R4Z Installation and Configuration Guide

Qlik Replicate™

November 2020 or above

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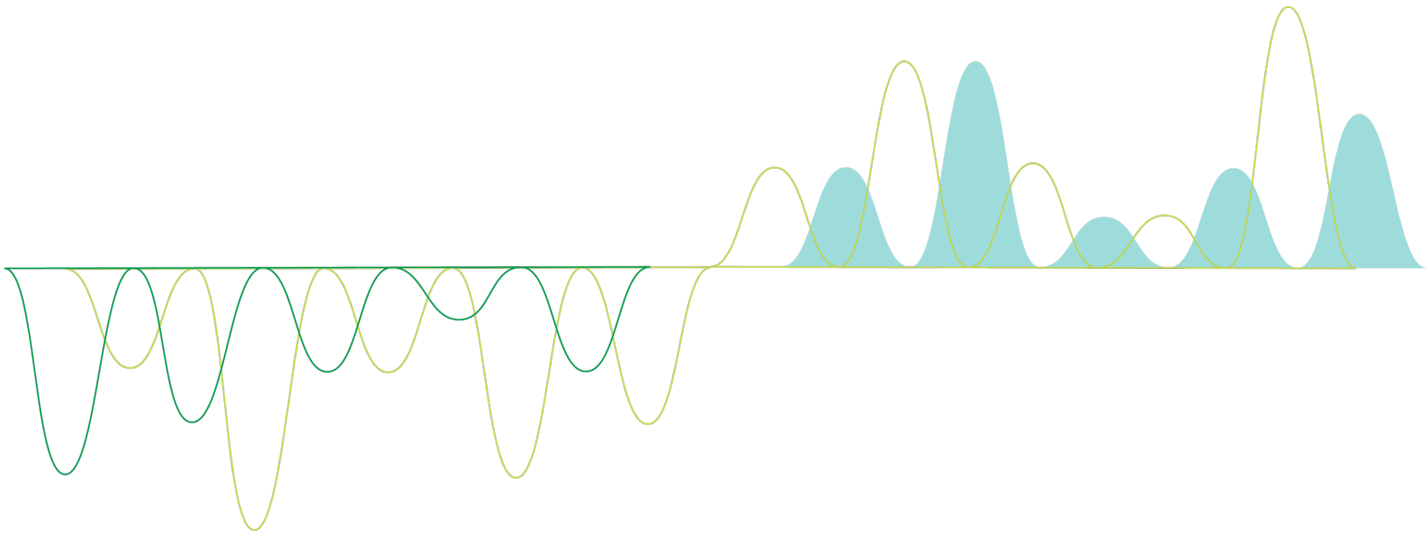

Contents

1 Introduction

This guide describes how to install, upgrade, and configure the Qlik R4Z component on the DB2 mainframe environment. This component is required when working with the *Qlik Replicate* IBM DB2 for z/OS endpoint.

For instructions on configuring the Qlik Replicate IBM DB2 for z/OS endpoint, please refer to the Qlik Replicate Setup and User Guide.

2 R4Z Components and the Associated Environment

This guide uses the terms highlighted below to designate the relation between all components involved in the replication process.

- The **Replicate endpoint** is associated with:
  1. A *z/OS host*, which can be a single system (LPAR) or a Sysplex, via a TCP/IP address. Referring to a Sysplex requires defining a VIPA that points to a set of systems.
  2. A *DB2 location name* active within the above z/OS host, which is the logical identification of a DB2 subsystem ID (non-data sharing) or a "group attach", which may refer to several members of a data sharing DB2.
     The endpoint also specifies a **CDC reader UDF** name (in the *Advanced* pane). This is an external UDTF (User-Defined Table Function) which is referenced by a "SELECT … FROM TABLE(…)" statement issued from the Replicate task. The CDC reader UDF (UDF for short) is created in DB2, at the location name specified above, by SQL DDL, as part of the installation. This definition also specifies:
     1. The name of the external program to be executed for serving the function call. This name must not be changed;
     2. The name of the WLM APPLENV (application environment) through which the program is to be executed – Defined as part of the installation.
        The WLM APPLENV specifies, as one of its attributes, the name of a JCL procedure for initiating a started task (STC) address space. Such STC address spaces, also known as WLM servers, are started and managed by WLM) upon calls to the UDF, to invoke the external program to be executed for serving the function call. The JCL procedure is being stored in a PROCLIB library as part of the installation.
- The CDC reader UDF name.
  If this name matches a specific pattern, it specifies a CDC service qualifier to be associated with the UDF invocation. The CDC service, which is defined in the R4Z CONFIG library as part of the installation and may be altered at any time later, designates certain system resources and configuration settings to be used by the CDC processing. If the UDF name does qualify for the said pattern, a default CDC service is associated with the UDF.

