HURRICANE ELECTRIC
INTERNET SERVICES

Peering Security

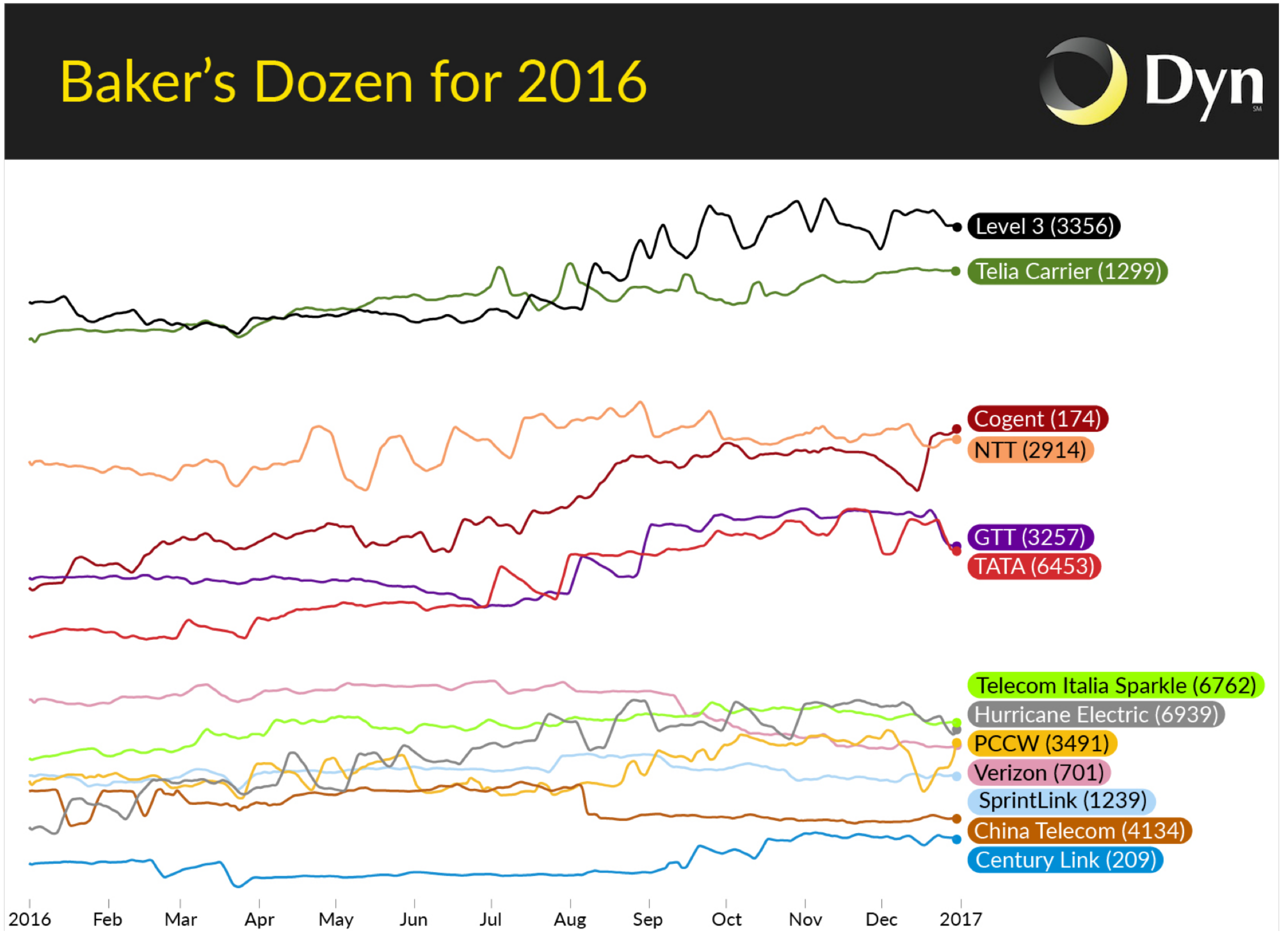
Peering Days
Zagreb Croatia 2019

Walt Wollny, Director Interconnection Strategy
Hurricane Electric AS6939

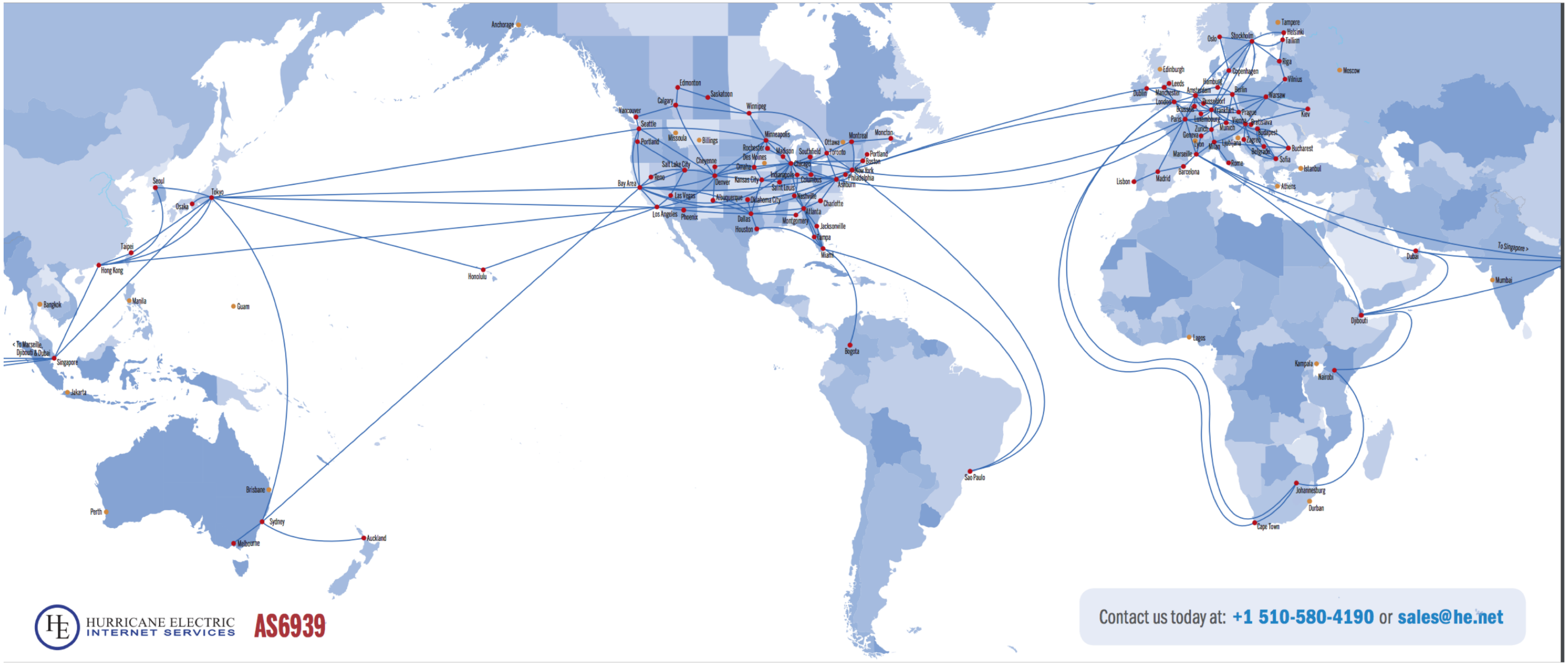
Who is Walt Wollny?

