Expert Reference Series of White Papers

Cisco UCS B Series
Uplink Strategies

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Overview of the Cisco UCS Infrastructure

In 2014, Cisco Unified Computing Solution (UCS) became the number one server in the US in the x86 blade server market with more than 42 percent market share up from 2.4 percent in 2009. One of the main differentiators in Cisco's server solution is the capacity for two totally redundant failover paths for all server Ethernet and Fibre Channel traffic for every server. The other main differentiator is the Service Profile. See my other white paper titled **Solving Issues on creating a UCS Service Profile** for more info on troubleshooting Service Profiles.

To illustrate the hardware options in UCS, log in to UCS Manager and under the **Equipment** tab and click on the **Equipment** icon. In the right pane, click on the **Main Topology View**.

Cisco allows an option of either one or two Fabric Interconnects (FI) in a UCS management domain. If you have only one FI, then you will not be able to implement any UCS failover options and the topics in this white paper would not apply. Note that one of the FIs is labeled A, and the other B. These are the "official names" of the FIs and a maximum of two FIs are supported per a UCS management domain.

Note that the above example shows only one chassis, however the concepts in this white paper apply from any of the one through twenty chassis supported by the currently available UCS Manager (UCSM) software versions.
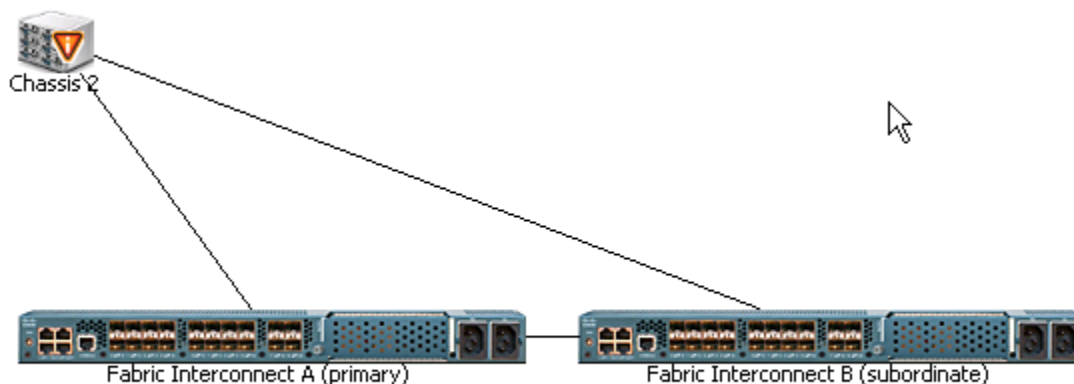

The focus of this white paper is on uplink strategies for traffic coming in and out of a UCS chassis. An uplink can be Ethernet, Fibre Channel, or FCoE and is a physical connection on the FI that leaves the UCS domain directed away from the B Chassis.

Service Profile Configurations

Cisco's implementation of stateless computing allows all the hardware settings of a server to be saved on a location outside the server itself. Stateless computing in UCS is implemented with an XML-based software feature called a Service Profile. In the event of disaster recovery, the amount of time to restore the server to its identical former condition is dramatically reduced with Service Profiles. Service Profiles contain virtually all possible hardware settings of a server, which can be applied, modified, or moved to a different blade.

