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CISCO

UCS Firmware Management Architecture

BRKCOM-2008

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Agenda

- Firmware Component Comparison
- UCS Firmware Management Overview
- UCS Firmware Guidelines and Best Practices
- UCS Firmware Upgrade/Downgrade Sequence
- UCS Firmware Automation

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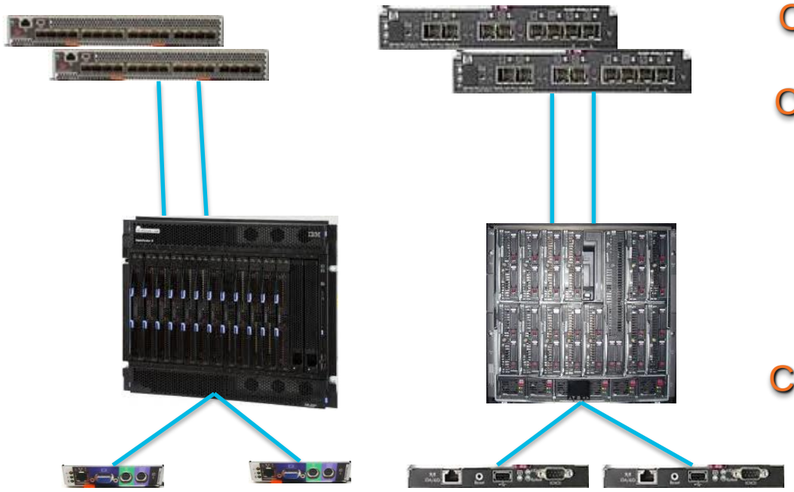
Firmware Component Comparison

Endpoints for Legacy Compute

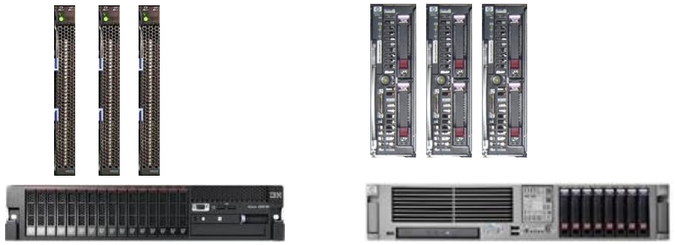


Chassis Based Ethernet Switch

Chassis Based FC Switch

Each chassis is independent

Chassis Mgmt Controller Firmware



Blade BIOS and BMC Firmware

Rackmount Server Firmware

RAID and Disk Firmware

Adapter Firmware

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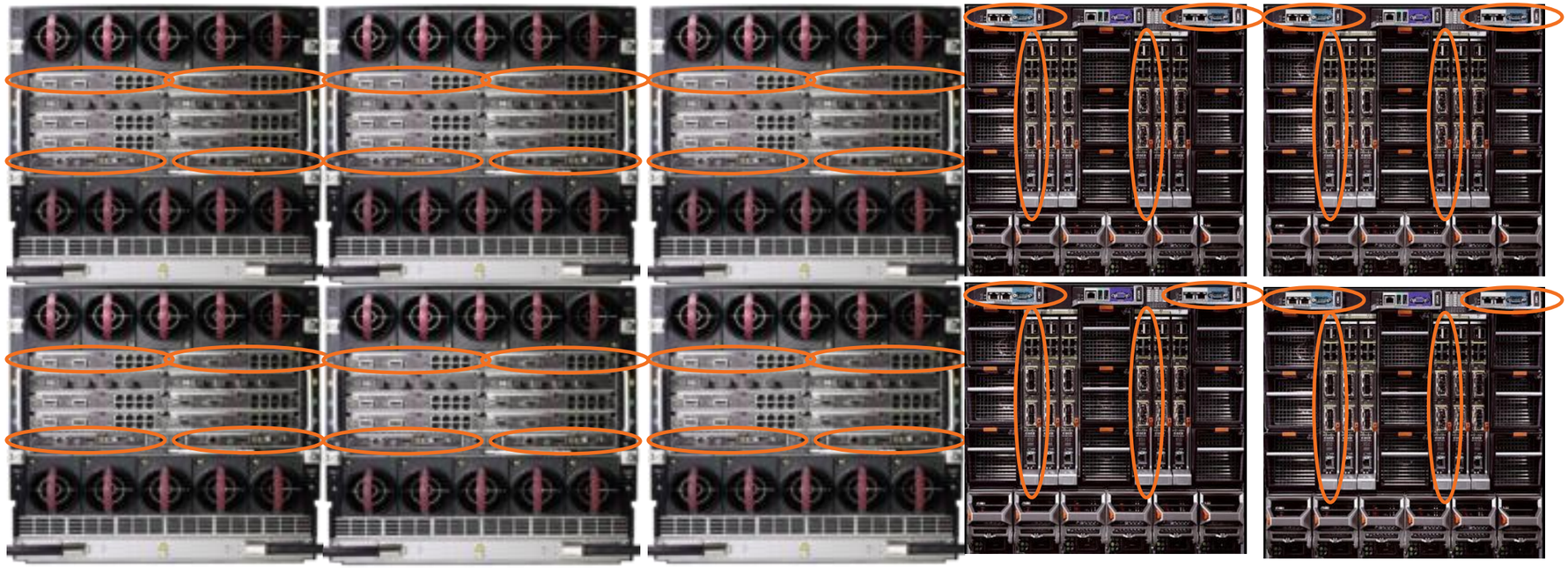
Legacy Firmware Touch Points

160 Server Configuration

- 10 Individual Chassis with separate inter-dependent endpoints
- On board chassis management modules 2 (two) per chassis
- Minimum- pair (2) of on board switches (up to 8) per chassis
- 40 infrastructure touch points



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Legacy Firmware Touch Points

Endpoint Disruption

- Host Management Controllers
  - Local for each host
  - No host data plane disruption
- On board chassis administration modules
  - Active/Passive pair PER chassis
  - No host data plane disruption
- Chassis Ethernet/FC modules
  - Data plane I/O modules
  - Must be updated in precise order to prevent data plane connectivity loss
  - Typically a separate execution tool to run updates
- Host Servers
  - Updates are pushed locally through multiple tools
  - Requires host to reboot in order to activate firmware

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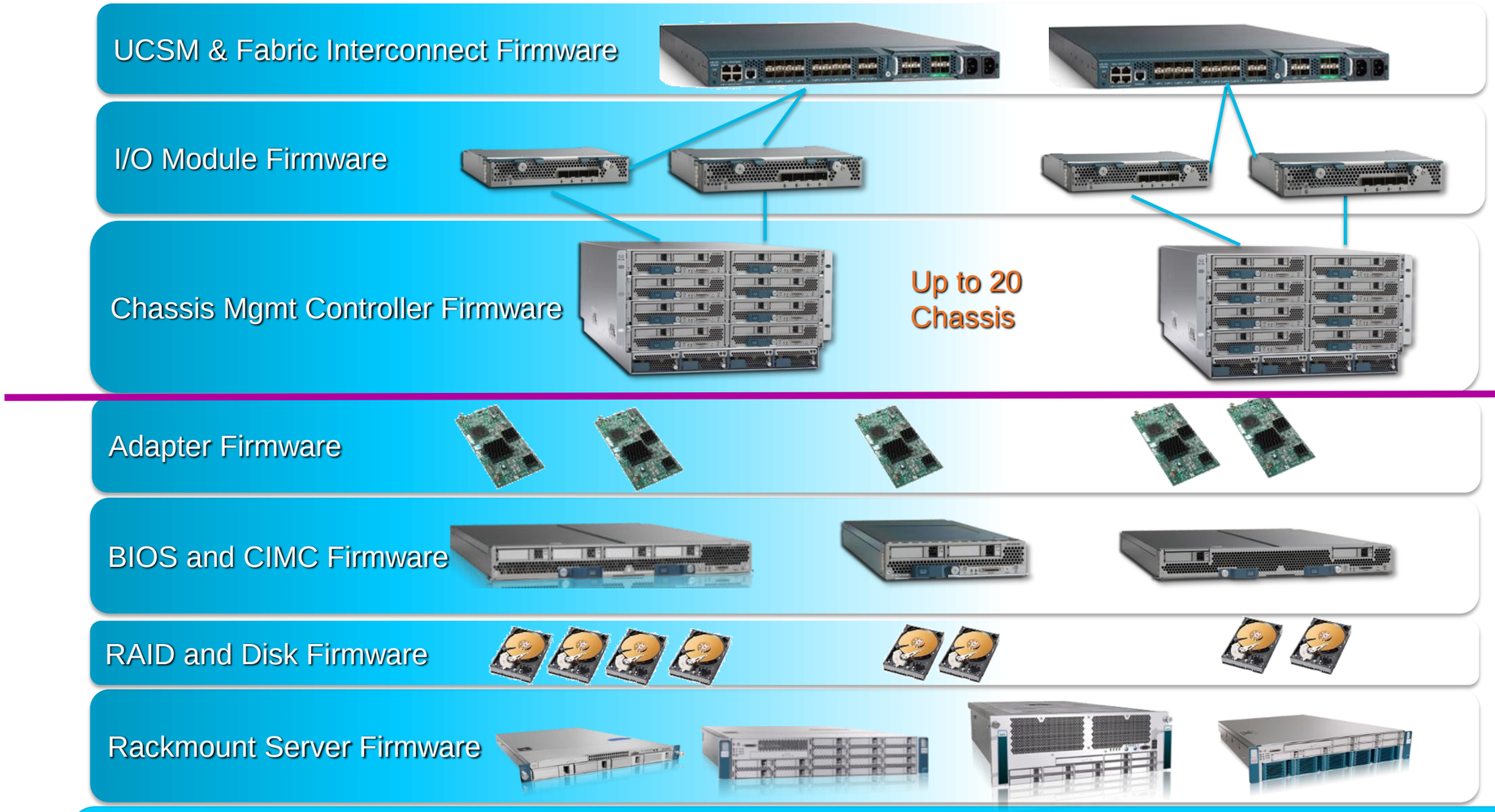
Endpoints for UCS Domain



Infrastructure Bundle

Server Bundles:

- **B-Series Blade Server Bundle**
- **C-Series Rack-Mount Server Bundle**

- Easy change of firmware on servers from one version to another
- Mapping of applications with specific firmware through service profiles
- One step change of firmware for multiple servers

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Legacy Firmware Management Complexity

Examples for non Cisco UCS

- Multiple software tools and deployment methods required to update infrastructure and component firmware
- Complex firmware methodology, some best practice implementation guides are near 200 pages long
- Many infrastructure endpoints to manage
- Hardware must be ‘touched’ to manage firmware across Data Centre
- No policy driven approach
- Requires an IP based network for one to many updates
- Complex authentication steps

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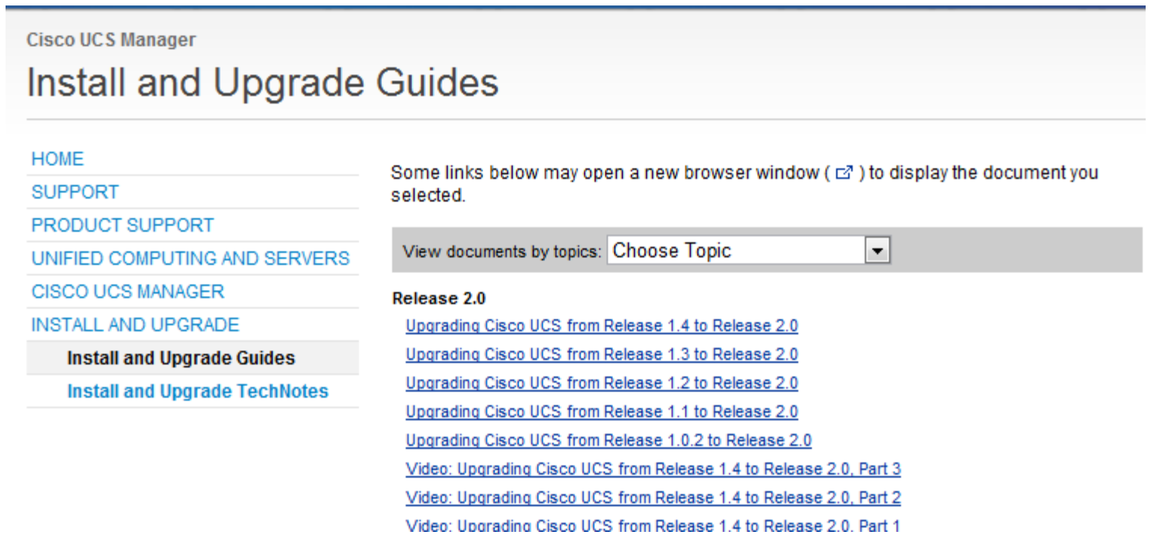
Firmware Management Overview

