Global Network Trends & Challenges

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Routing Security

- MANRS (https://www.manrs.org)
  - Prefix filtering inbound and outbound (by default) on all external BGP sessions
  - BCP38 (unicast reverse path forwarding)
    - Deny outbound traffic using spoofed source address from your end-sites
  - Keep NOC & Technical Contact details up to date
    - Particularly in Internet Routing Registry objects and the PeeringDB
  - Validate routing information
    - Create Route Origination Authorisations for your routes, and implement Route Origin Validation on prefixes received from external BGP neighbours

Denial of Service Attacks

- Scanning
  - There will always be scanning (IPv4 and IPv6)
- Targeted on specific websites or infrastructure
- How have devices being hardened?
  - Firewall is not a solution, being a single point of failure (and this a target) becomes part of the problem
- Remotely Triggered Blackhole Filtering is the solution
  - How is RTBH deployment?
  - Every AS operator must be able to support RTBH
  - Every AS operator must be able to support RTBH initiated by their customer AS operator

Device Hardening

- Built-in firewalls on all major operating systems
  - (Yes, even Windows!!)
  - Too many are still off by default
- Operating System updates must be implemented when released
  - End of support OS must be retired – no security updates spells potential disaster
- Usernames/password
  - Strong passwords, change them frequently
  - No role accounts!!
  - 2 Factor Authentication for public accessible systems/sites

DNS

- Open Resolvers
  - No system connected to the Internet should be providing DNS resolution services (ie listening on tcp/udp 53) – but vast numbers do!!
  - Look at: https://odns-data.netd.cs.tu-dresden.de/
- Public “free” resolvers
  - Why feed your (often confidential) data to Google, Cloudflare, Level3, Quad9 and other “free” resolvers
  - Where are they? High latency means SLOW lookups and SLOW Internet
  - What do they do with your data?
- All network operators need to run their own resolvers
  - It’s not hard – “unbound” by NLnetLabs makes it very simple

“Artificial Intelligence”

- “AI” is promoted heavily as panacea
  - It’s not Intelligence, it is a Large Language Model, with billions of lines of rules doing a best fit in a circumstance presented to the model
- Vendors promoting their “AI ready” equipment and software
  - What does this even mean?
- Networks designed, operated, managed by “AI”

“Artificial Intelligence”

- Private information being sent to “AI” results in security breaches
- Personally identifiable information being leaked because log files (etc) are sent to “AI”
- Mistakes in the Model results in mistakes in network infrastructure
  - Humans no longer think or understand what their network is doing
  - Operational Best Practices replaced by “AI will do this”

Infrastructure

- The submarine fibre boom shows no sign of ending
  - Superb for connectivity across the Pacific
  - But this huge capacity now means operators and end-site infrastructure is an easier and higher bandwidth target
  - How are security best current practices looking?

Internet Exchange Points

- Only Guam and Hawaii have functioning Internet Exchange Points adhering to international standards & best practices
- We urgently need in-country/on-island operators to interconnect through local open neutral infrastructure, open to allcomers (not just domestic commercial providers)
- Barriers to interconnection harm local Internet community and the general population's access – cartels have never operated in the interests of the general population
- An IXP allows all participants (who have their own ASN and own address space) to interconnect, exchange their routes and traffic. That's it!
  - Blocking participation causes serious harm to:
  - Connectivity | Business opportunities | Education | Content access

