Site-Based Rolling AP Upgrade in N+1 Networks

Feature History for Site-Based Rolling AP Upgrade in N+1 Networks

This table provides release and related information for the features explained in this module.

These features are available in all releases subsequent to the one they were introduced in, unless noted otherwise.

Table 1: Feature History for Site-Based Rolling AP Upgrade in N+1 Networks

Release	Feature	Feature Information
Cisco IOS XE 17.9.1	Site-Based Rolling AP Upgrade in N+1 Network	This feature helps to achieve a zero downtime network upgrade in N+1 networks.

Information About Site-Based Rolling AP Upgrade in N+1 Network

The Site-Based Rolling AP Upgrade in an N+1 Network feature allows you to perform a staggered upgrade of APs in each site in an N+1 deployment.

This feature helps you to effectively achieve a zero-downtime network upgrade in an N+1 network. The existing site filter functionality allows you to perform a software upgrade of a site or all the sites managed by the controller.

In a typical scenario, the software of the APs belonging to a site is upgraded and the network is monitored to see whether it is functioning as intended, before adding more sites to the site filter. If the upgrade fails to meet the objectives, all the sites in the site filter can be removed using the **ap image site-filter file any-image remove-all** command. The **ap image site-filter** command is modified to include the **any-image** keyword as a substitute for the image file name to support the N+1 AP move site filter.

Prerequisites for Site-Based Rolling AP Upgrade in N+1 Networks

- The source and destination controllers should be in the same mobility group (preferably running the latest image) but with different AP image versions.
- Image of the destination controller should be available on the source controller.
- Both the source and destination controllers should be in INSTALL mode.

Restrictions for Site-Based Rolling AP Upgrade in N+1 Networks

- Site filter operations are supported only for N+1 upgrade and N+1 move; **fallback** and **reset** options of the **ap image upgrade destination** command are not supported.
- APs can only move across the controllers having the same software.
- The **any** and **remove-all** keywords of the **ap image site-filter** command work only for the N+1 AP upgrade or move. It will not work for other site filter operations such as AP Model Service Pack (APSP) or AP Device Package (APDP).
- A reboot of the source or the destination controller during the N+1 upgrade requires a re-execution of the procedure.

Use Cases

The N+1 deployments are more common compared to 1+1 redundancy deployments. In the N+1 deployments, spare controllers are used and APs can fail over to it whenever their primary controller goes down. For local mode networks, this results in a small network downtime (30 to 40 seconds), during which APs re-discover and re-join the network. However, during network upgrades, the downtime is much longer, and all the devices have to reboot and converge. The feature can effectively provide a zero-downtime network upgrade in an N+1 deployment.

N+1 Upgrade and Move to Destination Controller

Note

- Run all the commands only on the source controller.
- By default, the Rolling AP Upgrade feature sends a basic service set (BSS) transition message to 11v clients to notify them that the AP they are connected to is going down, along with a list of alternate APs. In scenarios where clients are sensitive to roaming, this feature can cause unnecessary packet drops. In such instances, you can disable the 11v message using the **no ap upgrade staggered client-steering** command.

Before you begin

See the *Prerequisites for Site-based Rolling AP Upgrade in an N+1 Network* section.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**no ap upgrade staggered client-steering** **Example:** `Device# no ap upgrade staggered client-steering`	(Optional) Disables client steering.
Step 3	**ap upgrade staggered iteration completion** *min-percent* **Example:** `Device(config)# ap upgrade staggered iteration completion 50`	(Optional) Configures the minimum percentage of APs that must join the destination controller to signal iteration completion.
Step 4	**ap upgrade staggered iteration error action stop** **Example:** `Device(config)# ap upgrade staggered iteration error action stop`	(Optional) Configures the action to be taken when APs are missing after an iteration during AP upgrade.
Step 5	**ap upgrade staggered iteration timeout** *timeout-duration* **Example:** `Device(config)# ap upgrade staggered iteration timeout 18`	(Optional) Configures the maximum time allowed per iteration during AP upgrade. Valid values range from 9 to 60.

