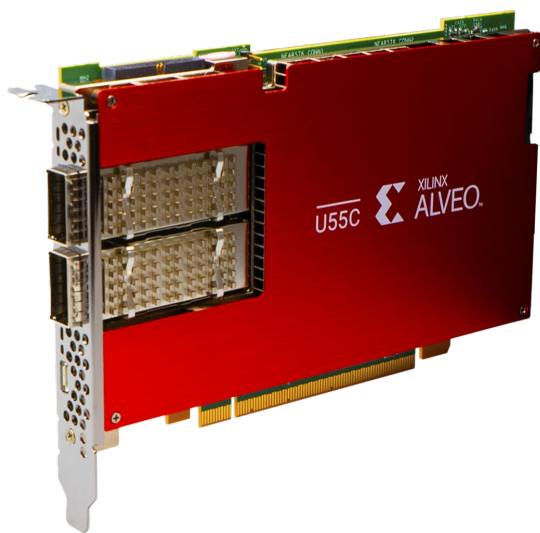


The ESnet Framework: Showcasing P4 Applications on Alveo Cards

MOHAMMAD FIRAS SADA

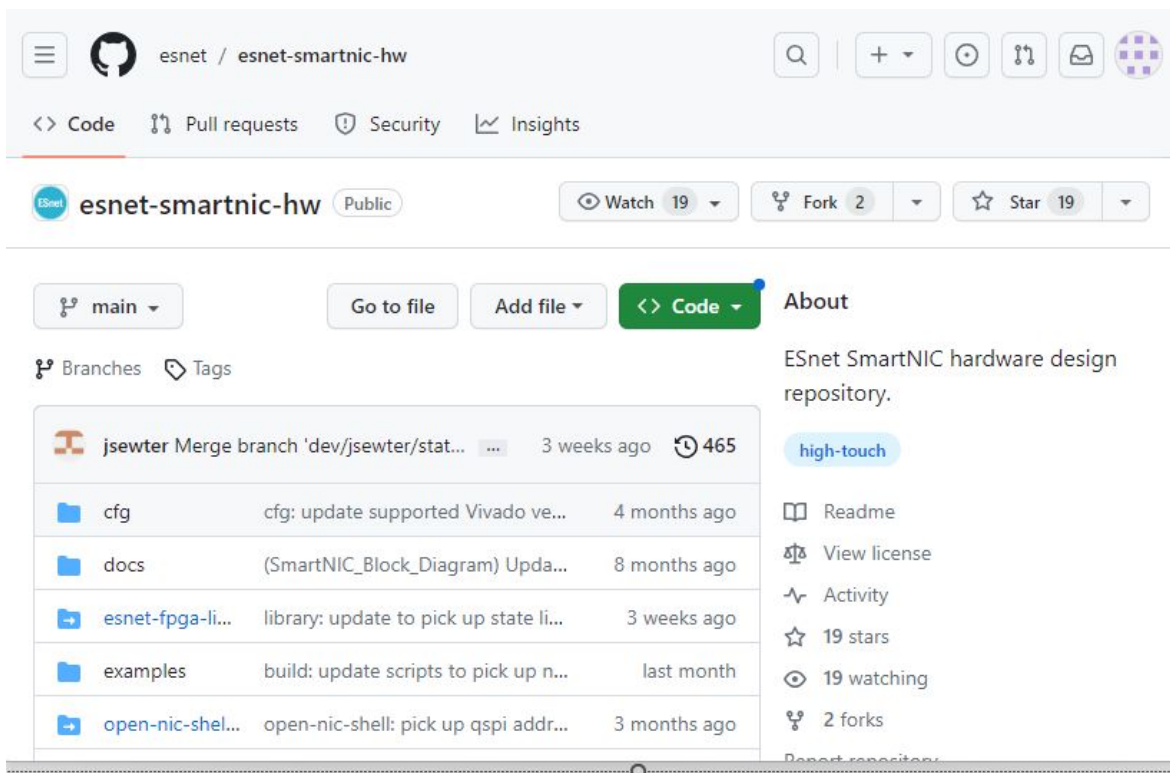
The Xilinx Alveo FPGAs

- High-performance programmable accelerators.
- Workloads: Networking, Security, Compute, and Artificial Intelligence (AI).
- 2x100Gbps ports for being used as programmable SmartNICs.