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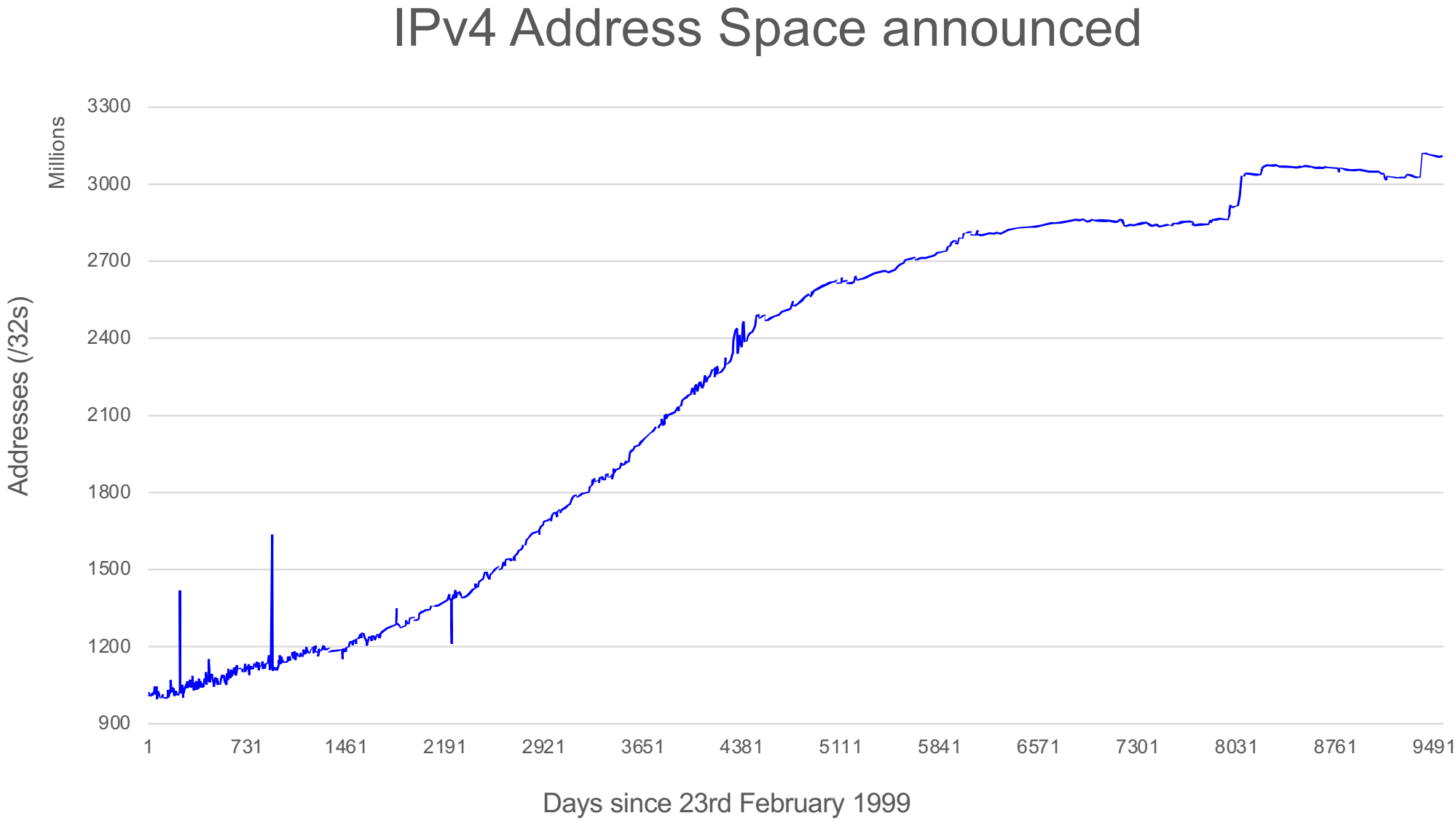
