The Internet's Biggest BGP Incidents

A Brief History

kentik®
The network observability company

Justin Ryburn
Field CTO

Who’s this guy?

Current

Field CTO - Kentik

Past

25 years in networking

Ran networks (including peering) before migrating to the vendor side

More details

@JustinRyburn

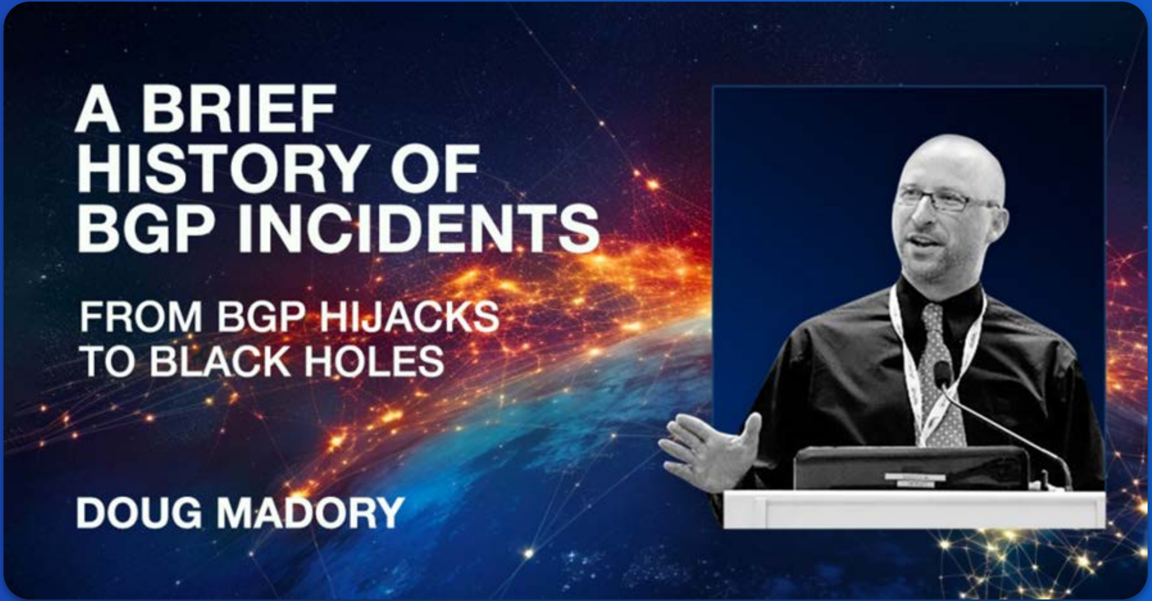
/in/justinryburn

Credit Where Due

Talk based on the work of Doug Madory, “The Man Who Sees the Internet”

- @DougMadory
- /in/dougmadory

Great resource to follow on social media for news on this topic.


A BRIEF HISTORY OF BGP INCIDENTS
FROM BGP HIJACKS TO BLACK HOLES
DOUG MADORY

BGP Incident Definitions

Hijacks

- *Prefix hijacking happens when a network, whether intentionally or mistakenly, originates a prefix that belongs to another network without its permission. [MANRS]*
- Presumes malicious intent
- Generally used to describe an illegitimate origination of a prefix

Route Leaks

- *A route leak is the propagation of routing announcement(s) beyond their intended scope. [RFC7908]*
- Often occur accidentally due to configuration errors
- Malicious actors may also attempt to hide attacks as a leak
- Generally used to describe a leak of prefixes upstream for the legitimate origin of the prefix

Even experts debate the definitions

Definitions for Our Purposes

Origination Errors

- Occurs when an AS originates (announces with its ASN as the origin) a new advertisement of a route to an IP address block over which it does not possess legitimate control
- Solicits traffic destined to those IP addresses to the new ASN

