



# INCREMENTAL INSERTION OF STRATUM/P4

Strategy and Use Cases

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ONF CONNECT 2018

JUNIPER  
NETWORKS

Engineering  
Simplicity

# AGENDA

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- Motivation
- Introduction to AFI and AFI Sandboxes
- Use Case: Transponder, Flexible Tunnels
- Stratum/P4 in Juniper

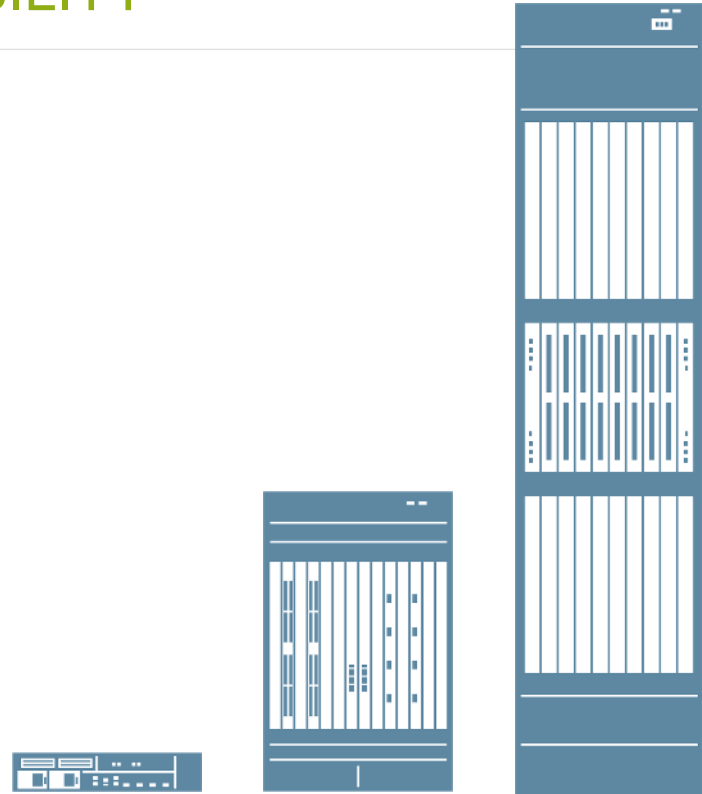


# MOTIVATION

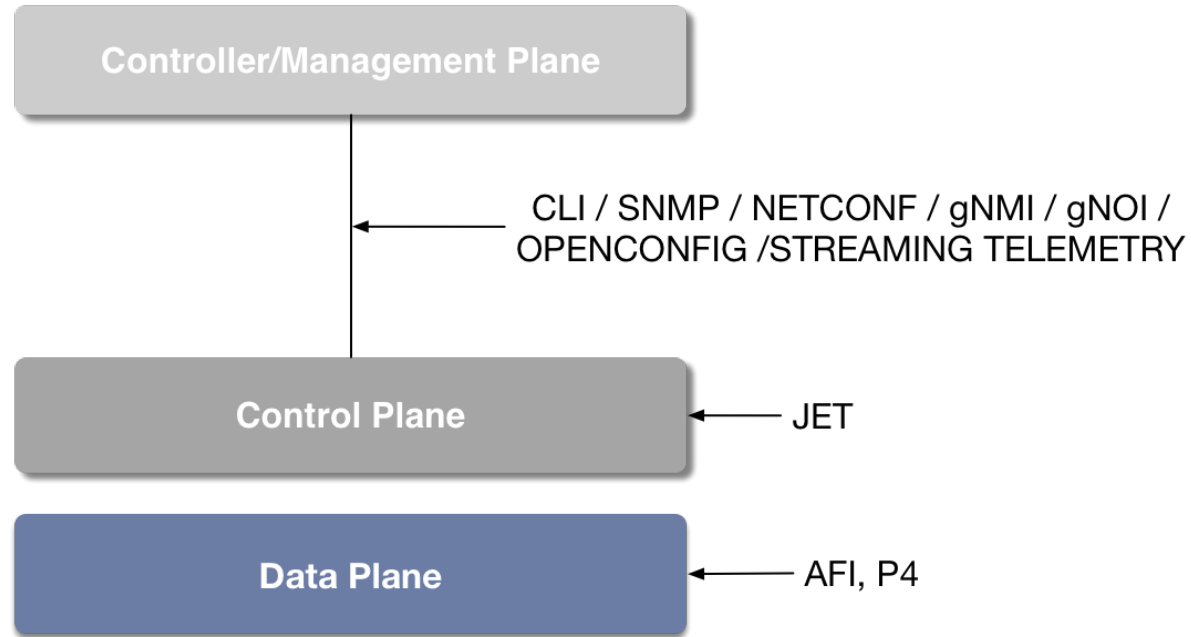
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- Existing data plane code of various networking vendors has value which has been created over a long period of time.
- Defining (re-writing ) the complete data plane in P4, which would involve compiler backend changes and changing the existing local control planes' south-bound interface to P4Runtime) for all the features, which are currently supported by vendors' routers and switches, would require significant development and testing efforts.
- Customers may not want to assume complete ownership of control plane. They may not either be equipped (read resource constraints) or do not want to handle/rewrite P4 enabled control plane (even if vendors are willing to provide P4 programmable data plane) for features which are already available from vendors' existing field-proven control-plane and data-plane code.

