Action Req'd: 32 Bit AS Numbers

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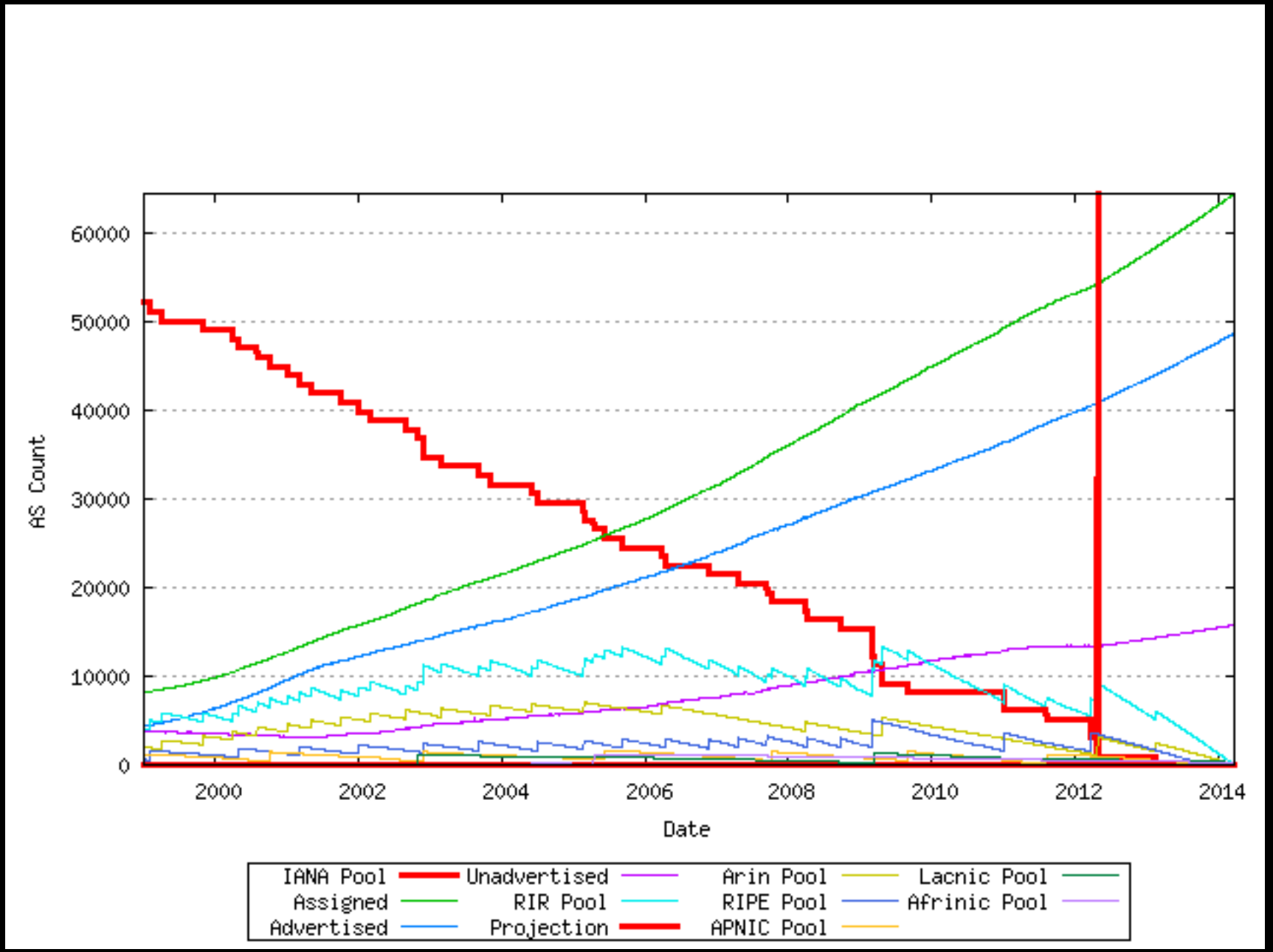
AS Numbers

- Formerly a 16 bit number: 0 to 65535
- 1,023 numbers reserved for local or private use
- Therefore, historically, there were 65,410 available AS numbers for assignment.

