FCoE Boot Configuration Setup on Broadcom using Lifecycle Controller

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FCoE Boot Configuration

Introduction
The ability to programmatically configure a network controller card for FCoE boot is a powerful feature of Dell’s Lifecycle Controller. FCoE boot configuration allows you to set up a network controller with FCoE boot support to boot into a remote FCoE target. Lifecycle Controller also provides the ability to override some of the I/O identity attributes of the card (i.e. WWPN) with its Virtual Attributes. This feature in turn provides more flexibility in deployments that need rapid re-configuration of system workloads to another system. The configuration workflow varies by vendor (Broadcom, Intel, and Qlogic, etc.). This paper will focus on the Broadcom Mezzanine card implementation and a white paper about FCoE boot for Intel card can be found in [3].

This document describes the FCoE boot workflow steps using the remote API exposed by the LifeCycle Controller 2 (LC2) capability of Dell PowerEdge 12th generation servers. The goal of this paper is to provide clear steps to set up FCoE boot on Broadcom’s network controllers.

Additional FCoE information with accompanying PYTHON scripts, Broadcom, QLogic and Intel cards inclusive, can be found in the Best Practice Guide.

FCoE boot workflow

First, delete all pending jobs and pending values as they may prevent further configuration changes.

1) FQDD selection

Select the network device that is connected to the FCoE boot target by the Fully Qualified Device Descriptor (FQDD). The FQDD (for example, NIC.Mezzanine.1C-1-1) of the network device uniquely identifies the device. This information can be acquired by enumerating the DCIM_NICView class. The InstanceID field is the FQDD of the device.

If the FQDD is not visible on the target server, one of the following two circumstances is possible:

- The server does not contain such a device
- The device is disabled in the BIOS and needs to be enabled prior to configuration

See “Appendix: Sample winrm commands and sample trimmed results 1. Select FQDD” for sample winrm commands and sample results

2) Device enablement

To use the NIC card, the card must be enabled, and to enable a disabled device, we must identify the type of network device, i.e. whether it is on-board, a daughter card, or an add-in. The FQDD contains this information: for example NIC.Mezzanine.1C-1-1 is an add-in Mezzanine card.

For Dell PowerEdge 12th generation servers, NDC and add-in controllers can be disabled in the BIOS. If the target device is disabled and not visible in the DCIM_NICView enumeration, that device must be enabled in the BIOS prior to configuring FCoE.

To enable these devices in the BIOS, the following BIOS attributes must be manipulated:

- For NDC on Dell PowerEdge 12th generation servers
  i. IntegratedNetwork1 = Enabled for 1-1, 1-2, 1-1-1,1-1-4, etc
  ii. IntegratedNetwork2 = Enabled for 2-1, 2-2, 2-1-1, etc
  iii. ...
- Add-ins on Dell PowerEdge 12th generation servers
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i. Set Slot1 = Enabled for Slot.1-1 or Mezzanine.1-1
ii. Set Slot2 = Enabled for Slot.2-1 or Mezzanine.2-1
iii. ...

Using the SetAttributes() method on the DCIM_BIOSService class to set up these attributes as required.

Dell also recommended that you ensure BootMode = Bios at this point. The current value of the BootMode attribute can be obtained by enumerating the DCIM_BIOSEnumeration class.

Since a BIOS job is being scheduled, Dell recommends disabling all boot sources on the system. This will ensure that the system will not boot into another source until FCoE boot configuration is completed. Disabling boot sources can be done with the ChangeBootSourceState() method on the DCIM_BIOSService class on every source.

All boot sources on the system can be listed by enumerating the DCIM_BootSourceSetting class.

Next, using the CreateTargetedConfigJob() method on the DCIM_BIOSService class, create a BIOS job in order for the changes to be committed.

Since boot source changes only occur after reboot, they get detected only after CSIOR completes and the iDRAC database (configDB) is refreshed. This information can be polled by invoking the GetRemoteServicesAPIStatus() method from the DCIM_LCService class.

See “Appendix: Sample winrm commands and sample trimmed results 2. Check if NIC is enabled and 3. Enable NIC” for sample winrm commands and sample results

3) FQDD check

After a disabled NIC is enabled and the BIOS job is completed, re-enumerate the DCIM_NICView class to ensure that the target FQDD is now present.

