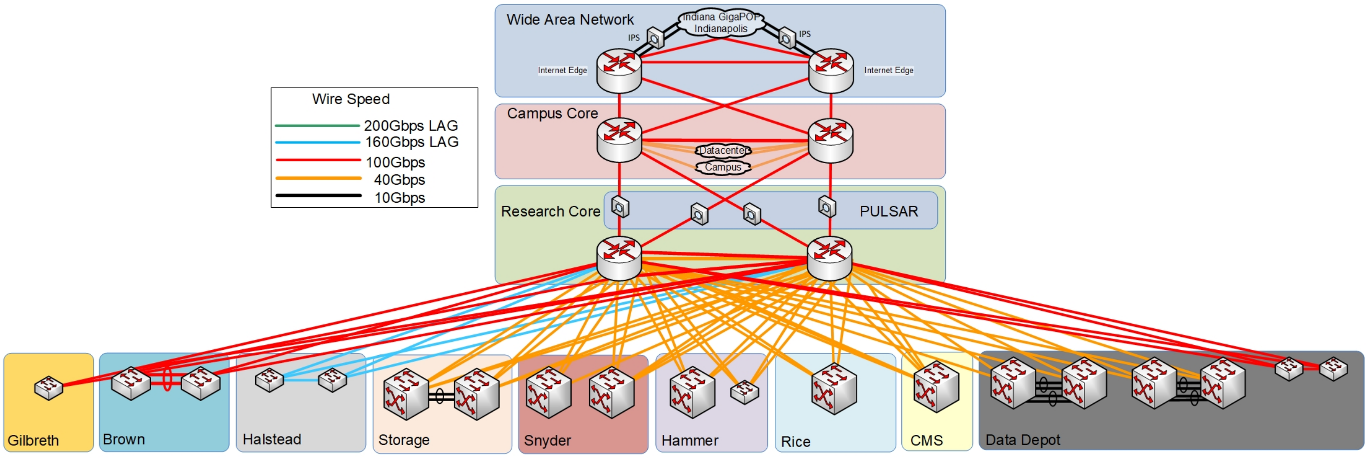
TAP Aggregation and Traffic Distribution

Purdue Research Network Diagram



Network Test Access Points (TAPs)

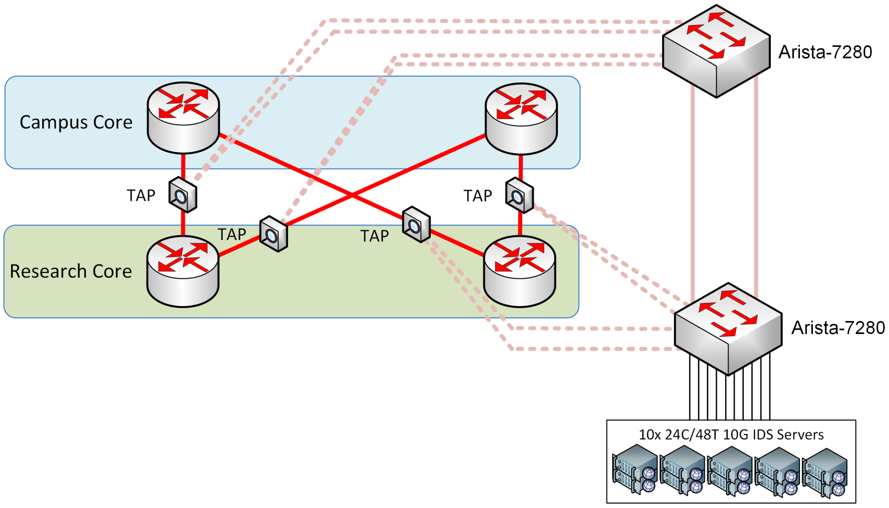
A network TAP is an external monitoring device that mirrors the traffic that is passing between two network nodes. Passive network TAPs are wired between network nodes and duplicate traffic without adding additional latency to the connection. At Purdue, network TAPs mirror traffic between four 100G links between the Campus Core and Research Core routers. Please refer to Wide Network Map above for placement details. This allows traffic to be monitored that is going from internal campus networks to the research network as well as traffic from other institution's research networks to Purdue's research network. Commodity Internet traffic is analyzed by an in-line IPS as shown in the diagram.

Hardware

Chassis: Gigamon 1/2 U chassis, supports 1,2,3,or 4 Dual Optical G-TAP Modules, stand alone chassis, 1/10G10

TAPs: Dual optical HighFlow GigaTAP module, 50/50 Singlemode, 1310/1550nm, 10/40/100G

TAP Aggregration and Traffic Distribution



Hardware

Two Arista switches are used to distribute network traffic from 8 100G taps to 10 10G Zeek workers.