Service Profile Fundamentals

For starters, if a Service Profile is not associated with a blade (individual hardware server), the blade literally can't even be turned on. After you log in to UCS Manager (UCSM), highlight your server under the **Equipment** tab.
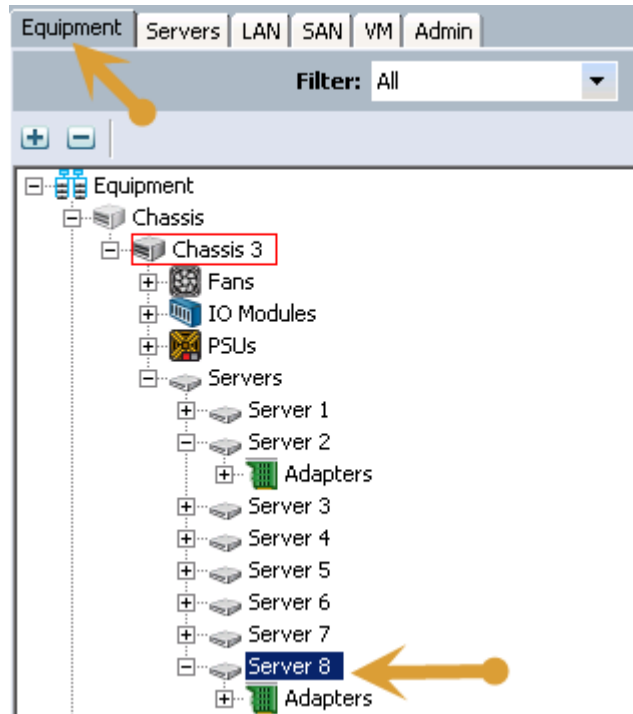
Note in this example under the **General** tab on the right for a server that the **Overall Status** is **Unassociated** and that the **Boot Server** option is greyed out. The point here is that without a Service Profile association, the server can't even be turned on.
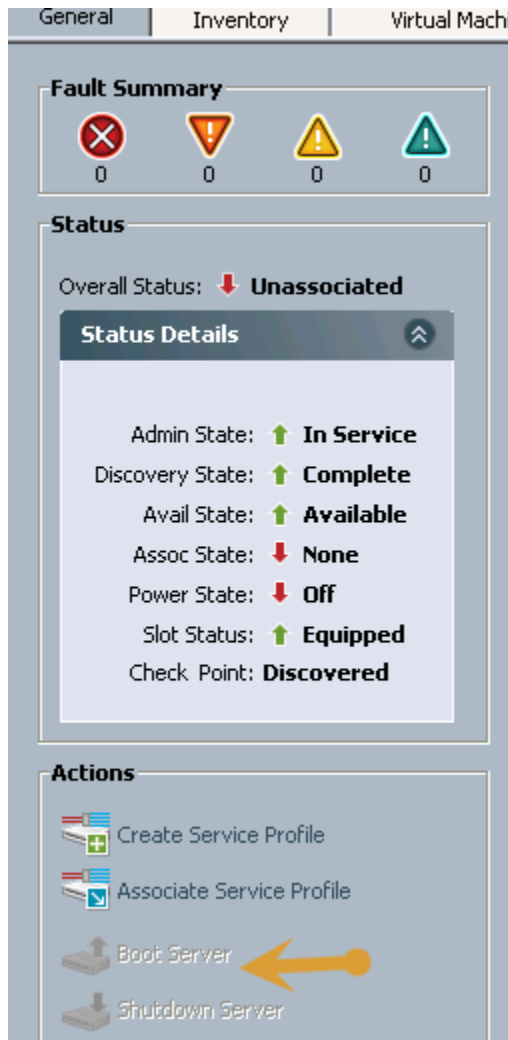
In UCSM, click on the **Servers** tab, and navigate down to your Service Profile. In this example a Service Profile was created with the name Pod8SP1.
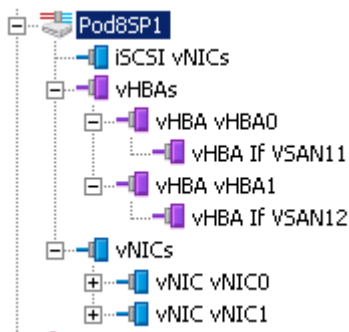
The following are the critical requirements in the Service Profile to enable and optimize failover.

First, it is mandatory to have a minimum of two vNICs for an optimal failover design as well as for optimizing bandwidth in non-failover scenarios. It is very desirable to have more vNICs, for sure! Highlight the first vNIC. In the right pane, click the **General** tab. This example shows the "WARNING" because a vNIC template was used, which causes the entries to be greyed out. While vNIC templates are very desirable in a large UCS deployment to ease the repetition of configurations on many different blades, vNIC templates do not enhance or reduce the failover options. What is important to note is the setting of fabric **A** or **B** (**A** in this example), and the selection of the **Enable Failover** box.

Now, click the next vNIC in the service profile and again in the right pane, click the **General** tab.

It is important to have the *other* Fabric selected (in this example **B**) and optimally the **Enable Failover** box checked as well.

The idea is that during a non-failover scenario, half of the Ethernet traffic will leave the server to the A fabric, and the other half will leave the server to the B fabric. In the event of a failure or reboot of the **A** FI or the IOM in **A**, all will failover to **B**. Conversely, in the event of a failure or reboot of the FI or IOM in **B**, all will failover to **A**.

As more vNICs are added to the Service Profile, continue the same pattern, half vNICs point to **A** with failover, and the other half of the vNICs point to **B** with failover.