If the FQDD is still not returned by the enumeration, the device FQDD is invalid.

4) NIC partition check and enable

Unlike Intel card, which has no partition, and QLogic card, whose partition can’t be disabled, Broadcom card has partition and it can be enabled and disabled. For FCoE boot, the partition must be enabled. Unlike QLogic card, for which the FCoE boot protocol must be on partition 4, for Broadcom card, the FCoE boot protocol can be enabled for any partitions as long as there is one and only one FCoE boot protocol enabled for the port(at most you can have two storage protocols enabled for a port, it could be 2 iSCSIs, or 1 iSCSI and 1 FCoE).

If partition is not enabled, the FCoEOffloadMode attribute is not visible and all the VirtFIPMacAddr, VirtWWN, and WirtWWPN will be readonly. The NIC will be in HBA boot mode and the controller will do all the job. FCoEOffloadMode, VirtFIPMacAddr, VirtWWN, and WirtWWPN can’t and need not to be set.

To check the partition, enumerate the DCIM_NICEnumeration class, and Look for AttributeName = NicPartitioning and check its CurrentValue. If the CurrentValue=Disabled. Need to enable it. If the
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CurrentValue=Enabled. No further work need to be done.

Since a NIC job is being scheduled, Dell recommends disabling all boot sources on the system. This will ensure that the system will not boot into another source until FCoE boot configuration is completed. Disabling boot sources can be done with the ChangeBootSourceState() method on the DCIM_BIOSService class on every source.

To enable the partition, a SetAttributes() call on the DCIM_NICService class can be used to set NicPartitioning=Enabled. Next, using the CreateTargetedConfigJob() method on the DCIM_NICService class to create a NIC job in order for the changes to be committed.

Since boot source changes only occur after reboot, they get detected only after CSIOR completes and the iDRAC database (configDB) is refreshed. This information can be polled by invoking the GetRemoteServicesAPIStatus() method from the DCIM_LCService class.

After a disabled NIC partition is enabled and the NIC job is completed, re enumerate the DCIM_NICEnumeration class to ensure that the target NIC partition is now enabled.

If the target partition is still not enabled, the device is invalid.

See “Appendix: Sample winrm commands and sample trimmed results 4. Check if partition is enabled and 5. Enable partition” for sample winrm commands and sample results

5) Link status check

To ensure a successful boot it is a good practice to check the link status prior to reconfiguration. This can be achieved by performing a get on the DCIM_NICEnumeration class for the LinkStatus attribute for the targeted FQDD. The instanceID for the get should be <FQDD>:LinkStatus (example: NIC.Mezzanine.1C-1-1:LinkStatus). The value of this attribute is either ‘Connected’ or ‘Disconnected’. Make sure the value of this attribute is ‘Connected’ before trying to boot to FCoE target.

6) FCoE boot enablement check and configuration

Since the NIC is enabled, it is visible now. The next step is to ensure that the network device is enabled for FCoE boot. This can be done on the Broadcom card we are dealing with here by performing a get on a particular instanceID (For example: NIC.Mezzanine.1C-1-1) in the DCIM_NICEnumeration class. Look for AttributeName = LegacyBootProto, and check if the AttributeValue = FCoE.

If AttributeValue != FCoE , a SetAttributes() call on the DCIM_NICService class can be used to set LegacyBootProto = FCoE.

In this way FCoE boot is enabled. When it is enabled, there will be a corresponding entry in the boot sources list for the NIC. As mentioned earlier, all sources on the system can be listed by enumerating the DCIM_BootSourceSetting class.

Since a NIC job is being performed on the NIC, Dell recommends configuring all FCoE settings within the same job. The list of attributes to set in the same job is as follows:

a) LegacyBootProto=FCoE
b) ConnectFirstFCoETarget=Enabled
c) FCoEOffloadMode=Enabled
d) FCoETgtBoot=Enabled
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e) VirtWWPN=your WWPN address
f) FirstFCoEWWPNTarget=your FirstFCoEWWPNTarget address
g) FirstFCoEBootTargetLUN=your FirstFCoEBootTargetLUN value

Next, a NIC job needs to be created in order for the changes to be committed. This can be done using the CreateTargetedConfigJob() method on the DCIM_NICService class.