# NETWORK DEVICE PROGRAMMABILITY



# NETWORK DEVICE PROGRAMMABILITY



# AFI

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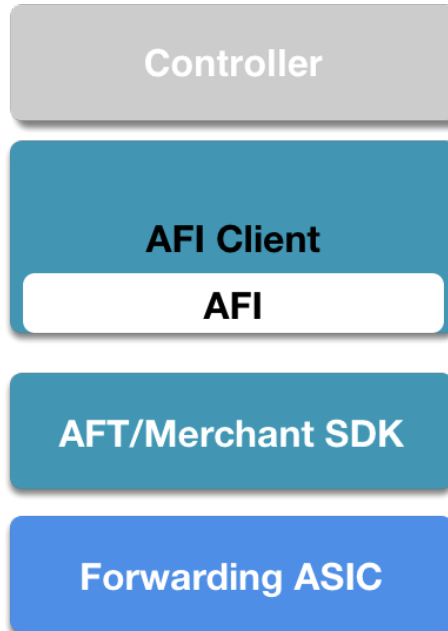
Advanced Forwarding Interface



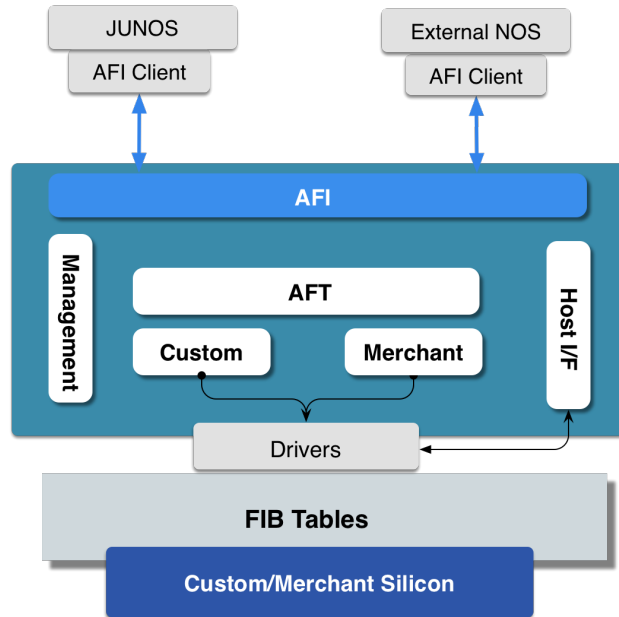
# AFI SYSTEM

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## AFI System Layers



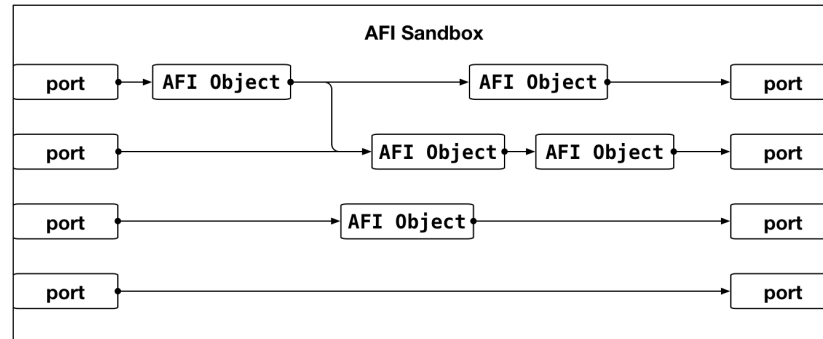
# AFI HIGH LEVEL ARCHITECTURE



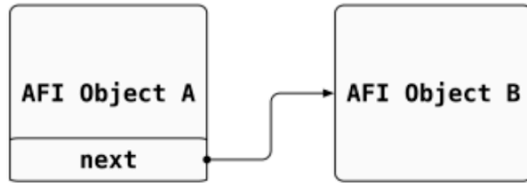


# ADVANCED FORWARDING INTERFACE

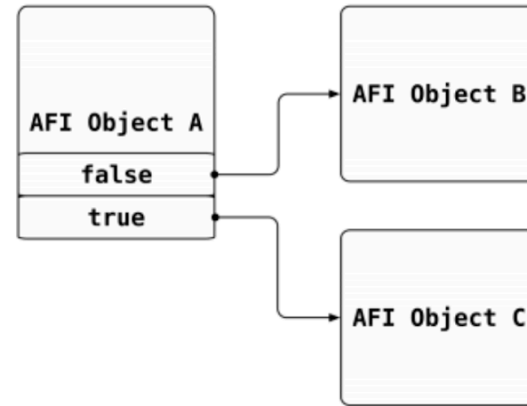
AFI (Advanced Forwarding Interface) is Juniper's approach of modeling the forwarding plane of networking devices. AFI defines data plane as graph of potential operations (AFI Objects) to be performed by packet forwarding engine (PFE) on the packet.



