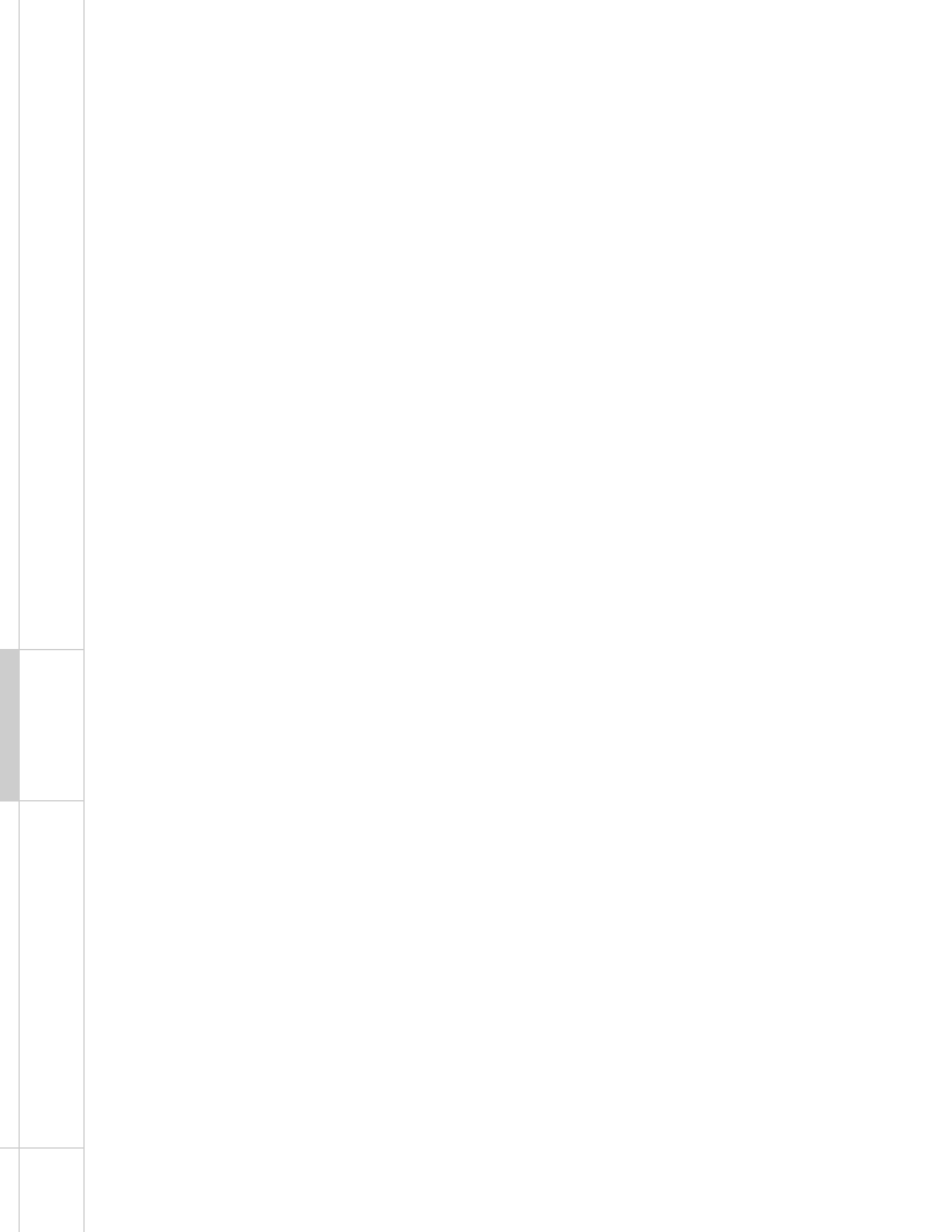




Internals of Embedded Replication Server System Database

technology



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1 Introduction

Embedded Replication Server System Database (ERSSD) is introduced in Replication Server 12.6 release to improve on the ease of use of a replication system. ERSSD is provided as an option. Traditional RSSD on ASE will continue to be supported.