If not already done in Step 2, Dell recommends that you set BootMode = Bios and disable all boot sources on the system to assure that until FCoE boot configuration is completed, the system will not boot into another source.

Once again, since boot source changes only occur after reboot, they get detected only after CSIOR completes and the iDRAC database is refreshed.

If LegacyBootProto = FCoE already, then the boot sources need to be checked for an entry for the device FQDD. The condition to look for is:

- InstanceID = IPL
- source contains IPL and device FQDD

See “Appendix: Sample winrm commands and sample trimmed results 6. Enable FCoE” for sample winrm command and sample results

7) Boot order check

In this step, ensure that the network device is the first boot source in the IPL boot list. In previous steps, all other boot devices have been disabled and the network device is readied for FCoE boot enablement.

Ensure that the network device is the primary bootable device in the boot order:

- Verify if the device FQDD will boot
  i. Enumerate DCIM_BootSourceSetting class
  ii. Get EnabledState of IPL entry for device FQDD
  iii. If EnabledState = 0, device needs to be enabled
  iv. Invoke ChangeBootSourceState() method on DCIM_BIOSService to enable source

- Verify if the device FQDD will boot *first*
  i. Get CurrentAssignedSequence from enumeration above
  ii. If not first, need to ensure all preceding sources are disabled
  iii. If other sources will boot before device FQDD, need to fix boot order
  iv. Invoke ChangeBootOrderByInstanceId() method on DCIM_BIOSService to reorder source

If the above methods are invoked to fix the boot order, create a BIOS job to commit the changes. This can be done using the CreateTargetedConfigJob() method in the DCIM_BIOSService class.

Multi-port boot for resiliency

It is possible to configure both ports of the Broadcom card for FCoE boot for resiliency. This allows the system to try the second port if the first port fails to boot. To accomplish this, repeat workflow steps 1-7 with the FQDD of the second port. For Step 7, the boot order of the second port should follow the first port.
Appendix: Sample winrm commands and sample trimmed results

For all the following sample winrm commands, you need to change “your iDRAC IP Address” in the command to your actually iDRAC IP address and the username/password to your system’s username/password before you run any of them.

1. Select FQDD

   winrm enumerate “cimv2/root/dcim/DCIM_NICView” -r:https://your iDRAC IP address/wsman -u:root -p:*** -SkipCNcheck -SkipCAcheck -encoding:utf-8 -a:basic -format:pretty

   DCIM_NICView
   
   FQDD = NIC.Mezzanine.1C-1-1

2. Check if NIC is enabled

   winrm enumerate “cimv2/root/dcim/DCIM_BIOSEnumeration” -r:https://your iDRAC IP address/wsman -u:root -p:*** -SkipCNcheck -SkipCAcheck -encoding:utf-8 -a:basic -format:pretty

   DCIM_BIOSEnumeration

   AttributeDisplayName = Mezzanine Slot 1C
   AttributeName = Slot1
  CurrentValue = Disabled
   Dependency
   DisplayOrder = 1102
   FQDD = BIOS.Setup.1-1
   GroupDisplayName = Mezzanine Slot Disablement
   GroupID = SlotDisablement
   InstanceID = BIOS.Setup.1-1:Slot1
   IsReadOnly = false
   PendingValue
   PossibleValues = Enabled
   PossibleValues = Disabled
   PossibleValues = BootDriverDisabled
   PossibleValuesDescription = Enabled
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PossibleValuesDescription = Disabled
PossibleValuesDescription = Boot Driver Disabled

3. Enable NIC

1) Use the following winrm command to set the attributes

```
winrm invoke SetAttributes
"cimv2/root/dcim/DCIM_BIOSService?SystemCreationClassName=DCIM_ComputerSystem+CreationClassName=DCIM_BIOSService+SystemName=DCIM:ComputerSystem+Name=DCIM:BIOSService"
-r:https://your iDRAC IP address/wsman -u:root -p:*** -SkipCNcheck -SkipCAcheck -encoding:utf-8 -a:basic -format:pretty -file:c:\your xml file name
```

```
  <p:AttributeName>Slot1</p:AttributeName>
  <p:AttributeName>BootMode</p:AttributeName>
  <p:AttributeValue>Enabled</p:AttributeValue>
  <p:AttributeValue>Bios</p:AttributeValue>
  <p:Target>BIOS.Setup.1-1</p:Target>
</p:SetAttributes_INPUT>
```