Next, inspect the settings in the Service Profile on the vHBA. There should always be a minimum of two vHBAs in a Service Profile for proper failover. In this example, note how fabric **A** is selected.
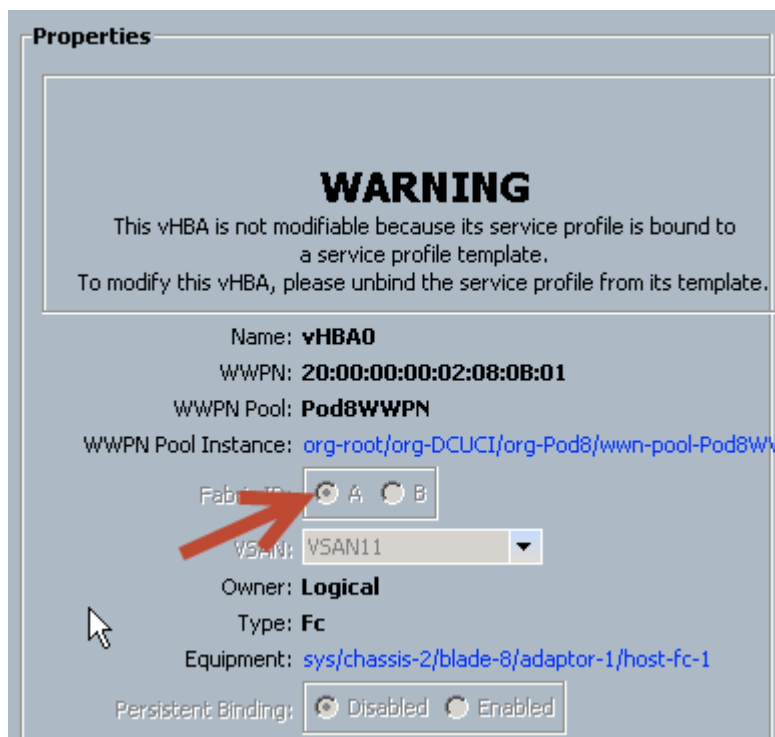
Once again, inspect the other vHBA, and ensure the *other* Fabric is selected, in this example, **B**.

Also note that there is not a failover checkbox in the vHBAs like there is for the vNICs.

