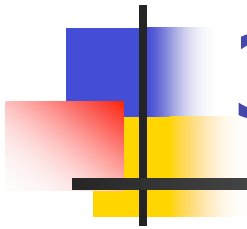
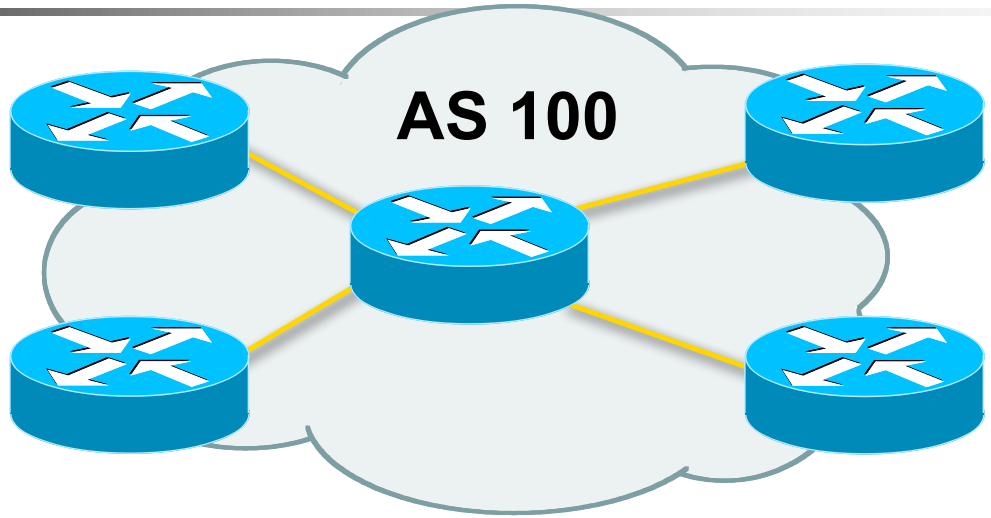


32-bit ASNs

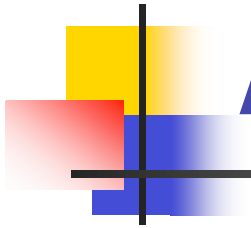
Philip Smith

SANOG 11
10th-18th January 2008
Dhaka, Bangladesh

Autonomous System (AS)

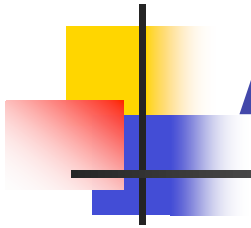


- Collection of networks with same routing policy
- Single routing protocol
- Usually under single ownership, trust and administrative control
- Identified by a unique number