Arista Switch Model: DCS-7280SRA-48C6

Optics for taps: 100GBASE-LR4

Optics for connections between Aristas: 100GBASE-CR4

Online Resources

Quick Start Guide for Arista switches: https://www.arista.com/en/qsg-7280x-series-1ru-gen3

Status Indicators: https://www.arista.com/en/qsg-7280x-series-1ru-gen3/7280x-series-1ru-gen3-status-indicato

Arista Configuration

DNS Configuration

https://www.arista.com/en/um-eos/eos-section-6-1-managing-the-switch-name

```
pulsar-arista7280-1(config)#ip name-server X.X.X.X

pulsar-arista7280-2(config)#ip name-server X.X.X.X
```

Arista API Configuration

```
pulsar-arista7280-1(config)# management api http-commands

pulsar-arista7280-1(config-mgmt-api-http-cmds)# no shutdown
```

This enables the HTTPS server. Certificate configuration is below. Admin account can be used to access the API. It is highly recommended to apply an ACL to the management interface.

Certificate Configuration

The HTTPS API needs a trusted certificate unless you want a bunch of warnings.

https://<hostname>/overview.html

```
pulsar-arista7280-1(config)#copy scp:user@<host>//path/to/cert.cer certificate:eapiServerCert

pulsar-arista7280-1(config)#copy scp:user@<host>//path/to/private.key sslkey:eapiServerKey

pulsar-arista7280-1(config)#management security

pulsar-arista7280-1(config-mgmt-security)#ssl profile eapi

pulsar-arista7280-1(config-mgmt-sec-ssl-profile-eapi)#certificate eapiServerCert key eapiServerKey

pulsar-arista7280-1(config-mgmt-sec-ssl-profile-eapi)#management api http-commands

pulsar-arista7280-1(config-mgmt-api-http-cmds)#protocol https ssl profile eapi
```

SNMP Configuration

https://www.arista.com/en/um-eos/eos-section-42-3-configuring-snmp

The only configuration needed on the Arista switches is to set an RO community string, which also starts the snmp agent on the switch.

```
pulsar-arista7280-1(config)# snmp-server community <password> ro

pulsar-arista7280-2(config)# snmp-server community <password> ro
```

Load balancing Configuration

Set the switch to tap aggregation mode.

```
pulsar-arista7280-2(config)#tap aggregation

pulsar-arista7280-2(config-tap-agg)#mode exclusive
```

Create a new load balance profile called "TAP"

```
pulsar-arista7280-2(config)#load-balance policies
```

```
pulsar-arista7280-2(config-load-balance-policies)#load-balance sand profile TAP
```

By default, symmetric hashing is not enabled. This can be seen with the `show load-balance profile TAP` command.

```
pulsar-arista7280-2#show load-balance profile TAP | grep Symm
Symmetric hashing is OFF
```

This command enables symmetric hashing (which we need to direct bi-directional traffic to the same Zeek worker).

```
pulsar-arista7280-2(config-sand-load-balance-profile-TAP)#fields symmetric-hash
```

At this point you have the option of two additional commands, which will only slightly affect how hashing works.

This command will disable hashing based on the Protocol field in the IP header.

```
arista7280-2(config-sand-load-balance-profile-TAP)#fields ipv4 dst-ip src-ip
```

This command will disable hashing based on the MAC header. Depending on your TAP solution, these might only be a set of a few MACs between the routers you are monitoring.

```
arista7280-2(config-sand-load-balance-profile-TAP)#port-channel ip ip-tcp-udp-header
```

Once you create the profile, it isn't applied automatically. You will see this output in show load-balance profile TAP.

```
Profile TAP (global) is applied on the following
None
```

Apply the load balancing profile you created.

```
arista7280-2(config-sand-load-balance-profile-TAP)# port-channel load-balance sand profile TAP
```

Then you should see that the profile is applied globally.

```
Profile TAP (global) is applied on the following
FixedSystem
```

Full output of `show load-balance profile TAP`.

```
pulsar-arista7280-2#show load-balance profile TAP
---------- TAP (global) ----------

Lag Hashing on IP-TCP-UDP headers for IP packets is ON
Lag Hashing on MAC header for IP packets is OFF
Symmetric hashing is ON
Lag Hashing mode is flow-based
Lag Hash polynomial is 3
Lag Hash seed is 0
Port-channel load-balancing in egress replication is OFF

MAC hash fields:
   Source MAC Address is ON
   EtherType is ON
   Destination MAC Address is ON
   VLAN is ON
MPLS hash fields:
   Label is ON
IPv4 hash fields:
   Source IPv4 Address is ON
   Destination IPv4 Address is ON
   Time-To-Live is OFF
IPv6 hash fields:
   Hop Limit is ON
   Source IPv6 Address is ON
   Destination IPv4 Address is ON
L4 hash fields:
   Destination Port is ON
   Source Port is ON
Packet type MPLS over GRE:
   Hashing mode is inner-ip

Profile TAP (global) is applied on the following
FixedSystem
```

The best place to check to see if symmetric hashing is working is via the Zeek connection log (conn.log). You shouldn't see any duplicate connections, i.e.the same source/destination IP and TCP/UDP port across two workers. An easy way to verify this is via the "bro doctor" script.

