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# Introduction to RunTime Adaptor

Welcome to the Mainframe Cloud (MfC) RunTime Adaptor Installation and Administration Guide.

The MfC RunTime Adaptor is a Web Service Agent (WS Agent) that allows web app developers to build applications for the mainframe in modern web languages.

The MfC RunTime Adaptor provides a web service endpoint and runs as a standalone agent on a z/OS mainframe. Any standard web application can connect with the web service agent using a standard web service request.

The MfC RunTime Adaptor is designed for organisations that have an existing web application server infrastructure. Once installed the WS Agent is available 24/7.

This release of RunTime Adaptor supports a DB2 Interface.


## Intended Audience

This guide is intended for technical personnel responsible for installing, maintaining and administering a web service.

The RunTime Adaptor Install section will guide you through the installation of the RunTime Adaptor. Bundled with the RunTime Adaptor is the Security Interface Module (SIM). Full user authentication is managed through the installation of the SIM where the SIM manages individual user authority per RESTful transaction. For more information refer to the Administration section Security Interface Module (SIM).

The Administration section provides more detailed information regarding management of the web service agent.


## Writing Apps

Once the WS Agent is installed and setup, to learn how to write web apps for the WS Agent using the MainSpace SDK, refer to the MfC RunTime Adaptor User Guide on the Mainframe Cloud User Resources page.


## Detailed Specification

For a detailed overview of the RunTime Adaptor web service specification refer to the MfC RunTime Adaptor Reference Guide on the Mainframe Cloud User Resources page.

# Install, Setup and Start the RunTime Adaptor

The steps below guide you through the process of installing the Mainframe Cloud RunTime Adaptor and the Mainframe Cloud Security Interface Module.

MfC recommend running the RunTime Adaptor (WS Agent) as a started task.

## Step 1 – Requirements

1.      Confirm that you have the following z/OS components:

   - IBM z/OS 2.1 or later for supported z/OS releases.

   - A z/OS TSO userid.

2.      Confirm that you have an existing web application framework.


## Step 2 – Obtain a Licence

The RunTime Adaptor (WS Agent) requires a Licence from Mainframe Cloud. To obtain a licence provide Mainframe Cloud with your machine serial number. Mainframe Cloud will issue you the LICCODE and LICEXPDT that are required in Step 3 – Collect Input Parameters.

To determine the machine serial number, dependant on your configuration, issue one of the system commands below:

   - D M=CPU
     This will display the serial number where the serial number is 02F45B, and the last 4 characters are the machine type:

     ```
     D M=CPU
      IEE174I 16.44.26 DISPLAY M 971
      PROCESSOR STATUS
      ID  CPU                 SERIAL
      00  +                     02F45B1090
     ```

   - D M=CORE
     This will display the serial number where the serial number is 003D7E.

     ```
     D M=CORE
      IEE174I 14.17.27 DISPLAY M 833
      CORE STATUS: HD=Y    MT=1
      …
      CPC SI = 1090.306.IBM.02.0000000000003D7E
     ```
   - Provide Mainframe Cloud with the 6-character serial number.

   - Mainframe Cloud will provide you with the LICCODE and LICEXPDT.

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## Step 3 – Collect Input Parameters

To start your RunTime Adaptor (WS Agent) on your z/OS mainframe you need the following information as input to your JCL.

### WS Agent Parameters

**TCP/IP Listen Port**

>The TCP/IP port that the WS Agent listens for requests on. Assign a port number between 1024 to 65535 that is not used by another application.
>If in doubt, consult your Network/System Administrator.
>Valid Range: A port number from 1024 to 65535

**RUNMODE**

>The RUNMODE identifies the type of user.
>
>- 1 = Multi-user mode (Default)
>
>- 2 = Single-user mode
>
>Recommend using RUNMODE=1

**LICEXPDT**

>Mainframe Cloud will provide you with this licence date.
>The LICEXPDT specifies the Licence expiry date (YYYYMMDD).

**LICCODE**

>Mainframe Cloud will provide you with this licence code.
>The LICCODE specifies the Licence Code (8 hex digits).

**SSLRING**

>SSLRING specifies the SSL RING name. The RACF SSL ring name is the name attached to the WS Agent region userid. If not specified, then the Agent will run in non-encrypted mode.

**SSLCERT**

>SSLCERT specifies the SSL certificate. This field is only applicable if SSLRING is specified. SSLCERT value must be enclosed in quotes if there are any blanks included.
>Default is either the only certificate defined in the SSL ring, or the certificate marked as the default certificate in the SSL ring.