Documentation and Release Notes

Where to Find Update Documentation

- Important to review the release notes for the appropriate version of FW upgrading or downgrading to.
- Upgrade Guides and videos located at: http://www.cisco.com/en/US/products/ps10281/prod_installation_guides_list.html



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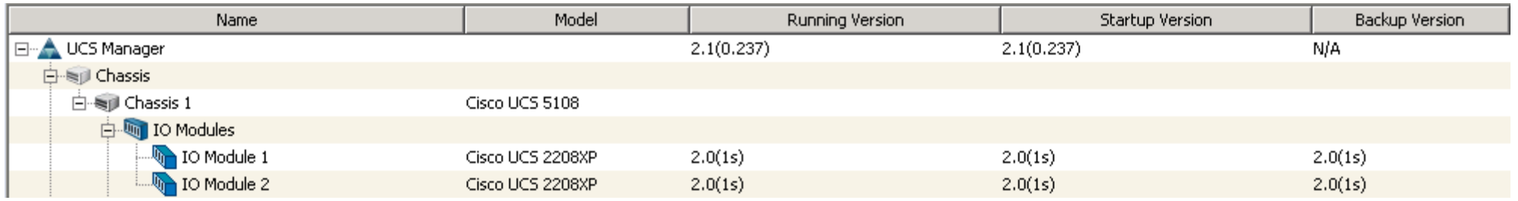
Firmware Terminology

Used by UCSM



Name	Model	Running Version	Startup Version	Backup Version
UCS Manager		2.1(0.237)	2.1(0.237)	N/A
Chassis				
Chassis 1	Cisco UCS 5108			
IO Modules				
IO Module 1	Cisco UCS 2208XP	2.0(1s)	2.0(1s)	2.0(1s)
IO Module 2	Cisco UCS 2208XP	2.0(1s)	2.0(1s)	2.0(1s)

- Running Version
  - Firmware that is active and in use by an endpoint
- Startup Version
  - Firmware that will be used on next reboot
  - UCSM uses the activate operation to change the startup version
- Backup Version
  - Firmware in secondary slot and not in current use by endpoint
  - Older firmware version stored here
  - Update operation replaces the image in the backup slot

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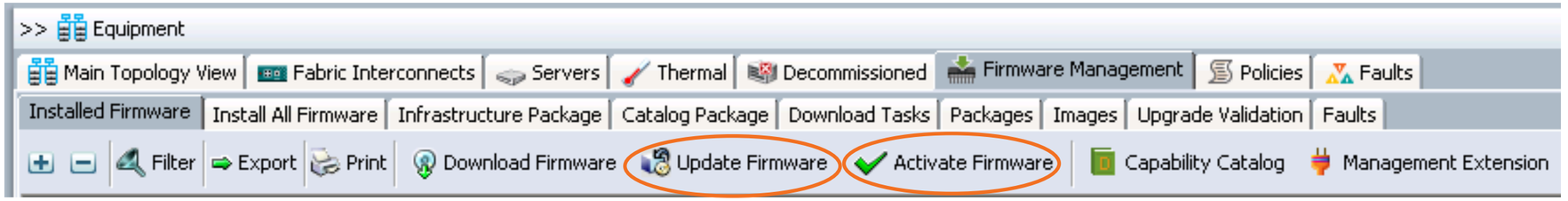
Firmware Management Definition

- Update
  - Copies the firmware to the backup partition on an endpoint
  - Not disruptive
  - Can be done to all devices at the same time
- Activate
  - Firmware in the backup partition is set to active (startup version)
  - Activates the startup version on the endpoint
  - Disruptive
  - Follow specific order according to documentation



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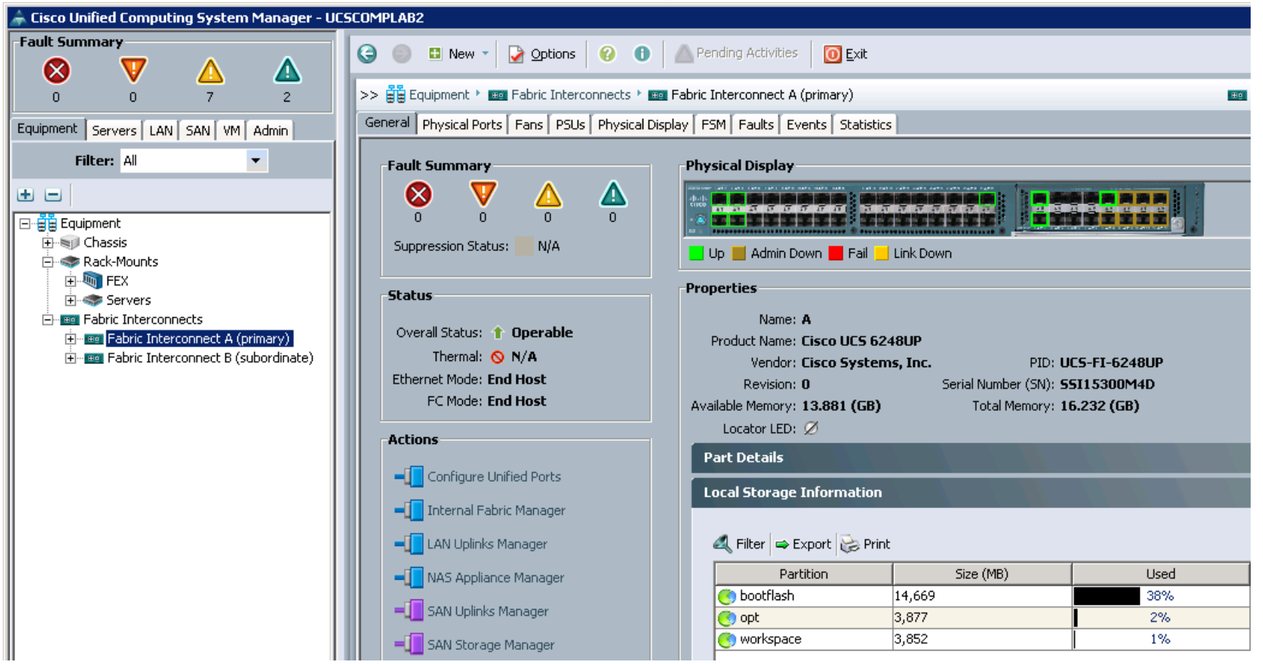
Firmware Management - Download

Placing Firmware on the Fabric Interconnect

- Before downloading a new bundle check the available free space on the Fabric Interconnects
- Images stored in dedicated /bootflash partition of Fabric Interconnect
- Delete Images and Packages if space is limited
- Can use multiple methods for downloading firmware to the Fabric Interconnect
  - Local
  - SCP
  - FTP
  - SFTP
  - TFTP



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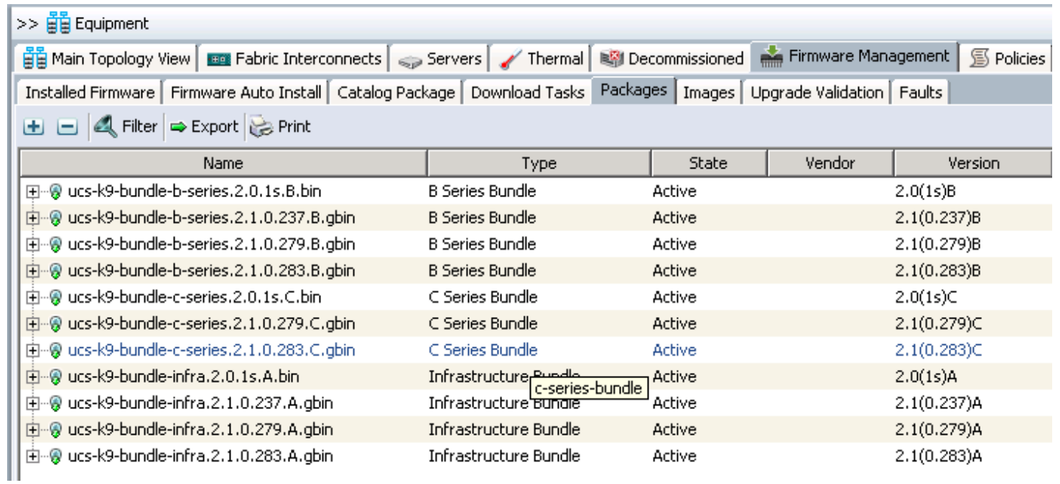
Firmware Bundles

What is a Bundle?

- Firmware bundles (packages) contain individual endpoint images
- A package is only meant for ease of distribution
- Multiple images are bundled together to form an bundle package
- Images contain endpoint Firmware and BIOS (.bin files)
- Bundles (packages) are logical representations in UCSM
- Bundles (packages) may be removed by deleting all images associated with the bundle



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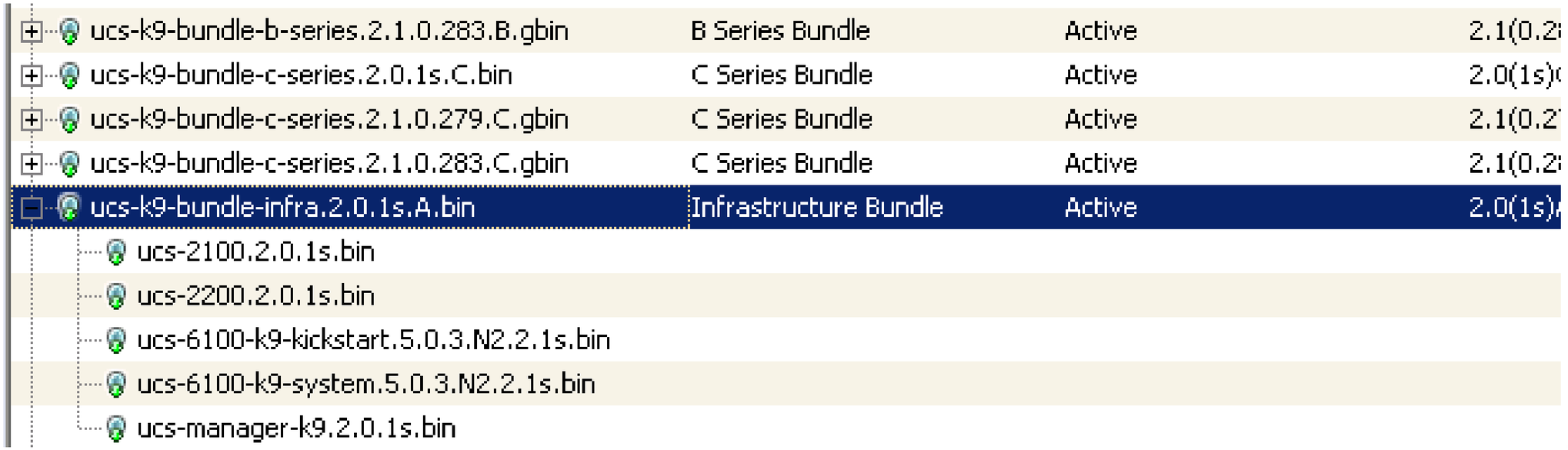
Firmware Bundles

Cisco UCS Infrastructure Software Bundle

- Infrastructure Bundle includes the following firmware images
  - Cisco UCS Manager software
  - Kernel and system firmware for fabric interconnects
  - I/O module firmware



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Firmware Bundles

Cisco UCS B-Series Blade Server Software Bundle

- Bundle includes the following Blade firmware images
  - CIMC firmware
  - BIOS firmware
  - Adapter firmware
  - Board controller firmware
  - Third-party firmware images as required

- New bundles may be released between infrastructure bundles to support new hardware.

