSG-MOUSE-ENTERED, MSG-MOUSE-EXITED, MSG-MOUSE-CLICKED, MSG-MOUSE-DBLCLICK.

CHECK-BOX

In the CHECK-BOX control the following styles are not supported: LEFT-TEXT, VTOP, MULTILINE, FLAT, FRAMED, UNFRAMED, SQUARE.

Check-boxes have a default layout that cannot be altered.

The TITLE-POSITION and BITMAP-DISABLED properties are not supported.

COMBO-BOX

In the COMBO-BOX control the 3-D style is not supported.

MASS-UPDATE has no effect on loading items.

The NOTIFY-DBLCLICK style is not supported and the CMD-DBLCLICK event is not returned.

The list of Combo-Box items is never horizontally truncated. If the item text is too long, then the list width will be greater than the Combo-Box width to ensure that items text is displayed entirely.

The configuration properties *iscobol.gui.curr_bcolor* and *iscobol.gui.curr_fcolor* have no effect.

You can type something when the focus is on a DROP-LIST Combo-Box in order to change the selection. The Combo-Box selects the first item whose value begins with the digit that you typed. In WD2 only the first letter is evaluated, there's no buffering of digits typed quickly.

DATE-ENTRY

In the DATE-ENTRY control the following styles are not supported: NO-F4, RIGHT-ALIGN, SHORT-DATE, NO-UPDOWN, SHOW-NONE, SPINNER (that is default for ZK), DECORATION-BACKGROUND-VISIBLE, DECORATION-BORDERS-VISIBLE and WEEK-OF-YEAR-VISIBLE.

The following properties are not supported: CALENDAR-FONT, BITMAP-HANDLE, BITMAP-WIDTH, BITMAP-NUMBER, DECORATION-BACKGROUND, SUNDAY-FOREGROUND, WEEKDAY-FOREGROUND and MAXDAY-CHARACTERS.

ENTRY-FIELD

In the ENTRY-FIELD control the following styles are not supported: AUTO, EMPTY-CHECK, NO-BOX, NO-WRAP, SPINNER, USE-RETURN, USET-TAB and VSCROLL.

The following properties are not supported: ACTION, AUTO-DECIMAL, CURSOR, CURSOR-COL, CURSOR-ROW, MAX-LINES, PROPOSAL-DELAY, SELECTION-TEXT, SELECTION-START, SELECTION-START-ROW, SELECTION-START-COL, FORMAT-STRING and FORMAT-TYPE.

The PLACEHOLDER implementation is a little different than the Swing implementation. In Swing the placeholder text disappears at the first digit from the user, while in WD2 it disappears as soon as the field gets the focus.

The NTF-CHANGED event is fired only when the user stops typing data into the field. For this reason, there's no point in setting the property NOTIFY-CHANGE-DELAY.

FRAME

In the FRAME control FILL-COLOR2 and FILL-PERCENT properties are not supported as well as the ALTERNATE and FULL-HEIGHT styles.

GRID

In the GRID control the following events are not fired: MSG-BEGIN-ENTRY produced by the Enter key (the user must double click with the mouse in order to produce such event), MSG-BEGIN-ENTRY produced by typing text while the cell is not in edit mode (note that if you wish to provide direct editing, without the need of double clicking on the cell, you can display ENTRY-FIELDS within GRID cells as shown in the installed example), MSG-BEGIN-DRAG, MSG-BEGIN-HEADING-DRAG, MSG-COL-WIDTH-CHANGED, MSG-END-DRAG,

MSG-END-HEADING-DRAG, MSG-GOTO-CELL, MSG-GOTO-CELL-DRAG, MSG-GOTO-CELL-MOUSE on the current cell (clicking on the current cell doesn't fire the event; the event is fired when you click on another cell) and MSG-HEADING-DRAGGED.

When the GRID component doesn't have the focus and the user clicks on a cell, the MSG-GOTO-CELL-MOUSE event may not be fired along with the CMD-GOTO event.

The ADJUSTABLE-ROWS and REORDERING-COLUMNS styles are not supported.

The following properties are not supported: ACTION-HIDE-DRAG, CURSOR-FRAME-WIDTH, DRAG-BACKGROUND-COLOR, DRAG-COLOR, DRAG-FOREGROUND-COLOR, END-COLOR, ENTRY-REASON, FINISH-REASON, HEADING-DIVIDER-COLOR, HSCROLL-POS, ROW-DIVIDERS, ROW-HIDING and VSCROLL-POS.

It's not possible to move the cursor from a cell to another using the arrow keys.

The COLUMN-HIDING property is supported only along with the COLUMN-HEADINGS style, you cannot hide columns of a grid without headings. Setting the VIRTUAL-WIDTH property to a value that is less than the Grid size in order to hide the last column (or columns) has no effect in Web Direct 2.0.

Modifying CURSOR-X and CURSOR-Y changes the cursor position on the screen only when the Grid gets the focus.

A vertical cursor bar is always visible in the selected cell, even if you're not editing the cell content. This is because a grid cell that is not in edit mode is emulated by a ZK read-only text field and this kind of field always shows the cursor.

Only the first value specified in COLUMN-DIVIDERS and ROW-DIVIDERS is used. Also, the default divider color is light gray.

It's not possible to vertically merge cells in the column heading via the CELL-ROWS-SPAN property if the GRID control has SORTABLE-COLUMNS style or ADJUSTABLE-COLUMNS style.

Scroll-bars are always shown when columns exceed the Grid's size. This is because in WD2 it is not possible to move among cells using the keyboard, so, without scroll-bars, the columns over the Grid's size would not be reachable.

The HEADING-MENU-POPUP button is shown over each single column. It's possible to show and hide columns, but the entries 'Export...' and 'Copy' are not available.

It's not possible to copy Grid content to the clipboard via the ACTION property.

TILED-HEADINGS may be rendered differently by some browsers.

JAVA-BEAN

In Web Direct 2.0 only the controls of the ZK Framework can be used as JAVA-BEAN; Swing controls are not supported.

In the JAVA-BEAN control the following styles are not supported: HAS-BITMAP, HSCROLL, VSCROLL, NO-BOX, BOXED, 3-D, USE-RETURN and USE-ALT.

As a consequence of the lack of HAS-BITMAP, the BITMAP-HANDLE and BITMAP-WIDTH properties are not supported.

If you want to force the focus on the Java-Bean by invoking the setFocus() method, you have to invoke this method in the Java-Bean BEFORE PROCEDURE.

LABEL

In the LABEL control the VERTICAL style is not supported.

LIST-BOX

In the LIST-BOX control THUMB-POSITION is not supported.

It's not possible to copy List-Box content to the clipboard via the ACTION property.

PUSH-BUTTON

In the PUSH-BUTTON control the following styles are not supported: DEFAULT-BUTTON, FRAMED, MULTILINE, SQUARE and UNFRAMED.

In Web Direct 2.0 Push-Button titles are always shown entirely. If the Push-Button SIZE is not sufficient to store the title text, then the Push-Button is automatically extended by the Framework.

RADIO-BUTTON

In the RADIO-BUTTON control the following styles are not supported: 3-D, LEFT-TEXT, VTOP, MULTILINE, FLAT, FRAMED, UNFRAMED and SQUARE.

Radio-Buttons have a default layout that cannot be altered.

The TITLE-POSITION and BITMAP-DISABLED properties are not supported.

TAB-CONTROL

In the TAB-CONTROL the following styles are not supported: MULTILINE, BUTTONS, FIXED-WIDTH, BOTTOM, HOT-TRACK, FLAT-BUTTONS and NO-DIVIDERS.

After Procedure and Before Procedure are not supported. The Tab-Control never gets the focus, so it's not possible to change the page by pressing TAB to activate the Tab-Control and then using left and right arrow keys. Use the mouse to change the page in a Tab-Control.

TREE-VIEW

In the TREE-VIEW control the SHOW-SEL-ALWAYS style is not supported. The following properties are not supported: ACTION, BITMAP-NUMBER, BITMAP-HANDLE, BITMAP-WIDTH, ACTION, MASS-UPDATE.

The NEXT-ITEM property doesn't support TVNI-FIRST-VISIBLE, TVNI-NEXT-VISIBLE and TVNI-PREVIOUS-VISIBLE.

No editing is allowed and the following events are not returned: MSG-TV-EXPANDING, MSG-TV-SELCHANGING, MSG-BEGIN-ENTRY, MSG-CANCEL-ENTRY and MSG-FINISH-ENTRY.

WINDOW

Windows must be Initial/Standard, Independent or Floating.

Initial/Standard windows lose their decoration unless they have the RESIZABLE style; their title becomes the title of the web page also if they're invisible.

Subwindows are not supported.

SHADOW, SCROLL and POP-UP AREA are not supported.

AT LINE / COL syntax is not supported. Windows appear at the center of the web page. AUTO-RESIZE, MIN-SIZE, MIN-LINES, MAX-SIZE, MAX-LINES and LAYOUT-MANAGER are not supported.

Windows can have the RESIZABLE style, but you cannot configure resizing boundaries and rules. The CONTROLS-UNCROPPED style is not supported.

The CMD-ACTIVATE and NTF-RESIZED events are not fired by windows in Web Direct 2.0.

The UNDECORATED style just reduces the border, but the title bar is still visible.

Unsupported Controls

The RIBBON, the SCROLL-BAR, the SLIDER, the STATUS-BAR and the WEB-BROWSER controls are not supported in Web Direct 2.0.

Other Differences with Desktop Applications

All keyboard input is trapped by the web-browser and therefore keystrokes mapped to exception or termination values will not work. The key that allows the user to move between controls is TAB (use SHIFT+TAB to move to the previous control). Only function keys from F1 to F12 that are not trapped by the web-browser will cause an ACCEPT to terminate with an exception. The other function keys and other keys will not, so it is strongly suggested that you provide a graphical push-button for each mapped keystroke that the COBOL program expects.

An ACCEPT can be terminated by pressing ENTER unless the focus is on a Push-Button, a multiline Entry-Field, a Grid or a Tab-Control.

An ACCEPT can be terminated by pressing ESC unless the focus is on a Grid or a Tab-Control.

Relative columns in Screen Section are not supported by Web Direct 2.0 because the Framework doesn't know the real font size that the browser will use to paint the field. When working on the desktop with Java Swing controls, isCOBOL first puts the control in the window and then inquires its actual size. A similar operation would be very slow if executed by AJAX in the browser, and therefore is better for the user to specify the size and the column of the control using fixed values.

HTML rendering is supported only in the TITLE of Label, Check-Box, Push-Button and Radio-Button as well as in Grid cells when they're not editable.

The CALL CLIENT statement is not supported in Web Direct 2.0.

Unsupported Library Routines and functions

In Web Direct 2.0 all the library routines and functions work on the server machine. Generally speaking all the functions that need to show a dialog on the client machine or to manage files on the client machine are not supported. The following table lists in detail the routines that are partially or totally not supported.

Routine	Notes
A\$CURRENT-USER A\$GET-USER A\$GETTHREAD A\$LIST-LOCKS A\$LIST-USERS A\$USERINFO AS\$COPY	Not supported
C\$COPY C\$DELETE	"@[DISPLAY]:" in the file name is not supported
C\$EASYOPEN C\$GETCGI C\$GUICFG C\$OPENSABEBOX	Not supported
C\$SYSTEM	The CSYS-DESKTOP flag is not supported

Routine	Notes
CBL_READ_SCR_CHARS CBL_READ_SCR_CHATTRS CBL_WRITE_SCR_CHARS CBL_WRITE_SCR_CHATTRS J\$GETFROMLAF KEISEN KEISEN1 KEISEN2 KEISEN_SELECT P\$CLEARDIALOG P\$DISPLAYDIALOG P\$ENABLEDIALOG P\$SETDIALOG W\$CAPTURE W\$CENTER_WINDOW	Not supported
W\$FONT	The WFONT-CHOOSE-FONT function is not supported
W\$HINT W\$KEYBUF	Not supported
W\$MENU	The WMENU-NEW-TRAY function is not supported
W\$MOUSE	All settings of the SET-MOUSE-SHAPE function are supported except a custom mouse pointer
W\$PALETTE	The WPALETTE-CHOOSE-COLOR function is not supported
W\$PROGRESSDIALOG WIN\$PLAYSOUND	Not supported
WIN\$PRINTER	The WINPRINT-SETUP function is not supported

Note - when a routine that is not supported is called, the effect are unpredictable.

Developing a hello world application from scratch

The next chapter illustrates the steps to create a hello world application from scratch, compile it, deploy it and eventually debug it.

Writing the source

Programs for the web are standard COBOL programs. The following source code produces a screen with a button with "Hello World" inside:

```
PROGRAM-ID. HELLO.
SCREEN SECTION.
01 SCREEN1.
03 PUSH-BUTTON
    LINE 4
    COL 4
    SIZE 15 CELLS
    TITLE "Hello World"
    EXCEPTION-VALUE 100
.
PROCEDURE DIVISION.
MAIN.
    DISPLAY STANDARD GRAPHICAL WINDOW.
    DISPLAY SCREEN1.
    ACCEPT SCREEN1 ON EXCEPTION CONTINUE.
```

Compiling the source

Since we plan to debug the program after the deployment, we'll use the -d option.

The -wd2 option is also used to be sure that our program is compatible with Web Direct.

```
iscc -d -wd2 hello.cbl
```

Creating the configuration file

In order to run with Web Direct 2.0 we must instruct the program to use a specific guifactory class.

In addition, the license codes for the isCOBOL Framework and Web Direct 2.0 must be provided, so our configuration file will look like this:

```
iscobol.guifactory.class=com.iscobol.gui.client.zk.GuiFactoryImpl
iscobol.license.2019=XXXXXXXXXXXXXXXXXXXXXXXXXXXX
iscobol.eis.license.2019=XXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

The configuration file will be placed between program classes in the webapp directories. However, the configuration is also loaded from /etc directory and from the user home directory depending on the drive where Tomcat was started and on the user that owns its process.

Deploying in Tomcat

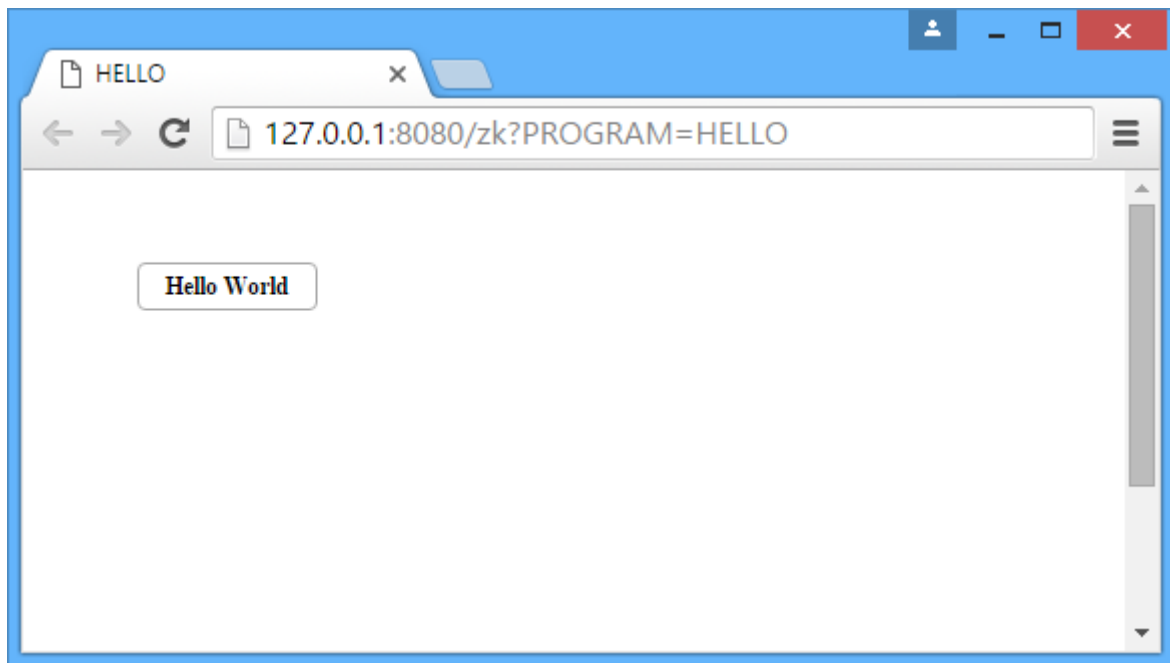
The easiest way to deploy a new web app is to:

- Deploy the WD2 sample program as explained in [Running the sample application](#) chapter
- Make a copy of the tomcat/webapps/wd2 folder and rename the copy to the name of your choice (i.e. 'test')
Note - the subfolders "pdf" and "upload" are specific for the WD2 sample; you can either delete them or rename them, depending on your needs. The other subfolders instead should be left unchanged.
- Add your class files to one of the following:
 - o one of the folders listed in *iscobol.code_prefix* configuration property

- or, if *iscobol.code_prefix* is not set,
 - o the WEB-INF/classes folder
 - o a jar file placed in the WEB-INF/lib folder
- Add your properties to the WEB-INF/classes/iscobol.properties file
- Restart Tomcat

Running the application

Run the HELLO program from a web browser using the following URL: <http://127.0.0.1:8080/test/zk/IsMainZK?PROGRAM=HELLO> to have:



Debugging

In order to debug the web application

- Programs must be compiled with -d option
- The following entry must appear in the configuration