	Command or Action	Purpose
Step 6	**exit** **Example:** `Device(config)# exit`	Returns to privileged EXEC mode.
Step 7	**ap image site-filter any-image add** *site-tag* **Example:** `Device# ap image site-filter any-image add site1`	Adds a site tag to a site filter. You can repeat this step to set up a multisite filter.
Step 8	**ap image move destination** *controller-name controller-ip* **Example:** `Device# ap image move destination controller2 10.9.34.4`	Moves the APs to a different controller in the mobility group. **Note** It is preferable to move the APs to a different controller running the same image. Wait for the upgrade to complete. If upgrade is not completed successfully, you can use the **ap image upgrade destination** or **ap image move destination** commands to restart the upgrade process.
Step 9	**ap image site-filter any-image add** *site-tag* **Example:** `Device# ap image site-filter file any-image add site2`	Adds additional site tag to a site filter.
Step 10	**ap image site-filter any-image apply** **Example:** `Device# ap image site-filter file any-image apply`	Predownloads the image and upgrades the APs based on the site filter. **Note** Wait for the upgrade to complete.
Step 11	**ap image site-filter any-image clear** **Example:** `Device# ap image site-filter file any-image clear`	(Optional) Clears the site filter table and predownloads the image and does a rolling AP upgrade to all the sites.
Step 12	**ap image site-filter file any-image remove-all** **Example:** `Device# ap image site-filter file any-image remove-all`	(Optional) Removes all the site filters.

N+1 Move to Destination Controller

Note Run all the commands only on the source controller.

Before you begin

See the *Prerequisites for Site-based Rolling AP Upgrade in an N+1 Network* section.

Procedure

	Command or Action	Purpose
Step 1	**ap image site-filter any-image add** *site-tag* **Example:** `Device# ap image site-filter any-image add site1`	Adds a site tag to a site filter.
Step 2	**ap image move destination** *image-name controller-ip* **Example:** `Device# ap image move destination controller2 10.9.34.2`	Moves the APs back to the parent controller. **Note** Wait for the upgrade to complete.
Step 3	**ap image site-filter any-image add** *site-tag* **Example:** `Device# ap image site-filter any-image add site2`	Adds an additional site tag to a site filter.
Step 4	**ap image site-filter any-image apply** **Example:** `Device# ap image site-filter any-image apply`	Upgrades the APs based on the site filter. **Note** Wait for the upgrade to complete. If upgrade is not completed successfully, use the **ap image upgrade destination** or **ap image move destination** command to restart the upgrade process.
Step 5	**ap image site-filter any-image clear** **Example:** `Device# ap image site-filter any-image clear`	(Optional) Clears the site filter table and predownloads the image and does a rolling AP upgrade to all the sites where it is not active.

Hitless Software Upgrade (N+1 Upgrade)

Hitless software upgrade uses the concept of N+1 high availability using a spare controller to upgrade the CAPWAP infrastructure comprising controllers and access points (AP). Depending on what you choose, the APs are upgraded in a staggered fashion, per site, or on all sites , using the Rolling AP upgrade feature thereby avoiding network disruption. This ensures that the clients are serviced by the neighboring APs while one or the selected APs undergo the upgrade process.

The upgrade workflow is as follows :

1. Initiate upgrade on the source controller. You can choose to upgrade all sites or per site based on your preference.
2. Move the APs to the destination controller. APs are upgraded in a staggered fashion using the rolling AP upgrade algorithm.
3. Once all the APs move to the destination controller in multiple iterations, activate the target image on the source controller.
4. The source controller reloads for the new image to take effect.
5. (Optional) Move the APs back to the source controller using the cli commands.

Before you begin

- The controller should be in INSTALL mode.
- The controller should be paired with another controller and both should be part of the same mobility group.

  The spare controller should be upgraded with the target image.

Procedure

Step 1 Choose **Administration > Software Management** .

Step 2 From the Software Upgrade tab check the **One-Shot Install Upgrade** checkbox.

Step 3 From the **Transport Type** drop-down list, choose an option.

a) If you choose **My Desktop** as the transport type, click **Select File** to navigate to the file from the **Source File Path** field.

b) If you choose **SFTP** as the transport type, enter the source IP address, SFTP username, SFTP password, file path, and select the destination.

c) If you choose **FTP** as the transport type, enter the source IP address, FTP username, FTP password, file path, and select the destination.

d) If you choose **TFTP** as the transport type, enter the source IP address, file path, and select the destination.

Note In controllers, the IP TFTP source is mapped to the service port by default.

e) If you choose **Device** as the transport type, choose the file system and file path.

Note In the **File Path** field, enter the complete path from where you want to download the software image file, including the name of the file.

Step 4 Check the **Enable Hitless Upgrade** check box to allow the APs and the controller to be upgraded.

Step 5 From the **Site Filter** drop-down list, choose **All Sites** or one or more **Custom Sites**.

In case you choose to upgrade for **All Sites**, you can optionally enable **Fallback after Upgrade** so that the APs move back to the parent controller after the new image has been activated and the parent controller has reloaded.

In case you choose a **Custom Site**, select the site from the **Site Tags** drop-down list. In this case, the APs do not move back to the parent controller automatically and you will have to manually move them using CLIs.