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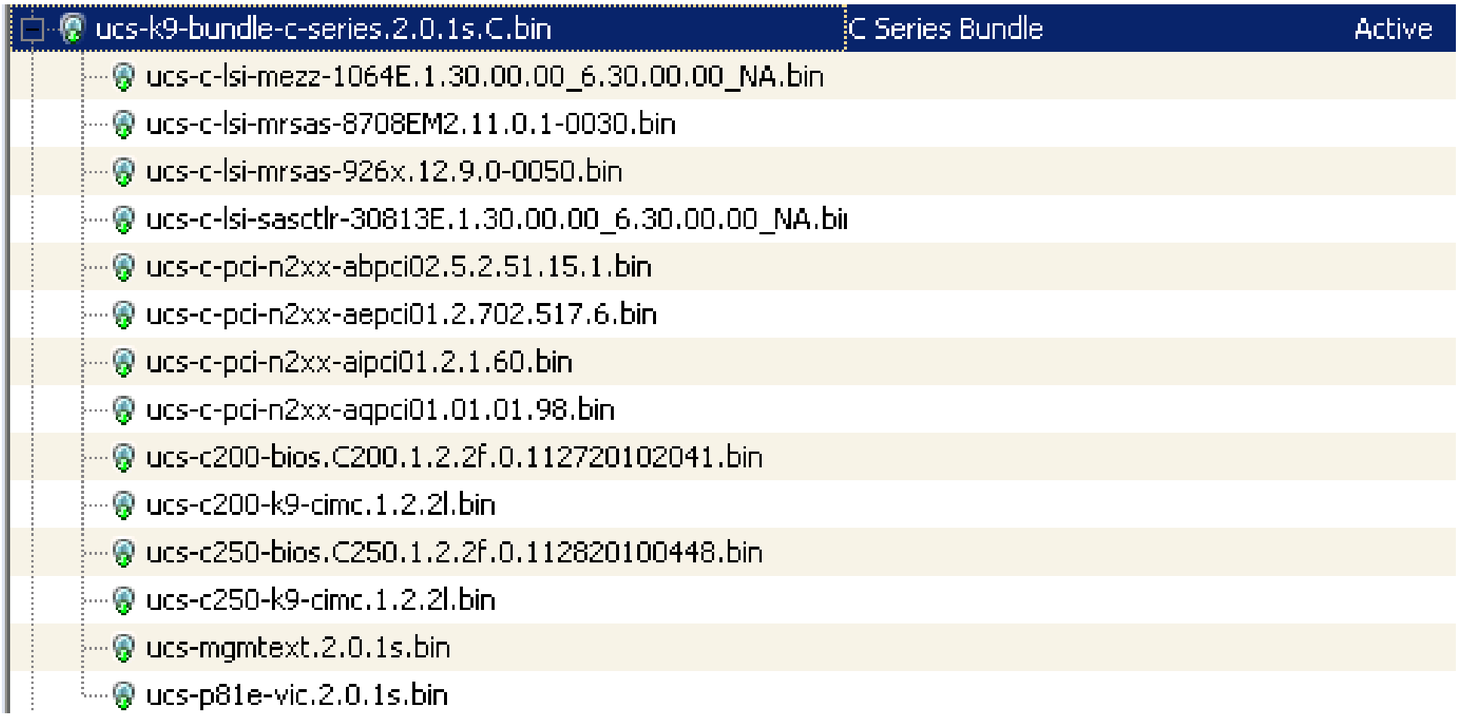
Firmware Bundles

Cisco UCS C-Series Rack Server Software Bundle

- Bundle includes the following firmware images for Rack servers integrated with UCSM
  - CIMC firmware
  - BIOS firmware
  - Adapter firmware
  - Storage controller firmware
- Only used for UCSM integrated C-Series servers



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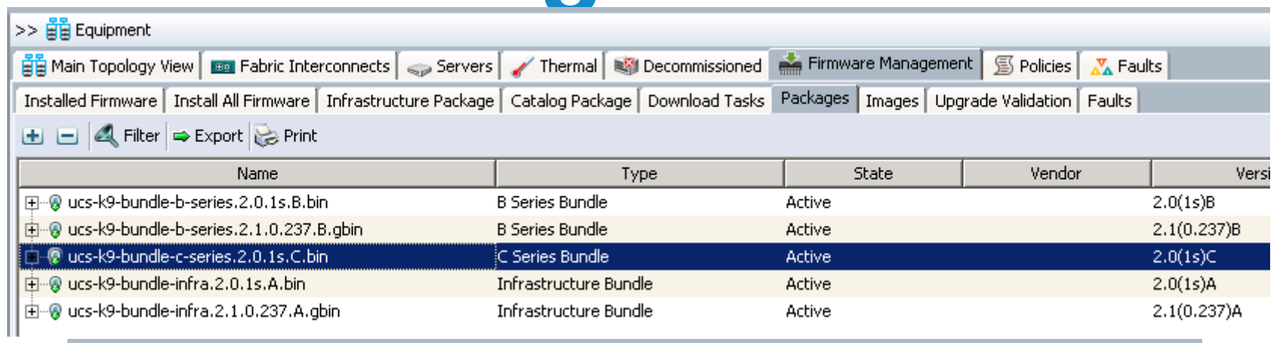
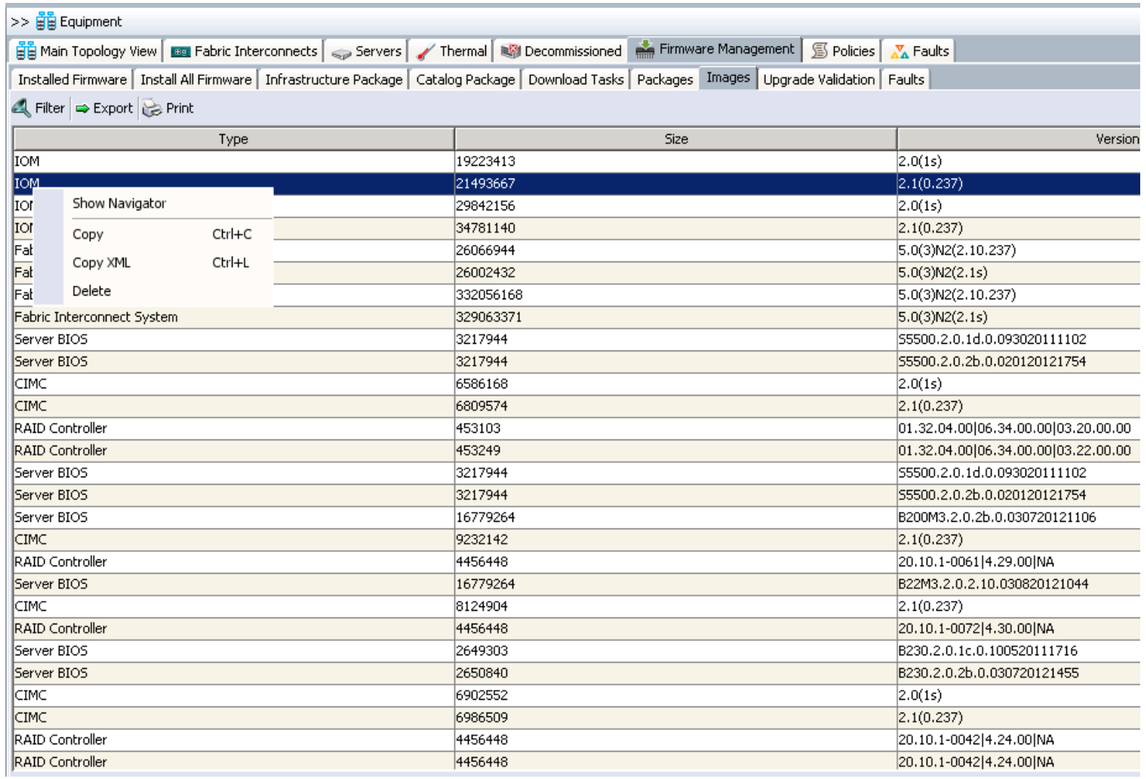
Firmware Management - Images

Image Maintenance

- Images tab presents information on individual images in the package
- Allows the deletion of the Images
- Once all images associated to a package are deleted, the package will be removed from the Packages tab
- Delete Bundle to remove all image files from Fabric Interconnect





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Firmware Guidelines and Best Practices

Firmware Update Guidelines

Configuration Validation Before Upgrading to 2.x

- Ensure that overlapping FCoE VLAN IDs and Ethernet VLAN IDs are not present
  - VLAN configured as the FCoE VLAN for a VSAN cannot carry Ethernet traffic
- Do no use both Fabric Failover AND Host NIC Teaming on the same vNIC
  - May cause connectivity loss when upgrading adapter firmware
- Ensure that iSCSI IQN names are unique for each iSCSI vNIC
  - Only applicable on 2.0(1) upgrades to 2.0(2)
- VLAN 4048 is reserved in release 1.4(1) and higher

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Firmware Update Guidelines

Upgrading Endpoints

- Do not perform any server or chassis maintenance during updates
  - Do not remove hardware that contains endpoints
  - Do not perform maintenance on hardware
- Avoid replacing RAID hard disks prior to upgrade
  - Perform any physical disk maintenance after upgrade process is complete
- Update adapters through a host firmware package policy
- Redundant Fabric Interconnects can be updated without disrupting data traffic

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Firmware Update Best Practices

Best Practices for Upgrades

- Backup All Configuration from UCSM to a backup file
- Select Ignore Compatibility Check when upgrading
  - Set when performing a direct upgrade to a newer release
  - Ensures that the upgrade can proceed and avoids compatibility issues
- Disable Call Home
  - Ensure that Call Home is off before starting upgrade process
  - Restarts cause events that are identical to service disruptions and component failures to trigger alerts

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Firmware Update Best Practices

Best Practices for Upgrades

- Use Host Firmware Package Policies for all host endpoint management for production systems
- Set and use Maintenance Policies to control host outage windows
- Ensure HA State is healthy before updating Fabric Interconnects
- Optional – Administratively shut down uplink Ethernet and FC ports on Fabric Interconnect being updated.
  - Validate operation of Fabric Failover/MPIO on host OS's
  - Prevent any obscure issues on upstream switch devices

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Mismatched Firmware Support

Starting with UCS 2.1

- May have Infrastructure and Host server firmware at different levels starting with UCS 2.1 and above
  - Infrastructure will need to be at 2.1
  - Host firmware may be at 2.0(x)
- Support for host firmware levels throughout an entire major release of UCS
  - Ex 2.1 up to 2.1(X) supported; 2.1(x) mix with 2.2(x) not supported
  - Maintenance releases, incremental updates or patch version differences are supported
- Pre-2.1 Firmware levels in a domain must be the same version for support

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Firmware Upgrade Outage Impacts

Online or Offline Updates

- Fabric Interconnect upgrade
  - Redundant Fabric Interconnects can failover to other fabrics to keep data plane operational
  - Fabric Interconnect reboots disrupting data plane on corresponding fabric
  - Reboots all I/O modules on corresponding fabric
- UCS Manager upgrades
  - **NO** data plane disruption, can be done online
  - All users logged into UCSM GUI or CLI will be logged out
- CIMC upgrades
  - **NO** data plane disruption can be done online
  - Any activity on KVM/SoL/IPMI is interrupted

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Firmware Upgrade Outage Impacts

Online or Offline Updates

- I/O Module firmware upgrade
  - Using Set Startup Version Only, **NO** data plane disruption
  - Corresponding I/O modules reboot only when Fabric Interconnect reboots
  - Data traffic fails over to the other I/O module and data path

- Host firmware upgrade
  - Use Host Firmware Package policies to manage host endpoints
  - Using Maintenance Policy can stage host reboot for later time
  - Host must reboot to activate all endpoint firmware

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Firmware Upgrade/Downgrade Sequence

Firmware Upgrade Sequence

Upgrade/Downgrade Procedure

1. Download firmware images

2. Disable Call Home (If enabled)

3. Update CIMC and IOMs – **NO** host OS impact

4. Activate CIMC – **NO** host OS impact
   - Best Practice to use management/host firmware package policy

5. Activate UCSM – **NO** host OS impact

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Firmware Upgrade Sequence

Upgrade/Downgrade Procedure

6. Activate I/O Modules – Set Startup Version Only – **NO** host OS impact
7. Activate Subordinate fabric interconnect
8. Verify cluster health / data path has been restored
9. Activate Primary fabric interconnect
10. Update and apply Host Firmware Package Policies
11. Enable Call Home