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3 R4Z Product Libraries

The following library types are required by the product:

- LOAD and INSTALL libraries - These libraries are received from the installation kit. Therefore, their content is version-dependent and cannot be reused by other versions.
- CONFIG and CNTL libraries - These libraries are created during the installation and configuration. As a result, their content can be reused by successive versions of the product (depending on the specific case).

To accommodate for these different use types, it is recommended to use separate high-level qualifiers for the R4Z product libraries:

- R4Z “version-specifc” high-level qualifier, with the following libraries:
  - **LOAD** - Found in the kit; contains executable load modules.
  - **INSTALL** - Found in the kit; contains installation scripts/JCLs and sample jobs.

    This qualifier will henceforth be referred to as **`<r4z-vnd-hlq>`**.
- R4Z "basic" high-level qualifier, independent of versions, with the following libraries:
  - **CONFIG** - Created during the installation; contains the CDC services configuration.
  - **CNTL** -To be created by the person performing the installation, for saving JCL components - jobs and Include members. It is possible to allocate several CNTL libraries, assigning them a name that contains the CDC service name. This is useful if the CDC services are to be managed independently of one another.

    This qualifier will be henceforth referred to as **`<r4z-bsc-hlq>`**.

4 Receiving Product-Supplied Modules and Scripts

The following instructions explain how to download and receive the required modules and scripts.

To receive the load modules and installation components:

1. Download the **AttunityReplicate_<version>_R4Z.zip** file from the Downloads site or obtain it from your Qlik Sales representative. Once downloaded, unzip the file contents to your workstation.
   The zip file contains the following files:
   - `r4z.vxx.ryy.spzz.install.xmit` – JCLs; ISPF dialog components.

     > *The version identifiers, namely: major release, minor release, and service pack, are indicated by `xx`, `yy` and `zz` respectively.*

   - `r4z.vxx.ryy.spzz.load.xmit` – Executable load modules.
   - `version.txt` - A text file listing the version identifiers in this kit.
   - `ftpxmit.bat` – A .bat file to transfer the XMIT files mentioned above to z/OS, through FTP.
2. Pre-allocate the following 1 cylinder datasets with LRECL=80,RECFM=FB,DSORG=PS:
   - <xmit-HLQ>.INSTALL
   - <xmit-HLQ>.LOAD
3. Perform a binary transfer of `r4z.vxx.ryy.spzz.load.xmit` to **<xmit-HLQ>.LOAD** and of `r4z.vxx.ryy.spzz.install.xmit` to **<xmit-HLQ>.INSTALL**.
4. In TSO, use the RECEIVE command to create and populate the INSTALL and LOAD libraries from the matching xmit files, which should now exist in the host z/OS.
   You can do that in either of the following methods:
   - Using the sample job below to invoke the RECEIVE command;
   - Running the RECEIVE command directly under TSO:

   a. From the ISPF TSO command shell run the command bellow per each library <type>, INSTALL or LOAD:
      ```
      Receive indsn('<xmit-HLQ>.<type>')
      ```
   b. When prompted `INMR906A Enter restore parameters or 'DELETE' or 'END' +`, respond with the output dataset and other parameters; for example: `Receive dsn ('<r4z-vnd-HLQ>.<type>').`
      These RECEIVE commands will populate the INSTALL and LOAD libraries.