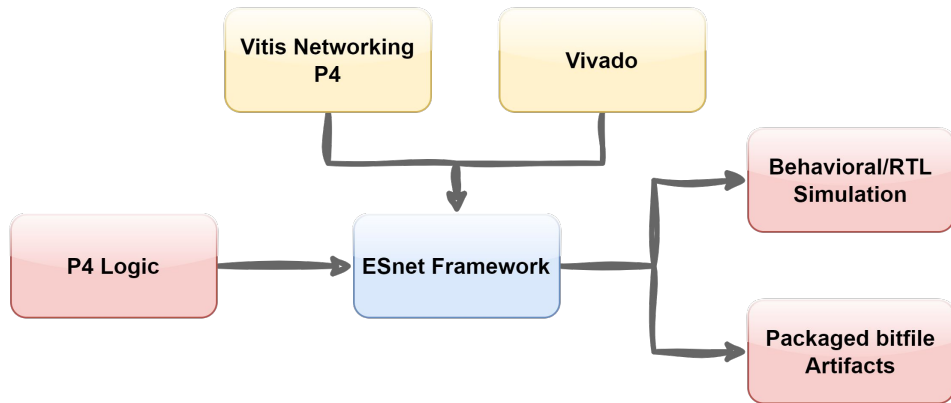


Understanding the ESnet Framework

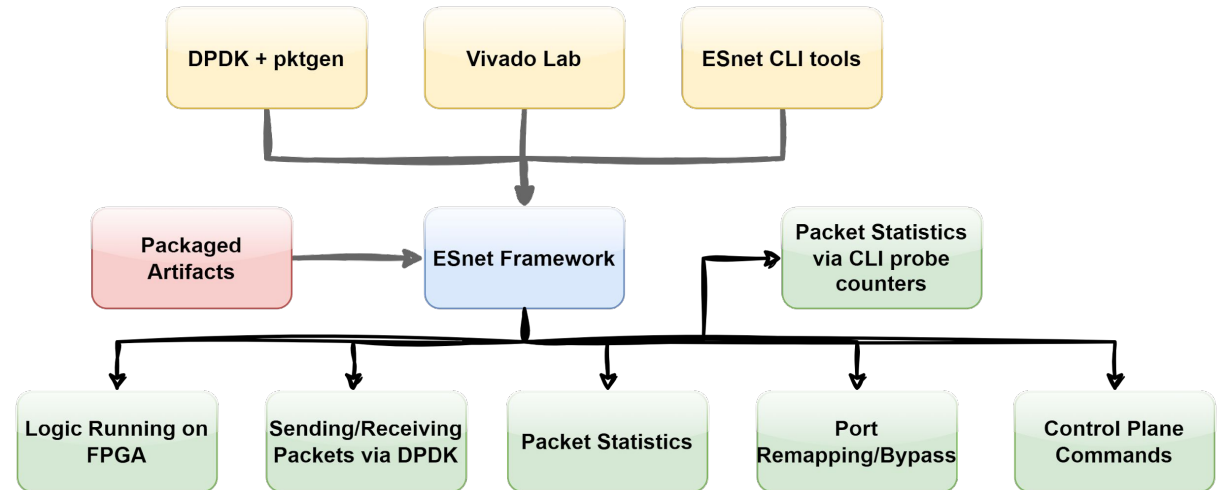
- ESnet SmartNIC framework provides an entire workflow for Xilinx Alveo FPGAs.
- It is open-source (on github).
- It seamlessly integrates Xilinx tools along with various tools like DPDK to provide an easy way of programming Alveo FPGAs as SmartNICs.
- Various debugging, testing and simulating tools.
- Containerized environment that makes it as easy as plug-and-play for P4 on FPGAs.