End Host Mode vs. Switching Mode

In the 1990s, the Spanning Tree Protocol did its job well blocking Layer 2 loops in an Ethernet network. However, in today's refined Cisco UCS datacenter design approach, losing bandwidth due to a blocked Spanning Tree port on even one 10 Gbps link is very inefficient, not to mention totally unacceptable. While there are several technologies in the data center to improve upon Spanning Tree, the default Cisco UCS method to eliminate Spanning Tree blocked ports on a UCS Ethernet uplink port is called pinning. Pinning is a logical path of connectivity that starts from the vNIC to the Ethernet Uplink Port and from the vHBA to the Fibre Channel Uplink port. Study the following drawing. For illustration purposes only, generation I hardware is shown on the left and generation II on the right. Pinning is illustrated with the blue arrows for Ethernet and orange for FC.
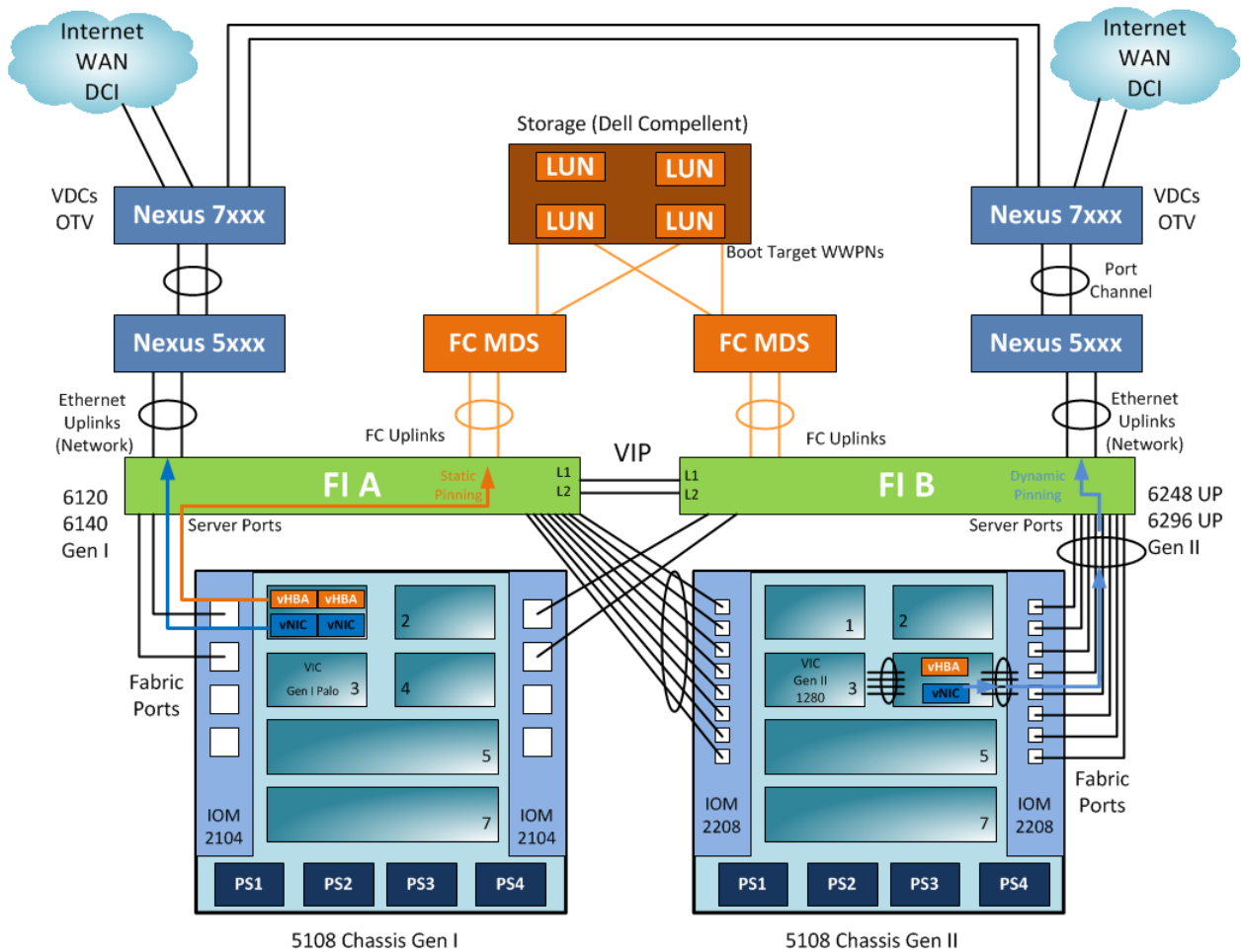
Pinning can be either static or dynamic. Static pinning was the only option in generation I hardware and always uses a single physical connection. Dynamic pinning is available only in generation II hardware and later and is far more desirable as it pins to port channels, which optimizes bandwidth and failover.

Pinning is the default in UCS and is also called End Host mode. In UCS Manager navigate to **Equipment > Fabric Interconnects** and highlight one of your FIs. Under the **General** tab, note the four settings.
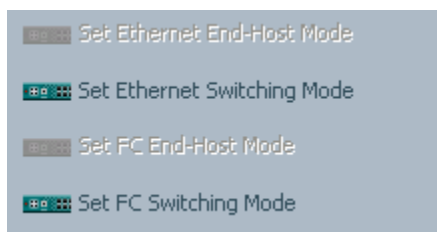

In this example **Set Ethernet End-Host Mode** is greyed out as that is the current setting. Being foolish and turning on **Set Ethernet Switching Mode** turns pinning off and turns Spanning Tree on the uplink ports.

Uplink Port Channels and Virtual Port Channels (vPC)

It is always desirable to have at the minimum basic port channels configured for both Ethernet and FC uplink ports. First, all individual uplink ports must be manually configured. In UCS Manager navigate to **Equipment > Fabric Interconnects** and highlight one of your FIs. Click on the valid cabled uplink port and click **Reconfigure**.
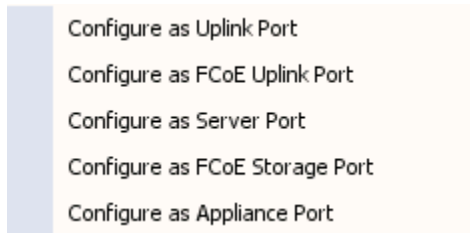
After all links are configured as Uplink Ports, navigate under the **LAN** tab right click **Port Channels** and click **Create Port Channel**. Add the uplinks for both the A and the B path.
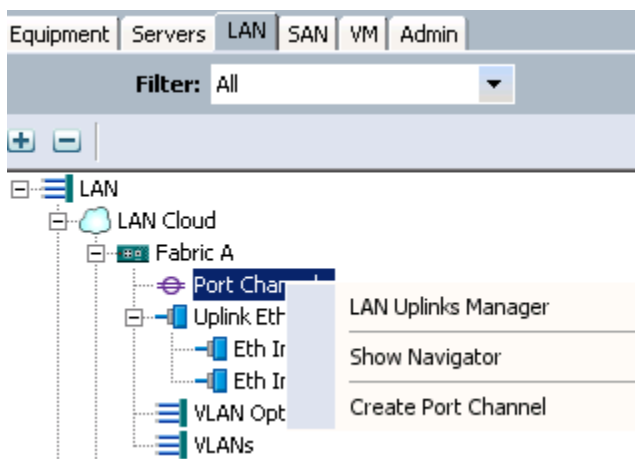

