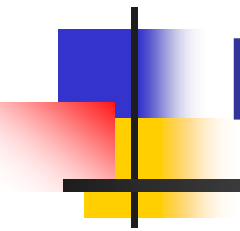

Hunting the Bogon

Geoff Huston

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What's a "BOGON" ?

- A "bogon" is the advertisement in BGP of an address block or an Autonomous System number that is not registered as being allocated
- Example:
  - Advertise an address block drawn from the RFC 1918 private address space: 10.0.1.0/24

What's "allocated" ?

- There are 3 primary resources that need to be examined to answer this query:
  - IANA registry report
    - Determines what number blocks have been allocated to RIRs and what number blocks are reserved and are not to be used
  - The RIR 'stats files' report
    - A summary of number allocations that list the number block and the date of allocation –these files are updated periodically (daily or monthly, depending on the RIR)
  - RIR whois data
    - An online database query tool used to list RIR information relating to the allocation of a particular number

1. IANA Registries

- AS number registry
  - http://www.iana.org/assignments/as-numbers
- IPv4 address registry
  - http://www.iana.org/assignments/ipv4-address-space

There are also other IANA address registries listed at

- http://www.iana.org/ipaddress/ip-addresses.htm

Inconsistencies in IANA Data

- Why are these entries different?

036/8 Jul 00 IANA - Reserved (Formerly Stanford University - Apr 93)

049/8 May 94 Joint Technical Command (Returned to IANA Mar 98)
050/8 May 94 Joint Technical Command (Returned to IANA Mar 98)

  - i.e. are 49/8 and 50/8 held in reserve by IANA or not?
  - Is this a registry or a log?

Inconsistencies in IANA Data

- Why are these entries the same?

197/8 May 93 IANA - Reserved

240/8 Sep 81 IANA - Reserved

- It would be useful for the IANA registry to consistently distinguish between IPv4 global unicast address space that is assignable and useable as unicast address space, and those blocks of address space that are currently reserved by the IETF pending a protocol standards action to define their interpretation and use

Inconsistencies in IANA Data

- From RFC3330:

39.0.0.0/8 Reserved but subject to allocation
128.0.0.0/16 Reserved but subject to allocation
191.255.0.0/16 Reserved but subject to allocation
192.0.0.0/24 Reserved but subject to allocation
223.255.255.0/24 Reserved but subject to allocation
240.0.0.0/4 Reserved for Future Use

- What is the difference between “Reserved”, “Reserved for Future Use” and “Reserved but subject to allocation”?

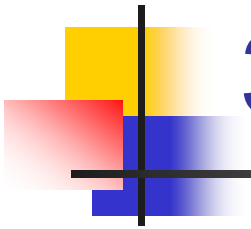
- Others at http://www.potaroo.net/IPAddrs

2. RIR Stats Files

- Produced every day
  - Contains a summary of the RIR's allocations for all number blocks that are managed by the RIR

Inconsistencies in RIR Stats Data

- Its incomplete!
  - Some additional data can be found in the ERX areas in ARIN
  - The RIRs whois databases appear to contain additional records not found in the stats data - These records describe allocations of address space not listed in the stats files
  - For RIPE the ‘issued’ files contain some additional allocations not listed in the stats file
  - I’ve *assumed* that these additional sources of data describe valid allocated address blocks



3. RIR whois Data

- RIPE: ftp://ftp.ripe.net/base/ripe.db.gz
- APNIC: ftp://ftp.apnic.net/apnic/whois/apnic.181.db.gz
- ARIN, LACNIC
  - Whois databases appear to be updated daily
  - Perform the individual queries
    - And be careful about whois query rate throttles

Inconsistencies in RIR Whois Data

- RIPE whois has some strange data:
  - E.g. 2.6.190.56/29 and 5.163.66.80/28
  - It is not obvious (to me) to identify which whois database entries are authoritative
- APNIC and ARIN whois has entries that are not listed in the stats files
  - Are these authoritative entries?
- This is being worked on by the RIRs

+ Historical IANA allocations

- A number of allocations performed by IANA do not appear to be recorded in the RIR data files
  - whois.nic.mil contains additional information
  - BUT some blocks appear to have been assigned to the DDN without any record
    - E.g. AS1451 – AS1533

Bogon Detection Resources

- http://www.cidr-report.org/bogons/
- List of Allocated and UnAllocated IPv4 space in various formats – updated hourly
- List of Allocated and UnAllocated ASNs
- No, I do not use the unallocated address block description to run a BGP Unallocated Address route server
  - But you can if you want!