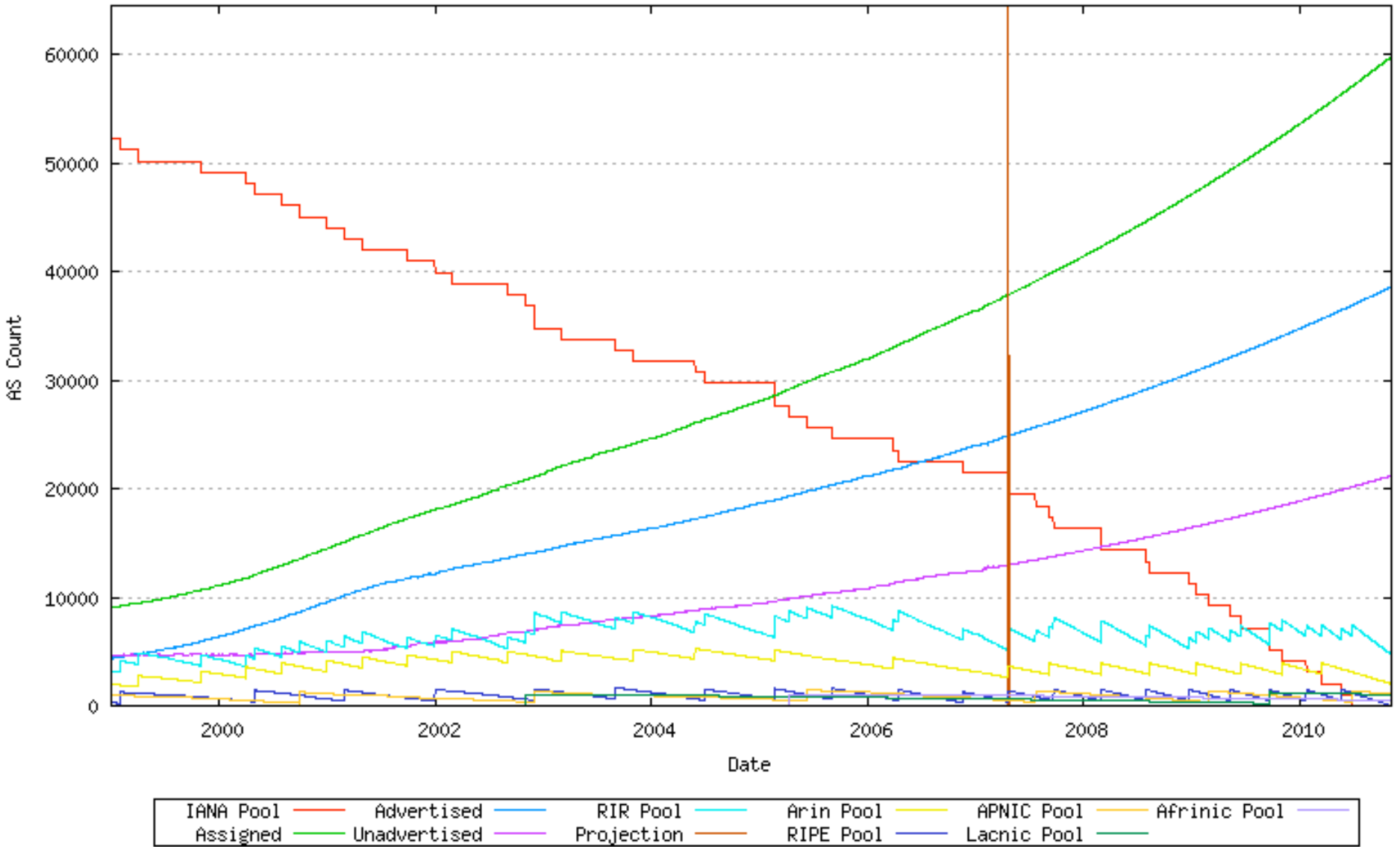
Autonomous System Number

- An ASN is a 16-bit integer
  - 1-64511 are assigned by the Regional Internet Registries
  - 64512-65534 are private ASNs and should never be used on the Internet
  - 0 and 65535 are reserved
- Current allocations up to 43007 have been made to the RIRs

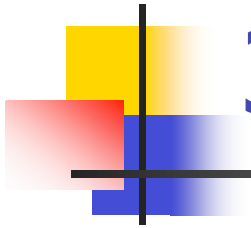


ASN status

- The pool of 16-bit ASNs will soon be exhausted
  - Analysis at http://www.potaroo.net/tools/asns/
  - Estimates are that the 16-bit ASN pool will be exhausted late 2010
- Work started in 2001 to extend the ASN pool to 32-bits

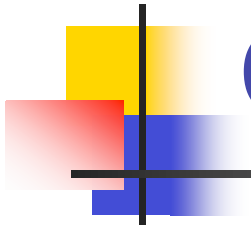


Source: http://www.potaroo.net/tools/asns/fig28.png



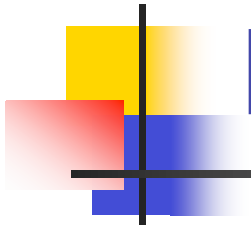
32-bit ASNs

- Standards documents (drafts)
  - Description of 32-bit ASNs
    - www.rfc-editor.org/rfc/rfc4893.txt
  - Proposal for the representation of 32-bit ASNs
    - www.ietf.org/internet-drafts/draft-michaelson-4byte-as-representation-05.txt
  - New extended community
    - www.ietf.org/internet-drafts/draft-rekhter-as4octet-ext-community-01.txt
- AS 23456 is reserved as interface between 16-bit and 32-bit ASN world



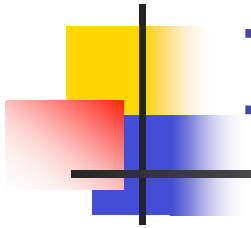
Getting a 32-bit ASN

- Sample RIR policy
  - www.apnic.net/docs/policy/asn-policy.html
- From 1st January 2007
  - 32-bit ASNs available on request
- From 1st January 2009
  - 32-bit ASNs assigned by default
  - 16-bit ASNs only available on request
- From 1st January 2010
  - No distinction – ASNs assigned from 32-bit pool



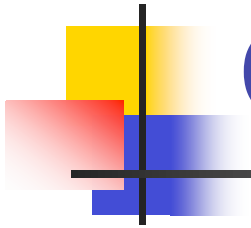
Representation

- 32-bit ASNs extend the pool:
  - 0-65535 extended to 0-4294967295
- Still discussion on representation of 65536-4294967295 range
- Some favour:
  - For 65536-4294967295: X.Y
    - (draft-michaelson-4byte-as-representation-05.txt)
  - But how will regular expressions work?
- Some favour traditional format
  - But gets bulky to handle when numbers get v big