Development and Deployment



Development

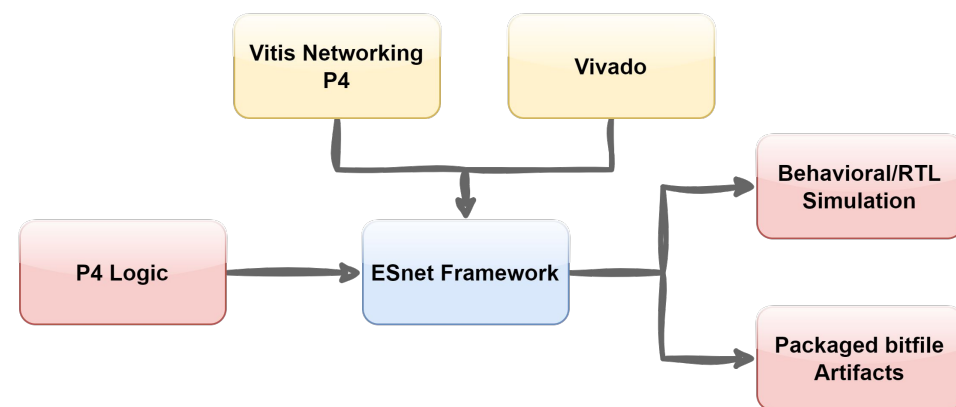


Deployment

Writing P4 programs

The *esnet-smartnic-hw* repository:

1. ESnet SmartNIC Hardware Design Repository
2. Based on the AMD (Xilinx) OpenNIC Shell
3. Implements a P4-programmable packet processing core within the OpenNIC shell
4. Includes:
 1. **Behavioral Simulation** test files (against packets)
 2. **RTL simulation** test files
 3. **Build scripts** for compiling a user P4 file into a loadable bitfile
5. Requires: **Ubuntu 20.04 + AMD (Xilinx) Vivado software tool suite + VitisNetP4 IP core**



Writing P4 programs

```
> git clone https://github.com/esnet/esnet-smartnic-hw.git
```

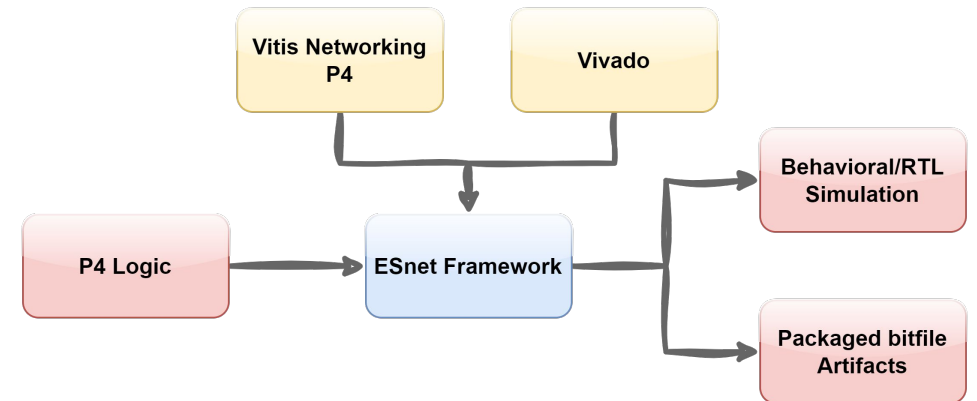
```
> cd esnet-smartnic-hw
> git submodule update --init --recursive
```

```
> source /tools/Xilinx/Vivado/2023.1/settings64.sh
```

```
> cd examples/p4_only
> make
```