```
iscobol.rundebbug=2
```

- The Remote Debugger feature is used

When you connect to the page of your application you will see a blank page. It means that the web application is waiting for the Debugger to connect. Launch the following command to use the Debugger:

```
isrun -J-Discobol.debug.code_prefix=sourcePath -d -r serverIp
```

Where:

- *sourcePath* is the list of paths where program source code and copyfiles can be found

- `serverIp` is the ip (or name) of the web-server where the web application is running, in our case: 127.0.0.1

If everything has been done correctly, you should see the web page show up while you debug the DISPLAY statements.

Using Native Libraries inside isCOBOL EIS WD2

Usually c-treeRTG and other file handlers provide a file connector solution. When a file connector is available, it's preferable to use it instead of using native libraries. In order to use the file connector you just set the `iscobol.file.index` and `iscobol.file.connector.program(connector_name)` properties to proper values in the `iscobol.properties` file installed in your webapp.

If a file connector is not available or you have to use other native libraries for features not related to file handling, proceed as follows:

- If the servlet container (Tomcat) is running on Windows, the folder containing the native library must appear in the PATH (System PATH setting, not User PATH). Alternatively, you can copy the necessary native libraries into the Tomcat bin folder.
- If you're working on UNIX/Linux, instead, ensure that the directory containing the native library is listed in the library path (e.g. `LD_LIBRARY_PATH`, `LIBPATH`, `SHLIB_PATH`, etc.)

For example, in a typical configuration `/etc/tomcat7/tomcat7.conf` sources `/usr/share/tomcat7/bin/setenv.sh` which is the appropriate place to set global `CLASSPATH` and `LD_LIBRARY_PATH` for Tomcat. In some cases, you can also set variables in `$HOME/.tomcatrc`.

If you're using a container different than Tomcat, consult the documentation for the specific product.

How to receive parameters in EIS WD2

Programs can receive parameters from the URL.

Parameters must be added at the end of the URL using the syntax `"&PARAMN=Value"` (where *N* is a progressive number) and they're intercepted by the COBOL program as chaining parameters.

The following COBOL program, for example, expects 2 parameters, `p1` and `p2`:

```
PROGRAM-ID. prog.
WORKING-STORAGE SECTION.
77 p1 pic x(10).
77 p2 pic x(10).
PROCEDURE DIVISION chaining p1 p2.
main.
    display message "p1=" p1.
    display message "p2=" p2.
    Goback.
```

The parameters will be passed through HTTP using GET or POST methods.

Example of GET

The following URL passes two parameters named `PARAM1` and `PARAM2`:

```
http://127.0.0.1:8080/wd2/zk/IsMainZK?PROGRAM=PROG&PARAM1=AAA&PARAM2=BBB
```

Example of POST

The following HTML form passes two parameters named PARAM1 and PARAM2:

```
<html>
  <form method="POST" action="zk/IsMainZK?PROGRAM=PROG">
    <input type="text" placeholder="Param1" name="PARAM1"/>
    <input type="text" placeholder="Param1" name="PARAM2"/>
    <input type="submit" value="Chiama COBOL"/>
  </form>
</html>
```

Note - the name of the parameter in the URL can be different than the name used by the COBOL program. Parameters are passed according to their ordinal position.

How to Handle Program Exit

By default, when the program terminates due to a GOBACK statement, the last screen remains in the web-browser, but is no longer active. This may result in the impression that the program hung, while it was just terminated.

The proper way to handle the program exit is by redirecting the browser to a different web page. This may be the page from which the application was launched, the home page of your website or another of your choosing.

This objective is achieved through JavaScript.

In order to make Web Direct 2.0 execute JavaScript code:

- define a variable in the Working-Storage Section

```
77 MY-JAVA-SCRIPT PIC X ANY LENGTH
      VALUE ' <script type="text/javascript">
-           'form = document.createElement("form");
-           'form.method = "GET";
-           'form.action = "http://www.veryant.com";
-           'form.target = "_self";
-           'document.body.appendChild(form);
-           'form.submit();
-           ' </script>'.
```

The above code redirects the browser to Veryant's home page. Change the URL according to your needs.

- In the Procedure Division, call WD2\$RUN_JS, passing this variable, when you want the JavaScript to be executed:

```
CALL "WD2$RUN_JS" USING MY-JAVA-SCRIPT
```

When a program is running and the user closes the browser window or someone stops the web or application server, an exception with value 91 in crt-status is sent to program in order to terminate the ACCEPT.

Note: always remember to use GOBACK instead of STOP-RUN to make the program exit.

How to Handle Event Lists

EVENT-LIST and EXCLUDE-EVENT-LIST properties work differently in Web Direct 2.0 environment.

if EXCLUDE-EVENT-LIST = 1:

- if EVENT-LIST is empty ALL EVENTS are NOT SENT to the program.
- if EVENT-LIST is not empty:
 - the events in the EVENT-LIST are NOT SENT to the program.
 - the events NOT in the EVENT-LIST are SENT to the program.

if EXCLUDE-EVENT-LIST = 0:

- if EVENT-LIST is empty ALL EVENTS are SENT to the program.
- if EVENT-LIST is not empty:
 - the events in the EVENT-LIST are SENT to the program.
 - the events NOT in the EVENT-LIST are NOT SENT to the program.

Customize the EIS WD2 Layout using CSS

Like all web sites and web applications, the layout of programs running with Web Direct 2.0 can be customized using CSS (Cascading Style Sheets).

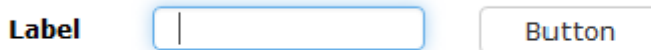
ZK8 default and alternative themes

By default the COBOL screens are rendered using the ZK8 default theme.

The following screenshot shows how a simple screen including a label, a text field and a push-button appears in a web browser with the default ZK8 theme.



It is possible to change this theme by setting the [iscobol.wd2.style](#) configuration property. The following screenshot shows how the same screen as above is shown when *iscobol.wd2.style=bs* (Bootstrap styling)



Custom Style Association

The file *iscobol.css* provided along with isCOBOL should always be stored in the *resources/css* folder of any WD2 web application. This file contains the default styling for the COBOL graphical controls. Editing or omitting this file may produce a bad layout for the web application.

The default styling can be customized by writing a new css file, putting it in the resources/css folder of the web application and point to it by setting the configuration property `iscobol.wd2.additional_stylesheet`.

The css file must have the following syntax:

```
<css-style-name> {  
<attribute>:<value>;  
...  
<attribute>:<value>;  
}
```

In order to associate a particular style to a graphical control, you take advantage of the CSS-BASE-STYLE-NAME and CSS-STYLE-NAME properties, that are supported for all controls.

These properties take a string parameter that specifies the style name.

Different controls can use the same style.

Css allow you to create effects that would not be possible using the COBOL language. In the example below, all GUI controls with CSS-STYLE-NAME="highlite" will be highlighted with a shadow when the mouse pointer goes over them.

Content of the custom css file:

```
.highlite:hover{  
  box-shadow: 10px 10px 5px #888888;  
  transition: all 0.2s;  
}
```

content of COBOL program Screen Section:

```
01 SCR-SAMPLE.  
05 CHECK-BOX ... CSS-STYLE-NAME "mystyle" ....  
05 RADIO-BUTTON ... CSS-STYLE-NAME "mystyle" ....
```

CSS-BASE-STYLE-NAME acts similarly to CSS-STYLE-NAME, in which it allows one or more css classes to be applied to the control, but differs from it because specifying a css class in the CSS-BASE-STYLE-NAME will overwrite any isCOBOL default classes, allowing a completely customized style to be applied. On the other hand, using CSS-STYLE-NAME to supply a css class to the control, will cause the runtime to append the specified class name to the default one supplied by the environment. If you wish to completely overwrite default styling, use CSS-BASE-STYLE-NAME, and if you want to complement the default styles, use CSS-STYLE-NAME.

Both properties can be used simultaneously. For example, to completely customize the look of your application, use CSS-BASE-STYLE-NAME to overwrite the COBOL styles and provide your own styling to each control class (i.e. buttons, entry-fields, etc.), and CSS-STYLE-NAME to provide specific styling for a specific control's purpose.

Example

```
01 SCR-SAMPLE.  
05 PUSH-BUTTON ... CSS-BASE-STYLE-NAME "my-btn" CSS-STYLE-NAME "ok-btn" ....  
05 PUSH-BUTTON ... CSS-BASE-STYLE-NAME "my-btn" CSS-STYLE-NAME "cancel-btn" ....
```

Fonts and colors set by the COBOL program have priority over fonts and colors set by the style associated to the CSS-STYLE-NAME property, unless you put the *!important* clause after the css entries. Fonts and colors set by the COBOL program are overridden by fonts and colors set by the style associated to the CSS-BASE-STYLE-NAME property instead.

When `iscobol.wd2.style` is set to "bs", you have available Bootstrap css classes for easy styling of the application. For example, to create OK and CANCEL buttons, you could use the following:

```
03 PUSH-BUTTON
  LINE 22, COL 2 LINES 2 SIZE 10 CELLS
  CSS-BASE-STYLE-NAME "btn"
  CSS-STYLE-NAME "btn-success"
  OK-BUTTON
.

03 PUSH-BUTTON
  LINE 22, COL 13 LINES 2 SIZE 20 CELLS
  CSS-BASE-STYLE-NAME "btn"
  CSS-STYLE-NAME "btn-danger"
  CANCEL-BUTTON
.
```

Where *btn-success* and *btn-danger* are two of the available CSS classes provided by Bootstrap. See <http://getbootstrap.com/components> for the list of available classes.

With the above code the OK button will have a green color and the Cancel button will have a red color.

You can use your web-browser development features to check styles and classes that were applied to the Screen Section elements.

Font Awesome icons on Push-Buttons

For the Push-Button controls, the CSS-ICON is also available. This alphanumeric property allows you to access Font Awesome icons when the application is deployed as WD2. The icon list is available at the following web page: <https://fontawesome.com/icons?from=io>.

Note - ZK integrates Font Awesome 4.0.1, therefore some of the icons listed in the above page might not be available.

For example, to have a Push-Button with a checkmark, all is needed is to find the relevant icon from the list at the above web page (in this case is <https://fontawesome.com/icons/check?style=solid&from=io>), copy the icon class name, in this case "fa-check", and paste it in the CSS-ICON property of the PUSH-BUTTON, e.g.

```
05 PUSH-BUTTON ... CSS-ICON "fa-check" ...
```

At runtime the chosen icon will be displayed.

Note - CSS-ICON replaces the icon set by BITMAP-HANDLE property, if any.

Chapter 7

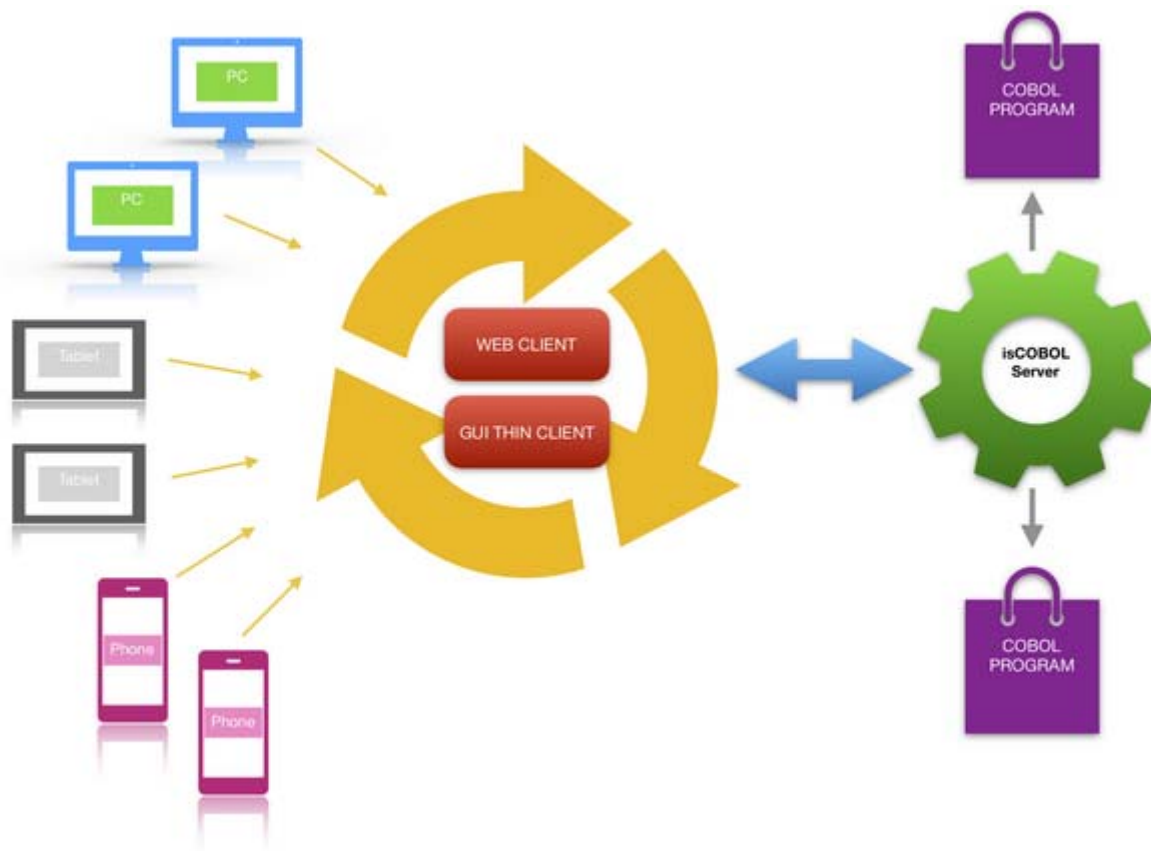
WebClient option

Introduction

With isCOBOL EIS WebClient option your organization can leverage existing COBOL syntax to develop and deploy a universally accessible, zero client, rich Internet application (RIA) using standard COBOL screen sections and existing program procedure flow. No knowledge of object-oriented programming, JavaScript, HTML, or other Web languages is required.

isCOBOL EIS WebClient is an HTTP server that reproduces the GUI of the isCOBOL Thin Client in a web browser.

The WebClient's HTTP server runs on a computer that can access the isCOBOL Application Server, just as the isCOBOL Thin Client does. This machine then becomes the 'web server' for users connecting to your COBOL application from a web browser.



This WebClient architecture brings some notable capabilities:

- User can interact with the application as if it were a regular desktop application.
- Users can re-establish their sessions after a lost connection with session persistence.
- Administrators can monitor running applications in real time, viewing important information such as memory usage, CPU usage and response times.
- Administrators can provide assistance to end users by using the built-in remote assistance feature, which mirrors the user's screen on the WebClient administrative console, and allows administrator to take control of the session and help the user accomplish a task or troubleshoot a problem.
- The WebClient includes an administration web console you can use to configure users, isCOBOL programs, and a wide variety of customizations and settings.

Installation Environment

isCOBOL EIS WebClient is based on WebSwing technology.

isCOBOL EIS WebClient works with Java 7 and Java 8. Other Java versions are currently not supported.

isCOBOL EIS WebClient is available for Windows and Linux platforms.

The product is provided and supported only for the 64 bit architecture.

In order to run on Linux, WebClient requires the X virtual framebuffer (Xvfb) and a X Window System (X11).

Getting Started

In this guide we're going to run the isCOBOL Demo program (Iscontrolset) in a web browser through isCOBOL EIS WebClient.

Before you start the WebClient service, it's good practice to ensure that the isCOBOL Thin Client can execute the program correctly. So, ensure that this command opens the isCOBOL Demo program:

```
iscclient -hostname <yourAppServerNameOrIp> ISCONTROLSET
```

The above command assumes that there is an isCOBOL Server running on the machine identified by *yourAppServerNameOrIp* and the folder containing ISCONTROLSET.class is in the Server's Classpath or code-prefix.

See [isCOBOL Evolve: Application Server](#) for more information about how to start programs in a thin client environment.

Once the above command works correctly, you can start the WebClient service.

Note - If you wish to connect to the web application from different machines in the network in addition to your PC, then the service must be listening on the IP address of the PC instead of localhost. You can configure this setting in [JETTY Configuration](#).

Use the following command to start the service:

- Windows

