

# Deploying P4 Applications in Server-Based Networks

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# P4 in Server-Based Networking: Diverse Applications | NETRONOME

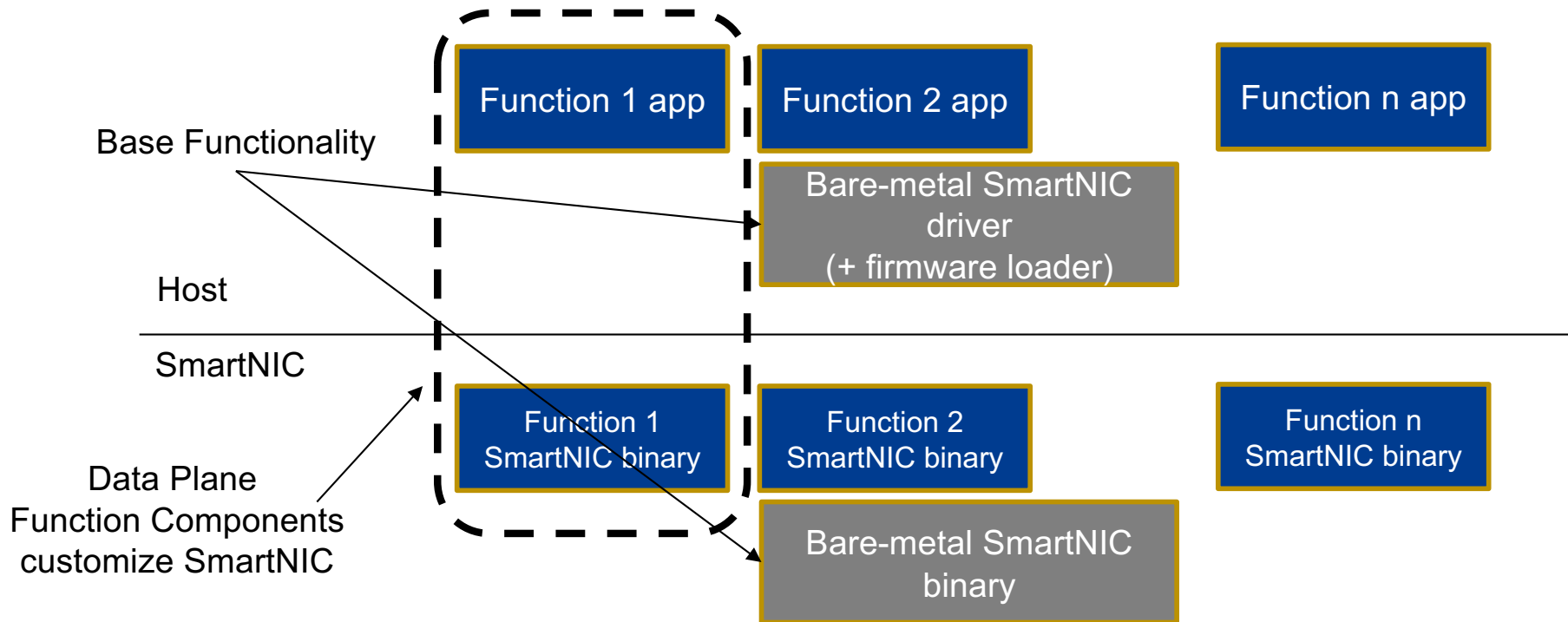
- New complex use cases drive server-based networking requirements
  - Virtualization, NFV, Security, SDN, Analytics, Streaming
- P4 used in diverse applications for server-based networking
  - P4 applications on Netronome SmartNICs:
    - Connection authentication, stateful security appliance, flow aggregation, telemetry, consensus as a service, and others in development
- Modern data center workloads are elastic
  - Networking requirements change as rapidly as the workloads
- Need to easily manage and operate P4 applications

To Scale: Need to manage server-based networking P4 apps like server software apps

Step	Netronome	Xilinx	
Develop P4 App	Programmers' Studio IDE	Vivado Design Suite	Vendor-specific
Compile into Binary	SDK 6.0 Compiler	Xilinx Vivado + SDNet	
Load Executable	SDK Linker/Loader	Xilinx Vivado + SDNet	
Configure Application	Rule updates through server		Application-specific
Launch Application	Control application through server		

Experience with Paxos on Netronome SmartnNIC and Xilinx NetFPGA

P4-based SmartNIC applications can be managed like other server applications.