4.1 Sample Job

Bellow is a sample RECEIVE job. For non-SMS datasets, change `<volser>` to a valid volume serial number. For SMS datasets, delete **UNIT** and **VOLUME**.

```
//RECEIVE JOB NOTIFY=&SYSUID

//RECEIVE1 EXEC PGM=IKJEFT01,DYNAMNBR=11

//SYSTSPRT DD SYSOUT=*

//SYSTSIN DD *

RECEIVE INDSNAME(<xmit-HLQ>.INSTALL')

DSNAME('<r4z-vnd-HLQ>.INSTALL') UNIT(3390) VOLUME(<volser>)

RECEIVE INDSNAME('<xmit-HLQ>.LOAD')

DSNAME('<r4z-vnd-HLQ>.LOAD') UNIT(3390) VOLUME(<volser>)
```

5 Migrating the R4Z Product in z/OS

If an older version of the product is already installed and operating in the environment, it is mandatory to complete these instructions before starting the installation of the new version.

If you want to upgrade your R4Z installation and override the current installation, or if you want to upgrade your R4Z installation without overriding the currently installed version, you need to perform the relevant steps outlined below.

If the existing version is 5.5 or 6.0, consult with Qlik Support. Depending on the level, running the two versions in parallel may not be supported.

To upgrade your R4Z installation without overriding the currently installed version:

If you are running version 6.1 or above, you should be able to run the two versions in parallel, provided that:

- Each version has its own WLM server JCL procedure, where the LOAD library of that version is specified in the STEPLIB DD of the JCL procedure.
- The R4Z product must already be installed with `DEFWLMAE=PER` specified, to ensure that each CDC service is executed in its own WLM server.

To upgrade your R4Z installation and override the currently installed version:

Suspend all CDC services using R4Z as follows:

1. Use the following operator command to quiesce the WLM application environment and prevent clients from auto-activating the CDC service before it is ready:
   `VARY WLM,APPLENV=<applic.env-name>,Q`
   Repeat this for all application environments using the JCL procedure(s) which specify the LOAD library of the version being replaced. If the host is a Parallel Sysplex, precede the command with `ROUT *ALL`, routing it to all systems in plex.
2. Use the `R4ZUTIL TERMINATE` verb to free all system resources currently used by the CDC service. Repeat this in all LPARs where it may be executing (if the source DB2 has data sharing members in those systems).

6 Installing the R4Z Product in z/OS

The configuration steps below include submitting jobs found in the INSTALL library (referred to as **<r4z-vnd-hlq>.INSTALL** in topic *R4Z Product Libraries (page 6)*). Each job requires the INSTALL library (or its copy) as its JCLLIB, and must have both a job card and JES control statements that comply with the site's regulations.

6.1 Applying the Installation in the Processing Environment

During the installation process you are required to submit most of the members with the prefixed "DO*" in the library. Before you submit these members you have to edit them as follows:

1. Set the job name, the job card parameters, and JES control statements to comply with your system requirements.
2. Set the library specified in the `JCLLIB ORDER` parameter as the INSTALL library.

Therefore, before submitting any job, you should create a JCL library that contains all updated "DO" jobs. If you want to create a single set of jobs per all CDC services, it is advisable to assign the JCL library the name **<r4z-hlq>.COMMON.CNTL**; otherwise use the CDC service qualifier as a DSNAME node; for example **<r4z-bsc-hlq>.<CDC-qual>.CNTL**.

The installation kit also includes members with the prefix "UN"; each job starting with "UN" performs the UNDO action of the job by the same name that starts with "DO". If need to use one of these jobs, make the same changes that you applied to the "DO" jobs.*

Step 1: Setting the INSTALL Library INCLUDE Members

You need to set the JCL symbols below before running any job, as the "DO" jobs use these JCL symbols to configure the R4Z processing. To change their values, you will need to first run the "UNDO" job with the old value, and then the "DO" job with the new value.

- Variables common to the entire R4Z installation

DFSYMLST	**INCMEM: define general system resources**	**Once per installation**
Sets: &SSID, &PROCLIB, &DB2HLVL, &CEERUNL, &DB2LOADL, &DB2EXITL, &DB2RUNL, &DB2VER, &R4ZHLVL, &R4ZLOADL, &R4ZINSTL, &R4ZCNFGL, &R4ZUSER, &DEFWLMAE, &ALCSMS, &ALCSMSPM, &ALCVLSER		

Edit this member to set the JCL symbols to be used by jobs in this library and then save (override) the member. These symbols are listed in the *Installing the R4Z Product in z/OS (page 10)* table.

