# Introduction

The Goal is to have SFD into mid-market (and Edge computing) via VxRail. For those customers who want overlay, SFD with Dell Switches will provide standards-based overlay support via the BGP EVPN feature.

There are two possible approaches to inserting SFD to orchestrate the networking in VxRail. In this document we would cover the two approaches.

# SFD: An Overview

SmartFabric Director (SFD) is a pure software controller (distributed as an OVA) which would run on a server in the DC (on prem) and manage the network devices which form the DC network fabric. Customer data traffic (traffic between servers and storage devices) flows over the network fabric. SFD interfaces with vCenter and NSX-T via their REST Interface to provide the integration between server virtualization and controller-based overlay provided by vCenter and NSX-T respectively. SFD ensures that the network fabric (also known as underlay in these cases) is configured without active operator actions to ensure smooth DC operations. SFD’s LCM (Life Cycle Management) feature provides upgrade/downgrade of switch software without disrupting the network connectivity and operation. SFD constantly monitors the fabric by subscribing to the metrics (counters), states, events, logs (telemetry data) from the switches. SFD performs variety of data analysis, correlations across metrics and takes any remedial actions. It stores the telemetry data in a time series data store which is also visualized in its GUI. All of its telemetry data is accessible via its REST API.

In standalone mode the operator is likely to use the SFD GUI to interact with SFD. An operator uses a browser to access SFD GUI by pointing its browser to the SFD’s IP address. SFD GUI is built over REST API and when SFD is used as part of a solution (e.g. VxRail) the solution orchestrator (e.g. VxRail Manager) would interface with SFD using these REST API over HTTPS.

Given the smallest deployments may not have an out of band management network the goal is to find a way to inband access to switches from SFD. SFD will also use inband for interface to vCenter, and VxRail Manager.

## SFD – Switch Interface

SFD communicates with the switch using OpenConfig to both configure and collect streaming telemetry data from them. OpenConfig is an open standard championed by Google. It consists of OpenConfig models of switch objects required that can be configured or metrics. The switches have a process/function called gNMI agent which supports OpenConfig. SFD communicates with the gNMI agent(s) on the switch via messages containing gProtoBufs sent over gRPC. These messages are encrypted for security. OpenConfig supports streaming telemetry whereby SFD subscribes to receive Telemetry objects from the switches and the gNMI Agent (a switch may have a dedicated process/function called Telemetry Agent) periodically streams the Telemetry data. SFD requires a gNMI Agent on the switch and needs to know the IP address and credentials (e.g. username, password).

# Switch Bootstrap (Day 0)

For TCP/IP communication every networking device/endpoint (e.g. SFD, Switch) needs an IP address. When encryption is used for security, we would need the creds (username, password) to be configured on the switch and these stored in non-volatile memory of the switch so that they are applied every time the switch reboots. We also want to ensure that when SFD managing the devices the config mode of the switch CLI is disabled. Additionally, we would need the OpenConfig Agents launched and running on the switches.

In case of OS10, the switch has a personality called SFD mode. When the switch is put in that mode the config mode of the switch CLI is disabled and the gNMI agent is launched. It will also remove any previously stored configuration in the non-volatile memory. This is done via configuring a *sfd* mode in CLI. So, an operator needs to do the following when putting a switch under SFD control for the first time.

1. Ensure that the OS (image) running on the switch is compatible with the version of the SFD.
2. Using CLI of the switch configure:
   1. IP address on the interface used to communicate with the switch. In case of Standalone SFD this is the management interface of the switch (In case of VxRail, details of which interface depends on the options which are discussed later).
   2. Username and password (with administrative role)
   3. Sfd mode
   4. Write mem (this will save the above configuration in the non-volatile memory of the switch and the config will get applied after every reboot)
3. Reboot the switch (to ensure that the switch applies the above config)

**Note**: Switch Day 0 or Bootstrap has to be done **only once** and only the first time the switch is put under SFD control.

