Kaloom Networks Hardware Compatibility List

1   Introduction

This document provides guidelines for hardware selection and connectivity for Kaloom^{TM} Unified Edge configuration:

- Kaloom Unified Edge ™ release 2.8.1, and associated nodes, for all configurations.

Further in this document, this product is referred to as Kaloom^{TM} Fabric.

5G User Plane Function (UPF) application can be delivered with any Fabric configuration.

1.1   Hardware Equipment

Hardware equipment related to the Fabric fall under the following categories:

- Fabric equipment, one of the following
  - Fabric Switch: Spine, Leaf, UPF-User Plane (UP) Application
  - Fabric Server
- Auxiliary equipment
  - Deployer Host
  - Management Switch
- User equipment, any external equipment connected to Fabric user ports, for example
  - User (Application) Server
  - User Network Equipment (switch/router)

1.2   Software Platform

Fabric software runs on embedded Red Hat ® OpenShift Container Platform (OCP). Each node in an OCP cluster has a *worker* role, where workloads (application pods) run. Three nodes in the cluster also have a *supervisor* role, where OCP control plane components run.

Nodes having a supervisor role have different system requirements than those having only a worker role. See further in this document for details.

Kaloom ™ Fabric inherits hardware requirements from the underlying OCP version. See OCP 4.10 requirements for more information.

2   Common Fabric Switch Requirements

2.1   Intel ® Tofino™

All Fabric switches require Intel ® Tofino™ P4-programmable ASIC. The Intel ® Tofino™ comes in different flavors:

ASIC model	No. of ports	No. of pipelines
BFN-T10-064Q	64 x 100GbE	Quad
BFN-T10-032Q	32 x 100GbE	Quad
BFN-T10-032D	32 x 100GbE	Dual

Leaf and Spine switches work on any Intel ® Tofino™ model.

UPF-UP switches require the Intel ® Tofino™ model with Quad pipelines.

2.2   Switch Host Module

All Fabric switches have a Host Module where a CPU running the host operating system is located. On most switch models the Host Module is realized as a Computer-On-Module Express (COM-E) module. Typically, this COM-E module will have an Intel ® CPU, memory, and storage.

Nodes with a supervisor role have been verified to run on equipment with at least the following:

- 8-core CPU
- 48GB memory
- 512GB SSD

Nodes with only a worker role have been verified to run on equipment with the following minimal requirements:

- 4-core CPU
- 8GB memory
- 128GB SSD

3   Common Fabric Server Requirements

3.1   Server Requirements

Servers with a supervisor role have been verified to run on equipment with at least the following:

- 8-core CPU
- 128GB memory
- 512GB SSD

Fabric Server hardware must support RHCOS/RHEL 8.4. See Red Hat documentation for more information.

3.2   NIC

The following table lists NIC models validated for Fabric connectivity, with corresponding firmware version:

Model	Ports	Firmware Version	DPDK Version
Intel ® XXV710-DA2	2x 25GbE	6.01	DPDK version 19.11.13
Intel ® E810-C			
NVIDIA® MELLANOX® MCX512F-ACAT	2x 25GbE	16.26.1040	DPDK version 19.11.13

Fabric Servers use Kaloom Virtual Switch (KVS) for connectivity to Fabric Switches.

Since KVS requires DPDK, the server must support DPDK binding on the NIC card listed above.

Note that interfaces bound to DPDK will not have a kernel driver assigned.

Note: Nvidia Mellanox Connectx-6 Dx is not fully tested.

3.3   Out-Of-Band (OOB) Management

Each server must have at least one dedicated 1GbE or 10GbE port for OOB host management connectivity, and support UEFI PXE boot using IPv6 protocol on that interface.

A dedicated BMC Ethernet port is required for remote management using IPMI.

Note: Some server vendors build additional management functionalities on top of BMC. They may refer to the dedicated BMC port by a proprietary name (such as iDRAC by Dell, or iLO by HPE, or XCC by Lenovo, or SSM by SuperMicro).