SetAttributes_OUTPUT

- Message = The command was successful
- MessageID = BIOS001
- RebootRequired = Yes
- ReturnValue = 0
- SetResult = Set PendingValue

2) Use the following winrm command to execute the job and apply the changes

```
winrm invoke CreateTargetedConfigJob
"cimv2/root/dcim/DCIM_BIOSService?SystemCreationClassName=DCIM_ComputerSystem+CreationClassName=DCIM_BIOSService+SystemName=DCIM:ComputerSystem+Name=DCIM:BIOSService"
@{RebootJobType="1";ScheduledStartTime="TIME_NOW";Target="BIOS.Setup.1-1"}
```
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1";UntilTime="20211111111111"} -r:https://your iDRAC IP address/wsman -u:root -p:*** -SkipCNcheck -SkipCAcheck -encoding:utf-8 -a:basic -format:pretty

CreateTargetedConfigJob_OUTPUT

Job

EndpointReference

Address = http://schemas.xmlsoap.org/ws/2004/08/addressing/role/anonymous

ReferenceParameters


SelectorSet

InstanceID = JID_383876520602

__cimnamespace = root/dcim

ReturnValue = 4096

4. Check if partition is enabled


DCIM_NICEnumeration

AttributeDisplayName = NIC Partition

AttributeName = NicPartitioning

CurrentValue = Disabled

Dependency

FQDD = NIC.Mezzanine.1C-1-1

GroupDisplayName = Device Configuration

GroupID = DeviceLevelConfig

InstanceID = NIC.Mezzanine.1C-1-1:NicPartitioning

IsReadOnly = false

PendingValue
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PossibleValues = Disabled
PossibleValues = Enabled
PossibleValuesDescription = Disabled
PossibleValuesDescription = Enabled

5. Enable partition

1) Use the following winrm command to set the attributes

```
winrm invoke SetAttributes
"cimv2/root/dcim/DCIM_NICService?SystemCreationClassName=DCIM_ComputerSystem+CreationClassName=DCIM_NICService+SystemName=DCIM:ComputerSystem+Name=DCIM:NICService" -r:https://your iDRAC IP address/wsman -u:root -p:*** -SkipCNcheck -SkipCAcheck -encoding:utf-8 -a:basic -format:pretty
```

```xml
<p:AttributeName>NicPartitioning</p:AttributeName>  
<p:AttributeValue>Enabled</p:AttributeValue>  
<p:Target>NIC.Mezzanine.1C-1-1</p:Target> 
</p:SetAttributes_INPUT>
```

SetAttributes_OUTPUT

Message = The command was successful
MessageID = NIC001
RebootRequired = Yes
ReturnValue = 0
SetResult = Set PendingValue

2) Use the following winrm command to execute the job and apply the changes

```
winrm invoke CreateTargetedConfigJob
"cimv2/root/dcim/DCIM_NICService?SystemCreationClassName=DCIM_ComputerSystem+CreationClassName=DCIM_NICService+SystemName=DCIM:ComputerSystem+Name=DCIM:NICService" @{RebootJobType="1";ScheduledStartTime="TIME_NOW";Target="NIC.Mezzanine.1C-1-1";UntilTime="20211111111111"} -r:https://your iDRAC IP address/wsman -u:root -p:*** -SkipCNcheck -SkipCAcheck -encoding:utf-8 -a:basic -format:pretty
```
CreateTargetedConfigJob_OUTPUT

Job

EndpointReference

Address = http://schemas.xmlsoap.org/ws/2004/08/addressing/role/anonymous

ReferenceParameters


SelectorSet

InstanceID = JID_383880001475
__cimnamespace = root/dcim

ReturnValue = 409

6. Enable FCoE
   1) Use the following winrm command to set the attributes

   winrm invoke SetAttributes
   "cimv2/root/dcim/DCIM_NICService?SystemCreationClassName=DCIM_ComputerSystem+CreationClassName=DCIM_NICService+SystemName=DCIM:ComputerSystem+Name=DCIM:NICService" -r:https://your iDRAC IP address/wsman -u:root -p:*** -SkipCNcheck -SkipCAcheck -encoding:utf-8 -a:basic -format:pretty -file:c:\ your xml file name