- Hurricane Electric AS6939 – 4 years
- Amazon AS16509 – 4 years
- Microsoft AS8075 – 13 years

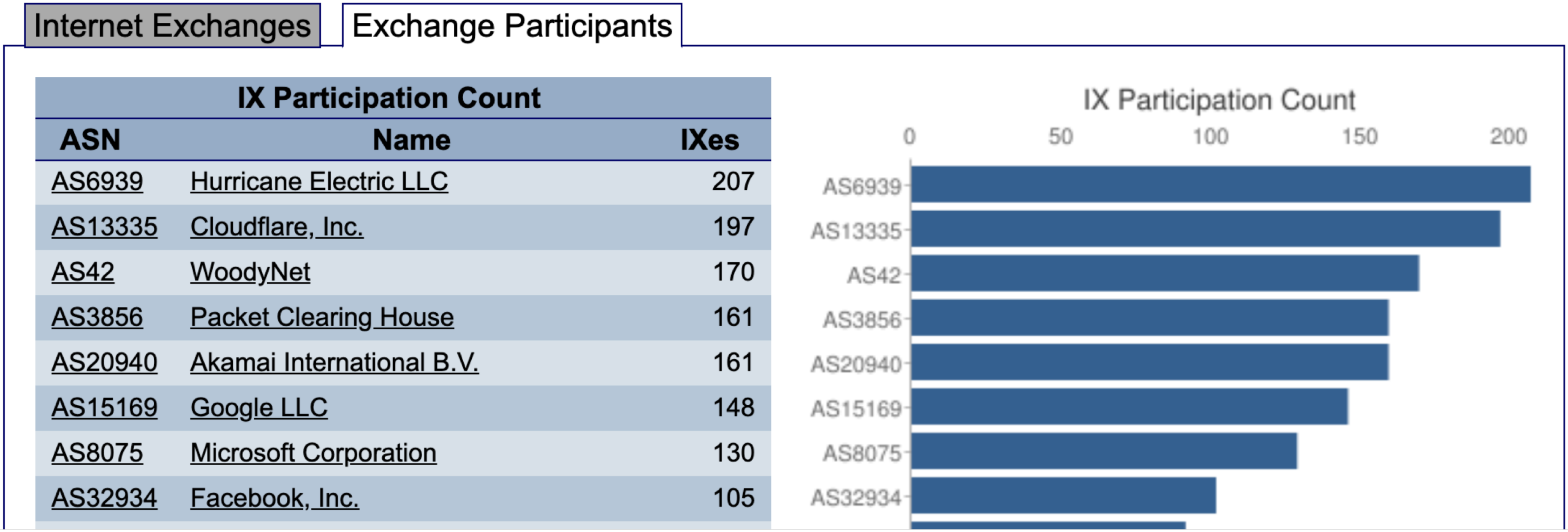
Hurricane Electric #8 in 2017 up from #13 in 2016 in the Global IPv4 rankings!



Hurricane Electric Backbone



The Most Peering Exchanges



Internet Exchanges | Exchange Participants

IX Participation Count		
ASN	**Name**	**IXes**
AS6939	Hurricane Electric LLC	207
AS13335	Cloudflare, Inc.	197
AS42	WoodyNet	170
AS3856	Packet Clearing House	161
AS20940	Akamai International B.V.	161
AS15169	Google LLC	148
AS8075	Microsoft Corporation	130
AS32934	Facebook, Inc.	105

What does security have to do with Peering?

A lot. Now.

Security was an afterthought, but it has become critically important.

Some of the basics...

Basics

- Best defenses for your network?
  - Logical Port Security
  - Routing Security
  - Best Practices

Basics - Port Security

- Many IXPs will post their recommended port configuration (HKIX, AMS-IX, etc).
- Don’t just connect an interface with a default configuration to an IX Port!
- Services like Proxy-ARP will disrupt the IX as well as degrade your own network.
- Most IXs allow only unicast traffic. (IPv6 multicast neighbor discovery packets are an exception.0

Basics - Port Security

- Apply ACL's to your interfaces—don't forget to configure both IPv4 and IPv6 ACLs!
- The SIX (Seattle Internet Exchange) has a great example here.
- Your IX port is an exposed piece of your network.
- Hundreds of other networks are directly connected.
- Remove this security risk!

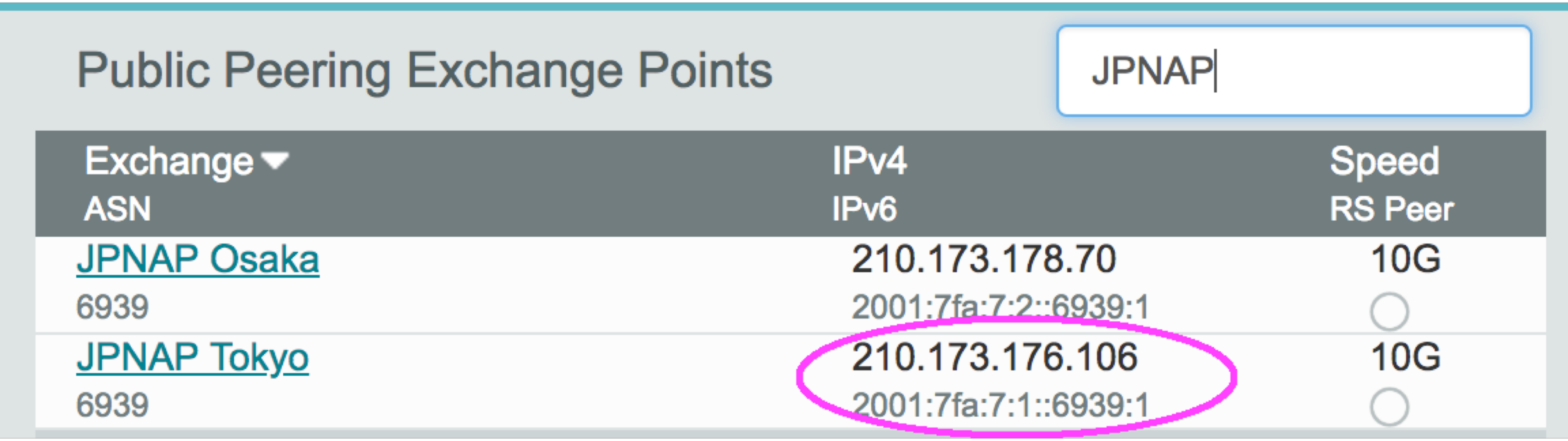
Basics - Port Security

- Your IX Port is a target for DDoS Attacks!
- Applying the best security practices will help keep your network online during attacks.

Basics - Routing Security

- The IXP is responsible for protecting the infrastructure.
- The IX LAN is not your IP space and should not be routed.
- Checking this...

Basics - Routing Security

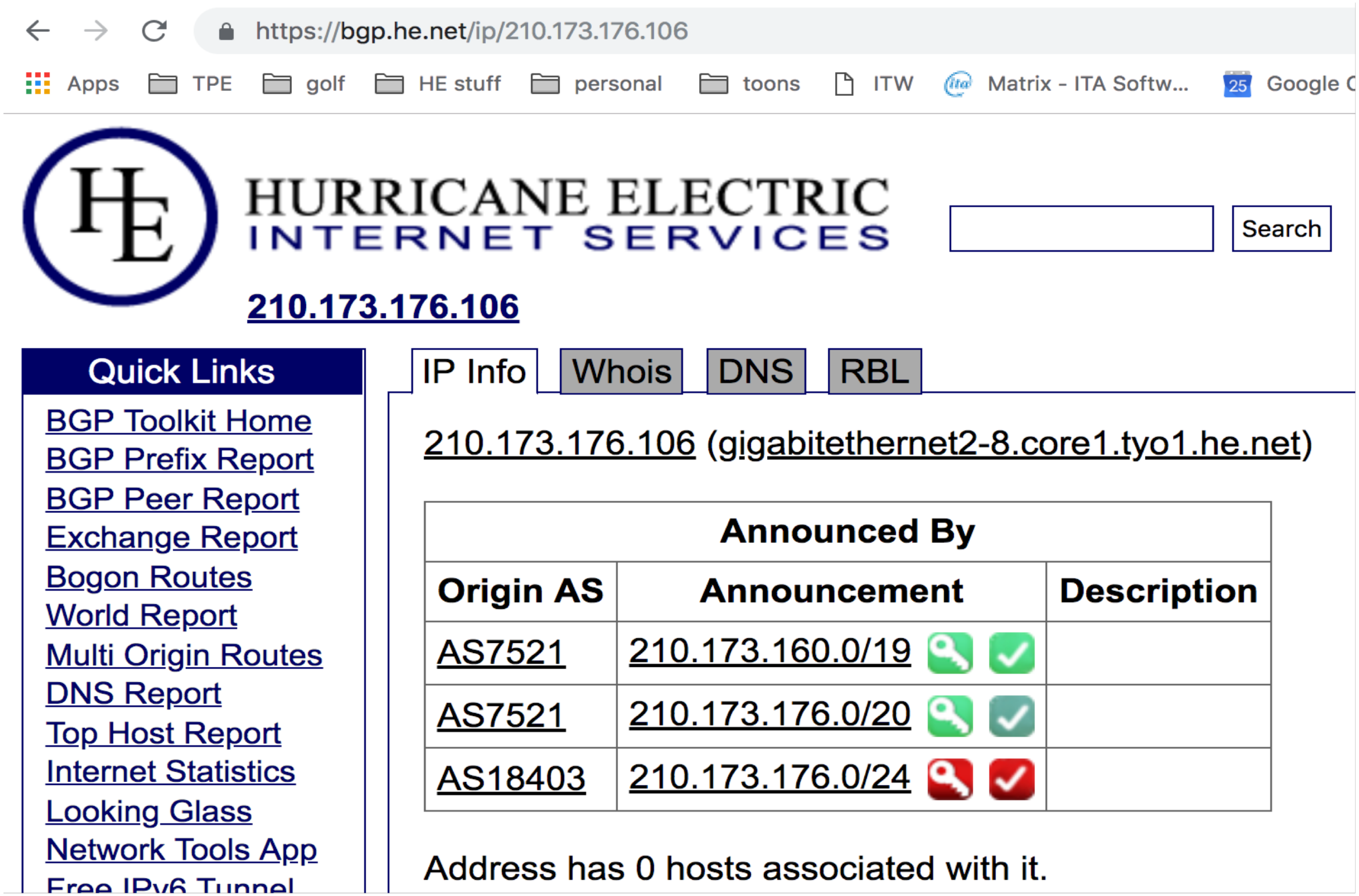


Public Peering Exchange Points

JPNAP

Exchange ASN	IPv4 IPv6	Speed RS Peer
JPNAP Osaka 6939	210.173.178.70 2001:7fa:7:2::6939:1	10G ○
JPNAP Tokyo 6939	210.173.176.106 2001:7fa:7:1::6939:1	10G ○

