Hewlett Packard
Enterprise

HPE Telco Core Validated Reference Design with Robin.io Cloud Native Platform

Test Report

Abstract

This document captures the test cases, execution steps and results of HPE Telco Core Robin platform reference design. This document is intended for the system integration test personnel who customize this reference architecture according to the end customer's requirements and deploy the optimized solution at the customer site or factory and execute the test cases. The reader must have an understanding of the NFV solution and be familiar with the HPE NFV hardware.

Published: June 2020
Edition: 1

Notices

Acknowledgments

Revision history

Publication date	Edition	Summary of changes
June 2020	1	First version

Contents

Overview

These test cases are planned for Robin platform validation on HPE hardware. The test cases can be run from Robin dashboard or using Robin CLI commands

Assumptions

The testing teams have experience with OpenStack, are trained with the Robin platform and understand tested HW.

Prerequisites

- Robin Installation guide.
- Download OS, DPDK driver, NIC firmware and Robin Artifacts version as listed in the appendix.
- Robin platform license

Test Conditions

- Pass – Passed successfully
- Partially passed – Passed with comments (can be correct in a later release or in a roadmap commitment)
- Failed – The test case was not executed successfully

Container workload

Sample application deployment

Description	Deploy MySQL container on worker node
Objective	Verify sample application deployment with automated storage provisioning
Prerequisite/s	1. Robin Cluster is operational and running 2. Robin Application Bundle for MySQL should be available

Test Execution	1. Login to Master Node
	2. Run the below command to upload the bundle to Robin
	`# robin bundle add <name> <version> <bundle path>`
	`E.g.:`
	`# robin bundle add MySQL 5.7 ./docker-mysql-5.7-333_master.tar.gz`
	3. The bundle should be uploaded successfully
	4. Login to Robin Dashboard
	5. Navigate to Application Bundles
	6. Click on MySQL Bundle
	7. Provide required details and click on "Provision Application"
	8. The application should be provisioned successfully
	9. Login to the application using Application Console

Expected Result	MySQL application is successfully provisioned in Robin Cluster with selected cores, memory, storage and network.
Status	OK
Comments	Application Bundle for MySQL successfully uploaded to Robin MySQL application is successfully provisioned Login to MySQL is successful through application console and database connection is successful.

Network reachability

Description	Deploy PODs with single network
Objective	Verify that PODs can communicate with other PODs in the cluster
Prerequisite/s	1. Robin Cluster is operational and running 2. Application Bundle should be present in Robin

Test Execution	1. Login to Master Node
	2. Run below command to create ip pool based on ovs driver
	`# robin ip-pool add ovsnet1 --ranges <network range> --netmask <netmask> --driver ovs --gateway <network gateway> --vlan <vlanid>`
	
	E.g.:
	
	`# robin ip-pool add ovsnet1 --ranges 10.xx.xx.100-110 --netmask 255.255.255.0 --driver ovs --gateway 10.xx.xx.1 –vlan 361`
	3. Create Application Bundle with the network created based on ovs
	4. Application should be deployed successfully
	5. List the application instances
	`# robin instance list`
	6. Login to the application using
	`# rbash <instance container name>`
	7. Verify the ip address details using ifconfig
	8. Verify communication with other instance using ping command
	9. Verify internet connectivity by CURL to “google.com”

Expected Result	1. Network, subnet and ports are created successfully 2. PODs are instantiated successfully and have the expected IP address 3. If the application is deployed as 2 POD, there is connectivity between the 2 PODs 4. The POD is able to reach to internet
Status	OK
Comments	The OVS based ip-pool created successfully Application is deployed successfully with ovs ip-pool created The Application successfully configured with the ip address from the ip pool range. Ping to the other application on the same ovs ip-pool is successful Ping to the network gateway hosted in the switch is successful Curl to www.google.com is successful.