Following is a more detailed explanation of several of the parameters:

- Parameters that specify the R4Z product library names:
  `&R4ZHLVL` - Set to the high-level-qualifier which is common to the R4Z INSTALL, LOAD and CONFIG libraries, i.e. the longest common part of these libraries names.
  - `&R4ZVNDH` - Set to the value you used as the "versioned" high-level qualifier (**<r4z_vnd_HLQ>**) when receiving the INSTALL and LOAD libraries.
  - `&R4ZBSCH` - Set to the value you chose for the "basic" high-level qualifier (**<r4z_bsc_HLQ>**), which will be used when creating the CONFIG library.
  - `&R4ZINSTL, &R4ZLOADL, &R4ZCNFGL` - Specify these only if their value is different than that set within DFSYMLST member, based on the symbols described above.
- Parameters that control DASD allocation.
  - `ALCSMSPM, &ALCVLSER` - Use these parameters to designate the volume(s) on which the CONFIG library, and some intermediate datasets will be allocated.
    Use `&ALCSMSPM` to specify SMS allocation attributes in a comma-delimited, space-terminated string, in the following format:
    `'[STORCLAS=...][,MGMTCLAS=...][,DATACLAS=...] '`
    Use `&ALCVLSER` to specify the volume serial.
    If SMS-managed allocation is driven by ACS routines, you can omit all attributes and specify `&ALCSMSPM=' '`(a single space) instead.
    If you specify `&ALCSMSPM=' '`(a single space), you must specify a value for the `&ALCVLSER` parameter.
    For non SMS-managed allocations, use `&ALCVLSER` to specify the volume serial.

- CDC service and UDF- related variables

DFSYMPER	**Define names for the UDF, the WLM application env and STC procedure, based on the CDC service qualifier**	**Per R4Z installation**
Uses: `&CDCSRV` Sets: `&R4ZWLMPR, &R4ZAPPNV, &R4ZIFITF, &R4ZSCNM, &STCUSER, &UDFUSER`		
DFSYMONE	**Define names for the UDF, the WLM application env and STC procedure, assuming a single CDC service is used**	**Per DB2 subsystem**
Sets: `&R4ZWLMPR, &R4ZAPPNV, &R4ZIFITF, &R4ZSCNM, &STCUSER, &UDFUSER`		

Depending on the value selected for DEFWLMAE, ONE or PER, edit member DFSYMONE or DFSYMPER respectively, and select values for the WLM APPLENV, the WLM JCL procedure for the CDC reader UDTF.

In DFSYMPER member, these names are formed by a symbol designating the name prefix, followed by a 4-character qualifier specifying the CDC service. Do not remove the double-underscore at the end of the APPLENV name or UDTF name – these are used as delimiters, denoting the CDC service to be associated with the named resource.

Step 2: Performing Configuration Actions

1. Set the R4Z LOAD library as APF-authorized.
   To set a library as APF-authorized temporarily (until the next IPL or APF update), you can run one of the following system commands:
   - For non SMS-managed data sets:
     setprog apf,add,dsn=<xmit-HLQ>.LOAD,volume=<volser>
   - For SMS-managed data sets:
     setprog apf,add,dsn=(<xmit-HLQ>.LOAD,sms
     To make the setting permanent, add the library to your PROGxx member in PARMLIB.
2. Set up a WLM application environment to execute the CDC process.|

DO2WLMAE	Define WLM Application environment	Per CDC service
Accepts: &CDCSRV Uses: &R4ZAPPNV, &R4ZWLMPR, &CEERUNL, &DB2EXITL, &DB2LOADL, &DB2RUNL		
DO2WLMPR	Create JCL procedure for WLM STC	per WLM procedure
Accepts: &CDCSRV Uses: &PROCLIB, &R4ZWLMPR, &SSID		
DO2WLMPV	Job: In define WLM server as a resource in RACF, and authorize APPLENV and DB2 subsystem to use it	per CDC service and WLM procedure
Accepts: &CDCSRV Uses: &R4ZAPPNV, &R4ZWLMPR, &STCUSER		

   Depending on the value set for DEFALMAE, run the following jobs, once (if ONE is selected) or PER each CDC service to be defined (if PER is selected), after setting JCL symbol CDCSRV with the relevant CDC service qualifier.
   1. Edit job DO2WLMAE; set symbol &CDCSRV to the relevant CDC service qualifier and submit. The job will define the WLM APPLENV in the WLM policy dataset and activate it.
      - **Prerequisites:**
        - &R4ZWLMPR is the name of the started task that WLM will use. You need to associate a valid user to the started task and set &STCUSER to that user.