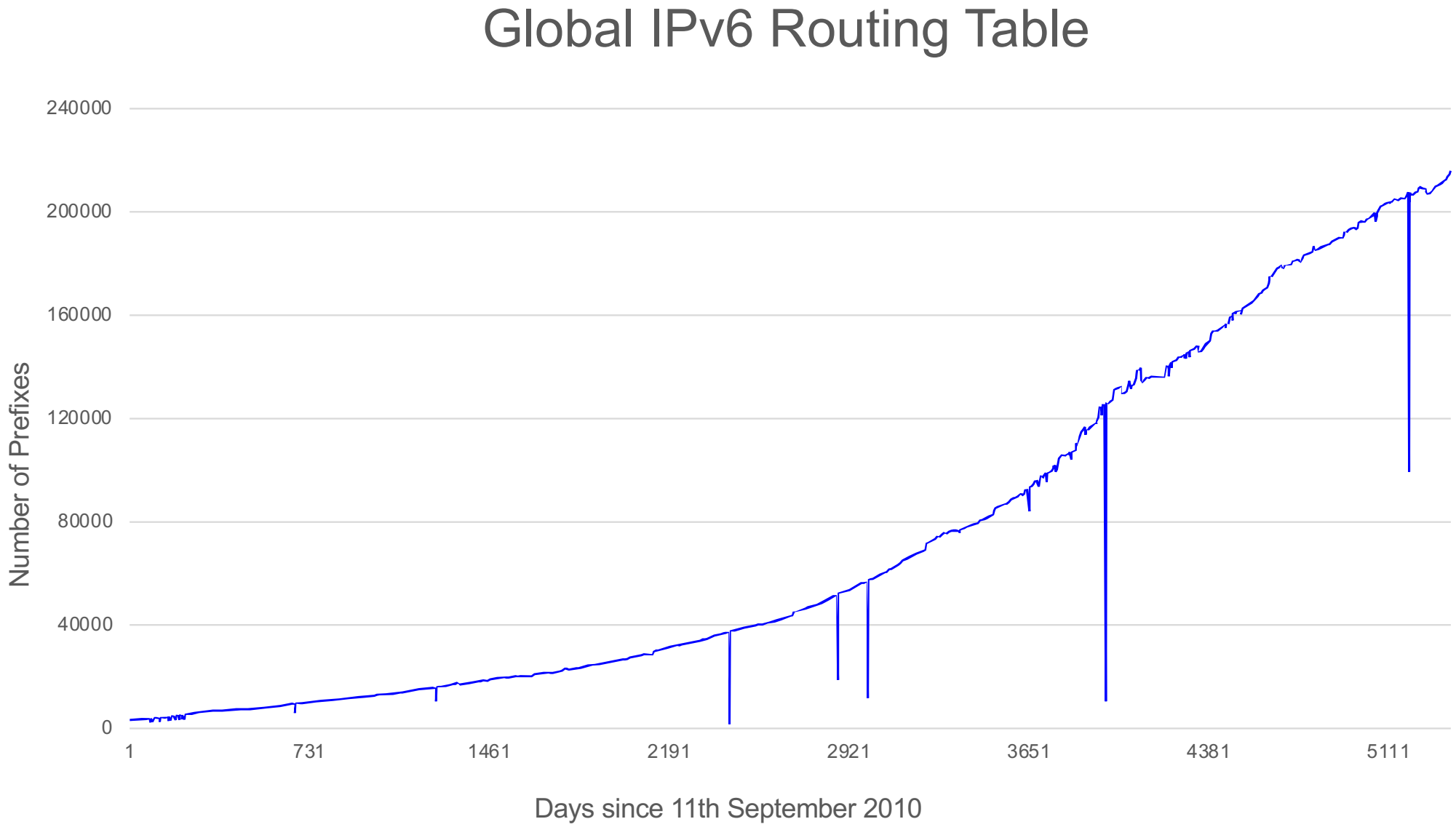
Address Space Hijacks