# AFI OBJECTS



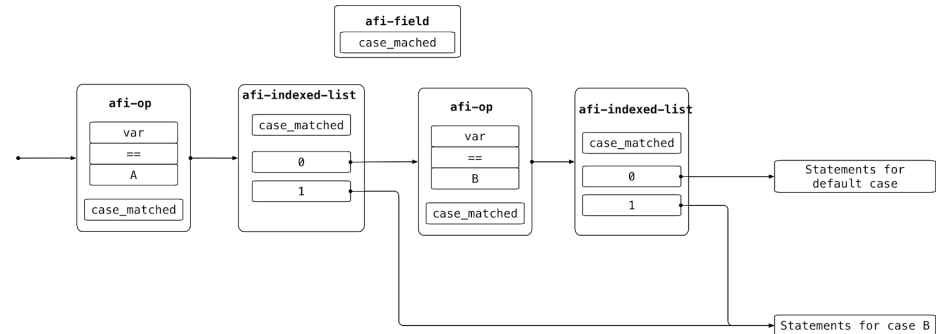
An AFI object can reference other AFI objects



A conditional if-else AFI object

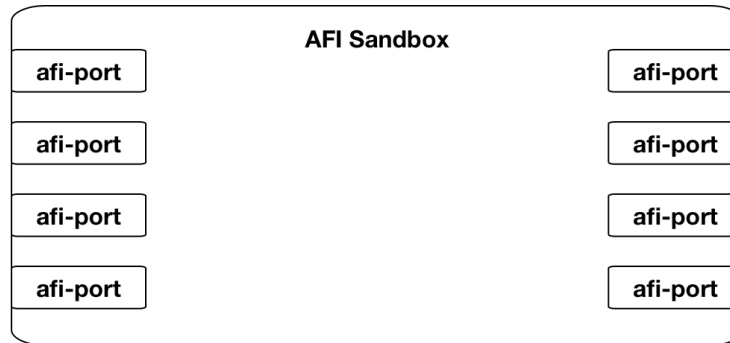
# SWITCH STATEMENT AFI MODEL

```
switch(var) {  
    case A:  
        /* fall through */  
  
    case B:  
        statements (s);  
        break; /* optional */  
  
    default : /* Optional */  
        statements (s);  
}
```



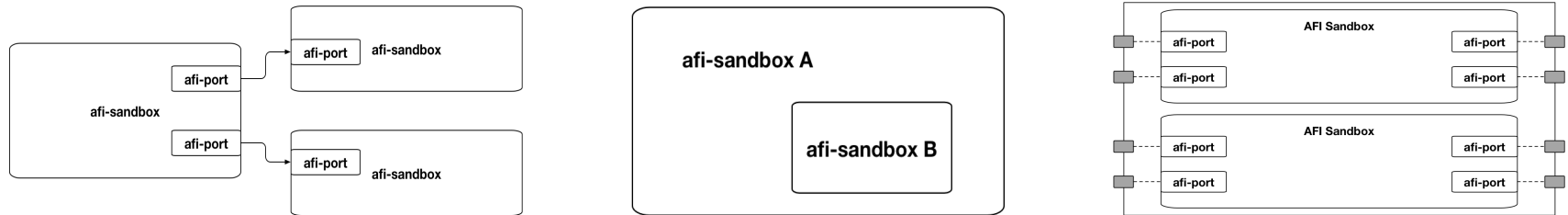
# AFI SANDBOX

AFI defines a sandbox as a section of forwarding topology graph. A sandbox is small virtual container which can be programmed via AFI.