   <p:AttributeName>LegacyBootProto</p:AttributeName>

   <p:AttributeName>ConnectFirstFCoETarget</p:AttributeName>

   <p:AttributeName>FCoEOffloadMode</p:AttributeName>

   <p:AttributeName>FCoETgtBoot</p:AttributeName>

   <p:AttributeName>VirtFIPMacAddr</p:AttributeName>

   <p:AttributeName>VirtWWN</p:AttributeName>

   <p:AttributeName>VirtWWPN</p:AttributeName>

   <p:AttributeValue>FCoE</p:AttributeValue>

   <p:AttributeValue>Enabled</p:AttributeValue>
FCoE Boot Configuration

<p:AttributeValue>Enabled</p:AttributeValue>
<p:AttributeValue>Enabled</p:AttributeValue>
<p:AttributeValue>00:0E:1E:06:06:6E</p:AttributeValue>
<p:AttributeValue>20:01:00:0e:1e:06:06:6e</p:AttributeValue>
<p:AttributeValue>20:01:00:10:18:c3:db:41</p:AttributeValue>
<p:Target>NIC.Mezzanine.1C-1-1</p:Target>

</p:SetAttributes_INPUT>

SetAttributes_OUTPUT

Message = The command was successful
MessageID = NIC001
RebootRequired = Yes
ReturnValue = 0
SetResult = Set PendingValue

winrm invoke SetAttributes
"cimv2/root/dcim/DCIM_NICService?SystemCreationClassName=DCIM_ComputerSystem+CreationClassName=DCIM_NICService+SystemName=DCIM:ComputerSystem+Name=DCIM:NICService" -r:https://your iDRAC IP Address/wsman -u:root -p:*** -SkipCNcheck -SkipCAcheck -encoding:utf-8 -a:basic -format:pretty -file:c:\users\zhan_liu\appdata\local\temp\tmpdhhnsd

<p:AttributeValue>FirstFCoEBootTargetLUN</p:AttributeValue>
<p:AttributeValue>0</p:AttributeValue>
<p:Target>NIC.Mezzanine.1C-1-1</p:Target>

</p:SetAttributes_INPUT>
SetAttributes_OUTPUT
Message = The command was successful
MessageID = NIC001
RebootRequired = Yes
ReturnValue = 0
SetResult = Set PendingValue

2) Use the following winrm command to execute the job and apply the changes

```
winrm invoke CreateTargetedConfigJob
"cimv2/root/dcim/DCIM_NICServic?SystemCreationClassName=DCIM_ComputerSystem+Creatio
className=DCIM_NICServic+SystemName=DCIM:ComputerSystem+Name=DCIM:NICService" @
{RebootJobType="1";ScheduledStartTime="TIME_NOW";Target="NIC.Mezzanine.1C-1-
1";UntilTime="20211111111111"} -r:https://your iDRAC IP Address/wsman -u:root -p:*** -
SkipCNcheck -SkipCAcheck -encoding:utf8 -a:basic -format:pretty
```

CreateTargetedConfigJob_OUTPUT
Job
EndpointReference
Address = http://schemas.xmlsoap.org/ws/2004/08/addressing/role/anonymous
ReferenceParameters
ResourceURI = http://schemas.dell.com/wbem/wscim/1/cim-
schema/2/DCIM_LifecycleJob
SelectorSet
_InstanceID = JID_383883925864
__cimnamespac = root/dcim
ReturnValue = 4096

References
http://www.delltechcenter.com/page/Lifecycle+Controller

[2] Lifecycle Controller Best Practice Specification
http://www.delltechcenter.com/page/Lifecycle+Controller
FCoE Boot Configuration

[3] FCoE Boot Configuration Setup on Intel using Lifecycle Controller

http://en.community.dell.com/techcenter/extras/m/white_papers/20118779.aspx

Glossary

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSIOR</td>
<td>Collect System Inventory on Restart</td>
</tr>
<tr>
<td>BIOS</td>
<td>Basic Input / Output System</td>
</tr>
<tr>
<td>NIC</td>
<td>Network Interface Controller</td>
</tr>
<tr>
<td>NDC</td>
<td>Network Daughter Card</td>
</tr>
<tr>
<td>iDRAC</td>
<td>Integrated DELL Remote Access Controller</td>
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</tbody>
</table>