

#### The ESnet Framework: Showcasing P4 Applications on Alveo Cards

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## The Xilinx Alveo FPGAs

- High-performance programmable accelerators.
- Workloads: Networking, Security, Compute, and Artificial Intelligence (AI).
- 2x100Gbpgs ports for being used as programmable SmartNICs.







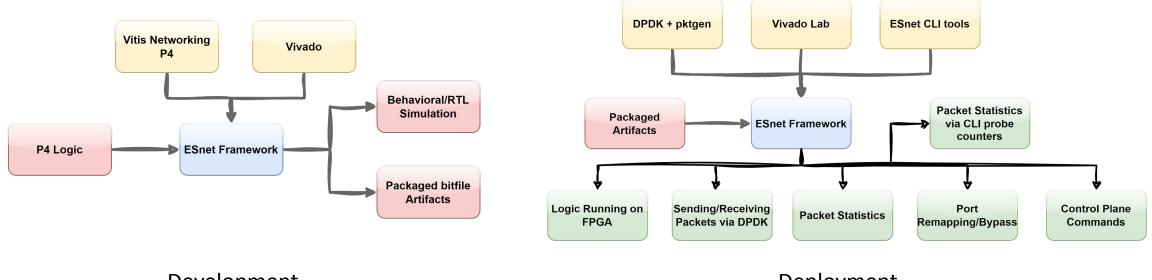
## Understanding the ESnet Framework

- 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.

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### **Development and Deployment**



Development

Deployment

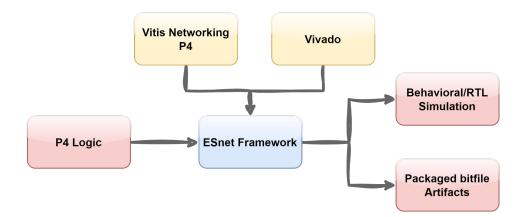


## Writing P4 programs

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

$\left( \right)$	> git clone https://github.com/esnet/esnet-smartnic-hw.git	
	> cd esnet-smartnic-hw > git submodule updateinitrecursive	
	> source /tools/Xilinx/Vivado/2023.1/settings64.sh	Vitis Networking P4 Vivado
		Behavioral/RTL Simulation
	> cd examples/p4_only > make	P4 Logic ESnet Framework
/		Packaged bitfile Artifacts

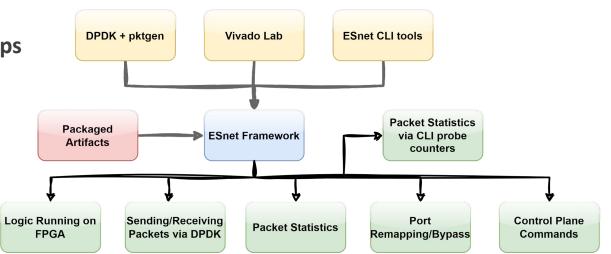
artifacts.au55c.p4\_only.0.zip



## 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



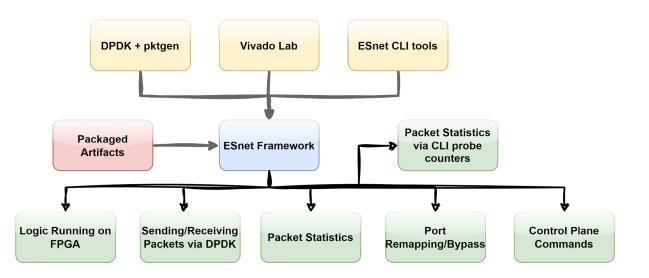


## Deployment

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

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#### Getting Started on NRP

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Sum	nmary	Docs	Source Code	Versions	Embed	Insights			



### 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-f	w/sn-stack\$ docker compos	se 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

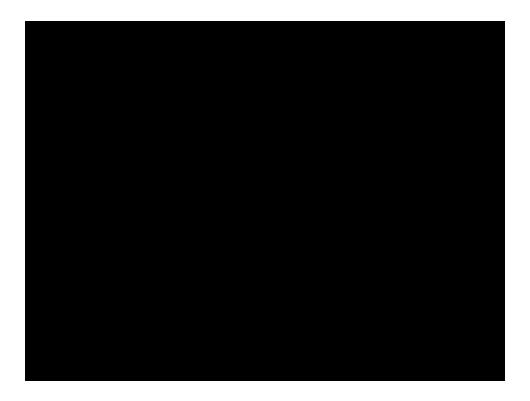
[coder@coder-msada-sidecar1:~/esnet-smartnic-fw/sn-stack\$ [coder@coder-msada-sidecar1:~/esnet-smartnic-fw/sn-stack\$ docker compose exec smartnic-dpdk bash [root@smartnic-dpdk:/# exit exit

[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:** 



**Getting Started on FABRIC:** 

**Our ESnet Tutorial:** 



**Our ESnet Video Tutorial:** 

email: <u>msada@hawk.iit.edu</u> <u>mfsada@ucsd.edu</u>