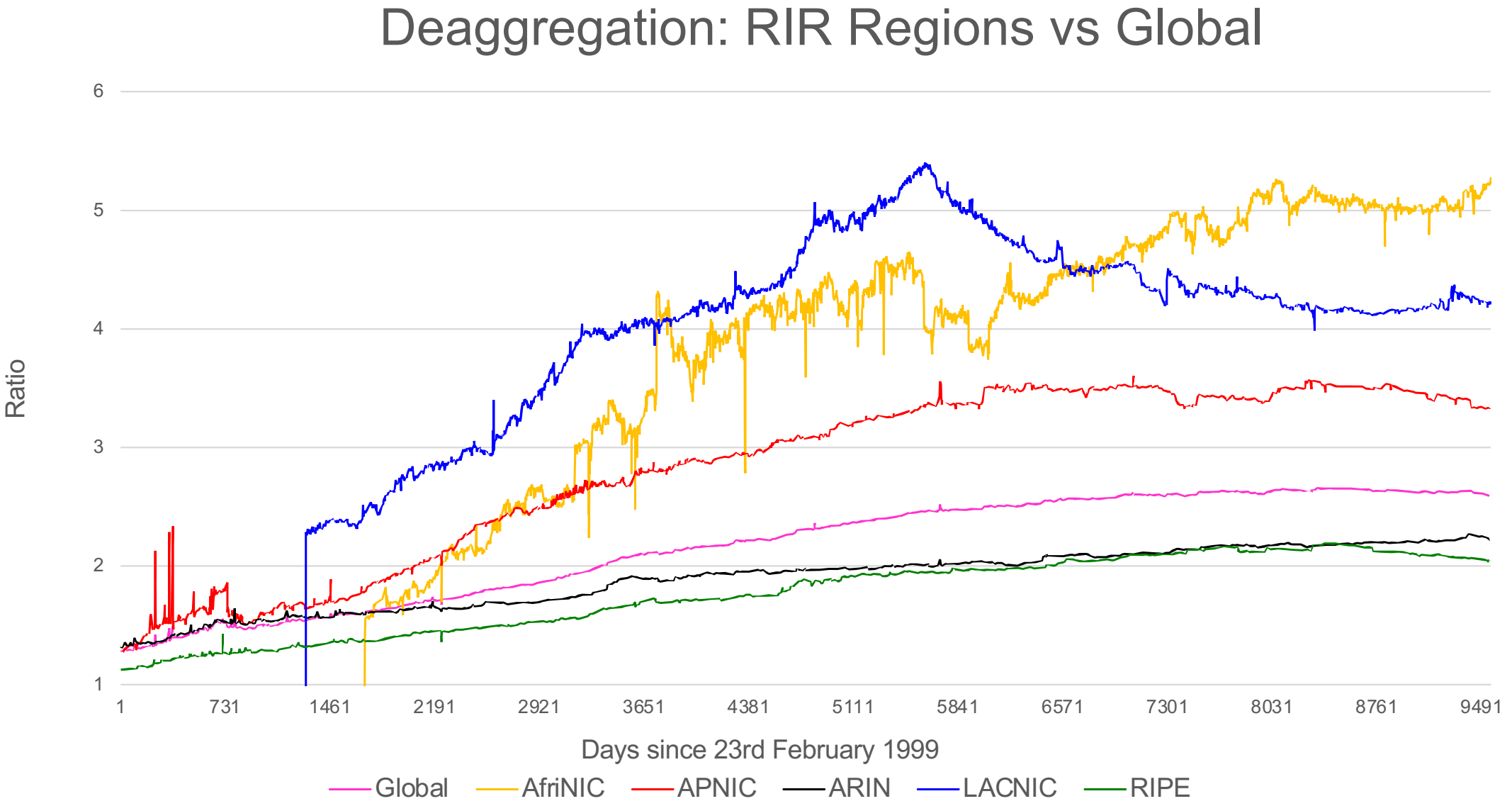
- RPKI was developed more than a decade ago to help mitigate this problem
  - A ROA is a digital signature attaching an address block to an ASN
  - Only the stated ASN can originate the stated address block
    - Covering aggregates not allowed
    - Subnets not allowed
    - Other ASNs not allowed
    - ROA created must match the announced address block