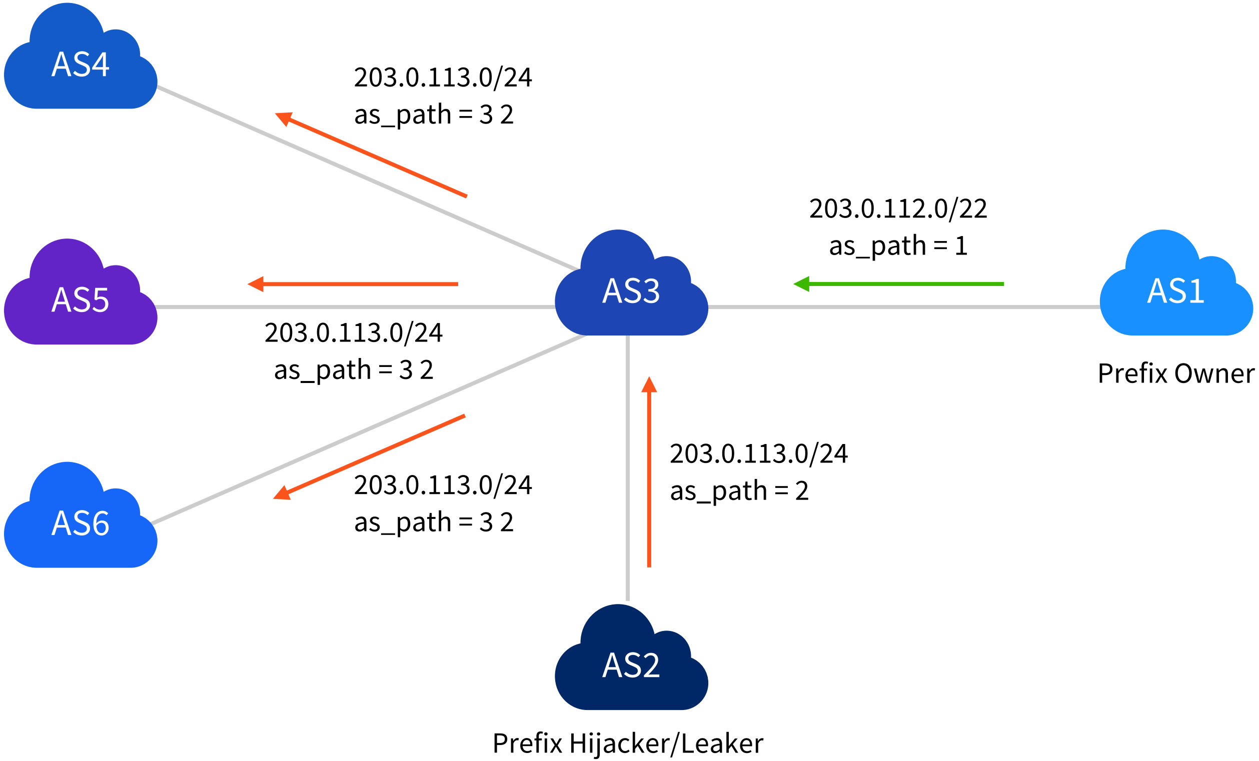
AS Path Errors

- Occurs when an AS inserts itself as an illegitimate intermediary into the forwarding path of traffic bound for a different destination
- Traffic may still reach its ultimate destination, albeit along a sub-optimal path

IP Squatting

- Occurs when an AS announces IP address ranges that are normally unrouted on the global Internet
- Typically for the purpose of evading IP-based blocklists and complicating attribution

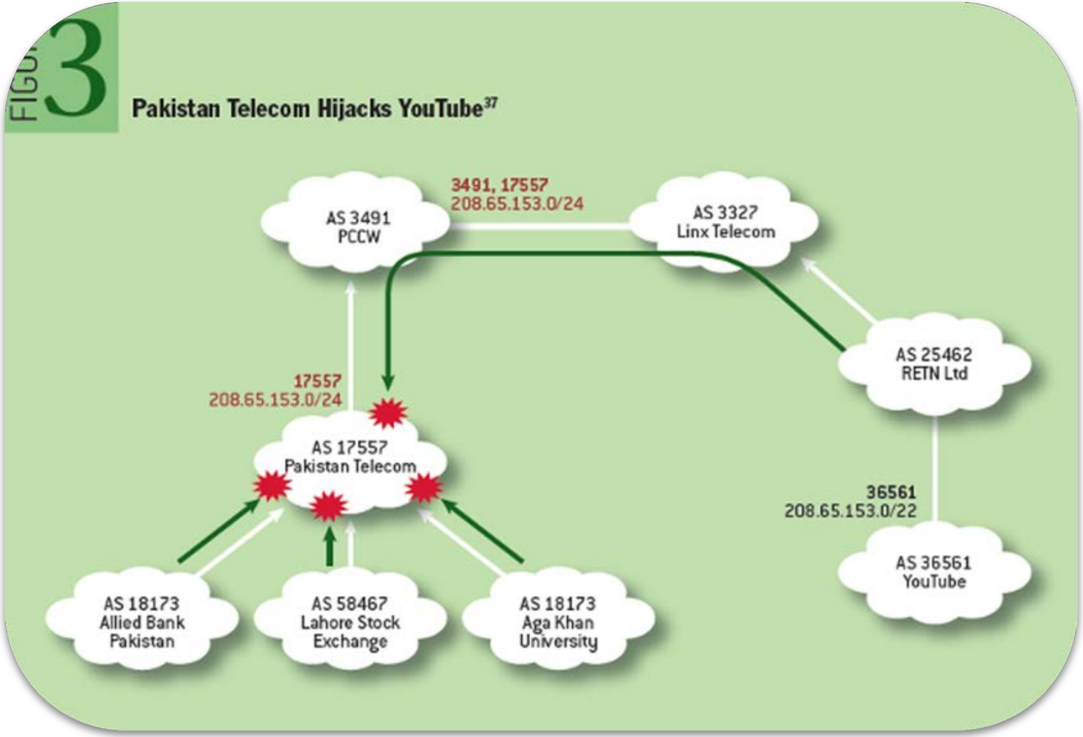
Origination Error



Pakistan Telecom Hijack of YouTube (2008)