Step 6 In the **Controller IP Address (IPv4/IPv6)** field, enter the source controller's IPv4/IPv6 address.

Step 7 In the **Controller Name** field, enter the source controller's name.

Step 8 In the **AP Upgrade Configuration** section, use the **AP Upgrade per Iteration** drop-down list to select the percentage of APs to be upgraded per iteration. This configures the minimum percentage of APs that must join the destination controller to signal completion of iteration.

Step 9 Check the **Client Steering** check box to move clients attached to APs undergoing an upgrade to other APs. If the clients still persist on the candidate APs, they are disconnected and the APs will reload with the new image.

Step 10 In the **Accounting Percentage** field, choose the percentage of APs that should join the destination controller after each iteration (of the staggered AP upgrade) to consider the iteration as successful. The default value is 90%.

Step 11 Tap to select the type of **Accounting Action** to configure for the APs. If you enable **Terminate**, the upgrade is terminated if the configured percentage of APs does not join the mobility peer, and a notification is sent via Syslog message. If you choose **Ignore**, the upgrade continues irrespective of whether the configured percentage of APs are joining the controller or not.

Step 12 In the **Iteration Expiry** field, select the number of minutes from the drop-down list to configure the expiry time for each iteration.

Step 13 Click **Download & Install**.

Step 14 Click **Save Configuration & Activate**.

Step 15 Click **Commit** to make the activation changes persistent across reloads.

Verifying Site-based Rolling AP Upgrade in a N+1 Network

Use the following **show** commands to check the progress of the upgrade and debugging:

- **show ap summary**
- **show ap tag summary**
- **show ap status**
- **show wireless mobility summary**
- **show ap image**
- **show ap upgrade**
- **show ap upgrade site**
- **show ap upgrade site summary**

- **show ap upgrade name** *report-name*
- **show wireless mobility ap-list**

To view the summary of all the connected Cisco APs, use the following command:

```
Device# show ap summary

Number of APs: 8

AP Name             Slots  AP Model           Ethernet MAC    Radio MAC       Location
       Country  IP Address    State
-------------------------------------------------------------------------------------------
AP00D7.8F9A.43DE    2      AIR-AP2802I-D-K9   00d7.8f9a.43de  002c.c8df.3ca0  default
location    IN       10.9.48.254  Registered
AP4C77.6D21.9098    2      AIR-AP2802E-N-K9   4c77.6d21.9098  00be.7573.b340  default
location    IN       10.10.10.52  Registered
AP00F2.8B27.BB2C    2      AIR-AP2802I-D-K9   00f2.8b27.bb2c  0896.ad9b.f9e0  default
location    IN       10.9.44.51   Registered
APA023.9F41.5A38    2      AIR-AP2802I-D-K9   a023.9f41.5a38  1880.90f4.7b00  default
location    IN       10.10.10.51  Registered
AP00A3.8E4A.762C    2      AIR-AP2802I-D-K9   00a3.8e4a.762c  1880.90f5.14e0  default
location    IN       10.9.48.54   Registered
AP40CE.2485.D616    2      AIR-AP3802I-D-K9   40ce.2485.d616  4001.7aca.5960  default
location    IN       10.9.50.42   Registered
AP40CE.2485.D62C    2      AIR-AP3802I-D-K9   40ce.2485.d62c  4001.7aca.5aa0  default
location    IN       10.10.10.53  Registered
AP2C57.4188.4BC4    3      C9130AXE-D         2c57.4188.4bc4  cc7f.75a8.78e0  default
location    IN       10.9.34.207  Registered
```

To view the summary of all the access points with policy tags, use the following command:

```
Device# show ap tag summary
Number of APs: 8

AP Name             AP Mac           Site Tag Name     Policy Tag Name       RF Tag Name
     Misconfigured    Tag Source
-------------------------------------------------------------------------------------------
AP00D7.8F9A.43DE    00d7.8f9a.43de   site3             default-policy-tag   default-rf-tag
    No               Static
AP4C77.6D21.9098    4c77.6d21.9098   site3             default-policy-tag   default-rf-tag
    No               Static
AP00F2.8B27.BB2C    00f2.8b27.bb2c   site3             default-policy-tag   default-rf-tag
    No               Static
APA023.9F41.5A38    a023.9f41.5a38   default-site-tag   default-policy-tag   default-rf-tag
    No               Default
AP00A3.8E4A.762C    00a3.8e4a.762c   site1             default-policy-tag   default-rf-tag
    No               Static
AP40CE.2485.D616    40ce.2485.d616   site2             default-policy-tag   default-rf-tag
    No               Static
AP40CE.2485.D62C    40ce.2485.d62c   site2             default-policy-tag   default-rf-tag
    No               Static
AP2C57.4188.4BC4    2c57.4188.4bc4   default-site-tag   default-policy-tag   default-rf-tag
    No               Default
```