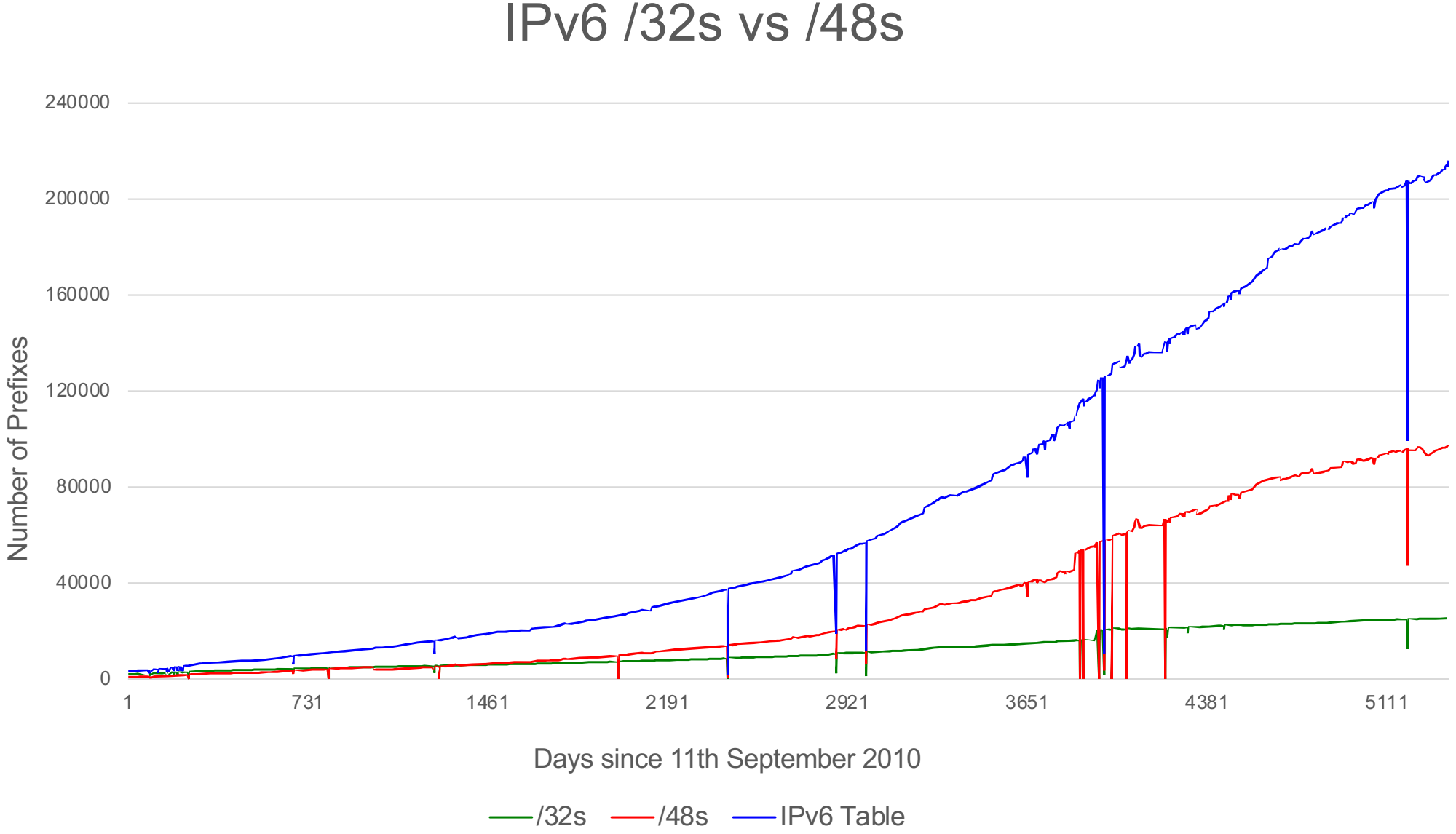
IP Addresses

- IPv4 address space in use on the Internet has plateaued several years ago
  - IPv4 addresses still being transferred between operators
  - It's quite clear that "unused" addresses never seen on the Internet are not being flushed out by the $60+ per IP address being sought in the transfer "market"
- IPv6 address space growth continues
  - More operators deploying, especially mobile networks
- Deaggregation is rampant, both for IPv4 and IPv6 😭🤯


IPv4 Address Space announced
Millions
Addresses (/32s)
3300
3000
2700
2400
2100
1800
1500
1200
900
1
731
1461
2191
2921
3651
4381
5111
5841
6571
7301
8031
8761
9491
Days since 23rd February 1999


Global IPv6 Routing Table
240000
200000
160000
120000
80000
40000
0
Number of Prefixes
1
731
1461
2191
2921
3651
4381
5111
Days since 11th September 2010


Deaggregation: RIR Regions vs Global
Ratio
6
5
4
3
2
1
1
731
1461
2191
2921
3651
4381
5111
5841
6571
7301
8031
8761
9491
Days since 23rd February 1999
Global
AfriNIC
APNIC
ARIN
LACNIC
RIPE


IPv6 /32s vs /48s
240000
200000
160000
120000
80000
40000
0
Number of Prefixes
1
731
1461
2191
2921
3651
4381
5111
Days since 11th September 2010
/32s
/48s
IPv6 Table

Deaggregation

- IPv4 Routing Table will pass 1m entries in the next few weeks
- IPv6 Routing Table will pass 250k entries in the next month or two
- What are Pacific operators doing to help?
- To Do:
  - Stats from my BGP pages