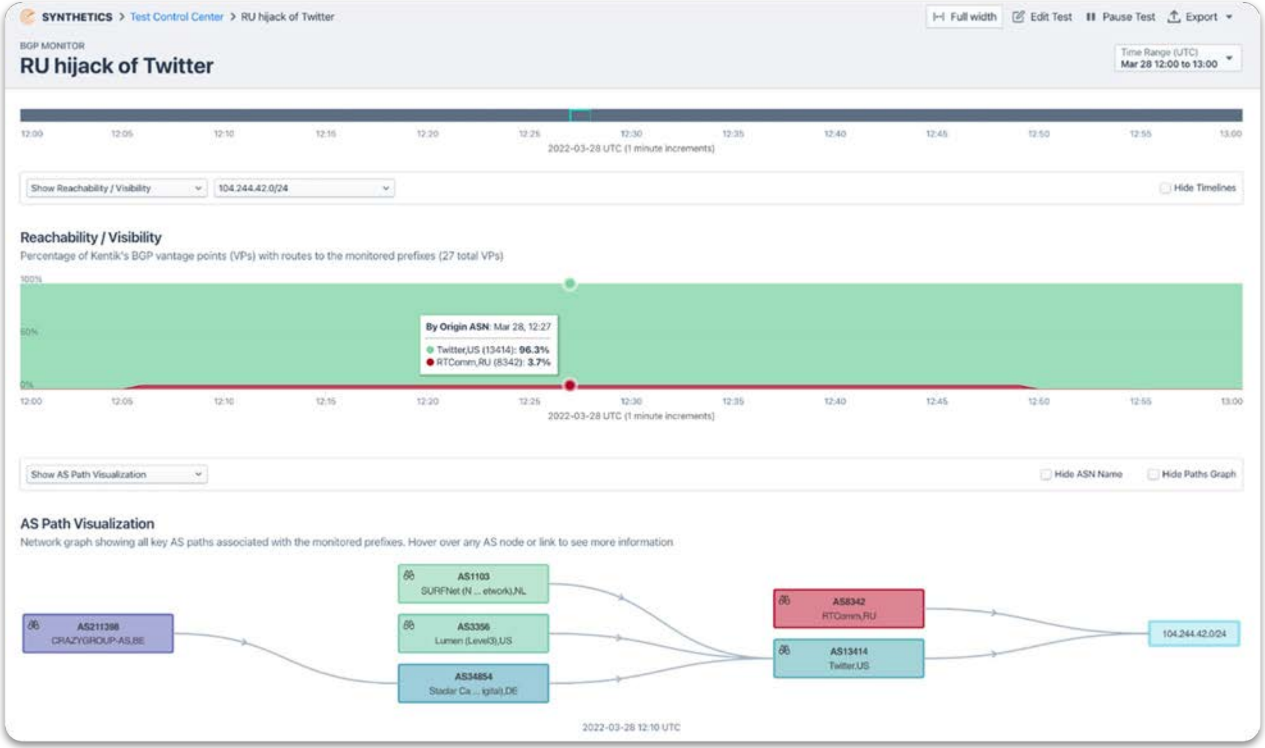
- Government of Pakistan ordered access to YouTube to be blocked in the country due to a video it deemed anti-Islamic
- Pakistan Telecom intended to blackhole traffic inside their network
- Leaked it to their upstream providers

Image source: https://dl.acm.org/doi/fullHtml/10.1145/2668152.2668966



Russian Hijack of Twitter (2022)

- Twitter prefix (104.244.42.0/24) announced by Russian Telecom RTComm during the Russian invasion of the Ukraine
- Same prefix was hijacked during the military coup in Myanmar in 2021
- Less propagation this time due to RPKI ROA



SYNTHETICS > Test Control Center > RU hijack of Twitter

BGP MONITOR

RU hijack of Twitter

Time Range (UTC) Mar 28 12:00 to 13:00

Show Reachability / Visibility | 104.244.42.0/24

Reachability / Visibility

Percentage of Kentik's BGP vantage points (VPs) with routes to the monitored prefixes (27 total VPs)

By Origin ASN: Mar 28, 12:27
- Twitter,US (13414): **96.3%**
- RTComm,RU (8342): **3.7%**