What's a Bogon?

IF

- its listed in the IANA registry as reserved

OR

- If its not listed in collection of RIR stats files and whois allocation data

AND

- Its being advertised as reachable and connected in the global BGP table

THEN

- It could be a bogon advertisement

- Or it could be a data inconsistency in the RIR's records

A Bogon is NOT...

- The hijacking or otherwise unauthorized use of allocated number resources
  - All the bogon check performs is a lookup for any registry data for each advertised address block and AS using RIR stats and whois data.
  - It does not perform any form of consistency checks relating to the identity of the advertiser of the address space and the identity listed in the registry data

Bogon Listing

- www.cidr-report.org
  - Updated hourly
  - Bogon databases updated daily
  - Includes list of possibly Bogon AS and IP Address advertisements

Bogon Counts - ASNs

- 54 AS numbers cannot be located in the RIR data (5 May 2003)
  - 17 on 7 July 2003

Bogon Report

Bogus AS	Announcing-AS		
AS1462	Announced by	AS721	DLA-ASNBLOCK-AS DoD Network Information Center
AS1466	Announced by	AS721	DLA-ASNBLOCK-AS DoD Network Information Center
AS1483	Announced by	AS721	DLA-ASNBLOCK-AS DoD Network Information Center
AS1484	Announced by	AS721	DLA-ASNBLOCK-AS DoD Network Information Center
AS1489	Announced by	AS721	DLA-ASNBLOCK-AS DoD Network Information Center
AS1495	Announced by	AS668	ASN-ASNET-NET-AS Defense Research and Engineering Network
AS1521	Announced by	AS721	DLA-ASNBLOCK-AS DoD Network Information Center
AS3363	Announced by	AS3662	ERX-HARNET The Chinese University of Hong Kong
AS4528	Announced by	AS3662	ERX-HARNET The Chinese University of Hong Kong
AS4528	Announced by	AS9381	NEWTT-IP-AP New T&T HK Ltd.
AS4634	Announced by	AS10097	FLOWCOM flow communications level 2 541 kent st sydney nsw 2000
AS4665	Announced by	AS3786	ERX-DACOMNET DACOM Corporation
AS4665	Announced by	AS4766	KIX Korea Internet Exchange for "96 World Internet Exposition
AS6686	Announced by	AS7018	ATT-INTERNET4 AT&T WorldNet Services
AS6688	Announced by	AS7018	ATT-INTERNET4 AT&T WorldNet Services
AS7617	Announced by	AS3409	INET-1-AS Internetworks, Inc.
AS9671	Announced by	AS18042	KBT Koos Broadband Telecom
AS10095	Announced by	AS1239	SPRINTLINK Sprint
AS26233	Announced by	AS16399	NETWORKGCI Globalcom
AS64732	Announced by	AS9808	CMNET-GD Guangdong Mobile Communication Co.Ltd.
AS65001	Announced by	AS14900	USLEC-CORP-1 USLEC Corp.

Bogon Counts – IP Addresses

- 264 address block advertisements are bogon advertisements (5 May 2003)
  - 173 on 7 July 2003

So what?

- The integrity of the Internet depends on uniqueness of addresses.
- Uniqueness depends on the integrity of the records that describe deployment of address space and integrity of the network operators to use address space in accordance with this recorded information
- So its important to ensure that there are authoritative sources of information that describe all ‘valid’ addresses

If you find your address space listed in the Bogon Report...

- What should you do?
  1. Check your records to confirm that you have been allocated the number resources that are listed as being a bogon
  2. Check with your RIR about the history of the address record
- Ultimately, there are 2 ways to get off the report:
  1. Stop using the address resources and ensure that you are only using and advertising resources that are validly listed with the RIRs
  2. The RIR updates its database to correct an anomaly and the address space is listed in the updated RIR stats file report

Next Steps:...

- Obviously, it would be good to motivate IANA and the RIRs to resolve inconsistencies in the current databases
  - And this is underway
- And it would be good to have tools to allow network operators to efficiently identify what may be an invalid routing advertisement