Misused Top ASNs

Analysis of AS1, AS2 and AS3 misuse!

Officially allocated to...

AS 1 - Level3 Communications

AS 2 - University of Delaware

AS 3 - MIT

How they are “misused” ?

Reasons for mis-use...

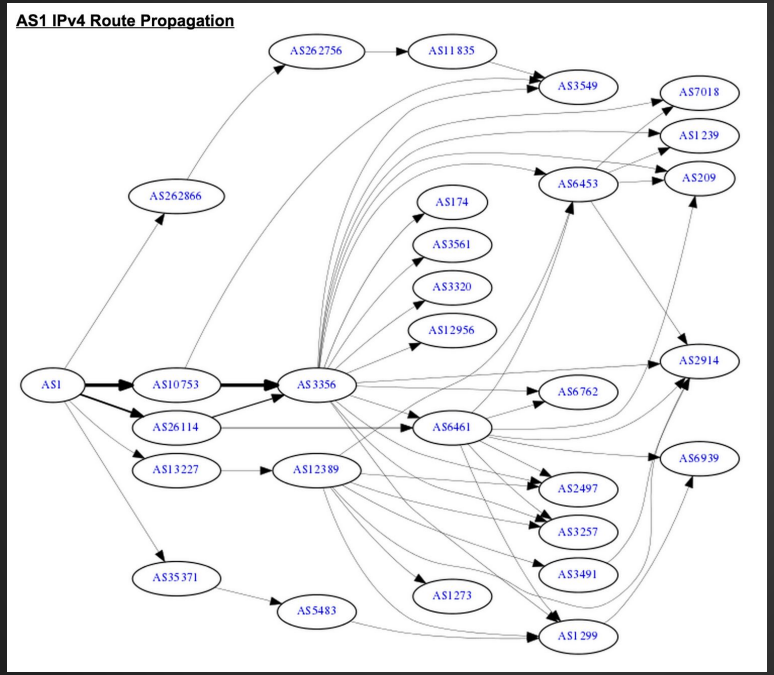
- “Copy-paste” of sample prepend configuration “1 2 3”
- Mistakenly typing “1 2 or 3” in prepend rules in route filter / export policy statement

Impact of mis-use

Hard to determine statistically but ...

- Shows unexpected relationship of leaking AS with top ASN and among top ASNs!
- Considered to be “AS hijack” and bad for trust based BGP routing
- Can result in *(a wrongly prepended)* announcement getting filtered across parts of internet
- Chances of broken connectivity of these routes with top ASNs network due to BGP loop prevention

AS1 Graph V4


AS1 IPv4 Route Propagation
AS262756
AS11835
AS3549
AS7018
AS1239
AS6453
AS209
AS262866
AS174
AS3561
AS3320
AS12956
AS1
AS10753
AS3356
AS2914
AS6762
AS26114
AS6461
AS6939
AS13227
AS12389
AS2497
AS3257
AS3491
AS35371
AS1273
AS5483
AS1299