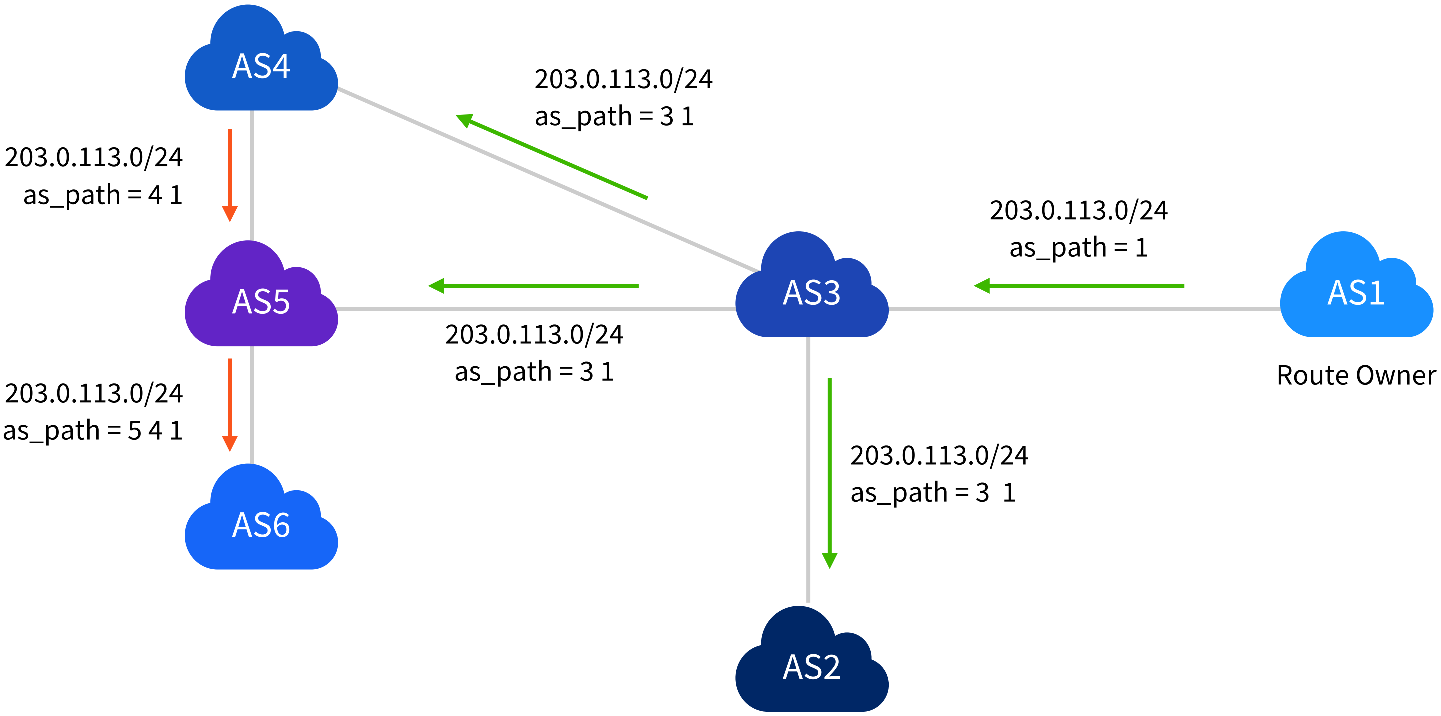
Show AS Path Visualization

AS Path Visualization

Network graph showing all key AS paths associated with the monitored prefixes. Hover over any AS node or link to see more information

2022-03-28 12:10 UTC

AS Path Error

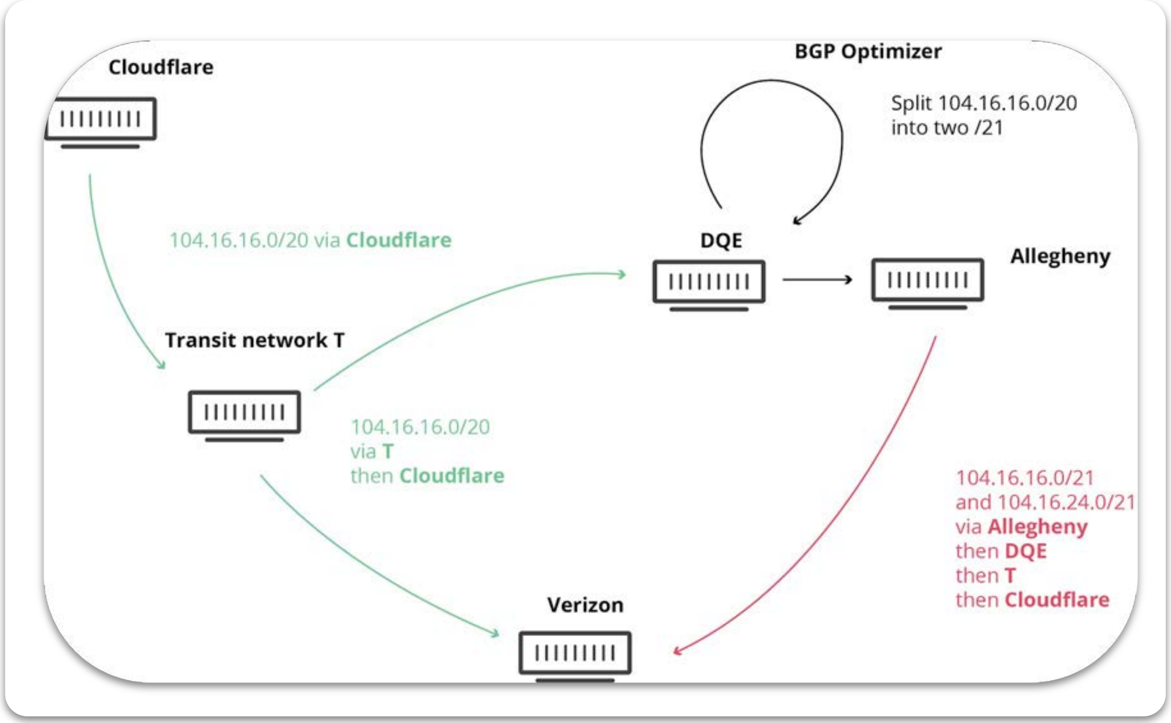


AS7007 Incident (1997)

