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1 New Features in Version 15.7.1 SP302

SAP Replication Server 15.7.1 SP302 includes several new features.

Related Information

New Configuration Parameters [page 5]

1.1 New Configuration Parameters

Replication Server introduces several new configuration parameters in 15.7.1 SP302.

Related Information

ddl_dup_detect [page 5]
dsi_varchar_convert_multiplier [page 6]
erssd_cache_size [page 6]

1.1.1 ddl_dup_detect

Replication Server introduces a new configuration parameter, `ddl_dup_detect`, at both the server level and the connection level. When you enable this parameter, Replication Server checks if Data Definition Languages (DDLs) are replicated successfully after the connection is resumed. Without this configuration parameter, when Data Server Interface (DSI) shuts down due to SAP ASE shutdown, you need to manually check if the DDL replicated before the SAP ASE shutdown has been successfully replicated to the replicate SAP ASE, and resume the connection with different conditions according to the result. Using this configuration parameter, you only need to resume the connection when DSI shuts down; Replication Server will check if DDL replication is completed and take relevant actions automatically.

Refer to the Replication Server Reference Manual for more details.
1.1.2 dsi_varchar_convert_multiplier

Replication Server introduces the `dsi_varchar_convert_multiplier` parameter to estimate the buffer size to store the data after character set conversion from Replication Server to the replicate database.

If the Replication Server character set is different from the replicate database character set, Replication Server multiplies the size of a Replication Server character by the value of this parameter to determine the size of the corresponding character in the replicate database.

You can specify the value of the `dsi_varchar_convert_multiplier` parameter with the `alter connection` or `configure replication server` command. If the value of this parameter is too small, the data might be truncated and an error might occur on the replicate database. You need to restart Replication Server or the connection after configuring the parameter. Refer to the *Replication Server Reference Manual* for more details.

1.1.3 erssd_cache_size

The `erssd_cache_size` parameter is a server level configuration parameter. It controls the maximum percentage of virtual memory that the ERSSD cache can use. It prevents the ERSSD cache size from growing too large.

You can set the value of this parameter with the `configure replication server` command. The default value is 0, which is the default cache size that SQL Anywhere uses. Refer to the *Replication Server Reference Manual* for more details.
SAP Replication Server 15.7.1 SP301 focuses on stability and quality. There are no new features.
3 New Features in Version 15.7.1 SP300

SAP Replication Server 15.7.1 SP300 includes several new features.

Related Information

Replication Support for SAP HANA Database [page 8]
Removal of ID Server as a Single Point of Failure [page 11]
Change in Data Type Mapping for SAP ASE to SAP HANA Data Replication [page 12]
Early Dispatch of Large Transactions [page 12]
Replication Agent for SAP HANA New Features [page 12]
New and Enhanced Commands and Parameters [page 15]

3.1 Replication Support for SAP HANA Database

SAP Replication Server 15.7.1 SP300 includes several enhancements that support SAP HANA® database replication.

Related Information

Additional Support for Cluster Table Replication [page 8]
Database Replication Enhancements in Heterogeneous Replication Environments [page 9]

3.1.1 Additional Support for Cluster Table Replication

Database replication from SAP Business Suite applications that use cluster tables into an SAP HANA database is enhanced to support SAP Kernal 740 and 741.

See Cluster Table Replication in the SAP Replication Server Heterogeneous Replication Guide for more information.
3.1.2 Database Replication Enhancements in Heterogeneous Replication Environments

In addition to support of Oracle-to-HANA environments, Replication Server SP300 also supports several enhancements from Microsoft SQL Server and IBM DB2 UDB to SAP HANA.

The following enhancements are developed to support Microsoft SQL Server and IBM DB2 UDB as primary databases:

- Configuration of the `create table` command with row store and column store
- Configuration of datatype mapping for data definition language (DDL) replication
- Additional options in table creation

**Related Information**

Configuration of Datatype Mapping for DDL Replication [page 9]

### 3.1.2.1 Configuration of Datatype Mapping for DDL Replication

Replication Server allows you to define mapping for the datatypes in the DDL commands when replicating and initializing replicate tables during materialization.

By adding the support of Microsoft SQL Server and IBM DB2 UDB as primary databases, the syntax is enhanced with:

**Syntax**

```
configure replication server set ddl_datatype_map from {ORA | MSSQL | UDB}. {
  <pdatatype> | <pdatatype(n)> | <pdatatype(precision,scale)> }
  to {HDB}.{NULL | <rdatatype> | <rdatatype> [multi] | <rdatatype(n)> | <rdatatype(precision,scale)>}
```

The datatype for the primary database in the mapping should match the datatype stored in the database system except for the datatypes listed in the following table:

**Table 1: Special Cases in DDL Datatype Mapping**

<table>
<thead>
<tr>
<th>Primary Database</th>
<th>Primary Table Datatype</th>
<th>Primary Datatype in DDL Datatype Mapping</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oracle</td>
<td>Integer</td>
<td>NUMBER(38,0)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Binary Float</td>
<td>Binary_Float(-2147483647)</td>
<td></td>
</tr>
<tr>
<td>Primary Database</td>
<td>Primary Table Datatype</td>
<td>Primary Datatype in DDL</td>
<td>Comments</td>
</tr>
<tr>
<td>------------------</td>
<td>------------------------</td>
<td>-------------------------</td>
<td>----------</td>
</tr>
<tr>
<td></td>
<td>Timestamp(n)</td>
<td>Timestamp(n)</td>
<td>The ( n ) parameter is defined in the column DATA_SCALE in the table USER_TAB_COLUMNS</td>
</tr>
<tr>
<td></td>
<td>Nchar(n)/nvarchar2(n)</td>
<td>Nchar(n)/nvarchar2(n)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Float</td>
<td>float(126,0)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Binary_float</td>
<td>BINARY_FLOAT(-1,-1)</td>
<td></td>
</tr>
<tr>
<td>IBM DB2 UDB</td>
<td>Time(n)/Timestamp(n)</td>
<td>Time(n)/Timestamp(n)</td>
<td>The ( n ) parameter matches the scale provided in the table SYSCOLUMNS</td>
</tr>
<tr>
<td></td>
<td>Large Objects</td>
<td>Large Objects(n)</td>
<td>The ( n ) parameter is defined in column Long-Length in the table SYSCOLUMNS</td>
</tr>
<tr>
<td></td>
<td>Char(10) for bit data</td>
<td>CHARACTERFORBITDATA(10)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>varchar(1000) for bit data</td>
<td>VARCHARFORBITDATA(1000)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>long varchar for bit data</td>
<td>LONG VARCHARFORBITDATA(32700)</td>
<td></td>
</tr>
<tr>
<td>Microsoft SQL Server</td>
<td>Varchar(max)</td>
<td>Varchar(2147483647)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Varbinary(max)</td>
<td>Varbinary(2147483647)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nvarchar(max)</td>
<td>Nvarchar(1073741823)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Text</td>
<td>Text(2147483647)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Image</td>
<td>Image(2147483647)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ntext</td>
<td>Ntext(1073741823)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nchar(n)/nvarchar(n)</td>
<td>Nchar(n)/nvarchar(n)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Time</td>
<td>Time(n)</td>
<td>The ( n ) parameter is defined in column precision in the database system table sys.columns</td>
</tr>
<tr>
<td></td>
<td>Timestamp</td>
<td>Timestamp</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Float</td>
<td>float(126,0)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>uniqueidentifier</td>
<td>uniqueidentifier(36)</td>
<td></td>
</tr>
</tbody>
</table>
### 3.2 Removal of ID Server as a Single Point of Failure

In versions of SAP Replication Server prior to 15.7.1 SP300, there could be only one ID Server in a replication domain. This design had the following limitations and concerns:

- **Single point of failure:** If the ID Server was inaccessible or down, you could not add a new Replication Server or database to a domain.
- **Inability to move to a different backup server:** After a particular Replication Server was selected as the ID Server, it was not possible to change or move to a different Replication Server.

To resolve these problems, a Backup ID Server has been introduced in SAP Replication Server 15.7.1 SP300. This reduces the risk of single point of failure, and improves overall availability with the introduction of a Backup ID Server. The solution works as follows:

- Currently, there is only one active ID Server in a replication domain. Replication Server knows about, and contacts only this ID Server for ID Management. Also, the Backup ID Server syncs through a Remote Procedure Call (RPC) whenever there is any change in the Primary ID Server.
- When the Primary ID Server goes down, dies, or crashes, RSA repairs the Primary ID Server, or promotes the Backup ID Server as the Primary ID Server.

Replication Command Language (RCL) Commands to perform related tasks are listed and described below:

- **sysadmin idserver, config:** This command helps you to configure ID Servers, and may change the Replication Server configuration file and RSSD. You can use it to show current ID Server configurations, and to configure Primary/Backup ID Servers.

  **Syntax:**

  ```
  sysadmin idserver[, config[, primary|backup[, rsname, username, pwd]]]
  ```

  **Examples:**

  1. Display all configurations about ID servers, including the Primary and Backup ID Servers:
     - `sysadmin idserver`
     - `sysadmin idserver, config`

  2. Show configurations of Primary or Backup ID Server only:
     - `sysadmin idserver, config, 'primary'`
     - `sysadmin idserver, config, backup`

  3. Configure Primary ID Server for a Replication Server:
     - `sysadmin idserver, config, primary, rsname, username, pwd`
4. Configure the Backup ID Server:
   - `sysadmin idserver, config, backup, rsname, username, pwd`
   - `sysadmin idserver, sync`: This command enables you to manually force a sync between the Primary and Backup ID Servers, and can only be executed on the Primary ID Server. When you run the command, the sync up happens instantly.
     Syntax: `sysadmin idserver, sync`

3.3 Change in Data Type Mapping for SAP ASE to SAP HANA Data Replication

The data type mapping for ASE to HANA (A2H) has been modified from ASE time to HANA time to ASE time to HANA timestamp.

3.4 Early Dispatch of Large Transactions

To reduce latency, Replication Server can dispatch a large transaction (one that contains many commands) before it receives the `commit` command.

To enable this option:
1. Set the `parallel_dist` parameter to on.
2. Set the value of the `dsi_num_large_xact_threads` parameter to 1 or larger.
3. Set the value of the `dsi_num_threads` parameter to a number larger than the value of `dsi_num_large_xact_threads`.

You can also enable High Volume Adaptive Replication (HVAR) to improve replication performance.

3.5 Replication Agent for SAP HANA New Features

Replication Agent for SAP HANA includes several new enhancements in 15.7.1 SP300.

- The support of replication from Teradata database.
- HANA SP10 transaction ID performance improvement.
- New command: `ra_get_license`
- New option for `ra_stop`
- New table ID for primary tables
- `-v` added in the startup scripts

For details on these features, see the sections that follow.
3.5.1 Teradata Support

Replication Agent for SAP HANA supports replication from the primary Teradata database to the replicate SAP HANA database.

See Replication Agent for SAP HANA Database Configuration and Users Guide for more details.

3.5.2 HANA SP10 Transaction ID Performance Improvement

HANA SP10 provides a new way to access the current update transaction ID which is much quicker than previous versions. Replication Agent for SAP HANA automatically uses this new SAP HANA functionality to improve the performance of the transactional replication mode and transactional change data capture (CDC) replication mode.

One effect is that Replication Agent for SAP HANA stores the transaction ID as a bigint, instead of an integer.

These tables are affected on the primary database:
- trigger queue
- shadow tables

These tables are affected on the replicate database:
- staging tables
- transaction log table

In order to take advantage of this new functionality, undeploy and redeploy the existing models to migrate to the new version of Replication Agent for SAP HANA.
3.5.3 New Command: ra_get_license

Replication Agent for SAP HANA provides the new ra_get_license command to retrieve current license information such as the license name, the license version, and the license type.

3.5.4 New Option for ra_stop

Replication Agent for SAP HANA adds the new wait option within the ra_stop command. The wait option is useful when you run the ra_stop command sequentially. If the subsequent command relies on the model being stopped (for example, ra_undeploy), running ra_stop with wait set to true ensures the subsequent command starts to run after the stop of the model is completed.

3.5.5 New Table ID for Primary Tables

The naming of the Replication Agent for SAP HANA adds the new wait option within the ra_stop command. The wait option is useful when you run the ra_stop command sequentially. If the subsequent command relies on the model being stopped (for example, ra_undeploy), running ra_stop with wait set to true ensures the subsequent command starts to run after the stop of the model is completed.

The TABLE_ID column has been added to the output of some commands. For example, ra_get_model_tables.

See Replication Agent for SAP HANA Database Configuration and Users Guide for more details.

3.5.6 Add -v to Startup Scripts

Replication Agent for SAP HANA provides a way to check the version and build of the product without having to start the Container first.

On Windows systems, run:

```bash
%SAP%\HANARAX\bin>RunContainer.cmd -v
```

On Unix systems, run:

```bash
$SAP/HANARAX/bin>./RunContainer.sh -v
```

Where %SAP% and $SAP are the installation roots respectively.
3.6 New and Enhanced Commands and Parameters

SAP Replication Server 15.7.1 SP300 includes enhancements to several SAP Replication Server commands and parameters.

Related Information

- Display the Stable Queue Parameter Value [page 15]
- Changes to create subscription [page 16]
- Changes to define subscription [page 17]
- New Option for rs_init Command Line [page 19]
- Concurrent Subscriptions [page 19]
- Retrieve and Clean Logged Errors [page 19]
- Dump Open Transactions in a Stable Inbound Queue [page 20]

3.6.1 Display the Stable Queue Parameter Value

The sqm parameter has been added to the admin config command to display the Stable Queue parameter value.

Syntax

```
admin config, "sqm", q_number , q_type, configuration_name
```

Examples

**Example 1**

The following command gets the value of the sqm_cache_size parameter for one queue.

```
admin config, "sqm", 104 , 1, sqm_cache_size
```

**i Note**

SQM currently supports only the sqm_cache_size parameter. Support for other parameters will be added in later releases.

For more information, refer to the SAP Replication Server Reference Manual.
3.6.2 Changes to create subscription

The syntax for the create subscription command has been modified. The command now supports "and", "or", and "in value list" operators in subscription where clauses. The only limitation is that each sub-clause in "and" and "or" must conform to the standards that SAP Replication Server currently accepts. Syntax and examples below illustrate the use of these operators.

Syntax

Syntax to create a database subscription:

```
create subscription <subname>
for database replication definition <repdefname>
with primary at <pdsnname>.<pdbname>
with replicate at <rdsnname>.<rdbname>
{with materialization
    [init replicate table with {create | create_or_truncate | truncate | recreate}
    [date time]
    [user <username> password <password>]]
| without materialization} 
[subscribe to truncate table]
```

Syntax to create a non-database subscription:

```
create subscription <subname>
for {table_repdef | func_repdef | publication pub}
[with primary at <pdsnname>.<pdbname>]
with replicate at <rdsnname>.<rdbname>
[where
    {{column_name | @param_name}
     {< | > | >= | = | &} value
     [and {column_name | @param_name}
     {< | > | >= | = | &} value}...
     [or where { column_name | @param_name }
     {< | > | >= | = | &} value
     [and {column_name | @param_name}
     {< | > | >= | = | &} value}...
     [or where { column_name | @param_name }
     {< | > | >= | = | &} value}...]
    | {{column_name | @param_name}
     in (value1,value2,value3...)
     [and {column_name | @param_name}
     in (value1,value2,value3...}]
     [or where { column_name | @param_name }
     in (value1,value2, value3...]
     [and {column_name | @param_name}
     in (value1,value2, value3...}]
     [or where { column_name | @param_name }
     in (value1,value2, value3...}]
    [without holdlock {direct_load [init replicate table with {create | create_or_truncate | truncate | recreate}]
    [user <username> password <password>] [num_of_selects selects]
    [hold_resource_on_error]] | incrementally | without materialization]
[subscribe to truncate table]
[for new articles]```
Examples

Example 1
Create a subscription with the "or" keyword in the "where" clause:

```sql
create subscription tb_name_demo
for tb_name_repdefdemo
with replicate at rqa10.tdb2
where col1 > 20
and col1 < 100
or where col2 = 'charvalue0'
or where col3 = 'varcharvalue0'
```

Example 2
Create a subscription with the "in value list" keyword in the "where" clause:

```sql
create subscription tb_name_subdemo
for tb_name_repdefdemo
with replicate at rqa10.tdb2
where col2 in ('charvalue0','charvalue2', 'charvalue3','charvalue4')
or where col3 in ('varcharvalue0')
```

For more information, refer to the SAP Replication Server Reference Manual.

3.6.3 Changes to define subscription

The syntax for the define subscription command has been modified. The command now supports "and", "or", and "in value list" operators in subscription where clauses. The only limitation is that each sub-clause in "and" and "or" must conform to the standards that SAP Replication Server currently accepts. Syntax and examples below illustrate the use of these operators.

Syntax

Syntax with and, or and in value list operators in the where clause:

```sql
define subscription sub_name
for {table_rep_def | function_rep_def | publication pub_name | database replication definition db_repdef
with primary at data_server.database} |
with replicate at data_server.database
[where
    {{column_name | @param_name}
        {< | > | >= | <= | = | &} value
        [and {column_name | @param_name}]
        {< | > | >= | <= | = | &} value...
        [or where {column_name | @param_name}]
        {< | > | >= | <= | = | &} value
        [and {column_name | @param_name}]
        {< | > | >= | <= | = | &} value...} |
    {{column_name | @param_name}
in (value1,value2,value3...)
```
Examples

Example 1

Define a subscription while using the in value list operator:

define subscription tb_name_subdemo
for tb_name_repdefdemo
with replicate at rqa10.tdb2
where col2 in ('charvalue0','charvalue2','charvalue3','charvalue4')
or where col3 in ('varcharvalue0')

Example 2

Define a subscription while using the and and or operators:

define subscription tb_name_demo
for tb_name_repdefdemo
with replicate at rqa10.tdb2
where col1 > 20
and col1 < 100
or where col2 = 'charvalue0'
or where col3 = 'varcharvalue0'

For more information, refer to the SAP Replication Server Reference Manual.
3.6.4 New Option for rs_init Command Line

Replication Server adds a new option `-w` to the `rs_init` command line for Linux utility.

<table>
<thead>
<tr>
<th>Flag</th>
<th>Parameter</th>
<th>Explanation</th>
</tr>
</thead>
</table>
| `-w` | display_width | Set the `display_width` to change the maximum length of characters displayed in one line in `rs_init` interactive mode.  
Value: 80 to 200 characters  
If not set, the maximum number of characters allowed is 80; any additional characters will be truncated.  
To view the full message of long characters, you may need to enlarge the window size of `rs_init` interactive mode manually. |

For more details of `rs_init` command line, refer to `rs_init Command Line Options` in the `Replication Server Configuration Guide`.

3.6.5 Concurrent Subscriptions

Replication Server supports the configuration of concurrent subscriptions by adding a new `num_concurrent_subs` option into the `configure replication server` command. The option allows you to set the number of concurrent subscriptions.

3.6.6 Retrieve and Clean Logged Errors

New commands have been added to Replication Server to retrieve and clean errors logged in the database memory. You can use these commands to lookup the errors that were logged into the database, and cleanup the errors that are of no further use or utility.

**Syntax**

```
sysadmin dump_error: Use this command to retrieve diagnosable error information from the database:

  sysadmin dump_error
  [, row_id [, option]]
  [, thread[, {conn_id | server[, database]}[, qtype]]]
```
**Parameters**

**row_id**
If this is not specified, the command searches for and returns multiple diagnosable errors, and does not search for a unique thread instance, or for multiple errors that were logged for a unique thread instance. The first column in the output indicates the row number.

**option**
Identifies additional options to dump diagnosable errors. Currently, the only acceptable value for this parameter is `<diag>`, which instructs Replication Server to dump all additional internal information.

**thread**
Identifies the type of thread to retrieve errors from. Acceptable parameter values are `<DSI EXEC>, <DIST>, <SQT>, <SQM>, and so on.

**conn_id**
Identifies the thread instance. For DSI and DIST threads, this is the Database ID. For SQT and SQM threads, it is the queue number.

**server; database**
These parameters identify the instance name of the thread for which you want to retrieve the error.

**qtype**
Applicable only if you are retrieving error information for SQM/SQT thread.

**sysadmin clean_error:** Use this command to cleanup error information that is of no further use or utility, for instance, connections already dropped from the system, or a thread already recovered from a previous error. If no parameter specified, all diagnosable errors saved in memory are removed.

**Syntax**

```
sysadmin clean_error [, thread[, server[, database[, qtype]]]]
```

Parameters: Refer to the descriptions above.

### 3.6.7 Dump Open Transactions in a Stable Inbound Queue

The `sysadmin dump_open_tran` command has been added to Replication Server to dump all open transactions in a stable inbound queue.

**Syntax**

```
sysadmin dump_open_tran {, q_number | server[,database]}, qtype
```

For more information, refer to the SAP Replication Server Reference Manual.
4 New Feature in Version 15.7.1 SP206

SAP Replication Server 15.7.1 SP206 includes the new feature of Microsoft replication to SAP IQ.

Related Information

Microsoft SQL Replication to SAP IQ [page 22]

4.1 Microsoft SQL Replication to SAP IQ

SAP Replication Server includes a real-time loading (RTL) solution for replication directly into SAP IQ. In SP206, Microsoft SQL Server is supported as the primary replication server for RTL replication to SAP IQ.

Database and Platform Support

Make sure to have the following database and platform support for the replication:

- SAP IQ – You can use real-time loading to replicate into SAP IQ version 15.4 ESD#4 or later.
- SAP Replication Server – You must have Replication Server SP205 NOFF EBF 24041 or later.
- SAP Replication Agent – You must have the latest version of SAP Replication Agent for Unix and Windows: 15.7.1 SP206.

Replication Agent Requirements

Set the required values of the ra_autocorrect_on_mark and lr_partial_updates_allowed parameters:

- Set the value of the ra_autocorrect_on_mark parameter to true.
  ra_autocorrect_on_mark
  Determines whether to auto correct a table marked for replication immediately.
  Default
    true
  Values
    ○ true – Enables autocorrection of tables marked for replication.
    ○ false – Disables autocorrection of tables marked for replication.
• Set the value of the lr_partial_updates_allowed parameter to false.

*lr_partial_updates_allowed*

Converts partial updates to varchar(max), nvarchar(max), and varbinary(max) large object (LOB) datatypes at the primary database to a full update. Sends partial updates to LOB data to databases that have native support.

**Default**

true

**Values**

- true – Sends changes to LOB datatype columns as partial updates to Replication Server. Replication Server sends partial updates to the replicate databases that have native support for partial LOB updates, such as Microsoft SQL Server.
- false – Converts partial LOB updates to a full update, which is consumed in heterogeneous replication environments. If partial LOB updates are detected, an error exception occurs.

Command

```sql
isql>rq_config lr_partial_updates_allowed,false
```

See the Configuration Parameter Reference chapter of the *Reference Manual Replication Agent 15.7.1 for Linux, UNIX, and Microsoft Windows Guide* for more information.

### Replication Server Changes and Requirements

Make sure to meet the following Replication Server requirements for the replication:

• Use a new connection profile to create the connection from Microsoft SQL Server to SAP IQ:

```sql
rs_msss_to_iq

isql>create connection to IQ154.iqdemo using profile rs_msss_to_iq;standard
set username iq_maint_user
set password iq_maint_user_ps
```

Connection profiles are a part of the Replication Server installation package, and are registered when you install Replication Server. For details about connection profiles, see the SAP IQ Replicate Database Configuration chapter of the *SAP Replication Server 15.7.1 Heterogeneous Replication Guide*.

• In MultiSite Availability (MSA) setup, replication definitions are not required for tables without LOB columns while replication definitions with standby clauses are required for tables with LOB columns.

```sql
isql>create replication definition rep_T with primary at PDS.pdb with all tables named T (col1 bigint,
col2 int,
col3 varchar(200),
col4 image,
col5 text,
col6 int,
```

New Features Guide

New Feature in Version 15.7.1 SP206

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Use Microsoft SQL datatype translation for replication definitions.

```
isql>create replication definition rd_test_mssql3
with primary at PDS.pdb
with all tables named test_mssql