A "Bare-Metal" SmartNIC model can simplify function management

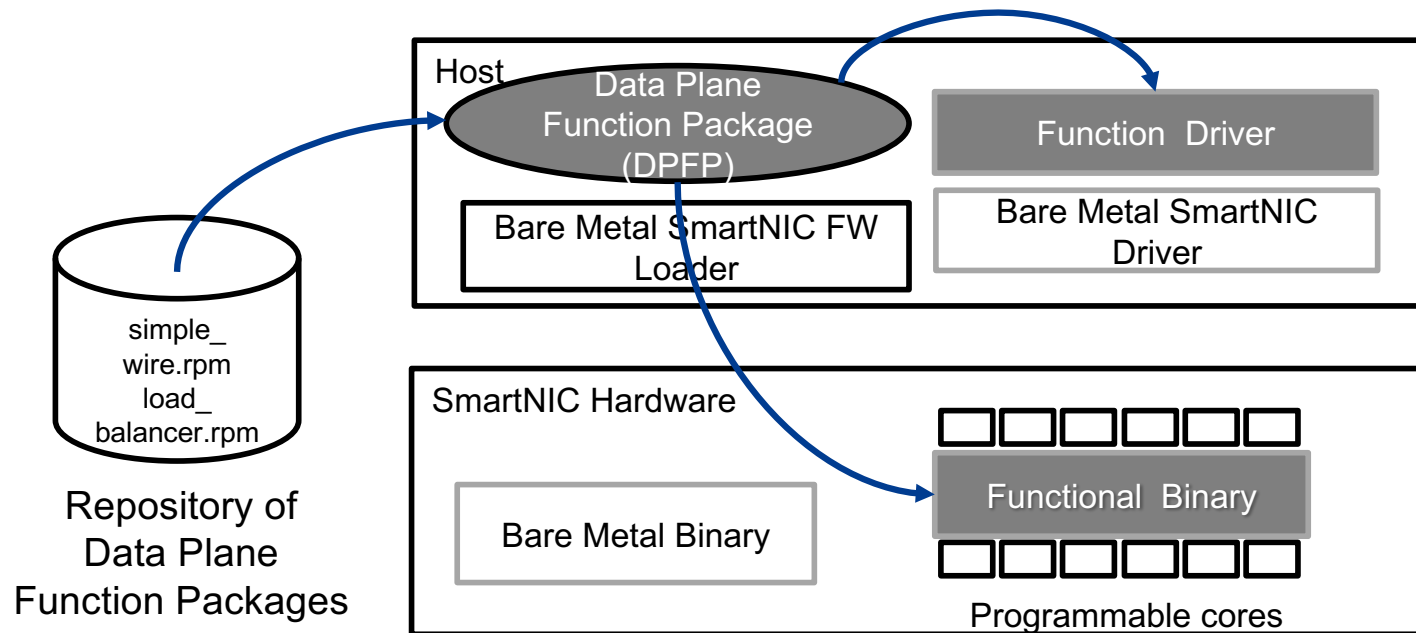
## Create Data Plane Function Packages

- A standard binary package format
- Combine Function app and Function binary components
- Should only depend on Bare metal driver and Bare metal binary
- Common installation and configuration locations

