ACI Upgrade/Downgrade Architecture

High Level Summary of APIC Upgrade

When performing an upgrade of an APIC cluster, there is a certain sequence of events that occur to allow for the upgrade of each APIC separately, along with ensuring that the data on the upgraded APIC will be compatible with the target image. Most of these events happen in the background, so it's important to understand what you should expect to see when you trigger an upgrade of the APIC cluster.

1. Image is uploaded to the firmware repository. The image is synced to all APIC cluster members.
2. Upgrade is triggered to a specific target version.
3. Each APIC in the cluster goes through the process to install the new image in the first grub partition. It's important to note that this happens in parallel to speed up the upgrade process.
4. Once the image installation is completed, each APIC takes its turn to go through a data conversion process of the database files in a sequential order. When this occurs, the following events happen:
   a. The Data Management Engine (DME) processes shut down. This includes the nginx web server which services all API requests. Because of this, you will lose access to the UI/API, as well as any other backend application that runs on that APIC.
   b. The database files are converted from the initial version to the target version. The amount of time this takes is dependent on the size of the configuration deployed on the ACI fabric. Because of this, the total time to complete the conversion will vary between deployments.

Note ***It's critical that there is no disruptive action taken to the APIC at this stage, as it could result in data loss or partial configuration if this stage does not complete successfully.*** See Operations You Must Avoid During an Upgrade/Downgrade, on page 10 for more information.

c. The APIC will then reload after the database conversion process has completed successfully and will boot up on the version of software defined in the target version.

5. Once the APIC that performed the reload comes back online, the sequence of events outlined in Step 4 happen to the next APIC in the cluster. This process repeats itself until all members of the cluster have been upgraded.

Detailed Summary of APIC Upgrade

The following sections provide a detailed summary of APIC upgrades.

Understanding APIC Upgrade Stages

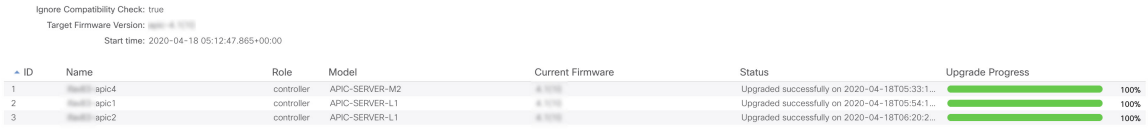
The stages that the APICs go through during an upgrade process will vary, depending on the current running version of your software and the version of the software that you are upgrading to.

• Upgrading from a Pre-4.2(5) Release to Release 4.2(5) or Later, on page 2
• Upgrading from Release 4.2(5) or Later to a Later Release, on page 4

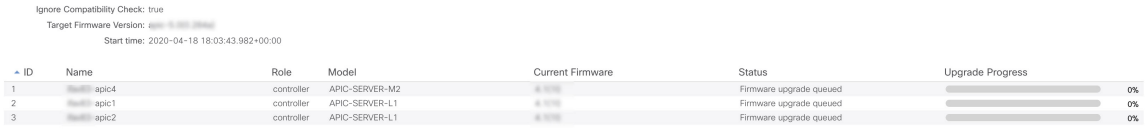
Upgrading from a Pre-4.2(5) Release to Release 4.2(5) or Later

If the current running version of your software is earlier than Cisco APIC Release 4.2(5), and you are upgrading to Release 4.2(5) or later, this section provides information on the stages that each APIC will go through during the upgrade process.

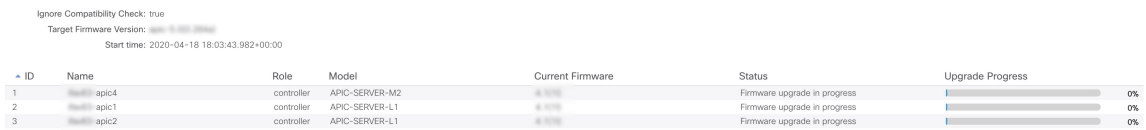
- Before you begin the upgrade, each APIC will be shown at 100%, which shows that the installation, upgrade, or downgrade that was previously performed on each APIC was completed successfully.



- Once you begin the upgrade process, the status will change from 100% to 0% for all of the APICs, going through the following stages:
  - The status will first show as `Firmware upgrade queued`.

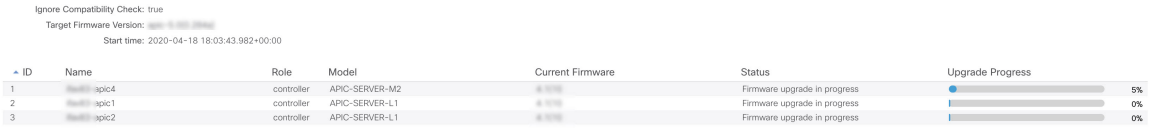


  - The status will then change to `Firmware upgrade in progress`.

