

# IPv6 in Asia from Akamai Perspective

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# Who am I ?



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# Akamai Intelligent Platform

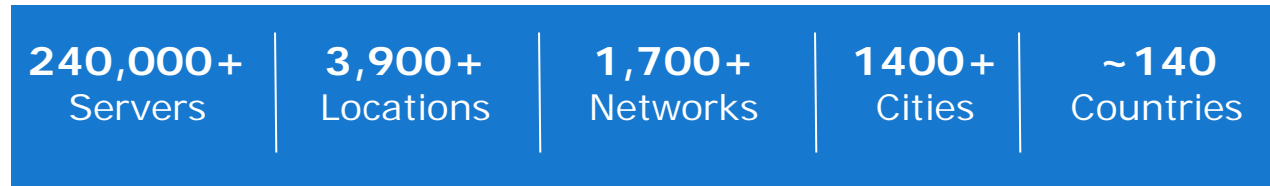


# The Akamai Intelligent Platform



The world's largest on-demand, distributed computing platform delivers all forms of web content and applications

## The Akamai Intelligent Platform:



### Typical daily traffic:

- More than **10 trillion** requests served
- Delivering over 40 **Terabits/second**
- **Up to 15%** of all daily web traffic

# How CDNs Work



- When content is requested from CDNs, the user is directed to the optimal server to serve this user
- There's 2 common ways to do that:
  - **Anycast:** the content is served from the location the request is received (easy to build, requires symmetric routing to work well)
  - **DNS:** the CDN decides where to best serve the content from based on the resolver it receives the request from, and replies with the optimal server

# How DNS based CDNs Work



- Users querying a DNS-based CDNs will be returned different A (and AAAA) records for the same hostname depending on the resolver the request comes from
- This is called “mapping”
- The better the mapping, the better the CDN service

# How DNS based CDNs Work



- Example of Akamai mapping
  - Notice the different A/AAAA records for different locations:

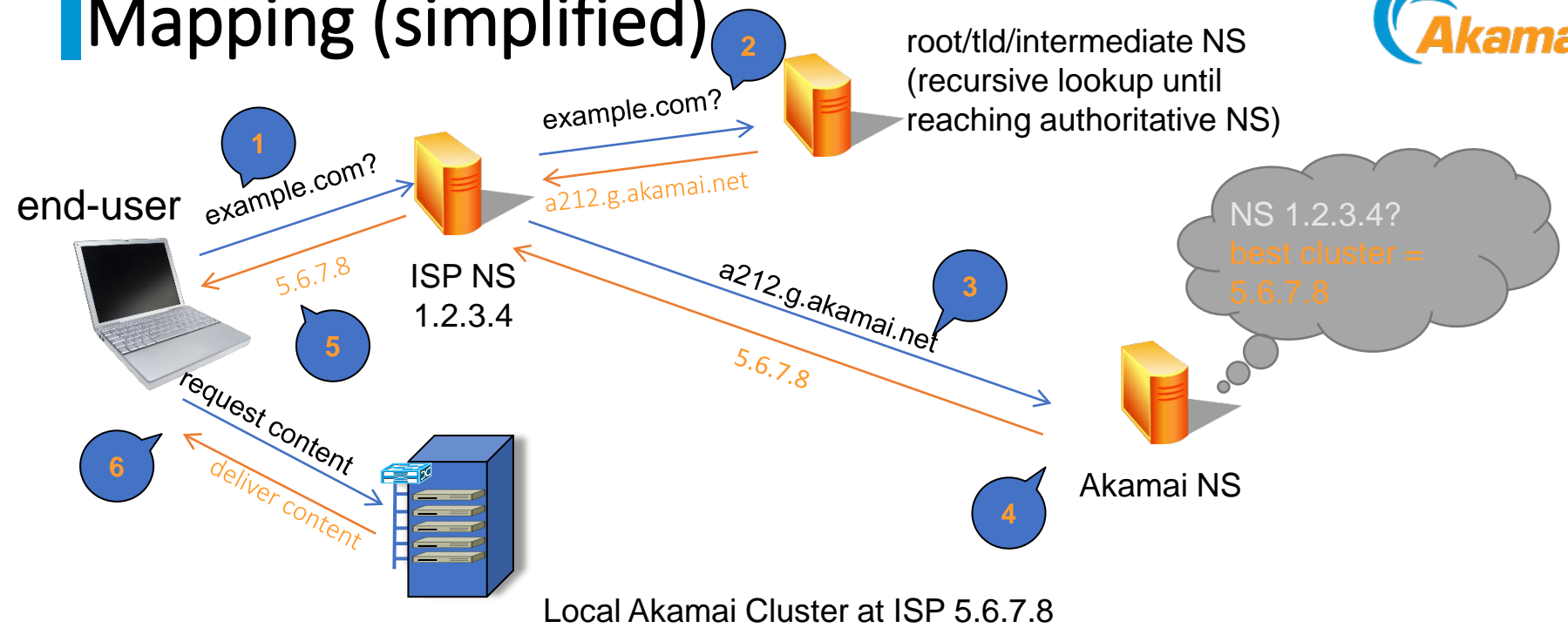
## [Taipei]% host [www.akamai.com](http://www.akamai.com)