Fiji Deaggregation

ASN	No of nets	/20 equiv	MaxAgg	Description
4638	97	6	9	IS-FJ-AS Telecom Fiji Limited, FJ
38442	25	5	4	VODAFONEFIJI-AS-FJ Vodafone Fiji Limited
45355	9	3	7	DIGICELPACIFIC-1-AP Digicel Fiji Limited
141470	7	1	1	GOVNET-AS-AP ITC Services, FJ
45349	6	0	3	TFL-AS-AP Telecom Fiji Ltd, FJ
9241	5	3	2	FINTEL-FJ Fiji International Telecomunia
135647	2	0	2	AFL-AS-AP Airports Fiji Limited, FJ
149429	1	0	1	RBOF-AS-BRS Reserve Bank of Fiji, FJ
137890	1	0	1	WALESILTD-AS-AP Walesi Ltd, FJ
136921	1	0	1	FNU-AS-AP Fiji National University, FJ
132248	1	0	1	RBOF-AS-AP Reserve Bank of Fiji, FJ
24390	1	16	1	USP-AS-AP The University of the South Pa

PNG Deaggregation

ASN	No of nets	/20 equiv	MaxAgg	Description
58460	49	3	13	DIGICELPNG-AS-AP Digicel PNG Ltd, PG
55792	44	2	3	DATEC-PNG-AS-AP Datec-PNG, PG
38009	22	2	1	TELIKOM-PNG-AS-AP Telikom PNG Satellite
139898	17	1	5	DCL-AS-AP Digitec Communications Limite
17828	10	3	6	PNGDATACOLIMITED-AS-PG PNG DATACO LTD,
134151	6	0	1	STC-AS-AP Steamships Ltd, PG
63945	6	0	2	DIGITECPNG-AS-AP Digitec PNG Limited, PG
136587	5	0	3	PNGDATACOLIMITED-AS-AP PNG DATACO LIMITE
136239	5	0	2	CLICKPACIFICLTD-AS-AP CLICK PACIFIC LTD
133137	4	0	1	BEMOBILEPNG-AS-AP Bemobile LTD, PG
45924	3	1	2	GLOBAL-AS-AP Global Technologies Limited
152477	2	0	1	LBL-AS-AP LOTIC Bige Limited, PG
151398	2	0	1	CCPL-AS-AP Credit Corporation PNG Limited
142269	2	0	2	KINA-AS-AP KINA BANK, PG

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Samoa Deaggregation

ASN	No of nets	/20 equiv	MaxAgg	Description
17993	37	2	3	VODAFONESAMOA-AS-AP Vodafone Samoa Limi
38800	6	1	5	DIGICELSAMOA-WS-AS-AP Digicel Samoa Ltd
38227	3	1	2	CSLSAMOA-WS-AS-AP Computer Services Lim
153053	1	0	1	LTSCL-AS-AP Lesamoa.net, WS
150321	1	0	1	SOTPREP-AS-AP Secretariat of the Pacific
139679	1	0	1	OEC-AS-AP Office of the Electoral Commis
134376	1	0	1	CSLSAMOA-IX-AS-AP Samoa IXP, WS

Guam Deaggregation

ASN	No of nets	/20 equiv	MaxAgg	Description
3605	23	23	9	ERX-KUENTOS-AS Guam Cablevision, LLC., GU
9246	10	9	8	GTA-AP Teleguam Holdings, LLC, GU
395400	6	16	2	UNIVERSITY-GUAM, GU
17456	6	1	5	PDSGUAM-USTRANSPORT-AS-GU-AP Pacific Data
152735	1	0	1	CPDCL-AS-AP Guam Exchange, GU
56200	1	0	1	GCC-NETOPS-GU Guam Community College, GU
23676	1	0	1	MARIIX-GU Mariana Islands Internet Exchan

Tonga Deaggregation

ASN	No of nets	/20 equiv	MaxAgg	Description
38201	9	1	7	KALIANET-PUBLIC-AS-AP Tonga Communicatio
132831	8	1	5	TOKOWIRELESSLTD-AS-AP TokoWireless Limit
38198	4	1	1	DIGICELNET-TO Digicel Tonga Ltd, TO
132579	2	0	2	TONGACABLELIMITED-AS-AP Tonga Cable Limi

Summary

- Routing Security
- DoS Attacks
- Device Hardening
- DNS
- “AI”

- Infrastructure
- IXPs
- Address Space (Hijacks & Growth)
- Deaggregation