(id int,
 cr1 binary(20),
 cr2 bit,
 cr3 char(10),
 cr4 date,
 cr5 decimal,
 cr6 float,
 cr7 image,
 cr8 money,
 cr9 unichar(10),
 cra10 unitext,
 cra11 univarchar(50),
 cra12 numeric,
 cra13 real,
 cra14 smalldatetime,
 cra15 smallint,
 cra16 smallmoney,
 cra17 text,
 cra18 time,
 cra19 timestamp,
 cra20 tinyint,
 cra21 varbinary(20),
 cra22 varchar(50),
 cra23 rs_msss_datetime,
 cra24 rs_msss_datetime2,
 cra25 rs_msss_datetimeoffset,
 cra26 rs_msss_bigint,
 cra27 text,
 cra28 unitext,
 cra29 image,
 cra30 varchar(38))
```

primary key (id)

send standby replication definition columns

For Microsoft SQL datatype mappings, see Replication Agent 15.7.1 Primary Database Guide for Linux, UNIX, and Microsoft Windows chapter of the SAP Replication Server, heterogeneous edition 15.7.1 Guide.

Use UTF-8 settings to replicate Microsoft SQL UTF-16 data.

To replicate UTF-16 data from MSSQL server to IQ, configure both Replication Server and SAP IQ to use UTF-8. See the Character Sets chapter of the SAP Replication Server 15.7.1 Design Guide for Unicode UTF-8 and UTF-16 support.
SAP Replication Server 15.7.1 SP204 includes:

- Support for replication into Apache Hive on Linux, replication in the Amazon Web Services Elastic Compute Cloud, suspending and resuming routes from the source Replication Server, and a replication diagnostic utility.
- Enhancements to the upgrading and downgrading of Replication Server, replication for the SAP HANA database, and the heterogeneous replication environment.
- Enhancements in SAP Replication Agent for SAP HANA.

Related Information

- Hive Support [page 25]
- Replication Server Certified on Amazon Web Services [page 31]
- Replication Diagnostic Utility [page 35]
- Replication Support for SAP HANA Database [page 37]
- Replication Agent for SAP HANA New Features [page 39]
- Database Replication Enhancements in Heterogeneous Replication Environments [page 45]
- Support to Suspend and Resume Route from Source Replication Server [page 50]
- Changes to the Upgrade or Downgrade of SAP Replication Server [page 51]

5.1 Hive Support

Starting with version 15.7.1 SP204, SAP Replication Server supports replication into Apache Hive on Linux.

Related Information

- Creating a Connection to Hive [page 26]
- Table Level Replication [page 27]
- Supported Datatypes [page 27]
- Limitations [page 30]
5.1.1 Creating a Connection to Hive

You can create a connection to Apache Hive using a connection profile.

Context

The Apache Hive data warehouse software facilitates querying and managing large data sets residing in distributed storage. Hive provides a mechanism to project structure onto this data and query the data using a SQL-like language called HiveQL. At the same time this language also allows traditional map/reduce programmers to plug in their custom mappers and reducers when it is inconvenient or inefficient to express this logic in HiveQL.

Procedure

1. Select a connection profile. In SP204, new connection profiles are:
   - rs_oracle_to_hive.sql - defined for replication from Oracle to Hive.
   - rs_ase_to_hive.sql - defined for replication from ASE to Hive.

2. Set new system environment variables for Hive:
   - RS_HIVE_TEMP_FILE_PATH – specifies the file path for the Hive temporary file. By default, it is set to the working directory of Replication Server. Ensure that the file path can be accessed by both Replication Server and Hive.
   - RS_HIVE_AUTH_TYPE – specifies the authentication type used by Hive. It has only two case-insensitive values: <SASL> and <NoSASL>. By default, the value for this environment variable is <SASL> (Simple Authentication and Security Layer), which works for most Hive servers.

In addition to setting the system variables for Hive, note the following change in the existing system environment variables; this change is implemented by the Replication Server installer automatically.

   - Library paths for Boost, Thrift, SASL, and OpenSSL are added to the LD_LIBRARY_PATH. These 3rd-party libraries are included in the Replication Server release package, and you can refer to them from these Replication Server installation directories:
     - $SYBASE/REP-15_5/lib64/boost/lib
     - $SYBASE/REP-15_5/lib64/thrift/lib
     - $SYBASE/REP-15_5/lib64/cyrussasl/lib
     - $SYBASE/REP-15_5/lib64/openssl/lib
5.1.2 Table Level Replication

Replication Server 15.7.1 SP204 supports table-level replication into Hive.

Table-level replication setup

Prerequisites for table-level continuous replication into Hive:

- Create a connection to the Hive target using a connection profile.
- Create a subscription using direct load.

Clean up these items if table-level replication is not required:

- Drop subscriptions
- Drop connection

Table-level continuous replication

- For table-level continuous replication into Hive, Replication Server supports insert, update, and delete. These commands execute in primary databases and can be replicated to the Hive target. Stored procedures and DDLs are not supported.
- For table-level continuous replication into Hive, Replication Server supports HVAR. Replication Server uses this apply mode internally.

5.1.3 Supported Datatypes

Replication Server provides heterogeneous support and class-level datatype mapping between sources (ASE and Oracle) and Hive.

Related Information

ASE to Hive Datatype Mapping [page 28]
Oracle to Hive Datatype Mapping [page 29]
5.1.3.1 ASE to Hive Datatype Mapping

This table identifies the ASE datatype, the Replication Definition datatype, and the Hive datatype.

Table 3:

<table>
<thead>
<tr>
<th>ASE datatype</th>
<th>Replication Definition datatype</th>
<th>Hive datatype</th>
</tr>
</thead>
<tbody>
<tr>
<td>bigint</td>
<td>bigint</td>
<td>bigint</td>
</tr>
<tr>
<td>int</td>
<td>Integer</td>
<td>int</td>
</tr>
<tr>
<td>smallint</td>
<td>smallint</td>
<td>smallint</td>
</tr>
<tr>
<td>unsigned bigint</td>
<td>unsigned bigint</td>
<td>varchar</td>
</tr>
<tr>
<td>unsigned int</td>
<td>unsigned int</td>
<td>bigint</td>
</tr>
<tr>
<td>unsigned smallint</td>
<td>unsigned smallint</td>
<td>int</td>
</tr>
<tr>
<td>tinyint</td>
<td>tinyint</td>
<td>smallint</td>
</tr>
<tr>
<td>int identity</td>
<td>integer</td>
<td>int</td>
</tr>
<tr>
<td>numeric</td>
<td>numeric</td>
<td>decimal</td>
</tr>
<tr>
<td>decimal</td>
<td>decimal</td>
<td>decimal</td>
</tr>
<tr>
<td>float</td>
<td>float</td>
<td>double</td>
</tr>
<tr>
<td>real</td>
<td>real</td>
<td>float</td>
</tr>
<tr>
<td>double precision</td>
<td>float</td>
<td>double</td>
</tr>
<tr>
<td>money</td>
<td>money</td>
<td>decimal</td>
</tr>
<tr>
<td>smallmoney</td>
<td>smallmoney</td>
<td>decimal</td>
</tr>
<tr>
<td>datetime</td>
<td>datetime</td>
<td>timestamp</td>
</tr>
<tr>
<td>smalldatetime</td>
<td>smalldatetime</td>
<td>timestamp</td>
</tr>
<tr>
<td>bigdatetime</td>
<td>bigdatetime</td>
<td>timestamp</td>
</tr>
<tr>
<td>date</td>
<td>date</td>
<td>date</td>
</tr>
<tr>
<td>time</td>
<td>time</td>
<td>timestamp</td>
</tr>
<tr>
<td>char</td>
<td>char</td>
<td>char</td>
</tr>
<tr>
<td>varchar</td>
<td>varchar</td>
<td>varchar</td>
</tr>
<tr>
<td>unichar</td>
<td>unichar</td>
<td>varchar</td>
</tr>
<tr>
<td>univarchar</td>
<td>univarchar</td>
<td>varchar</td>
</tr>
<tr>
<td>nchar</td>
<td>char</td>
<td>varchar</td>
</tr>
<tr>
<td>nvarchar</td>
<td>varchar</td>
<td>varchar</td>
</tr>
<tr>
<td>image</td>
<td>image</td>
<td>No Default</td>
</tr>
<tr>
<td>text</td>
<td>text</td>
<td>No Default</td>
</tr>
<tr>
<td>unitext</td>
<td>unitext</td>
<td>No Default</td>
</tr>
<tr>
<td>binary</td>
<td>binary</td>
<td>binary</td>
</tr>
<tr>
<td>varbinary</td>
<td>varbinary</td>
<td>binary</td>
</tr>
<tr>
<td>ASE datatype</td>
<td>Replication Definition datatype</td>
<td>Hive datatype</td>
</tr>
<tr>
<td>-----------------</td>
<td>---------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>bit</td>
<td>tinyint</td>
<td>tinyint</td>
</tr>
<tr>
<td>timestamp</td>
<td>timestamp</td>
<td>No Default</td>
</tr>
<tr>
<td>sysname</td>
<td>varchar</td>
<td>varchar</td>
</tr>
<tr>
<td>longsysname</td>
<td>varchar(255)</td>
<td>varchar</td>
</tr>
<tr>
<td>bigtime</td>
<td>bigtime</td>
<td>timestamp</td>
</tr>
</tbody>
</table>

**Note**

When no default value is provided, the successful replication of the ASE type requires you to choose the customization tool of your choice to map to the Hive datatype based on your business needs.

## 5.1.3.2 Oracle to Hive Datatype Mapping

This table identifies the Oracle datatype, Replication Definition datatype, and the Hive datatype.

**Table 4:**

<table>
<thead>
<tr>
<th>Oracle datatype</th>
<th>Replication Definition datatype</th>
<th>Hive datatype</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integer</td>
<td>rs_oracle_decimal</td>
<td>double</td>
</tr>
<tr>
<td>Number</td>
<td>rs_oracle_decimal</td>
<td>double</td>
</tr>
<tr>
<td>Number(10) · Number(18)</td>
<td>rs_oracle_decimal</td>
<td>Bigint</td>
</tr>
<tr>
<td>Number(5) · Number(9)</td>
<td>rs_oracle_decimal</td>
<td>int</td>
</tr>
<tr>
<td>Number(2) · Number(4)</td>
<td>rs_oracle_decimal</td>
<td>smallint</td>
</tr>
<tr>
<td>Number(P,S)</td>
<td>rs_oracle_decimal/varchar</td>
<td>decimal/varchar</td>
</tr>
<tr>
<td>Number(1)</td>
<td>rs_oracle_decimal</td>
<td>tinyint</td>
</tr>
<tr>
<td>FLOAT</td>
<td>rs_oracle_float</td>
<td>double</td>
</tr>
<tr>
<td>BINARY_FLOAT</td>
<td>rs_oracle_float</td>
<td>double</td>
</tr>
<tr>
<td>BINARY_DOUBLE</td>
<td>rs_oracle_decimal</td>
<td>double</td>
</tr>
<tr>
<td>DATE</td>
<td>rs_oracle_datetime</td>
<td>timestamp</td>
</tr>
<tr>
<td>TIMESTAMP(N)</td>
<td>rs_oracle_timestamp9</td>
<td>timestamp</td>
</tr>
<tr>
<td>CHAR</td>
<td>Char</td>
<td>varchar</td>
</tr>
<tr>
<td>NCHAR</td>
<td>Unichar</td>
<td>varchar</td>
</tr>
<tr>
<td>VARCHAR2</td>
<td>Varchar</td>
<td>varchar</td>
</tr>
<tr>
<td>NVARCHAR</td>
<td>univarchar</td>
<td>varchar</td>
</tr>
<tr>
<td>NVARCHAR2</td>
<td>univarchar</td>
<td>varchar</td>
</tr>
<tr>
<td>BLOB</td>
<td>image</td>
<td>No Default</td>
</tr>
<tr>
<td>BFILE</td>
<td>image</td>
<td>No Default</td>
</tr>
<tr>
<td>Oracle datatype</td>
<td>Replication Definition datatype</td>
<td>Hive datatype</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>---------------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>NCLOB</td>
<td>unitext</td>
<td>No Default</td>
</tr>
<tr>
<td>INTERVAL</td>
<td>rs_oracle_interval</td>
<td>No Default</td>
</tr>
<tr>
<td>ROWID</td>
<td>rs_oracle_rowid</td>
<td>No Default</td>
</tr>
<tr>
<td>UROWID</td>
<td>rs_oracle_rowid</td>
<td>No Default</td>
</tr>
<tr>
<td>TIMESTAMP with time zone</td>
<td>rs_oracle_timestamp</td>
<td>No Default</td>
</tr>
<tr>
<td>TIMESTAMP with local time zone</td>
<td>rs_oracle_timestamp9</td>
<td>No Default</td>
</tr>
<tr>
<td>ANYDATA</td>
<td>opaque</td>
<td>No Default</td>
</tr>
<tr>
<td>VARRAY</td>
<td>opaque</td>
<td>No Default</td>
</tr>
<tr>
<td>NESTEDTAB</td>
<td>opaque</td>
<td>No Default</td>
</tr>
<tr>
<td>Object</td>
<td>opaque</td>
<td>No Default</td>
</tr>
<tr>
<td>REF</td>
<td>rs_oracle_binary</td>
<td>No default</td>
</tr>
<tr>
<td>RAW</td>
<td>rs_oracle_binary</td>
<td>binary</td>
</tr>
</tbody>
</table>

**Note**

When no default value is provided, the successful replication of the Oracle type requires you to choose the customization tool of your choice to map to the Hive datatype based on your business needs. Refer to *Oracle Datatype Compatibility* and *Oracle Datatype Restrictions* of the Replication Agent Primary Database Guide for additional Oracle datatype information.

### 5.1.4 Limitations

Hive and Replication Server support for Hive have these limitations:

- **Limited platform support:**
  SAP Replication Server supports Hive only on Linux.
- **Temporary file path:**
  When loading data into a Hive table, Replication Server generates a temporary file, then Hive reads data in that temporary file, and loads it into Hive table. Hive needs access to this temporary file.
- **Column list:**
  The column list in the table replication definition should match the Hive table schema, as currently the Hive load and insert commands do not provide a column list clause.
- **Partition table:**
  Although Hive supports both static and dynamic partition columns within partition tables, Replication Server only supports replication into static partition columns.
- **Row-level updates/deletes:**
  Apache Hive is designed for one write and multiple reads, and so does not provide row-level updates or deletes. To correctly replicate data, create two extra columns when creating a table in the target database. The two extra columns will include the operation type and an operation timestamp for the current command. The names of the extra columns can be any string, but the type and sequence of the two columns must be fixed. The first column is of type int, and it tracks the operation type (1 insert, 2 update, 3
delete). The second column, of type timestamp, represents the time that the command is replicated into the Hive table.
With the exception of these two columns, the name and sequence of columns in the primary table, the replication definition, and the destination Hive table should match.

5.2 Replication Server Certified on Amazon Web Services

SAP Replication Server is certified to provide replication in the Amazon Web Services Elastic Compute Cloud (EC2). The certification covers replication between a Replication Server on your premises and a Replication Server in the cloud, and between Replication Servers in the cloud.

Supported databases are SAP HANA® and SAP ASE. SAP ASE is certified as both a source database and a target database. SAP HANA is certified as a target database only.

Table 5: Supported Platforms

<table>
<thead>
<tr>
<th>On premises</th>
<th>Run Replication Server, SAP HANA, and SAP ASE on any supported platform</th>
</tr>
</thead>
<tbody>
<tr>
<td>In the cloud</td>
<td>Replication Server</td>
</tr>
<tr>
<td></td>
<td>Red Hat Enterprise Linux 6.5 (PV)</td>
</tr>
<tr>
<td></td>
<td>SusE Enterprise Server 11 p3 (PV), SSD Volume Type</td>
</tr>
<tr>
<td></td>
<td>Microsoft Windows Server 2008 R2 Base</td>
</tr>
<tr>
<td></td>
<td>SAP HANA</td>
</tr>
<tr>
<td></td>
<td>SusE Enterprise Server 11 p3 (PV), SSD Volume Type</td>
</tr>
<tr>
<td></td>
<td>SAP ASE</td>
</tr>
<tr>
<td></td>
<td>Red Hat Enterprise Linux 6.5 (PV)</td>
</tr>
<tr>
<td></td>
<td>SusE Enterprise Server 11 p3 (PV), SSD Volume Type</td>
</tr>
<tr>
<td></td>
<td>Microsoft Windows Server 2008 R2 Base</td>
</tr>
</tbody>
</table>

Replication Server supports these cloud replication scenarios:

- SAP ASE on premises to SAP ASE on EC2
- SAP ASE on premises to SAP HANA on EC2
- SAP ASE on EC2 to SAP ASE on another EC2
- SAP ASE on EC2 to SAP HANA on another EC2
- SAP ASE on EC2 to SAP ASE on premises
- SAP ASE on EC2 to SAP HANA on premises

Not supported:

- SAP HANA multitenant database containers and conflict resolution
- Use of Amazon Simple Storage Service
- SYSAM Server on Amazon EC2
- Running Replication Server in a mixed-version environment

Related Information

Replication Use Cases for the Amazon Cloud [page 32]
5.2.1 Replication Use Cases for the Amazon Cloud

Determine how many SAP Replication Servers to deploy and where to deploy them in various cloud replication scenarios.

Replicating Data from Your Premises to EC2

When you replicate from an on-premises database to a database in Amazon Elastic Compute Cloud (EC2), deployment of Replication Servers depends on the configuration of EC2 security groups and your firewall.

- Replication Servers on-premises and in the cloud
  When EC2 security groups allow your on-premises machine to access the RS port (a custom TCP port) on the EC2 instance and your firewall allows the EC2 instance to access the on-premises machine’s RS port, you can install two Replication Servers—one on your premises, near the primary database, and one on the EC2 instance where the target database is running. Installing Replication Servers at both ends of the connection, where configuration permits, can reduce the effect of network latency on replication performance. The two Replication Servers in this scenario can communicate using the TDS protocol:

- Replication Server on-premises only
  In a restricted network environment where EC2 security groups do not allow your on-premises machines to access the EC2 RS port, install Replication Server on your premises near the primary database. It can communicate with the target database on EC2 through ODBC or TDS:

- Replication Server in the cloud only
  If your firewall does not allow the EC2 instance you are replicating to access the RS port on your on-premises database machine, you can install Replication Server on the EC2 instance alongside the target database. A Replication Agent on your on-premises machine captures data and transfers it to the EC2 Replication Server through the TDS protocol:
Replicating Data from One EC2 to Another

You can replicate between EC2 instances in the same region or in different regions.

- Replication Server on both EC2 instances
  When security groups on EC2 instance A (running the primary database) allow EC2 instance B to access EC2 A’s RS port (a custom TCP port), and security groups on EC2 B (running the target database) allow EC2 A to access EC2 B’s RS port, you can install two Replication Servers—one on EC2 A, with the primary database, and one on EC2 B, with the target database. Installing Replication Servers at both ends of the connection, where configuration permits, can reduce the effect of network latency on replication performance. The Replication Servers in this scenario can communicate using the TDS protocol:

- Replication Server on the source database’s EC2 only
  In a restricted network environment where security groups on EC2 instance B, where the target database runs, do not allow EC2 instance A to access EC2 B’s RS port, install Replication Server on EC2 A, near the primary database. It can communicate with the target database on EC2 B through ODBC or TDS.

- Replication Server on the target database’s EC2 only
  If security groups on EC2 instance A (running the primary database) do not allow EC2 instance B to access EC2 A’s RS port, you can install Replication Server on EC2 B alongside the target database. A Replication Agent on EC2 A captures data and transfers it to the target database on EC2 B through the TDS protocol:
Replicating Data from EC2 to Your Premises

When you replicate from a database in EC2 to an on-premises database, deployment of Replication Servers depends on the configuration of EC2 security groups and your firewall.

- Replication Server in the cloud and on-premises
  When EC2 security groups allow your on-premises machine to access the RS port (a custom TCP port) on the EC2 instance and your firewall allows the EC2 instance to access the on-premises machine’s RS port, you can install two Replication Servers—one on the EC2 instance where the primary database is running and one on your premises with the target database. Installing Replication Servers at both ends of the connection, where configuration permits, can reduce the effect of network latency on replication performance. The Replication Servers in this scenario can communicate using the TDS protocol:

- Replication Server in the cloud only
  If your firewall does not allow the EC2 instance running your primary database to access the RS port on your on-premises database machine, you can install Replication Server on the EC2 instance with the primary database. It can communicate with the target database on your premises through ODBC or TDS:

- Replication Server on-premises only
  In a restricted network environment where EC2 security groups do not allow your on-premises machine to access the EC2 RS port, install Replication Server on your premises, near the target database. A Replication Agent on the EC2 instance captures data and transfers it to the on-premises Replication Server through the TDS protocol:
5.3 Replication Diagnostic Utility

The rsdiag command line utility captures critical information in a replication environment.

The rsdiag command line utility:

- Captures information about a Replication Server configuration, log and other files, and host details
- Archives the information into a file that the customer can send to SAP technical support
- Stores the results in XML format
- Provides a simple HTML file that allows the information to be displayed in a browser

Syntax

rsdiag -U username
[-P password]
-S [server_name | host:port]
[-I interfaces_file]
[-L log_file]
[-N num_threads]
[-O output_directory]
[-R resource_file]
[-T feature_list]
[-h]
[-m message_level]
[-D user_data_directory [-v]]

Parameters

- **<-I interfaces_file>** – (optional) specifies the name of the interfaces file. If **<-I>** is specified, rsdiag uses the **<interfaces_file>** specified and displays an error if that file is not found. If **<-I>** is not specified, rsdiag first checks the LDAP server for the server entry, and if the entry is not found, rsdiag uses the default interfaces file in the directory specified by the SYBASE environment variable.
- **<-L log_file >** – (optional) specifies the name of the log file that rsdiag creates. If **log_file** is not an absolute path, the log file is created in the directory where rsdiag is executed. Whether you specify this parameter or not, rsdiag creates a default log file called rsdiag.log in the .zip output file.
- **<-N num_threads>** – (optional) specifies the maximum number of parallel threads that rsdiag executes in parallel. The default value is <5>. Do not change the default value unless you cannot execute parallel collections.
- **<-O output_directory>** – (optional) specifies the name of a local directory in which to store rsdiag output. If not specified, rsdiag creates the output .zip file in the directory where the command was executed. The output file is named rsdiag-<server name>-<datetime stamp>.zip.
- **<-R resource_file>** – (optional) specifies the resource file that rsdiag uses on start-up. Use this option only at the direction of SAP Technical Support.
- **<-P password>** – specifies your Replication Server password. If you do not specify the -P flag, rsdiag prompts for a password. If your password is NULL, use the -P flag without any password.
• `<-S server_name | host:port>` – server_name specifies the name of the Replication Server to which rsdiag connects. rsdiag looks for this name in the interfaces file or the LDAP directory. If you specify `<-S>` with no argument, rsdiag looks for a server named SYBASE. If you do not specify `<-S>`, rsdiag looks for the server specified by your DSQUERY environment variable. The host:port entry specifies the machine name and the port number.

• `<-T feature_list>` – (optional) specifies the type of diagnostic data that rsdiag gathers, based on these feature_list values:
  ○ osdata – operating system data
  ○ rscore – Replication Server configuration data
  ○ rsadd – Replication Server monitoring data
  ○ keyfile – information about Replication Server and operating system files
All diagnostic data is collected if you do not specify `<-T>`.

• `<-U username>` – specifies a case-sensitive login name.

• `<-h>` – (optional) displays all help options.

• `<-m message_level>` – (optional) displays different levels of error messages depending on the value of message_level:
  ○ 0 – no messages
  ○ 1 – fatal errors only
  ○ 2 – all errors
  ○ 3 – warnings and all errors
  ○ 4 – informational messages, warnings, and all errors
  ○ 5 – debug and informational messages, warnings, and all errors
By default, the error message display level is set to 4.

• `<-v>` – (optional) displays version information.

Example

```
# source SYBASE.sh
# rsdiag -Usa -PSybase123 -SD01
```

Permissions

• To gather all Replication Server data, you must have permission to access all datasources. You must run this command with user `<sa>` or a user who has the `<sa_role>` to collect Replication Server configuration and monitoring data.

• To gather all environment data, you must have authorized access to operating system and device files.

Note

On Linux, you must have read permission to access operating system messages in `/var/log/messages`.
You must have read permissions on these files:
- Replication Server error log
- Replication Server configuration file
- Environment scripts such as SYBASE.csh, SYBASE.sh or SYBASE.bat
- You must have write permissions on an output directory specified by the `<O>` parameter.

**Note**

If you do not have the required permissions on a file, `rsdiag` displays an error message and does not process that file.

5.4 Replication Support for SAP HANA Database

SAP Replication Server 15.7.1 SP204 includes several enhancements that support SAP HANA database replication.

**Related Information**

- Pool Tables Replication [page 37]
- Setup and Configuration of Replication to SAP HANA Database Using RMA [page 39]
- RMA Administration and Usability Enhancement [page 39]

5.4.1 Pool Tables Replication

Replication Server supports database replication from the SAP Business Suite applications that use pool tables into an SAP HANA database.

SAP Business Suite defines logical tables in the application layer. Logical tables are pooled and stored in physical tables in the database. A pool table is a physical table that contains a number of logical tables. When performing materialization and replication of databases containing pool tables, SAP Replication Server depools the data before sending data manipulation languages (DMLs) to the SAP HANA database as the SAP HANA database stores the logical tables in the database.

Pool table replication can only be enabled when cluster table replication is enabled. Pool tables can be subscribed to at the table or the database level. If you are replicating pool tables:

- Ensure that tables meet requirements for replicating cluster tables described in **Cluster Table Replication** in the **Replication Server Heterogeneous Replication Guide**.
- Enable cluster table replication.
- Materialize table DDO6L.
In Replication Server 15.7.1 SP204, the `alter connection to` syntax is enhanced with:

```
alter connection to <rds>.<rdb> set schemamap with decluster [with | without]
depool from <pds>.<pdb>.<from_schema> to <to_schema>
```

### Parameters

- **rds.rdb**
  Specifies the connection name for the SAP HANA database.
- **with depool**
  Enables depooling of pool tables for a schema.
- **without depool**
  Disables depooling of pool tables for a schema.
- **pds.pdb**
  Specifies the connection name used in the `create connection` command for the primary database.
- **from_schema**
  Specifies the schema of the primary database.
- **to_schema**
  Specifies the schema in the SAP HANA database.

### SAP Business Suite Database Materialization and Replication Scenarios

To materialize and replicate SAP Business Suite applications running on supported databases that contain pool tables into the SAP HANA database, you must configure the Replication Server.

Configuration to enable materialization and replication for cluster tables is described in Scenario 1 and Scenario 2 of SAP Business Suite Database Materialization and Replication Scenarios in the Replication Server Heterogeneous Replication Guide. The following additional steps are required to enable materialization and replication for pool tables:

1. Create a subscription for DD table DD06L.
2. Enable pool table replication:

```
alter connection to <rds>.<rdb> set schemamap with decluster with depool from <pds>.<pdb>.<from_schema> to <to_schema>
```

In scenario 1 and scenario 2, add the preceding steps after the materialization of the UMGPOCNV table.
5.4.2 Setup and Configuration of Replication to SAP HANA Database Using RMA

Replication Management Agent (RMA) is a distributed management agent for configuring and managing replication from supported databases to an SAP HANA database.

RMA supports automated setup, configuration and materialization, monitoring, and administration of an SAP Business Suite or non-Business Suite system.

With RMA, you can set up replication for these primary databases to a replicate SAP HANA database:

- IBM DB2 UDB
- Microsoft SQL Server
- Oracle

In RMA 15.7.1 SP204, you can also set up replication for SAP Adaptive Server Enterprise (ASE) to a replicate SAP HANA database.

RMA also supports replicating an ERP database from any of the supported databases. For instructions about setting up replication using RMA, see the Replication Management Agent Configuration and Users Guide.

5.4.3 RMA Administration and Usability Enhancement

Replication Management Agent (RMA) is enhanced for the configuration and management of replication from supported databases to the SAP HANA database, especially for Business Suite replication involving large numbers of tables. The enhancements are improved stability, error handling, and reporting during initial setup and table materialization.

Enhancements include:

- Significant reduction in log sizes
- GUI update to filter tables by table replication status. You can select actions for tables with specific status, for example, for the tables that are not replicated, you can select the Create action to enable replication.
- GUI update to show the total number of tables and the selected number of tables
- Automatic rematerialization for the DDIC tables for redeployment

5.5 Replication Agent for SAP HANA New Features

Replication Agent for SAP HANA Database includes several new enhancements in 15.7.1 SP204.

Related Information

Support for COLUMN Table Type [page 40]
New Command: ra_get_table_columns [page 40]
5.5.1 Support for COLUMN Table Type

Replication Agent for SAP HANA Container creates replicate tables with the same table type as defined in the primary database: ROW tables are replicated as ROW tables and COLUMN tables are replicated as COLUMN tables. In previous versions, SAP HANA Container only supported ROW tables. In this release, the replication of COLUMN tables is also supported.

5.5.2 New Command: ra_get_table_columns

After deploying the SAP HANA Container, the ra_get_table_columns command shows what column properties are obtained by the container when table metadata is obtained from the database. SAP HANA Container gets the table column information during model deployment so that tables do not need to be added to the model for this command to work.

Syntax

```
ra_get_table_columns <modelName>, <tableName>
```

Parameters

- **modelName**
  - Specifies the name of the replication model.

- **tableName**
  - Specifies the name of the table.
Example 1

Run the `ra_get_table_columns` command on the "jmt" model and the "ALL_DATATYPES" table:

```plaintext
ra_get_table_columns jmt, ALL_DATATYPES
```

The returned result is:

<table>
<thead>
<tr>
<th>POSITION</th>
<th>NAME</th>
<th>TYPE</th>
<th>TYPE NAME</th>
<th>SIZE</th>
<th>PRECISION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>COL_ID</td>
<td>4</td>
<td>INTEGER</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>COL_DATE</td>
<td>91</td>
<td>DATE</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>COL_TIME</td>
<td>92</td>
<td>TIME</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>COL_TIMESTAMP</td>
<td>93</td>
<td>TIMESTAMP</td>
<td>27</td>
<td>27</td>
</tr>
<tr>
<td>5</td>
<td>COL_TINYINT</td>
<td>-6</td>
<td>TINYINT</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>COL_SMALLINT</td>
<td>5</td>
<td>SMALLINT</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>COL_INTEGER</td>
<td>4</td>
<td>INTEGER</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>8</td>
<td>COL_BIGINT</td>
<td>-5</td>
<td>BIGINT</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>COL_DECIMAL</td>
<td>3</td>
<td>DECIMAL</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>COL_REAL</td>
<td>7</td>
<td>REAL</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>11</td>
<td>COL_DOUBLE</td>
<td>8</td>
<td>DOUBLE</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>12</td>
<td>COL_CHAR</td>
<td>1</td>
<td>CHAR</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>13</td>
<td>COL_VARCHAR</td>
<td>12</td>
<td>VARCHAR</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>14</td>
<td>COL_SECONDDATE</td>
<td>93</td>
<td>SECONDDATE</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td>15</td>
<td>COL_SMALLDECIMAL</td>
<td>3000</td>
<td>SMALLDECIMAL</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>16</td>
<td>COL_NCHAR</td>
<td>-8</td>
<td>NCHAR</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>17</td>
<td>COL_NVARCHAR</td>
<td>-9</td>
<td>NVARCHAR</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>18</td>
<td>COL_ALPHANUM</td>
<td>-9</td>
<td>ALPHANUM</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>19</td>
<td>COL_VARBINARY</td>
<td>-3</td>
<td>VARBINARY</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SCALE</th>
<th>PRIMARY KEY</th>
<th>NULLABLE</th>
<th>SEARCHABLE</th>
<th>LOB</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Y</td>
<td>NOT NULL</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>NULL</td>
<td>Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>NULL</td>
<td>Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>NULL</td>
<td>Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>NULL</td>
<td>Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>NULL</td>
<td>Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>NULL</td>
<td>Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>NULL</td>
<td>Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>NULL</td>
<td>Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>NULL</td>
<td>Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>NULL</td>
<td>Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>NULL</td>
<td>Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>NULL</td>
<td>Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>NULL</td>
<td>Y</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

New Features Guide
New Features in Version 15.7.1 SP204

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5.5.3 New command: ra_mat_status

Gets the materialization status for the specified model and shows the materialization status for each table in the model.

Syntax

```
ra_mat_status <modelName>
```

Parameters

- **modelName**: Specifies the name of the replication model.

Examples

**Example 1**

Run the `ra_mat_status` command on the "jmt" model and the "ALL_DATATYPES" table when the table is being materialized:

```
ra_mat_status jmt
go
```

The returned result is:

```
TABLE NAME     TABLE STATUS
-------------- --------------
ALL_DATATYPES  Materializing
```

**Example 2**

Run the `ra_mat_status` command on the "jmt" model and the "ALL_DATATYPES" table after the table is materialized:

```
ra_mat_status jmt
go
```

The returned result is:

```
TABLE NAME     TABLE STATUS
-------------- ------------------------
ALL_DATATYPES  Materialization complete
```
5.5.4 New Command Option: forceMatStop

In previous versions of Replication Agent for SAP HANA, the `ra_stop` command took no parameters. If the model was in a materializing state, the model waited for some time before exiting. If you were unaware that the materialization was in progress, you had to restart materialization from the beginning.

The new `forceMatStop` option for the `ra_stop` command ensures that the model cannot be stopped by running the `ra_stop` command alone if materialization is in progress. You must set the `forceMatStop` option to true to stop a model if any materialization is in progress.

Syntax

```
ra_stop <modelName>, forceMatStop [true|false]
```

Parameters

- **modelName**
  
  Specifies the name of the replication model.

- **forceMatStop**
  
  - true – forcibly stops any active materialization before the model is stopped.
  - false – (default) stops the model without trying to stop any materialization. If any materialization is in progress, the model fails to stop.

5.5.5 New Model Properties

The `propertyName` parameter of the `ra_add_prop` command includes three new properties:

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>ddlCreateNewTable</code></td>
<td>When the <code>handleDDL</code> property value is set to true, this property determines whether newly found tables on the primary database are added to the model and are set for materialization and replication. Default: false Valid values are true or false.</td>
</tr>
</tbody>
</table>
### Property Name: sequenceCacheSize

The value used by SAP HANA sequences for the sequence cache:

- If the property value is set to a positive value, the HANA sequence uses the value for the sequence cache. For example:
  ```sql
  CREATE SEQUENCE <name> CACHE <sequenceCacheSize>
  ```

- If the property value is set to a negative or zero value, the HANA sequence is created without cache setting. For example:
  ```sql
  CREATE SEQUENCE <name>
  ```

Default: 0

Valid values are positive, negative, or zero.

### Property Name: keepBeforeStateInTriggers

Determines whether the trigger records the before state of rows:

Default: true

If the property value is set to false, the trigger only records the after state of rows but not the before state. This can be a performance boost because the trigger has fewer rows to insert into the shadow table of the system.

---

### 5.5.6 Comment Enablement to Mark Primary Key Column

Add a new configuration setting to enable primary key columns to be marked in the replicate table by column comments.

For some replication modes such as CDC and TRANS_CDC, the replicate tables contain additional columns that form the new primary key of the table. To keep a reference to which columns form the primary key in the primary table, a comment is added to each column.

The comment is stored under the `rep.column.pk` container configuration setting. Run the `ra_get_all_config` command to check the current values and look for `rep.column.pk` in the value list.

The default primary key column comment is PRIMARY_KEY.

### 5.5.7 DDL Handling Improvements

Replication Server 15.7.1 SP204 improves overall DDL handling within the SAP HANA Container. This ensures that changes to column metadata are handled correctly. The changes include adding and removing columns, changing datatypes and changing properties (such as size, precision, and scale) of a column.

Changes to table metadata cause the drop and re-creation of the replicate table and the rematerialization of the primary table data. This ensures that the data of the replicate table is fully in synchronization with that of the primary table.
5.6 Database Replication Enhancements in Heterogeneous Replication Environments

Replication Server supports more enhancements in the heterogeneous replication environment from Oracle to the SAP HANA database.

Related Information

Configuration of the Create Table Command with Row Store and Column Store [page 45]
Configuration of Datatype Mapping for DDL Replication [page 46]
Unique Index Replication [page 48]
Additional Options in Table Creation [page 49]

5.6.1 Configuration of the Create Table Command with Row Store and Column Store

When replicating the create table command and initializing replicate tables during materialization, Replication Server supports the configuration to decide whether to store tables in rows or in columns into the SAP HANA database. In previous releases, you can only store tables in rows into the SAP HANA database, with the new configuration in 15.7.1 SP204, you can also configure to store tables in columns into the SAP HANA database.

Replication Server adds a new configuration parameter dsi_ddl_create_column_table in the replicate Replication Server at both the server level and the connection level. The default value is off. When you set the parameter to on, Replication Server issues the create column table command when sending the create table commands to the replicate database.

At the connection level, use the alter connection command to set the configuration for the SAP HANA database. Use the admin config, 'connection' command to check the configuration results.

At the server level, use the configure replication server command to set the configuration for all connections in the server. Use the admin config command to check the configuration results.

Note
- Restart the connection to the replicate database to enable the configuration.
- This configuration parameter does not take effect in the SAP Business Suite when cluster table replication is enabled.
5.6.2 Configuration of Datatype Mapping for DDL Replication

Replication Server allows you to define mapping for the datatypes in the data definition language (DDL) commands when replicating and initializing replicate tables during materialization.

You can define the mapping through the new configuration parameter `ddl_datatype_map` at the replicate Replication Server.

**Syntax**

```plaintext
configure replication server set ddl_datatype_map from {ORA}.{<pdatatype> | <pdatatype(n)> | <pdatatype(precision,scale)>} to {HDB}.{NULL | <rdatatype> | <rdatatype>multi | <rdatatype(n)> | <rdatatype(precision,scale)>}
```

**Parameters**

- **pdatatype(n)**
  Datatype and length of the primary datatype. When the `n` parameter is a negative number, the datatype with all lengths in the primary database are mapped with the same replicate datatype as indicated in the command.

- **pdatatype(precision,scale)**
  Datatype, precision and scale of the primary datatype. When the values of the `precision` and `scale` parameters are negative numbers, the datatype with all precisions and scales in the primary database are mapped with the same replicate datatype as indicated in the command. Both precision and scale must have either the same negative value or the same positive value. When you specify a primary datatype that can have precision and scale, you have to specify both precision and scale. For example: `NUMBER(1)` is not valid.

- **NULL**
  Configures the mapping to the default replicate datatype for this particular primary datatype.

- **multi**
  When the `multi` parameter is specified, the length of the replicate datatype equals the primary datatype length multiplied by the `multi` parameter. When the `multi` parameter is omitted, the primary datatype and replicate datatype have the same length.

**Note**

- The `multi` parameter works only for datatype length, not for precision and scale.
- The `multi` parameter can only be a positive integer.
For a specific DDL command, Replication Server first finds the exact match of datatype, length, precision, and scale in the datatype mapping. If this match cannot be found, Replication Server finds the match in the generic map, which is specified with negative numbers in length, precision, and scale. Otherwise, the default datatype mapping is used.

If you do not configure datatype mapping, the default mapping takes effect. Refer to Datatype Mapping Changes in the SAP Replication Server New Features Guide for details of default mapping.

**Note**
- The datatype that has properties of length, precision, or scale has to be specified with explicit length, precision, and scale for the mapping.
- The datatype mapping does not take effect in the SAP Business Suite when cluster table replication is enabled.
- When you change Replication Server from previous versions to 15.7.1 SP204 without upgrading, you need to grant RSSD_primary_user the sa role to restart the Replication Server for the first time.
- The datatype for the primary database in the mapping should match the datatype stored in the database system except for the datatypes listed in the following table:

<table>
<thead>
<tr>
<th>Primary Database</th>
<th>Primary Table Datatype</th>
<th>Primary Datatype in DDL Datatype Mapping</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oracle</td>
<td>Integer</td>
<td>NUMBER(38,0)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Binary Float</td>
<td>Binary_Float(-2147483647)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Timestamp(n)</td>
<td>Timestamp(n)</td>
<td>The n parameter is defined in the column DATA_SCALE in the table USER_TAB_COLUMNS</td>
</tr>
<tr>
<td></td>
<td>Nchar(n)/nvarchar2(n)</td>
<td>Nchar(n)/nvarchar2(n)</td>
<td></td>
</tr>
</tbody>
</table>

**Example**

Configure the replicate datatype mapping:

```bash
configure replication server set ddl_datatype_map from ORA.NUMBER(38,0) to HDB.INTEGER
```

**Example**

Configure the replicate datatype mapping:

```bash
configure replication server set ddl_datatype_map from ORA.CHAR(10) to HDB.NCHAR[]
```
5.6.3 Unique Index Replication

Replication Server supports replication of index-related DDL commands to the SAP HANA database with the control of a new configuration parameter, applied_ddl_index_support.

The following DDL commands are supported:

- create unique index
- drop index

To enable the replication of these DDL commands, turn on the new configuration parameter applied_ddl_index_support for the connections at both the connection level and the server level. The default value is off.

At the connection level, use the alter connection command to set the configuration for the primary database connection. Use the admin config, 'connection' command to check the configuration results.

At the server level, use the configure replication server command to set the configuration for all connections in the server. Use the admin config command to check the configuration results.

Also see Unique Index Replication in the SAP Replication Server Options New Features Guide for more details.
i Note

- Restart the connection to the primary database to enable the configuration.
- After you turn on this configuration parameter, you cannot change the Replication Server back to versions before 15.7.1 SP204 without purging stable queues if the stable queues contain the index commands in the new format.
- This configuration only applies to DDL replication during continuous replication. Creating an index is not supported during materialization for initializing the replicate table, except for the materialization for the SAP Business Suite.
- To replicate the index commands, you must use the same Replication Server to manage the connections to both the primary database and the replicate database.

5.6.4 Additional Options in Table Creation

Replication Server allows you to add additional options to all the `create table` commands sent from Replication Server to the SAP HANA database.

You can add additional options for your SAP HANA schema through the new configuration parameter `create_table_append_text` by using the `alter connection` command. After configuration, the configuration value is appended to the end of the `create table` command during materialization for initializing replicate tables and continuous replication.

Syntax

```sql
alter connection to <rds>,<rdb>
for replicate schema named <to_schema>
set <param> to '<value>'
```

Parameters

- `rds.rdb`
  Name of the replicate data server and database.
- `to_schema`
  The schema of the replicate database.
- `param`
  Currently, only `create_table_append_text` is supported. After configuration, the value of this configuration is appended to all the `create table` commands sent to the connected SAP HANA database.
- `value`
The additional options to the `create table` command. Only the `group_option` and the `location_clause` syntax elements are supported to be added as additional options. To remove the additional options, set the value to a string with zero length.

5.7 Support to Suspend and Resume Route from Source Replication Server

SAP Replication Server 15.7.1 SP 204 supports suspend and resume commands which control the replication flow between the primary database and all the standby databases to route from source replication server.

With this enhancement, the suspend and resume route commands control routing from another instance of Replication Server.

Suspend/Resume route from source Replication Server

You can use the suspend/resume command for a direct route which is destination to this site.

Syntax

