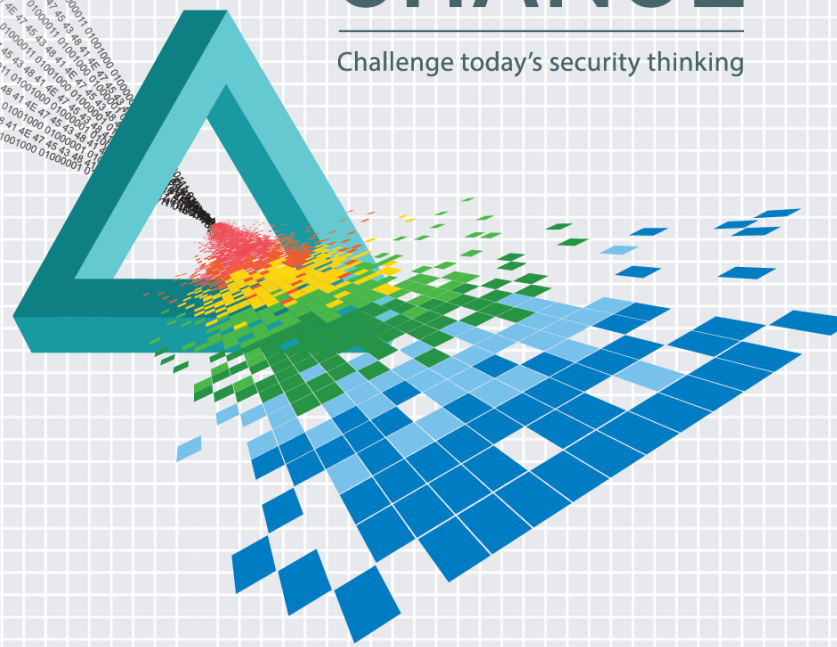
RSAConference2015

San Francisco | April 20-24 | Moscone Center

CHANGE

Challenge today's security thinking



SESSION ID: BR-W02

Internet of Threats: What's Really Connected to the Net and Why You Care

Trey Ford

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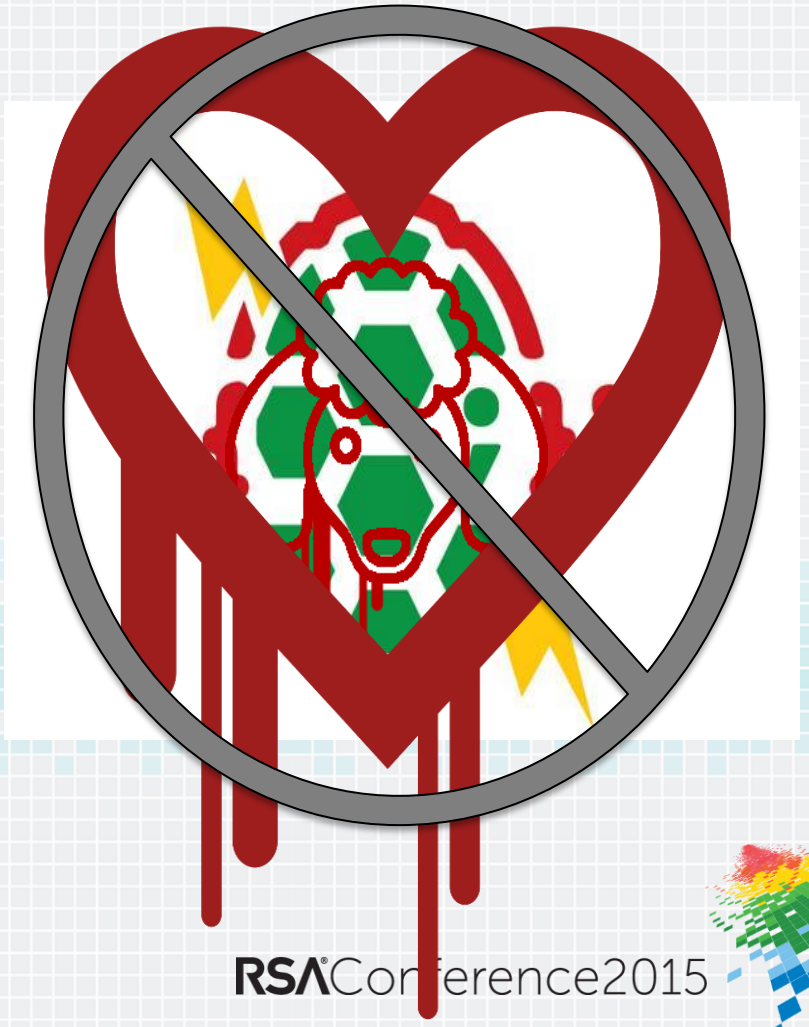
Rapid7 LLC
@treyford

Agenda

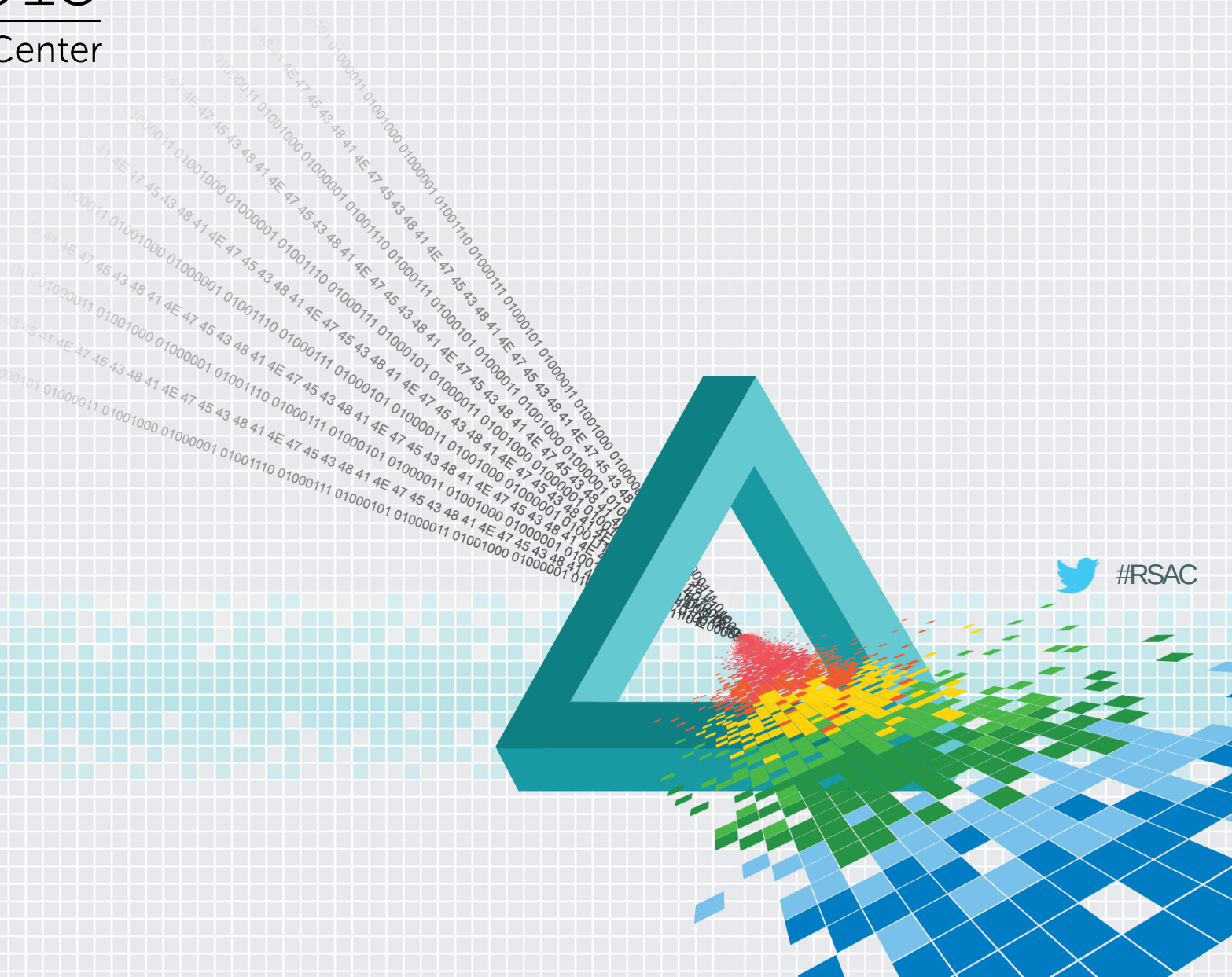
- Internet Scanning
- Global Overview
- Exposure Trends
- Affecting Change

What this talk is NOT about

- Making fun of technology users due to product flaws
- Image galleries of open industrial systems
- Snapshots of baby monitor cameras
- Shaming product vendors
- ShellHeartPoodleBleed
- Pew Pew Attack Maps



Internet Scanning



Why Scan the Internet?

- Improve security decision making with real-world data
  - Fix endemic security flaws before they get exploited
  - Prioritize vulnerability research according to impact
- Improve open source security tools
  - Hold vendors accountable
  - Make the Internet safer
- The kids are doing it

Why You Shouldn't Scan the Internet

- Network administrators can see scans as attacks
- Scanning the internet is resource-intensive
- Lots of complaints (legal & physical)
- IP addresses constantly shuffling
- Processing can be difficult

Skip all of this and use publicly available data!