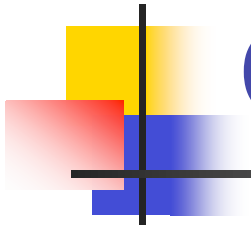
IANA Assignments

- 0.0 - 0.65535 16-bit ASN block
- 2.0 - 2.1023 APNIC
- 3.0 - 3.1023 RIPE NCC
- 4.0 - 4.1023 LACNIC
- 5.0 - 5.1023 AfriNIC
- 6.0 - 6.1023 ARIN
- Remainder are reserved or held by IANA



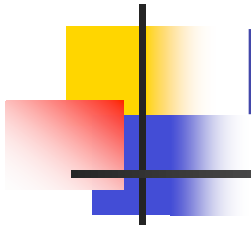
Changes (1)

- 32-bit ASNs are backwardly compatible with 16-bit ASNs
- There is no flag day
- You do NOT need to:
  - Throw out your old routers
  - Replace your 16-bit ASN with a 32-bit ASN



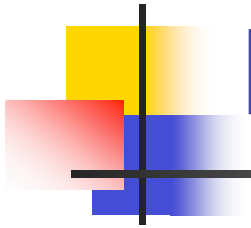
Changes (2)

- You do need to be aware that:
  - Your customers will come with 32-bit ASNs
  - ASN 23456 is not a bogon!
  - You will need a router supporting 32-bit ASNs to use a 32-bit ASN
- If you have a proper BGP implementation, 32-bit ASNs will be transported silently across your network



How does it work (1)?

- Local router only supports 16-bit ASN
- Remote router uses 32-bit ASN
- BGP peering initiated:
  - Remote asks local if 32-bit supported (BGP capability negotiation)
  - When local says “no”, remote then presents AS23456
  - Local needs to be configured to peer with remote using AS23456