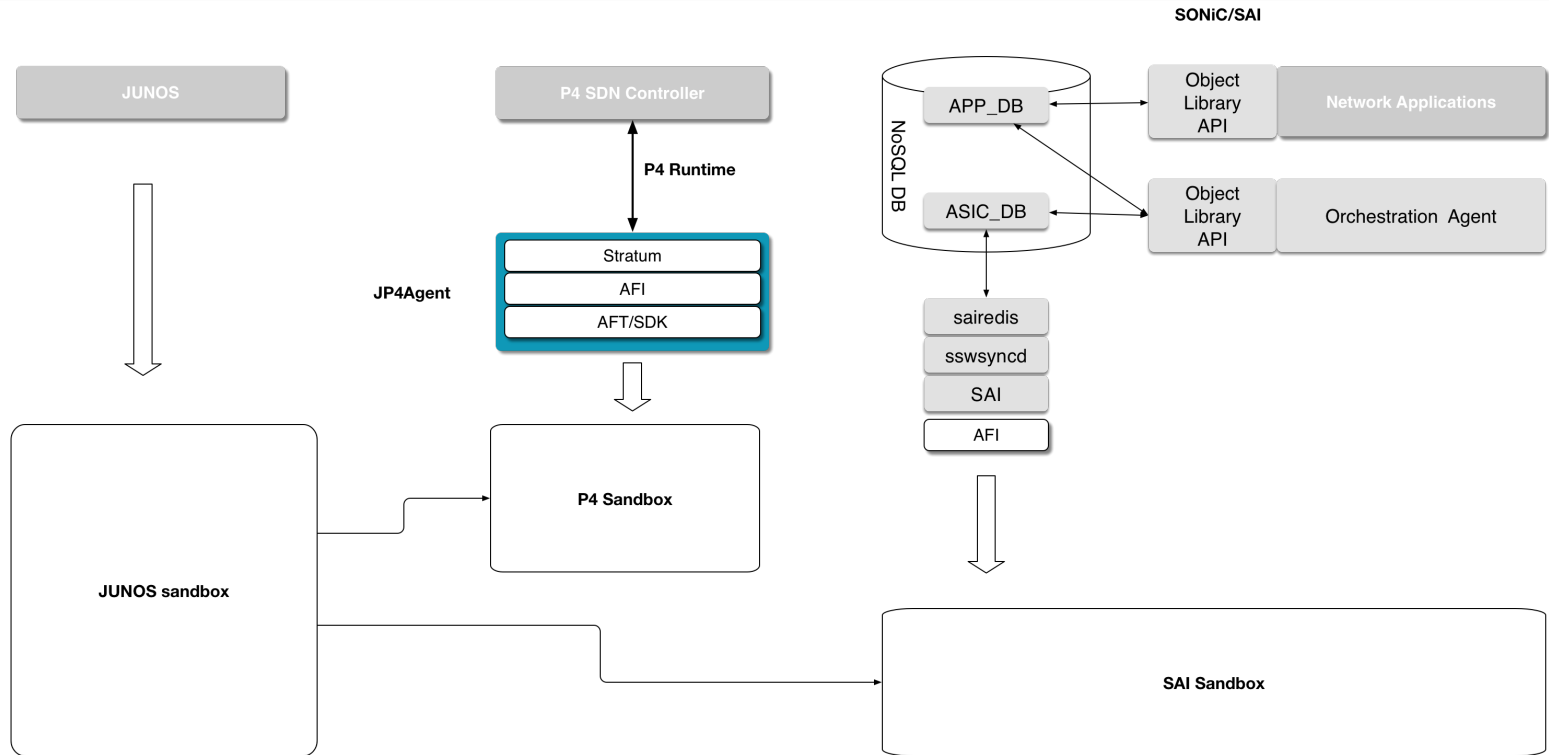


# AFI SANDBOXES CHAINING/NESTING/SLICING

AFI defines a sandbox as a section of forwarding topology graph. A sandbox is small virtual container which can be programmed via AFI.



# AFI SANDBOXES



# P4 IN JUNIPER

P4 is a great language to have conversations with our customers and partners. In P4, customers can articulate intent of feature which they want Juniper to implement in our forwarding plane. P4 compiler and JP4Agent translates that intent, written in P4, to data plane of Juniper's routing and switching platforms.