Internet Scanning with Project Sonar

- Focused entirely on IPv4 and public DNS records
  - 1.0.0.0 to 223.255.255.255
  - Exclude reserved & private ranges
  - Exclude our opt-out list
- Scan about 3.7 billion IPv4 addresses
  - Scans run sequentially, from a single server
  - Typically span Monday - Friday

* Unless you opted out, see https://sonar.labs.rapid7.com/

TCP & UDP Scanning

- Use Zmap to scan all of IPv4 (except for opt-out ranges)
- UDP scans are throttled to 180,000 pps on average
- TCP scans only send the SYN packet
- AWS nodes used to grab banners
- Data is de-duplicated & decoded
- Uploaded to https://scans.io/

Project Sonar TCP & UDP Services

UDP	UDP	SSL	TCP
53	1900	25	22*
111	5060	143	80*
123	5351	443	445*
137	5353	993	
623	17185	995	
1434	47808		

Reverse DNS Enumeration

- Reverse DNS lookup of 0.0.0.0/0 every two weeks
  - Use dozens of cloud nodes to balance the load
  - Accidentally melted a few Tier-1 ISPs*
- 1.2 billion PTR records on average

Forward DNS Enumeration

- Forward DNS is driven by a giant list of hostnames
  - Pulled from TLD/gTLD zone files
  - Extracted form SSL certificates (SAN/CN)
  - Extracted from HTTP scan HTML references
  - Extracted from PTR records

- 1.4 billion records on average

Data, Tools, and Documentation

- Public Datasets
  - https://scans.io/
- Open Source Tools
  - https://zmap.io/
  - https://nmap.org/
  - https://github.com/rapid7/dap/ && https://github.com/rapid7/recog/
- Documentation
  - https://github.com/rapid7/sonar/wiki

Other Projects & Data Sources

- Active scanning projects with public data
  - University of Michigan: https://scans.io/
  - Shodan: https://shodan.io/
- Older scanning projects with public data
  - http://internetcensus2012.bitbucket.org/ (2012)
- Previous scanning projects
  - Critical.IO (2012-2013)
  - PTCoreSec (2012+)
  - Metlstorm: “Low Hanging Kiwi Fruit” (2009+)
  - Nmap: Scanning the Internet (2008)
  - BASS (1998)

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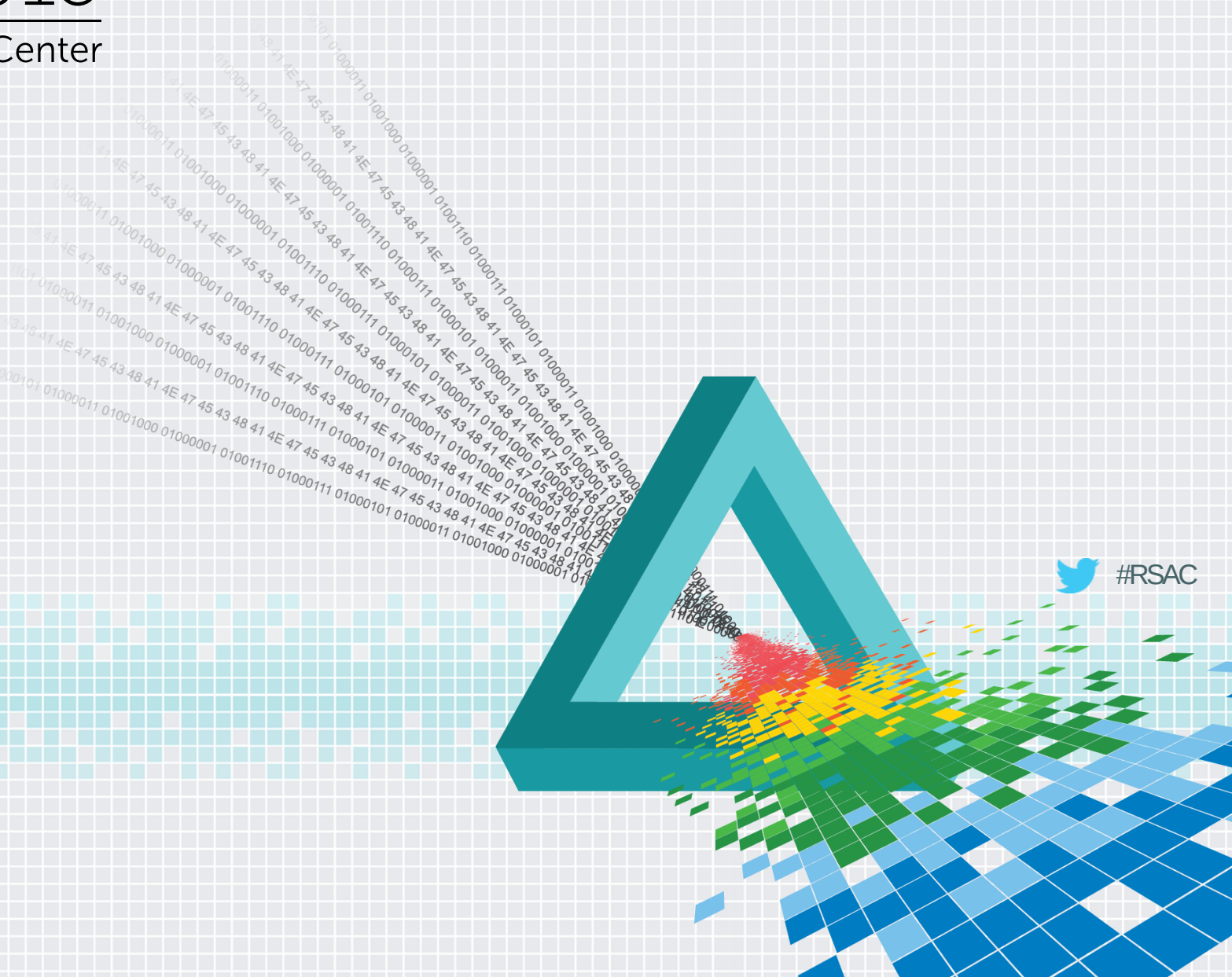
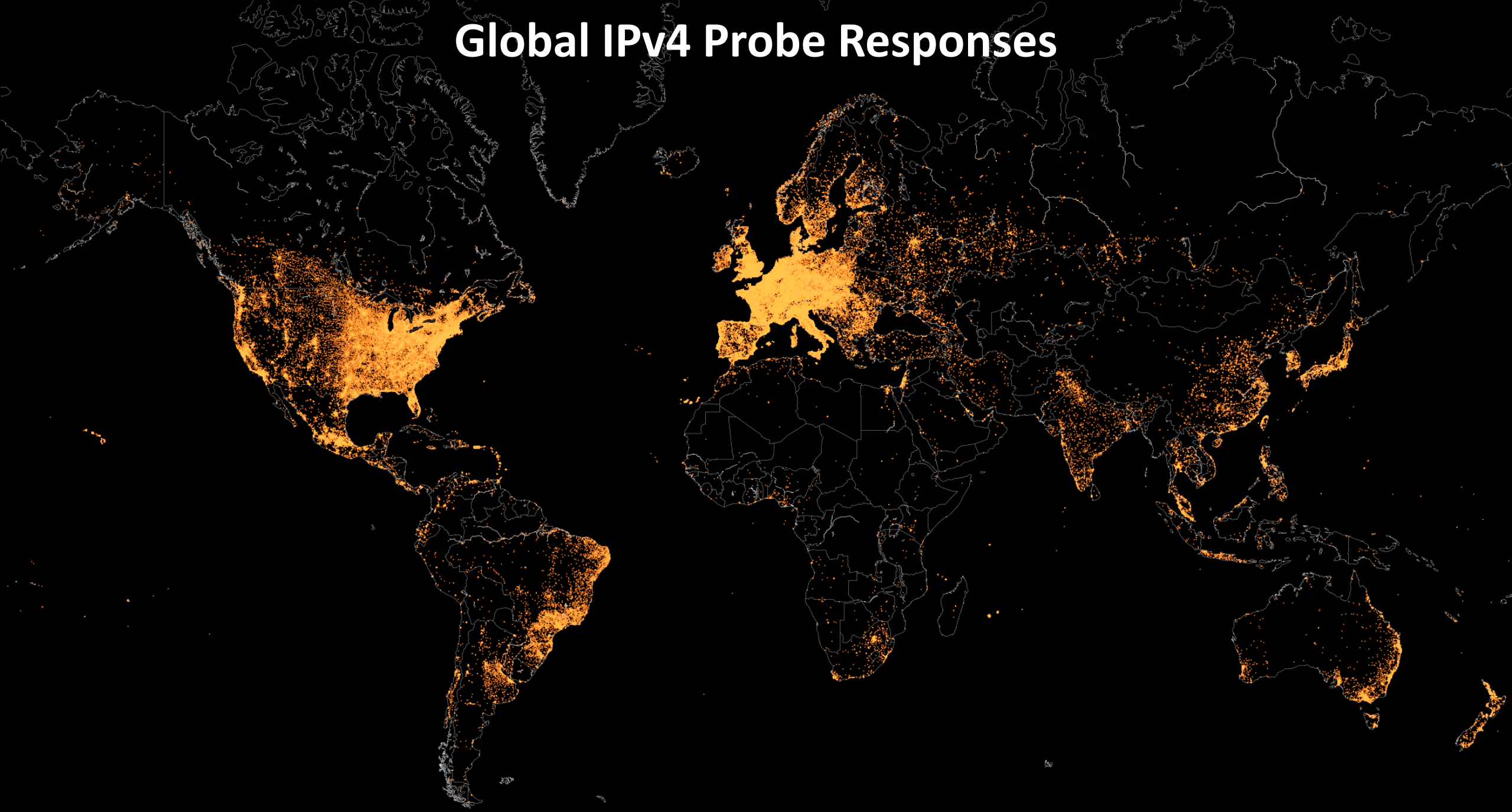


Global Overview

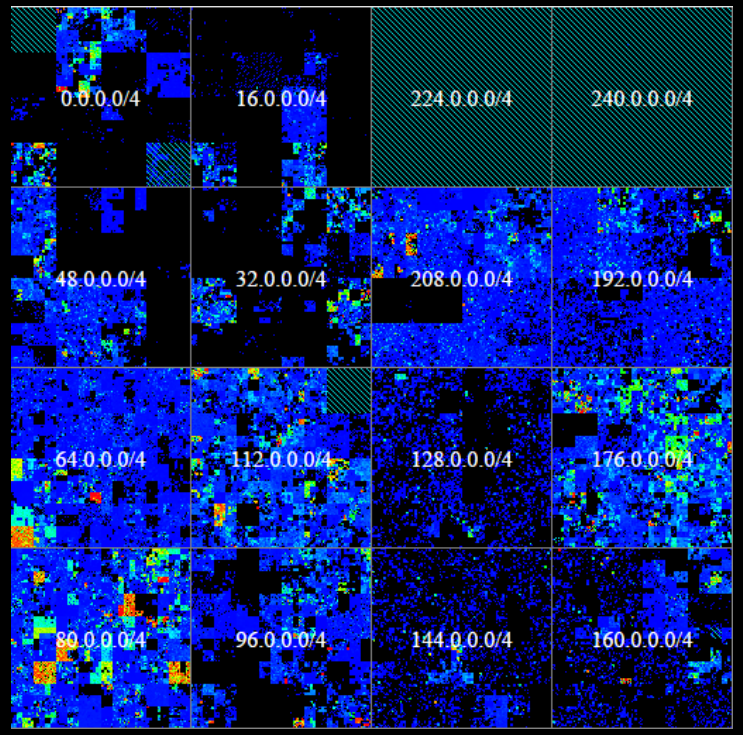
Global IPv4 Probe Responses



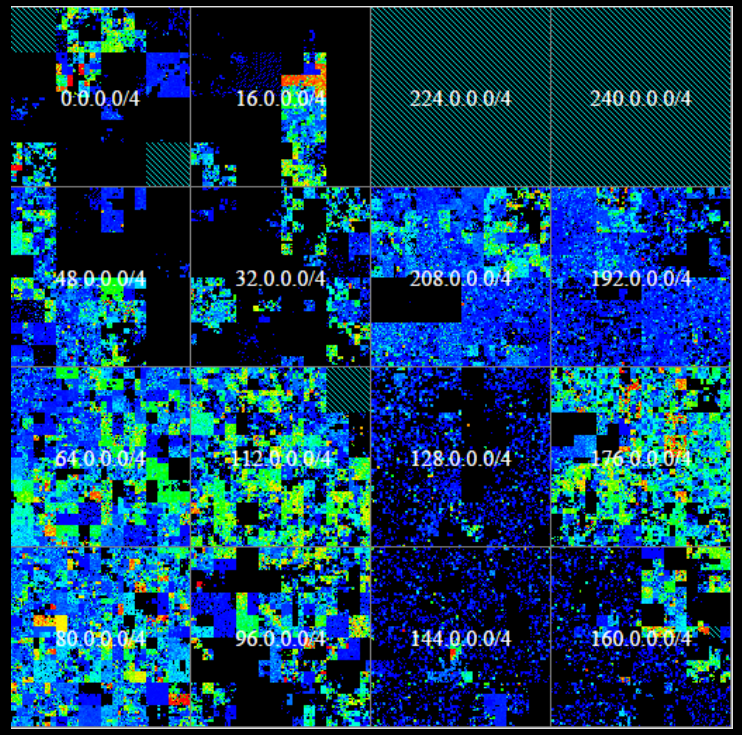
Source: 2015-04-06 Shodan ICMP scan + Project Sonar UDP & TCP scans

