Asynchronous Replication

Asynchronous Replication (hereafter referred to as Async Replication) is an optional and separately licensed feature. It provides a permission-based mechanism to create a duplicate version of a LUN on a device attached to a partner host.

Cisco uses block-level Async Replication and incorporates an Async snapshot feature to capture a point-in-time state that allows applications to continue writing their data. These features help to prevent damage from failures or disasters that may occur in one location and improves the ability to recover a copy of the data in another location.

Before you use the Asynchronous (Async) Replication feature, make sure that you do not use the LUN or Snapshot "Snapdiff1_xyz" as the name (where 'xyz' is either the Source or Target, LUN, or Snapshot name) because the user data might get deleted during the replication process.

When using the Async Replication feature, both the Source and the Target must be LUNS, except for the Windows Pairing type where the Destination is a Windows file.

The Source and Target LUNs must be the same size and must be 2TB or less.

When available free space on the system falls below a threshold level of 10%, on both the Async Replication Source or Destination, the system automatically deletes the oldest Snapshot(s) on the device to free up at least 15% of space. Neither manual nor scheduled Snapshots can be created until this 15% threshold is met.

If either the Source or Destination LUN used for Async Replication has a Snapshot merge in progress, neither manual nor scheduled Snapshots can be created until the merge is complete causing Async Replication to fail.

If an Async Replication or Restore is in progress for a given pairing, a LUN Merge operation will not be permitted on a LUN that has either been configured as an Async Source or Destination until the Replication or Restore operation is complete.

Use “Create New Pairings” to add a new partner host. A LUN must be present before a pairing can be created.
The Cisco UCS Invicta Scaling System uses the standard remote shell facility, ssh, to send the public key. Use "Public Key" to display this key. The key must be copied and pasted into the authorized_keys list. See section - Communicating with the Partner Host.

Use "Windows Installer" to obtain an installation package for software required for Windows use of Async Replication.

The first replication that is performed on a pairing is always a FULL replication. Subsequent replications reflect the delta changes, except where an "Update Partner" operation is performed. In that case, the next replication is a FULL replication.

When updating a partner host, a full replication is triggered.

We do not recommend using Destination entities in Read-Write mode as this poses a risk to the accuracy of the data replication and may corrupt data recovery.

During the replication process, the Destination LUN will be unmapped and unmounted and is, therefore, inaccessible. This state prevents possible corruption of the Source data. The replication process will automatically remap and remount at its completion. The Source SSR will continue to have access to the Source LUN throughout the replication process.

Right-click a pairing in the list to display pairing menu options to: Delete, Verify Partner, Update Partner, Schedule, Restore (always the entire LUN), or View Log File.

On mouse hover, the replication schedule for that LUN pairing appears in a pop-up box.

Once Async Replication pairing is setup, the “Increase in Size” and “Delete” operations are not permitted on the Source LUN used for the pairing.

A LUN that has been configured as a Mirror is not supported to be used either as an Async Source or Destination for performing Async Replication.

When restoring the Source LUN, the Restore process will unexport and unmount the LUN and it will not be accessible. The Restore process will automatically re-mount and re-export at its completion.

Pairing setup, configuration, and scheduling applies to the current SSR only and is not accessible from other SSRs.

If a host and/or device is not detected when checked, the respective fields turn red. The following actions trigger checks: page refresh, new host pairing creation, pairing deletion, pairing host update (check is performed on a specific update entry), manual replication scheduling and replication termination.

Device column displays in green for a replication that is in progress and tan when a restore is in progress.

When scheduling an Async Replication, note that the higher the thread numbers the higher the throughput the greater the impact on system processing. The default is two. Initial transmission block size parameter is used for the initial replication for a device, (including if the initial replication is manually triggered). Subsequent delta replications for the device always use a 1Mb block size.

We do not recommend running several simultaneous replications and / or concurrent restores as these operations will have a severe performance impact on the Source and or Destination devices.

---

**Note**

The first replication that is performed on a pairing is always a FULL replication. Subsequent replications reflect the delta, except where an “Update Partner” operation is performed. In that case, the immediate next replication would become a FULL replication.
Communicating with a Partner Host

To perform replication successfully, there must be a way for communicating between the local LUN and the remote replication site to establish that the client (local Cisco Array) is allowed to invoke commands on the server (remote replication site).