Basics - Routing Security



https://bgp.he.net/ip/210.173.176.106

210.173.176.106

210.173.176.106 (gigabitethernet2-8.core1.tyo1.he.net)

Announced By		
Origin AS	**Announcement**	**Description**
AS7521	210.173.160.0/19 🔑 ✓	
AS7521	210.173.176.0/20 🔑 ✓	
AS18403	210.173.176.0/24 🔑 ✓	

Address has 0 hosts associated with it.

Basics - Routing Security

Oceania

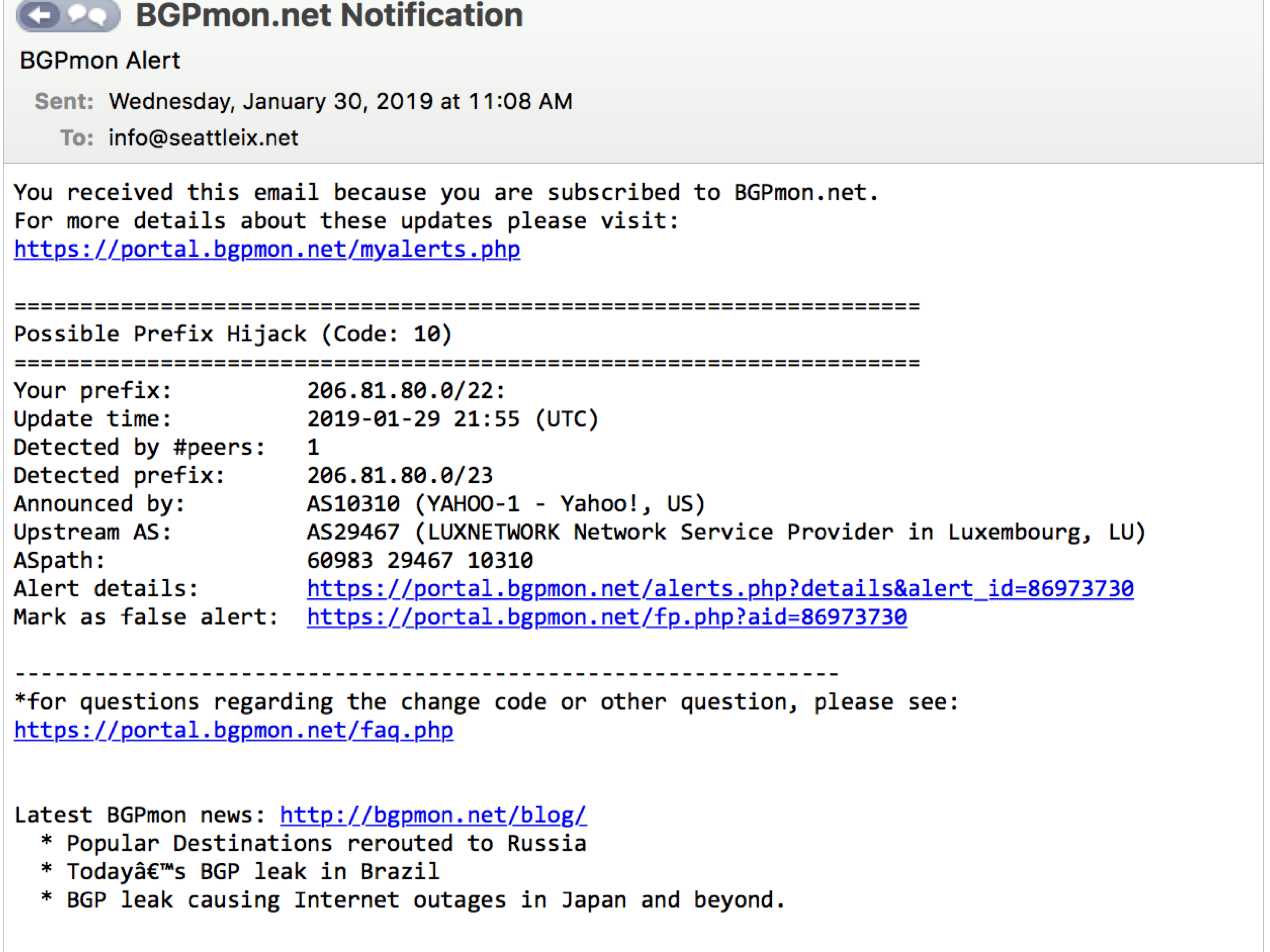
```
CC Exchange              Speed   IPv4            IPv6
-- -------------------- ------- --------------- ------------------------
AU Equinix Melbourne     10GE    183.177.61.28   2001:de8:6:1::6939:1
AU Equinix Sydney        10GE    45.127.173.24   2001:de8:6::6939:1
AU NSW-IX Sydney         10GE    218.100.52.249  2001:7fa:11:4:0:1b1b:0:1
AU VIC-IX Melbourne      10GE    218.100.78.108  2001:7fa:11:1:0:1b1b:0:1
AU MegaIX Melbourne      10GE    103.26.71.122   2001:dea:0:30::7a
AU MegaIX Sydney         10GE    103.26.68.236   2001:dea:0:10::ec
NZ APE                   10GE    192.203.154.197 2001:7fa:4:c0cb::9ac5
NZ AKL-IX                10GE    43.243.21.17    2001:7fa:11:6:0:1b1b:0:1
NZ MegaIX Auckland       10GE    43.243.22.82    2001:dea:0:40::52
```

Basics - Routing Security

- Leaks are easy to prevent. Generate filters for your advertisements.
- bgp.he.net is a quick and easy way to check.
- Please announce only directly learned routes to your peers.
- Please help eliminate this risk.

Basics - Routing Security

- https://bgpmon.net/
  - Monitoring, notifications of when errors occurs
  - Price is free for up to five prefixes per month.



BGPmon.net Notification

BGPmon Alert

Sent: Wednesday, January 30, 2019 at 11:08 AM

To: info@seattleix.net

```
You received this email because you are subscribed to BGPmon.net.
For more details about these updates please visit:
https://portal.bgpmon.net/myalerts.php

=====================================================================
Possible Prefix Hijack (Code: 10)
=====================================================================
Your prefix:          206.81.80.0/22:
Update time:          2019-01-29 21:55 (UTC)
Detected by #peers:   1
Detected prefix:      206.81.80.0/23
Announced by:         AS10310 (YAHOO-1 - Yahoo!, US)
Upstream AS:          AS29467 (LUXNETWORK Network Service Provider in Luxembourg, LU)
ASpath:               60983 29467 10310
Alert details:        https://portal.bgpmon.net/alerts.php?details&alert_id=86973730
Mark as false alert:  https://portal.bgpmon.net/fp.php?aid=86973730

---------------------------------------------------------------
*for questions regarding the change code or other question, please see:
https://portal.bgpmon.net/faq.php


Latest BGPmon news: http://bgpmon.net/blog/
  * Popular Destinations rerouted to Russia
  * Todayâ€™s BGP leak in Brazil
  * BGP leak causing Internet outages in Japan and beyond.
```