Hilbert Graphs

UDP Only



ICMP Only



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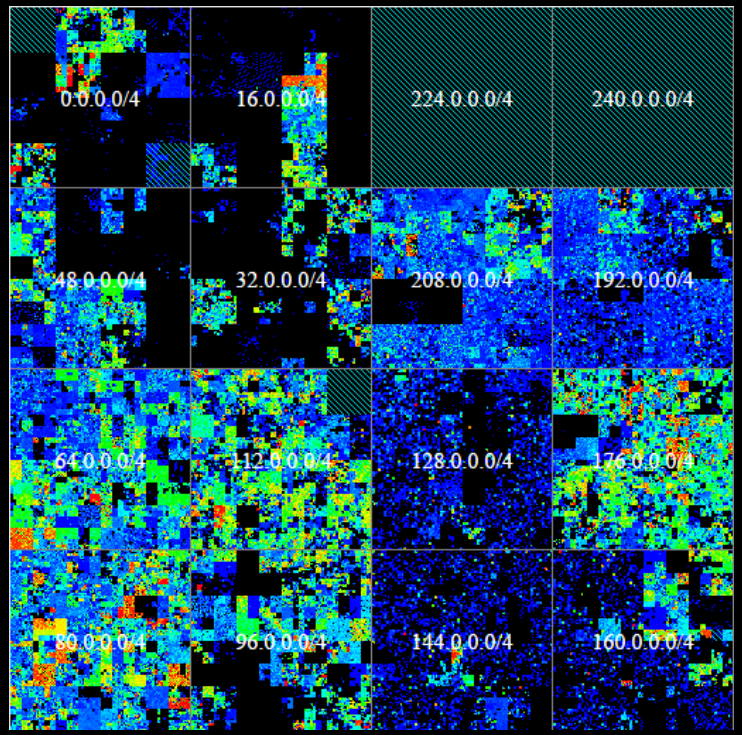

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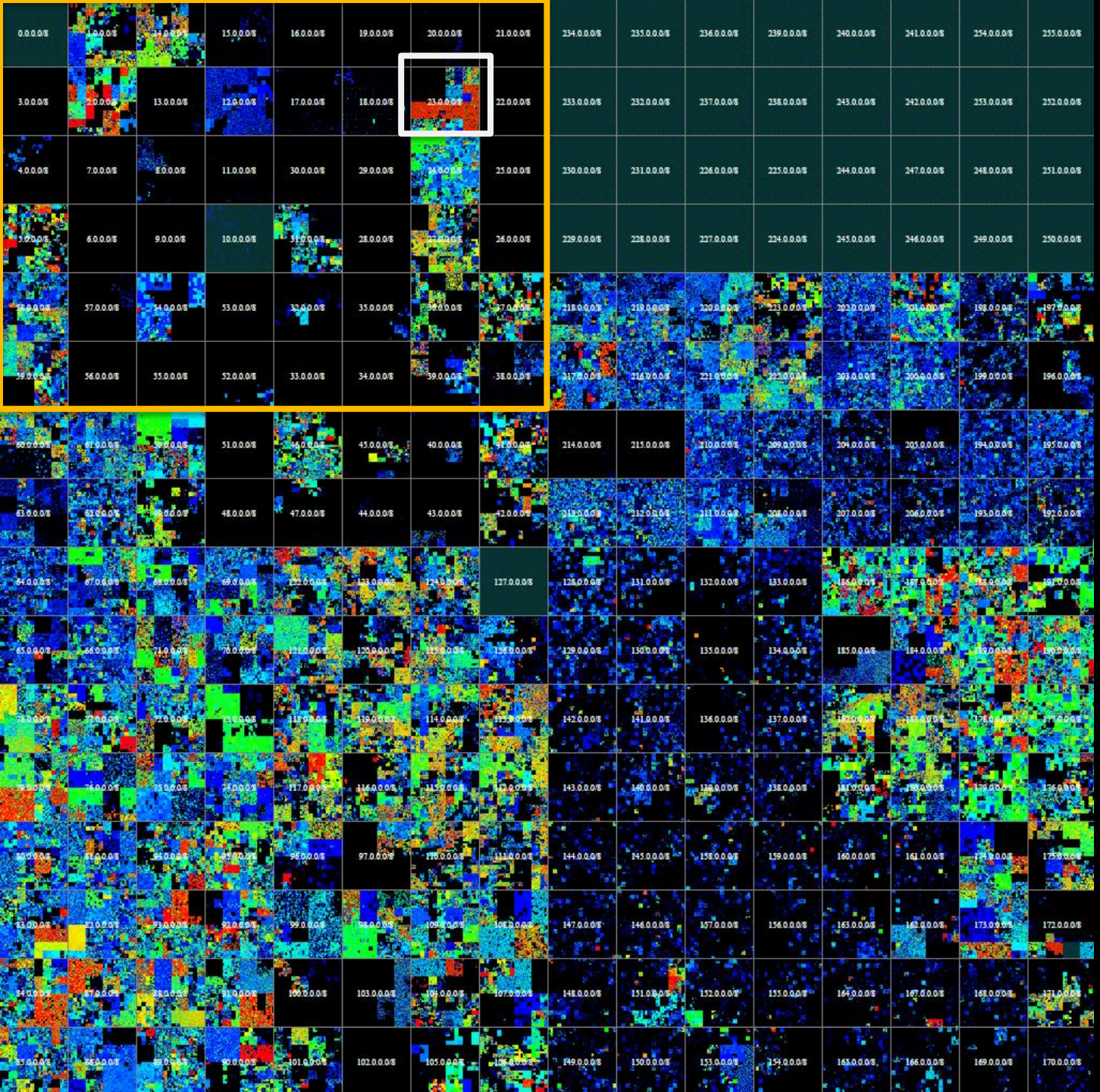
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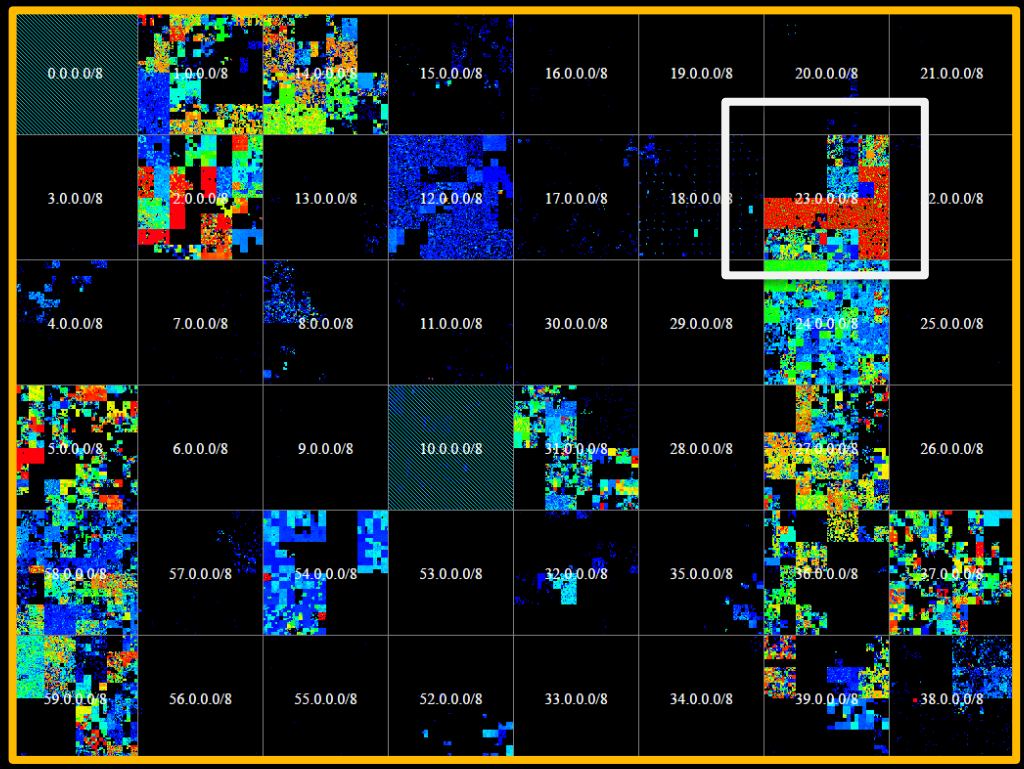
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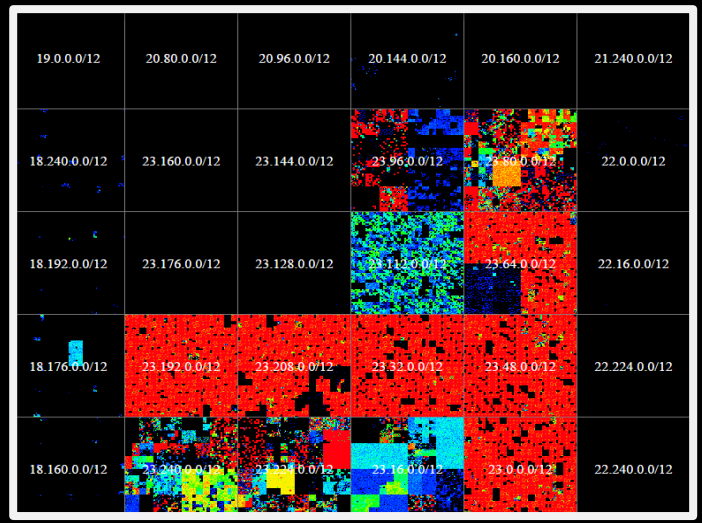
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What is the internet?