4   Intel ® Tofino ™ Based Switches

4.1   Edgecore (Accton) Switches

The following table lists switch models that have been verified to work with Kaloom software:

Switch model	ASIC	CPU	RAM	SSD
Edgecore (Accton) Wedge 100BF-65X	BFN-T10-064Q	Intel® Xeon® D-1517 (4-cores)	8GB	128GB
Edgecore (Accton) Wedge 100BF-32QS	BFN-T10-032Q	Intel® Xeon® D-1548 (8-cores)	48GB	2TB
Edgecore (Accton) Wedge 100BF-32X	BFN-T10-032D	Intel® Xeon® D-1517 (4-cores)	8GB	128GB

4.1.1   Out-Of-Band (OOB) Management

All models have one management port that hosts both Baseboard Management Controller (BMC) and host interfaces, therefore one port from the Management switch is required per each Leaf and Spine switch.

All models have one console port that can be used to connect to a serial console terminal.

4.1.2   Firmware Versions

The following table lists the firmware versions validated to work with Kaloom ™ software.

Note: the procedures to collect and install the software referred below are available on the Edgecore web site: https://www.edge-core.com/supDownload.php

Item	Version	Comments
OpenBMC	01.10.00 2.0v05.01.00	
COM-E BIOS	BIOS: R1.00.E4 EC: R04.E02	
ONIE	2018_05_00_09 (32X, 65X) 2018_05_00_10 (32QS)	
CPLD	10.3	the 65X has TWO CPLD components (upper and lower)
SPI EEPROM	20180416	

Starting with KSDF version 2.8, the product is compatible with BMC 2.0. Kaloom strongly recommends upgrading to thisnew version of BMC and should be installed **manually** prior to the deployment of the KSDF software.

Instructions to download and install BMC 2.0 can be found on EdgeCore support page:
https://support.edge-core.com/

5   Software Defined Fabric ^{TM} Nodes

This section covers the requirements for Software Defined Fabric ^{TM} system nodes.

5.1   Spine Switch (worker)

The following hardware models have been verified as a Spine switch:

- Edegcore (Accton) Wedge 100BF-65X
- Edgecore (Accton) Wedge 100BF-32QS
- Edgecore (Accton) Wedge 100BF-32X

5.2   Leaf Switch (worker)

The following hardware models have been verified as a Leaf switch, with only the worker role:

- Edegcore (Accton) Wedge 100BF-65X
- Edgecore (Accton) Wedge 100BF-32QS
- Edgecore (Accton) Wedge 100BF-32X

5.3   Leaf Switch (supervisor)

The following hardware models have been verified as a Leaf switch, with the supervisor role:

- Edgecore (Accton) Wedge 100BF-32QS

5.4   UPF-UP Switch (supervisor and worker)

The following hardware models have been verified as a UPF-UP switch, with either only the worker role or both worker and supervisor roles:

- Edgecore (Accton) Wedge 100BF-32QS

5.5   Fabric Server (supervisor and worker)

The following hardware models have been verified as a Fabric Server, with either only the worker role or both worker and supervisor roles:

- Dell R640
- HPE DL380 Gen 10

For detailed configuration of each model refer to Annex in this document.

6 Cloud Edge Fabric ^{TM} Nodes

This section covers the requirements for Cloud Edge Fabric ^{TM} system nodes.

6.1 Leaf Switch (supervisor)

The following hardware models have been verified as a Leaf switch, with the supervisor role:

- Edgecore (Accton) Wedge 100BF-32QS

6.2 UPF-UP Switch (supervisor)

The following hardware models have been verified as a UPF-UP switch, with the supervisor role:

- Edgecore (Accton) Wedge 100BF-32QS

7   Auxiliary Equipment

7.1   Provisioning Server (Deployer Host) Requirements

The Deployer runs either Red Hat Enterprise Linux (RHEL) or CentOS Stream. Supported versions of RHEL are 8.4 or greater. For CentOS Stream, supported versions are 8 or 9. See Red Hat documentation for more information.