To view the status of the access points, use the following command:

```
Device# show ap status
AP Name                              Status     Mode              Country
-------------------------------------------------------------------------------
```

```
AP00A3.8E4A.762C                    Enabled    Local            IN
AP00D7.8F9A.43DE                    Enabled    Monitor          IN
AP00F2.8B27.BB2C                    Enabled    Local            IN
AP2C57.4188.4BC4                    Enabled    Local            IN
AP40CE.2485.D616                    Enabled    Local            IN
AP40CE.2485.D62C                    Enabled    Local            IN
AP4C77.6D21.9098                    Enabled    Local            IN
APA023.9F41.5A38                    Enabled    Local            IN
```

To display the summary of the mobility manager, use the following command:

```
Device# show wireless mobility summary

Mobility Summary

Wireless Management VLAN: 34
Wireless Management IP Address: 10.9.34.5
Wireless Management IPv6 Address:
Mobility Control Message DSCP Value: 48
Mobility High Cipher : False
Mobility DTLS Supported Ciphers: TLS_ECDHE_RSA_AES128_GCM_SHA256, TLS_RSA_AES256_GCM_SHA384,
 TLS_RSA_AES128_CBC_SHA
Mobility Keepalive Interval/Count: 10/3
Mobility Group Name: mobility-1
Mobility Multicast Ipv4 address: 10.0.0.1
Mobility Multicast Ipv6 address: ::
Mobility MAC Address: 001e.14a5.b3ff
Mobility Domain Identifier: 0x39ab

Controllers configured in the Mobility Domain:

 IP        Public Ip  MAC Address    Group Name  Multicast IPv4 Multicast IPv6  Status
PMTU
-------------------------------------------------------------------------------------------
10.9.34.5  N/A        001e.14a5.b3ff mobility-1  0.0.0.0        ::              N/A     N/A
10.9.34.2  10.9.34.2   001e.bd2d.f2ff mobility-1  0.0.0.0        ::              Up
1385
10.9.34.3  10.9.34.3   001e.14c1.cbff mobility-1  0.0.0.0        ::              Up
1385
10.9.34.4  10.9.34.4   001e.140e.4bff mobility-1  0.0.0.0        ::              Up
1385
```

To view the cumulative statistics regarding the AP images in the controller, use the following command:

```
Device# show ap image

Total number of APs  : 8


Number of APs
        Initiated                : 0
        Downloading              : 0
        Predownloading           : 0
        Completed downloading    : 0
        Completed predownloading : 0
        Not Supported            : 0
        Failed to Predownload    : 0
        Predownload in progress  : No
AP Name           Primary Image Backup Image Predownload Status Predownload Version  Next
Retry Time Retry Count  Method
-------------------------------------------------------------------------------------------------
AP00D7.8F9A.43DE  17.9.0.19     17.8.0.74    None               0.0.0.0             N/A
            0           N/A
```

```
AP4C77.6D21.9098  17.9.0.19     17.8.0.74    None                0.0.0.0             N/A
            0           N/A
AP00F2.8B27.BB2C  17.9.0.19     17.9.1.19    None                0.0.0.0             N/A
            0           N/A
APA023.9F41.5A38  17.9.0.19     17.8.0.74    None                0.0.0.0             N/A
            0           N/A
AP00A3.8E4A.762C  17.9.0.19     17.9.1.19    None                0.0.0.0             N/A
            0           N/A
AP40CE.2485.D616  17.9.0.19     17.9.1.19    None                0.0.0.0             N/A
            0           N/A
AP40CE.2485.D62C  17.9.0.19     17.8.0.82    None                0.0.0.0             N/A
            0           N/A
AP2C57.4188.4BC4  17.9.0.19     17.9.1.19    None                0.0.0.0             N/A
            0           N/A
```