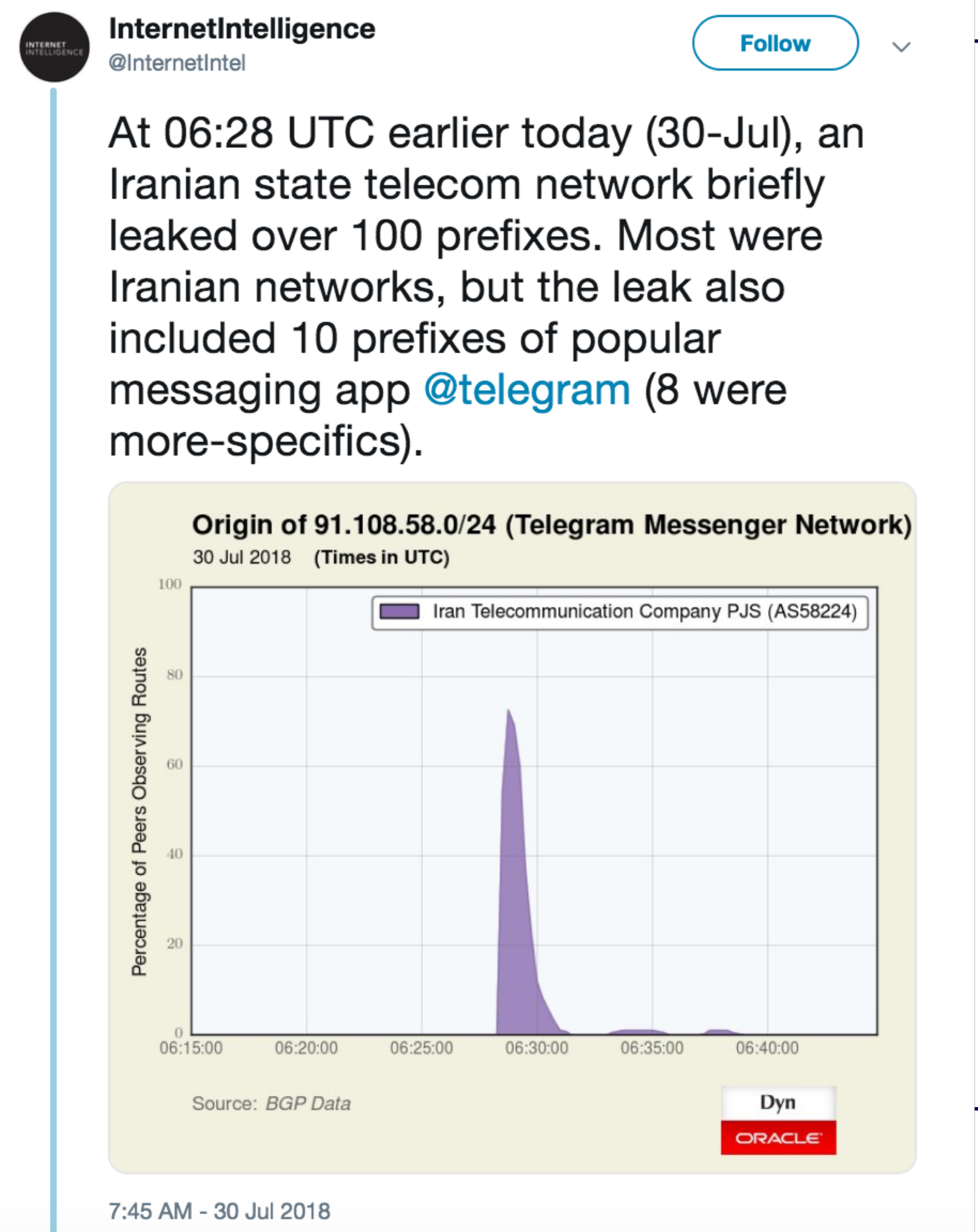
Basics - Routing Security

- Why we should care
  - The DDoS That Almost Broke the Internet

    Cloudflare March 2013 ~120Gbps attack on LINX

Basics - Routing Security

You must filter your peers.



InternetIntelligence
@InternetIntel

Follow

At 06:28 UTC earlier today (30-Jul), an Iranian state telecom network briefly leaked over 100 prefixes. Most were Iranian networks, but the leak also included 10 prefixes of popular messaging app @telegram (8 were more-specifics).

Origin of 91.108.58.0/24 (Telegram Messenger Network)
30 Jul 2018 **(Times in UTC)**

Percentage of Peers Observing Routes
100
80
60
40
20
0
06:15:00
06:20:00
06:25:00
06:30:00
06:35:00
06:40:00
▨ Iran Telecommunication Company PJS (AS58224)
Dyn
ORACLE

Source: *BGP Data*

7:45 AM - 30 Jul 2018

Basics - Routing Security

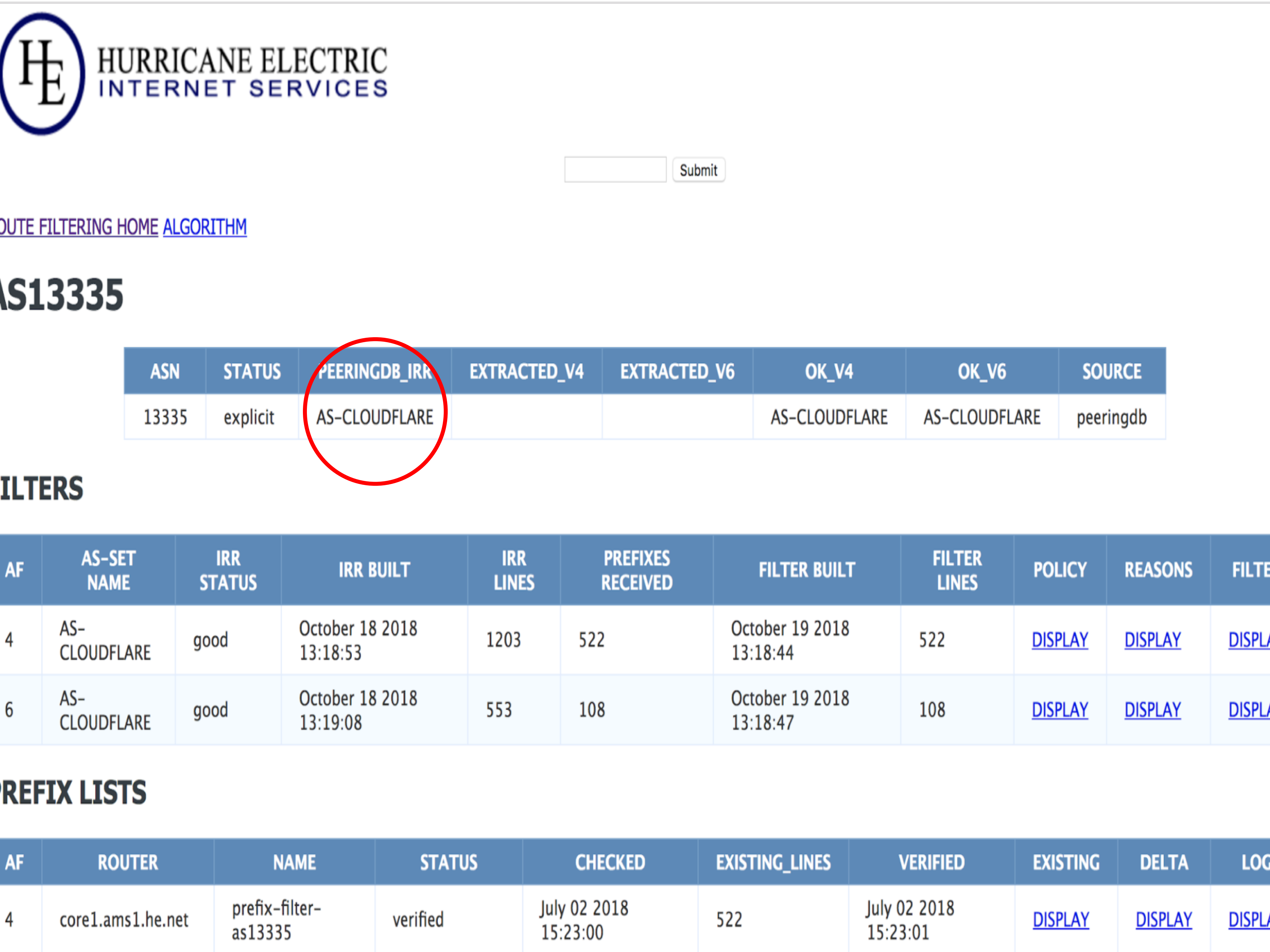
- Routing security is important in two directions:
  - The routes you receive
  - The routes you announce

- Starting with the routes you receive...