- 54,863 16 bit ASNs are assigned
- 6,608 ASNs are “with the RIRs”
- 3,023 ASNs are “with IANA” – very few remaining


AS Count
60000
50000
40000
30000
20000
10000
0
2000
2002
2004
2006
2008
2010
2012
2014
Date
IANA Pool
Unadvertised
Arin Pool
Lacnic Pool
Assigned
RIR Pool
RIPE Pool
Afrinic Pool
Advertised
Projection
APNIC Pool

Everybody already knows….

…The Internet is **full**!

16 bit ASN Exhaustion:

Mid 2014

But there is a plan…

- RFC 4893 (May 2007)
- 4 byte ASNs are 4 byte numbers - 0 to 4,294,967,295
- Allows for operation of BGP networks with ASN higher than 65536

```
aut-num:        AS198408
as-name:        EMOUSE-NET
descr:          E-Mouse Karol Urbanowicz
remarks:        Ul.Chlodna 11
remarks:        Suwałki
org:            ORG-EA522-RIPE
remarks:        ========== NETIA ============
import:         from AS12741 accept ANY
export:         to AS12741 announce AS198408
remarks:        ========== HE ==========
import:         from AS6939 accept ANY
export:         to AS6939 announce AS198408
admin-c:        BT2299-RIPE
tech-c:         BT2299-RIPE
mnt-by:         RIPE-NCC-END-MNT
mnt-routes:     EMOUSE-MNT
mnt-by:         EMOUSE-MNT
source:         RIPE #Filtered
```

A real, in production 32 bit ASN in the RIPE Database……

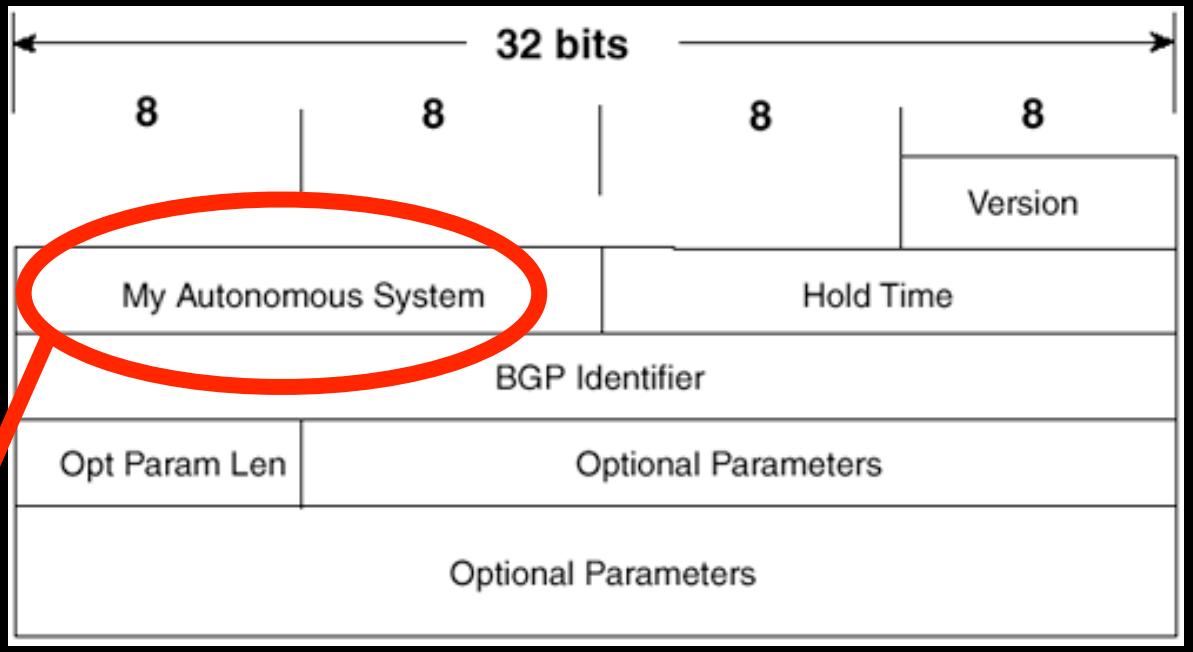
```
route-server> sh ip bgp regexp _198408$
BGP table version is 0, local router ID is 64.62.142.154
Status codes: s suppressed, d dampened, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale, R Removed
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
* i195.245.104.0/23 195.182.218.13          20     47      0 12741 198408 198408 198408 198408 198408 i
* i                 195.182.218.13          20    100      0 12741 198408 198408 198408 198408 198408 i
*>i                216.218.252.189          1    100      0 12741 198408 198408 198408 198408 198408 i
```