Robin Carrier grade

NUMA Awareness

Description	Test the NUMA Awareness behavior.
Objective	Verify the proper behavior of NUMA awareness.
Prerequisite/s	1. Robin Worker should be enabled with NUMA configurations
Test Execution	1. Login to Master Node 2. Run below command to verify the NUMA configurations of worker node `# robin host info <fqdn of worker node>` 3. Verify the NUMA Topology details discovered for the worker node by Robin
Expected Result	1. The NUMA Topology discovered by Robin should be displayed
Status	OK
Comments	Robin host information for the worker node successfully displays the NUMA topology, huge pages, isolated CPU configured, SRIOV virtual function devices, DPDK configured drivers and devices.

CPU Pinning

Description	CPU Pinning testing.
Objective	Verify that CPU pinning operates as expected. Items checked: • Simple CPU pinning with different number of CPUs (up to the number in NUMA).
Prerequisite	1. Worker Node should be configured with isolated CPU as listed in Grub settings under Appendix section. 2. Application bundle should be available in Robin with CPU cores reservation.
Test execution	1. Login to Robin Dashboard 2. Create Application using the application bundle 3. After the application is provisioned 4. Verify the cores allocated to the application

Expected Result	**1.** The cores allocated to the application is from the same NUMA and from the isolated CPU cores.
Status	OK
Comments	Application created successfully The containers provisioned is assigned to the CPU cores from the isolated CPU list of worker node.

Huge Pages

Description	Huge pages testing.
Objective	Verify that Huge pages are configured as expected. Items checked:
Prerequisite	1. Worker Node should be enabled with 1G Huge pages 2. Application bundle with apps configured with 1G huge pages should be available
Test Execution	1. Login to Robin Dashboard 2. Create Application with the bundle enabled for huge pages 3. The Application should be created successfully 4. Verify Application information to check huge pages allocation. `# robin app info <application name>`
Expected Result	1. The application should be deployed with Huge pages 2. The application information should display the huge page details.
Status	OK
Comments	The Application is successfully provisioned in Robin Cluster Robin command displays successfully the huge pages assigned to the applications The number of 1G huge pages available in the worker node is reflected correctly.

SRIOV

Description	Deploy PODs to use SR-IOV
Objective	Verify that PODs deploy on SR-IOV computes and use SR-IOV networks
Prerequisite/s	1. Worker Node should be enabled with SR-IOV configurations 2. Application bundle which supports SR-IOV should be present

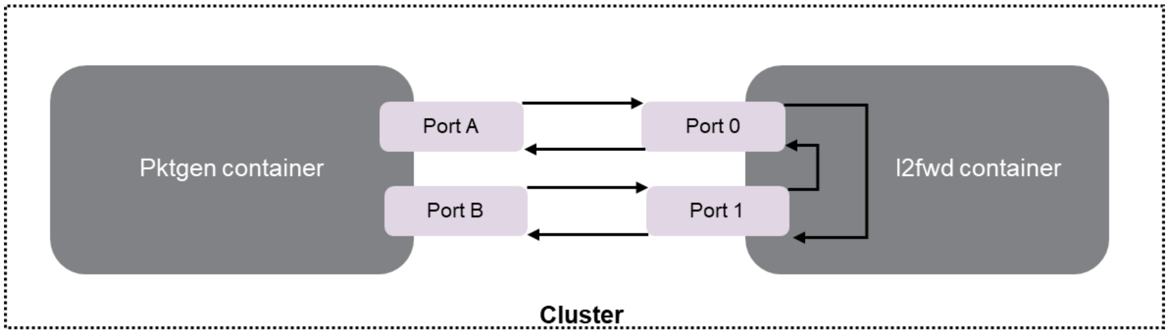
Test Execution	1. Login to Master Node
	2. Run below commands to create SR-IOV ip-pools
	`# robin vlan add <vlan1> --wait`
	`# robin vlan add <vlan2> --wait`
	`# robin ip-pool add <sriov net1> --ranges <net1 range> --netmask <net1 mask> --driver sriov --nictags name=<SR-IOV interface name> --ifcount 1 --vlan <vlan1>`
	`# robin ip-pool add <sriov net2> --ranges <net2 range> --netmask <net2 mask> --driver sriov --nictags name=<SR-IOV interface name> --ifcount 1 --vlan <vlan2>`
	3. Create application from Robin Dashboard using the created SRIOV networks
	4. Verify the SR-IOV VFs assignment to the application on Worker Node
	`# ip link show`