This white paper covers the technical details of the ERSSD feature. The section Introduction to ERSSD is for first time users who want some insight into ERSSD. The rest of the white paper provides ERSSD internals to help Sybase tech support troubleshoot in case of ERSSD problems.

2 Introduction to ERSSD

Replication Server stores its system data in a database called RSSD (Replication Server System Database). There is one RSSD per Repserver. Starting from Replication Server 12.6, user can choose between ERSSD (embedded RSSD) and traditional RSSD.

2.1 Choosing Between ASE RSSD and ERSSD

From the first release, replication server has used Sybase ASE as its RSSD. An ASE server has to be started before configuring a replication server, and RSSD has to be managed separately.

Embedded RSSD feature is introduced out of market demand to simplify replication server system management. The goal is to remove the need for users to configure and manage a separate RSSD for every replication server. ERSSD does not require routine management. It simplifies management tasks especially where there is not ASE expertise in house. It is light-weight and requires much less memory, disk space, and CPU power. For advanced replication server users who prefer to fine-tune RSSD, ASE RSSD is more appropriate.

2.2 ERSSD Overview

ERSSD uses Adaptive Server Anywhere 8.0.2 network server. It requires less disk space, memory and CPU power than ASE RSSD.

ERSSD acts as an Open Server to Replication Server. Users can isql into ERSSD the same way as ASE RSSD using the primary user name and password.

ERSSD is initialized, configured and started automatically by rs_init at Replication Server configuration time, making the Repserver configuration process much simpler than before.

ERSSD does not require routine maintenance. It is configured to have a nightly automatic backup. Its transaction log is mirrored, offering better recovery protection than ASE RSSD.

Replication Server starts and shuts down its ERSSD as needed. No ASA expertise is required to manage a replication server with ERSSD.

For 12.6, there are some limits on the ERSSD feature. ERSSD cannot be replicated. Therefore, replication server with ERSSD cannot be the source of a route. ERSSD is only available to new installation. It cannot be upgraded directly from an ASE RSSD. No migration support is provided between Replication Server with ERSSD and Replication Server with RSSD on ASE.

The embedded RSSD feature is available on Sun, HP, IBM, Linux, and Windows.

3 Configuring Replication Server with ERSSD

The configuration process is simplified with the embedded RSSD feature. No server needs to be running before starting `rs_init`. `rs_init` will ask for the ERSSD name and the directory paths for the ERSSD files, and automatically initialize, configure, and start ERSSD.

3.1 ASA Release Area

Replication Server ERSSD uses its own ASA release under `$$SYBASE/$SYBASE_REP/ASA8`. This directory contains the ASA executables, libraries, scripts, and locale files necessary for ERSSD.

This release is not a full release of ASA. It only contains files necessary for ERSSD. It is intended for ERSSD use only. It is set to have 10 concurrent license seats.

3.2 ERSSD Configuration

3.2.1 ERSSD Name

We use the same name for the ERSSD as well as its server. During replication server configuration with `rs_init`, you will be asked to enter the ERSSD name. ERSSD acts as an open server to the replication server it serves. Therefore the ERSSD name must be in the interfaces file.

3.2.2 ERSSD Files

Embedded RSSD runs on three regular operating system files:

File Name	Description	File Path	Default PATH
<code><ErssdName>.db</code>	ERSSD database file	The database directory specified during <code>rs_init</code>	<code>\$\$SYBASE/\$SYBASE_REP/dbfile</code>
<code><ErssdName>.log</code>	ERSSD transaction log	The transaction log directory specified during <code>rs_init</code>	<code>\$\$SYBASE/\$SYBASE_REP/translog</code>
<code><ErssdName>.mlg</code>	ERSSD transaction log mirror	The backup directory specified during <code>rs_init</code>	<code>\$\$SYBASE/\$SYBASE_REP/backup</code>

During the replication server configuration process, users are asked to enter three directories for these three files. For better performance and recoverability, it is strongly recommended that these three directories be put on different physical devices.