```
suspend route from source_replication_server
resume route from source_replication_server
```

`source_replication_server`:
The name of the source Replication Server with a direct route to destination site.

Examples

Suspend/Resume command route from SYDENY_RS Replication Server to destination site:

```
suspend/resume route from SYDENY_RS
```

Usage

- To suspend a direct route to destination site and control when the messages are sent from one Replication Server to the destination site.
While a route is suspended, this Replication Server does not receive messages from the source Replication Server and blocks the message sender in the source Replication Server.

You can suspend only a direct route.

To reactivate a suspended route, use `resume route`

## 5.8 Changes to the Upgrade or Downgrade of SAP Replication Server

Two new configuration file items are generated by seamless upgrade when using the `-A` option - `erssd_release_dir_generated` and `erssd_start_cmd_generated`.

**Note**

These two configuration file items are generated by Replication Server internally. Do not manually change them. When upgrading or downgrading using `rs_init`, the `-A` option is ignored. The `rs_init` command uses only the `erssd_start_cmd` and `erssd_release_dir` parameters specified in the configuration file.

**Suggested usage for Replication Server upgrade when using embedded RSSD (eRSSD)**

1. When using the seamless upgrade function to upgrade eRSSD, that is `repserver -upgr ....` always use the `-A` option to specify your ASA release directory.

2. When using `rs_init` to upgrade eRSSD, specify the correct `erssd_start_cmd` and `erssd_release_dir` values manually in the configuration file.
New Features in Version 15.7.1 SP203

SAP Replication Server 15.7.1 SP203 includes support for multiple select threads, a new function string `rs_select_count_star`, and several new and enhanced commands.

Related Information

- Multiple Select Threads [page 52]
- `rs_select_count_star` Function String [page 53]
- New SAP Replication Server Commands [page 54]
- Enhanced SAP Replication Server Commands [page 58]

### 6.1 Multiple Select Threads

When a replicate table is materialized, Replication Server now allows more than one select threads.

In earlier releases, when a replicate table is materialized, Replication Server would spawn one select thread to get data from the primary table. To improve the performance of materialization, the syntax for creating a subscription with the `direct_load` option is extended to allow more than one select threads. Also, the maximum value of the direct load materialization configuration parameter `max_mat_load_threads` is changed from 20 to 80.

#### Syntax

```sql
create subscription <sub_name>
for {table_repdef | func_repdef | publication pub |
    database replication definition <db_repdef> }
[ with primary at <server_name.db> ]
with replicate at <data_server.database >
[where {column_name | @param_name}
  {< | > | >= | <= | = | &} value
[and {column_name | @param_name}
  {< | > | >= | <= | = | &} value]...]
[without holdlock [direct_load [init replicate table with {create |
  create_or_truncate | truncate | recreate}]]
[user <username> password <pass>][<num_of_selects> selects [ on <column_name> |
  with {<condition1>, <condition2> [, <condition3>] [,...
  <condition4>...]})]
[hold_resource_on_error]]| incrementally | without
materialization][subscribe to truncate table]
[for new articles]```
The `num_selects` column added to the `rs_subscriptions` system table in SAP Replication Server 15.7.1 SP202 accepts values 1 (default) through 10.

**Example 1**

(Only supported for DB2 version 9.7 or higher, and Oracle) In this example, there are four select threads.

```sql
create subscription sub1 for repdef1 with replicate at rds1.rdb1
where col1 > 0 and col1 <= 1000000
without holdlock direct_load
4 selects
```

**Example 2**

(Only supported for DB2 version 9.7 or higher, and Oracle) In this example, the data is divided among the select threads using column `<col1>`. `<col1>` is part of primary key or searchable columns.

```sql
create subscription sub1 for repdef1 with replicate at rds1.rdb1
where col1 > 0 and col1 <= 1000000
without holdlock direct_load
4 selects on col1
```

**Example 3**

(Supported for Adaptive Server, Microsoft SQL Server, Oracle, and IBM DB2 UDB) In this example, there are four select threads, with user provided `where` clauses. Here, select thread 1 handles data with `<col2> < 10000`, select thread 2 handles data with `<col2> >= 10000 and <col2> < 20000`, select thread 3 handles data with `<col2> >= 20000 and <col2> < 30000`, and select thread 4 handles data with `<col2> >= 30000`.

```sql
create subscription sub1 for repdef1 with replicate at rds1.rdb1
where col1 > 0 and col1 <= 1000000
without holdlock direct_load
4 selects with (col2 < 10000,
            col2 >= 10000 and col2 < 20000,
            col2 >= 20000 and col2 < 30000,
            col2 >= 30000)
```

### 6.2 rs_select_count_star Function String

SAP Replication Server introduces a new function string `rs_select_count_star` to get the number of rows from a primary table.

`rs_select_count_star` is used by the select thread in subscriptions created with the `direct_load` option.
You can customize the `rs_select_count_star` function string. The default function string for `rs_select_count_star` is:

```sql
select count(*) from <primary table> [<where_clause>]
```

**rs_select_count_star**

Use `rs_select_count_star` to get the number of rows from a primary table.

**Example**

Suppose a subscription is created with where `<au_lname>` > 1010. In this example, the function string `rs_select_count_star` is changed so that it returns number of rows for table authors where `<au_lname>` > 1000.

```sql
create function string authors.rs_select_count_star;select_count_1 for flat_file_class _function_class with overwrite scan 'select count(*) from authors where au_lname > ?au_lname!user?' output language 'pdb_execute_sql
*select count(*) from authors where au_lname >?au_lname!user? - 10''
```

**Usage**

`rs_select_count_star` should be consistent with `rs_select`. For example, if you alter the function string for `rs_select` to select from another table, either:

- Change the function string for `rs_select_count_star` if the two tables do not have the same number of rows.
- Do not change the function string for `rs_select_count_star` if the two tables have the same number of rows.

### 6.3 New SAP Replication Server Commands

New SAP Replication Server commands.

**Related Information**

Command to View Database Replication Definition Status Information [page 55]
6.3.1 Command to View Database Replication Definition Status Information

Use `check database replication definition` to view the names of all the database replication definitions defined in an SAP Replication Server and the status of each database replication definition.

**Syntax**

```
check database replication definition [<db_repdef>, <primary_data_server>, <primary_database>, {table | ddl}]
```

**Parameters**

- **db_repdef**: The name of a database replication definition.
- **primary_data_server**: The primary data server name.
- **primary_database**: The primary database name.
- **table**: `table`, a keyword, displays the table replication list and its status.
- **ddl**: `ddl`, a keyword, displays the status of DDL replication (enabled or disabled).

**Example**

This command displays all the database replication definitions defined in this SAP Replication Server.

```
check database replication definition
```

**Example**

This command displays the attributes of this replication definition in detail.

```
check database replication definition <db_repdef>, <pds>, <pdb>
```
Example
This command displays the attributes of the database replication definition and information about the replicating table list.

```
check database replication definition <db_repdef>, <pds>, <pdb>, table
```

Example
This command displays the attributes of the database replication definition and the status of DDL replication (enabled or disabled).

```
check database replication definition <db_repdef>, <pds>, <pdb>, ddl
```

Usage

- Use `check database replication definition` to display a list of database replication definitions, including the primary database and primary Replication Server for each definition.

6.3.2 Command to View Database Subscription Status Information

Use `check database subscription` to view the status of a database subscription defined at the replicate server.

Syntax

```
check database subscription [<sub_name>, <replicate_data_server>,
<replicate_database> [{pending | materializing | valid | error | user}]
```

Parameters

- `<sub_name>`
  
  The name of the subscription.

- `<replicate_data_server>`
  
  The name of the replicate data server.

- `<replicate_database>`
The name of the replicate database.

**pending**
Displays a list of tables that are pending materialization.

**materializing**
Displays a list of tables that are undergoing materialization.

**valid**
Displays a list of tables that have completed materialization.

**error**
Displays all the tables that failed materialization.

**user**
Verifies whether the materialization user is valid at the primary database and also displays the user name.

**Example**
This example displays all the database subscriptions defined at the replicate server.

```
check database subscription
```

**Example**
This example displays the details about the `<subname>` subscription defined at the replicate server, that is, the subscription status, the percentage of tables that have the pending, materializing, valid, or error states, and the materialization user.

```
check database subscription <subname>, <rds>, <rdb>
```

**Example**
This example displays all the tables that are in pending materialization.

```
check database subscription <subname>, <rds>, <rdb>, pending
```

**Example**
This example displays all the tables that have completed materialization.

```
check database subscription, <rds>, <rdb>, valid
```

**Example**
This example displays all the tables that have failed materialization.

```
check database subscription, <rds>, <rdb>, error
```
Example
This example verifies whether the materialization user is valid at the primary database and also displays the user name.

```
check database subscription, <rds>, <rdb>, user
```

Usage

- Use `check database subscription` to find the status of a subscription during subscription materialization or after subscription materialization.
- Execute `check subscription` at the Replication Server that manages the database where the replicate data is to be stored or the Replication Server that manages the replicate database.

6.4 Enhanced SAP Replication Server Commands

Enhanced SAP Replication Server commands.

Related Information

- Changes to create database replication definition [page 58]
- Changes to alter database replication definition [page 59]
- Changes to create subscription [page 60]
- Changes to alter subscription [page 61]

6.4.1 Changes to create database replication definition

The create database replication definition syntax has been modified to allow the `in files` parameter to accept an include table list.

Syntax

```
create database replication definition <db_repdef>
with primary at <server_name.db>
[not replicate DDL] |
```
[replicate DDL [{with | without} auto_update_table_list] | 
{with | without} auto_extend_table_list])
[[not] replicate functions <setcont>]
[[not] replicate transactions <setcont>]
[[not] replicate system procedures <setcont>]
[[not] replicate tables [[<setcont> [except <setcont>]] | in files [[<file1> [, <file2> [[, ..]]] | 
[[not] replicate {SQLDML | DML_options} [in <table_list>]]
[user <username> password <pass>]]
<setcont> ::= [[in] [{<owner1>.<name1>[, {<owner2>.<name2>[, ... ]}]]
<setname> ::= {tables | functions | transactions | system procedures}

Usage

- The order of the files in the in files parameter’s file list sets the materialization order. All the tables in the first file in the list materialize—in the order in which they are listed in the file—before tables in the second file begin to materialize, and so on.
- If a table in any file fails to materialize, SAP Replication Server finishes materializing all the other tables in that file, but does not move on to the next file.
- If a table occurs in more than one file, only the first occurrence triggers materialization.
- If a table is later added to the replication definition using the alter database replication definition command, the file will not be updated.
- The user who starts the primary Replication Server must have read permission for the files in the in files parameter’s file list.

6.4.2 Changes to alter database replication definition

The alter database replication definition syntax has been modified to add tables to the replication path and remove tables from the replication path. You can specify tables inline or in a file list.

Syntax

alter database replication definition <db_repdef>
with primary at <data_server.database>
{{not replicate DDL} | 
{replicate DDL [{with | without} {auto_update_table_list | 
auto_extend_table_list}]} | 
[[not] replicate <setname> <setcont> | 
[not] replicate {SQLDML | DML_options} [in <table_list>]] | 
[alter owner from <current_table_owner> to <new_table_owner> [for <table_name>]] | 
[[add | remove] tables {[setcont]}] | 
[with dsi_suspended] | 
[user <username> password <pass>]
<setcont> ::= [[in] {[<owner1>.<name1>[, [<owner2>.<name2>[, ... ]]} | [in files {[<file1> [, <file2> [, ..]]}]}
<setname> ::= {tables | functions | transactions | system procedures}
Usage

- When adding tables:
  - If a table is already defined as replicating in the database replication definition, nothing changes. Otherwise, this table is added to the replication path.
  - If a replicate site subscribes to a database replication definition, and the database subscription is created with the with materialization option, the table materializes automatically.
  - If multiple sites subscribe to a database replication definition, the table is not updated in the rs_dbsubsets table until all sites finish materialization.
- When removing tables, if a table is defined as not replicating in the database replication definition, nothing changes. Otherwise, the table is removed from the replication path.
- If multiple replicate sites subscribe to a database replication definition, changing the definition affects all of them. To avoid a global change, use a different database replication definition.

6.4.3 Changes to create subscription

In this release, you can create a database subscription with materialization of the whole database or a subset of the tables.

Syntax

```
create subscription <subname>
for database replication definition <repdefname>
with primary at <pdsname.pdbname>
with replicate at <rdsname.rdbname>
{with materialization
  [[init replicate table with {create | create_or_truncate | truncate | recreate}
  [user <username> password <password>]]
  | without materialization]
setname ::= {tables | transactions}
  setcont ::= [[in] ([owner1.]name1[, [owner2.]name2 [, ... ]])]
```

Usage

- If you use `create subscription` with the `with materialization` option, before the materialization process begins, SAP Replication Server automatically marks the primary table replicable with owner on. If the table is already marked as replicable with owner on, the materialization continues. If the table is already marked as replicable with owner off, the materialization process stops and reports an error.
- To perform database materialization for tables with `timestamp` columns, enable the `send_timestamp_to_standby` configuration parameter for the direct load connection to the primary Replication Agent, and for the connection to the replicate database.
6.4.4 Changes to alter subscription

In this release, you can change a subscription’s user and init-table options.

Syntax

```sql
alter subscription <subname>
for database replication definition <repdefname>
with primary at <pri_dataserver.pri_database>
with replicate at <data_server.database>
[user <username> password <password>]
[[not] [create | create or truncate | truncate | recreate] replicate table]
```

Parameters

user <username> password <password>

Set the user who performs the select and mark operations at the primary for materialization.

[not] [create | create or truncate | truncate | recreate] replicate table

Change the way a materialized table is added to the replication path. At most one of the init-table options (create, create or truncate, truncate, or recreate) can be in force at a time. For details and restrictions, see Reference Manual SAP Replication Server > SAP Replication Server Commands > create subscription.

Usage

- Executing `alter subscription move replicate` is not allowed while the database subscription is being materialized.
7 New Features in Version 15.7.1 SP202

SAP Replication Server 15.7.1 SP202 includes support for XStream and Oracle Data Vault in the Replication Management Agent (RMA) replication model deployment, distributed application of transactions in the DSI thread, and enhancement to Replication Agent for SAP HANA database to start as a Windows service.

Related Information

Oracle XStream and Data Vault Support in RMA [page 62]
Replication Agent for SAP HANA as a Windows Service [page 63]
Distributed Application of Transactions in the DSI Thread [page 70]
SAP ASE RepAgent Parameter max writetext groups [page 70]

7.1 Oracle XStream and Data Vault Support in RMA

The RMA replication model deployment is enhanced to include support for XStream and Data Vault in an Oracle primary database.

Data Change Interface - XStream and LogMiner

If you select Oracle as your primary database, a Data Change Interface selection is now provided during replication deployment model set up. This determines the interface used to detect and replicate data changes in the Oracle database.

Oracle Data Vault

During database configuration verification, RMA detects if Data Vault is in use with the Oracle database and verifies Data Vault privileges. If configuration verification returns errors and you select to automatically correct the configuration, you will be prompted to supply Data Vault Admin credentials for any Data Vault privileges issues. The Data Vault Admin credentials are only used during configuration correction, and are not retained once correction is complete.

See Deploying a Replication Model in the Replication Management Agent (RMA) Configuration and Users Guide under the SAP Replication Server 15.7.1 SP202 documentation set.
7.2 Replication Agent for SAP HANA as a Windows Service

Replication Agent for SAP HANA now includes an option to be installed as a Windows service. When you install Replication Agent for SAP HANA container as a Windows service, you can administer the container service using the Windows Services console or the ServerAdmin utility.

Related Information

Installing Replication Agent for SAP HANA Container as a Windows Service Using the GUI [page 63]
Removing Replication Agent for SAP HANA Container Windows Service Using the GUI [page 64]
Starting and Stopping Replication Agent for SAP HANA Container as a Service Using Microsoft Windows Services Tool [page 65]
Administering the Replication Agent for SAP HANA Container as a Windows Service Using the ServiceAdmin Utility [page 66]

7.2.1 Installing Replication Agent for SAP HANA Container as a Windows Service Using the GUI

Use the Replication Agent for SAP HANA Control Center GUI to install a container as a Windows service.

Procedure

1. On a Windows machine, navigate to Start ➔ All Programs ➔ Accessories ➔
2. Right-click on the Command Prompt and select the Run as Administrator menu item.
3. Enter the Replication Agent for SAP HANA Control Center GUI startup script batch file name: HANARAXCC.cmd
4. Once the Replication Agent for SAP HANA Control Center GUI starts:
   a. Right-click on the RAXContainer under the Known Agents in the Agent Servers pane.
   b. Select the Install Server RAXContainer As a Windows Service menu item.

   where RAXContainer is the name of your Replication Agent for SAP HANA server.