…….**and** on the internet

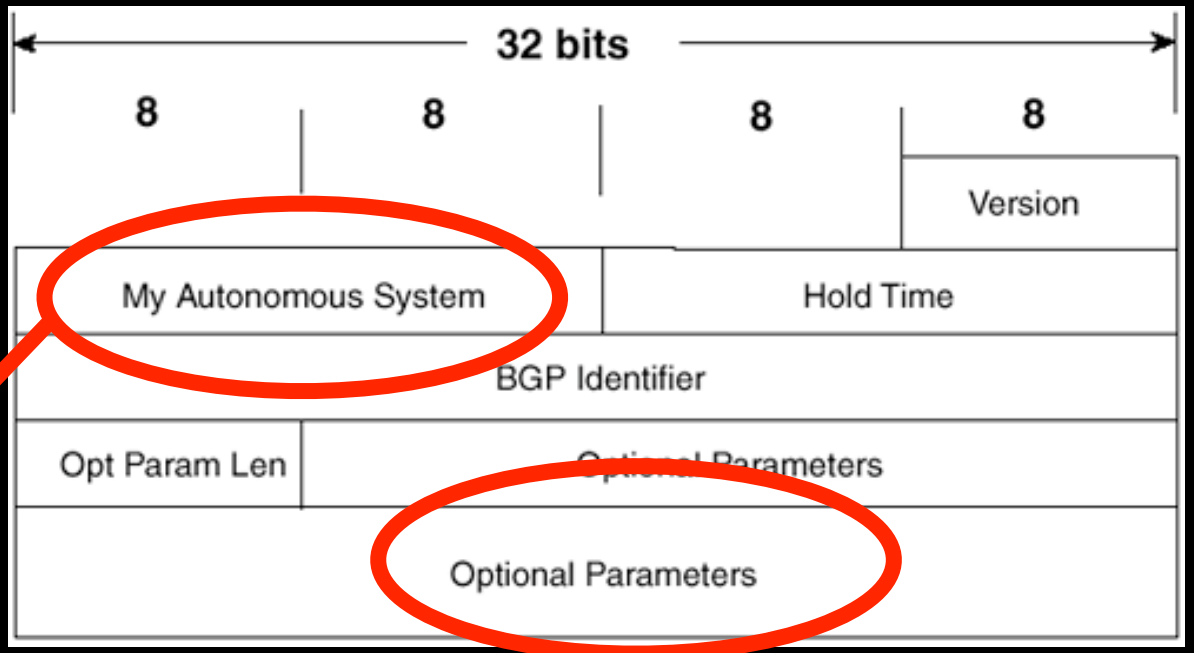
What's the change about?