## **TRIO/PENTA:**

With TRIO, full potential of P4 can be realized.

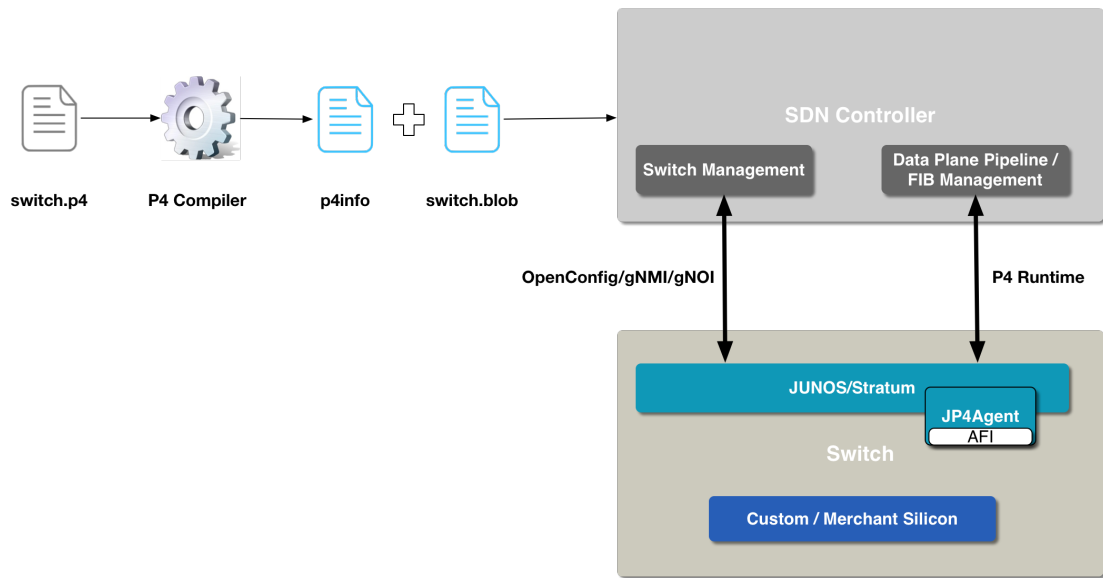
## **Fixed Function ASICs: ZX**

P4 can be used to program our fixed pipeline ASICs based platform

## **Merchant Silicon:**

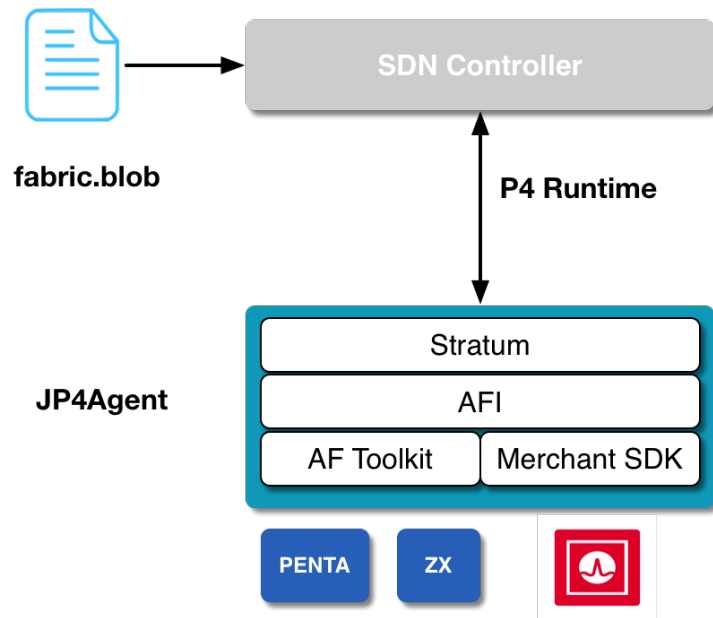
Support of P4 on the platforms which Juniper builds using merchant silicon.

