

BGP Routing Table Report

View of routing table between 2006 - 2016



Ranking top connected networks



Objective

Analysing changes in global routing table between 2006 to 2016

Analysis is along:

1. Top 5 well connected ASNs
2. Growth of ASNs
3. Growth of Prefixes
4. Changes in across multihomed networks



Networks with highest adjacencies (IPv4)

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Year	2006	2007	2008	2009	2010	2011
Rank 1	AS701	AS701	AS701	AS3356	AS174	AS174
Rank 2	AS7018	AS7018	AS7018	AS174	AS3356	AS3356
Rank 3	AS1239	AS174	AS174	AS7018	AS7018	AS7018
Rank 4	AS174	AS1239	AS3356	AS701	AS701	AS701
Rank 5	AS3356	AS3356	AS1239	AS1239	AS6939	AS6939

** Data belongs to Dec of each year*



Networks with highest adjacencies (IPv4) (cont.)

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Year	2012	2013	2014	2015	2016
Rank 1	AS174	AS174	AS174	AS174	AS6939
Rank 2	AS3356	AS3356	AS3356	AS3356	AS174
Rank 3	AS6939	AS6939	AS6939	AS6939	AS3356
Rank 4	AS7018	AS7018	AS7018	AS7018	AS3549
Rank 5	AS701	AS4323	AS4323	AS4323	AS7018

** Data belongs to Dec of each year*



Summary of adjacencies (IPv4)

ASN	2006	2007	2008	2009	2010
AS701	2442	2720	2293	2090	1981
AS7018	2073	2104	2217	2294	2394
AS1239	1765	1723	1631	1449	1226
AS3356	1373	1746	2184	2656	2908
AS174	1612	1854	2192	2476	2931
AS6939	567	778	960	1312	1563
AS4323	839	1011	1175	1307	1322



Summary of adjacencies (IPv4)

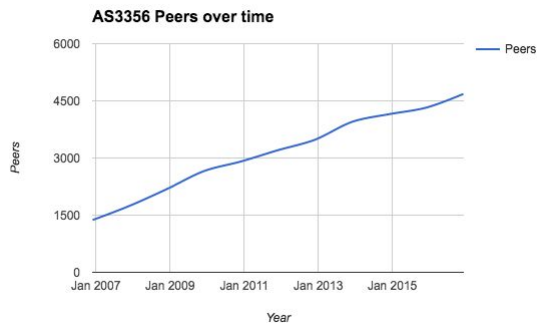
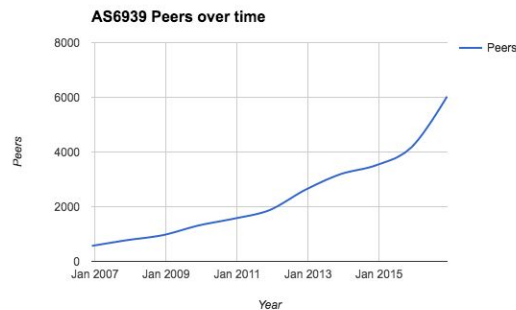
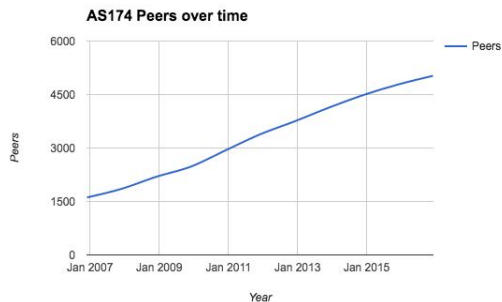
ASN	2011	2012	2013	2014	2015	2016
AS701	1929	1656	1597	1511	1353	1337
AS7018	2446	2428	2431	2393	2422	2396
AS1239	1074	918	798	725	621	524
AS3356	3205	3480	3950	4150	4321	4680
AS174	3381	3747	4135	4489	4783	5025
AS6939	1871	2612	3190	3513	4173	6029
AS4323	1433	1593	1715	1897	1895	37