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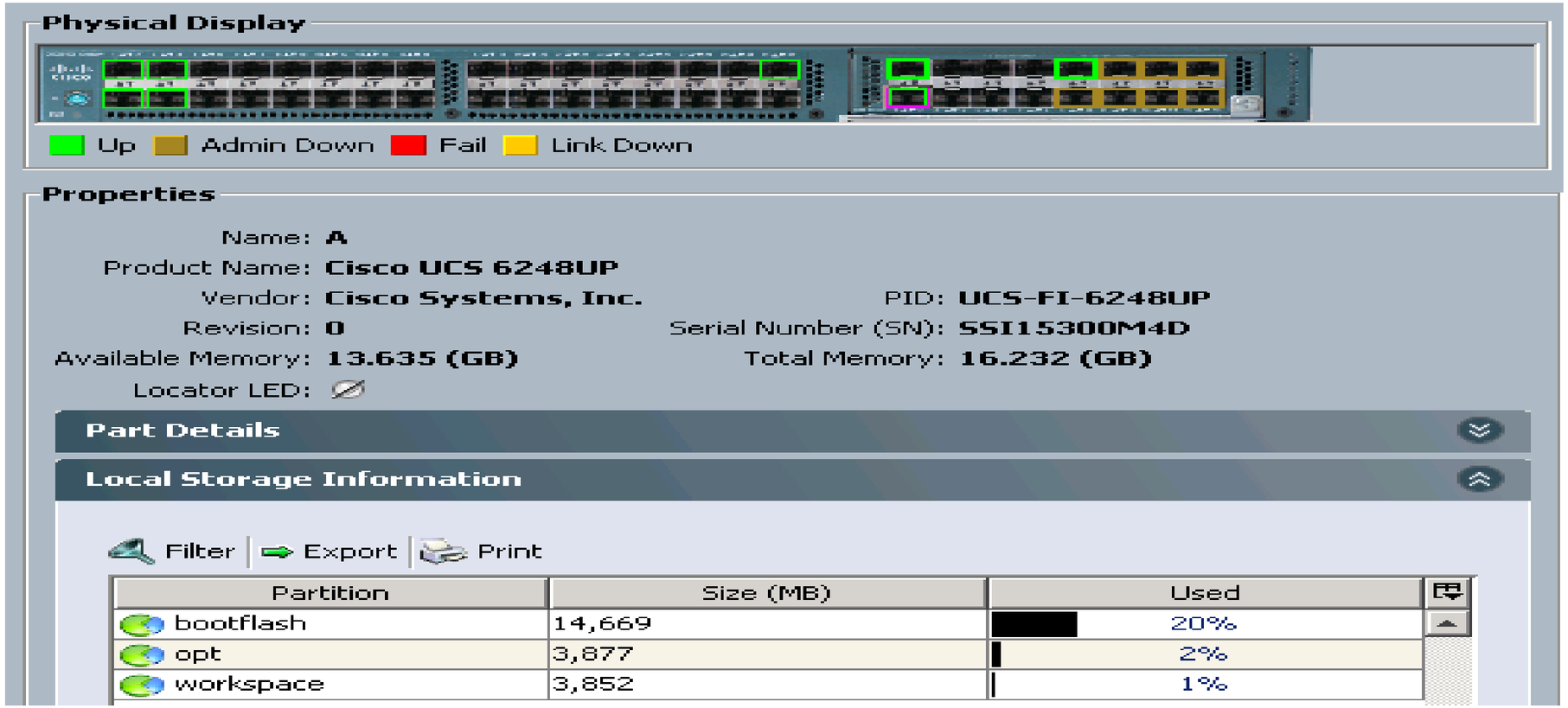
Firmware Steps

Download Firmware Images

- Before Downloading check available space on Fabric Interconnect
- Delete Images and Packages if space is limited



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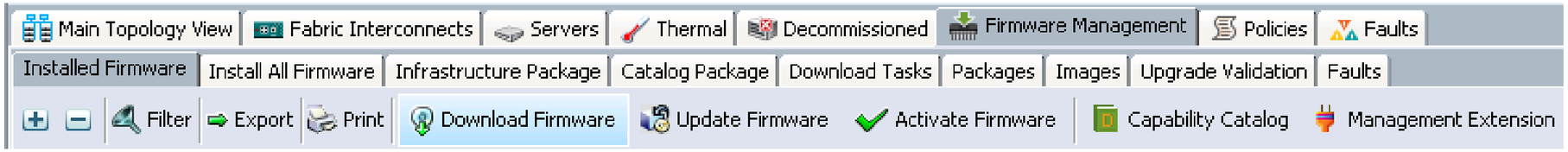
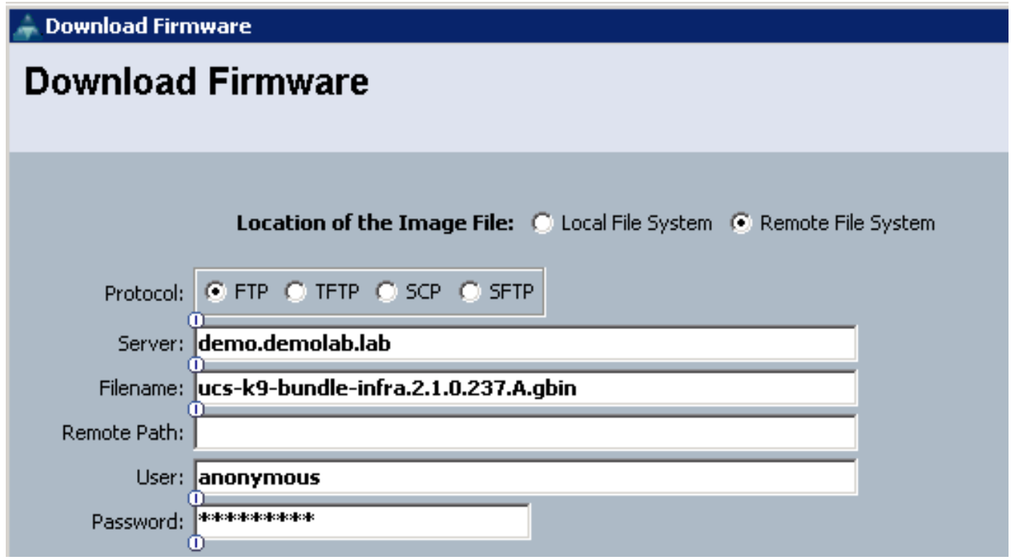
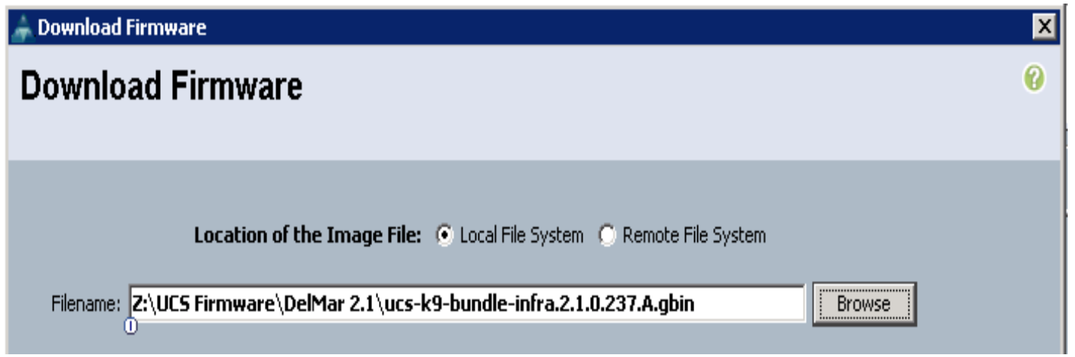
Firmware Steps

Download Firmware Images

- To download firmware use the download tab







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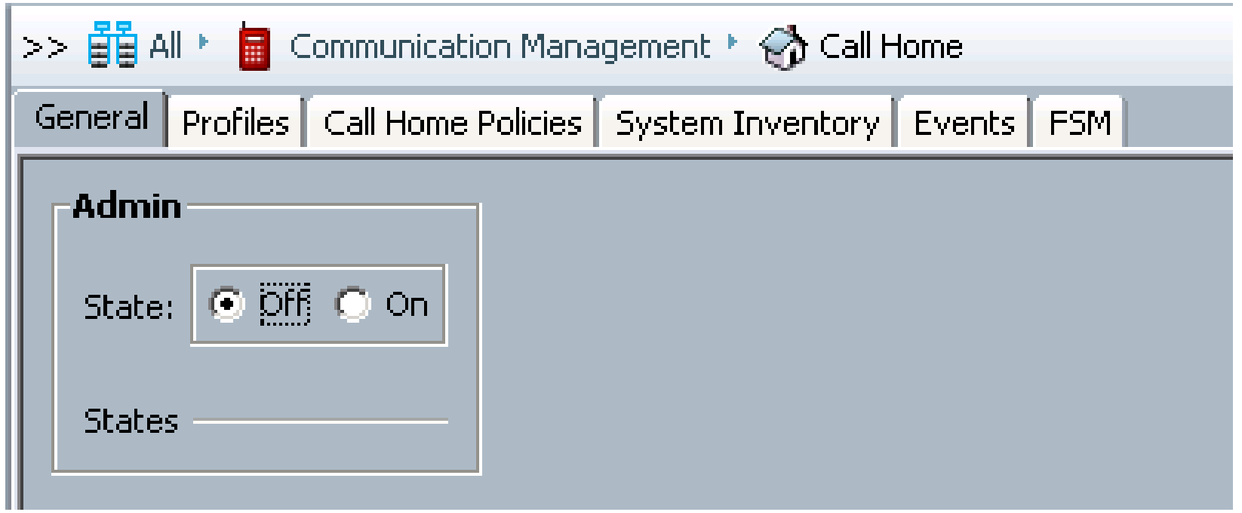
Firmware Steps

Disable Call Home

- Prevents unnecessary alerts or notifications being sent
- Admin Tab →Communication Management→Call Home
- Set State to Off
- Building in alert suppression



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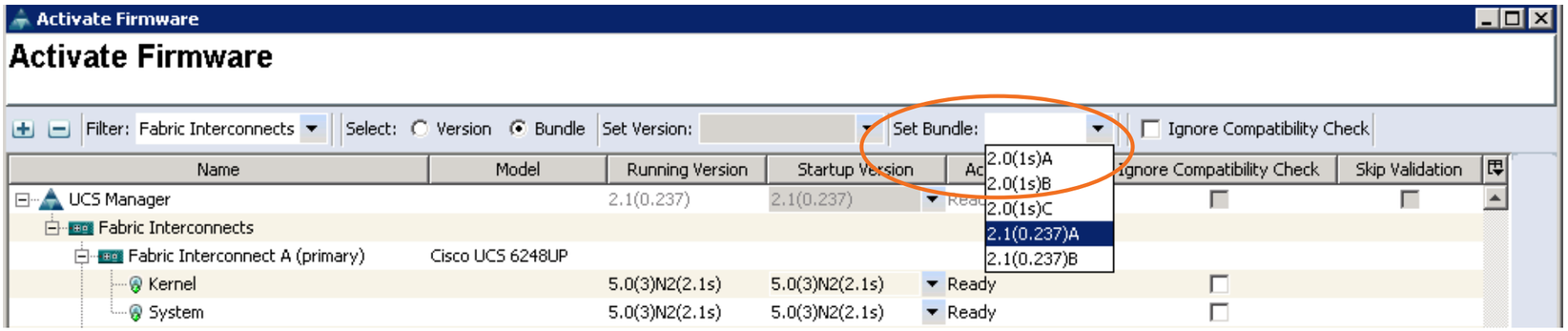
Firmware Steps

Set Version or Set Bundle

- Set Version
  - Original method of selecting firmware for endpoints
  - Used for Update and Activation of an endpoint
  - Firmware version may not match the bundle numbering scheme
- Set Bundle
  - New option for selecting a full bundle without having to know the version numbers
  - Simplified image selection for endpoints
  - Used by Firmware Auto Install



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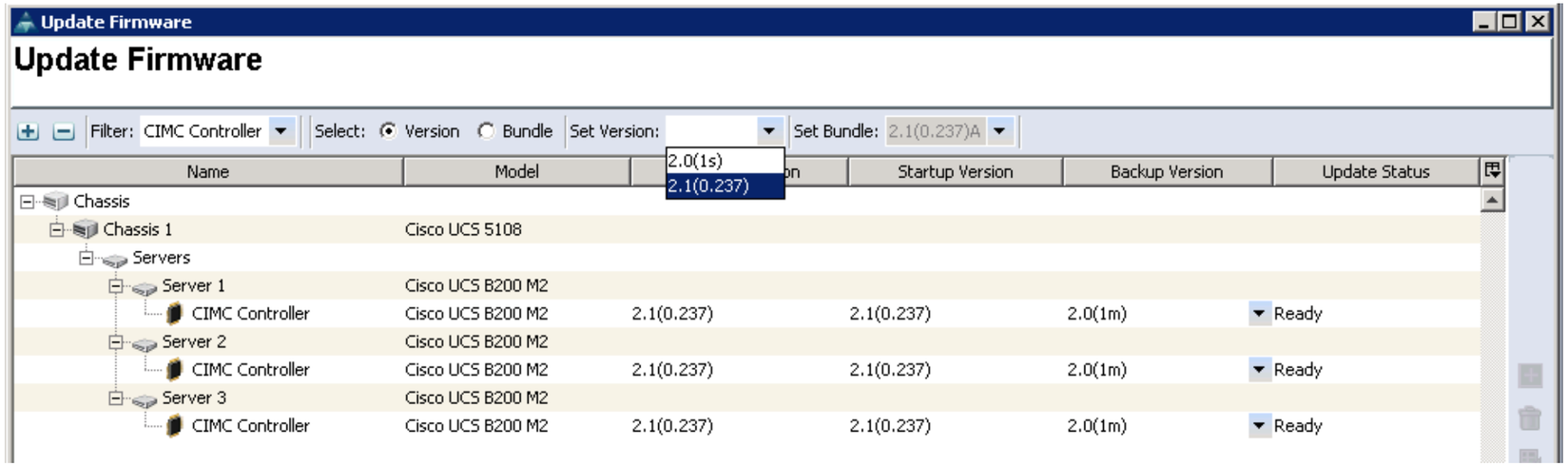
Firmware Steps