## Leverage package management infrastructure

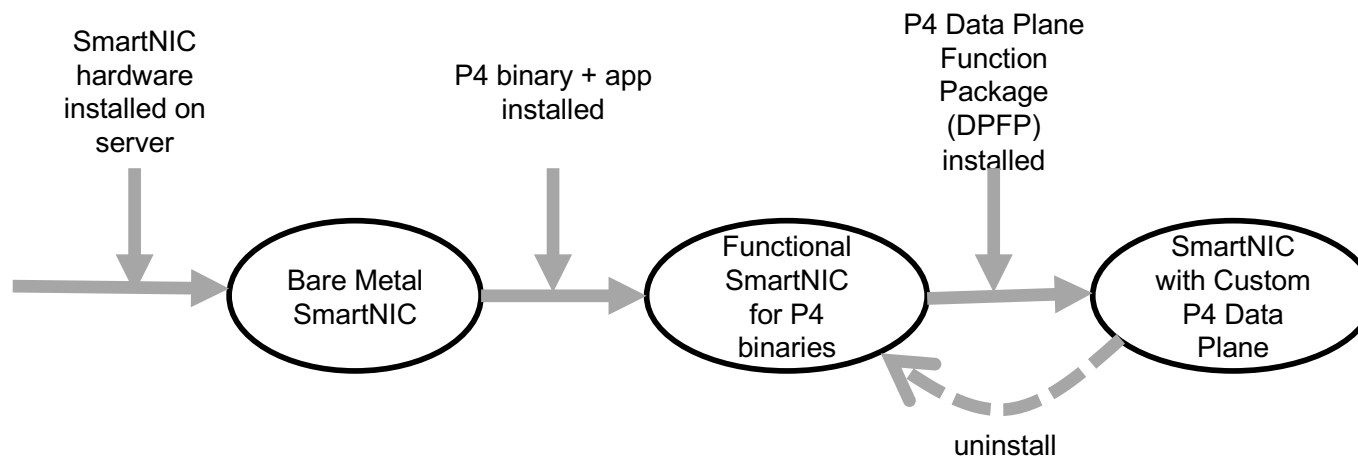
- Package downloads
- Install process

Create data plane function packages, distribute