Year on year IPv4 peering change across top ASNs

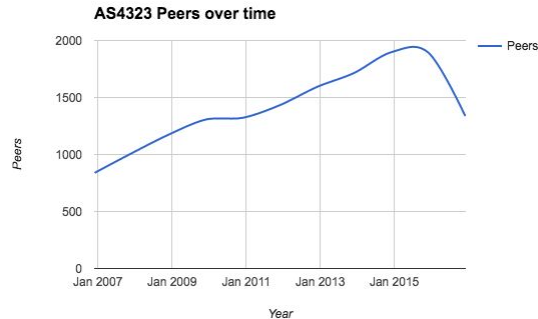
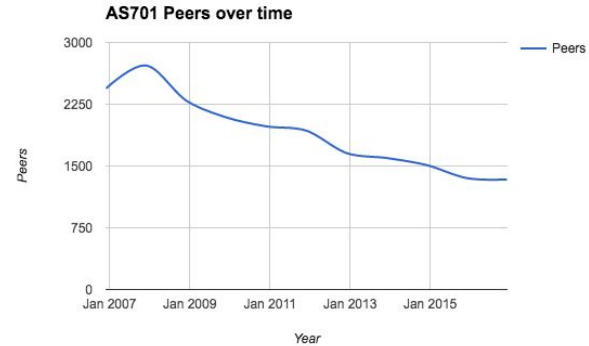
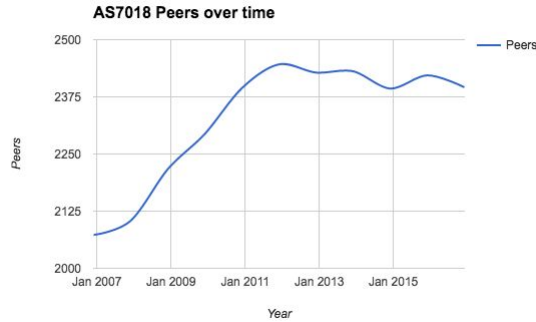


Year on Year peering change between 2006 - 2016



Year on Year peering change between 2006 - 2016 (cont)

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Networks with highest adjacencies (IPv6)

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Month	2006	2007	2008	2009	2010	2011
Rank 1	AS3257	AS3257	AS6939	AS6939	AS6939	AS6939
Rank 2	AS2914	AS2914	AS3257	AS13030	AS3257	AS3356
Rank 3	AS30071	AS6939	AS2914	AS3257	AS13030	AS174
Rank 4	AS6175	AS30071	AS3549	AS2914	AS2914	AS13030
Rank 5	AS2497	AS6175	AS30071	AS3549	AS3549	AS3257

** Data belongs to Dec of each year*



Networks with highest adjacencies (IPv6)

— — —

Month	2012	2013	2014	2015	2016
Rank 1	AS6939	AS6939	AS6939	AS6939	AS6939
Rank 2	AS3356	AS174	AS174	AS174	AS174
Rank 3	AS174	AS3356	AS3356	AS3356	AS3356
Rank 4	AS13030	AS13030	AS2914	AS37100	AS37100
Rank 5	AS3257	AS2914	AS1299	AS2914	AS1299

** Data belongs to Dec of each year*



Summary of adjacencies (IPv6)

ASN	2006	2007	2008	2009	2010
AS3257	144	179	200	274	423
AS2914	115	162	191	210	281
AS30071	83	117	110	119	97
AS6175	75	94	100	100	72
AS3356	22	49	62	87	191
AS6939	21	160	335	659	1106
AS174	-	-	-	21	188



Summary of adjacencies (IPv6)