3.2.3 ERSSD Charset and Language

ASA database and server determine its language and charset by checking the `SQLLOCALE` environment variable. If `SQLLOCALE` is undefined, ASA will use the default operating system language setting.

To ensure that ERSSD always uses the same language and charset as the replication server it serves, `rs_init` and `Repserver` will set the `SQLLOCALE` environment variable according to the `Repserver` language and charset setting unless it is already defined:

```
SQLLOCALE="Charset=<rsCharset>;Lanauge=<rsLanauge>"
```

User can overwrite it by setting the `SQLLOCALE` environment variable before starting `rs_init` and `Repserver`.

3.2.4 Behind the Scenes in rs_init

To install a replication server with ERSSD, rs_init performs the following tasks:

- Call ASA utility dbinit to initialize the database file in the database directory:

```
dbinit -c -b -k -o <errorlog> <databaseFile>
```

This command initializes a database file and logs its messages in the error log.

The parameter “-c” makes strings in the database case sensitive.

The parameter “-b” makes the database ignore trailing blanks in comparison. Without this option, 0x00=0x0000 would be false.

The parameter “-k” creates a database without Watcom SQL compatibility views SYS.SYSCOLUMNS and SYS.SYSINDEXES. These views conflict with ASE views dbo.syscolumns and dbo.sysindexes.

The parameter “-o” tells the dbinit utility to write its output messages to the named file.

- Call ASA utility dblog to specify the paths for transaction log file and the transaction log mirror file:

```
dblog -m <LogMirror> -t <TransactionLog>  
-o <errorLog> <databaseFile>
```

- Call dbspawn to start the ERSSD:

```
dbspawn -f -q dbsrv8 -ti 0 -x  
"tcpip(PORT=<portNumber>;DOBROAD=NO;BLISTENER=NO) "  
-o <errorLog> <databaseFile>
```

This command spawns a dbsrv8 process and returns when the database is accepting connections.

The dbspawn parameter “-f” starts the ERSSD in its own server. Without it, dbspawn will look for an ASA server on the local machine and try to start the ERSSD under the same server.

The parameter “-q” makes dbspawn execute in quiet mode.

The dbsrv8 parameter “-ti 0” makes the ASA server not disconnect inactive connections. By default, inactive connections are terminated after 4 hours.

The dbsrv8 parameter “-x tcpip” starts the server to use TCPIP communication protocol. “PORT=...” specifies the port the ERSSD server will listen on. “DOBROAD=NO” tells the server not to broadcast to check for servers with the same name. “BLISTENER=NO” tells the server to not listen to broadcast from other server or client.

ERSSD always runs on the same machine as the Repserver it supports.

- Load `rs_init_asa.sql` to configure ERSSD. First backup of the ERSSD database file and transaction log is performed at the end of this script.
- Continue with other `rs_init` tasks similar to RSSD on ASE.

4 ERSSD Internals

ERSSD does not require an ASA system administrator to manage the database. ASA expertise is not required to run a replication server with ERSSD. The routine maintenance for ERSSD is scheduled and automatic. In this section, we will cover some of the technical details of the ERSSD. Such knowledge is NOT required for a replication server system administrator.

4.1 Obtain ERSSD Information

There are two ways to obtain ERSSD information: using the new replication server command “`sysadmin erssd`” and looking up the Repserver config file.

4.1.1 New Command

The following replication server command can be used to obtain ERSSD information:

```
1> sysadmin erssd
2> go

ERSSD Name      ERSSD Database File
              ERSSD Transaction Log      ERSSD Transaction Log Mirror
ERSSD Backup Start Time ERSSD Backup Start Date ERSSD Backup Interval
ERSSD Backup Location

-----
-----
-----
-----
-----
REP_ERSSD      /dbfile/REP_ERSSD.db
              /translog/REP_ERSSD.log      /backup/REP_ERSSD.mlg
              1:00AM                2003-09-23                24 hours
              /backup
```

4.1.2 Repserver Config File

Here is a sample Repserver config file where ERSSD is used:

```
#
# Configuration file for Replication Server 'REP'. Created by
# rs_init.
RSSD_embedded=yes
RSSD_server=REP_ERSSD
RSSD_database=REP_ERSSD
RSSD_primary_user=REP_RSSD_prim
RSSD_primary_pw=REP_RSSD_prim_ps
RSSD_maint_user=REP_RSSD_maint
RSSD_maint_pw=REP_RSSD_maint_ps
RSSD_ha_failover=no
ID_server=REP
ID_user=id_user1
ID_pw=id_user1_pwd
```

```

RS_charset=iso_1
RS_language=us_english
RS_sortorder=binary
erssd_errorlog=/work2/ERSSD/errorlog/ERSSD.out
erssd_port=5003
#
# Do not edit the following ERSSD lines.
#
erssd_dbfile=/dbfile/REP_ERSSD.db
erssd_translog=/translog/REP_ERSSD.log
erssd_logmirror=/backup/REP_ERSSD.mlg
erssd_backup_dir=/backup

```

From the configuration file, we know that RSSD is embedded and ERSSD name is REP_ERSSD. We can find the primary and maintenance user names and passwords, as well as ERSSD file paths and port number in the configuration file.

4.2 Backup

A full backup of the database file and transaction log is scheduled to start at 1am every night. The backup files are located at

```

/backupPath/ERSSDName.db
/backupPath/ERSSDName.log

```

The previous backup is saved to

```

/backupPath/ERSSDName.db.pre
/backupPath/ERSSDName.log.pre

```

We always save the previous copy of the backup so that in case of machine crash during backup, we will have the old backup to fall back on.

4.2.1 To change the backup path:

```

configure replication server
set erssd_backup_dir
to <newPath>

```

Repserver will check that the new path is not the same as the database directory or the transaction log directory, do a backup to the new path to make sure it is valid path, change the backup event to use the new backup path, and update the rs_config table and the Repserver config file to reflect the new backup path.

It is important that users do not update the rs_config table or the config file directly.

4.2.2 To change the backup start time:

```

configure replication server
set erssd_backup_start_time
to <newTime>

```

Repserver will update the backup event where ASA will validate the time, and change the rs_config table to reflect the new backup start time.

It is important that users do not update the rs_config table directly.

4.2.3 To change the backup start date:

```
configure replication server
set erssid_backup_start_date
to <newDate>
```

Repserver will update the backup event where ASA will validate the date, and change the rs_config table to reflect the new backup start date.

It is important that users do not update the rs_config table directly.

4.2.4 To change the backup interval:

```
configure replication server
set erssid_backup_interval
to <newInterval>
```

Repserver will update the backup event where ASA will validate the interval, and change the rs_config table to reflect the new backup interval.

It is important that users do not update the rs_config table directly

4.3 Truncation Point Management

For 12.6, ERSSD cannot be replicated. So there is no secondary truncation point to manage. After each backup, the transaction log is truncated, preventing the transaction log from growing indefinitely.

4.4 ERSSD Users

There are two users in ERSSD, the primary user and the maintenance user. The primary user can be used by sysadmin to isql to the ERSSD if needed. Since primary user name is usually very long, you may also want to create another login to be used by sysadmin to isql to the ERSSD.

4.4.1 ERSSD Primary User

The primary user is used by Repserver to access the ERSSD. It also functions as the SA user. The primary user name is *repserverName_RSSD_prim*. Its password is *repserverName_RSSD_prim_ps*. To change the primary user password, use the Repserver command:

```
alter user <primaryUser>
set password to <newPassword>
```

With this command, Repserver will change the primary user password at ERSSD, update the configuration file and the rs_users table, and refresh the Repserver global memory. There is no longer a need to update the configuration file separately, or use rs_init to update the configuration file when password encryption is used.

