SWINBURNE UNIVERSITY OF TECHNOLOGY

CAIA Realtime VoIP Classification and Redirection

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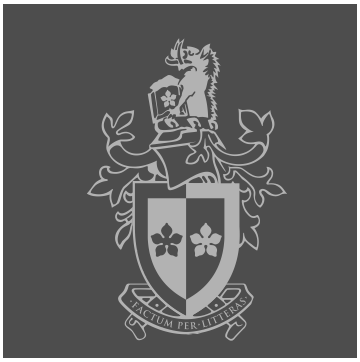
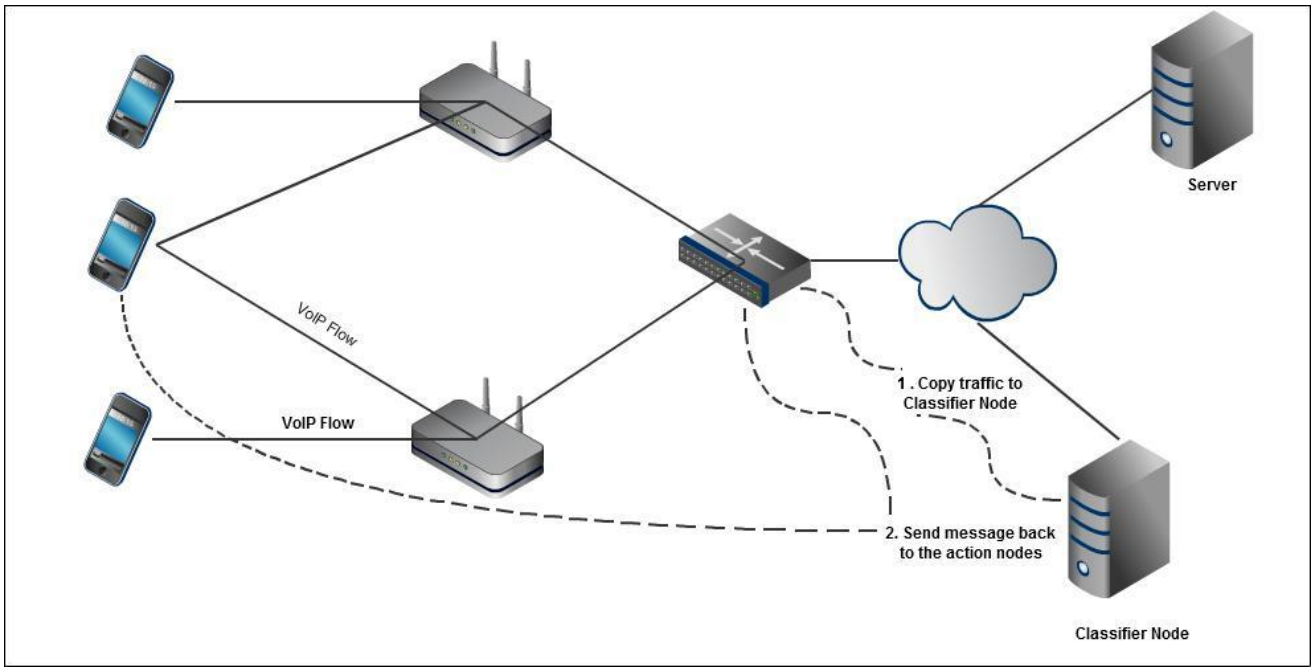


Outline

- Multiple Access Point Connections
- Testing
- Routing Tables
- Redirecting Traffic
- Selecting Routing Tables
- Testing Routing Tables

Scenario



Multiple Access Points Connections (1)

- Linux provides 'virtual managed interfaces' [1]
- Enables multiple access point connections
- Wireless interface card was an Atheros card AR928X
- To be tested on other wireless interface cards

[1] http://wireless.kernel.org/en/users/Documentation/iw

Multiple Access Points Connections (2)

Example [1]:

Virtual interface 1 (managed0):

```
iw phy phy0 interface add managed0 type managed
ip link set managed0 address 12:34:56:78:9A:BC
ifconfig managed0 up
iwconfig managed0 essid "tsunami" ap 00:07:50:d5:a2:3a
ifconfig managed0 10.0.0.5 netmask 255.255.255.0
```