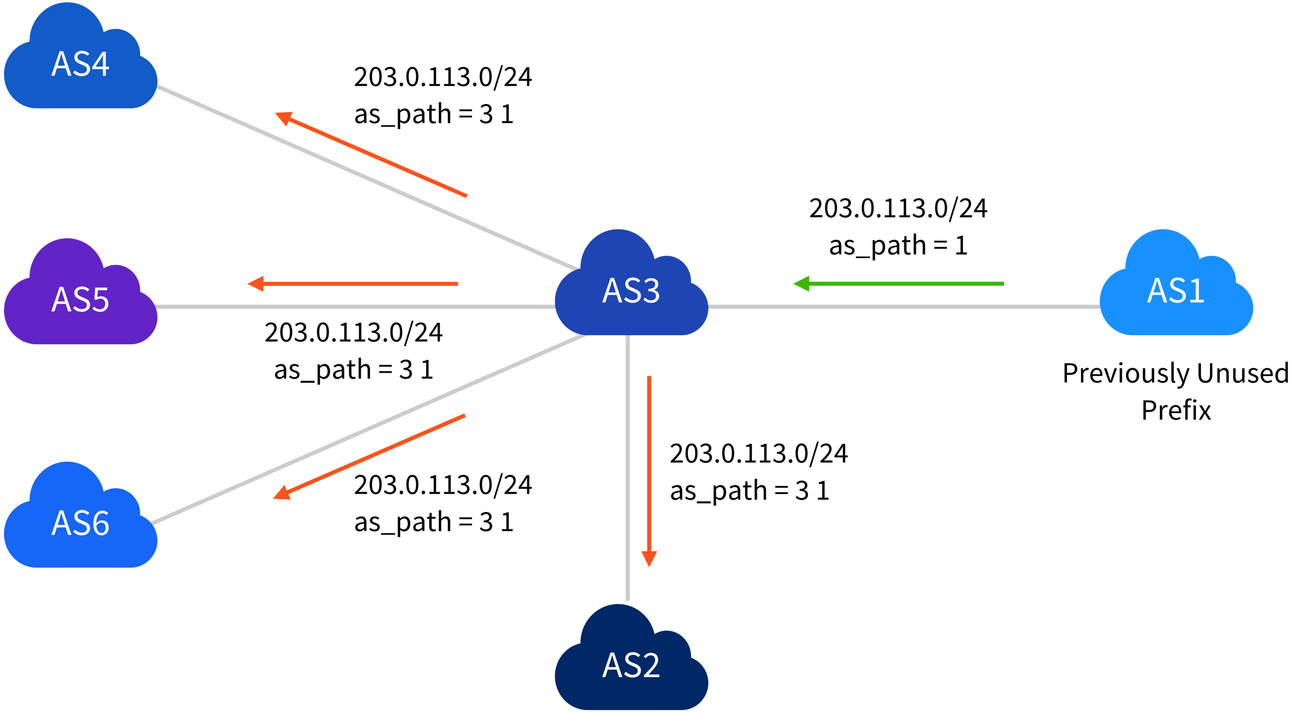
- The OG of BGP Incidents
- Code bug caused a router inside AS7007 (MAI Network Services) to leak routes to the Internet
- Existing prefixes de-aggregated to /24 prefixes and originated from AS7007
- Routes remained even after the originating router had been taken offline

Allegheny Leak (2019)

- BGP Optimizer inside DQE split 104.16.16.0/20 into two /21 prefixes
- Advertised those routes to their customer, Allegheny
- Allegheny in turn advertised upstream to Verizon
- BGP prefers a /21 over a /20 so all of the Internet connected to Verizon preferred the route through DQE