- [www.akamai.com](http://www.akamai.com) CNAME [e1699.dscx.akamaiedge.net](http://e1699.dscx.akamaiedge.net).
- [e1699.dscx.akamaiedge.net](http://e1699.dscx.akamaiedge.net) has address 104.115.234.97
- [e1699.dscx.akamaiedge.net](http://e1699.dscx.akamaiedge.net) has IPv6 address 2600:1417:18:196::6a3
- [e1699.dscx.akamaiedge.net](http://e1699.dscx.akamaiedge.net) has IPv6 address 2600:1417:18:18e::6a3

## [Tokyo]% host [www.akamai.com](http://www.akamai.com)

- [www.akamai.com](http://www.akamai.com) CNAME [e1699.dscx.akamaiedge.net](http://e1699.dscx.akamaiedge.net).
- [e1699.dscx.akamaiedge.net](http://e1699.dscx.akamaiedge.net) has address 23.37.145.245
- [e1699.dscx.akamaiedge.net](http://e1699.dscx.akamaiedge.net) has IPv6 address 2600:140b:4:18e::6a3
- [e1699.dscx.akamaiedge.net](http://e1699.dscx.akamaiedge.net) has IPv6 address 2600:140b:4:199::6a3

# Mapping (simplified)



- 1) end-user requests www.example.com from ISP NS
- 2) ISP NS recursively (multiple iterations) looks up www.example.com being referred to authoritative Akamai NS (by CNAME)
- 3) ISP NS asks authoritative Akamai NS
- 4) Akamai NS looks up IP of requestor (ISP NS) and replies with IP of optimal cluster to serve content (local cluster in that ISP)
- 5) ISP NS replies to end-user who requests content from local Cluster
- 6) end-user requests content from local Cluster



# IPv6

## More address spaces only!?



# Everyone knows - IPv4 exhaustion

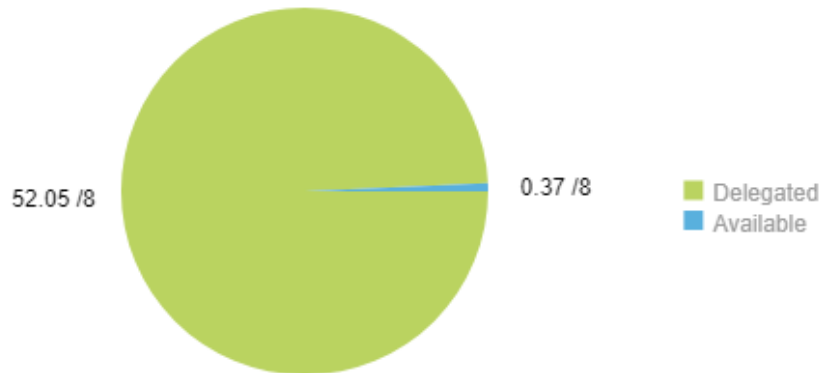


On 15 April 2011, the APNIC pool reached the last /8 of available IPv4 addresses, triggering the Final /8 policy.