The similar steps can be repeated for the FC connections under the SAN tab.

Note there are no configuration options in UCS Manager for Virtual Port Channels (vPC) and none are needed. However, the Ethernet Uplink Port Channels can be enhanced upon even still by configuring vPC on the directly connected upstream Ethernet switches. The previous topology drawing shows the upstream device to be the Nexus 5xxx switch, but vPC works great on the Nexus 7xxx switches as well. The UCS Manager Port Channel configuration steps just described remain identical if vPC is properly configured on the upstream ports.

LAN and SAN Pin Groups

In most UCS topologies, the only uplinks leaving the FI are those just discussed. However, in some unique design requirements, the uplink ports may need to go to different uplink switches. The ability to have some UCS server vNICs send traffic to some uplinks and other server vNICs to different uplinks requires the use of manually created pin groups. Under the **LAN** tab as show below, navigate to **LAN Pin Groups**, right click, and then click **Create LAN Pin Group**.
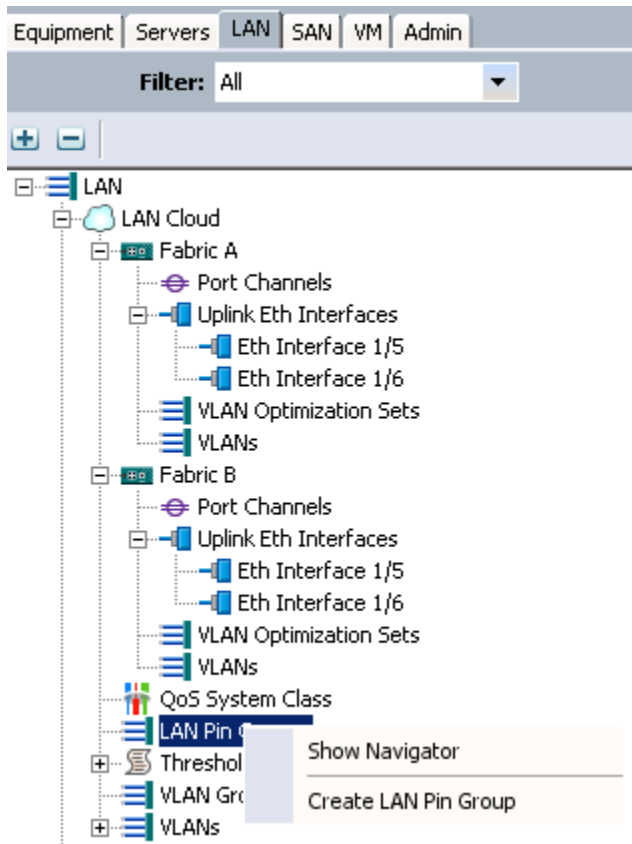
Note that the only Port Channels or Uplinks that can be selected are those already created from the previous steps. Be very careful to select the correct ports.
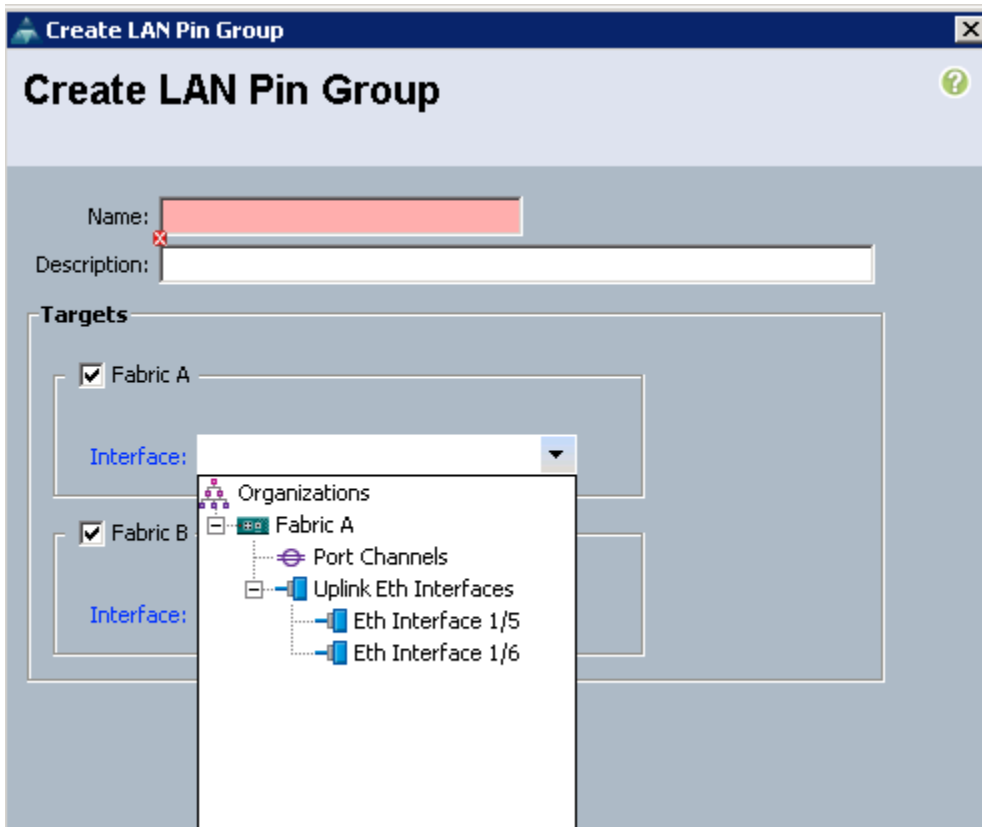