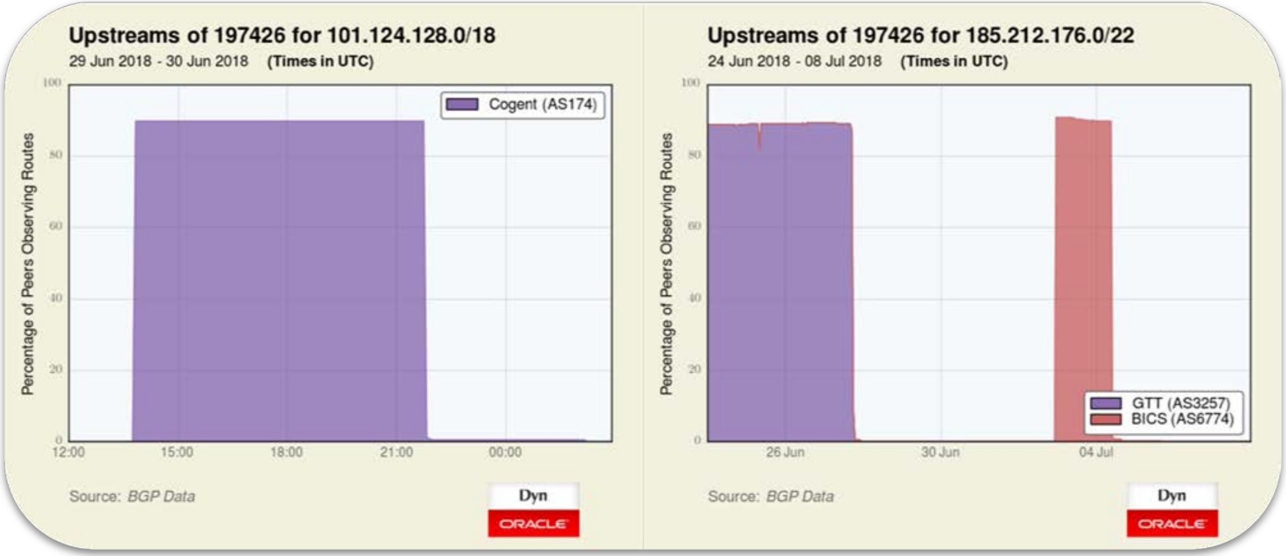
IP Squatting



Previously Unused Prefix

Bitcanal

- IP Squatting on 101.124.128.0/18 until Cogent disconnected them
- Then moved to 185.212.176.0/22 via GTT and BICS
- Used IPs as source of spam to avoid IP Blacklist



Upstreams of 197426 for 101.124.128.0/18

29 Jun 2018 - 30 Jun 2018 (Times in UTC)

Source: *BGP Data*

Upstreams of 197426 for 185.212.176.0/22

24 Jun 2018 - 08 Jul 2018 (Times in UTC)

Source: *BGP Data*

Impact of a BGP Incident

⚠ Disrupt the flow of legitimate internet traffic

⚠ Nation state control on flow of information

⚠ Misdirection of communications

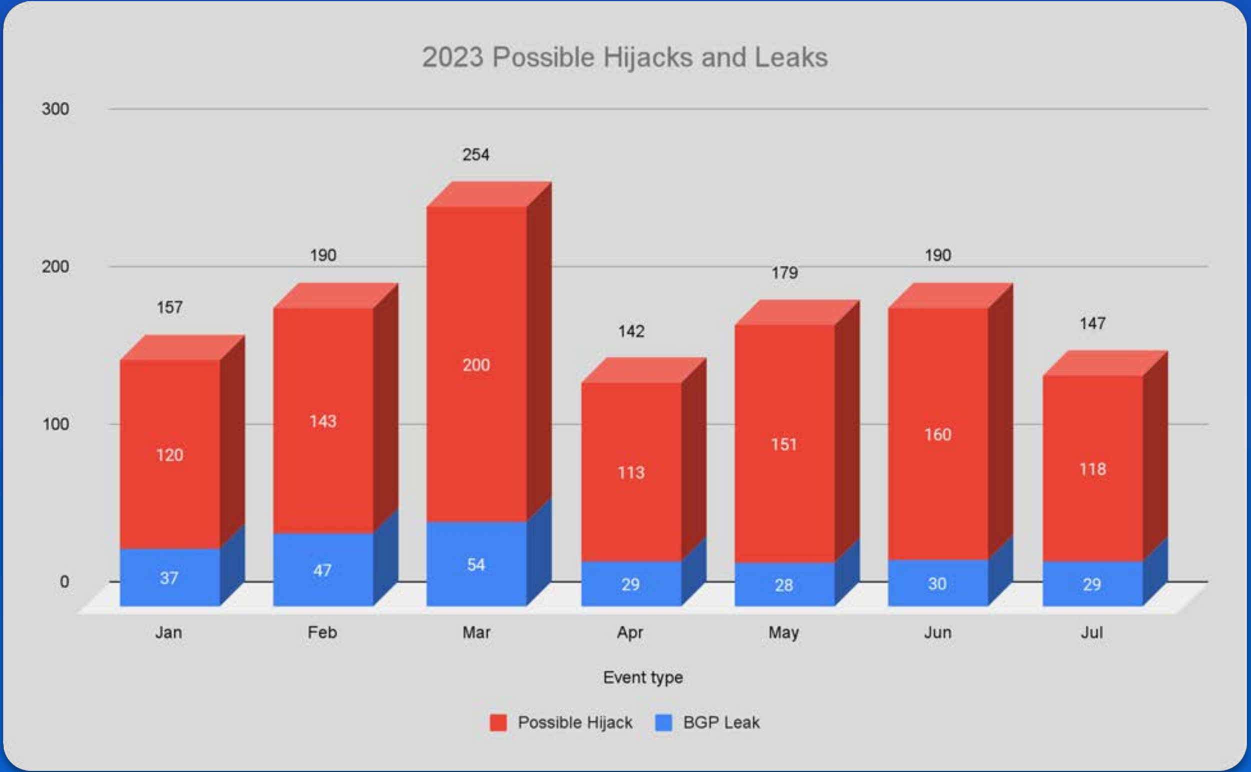
⚠ Security risk from interception or manipulation