- In terms of unique systems? Nobody really knows
  - Cisco claimed **8.7 billion** in 2012, predicted **15 billion** in 2015
  - Carrier NAT hides millions of connected nodes
  - Firewalls and traditional NAT hide the rest
  - Over 7 billion active mobile phones
  - IPv6 gateways also do IPv4 NAT

What is directly exposed on the IPv4 internet?

- Approximately 1 billion IPv4 systems are directly connected
  - ~500 million broadband clients and gateways
  - ~200 million servers (web, email, database, VPN)
  - ~200 million mobile devices (phones, tablets)
  - ~100 million devices (routers, printers, cameras)

What about IPv6?

- Somewhere between 10-20 million IPv6 global unicast nodes
  - 97.6% of top-level domains have an IPv6 DNS record*
  - 6.7 million domain names with a top-level AAAA record*
  - RIPE has issued over 8000 network blocks
  - HE.net TunnelBroker alone serves 562,000 users

*** 2015-04-19 Hurricane Electric IPv6 Progress Report http://bgp.he.net/ipv6-progress-report.cgi**

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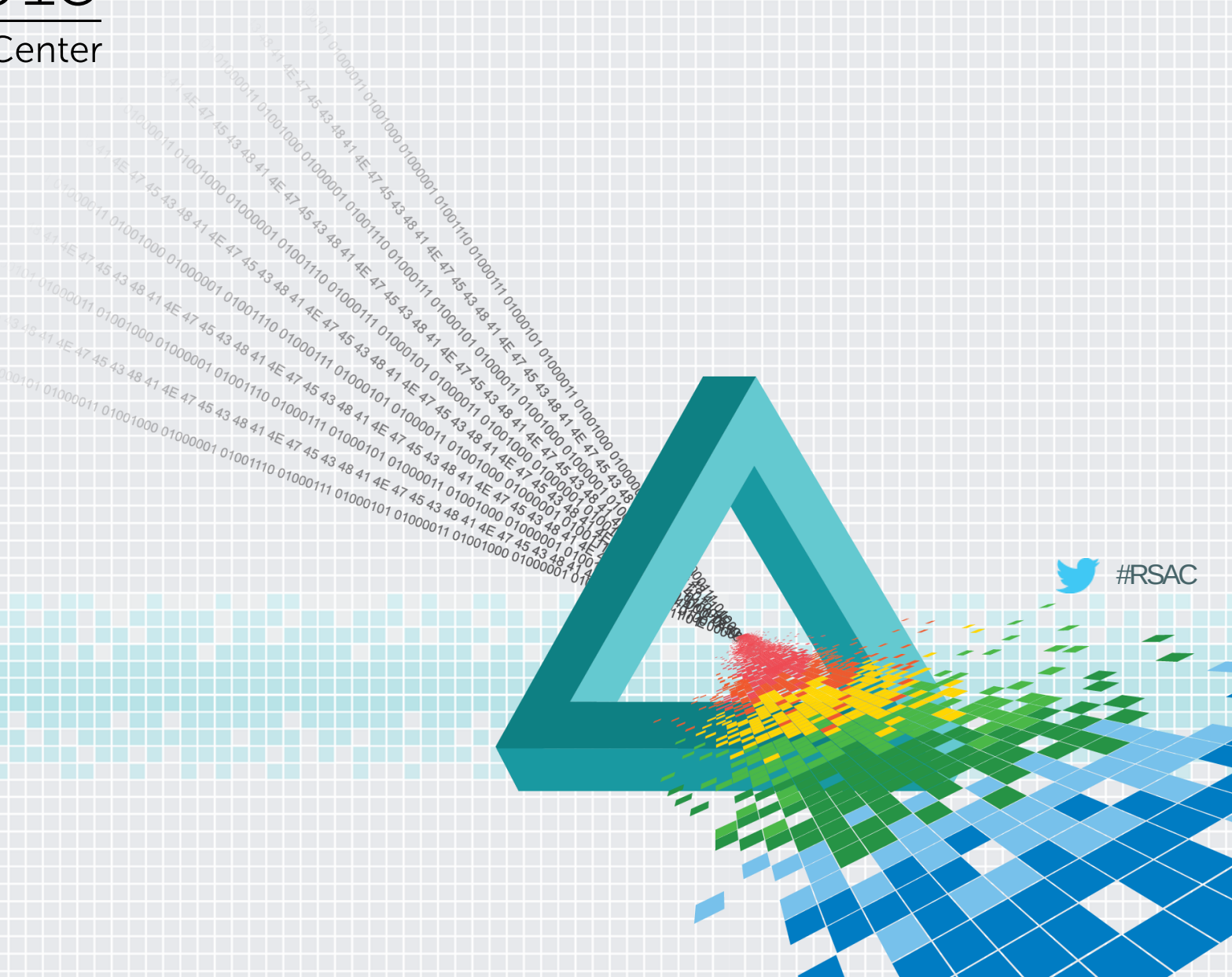


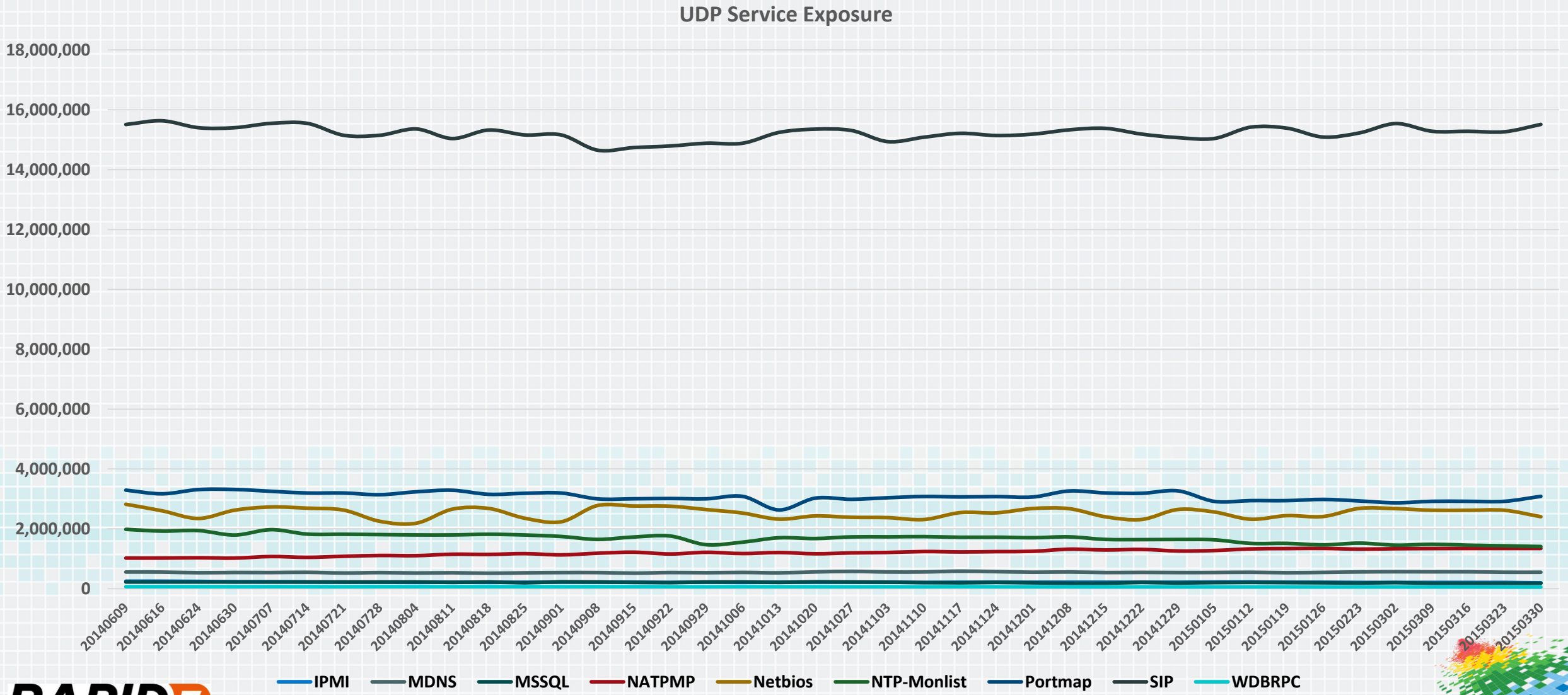
#RSAC

Exposure Trends

Service Trends

- Project Sonar has been tracking 12 UDP services since June 2014
- Scans run weekly and provide a quick snapshot of exposure
- Most should never be exposed to the internet
- Many can lead to a direct compromise
- How have exposure levels changed?

UDP Service Exposure (Non-)Trends

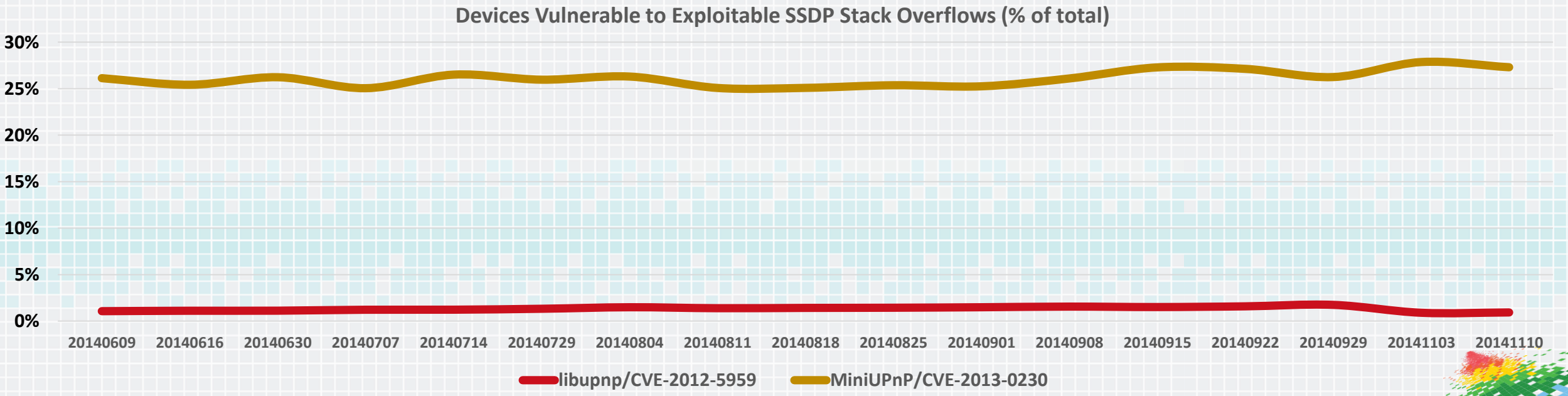


Vulnerability Trends

- Instead of service trends, how about vulnerability trends?
- Are known vulnerabilities getting patched?
- How quickly are patches being applied?