BGP Open Packet



Someone's going to be AS65536 - which wont fit here

AS4 BGP Open Packet



AS_TRANS

Magic Number

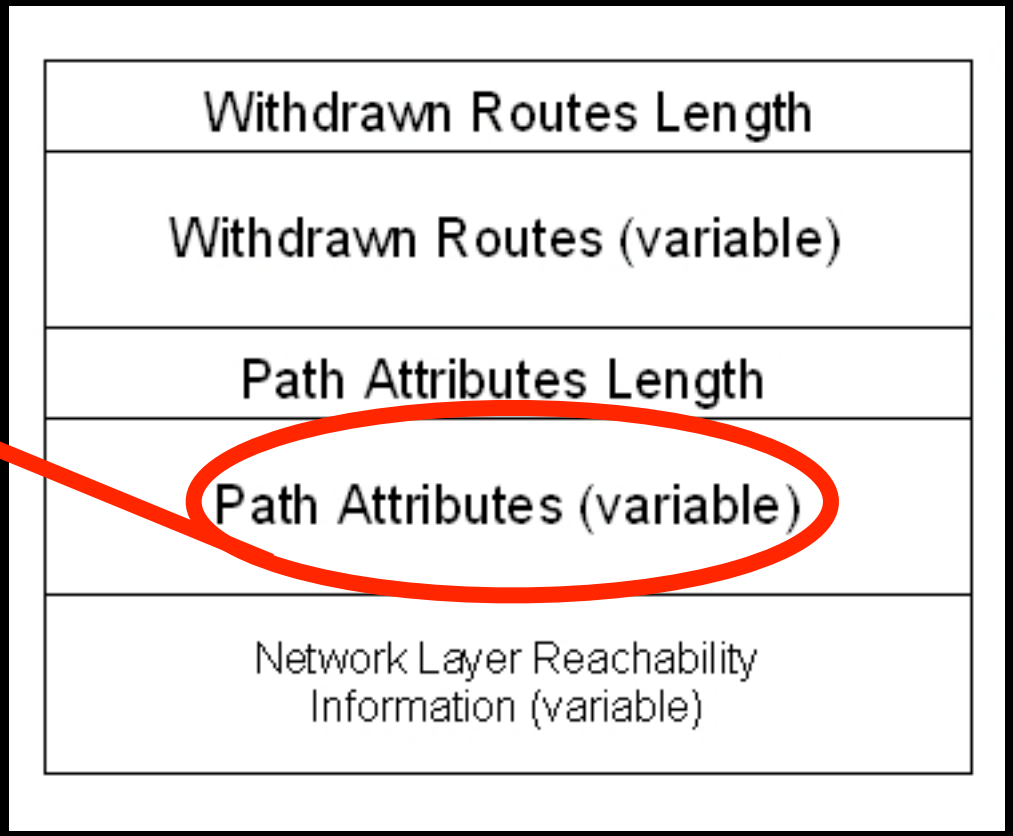
AS23456

My proper ASN lives in a value, inside here

BGP Updates

AS_PATH can contain 32 bit numbers on 32-bit safe path

New optional, transitive AS4_PATH contains 32 bit path in 16 bit world.
32 bit ASN replaced with 23456 in AS_PATH



How to display AS4

Name	16 bit (as2905)	32 bit (as327676)	Notes
asplain	2905	327676	**Use this one** RFC5396
asdot+	0.2905	5.1	
asdot	2905	5.1	Was popular 2008 Made regexp hard!
ascolon	0:2905	5:1	Redback

ASN16 to ASN32

- RFC4893 implements a new capability (“I speak ASN32”) and carries the 32 bit ASN as a capability value.
- AS4_PATH is a new optional, transitive attribute in UPDATE which carries 32-bit portion of the AS_PATH.
- BGP speakers without 32 bit support see AS23456 for a 32 bit originated or transited prefix
- Both implementations co-exist, ASN32 originated prefixes in table today.