	5. Connect to application instances from Robin Master Node `# rbash <instance container name>` 6. Verify the IP addresses assigned to the container using ifconfig 7. Verify ping to the other instances 8. Verify ping to the external network
Expected Result	1. The SR-IOV ip-pools should be created 2. Application should be provisioned with the SR-IOV networks 3. IP addresses should be assigned to the instances 4. Network connectivity should be successful
Status	OK
Comments	Robin ip-pools with driver SRIOV are created successfully Application with SRIOV networks is created successfully The IP addresses are assigned to the instances from created ip-pools The VFs associated with the SRIOV PODs are visible in the worker node with proper VLAN tags associated. Ping to the other Pods within the same network is successful Ping to the gateway is successful Curl to www.google.com is successful

DPDK

Description	Deploy PODs with DPDK
Objective	Verify that the system deploys the POD with DPDK networking.
Prerequisite/s	1. The Worker Node should be enabled with DPDK configurations as mentioned in Appendix 2. SRIOV supported NIC is used in Worker node. Refer to Appendix for hardware BOM. VFs in the NIC will bind with DPDK driver 3. Application Bundle supporting DPDK should be available

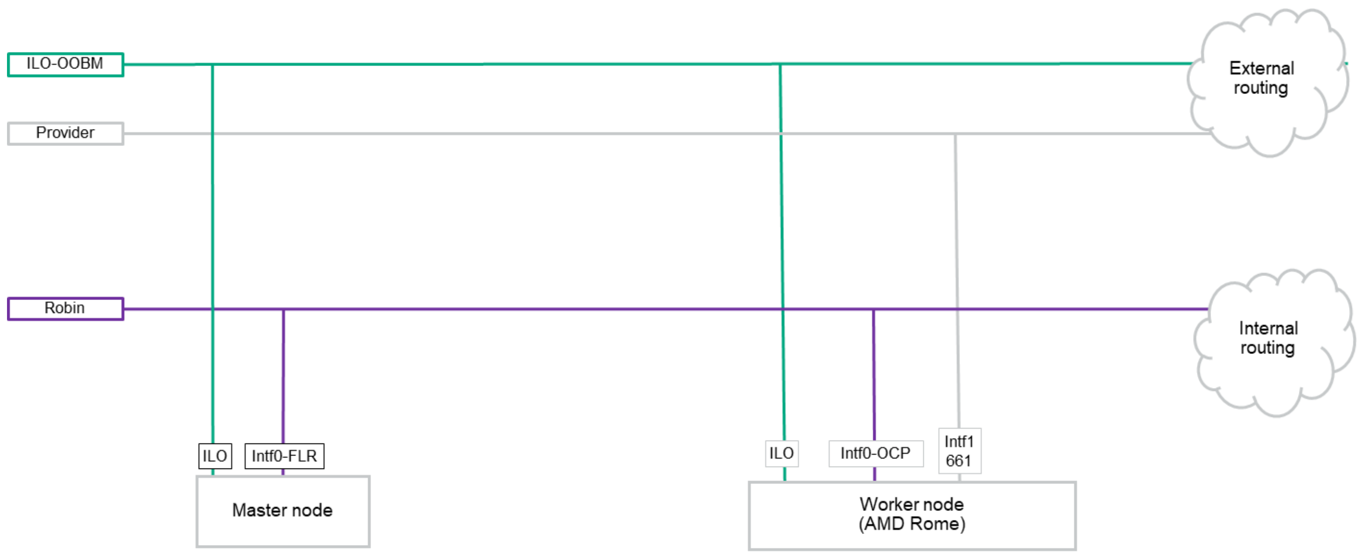
Test Execution	1. Login to Master Node
	2. Run below commands to create DPDK ip-pools
	`# robin vlan add <vlan1> --wait`
	`# robin ip-pool add <dpdk net1> --driver sriov --range <dpdk net1 pool> --prefix 24 --vfdriver vfio-pci --nictags=name=<interface1 name> --vlan <vlan1>`
	`# robin ip-pool add <dpdk net2> --driver sriov --range <dpdk net2 pool> --prefix 24 --vfdriver vfio-pci --nictags=name=<interface2 name> --vlan <vlan1>`
	3. Create application from Robin Dashboard using the created DPDK networks
	4. Connect to l2fwd application instance from Robin Master Node in new terminal
	`# rbash <appname>. l2fwd.01`
	`[l2fwd-01 ~]#   /.robin/scripts/cmds.sh  # (which display the l2fwd command to execute)`
	`[l2fwd-01 ~]#   /root/l2fwd/l2fwd -l 10,2,1 -w $ROBIN_MYNET1_PCI_ADDR -w $ROBIN_MYNET2_PCI_ADDR -n 4 --in-memory -- -p 3     # (Modify MYNET1 and MYNET2 to the DPDK network names)`
	`# Note down the Port 0 Mac and Port 1 Mac displayed`
	5. Connect to pktgen application instance from Robin Master Node
	`# rbash <appname>. pktgen.01`
	`[ pktgen-01 ]# ~]#   /.robin/scripts/cmds.sh  # (which display the pktgen command to execute)`
	`[ pktgen-01 ]# ~]#   /root/pktgen/pktgen -l 8,7,6,5,4 -w $ROBIN_MYNET1_PCI_ADDR -w $ROBIN_MYNET2_PCI_ADDR -n 4 --in-memory -- -m [8:7].0 -m [6:5].1  #(Modify MYNET1 and MYNET2 to the dpdk network names)`
	`set 0 dst mac <l2fwd app Port 0 MAC>`
	`set 1 dst mac <l2fwd app Port 1 MAC>`
	`set 0,1 proto udp`
	`set 0,1 rate 80`
	`set 0,1 size 1024`
	`start 0,1`
	`# Verify the traffic Rx/Tx between the Pktgen and L2fwd instances using DPDK`