**SOCKIDLETIMEOUT**

>SOCKIDLETIMEOUT specifies the Socket timeout (in seconds). Any open sockets waiting for input from the client for this time period will be terminated.
>Default is 60 seconds.

**APPIDLEWARN**

APPIDLEWARN specifies the application idle warning timeout (in seconds). When an application task is waiting for client input for this interval, an informational message will be issued.

Default is 300 seconds (5 minutes).

**APPIDLETIMEOUT**

APPIDLETIMEOUT specifies the application idle timeout (in seconds). An application task that is waiting for client input for this time period will be cancelled.

Default is 3600 seconds (1 hour).

**TRACE**

TRACE specifies the tracing options to be turned on. Options are:

- TRACE=7F        for Full tracing of AGENT, DATA, MODULE and C.

- TRACE=7C        for All tracing excluding C socket tracing.

- TRACE=00        for no tracing (Default).

**Example** (an asterisk in column 1 denotes a comment line).

```
PORT=34567              TCP/IP Port
RUNMODE=1
LICEXPDT=20171231       Provided by Mainframe Cloud
LICCODE=A1B2C3D4        Provided by Mainframe Cloud
*SSLRING=MFCRING
*SSLCERT='MFC WS Agent Certificate'
SOCKIDLETIMEOUT=60      Socket idle timeout (seconds)
APPIDLEWARN=300         Application idle warn (seconds)
APPIDLETIMEOUT=3600     Application idle timeout (seconds)
*TRACE=7F               Set Tracing on
```

## App Input Parameters

**IP Address or Host Name**

Identify the IP Address or Host Name of the z/OS LPAR you plan to run the WS Agent.

**TCP/IP Port**

Note the TCP/IP Listen Port for your first App test.

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## Step 4 – Install and Setup RunTime Adaptor

1. Allocate a dataset, say *tsopref*.V2.FILES. Any target filename can be used. This will be the target of the file upload in a later step.

   - where *tsopref* is your default prefix, typically your userid

   - with attributes SPACE 15 tracks, RECFM=FB,LRECL=80,BLKSIZE=27920

2. Download the Mainframe Cloud binary installation file to your PC from here.

3. Use FTP or IND$FILE transfer service associated with your 3270-emulator software to upload the Mainframe Cloud installation file to your mainframe, in binary, to the dataset allocated in a previous step (*tsopref*.V2.FILES).

4. From ISPF/PDF COMMAND option (option 6) issue the following:

   - RECEIVE INDA('*tsopref*.V2.FILES')

   - This will unload to *installhlq*.INSTALL where *installhlq* = *tsopref*.V2.D*yymmdd*

   - This INSTALL library is only used for the installation process.

   - Change *installhlq* to your naming standards, if required. For example, after the prompt INMR906A Enter restore parameters… specify DA('MFC.V2.INSTALL') to unload to MFC.V2.INSTALL.

5. From ISPF/PDF COMMAND option (option 6) issue the following:

   - EXEC '*installhlq*.INSTALL(install)' where *installhlq* was the target HLQ of the RECEIVE command in the previous step.

   - This will prompt for the target HLQ *mfchlq* to use for the MFC libraries.

   - Mainframe Cloud recommends *mfchlq* = **MFC.V2** as the HLQ for the RunTime Adaptor (agent) libraries.

   - If none is entered, the default *mfchlq* = *installhlq*

   - This EXEC will unload the EXE, LOAD, LOADAUTH and PARMLIB datasets, all with *mfchlq* prefix. These are the production datasets required by the RunTime Adaptor region. These may be copied or renamed as appropriate according to your naming standards and installation scheduling processes.

6. Customise the started task JCL in *installhlq*.INSTALL(MFCWSERV)

   - Change the HLQ on the MFC libraries as required.

   - Change the DB2 loadlib SDSNLOAD to its correct name if required.

   - If SDSNLOAD is already in the system LINKLIST, then there is no need to include it in the STEPLIB.

7. Copy this started task JCL *installhlq*.INSTALL(MFCWSERV) to a system PROCLIB.

8. Customise the parameter file in *mfchlq*.PARMLIB(WSAGENT)

   - Change the input parameters as collected in [Step 3 – Collect Input Parameters.](#)

| PORT= | Mandatory | |
|---|---|---|
| RUNMODE= | Optional | Default=1 |
| LICEXPDT= | Mandatory | Provided by Mainframe Cloud |
| LICCODE= | Mandatory | Provided by Mainframe Cloud |
| SSLRING= | Optional | |
| SSLCERT= | Optional | |
| SOCKIDLETIMEOUT= | Optional | Default is 60 seconds |
| APPIDLEWARN= | Optional | Default is 300 seconds |
| APPIDLETIMEOUT= | Optional | Default is 3600 seconds |
| TRACE= | Optional | Default is no tracing |

9. APF authorise *mfchlq*.LOADAUTH

   - This typically is done by a Systems Programmer.