Deployer Host functionality has been verified to run on equipment with at least the following:

- 4-core CPU
- 16GB memory
- 200GB SSD

Note: SSD is crucial since HDD has slow read/write speed, which might cause unexpected issues (e.g., deployment timeout, race condition).

Each server must have at least one dedicated 1GbE or 10GbE port for OOB host management connectivity, and support UEFI PXE boot using IPv6 protocol on that interface.

A dedicated BMC Ethernet port is required for remote management using IPMI.

7.2   Management Switch

The Management switch is an L2 switch that enables connectivity between the host management and BMC interfaces. Any "managed" L2 switch (typically supporting VLAN (802.1Q) & trunking (static or dynamic as 802.3ad) with enough ports to connect to all the Fabric elements can act as a management switch.

Ports typically support either a 1GbE or 10GbE copper interface with an RJ45 form-factor connector.

The number of required ports depends on the number of nodes in the deployment.

7.3   Console Server (optional)

For Out-of-Band (OOB) management of equipment and troubleshooting purposes, it is highly recommended to connect a serial console from all Fabric nodes to a Console Server to enable centralized access to console output.

Depending on the type of port used for the console on each piece of equipment, a different type of Console Server, or a combination of Console Servers may be required.

Fabric Switches offer a dedicated serial console port, which can be connected to a standard Terminal Server for remote access.

Most servers have a graphical interface for an extended management suite (such as iDRAC by Dell, iLO by HPE, XCC by Lenovo, and SSM by SuperMicro). These suites are built on top of BMC, which means that a BMC port connected to the Management switch can also be accessed through a browser, using an assigned BMC IP address.

In addition, servers are typically equipped with a VGA port for the video monitor, and USB ports for the keyboard and mouse. These ports can be connected to a Keyboard, Video, and Mouse (KVM) switch to enable remote access to a server console.

Note: Some KVM switches also offer some serial console ports, which can be used to enable remote access for all types of equipment.

8   User Equipment

The user equipment is connected to Fabric user ports. The only hardware requirement for such equipment is to have at least one port that supports rates offered by the Fabric Leaf switch.

The following port rates are currently supported:

- 100GbE
- (2x) 50GbE
- (4x) 25GbE
- 40GbE
- (4x) 10GbE

8.1   User (Application) Server NIC

Various NIC models have been validated to work with the Fabric. The validation was performed using a server running RHEL 7.6, both with Kaloom Virtual Switch (KVS) installed on a server and without KVS. The following table lists validated NIC models, with corresponding driver and firmware versions:

Model	Ports	Driver	Firmware
Intel ® XXV710-DA2	2x 25GbE	i40e 2.8.20-k	6.01
Intel ® X710-DA2	2x 10GbE	i40e 2.3.2-k	4.53.0
Marvell QLogic FastLinQ QL45212-DE	2x 25GbE	qede 8.33.0.20 storm 8.33.11.0	mfw 8.35.41
NVIDIA® MELLANOX® MCX512F-ACAT	2x 25GbE	mlx5_core 5.0-0	16.26.1040

Note that when a Kaloom Virtual Switch (KVS) is used on a User (Application) Server, the server must support DPDK binding on the NIC card listed above. Note that interfaces bound to DPDK will not have a kernel driver assigned. DPDK versions 19.11.3 have been validated.

In the current version of the Intel ® Tofino ™ chipset, auto-negotiation is not supported. Therefore, depending on the NIC used in a server, the speed of the link, and the type of cable used, the corresponding port on the Leaf node must be correctly configured (speed and fecType).