through repository



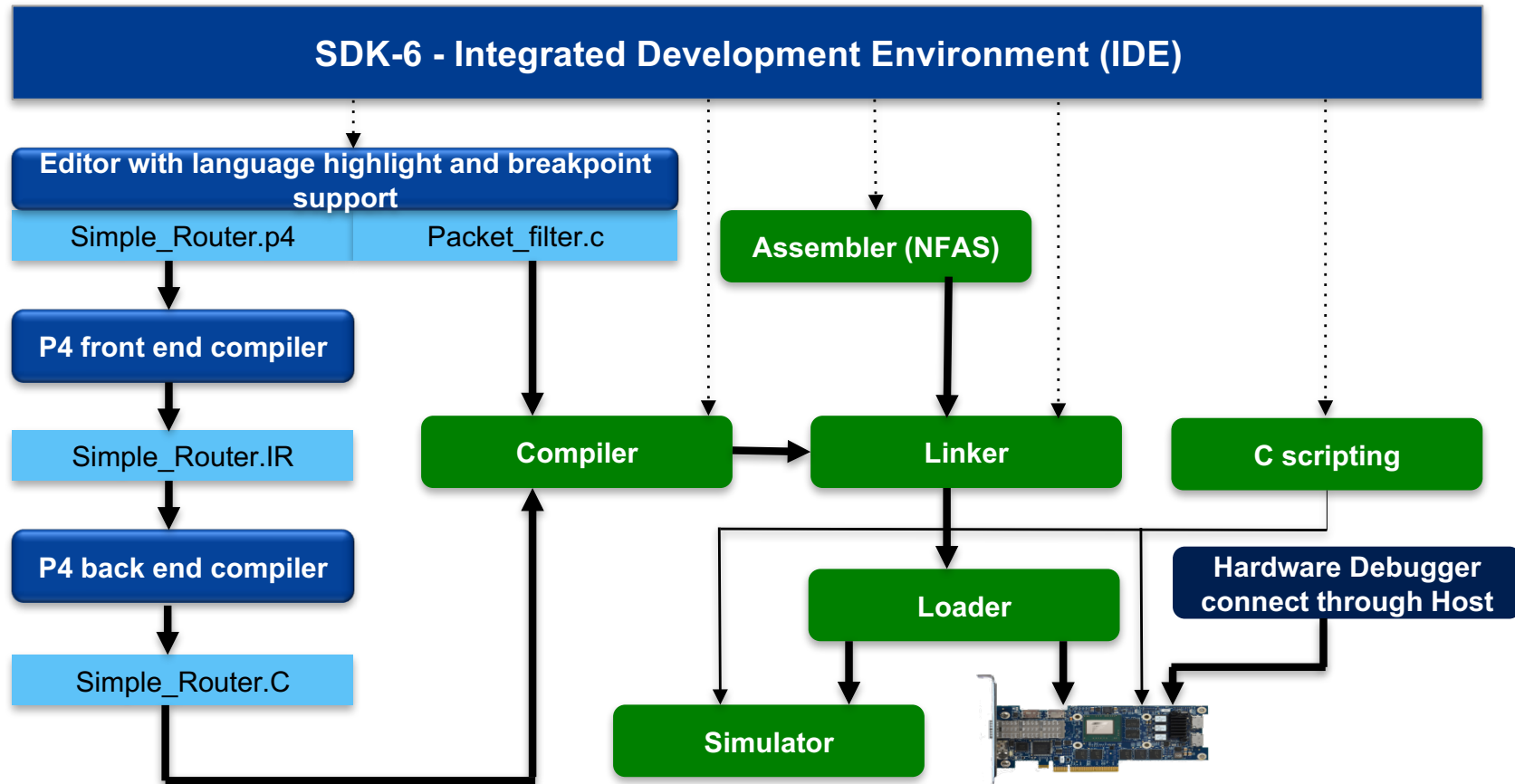
- Draft specification submitted to the Open Compute Project
  - Accessible @ <https://iconics.io>