   The Install Server RAXContainer As a Windows Service menu item is disabled, when the:
   ○ Container is installed as a Windows service
   ○ User does not have the administrative privileges
5. After a successful installation, a dialog is displayed indicating the Windows service was created. Click OK.

   Replication Agent for SAP HANA creates an <yourcontainername>.ini file in the instances\config directory.
This .ini file contains the configuration information required by the Windows service to start the container.

A sample .ini file:

```ini
[JavaOptions]
jvmDLL=C:\test\rah\Shared\SAPJRE-7_1_011_64BIT\bin\server\jvm.dll
mainClass=com/sap/rahana/util/winservice/Service
exePath=C:\Users\I825357\Documents\rsngdev\gitrepo\rah\hanarax\native\bin\amd64\ContainerService.exe
classPath=\libs\container\container-1.0-SNAPSHOT.jar;\libs\container\common-1.0-SNAPSHOT.jar;\bin\hana_runtime-1.0.jar;\bin\hana_runtime.jar;\lib\cryptoj.jar;\lib\cryptojce.jar;\lib\cryptocommon.jar;\lib\jclp-annotations.jar;\lib\conn4.jar;\lib\jTDS3.jar;\lib\git\hanarax\lib\ngdbc.jar;\lib\container\spring\spring-core-3.2.5.RELEASE.jar;\lib\container\spring\spring-beans-3.2.5.RELEASE.jar;\lib\container\derby\derby.jar;\lib\container\derby\derbynet.jar;\lib\container\sysam\sylapi.jar;\lib\container\csi\commons-pool-1.6.jar;\lib\container\csi\csi-core.jar;\lib\container\csi\csi-ldap.jar;\lib\container\csi\csi-nativeos.jar;\lib\container\xbean-spring-3.6.jar;\lib\container\commons-logging-1.1.jar;\lib\container\xeroes\mpl.jar;\lib\container\xml-apis.jar;\lib\container\spring\spring-beans-3.2.5.RELEASE.jar;\lib\container\spring\spring-core-3.2.5.RELEASE.jar;\lib\container\derby\derby.jar;\lib\container\derby\derbynet.jar;\lib\container\sysam\sylapi.jar;\lib\container\csi\commons-pool-1.6.jar;\lib\container\csi\csi-core.jar;\lib\container\csi\csi-ldap.jar;\lib\container\csi\csi-nativeos.jar;\lib\container\xbean-spring-3.6.jar;\lib\container\commons-logging-1.1.jar;\lib\container\xeroes\mpl.jar;\lib\container\xml-apis.jar
javaHeap=-Xmx2g -Xms2g -XX:MaxPermSize=512m
numberOfOptions=8
jvmoption1=-XX:+UseConcMarkSweepGC
jvmoption2=-XX:+CMSIncrementalMode
jvmoption3=-XX:+CMSIncrementalPacing
jvmoption4=-XX:MaxTenuringThreshold=30
jvmoption5=-XX:+CMSClassUnloadingEnabled
jvmoption6=-Djava.security.policy=\config\java.policy
jvmoption7=-Dlog.directory=\logs
jvmoption8=-Djava.util.logging.manager=com.sybase.rs.container.logger.BridgedLogManager

[HRAXOptions]
containerName=RAXContainer
workingDirectory=C:\Users\I825357\Documents\rsngdev\gitrepo\rah\hanarax
serviceLog=C:\Users\I825357\Documents\rsngdev\gitrepo\rah\hanarax\instances\RAXContainer\logs\WindowsService.log
# Enable this to see Debugging Messages
# debug=true
# Enable this to pause the Service allowing the attaching of a debugger (in ms)
# startDelay=15000
```

### 7.2.2 Removing Replication Agent for SAP HANA Container Windows Service Using the GUI

Use the Replication Agent for SAP HANA Control Center GUI to remove a container from Windows services.

**Procedure**

In the Replication Agent for SAP HANA Control Center GUI, to remove a container from Windows services:
a. Right-click on the RAXContainer under the Known Agents in the Agent Servers pane.
b. Select the Remove Server RAXContainer As a Windows Service menu item.

where RAXContainer is the name of your Replication Agent for SAP HANA server.

The Remove Server RAXContainer As a Windows Service menu item is enabled, when the container is installed as a Windows service.

7.2.3 Starting and Stopping Replication Agent for SAP HANA Container as a Service Using Microsoft Windows Services Tool

Use the Microsoft Windows Services tool to start and stop Replication Agent for SAP HANA container as a Windows service.

Procedure

2. In the Services dialog, to start a container, right-click the HANA Replication Agent Service for <your container name> and select the Start menu item.

   **Note**
   If you have installed multiple servers as services, you see an entry for each container service.

   For example, if you have installed RAXContainer and MyOtherContainer as services, you see these entries in the Services window:
   - HANA Replication Agent Service for RAXContainer
   - HANA Replication Agent Service for MyOtherContainer

   When the container service starts, it creates a log file in the instances\<your container name>\logs directory with a default WindowsServiceLog file name. You can change the path to the Windows service log by changing the serviceLog value in the container .ini file.
3. To stop a container, right-click the HANA Replication Agent Service for <your container name> and select the Stop menu item.

   **Note**
   You cannot start and stop the container directly from the Services console unless you remove that container service from the Replication Agent for SAP HANA Control Center GUI.
7.2.4 Administering the Replication Agent for SAP HANA Container as a Windows Service Using the ServiceAdmin Utility

Use the ServiceAdmin utility in the HANARAX\bin directory to administer a Replication Agent for SAP HANA container as a Windows Service.

Procedure

1. In the command prompt, navigate to the HANARAX\bin directory and enter:

   ServiceAdmin

2. In the Replication Agent for SAP HANA Windows Service Agent console, enter the appropriate command to administer a container as Windows service.

   For the list of administrative commands, see New Commands [page 66].

Related Information

New Commands [page 66]

7.2.4.1 New Commands

New Replication Agent for SAP HANA commands to administer a container as a Windows service.

Related Information

AddService [page 67]
RemoveService [page 67]
ListService [page 67]
StartService [page 68]
StopService [page 68]
quit [page 69]
help [page 69]
7.2.4.1.1 AddService

Creates a Windows service for the specified server.

Syntax

```
AddService <ServerName>
```

Parameters

ServerName
Specifies the name of an existing Replication Agent for SAP HANA server.

7.2.4.1.2 RemoveService

Removes a Windows service for the specified server.

Syntax

```
RemoveService <ServerName>
```

Parameters

ServerName
Specifies the name of an existing Replication Agent for SAP HANA server.

7.2.4.1.3 ListService

 Displays the Windows service configuration file for the specified server.
Syntax

ListService <ServerName>

Parameters

ServerName

Specifies the name of an existing Replication Agent for SAP HANA server.

7.2.4.1.4 StartService

Starts the Windows service for the specified server.

Syntax

StartService <ServerName>

Parameters

ServerName

Specifies the name of an existing Replication Agent for SAP HANA server.

7.2.4.1.5 StopService

Stops the Windows service for the specified server.

Syntax

StopService <ServerName>
**Parameters**

**ServerName**
Specifies the name of an existing Replication Agent for SAP HANA server.

### 7.2.4.1.6  quit

Quits the ServiceAdmin utility.

**Syntax**

```plaintext
quit
```

**Parameters**

None

### 7.2.4.1.7  help

Provides help information for a command. When you execute the `help` command without any parameters, it will display help information for all commands.

**Syntax**

```plaintext
help <command>
```

**Parameters**

**command**
Specifies the name of the command for which to display help information.
7.3 Distributed Application of Transactions in the DSI Thread

With SAP Replication Server 15.7.1 SP202, dt_apply is available on all supported SAP Replication Server platforms except for Linux on IBM p-Series.

See Distributed Application of Transactions in the DSI Thread in the Administration Guide Volume 2.

See the SAP Replication Server Release Bulletin for supported platforms.

7.4 SAP ASE RepAgent Parameter max writetext groups

Use the max writetext groups parameter of sp_config_rep_agent to specify the maximum number of off-row LOB data chunks that RepAgent sends in a single writetext LTL command.

Use this parameter for non-compressible off-row LOB data:

```
sp_config_rep_agent [<dbname> [, 'max writetext groups', { '<max writetext groups value>' } ]]
```

The default value depends on the SAP ASE page size:

Table 8: Default Values for max writetext groups

<table>
<thead>
<tr>
<th>SAP ASE Page Size (kilobytes)</th>
<th>Maximum textinsert Size (bytes)</th>
<th>&lt;max writetext groups&gt; default (kilobytes)</th>
<th>Maximum rs_write_text Size (bytes)</th>
<th>Replication Server Block Size (kilobytes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>450</td>
<td>9</td>
<td>4500</td>
<td>16</td>
</tr>
<tr>
<td>4</td>
<td>900</td>
<td>5</td>
<td>4500</td>
<td>16</td>
</tr>
<tr>
<td>8</td>
<td>1800</td>
<td>3</td>
<td>5400</td>
<td>16</td>
</tr>
<tr>
<td>16</td>
<td>3600</td>
<td>1</td>
<td>3600</td>
<td>16</td>
</tr>
</tbody>
</table>

Whenever a system replicates large amount of off-row LOB data, increasing the value of max writetext groups may help the performance with replication. When you increase the max writetext groups value in SAP ASE, SAP recommends that you also increase the SAP Replication Server block size.
8 New Features in Version 15.7.1 SP201

SAP Replication Server 15.7.1 SP201 includes enhancements to the table replication definition creation process, RMA replication model deployment, and support for DB2 UDB on an IBM z/OS platform.

Related Information

Enhanced Table Replication Definition Creation Process [page 71]
Enhanced Replication Model Deployment Using RMA [page 72]
Support for DB2 UDB Server on an IBM z/OS Platform [page 73]

8.1 Enhanced Table Replication Definition Creation Process

Use configure replication server to set the new SAP Replication Server configuration parameters that improve the table replication definition creation process.

Syntax

```
configure replication server set <repserver_param> to '<value>'
```
Parameters

Table 9: Replication Server Configuration Parameters

<table>
<thead>
<tr>
<th>repserver_param</th>
<th>Description</th>
</tr>
</thead>
</table>
| create_repdef_without_func | Set this to on to allow SAP Replication Server to create a table replication definition without creating the corresponding table level function and function strings. This decreases the time taken to create a table replication definition. Valid values are:  
  - on (default)  
  - off  
  
  **Note**  
  If create_repdef_without_func is on and you want to customize a function string for a table replication definition, use the create function string command. |

| create_repdef_without_lock | Set this to on to allow SAP Replication Server to create table replication definitions for different tables in parallel. This decreases the time taken to create table replication definitions. Valid values are:  
  - on  
  - off (default)  
  
  **Note**  
  If you want to create multiple replication definitions for a specific table, you must set create_repdef_without_lock to off. |

8.2 Enhanced Replication Model Deployment Using RMA

When you configure the required database during replication model deployment, RMA now verifies the database configuration and provides the ability to generate scripts to correct the database configuration, if necessary.

See Deploying a Replication Model in the Replication Management Agent (RMA) Configuration and Users Guide under the SAP Replication Server 15.7.1 SP201 documentation set.
8.3 Support for DB2 UDB Server on an IBM z/OS Platform

For replication from DB2 UDB on z/OS to SAP HANA database, these replication components are certified to work with SAP Replication Server 15.7.1 SP201:

- SAP Replication Agent for DB2 UDB for z/OS 15.0 SP07
- IBM DB2 v 10.1 for z/OS running z/OS v 2.1
- SAP HANA database SPS07 Revision 74
9 New Features in Version 15.7.1 SP200

SAP Replication Server 15.7.1 SP200 includes database support, performance, and usability enhancements.

Related Information

- Replication Support for SAP HANA Database [page 74]
- Replication Support for SAP ASE [page 81]
- Replication of Quoted Identifiers at the Table Level [page 83]
- Performance Tuning Enhancements [page 83]
- Enhanced SAP Replication Server Commands [page 86]
- Systems Management Tools [page 94]
- System Tables [page 96]

9.1 Replication Support for SAP HANA Database

SAP Replication Server 15.7.1 SP200 includes several enhancements that support SAP HANA database replication.

Related Information

- SAP Replication Server Support for SAP Business Suite Database Replication [page 75]
- Setup and Configuration of Replication to SAP HANA Database Using RMA [page 76]
- Support for SAP HANA Database as a Primary Data Server [page 77]
- DDL Replication Support in Heterogeneous Replication Environment [page 77]
- Table Replication Definition Elimination [page 78]
- Replication of LOB Columns in a Table Without a Unique Key [page 78]
- Check the Schema Mappings Defined in SAP Replication Server [page 79]
- Datatype Mapping Changes [page 80]
9.1.1 SAP Replication Server Support for SAP Business Suite Database Replication

SAP Replication Server 15.7.1 SP200 supports replication of an entire database or a list of tables from SAP Business Suite applications that are running on supported databases into SAP HANA database.

You can replicate an SAP Business Suite application that is running on any of these supported databases into SAP HANA database:

- Oracle
- IBM DB2 UDB
- Microsoft SQL Server

**Note**

Replication Server does not support database-level materialization from heterogeneous primary databases.

**Truncating Tables Using Replication Agent for Microsoft SQL Server:**

In an SAP enterprise resource planning (ERP) system that uses Replication Agent for Microsoft SQL Server for replication, you must execute the `sp_SybTruncateTable` stored procedure to override the Microsoft SQL Server limitation for truncation of tables. See *SAP Business Suite Database Replication* in the *Heterogeneous Replication Guide*.

If your primary and replicate databases are not already participating in replication using SAP Replication Server, use SAP Replication Management Agent Designer to set up the replication environment. See *Replication Management Agent Configuration and Users Guide*. To manually set up the replication environment, see *Replication Server Quick Start Guide for SAP HANA Database*.

**Related Information**

[SAP Replication Server Support for Cluster Tables](#)

[SAP Replication Server Support for Cluster Tables](#)

9.1.1.1 SAP Replication Server Support for Cluster Tables

SAP Replication Server 15.7.1 SP200 supports database replication from SAP Business Suite applications that use cluster tables into SAP HANA database.

SAP Business Suite defines logical tables in the application layer that are clustered and stored in physical tables in the database. A cluster table is a compressed representation of a materialized natural join of a number of tables. When performing materialization and replication of databases containing cluster tables, SAP Replication Server declusters the data before sending DML to the SAP HANA database.

**Note**

SAP Replication Server does not support replication of pool tables.
If you are replicating cluster tables, make sure that:

- SAP HANA version is 1.00.62 or above.
- SAP Kernel is 720 or 721.
- Library `libSQLDBCHDB.dll` (Windows) or `libSQLDBCHDB.so` (UNIX) is Revision 1.00.70.00 or above.
- Library `libodbcHDB.dll` (Windows) or `libodbcHDB.so` (UNIX) is Revision 1.00.70.00 or above.

**Note**

Make sure that you do not mark the cluster tables CLU4 and VER_CLUSTR for replication. For more information, see SAP Note 902817 – Inconsistencies in cluster tables (log vs phys field name): [http://service.sap.com/sap/support/notes/902817](http://service.sap.com/sap/support/notes/902817)

See Cluster Table Replication in the Heterogeneous Replication Guide.

### 9.1.1.2 DDL Replication Support for SAP Business Suite

Replication Server supports replication of several data definition language (DDL) commands in a heterogeneous replication environment when the replicate is an SAP HANA database, except when the primary database is SAP Adaptive Server.

### 9.1.2 Setup and Configuration of Replication to SAP HANA Database Using RMA

Replication Management Agent (RMA) is a distributed management agent that you can use to set up and manage replication from any supported databases to an SAP HANA database.

RMA supports automated setup, configuration and materialization, monitoring, and administration of an SAP Business Suite or non-Business Suite system.

Using RMA, you can set up replication for these primary databases to a replicate SAP HANA database:

- IBM UDB DB2
- Microsoft SQL Server
- Oracle

RMA also supports replicating an ERP database from any of the supported databases. For instructions about setting up replication using RMA, see the Replication Management Agent Configuration and Users Guide.
9.1.3 Support for SAP HANA Database as a Primary Data Server

You can now use the Replication Agent for SAP HANA database to configure, manage, and deploy a replication model to replicate data from a primary to a replicate SAP HANA database.

Replication Agent for SAP HANA, which runs inside an RMA container, performs initial data extraction and load, and also replicates data changes on the primary SAP HANA server to the replicate SAP HANA server.

For instructions about installing and deploying a replication model, see the Replication Agent for SAP HANA Configuration and Users Guide.

9.1.4 DDL Replication Support in Heterogeneous Replication Environment

Replication Server supports replication of several data definition language (DDL) commands in a heterogeneous replication environment when the replicate is an SAP HANA database.