Basics - Routing Security

- Most networks won’t/don’t filter their peers.
- This is negligent behavior.
- The routes you receive should be filtered in three ways:
    - Prefix Count
    - AS-Path
    - Prefix list
    - RPKI

http://routing.he.net



OUTE FILTERING HOME ALGORITHM

S13335

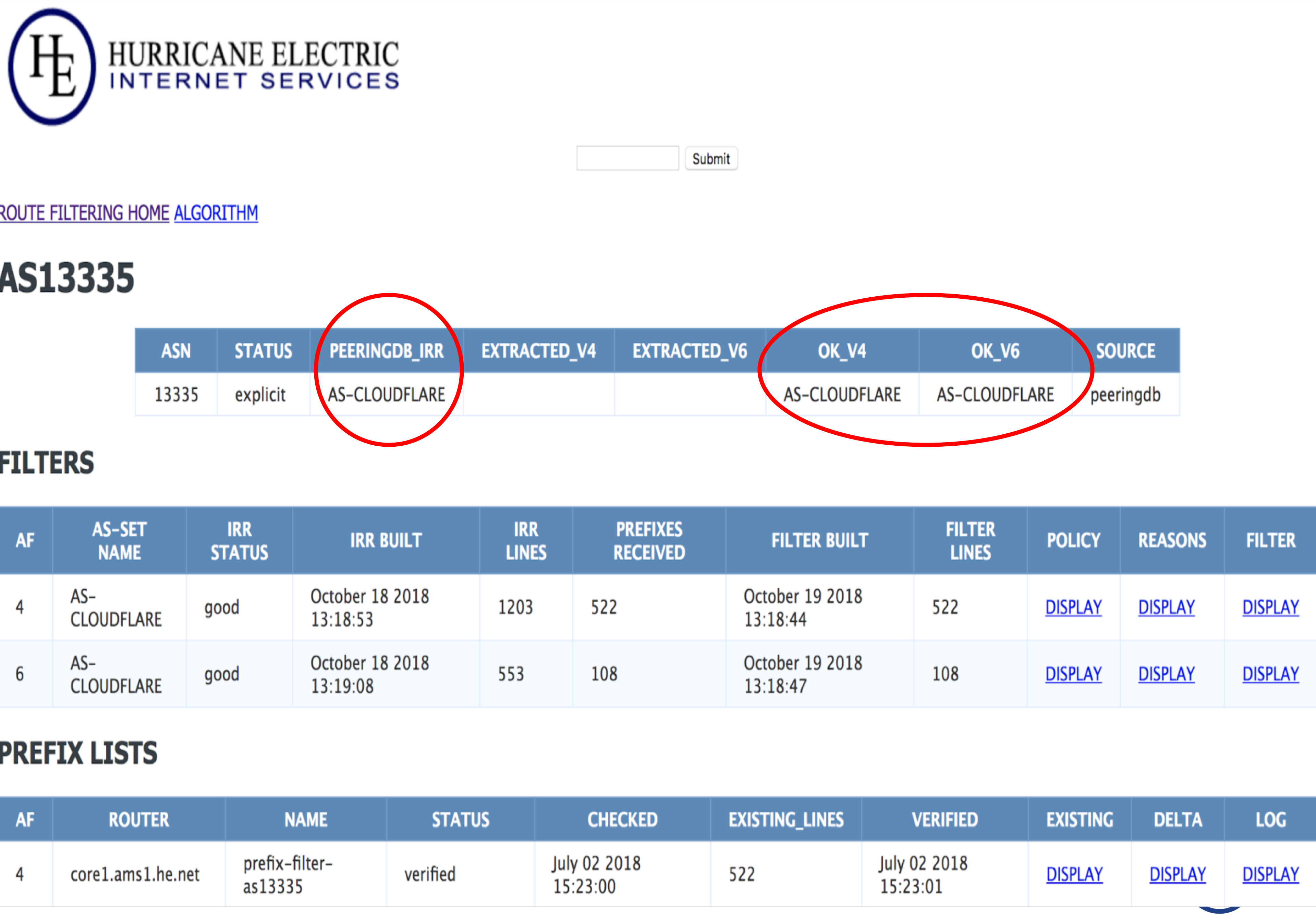
ASN	STATUS	PEERINGDB_IRR	EXTRACTED_V4	EXTRACTED_V6	OK_V4	OK_V6	SOURCE
13335	explicit	AS-CLOUDFLARE			AS-CLOUDFLARE	AS-CLOUDFLARE	peeringdb

ILTERS

AF	AS-SET NAME	IRR STATUS	IRR BUILT	IRR LINES	PREFIXES RECEIVED	FILTER BUILT	FILTER LINES	POLICY	REASONS	FILTE
4	AS-CLOUDFLARE	good	October 18 2018 13:18:53	1203	522	October 19 2018 13:18:44	522	DISPLAY	DISPLAY	DISPL
6	AS-CLOUDFLARE	good	October 18 2018 13:19:08	553	108	October 19 2018 13:18:47	108	DISPLAY	DISPLAY	DISPL

REFIX LISTS

AF	ROUTER	NAME	STATUS	CHECKED	EXISTING_LINES	VERIFIED	EXISTING	DELTA	LOG
4	core1.ams1.he.net	prefix-filter-as13335	verified	July 02 2018 15:23:00	522	July 02 2018 15:23:01	DISPLAY	DISPLAY	DISPL



HURRICANE ELECTRIC
INTERNET SERVICES

ROUTE FILTERING HOME ALGORITHM

AS13335

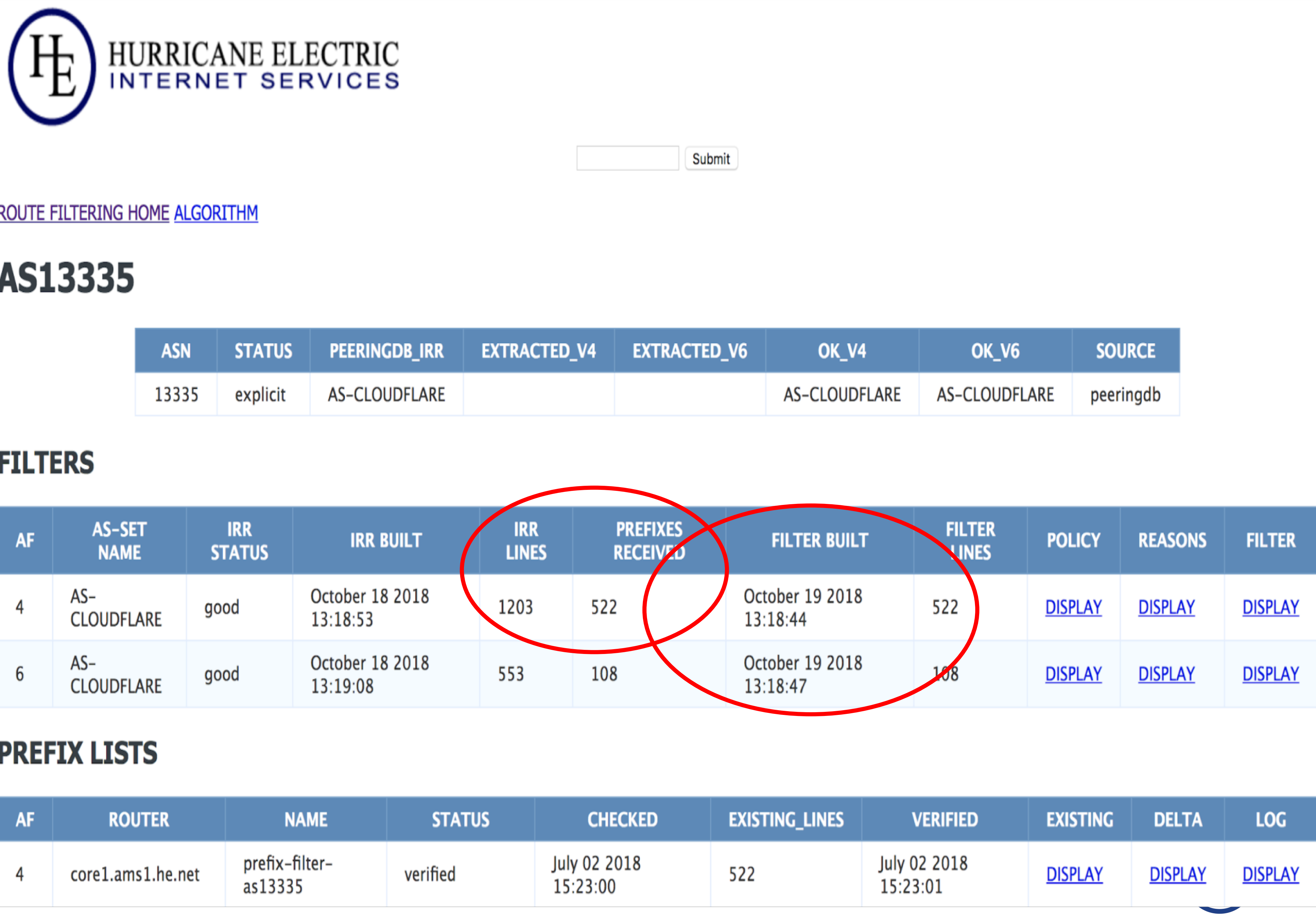
ASN	STATUS	PEERINGDB_IRR	EXTRACTED_V4	EXTRACTED_V6	OK_V4	OK_V6	SOURCE
13335	explicit	AS-CLOUDFLARE			AS-CLOUDFLARE	AS-CLOUDFLARE	peeringdb