**Call For Action: Join to define and refine ICONICS**

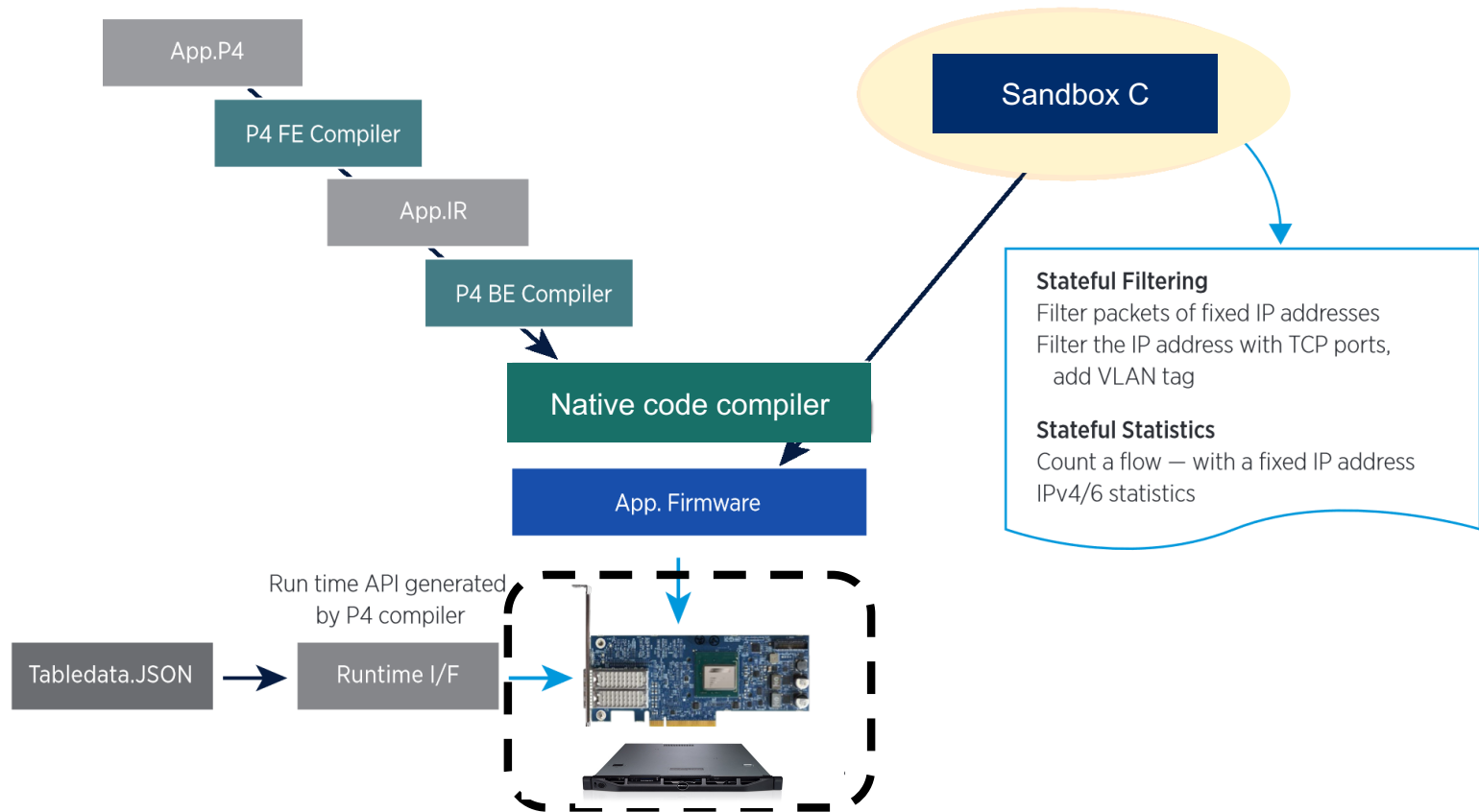


Component	Binary Functionality	Server App
Bare metal SmartNIC	Host loopback	Open-source kernel driver
Functional SmartNIC for P4 binaries	Simple wire pass through. Host interface Network interface	P4 firmware loader Real-time Thrift interface for match-action tables
P4 Dataplane Function Package	Application-specific binary (vendor provides tools)	Application-specific creation and operation (developer specifies)