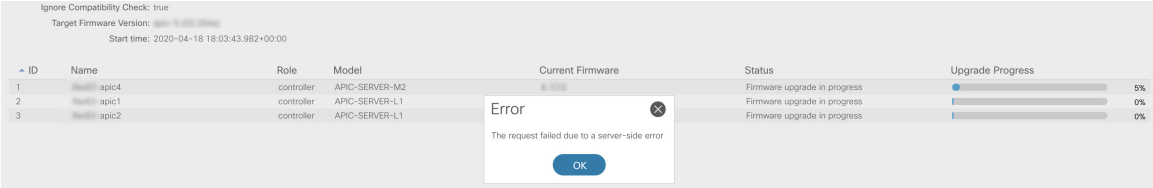


- Next, the APIC that is selected first by the installer will begin upgrading and will advance to 5%, as shown in the following figure.

Note The APIC that is selected first to begin the upgrade process is a random selection, depending on which APIC is called first by the installer. That means that the first APIC that will begin upgrading in the cluster is not necessarily the APIC with the lowest-numbered name.



During this stage, an error and warning message similar to the following might appear:



This is normal and expected behavior, and is due to the fact that the APIC is being rebooted as part of the upgrade process.

Once the first APIC in your cluster has reached 5%, each APIC will then advance through the following stages in the upgrade process, which will be shown in the **Upgrade Progress** area:

- **First APIC called by installer**: 0% → 5% → 100%
- **Remaining APICs in cluster**: 0% → 100%

The following table provides more details on what happens at each stage of this upgrade process:

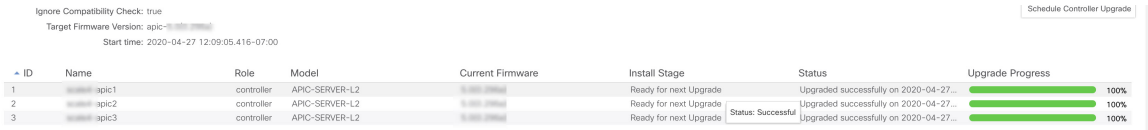
Upgrade Progress	Description
0%	Displayed when the upgrade installer is initiated and the upgrade process has started.

Upgrade Progress	Description
5%	During this stage, the following configurations occur for all APICs in the cluster, with the status of the first APIC called by the installer remaining at 5% and the status of the remaining APICs in the cluster remaining at 0%: • The first APIC called by the installer performs internal sanity checks such as a preparation for database conversions to be compatible with the new firmware and a firmware image status check on each APIC. • Internal sanity checks are completed, and the target version gets pre-loaded into the APICs. • All APICs in the cluster upgrade sequentially, going in the order of the first APIC called by the installer, then the second APIC, then the third APIC. In this stage, each APIC waits for the other APICs ahead of it to complete before that APIC begins upgrading. In other words, the first APIC begins upgrading first, with the second and third APICs waiting until the first APIC has completed the upgrade process. Once the first APIC has completed this stage, the second APIC begins the upgrade process, as the third APIC waits. • All APICs go through the data conversion phase of the upgrade process, in sequential order. At this stage of the upgrade process, if the upgrade process fails, the system will roll back to the previous version of the software. Each APIC will reboot during this stage, once the data conversion part of this stage is completed. As each APIC goes through a reboot, you will see the following: • The following error and warning message might appear: `Request failed due to server-side error or web-socket connection closed due to unknown reason` This is normal and expected behavior, and is due to the fact that the APIC is being rebooted as part of the upgrade process. • The APIC will disappear briefly from the list of APIC controllers in the GUI, and will then reappear in the list after the reboot has completed and the upgrade has completed successfully. When the Cisco APIC that the browser is connected to is upgraded and it reboots, the browser first displays an error message, then you will not be able to see anything in the browser that you used to log into this APIC. However, you can log into any of the remaining APICs in the cluster to continue to monitor the progress of the upgrade process, if you want.
100%	Displayed when that APIC has successfully completed the entire upgrade process.

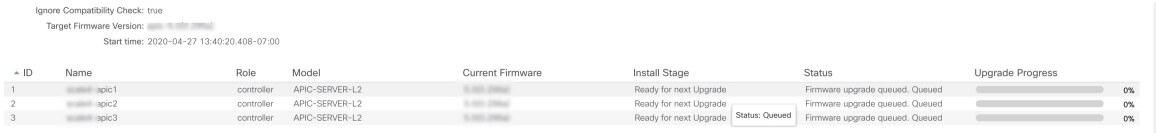
Upgrading from Release 4.2(5) or Later to a Later Release

If the current running version of your software is Cisco APIC Release 4.2(5) or later, and you are upgrading to a later release, this section provides information on the stages that each APIC will go through during the upgrade process.