```
cd %ISCOBOL%\bin  
webcclient.exe
```

- Linux

```
cd $ISCOBOL/bin  
./webcclient
```

Note - On Windows you may require Administrator privileges in order to start the service.

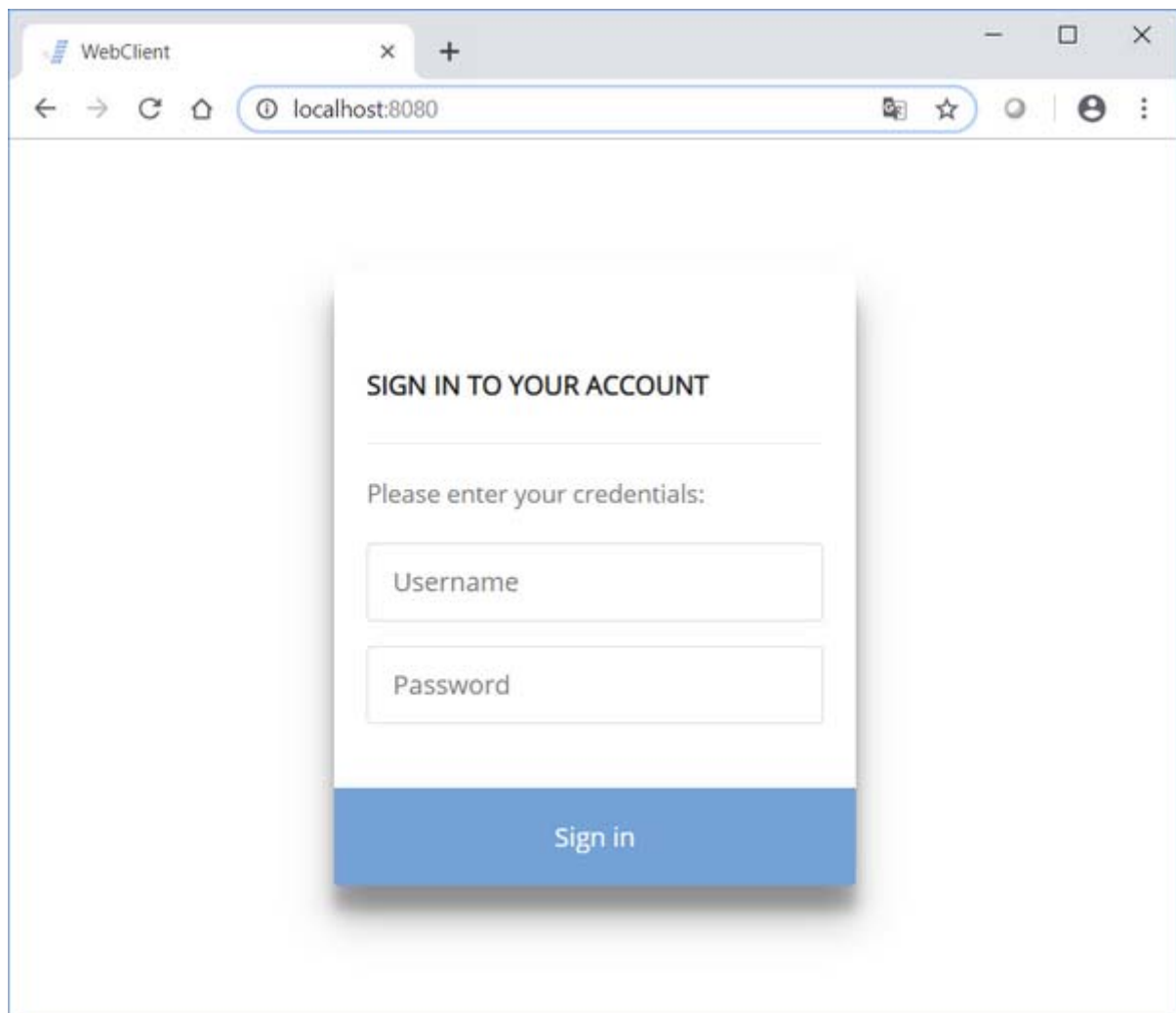
A correct startup shows a message like this at the bottom of the console output:

```
INFO:oejs.Server:main: Started @3791ms
```

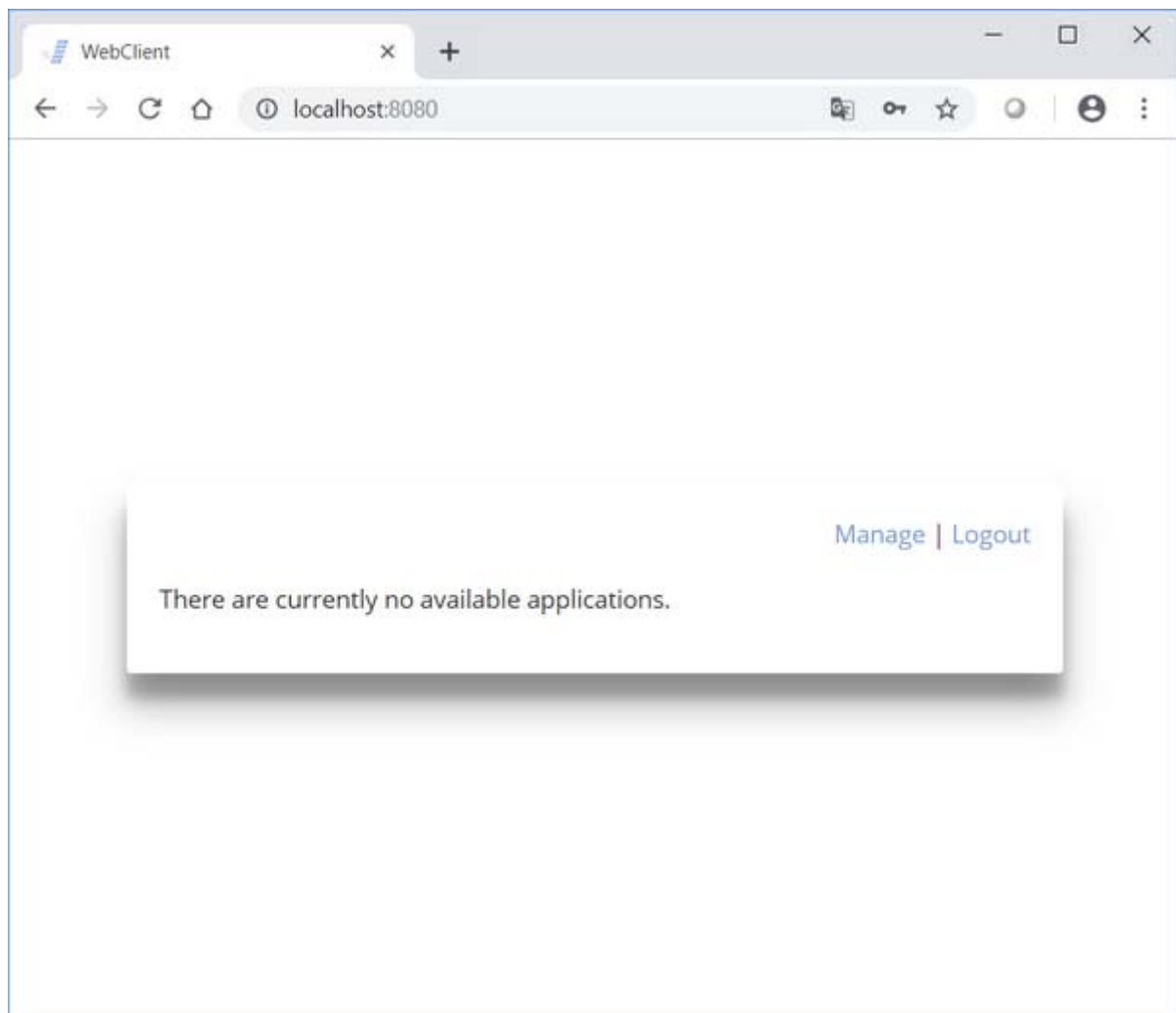
At this point you can navigate to `http://machine-ip:port` with a web browser.

Note - *machine-ip* and *port* must match the *server.host* and *server.http.port* values set [JETTY Configuration](#).

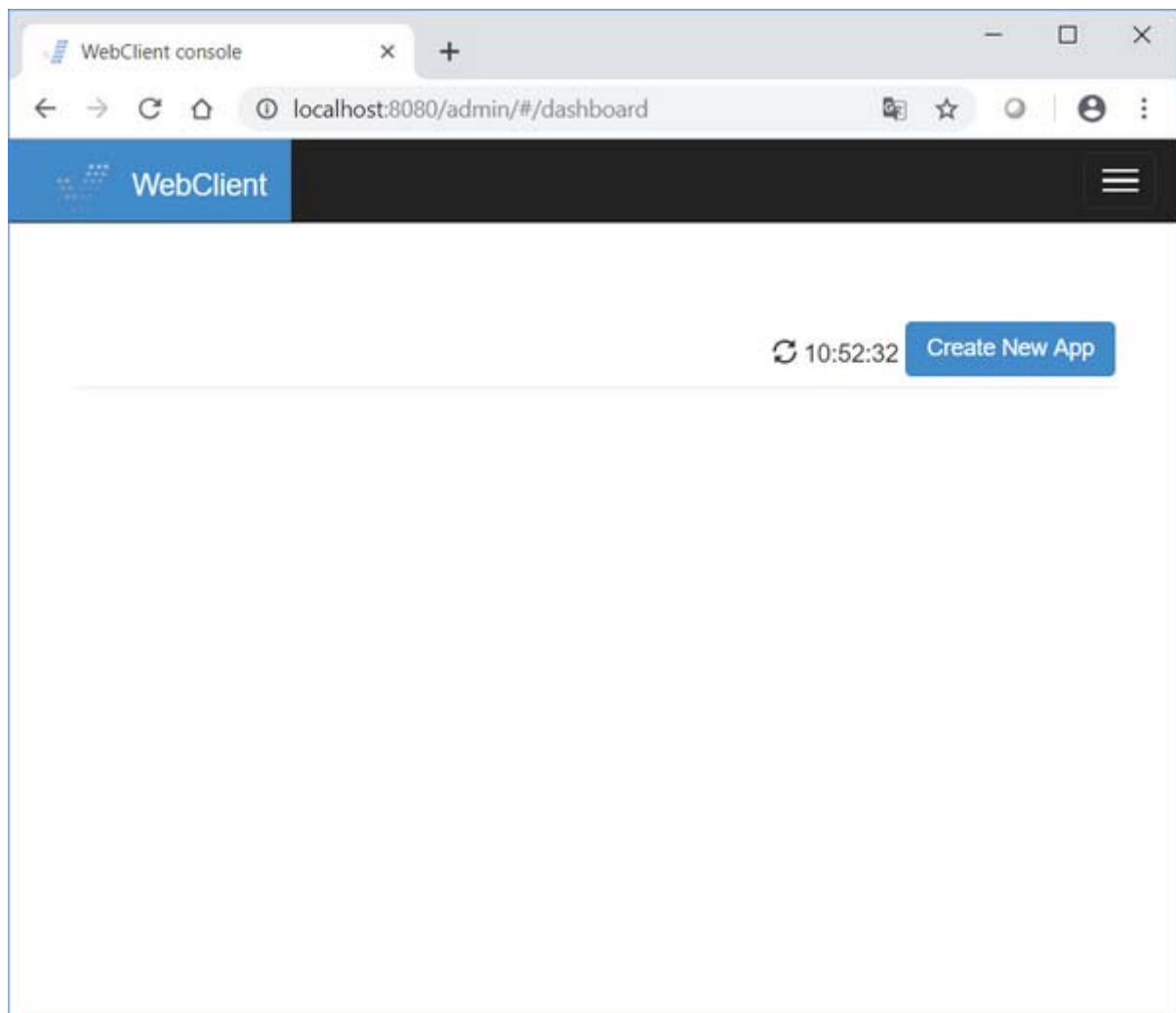
You will get this screen:



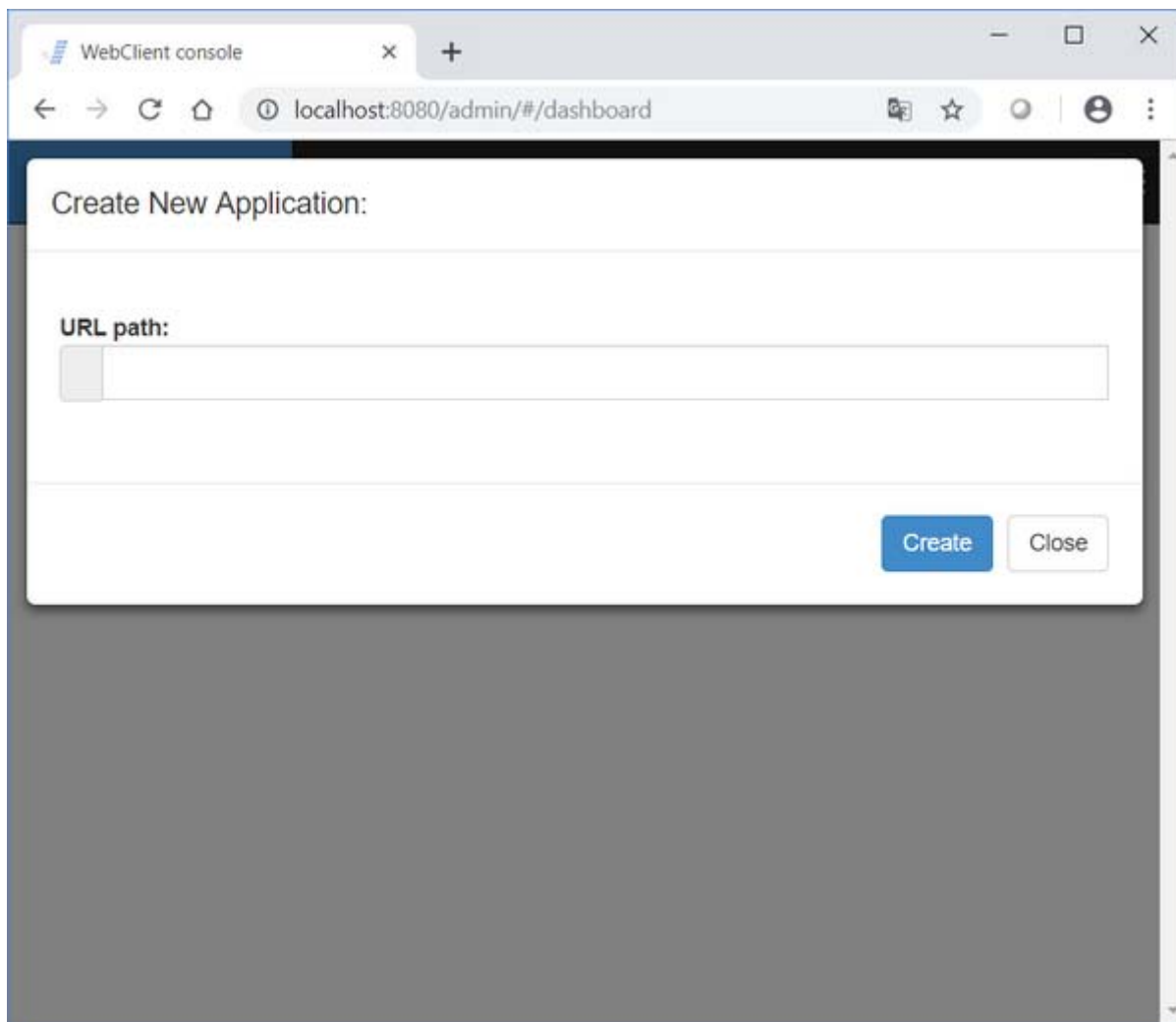
Log in as user "admin" with password "admin", you will get this screen:



Click on "Manage" and you will get this screen:

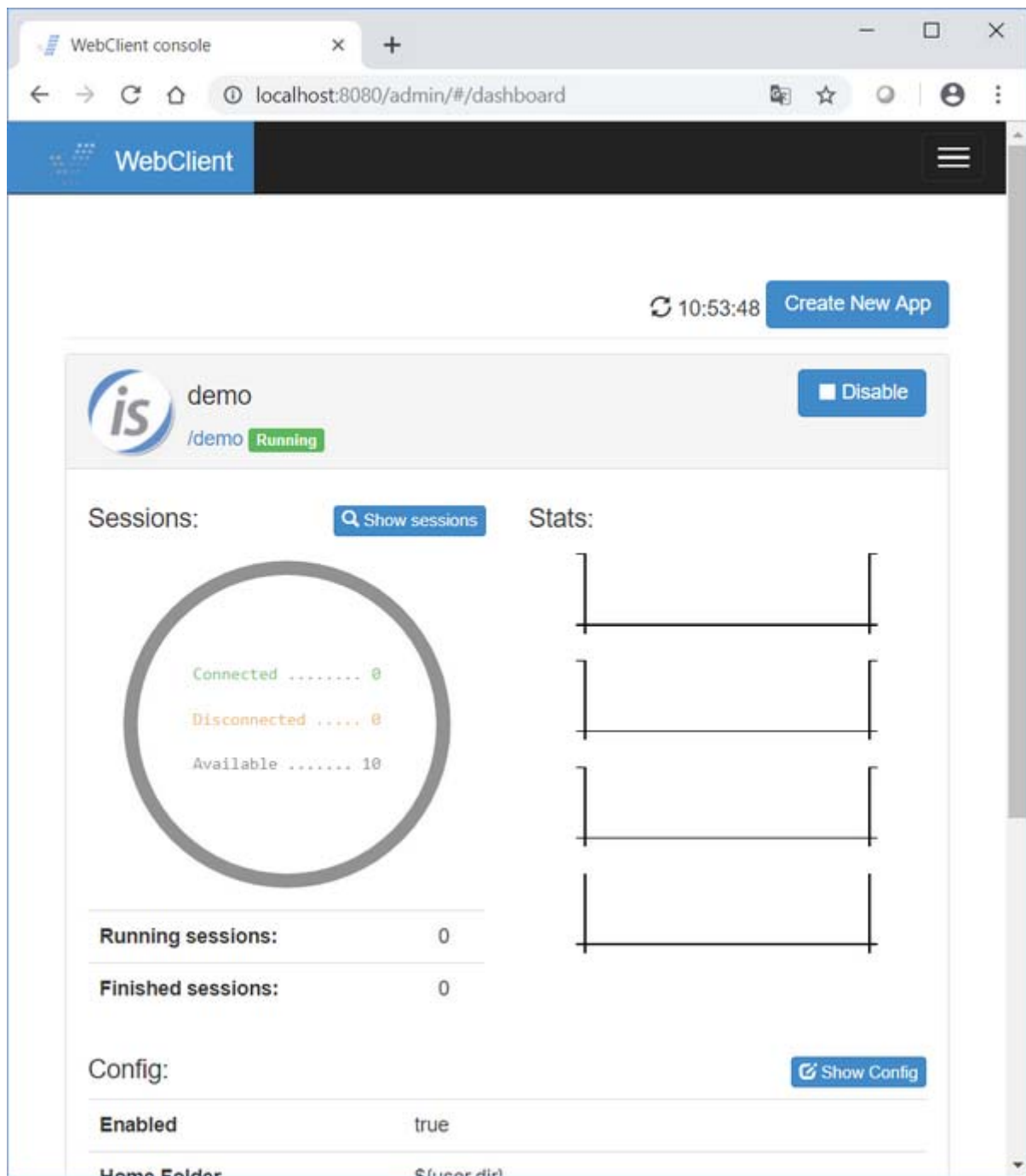


Click on "Create New App" and you will get this screen:



Type "demo" in the *URL path* field. This is the name that will be used in the URL in order to use the COBOL application. Note that this name cannot be changed after the application is created.

Click on "Create" and you will get this screen:



Click on "Show config" and you will get this screen:

The screenshot shows a web browser window titled "WebClient console" with the address bar displaying "localhost:8080/admin/#/config/swing/demo". The page has a dark navigation bar with "WebClient", "Dashboard", "Configuration", "Logs", "Exit", and "Logout". Below the navigation bar, there are buttons for "Back" and "Sessions". A status bar shows the "demo" application with an "is" logo, a "Running" status, and a "Disable" button. The main section is titled "Configuration" and contains a "Reset" button and an "Apply" button. The configuration fields are as follows:

Field	Value
Enabled	ON
Home Folder	\$(user.dir)
Icon	\$(webclient.rootDir)/iscobol.png
Security Module Name	NONE
Security Module Class Path	+
Name	demo
isCOBOL Server address	127.0.0.1
isCOBOL Server port	10999
Program name and arguments	

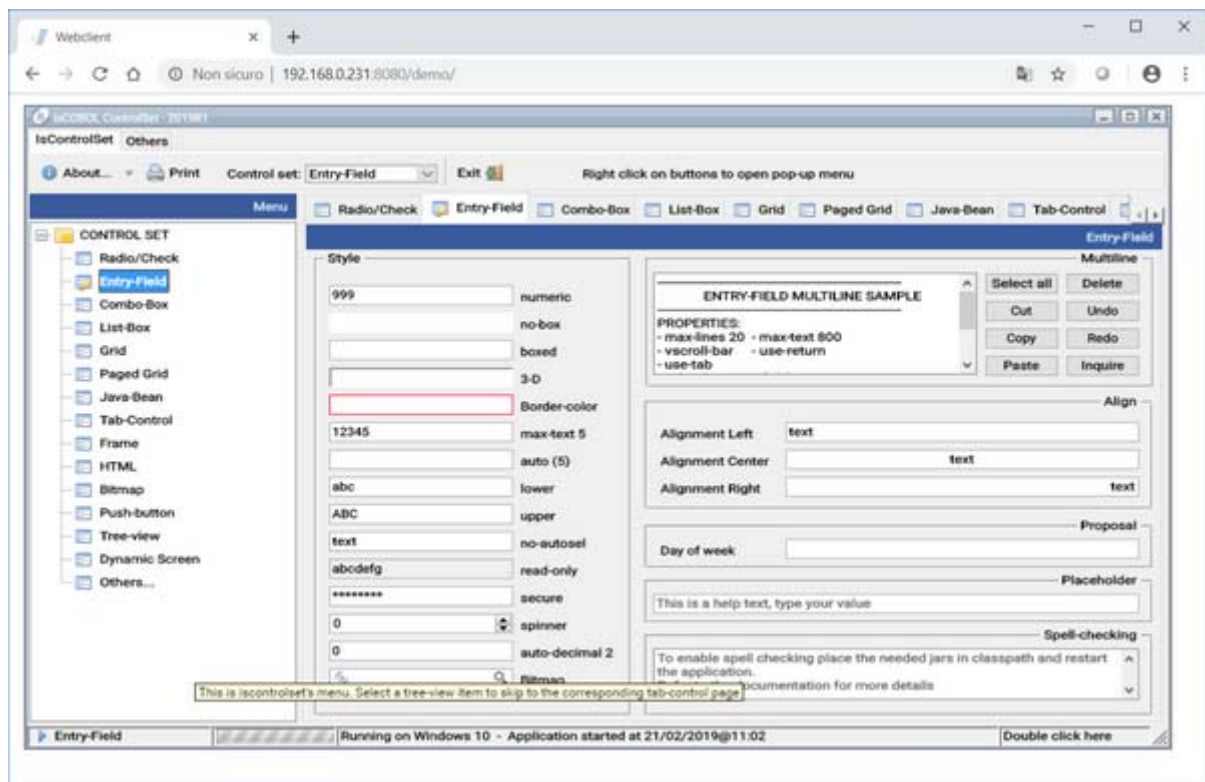
Type "ISCONTROLSET" (upper case) in the *Program name and arguments* field.

See [Change the application configuration](#) for more details about the configuration of a WebClient application.

Click on "Apply".

At this point you can test your application from any web browser from any machine in the network by navigating to: `http://machine-ip:port/demo`.

Note - *machine-ip* and *port* must match the *server.host* and *server.http.port* values set [JETTY Configuration](#).



Applications Monitoring and Configuration

Note - The application's configuration is saved in the file `eis/webclient/webclient.config` under the isCOBOL installation folder. It's good practice to make a backup copy of this file every time you change it, as it may be overwritten by the installation of an isCOBOL SDK update.

Applications created in the WebClient can be monitored and configured through the Dashboard.

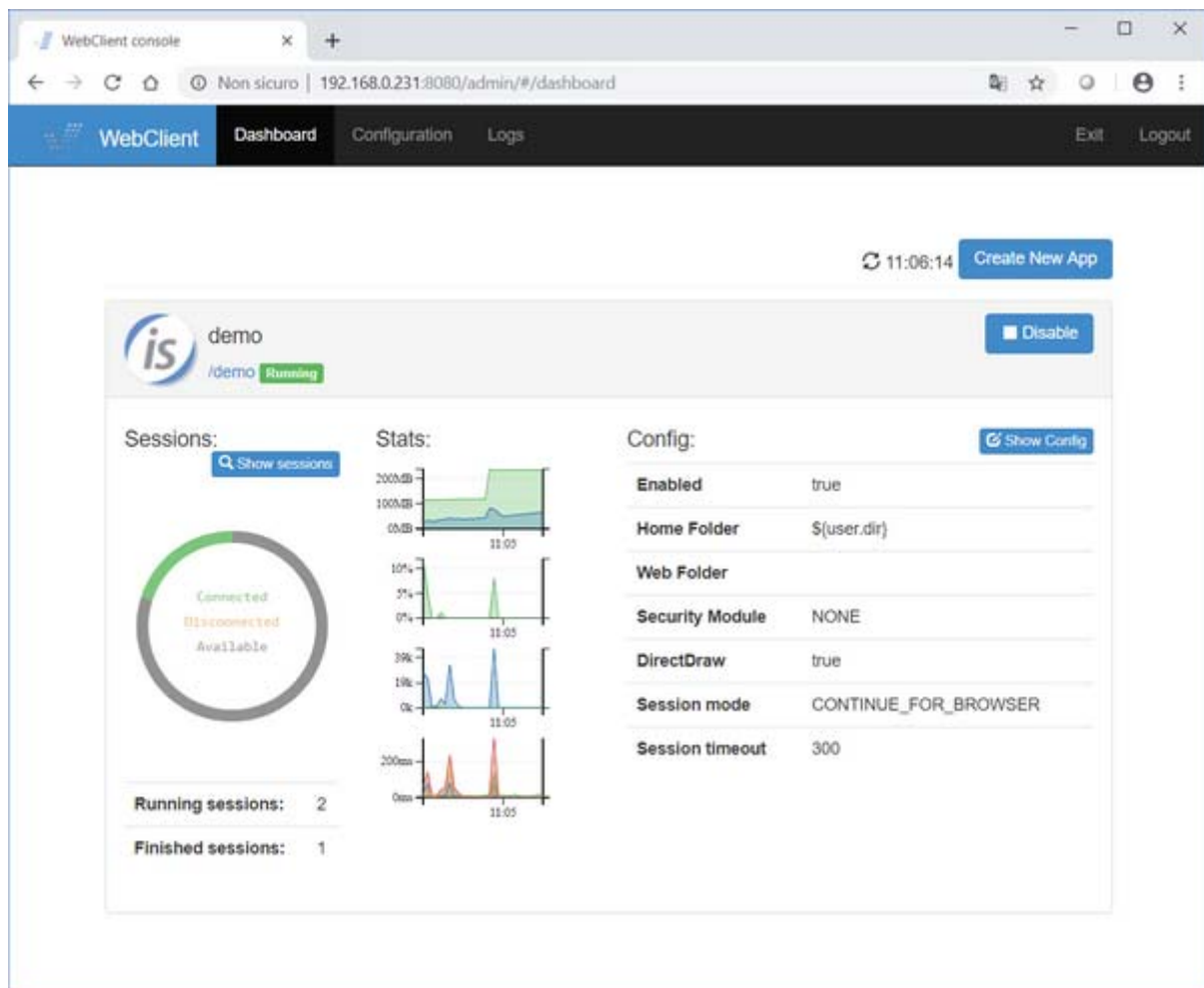
Navigate to the following URL in order to access the Dashboard:

```
http://machine-ip:port/admin/#/dashboard
```

Note - *machine-ip* and *port* must match the *server.host* and *server.http.port* values set [JETTY Configuration](#).

The Admin credentials are required in order to access the Dashboard.

The Dashboard lists all the available applications with a small summary of their status:



From here it's possible to

- [Enable or Disable applications](#)
- [Manage active sessions](#)
- [Change the application configuration](#)

Enable or Disable applications

Click on the "Disable" button to make the application unavailable to the users. You will be prompted to kill active connections, if any.

Disabling an application is useful during maintenance (e.g. during a update of program classes).

Click on the "Enable" button in order to make the application available to the users.

Manage active sessions

Click on the "Show sessions" button in order to access the list of active sessions:

The screenshot shows the WebClient console interface. At the top, there's a navigation bar with 'WebClient', 'Dashboard', 'Configuration', and 'Logs'. Below this, there's a 'demo' status bar with a 'Disable' button. The main content area is divided into two sections: 'Running sessions' and 'Finished sessions'.

Running sessions: This section displays a table of active sessions. Each session entry includes a unique ID, user name, IP address, start time, client status (e.g., 'Connected'), metrics (CPU and Memory usage), bandwidth (IN and OUT), and latency (E2E and PING). Actions like 'View' and 'Shutdown' are available for each session.

No. (Id)	User	IP	Start time	Client status	Metrics (min avg max)	Bandwidth (min avg max)	Latency (min avg max)	Actions
1	anonym	192.168.0.17	21 Feb 11:04:37	Connected	MEM: 37MB (0/30/38) CPU: 0% (0/0/8)	IN: 0k/s (0/0/0) OUT: 46k/s (0/23/46)	E2E: 333ms (0/174/333) PING: 11ms (0/25/161)	View, Shutdown
2	anonym	192.168.0.231	21 Feb 11:02:04	Connected	MEM: 59MB (0/36/49) CPU: 0% (0/1/12)	IN: 0k/s (0/0/0) OUT: 0k/s (0/0/33)	E2E: 7ms (0/58/232) PING: 9ms (0/9/20)	View, Shutdown

Finished sessions: This section displays a table of completed sessions. Each entry includes the session ID, user name, IP address, start time, end time, and status (e.g., 'Finished').

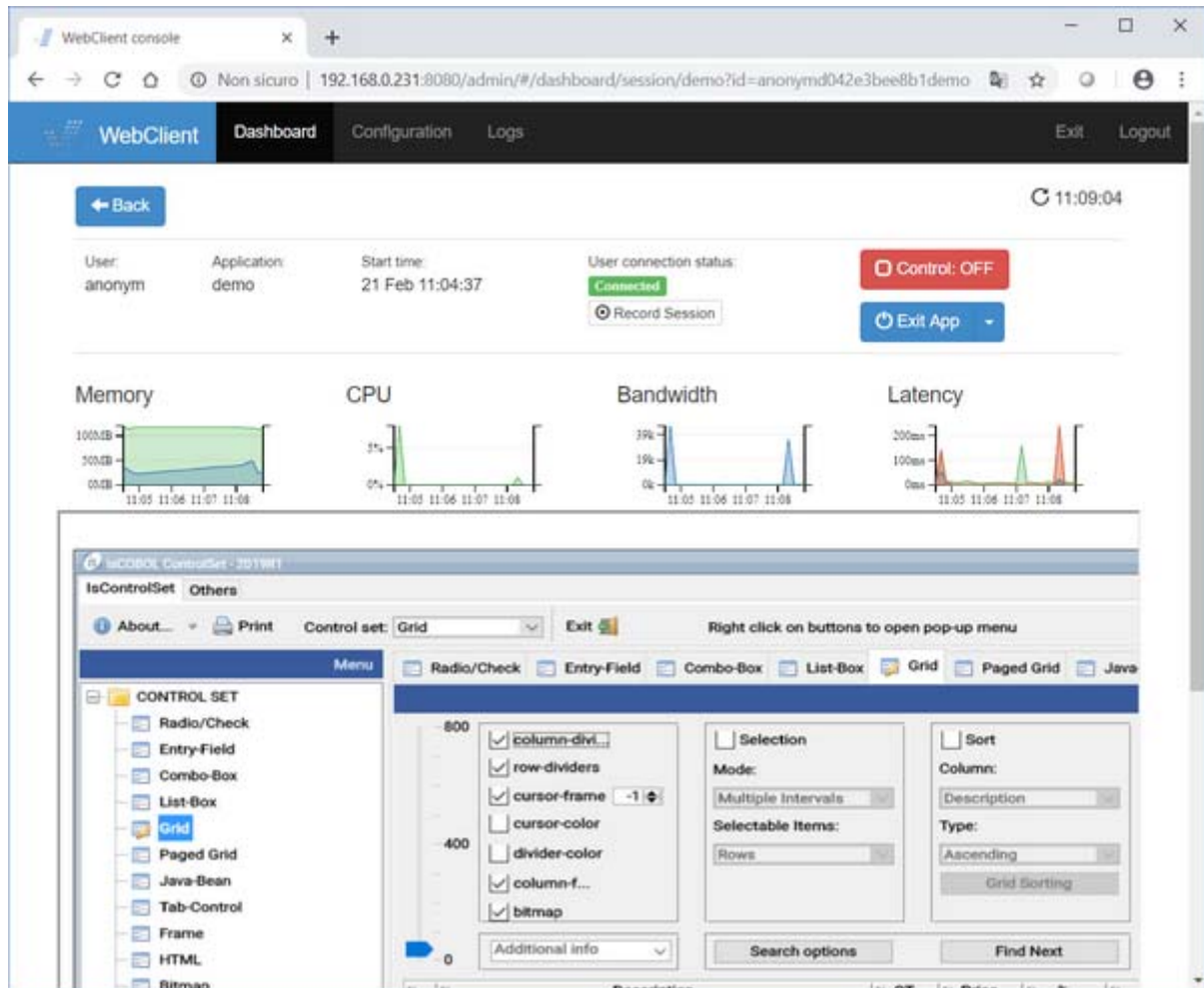
No. (Id)	User	IP	Start time	End time	Status	Actions
1	anonym	192.168.0.231	21 Feb 11:01:35	21 Feb 11:02:04 (0 min 29 sec)	Finished	

For each session, the following information is returned:

Entry	Meaning
No. (Id)	Unique ID assigned by WebClient to the session
User	Login user name, or "anonym" if no login was performed
IP	IP of the client machine
Start time	Date and time when the session was started
Client status	Status of the client PC
Metrics	CPU and Memory usage
Bandwitch	Bandwitch usage
Latency	Latency

For each session, the following actions are possible:

- Click on the "Shutdown" button in order to terminate the session, causing the user to be disconnected.
- Click on "Record Session" in order to record the user actions. The recording will stop when the user session terminates and the recorded video will be playable by clicking on the "Play" button in the *Finished sessions* list.
- Click on the "View" button in order to monitor the user activity on the application.



From this dialog it's possible to:

- Click on "Control:OFF" changing it to "Control:ON" and take control of the application. This is useful, for example, in order to provide remote support.
- Click on "Exit App" to close the application as if the user clicked on the exit button.

Change the application configuration

Click on the "Show Config" button to access the list of available configuration entries.

Entry	Meaning
Enabled	ON - The application is Enabled by default when the service starts OFF - The application must be enabled manually after the service starts

Entry	Meaning
Home Folder	Working directory of the application. This is equivalent to the working directory of the isCOBOL Client
Icon	Image icon shown in the application selection dialog
Security Module Name	<p>INHERITED - Requires you to provide a custom class that implements the WebSwingSecurityModule interface. Refer to WebSwing documentation for more information.</p> <p>NONE - No authentication is required to access this application. The authentication may be required anyway to access Web Client.</p> <p>EMBEDED - User authentication is required to access this application. Selecting this value will display a pop-up window with the list of current users, allowing you to edit them or to define new users.</p> <p>PROPERTY_FILE - User authentication is required to access this application. The users must be defined in a property file. By default, the file <i>user.properties</i> under the WebClient working directory is used.</p> <p>DATABASE - User authentication is required to access this application. The users must be defined in a JDBC data source.</p> <p>The rules to configure this field are the same described in Configuring Users except that they affect the single application instead of the whole Web Client.</p>
Security Module Class Path	<p>Additional classpath for built-in Security module or for defining custom security module.</p> <p>Use the '+' button to add a new entry.</p> <p>Use the 'x' button to remove an entry.</p>
Name	Name of the application.
isCOBOL Server address	IP address of the machine where isCOBOL Server is listening. WebClient will connect to the isCOBOL Server in the same way as a isCOBOL Client. This is equivalent to the -hostname option of the isCOBOL Client
isCOBOL Server port	Port where isCOBOL Server is listening. WebClient will connect to the isCOBOL Server in the same way as a isCOBOL Client. This is equivalent to the -port option of the isCOBOL Client
Program name and arguments	<p>Name of the main program of the application optionally followed by one or more variables.</p> <p>See How to pass command line arguments and end user info to the COBOL program for more details.</p>
Username	User name for authenticating to the isCOBOL Server in case iscobol.as.authentication is set to "2" in isCOBOL Server's configuration
Password	Password for authenticating to the isCOBOL Server in case iscobol.as.authentication is set to "2" in isCOBOL Server's configuration
LAF	Look and feel to be used to display application's windows
Remote configuration	Remote configuration file for the application. This is equivalent to the -c option of the isCOBOL Client
Local configuration	Local configuration file for the application. This is equivalent to the -lc option of the isCOBOL Client

Entry	Meaning
Fonts	<p>Customize logical font mappings and define physical fonts available to application. These fonts will be used for DirectDraw as native fonts. Use the '+' button to add a new mapping. Use the 'x' button to remove a mapping.</p> <p>Every mapping is composed of two items: <i>Key</i> and <i>Value</i>. <i>Key</i> is the name of the font. <i>Value</i> is the path to the font file. Only True Type (ttf) fonts are supported.</p>
DirectDraw Rendering	DirectDraw rendering mode uses canvas instructions to render the application instead of server-rendered png images. DirectDraw improves performance but is not recommended for applications with lot of graphics content.
Working Directory	Specifies the working directory of the isCOBOL Client on the machine where WebClient is running.
Class Path	Local Classpath. The isCOBOL's lib directory content must appear here. This is equivalent to the isCOBOL Client's Classpath
JVM Arguments	Java options like -Xmx go here. You should use the same options that you would use to start the isCOBOL Client
Max. Connections	Limit the maximum number of concurrent sessions for this application. By default, up to 10 concurrent sessions are allowed
Session Mode	<p>Define if and how sessions can be restored.</p> <p>ALWAYS_NEW_SESSION - every time the application URL is loaded, a brand new runtime session is started.</p> <p>CONTINUE_FOR_BROWSER - every time the application URL is loaded from the same browser, the user is offered the choice of starting a new runtime or restoring the previous one.</p> <p>CONTINUE_FOR_USER - every time the application URL is loaded by the same user, the user is offered the choice of starting a new runtime or restoring the previous one. In this mode, the user can also restore the runtime session from different devices. This mode will have no effect if <i>Security Module Name</i> is not set to NONE, which would require users to perform authentication each time they open the application.</p>
Session Timeout	Specifies how long will be the application left running after the user closes the browser. User can reconnect in this interval and continue in last session. The value is expressed in seconds.
Timeout if Inactive	<p>ON - Session Timeout will apply for user inactivity.</p> <p>OFF - Only disconnected sessions will time out.</p>
Session Stealing	<p>ON - If Session Mode is 'CONTINUE_FOR_USER', users can resume WebClient session even if the connection is open in other browser. Former browser window will be disconnected.</p> <p>OFF - Users can't resume WebClient session if the connection is open in other browser.</p>
Auto Logout	<p>ON - Users are automatically logged out after the application finished.</p> <p>OFF - Users remain logged in also after the application finished.</p>
Isolated Filesystem	<p>ON - the Open and Save dialogs of C\$OPENSABEBOX can only browse the WebClient's Upload Folder and its subfolders.</p> <p>OFF - the Open and Save dialogs of C\$OPENSABEBOX can browse every folder of the machine where WebClient is running.</p>

Entry	Meaning
Uploading Files	Enable the ability to upload files through the Open File dialog generated by the C\$OPENSABEBOX library routine.
Deleting Files	Enable the ability to delete files from the Open and Save dialogs generated by the C\$OPENSABEBOX library routine.
Downloading Files	Enable the ability to download files through the Save File dialog generated by the C\$OPENSABEBOX library routine.
Auto-Download from Save Dialog	Enable the automatic download of files to the end user's PC when the Save File dialog of C\$OPENSABEBOX is called.
Upload Folder	Folder where files uploaded by the user through C\$OPENSABEBOX are stored.
Clear Upload Folder	ON - Delete all files in the transfer folder when the application process is terminated. OFF - Don't delete any file when the application process is terminated.
Upload Size Limit	Maximum size in MB of upload for single file. A value of 0 means unlimited size.
Allow Local Clipboard	ON - Allow access to the end user PC local clipboard. OFF - The user can't cut, copy or paste text in the application screen.
Allow Server Printing	ON - Allow access to the printers installed on the machine where WebClient is running. OFF - Print to PDF using the internal WebPrintService printer and send the PDF to the client browser.

After changing one or more of the above settings, you can either

- Click on "Apply" if you wish to activate the new configuration, or
- Click on "Reset" to clean your changes and restore the active configuration.

Click on "Back" to return to the Dashboard.

The application's configuration is saved in the file *eis/webclient/webclient.config* under the isCOBOL installation folder.

How to pass command line arguments and end user info to the COBOL program

In the "Program name and arguments" field, the following variables can be used:

<code>\${user}</code>	WebClient specific logged in user name
<code>\${clientId}</code>	WebClient specific unique browser identifier
<code>\${clientIp}</code>	IP address of browser that started this application
<code>\${clientLocale}</code>	Locale of browser that started this application

<code>\${customArgs}</code>	Parameters specified via the "args" parameter in the URL. The value of "args" matches the parameters that you would pass on the command line when running the isCOBOL Client from a command prompt. Multiple parameters must be separated by "%20" that matches the space you would use on the command line. For example, a URL like: <i>http://.../?args=ABC%20123</i> matches a command like: <i>iscclient PROG ABC 123</i>
-----------------------------	---

These variables are received by the COBOL program as chaining parameters in the order they appear in the field "Program name and arguments". Since *customArgs* generates a variable number of chaining parameters for the COBOL program, it's good practice to put it at the end of the list, if used.

For example, if you set

Program name and arguments	PROG \${clientIp} \${customArgs}
----------------------------	----------------------------------

Use a URL like this to pass 'ABC' and '123' as command line arguments:

```
http://yourwebsite/yourapp/?args=ABC%20123
```

Use the following COBOL code to receive the IP address of the end user and the two command line parameters:

```
program-id. prog.
...
working-storage section.
...
77 wrk-clientIp pic x any length.
77 wrk-param-1 pic x any length.
77 wrk-param-2 pic x any length.
...
procedure division chaining wrk-clientIp
                             wrk-param-1
                             wrk-param-2
                             .
```

Configuring Users

By default only the Admin user exists and a login is required only for admin operations like creating and configuring applications.

It's possible to create additional users and configure the applications to ask for user credentials when the session starts.

Navigate to the following URL in order to access the Configuration page:

```
http://machine-ip:port/admin/#/config/server
```

Note - *machine-ip* and *port* must match the *server.host* and *server.http.port* values set [JETTY Configuration](#).

The Admin credentials are required in order to access the Configuration page.

The users can be defined in two ways:

1. via the WebClient interface
 - a. set the *Security Module Name* field to EMBEDDED to make the list of current defined users appear

WebClient console

Non sicuro | 192.168.0.231:8080/admin/#/config/server

WebClient Dashboard Configuration Logs Exit Logout

Server Configuration

Status: Running

Reset Apply

Home Folder ⓘ ⚡

Security Module Name ⓘ ▼

Security Module Class Path ⓘ +

No.	Username	Password	Roles
1	<input data-bbox="443 1150 595 1203" type="text" value="admin"/>	<input data-bbox="627 1150 778 1203" type="text" value="admin"/>	<input data-bbox="818 1150 906 1203" type="text" value="admin"/> + × + ×
2	<input data-bbox="443 1234 595 1287" type="text" value="support"/>	<input data-bbox="627 1234 778 1287" type="text" value="support"/>	<input data-bbox="818 1234 906 1287" type="text" value="suppor"/> + × + ×
3	<input data-bbox="443 1318 595 1371" type="text" value="user"/>	<input data-bbox="627 1318 778 1371" type="text" value="user"/>	+ + ×

Extensions ⓘ +

- b. click on the second "+" button (the second to last button) in one of the rows; a new row appears in the list
 - c. fill *Username* and *Password* fields with the new user credentials
 - d. click on the "Apply" button
 2. through a property file
 - a. set the *Security Module Name* field to PROPERTY_FILE. A new field named *File* will appear allowing to provide the location of the property file (by default a file named *user.properties* is searched in the WebClient working directory).

Each line in that file defines a user. The syntax is:

```
user.<username>=<password>[,role1][,role2]
```

b. For example, in order to reflect the content of the above screenshot in a user.properties file, use:

```
user.admin=admin,admin  
user.support=support,support  
user.user=user
```

Setting *Security Module Name* field to NONE allows all users to access WebClient without authentication. This is not good practice.

Setting *Security Module Name* field to INHERITED requires you to provide a custom class that implements the WebSwingSecurityModule interface. Refer to WebSwing documentation for more information.

Setting *Security Module Name* field to DATABASE requires you to provide a JDBC data source. See Reading Users from a JDBC data source for more details.

The users configured here are available in the whole WebClient environment. It's also possible to define different users for the single applications. See [Applications Monitoring and Configuration](#) for details.

Reading Users from a JDBC data source

Users can be registered in a database that WebClient will query via JDBC.

Every database that allow JDBC connections is suitable, including the c-treeRTG SQL engine.

In order to make WebClient look for users in a JDBC data source, set the *Security Module Name* field to DATABASE.

WebClient console

localhost:8080/admin/#/config/server

WebClient Dashboard Configuration Logs Exit Logout

Server Configuration

Status: Running

Reset Apply

Home Folder ⓘ

Security Module Name ⓘ

Security Module Class Path ⓘ +

DataSource Class ⓘ

DataSource Settings ⓘ +

Authentication Query

User Roles Query

Permissions Query

Resolve Permissions ⓘ OFF

Salted Password Hash ⓘ ON

Hash Matcher Algorithm ⓘ

Hash Hex Encoded ⓘ OFF

Hash Iterations ⓘ

Extensions ⓘ +

Use the *Security Module Class Path* to provide the full path of the jar libraries of the JDBC drivers you wish to use. Use the '+' button to add a new driver. Use the 'x' button to remove a driver.

Set the *DataSource Class* field to the name of the data source class. The class must implement the [DataSource interface](#). The field includes a list of known data source classes. If the class that you wish to use doesn't appear in this list, type the class name in the field.

Examples:

	Security Module Class Path	DataSource Class
c-treeSQL	/path/to/ctreeJDBC.jar	ctree.jdbcx.CtreeDataSource

	Security Module Class Path	DataSource Class
Oracle	/path/to/ojdbc7.jar	oracle.jdbc.pool.OracleDataSource
MySQL	/path/to/mysql-connector-java-bin.jar	com.mysql.jdbc.jdbc2.optional.MysqlDataSource
PostgreSQL	/path/to/postgresql.jdbc4.jar	org.postgresql.ds.PGSimpleDataSource

When the *DataSource Class* has been selected, the *DataSource Settings* will provide possible parameters. Use the '+' button to add a new setting. Use the 'x' button to remove a setting.

Parameter name	Parameter value
serverName	IP or name of database server
databaseName	Name of database with user configuration tables
user	Username to connect to the database
password	Password to connect to the database
portNumber	TCP port number used by the database server

The fields *Authentication Query*, *User Roles Query* and *Permissions Query* show the queries that will be performed by WebClient in order to retrieve the desired data. Ensure that your database include the required tables and fields. Fields must be of type VARCHAR.

The minimum database schema to support the DATABASE authentication needs the following tables:

Table "users"	
username	varchar()
password	varchar()
password_salt	varchar()
Table "user_roles"	
username	varchar()
role_name	varchar()
Table "user_permissions"	
role_name	varchar()
permission	varchar()

If your tables have different names, different field names or different field type, then you should adapt the queries in the *Authentication Query*, *User Roles Query* and *Permissions Query* fields. For example, if you're using a c-treeRTG database whose tables are ISAM files that were sqlized, then the field type is CHAR instead of VARCHAR, so the queries should be changed from:

```
select password, password_salt from users where username = ?
select role_name from user_roles where username = ?
select permission from roles_permissions where role_name = ?
```

to:

```
select trim(password), trim(password_salt) from users where trim(username) = ?
select trim(role_name) from user_roles where trim(username) = ?
select trim(permission) from roles_permissions where trim(role_name) = ?
```

If you wish to store password as clear text, set the *Hash Matcher Algorithm* field to NONE. If you wish to store password encoded, select the appropriate encoding in the *Hash Matcher Algorithm* field. For example, if passwords are stored as MD5 hash, set the *Hash Matcher Algorithm* to MD5.

JETTY Configuration

The WebClient service is based on Eclipse Jetty, a Java HTTP (Web) server and Java Servlet container.

By default the service starts on localhost on port 8080.

You can change these settings by editing the file *eis/webclient/jetty.properties* under the isCOBOL installation folder. It's good practice to make a backup copy of this file every time you change it, as it may be overwritten by the installation of an isCOBOL SDK update.

Entry	Meaning
jetty.webclient.server.host	IP address or machine name where the service listens for connections. Replace 'localhost' by the IP of the current PC if you wish to allow connections from other machines in the network.
jetty.webclient.server.http	Enable or disable listening on the HTTP protocol
jetty.webclient.server.http.port	Port number the server listens to for HTTP connections

Note - If you wish to disable the HTTP protocol, don't comment *jetty.webclient.server.http*, but set it to "false". If the entry is commented, the webclient service may not start.

The file contains also entries to enable secure HTTP (HTTPS). The entries are commented so by default HTTPS is not enabled. Uncomment and edit the entries if you wish to enable HTTPS.

Entry	Meaning
jetty.webclient.server.https	Enable or disable listening on the HTTPS protocol
jetty.webclient.server.https.port	Port number the server listens to for HTTPS connections

Entry	Meaning
jetty.webclient.server.https.truststore	Location of the truststore file
jetty.webclient.server.https.truststore.password	Truststore password
jetty.webclient.server.https.keystore	Location of the keystore file
jetty.webclient.server.https.keystore.password	Keystore password

Logging

WebClient generates and updates the following log files in the working directory:

audit.log	This log traces the access to the configuration. It is useful if more than one user can access to the configuration.
stats.log	This log stores the statistics of applications usage. Only the activity of connections coming from foreign machines is traced, the activity on localhost is not traced. This information is reflected by the charts shown in the Dashboard.
webclient.log	This log traces the startup of the WebClient service and the COBOL applications. Java exceptions, if any, are stored in this log, so this is the first thing to check if you experience odd behaviors.

When the WebClient service is restarted, the above files are not initialized, the new log content will be appended to them.

Known limitations and differences between WebClient and Thin Client

This chapter lists the features that are currently not supported by WebClient as well as behaviors that are different between running as a standard COBOL application and running as a web application.

The list is updated to the date this document has been written.

Most of these differences and limitations are related to the more complex architecture required for the WebClient. In a Thin Client environment, there are only two machines involved: the user's PC and the application server, both using isCOBOL products. But in a WebClient environment, there are three machines involved, the web server, the web client, and the application server. The machine previously known as the user's PC becomes a web server, with no isCOBOL products installed. Instead the PC uses a web browser to interact with the web server. This means that when the COBOL application looks for client resources, it will find the web server's resources, not the resources on the end user's PC.

Printing

By default there is only one printer available, it's name is "WebPrintService" and it's a PDF printer. When a print is performed on WebPrintService, the browser automatically opens the resulting PDF in a new tab at the end of the print job. This is the suggested way of dealing with print jobs in WebClient environment. In the rare case your application needs to interact with the printers installed on the web server, enable *Allow Server Printing* in the configuration of the application.

The WebPrintService printer is not recognized as default printer by the Win\$Printer functions that return printer information (e.g. WINPRINT-GET-CURRENT-INFO).

Some print operations, like the print preview, cause a new tab to be opened in the browser.

Library Routines

The J\$GETFROMLAF routine is not supported. Calling it will return unpredictable results.

The W\$MENU routine is not able to manage the tray icon.

The \$WINHELP routine is not supported. Calling it may cause a crash of the application.

The C\$OPENSABOX routine's behavior is affected by the following configuration entries: [Isolated Filesystem](#), [Uploading Files](#), [Deleting Files](#), [Downloading Files](#) and [Auto-Download from Save Dialog](#).

The W\$CAPTURE routine is not supported. Calling it will return unpredictable results.

The WIN\$PLAYSOUND routine plays the sound on the web server machine where WebClient is running.

GUI

The windows decoration is driven by an internal theme and differs from the decoration of your current Java Swing Look & Feel.

Exporting data to xls/xlsx from List-Box and Grid may produce documents whose layout doesn't match with the layout of the control.

The default Web-Browser implementation (DJBrowser) doesn't work. Use the JavaFx implementation by setting *iscobol.gui.webbrowser.class=com.iscobol.fx.JFXWebBrowser* in the COBOL configuration.

The Tab-Control doesn't render vertical tabs correctly.

The rollover effect on Push-Buttons is not supported.

Debug

In order to debug a program running under WebClient, the Remote Debugger should be used.

Set *iscobol.rundebug* to "1" or "2" in the COBOL configuration and ensure that the classes loaded by the isCOBOL Server are compiled in debug mode.

Start the application in your web browser.

Launch the Debugger on your PC, the same where you're executing the browser and connect it to the port where the Remote Debugger is listening (usually 9999) on the machine where isCOBOL Server is running.

For more information about remote debugging, see [Remote Debugging](#).

Function Keys

Function keys are caught by both browser and COBOL application.

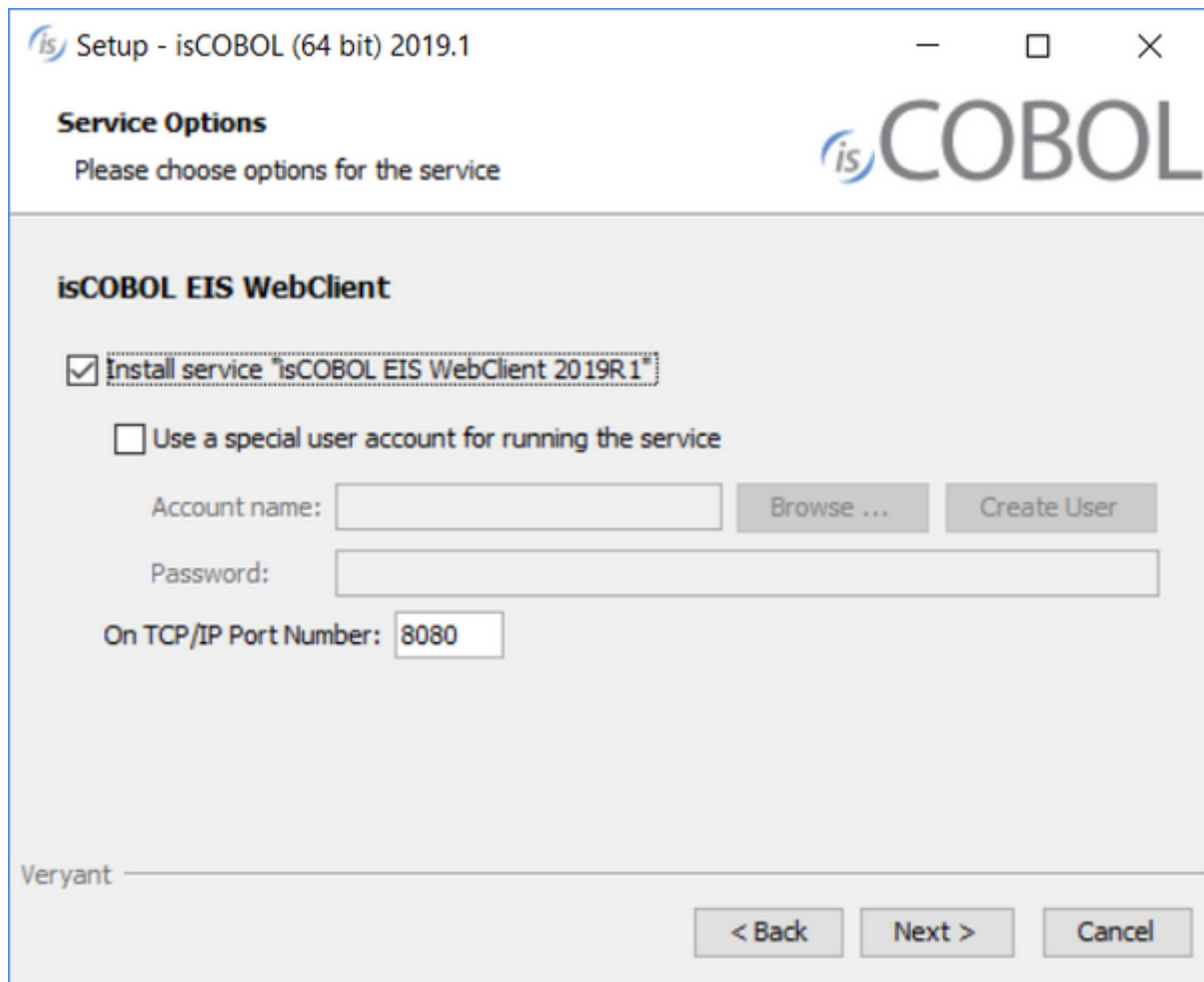
If the F5 key is caught by the COBOL program, then the browser will not refresh the page.

Windows service and Unix daemon

Windows service

On Windows it's possible to install isCOBOL WebClient as a Windows Service.

The isCOBOL WebClient service can be installed during the setup process:



Setup - isCOBOL (64 bit) 2019.1

Service Options
Please choose options for the service

isCOBOL EIS WebClient

☒ Install service "isCOBOL EIS WebClient 2019R1"

☐ Use a special user account for running the service

Account name:

Password:

On TCP/IP Port Number:

Veryant

When isCOBOL has been installed, the service can be installed, removed and managed through the webclient.exe command line utility.

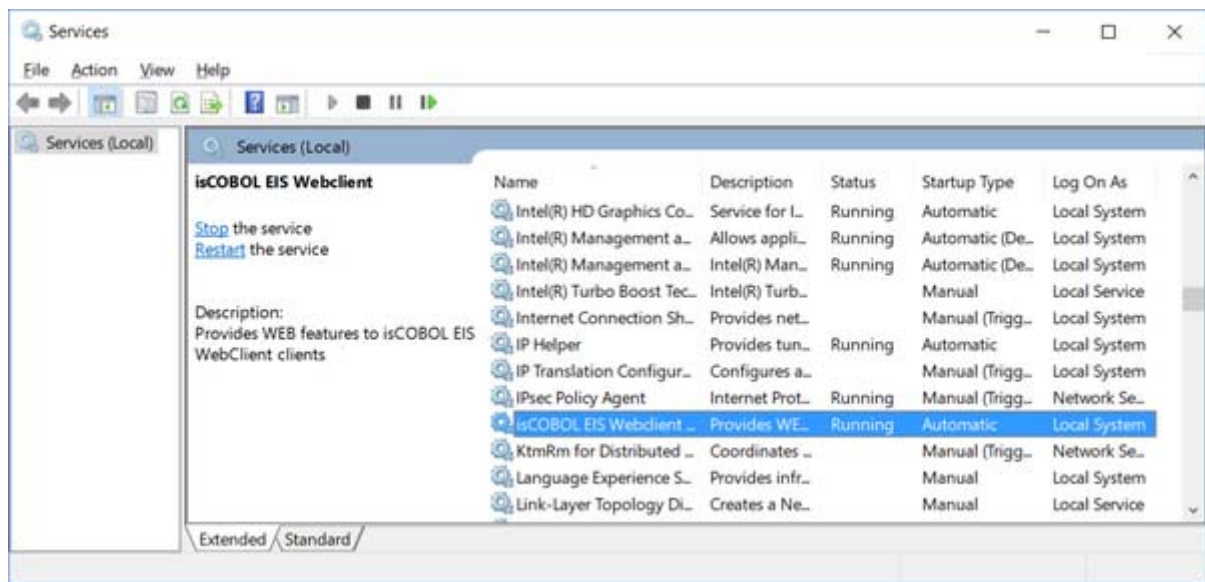
webclient.exe usage

The service maintenance is done through webclient.exe.

To install the service, use the command:

```
webclient -install
```

If the operation is successful, there will be a new entry in the Windows service manager.



The service is installed in auto mode, which means the service will automatically start along with the system.

To install the service in demand mode, use the command:

```
webclient -install-demand
```

In this mode, the service must be manually started by the user in the Windows service manager.

To retrieve the service status, use the command:

```
webclient -status
```

The exit code of this command is 0 when the service is running, 3 when it is not running and 1 when the state cannot be determined.

To start the service, use the command:

```
webclient -start
```

To stop the service, use the command:

```
webclient -stop
```

To uninstall the service, use the command:

```
webclient -uninstall
```

If the command is successful, the isCOBOL WebClient service will disappear from the Windows service manager.

In some situations, you might want to install a Windows service as a non-interactive service so that the service does not have any possibility to access the GUI subsystem. In order to do that, add the phrase non-interactive after the -install parameter. A custom service name can still be specified after the non-interactive parameter:

```
webclient -install non-interactive
```

It's also possible to specify a custom name for the service. This name should be added as last parameter of isserver.exe command line for all the options. For example, the following list of commands manages an isCOBOL WebClient service named "myservice":

```
webclient -install myservice
webclient -start myservice
webclient -status myservice
webclient -stop myservice
webclient -uninstall myservice
```

Output redirection

The isCOBOL WebClient service redirects all the console output (stderr and stdout) to two files named *webclient_err.log* and *webclient_out.log*. These files are located in the isCOBOL bin directory, which is the default directory of the service.

Service configuration

Java options must be put in the *webclient.vmoptions* file, located in the isCOBOL bin directory, which is the default directory of the service. In this file, comments are prefixed by a hash and each option is on a separate line.

The following snippet shows how to configure memory limits, pass a custom configuration file and alter the Classpath for the isCOBOL WebClient service:

```
#memory settings
-Xmx256m
-Xms128m

#configuration
-Discobol.conf=/myapp/myconf

#classpath
-classpath/p .
-classpath/a C:\Program Files\Java\jdk1.8.0_161\lib\tools.jar
```

The isCOBOL WebClient service inherits the Classpath from the system and adds all jar libraries in the isCOBOL lib directory to it. Using the *-classpath* option you can add additional items to the active Classpath. The value of *-classpath/p* is prepended to the active Classpath. The value of *-classpath/a* is appended to the active Classpath.

Note: On some Windows distributions it's necessary to reboot the system in order to make services aware of modifications to the system environment.

isCOBOL configuration properties to configure port number, hostname, rundebug, etcetera, can be set either in *webclient.vmoptions* with the syntax "*-Dproperty=value*" or in a file named *iscobol.properties* that will be loaded from:

1. The \etc directory
2. The user home directory

3. The Classpath

Unix daemon

On Unix systems, the isCOBOL WebClient can be installed as a daemon process and maintained using the `webclient` command.

webclient usage

The `webclient` command has the following options:

<code>run</code>	Run the WebClient service keeping the console busy
<code>start</code>	Run the WebClient service without taking the console busy
<code>stop</code>	Stop the WebClient service
<code>restart</code>	Restart the WebClient service
<code>status</code>	Show the status of the WebClient service

You need to be root in order to use this command.

Daemon configuration

The `webclient` command looks for the file `default_java.conf` that is located in the isCOBOL bin directory.

This file is generated by the setup process and it includes the location of the isCOBOL SDK and the associated Java.

In this file, comments are prefixed by a hash and each option is on a separate line.

Chapter 8

Troubleshooting

This chapter lists the most common errors that may appear while working with isCOBOL EIS.

Tomcat startup errors

If a connection error occurs and the browser cannot load the page with the COBOL application, ensure that Tomcat is correctly started.

Information on Tomcat startup errors can be found in `catalina.currentdate.log` file in Tomcat's logs directory.

Blank page with EIS WD2

If an empty blank screen appears in place of the COBOL application, it could mean that WD2 could not initialize the program correctly. Error messages that help troubleshooting the cause of the problem can be found in the `stdout.currentdate.log`, `stderr.currentdate.log` and `localhost.currentdate.log` files in Tomcat's logs directory.

"Missing License" is a common problem that causes blank screen. Check that the `iscobol.eis.license.2019` property is set in `/etc/iscobol.properties` or in the web application's `WEB-INF/classes/iscobol.properties` file.

The blank page may also be caused by the application waiting for Debugger, if `iscobol.rundebbug` property is set in the configuration.

Also, the blank page may be caused by the web application terminating before the first `DISPLAY`, for example due to i/o errors. Remote debugging can help in this case.

HTTP errors

When an error occurs in the web application, it usually causes HTTP ERRORS like 404 and 500.

In order to retrieve the full Exception stack, consult the log files in Tomcat's `logs` directory.

Preventing errors related to the UI in EIS Servlet and Web Service environments

It can happen that a COBOL program performs a DISPLAY or ACCEPT on the user interface in a EIS environment. This could happen, for example, if you reuse existing code that was previously used in a Desktop environment. These operations are not supported by Servlets and Web Services and may lead to unexpected behaviors and errors. In order to prevent these error conditions, Veryant recommends to add [-whhttp](#) to your compiler options when you compile programs for the EIS environment.

Chapter 9

Tomcat Installation

Introduction

In order to host isCOBOL EIS COBOL Servlets, you need to install and run a Servlet container. There are many Servlet containers available.

You can see lists and comparisons of Servlet containers at http://en.wikipedia.org/wiki/Comparison_of_web_servers. In the *Features* table, search for "Yes" in the *Java Servlets* column.

Veryant has tested and recommends Apache Tomcat 7 or above.

Download and install Tomcat

The Apache Tomcat main page is <http://tomcat.apache.org/>.

Here are some steps to download and install Tomcat 7 on Windows:

NOTE - To avoid problems, uninstall earlier versions of the Tomcat service before installing Tomcat 7

- Make sure that you already have installed JDK 7 (or greater) and isCOBOL Evolve
- Visit <http://tomcat.apache.org/>
- Click on the Tomcat 7.x Download link (on the left menu)
- Find the Binary Distributions section and click on the *Windows Service Installer* link
- Run the downloaded executable file and follow the prompts accepting the defaults

Configure Tomcat to use the isCOBOL EIS framework

\$CATALINA_HOME is the Tomcat installation directory. The default location on Windows is:

`C:\Program Files\Apache Software Foundation\Tomcat 7.0`

To configure Tomcat to use the isCOBOL Runtime Framework on Windows you can change the value of the `shared.loader` property in `$CATALINA_HOME/conf/catalina.properties` to the following:

`shared.loader=/program\ files/veryant/iscobol2019R1/lib/iscobol.jar`

On Unix, set the CLASSPATH in Tomcat's startup environment to include iscobol.jar. For example, on Linux add the following line to /etc/tomcat7/tomcat7.conf or other script called during the Tomcat startup:

```
CLASSPATH=$ISCOBOL/lib/iscobol.jar:$CLASSPATH; export CLASSPATH
```

Make sure that you have a valid license for isCOBOL Evolve in /etc/iscobol.properties (i.e. iscobol.license.<release year>=<license key>) or in the iscobol.properties in the home directory for the user that starts Tomcat.

Disable persistence across restarts

Whenever Apache Tomcat is shut down normally and restarted, or when an application reload is triggered, the standard Manager implementation will attempt to serialize all currently active sessions to a disk file located via the pathname attribute. All such saved sessions will then be deserialized and activated (assuming they have not expired in the mean time) when the application reload is completed. In order to successfully restore the state of session attributes, all such attributes must implement the java.io.Serializable interface. Since not all isCOBOL classes are serializable, we strongly suggest you disable this persistence feature.

To disable this persistence feature, create a Context configuration file for your web application and add the following element there:

```
<Manager pathname="" />
```

Note - The file *context.xml* in the Tomcat home directory already includes the above entry, but it's commented. You can easily disable the persistence for all your web applications by removing the comment markers around the entry.

Data access

When relying on file handler that includes native parts (e.g. DCI, c-tree or Vision) we suggest using a File Connector, if available.

However, the c-tree file handler is also certified to work without the need of a File Connector if installed and configured as follows:

- copy *iscobol.jar* to the webapp's WEB-INF/lib folder
- copy *ctree-rtg.jar* to the Tomcat's lib folder
- set *iscobol.file.index=ctreej* in the configuration

Relative paths

Relative paths used by COBOL programs in EIS environment are relative to the webapp directory except for *iscobol.code_prefix* paths that are relative to the Tomcat working directory.

Chapter 10

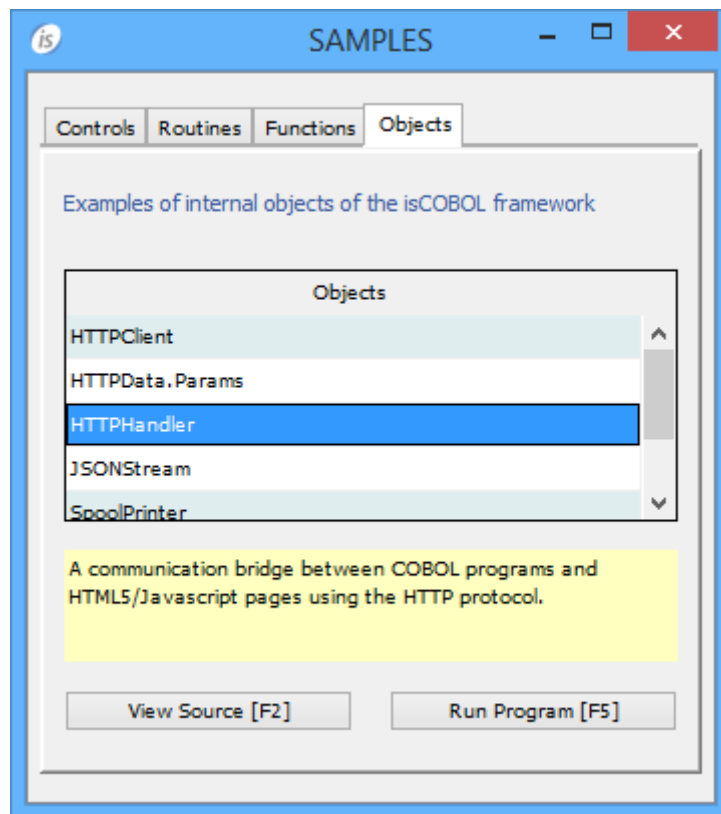
Appendices

- [HTTPHandler class \(com.iscobol.rts.HTTPHandler\)](#)
- [HTTPClient class \(com.iscobol.rts.HTTPClient\)](#)
- [HTTPData.Params class \(com.iscobol.rts.HTTPData.Params\)](#)
- [Connecting to a SSL-enabled web service](#)
- [Useful definitions](#)

HTTPHandler class (com.iscobol.rts.HTTPHandler)

The HTTPHandler is an internal class that provides a communication bridge between COBOL programs and HTML5/Javascript pages using the HTTP protocol.

A sample program can be found in isCOBOL Samples.



Constructor

Creates a new instance of the HTTPHandler class.

General format