## Simple P4 application management



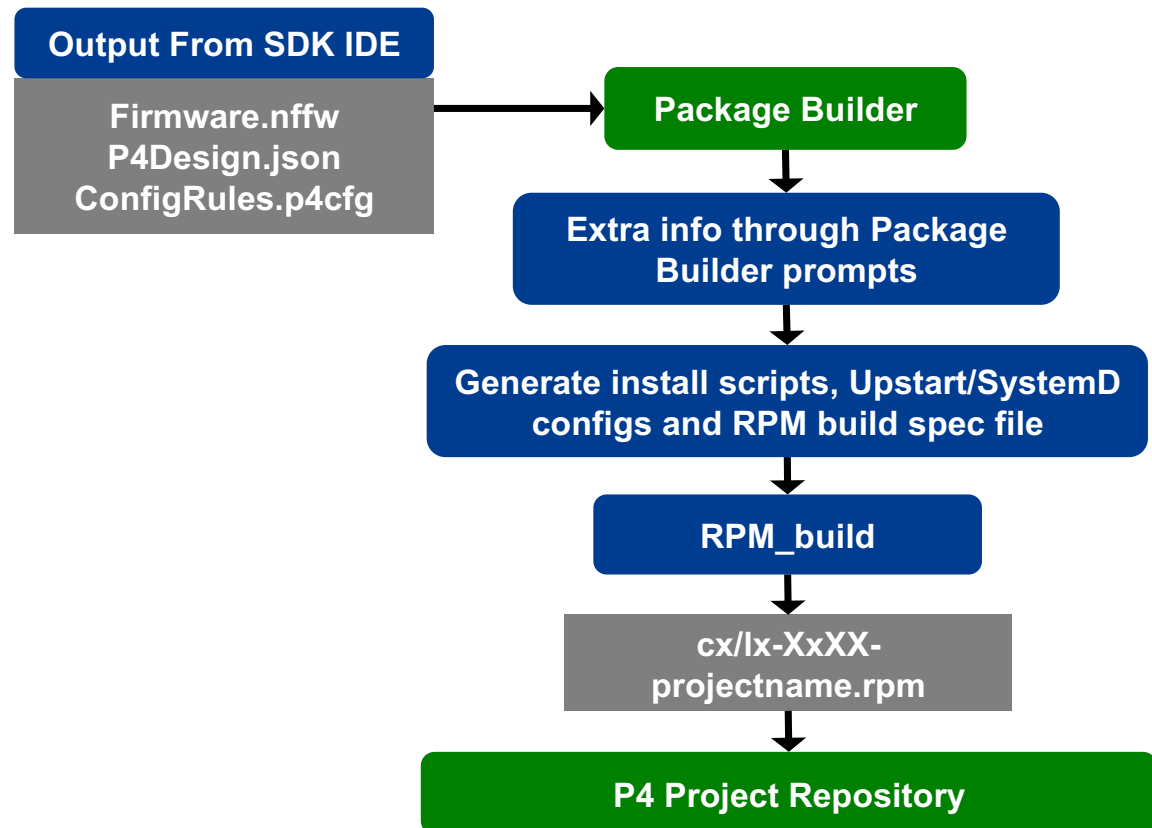




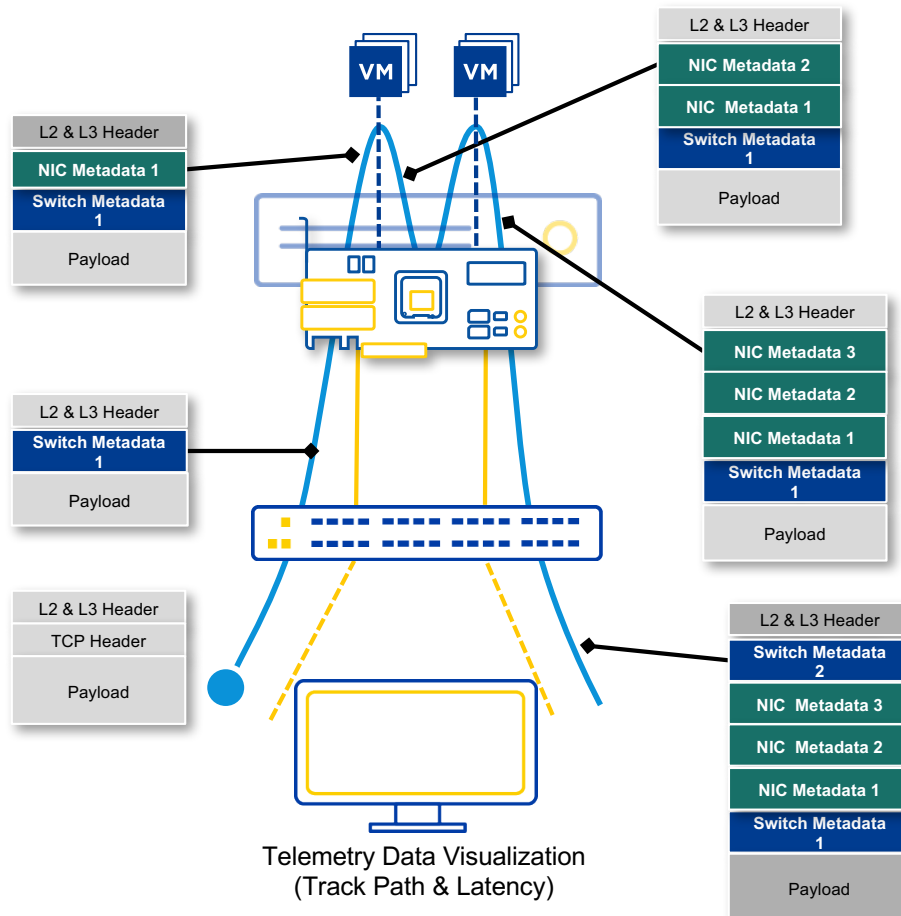
# P4 DPFP Build Step 2: Package Builder

## Prototype:

- Combine firmware with table configuration
- Separate DPFP package per SmartNIC type
- Supported only on CentOS
- Operated through server management interface
- In-field configuration, outside scope



P4 DPFP builder prototype available. Contact Open-NFP for access.