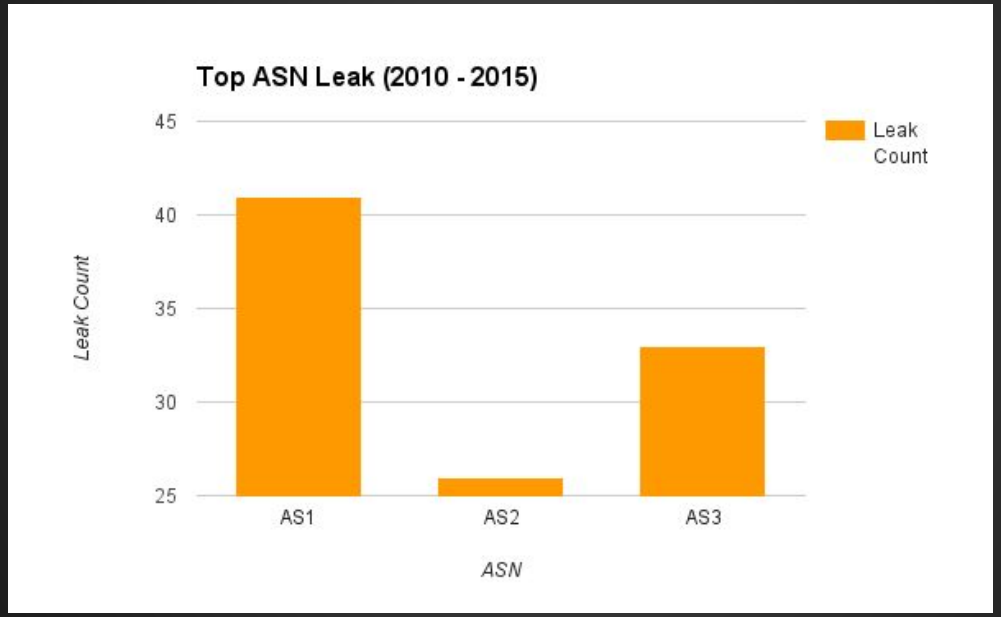
AS1 Peer V4

Rank	Description	IPv6	Peer
1	Level 3 Communications, Inc.		AS10753
2	Anaplan, Inc.		AS26114
3	Kraft-S JSC		AS13227
4	Softkit SRL		AS35371
5	TURBO 10 Telecomunicaes Ltda.		AS262866
6	Internet2		AS11537
7	Fibercut SRL		AS43647
8	OANTA SRL		AS44912
9	PAN-NET SRL		AS42405
10	National Exchange Carrier Association, Inc.		AS21616

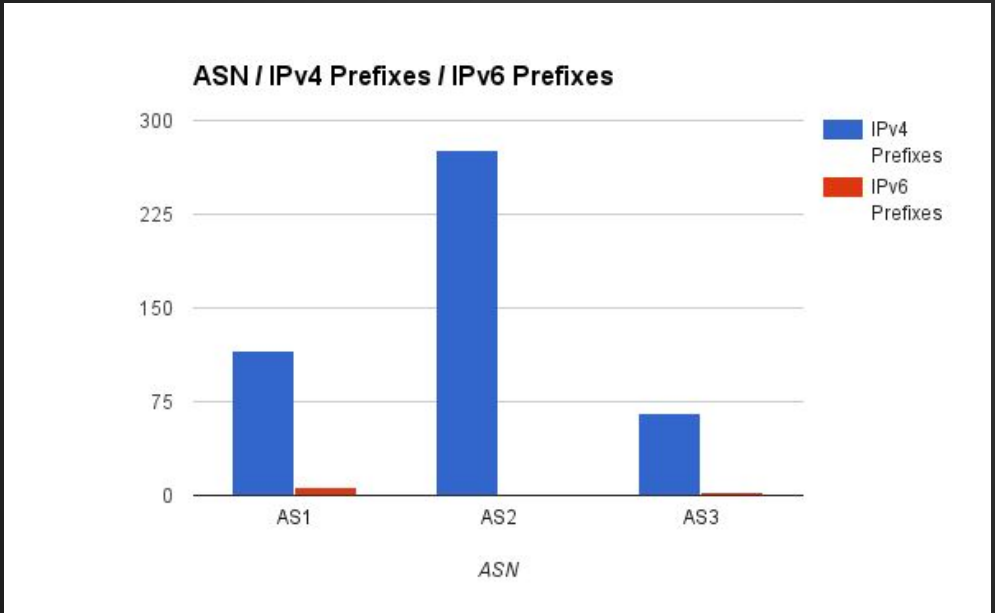
Hunting for leakers...