The Cisco Array uses the standard remote shell facility, ssh, leveraging on password-less access after putting its public key to the proper location at the remote replication site.

For LUNs, Cisco supports open-target Async Replication. It can duplicate to the following platforms:

- Cisco Array
- Linux systems:
  - Linux-LVM
  - Linux-RAW
- Windows 2008 R2 or later Server editions.

Table 5.1 lists the releases that are supported for LUNS. Instructions for each platform follow:

<table>
<thead>
<tr>
<th>Platform</th>
<th>Supported Releases</th>
<th>Additional Information</th>
<th>Examples</th>
</tr>
</thead>
</table>
| Cisco      | Cisco UCS Invicta OS >= 5.0.0 | Destination LUN needs to be a LUN of the same size as the source LUN and they both need to be 2 TB or less. | • Source Device: dk_CiscoPairingSourceLun_143  
• Partner Host: 192.168.200.103  
• Remote IDF Directory: /var/log/dk_CiscoPairingSourceLun_143  
• Target Type: Cisco  
• Target Device: /dev/SSN/dk_CiscoPairingDestinationLun |
| Linux-LVM  | Kernel version >= 2.6.3  
LVM2 version >= 2.02 | Destination target needs to be a logical volume of the same size as the source LUN and they both need to be 2 TB or less. | • Source Device: dk_LinuxLvm_src  
• Partner Host: 192.168.200.119  
• Remote IDF Directory: /var/log/dk_LinuxLvm_src  
• Target Type: Linux-LVM  
• Target Device: /dev/SSN/dk_LinuxLvm_tgt |
Chapter 5      Asynchronous Replication

Note
When using Async Replication for Non-Cisco Pairing types (i.e., Windows, Linux-LVM, and Linux-Raw), the mounting the Destination LUN any initiator for the purposes of viewing the data is not supported. The ability to mount the Destination LUN is supported only when a Cisco-partner type is used and the Destination entity resides on a Cisco UCS Invicta Appliance or Cisco UCS Invicta Scaling System.

Cisco to Cisco
Cisco-to-Cisco Async Replication is preconfigured and is complete. To create a pairing, see “Create a Pairing, page 5-8.”

Cisco to Linux-LVM

<table>
<thead>
<tr>
<th>Platform</th>
<th>Supported Releases</th>
<th>Additional Information</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linux-RAW</td>
<td>Kernel version &gt;= 2.6.3</td>
<td>Destination block device needs to be the same size as the source LUN and they both need to be 2 TB or less.</td>
<td>• Source Device: dk_LUN_LinuxRaw&lt;br&gt;• Partner Host: 192.168.200.118&lt;br&gt;• Remote IDF Directory: /var/log/dk_Linuxraw_src&lt;br&gt;• Target Type: Linux-Raw&lt;br&gt;• Target Device:/dev/SSNdk_Linux_tgt</td>
</tr>
<tr>
<td>Windows</td>
<td>Windows 2008 R2 or later Server editions</td>
<td>Duplicates directly to a file.&lt;br&gt;Note This pairing type is not designed for large size or Replication</td>
<td>• Source Device: dk_win_143&lt;br&gt;• Partner Host: 192.168.200.103&lt;br&gt;• Remote IDF Directory: c:\dk_temp\dk_win_143&lt;br&gt;• Target Type: Windows&lt;br&gt;• Target Device: c:\dk_win_luns\dk.txt</td>
</tr>
</tbody>
</table>

Note
The Target device the format is /dev/<VG name>/<destination entity>.

Step 1 Click Public Key to obtain the public key necessary for using password-less ssh access.

Step 2 Copy the ssh key and click OK.

Step 3 Open a Terminal window and navigate to the /root/.ssh directory.

Step 4 Enter vi authorized_keys.

Step 5 Paste the Cisco Public Key copied in Step 2 into the authorized_keys list and click Enter.
See the following sample procedure to configure a Linux Host to be used as a Linux ‘Open Target’ partner for Async Replication.

