

# R3 Test Document of IEC Type 5: SmartNIC for Integrated Edge Cloud (IEC) Blueprint Family

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## Introduction

The R3 release will evaluation the throughput and packet forwarding performance of the Mellanox BlueField SmartNIC card.

A DPDK based [Open vSwitch](#) (OVS-DPDK) is used as the virtual switch, and the network traffic is virtualized with the VXLAN encapsulation.

Currently, the community version OVS-DPDK is considered experimental and not mature enough, it only supports "partial offload" which cannot utilize the full performance advantage of Mellanox NICs. Thus the OVS-DPDK we used is a fork of the community Open vSwitch. We develop our own offload code which enables the full hardware offload with DPDK rte\_flow APIs.

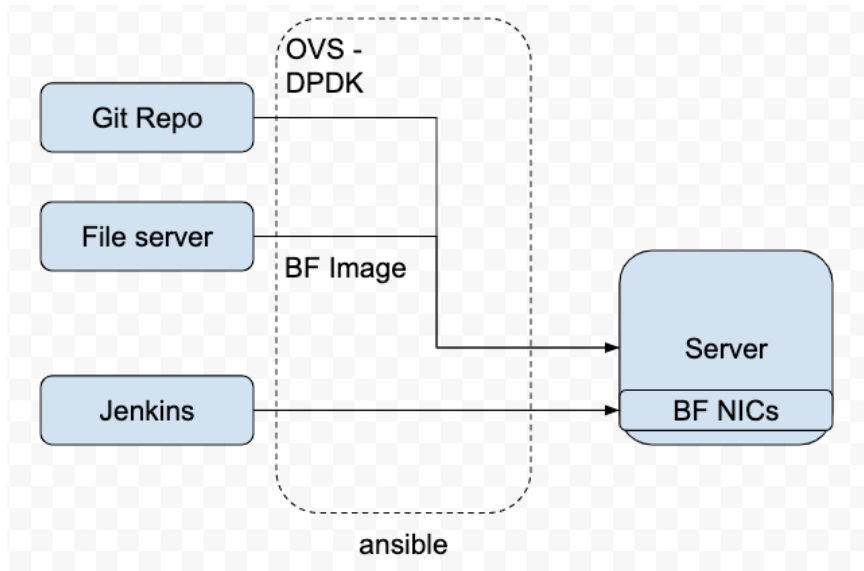
We have plans to open-source this OVS-DPDK. More details will be provided in future documentation.

## Akraio Test Group Information

### Overall Test Architecture

To deploy the Test architecture, we use a private Jenkins and an Intel server equipped with a BlueField v1 SmartNIC.

We use [Ansible](#) to automatically setup the filesystem image and install the OVS-DPDK in the SmartNICs.



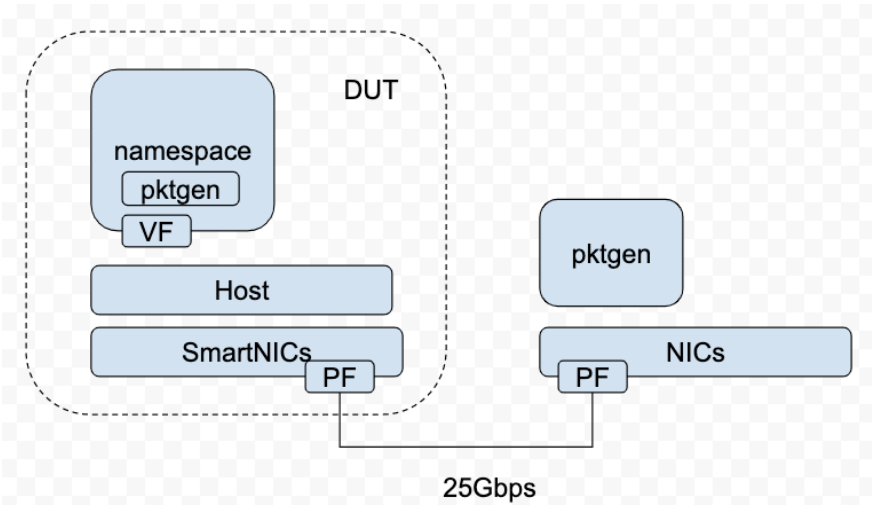
The File Server is a simple [Nginx](#) based web server where stores the BF drivers, FS image.

The Git repo is our own git repo where hosts OVS-DPDK and DPDK code.

The Jenkins will use ansible plugin to download BF drivers and FS image in the test server and setup the environment according to the ansible-playbook.

Image	download link
BlueField-2.5.1.11213.tar.xz	<a href="https://www.mellanox.com/products/software/bluefield">https://www.mellanox.com/products/software/bluefield</a>
core-image-full-dev-BlueField-2.5.1.11213.2.5.3.tar.xz	<a href="https://www.mellanox.com/products/software/bluefield">https://www.mellanox.com/products/software/bluefield</a>
mft-4.14.0-105-x86_64-deb.tgz	
MLNX_OFED_LINUX-5.0-2.1.8.0-debian8.11-x86_64.tgz	

## Test Bed



The testbed setup is shown in the above diagram. DUT stands for Device Under Test

## Test Framework

The software used and the OVS-DPDK setup is shown below.