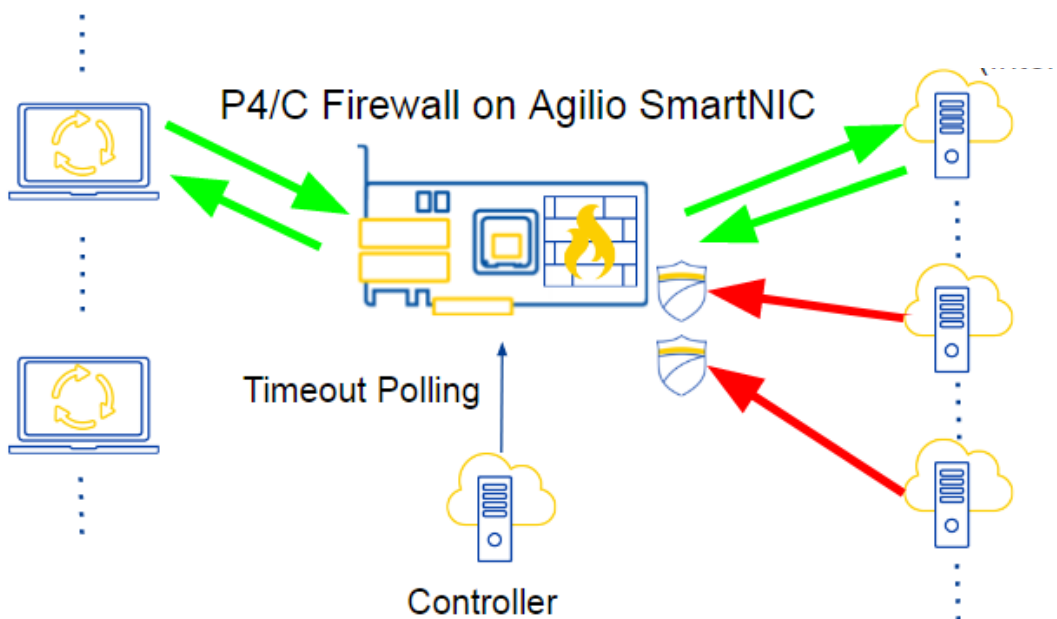


## P4 Telemetry DPFP

- **Binary:** Per hop telemetry functions
- **Host App:** Interface to collector
- **In-field:** Configuration to support target flow

## System Flow

- In-Band Network Telemetry (INT) instruments every packet
- VXLAN GPE Encapsulation used to carry the metadata (other encapsulations are possible)
- Each hop adds:
  - Hop ID
  - Ingress Timestamp
  - Egress Timestamp