**Sample Procedure:**

**Note**

This example uses CentOS 6.2

You need the following:

- LVM 2.0.2:
  
  ```bash
  yum -y install lvm2
  ```

- Install Openssh server and clients:
  
  ```bash
  yum -y install openssh-server openssh-clients
  ```

- Add and start sshd service daemon:
  
  ```bash
  - chkconfig sshd on
  - service sshd start
  ```

- If you need Multipath support for future use, configure `/etc/multipath.conf` file on your storage device (from the other storage vendor) as your target LUN.

5a. Make sure public key is there in the `~/.ssh` folder:

- `$ cd ~`
- `$ chmod 755 .ssh`
- `$ chmod 600 ~/.ssh/authorized_keys`
- `(Do a `cat authorized_keys` and make sure the public key is copied there)`
- `$ exec /usr/bin/ssh-agent $SHELL`
- `$ ssh-add`

5b. As the Linux root user, type the following command to relabel all the files under the correct security context for SELinux:

  ```bash
  restorecon -Rv /root/.ssh
  ```

(These should allow the Cisco array to communicate with the Linux host via password-less ssh)

5c. Get your target LV device ready by using LVM2 tools.

With a multipath setup mapped, the target storage array from the other vendor is mapped as:

```
/dev/mapper/26439363962386365
```

5d. Setup the LV using the following commands

- `pvcreate /dev/mapper/26439363962386365 vgcreate VG1 /dev/mapper/26439363962386365`
- `lvcreate -L 90G -n async_lun VG1`
- `vgchange -a y`
- `(lvdisplay should now show the LV created as active)`

You are now ready to use the LV you created as your Async Target device.

**Step 6**

Close the session on the remote replication site.
Step 7 Return to the Async Replication window to create a pairing (see Create a Pairing, page 5-8).

Cisco to Linux-RAW

Step 1 Click Public Key to obtain the public key necessary for using password-less ssh access.

Step 2 Copy the ssh key and click OK.

Step 3 Open a Terminal window and navigate to the /root/.ssh directory.

Step 4 Enter vi authorized_keys.

Step 5 Paste the Cisco Public Key copied in Step 2 into the authorized_keys list and click Enter.

See the following sample procedure to configure a Linux Host to be used as a Linux ‘Open Target’ partner for Async Replication.

Sample Procedure:

Note This example uses CentOS 6.2.

You need the following:

- Install Openssh server and clients:
  yum -y install openssh-server openssh-clients
- Add and start sshd service daemon:
  - chkconfig sshd on
  - service sshd start
- If you need Multipath support for future use, configure /etc/multipath.conf file on your storage device (from the other storage vendor) as your target LUN.

5a. Make sure public key is there in the ~/.ssh folder:

- $ cd ~
- $ chmod 755 .ssh
- $ chmod 600 ~/.ssh/authorized_keys
- (Do a cat authorized_keys and make sure the public key is copied there)
- $ exec /usr/bin/ssh-agent $SHELL
- $ ssh-add

5b. As the Linux root user, type the following command to relabel all the files under the correct security context for SELinux:

    restorecon -Rv /root/.ssh

(These should allow the Cisco array to communicate with the Linux host via password-less ssh)
Step 6 Close the session on the remote replication site.

Return to the Async Replication window to create a pairing (see Create a Pairing, page 5-8).

Cisco to Windows

**Note**
The Windows Server firewall must be turned off before Async Replication can be set up.

Cisco-to-Windows Async Replication requires that Cygwin along with two services, sshd and cyg_server, are installed on the target Windows machine. An automated method for downloading this software is provided on the Async Replication window.

To install the Windows software package and to configure for the Async Replication to run, do the following:

---

**Step 1** Login to the Windows 2008 R2 Server machine as Administrator and open a browser to go to Cisco page.

**Step 2** Choose Async Replication > Pairings.

The Async Replication window appears.

**Step 3** Click Windows Installer.

**Note** This step is to be used if Cygwin packages and services (sshd and cyg_server) are not already installed on the Windows Partner Host. If the Cygwin packages and services are already installed, skip to Step 4.

The software package is downloaded and executed. If your browser downloads the software but does not run automatically, click Run to install. The Cygwin packages will be downloaded from the Redhat website and installed. The services required for Async Replication will be configured and started.

This setup will take several minutes.

**Step 4** Click Public Key to obtain the public key necessary for using password-less ssh access.

The SSH Public Key dialog box appears.