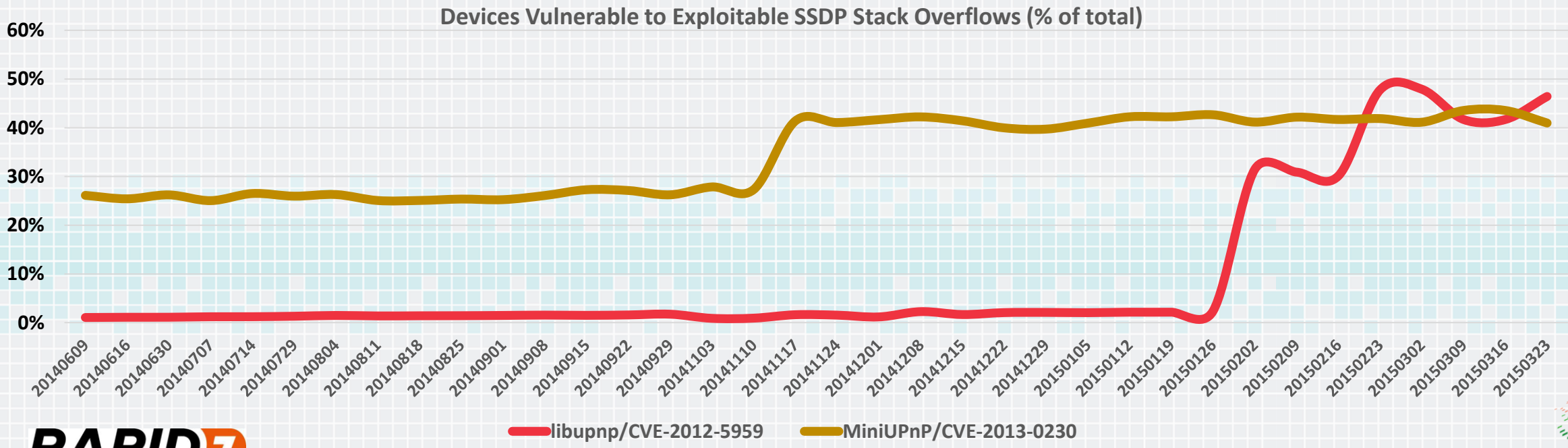
UPnP SSDP Vulnerabilities (1900/udp)

- Lets look at two UPnP SSDP vulnerabilities with Metasploit exploits
- We tracked the % of vulnerable services for libupnp & miniupnp
- June 2014 to November 2014 is basically flat…



UPnP SSDP Vulnerabilities (1900/udp)

- In late 2014, both of these issues spiked dramatically
- Likely the result of a new broadband ISP deployment
- Vulnerability ratio is higher in 2015 than 2014!



SSDP Distributed Reflective Denial of Service

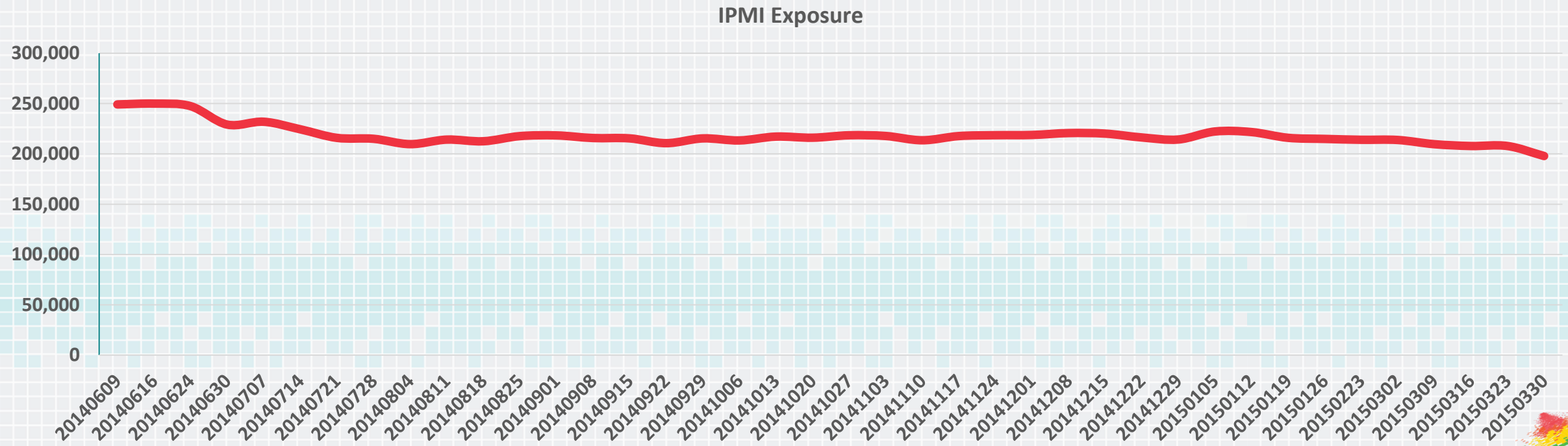
- SSDP should never be internet-facing in the first place
- DrDoS capabilities in addition to exploits
- 15+ million SSDP services
- Massive amplification
- Live stats at SS
  - https://ssdpscan.shadowserver.org/

IPMI: The Server Backdoor (623/udp)

- IPMI is used for OOB server management (iDRAC, iLO, SMC IPMI)
- Almost the equivalent of physical access
  - Keyboard, video, mouse, ISO boot, I2C bus access
- Typically Linux running on ARM or MIPS SoCs
- Enabled by default on major server brands
- Dan Farmer broke the IPMI protocol
  - http://fish2.org/ipmi/

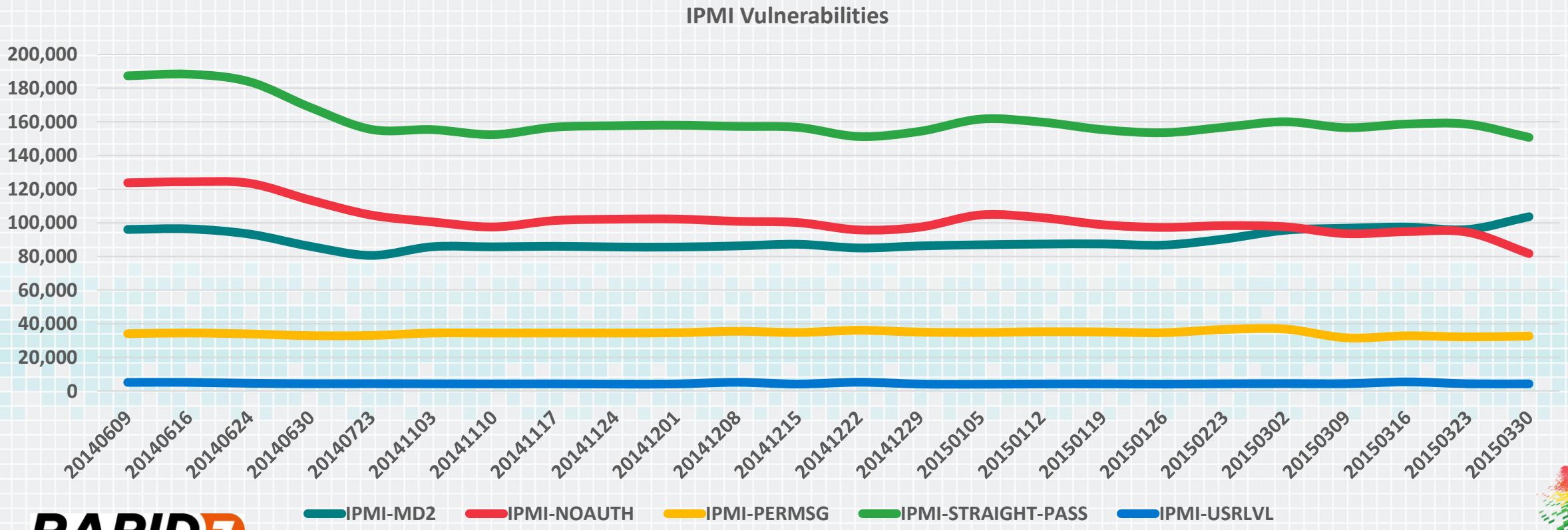
IPMI Exposure

- We identified ~300,000 exposed instances in 2013
- This dropped down to ~250,000 as of June 2014
- Leveled off at ~210,000 in January 2015