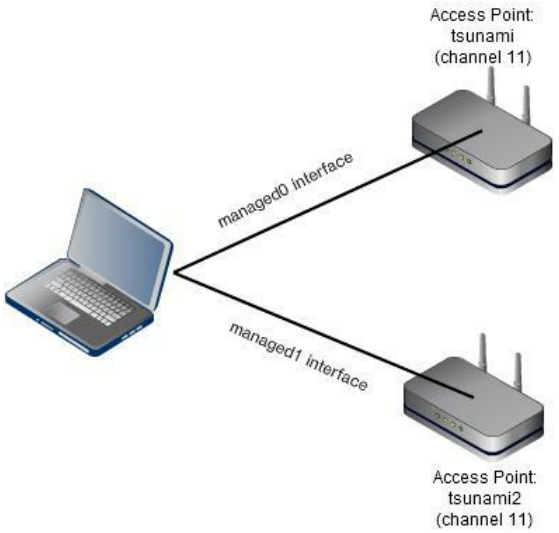
Virtual interface 2 (managed1):

```
iw phy phy0 interface add managed1 type managed
ip link set managed1 address AA:AA:AA:BB:BB:BB
ifconfig managed1 up
iwconfig managed1 essid "tsunami2" ap 00:07:50:d5:a7:f6
Ifconfig managed1 192.168.1.3 netmask 255.255.255.0
```

[1] http://wireless.kernel.org/en/users/Documentation/iw

Testing

- Different SSID Same Channel (11) ✓
- Different SSID Different Channel (1,11) ✗
- Same SSID Different Channel (1,11) ✗



Limitations

- My current work does not support WPA or encryption
  - WPA requires **wpa_supplicant**[1]
  - **wpa_supplicant** 'appears' to only allow one connection at a time
  - Needs further investigation and/or perhaps extending **wpa_supplicant** to support multiple connections

[1] https://wiki.archlinux.org/index.php/WPA_supplicant

Routing Tables

- The routing tables needed to be changed on both the Laptop and PC
- **iproute2**[1] was used to provide multiple routing tables
- Creating multiple tables (**iproute2**)
- Mark packets based on the flow id value (**fwmark**)[2]
- Redirect marked packets to nominated routing table (**iptables**)[2]

[1] http://www.policyrouting.org/iproute2.doc.html

[2] http://linux-ip.net/html/adv-multi-internet.html

Changing Routing Tables (iproute2)

- **iproute2** creates the multiple routing tables
  - tsunami table has a value of 1
  - tsunami2 table has a value of 2

First step:

```
/etc/iproute2/rt_tables
1 tsunami
2 tsunami2
```


Kernel Options needed

- To enable this feature (marking of packets), the following options needs to be enabled in the kernel*

```
IP: advanced router (CONFIG_IP_ADVANCED_ROUTER) [Y/n/?]
IP: policy routing (CONFIG_IP_MULTIPLE_TABLES) [Y/n/?]
IP: use netfilter MARK value as routing key (CONFIG_IP_ROUTE_FWMARK[Y/n/?]
```

[1]

*Kernel Options for 3.5.0-22-generic

[1] http://www.tldp.org/HOWTO/Adv-Routing-HOWTO/lartc.netfilter.html

Redirecting traffic (fwmark)

Second Step:

Laptop:

```
1- ip rule add fwmark 1 table tsunami
2- ip route add default via 10.0.0.6 table tsunami
3- ip rule add fwmark 2 table tsunami2
4- ip route add default via 192.168.1.6 table tsunami2
```