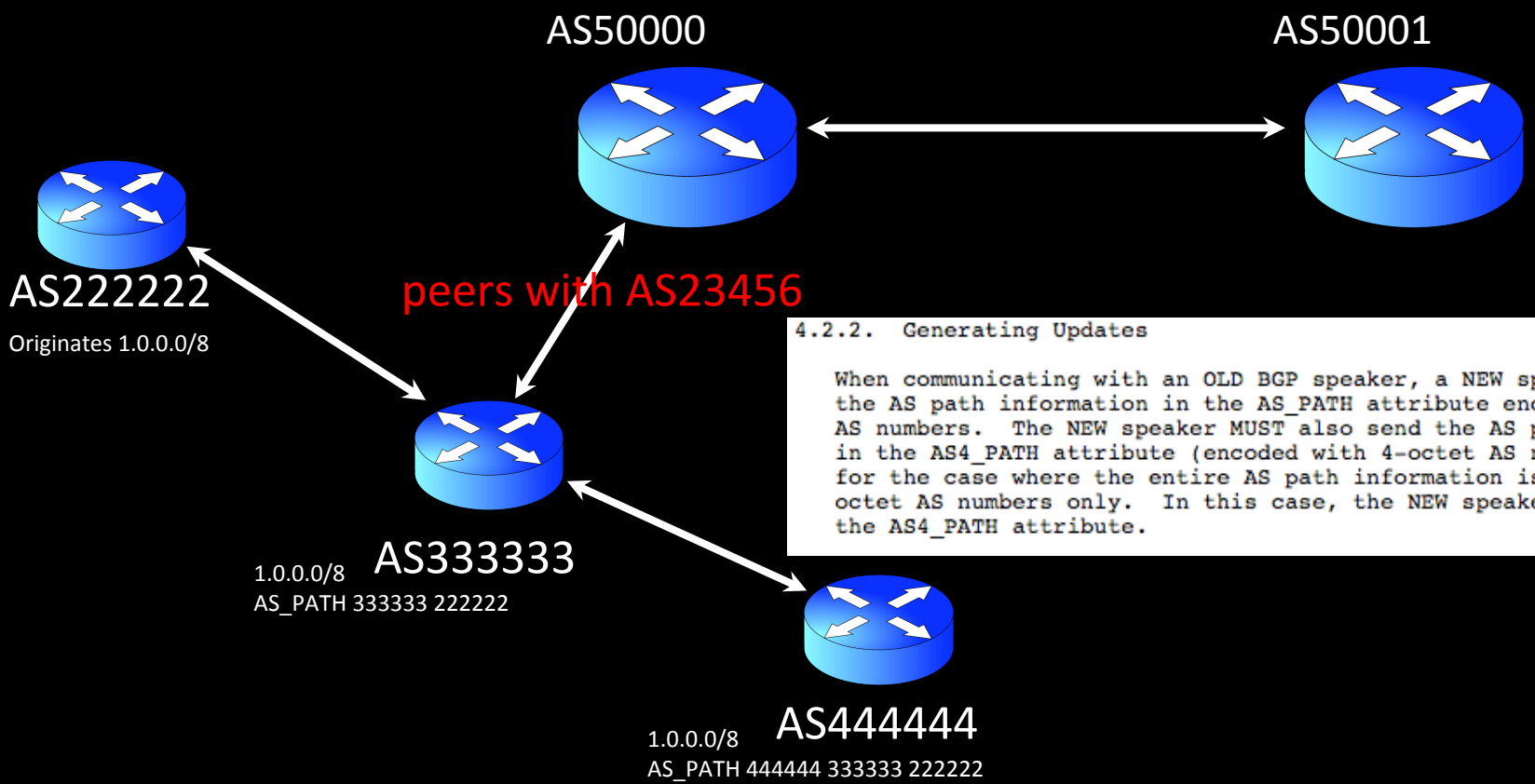
Native ASN32

> The new attributes, AS4_PATH and AS4_AGGREGATOR SHOULD NOT be carried in the UPDATE messages between NEW BGP peers. A NEW BGP speaker that receives the AS4_PATH and AS4_AGGREGATOR path attributes in an UPDATE message from a NEW BGP speaker SHOULD discard these path attributes and continue processing the UPDATE message.

Compatibility mode

ASN16 ONLY
AS_PATH 50000 23456 23456
AS4_PATH 50000 333333 222222 (optional, transitive)

ASN32 UPGRADED
AS_PATH 50001 50000 23456 23456
AS4_PATH 50001 50000 333333 222222
(rfc4893, 4.2.3 mandates padding)



4.2.2. Generating Updates

When communicating with an OLD BGP speaker, a NEW speaker MUST send the AS path information in the AS_PATH attribute encoded with 2-octet AS numbers. The NEW speaker MUST also send the AS path information in the AS4_PATH attribute (encoded with 4-octet AS numbers), except for the case where the entire AS path information is composed of 2-octet AS numbers only. In this case, the NEW speaker SHOULD NOT send the AS4_PATH attribute.

Support is here

http://as4.cluepon.net/index.php/Software_Support

Name	Version	Notation
Alcatel-Lucent SR-OS	7.0	asplain
Allied Telesis - AlliedWare Plus	5.4.1	asplain
Arbor Peakflow SP	5.5	asplain
BIRD	1.0.12	asplain
Brocade (Foundry) IronWare	NetIron 4.0.00	asdot, asdot+, asplain
Cisco IOS	12.4(24)T (all supported platforms); 12.0(32)S11, 12.0(33)S, 12.0(32)SY8 (Cisco 7200/12000); 12.2(33)SXI1 (Catalyst 6500); 12.2(33)SRE1 (Cisco 7200/7301/7600); 15.0 (all supported platforms)	asplain (asdot optional), asdot only in 12.0(32)S11 and 12.4(24)T
Cisco IOS XE	2.3 (ASR 1000 series)	asplain (asdot optional)
Cisco IOS XR	3.4(1)	asdot (asplain from 3.9)
Cisco NX-OS	4.0(1)	asdot (asplain from 4.1(3))
ExtremeXOS	Need Information	Need Information
Juniper JUNOS	9.1R1	asplain (asdot optional)
Juniper JUNOSe	4.1.0	asplain
FireBrick FB6000	all	asplain
Force10 FTOS	7.7.1.0	asplain (asdot, asdot+ optional)
OpenBGPD	4.2, patches for 3.9 and 4.0	asdot (input+display), asplain (input, as of 4.6)
PaloAlto Networks Firewalls	4.1 onwards	asplain
Quagga	0.99.10, patches for 0.99.6 and other versions	asplain
Redback SEOS	2.0	ascolon (asplain planned for end of 2009)

Should you care?