Expected Result	1. IP pools should be created with vfio-pci driver 2. Application should be provisioned with DPDK bundle 3. Traffic should flow between pktgen and l2fwd instances.
Status	OK
Comments	Robin DPDK IP pools with SRIOV driver and vfio-pci VF driver are created successfully Application with DPDK IP pools is created successfully  Pktgen container Port A Port B Port 0 Port 1 l2fwd container Cluster Pktgen is a traffic generator application. Start pktgen app successfully L2fwd forwarding packet processing application using DPDK. It which takes traffic from a single RX port and transmits it with few modification on a single TX port. Configure the same VLAN on both connection pairs: • VLAN x on PortA and port0 • VLAN x on PortB and port1 Start l2fwd app successfully. The port 0 and port 1 Rx/Tx stats are reflecting with packets count received and transmitted successfully.

Appendix 1: Worker node hardware BOM

Quantity	Product #	Product Description
1	P18606-B21	HPE ProLiant DL325 Gen10 Plus Configure-to-order Server
1	P19622-L21	AMD EPYC 7702P (2.0GHz/64-core/200W) FIO Processor Kit for HPE ProLiant DL325 Gen10 Plus
16	P07646-B21	HPE 32GB (1x32GB) Dual Rank x4 DDR4-3200 CAS-22-22-22 Registered Smart Memory Kit
1	P15511-B21	HPE DL325 Gen10 Plus 8SFF Smart Carrier FIO Drive Cage Kit
1	P16979-B21	HPE DL325 Gen10 Plus 8SFF Smart Array Modular Controller Cable Kit
4	872479-B21	HPE 1.2TB SAS 12G Enterprise 10K SFF (2.5in) SC 3yr Wty Digitally Signed Firmware HDD
1	869081-B21	HPE Smart Array P408i-a SR Gen10 (8 Internal Lanes/2GB Cache) 12G SAS Modular LH Controller
1	782961-B21	HPE Smart Array Controller Batteries
1	P08452-B21	HPE Ethernet 10Gb 2-port SFP+ QL41132HQCU OCP3 Adapter
1	870825-B21	HPE Ethernet 10/25Gb 2-port 661SFP28 Adapter
2	865408-B21	HPE 500W Flex Slot Platinum Hot Plug Low Halogen Power Supply Kit