Update CIMC

- No impact to host OS on updates or activation
- Centralised distribution from the fabric interconnect
- Equipment Tab→Equipment→Firmware Management→Installed Firmware→Update Firmware
- Filter: Select all CIMC Controller



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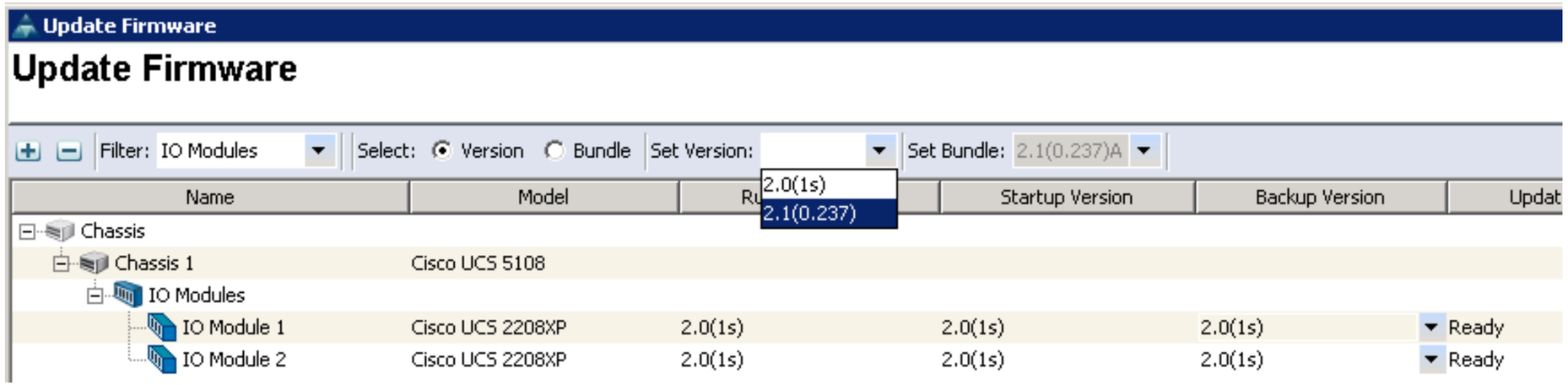
Firmware Steps

Update I/O Modules

- Update pushes firmware to I/O Module no host impact
- Equipment Tab→Equipment→Firmware Management→Installed Firmware→Update Firmware
- Filter: Select all I/O Modules
- Only 2 per Chassis



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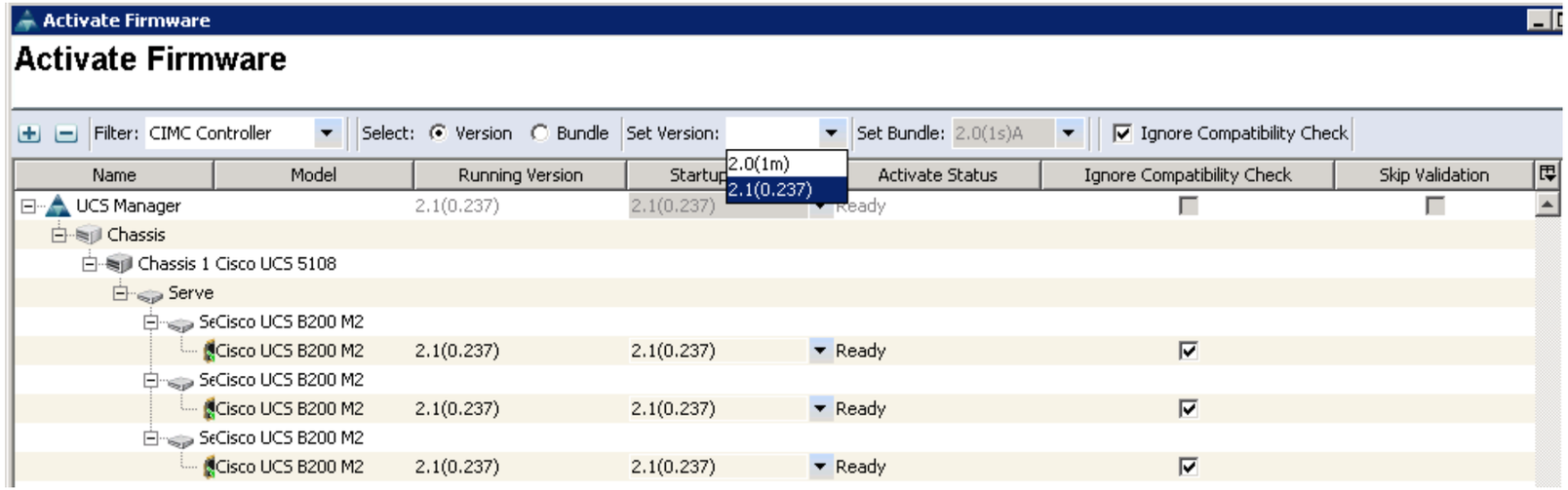
Firmware Steps

Activate CIMC

- No host data plane impact
- Equipment Tab→Equipment→Firmware Management→Installed Firmware→Update Firmware
- Filter: All CIMC Controller can be activated at the same time across domain



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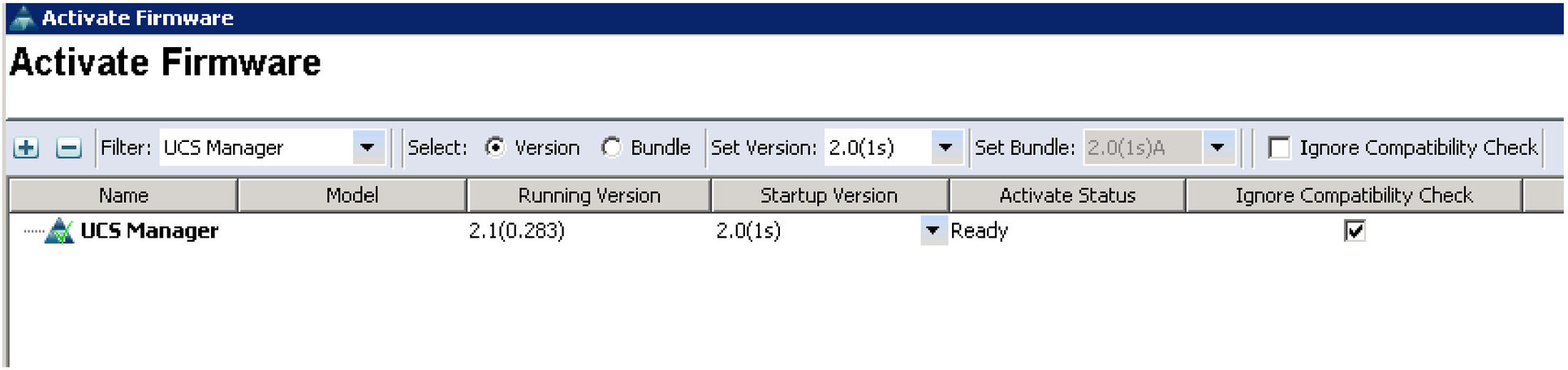
Firmware Steps

Activate UCSM

- No host data plane impact
- Equipment Tab→Equipment→Firmware Management→Installed Firmware→Update Firmware
- Filter: UCS Manager
- One Activation per domain



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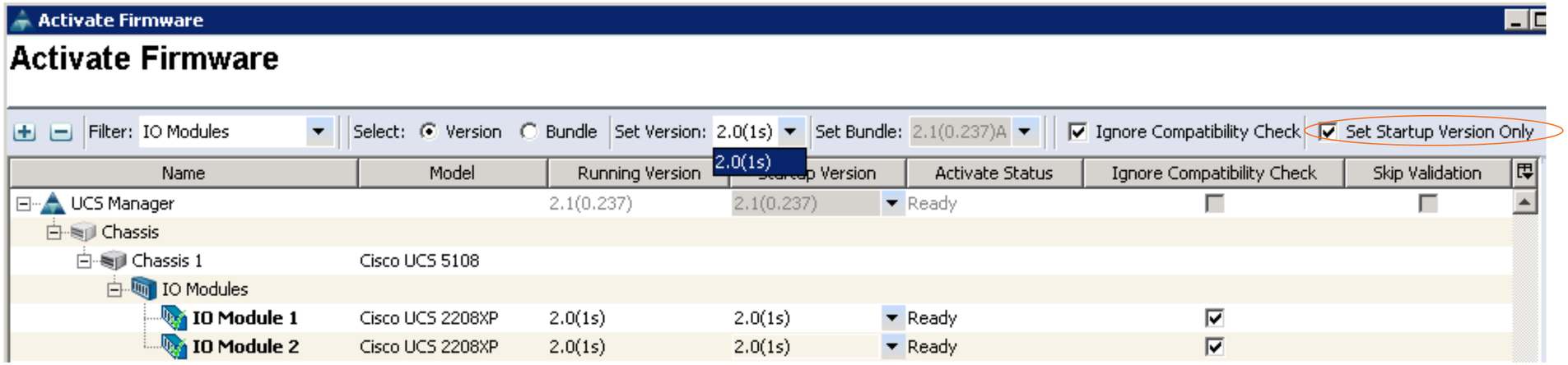
Firmware Steps

Activate I/O Modules

- No host data plane impact
- Equipment Tab → Equipment → Firmware Management → Installed Firmware → Update Firmware
- Filter: IO Modules can be activated at the same time across domain
- Check: Set Startup Version Only (prevents IO Modules from rebooting)



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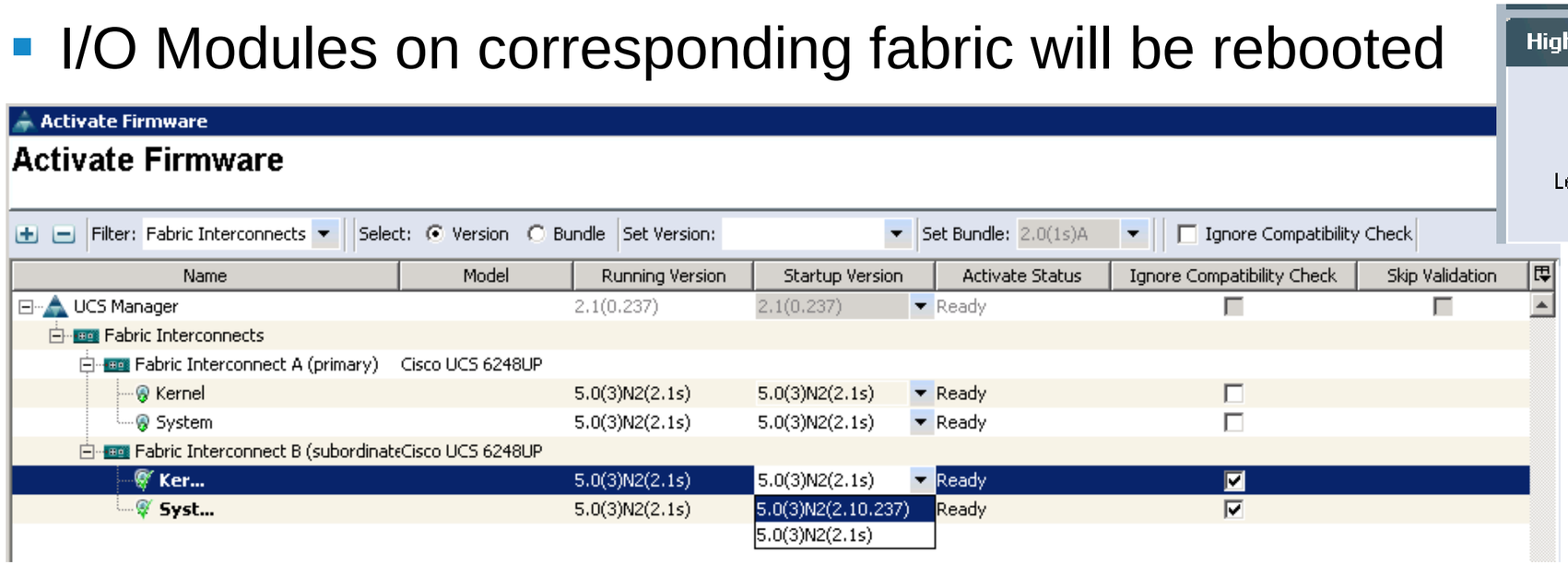
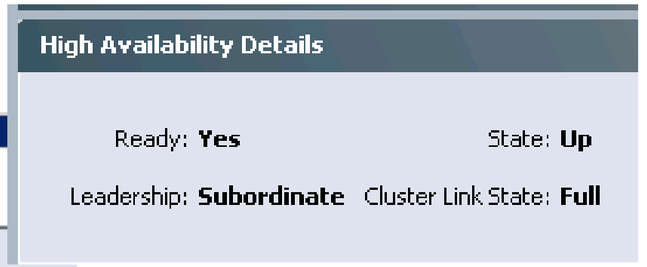
Firmware Steps