- Analysis of routing table from multiple RIPE RIS collectors
- Analysis from 2010 to 2015
- Looking for cases where top ASNs appear in AS_PATH for routes which belong to other ASNs.
- Focus of top ASNs appearance with prepends in the routing table
- Assumption that except AS1, other two top ASNs aren't transit provider *(since belonging to University)*
- Leaks which appeared for less then 24hrs are not collected

Distribution and Appearance



Distribution of leaks (IPv4 Vs IPv6)



Some of who leaked AS1...

AS Number	Start Date	End Date	Visibility in days
5927	22-Jul-2011	3-Dec-2011	134
7046	9-May-2010	11-Jun-2010	33
14758	25-Apr-2013	20-Jun-2013	56
21011	28-Jan-2013	5-Feb-2013	8
21219	28-Jan-2013	5-Feb-2013	8
26114	11-Jun-2013	22-Jul-2015	771
35819	23-Nov-2014	26-Nov-2014	3
40807	7-Jan-2010	24-Apr-2010	107
45899	1-Dec-2014	17-Apr-2015	137
49994	26-Nov-2013	29-Nov-2013	3
50113	31-May-2013	8-Jun-2013	8
51282	3-Nov-2010	19-Nov-2010	16
52931	3-Nov-2010	19-Nov-2010	16
55836	24-Nov-2014	26-Nov-2014	2

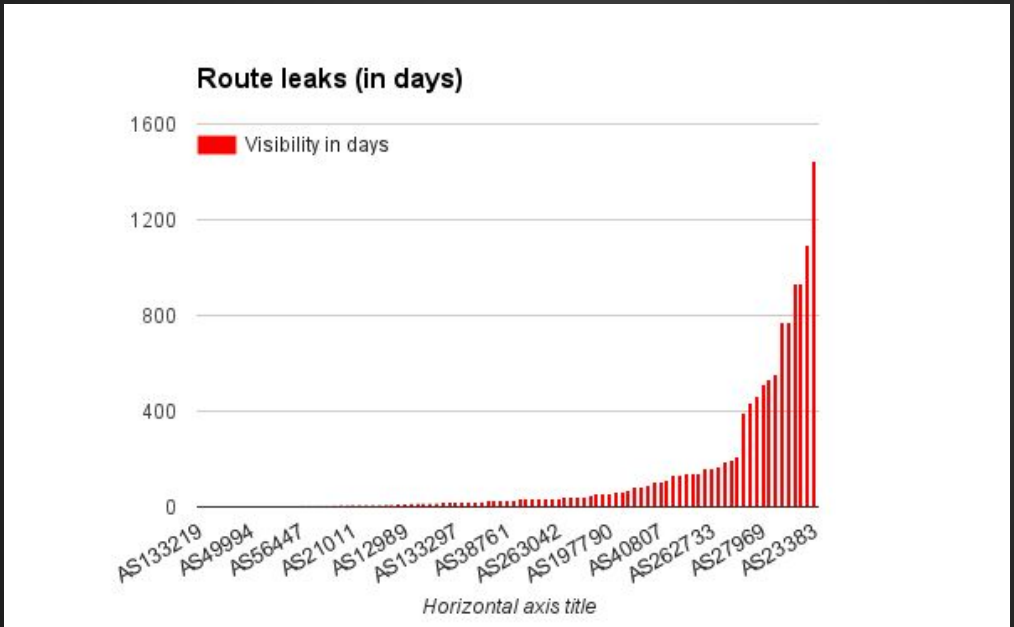
Some of who leaked AS2...

AS Number	Start Date	End Date	Visibility in days
12989	14-Oct-2014	26-Oct-2014	12
131211	19-May-2015	22-Jul-2015	64
131713	20-Apr-2015	4-Jun-2015	45
133219	6-Jul-2015	22-Jul-2015	16
17483	30-Jun-2010	7-Jul-2010	7
17658	7-Feb-2014	18-May-2015	465
197706	22-Sep-2011	25-Oct-2011	33
197790	7-Apr-2014	3-Jun-2014	57
197798	18-Jul-2013	26-Aug-2013	39
198040	2-Jan-2015	2-Feb-2015	31
23951	1-Feb-2011	23-Apr-2011	81
262587	29-May-2013	7-Jun-2013	9
262878	20-Aug-2011	25-Aug-2011	5
263042	17-Jul-2013	23-Aug-2013	37

Some of who leaked AS3...