"I already have a 16 bit AS number, So why do I care?"

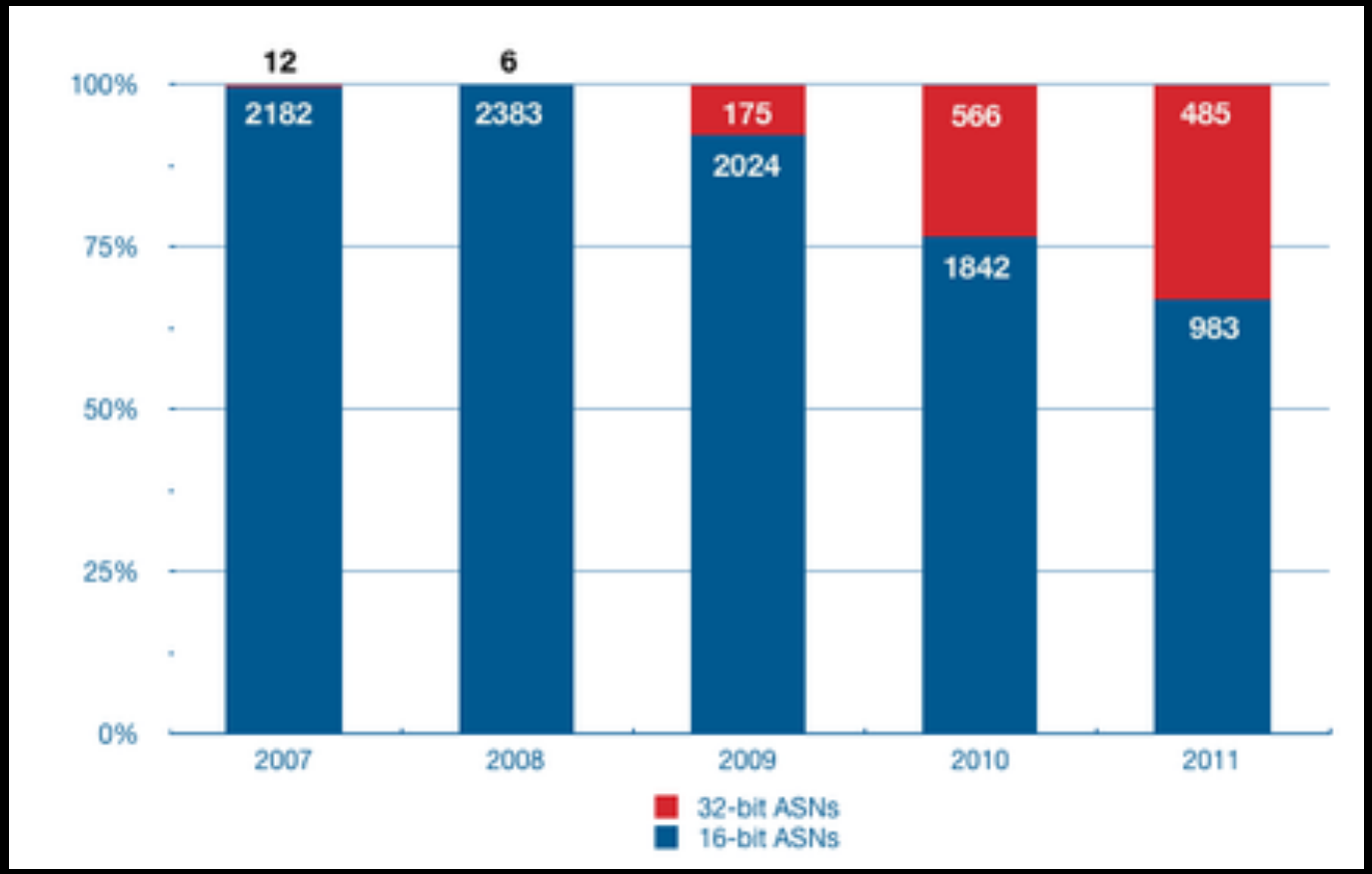
Do I have support?

```
bcliffe-gw#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
bcliffe-gw(config)#router bgp ?
  <1-4294967295>  Autonomous system number
  <1.0-XX.YY>     Autonomous system number
```

Since software support has been good for more than three years, you are probably OK, but you should check.