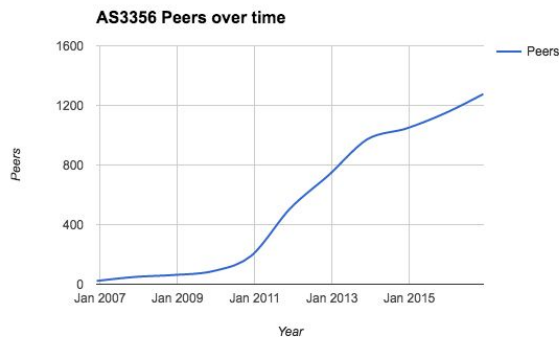
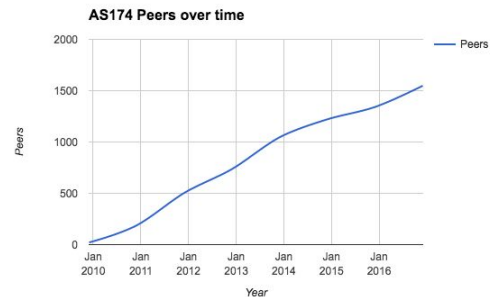
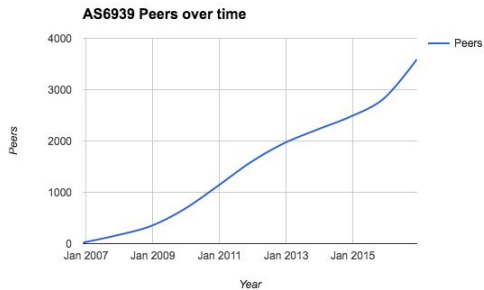
ASN	2011	2012	2013	2014	2015	2016
AS3257	412	482	511	553	670	700
AS2914	383	466	548	673	749	868
AS30071	154	261	291	290	260	174
AS6175	1	-	-	-	-	-
AS3356	507	732	973	1044	1146	1276
AS6939	1576	1950	2218	2471	2819	3589
AS174	505	737	1047	1221	1341	1548



Year on year IPv6 peering change across top ASNs

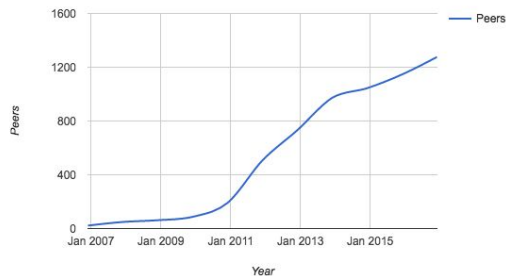


Year on Year peering change between 2006 - 2016

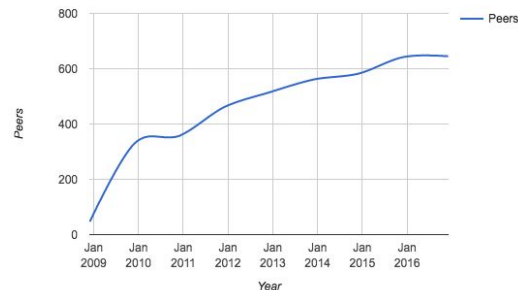


Year on Year peering change between 2006 - 2016 (cont)