To verify the AP upgrade on the controller, use the following command:

```
Device# show ap upgrade

AP upgrade is in progress

From version: 17.9.0.19
To version: 17.9.1.25

Started at: 01/28/2022 09:53:07 IST
Configured percentage: 5
Percentage complete: 0
Expected time of completion: 01/28/2022 13:33:07 IST

Client steering: Enabled
Iteration expiry time: 15 minutes
Accounting percentage: 95%
Accounting action: Abort

Rolling AP Upgrade Site Summary
-------------------------------
site3

Progress Report
---------------
Iterations
----------
Iteration       Start time                  End time                    AP count
-------------------------------------------------------------------------------------
0               01/28/2022 09:53:07 IST     01/28/2022 09:53:07 IST     1
1               01/28/2022 09:53:07 IST     ONGOING                     0

Upgraded
--------
Number of APs: 1
AP Name                Radio MAC       Iteration   Status     Site
-------------------------------------------------------------------------------------
AP00D7.8F9A.43DE       002c.c8df.3ca0  0           Rebooted    site3

In Progress
-----------
Number of APs: 1
AP Name                          Radio MAC
-------------------------------------------------
AP00F2.8B27.BB2C                 0896.ad9b.f9e0

Remaining
---------
Number of APs: 1
```

```
AP Name                          Radio MAC
-------------------------------------------------
AP4C77.6D21.9098                 00be.7573.b340

APs not handled by Rolling AP Upgrade
-------------------------------------
AP Name      Radio MAC           Status          Reason for not handling by Rolling AP
Upgrade
-----------------------------------------------------------------------------------------------------
```

To verify the AP upgrade information on the sites, use the following command:

```
Device# show ap upgrade site

Site-filtered AP upgrade report data
====================================
Source controller: Controller1
Destination controller: Controller2

From version: 17.9.0.19
To version: 17.9.1.25
Site-filters present: Yes

AP image upgrade site summary
-----------------------------
Operation: N+1 upgrade

Site Tag                                    Status
------------------------------------------------------------
site3                                       In Progress

AP upgrade reports linked to these site-filters
-----------------------------------------------

Start time               Operation type             Report name
-------------------------------------------------------------------------------
01/28/2022 09:53:07 IST  AP image upgrade/move CLI  AP_upgrade_to_DEvice2_28020229536
```

To verify the AP image upgrade site summary, use the following command:

```
Device# show ap upgrade site summary

AP image upgrade site summary
-----------------------------
Operation: N+1 upgrade

Site Tag                                    Status
------------------------------------------------------------
site3                                       In Progress
```

To view AP upgrade information based on the upgrade report name, use the following command:

```
Device# show ap upgrade name AP_upgrade_to_Device2

AP upgrade is complete

From version: 17.9.0.19
To version: 17.9.1.25

Started at: 01/28/2022 14:12:49 IST
Configured percentage: 5
Percentage complete: 100
End time: 01/28/2022 14:18:59 IST
```

```
Client steering: Enabled
Accounting percentage: 95%
Iteration expiry time: 15 minutes
Accounting action: Abort

Rolling AP Upgrade Site Summary
-------------------------------
site1
site2

Progress Report
---------------
Iterations
----------
Iteration     Start time                    End time                    AP count
-------------------------------------------------------------------------------------
0             01/28/2022 14:12:49 IST       01/28/2022 14:12:49 IST     0
1             01/28/2022 14:12:49 IST       01/28/2022 14:15:54 IST     1
2             01/28/2022 14:15:54 IST       01/28/2022 14:18:59 IST     1

Upgraded
--------
Number of APs: 2
AP Name               Radio MAC         Iteration  Status          Site
-------------------------------------------------------------------------------------------
AP40CE.2485.D616      4001.7aca.5960    1          Joined Member   site2
AP40CE.2485.D62C      4001.7aca.5aa0    2          Joined Member   site2

In Progress
-----------
Number of APs: 0
AP Name                           Radio MAC
-------------------------------------------------

Remaining
---------
Number of APs: 0
AP Name                           Radio MAC
-------------------------------------------------

APs not handled by Rolling AP Upgrade
-------------------------------------
AP Name      Radio MAC      Status    Reason for not handling by Rolling AP Upgrade
-------------------------------------------------------------------------------------------
```

To display the list of access points known to the mobility group, use the following command:

```
Device# show wireless mobility ap-list

AP name                            AP radio MAC      Controller IP     Learnt from
-------------------------------------------------------------------------------------
Unknown                            002c.c8df.3ca0    10.9.34.5          Self
Unknown                            00be.7573.b340    10.9.34.5          Self
Unknown                            0896.ad9b.f9e0    10.9.34.5          Self
Unknown                            1880.90f4.7b00    10.9.34.5          Self
Unknown                            1880.90f5.14e0    10.9.34.5          Self
Unknown                            4001.7aca.5960    10.9.34.5          Self
Unknown                            4001.7aca.5aa0    10.9.34.5          Self
Unknown                            687d.b45e.4b60    10.9.34.3          Mobility Group
Unknown                            cc7f.75a8.78e0    10.9.34.5          Self
```