⚠ Attacks on cryptocurrency services

⚠ BGP session flaps

Not covered here but unknown BGP attributes also affect the stability of the global routing table

Frequency

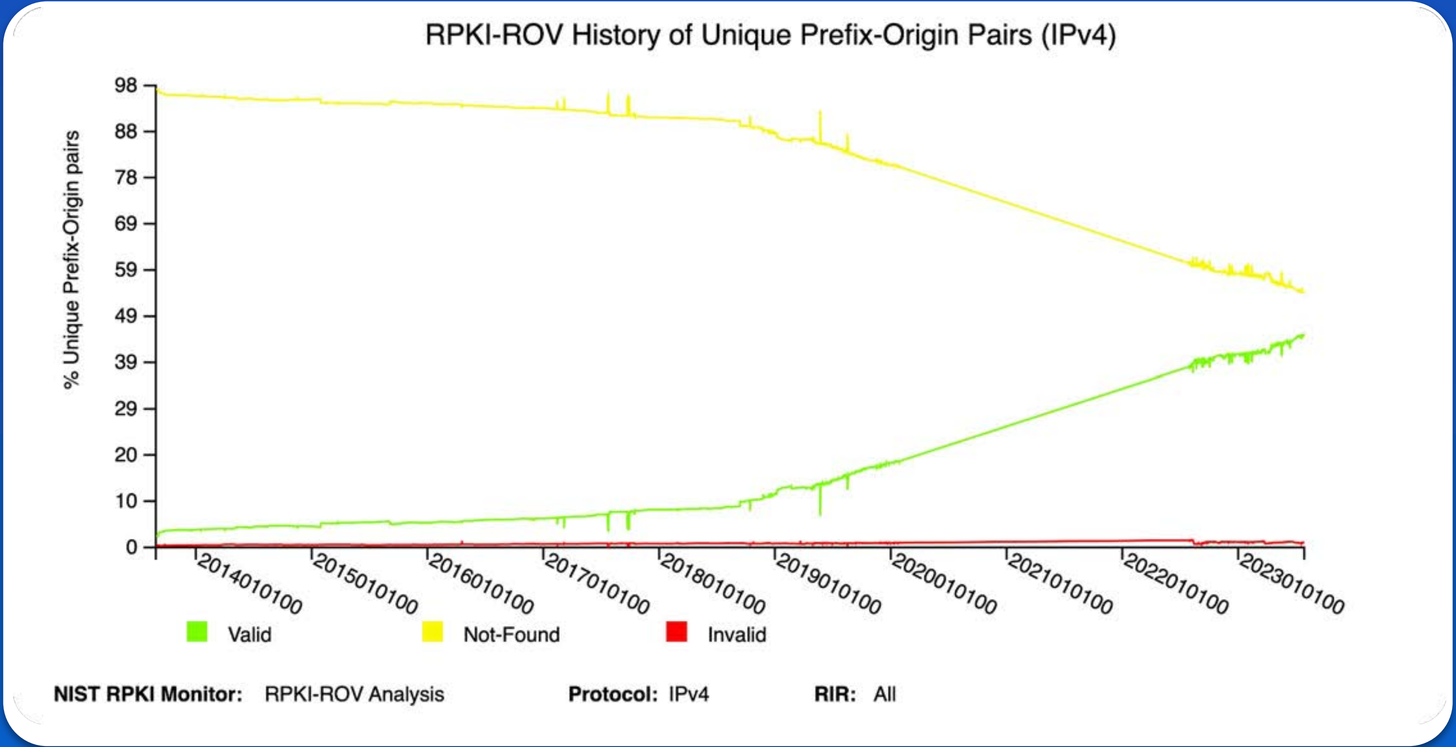


Source: https://bgpstream.com

What can operators do?