4.4.2 ERSSD Maintenance User

The maintenance user is used by Repserver to replicate the system data from another site to the ERSSD. The maintenance user name is *repserverName_RSSD_maint*. Its password is *repserverName_RSSD_maint_ps*. To change the primary user password, use the Repserver command:

```
alter connection to <erssdName>.<erssdName>
set password to <newPassword>
```

With this command, Repserver will change the maintenance user password at ERSSD, update the configuration file and the rs_maintusers table, refresh the Repserver global memory, and restart the DSI for the ERSSD to use the new maintenance user password. There is no longer a need to update the configuration file separately, or use rs_init to update the configuration file when password encryption is used.

4.4.3 Adding an ERSSD User

If you would like to avoid using the long primary user name and password to login to ERSSD, you can create another ERSSD user. Isql into ERSSD as the primary user and execute the following command:

```
grant connect to <username> identified by <passwd>
```

For example, you can create a user named "sa" with no password by issuing the ERSSD command:

```
grant connect to sa identified by ""
```

You can grant user access to the Repserver system tables by executing the following ERSSD command:

```
grant membership in group rs_systabgroup to <username>
```

You can grant user SA privilege by executing the following ERSSD command:

```
grant DBA to <username>
```

4.4.4 Dropping an ERSSD User

To drop a user from the ERSSD, use the following ERSSD command:

```
revoke connect from <username>
```

4.5 ERSSD File Management

ERSSD runs on three operating system files: database file, transaction log, and transaction log mirror. The paths of these files are specified during the initial Repserver installation through rs_init. Users may want to move these files to different devices/directories at some point of time.

For better performance and recoverability, always put these files on different physical devices.

In addition, because of file name conflicts as well as recoverability, database file and the transaction log file cannot share the same directory as the backup files.

4.5.1 Moving ERSSD Database File

To move the ERSSD database file to a different directory, isql into Repserver and issue the command:

```
sysadmin erssid, dbfile_dir, <directory>
```

This command will cause Repserver to shut down ERSSD, move the database file to the new directory, update the Repserver config file, refresh the Repserver memory, and restart ERSSD.

Repserver will stay up during this command. Some error messages are expected from ct_send, ct_result, etc. after ERSSD comes back up. These errors are temporary and harmless to replication server.

4.5.2 Moving ERSSD Transaction Log File

To move the ERSSD transaction log file to a different directory, isql into Repserver and issue the command:

```
sysadmin erssd, translog_dir, <directory>
```

This command will cause Repserver to shut down ERSSD, move the transaction log file to the new directory, call dblog to point the database to the new transaction log location, update the Repserver config file, and restart ERSSD.

Repserver will stay up during this command. Some error messages are expected from ct_send, ct_result, etc. after ERSSD comes back up. These errors are temporary and harmless to replication server.

4.5.3 Moving ERSSD Transaction Log Mirror File

To move the ERSSD transaction log mirror file to a different directory, isql into Repserver and issue the command:

```
sysadmin erssd, logmirror_dir, <directory>
```

This command will cause Repserver to shut down ERSSD, move the transaction log mirror to the new directory, call dblog to point the database to the new transaction log location, update the Repserver config file, and restart ERSSD.

Repserver will stay up during this command. Some error messages are expected from ct_send, ct_result, etc. after ERSSD comes back up. These errors are temporary and harmless to replication server.

4.6 Security

There are a few things user can do to improve the ERSSD security.

First, protect the ERSSD files. ERSSD uses regular operating system files as its database and transaction log files, as well as backup files. These files should not be accessible by unauthorized users to prevent intentional or unintentional delete, damage or read access.

Second, protect the replication server configuration file. The configuration file contains the passwords for the ERSSD primary and maintenance users. Make sure this file is not accessible by un-authorized users.