FILTERS

AF	AS-SET NAME	IRR STATUS	IRR BUILT	IRR LINES	PREFIXES RECEIVED	FILTER BUILT	FILTER LINES	POLICY	REASONS	FILTER
4	AS-CLOUDFLARE	good	October 18 2018 13:18:53	1203	522	October 19 2018 13:18:44	522	DISPLAY	DISPLAY	DISPLAY
6	AS-CLOUDFLARE	good	October 18 2018 13:19:08	553	108	October 19 2018 13:18:47	108	DISPLAY	DISPLAY	DISPLAY

PREFIX LISTS

AF	ROUTER	NAME	STATUS	CHECKED	EXISTING_LINES	VERIFIED	EXISTING	DELTA	LOG
4	core1.ams1.he.net	prefix-filter-as13335	verified	July 02 2018 15:23:00	522	July 02 2018 15:23:01	DISPLAY	DISPLAY	DISPLAY



ROUTE FILTERING HOME ALGORITHM

AS13335

ASN	STATUS	PEERINGDB_IRR	EXTRACTED_V4	EXTRACTED_V6	OK_V4	OK_V6	SOURCE
13335	explicit	AS-CLOUDFLARE			AS-CLOUDFLARE	AS-CLOUDFLARE	peeringdb

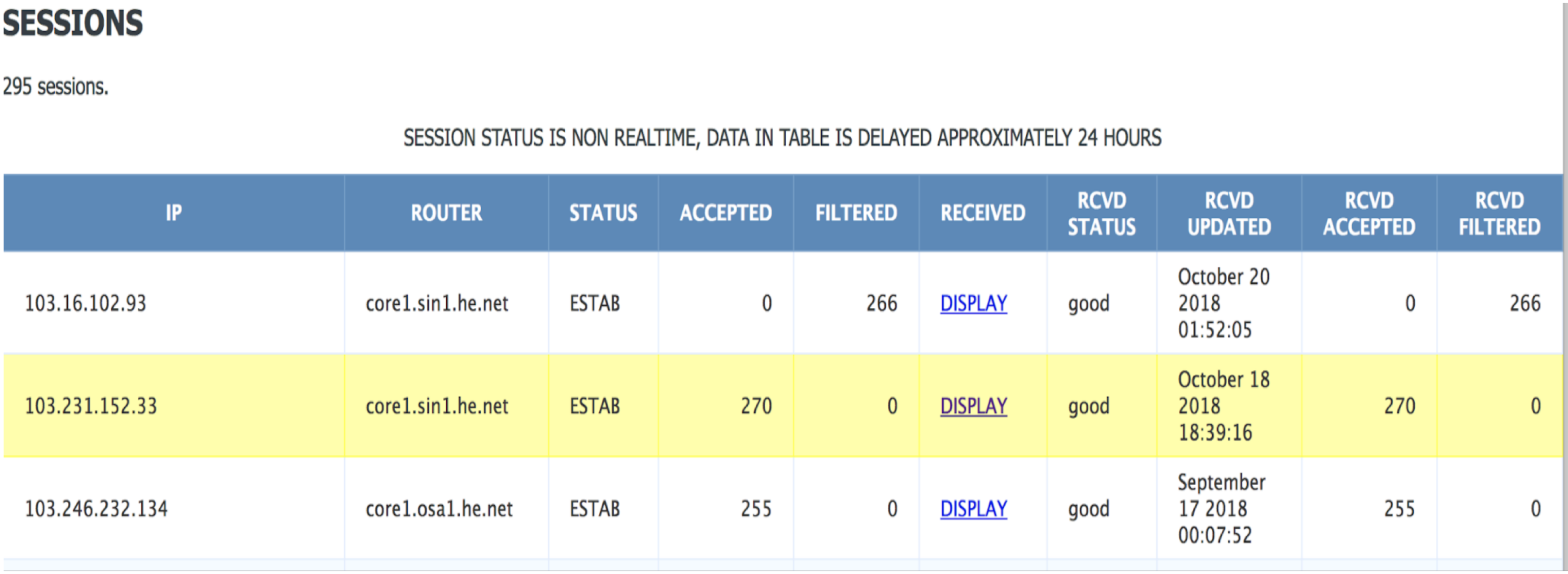
FILTERS

AF	AS-SET NAME	IRR STATUS	IRR BUILT	IRR LINES	PREFIXES RECEIVED	FILTER BUILT	FILTER LINES	POLICY	REASONS	FILTER
4	AS-CLOUDFLARE	good	October 18 2018 13:18:53	1203	522	October 19 2018 13:18:44	522	DISPLAY	DISPLAY	DISPLAY
6	AS-CLOUDFLARE	good	October 18 2018 13:19:08	553	108	October 19 2018 13:18:47	108	DISPLAY	DISPLAY	DISPLAY

PREFIX LISTS

AF	ROUTER	NAME	STATUS	CHECKED	EXISTING_LINES	VERIFIED	EXISTING	DELTA	LOG
4	core1.ams1.he.net	prefix-filter-as13335	verified	July 02 2018 15:23:00	522	July 02 2018 15:23:01	DISPLAY	DISPLAY	DISPLAY

http://routing.he.net



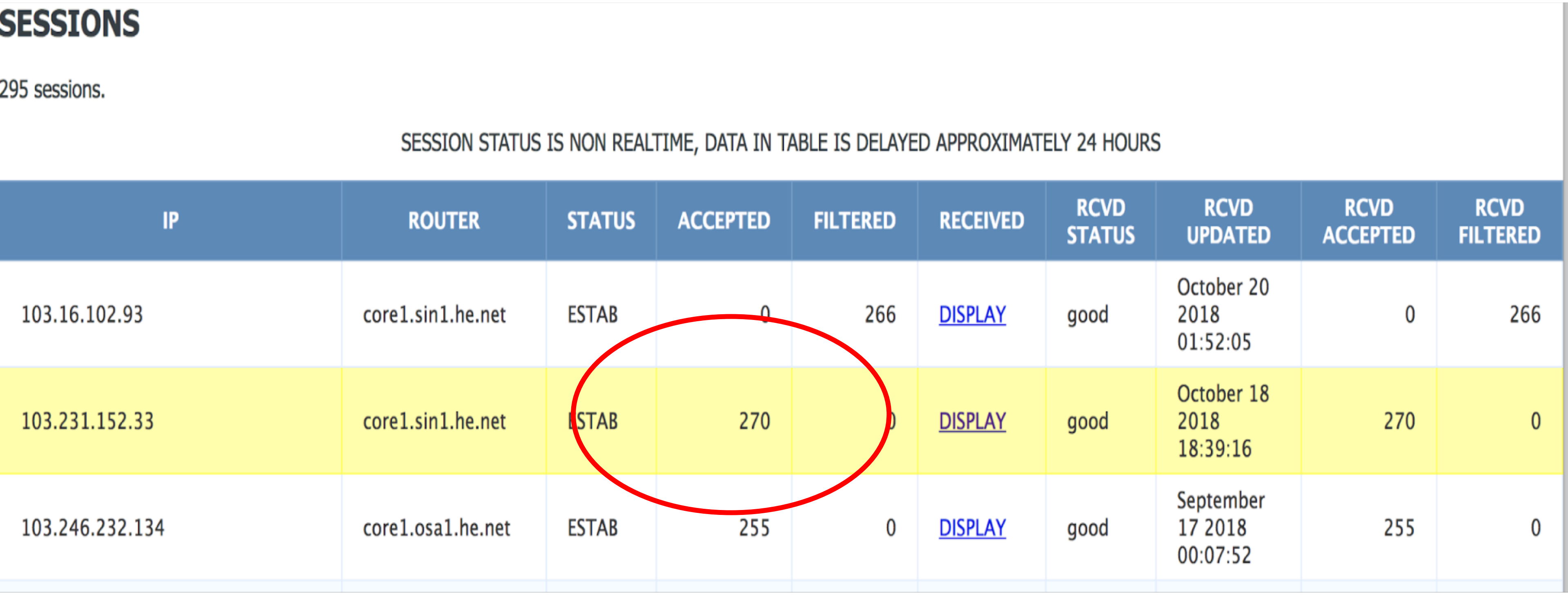
SESSIONS

295 sessions.