Replication Server supports replication of these DDL commands into SAP HANA database when the primary database is Oracle, Microsoft SQL Server, or IBM DB2 UDB (SAP ASE as a primary database is not supported):

- create table
- alter table (add column or drop column)
- rename table
- drop table

With this enhancement, Replication Server automatically alters the database replication definition to reflect any DDL changes in a database that is marked for replication at the database level, if database replication definition is defined with the auto_update_table_list or auto_extend_table_list parameter. For example, if a database is marked for replication and a table is subsequently added to the database, replication is automatically established for the newly added table.

Note that a table that is created, altered, renamed, or dropped is not normalized by the table replication definition except for the replicate table owner, if:

- The replicate table owner defined is in the table replication definition, and
- The replicate site is subscribed to the table replication definition.

i Note

In a heterogeneous replication environment, the primary datatypes map to the corresponding replicate datatypes.

See:

- Datatype Translation and Mapping in the Heterogeneous Replication Guide.
- DDL Replication Support in Heterogeneous Replication Environment in the Heterogeneous Replication Guide.
9.1.5 Table Replication Definition Elimination

If you use database replication definition and subscription in a heterogeneous environment, you do not need to use a table replication definition.

In earlier releases, a table replication definition was required for each table in a heterogeneous replication environment. In this kind of environment involving databases with many tables, maintaining all the table replication definitions requires more effort. During DDL replication, if the DDL changes the table definition without coordinating the changes with the table replication definition, the data might become inconsistent. To avoid data inconsistency and to eliminate the need to use table replication definition for each table, you can now use database replication definition and subscription.

See Table Replication Definition Elimination in the Heterogeneous Replication Guide.

9.1.6 Replication of LOB Columns in a Table Without a Unique Key

During replication from supported databases into SAP HANA database, Replication Server supports the replication of LOB columns in a table without a unique key.

If a table has no unique key and has LOB columns, the status of the LOB columns should be set to replicate_if_changed.

By default, the Replication Agents for Oracle, Microsoft SQL Server, or IBM DB2 UDB set the status of all LOB columns to replicate_if_changed.

For SAP Adaptive Server Replication Agent Thread, by default, sp_setreptable sets the replication status to always_replicate. You must use sp_setrepcol to set the replication status for LOB columns to replicate_if_changed.

See:
- Replication of LOB Columns in a Table Without a Unique Key in the Heterogeneous Replication Guide.
- Replication of Tables Without Unique Keys in the Administration Guide Volume 1.
9.1.7 Check the Schema Mappings Defined in SAP Replication Server

Use `check schema map` to view all primary and replicate schema maps defined in SAP Replication Server.

Syntax

```plaintext
check schema map [[from <primary_data_server>.<primary_database>.[<from_schema>|NULL]]
[to <replicate_data_server>.<replicate_database>.[<to_schema>|NULL]]
```

Parameters

- `<primary_data_server>.<primary_database>`
  - The name of the primary data server and database.
- `<from_schema>`
  - The schema of the primary database.
- `<replicate_data_server>.<replicate_database>`
  - The name of the replicate data server and database.
- `<to_schema>`
  - The schema of the replicate database.
- `<NULL>`
  - Specifies all primary schemas or all replicate schemas. Use NULL instead of `<from_schema>` and `<to_schema>`.

Examples

**Example 1**
Displays the schema map of the primary Oracle or Adaptive Server database.

```plaintext
check schema map from <PDS>.<PDB>.<SAPSR3>
```

**Example 2**
Displays the schema map of the primary IBM DB2 UDB database.

```plaintext
check schema map from <PDS>.<PDB>.<SAP<SID>
```
Example 3
Displays all the schema maps of the replicate database.

```
check schema map to <RDS>.<RDB>.NULL
```

Example 4
Displays the schema map of the replicate SAP HANA database.

```
check schema map to <RDS>.<RDB>.<tableowner>
```

Usage

If there is a schema mapping change during replication, you can use the `check schema map` command to check the current mapping relation. Later, you can alter the mapping according to your requirements.


9.1.8 Datatype Mapping Changes

Changes to datatype mappings from Oracle, Microsoft SQL Server, and DB2 UDB to SAP HANA database in Replication Server 15.7.1 SP200.

The datatype mappings that remain unchanged are not listed here. For the complete list of datatype mappings, see Datatype Translation and Mapping in the Heterogeneous Replication Guide.

Table 10: Oracle-to-SAP HANA Database Datatype Mappings

<table>
<thead>
<tr>
<th>Oracle Datatype</th>
<th>Replication Definition Datatype</th>
<th>SAP HANA Database Datatype</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHAR</td>
<td>char</td>
<td>varchar</td>
</tr>
<tr>
<td>NCHAR</td>
<td>unichar</td>
<td>nvarchar</td>
</tr>
<tr>
<td>RAW</td>
<td>rs_oracle_binary</td>
<td>varbinary</td>
</tr>
</tbody>
</table>

Table 11: Microsoft SQL Server-to-SAP HANA Database Datatype Mappings

<table>
<thead>
<tr>
<th>Microsoft SQL Server Datatype</th>
<th>Replication Definition Datatype</th>
<th>SAP HANA Database Datatype</th>
</tr>
</thead>
<tbody>
<tr>
<td>bigint</td>
<td>rs_msss_bigint</td>
<td>bigint</td>
</tr>
<tr>
<td>char</td>
<td>char</td>
<td>varchar</td>
</tr>
<tr>
<td>datetime</td>
<td>rs_msss_datetime</td>
<td>timestamp</td>
</tr>
<tr>
<td>datetime2</td>
<td>rs_msss_datetime2</td>
<td>timestamp</td>
</tr>
<tr>
<td>Microsoft SQL Server Datatype</td>
<td>Replication Definition Datatype</td>
<td>SAP HANA Database Datatype</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>--------------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>nchar</td>
<td>unichar</td>
<td>nvarchar</td>
</tr>
<tr>
<td>nvarchar(max)</td>
<td>rs_msss_nvarchar_max</td>
<td>nclob</td>
</tr>
<tr>
<td>smalldatetime</td>
<td>rs_msss_datetime</td>
<td>seconddate</td>
</tr>
<tr>
<td>timestamp</td>
<td>timestamp</td>
<td>varbinary(8)</td>
</tr>
<tr>
<td>time</td>
<td>rs_msss_time</td>
<td>timestamp</td>
</tr>
<tr>
<td>uniquenominator</td>
<td>char(36)</td>
<td>varchar(36)</td>
</tr>
<tr>
<td>varbinary(max)</td>
<td>rs_msss_varbinary_max</td>
<td>blob</td>
</tr>
<tr>
<td>varchar(max)</td>
<td>rs_msss_varchar_max</td>
<td>clob</td>
</tr>
</tbody>
</table>

Table 12: DB2 UDB-to-SAP HANA Database Datatype Mappings

<table>
<thead>
<tr>
<th>DB2 UDB Datatype</th>
<th>Replication Definition Datatype</th>
<th>SAP HANA Database Datatype</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLOB</td>
<td>rs_udb_varchar_for_bit</td>
<td>blob</td>
</tr>
<tr>
<td>CHAR</td>
<td>char</td>
<td>varchar</td>
</tr>
<tr>
<td>CHAR FOR BIT DATA</td>
<td>rs_udb_char_for_bit(recommended)</td>
<td>varbinary</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DECIMAL(16)</td>
<td>rs_udb_decfloat</td>
<td>double</td>
</tr>
<tr>
<td>GRAPHIC</td>
<td>unichar</td>
<td>nvarchar</td>
</tr>
<tr>
<td>INTEGER</td>
<td>rs_udb_bigint</td>
<td>integer</td>
</tr>
</tbody>
</table>

9.2 Replication Support for SAP ASE

SAP Replication Server 15.7.1 SP200 has been tested for compatibility with SAP Adaptive Server Enterprise.

Related Information

RepAgent scan verbose Parameter [page 82]
sp_setreplicate No Longer Supported [page 82]
9.2.1 RepAgent scan_verbose Parameter

In addition to the same output as the scan parameter of sp_help_rep_agent, the scan_verbose parameter displays the number of log pages to be processed by the Adaptive Server RepAgent from the current marker to the end of the log.


**Example**

For example, scan_verbose displays the scanning information for a multithreaded RepAgent with two replication paths and the default path, and with multiple scanners, and displays a count of the log pages to be processed from the current marker to the end of the log—see the log pages left column.

```sql
sp_help_rep_agent pdb2, 'scanVerbose'
```

You see:

<table>
<thead>
<tr>
<th>Replication Agent</th>
<th>Scan status</th>
<th>start_marker</th>
<th>end_marker</th>
</tr>
</thead>
<tbody>
<tr>
<td>dbname pathname</td>
<td>scanner_spid</td>
<td>------------</td>
<td>-----------</td>
</tr>
<tr>
<td>pdb2 default</td>
<td>34</td>
<td>(1099,0)</td>
<td>(1113,1)</td>
</tr>
<tr>
<td>pdb2 path1</td>
<td>35</td>
<td>(1099,0)</td>
<td>(1113,1)</td>
</tr>
<tr>
<td>pdb2 path2</td>
<td>36</td>
<td>(1099,0)</td>
<td>(1113,1)</td>
</tr>
<tr>
<td>current_marker</td>
<td>log_pages_left</td>
<td>log_recs_scanned</td>
<td></td>
</tr>
<tr>
<td>(1113,1)</td>
<td>0</td>
<td>125</td>
<td></td>
</tr>
<tr>
<td>(1113,1)</td>
<td>0</td>
<td>125</td>
<td></td>
</tr>
<tr>
<td>(1113,1)</td>
<td>0</td>
<td>125</td>
<td></td>
</tr>
<tr>
<td>oldest_transaction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(0,0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(0,0)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9.2.2 sp_setreplicate No Longer Supported

With Replication Server 15.7.1 SP200, there is no support for the sp_setreplicate Adaptive Server system procedure.

Instead, use the sp_setreptable and sp_setrepcol system procedures to control the replication of tables and columns, and to display the current replication status of tables and columns. See sp_setreptable and sp_setrepcol in the Replication Server Reference Manual.
9.3 Replication of Quoted Identifiers at the Table Level

You can configure `dsi_quoted_identifier` at the table level for an object to instruct Replication Server to replicate quoted objects correctly.

Suppose you perform table replication on a connection, where the connection-level `dsi_quoted_identifier` is `on` and subsequently you set up database replication on the same connection to replicate tables with quoted identifiers. This requires the connection-level `dsi_quoted_identifier` to be set to `always`. The existing table replication may fail because the table name and column names are all quoted. To make sure that the existing table replication is successful, set table-level `dsi_quoted_identifier` to `on` for the table.

In earlier releases, you could only set the `dsi_quoted_identifier` parameter at the connection-level or at the server-level. With Replication Server 15.7.1 SP200, you can set `dsi_quoted_identifier` at the table-level. The table-level `dsi_quoted_identifier` setting takes precedence over any existing connection-level `dsi_quoted_identifier` setting and the connection-level setting takes precedence over the server-level `dsi_quoted_identifier` setting.

If there are quoted identifiers in a primary table, to ensure replication proceeds correctly, you must create a table replication definition with the `quoted` clause and also set the connection-level `dsi_quoted_identifier` to `on`.

If there are quoted identifiers in a primary table and if you use `create subscription with the init replicate table` option for a table replication definition, you must set `dsi_quoted_identifier` to `always` and make sure that:

- The primary table name that you specify in the table replication definition must be the same as the table name in the primary database.
- The Replication Agent parameter `ltl_character_case` is set to `asis`. This ensures that the object names are sent in the same character case as they are specified in replication definitions.
- The column name that you specify in the table replication definition is the same as the column name in the primary database.
- The owner name that you specify in the schema mapping is the same as the owner name in the primary database.
- If you plan to drop the table replication definition after you create a database replication, you must quote all the identifiers (including the table name and column names) in the table replication definition.

See Quoted Identifiers in the Administration Guide: Volume 1.

9.4 Performance Tuning Enhancements

SAP Replication Server 15.7.1 SP200 includes several changes to improve and tune replication performance.
9.4.1 Ensure the SQM Reader Reads All Commands in Cache

Ensure the SQM reader always reads all commands from the stable queue manager cache.

The SQM cache reduces processing time since each read process does not require unpacking because the SQM cache caches commands written to the inbound and outbound queues. To ensure that commands that are not yet read are not discarded when the cache is full, and to ensure the SQM reader always obtains all commands in the cache, set `sqm_reader_first` on. Setting the parameter on also prevents the SQM writer from writing to the cache when the cache is full, and only allows the SQM writer to write to the cache when space is made available after the SQM reader catches up and reads commands from the cache.

See [Ensuring SQM Reader Reads All Commands in Cache](#) in the Administration Guide Volume 2 to configure `sqm_reader_first`.

9.4.2 Control the Number of Worker Threads

Control the number of worker threads available to the global task manager which can then assign the threads to process tasks scheduled by SAP Replication Server modules.

When SAP Replication Server starts, it creates a global task manager that creates the number of worker threads you can set with the `worker_thread_num` parameter at the server level for all connections. The global task manager makes the threads available for tasks scheduled by modules such as distributed application of transactions in DSI and parallel processing in DIST.

Tune the value of `worker_thread_num` only when you enable parameters that use worker threads such as when you enable distributed application of transactions in DSI or parallel processing in DIST.

In the Administration Guide Volume 2, see [Control the Number of Worker Threads](#) for tuning recommendations and [Setting the Number of Worker Threads](#) to configure `worker_thread_num`.

**Related Information**

- [Parallel Processing in DIST](#)
- [Distributed Application of Transactions in the DSI Thread for HVAR](#)
9.4.2.1 Parallel Processing in DIST

Maximize parallel processing of each transaction in the distributor (DIST) thread to improve replication performance.

For each primary database managed by an SAP Replication Server, the DIST thread uses the Stable Queue Transaction (SQT) thread to read transactions from the inbound queue, processes transactions one by one, and then uses the Stable Queue Manager (SQM) threads to write transactions to the outbound queue.

With parallel DIST processing, the DIST thread processes transactions in parallel after the SQT reads transactions from the inbound queue. Processing transactions in parallel increases the speed of replication, yet guarantees that the transaction delivery sequence to the replicate site is the same as the commit order of the transactions that occurred at the primary site.

Use the parallel_dist parameter to enable parallel processing in the DIST thread for a specific connection to a primary database or for all primary database connections to SAP Replication Server.

See Parallel Processing in DIST in the Administration Guide Volume 2.

9.4.2.2 Distributed Application of Transactions in the DSI Thread for HVAR

Distributed application of transactions for high volume adaptive replication (HVAR) to SAP ASE databases maximizes parallel processing within transactions to improve replication performance for the data server interface (DSI) thread.

With distributed application of transactions, SAP Replication Server separates commands within transactions into multiple groups and applies the command groups in parallel to the replicate database instead of applying each command serially. Use the dt_apply parameter to enable distributed application of transactions.

See Distributed Application of Transactions in the DSI Thread in the Administration Guide Volume 2.

Note

The replicate SAP ASE data server requires a separate license and configuration for distributed transaction management (DTM) to support distributed application of transactions from SAP Replication Server. See SAP ASE System Administration Guide: Volume 2 > Distributed Transaction Management > Enabling DTM features > Installing a license key.

Platform Support

dt_apply is available on all supported SAP Replication Server platforms except for Linux on IBM p-Series and Microsoft Windows. See the SAP Replication Server Release Bulletin for supported platforms.
9.5 Enhanced SAP Replication Server Commands

SAP Replication Server 15.7.1 SP200 includes enhancements to several SAP Replication Server commands.

Related Information

Changes to alter connection [page 86]
Changes to create database replication definition [page 88]
Changes to alter database replication definition [page 90]
Changes to create subscription [page 92]
Changes to activate subscription [page 93]

9.5.1 Changes to alter connection

Several new parameters are added to the alter connection command.

Syntax

```sql
alter connection to <data_server>.<database> { [for replicate table named [<table_owner>].]<table_name> [set <table_param> [to] ‘<value>’] | set function string class [to] <function_class> | set error class [to] <error_class> | set replication server error class [to] <rs_error_class> | set password [to] <passwd> | set dsi_connector_sec_mech [to] <hdbuserstore> | set log transfer [to] {on | off} | set <database_param> [to] ‘<value>’ | set <security_param> [to] ‘<value>’ | set security_services [to] ‘default’ | set dataserver and database name [to] <new_ds>.<new_db> | set trace [to] ‘<value>’ | set schemamap [with | without decluster] from <data_server>.<db>. {<from_schema> | NULL} to {<to_schema> | NULL} | set sap_trim_len to {'on' | 'off'} | set sap_systemname to ‘<sid_adm_value>’ | set reblock_ddntf to {'on' | 'off'}}
```

Parameters

Replication Server 15.7.1 SP200 adds these parameters:

- schemamap
Maps primary schema or owner (<from_schema>) to replicate schema or owner (<to_schema>).

During DML or heterogeneous DDL replication, if a replicate database is subscribing to a table replication definition that includes the table owner, the replicate owner of the table replication definition takes effect. A schemamap can take effect only if there is no table subscription for the table or if the table replication definition does include the replicate table owner.

data_server.db
Specifies the data server and database containing the primary data.

from_schema
Specifies the schema of the primary database.

to_schema
Specifies the schema of the replicate database.

with decluster
Enables declustering of cluster tables for a schema.

without decluster
Disables declustering of cluster tables for a schema.

NULL
Specifies all users. Mapping relations for <data_server>.<db> are dropped if you specify NULL for both <from_schema> and <to_schema>.

sapsystemname
(only for replication from SAP Business Suite applications) Specifies the environment variable for the SAP system name, that is <sid>.

sap_trim_len
(only for replication from SAP Business Suite on Oracle database to any supported database) Specifies whether Replication Server should truncate the first two bytes during replication if:

- The application datatype (DDIC type) of the column is RAW or LRAW, and
- The DDIC type length is greater than 255 bytes.

The valid values are ‘on’ and ‘off’ (default).

reblock_ddntf
(only for replication from SAP Business Suite on DB2 UDB database to any supported database) Specifies whether Replication Server should adjust each FIELDS column length in the replicate database to 32768 characters except the last row. The valid values are ‘on’ (default) and ‘off’.

9.5.2 Changes to create database replication definition

The create database replication definition syntax has been modified and several new parameters added.

Syntax

```
create database replication definition <db_repdef>
with primary at <server_name>..<db>
  [not replicate DDL] |
  [replicate DDL [{{with | without} auto_update_table_list} | {{with | without} auto_extend_table_list}] | [[not] replicate functions setcont]
  [[not] replicate transactions setcont]
  [[not] replicate system procedures setcont]
  [[not] replicate tables [[setcont [except setcont]] | in files '
  ('<file_path>')]]
  [[not] replicate {SQLDML | DML_options} [in <table_list>]]
  [user <username> password <pass>]]
setcont ::= [([in] [{<owner1>.<name1>[, ... ]})]]
```

Parameters

Replication Server 15.7.1 SP200 adds these parameters:

- [replicate DDL [{{with | without} auto_update_table_list} | {{with | without} auto_extend_table_list}] – Informs Replication Server to send DDL to subscribing databases and whether to update or extend the table list. If you specify replicate DDL without any option, DDL is sent to the replicate database, however, the table is not added to the replication path.
- replicate DDL with auto_update_table_list – Sends DDL commands to the replicate database. If pdb_automark_tables is true for a table, the table is automatically updated in the table list when drop table or rename table DDL commands are encountered.
- replicate DDL without auto_update_table_list – Sends DDL commands to the replicate database, but does not update the tables in the table list when drop table or rename table DDL commands are encountered.
- replicate DDL with auto_extend_table_list – Sends DDL commands to the replicate database. For a table, if pdb_automark_tables is true, the table is automatically added to the table list when create table DDL commands are encountered.
- replicate DDL without auto_extend_table_list – Sends DDL commands to the replicate database, but does not add the tables in the table list when create table DDL commands are encountered.
- [[not] replicate tables [setcont [except setcont]] | in files '
  ('<file_path>')]]

An exception list can only be used with table list. The exception list adds additional adjustment for the table list defined in the database replication definition and takes precedence over the table list.
• [[not] replicate tables in files ('<file_path>') – Specifies whether to send tables specified in the <file_path> to the replicate database.

where, <file_path> contains an include or exclude table list. You can specify only one file at a time and you must specify an absolute path for <file_path>.

**Note**
The user who starts the primary Replication Server must have read permission to read the file.

The table name format in a file and in a table list is the same. You can specify the table names in a table list in these formats:

○ <ownername>.<tablename>
○ <tablename> (the table name is stored as dbo.tablename)
○ *.<tablename>
○ <ownername>.*
○ '*x'y.'a*b' (wildcard embedded in the string)

**Note**
When create database replication definition is issued, the partial wildcard is expanded through all lists, including the table list and the exception list. The simple wildcard is expanded in the exception list before they are stored in the system table. You must specify values for user and password if your require any wildcard expansion.

When you use an include or exclude table list, observe these guidelines:

○ The table name delimiter in the file must be a new line character.
○ Lines starting with # are ignored as comments.
○ Blanks before an owner name or table name are truncated.
○ The max length of an owner name is 30 characters.

An exception list can only be used with table list. The exception list adds additional adjustment for the table list defined in the database replication definition and takes precedence over the table list.

• [user <username> password <pass>] – The user ID and password used to connect to the primary Adaptive Server database or Replication Agent and select from the primary table.

If you use wildcard in a table name, you must specify the <username> and <password>.

If you use wildcard in a table name, you must specify values for user and password.

**Note**
The user and password values are used once and are not stored in the RSSD.

**Examples**

**Example 1**

Creates a database replication definition <dbrepdef>. DDL is replicated and if a table is marked for replication at the primary, the table is automatically added to <table_list> when create table DDL.
commands are encountered. The command also replicates data for the table `<USER1.TABLE1>` and all data for `<TABLE2>`, except the `<TABLE2>` owned by `<USER2>`.

```sql
create database replication definition <dbrepdef>
with primary at <ds1>.<pdb1>
replicate DDL
with auto_extend_table_list
replicate tables in ((<USER1>.<TABLE1>, *.<TABLE2>) except in ((<USER2>).<TABLE2>)
```

**Example 2**

Creates a database replication definition `<db_repdef>`. DDL is replicated, but does update the `<table_list>` when new DDL commands are encountered. The command also replicates data for the table specified in the file `/sap/user/tablelist.txt`, which include tables `<USER1>.<TABLE1>`, and all data for `<TABLE2>`.

For example, `tablelist.txt` contains:

```
# user tables:
USER1.TABLE1
*.TABLE2
```

```sql
create database replication definition <db_repdef>
with primary at <ds1>.<pdb1>
replicate DDL
replicate tables in files ('/sap/user/table_list.txt')
```


### 9.5.3 Changes to alter database replication definition

The `alter database replication definition` syntax has been modified and several new parameters added.

**Syntax**

```sql
alter database replication definition <db_repdef>
with primary at <data_server>.<database>
[[(not replicate DDL) | [replicate DDL [[with | without] {auto_update_table_list | auto_extend_table_list}]]] | [not] replicate <setname> <setcont> | [not] replicate {{SQLDML | DML_options} [in <table_list>]} | [alter owner from <current_table_owner> to <new_table_owner> [for <table_name>]} | [{add | remove} tables {setcont}]]
with dsi_suspended]
user <username> password <pass>
<setcont> ::= [{in} ([<owner1>..<name1>], [<owner2>..<name2> [, ... ])] | [in files ('<file_path>')]
<setname> ::= {tables | functions | transactions | system procedures}
```
Parameters

Replication Server 15.7.1 SP200 adds these parameters:

- **not replicate DDL** – Informs Replication Server not to send DDL to subscribing databases.
- **replicate DDL** with [auto_update_table_list | auto_extend_table_list] – Informs Replication Server to send DDL to subscribing databases and whether to update or extend the table list. If you specify replicate DDL without any option, DDL is sent to the replicate database, however, the table is not added to the replication path.
- **replicate DDL with auto_update_table_list** – Sends DDL commands to the replicate database. For a table, if pdb_automark_tables is true, the table is automatically updated in the table list when drop table or rename table DDL commands are encountered.
- **replicate DDL without auto_update_table_list** – Sends DDL commands to the replicate database, but does not update the tables in the table list when drop table or rename table DDL commands are encountered.
- **replicate DDL with auto_extend_table_list** – Sends DDL commands to the replicate database. For a table, if pdb_automark_tables is true, the table is automatically added to the table list when create table DDL commands are encountered.
- **replicate DDL without auto_extend_table_list** – Sends DDL commands to the replicate database, but does not add the tables in the table list when create table DDL commands are encountered.
- **add tables in** { (<table_list>) | files '<file_path>' } – Adds tables to the replication path. You can either specify a list of tables or provide the table names in a file. After you add a table to the replication path, the data for that table starts replicating.

```markdown
<table>
<thead>
<tr>
<th>Note</th>
</tr>
</thead>
</table>
When adding or removing tables, you can specify only one file at a time and you must specify an absolute path for <file_path>.
```

- **remove tables in** { (<table_list>) | files '<file_path>' } – Removes tables from the replication path. You can either specify a list of tables or provide the table names in a file.
- **[in files '<file_path>' ]** – A file that contains an include or exclude table list. You can specify only one file at a time and you must specify an absolute path for <file_path>.

```markdown
<table>
<thead>
<tr>
<th>Note</th>
</tr>
</thead>
</table>
The user who starts the primary Replication Server must have read permission to read the file.
```

The table name format in a file and in a table list is the same. You can specify the table names in a table list in these formats:

- `<ownername>.< tablename >`
- `< tablename >` (the table name is stored as dbo.tablename)
- `*.< tablename >`
- `<ownername>.*`
• "x*y", '.a*b' (wildcard embedded in the string)

### Note

When `create database replication definition` is issued, the partial wildcard is expanded through all lists, including the table list and the exception list. The simple wildcard is expanded in the exception list before they are stored in the system table. You must specify values for `user` and `password` if you require any wildcard expansion.

When you use an include or exclude table list, observe these guidelines:

- The table name delimiter in the file must be a new line character.
- Lines starting with # are ignored as comments.
- Blanks before an owner name or table name are truncated.
- The max length of an owner name is 30 characters.

**[user <username> password <pass>]** – The user ID and password used to connect to the primary Adaptive Server database or Replication Agent and select from the primary table.

If you use wildcard in a table name, you must specify values for `user` and `password`.

### Note

The `user` and `password` values are used once and are not stored in the RSSD.


### 9.5.4 Changes to create subscription

The `create subscription` syntax has been modified and several new parameters added.

#### Syntax

```sql
create subscription <sub_name>
>for {<table_repdef> | <func_repdef> | publication <pub> |
  database replication definition <db_repdef> }
  [ with primary at <server_name.db> ]
with replicate at <data_server>..<database>
>[where {<column_name> | @<param_name>}]
  [with holdlock [direct_load [init replicate table with {create |
  create_or_truncate | truncate | recreate}]
  [user <username> password <pass>]}[<num_of_selects> selects]
  [hold_resource_on_error]]
incrementally | without materialization]
[subscribe to truncate table] [for new articles]
```
Parameters

Replication Server 15.7.1 SP200 adds these parameters:

- **init replicate table with create** – Creates the table at the replicate database. If the table already exists, the materialization fails.
- **init replicate table with create_or_truncate** – Creates the table at the replicate database. If the table already exists, Replication Server uses the existing table after truncation.
- **init replicate table with truncate** – Truncates the table at the replicate database. If the table does not exist, materialization fails.
- **init replicate table with recreate** – Drops the table at the replicate database and recreates the table.

**Note**

Materialization does not fail if the replicate table does not already exists.

- **hold_resource_on_error** – Holds the subscription resource if the subscription created with **direct_load** materialization results in an error. The default is not hold resource when a subscription created with the **direct_load** option results in an error.
- **<num_of_selects> selects** – enables multiple select threads to improve the materialization performance for subscriptions created with the **direct_load** option. The default value is 1, and valid values are 1 – 10. You can use this option only with the **direct_load** option, and it is available only when the primary database is either IBM DB2 9.7 or later, or Oracle, and when the function string **rs_select** is not customized. This number is adjusted down to 1 otherwise, or when there are not many rows in the primary table.

See **create subscription** in the Reference Manual.

9.5.5 Changes to activate subscription

The **activate subscription** syntax has been modified and a new parameter is added.

**Syntax**

```
activate subscription <sub_name>
>for {<table_rep_def> | <function_rep_def> | publication <pub_name>
  with primary at <data_server.database>}
with replicate at <data_server.database>
> [with suspension [at active replicate only] | with catchup_queue]
```
Parameters

with catchup_queue

Replication Server 15.7.1 SP200 adds the `with catchup_queue` parameter. Use the `with catchup_queue` clause to instruct Replication Server to start a catchup queue to store the DMLs for the primary table. Subsequent updates to the primary table are stored in a catchup queue. After the bulk materialization is complete and when you issue the `validate subscription` command, the subscription becomes VALID after all the DML operations in the catchup queue are applied to the replicate table. This eliminates the need to suspend replicate DSI or restrict DMLs at the primary table when bulk materialization is in progress.

See:
- `activate subscription` command in the *Administration Guide Volume 1*.
- `activate subscription` in the *Reference Manual*.

9.6 Systems Management Tools

You can use the Replication Management Agent (RMA) to set up and configure replication to SAP HANA database, and SAP® Control Center tools to manage your replication system.

Related Information

- SAP Control Center for Replication [page 94]
- Removal of Sybase Central [page 94]
- Setup and Configuration of Replication to SAP HANA Database Using RMA [page 76]

9.6.1 SAP Control Center for Replication

Use SAP Control Center for Replication version 3.3 to manage and monitor your replication environment.

9.6.2 Removal of Sybase Central

Sybase Central is no longer available for download from any SAP or Sybase Web site. Use SAP Control Center to manage your replication environment.

See `SAP Control Center for Replication` in the SAP Replication Server documentation set.
SAP Control Center for Replication Versus Sybase Central for Replication

Compare support for the replication systems management between SAP Control Center for Replication version 3.3 (SCC Replication), and version 15.0 and later of the Sybase Central components—Replication Monitoring Services (RMS) and Replication Manager Plug-in (RMP).

Table 13:

<table>
<thead>
<tr>
<th>Feature</th>
<th>SCC for Replication 3.3</th>
<th>RMP 15.x</th>
<th>RMS 15.x</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitor SAP Replication Server and Replication Agent status</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Monitor SAP Replication Server and Replication Agent availability</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Monitor replication performance</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monitor end-to-end latency (rs_ticket.heartbeat)</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Monitor paths that include SAP ASE primary and replicate databases</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monitor paths that include SAP IQ replicate databases</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monitor paths that include non-SAP primary and replicate databases: Oracle, Microsoft SQL Server, and IBM DB2 for Linux, UNIX, and Windows</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monitor SAP Replication Server statistics</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Save historical performance statistics</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chart historical performance statistics</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Display replication topology</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trace replication paths</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Display heat chart</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Configure alert notifications</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Configure SAP Replication Server user security and roles</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Display license information for version 15.7 and later of SAP Replication Server and Replication Agent</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Configure SAP Replication Server and Replication Agent</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Suspend and resume SAP Replication Server and Replication Agent</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Shut down SAP Replication Server and Replication Agent</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Group servers in a way that you choose (for example: geographically or functionally)</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Use RCL and SQL editor to execute commands at SAP Replication Server</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use a command line interface such as isql to execute the API commands</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use a wizard to simplify setting up an SAP ASE replication environment</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Set up SAP ASE RepAgent thread</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feature</td>
<td>SCC for Replication 3.3</td>
<td>RMP 15.x</td>
<td>RMS 15.x</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>-------------------------</td>
<td>----------</td>
<td>----------</td>
</tr>
<tr>
<td>Configure SAP ASE automatic materialization</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Create and delete SAP Replication Server connections</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Create and delete SAP Replication Server logical connections</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Create and delete SAP Replication Server routes</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Create and delete replication definitions and subscriptions for multisite availability (MSA)</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Create, alter, and delete SAP Replication Server replication definitions and subscriptions</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Create, alter, and delete SAP Replication Server users</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>View SAP Replication Server queue data</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manage SAP Replication Server exceptions log</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9.7 System Tables

SAP Replication Server 15.7.1 SP200 includes several new system tables and changes to existing system tables.

See descriptions of the tables and related indexes in *Replication Server System Tables* in the *Reference Manual*.

New System Tables

- `rs_dependtbls` — stores information about tables that are pending to add or remove from database replication definitions
- `rs_schemamap` — stores information about schema mapping between primary database and replicate database

Changes to Existing System Tables

- `rs_articles` — add an index on `objid`
- `rs_dbsubsets` — add the `status` and `priority` columns
- `rs_dictionary` — add a unique clustered index on `words`
- `rs_encryptionkeys` — add a unique clustered index on `name`
- `rs_passwords` — add:
  - A one to one relationship between the `uid` column in `rs_passwords` and the `uid` column in `rs_users`
- An index on (uid)
- rs_recovery – change the text column datatype length to binary(512).
- rs_subscriptions – add:
  - The released, mechanism, tableowner, tablename, prsid, and num_selects columns.
  - A one to one relationship between the prsid column in rs_subscriptions and the prsid column in rs_dbsubset.
  - The released column to the unique index on (subid, recovering, error_flag, materializing, dematerializing, primary_sre, replicate_sre).
  - An index on (recovering, requestdate)
- rs_targetobjs – add a unique clustered index on (dbid, objname, objowner, objtype)
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