- The submitter needs UPDATE access to MVSADMIN.WLM.POLICY, to query and update the WLM policy.
- UPDATE on the procedure library specified in DSSYMLST in the &PROCLIB symbol.

2. Edit job DO2WLMPR; set the symbol &CDCSRV to the relevant CDC service qualifier and submit. The job will create a JCL procedure for the APPLENV, and should terminate with RC 0.
   - **Authorizations:**
     UPDATE on the PROCLIB library.
3. Edit job DO2WLMPV; set the symbol &CDCSRV to the relevant CDC service qualifier and submit. The job will set RACF privileges for the APPLENV to use the WLM server, and for the DB2 subsystem to call it. The job should terminate with RC 0.
   - **Authorizations:**
     ALTER on class SERVER
     If you are using a security package other than RACF (for example, as CA-TSS or CA-ACF2) , you will need to run the commands relevant to your security package.

3. Create the CDC reader UDTF(s).

DO3SRVDF	**Create the default CDC service UDTF**	**Per DB2 subsystem**
Uses: &R4ZSCNM, &R4ZIFITF, &R4ZCNFGL, &ALCSMS, &ALCSMSPM, &ALCVLSER, &SSID, &DB2EXITL, &DB2LOADL, &DB2RUNL, &UDFUSER		
DO3SRVTF	**Create a UDTF to be used by a specific CDC service**	**Per CDC service and DB2 subsystem**
Accepts: &CDCSRV Uses: &R4ZSCNM, &R4ZIFITF, &R4ZCNFGL, &ALCSMS, &ALCSMSPM, &ALCVLSER, &SSID, &DB2EXITL, &DB2LOADL, &DB2RUNL, &UDFUSER		

The first job creates the default-service UDTF with specific name &R4ZIFITF (under schema name &R4ZSCNM) and grants execution on it to &UDFUSER. It also instantiates a “supplied” CDC service, CDC1 (by creating such a member CONFIG library), setting it with default configurations. This job must be run first.
The second job, which is ran per each CDC service defined explicitly, performs exactly as the first job, except each UDF is associated with a specific CDC service, which is instantiated from the CDC1 service.

1. Run job DO3SRVDF. It will:
   - Create a UDTF with an un-suffixed name, which will be associated with the default CDC service (CDC1).
   - Create the CONFIG library and place a member named CDCS, to be used when no CDC service-related member exists.

   Jobs should terminate with `RC4`.
2. Per each CDC service you want to define, edit job DO3SRVTF; set symbol &CDCSRV to the relevant

CDC Service qualifier and submit. It will

- Create a UDTF with its name suffixed "__&CDCSRV", which will be associated with the default CDC service ""&CDCSRV".
- Create a member named "&CDCSRV" in the CONFIG library.
- Set JCL symbol CDCSRV with the relevant CDC service qualifier (xxxx), and submit the job.

Jobs should terminate with `RC4`.

- **Authorizations:**
  The submitting user must have one of the following authorizations:
  - SYSADM or SYSCTRL authority.
  - CREATEIN authorization in the schema designated by `&R4ZSCNM`.

4. Enable specified user-ID to run CDC tasks.

DO4GRANT	Grant ODBC user access to catalog tables, and permission to read CDC	Per DB2 subsystem
Uses: &R4ZUSER, &SSID, &DB2EXITL, &DB2LOADL, &DB2RUNLR		

This job enables the user-ID selected for ODBC interaction, i.e.: the “ODBC user”, that is authorized (DB2-wise) to read CDC data and some of the DB2 catalog tables.

> *There is no point submitting the job from the ODBC user itself, (as a user cannot grant itself privileges), or from a user that does not own the privileges it attempts to grant.*

Run job DO4GRANT. It will:

- GRANT SELECT to the ODBC user on the following tables:
  - SYSIBM.SYSTABLES
  - SYSIBM.SYSTABLESPACE
  - SYSIBM.SYSCOLUMNS
  - SYSIBM.SYSROUTINES
  - SYSIBM.SYSDUMMY1
  - ALTER SYSIBM.SYSTABLES enabling DATA CAPTURE.