# P4/STRATUM IN JUNIPER

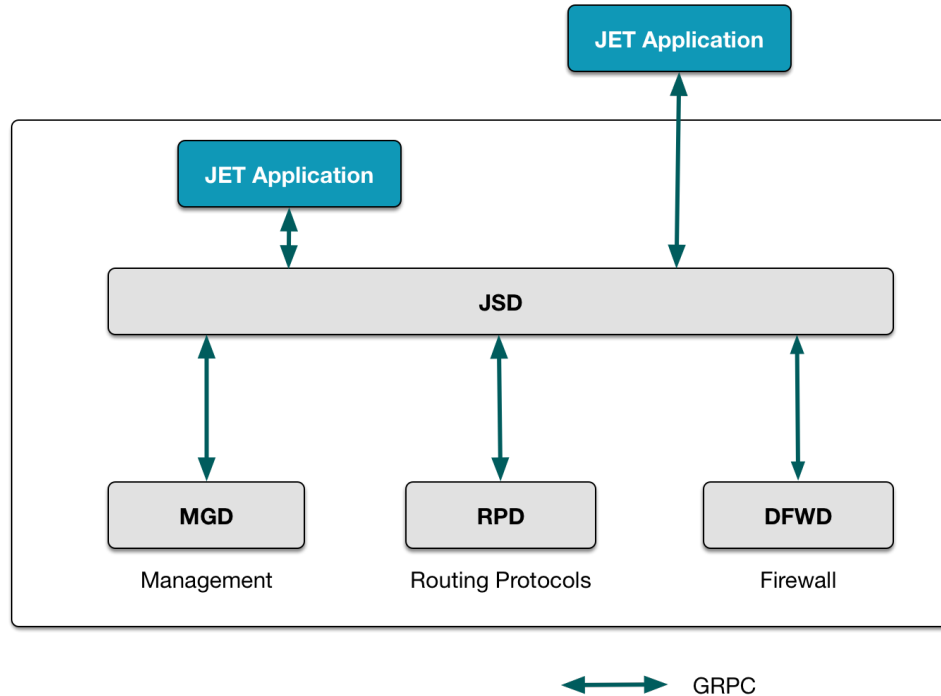




# P4/STRATUM IN JUNIPER: JP4AGENT

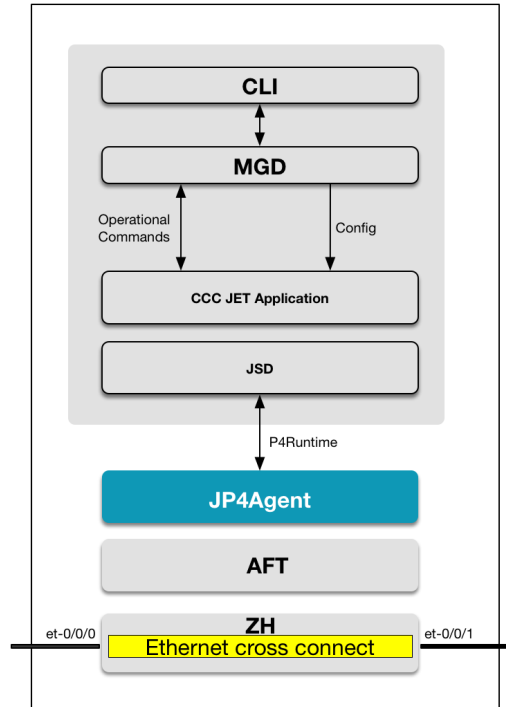


# JET (JUNIPER EXTENSION TOOLKIT)

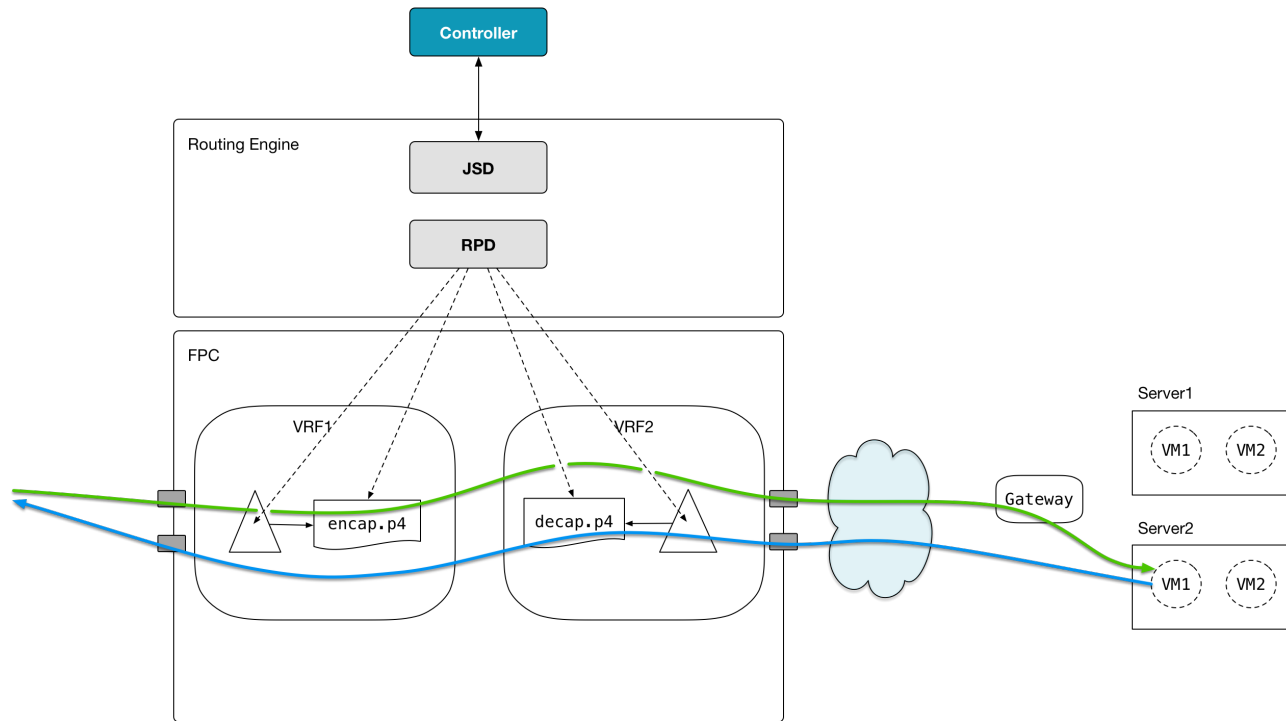


# TRANSPONDER USE CASE

## ACX6360

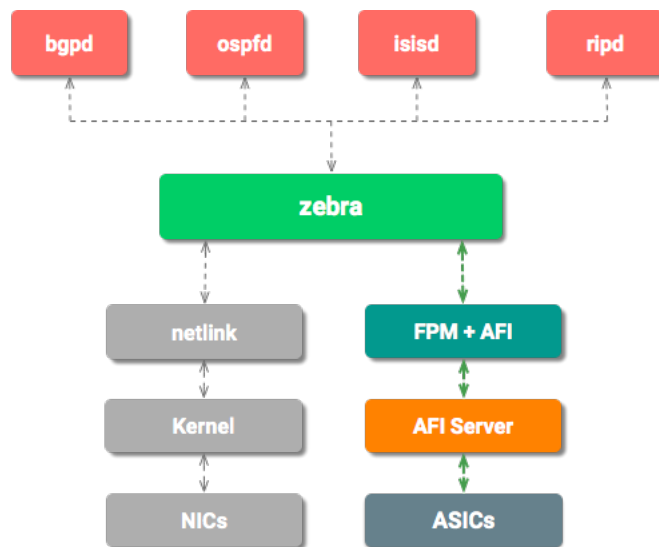


# FLEXIBLE TUNNELS

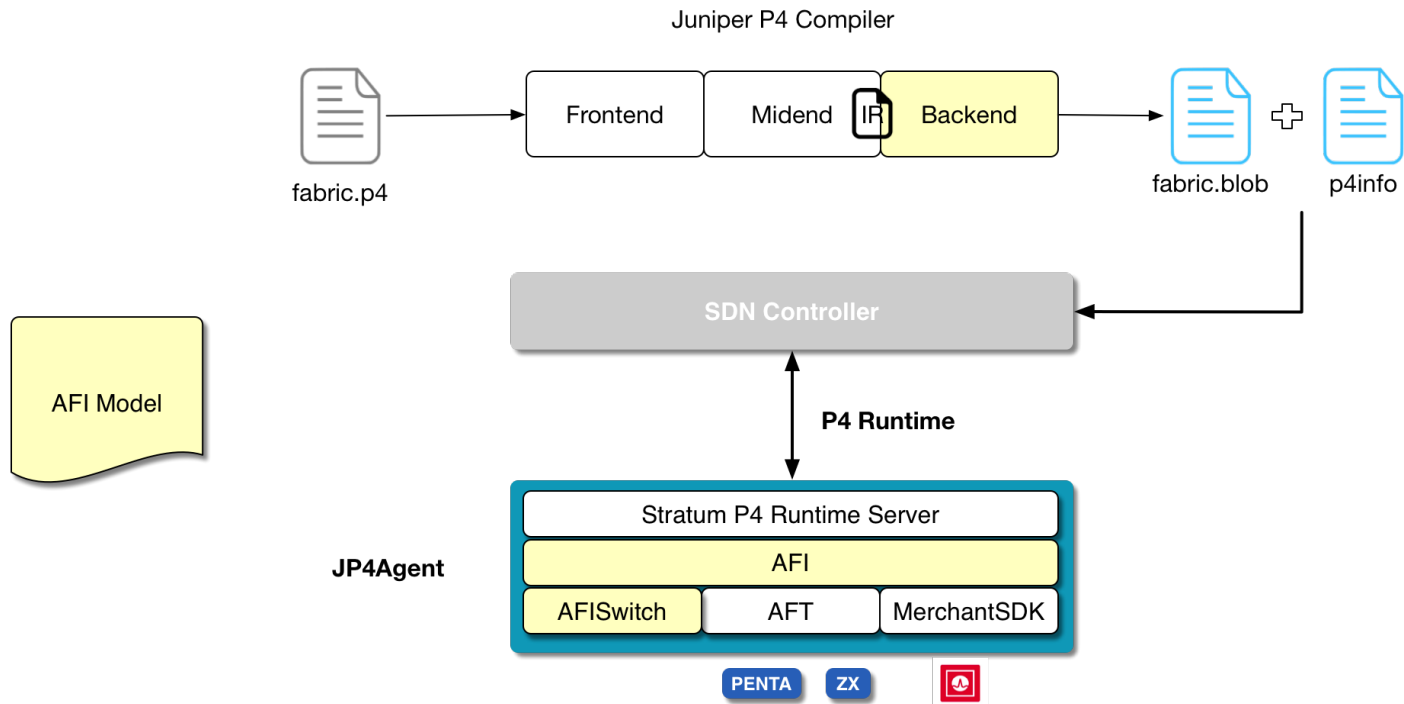


# FRROUTING ON JUNIPER'S ADVANCED FORWARDING INTERFACE

<https://forums.juniper.net/t5/Industry-Solutions-and-Trends/FRRouting-on-Juniper-s-Advanced-Forwarding-Interface/ba-p/318708>



# JUNIPER AND STRATUM



# AFI AND JP4AGENT ON GITHUB

The screenshot shows the GitHub repository for Juniper/AFI. The repository has 22 unwatchers, 23 stars, and 8 forks. The main content area displays the README for the AFI (Advanced Forwarding Interface), which is Juniper's Data Plane Programming Interface. The README includes a note about the Apache 2.0 license and the title "AFI (Advanced Forwarding Interface)".