8.2   User (Application) Server Operating System

SDF does not have any requirements on the Operating System used on Application Servers, except in the following cases:

- If a KVS is to be installed on a User (Application) Server,
- If an OpenStack instance is installed on a User (Application) Server, and the Kaloom ™ OpenStack Neutron plugin is to be installed,
- If a Kubernetes instance is installed on a User (Application) Server, and Kaloom ™ Kubernetes CNI plugin is to be installed.

In these cases, the OS must support RPM Package Manager for the installation of software packages (such as Red Hat Enterprise Linux, CentOS).

Note: In any of these cases, please contact Kaloom for the latest recommendations related to KVS, OpenStack, and Kubernetes plugins.

9   Cables and Transceivers

Fabric Switches have 100GbE ports requiring QSFP28 form-factor connectors, therefore each cable must have either a QSFP28 module on the switch end, as in the case of Direct Attach Copper (DAC) and Active Optical Cables (AOC) or plug into the separate QSFP28 transceiver.

Note that ports support transceivers up to power class 4 (power consumption up to 3.5W), so it is important to select correct transceivers when using Fiber Optic cables.

Since Fabric Servers have 25GbE ports requiring SFP28 form-factor connectors, the required cable is a fan-out (breakout) cable with one side having a QSFP28 module, and the other side fanning out to either four SFP28 connectors (in the case of DAC and AOC) or plugging into the four separate SPF28 transceivers. One such cable can connect one Fabric Switch with up to four Fabric Servers with a 25GbE link.

Cables connecting to User Equipment depend on the ports used on the "other" end. For example, connecting to a router that supports 40G ports requires the use of 40G modules (QSFP+).

Below is a list of transceivers fully supported and tested by EdgeCore:

Vendor	Model	P/N
Finisar	100G CWDM4	FTLC1157RGPL
Innolight	100G CWDM4	TR-FC13T-N00
Huawei	100G CWDM4	02312DYA
Accelink	100G CWDM4	RTXM420-431
Hisense	100G CWDM4	LTA1328-PC+
Finisar	100G LR4	FTLC1154RDPL
Huawei	100G LR4	02312KDM
Accelink	100G LR4	RTXM290-806
Hisense	100G LR4	LTA1315-PC+
Innolight	100G LR4	TR-FC13R-N00

Finisar	100G SR4	FTLC9558REPM
Innolight	100G SR4	TR-FC85S-N00
Huawei	100G SR4	02312DXW
Accelink	100G SR4	RTXM420-550
Hisense	100G SR4	LTA8531-PC+

Note: Some networking equipment manufacturers ensure the vendor lock-in, whereby they add a check in the device's firmware that will enable only the vendor's own active modules (transceivers). Verify that the selected modules are compatible with all equipment.

10 ANNEX

10.1 Server Dell PowerEdge R640

Details of configuration for a server used in testing

Item	Dell Firmware	Comments
NIC Intel ® i350	19.5.12	2x 1GbE
NIC Intel ® X550	19.5.12	2x 10GbE
NIC Intel ® XXV710-DA2	19.5.12	2x 25GbE
PERC H730P RAID controller	4.300.00-8352	With 6x SSD SATA 480GB 1DWPD
BOSS controller S1v5	2.5.13.3022	With 2x M.2 480GB
BIOS	2.7.7	
iDRAC9	4.20.20.34.20	
CPU Intel ® Xeon ® Silver 4210R		10-core @2.4GHz
RDIMM 12x 16GB DDR4		Total 192GB

10.2 Server HPE DL388 Gen 10

Details of configuration for a server used in testing

Item	Firmware	Comments
NIC HPE Ethernet 331i Adapter	20.12.41	4x 1GbE
NIC Intel ® XXV710-DA2	8.20	2x 25GbE
HPE Smart Array P408i-a SR Gen10	1.65	With 2x SSD SATA 480GB VK0480DJXV
BIOS	U30 v1.42	
iLO5	1.46	
CPU Intel ® Xeon ® Silver 4110		8-core @2.10GHz
RDIMM 8x 32GB DDR4		Total 256GB