# SFD in VxRail

Using SFD to manage Network in VxRail requires SFD to be present in a VxRail system. SFD would run on a server (let’s call it as an infrastructure server). There are two options on how the SFD is able to reach the switch(es).

## Option 1:

Every switch has a management port which is separate from the front panel (or data) ports. The management port is connected to a management network (which has its own simple infrastructure like a hub or management switch). The Server running SFD has one of its NIC connected to the management network. The management network is not under SFD management. One big advantage of this is that SFD’s reachability with the switches is not dependent on its network orchestration capability, thereby avoiding any Catch-22 situations.

# Key Components

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| **Component** | **Form Factor** | **Responsibility** |
| SFD | Virtual appliance | Provision and manage the fabrics. |
| Computer Manager  vCenter or NSX-T manager | Virtual appliance | Manage ESXi and/or transport nodes. |
| VxRail Manager | Virtual appliance | Manage VxRail cluster creation, expansion and shrink |
| VxRail Node | Physical servers | The building block of VxRail cluster. |
| Fabric switch Node | Physical switches | The building block of the data fabric. Provide in-band connectivity |
| Management switch node | Physical switches | Provide out-of-band network connectivity. |

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# Wiring Diagram

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**SFD multi-homing:**

1. Network connectivity to management fabric for data fabric management.
2. Network connectivity to data fabric for VxRail and VC communication.

# Component State Before VxRail Cluster Bringup

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| **Component** | **State** |
| SFD | Wiring diagram is ready. Can connect to the switch nodes through out-of-band network. |
| Computer Manager  vCenter or NSX-T manager | May or may not be deployed. |
| VxRail Manager | Not power on yet. |
| VxRail Node | LLDP is enabled for the PNICs that carry the management traffic. |
| Fabric switch Node | Management IP is configured, running in SFD mode. |
| Management switch node | Fully configured |

# VxRail Cluster Bringup Workflow

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## Option 2:

However, as mentioned above, in smaller setups customers may not have a management network.

To support an inband access to switches from SFD we would need the Dell Switches to have the capability for the gNMI and Telemetry Agents to be accessible from its data port (We have asked the OS10 engineer to look into the feasibility of inband support). We would also need a management VLAN to be configured on the switch which will be exclusively used by the Networking Infrastructure (the same Management VLAN will be used by SFD to interface with VxRail Manager, vCenter and NSX-S REST API interaction) and not be available for Customer Data Traffic. The Dell Switches would run the configuration from its non-volatile memory (saved there as part of Switch Day 0 (bootstrap) discussed earlier), which will create this Management VLAN, apply IP address to this VLAN interface and put the switch in SFD mode and launch the gNMI agents at bootup or upon every reset/reload.

Question: Can the Management VLAN used by SFD be the same as VxRail Internal Management VLAN?

# Wiring Diagram

SFD

vCenter

vSphere Management VLAN

VxRail Internal Management VLAN

SFD Management VLAN

vSAN VLAN

vMotion VLAN

Guest VMs VLAN

Once the SFD and Switch gNMI agent interface, SFD can start configuring the switch based on the intent required for the functioning of the offering. SFD would interface with the VxRail Manager to obtain the intent via REST API. As part of this interface if the operator wants to change the Management VLAN number and associated IP address subnet that intent is communicated to SFD which in turn will program the switch. Please note that doing so would require reestablishing the SFD-Switch Interface and SFD-VxRail Manager interface too.

SFD will then establish the physical networking (underlay) making the fabric ready for operation. VxRail Manager would then proceed with creating VxRail cluster.

With the inband mechanism the server hosting SFD, vCenter can be in the VxRail Rack and the above Management VLAN would also be active on that server and the physical port to which this server is connected will be part of the Management VLAN.

Question: Would the VxRail Manager reside on the same server?

# VxRail Cluster Bringup Workflow

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