Jobs should terminate with `RC 0` or `RC 4`.

Authorizations:

The submitting user must have either of the following authorizations:

- SYSADM or SYSCTRL authority.
- TRACE/ MONITOR2 with grant option.

5. Provide security permissions for the WLM started task to cancel itself. In RACF this is done as follows:
   a. Define a PROFILE for the OPERCMDS class called PERMIT MVS.CANCEL.STC.mbrname.*:
   ```
   RDEFINE OPERCMDS MVS.CANCEL.STC.mbrname.* UACC(NONE) SETROPTS
   REFRESH RACLIST(OPERCMDS)
   ```
   Where `mbrname` is the name of the started task.

b. Grant the USERID assigned to the WLM started TASK the authority to cancel the started task:
`PERMIT MVS.CANCEL.STC.mbrname.* CL(OPERCMDS) ACCESS(UPDATE) ID (stcuser)`
Where `stcuser` is the USERID associated with the WLM started task.

6. Performance considerations:
   a. **Full Load** – The Full Load processes will utilize any available ZIIP processors. Best practice is to set the performance goal that the processes get classified to lower than online workloads. In a very busy system, you might want to consider setting **Honor Priority** to **NO** for the service class assigned to the Full Load. This requires z/OS 2.1 + OA50845 or z/OS 2.2 and above.
   b. **CDC** – Best practice is to set the performance goal for the CDC processes equal to any online workloads and higher than the Full Load goal. These processes can either be classified using any of the following:
   - The name of the WLM application environment started task
   - The DDF classification with 'Procedure Name'

Symbol Name	**Description**	Attribute **Default Value**
&SSID	The subsystem-ID of the source DB2.	4-character name.
`DSN1`		
&DB2HLVL	High-level qualifier of DB2 installation libraries, not including SSID qualifier.	<qualifier>.<qualifier>…
`DSNB10`		
&DB2LOADL	High-level qualifier of DB2 SDSNLOAD library.	Library name.
`&DB2HLVL..&SSID..SDSNLOAD`		
&DB2EXITL	High-level qualifier of DB2 SDSNEXIT library.	Library name.
`&DB2HLVL..&SSID..SDSNEXIT`		
&DB2RUNL	High-level qualifier of DB2 RUNLIB.LOAD library.	Library name.
`&DB2HLVL..&SSID..RUNLIB.LOAD`		
&DB2VER	The z/OS DB2 version.	Number (10..12)
`11`		

Symbol Name	**Description**	Attribute **Default Value**
&CDCSRV	**CDC service:** A set of resources - ECSA structures, a table function and possibly a WLM application environment - used for reading CDC data by all tasks designating this service.	Qualifier of up to four characters, forming a valid name.
`CDC1`		
&CEERUNL	z/OS LE (language environment) and C++ runtime library.	Library name.
`CEE.SCEERUN`		
&PROCLIB	JCL procedure library where third-party JCL procedures are located. You can choose a PROCLIB used by third-party products.	Library name.
N/A		
&R4ZHLVL	Replicate for z/OS high-level qualifier.	<qualifier>.<qualifier>…
`R4Z`		
&DEFWLMAE	Determine whether a separate WLM APPLENV is to be created PER CDC service, or all services are to use ONE WLM APPLENV	'PER' or 'ONE'
N/A		
&R4ZLOADL	Replicate for z/OS load library.	Number (09..12).
`&R4ZHLVL..LOAD`		
&R4ZWLMPR	WLM STC for the Replicate application environment.	Member name (JCL procedure).

Symbol Name	**Description**	Attribute **Default Value**
`&SSID.WR4Z`		
&R4ZAPPNV	The WLM application environment serving the Replicate UDTF.	Upper case name, up to 32 characters (underscores allowed).
`R4ZWLM`		
&STCUSER	The user ID assigned to regions started by WLM application-environment	User ID (up to 7 characters).
`(none)`		
&R4ZUSER	User ID used for issuing SQL select statements IFI306 READS; may be overridden by &UDFUSER.	User ID (up to 7 characters).
`ATTUSER`		
&R4ZSCNM	Schema name qualifying the UDTF routine (to be specified in the Replicate endpoint connection settings).	Schema name.
`&R4ZUSER`		
&R4ZIFITF	User-defined function name (to be specified in the Replicate endpoint connection settings).	Function name (not including the schema name).
`R4ZUDF`		

7 Controlling the CDC process

Qlik Replicate uses ECSA memory structures - called R4Z CDC services - which are formed during CDC processing. Each z/OS LPAR may contain several such R4Z CDC services. To form the R4Z CDC services, a special utility program, R4ZCTL, is provided.