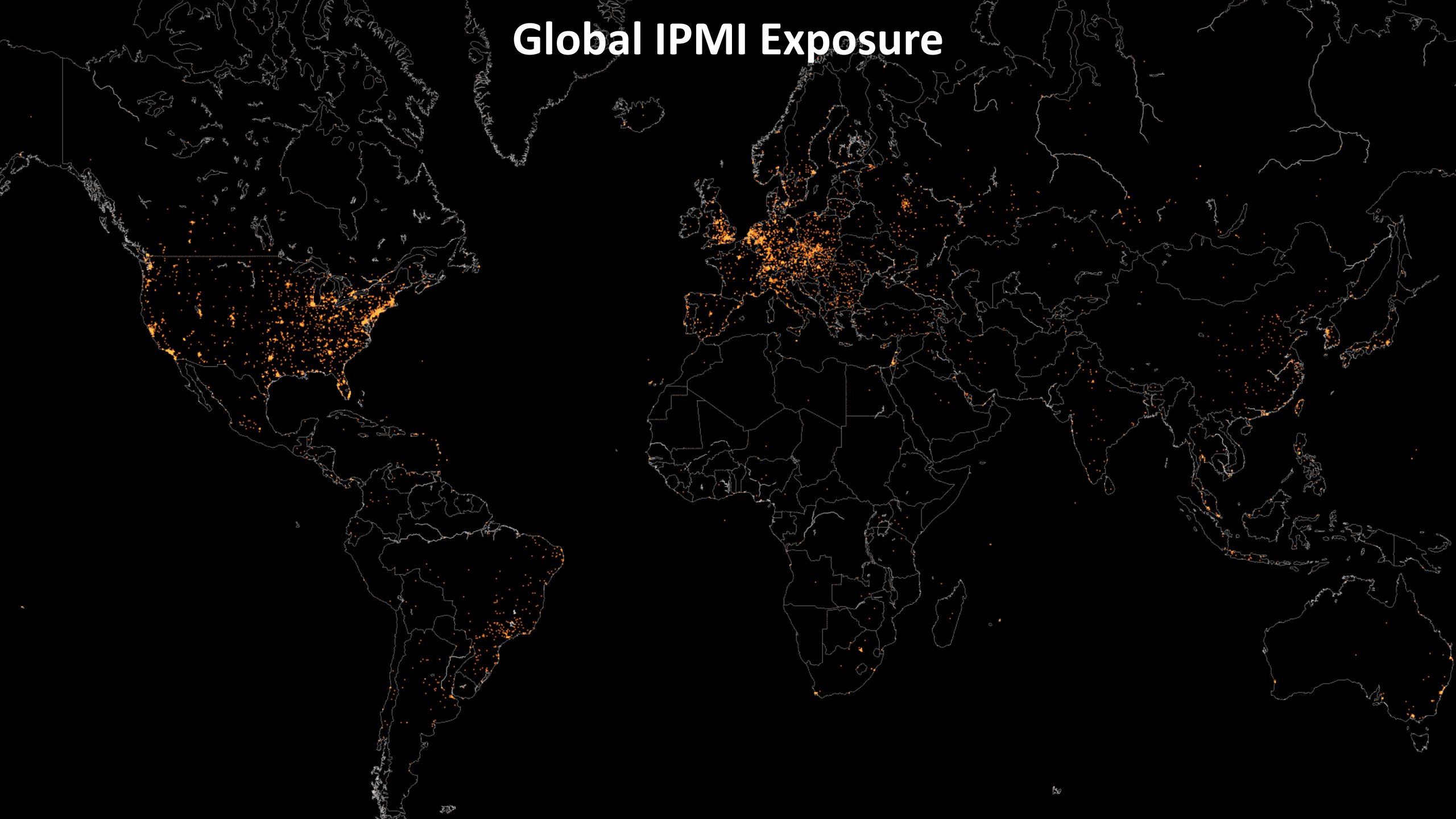


IPMI Exposure

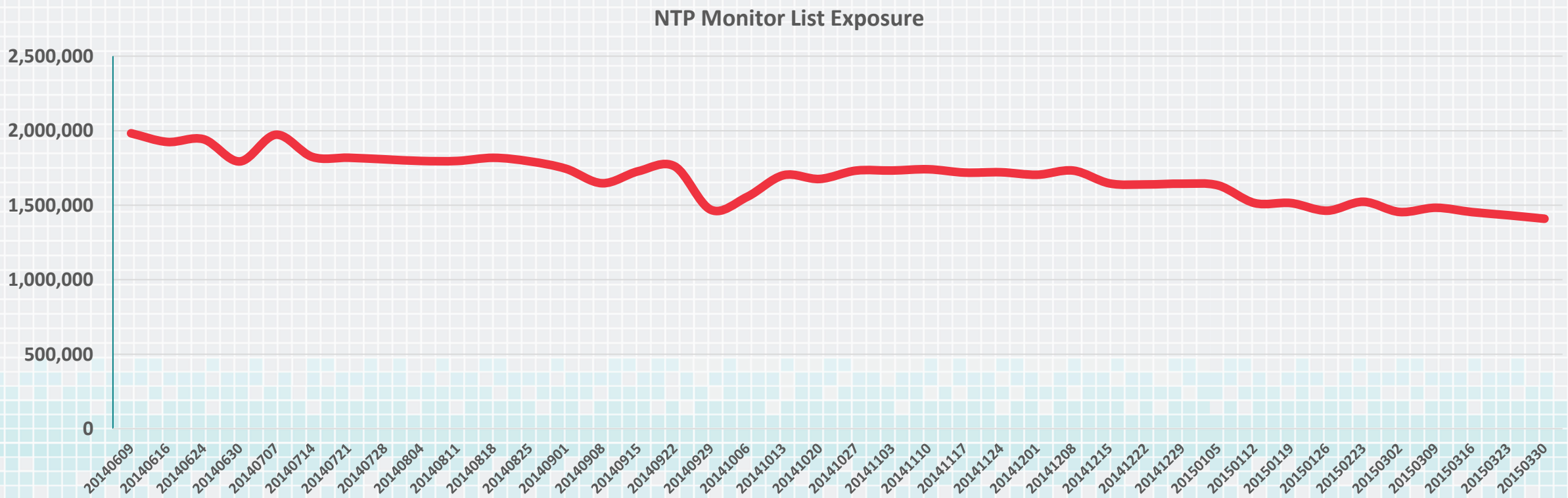
- Vulnerability exposure matches overall service trends
- Not a lot of IPMI hardening happening



Global IPMI Exposure

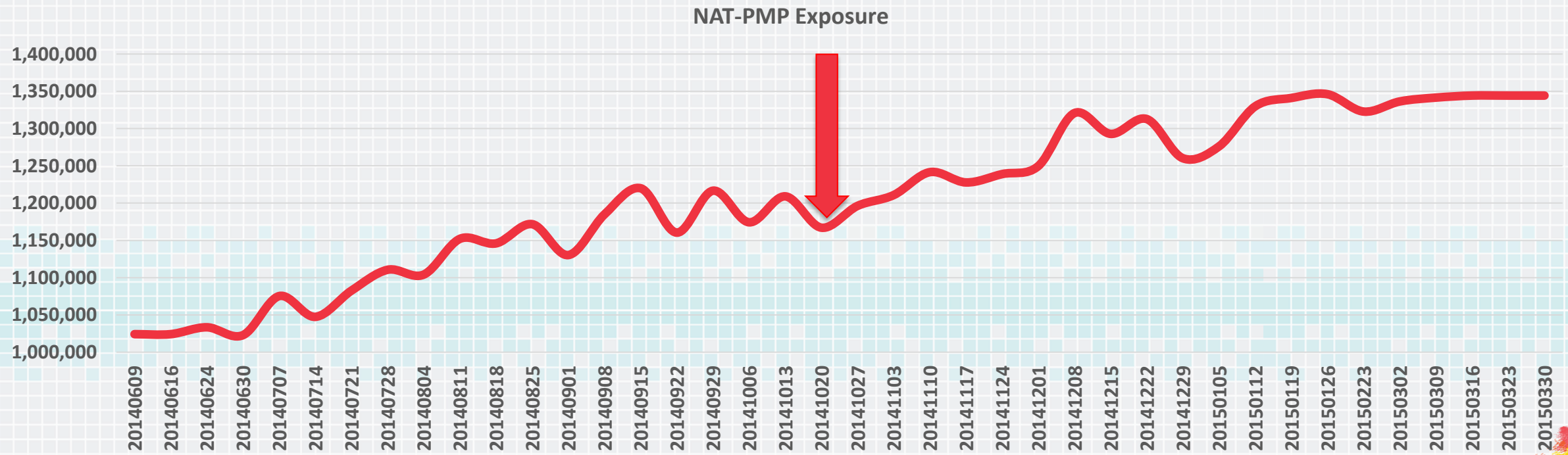


NTP Exposure



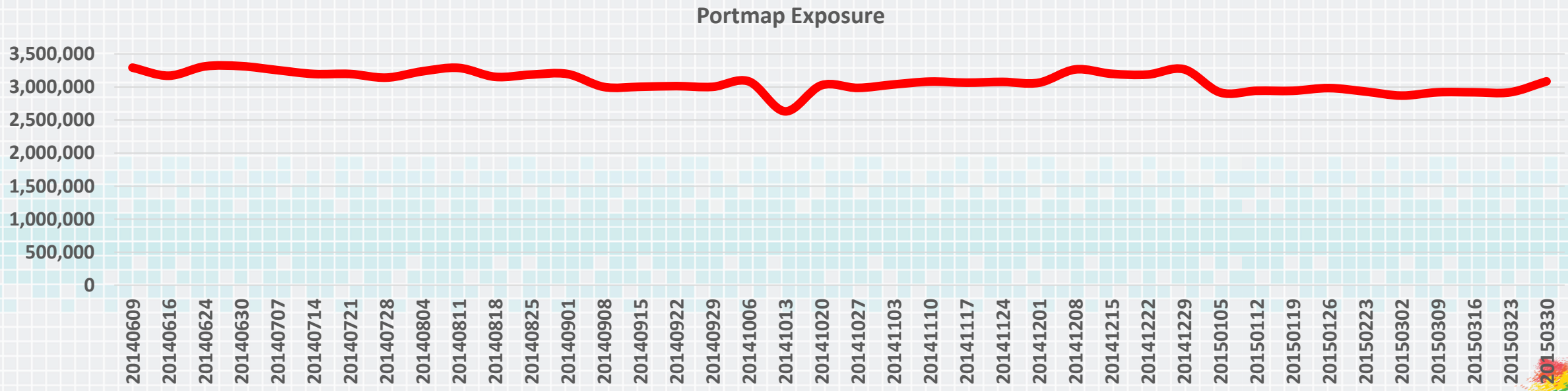
NAT-PMP Exposure

- This service should never be on the internet by definition
- Increasing exposure, even after CERT advisory



Portmap Exposure

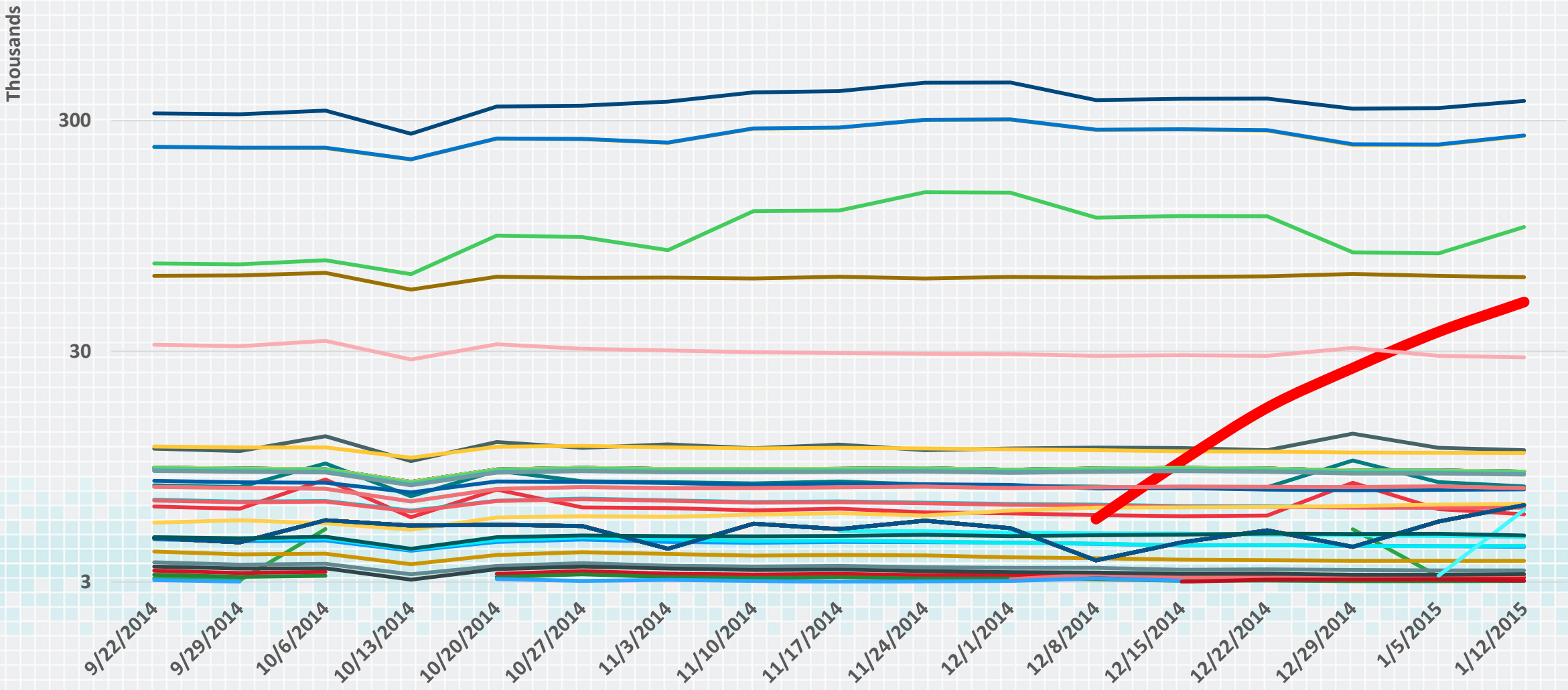
- Portmap (SunRPC) is a discovery mechanism for other services
- Not commonly used in new application development
- Commonly open on Linux servers