AS Number	Start Date	End Date	Visibility in days
9121	2-Mar-2010	10-Apr-2010	39
21385	28-Feb-2011	2-Mar-2011	2
24523	25-Nov-2011	16-Dec-2011	21
24953	5-Jul-2013	31-Jul-2013	26
25933	26-Jun-2015	29-Jun-2015	3
27969	15-Sep-2013	6-Feb-2015	509
33849	28-Jun-2010	3-Aug-2010	36
35631	2-Apr-2015	9-Apr-2015	7
37162	16-Jul-2014	8-Nov-2014	115
37371	29-Jan-2013	11-Apr-2014	437
38077	17-May-2010	25-May-2010	8
38761	22-Sep-2010	22-Oct-2010	30
41599	7-Jan-2010	30-Mar-2010	82
51002	27-Jul-2010	29-Jul-2010	2
53053	15-Apr-2015	27-May-2015	42

Route leak visibility (in days)



Longest leak

1445 days (~3.9 years) for AS1 by AS23383

Sample AS_PATHs

186.65.112.0/20,30132 6939 23520 23383 1 65430

186.65.112.0/20,8283 5580 23520 23383 1

190.185.108.0/22,30132 6939 23520 23383 1 65430

190.185.108.0/22,8283 5580 23520 23383 1

Most amusing AS_PATH ever!

31019 39326 39326 3356 7029 1614 1614 1614 1614 **1 2 3 4 5**

TABLE_DUMP_V2|02/02/14 00:00:01|A|195.69.146.99|50763|74.122.136.0/24|50763 8943 3549 7029 1614 1614 1614 1614 1 2 3 4 5|IGP

Preventing such leaks

- If prepending is needed, prepend correctly i.e by repeating your own ASN multiple times
- Avoid typing ASNs by hand in config and prefer to copy paste *(helps for long ASNs)*
- Lookout for your router’s vendor's documentation on how to prepend.

Prepend Sample Config - Cisco IPv4

Create route-map which would be applied in OUT direction with specific peer

```
route-map NetworkA-OUT permit 10
 set as-path prepend  64520 64520   <--- Important to prepend your own ASN. Don't use any other random number here!
```

Call the route-map in out direction on the BGP session for IPv4

```
router bgp 64520
 no synchronization
 bgp log-neighbor-changes
 neighbor 192.168.1.2 remote-as64521
 neighbor 192.168.1.2 route-map NetworkA-OUT out
 neighbor 192.168.1.2 route-map NetworkA-IN in
 no auto-summary
```

Prepend Sample Config - Cisco IPv6

Create route-map which would be applied in OUT direction with specific peer

```
route-map NetworkA-OUT permit 10
 set as-path prepend  64520 64520   <--- Important to prepend your own ASN. Don't use any other random number here!
```

Call the route-map in out direction on the BGP session for IPv6

```
!
address-family ipv6
neighbor 2001:DB8:1:1::2 activate
neighbor 2001:DB8:1:1::2 route-map NetworkA-OUT out
network 2001:DB8:2::/48
exit-address-family
!
```

Prepend Sample Config - JunOS

Create export policy which would be applied to the peer

```
edit policy-options policy-statement Network-A-Out
set term a from prefix-list Pool-set1
set term a then as-path-prepend " 64520 64520" <--- Important to prepend your own ASN. Don't use any other random number here!
```

Call the route-map in out direction on the BGP session

```
set protocols bgp group transits neighbor  192.168.1.êxport Network-A-Out
```

Thankyou!

Questions?
Peering?

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