Add customers

RIPE NCC ASN Assignments

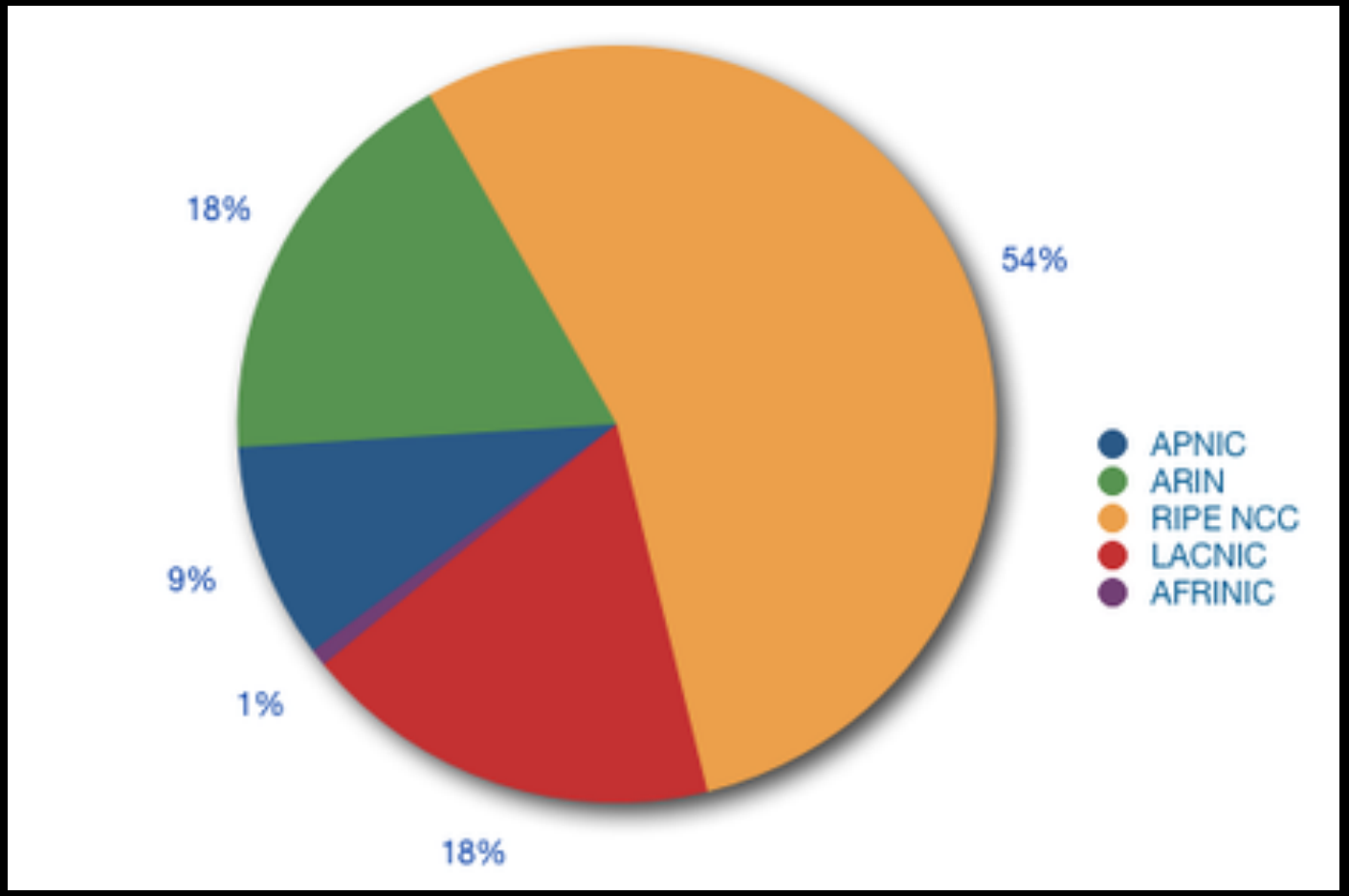


1/3 of new ASN (new customers!) are taking 32 bit ASN

RIPE NCC Assignment Procedure

- RIPE NCC assign 32 bit ASN by default
- Members can ask for a 16 bit number
  - Avoid confusion by ensuring your router is capable, and that your scripts/provisioning software can support 32 bit numbers.