The ERSSD primary user password can be changed using “alter user” command as needed. The ERSSD maintenance user password can be changed using “alter connection” command as needed.

4.7 Performance

ERSSD uses a transaction log, which dramatically improves its performance since the database doesn't have to do a checkpoint at the end of every transaction.

ERSSD relies on ASA dynamic cache sizing, which enlarge and shrink the cache size as needed for optimal performance given the machine memory limit.

Users can do the following to further improve performance:

- To ensure efficient disk writes for ERSSD, place dbfile, log, mirror on different physical devices.
- To reduce ERSSD database file fragmentation, put the dbfile on a disk partition by itself.

4.8 Recovery

ERSSD automatically recovers from operating system crash, machine crash, and improper database shutdown.

Regular backup protects ERSSD from disk or file system corruptions. To recover ERSSD database file or transaction from backup, follow the recovery steps outlined in the following.

4.8.1 Recovery From Transaction Log Corruption

There are two copies of the transaction log: the transaction log file and the transaction log mirror file. If one of them is corrupted, all we need to do is copy the good log over the corrupt log using operating system copy command (cp for Unix and copy for Windows), and restart the Repserver.

To identify which of the two files is corrupt, we can use the ASA utility dbtran

```
dbtran erssid_name.log
dbtran erssid_name.mlg
```

The dbtran utility will translate the log and output a sql file if the log is good. It will report error if the log is corrupt.

4.8.2 Recovery From Database File Corruption

When database file is corrupt, we can recover it by applying the backup transaction log and the online transaction to the backup database file. The following is the complete recovery steps:

1. Make an extra backup copy of the current transaction log for extra precaution:

```
cp /log/erssd_name.log /log/erssd_name.log.copy
```

2. Create a recovery directory to hold the files you use during recovery. For simplicity, let's call this directory /recovery.

3. Copy the dbfile from the last full backup to the recovery directory:

```
cp /backup/erssd_name.db /recovery/erssd_name.db
```

4. Copy the backup transaction log into the recovery directory

```
cp /backup/erssd_name.log /recovery/erssd_name.log
```

5. Apply the transactions from the backup transaction log to the recovery database:

```
dbsrv8 /recovery/erssd_name.db -a /recovery/erssd_name.log
```

Database shuts down automatically after it is done

6. Copy the online transaction log into the recovery directory:

```
cp /log/erssd_name.log /recovery/erssd_name.log
```

7. Apply the transactions from the online transaction log to the recovery database:

```
dbsrv8 /recovery/erssd_name.db -a /recovery/erssd_name.log
```

Database shuts down automatically after it is done

8. Copy the database file to the production directory

```
cp /recovery/erssd_name.db /root/erssd_name.db
```

9. Start ERSSD using the dbspawn command found in the Repserver errorlog (command syntax covered in 5.1.2)

10. Perform validity checks on the recovery database:

```
dbvalid -c "uid=<primUser>;pwd=<primPwd>;eng=erssd_name"
```

11. Restart Repserver.

5 Troubleshooting

5.1 Internal ASA Commands

Repserver uses ASA commands to ping, start and stop ERSSD.

5.1.1 ERSSD Ping Command

Repserver pings ERSSD at startup and when ERSSD connectivity fails. The result of the ping command is used to determine whether ERSSD needs to be restarted. The actual command used is:

```
dbping -q -c
"LOG=<dbpingLog>;ENG=<erssname>;Language=<rsLanguage>
;LINKS=tcPIP(DOBROAD=NONE;HOST=localhost;PORT=<port>)"
```

The parameter `-q` tells `dbping` to execute in quiet mode and not display output messages.

The parameter `-c` is followed by a connection string in quotes, which specifies the ERSSD to ping, the language used to ping the database, the communication protocol used, the host machine and the port number. "LOG=..." is only included in the diag Repserver to have the `dbping` log debugging information in a file.