SunRPC Program Trends

- Analyzing SunRPC program IDs from portmap “dump” scans
- These provide a list of all registered programs
- Vendors often create proprietary program IDs
- These can be used for precise fingerprints

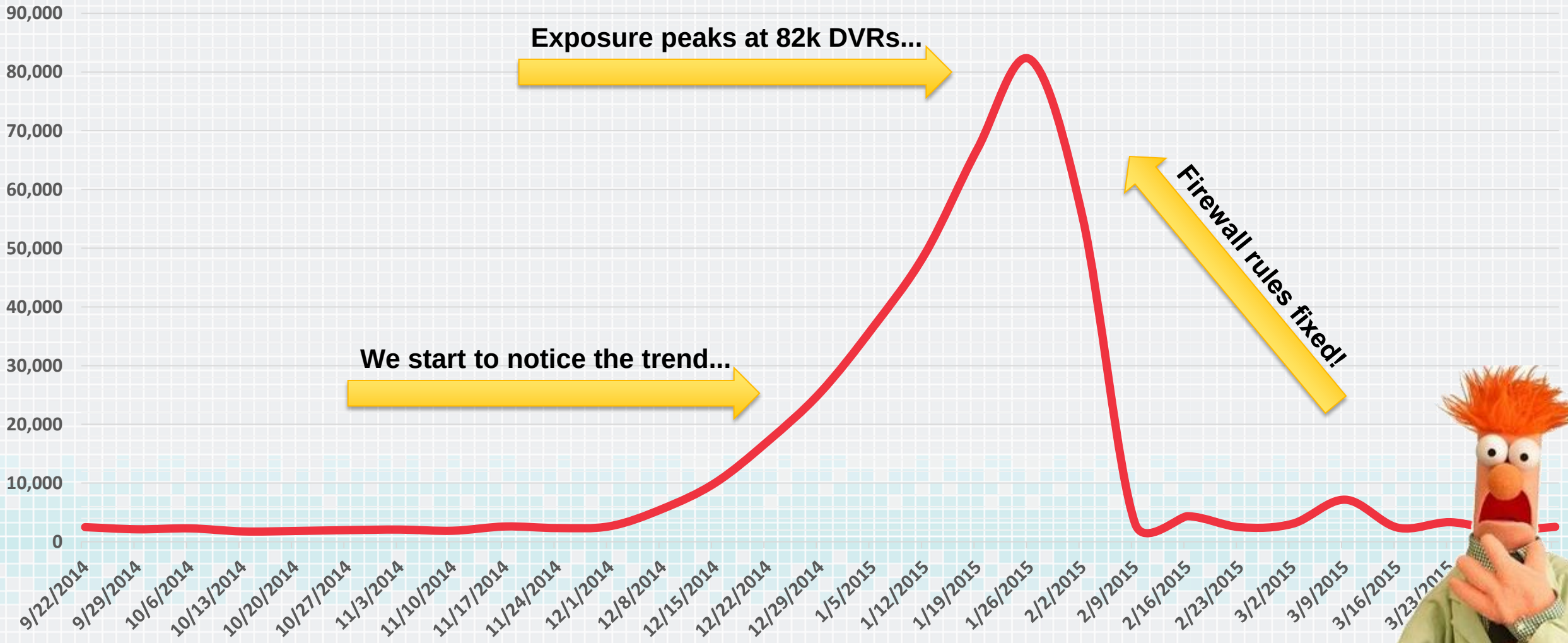
Log of SunRPC Program IDs Over Time



SunRPC Program ID: 302520656

- Zero to substantial in just a few months
- Seems to be a “Samsung SMT-H3270 DVR”
- Originally reported as Time Warner Cable...
- 80% show up on Comcast ranges...
- This is their 4K TV rollout!
- With no firewall?

SunRPC Program ID: 302520656

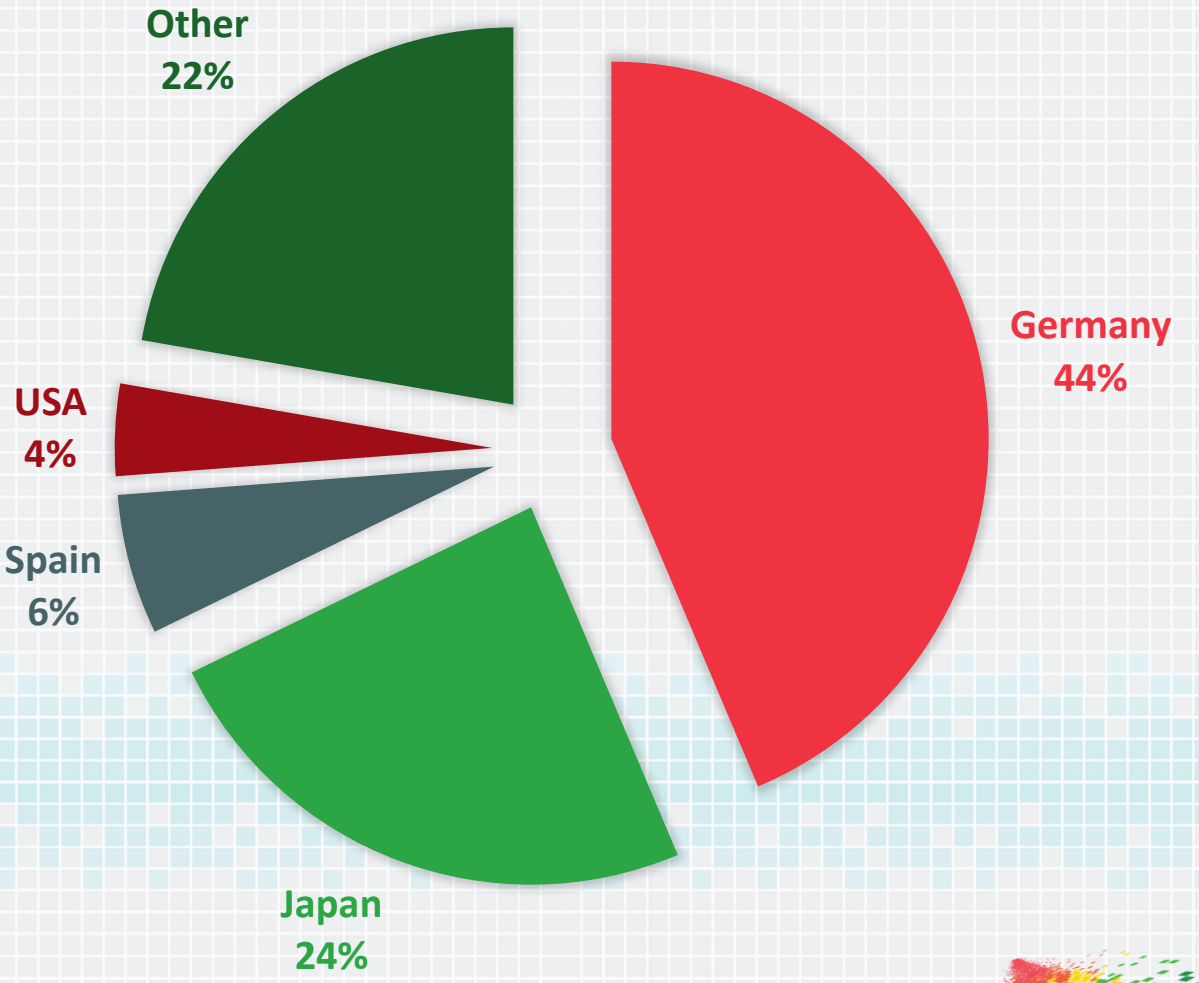


RAPID7

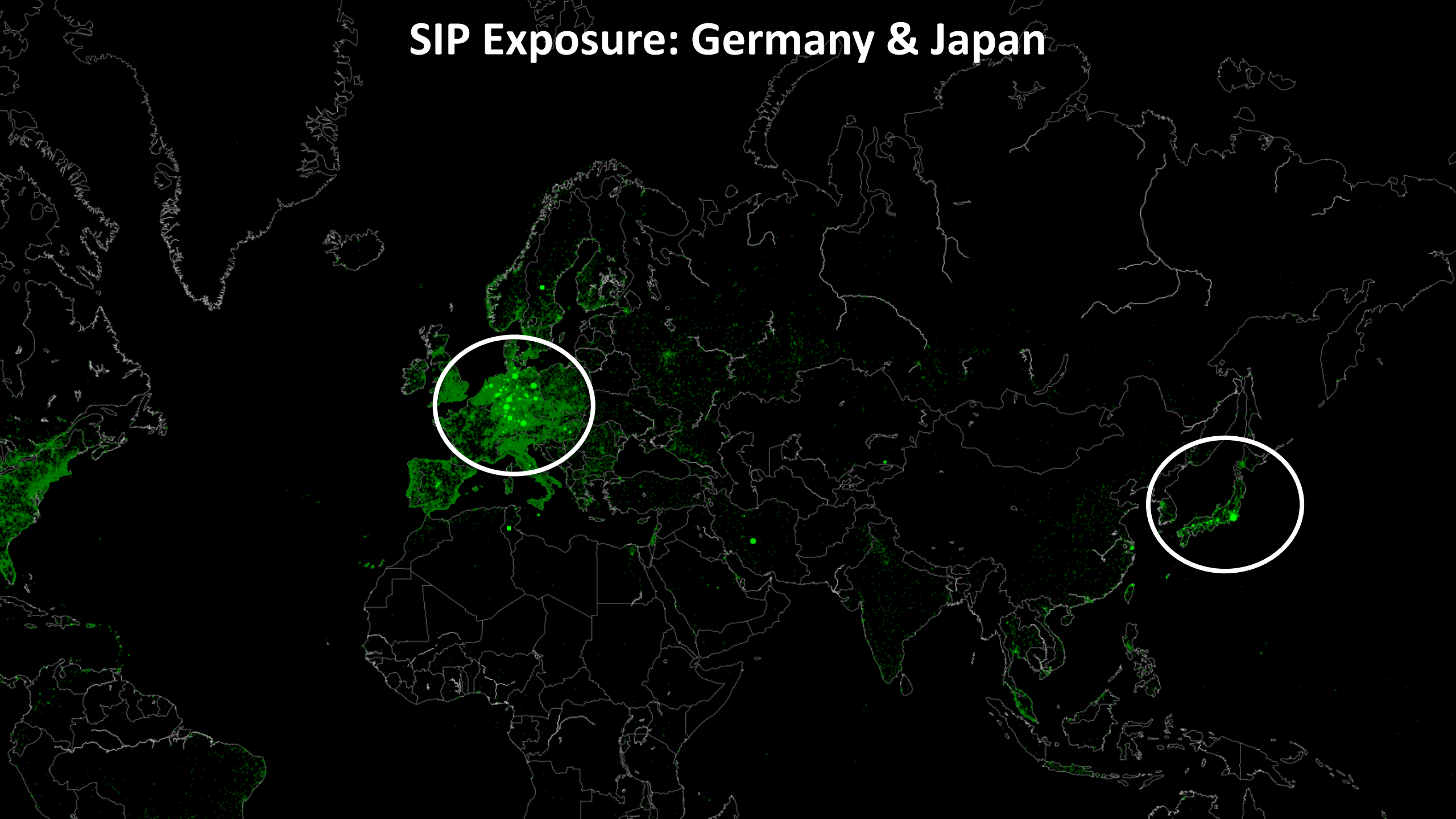
VoIP Session Initiation Protocol (5060/udp)