ASN Assignment by RIR



If you do not have support

- Everything you have needs upgrading if you make route-map/ policy based on ASN
- You could have many sessions to 23456 - all different networks
- Best Path Selection algorithm will get tricked
- NetFlow sees 32 bit world as one ASN
- Can not filter new world

```
sovgw1#sh ip bgp regexp _23456$
BGP table version is 22147747, local router ID is 193.239.35.240
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
*> 64.127.137.0/24  72.37.255.13             0    500      0 23456 i
*                   93.174.159.9                  450      0 34816 19151 18508 23456 i
*                   87.127.231.189           10           0 8468 19151 18508 23456 i
*  91.196.186.0/24  93.174.159.9                           0 34816 16150 15703 43531 23456 i
*>                  87.127.231.189           10           0 8468 15703 43531 23456 i
*> 91.207.218.0/23  72.37.255.13                    500      0 23456 18508 19151 35320 23456 2
*                   93.174.159.9                            0 34816 9002 13249 13249 13249 68
*                   87.127.231.189           10           0 8468 35320 23456 23456 ?
*> 91.208.44.0/24   72.37.255.13                    500      0 23456 18508 25973 1299 1213 234
*                   93.174.159.9                            0 34816 2914 1299 1213 23456 i
*> 93.89.236.0/22   72.37.255.13                    500      0 23456 18508 25973 1299 12301 23
*                   93.174.159.9                            0 34816 2914 1299 12301 23456 i
*> 94.199.136.0/21  93.174.159.9                           0 34816 2914 174 23456 i
*> 169.222.0.0/24   72.37.255.13                    500      0 23456 23456 i
*                   87.127.231.189           10           0 8468 6939 7091 715 23456 i
*                   93.174.159.9                  450      0 34816 6939 7091 715 23456 i
*> 192.26.93.0      72.37.255.13                    500      0 23456 18508 2914 4697 23456 i
*                   93.174.159.9                            0 34816 2914 4697 23456 i
*> 193.5.68.0/23    72.37.255.13                    500      0 23456 18508 25973 6830 8758 234
*                   87.127.231.189           10           0 8468 13030 8758 23456 i
*                   93.174.159.9                            0 34816 2914 13030 8758 23456 i
*> 193.31.7.0       72.37.255.13                    500      0 23456 18508 19151 5539 23456 i
*                   93.174.159.9                            0 34816 2914 3549 5539 23456 i
*                   87.127.231.189           10           0 8468 5539 23456 i
*> 195.47.195.0     72.37.255.13                    500      0 23456 18508 25973 6461 8495 234
*                   87.127.231.189           10           0 8468 33843 8495 23456 i
*                   93.174.159.9                            0 34816 2914 1299 8495 23456 i
*> 196.1.15.0       72.37.255.13                    500      0 23456 23456 i
*                   87.127.231.189           10           0 8468 3741 23456 i
*                   93.174.159.9                            0 34816 2914 174 3741 23456 i
*> 197.255.248.0/22 72.37.255.13                    500      0 23456 18508 25973 3741 23456 i
*                   87.127.231.189           10           0 8468 3741 23456 i
*                   93.174.159.9                            0 34816 2914 174 3741 23456 i
*> 202.255.47.0     72.37.255.13                    500      0 23456 18508 25973 2516 7667 234
*                   93.174.159.9                            0 34816 2914 3356 2516 7667 23456
*> 205.233.128.0    72.37.255.13                    500      0 23456 18508 25973 10026 7657 23
*                   93.174.159.9                            0 34816 2914 3257 10026 7657 2375
```

Summary

- Check that you have support in your router software
- Check that you have support in your Netflow analysis tool and scripts
- Train your NOC and provisioning team that AS numbers can be larger than 65535 now
- You no longer need to request 16 bit ASN for your customers

Any Questions?

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