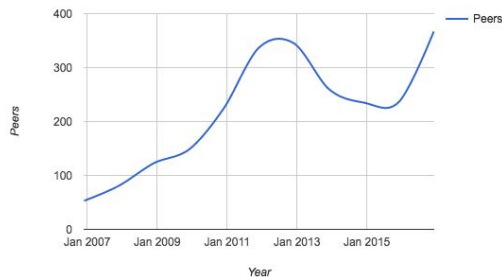
AS2914 Peers over time



AS13030 Peers over time



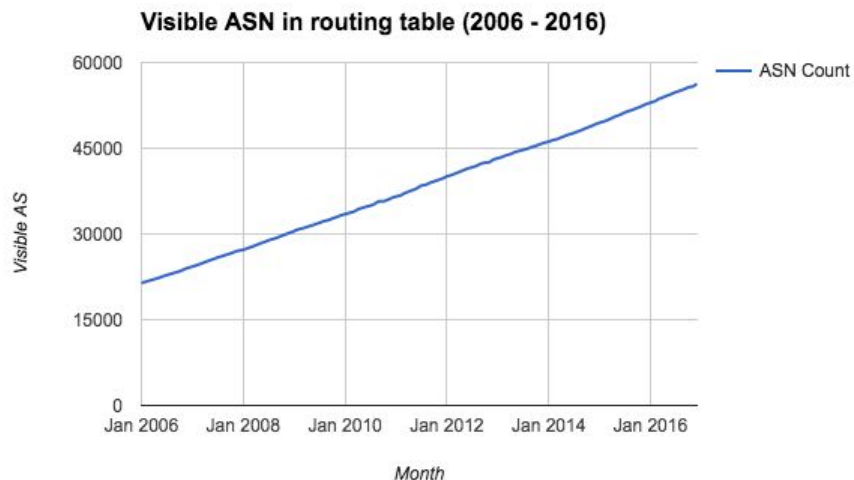
AS3549 Peers over time



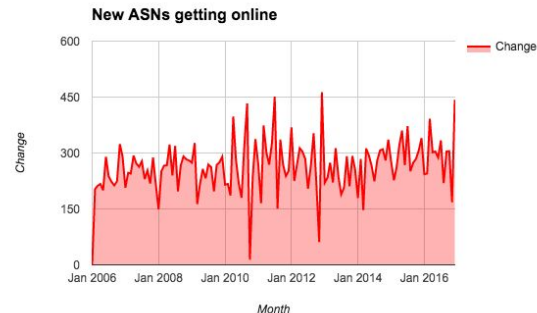
Growth of ASNs between 2006 - 2016



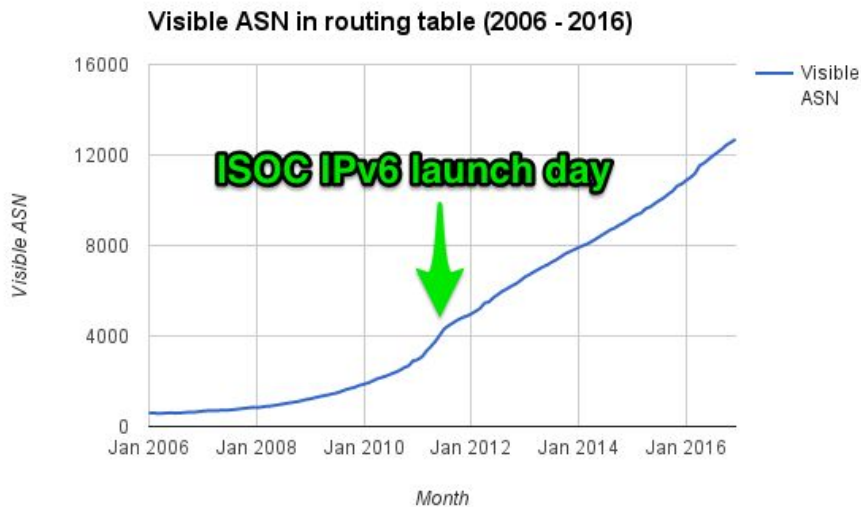
Year on Year growth of ASNs (IPv4)



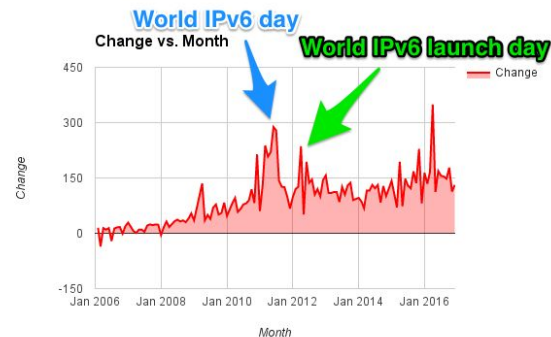
- Visible ASNs in Jan 2006: 21441
- Visible ASNs in Dec 2016: 56271
- Average change of 14.76% (every year) for 11 year period



Year on Year growth of ASNs (IPv6)