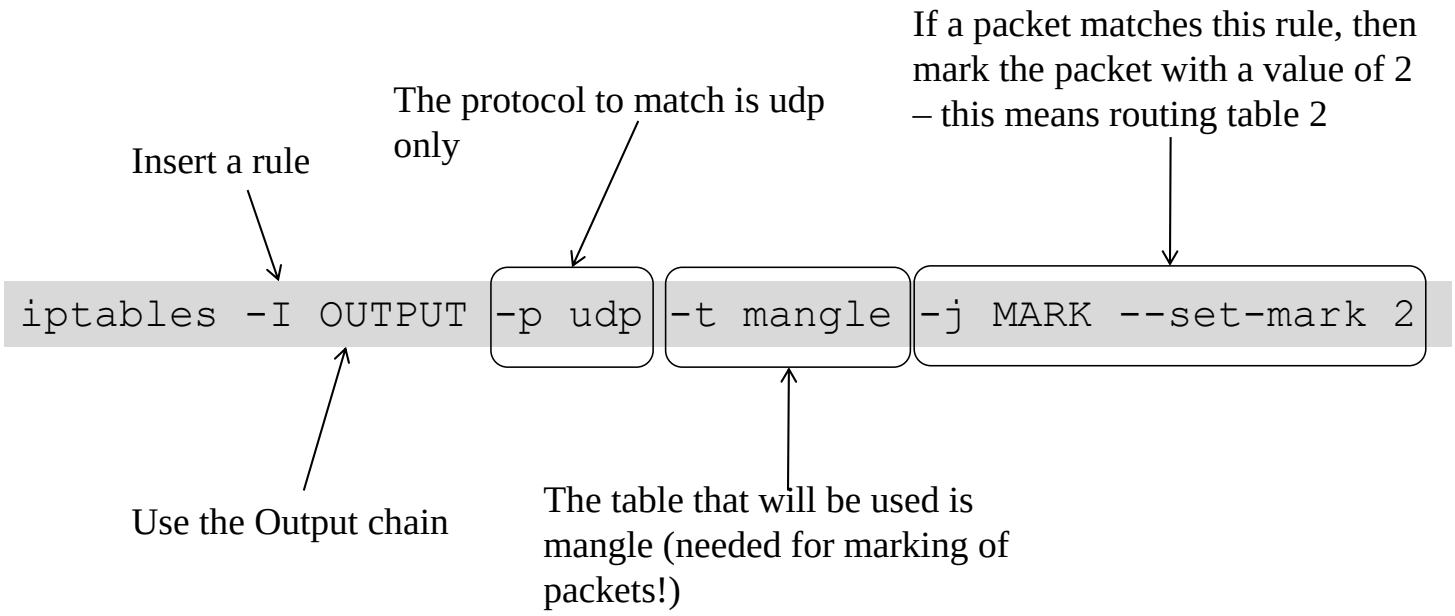
PC (Router):

```
ip rule add fwmark 1 table tsunami
ip route add default via 10.0.0.5 table tsunami
ip rule add fwmark 2 table tsunami2
ip route add default via 192.168.1.3 table tsunami2
```


Selecting Routing Tables (iptables) (1)

- Iptables has 4 different type of tables (raw, nat, filter and mangle)
- NAT table should only be used for Network Address Translation on different packets
- Raw table should only be used when no connection tracking system is desired
- Filter table uses 3 different type of chains:
  - Input chain – Processes packets that are destined for the host (not needed)
  - Output chain - Processes packets that are sent by the host (needed for Laptop and Mobile Node)
  - Forward chain – Processes packets that are received by the host and destined to another host (needed for wired router)
- Mangle table is very important – without it the marking of packets would not be possible!

Selecting Routing Tables (iptables) (2)



Testing the Route Tables (1)

Example:

```
iptables -I OUTPUT -p udp -t mangle -j MARK --set-mark 2
iptables -I OUTPUT ! -p udp -t mangle -j MARK --set-mark 1
```

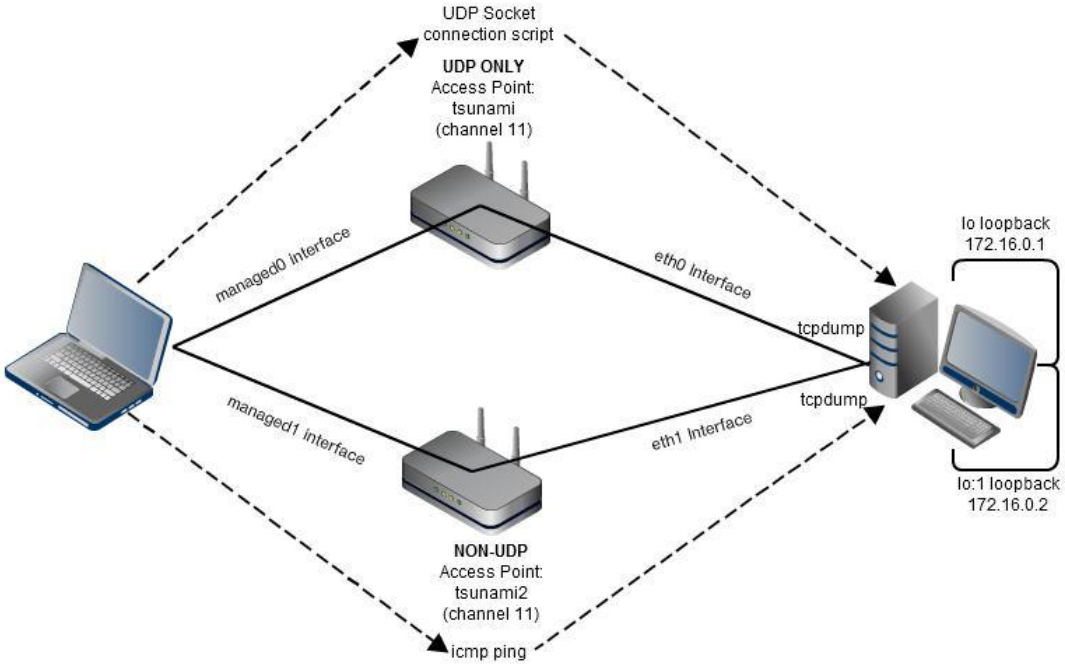
View Entries:

```
iptables -v -L -t mangle
```

Delete ALL Entries

```
iptables -F -t mangle
```

Testing the Route Tables (2)



Reverse Path Filtering

- Reverse Path Filtering prevents source address spoofing
- Checks the source IP of each packet received on that interface against its routing table
- If the route is not in the routing table, the packet will be dropped

- **Reverse path filtering will cause packets redirected via the 'wrong' interface to be dropped!**

Turn it off by doing [1]:

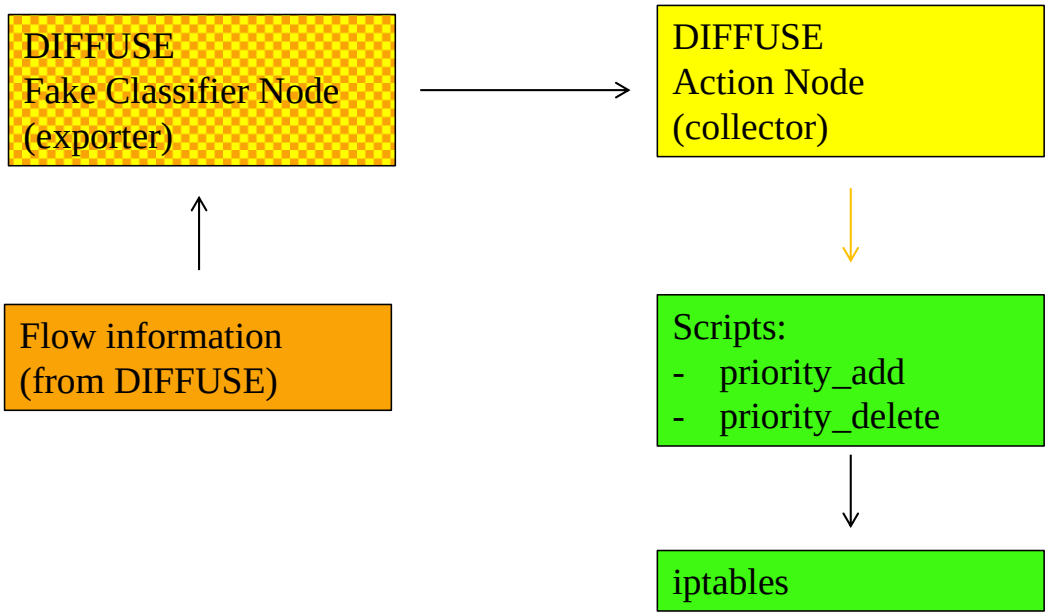
```
for i `ls /proc/sys/net/ipv4/conf `;
do echo "0" > /proc/sys/net/ipv4/conf/$i/rp_filter;
done;
```

[1] http://www.tldp.org/HOWTO/Adv-Routing-HOWTO/lartc.kernel.rpf.html

Priority flow Redirection

- Extend generic rule to match specific flows
- Command line script which takes five arguments:
  - (source ip:source port:destination ip:destination port:protocol)
- Based on these arguments the **priority_add** script and **priority_delete** script were tested, and will be integrated with the DIFFUSE system.

Currently working on



Conclusion

- Successful
  - Multiple access point connections (from single NIC)
  - Changing the routing tables to redirect traffic to a different path
  - Selecting routing tables based on arguments to prioritise a particular flow
- Ongoing Work
  - (Integrating DIFFUSE to do work and building/testing the classifier)

What I've gained from the Internship?

- Basic introduction via coursework enabled me to expand my experience whilst doing the internship, which improved my confidence
- More familiar with FreeBSD and Linux operating systems

What I've gained from the Internship?

- Using my theoretical and practical knowledge from my course units enabled me to develop and test various possible solutions needed to achieve the projects criteria
- It enabled me to experience more challenging tasks that can occur and how to accomplish them appropriately

Thank you

- A special thanks to, Grenville Armitage, Philip Branch and Jason But for giving me the opportunity to work at CAIA for my internship.

Q & A