This program can also be used for managing the state of CDC processing, as well as the level of traffic on the z/OS side.

From Replicate 6.1, the CDC services (known as R4Z environment in previous versions), do not need to be "activated" prior to invocation of the CDC reader UDTF. The services are "auto-activated" by the UDTF (when inactive). This means that the R4Z control program is no longer responsible of activating the service. It is, however, required for the following purposes: checking CDC and reporting the CDC service's status, pausing CDC processing, resuming a paused CDC, and terminating the CDC process, either normally or forcefully.

The command parameters available when running the R4ZCTL program are:

> *If you run the command without any parameters, it will return the current status of the CDC service.*

- `CHECKCONFIG` - Verifies that configuration parameters are valid
- `PAUSE_TASK` - Stops the service of a specific CDC task
- `PAUSE_CDC` - Stops the entire activity of a CDC service
- `RESUME_TASK` - Enables a paused task to continue
- `RESUME_CDC` - Enables a paused CDC service to continue
- `TERMINATE` - Stops the CDC service, and, once stopped – releases its resources
- `FORCE` - same as `TERMINATE`, when task holding resources "hangs"

As the R4ZCTL programs requires APF-authorization, all libraries in the STEPLIB must be APF- authorized.

When running R4ZCTL with no parameter, its completion-code is set based on whether the environment was initialized (`CC=0`) or not initialized (`CC=1`).

7.1 Control program invocation syntax

The `R4ZCTL` program is invoked as a job step, i.e. `EXEC PGM=R4ZCTL`, and accepts instructions via the invocation parameter of the job step.

The `R4ZCTL` invocation parameter is a string that can contain optional sub-parameters, separated by a comma as follows:

```
[SERVICE=CDC-service-qualifier,][MSGLVL={0 | 1},][action]
```

> *The order of the sub-parameters in the string is not important.*

Where:

`SERVICE=CDC-service-qualifier` designates the logical scope of Replicate activity, upon which the control program is to act.

For more information on CDC services, refer to the Qlik Replicate Help.

`MSGLVL={0 | 1 | 2}` designates the level of notifications to be displayed in the message file during the operation of the control program.

- 0 = No notifications
- 1 = Moderate
- 2 = Maximum

`action-verb` can be one of the following:

- `PAUSE_TASK(*|ALL|task-qualifier)`
  Suspends CDC retrieval for the task(s) designated in parentheses.
- `PAUSE_CDC`
  Suspends CDC retrieval for entire CDC service. Replication tasks suspended for more than a certain time are stopped will attempt recovery multiple times. No new tasks will be served.
- `RESUME_TASK(*|ALL|task-qualifier)`
  Resumes CDC retrieval for the task designated by `task-qualifier`.
- `RESUME_CDC`
  Resumes CDC retrieval for all instances matching the `session-limits` qualifier.
- `DUMP_TASK(*|ALL|task-qualifier)`
  Requests formatted dumping of the control information in the resident memory structures. `ALL` designates all sessions; `SUMMARYONLY` designates only the anchor.
- `TERMINATE`
  Frees all the R4Z resident memory structures, terminates all active instances and deletes associated resources. From this point on, all CDC requests will return the inactive status until CDC service is auto-activated by an incoming call to the CDC reader UDF.

Syntax elements reference

The elements used in the syntax descriptions above are as follows:

- `CDC-service-qualifier`
  A 4-character name (first character alphabetic, rest alphanumeric), which designates a CDC service. “CDC service” refers to a group of resources – memory structures, a user-defined table-function (UDTF) defined in DB2 and an application environment (APPLENV) defined in the WLM policy. R4Z lets you specify properties – memory limits and processing thresholds – per each CDC service. It may be necessary to manage several CDC services also for another reason: provide for more than one Replicate release being used in a single LPAR, each maintain its memory structures independently on others.
- `task-qualifier`

A 4-digit identifier being assigned upon initiation of the task. This identifier is aimed mainly for controlling and tracking CDC traffic of a specific task (defined in the client's endpoint definitions). It is being used to form the CORRID (Correlation-ID) of the DB2 thread serving CDC – it occupies bytes 9-12 there.