   - To make this permanent, update the appropriate PROGxx member in the system PARMLIB. Alternatively, issue the dynamic system command:

     o SETPROG APF,ADD,DSN=*mfchlq*.LOADAUTH,VOL=*volser*
       (Substitute the correct volser of the LOADAUTH dataset. If SMS managed, specify *SMS* as the volser).

## Step 5 - Start the RunTime Adaptor

To start the MfC RunTime Adaptor (WS Agent), issue the MVS Console command:

   - S  MFCWSERV

Or,

   - S  MFCWSERV,MEMBER=WSAGENT   to select a non-default PARMLIB member name.

To stop the MfC RunTime Adaptor (WS Agent), issue the MVS Console command:

   - P MFCWSERV

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## Step 6 – Verify the RunTime Adaptor

To verify that the MfC RunTime Adaptor (WS Agent) has been installed and setup correctly run this simple test.

From your Browser of choice issue the following request:

- http://*hostname*:*port*

Where:    *hostname* is the IP Address or Host Name collected in Step 3.
          *port* is the TCP/IP Listen Port collected in Step 3.

The expected response is:

"This is the root page of MfC Web Service. No web service name was passed."

## Step 7 – Add to System Automation

Add automatic startup of the Run Time Adaptor (WS Agent) to your system. The Run Time Adaptor is a sockets application and is therefore dependent on TCP/IP (z/OS Communications Server) being active.

Add the start MFCWSERV command to the post Communications Server automatic startup list. Similarly, add the stop MFCWSERV to the pre-Communications Server stop list.

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# Administration of RunTime Adaptor

## Security Interface Module (SIM)

The Security Interface Module (SIM) is installed during the installation of the WS Agent. The SIM Modules reside in the *mfchlq*.LOADAUTH library.

- SIM manages Full User Authentication.

- SIM manages individual user authority per RESTful transaction.

- SIM requires an APF authorised library.

- SIM is a pre-requisite for Multi-user Mode.

- Access to DB2 is based on the Userid and Password of the individual user and not the Web Service Agent region userid.

## TCP/IP Port

The TCP/IP Port is the port the WS Agent listens for requests on. Assign a port number between 1024 to 65535 that is not used by another application.
If in doubt, consult your Network/System Administrator.

Valid Range: A port number from 1024 to 65535.

## Multi-user or Single user Mode

The RunTime Adaptor can operate in either single user or multi-user mode with the parameter RUNMODE. The default is Multi-user mode.

### Multi-User Mode

A multi-user agent allows for a single agent region to perform services for any number of different users. The MfC authorised SIM load library is a pre-requisite for multi-user mode. Full security credential validation is performed using the site's security software system (RACF, ACF2 or TSS).

### Single User Mode

An agent operating in single user mode performs services for a single userid, that being the owner of the region who started the agent. Other users are prevented access to a single user agent. Single user mode can run with or without the MfC SIM authorised LOAD library. SIM provides for full user authentication. It is strongly recommended that the SIM library be enabled for single user mode, to perform full security validation.

## Licencing

Mainframe Cloud will provide you with the licence parameters as outlined in [Step 2 – Obtain a Licence](). The licence parameters LICEXPDT and LICCODE are managed in the initialisation parameters member *mfchlq*.PARMLIB(WSAGENT).

For the last month prior to a licence expiry, the agent region initialisation will issue a warning that the licence is about to expire.

## SSL Setup

Secure Sockets Layer (SSL) has been implemented in the C sockets module. SSL setup is actioned in the initialisation parameters member *mfchlq*.PARMLIB(WSAGENT) with the parameters:

- SSLRING=MFCRING

- SSLCERT='MFC WS Agent Certificate'

The MfC RunTime Adaptor (WS Agent) only supports certificates managed by RACF (or ACF2 or Top Secret). Certificate management by the z/OS shell-based gskkyman utility is not supported.

### SSLRING

The SSLRING parameter specifies the SSL ring name that is connected to the userid of the agent region. If SSLRING is not specified, then SSL is not used, and logic follows the standard HTTP logic. If SSLRING is specified, SSL is used for all socket connections.