Activate Subordinate Fabric Interconnect

- No host impact if Ethernet and FC teaming are used
- Equipment Tab→Equipment→Firmware Management→Installed Firmware→Update Firmware
- Verify HA State
- Filter: Fabric Interconnect ONLY Select the Subordinate
- I/O Modules on corresponding fabric will be rebooted





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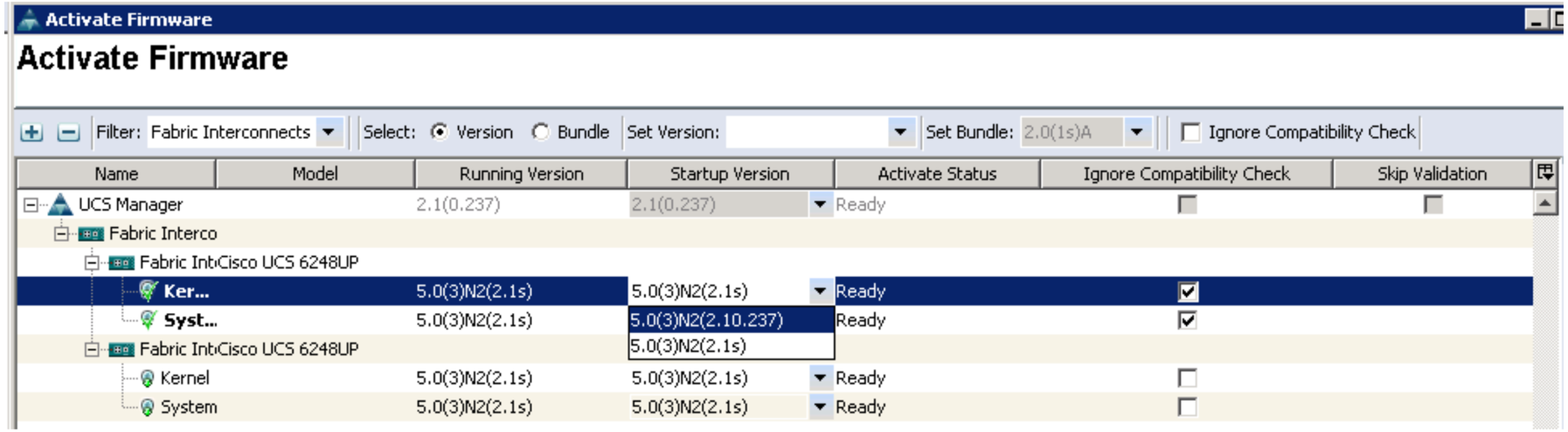
Firmware Steps

Activate Primary Fabric Interconnect

- No host impact if Ethernet and FC teaming are used
- Equipment Tab→Equipment→Firmware Management→Installed Firmware→Update Firmware
- Filter: Fabric Interconnect Select only the Primary
- I/O Modules on corresponding fabric will be rebooted



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Firmware Polices and Service Profiles

How to Leverage Polices to Manage Firmware

- Host Firmware package policies
  - Included in one or more service profiles
  - Included in an updating service profile template
  - Management Firmware Package is being deprecated

- Configure Maintenance Policy
  - Update immediately
  - User Acknowledged
  - Scheduled for maintenance window

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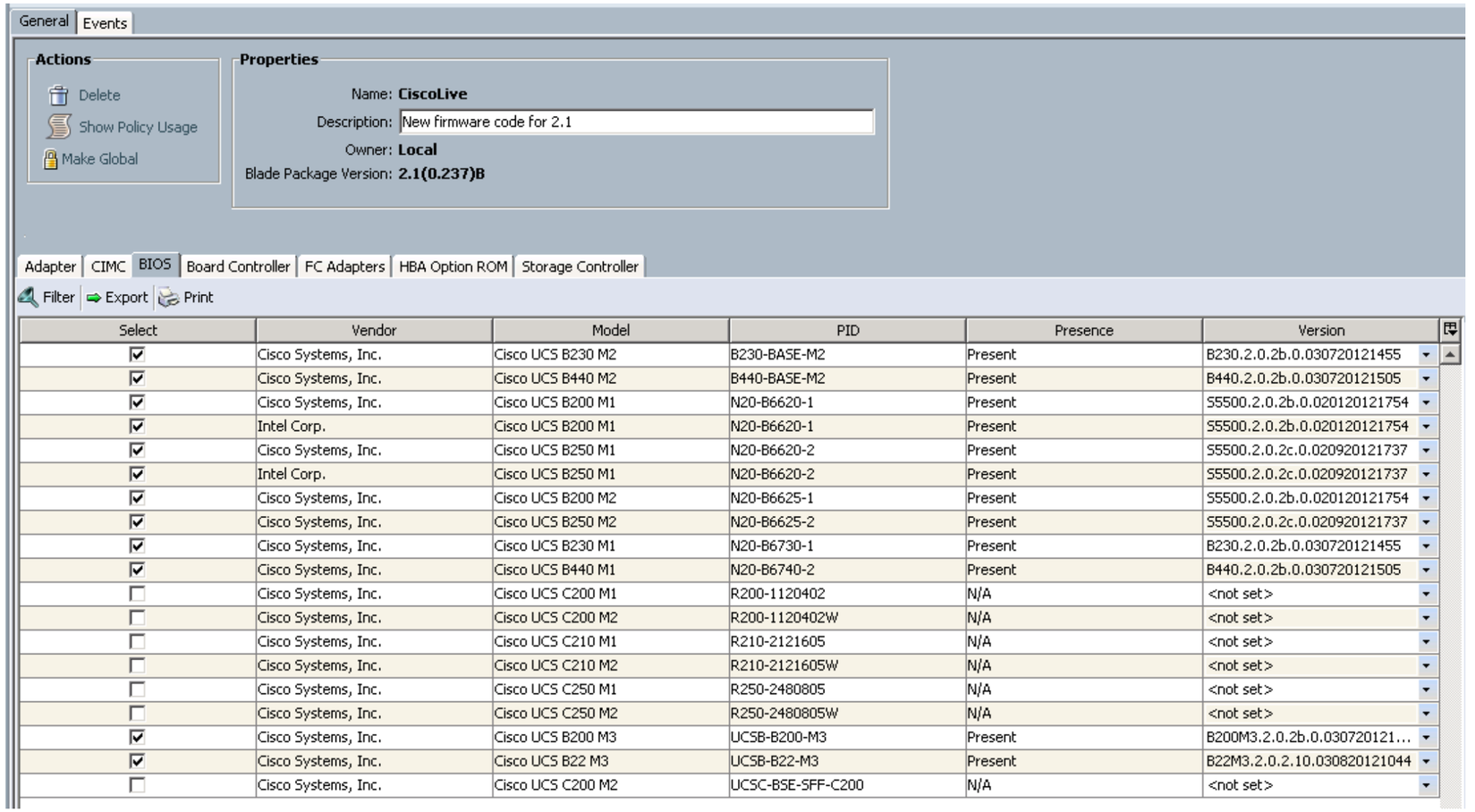
Firmware Polices and Service Profiles

Firmware Updated in a Host Firmware Package

- BIOS
- CIMC
- Adapter
- Board Controller
- FC Adapters
- HBA Option ROM
- Storage Controller



Select	Vendor	Model	PID	Presence	Version
☑	Cisco Systems, Inc.	Cisco UCS B230 M2	B230-BASE-M2	Present	B230.2.0.2b.0.030720121455
☑	Cisco Systems, Inc.	Cisco UCS B440 M2	B440-BASE-M2	Present	B440.2.0.2b.0.030720121505
☑	Cisco Systems, Inc.	Cisco UCS B200 M1	N20-B6620-1	Present	S5500.2.0.2b.0.020120121754
☑	Intel Corp.	Cisco UCS B200 M1	N20-B6620-1	Present	S5500.2.0.2b.0.020120121754
☑	Cisco Systems, Inc.	Cisco UCS B250 M1	N20-B6620-2	Present	S5500.2.0.2c.0.020920121737
☑	Intel Corp.	Cisco UCS B250 M1	N20-B6620-2	Present	S5500.2.0.2c.0.020920121737
☑	Cisco Systems, Inc.	Cisco UCS B200 M2	N20-B6625-1	Present	S5500.2.0.2b.0.020120121754
☑	Cisco Systems, Inc.	Cisco UCS B250 M2	N20-B6625-2	Present	S5500.2.0.2c.0.020920121737
☑	Cisco Systems, Inc.	Cisco UCS B230 M1	N20-B6730-1	Present	B230.2.0.2b.0.030720121455
☑	Cisco Systems, Inc.	Cisco UCS B440 M1	N20-B6740-2	Present	B440.2.0.2b.0.030720121505
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☐	Cisco Systems, Inc.	Cisco UCS C210 M2	R210-2121605W	N/A	<not set>
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☑	Cisco Systems, Inc.	Cisco UCS B22 M3	UCSB-B22-M3	Present	B22M3.2.0.2.10.030820121044
☐	Cisco Systems, Inc.	Cisco UCS C200 M2	UCSC-BSE-SFF-C200	N/A	<not set>

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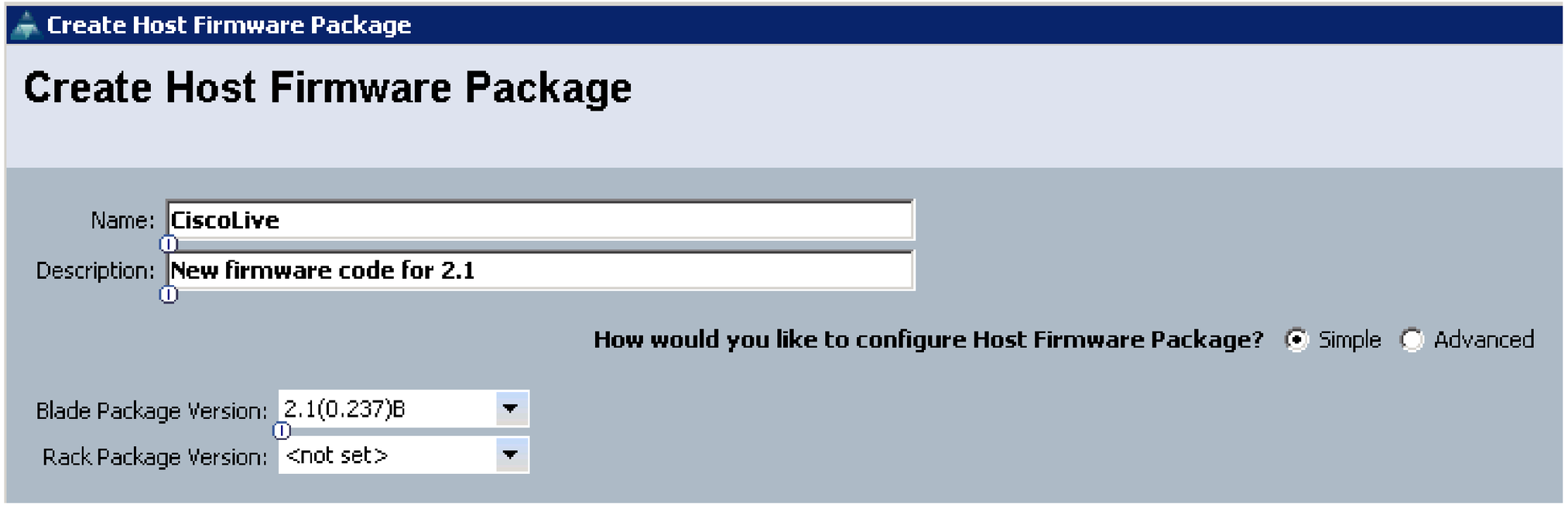
Firmware Steps

Host Firmware Package Policies

- Policies for defining rules and consistency for hardware
- Create a host firmware package policy
- May use simple (select a bundle) or Advanced (customise) method, starting with UCSM 2.1.x