7.2 Control program completion codes

- 0 – Normal completion
- 1 – Environment does not exit the `session-limits` qualifier (when no `action` is specified)
- 4 – Warning
- 8 – Error

7.3 Sample jobs (in the INSTALL library)

IV1CHECK – Checks the configuration of all CDC services

XMDUMP – Dumps all sessions

XMPAUSE – Pauses a session

XMRESUME – Resumes a session

XMTERMIN – Terminates all sessions

7.4 Enabling the CDC process (auto-activation)

To enable the CDC reader UDTF function to work, this function needs to be able to allocate and pre-format memory structures in ECSA when the UDTF is called and the first time after the z/OS system was started; it also needs to access the configurations set for the CDC service the UDTF is serving (or the "default" configurations, for values not specified at the CDC service level).

To account for this, the installation process ensures that:

1. A special UDTF is created to serve the CDC service. The created UDTF has its name suffixed with a double-underscore ("__") followed by the `CDC-service-qualifier`, forming a name as such: `<schema>.R4Z_UDTF__<CDC-service-qualifier>`.
2. A WLM APPLENV is created to execute invocations of the above UDTF. The created APPLENV may also have its name suffixed with the CDC service qualifier, to ensure uniqueness of the APPLENV name – which is recommended; however, multiple UDTFs may use a single APPLENV.
3. A JCL procedure is created to "host" the WLM APPLENV executions. This JCL procedure differs from a usual WLM STC procedures in that a special DDNAME, R4ZCNFG, must be specified, its DSN referring to the CONFIG library of the R4Z product. In this library, there MUST be an existing member named "CDCS", specifying the default CDC service configurations. There MAY also exist a member named "CDCS<`CDC-service-qualifier`>" with the configuration values you want to apply for this CDC service.
4. The content of each of the CDCS* members in the CONFIG library is a list of assignment statements, one per card, in the format "keyword=value". The statement may follow spaces, and are space-terminated; no spaces are allowed with the statement. Cards beginning with a hyphen ('-') are treated as comment

cards; and the content following the terminating space is also treated as comment.

Keywords, max values, min values, and default values

Keyword	Description	Minimum	Maximum	Default
MAXSESSIONS	The maximum number of CDC sessions.	1	128	32
SESSIONTIMEOUTSECS	The number of seconds after which session is timed out.	300	7200	900
MAXIFIBUFKBYTES	The maximum buffer size allowed for IFI reads, in Kbytes.	64	1024	256
MAXRESULTSETMBYTES	The maximum size in Mbytes for the accumulated result set to reach; when reached, the result set is returned.	1	2048	4
MAXRESULTSETSECS	The maximum time interval, in seconds, for accumulating the result set; when reached, the result set is returned.	1	120	30

7.5 Establishing R4Z CDC services

Deciding on the CDC services: Based on predicting the need for independent replication processes (to allow different versions, to ensure sufficient ECSA memory, to account for different latencies allowed, etc.), determine which R4Z CDC services are to exist in each LPAR. For each service, choose the CDC service qualifiers (4 characters). You also need to decide whether each CDC service is to have its own WLM APPLENV (application environment), or a single APPLENV to serve all CDC services.
You need to set variable DEFWLMAE (DEFine WLM Applic. Env.) in DFSYMLST member to either PER (first option) or ONE (second option). Once set, you can proceed with the installation:

- *If you select ONE for DEFWLMAE, jobs DO2* and DO3SRVTF should be run one time ; if you select PER , these jobs should be run for each CDC service, after the JCL SET variable CDCSRV is set to the CDC service's qualifier.*
- *Job DO3SRVDF creates a CONFIG library, and places a member named "CDCS", which serves as the default configuration file. After running job DO3SRVTF the library will contain the configuration of all CDC services, making it possible to edit them and change the configurations of a specific CDC service.*
- *If ONE is used for DEFWLMAE, then the product defaults are used instead of the CONFIG library members.*