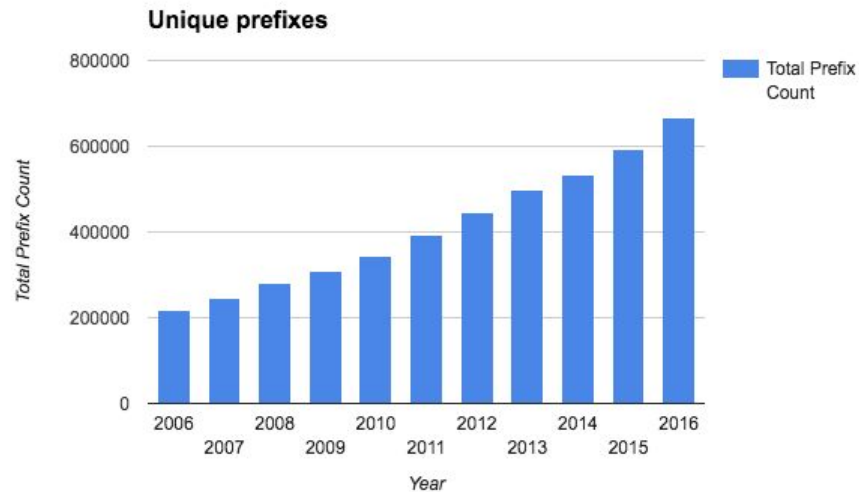


- Visible ASNs in Jan 2006: 590
- Visible ASNs in Dec 2016: 12691
- Average change of 186.45% (every year) for 10 year period



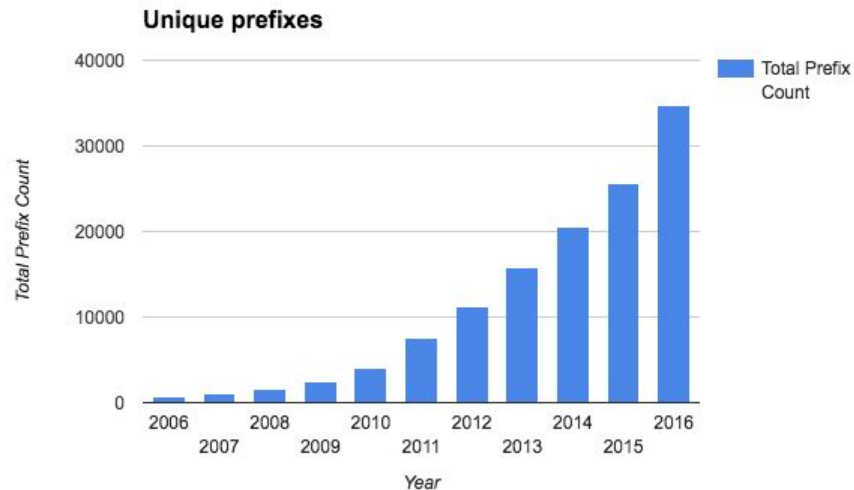
Growth of IPv4 Prefixes

Growth of unique IPv4 prefixes visible in routing table between 2006 to 2016

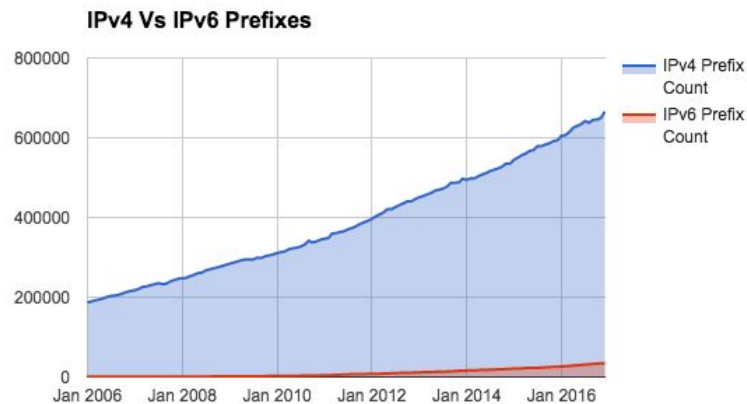
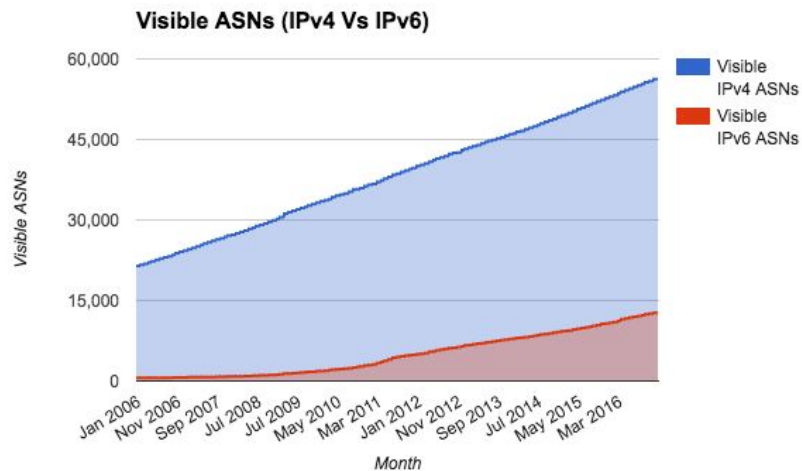