```
HTTPHandler
```

General rules

1. A reference to HTTPHandler should be defined in the program's Linkage Section.

Code example

```
...  
configuration section.  
repository.  
    class HTTPHandler as "com.iscobol.rts.HTTPHandler"  
....  
linkage section.  
77 objHTTPHandler object reference HTTPHandler.  
...  
procedure division using objHTTPHandler.  
...
```

accept

Receives parameters from the HTTP.

General format

```
void accept( params )
```

Syntax rules

1. *params* is a level 01 data item for which the **IS IDENTIFIED** clause has been used.

General rules

1. *params* elements name matches the name of the parameter passed by the HTTP client.
2. If the parameter passed by the HTTP client is a file, then
 - o The file is stored in the folder identified by the **iscobol.http.upload.directory** * configuration property, whose default is the server temp directory.
 - o The name of the file is returned to the COBOL program, not the file content. The name is formed by five parts:
 - i. the folder where the file has been stored
 - ii. the prefix specified by the configuration property **iscobol.http.upload.prefix** *, if set
 - iii. a unique prefix automatically generated by the framework in order to avoid duplicate names
 - iv. the underscore character
 - v. the name of the file passed by the client

Example

Consider the following HTML form:

```
<form action="servlet/isCobol(PROG1)" enctype="multipart/form-data" method="post">  
Type some text:<br>  
<input type="text" name="textline" size="30"><br>  
Choose a file to upload:<br>  
<input type="file" name="datafile" size="40"><br>  
Send to server<br>  
<input type="submit" value="Send">  
</form>
```


The user types data into the text area and browses for a file on disk.

When the 'Send' button is clicked, the COBOL program 'PROG1' is called. In order to intercept the field's content, PROG1 should be written as follows:

```
CONFIGURATION SECTION.  
REPOSITORY.  
    CLASS WEB-AREA AS "com.iscobol.rts.HTTPHandler"  
    .  
    ...  
WORKING-STORAGE SECTION.  
01 http-data identified by "http_data".  
03   identified by "textline".  
    05 w-textline pic x any length.  
03   identified by "datafile".  
    05 w-datafile pic x any length.  
    ...  
LINKAGE SECTION.  
01 LNK-AREA OBJECT REFERENCE WEB-AREA.  
  
PROCEDURE DIVISION USING LNK-AREA.  
MAIN.  
    LNK-AREA:>accept(http_data).
```

After the accept() invocation, *w-textline* is set to the text typed by the user in the text area of the HTML form, while *w-datafile* is set to the name of the uploaded file in the format of *<server_folder>/<random_id>_<filename>*.

acceptAllParameters

Receives a list of all parameters followed by their value. This is useful to monitor what is actually passed by the HTTP client.

General format

```
void acceptAllParameters( params )
```

Syntax rules

1. *params* is an alphanumeric data item. It's good practice to use items with picture X ANY LENGTH for this purpose.

General rules

1. A single buffer is returned by this method. The buffer contains all the parameter names followed by their respective value.

acceptEx

Receives parameters from the HTTP by invoking [acceptFromJSON](#) or [acceptFromXML](#) depending on the Content-type field. If no Content-type is available in the request header, then it invokes [acceptFromJSON](#) or [acceptFromXML](#) depending on the [iscobol.rest.default_stream](#) configuration setting.

General format

```
void acceptEx( params )
```

Syntax rules

1. *params* is a level 01 data item for which the [IS IDENTIFIED clause](#) has been used.

General rules

1. *params* elements name matches the name of the parameter passed by the HTTP client.

acceptFromJSON

Receives parameters from the HTTP assuming that they're passed as a JSON stream.

General format

```
void acceptFromJSON( params )
```

Syntax rules

1. *params* is a level 01 data item for which the [IS IDENTIFIED clause](#) has been used.

General rules

1. *params* elements name matches the name of the parameter passed by the HTTP client.

acceptFromXML

Receives parameters from the HTTP assuming that they're passed as an XML stream.

General format

```
void acceptFromXML( params )
```

Syntax rules

1. *params* is a level 01 data item for which the [IS IDENTIFIED clause](#) has been used.

General rules

1. *params* elements name matches the name of the parameter passed by the HTTP client.

addOutHeader

Adds an item to the response HTTP header.

General format

```
void addOutHeader( name, value )
```

Syntax rules

1. *name* and *value* are alphanumeric data items or literals.

displayBinaryFile

Returns the content of a binary file as a response to the HTTP client. The file is treated as a sequence of bytes, no unicode conversion is applied.

General format

```
void displayBinaryFile( fileName, mimeType )
```

Syntax rules

1. *fileName* and *mimeType* are alphanumeric data items.

General rules

1. It's good practice to provide a valid MIME type along with the file name.

displayError

Returns a numeric error code to the HTTP client.

General format

```
void displayError( errNum, errText )
```

Syntax rules

1. *errNum* is a numeric data item or literal
2. *errText* is an alphanumeric data item or literal.

General rules

1. You should provide a valid HTTP status code as described in the [latest HTTP/1.1 RFC](#) at page 39.

displayHTML

Returns an HTML stream to the HTTP client.

General format

```
void displayHTML( html, docType )
```

Syntax rules

1. *html* is a level 01 data item for which the *IS IDENTIFIED clause* has been used.

2. *docType* is an alphanumeric data item or literal.

General rules

1. *html* data item must be identified by html tags, in particular the item at level 01 must be IDENTIFIED BY "HTML".
2. *docType* specifies the <!DOCTYPE> declaration as described [here](#). It might be null.
3. The MIME type "text/html" is automatically applied.

Example

The following COBOL program produces an HTML output with different text styles:

```
CONFIGURATION SECTION.  
REPOSITORY.  
    CLASS WEB-AREA AS "com.iscobol.rts.HTTPHandler"  
.  
WORKING-STORAGE SECTION.  
01  html identified by "html".  
    03 identified by "p".  
        05 identified by "b".  
            07 bold-text pic x any length.  
    03 identified by "p".  
        05 identified by "i".  
            07 italic-text pic x any length.  
    03 identified by "p".  
        05 plain-text pic x any length.  
  
LINKAGE SECTION.  
01 LNK-AREA OBJECT REFERENCE WEB-AREA.  
  
PROCEDURE DIVISION USING LNK-AREA.  
MAIN.  
    move "bold" to bold-text.  
    move "italic" to italic-text.  
    move "plain" to plain-text.  
    lnk-area:>displayHTML(html, null).  
    goback.
```

displayText

Returns raw text to the HTTP client.

General format

```
void displayText( text )
```

Syntax rules

1. *text* is an alphanumeric data item or literal.

General rules

1. The MIME type "text/plain" is automatically applied.

displayTextFile

Returns the content of a binary file as a response to the HTTP client. The file is processed using the current encoding.

General format

```
void displayTextFile( fileName, mimeType )
```

Syntax rules

1. *fileName* and *mimeType* are alphanumeric data items.

General rules

1. It's good practice to provide a valid MIME type along with the file name.

displayEx

Returns a stream to the HTTP client by invoking [displayJSON](#) or [displayXML](#) depending on the Content-type field. If no Content-type is available in the response header, then it invokes [displayJSON](#) or [displayXML](#) depending on the [iscobol.rest.default_stream](#) configuration setting.

General format

```
void displayEx( stream )
```

Syntax rules

1. *stream* is a level 01 data item for which the *IS IDENTIFIED clause* has been used.

General rules

1. The MIME type is automatically applied.

displayXML

Returns a XML stream to the HTTP client.

General format

```
void displayXML( xml )
```

Syntax rules

1. *xml* is a level 01 data item for which the *IS IDENTIFIED clause* has been used.

General rules

1. The MIME type "text/xml" is automatically applied.

displayJSON

Returns a JSON stream to the HTTP client.

General format

```
void displayJSON( json )
```

Syntax rules

1. *json* is a level 01 data item for which the *IS IDENTIFIED clause* has been used.

getContent-type

Return the HTTP Content Type of the request

General format

```
String getContent-type( )
```

getHeader

Reads the value of a specific item in the HTTP header.

General format

```
String getHeader( name )
```

Syntax rules

1. *name* is an alphanumeric data item or literal.

General rules

1. The header name should be specified in lower case otherwise it's not found. For example, in order to get the value of "Content-Type", look for "content-type".

getIntHeader

Reads the value of a specific item in the HTTP header assuming that it's an integer number.

General format

```
int getIntHeader( name )
```

Syntax rules

1. *name* is an alphanumeric data item or literal.

General rules

1. The header name should be specified in lower case otherwise it's not found. For example, in order to get the value of "Content-Length", look for "content-length".

getMethod

Returns the HTTP request method used for client and server calls.

General format

```
String getMethod( )
```

General rules

1. The returned value is one of the following strings: CONNECT, DELETE, GET, HEAD, OPTIONS, POST, PUT.

getRequest

Return the HTTP Request object instance.

General format

```
Object getRequest( )
```

General rules

1. The returned object should be cast to *javax.servlet.http.HttpServletRequest*.

Example

Retrieve the IP address of the client machine that made the request:

```
repository.  
    class HTTPHandler as "com.iscobol.rts.HTTPHandler"  
    class HTTPRequest as "javax.servlet.http.HttpServletRequest"  
    .  
working-storage section.  
77 servlet-request object reference HTTPRequest.  
77 client-ip pic x any length.  
linkage section.  
77 http-handler object reference HTTPHandler.  
procedure division using http-handler.  
    set servlet-request to http-handler:>getRequest()  
        as HTTPRequest.  
    set client-ip to servlet-request:>getRemoteAddr().
```

getResponse

Return the HTTP Response object instance.

General format

```
Object getResponse( )
```

General rules

1. The returned object should be cast to *javax.servlet.http.HttpServletResponse*.

Example

Retrieve the Response object instance:

```
repository.  
    class HTTPHandler as "com.iscobol.rts.HTTPHandler"  
    class HTTPResponse as "javax.servlet.http.HttpServletResponse"  
    .  
working-storage section.  
77 servlet-response object reference HTTPResponse.  
linkage section.  
77 http-handler object reference HTTPHandler.  
procedure division using http-handler.  
    set servlet-response to http-handler:>getResponse()  
        as HTTPResponse.
```

getSession

Return the HTTP Session object instance.

General format

```
Object getSession( )
```

General rules

1. The returned object should be cast to *javax.servlet.http.HttpSession*.

Example

Retrieve the unique ID of the current HTTP session:

```
repository.  
    class HTTPHandler as "com.iscobol.rts.HTTPHandler"  
    class HttpSession as "javax.servlet.http.HttpSession"  
    .  
working-storage section.  
77 servlet-session object reference HttpSession.  
77 unique-id pic x any length.  
linkage section.  
77 http-handler object reference HTTPHandler.  
procedure division using http-handler.  
    set servlet-session to http-handler:>getSession()  
        as HttpSession.  
    set unique-id to servlet-session:>getId().
```

invalidateSession

Invalidates the current HTTP session and removes all session data. This is the correct way to terminate the whole application. This method should be associated with the "Exit" function of your application.

General format

```
void invalidateSession()
```

isRedirect

Tells if a redirect has been issued or not.

General format

```
boolean isRedirect()
```

Code example

```
if objHTTPHandler:>isRedirect()  
    |a redirect has been issued  
else  
    |a redirect has not been issued  
end-if
```

isSessionInvalidated

Tells if the current session has been invalidated or not.

General format

```
boolean isSessionInvalidated()
```

Code example

```
if objHTTPHandler:>isSessionInvalidated()  
    |the session has been invalidated  
else  
    |the session is still valid  
end-if
```

processHtmlFile

Process an HTML file, replacing items delimited by %% characters with the corresponding COBOL data item.

General format

```
boolean processHtmlFile (htmlFile)
```

Syntax rules

1. *htmlFile* is a level 01 data item for which the [IS IDENTIFIED clause](#) has been used.

General rules

1. *htmlFile*'s 01 level is identified by the name of the HTML file to be processed while the subsequent variable identifiers are searched for in the file inside the delimiters '%%' (or prefixed by colon, depending on the [iscobol.http.value_prefix_colon \(boolean\)](#) setting). The file is loaded in the directory (or directories) specified by the configuration property [iscobol.http.html_template_prefix *](#).
2. If the file name doesn't end with the extension ".html" nor ".htm" the method appends ".html" to the name. If the file with this name doesn't exist then it appends the extension ".htm". If still the file doesn't exist then the method looks for a file with the exact name.
3. The method returns true if the operation is successful and false otherwise: in the latter case an error message will be included in the HTML output.

Example

Consider having a file named "mypage.html" with the following content:

```
<html>
  <p>This page has been shown by %%cobolname%%</p>
</html>
```

The following COBOL program will display the above HTML with "isCOBOL" instead of "cobolname".

```
CONFIGURATION SECTION.
REPOSITORY.
  CLASS WEB-AREA AS "com.iscobol.rts.HTTPHandler"
  .
WORKING-STORAGE SECTION.
01  html identified by "mypage".
   03 identified by "cobolname".
   05 cob-name pic x any length.

LINKAGE SECTION.
01 LNK-AREA OBJECT REFERENCE WEB-AREA.

PROCEDURE DIVISION USING LNK-AREA.
MAIN.
  move "isCOBOL" to cob-name.
  LNK-AREA:>processHtmlFile(html) .
```

processHtmlString

Process the HTML code contained in an alphanumeric variable, replacing items delimited by %% characters with the corresponding COBOL data item.

General format

```
boolean processHtmlString (string, params)
```

Syntax rules

1. *string* is an alphanumeric data item or literal.
2. *params* is a level 01 data item for which the [IS IDENTIFIED clause](#) has been used.

General rules

1. *params* child variable identifiers are searched for in the *string* text inside the delimiters '%%' (or prefixed by colon, depending on the `iscobol.http.value_prefix_colon` (boolean) setting).
2. The method returns true if the operation is successful and false otherwise: in the latter case an error message will be included in the HTML output.

Example

The following COBOL program will display an HTML output whose text is "This output has been generated by isCOBOL":.

```
CONFIGURATION SECTION.  
REPOSITORY.  
    CLASS WEB-AREA AS "com.iscobol.rts.HTTPHandler"  
.  
WORKING-STORAGE SECTION.  
01  params identified by "_".  
    03  identified by "cobolname".  
        05  cob-name pic x any length.  
  
LINKAGE SECTION.  
01  LNK-AREA OBJECT REFERENCE WEB-AREA.  
  