### SSLCERT

The SSLCERT parameter specifies a certificate that is defined in the nominated SSL ring. SSLCERT is optional. If it is specified, then the nominated certificate must be defined in the SSL ring. If SSLCERT is not specified and there is only one certificate defined in the SSL ring, then that is the one used. If there are multiple certificates defined in the SSL ring and one of those certificates is marked as the default, then that marked certificate is used.

### Using SSL

To use SSL with the supplied JavaScript driver, one needs to address the local page using https:// prefix instead of the usual http://. The local server must be configured with SSL and certificate, etc. In addition, the URL for the mainframe RunTime Adaptor (WS Agent) on the driver page will also need the https:// prefix.

# Timeouts

There are 3 timeout options that can be specified in the initialisation parameters member *mfchlq*.PARMLIB(WSAGENT):

- SOCKIDLETIMEOUT=60          Socket idle timeout (seconds)

- APPIDLEWARN=300          Application idle warn (seconds)

- APPIDLETIMEOUT=3600          Application idle timeout (seconds)

The above values are the defaults, if these options are not specified.

### SOCKIDLETIMEOUT

The SOCKIDLETIMEOUT parameter specifies the maximum number of seconds that an idle socket connection will wait for the next input from the client web application. If the socket connection sits idle waiting for client input for the specified time interval, the socket connection is closed. This timeout is of no concern to the web application or the RunTime Adaptor (WS Agent), as the application task remains intact. A subsequent web service call should always specify a session id to target an existing session.

### APPIDLEWARN and APPIDLETIMEOUT

The APPIDLEWARN and APPIDLETIMEOUT parameters are timeouts related to the logical application session (associated with a specific session id). The timeouts relate to a session waiting for client input. They are not related to a busy (waiting or looping) application task. In the case of the defaults as above, an informational message will be produced every 300 seconds (5 minutes) noting that a session has been idle for n * 300 seconds. If the total idle time exceeds 3600 seconds (1 hour), then the logical session will be terminated. If an active DB2 session was in effect, a ROLLBACK (if applicable) will be initiated, followed by a DISCONNECT, and then the application task will be terminated.

# Tracing and Dumps

Some limited tracing has been added to the RunTime Adaptor (WS Agent). This is intended for MfC support purposes. It is recommended that tracing should only be done as requested by MfC Support.

Tracing can be started via the startup parameters or dynamically via system commands. The trace information will be included in the System Dump dataset and the region SYSOUT (for C socket tracing).

### TRACE startup parameter

The TRACE startup parameter was defined in Step 3 – Collect Input Parameters and included in the member *mfchlq*.PARMLIB(WSAGENT). The options are:

- TRACE=7F          for Full tracing with options AGENT, DATA, MODULE and C.

- TRACE=7C       for tracing with options AGENT, DATA and MODULE.

    That is, ALL excluding C socket tracing.

- TRACE=00       for no tracing (Default).

    If necessary, other trace options will be provided by MfC Support.

**Dynamic Tracing**

The options for turning on dynamic tracing are AGENT, DATA, MODULE and C.

To dynamically turn on or off full tracing use the following system commands:

- F MFCWSERV,TRACE START ALL

- F MFCWSERV,TRACE STOP ALL

To dynamically turn on or off specific tracing options (as specified above) use the following system commands, for example:

- F MFCWSERV,TRACE START AGENT DATA

- F MFCWSERV,TRACE STOP AGENT DATA

**Dump the region**

To DUMP the region, use system commands:

- F MFCWSERV,DUMP

Or,

- DUMP COMM=('MFC Dump')
  R *xx*,JOBNAME=*regionname*
       substituting *regionname* with the WS Agent jobname.

These commands will dump to a system dataset.

**Steps for Tracing the WS Agent and Reporting to MfC**

To report issues to Mainframe Cloud it would assist if MfC Support had a DUMP of the trace. Follow these steps to provide diagnostics to MfC.

1.    Put TRACE in the Startup parameter member or dynamically turn it on.

2.    Run the test.

3.    Take a system dump of the RunTime Adaptor (WS Agent) region.

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4. Send the following to MfC Support:

- o The System Dump dataset compressed with the standard IBM AMATERSE program. Sample JCL:

```
//jobcard
//STEP1    EXEC PGM=AMATERSE,PARM=PACK
//SYSPRINT DD   SYSOUT=*
//INFILE   DD   DISP=SHR,DSN=dump_dataset
//OUTFILE  DD   DISP=(NEW,CATLG),UNIT=3390,
//         SPACE=(TRK,(3000,150),RLSE),
//         DSN=MFC.DUMP.TERSE
```

- o The full RunTime Adaptor (WS Agent) JOB output.