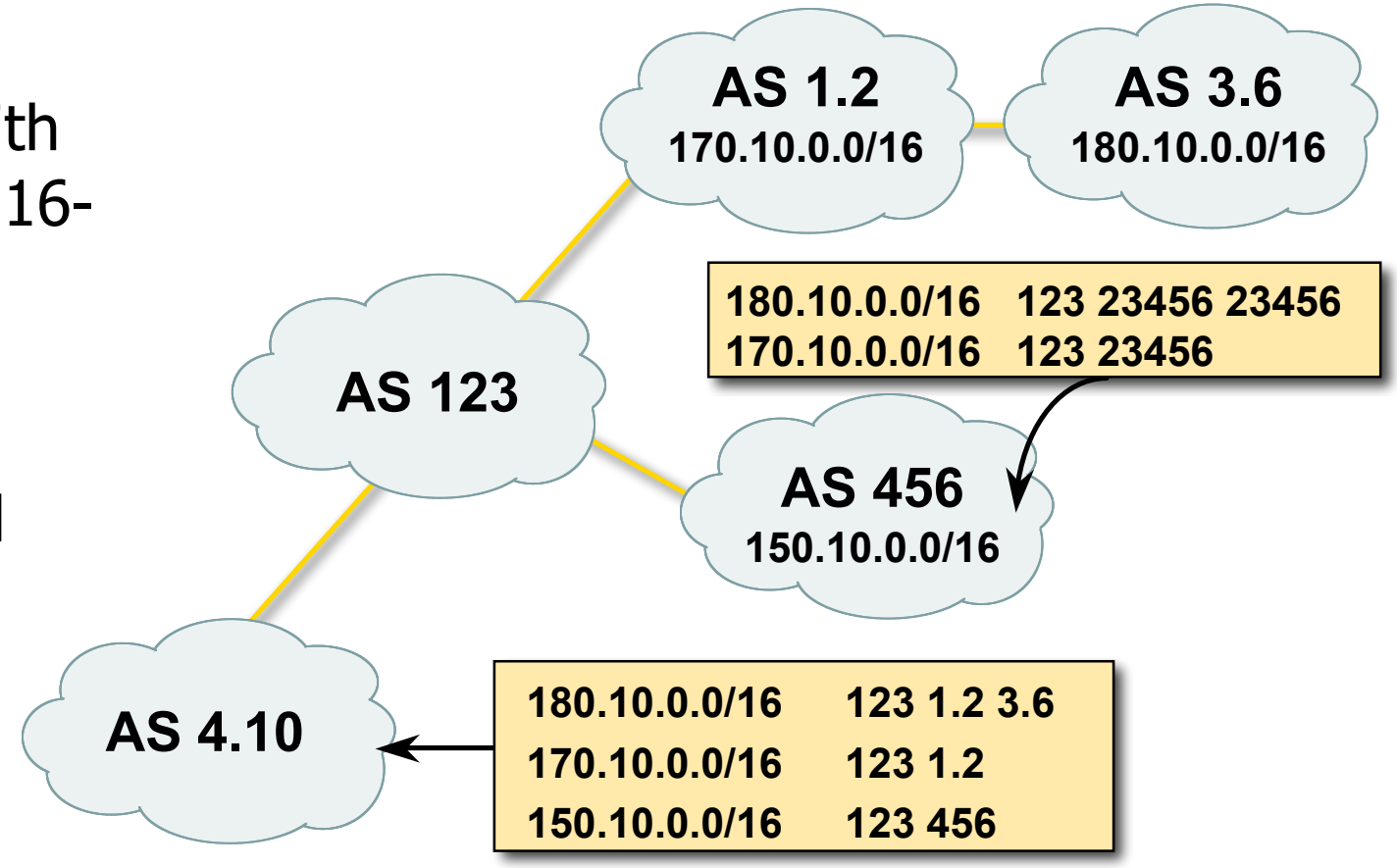


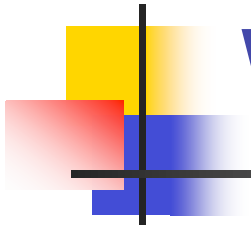
How does it work (2)?

- BGP peering initiated (cont):
  - BGP session established using AS23456
  - 32-bit ASN included in a new BGP attribute called AS4_PATH
    - (as opposed to AS_PATH for 16-bit ASNs)
- Result:
  - 16-bit ASN world sees 16-bit ASNs and 23456 standing in for 32-bit ASNs
  - 32-bit ASN world sees 16 and 32-bit ASNs

Example:

- Internet with 32-bit and 16-bit ASNs
- AS-PATH length maintained





What has changed?

- Two new BGP attributes:
  - AS4_PATH
    - Carries 32-bit ASN path info
  - AS4_AGGREGATOR
    - Carries 32-bit ASN aggregator info
  - Well-behaved BGP implementations will simply pass these along if they don't understand them
- AS23456 (AS_TRANS)

What do they look like?

- IPv4 prefix originated by AS 1.202
  - In 32-bit ASN world:

```
# bgpctl show rib 203.10.62.0/24
flags: * = Valid, > = Selected, I = via IBGP, A = Announced
origin: i = IGP, e = EGP, ? = Incomplete

flags destination     gateway   lpref med aspath origin
*>    203.10.62.0/24  147.28.0.1  100    0 0.3130 0.1239 0.4637 0.1221 1.202 i
```

  - In 16-bit ASN world:

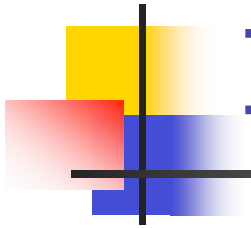
```
router# sh ip bgp 203.10.62.0

   Network          Next Hop            Metric LocPrf Weight Path
*> 203.10.62.0      202.249.2.169                0 2497 4637 1221 23456 i
```

What do they look like?

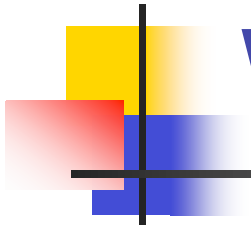
- IPv6 prefix originated by AS 6.3

```
RP/0/RP0/CPU0:leviathan#show bgp ipv6 unicast 2001:4810:2000::/35
BGP routing table entry for 2001:4810:2000::/35
Versions:
  Process           bRIB/RIB  SendTblVer
  Speaker               95735       95735
Paths: (1 available, best #1)
  Not advertised to any peer
  Path #1: Received by speaker 0
  19401 27750 20312 20080 11537 10886 33437 6.3
    2001:5e8:0:fffd:0:9:1:2 from 2001:5e8:0:fffd:0:9:1:2 (216.24.191.231)
      Origin IGP, metric 291, localpref 74, valid, external, best
      Community: 5050:42 19401:5000
```



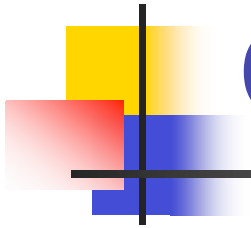
Implementations (Dec 07)

- Cisco IOS-XR 3.4 onwards
  - Cisco IOS – 12.5T, late 2008
- Quagga (patches for 0.99.6)
- OpenBGPd (patches for 3.9 & 4.0)
- JunOSe 4.1.0 (ERX only)
  - M and T series – no plans known
- Redback



What next?

- Pester your router vendors for 32-bit ASN support
  - Do you really want to run beta software in your core network?
  - October 2010 is not far away
    - Stable software, deployment cycles &c



Conclusion

- The Internet will not break
- Your network will not break

- If you have an ASN today:
  - You don’t need to change anything
  - 32-bit ASNs appear as AS 23456
- If you have no ASN today:
  - Your routers will need 32-bit ASN support after 1st January 2009