PROCEDURE DIVISION USING LNK-AREA.  
MAIN.  
    move "isCOBOL" to cob-name.  
    LNK-AREA:>processHtmlString("This output has been generated by  
%%cobolname%%", params).
```

redirect

Issues a redirect.

General format

```
void redirect( newPage )
```

Syntax rules

1. *newPage* is an alphanumeric data item or literal.

General rules

1. if *newPage* starts with a protocol (e.g. "http:"), then it is used as is, otherwise it is considered a relative URL and it is appended to the webapp base URL.

setMethod

Sets the HTTP request method used for client and server calls.

General format

```
void setMethod( method )
```

Syntax rules

1. *method* is an alphanumeric data item or literal.

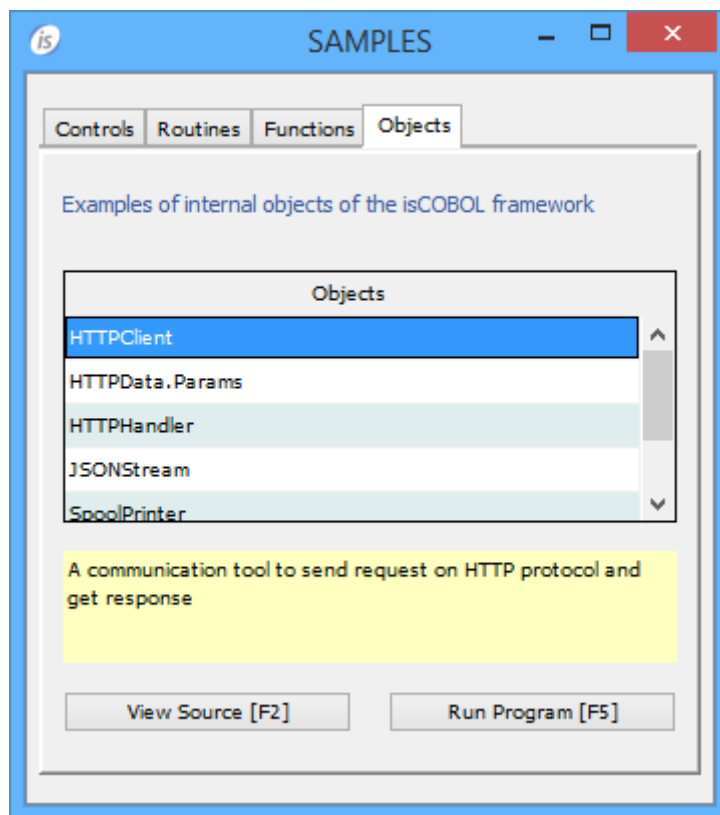
General rules

1. *method* must be one of the following strings: CONNECT, DELETE, GET, HEAD, OPTIONS, POST, PUT.

HTTPClient class (com.iscobol.rts.HTTPClient)

The HTTPClient is an internal class that provides many useful features to communicate with existing HTTP services like Web Service (REST/SOAP) HTTP server etc.

A sample program can be found in isCOBOL Samples.



Constructor

General Format

```
HTTPClient
```

General rules

A reference to HTTPHandler should be defined in the program's Working-Storage Section.

Code example.

```
...
  configuration section.
  repository.
    class http-client as "com.iscobol.rts.HTTPClient"
...
  working-storage section.
  77 http object reference http-client.
...
  procedure division.
...
  set http to http-client:>new().
...
```

doGet

Executes an HTTP request using GET method.

Format 1

```
void doGet( strUrl )
```

Format 2

```
void doGet( strUrl, params )
```

Syntax rules

1. *strUrl* is the URL to invoke.
2. *params* should contain an *HTTPData.Params* object where HTTP parameters are defined. See [HTTPData.Params class \(com.iscobol.rts.HTTPData.Params\)](#) for more information.

General rules

1. In Format 1, if you need to pass HTTP parameters, you can use the *setParameters()* method

doPost

Executes an HTTP request using the POST method.

Format 1

```
void doPost( strUrl )
```

Format 2

```
void doPost( strUrl, params )
```

Syntax rules

1. *strUrl* is the URL to invoke.
2. *params* should contain an *HTTPData.Params* object where HTTP parameters are defined. See [HTTPData.Params class \(com.iscobol.rts.HTTPData.Params\)](#) for more information.

General rules

1. In Format 1, if you need to pass HTTP parameters, you can use the [setParameter](#) method

doPostExecute

Executes an HTTP request using the POST method specifying the data stream and having the MIME type set automatically.

Format 1

```
void doPostExecute( strUrl, content )
```

Format 2

```
void doPostExecute( strUrl, type, content )
```

Format 3

```
void doPostExecute( strUrl, type, content, hasDuymmyRoot )
```

Syntax rules

1. *strUrl* is the URL to invoke.
2. *content* contains the data stream.
3. *type* is the MIME type (i.e. "text/xml")
4. *hasDuymmyRoot* is an alphanumeric data item or literal hosting a boolean value (e.g. "0", "1", "true", "false", "yes", "no", "on" or "off"). If the boolean value is TRUE, then the top level item of Record-Definition is discarded and will not appear in the JSON stream . This parameter can be NULL, in such case, FALSE is assumed.

General rules

1. In Format 1, *type* is set to "application/json" or "application/xml" depending on the Content-type request header field. If no Content-type field is available in the request header, then the type is controlled by the [iscobol.rest.default_stream](#) configuration setting.
2. If *content* is an appropriately structured variable with external names and the type is set to "application/json",

the method makes a request using the JSON format.

3. If *content* is an appropriately structured variable with external names but type is not set to "application/json", the method makes a request using the XML format.

doPostMultipart

Executes an HTTP request using the POST method sending the parameters using the multipart/form-data protocol.

General format

```
void doPostMultipart( strUrl, parameters )
```

Syntax rules

1. *strUrl* is the URL to invoke.
2. *parameters* is an instance of [HTTPData.Params class \(com.iscobol.rts.HTTPData.Params\)](#).

getRequestPlain

Returns the HTTP request as plain text.

General format

```
void getRequestPlain( req )
```

Syntax rules

1. *req* is an alphanumeric data item.

General rules

1. This method should be called after a request performed via [doPostEx](#).

getResponseCode

Returns the numeric HTTP status code from the HTTP response.

General format

```
void getResponseCode( rc )
```

Syntax rules

1. *rc* is a numeric data item.

General rules

1. This method should be called after a request performed via one of the following methods: [doGet](#), [doPost](#), [doPostEx](#) or [doPostMultipart](#).
1. Call this method to check if the method call was successful. The response code value for success is 200.

getResponseEx

Returns the HTTP response parsed with JSON or XML rules depending on the Content-type response header field. If no Content-type is available, then it uses the format specified by the [iscobol.rest.default_stream](#) configuration setting.

General format

```
void getResponseEx( data )
```

Syntax rules

1. *data* is a level 01 data item for which the [IS IDENTIFIED clause](#) has been used.

General rules

1. This method should be called after a request performed via one of the following methods: [doGet](#), [doPost](#), [doPostEx](#) or [doPostMultipart](#).

getResponseJSON

Returns the HTTP response parsed with JSON rules.

Format 1

```
void getResponseJSON( json )
```

Format 2

```
void getResponseJSON( json, encoding )
```

Syntax rules

1. *json* is a level 01 data item for which the [IS IDENTIFIED clause](#) has been used.
2. *encoding* is a string literal or data item that specifies the character set to be used while parsing the JSON stream. It accepts the same values as the [iscobol.encoding](#) * configuration property.

General rules

1. This method should be called after a request performed via one of the following methods: [doGet](#), [doPost](#), [doPostEx](#) or [doPostMultipart](#).

getResponseMessage

Returns the text message, if any, from the HTTP response.

General format

```
void getResponseMessage( msg )
```

Syntax rules

1. *msg* is an alphanumeric data item.

General rules

1. This method should be called after a request performed via one of the following methods: [doGet](#), [doPost](#), [doPostEx](#) or [doPostMultipart](#).
1. Call this method to check if the request was successful. The response message value for success is "HTTP/1.0 200 OK".

getResponsePlain

Returns the HTTP response as plain text.

General format

```
void getResponsePlain( res )
```

Syntax rules

1. *res* is an alphanumeric data item.

General rules

1. This method should be called after a request performed via one of the following methods: [doGet](#), [doPost](#), [doPostEx](#) or [doPostMultipart](#).

getResponseXML

Returns the HTTP response parsed with XML rules.

Format 1

```
void getResponseXML( xml )
```

Format 2

```
void getResponseXML( xml, encoding )
```

Syntax rules

1. *xml* is a level 01 data item for which the [IS IDENTIFIED clause](#) has been used.
2. *encoding* is a string literal or data item that specifies the character set to be used while parsing the XML stream. It accepts the same values as the [iscobol.encoding *](#) configuration property.

General rules

1. This method should be called after a request performed via one of the following methods: [doGet](#), [doPost](#), [doPostEx](#) or [doPostMultipart](#).

setAuth

Specify authentication via token (also called Bearer authentication) or via user and password.

Format 1

```
void setAuth( tok )
```

Format 2

```
void setAuth( user, password )
```

Syntax rules

1. *tok* is an alphanumeric data item that contains token authentication.
2. *user* is an alphanumeric data item that contains user name for the authentication.
3. *password* is an alphanumeric data item that contains user name for the authentication.

General rules

1. This method should be called before a request performed via one of the following methods: [doGet](#), [doPost](#), [doPostEx](#) or [doPostMultipart](#).

setHeaderProperty

Sets HTTP header properties like cookies and charset.

General format

```
void setHeaderProperty( key, value )
```

Syntax rules

1. *key* is an alphanumeric data item that specifies the name of the property to set
2. *value* is an alphanumeric data item that specifies the value for the property

General rules

1. This method should be called before a request performed via one of the following methods: [doGet](#), [doPost](#), [doPostEx](#) or [doPostMultipart](#).
2. *key* should be specified in lower case otherwise it's not found. For example, in order to get the value of "Content-Type", look for "content-type".

getHeaderProperty

Returns HTTP header properties like cookies and charset.

General format

```
void getHeaderProperty( key, value )
```

Syntax rules

1. *key* is an alphanumeric data item that specifies the name of the property to read
2. *value* is an alphanumeric data item that receives the value of the property

General rules

1. This method should be called after a request performed via one of the following methods: [doGet](#), [doPost](#), [doPostEx](#) or [doPostMultipart](#).
2. *key* should be specified in lower case otherwise it's not found. For example, in order to get the value of "Content-Type", look for "content-type".

getMethod

Returns the HTTP request method used for client and server calls.

General format

```
String getMethod( )
```

General rules

1. The returned value is one of the following strings: CONNECT, DELETE, GET, HEAD, OPTIONS, POST, PUT.

setParameter

Sets HTML parameters.

General format

```
void setParameter( name, value )
```

Syntax rules

1. *name* is an alphanumeric data item that specifies the name of the parameter to set
2. *value* is an alphanumeric data item that specifies the value for the parameter

General rules

1. This method should be called before `doPost()` to prepare parameters to be passed.

saveResponseRaw

Saves the response received from the web server in the specified file.

General format

```
void saveResponseRaw( fileName )
```

Syntax rules

1. *fileName* is an alphanumeric data item that specifies the name of the destination file.

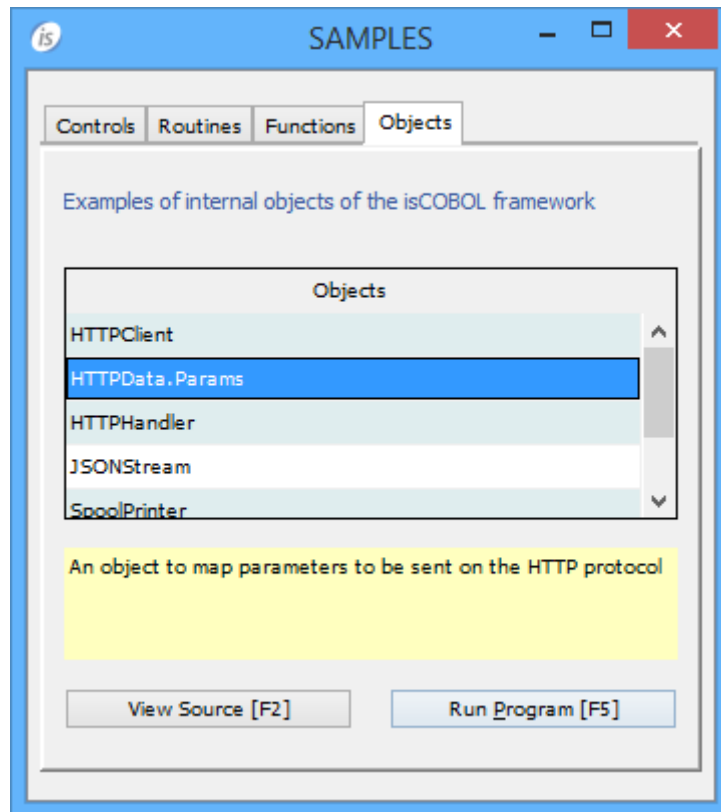
General rules

1. This method should be called when the response is a binary stream (e.g. a JPEG file).

HTTPData.Params class (com.iscobol.rts.HTTPData.Params)

The HTTPData.Params is an internal class that provides a simple way to define HTTP parameters to be passed in doGet and doPost methods.

A sample program can be found in isCOBOL Samples.



Constructor

Creates a new instance of the HTTPData.Params class.

General format

```
HTTPData.Params
```

General rules

1. A reference to HTTPData.Params should be defined in the program's Working-Storage Section.

Code example:

```
...
    configuration section.
    repository.
        class http-params as "com.iscobol.rts.HTTPData.Params"
...
    working-storage section.
...
    77 params object reference http-params.
...
    procedure division.
...
    set params to http-params:>new().
...
```

add

Adds an alphanumeric plain-text parameter.

General format

```
void add ( paramName, paramValue )
```

Syntax rules

1. *paramName* is an alphanumeric data item that specifies the parameter name.
2. *paramValue* is an alphanumeric data item that specifies the parameter value.

Example

To define parameters:

```
77 city-zipCode pic x(7) value "26456".
...
set params = http-param:>new()
               :>add("get_Zip_Code", city-zipCode).
```

addFile

Adds a disk file to the parameters. This method is useful to implement file upload features. The parameter created by this method is suitable for the [doPostMultipart](#) method.

Format 1

```
void addFile ( paramName, fileName )
```

Format 2

```
void addFile ( paramName, fileName, mimeType )
```

Syntax rules

1. *paramName* is an alphanumeric data item that specifies the parameter name.
2. *fileName* is an alphanumeric data item that specifies the disk file name.
3. *mimeType* is an alphanumeric data item that specifies the MIME type.

General Rules

1. *fileName* can be either just the file base name, a relative file path or an absolute file path.
2. In Format 1, the MIME type is automatically set to "application/octet-stream".

Connecting to a SSL-enabled web service

To connect to an SSL web server, you need to add the server's certificate to a local keystore.

Download the server's .cer file, and create a local keystore for it using the following command:

```
keytool -importcert -file <path_to_.cer_file> -keystore <keystore_file.jks> -alias  
    <keystore_alias>
```

You will be asked to assign a password to the keystore.

At this point you can add the following entries to the isCOBOL configuration (or set them from the program using the SET ENVIRONMENT statement):

```
iscobol.net.ssl.trust_store=/path/to/keystore_file.jks  
iscobol.net.ssl.trust_store_password=password
```

Useful definitions

User Agent / Client

The program that is used to request information from a server. This program is frequently a web browser, but it could be any program on the user's machine.

HTTP

Hypertext Transport Protocol, a standard encoding scheme used to transmit requests to web servers and receive responses from web servers. HTTPS is a secure version of HTTP.

Request

An HTTP packet that contains a command issued by the user agent. A request may simply GET a file from a web server, PUT a file to the web server, DELETE a file from the web server, or may POST data (such as a form) to the server, or it may cause a program to be run on the server. GET and POST are by far the most frequently used commands.

URL

Uniform Resource Locator, the location of a resource on the internet. A URL consists of a scheme (in this context, HTTP or HTTPS), the name of a machine, and a path to a file. For example, <http://www.veryant.com/eis/index.html> specifies the file called index.html from directories on a server machine veryant.com using the HTTP scheme. When this is typed into a web browser, the browser issues a HTTP GET request on this file.

REST

REST (Representational State Transfer) is an architectural style for distributed hypermedia systems and can be used to implement web services. While there is not a formal standard like SOAP, it is based on the four principle HTTP request types (GET, PUT, POST and DELETE), and URLs. In a REST architecture, a request payload be in any format desired, including XML or JSON.

Web Server

A program that runs on a server and listens for HTTP requests. When a request is received, the web server processes the request or sends it on to another program (such as J2EE Container like Tomcat) for processing.

Web Service (or WS)

A software system designed to support interoperable machine-to-machine interaction over a network

Servlet Container

A process that handles the execution of COBOL Servlets, turning them into a web page that the web server can deliver back to the client.

Response

A HTTP packet that contains the response to the request. The response may be text, to be displayed in a web browser, or data encapsulated for consumption by the requesting program.

Session

Requests are stateless, that is, the web server processes each request as if it had never received a previous request from the same user agent. A session is a BIS concept that allows sequential requests from the same user agent to be grouped together and preserves state information across requests on the server.

AJAX

Ajax (an acronym for Asynchronous JavaScript and XML) is a group of interrelated web development techniques used on the client-side to create asynchronous web applications

JS

JavaScript source code, or based on JavaScript source code

SOAP

(from <http://www.w3.org/TR/2007/REC-soap12-part1-20070427>): a SOAP message is specified as an XML infoset whose comment, element, attribute, namespace and character information items are able to be serialized as XML 1.0. Note, requiring that the specified information items in SOAP message infosets be

serializable as XML 1.0 does NOT require that they be serialized using XML 1.0. A SOAP message Infoset consists of a document information item with exactly one member in its [children] property, which MUST be the SOAP Envelope element information item (see 5.1 SOAP Envelope). This element information item is also the value of the [document element] property. The [notations] and [unparsed entities] properties are both empty. The Infoset Recommendation [XML InfoSet] allows for content not directly serializable using XML; for example, the character #x0 is not prohibited in the Infoset, but is disallowed in XML. The XML Infoset of a SOAP Message MUST correspond to an XML 1.0 serialization [XML 1.0].

WSDL

(from <https://www.w3.org/TR/2001/NOTE-wsdl-20010315>): A WSDL document defines services as collections of network endpoints, or ports. In WSDL, the abstract definition of endpoints and messages is separated from their concrete network deployment or data format bindings. This allows the reuse of abstract definitions: messages, which are abstract descriptions of the data being exchanged, and port types which are abstract collections of operations. The concrete protocol and data format specifications for a particular port type constitutes a reusable binding. A port is defined by associating a network address with a reusable binding, and a collection of ports define a service.