- Before you begin the upgrade, each APIC will be shown at 100%, which shows that the installation, upgrade, or downgrade that was previously performed on each APIC was completed successfully.



- Once you begin the upgrade process, the status will change from 100% to 0% for all of the APICs, as shown in the following figure.



- Next, the APIC that is selected first by the installer will begin upgrading and will advance to 5%, as shown in the following figure.

Note The APIC that is selected first to begin the upgrade process is a random selection, depending on which APIC is called first by the installer. That means that the first APIC that will begin upgrading in the cluster is not necessarily the APIC with the lowest-numbered name.

- The APIC that is selected second by the installer will then begin upgrading and will advance to 5%.
- The APIC that is selected third by the installer will then begin upgrading and will advance to 5%.

  If you have more than three APICs in your cluster, the process will continue until all the APICs in your cluster are at 5%.

Once all the APICs in your cluster have reached 5%, each APIC will then advance through the following stages in the upgrade process, which will be shown in the **Upgrade Progress** area:

- **First APIC called by installer**: 0% → 5% → 10% → 25% → 50% → 75% → 100%
- **Remaining APICs in cluster**: 0% → 5% → 25% → 50% → 75% → 100%

The following table provides more details on what happens at each stage of this upgrade process:

Upgrade Progress	Install Stage	Install Stage Status	Description
0%	Ready for next upgrade	Queued	Displayed when the upgrade installer is initiated and the upgrade process has started.
5%	Checking compatibility	Ensure hardware and software compatibilities for controller	Displayed when the upgrade installer is initiated and the upgrade process has started.

Upgrade Progress	Install Stage	Install Stage Status	Description
10%	Checking controller health	Performing internal sanity checks to prepare for the upgrade	In this stage, the first APIC called by the installer performs internal sanity checks such as a preparation for database conversions to be compatible with the new firmware and a firmware image status check on each APIC. The first APIC will move to 10% in this stage, while the other APICs in the cluster will remain at 5%.
25%	Performing upgrade	Install target version on controller	Displayed when the internal sanity checks have completed, and the target version is getting pre-loaded into the APIC. Note that the first APIC, which is performing the configuration checks and pre-upgrade configurations on the other APICs in the cluster, will move from 10% to 25% in this stage, whereas the remaining APICs in the cluster will jump from 5% directly to 25% in this stage.
50%	Waiting for other controllers to upgrade	Waiting for other controllers to complete migrating configuration	The APICs in the cluster do not upgrade simultaneously, all at one time, but rather upgrade sequentially, going in the order of the first APIC called by the installer, then the second APIC, then the third APIC. In this stage, each APIC waits for the other APICs ahead of it to complete before that APIC begins upgrading. In other words, the first APIC begins upgrading first, with the second and third APICs waiting until the first APIC has completed the upgrade process. Once the first APIC has completed this stage, the second APIC begins the upgrade process, as the third APIC waits.

Upgrade Progress	Install Stage	Install Stage Status	Description
75%	Migrating configuration	Now performing conversion on the controller	Displayed at the data conversion phase of the upgrade process. Again, because of the sequential order of the upgrade process between all of the APICs in the cluster, one APIC will move from 50% to 75% in this stage, while the other two APICs will remain at 50%. Once that first APIC has completed this phase of the upgrade process, the second APIC in the cluster will begin this phase and will move from 50% to 75%, with the remaining APICs in the cluster remaining at 50% until the second APIC has completed this phase of the upgrade process. At this stage of the upgrade process (between the 50% stage and the 75% stage), if the upgrade process fails, the system will roll back to the previous version of the software. Each APIC will reboot during this stage, once the data conversion part of this stage is completed. As each APIC goes through a reboot, you will see the following: • The following error and warning message might appear: `Request failed due to server-side error or web-socket connection closed due to unknown reason` This is normal and expected behavior, and is due to the fact that the APIC is being rebooted as part of the upgrade process. • The APIC will disappear briefly from the list of APIC controllers in the GUI, and will then reappear in the list after the reboot has completed and the upgrade has completed successfully. When the Cisco APIC that the browser is connected to is upgraded and it reboots, the browser first displays an error message, then you will not be able to see anything in the browser that you used to log into this APIC. However, you can log into any of the remaining APICs in the cluster (the APICs that were still at 50% at the point that the APIC was reloaded) to continue to monitor the progress of the upgrade process, if you want.
100%	Ready for next upgrade	Successful	Displayed when that APIC has successfully completed the entire upgrade process.