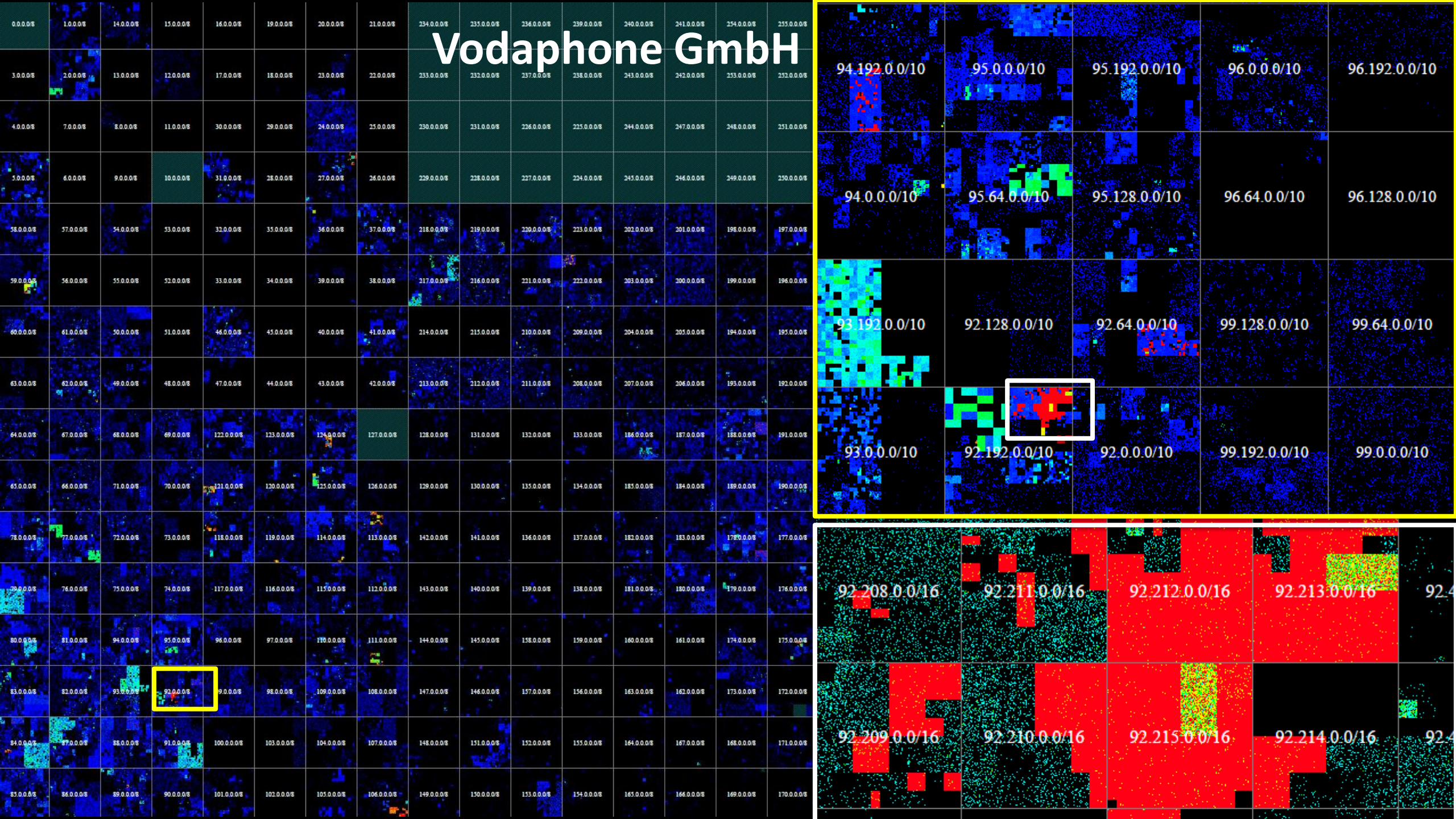
Internet-exposed SIP telephones

- 15 million exposed SIP endpoints
- 44% of these are in Germany
- 24% of these are in Japan
- Lets dig deeper…



SIP Exposure: Germany & Japan




Vodaphone GmbH
94.192.0.0/10
95.0.0.0/10
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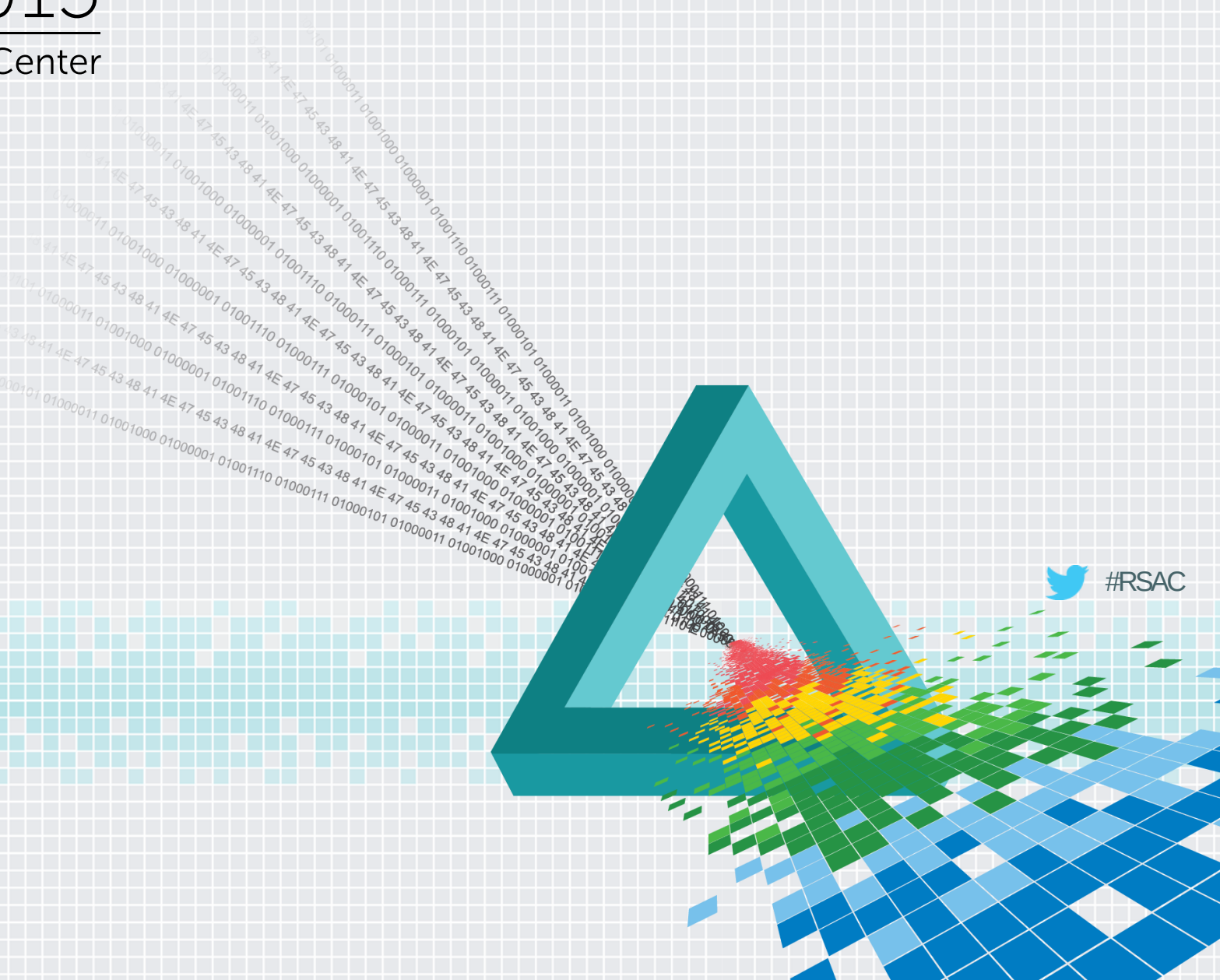
95.64.0.0/10
95.128.0.0/10
96.64.0.0/10
96.128.0.0/10
93.192.0.0/10
92.128.0.0/10
92.64.0.0/10
99.128.0.0/10
99.64.0.0/10
93.0.0.0/10
92.192.0.0/10
92.0.0.0/10
99.192.0.0/10
99.0.0.0/10
92.208.0.0/16
92.211.0.0/16
92.212.0.0/16
92.213.0.0/16
92.209.0.0/16
92.210.0.0/16
92.215.0.0/16
92.214.0.0/16

SIP: Hallo from Germany

5.5 million devices over three primary ISPs

- All based on the FRITZ!BOX sold by AVM.de
- All running variants of the same firmware
- Not the best security record
- At the least, DDoS potential
- At the worst, shells!

Conclusion



Help us destroy the 0-day!

- We have way too much zero-day, help make it not zero-day
- Linux + 1Tb disk space + quad-core + basic scripting = lots of 0day
  - https://scans.io/
  - https://github.com/rapid7/dap/
  - https://github.com/rapid7/recog/
- Go sell it to the highest bidder (so long as it gets fixed)

RSAConference2015

San Francisco | April 20-24 | Moscone Center

Questions?

@treyford

@Rapid7