https://github.com/ncsa/bro-doctor

Output like this means you are not seeing duplicate connections. If you see duplicate connections, there might be a problem with hashing at the Arista level **or** there could be a problem with load balancing at the host level via PF_RING, AF_PACKET, etc. You need to check and verify both cases.

```
########################################################################
# Checking if any recent connections have been logged multiple times #
########################################################################
ok, only 0.00%, 0 out of 1611 connections appear to be duplicate
```

Arista Configurations

These config excerpts show the important pieces of the Arista switch configuration. An MTU of 9214 was present by default on all interfaces even without specifying it in the interface configuration.

pulsar-arista7280-1 Configuration

```
! Startup-config last modified at  Tue Jun 18 17:46:59 2019 by admin
! device: pulsar-arista7280-1 (DCS-7280SRA-48C6, EOS-4.20.1F)
!
! boot system flash:/EOS-4.20.1F.swi
!

...

!
tap aggregation
   mode exclusive
!
interface Port-Channel1
   description LAG to Arista2
   switchport mode tool
   switchport tool group set core-tap-3 core-tap-4
!

...

!
interface Ethernet49/1
   description Core Tap 3-1
   switchport mode tap
   switchport tap default group core-tap-3
!
interface Ethernet50/1
   description Core Tap 3-2
   switchport mode tap
   switchport tap default group core-tap-3
!
interface Ethernet51/1
   description Core Tap 4-1
   switchport mode tap
   switchport tap default group core-tap-4
!
interface Ethernet52/1
   description Core Tap 4-2
   switchport mode tap
   switchport tap default group core-tap-4
!
interface Ethernet53/1
   description LAG to Arista2
   channel-group 1 mode on
   switchport mode tool
!
interface Ethernet54/1
   description LAG to Arista2
   channel-group 1 mode on
   switchport mode tool
!
interface Management1
   ip address X.X.X.X/Y
!

...

!
ip access-list mgmt
   10 permit ip X.X.X.X/Y any
   30 permit ip host X.X.X.X any
   40 permit ip host X.X.X.X any
   50 deny ip any any
!

...

!
management api http-commands
   protocol https ssl profile eapi
!
management security
   ssl profile eapi
      certificate eapiServerCert key eapiServerKey
!
management ssh
   ip access-group mgmt in
!
end
```

pulsar-arista7280-2 Configuration

```
! Startup-config last modified at  Fri Jul 12 14:30:18 2019 by admin
! device: pulsar-arista7280-2 (DCS-7280SRA-48C6, EOS-4.20.1F)
!
! boot system flash:/EOS-4.20.1F.swi
!

...

!
load-balance policies
   load-balance sand profile TAP
      fields ipv4 dst-ip src-ip
      fields symmetric-hash
      port-channel ip ip-tcp-udp-header
!
```

```
...

!
tap aggregation
   mode exclusive
!
interface Port-Channel1
   description Taps from core and arista1
   ip access-group bulk_1 in
   ipv6 access-group bulk_1 in
   switchport mode tap
   switchport tap default group TAP
!
interface Port-Channel10
   switchport mode tool
   switchport tool group set TAP
!
interface Ethernet1
   description bro-a000: enp59s0f1
   mtu 9214
   channel-group 10 mode on
!
interface Ethernet2
   description bro-a001: enp59s0f1
   mtu 9214
   channel-group 10 mode on

...

interface Ethernet21
   description bro-a000: enp59s0f0
   mtu 9214
   channel-group 10 mode on
!

...

!
interface Ethernet49/1
   description Core Tap 1-1
   mtu 9214
   channel-group 1 mode on
   switchport mode tap
!
interface Ethernet50/1
   description Core Tap 1-2
   mtu 9214
   channel-group 1 mode on
   switchport mode tap
!
interface Ethernet51/1
   description Core Tap 2-2
   mtu 9214
   channel-group 1 mode on
   switchport mode tap
!
interface Ethernet52/1
   description Core Tap 2-2
   mtu 9214
   channel-group 1 mode on
   switchport mode tap
!
interface Ethernet53/1
   description LAG to Arista1
   mtu 9214
   channel-group 1 mode on
   switchport mode tap
!
interface Ethernet54/1
   description LAG to Arista1
   mtu 9214
   channel-group 1 mode on
   switchport mode tap
!
interface Management1
   ip address X.X.X.X/Y
!
ip access-list api
   !! Access rules for https api
   10 permit ip host X.X.X.X any
   20 permit ip host Y.Y.Y.Y any
   30 deny ip any any
!
ip access-list mgmt
   !! Access rules for mgmt interface
   10 permit ip host X.X.X.X any
   20 permit ip host Y.Y.Y.Y any
   30 deny ip any any
!

...

!
management api http-commands
   protocol https ssl profile eapi
   no shutdown
   !
   vrf default
      ip access-group api
!
management security
   ssl profile eapi
      certificate eapiServerCert key eapiServerKey
!
management ssh
```

```
   ip access-group mgmt in
!
end
```