## APNIC IPv4 address pool

JS charts

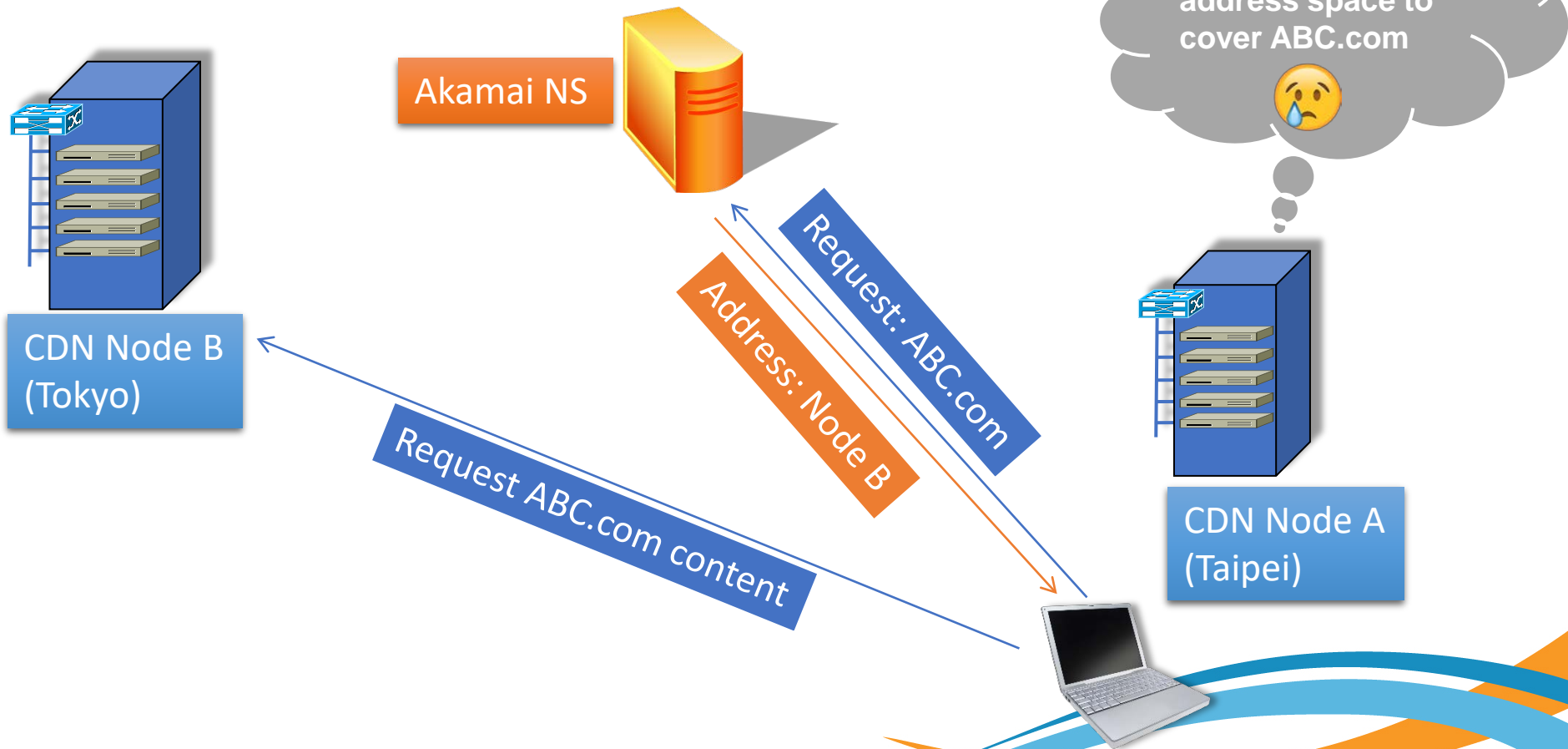
APNIC IPv4 Inventory Status



# Performance Impact to CDNSP




- Limit IP address --> Limit content slots for a CDN node.
  - Less choice of optimal nodes to be chosen.
  - Suboptimal mapping occurs
    - → Overall performance reduced





# Cost issue !!!!




**REGISTER TO BID ON IPv4 ADDRESSES**
REGISTER NOW

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11 Auction(s) SHOW:  : SORT BY:  :

ARIN /24 BLOCK	ARIN /19 BLOCK	ARIN /22 BLOCK	ARIN /21 BLOCK
			
<b>BUY NOW</b>	<b>AUCTION</b>	<b>AUCTION</b>	<b>AUCTION</b>
/24 Block Registered in ARIN Fixed price: <b>\$4,864</b> Avg. Cost Per Unit: <b>\$19.00</b> Closes in <b>3d 14h</b>	/19 Block Registered in ARIN Current bid: <b>\$147,456</b> Avg. Cost Per Unit: <b>\$18.00</b> Bids: <b>0</b> Closes in <b>3d 15h</b>	/22 Block Registered in ARIN Current bid: <b>\$17,408</b> Avg. Cost Per Unit: <b>\$17.00</b> Bids: <b>0</b> Closes in <b>12h 2m</b>	/21 Block Registered in ARIN Current bid: <b>\$33,792</b> Avg. Cost Per Unit: <b>\$16.50</b> Bids: <b>1</b> Closes in <b>12h 2m</b>