SESSION STATUS IS NON REALTIME, DATA IN TABLE IS DELAYED APPROXIMATELY 24 HOURS

IP	ROUTER	STATUS	ACCEPTED	FILTERED	RECEIVED	RCVD STATUS	RCVD UPDATED	RCVD ACCEPTED	RCVD FILTERED
103.16.102.93	core1.sin1.he.net	ESTAB	0	266	DISPLAY	good	October 20 2018 01:52:05	0	266
103.231.152.33	core1.sin1.he.net	ESTAB	270	0	DISPLAY	good	October 18 2018 18:39:16	270	0
103.246.232.134	core1.osa1.he.net	ESTAB	255	0	DISPLAY	good	September 17 2018 00:07:52	255	0

http://routing.he.net

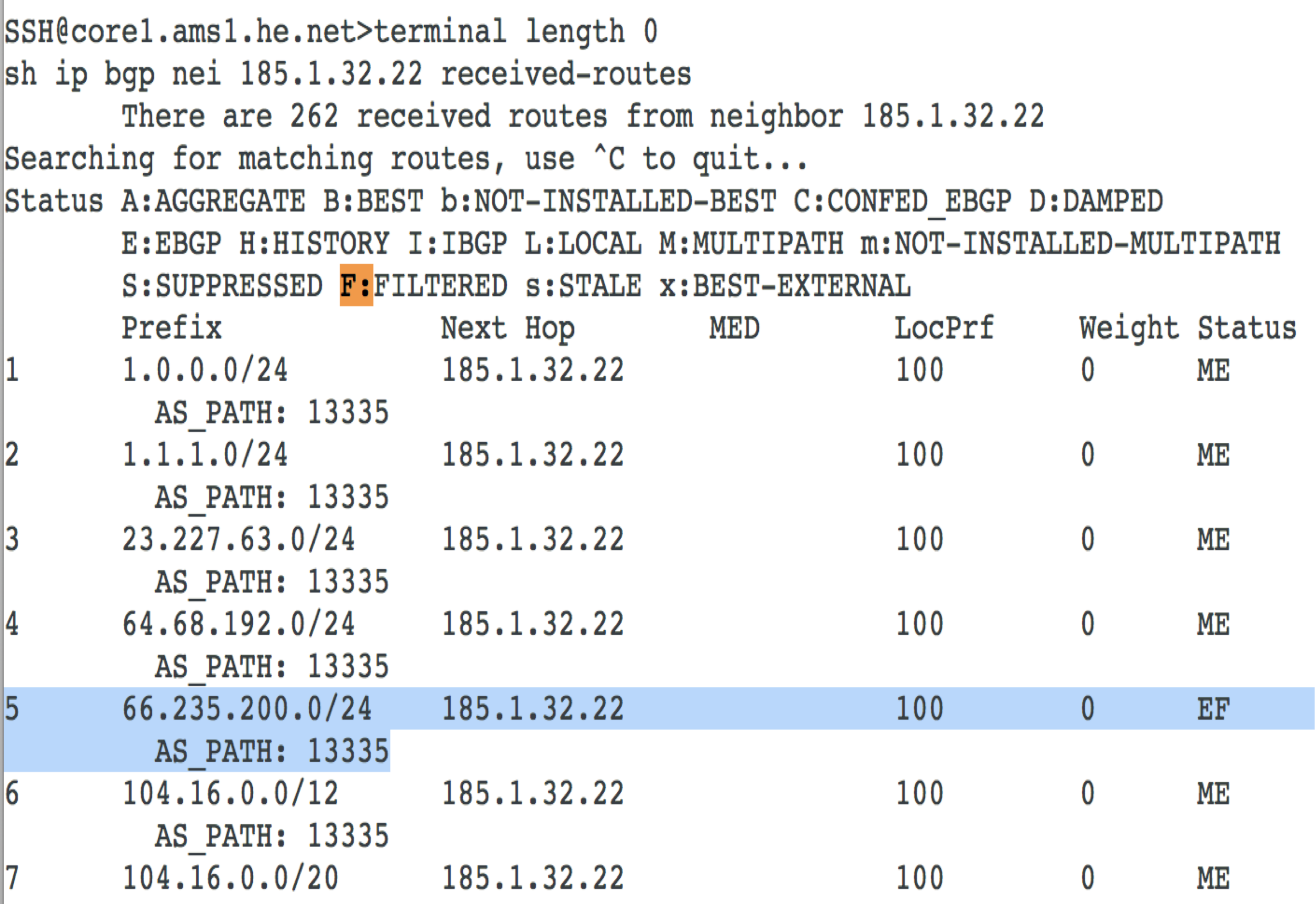


SESSIONS

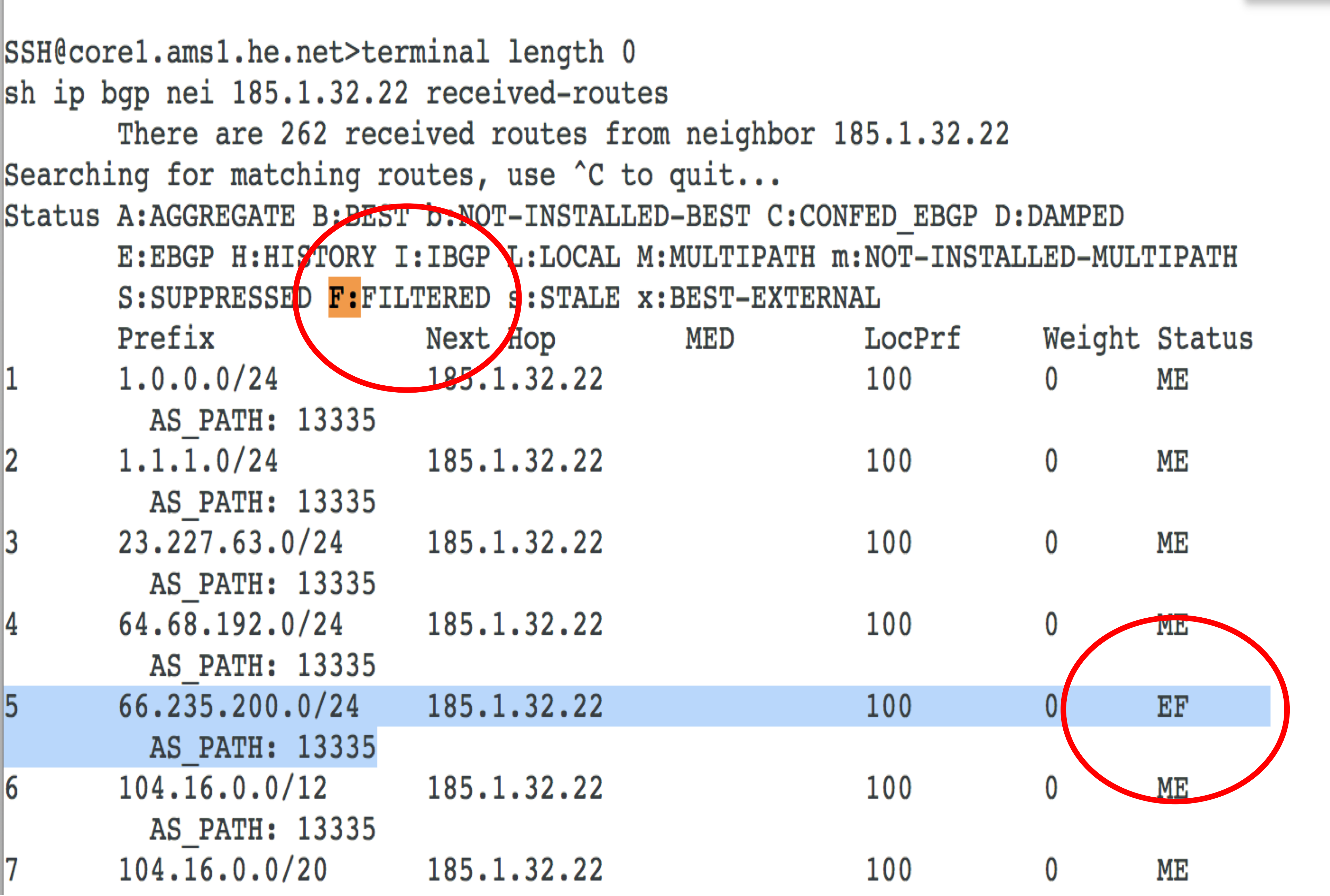
295 sessions.