Type	Description
SmartNICs	BlueField v1, 25Gbps
DPDK	version 19.11
vSwitch	OVS-DPDK 2.12 with VXLAN DECAP/ENCAP offload enabled. <a href="https://github.com/bytedance/ovs-dpdk">https://github.com/bytedance/ovs-dpdk</a>

```

root@bluefield:/home/ovs-dpdk# ovs-vsctl show
2dccd148-526c-44a5-9351-67b04c5e2da4
    Bridge br-int
        datapath_type: netdev
        Port vxlan-vtp
            Interface vxlan-vtp
                type: vxlan
                options: {dst_port="4789", key=flow, local_ip="192.168.1.1", remote_ip=flow, tos=inherit}
        Port br-int
            Interface br-int
                type: internal
        Port pflhpf
            Interface pflhpf
                type: dpdk
                options: {dpdk-devargs="class=eth,mac=ae:d8:8a:c5:22:fb"}
    Bridge br-ex
        datapath_type: netdev
        Port br-ex
            Interface br-ex
                type: internal
        Port p1
            Interface p1
                type: dpdk
                options: {dpdk-devargs="class=eth,mac=98:03:9b:af:7b:0b"}

```

```

root@bluefield:/home/ovs-dpdk# ovs-vsctl list open_vswitch
_uuid                : 2dccd148-526c-44a5-9351-67b04c5e2da4
bridges              : [22334686-733a-445e-9130-a42009a3586e, 38af610d-01f7-497d-878b-c6b6a44abf6a]
cur_cfg              : 10
datapath_types       : [netdev, system]
datapaths            : {}
db_version           : []
dpdk_initialized     : true
dpdk_version         : "DPDK 19.11.0"
external_ids         : {}
iface_types          : [dpdk, dpdkr, dpdkvhostuser, dpdkvhostuserclient, erspan, geneve, gre, internal,
ip6erspan, ip6gre, lisp, patch, stt, system, tap, vxlan]
manager_options      : []
next_cfg             : 10
other_config         : {dpdk-extra="-w 03:00.1,representor=[0,65535] --legacy-mem ", dpdk-init="true", hw-
offload="true"}
ovs_version          : []
ssl                  : []
statistics           : {cpu="16", file_systems="/,13521220,3918464 /data,243823,2064 /boot,357176,61104",
load_average="1.41,1.37,1.36", memory="16337652,5589928,1707640,0,0", process_ovs-vswitchd="
5959388,256352,11515170,0,11484792,11484792,7", process_ovsdb-server="12620,6260,13190,0,68233832,68233832,6"}
system_type          : []
system_version       : []

```

## Traffic Generator

We will use DPDK pktgen as the Traffic Generator.

## Test API description

The test is to evaluate the performance of SmartNIC offloading.

Thus we currently don't have any Test APIs provided.

## Test Dashboards

## Functional Tests

Open vSwitch itself contains a test suite for functional test, the link is <http://docs.openvswitch.org/en/latest/topics/testing/>

We have run the basic test suite according to the link.

By running,

```
make check TESTSUITEFLAGS=-j8
```

We got the below results.

Total Tests	Test Executed	Pass	Fail	In Progress
2225	2200	2198	2	0

The two failed cases are about sFlow sampling. We are investigating the internal reason.

25 cases are skipped due to the configuration.

## Performance Tests

### Single PF

OVS-DPDK	OF rules	Traffic	pktgen pps	received pps (hw)	received pps (no hw)	PMD idle cycles w/ hw offload	PMD idle cycles w/o hw offload
1 PMD(s)	Directly forwarding without the match  "in_port=vxlan-vtp, actions=output: pf1hpf"	single TCP flow with VXLAN encapsulation	24.6Mpps	23.9Mpps	745156	99%	0%

### Single PF, Single VF

OVS-DPDK	OF rules	Traffic	pktgen pps	received pps (hw)	received pps (no hw)	PMD idle cycles w/ hw offload	PMD idle cycles w/o hw offload
1 PMD(s)	Directly forwarding without the match  "in_port=vxlan-vtp, actions=output: pf1vf0"	single TCP flow with VXLAN encapsulation	24.6Mpps	23.8Mpps	747097	99%	0%
1 PMD(s)	match and forwarding  100 rules  "in_port=vxlan-vtp,ip,nw_dst=10.1.1.[1-100] actions=pf1vf0"	100 flows with nw_dst=10.1.1.[1-100]	24.6Mpps	21.6Mpps  (100 megafloWS offloaded)	624161	99%	0%
1 PMD(s)	match and forwarding  1000 rules  "in_port=vxlan-vtp,ip,nw_dst=10.1.[1-10].[1-100] actions=pf1vf0"	1000 flows with nw_dst=10.1.[1-10].[1-100]  891 flows  (due to pktgen limit, only 891 flows are loaded)	24.6Mpps	23.3Mpps  (891 megafloWS offloaded)	524144	99%	0%

### Single PF, 4 VFs (only test with offloaded)

OVS-DPDK	OF rules	Traffic	pktgen pps	received pps (VF0)	received pps (VF1)	received pps (VF2)	received pps (VF3)	in total
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1 PMD(s)	match and forwarding  1000 rules  "in_port=vxlan-vtp,ip,nw_dst=10.1.[1-10].[1-25] actions=pf1vf0"  "in_port=vxlan-vtp,ip,nw_dst=10.1.[1-10].[26-50] actions=pf1vf1"  "in_port=vxlan-vtp,ip,nw_dst=10.1.[1-10].[51-75] actions=pf1vf2"  "in_port=vxlan-vtp,ip,nw_dst=10.1.[1-10].[75-100] actions=pf1vf3"	1000 flows with nw_dst=10.1.[1-10].[1-100]  891 flows  (due to pktgen limit, only 891 flows are loaded)	24.6Mpps	5891903	5781310	5767825	5380159	23258808  ~ 23.2 Mpps
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## Additional Testing

n/a

## Bottlenecks/Errata

n/a