For the Pin Group to be functional, it must be applied to each Service Profile. Under the **Servers** tab, navigate under your Service Profile, highlight the vNIC, and in the **General** tab on the right select the **Pin Group**. Note that any one vNIC may be configured for no Pin Groups (default) or just one manually configured Pin Group.
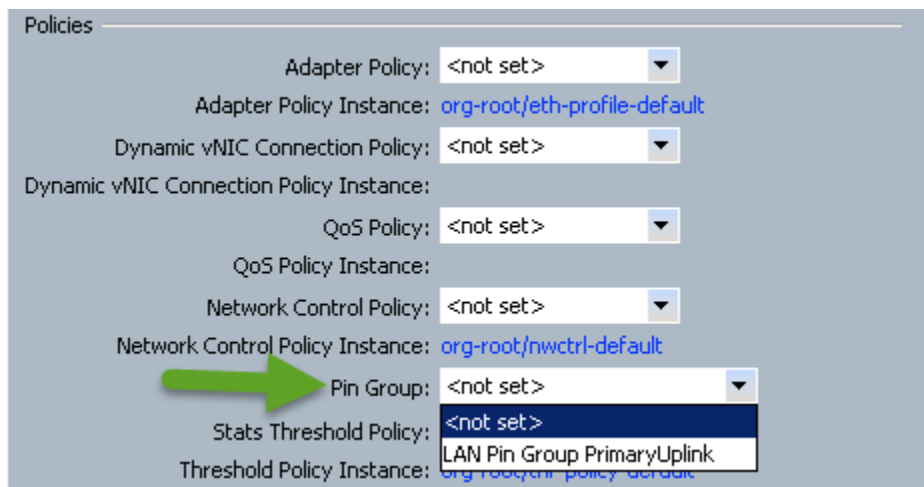
The similar configuration can be done under the **SAN** tab in large FC data centers if different FC uplinks are required.

Conclusion

UCS is a very popular and powerful solution driven by the flexibility and agility of the hardware failover options and the flexibility of Service Profiles combined with the power of path selection with the uplink ports.

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About the Author

Chris Olsen has been an IT trainer since 1993 and an independent consultant and technical writer since 1996. He has taught over 60 different IT, datacenter, and telephony classes to over 15,000 students. He is a technical editor for Global Knowledge's lab manuals and he has published two books with Cisco Press, CIPT2 and CCNA Voice Flash Cards. He is an author and technical editor on both Microsoft OCS 2007 and 2007 R2 certification exams, as well as a technical author for Cisco certified courses.