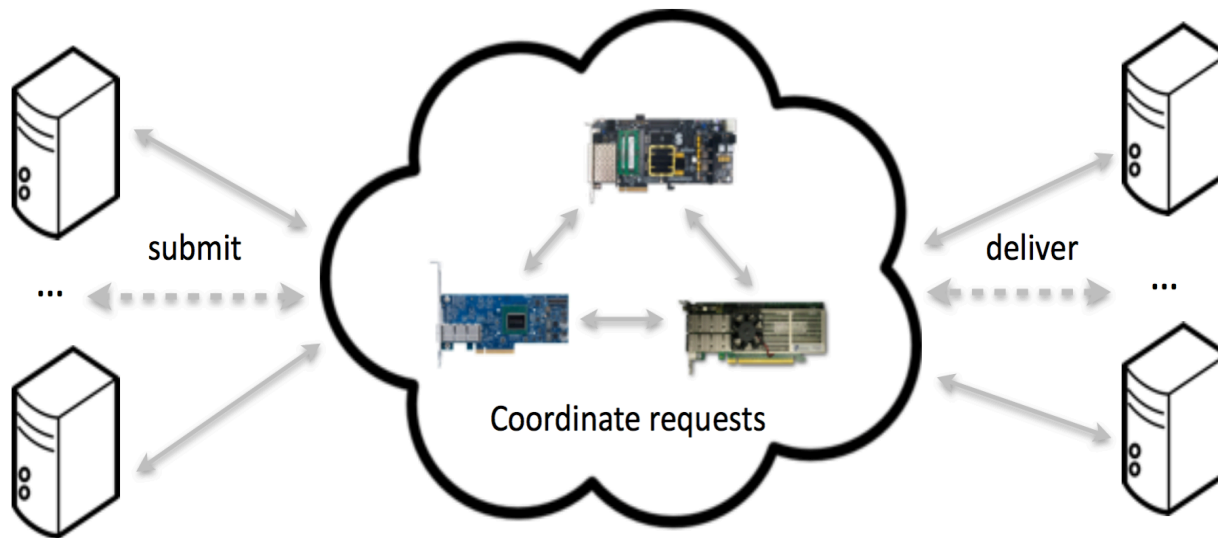
See the demo!

## P4/C Firewall DPFP

- **Binary:** P4/C Match-action flow
- **Host App:** Firewall controller
- **In-field:** System configuration

## System Flow

- Stateful Firewall + NAT
- P4 Tables, Actions and Rules
  - Lookup State Table
    - Match - Ingress Port
    - Action - Apply hash function for state lookup
  - Update State
    - Match - State, Egress Spec
    - Action - Update State
  - Controller Packet Table
    - Match - Ingress Port
    - Action - Clear Ports Timeouts



## Paxos DPFP

- **Binary:** Paxos data path
- **Host App:** Replicated key-value store
- **In-field:** Routing configuration identifying coordinators and acceptors

## System flow




- Coordinator
  - Add a monotonically increasing sequence number of every packet
- Acceptor
  - Store history of messages
  - compare instance number in arriving proposals to instance number in history, route forward or drop based on the result

# The Open-NFP P4 App Store

- [www.open-nfp.org](http://www.open-nfp.org)
  - Portal for research in data plane acceleration, 40+ organizations,
  - PS/SDK, Lots of P4 code at <https://github.com/open-nfpsw>

- **Creating ICONICS P4 Beta repository**

- Netronome Agilio 40GbE SmartNIC, CentOS, Live soon
- Bare metal SmartNIC installed as a tarball
- Functional SmartNIC for P4, Telemetry, Stateful firewall, Load balancer, Conensus as a service
- Aim to grow repository to include all apps on <https://github.com/open-nfpsw>
- Support cross-platform packaging, naming convention and documentation guidelines

Name	Last modified	Size	Description
 <a href="#">Parent Directory</a>		-	
 <a href="#">P4C-Firewall/</a>	2017-05-17 13:35	-	
 <a href="#">p4wire/</a>	2017-05-16 13:04	-	
 <a href="#">repopdata/</a>	2017-05-17 13:36	-	

- **Big Thank you**

- Pietro Bressana (USI), David George, Helgard van Rensburg, Rando Wiesemann (Netronome)

**Call For Action: Use repository, create and/or contribute P4 binary packages.**



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Thank You