If ERSSD is not up at Repserver startup, it is normal to see message saying `dbping` failed. `Dbping` failure indicates that ERSSD is not alive. Repserver should call the ASA command to start ERSSD following `dbping` failure.

5.1.2 ERSSD Start Command

Repserver starts ERSSD automatically when it is necessary. At Repserver startup and when ERSSD connectivity fails, Repserver will first call `dbping` to determine if ERSSD is alive. If `dbping` fails, Repserver will call the ERSSD start command:

```
dbspawn -f -q dbsrv8 -ti 0 -x
"tcPIP(PORT=<port>;DOBROAD=NO;BLISTENER=NO)" -o
<errorlog> <dbfile>
```

The command `dbspawn` spawns an ERSSD server (`dbsrv8`) process in the background. This command returns when the server is accepting requests.

The `dbspawn` parameter `-f` tells `dbspawn` to start a new server instead of trying to run the database under an existing server.

The `dbspawn` parameter `-q` tells `dbspawn` to operate in quiet mode and not display output messages.

The `dbsrv8` parameter `"-ti 0"` makes the ERSSD not terminate inactive connections.

The `dbsrv8` parameter `"-x tcPIP"` specifies TCPIP as its communication protocol. ERSSD does not use or listen to broadcasts.

The `dbsrv8` parameter `"-o <errorlog>"` specifies that `errorlog` file instead of machine console will be used for output messages.

The last parameter is the database file.

5.1.3 ERSSD Stop Command

Before Repserver shutdown, it will call the ERSSD stop command and use the primary user to shutdown the ERSSD. The ERSSD stop command is:

```
dbstop -q -y -c
"uid=<primaryUser>;pwd=<primaryPwd>;eng=<erssidName>;LI
NKS=tcPIP(HOST=localhost;PORT=<port>;DOBROAD=NONE)"
```

The parameter `-q` indicates that `dbstop` will operate in quiet mode and not display output messages.

The parameter `-y` indicates that `dbping` will stop without prompting even if there are active connections.

The parameter `-c "..."` specifies the connection string, which include ERSSD name, a user with DBA privilege, communication protocol, host and port.

When Repserver is about to shutdown, it simply calls this command and does not check its return code.

5.2 ERSSD Logs

There are two message logs related to ERSSD, the database error log, and the `dbping` log.

5.2.1 Database Error Log

ERSSD output messages are logged in its error log. Its full path can be found in the Repserver config file line "ERSSD_errorlog". ERSSD error log is the place to look if ERSSD will not start.

5.2.2 dbping Log

If Repserver calls `dbspawn` to start ERSSD when it is already up, it may be caused by `dbping` not returning correct result. To turn on the log for `dbping`, you need to switch to `diag` Repserver. The directory path for `dbping` is the same as the database errorlog, which can be found in the Repserver config file. Its file name is `dbping.out`. Users may want to use `diag` Repserver and look at this file if `dbping` reports failure when ERSSD is actually up.

5.3 Using Alternative ERSSD Release and Commands

Repserver ERSSD under normal circumstances should always run with the ERSSD release that comes with the Repserver release. This is the release we have tested against.

However, for debugging purpose, user may use alternative ERSSD release and commands by adding a few lines in the Repserver config file and restart Repserver. To use a different ASA release, add a line in the Repserver config file:

```
ERSSD_release_dir=...
```

The directory specified here should be the full path of the directory one level above the ASA bin directory. Repserver will add the bin directory under this release to the top of the PATH

environment variable, and lib directory to the LD_LIBRARY_PATH if they are not already there.

User may use a different ERSSD start command by defining

```
ERSSD_start_cmd=...
```

in the config file and restart Repserver. The command should contain the full command path to ensure that the intended ASA release is used.

User may use a different ERSSD ping command by defining

```
ERSSD_ping_cmd=...
```

in the config file and restart Repserver. The command should contain the full command path to ensure that the intended ASA release is used. Command options can be added to use different language or log the debugging message to a different file.

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