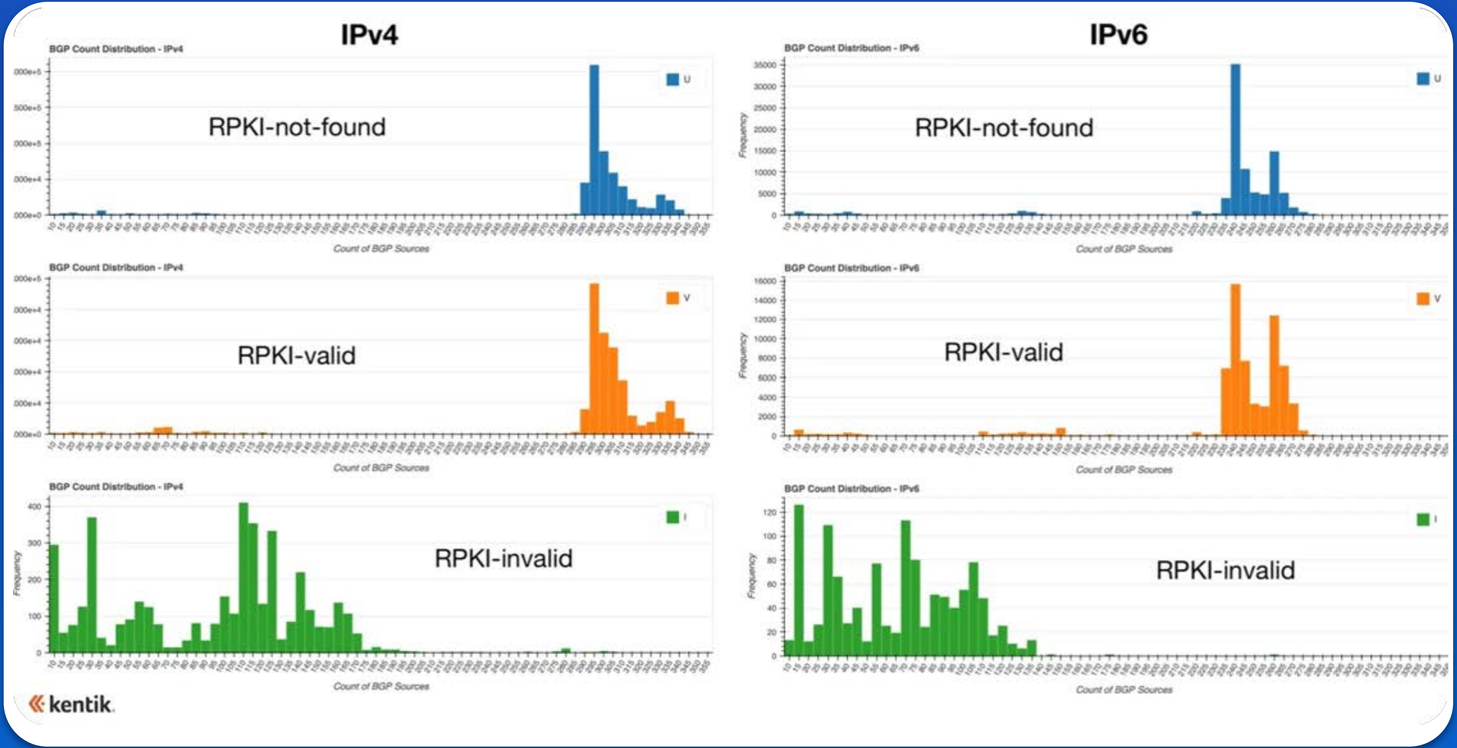
- ✓ Watch BGP monitoring solutions to respond quickly
- ✓ RPKI ROV by creating ROAs for your prefixes
- ✓ Configure your routers to reject RPKI Invalid routes
- ✓ Mutually Agreed Norms for Routing Security (MANRS)

We are making progress



Source: https://rpki-monitor.antd.nist.gov/

We are making progress



Source: https://www.kentik.com/blog/exploring-the-latest-rpki-rov-adoption-numbers/

Additional Resources

- A Brief History of the Internet’s Biggest BGP Incidents - https://www.kentik.com/blog/a-brief-history-of-the-internets-biggest-bgp-incidents/
- AS7007 Incident - https://en.wikipedia.org/wiki/AS_7007_incident
- Pakistan's Accidental YouTube Re-Routing Exposes Trust Flaw in Net - https://www.wired.com/2008/02/pakistans-accid/
- How Verizon and a BGP Optimizer Knocked Large Parts of the Internet Offline Today - https://blog.cloudflare.com/how-verizon-and-a-bgp-optimizer-knocked-large-parts-of-the-internet-offline-today/
- Some Twitter traffic briefly funneled through Russian ISP, thanks to BGP mishap - https://arstechnica.com/information-technology/2022/03/absence-of-malice-russian-isps-hijacking-of-twitter-ips-appears-to-be-a-goof/
- Shutting Down the BGP Hijack Factory - https://blog.apnic.net/2018/07/12/shutting-down-the-bgp-hijack-factory/
- MANRS - https://www.manrs.org/
- How much does RPKI ROV reduce the propagation of invalid routes? - https://www.kentik.com/blog/how-much-does-rpki-rov-reduce-the-propagation-of-invalid-routes/
- Exploring the Latest RPKI ROV Adoption Numbers - https://www.kentik.com/blog/exploring-the-latest-rpki-rov-adoption-numbers/
- Problem Definition and Classification of BGP Route Leaks - https://www.ietf.org/rfc/rfc7908.txt
- BGP Operations and Security - https://www.ietf.org/rfc/rfc7454.txt
- Autonomous System Provider Authorization (ASPA) - https://www.ietf.org/archive/id/draft-ietf-sidrops-aspa-verification-15.txt
- Unknown Attribute 23 - https://labs.ripe.net/author/emileaben/unknown-attribute-28-a-source-of-entropy-in-interdomain-routing

Questions?

Thank you!

Justin Ryburn
jryburn@kentik.com

@JustinRyburn

in/justinryburn

Join Kentik on Slack