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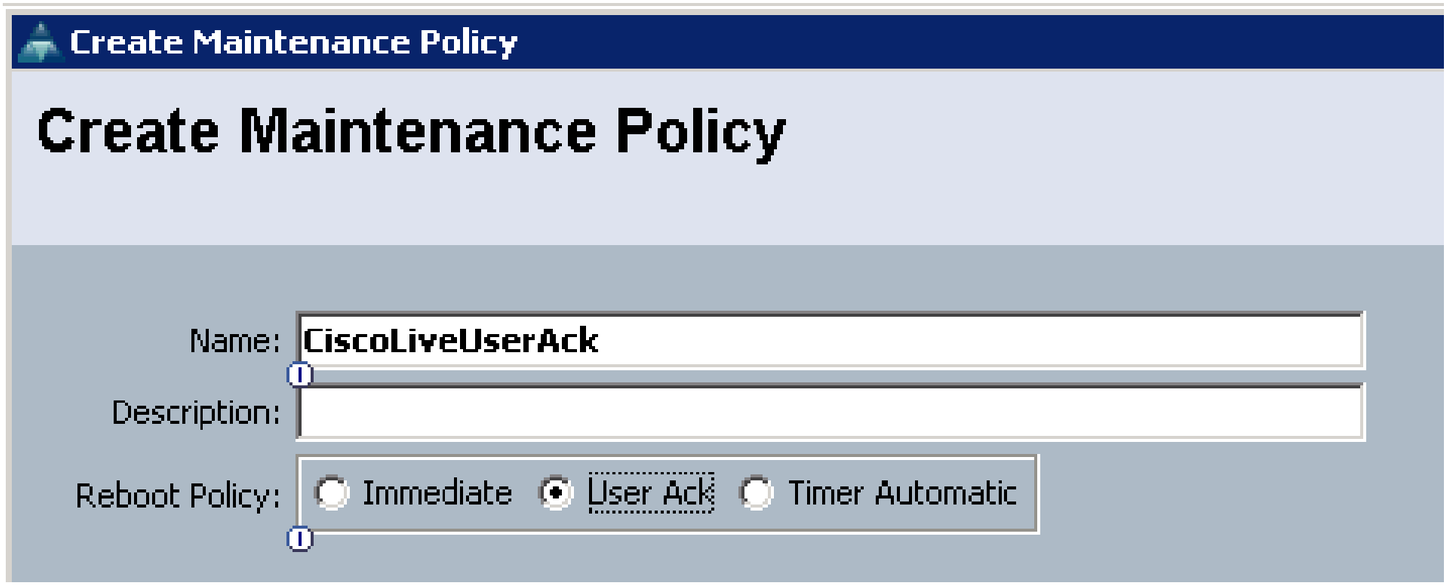
Firmware Steps

Maintenance Policies

- Used to defer Service Profile state changes
- 3 Policies for reboot behaviours
- Create a maintenance policy
  - User Acknowledged



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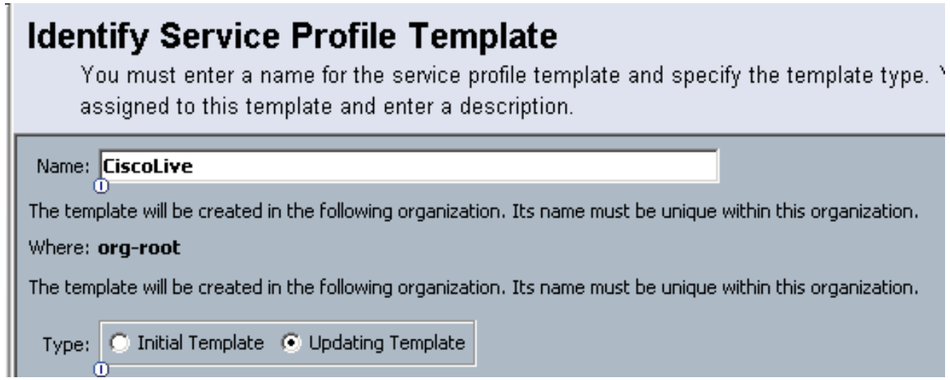
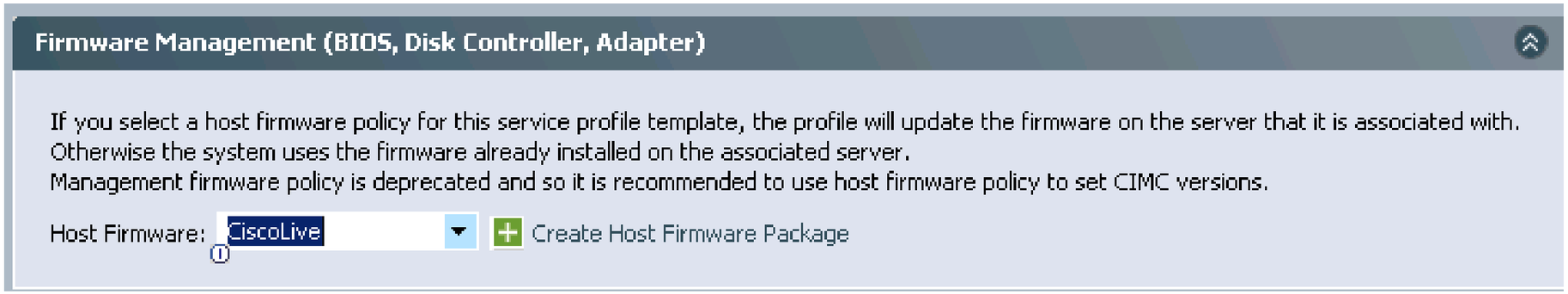
Firmware Steps

Create Service Profile Template

- Templates provide standardisation
- Create service profile template
- Configure Host firmware package policy
- Associate Policy to the Template





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Firmware Update Approx Times in Minutes

Function	Update	Activate
Upgrade CIMC	5-6	1-2
Upgrade UCSM	--	1-2
Upgrade I/O module	12-16	3-6sec
Upgrade FI pair and I/O modules	--	24-38
Upgrade Host server	1-2	4
TOTAL Minutes	**24**	**46**

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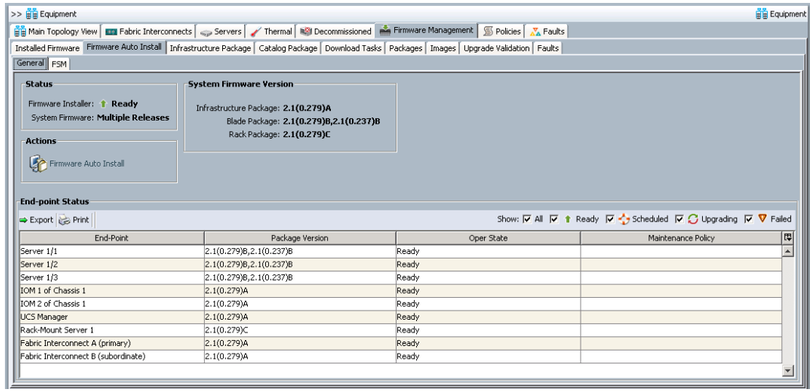
Firmware Automation

Firmware Auto Install

Automation for Firmware Deployment

- New Automated firmware deployment engine integrated into UCSM
- Can automate the update the firmware of all UCS components
- Multiple modes of operation
  - Auto Install firmware on Infrastructure components
  - Auto Install firmware on UCS Managed servers
- Managed from Local UCSM or from UCS Central
- Validates firmware dependencies automatically
- Update firmware in correct order
- All firmware components in the UCS domain can be updated



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Firmware Auto Install

Automation for Firmware Deployment

- Infrastructure package
  - Contains UCS Manager, FI kernel and system, IOM
  - Allows user to choose the version to update infrastructure to
  - Default pack is created and used by Auto Install
- Host Firmware Package
  - Same as existing host firmware package now includes CIMC
  - deprecating management firmware pack
- Current direct updates and firmware packs will continue to work with no changes
- A schedule can be applied to infrastructure pack to control firmware deployment time frame
- Server update can be controlled by maintenance policy on Service profile (Existing mechanism)

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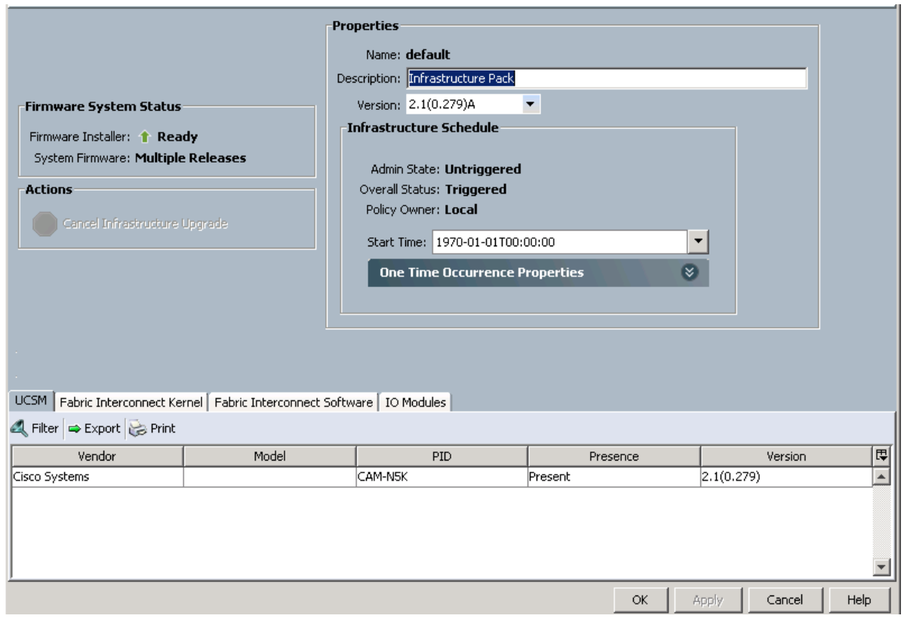
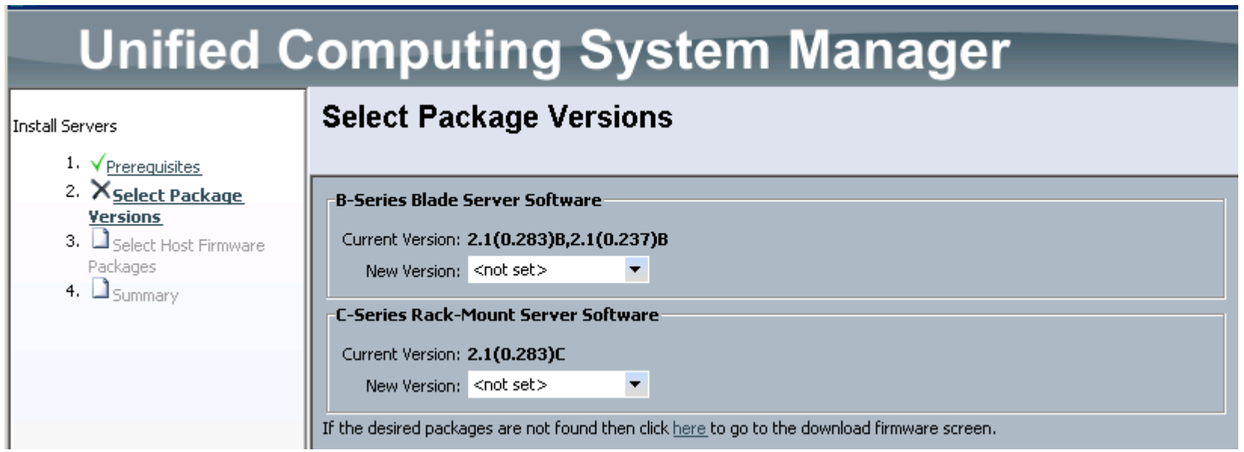
Firmware Auto Install

For a New UCS System

- Use for brand new UCS domain pre-deployment
  - Install all infrastructure
  - Install all B and C series servers
- Select Equipment→ Firmware Auto Install → Actions Install Infrastructure then Servers