Growth of IPv6 Prefixes

Growth of unique IPv6 prefixes visible in routing table between 2006 to 2016



IPv4 Vs IPv6 ASN Comparison



Growth of multi-homing

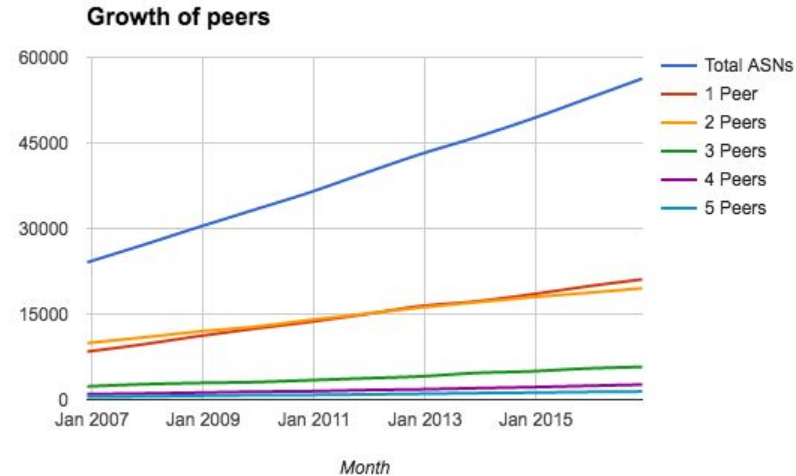


Comparison of growth of adjacencies

Month	1 Peer	2 Peers	3 Peers	4 Peers	5 Peers	Total Visible ASNs
Dec 2006	8424	9920	2319	970	498	24076
Dec 2007	9680	10894	2698	1080	575	27088
Dec 2008	11128	11931	2920	1226	680	30221
Dec 2009	12423	12767	3066	1389	781	33253
Dec 2010	13606	13948	3398	1467	814	36289
Dec 2011	14947	15028	3737	1675	913	39693
Dec 2012	16384	16134	4071	1804	1021	43022
Dec 2013	17205	17052	4670	2004	1146	45966
Dec 2014	18437	17951	4962	2187	1227	49184
Dec 2015	19839	18713	5461	2418	1347	52724
Dec 2016	21082	19520	5734	2636	1419	56271



Comparison of growth of adjacencies



How to get my ASN in the list?



Peer more!

- Follow & promote open peering policy
- Peer at Internet Exchange Points (IXPs)
- Start IXP in your home region if not there already
- Use peeringdb to list yourself & search for others
- Share your routing table to public route collectors - Oregon routeviews, RIPE RIS, PCH collector etc.



Conclusions

- Peering is good. *Remember somewhere down the transit path there's a peering!*
- More peerings = more entry & exit points in backbone giving tremendous flexibility, less points of failure, capacity to deal with high amounts of traffic and lot more!
- Large sized IPv4 routing table will consume more resources, very slow BGP convergence etc resulting in direct impact on networks
- Ironically unique IPv4 address not growing at the pace of internet will point to ugly reality of NATed deployment in post IPv4 depletion stage
- IPv6 deployment by global networks needs to accelerate. Remember each IPv6 route origination carries 2^{80} addresses at least
- IPv6 deployments need to be pushed all the way to the network edge to eyeballs to ensure scalable future of the internet



Misc Points about the study

- There can be large content networks which have very high amount of peering but not visible since neither side dumps data in public route collector
- Announcements smaller than /24 in IPv4 and /48 in IPv6 are ignored
- This study measures adjacencies which includes all three i.e peers, upstream & downstream



Thankyou!

Questions / Peering?

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