**Step 5** Copy the ssh key and click OK.

**Step 6** Open a Terminal window and navigate to the /home/Administrator/.ssh directory.

**Step 7** Enter vi authorized_keys.

**Step 8** Paste the Cisco Public Key copied in Step 2 into the authorized_keys list and click Enter.

**Step 9** Close session on remote replication site.

**Step 10** Return to the Async Replication window to create a pairing (Create a Pairing, page 5-8).

Create a Pairing

Note

A LUN must be present before a pairing can be created.

Caution

We do not recommended using target entities in Read-Write mode as this poses a risk to the accuracy of the data replication and may corrupt data recovery.

Once Async Replication pairing is setup, Increase Size and Delete operations are disabled on the Source LUN used for the pairing.

The Async Replication Pairings window displays a table of LUNs and their host pairings. Information about and the date and time of the last replication and the last restore is also displayed. From this window, create new pairings using the top left-hand window button. On mouse hover over each pairing, the replication schedule, and the source and target device info for that pairing appears in a pop-up box.

On right-click, an options menu appears for the selected pairing for the following:

- Delete
- Verify Partner Host
- Update Partner
- Schedule
- Restore
- View Log File

If a host and/or device is/are not detected when checked, the respective fields turn red. The following triggers checks:

- Async Replication window refresh
- New Host Pairing creation
- Pairing Deletion
- Pairing Host Update (check is performed on specific update entry)
- Manual replication scheduling
- Replication Termination

Additionally, the LUN column is green for replication in progress and tan when a restore is in progress.

To create an Async Pairing, do the following:

**Step 1** Choose Async Replication > Pairings.

The **Pairings** window appears.

**Step 2** Click **Create New Pairing**.

The **Pairing Definition** dialog box appears.
Step 3

Complete the Pairing Definition fields. (See Table 6.3 for field descriptions.)

Table 5-2 Pairing Definition Fields

<table>
<thead>
<tr>
<th>Pairing Definition Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LUN</td>
<td>Choose LUN for pairing.</td>
</tr>
<tr>
<td>Partner Host</td>
<td>The IP address of the target server used for the replication.</td>
</tr>
<tr>
<td>Remote IDF Directory</td>
<td>The directory on replication destination side for storing Intermediate Data Files (IDF).</td>
</tr>
<tr>
<td></td>
<td><strong>Note</strong> It is important that this directory is non-volatile for rebooting.</td>
</tr>
<tr>
<td>Target Type</td>
<td>Choose from the drop-down list.</td>
</tr>
<tr>
<td></td>
<td>• The target platform to which the replication is sent. Defaults to Cisco and is intended for use exclusively with Cisco storage arrays.</td>
</tr>
<tr>
<td></td>
<td>• Linux-LVM, Linux-RAW, and Windows are the other selections.</td>
</tr>
<tr>
<td>Target Device</td>
<td>The device for storing the replication.</td>
</tr>
<tr>
<td></td>
<td><strong>Note</strong> When replicating to a file, be sure to include the extension at the end of the file name.</td>
</tr>
</tbody>
</table>

Step 4

Click **Create Pairing** to create pairing or click **Cancel** to return to Async Replication window.

Note

All listed pairings are verified when a new pairing is created. If a Partner Host cannot be verified, the field displays in red.

Delete Async Replication Pairing

To delete an Async Replication pairing, do the following:

Step 1

Choose **Async Replication > Pairings**.

The **Pairings** window appears.

Step 2

Mouse over an Async Replication pairing to highlight it and right click.

The right-click menu appears.

Step 3

Choose **Delete**.

The **Delete Async Replication Pair** confirmation dialog box appears.

Step 4

Click **Delete** to delete the pairing and remove it from the list or click **Cancel** to return to the **Async Replication** window.

Verify Partner Host

Step 1

Choose **Async Replication > Pairings**.
The Pairings window appears.

**Step 2**
Mouse over an Async Replication pairing to highlight it and right click.
The right-click menu appears.

**Step 3**
Choose Verify Partner.
The Partner Host Column displays a “checking” indicator.
- If the verification fails, the associated Partner Host field turns red.
- If the Target Device does not exist, that field will turn red.