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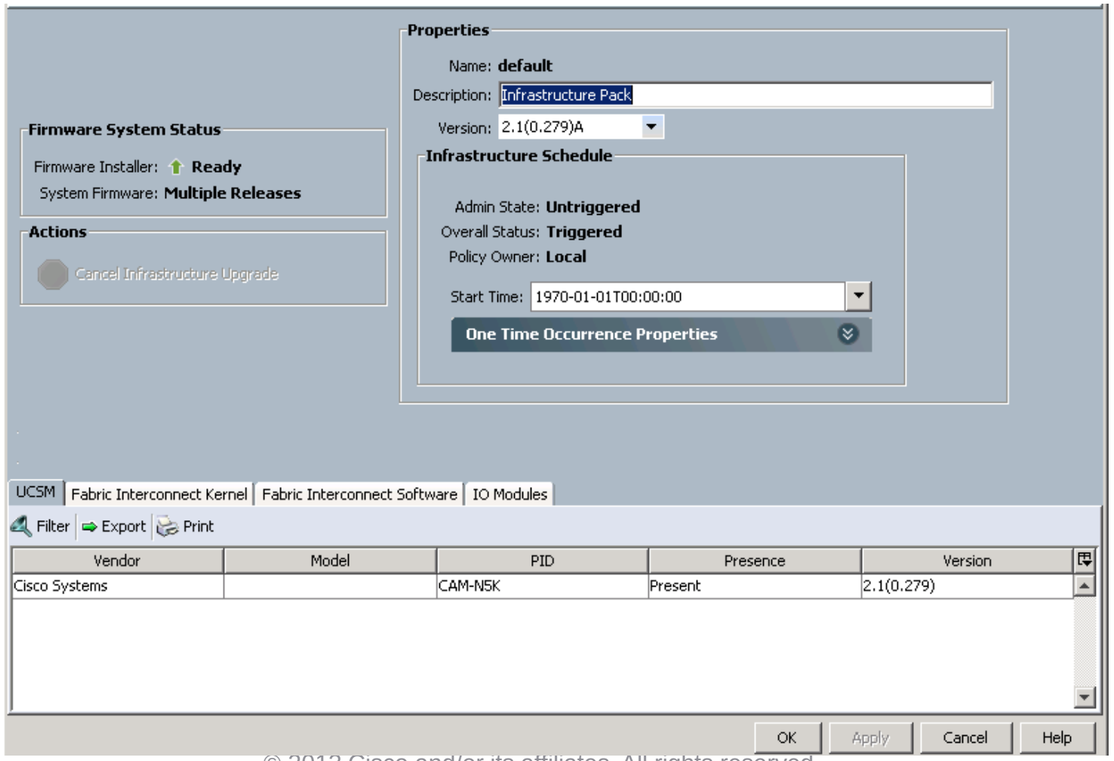
Firmware Auto Install

For an Existing UCS System

- Use for production UCS domain and leverage host firmware policies for support of multiple host code levels
- Select Equipment→ Firmware Auto Install → Actions Install Infrastructure
- Infrastructure updates: UCSM, both FIs, and I/O modules



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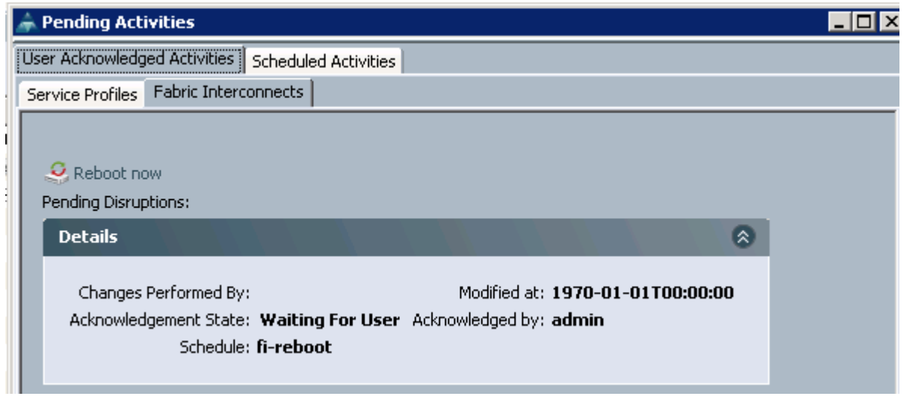
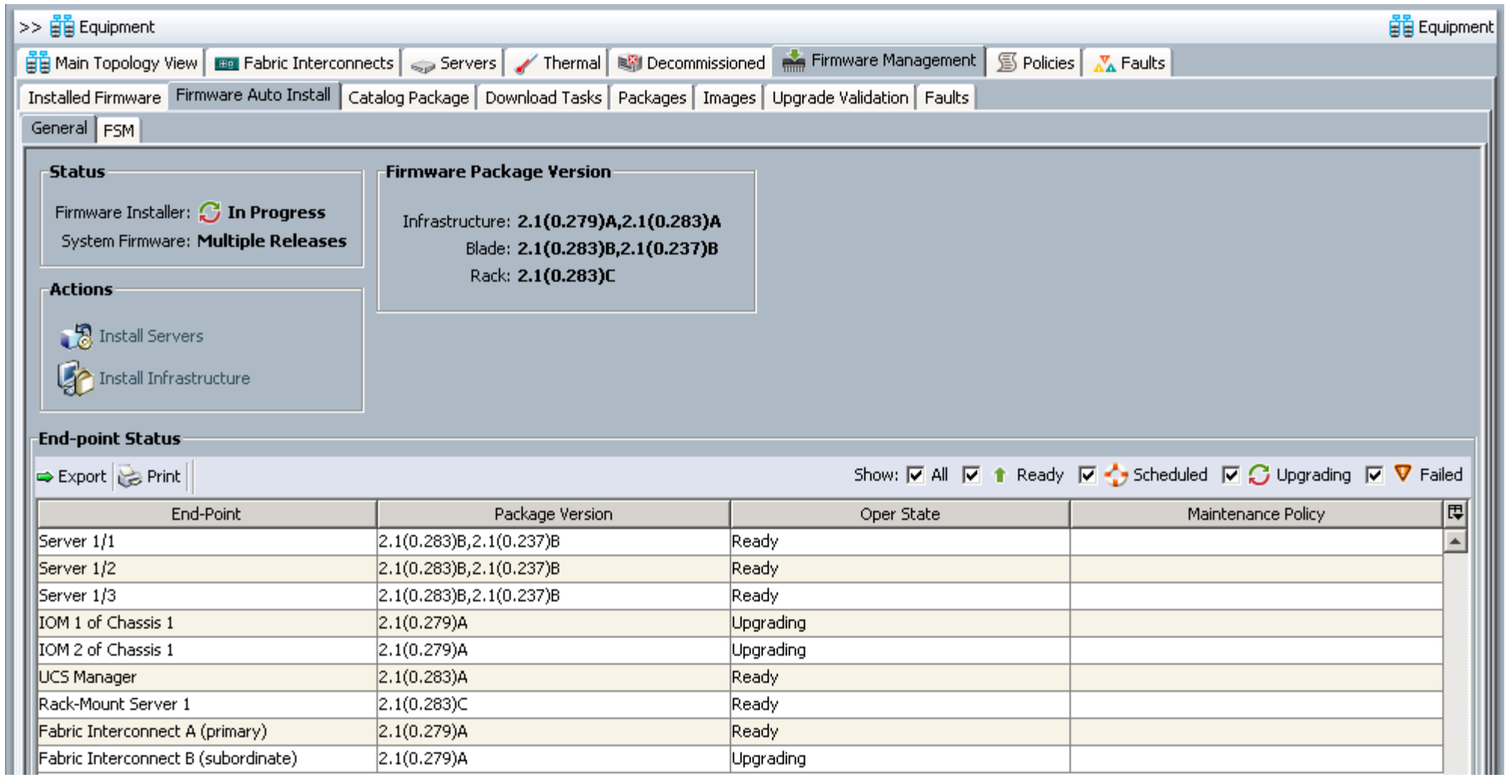
Firmware Auto Install

For an Existing UCS System

- Single screen for UCS Domain status
- Summary and logs
- View impact of end points





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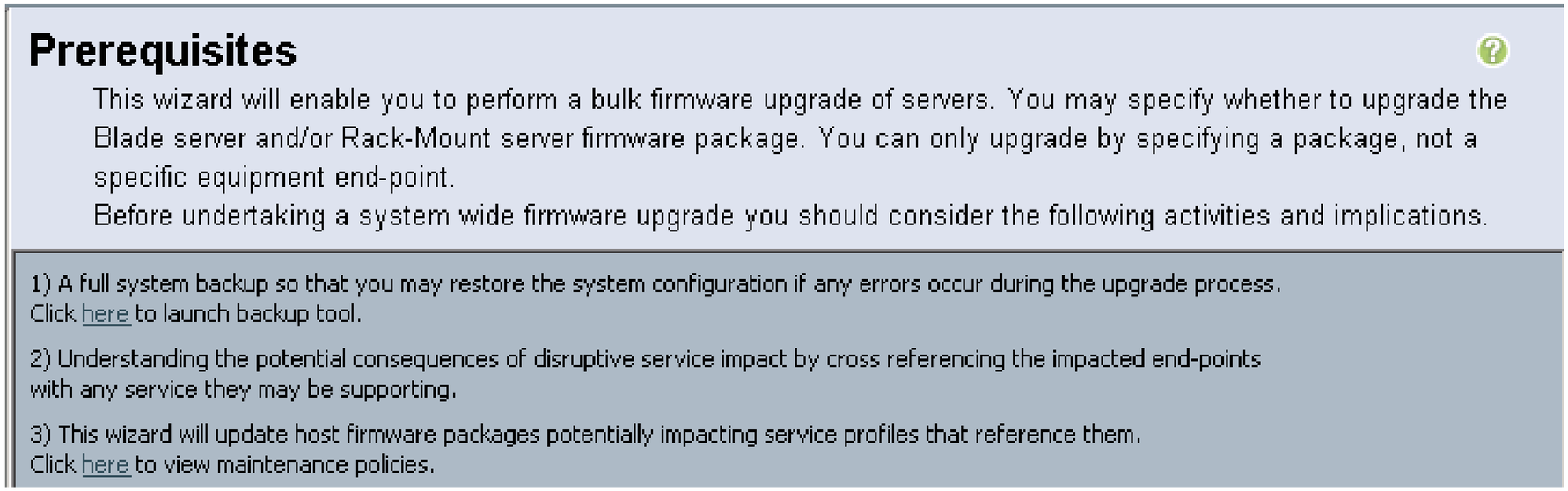
Server Firmware Auto Install

For an Existing UCS System

- FOLLOW the instructions on the last screen
- Create a Backup of the configuration
- Check all maintenance policies for host service profiles
- Once started the process must finish to completion



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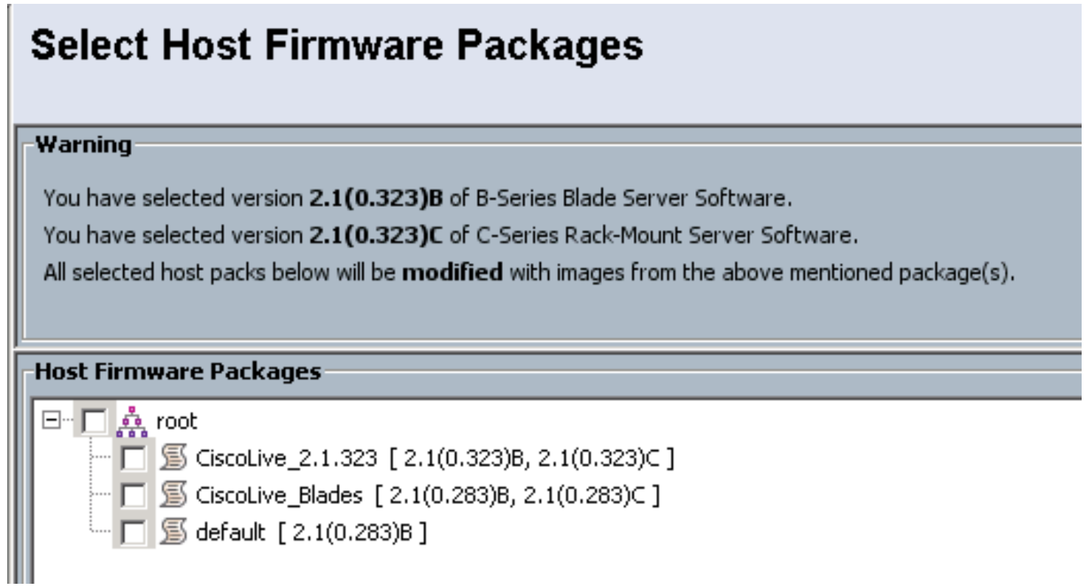
Firmware Auto Install

For an Existing UCS System

- Host firmware updates use existing Host Firmware Package Policies if selected
- By default Auto Install will honor Maintenance Policy settings for the service profiles
- By default Auto Install will change the contents of the host firmware package policy selected for update



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PowerShell

Firmware Automation

- Powerful and flexible object oriented scripting tool
- Most UCS commands and functions have PowerShell cmdlets
- Run commands against one or multiple UCS Domains
- Run commands manually in powertool
- Build your own scripts and automation methods
- Large open community to freely share scripts
- Demo

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DEMO/VIDEO

Cisco UCS Firmware Simplicity Summary

Firmware Management Simplified vs. Legacy

- Reduced number of infrastructure endpoints
- Reduced firmware management complexity
- Centralised firmware management for entire UCS domains
  - 160 servers and endpoints under one UCSM instance
  - 800 servers and endpoints under UCS Central instance
- Single tool and interface used for all firmware tasks
- Built in firmware deployment automation

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