SESSION STATUS IS NON REALTIME, DATA IN TABLE IS DELAYED APPROXIMATELY 24 HOURS

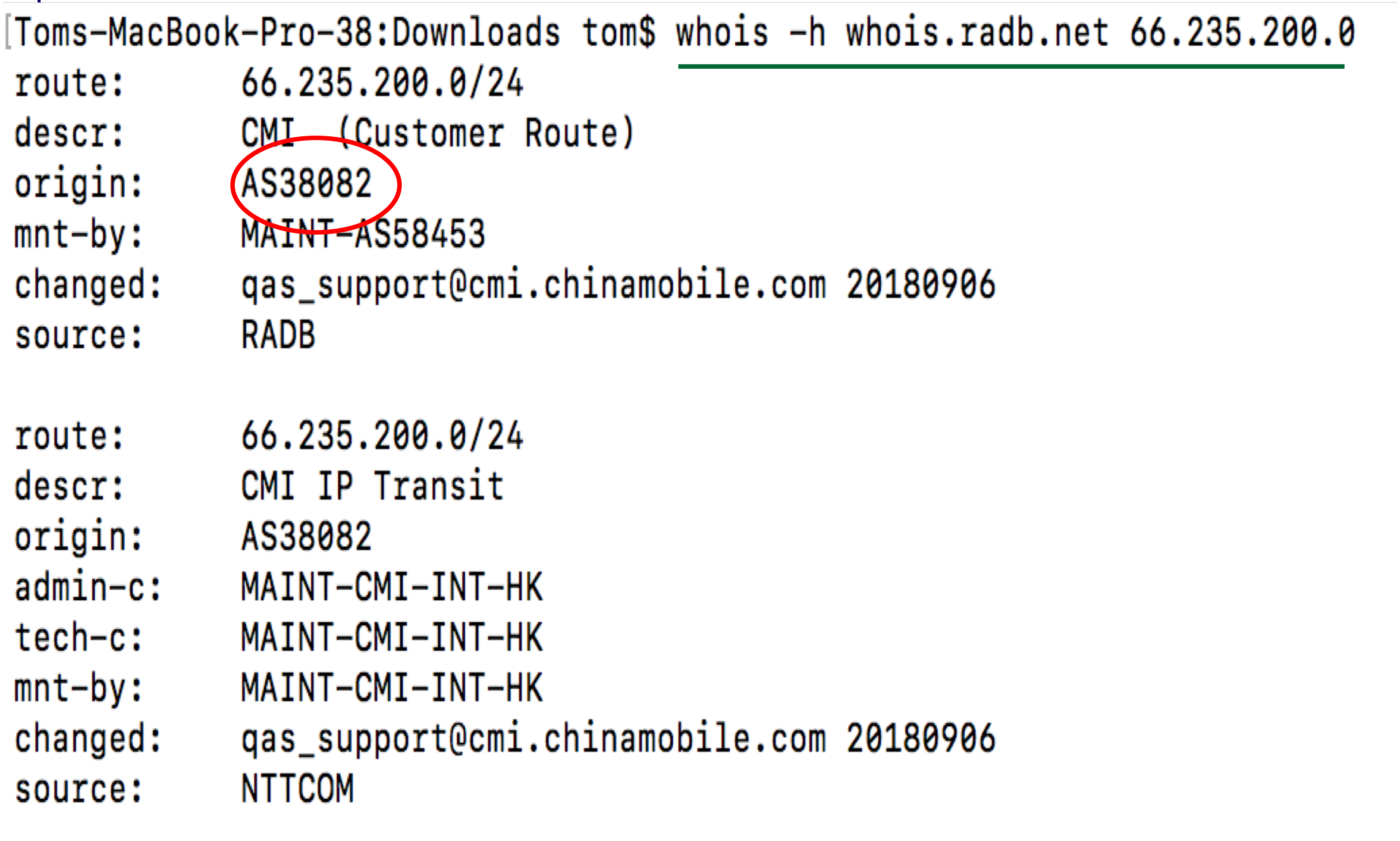
IP	ROUTER	STATUS	ACCEPTED	FILTERED	RECEIVED	RCVD STATUS	RCVD UPDATED	RCVD ACCEPTED	RCVD FILTERED
103.16.102.93	core1.sin1.he.net	ESTAB	0	266	DISPLAY	good	October 20 2018 01:52:05	0	266
103.231.152.33	core1.sin1.he.net	ESTAB	270	0	DISPLAY	good	October 18 2018 18:39:16	270	0
103.246.232.134	core1.osa1.he.net	ESTAB	255	0	DISPLAY	good	September 17 2018 00:07:52	255	0



```
SSH@core1.ams1.he.net>terminal length 0
sh ip bgp nei 185.1.32.22 received-routes
       There are 262 received routes from neighbor 185.1.32.22
Searching for matching routes, use ^C to quit...
Status A:AGGREGATE B:BEST b:NOT-INSTALLED-BEST C:CONFED_EBGP D:DAMPED
       E:EBGP H:HISTORY I:IBGP L:LOCAL M:MULTIPATH m:NOT-INSTALLED-MULTIPATH
       S:SUPPRESSED F:FILTERED s:STALE x:BEST-EXTERNAL
       Prefix             Next Hop        MED        LocPrf     Weight Status
1      1.0.0.0/24         185.1.32.22                100        0      ME
         AS_PATH: 13335
2      1.1.1.0/24         185.1.32.22                100        0      ME
         AS_PATH: 13335
3      23.227.63.0/24     185.1.32.22                100        0      ME
         AS_PATH: 13335
4      64.68.192.0/24     185.1.32.22                100        0      ME
         AS_PATH: 13335
5      66.235.200.0/24    185.1.32.22                100        0      EF
         AS_PATH: 13335
6      104.16.0.0/12      185.1.32.22                100        0      ME
         AS_PATH: 13335
7      104.16.0.0/20      185.1.32.22                100        0      ME
```



```
SSH@core1.ams1.he.net>terminal length 0
sh ip bgp nei 185.1.32.22 received-routes
       There are 262 received routes from neighbor 185.1.32.22
Searching for matching routes, use ^C to quit...
Status A:AGGREGATE B:BEST b:NOT-INSTALLED-BEST C:CONFED_EBGP D:DAMPED
       E:EBGP H:HISTORY I:IBGP L:LOCAL M:MULTIPATH m:NOT-INSTALLED-MULTIPATH
       S:SUPPRESSED F:FILTERED s:STALE x:BEST-EXTERNAL
       Prefix             Next Hop        MED         LocPrf      Weight Status
1      1.0.0.0/24         185.1.32.22                 100         0      ME
         AS_PATH: 13335
2      1.1.1.0/24         185.1.32.22                 100         0      ME
         AS_PATH: 13335
3      23.227.63.0/24     185.1.32.22                 100         0      ME
         AS_PATH: 13335
4      64.68.192.0/24     185.1.32.22                 100         0      ME
         AS_PATH: 13335
5      66.235.200.0/24    185.1.32.22                 100         0      EF
         AS_PATH: 13335
6      104.16.0.0/12      185.1.32.22                 100         0      ME
         AS_PATH: 13335
7      104.16.0.0/20      185.1.32.22                 100         0      ME
```



```
Toms-MacBook-Pro-38:Downloads tom$ whois -h whois.radb.net 66.235.200.0
route:      66.235.200.0/24
descr:      CMI  (Customer Route)
origin:     AS38082
mnt-by:     MAINT-AS58453
changed:    qas_support@cmi.chinamobile.com 20180906
source:     RADB

route:      66.235.200.0/24
descr:      CMI IP Transit
origin:     AS38082
admin-c:    MAINT-CMI-INT-HK
tech-c:     MAINT-CMI-INT-HK
mnt-by:     MAINT-CMI-INT-HK
changed:    qas_support@cmi.chinamobile.com 20180906
source:     NTTCOM
```

Hurricane Electric
Route Filtering Algorithm

- Read more here
  http://routing.he.net/algorithm.html

- Example:
- xx.7.224.0/24,rejected,does not strictly match IRR policy or RIR handles
- xx.10.254.0/23,accepted,strictly matched IRR policy
- xx.17.248.0/24,accepted,strictly matched IRR policy
- xx.26.36.0/22,rejected,does not strictly match IRR policy or RIR handles
- xx.26.39.0/24,rejected,does not strictly match IRR policy or RIR handles

Hurricane Electric Route Filtering

- Please check and update your IRR or RIR handles
- Check your routing here:
  http://routing.he.net/
- We at now filtering ~90% of all our peers.
- Rolling it out slowly over the last six months

Resources

- Seattle SIX
- Tom Paseka tom@cloudflare.com
- BGP.HE.NET
- https://bgpmon.net/
- https://twitter.com/InternetIntel
- DYN

Thanks!

Walt Wollny, Director Interconnection Strategy
Hurricane Electric AS6939
walt@he.net