## Update Partner Host

**Note**
A pairing should not be updated while an Async Replication or a Restore is in progress.

To update an existing Partner Host, do the following:

**Step 1**
Choose Async Replication > Pairings.
The Pairings window appears.

**Step 2**
Mouse over an Async Replication pairing to highlight it and right click.
The right-click menu appears.

**Step 3**
Choose Update.
The Update Partner Host dialog box appears.

**Step 4**
Update the field or fields, as necessary.

**Step 5**
Click Update to update the pairing or click Cancel to return to the Async Replication window.

**Note**
When updating a partner host, a full replication is triggered.

## Async Replication Scheduling

**Note**
During the occurrence of each scheduled replication the target LUN will be unmapped/dismounted and, therefore inaccessible.

**Note**
During the replication process, the source LUN will be unmapped/unmounted on the peer SSR and is therefore inaccessible from the peer SSR. This prevents possible corruption of source data. The replication process will automatically re-map and re-mount.
The Async Replication function can be set at scheduled intervals or may be triggered for immediate replication.

To schedule an Async Replication, do the following:

Step 1  Choose **Async Replication > Pairings**.

Step 2  Mouse over an Async Replication pairing to highlight it and right click.

Step 3  Choose **Schedule**.

Step 4  Complete the fields as described in **Table 5-3**.

-  **Threads**
-  **Init Block Size (MB)**

Step 5  Do one or both of the following:

Note  Entries with “occurs every” interval set to “off” on the drop-down list are ignored.

-  Click **Run Now** to manually trigger an Async Replication.
-  Click **New Schedule Entry** one or more times to schedule one-time or recurring Async Replications.
  -  Enter the replication start time (24-hour clock) or use the Hour and Minute slide bar to choose a time.
  -  Choose a time interval, day of the week or calendar date from the Occurs Every drop-down list.

Step 6  Click **Delete** for any scheduled entry you want to remove.

Note  The choices for Thread and Init Block Size stay constant for any Async Replication that is scheduled for this LUN Pairing.
Table 5-3  Schedule Replication Fields

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Threads</td>
<td>Multiprocessing capability. The higher the thread numbers the higher the throughput but the greater the impact on system processing. The default is two.</td>
</tr>
<tr>
<td></td>
<td><strong>Tip</strong> Use the default (2) for peak computing hours. Use higher thread for off-peak computing hours.</td>
</tr>
<tr>
<td>Init Block Size (MB)</td>
<td>Initial transmission block size only. This parameter is used for the initial replication for a device, (including if the initial replication is manually triggered). Subsequent delta replications for the device always use a 1Mb block size.</td>
</tr>
</tbody>
</table>

Step 7  Click **Save Schedule** or click **Cancel** to return to the **Pairings** window.

**Restore**

After replicating a LUN to a remote target device, the restore function can replicate the data copy back to the source LUN (in-place) or, if needed, can send the copy to a new LUN (out-of-place).

To Restore a Replication do the following:

Step 1  Choose **Async Replication > Pairings**.

The **Pairings** window appears.

Step 2  Mouse over an Async Replication pairing to highlight it and right click.

The right-click menu appears.

Step 3  Choose **Restore**.

The **Restore** box appears for the LUN selected.

Step 4  Complete the Restore fields appropriate to the restore the selection (see Table 5.4) using the drop-down lists or typing (Name field).

Click **Restore** or click **Cancel** to return to the **Async Replication** window.

Table 5-4  Restore Selection Options

<table>
<thead>
<tr>
<th>Source:</th>
<th>Threads</th>
</tr>
</thead>
<tbody>
<tr>
<td>New</td>
<td>• LUN Name</td>
</tr>
<tr>
<td></td>
<td>• Volume Group</td>
</tr>
<tr>
<td></td>
<td>• Threads</td>
</tr>
</tbody>
</table>

**View Log File**

To view replication and restoration log files, do the following:
Step 1  Choose Async Replication > Pairings.
The Pairing window appears.

Step 2  Mouse over an Async Replication pairing to highlight it and right click.
The right-click menu appears.

Step 3  Choose View Log File.
The Replication/Restoration Activity dialog box appears.

Step 4  Do one of the following:

- Click Clear to clean the log for that specific pairing.
  A confirmation dialog box appears.

- Click OK to close the dialog box or click Cancel to return to the log.