Juniper / AFI

Unwatch 22 Star 23 Fork 8

Code Issues 3 Pull requests 2 Projects 0 Wiki Insights Settings

AFI (Advanced Forwarding Interface) is Juniper's Data Plane Programming Interface which provides Juniper internal and third party developers with ability to control and manage forwarding path in the data planes of Juniper's platforms.

Manage topics

11 commits 1 branch 0 releases 1 environment 2 contributors Apache-2.0

Branch: master New pull request Create new file Upload files Find file Clone or download

File	Description	Last Commit
docs	Updated documentation	2 years ago
example-clients	example-clients: fix inverted arguments	a year ago
tools/docker	Waiting at right spot	a year ago
LICENSE	Initial publish	2 years ago
README.md	Adding contact	11 months ago

README.md

Note: Use of this software is governed by an Apache 2.0 license, and can be found in the "LICENSE" file.

## AFI (Advanced Forwarding Interface)

The screenshot shows the GitHub repository for Juniper/JP4Agent. The repository has 22 unwatchers, 7 unstars, and 3 forks. The main content area displays the README for the JP4Agent (Juniper P4 Agent), which is Juniper's P4 Runtime server implementation. The README includes a note about the Apache 2.0 license and a diagram showing the architecture of the P4 Runtime server implementation.

Juniper / JP4Agent

Unwatch 22 Unstar 7 Fork 3

Code Issues 0 Pull requests 0 Projects 0 Wiki Insights Settings

Juniper's P4 Runtime server implementation.

Manage topics

90 commits 1 branch 0 releases 1 environment 4 contributors Apache-2.0

Branch: master New pull request Create new file Upload files Find file Clone or download

README.md

build: passing

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## JP4Agent (Juniper P4 Agent)

Juniper's P4 Runtime server implementation.

```
graph TD; SDN[SDN Controller] <--> P4[P4 Runtime]; P4 --> JP4Agent[JP4Agent];
```

THANKS