Appendix 2: Deployment diagram



Appendix 3: Configuration parameters

BIOS settings

The BIOS settings should be enabled for Virtualization, NUMA and SRIOV.
ProcAMDBoost: "Enabled",
ProcAmdIOMMU: "Enabled",
ProcAmdVirtualization: "Enabled",
Sriov: “Enabled”
NumaGroupSizeOpt: "Clustered",
NumaMemoryDomainsPerSocket: "Auto",

Grub settings

- Parameters:

```
GRUB_TIMEOUT=5
GRUB_DISTRIBUTOR="$(sed 's, release .*$,,g' /etc/system-release)"
GRUB_DEFAULT=saved
GRUB_DISABLE_SUBMENU=true
GRUB_TERMINAL_OUTPUT="console"
GRUB_CMDLINE_LINUX="crashkernel=auto rd.lvm.lv=centos/root
rd.lvm.lv=centos/swap rhgb quiet amd_iommu=pt amd_iommu=on hugepagesz=1G
hugepages=50 isolcpus=1-50"
GRUB_DISABLE_RECOVERY="true"
```

- SRIOV/DPDK:

SR-IOV requires support in the BIOS as well as in the operating system instance or hypervisor that is running on the hardware NIC naming

```
[root@pocf02 ~]# cat /etc/udev/rules.d/70-persistent-net.rules
ACTION=="add", SUBSYSTEM=="net", ATTR{address}=="00:25:90:fa:7b:4f",
ATTR{type}=="1", NAME:="sriov0"
ACTION=="add", ...
```

Configuring Virtual functions:

```
[root@pocf02 ~]# cat /etc/udev/rules.d/75-allocate-sriov-vfs.rules
ACTION=="move", SUBSYSTEM=="net", KERNEL=="sriov[0-9]*", RUN+="/bin/sh
-c '/usr/bin/echo 4 > /sys/class/net/%k/device/sriov_numvfs'"
ACTION=="change", SUBSYSTEM=="net", KERNEL=="sriov[0-9]*",
RUN+="/bin/sh
-c '/usr/bin/echo 4 > /sys/class/net/%k/device/sriov_numvfs'"
```

Verifying Virtual functions:

```
[root@pocf02 ~]# ip link show sriov0
```

```
3: sriov0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc mq state UP
mode DEFAULT group default qlen 1000
link/ether 00:25:90:fa:7b:4f brd ff:ff:ff:ff:ff:ff
vf 0 MAC 9e:62:16:73:78:c2, spoof checking on, link-state auto,
trust off, query_rss off
vf 1 MAC de:ed:94:72:47:f2, spoof checking on, link-state auto,
trust off, query_rss off
vf 2 MAC d2:fe:8f:2f:d2:d0, spoof checking on, link-state auto,
trust off, query_rss off
vf 3 MAC 00:00:00:00:00:00, spoof checking on, link-state auto,
trust off, query_rss off
```

Security settings

- Disable SELinux
- Disable Firewall

Appendix 4: Artifact Files

OS Image

In the ATP, Cent OS is used as OS:

- Centos 7.7 kernel 3.10.0-1062

Robin Images

Pre-installation script to validate the host settings.

Note: Pre-install script output errors are fixed. Warnings can be ignored

In the ATP, 3 images were used. They are:

- Robin installer scripts
- Kubernetes images
- Robin application as container images

Application Bundle

- MySQL Bundle - docker-mysql-5.7-333_master.tar.gz
- DPDK application Bundle - docker-dpdk-v2-517_master.tar.gz

Drivers and compiled image

The driver versions are listed below:

VFdriver	vfio-pci
i40e Driver Version	2.8.43 firmware-version: 6.80 0x80003f2b 1.2007.0
i40evf Driver version	3.6.15
iavf version	3.2.3-k
DPDK Version	20.05

Firmware components

The versions are listed below:

ILO 5	2.14 Feb 11 2020
System ROM	A43 v1.16 (01/10/2020)
HPE Ethernet 10/25Gb 2-port 661SFP28 Adapter	1.2007.0