Default Interface Policies in the 5.2(4) release and later

When you upgrade to the 5.2(4) or later release, the Cisco Application Policy Infrastructure Controller (APIC) creates the following default interface policies automatically:

- CDP (cdpIfPol)
  - system-cdp-disabled
  - system-cdp-enabled

- LLDP (lldpIfPol)
  - system-lldp-disabled
  - system-lldp-enabled
- LACP (lacpLagPol)
  - system-static-on
  - system-lacp-passive
  - system-lacp-active
- Link Level (fabricHIfPol)
  - system-link-level-100M-auto
  - system-link-level-1G-auto
  - system-link-level-10G-auto
  - system-link-level-25G-auto
  - system-link-level-40G-auto
  - system-link-level-100G-auto
  - system-link-level-400G-auto
- Breakout Port Group Map (infraBrkoutPortGrp)
  - system-breakout-10g-4x
  - system-breakout-25g-4x
  - system-breakout-100g-4x

During the upgrade, if there is already a policy with the exact same name and the exact same parameters as any of these policies, the system takes ownership of those policies and the policies become read-only. If instead the parameters are different, such as the `system-cdp-disabled` has a setting "enabled," then the policies will continue to be user policies. That is, a user can modify the policies.

High Level Summary of Switch Upgrade

When performing an upgrade of an ACI switch node, there is a certain sequence of events that occur to the device(s) being upgraded. Most of these events happen in the background, so it’s important to understand what you should expect to see when you trigger an upgrade of an ACI switch node.

1. The image is pushed from the APIC to the switch.
2. The filesystem and bootflash of the switch is checked to ensure that there is enough space to extract the image.
3. The image is extracted, and the primary grub partition is updated to the target version. The older version is moved into the recovery partition.

4. The BIOS and EPLD images are upgraded if applicable.
5. The switch will do a clean reload, and will re-join the ACI fabric running the newer version of software.

Starting with release 2.1(4), support was added for the third-party Micron Solid State Drive (SSD) firmware auto update. As part of the standard Cisco APIC software upgrade process, the switches will reboot when they upgrade. During that boot-time process, the system will also check the current SSD firmware and will automatically perform an upgrade to the SSD firmware, if necessary. If the system performs an SSD firmware upgrade, the switches will then go through another clean reboot afterward.

Detailed Summary of Switch Upgrade

The following sections provide a detailed summary of switch upgrades.

Understanding Switch Upgrade Stages

During an ACI switch node upgrade, the upgrade progress will advance based on the stages which have completed.

The following table provides more details on what happens at each stage of this upgrade process:

Upgrade Progress	Install Stage	Description
0%	Firmware upgrade queued	Displayed when firmware is being downloaded to the switch from the APIC.
5%	Firmware upgrade in progress	Displayed when the upgrade installer is initiated, and the upgrade process has started.
45%	Firmware upgrade in progress	Displayed after the bootflash check has completed and the image extraction stage has begun.
60%	Firmware upgrade in progress	Image Extraction stage has completed and the grub partition is being updated with the new software information.
70%	Firmware upgrade in progress	The software has been updated on the switch.
80%	Firmware upgrade in progress	The EPLD and BIOS upgrade has begun.
95%	Firmware upgrade in progress	The EPLD and BIOS upgrade has completed, and switch reboot has been initiated.
100%	Upgraded Successfully	The switch has re-joined the fabric after the clean reload running target version of software.

Understanding APIC Downgrade Stages

The ACI APIC and switch downgrade stages are identical to the upgrade stages described in High Level Summary of APIC Upgrade, on page 1, just that the version of software would be lower than the running version.

Operations You Must Avoid During an Upgrade/Downgrade

If at any point in time you believe the upgrade/downgrade has either stalled or failed, it is critical that you do not take any of the actions listed below:

- Don't reload any APIC in the cluster.
- Don't decommission any APIC in the cluster.
- Don't change the firmware target version back to the original version.

Instead, follow the guidelines below:

1. View the installer log files outlined in the Troubleshooting section if applicable (see APIC Installer Log Files and ACI Switch Installer Log Files). This will help in understanding if there is still activity ongoing on the devices being upgraded.
2. Collect the Tech-Support files outlined in the Troubleshooting section (see Collecting Tech-Support Files).
3. Contact Cisco TAC if the upgrade does not complete successfully, and upload the tech-support files to the TAC case after it has been created.