artifacts.au55c.p4_only.0.zip

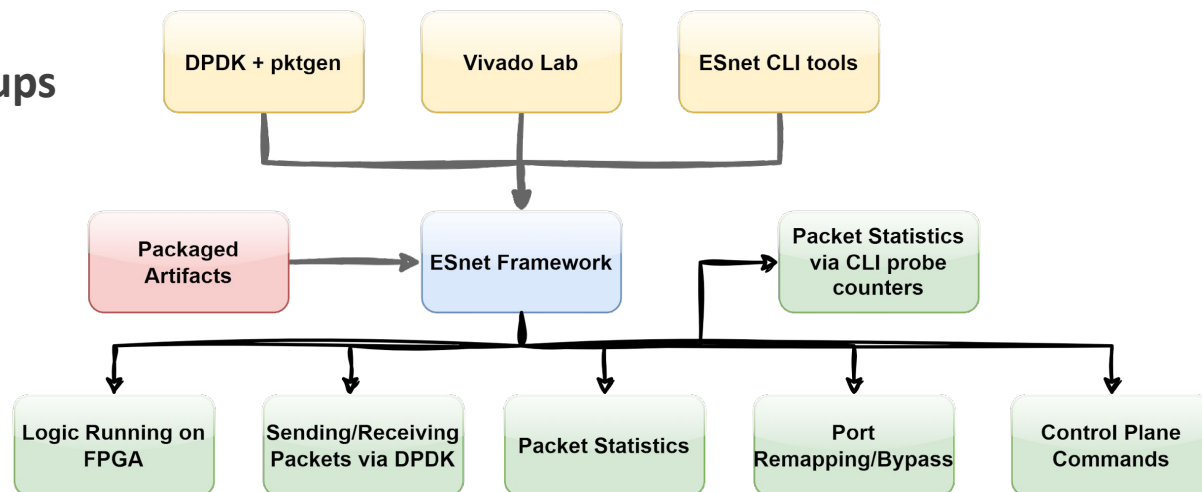


Deployment

Deployment Repositories:

1. smartnic-dpdk-docker:
 - Container with dpdk + xilinx qdma + pktgen-dpdk for use in high speed test setups
 - Result: docker image

2. xilinx-labtools-docker:
 - Docker image to provide Xilinx LabTools
Most importantly: *vivado_lab*
 - Result: docker image



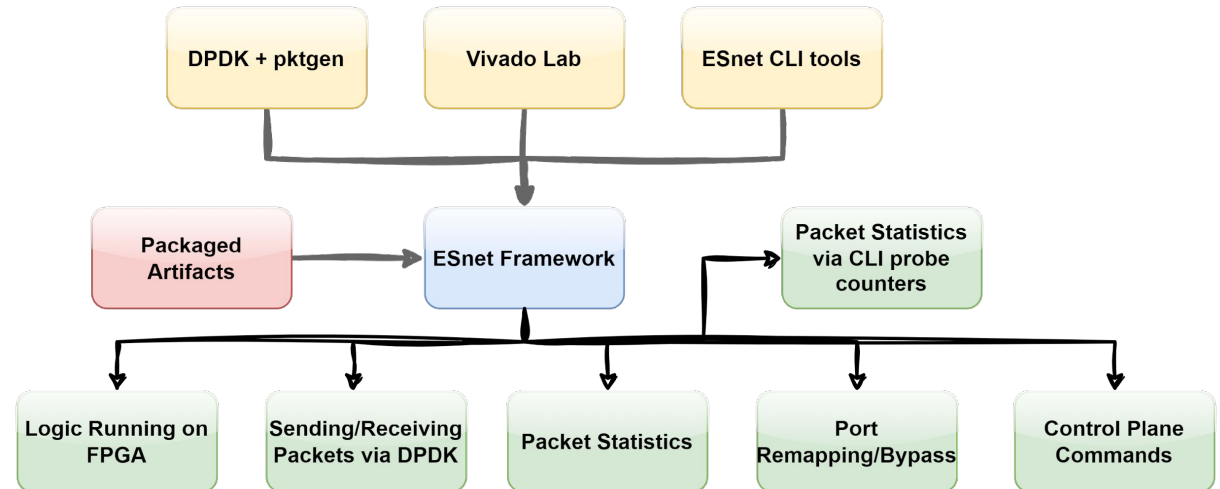
Deployment

Deployment Repositories:

3. esnet-smartnic-fw:

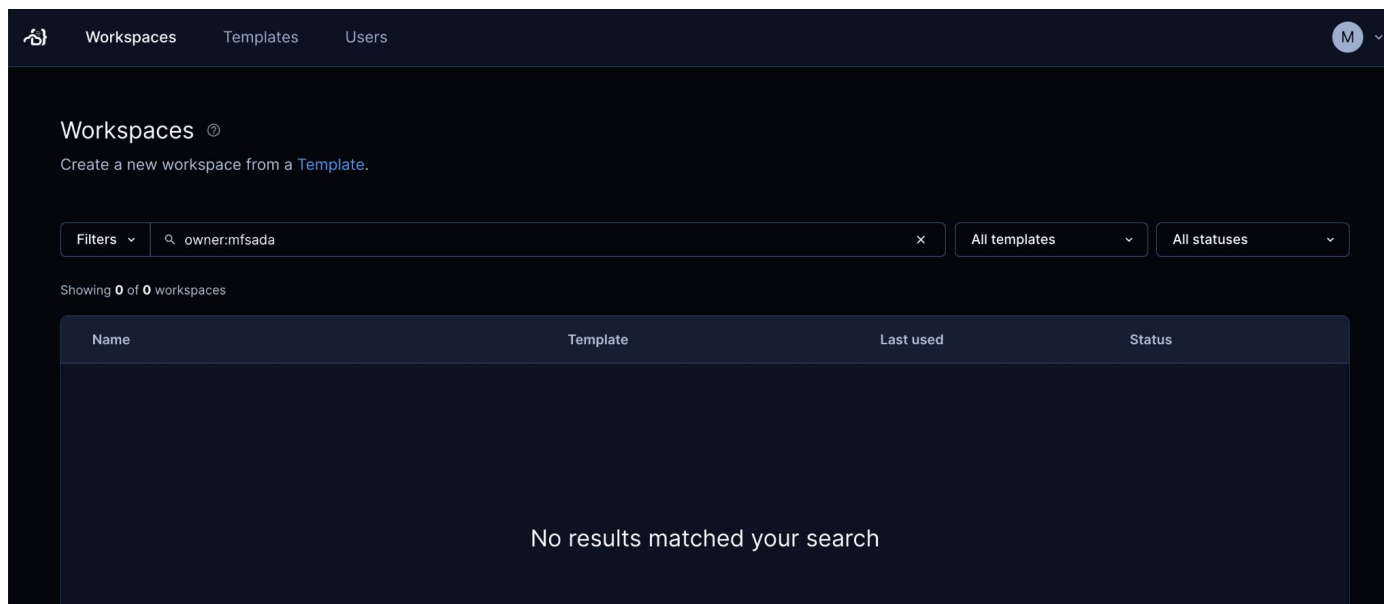
- SmartNIC firmware design repository
- Artifacts + 2 previous docker images + esnet-smartnic-fw docker image + **= SmartNIC Stack**

As simple as running: `./build.sh`

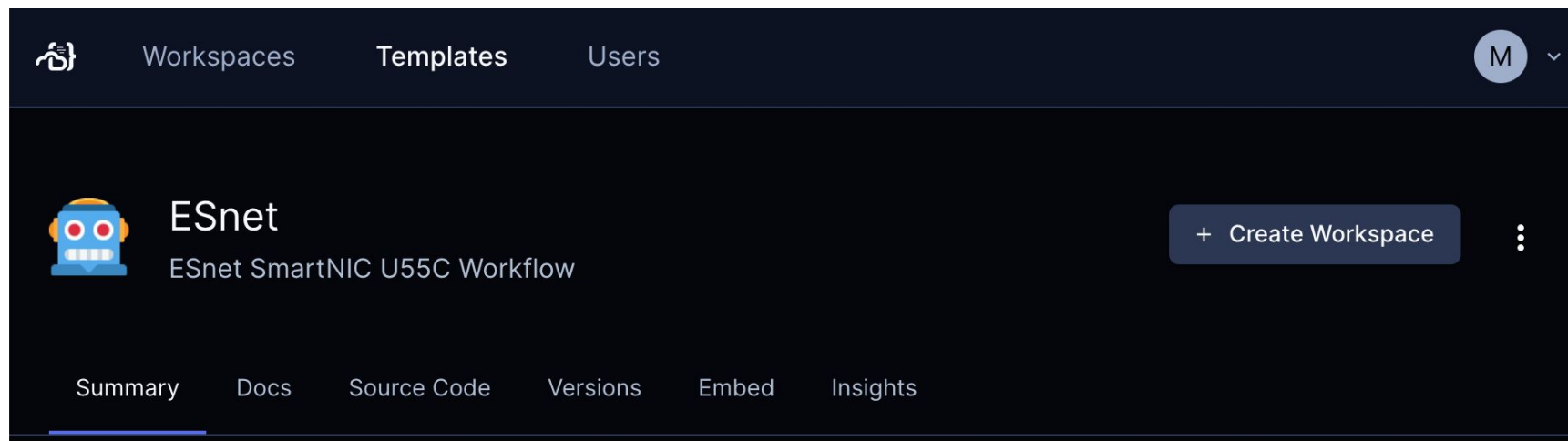


Getting Started on NRP

- Go to <https://portal.nrp-nautilus.io/>
- Create an account
- Request access to the ***coder*** namespace
- Go to: <https://coder.nrp-nautilus.io/> and login:



Getting Started on NRP



Getting Started on NRP

```

Terminal · msada/sidecar1 - Coder
coder.nrp-nautilus.io/@msada/sidecar1.main/terminal?reconnect=b7706676-64f7-4987-a162-dd899affc009

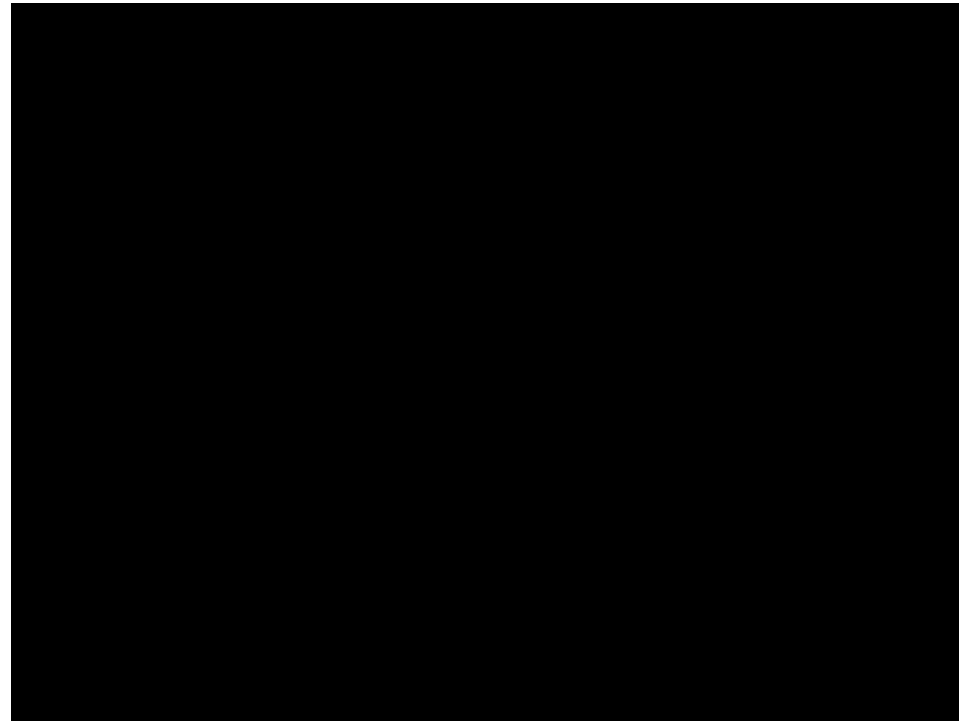
coder@coder-msada-sidecar1:~/esnet-smartnic-fw/sn-stack$ docker compose up -d
[+] Running 7/9
 ✓ Network sn-stack-coder_default          Cr...          0.0s
 ✓ Volume "sn-stack-coder_bitfiles"       Created        0.0s
 :: Container sn-stack-coder-xilinx-hwserver-1 Starting       18.1s
 :: Container sn-stack-coder-smartnic-unpack-1 Starting       18.1s
 ✓ Container sn-stack-coder-smartnic-hw-1   Created        5.7s
 ✓ Container sn-stack-coder-smartnic-p4-1   Created        3.6s
 ✓ Container sn-stack-coder-smartnic-devbind-1 Created        3.6s
 ✓ Container sn-stack-coder-smartnic-fw-1   Created        3.5s
 ✓ Container sn-stack-coder-smartnic-dpdk-1 Created        1.8s

```

Getting Started on NRP

```
coder@coder-msada-sidecar1:~/esnet-smartnic-fw/sn-stack$  
coder@coder-msada-sidecar1:~/esnet-smartnic-fw/sn-stack$ docker compose exec smartnic-dpdk bash  
root@smartnic-dpdk:/# exit  
exit  
coder@coder-msada-sidecar1:~/esnet-smartnic-fw/sn-stack$ docker compose exec smartnic-fw bash  
root@smartnic-fw:/#
```

Demo



Resources

The ESnet Framework:



Getting Started on NRP:



Our ESnet Tutorial:



email: msada@hawk.iit.edu
mfsada@ucsd.edu

Getting Started on FABRIC:



Our ESnet Video Tutorial:

