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The Brothers WISP

Greg Sowell Consulting

Using BGP For QoS
MUM 2015

Who Am I

- Greg Sowell – A+, Network+, CCNA, CCNP, CCIE Written, MTCNA, MTCRE, MTCINE, Mikrotik Certified Trainer
- Director of Technology FIBERTOWN Datacenters
- Consultant – GregSowell.com

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Justin

JJ

Greg and Andrew Cox

Tom

Fabio

Thrift

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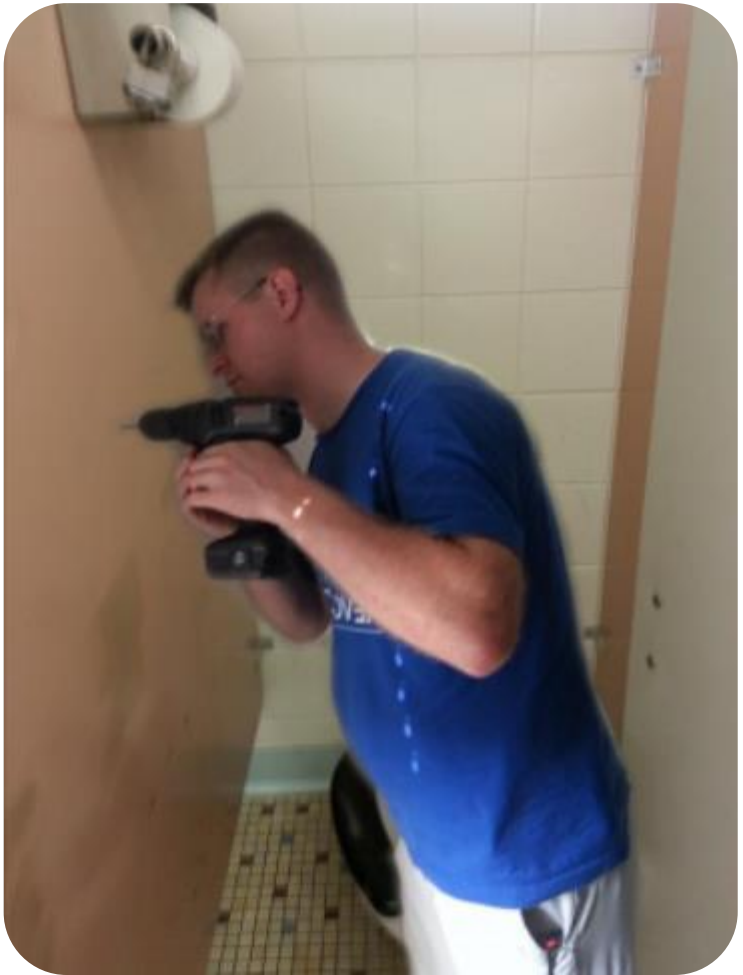
And then there is Mike



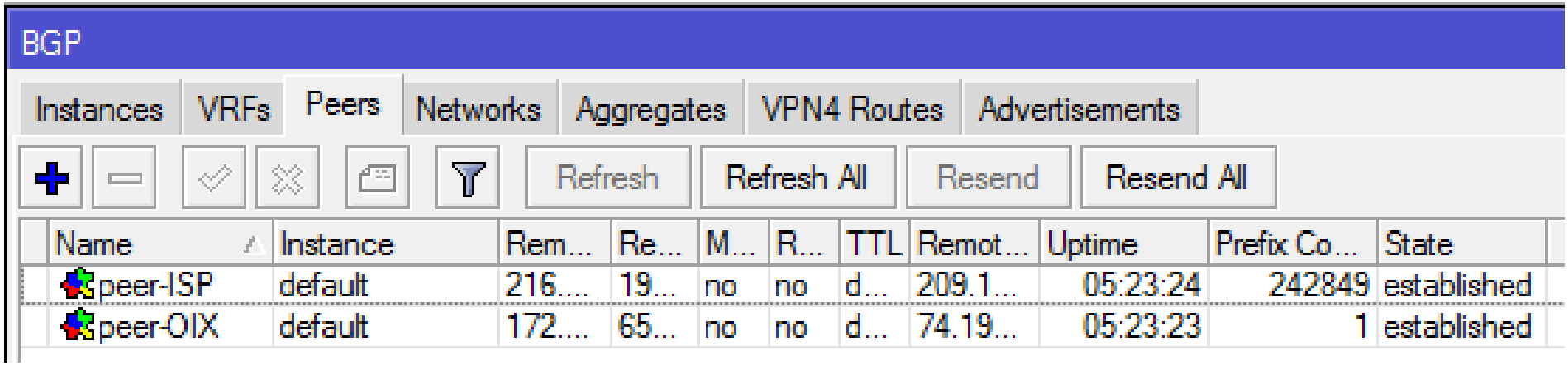
Assumptions

- You are somewhat familiar with BGP and its configuration.
  - ASN.
  - Peers.
  - Filters.
- You are somewhat familiar with QoS and its configuration.
  - Address-lists.
  - Mangle rules.
  - Queue trees.

- But we will review a little anyway as we go along…

What is BGP

- Border Gateway Protocol is the dynamic routing protocol that carries all of the routing information for the Internet…no big deal.
- You can choose to accept all routes, partial routes, default route, or some combination of them all.
  - You can also filter on your side to be even more selective.
  - We will be accepting all routes /23 or larger.



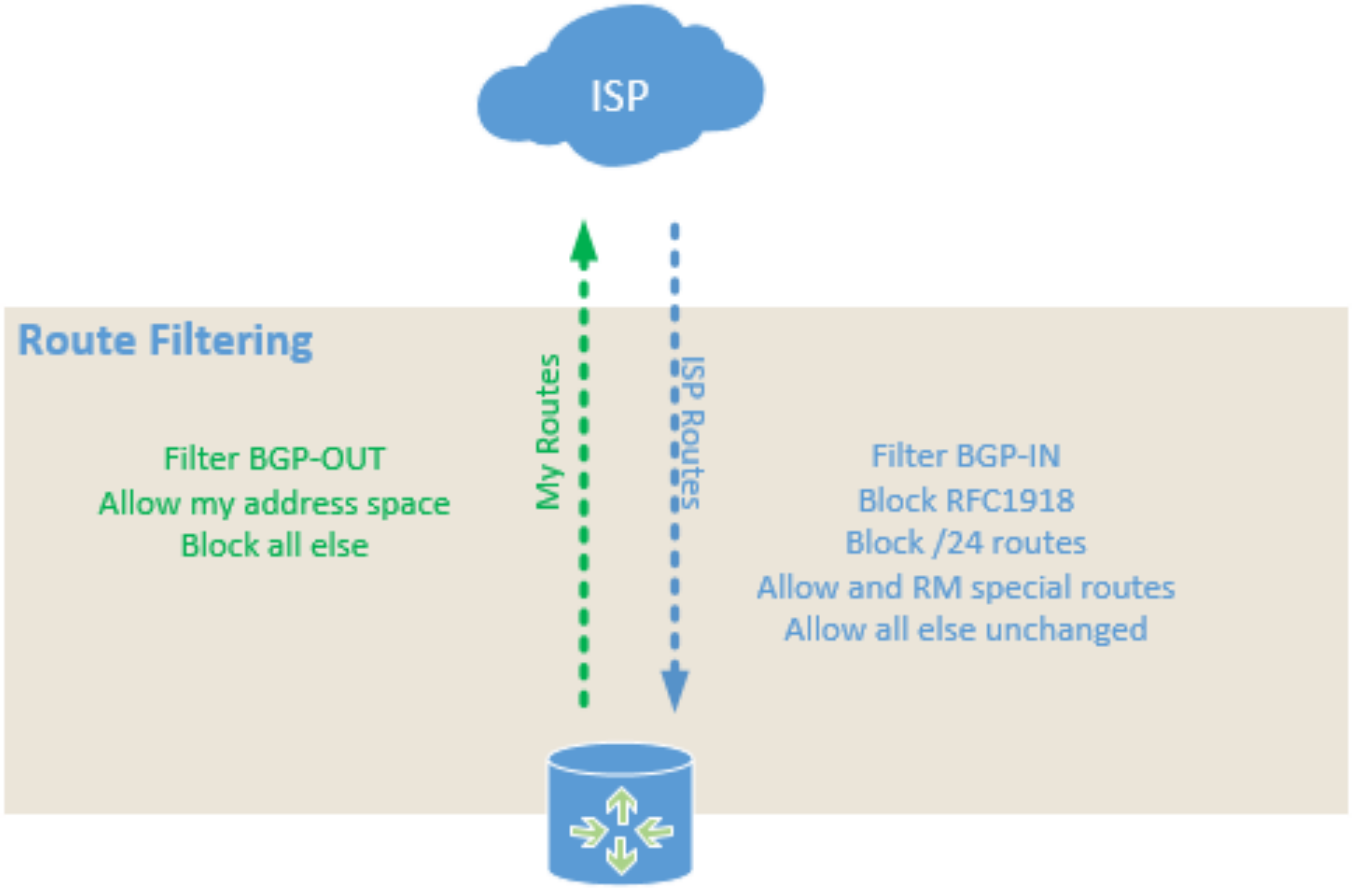
Open Internet Exchange

- An OIX is a network connection where you peer with multiple other organizations.
- There is, generally, no charge from the other organizations for this peering.
- Local transit from this area.
- Content providers (Netflix), CDNs(CloudFlare)

Steps

- Route Filters
  - Create
  - Apply
  - Verify
- BGP QoS Script
- Address-lists
- Mangle Rules
- Queue Trees
- Verification of Mangle/Queues

Route Filters

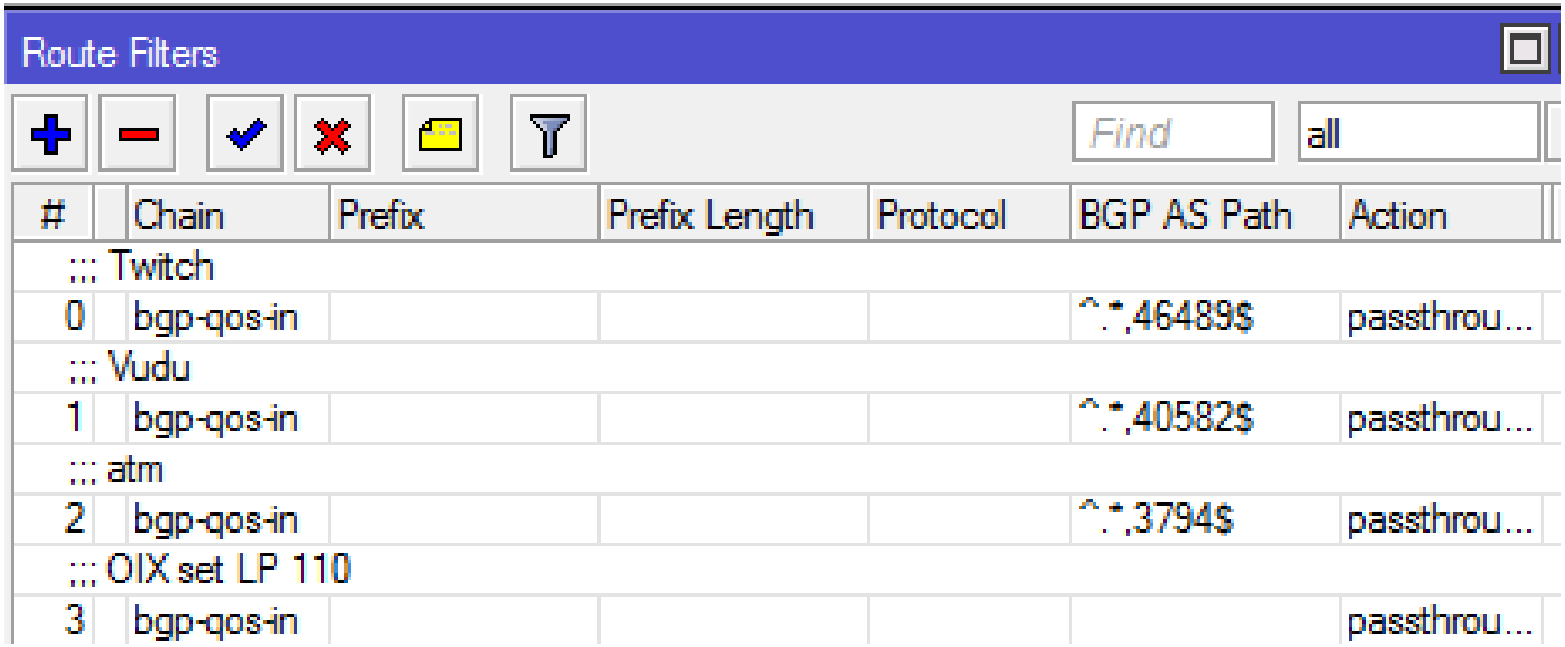


Route Filters

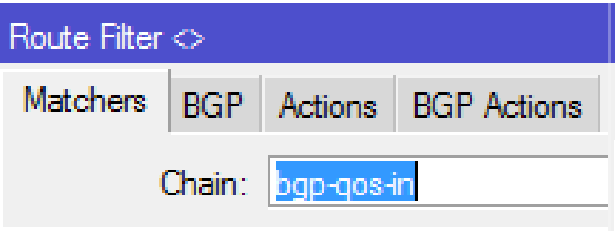
- Route filters (/routing filter) are used to identify and act upon routes received or sent via various dynamic routing protocols.
- Match on various BGP attributes, prefix, prefix lengths, OSPF type, etc.
- Simple actions can be taken like accept the route or reject the route.
- Complex actions can be taken like set next hop, set distance, set BGP prepending, set BGP community.

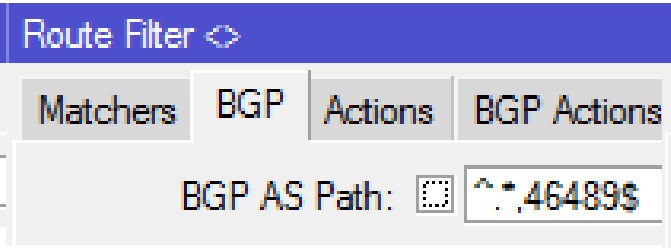
Route Filters

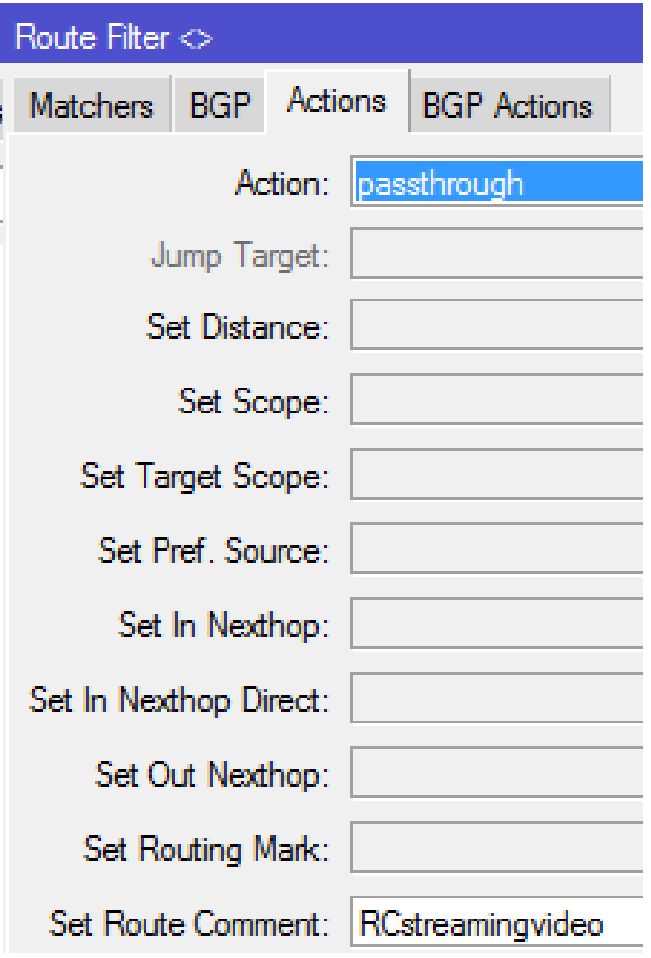
- Our example includes 4 filter statements.
  - 3 match based on BGP AS Path
  - 1 matches on BGP community



Twitch.tv Route Filter



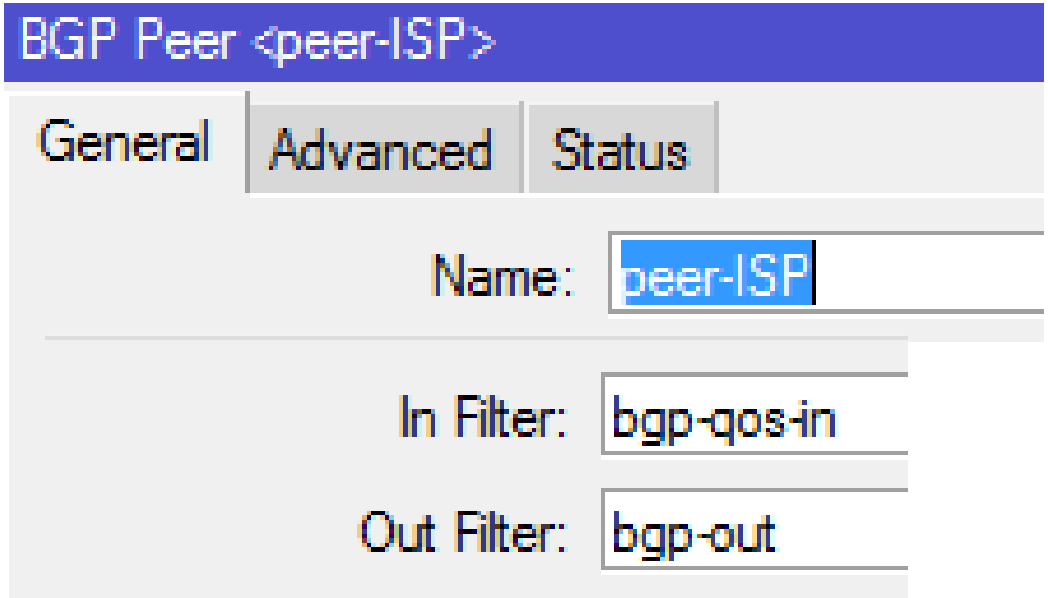




- This is the Twitch.tv rule. Twitch sources all of its traffic from ASN 46489.
- We create a new chain for all peers called bgp-qos-in.
- In the AS path match the ^ marks the beginning of the string and the $ matches the end. We use regex to match all traffic sourced from Twitch's ASN.
- Our action is to pass the NLRI through and set a comment on any routes from this ASN as "RCstreamingvideo".

Apply Filter

- *Remember that when you apply a filter to a peer, it resets the peer completely.
- **Remember that when you adjust these lists, all of your routes from this peer become momentarily disabled while they run through the adjusted filter.

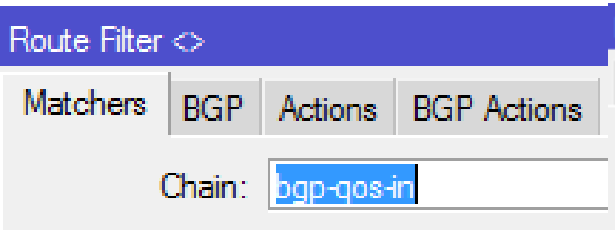


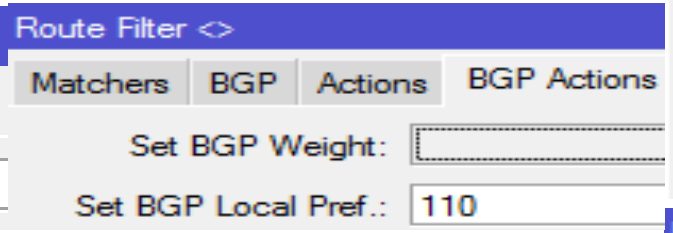
Route Filter Verification - Twitch

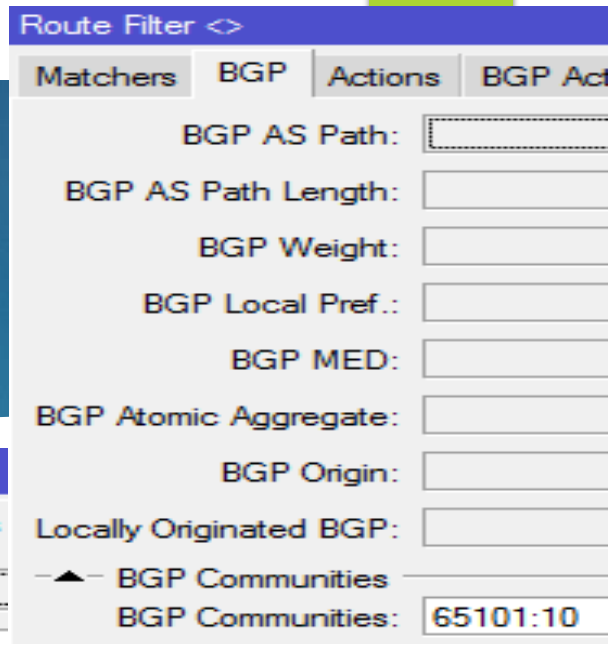
- You can see the route comment of RCstreamingvideo
- You can see the full AS path.
  - Note source is on the right and each new AS is added to the left as it traverses ASNs.

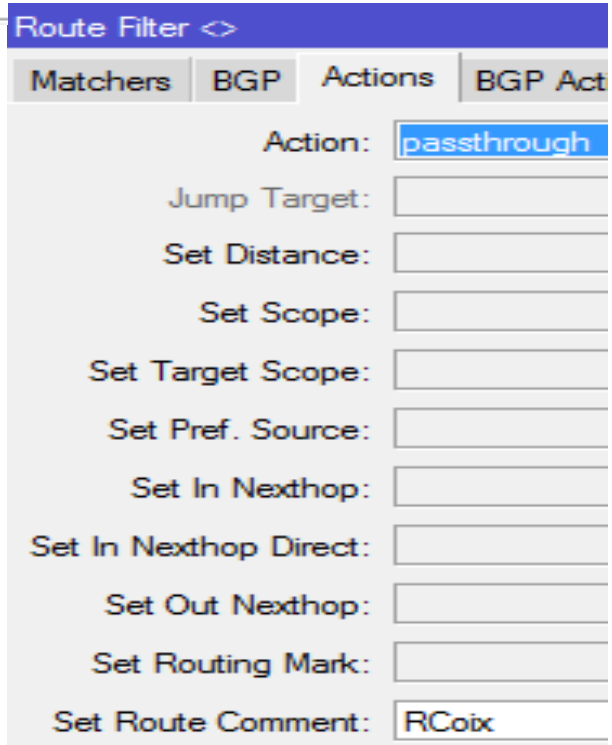
```
[admin@BGP-QOS] /ip route> print detail where dst-address=199.9.248.0/21
Flags: X - disabled, A - active, D - dynamic,
C - connect, S - static, r - rip, b - bgp, o - ospf, m - mme,
B - blackhole, U - unreachable, P - prohibit
 0 ADb  ;;; RCstreamingvideo
        dst-address=199.9.248.0/21 gateway=216.81.32.81
        gateway-status=216.81.32.81 reachable via  ether3 distance=20 scope=40
        target-scope=10 bgp-as-path="19366,1299,46489" bgp-origin=igp
        received-from=peer-ISP
```

Open Internet Exchange Route Filter









- The peering OIX router is tagging everything sent to us with community 65101:10.
- In the BGP tab we simply put 65101:10 in the communities column.
- Our action is to pass the NLRI through and set a comment on any routes from this ASN as “RCoix”.
- Optionally we are setting the local preference to 110 in the BGP actions tab. This will prefer routes learned here above all others.

Route Filter Verification - OIX

- You can see the route comment of RCoix
- You can see the BGP community attached 65101:10.
- You will also notice our adjusted local preference of 110.

```
[admin@BGP-QOS] /ip route> print detail where dst-address=4.4.4.0/24
Flags: X - disabled, A - active, D - dynamic,
C - connect, S - static, r - rip, b - bgp, o - ospf, m - mme,
B - blackhole, U - unreachable, P - prohibit
 0 ADb  ;;; RCoix
        dst-address=4.4.4.0/24 gateway=172.17.1.2
        gateway-status=172.17.1.2 reachable via  gre-oix distance=20 scope=40
        target-scope=10 bgp-as-path="65101" bgp-local-pref=110 bgp-origin=igp
        bgp-communities=65101:10 received-from=peer-OIX
```

Steps

- Route Filters
- BGP QoS Script
  - Create
  - Explain
  - Verify
  - Schedule
- Address-lists
- Mangle Rules
- Queue Trees
- Verification of Mangle/Queues

BGP Script

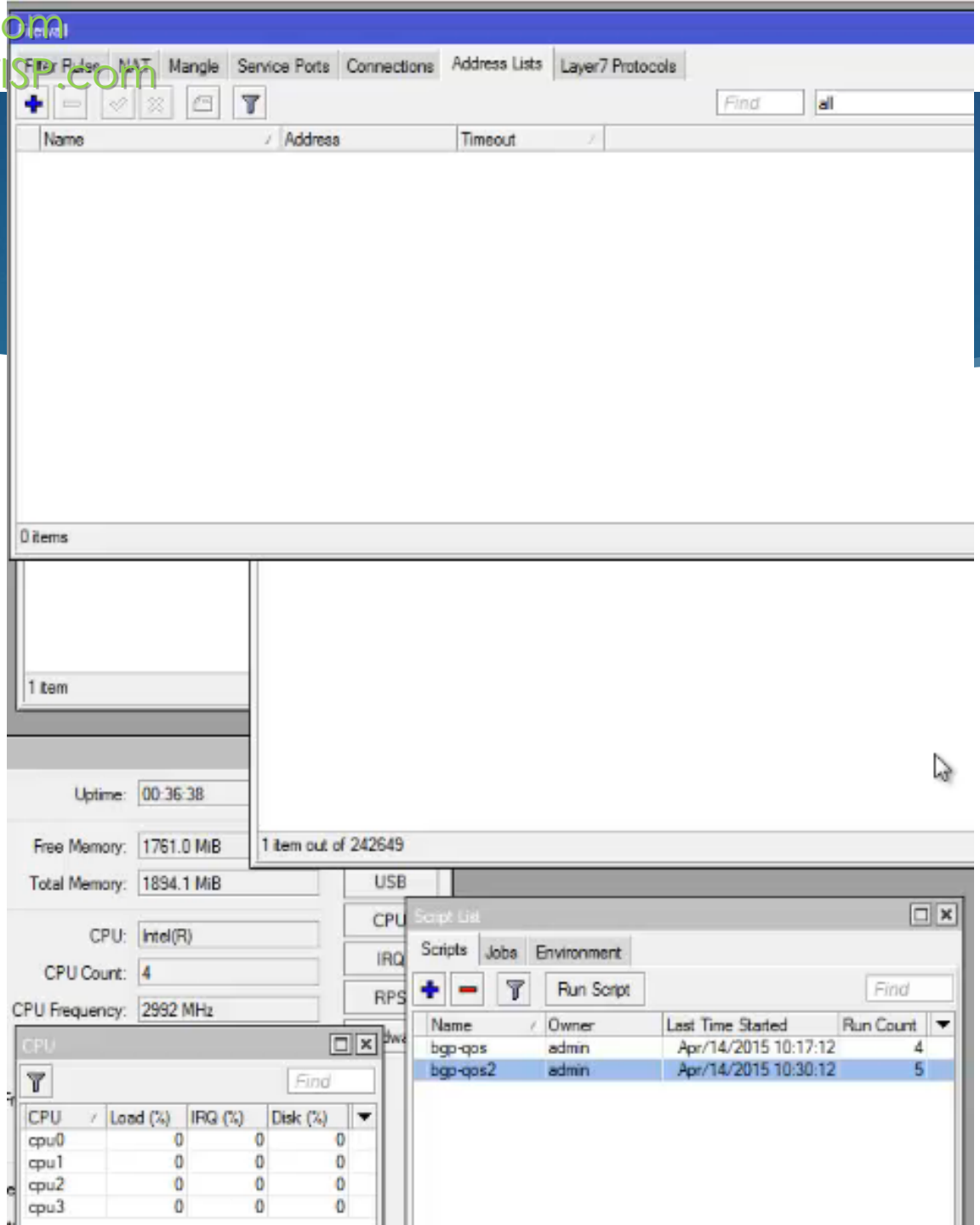
```
:log info "BGP QoS script start";
#Define Local Var and load data
#loop variables
:local i 0;
#route ip address
:local ipAddress;
#is it marked for us
:local routeMark "null";
#route comment
:local routeComment "null";
#check the beginning of our routeComment
:local listName "null";
#loop to check the entire routing table
:foreach i in=[/ip rou find] do={
  #grab the route's comment
  :set routeComment [/ip route get $i comment]
  #check if to make sure the route comment isn't null
  :if ($routeComment!="") do={
    #grab the first two letters off of the route comment
    set listName [:pick $routeComment 0 2]
    #make sure the first two letters are RC
    :if ($listName="RC") do={
      #get the IP address of the route
      :set ipAddress [/ip route get $i dst-address]
      #log debug info to the log
        #if it is the default gateway don't add it, otherwise add it to the addresslist for 24 hours and 30 seconds
          :if ($ipAddress!=0.0.0.0/0) do={
          /ip firewall address-list rem [find where list=$routeComment address=$ipAddress];
          /ip firewall address-list add list=$routeComment address=$ipAddress timeout=88200;}
    }
  }
}
:log info "BGP QoS script complete";
```

What it does

- Loop through routing table.
- Identify routes with a route comment starting with RC.
- Delete any old address-list entries that are the same.
- Create a new address-list entry that has the route's address with a 24.5 hour timeout.
- Name the address-list entry that of the route comment "Rcstreamingvideo".

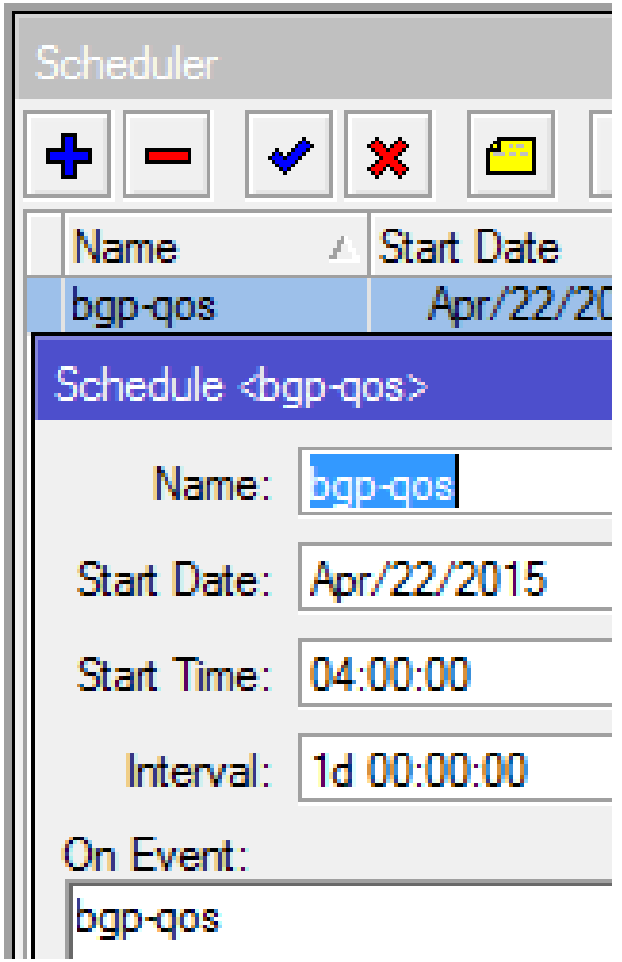
Running Our Script - CPU

- Dual 3.5Ghz Xeon
  - 75 seconds to run
  - CPU ~80%
- Quad 3Ghz Xeon
  - 45 seconds to run
  - CPU ~40%



Schedule Script

- Create the script to run every 24 hours.
- Schedule it to run at a time of low network utilization so it won't impact services.

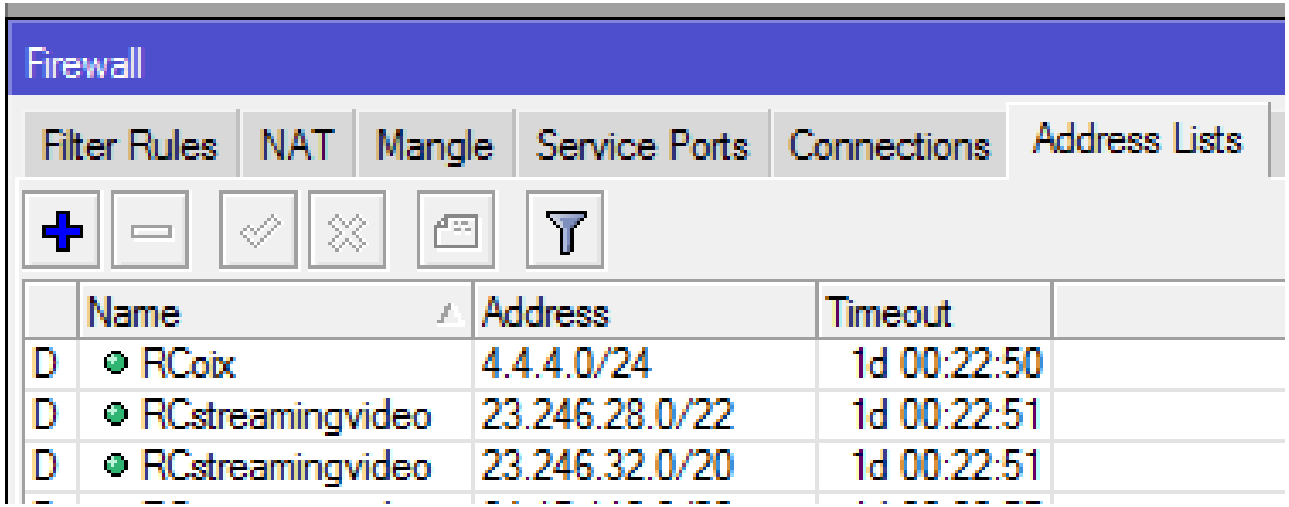


Steps

- Route Filters
- BGP QoS Script
- Address-lists
  - Review a few created
- Mangle Rules
- Queue Trees
- Verification of Mangle/Queues

Address-lists

- Our script builds address lists.
- If our route comment starts with "RC", then it takes the destination address and creates an address list entry with that comment name.
- All entries are set for 24.5 hours.



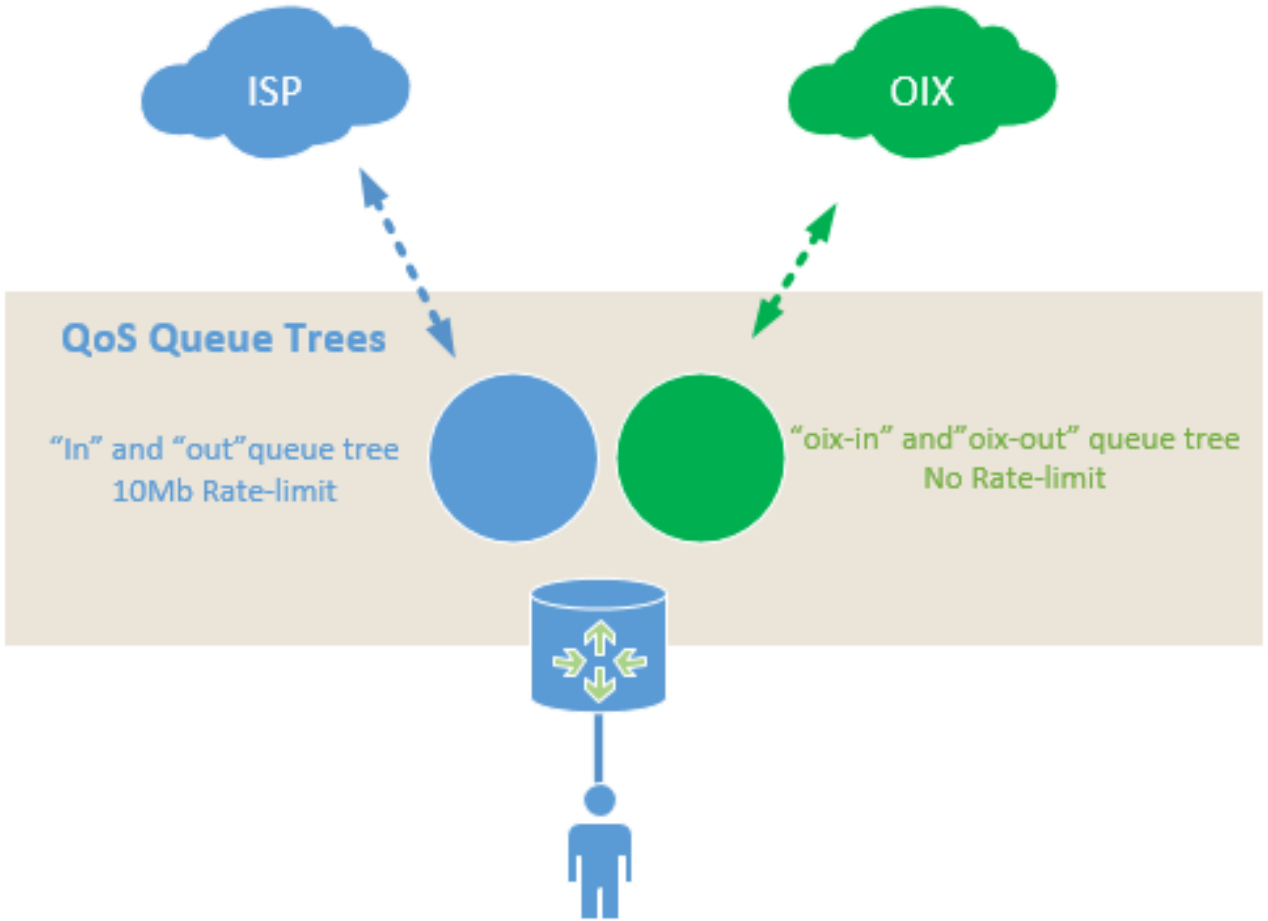
Now We Can Take Over The World

- We can use our Address-list entries in:
  - Filter rules
  - NAT rules
  - Mangle rules
- We will be using them in mangle to classify traffic for use in QoS

Steps

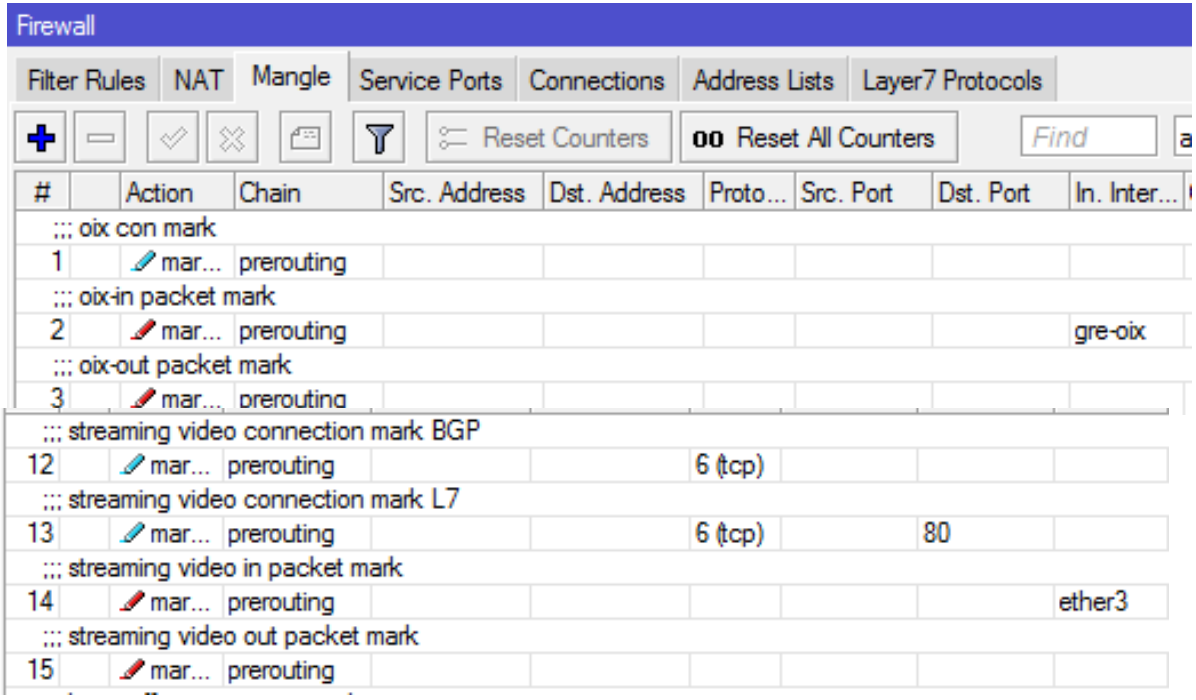
- Route Filters
- BGP QoS Script
- Address-lists
- Mangle Rules
  - Creation OIX/Twitch
- Queue Trees
- Verification of Mangle/Queues

No Rate Limit On OIX Traffic

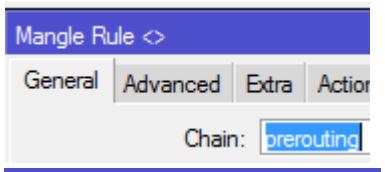


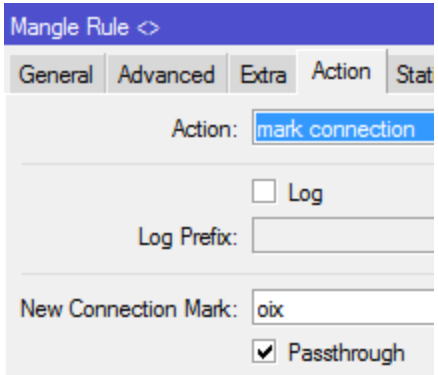
Mangle Rules

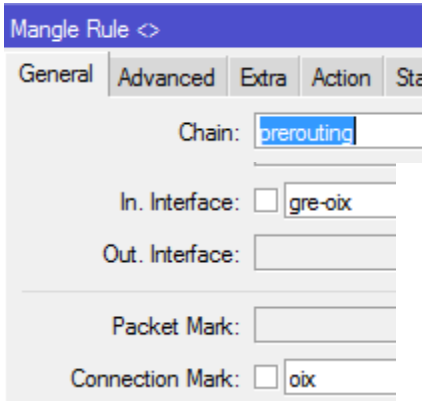
- We connection mark the traffic based on address-lists built from the BGP-QoS script.
- Using the connection mark we packet mark traffic inbound and outbound.

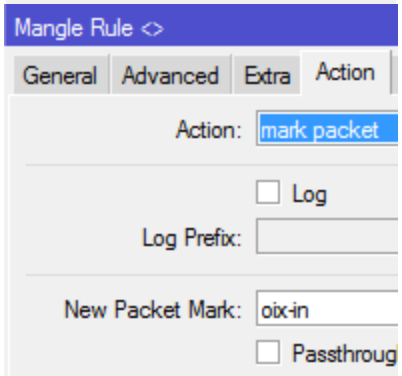


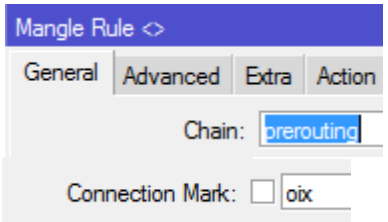
Marking OIX

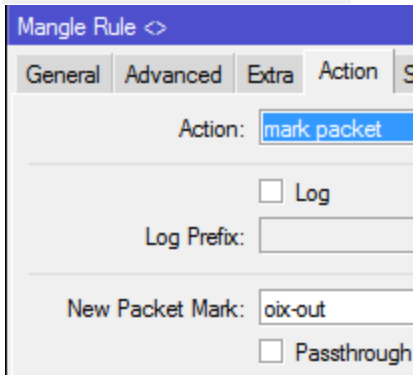




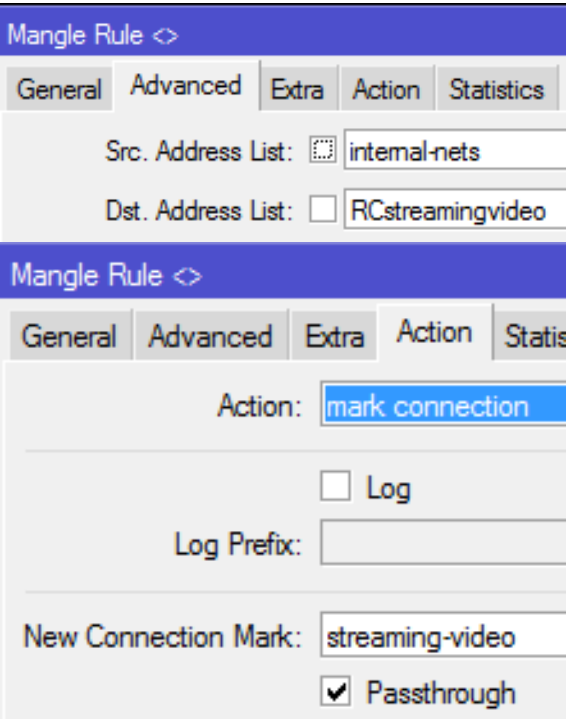


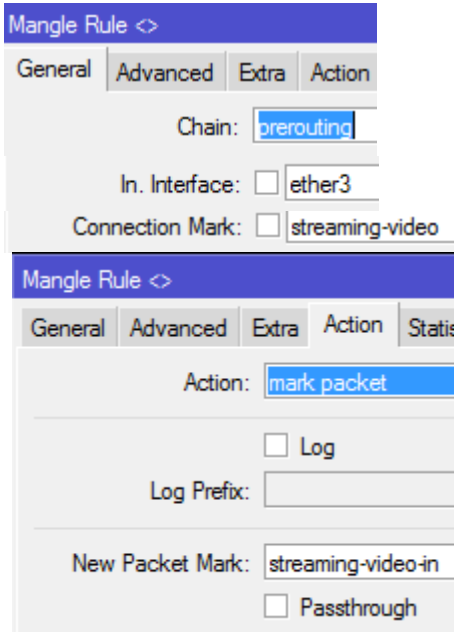


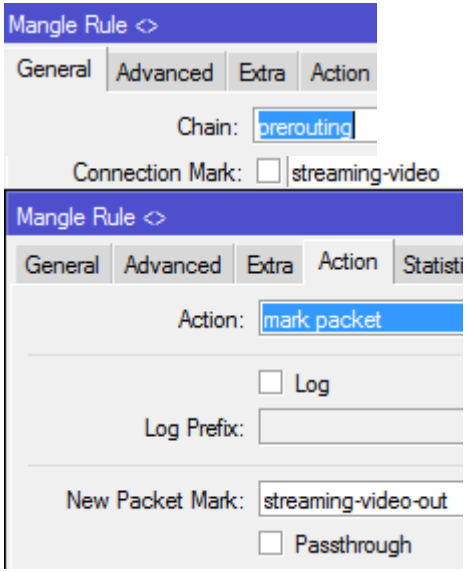




Marking Twitch.TV Traffic





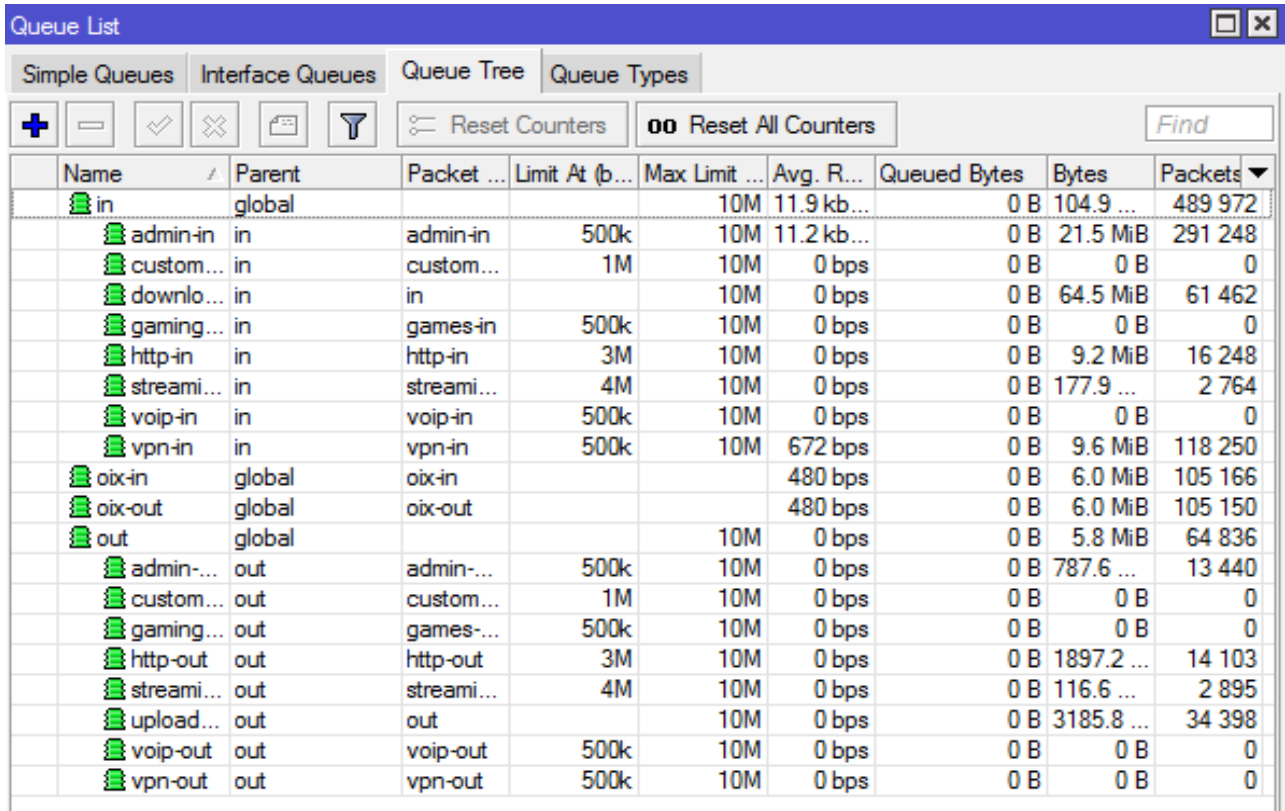


Steps

- Route Filters
- BGP QoS Script
- Address-lists
- Mangle Rules
- Queue Trees
  - Creation
- Verification of Mangle/Queues

Queue Trees

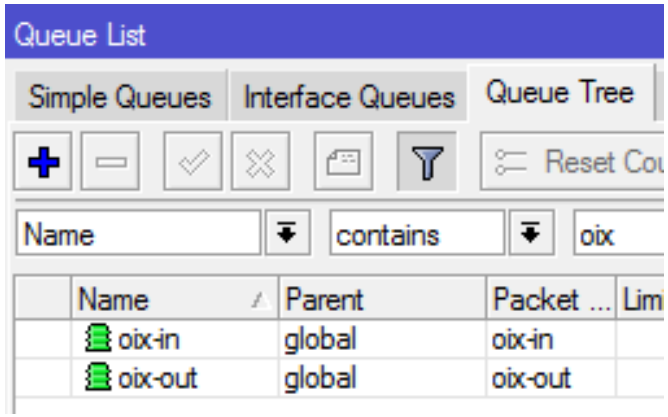
- Single direction HTBs.
- Allows for ingoing and outgoing queues.
- Break down each via packet marks.
- We have different services separated and prioritized.

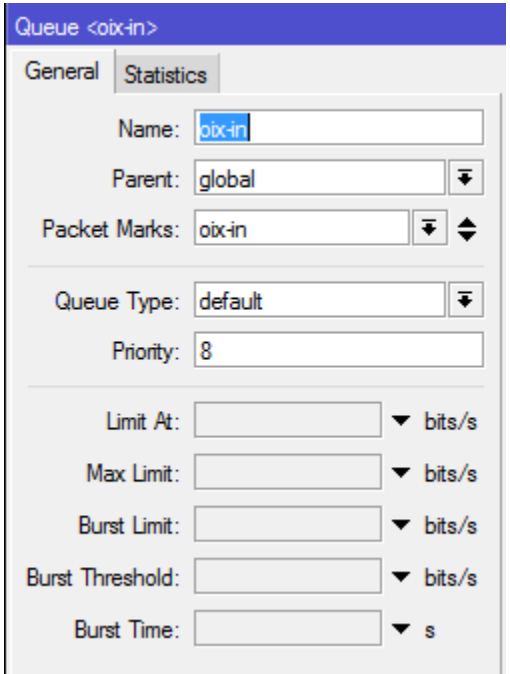


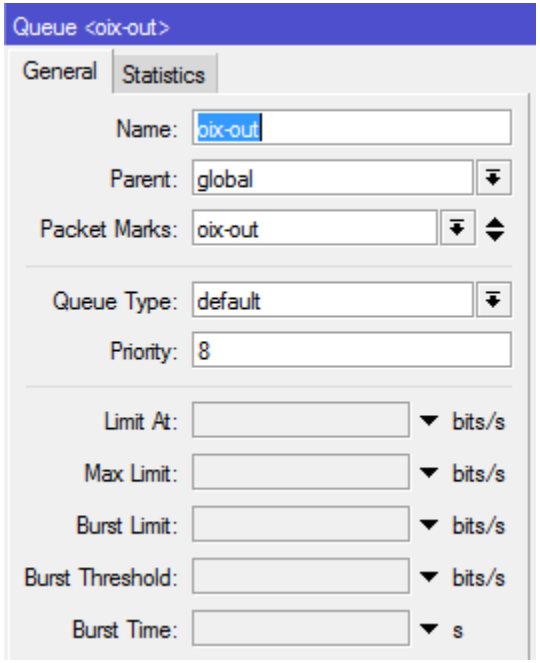
Name	Parent	Packet ...	Limit At (b...	Max Limit ...	Avg. R...	Queued Bytes	Bytes	Packets
in	global			10M	11.9 kb...	0 B	104.9 ...	489 972
admin-in	in	admin-in	500k	10M	11.2 kb...	0 B	21.5 MiB	291 248
custom...	in	custom...	1M	10M	0 bps	0 B	0 B	0
downlo...	in	in		10M	0 bps	0 B	64.5 MiB	61 462
gaming...	in	games-in	500k	10M	0 bps	0 B	0 B	0
http-in	in	http-in	3M	10M	0 bps	0 B	9.2 MiB	16 248
streami...	in	streami...	4M	10M	0 bps	0 B	177.9 ...	2 764
voip-in	in	voip-in	500k	10M	0 bps	0 B	0 B	0
vpn-in	in	vpn-in	500k	10M	672 bps	0 B	9.6 MiB	118 250
oix-in	global	oix-in			480 bps	0 B	6.0 MiB	105 166
oix-out	global	oix-out			480 bps	0 B	6.0 MiB	105 150
out	global			10M	0 bps	0 B	5.8 MiB	64 836
admin-...	out	admin-...	500k	10M	0 bps	0 B	787.6 ...	13 440
custom...	out	custom...	1M	10M	0 bps	0 B	0 B	0
gaming...	out	games-...	500k	10M	0 bps	0 B	0 B	0
http-out	out	http-out	3M	10M	0 bps	0 B	1897.2 ...	14 103
streami...	out	streami...	4M	10M	0 bps	0 B	116.6 ...	2 895
upload...	out	out		10M	0 bps	0 B	3185.8 ...	34 398
voip-out	out	voip-out	500k	10M	0 bps	0 B	0 B	0
vpn-out	out	vpn-out	500k	10M	0 bps	0 B	0 B	0

Queue Trees

- Incoming and outgoing based on packet marks from our mangle rules.



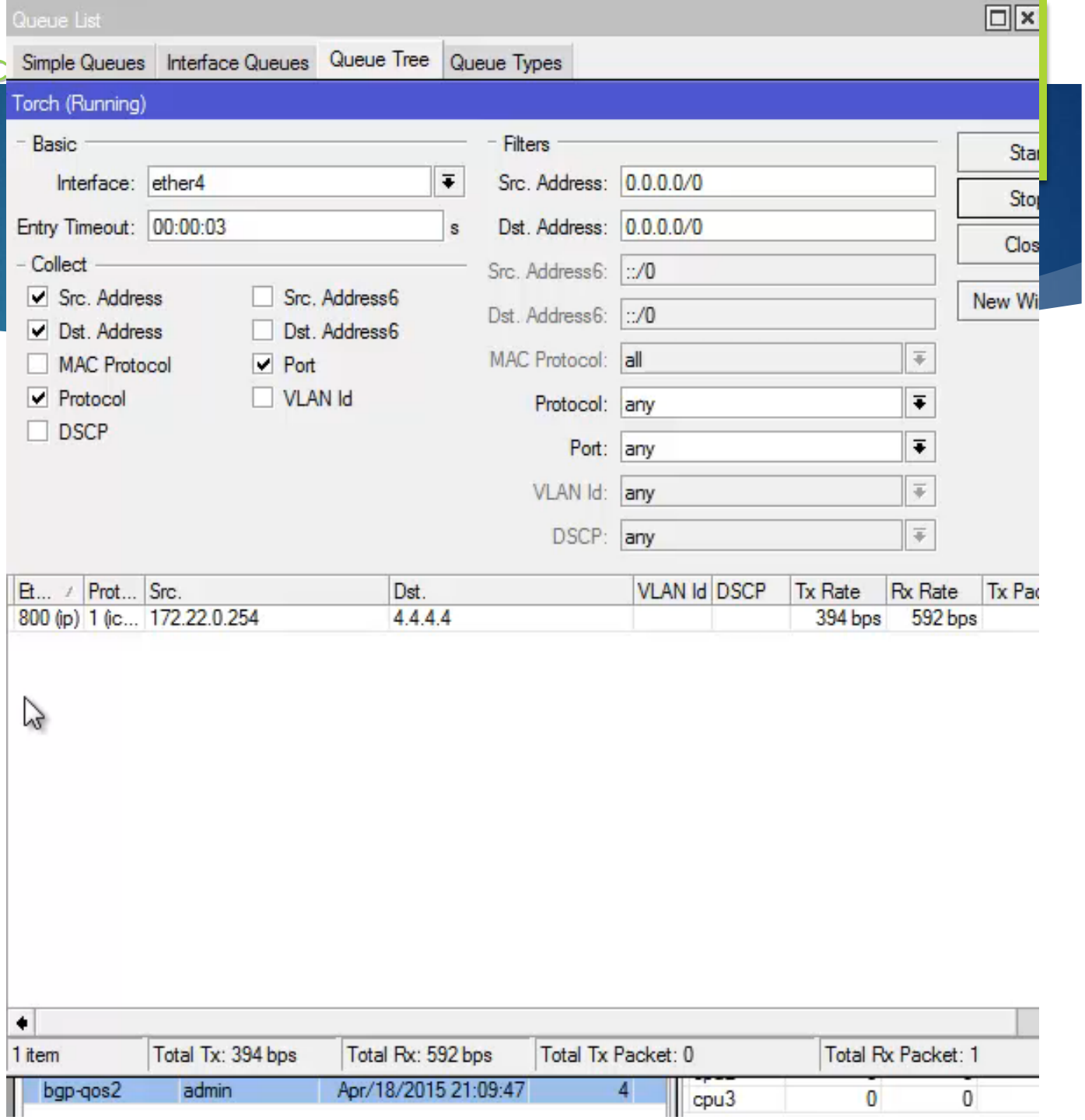




Steps

- Route Filters
- BGP QoS Script
- Address-lists
- Mangle Rules
- Queue Trees
- Verification of Mangle/Queues
  - OIX
  - Twitch

OIX Testing



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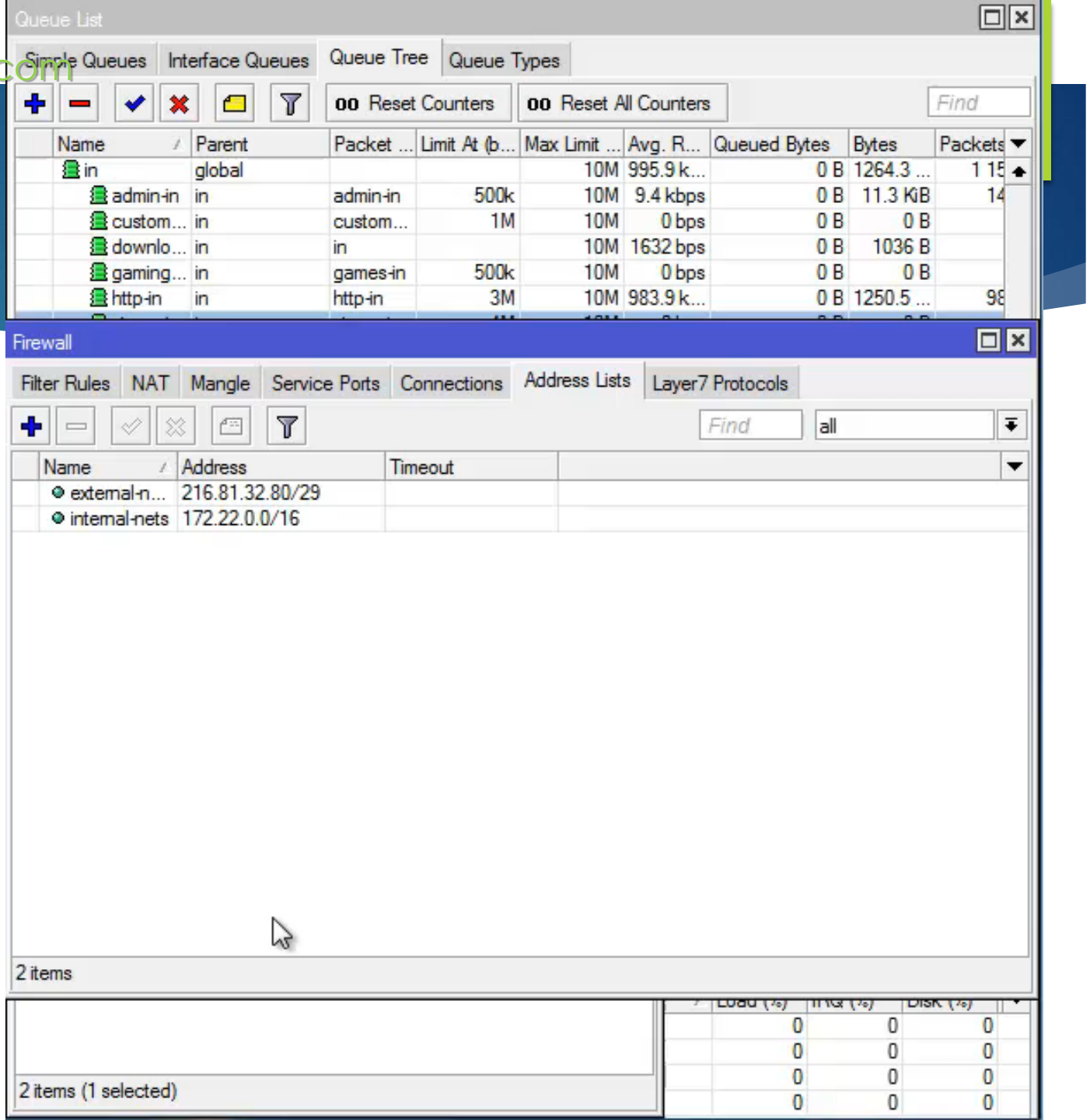
Twitch Testing



One last thing, shake my hand and buy the brothers a beer!

Thanks and happy routing!

Resources

- Greg's Blog
  - http://GregSowell.com
- TheBrothersWISP
  - http://thebrotherswisp.com/
- Greg Sowell Routing
  - http://gregsowell.com/?p=1611
- Greg Sowell QoS
  - http://gregsowell.com/?p=4665