Block Size*	/24	/23	/22	/21	/20	/19	/18	/17	/16
Price/IP (USD)	\$24.00	\$21.00	\$18.00	\$16.00	\$15.00	\$15.00	\$15.00	\$15.00	\$15.00

Pic Source: IPv4auction.com

<https://ipv4auction.com>

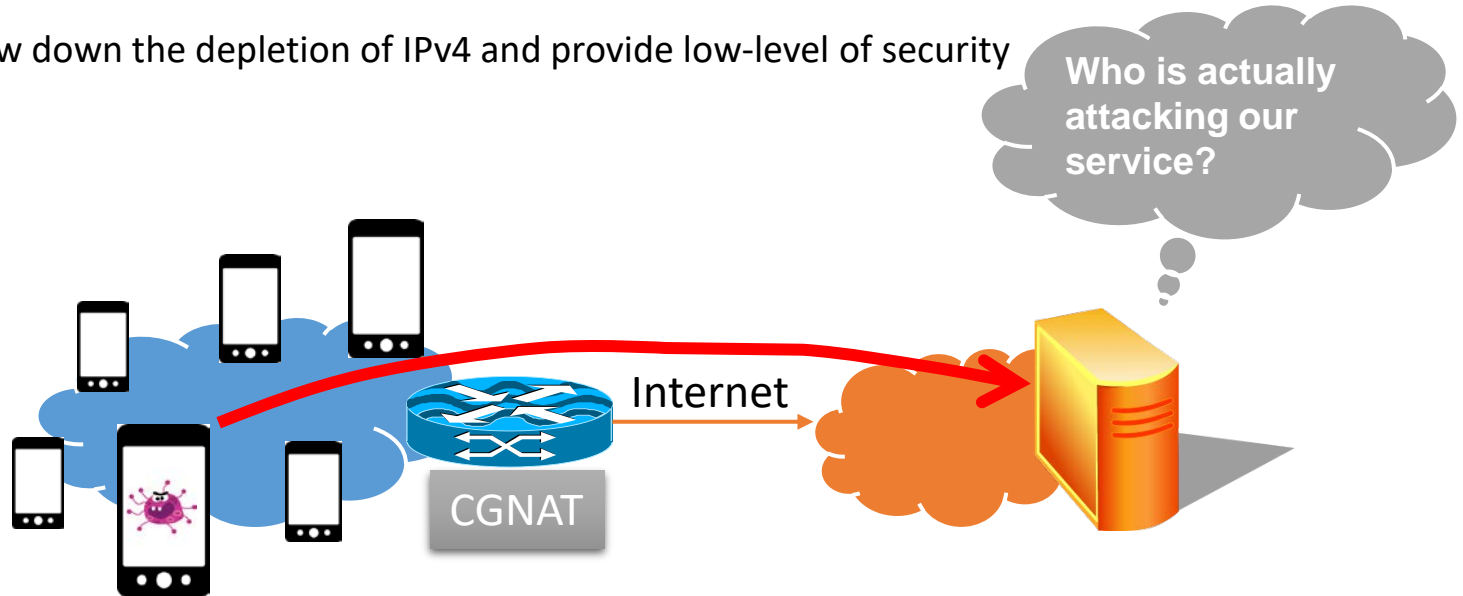
Table Source: IPv4 Market Group

<https://ipv4marketgroup.com/broker-services/buy/>

# Network Complexity



- Network Address Translation (NAT)
  - Slow down the depletion of IPv4 and provide low-level of security



- Difficult to identify attackers behind CGNAT
- induce performance bottleneck and additional cost
- is not a necessary component
- Induce extra complexity

# Address space management



Branch A

**Prefix\_v4:**

23.210.215.0/24  
23.219.32.0/22  
104.116.243.0/24  
104.124.188.0/22

**Prefix\_v6**

**2600:1417:AA::/48**

**Prefix\_v4:**

104.124.224.0/20  
104.124.240.0/20  
104.125.0.0/23  
184.28.218.0/24  
184.87.132.0/22

**Prefix\_v6**

**2600:1417:CC::/48**

Branch B

Branch C

**Prefix\_v4:**

23.13.219.0/24  
23.47.152.0/22  
23.50.63.0/24  
23.66.32.0/20  
23.76.206.0/23  
23.77.0.0/19  
23.198.11.0/24  
23.217.206.0/23  
23.219.132.0/22  
104.89.96.0/20  
104.111.200.0/21  
118.214.179.0/24

**Prefix\_v6**

**2600:1417:BB::/48**

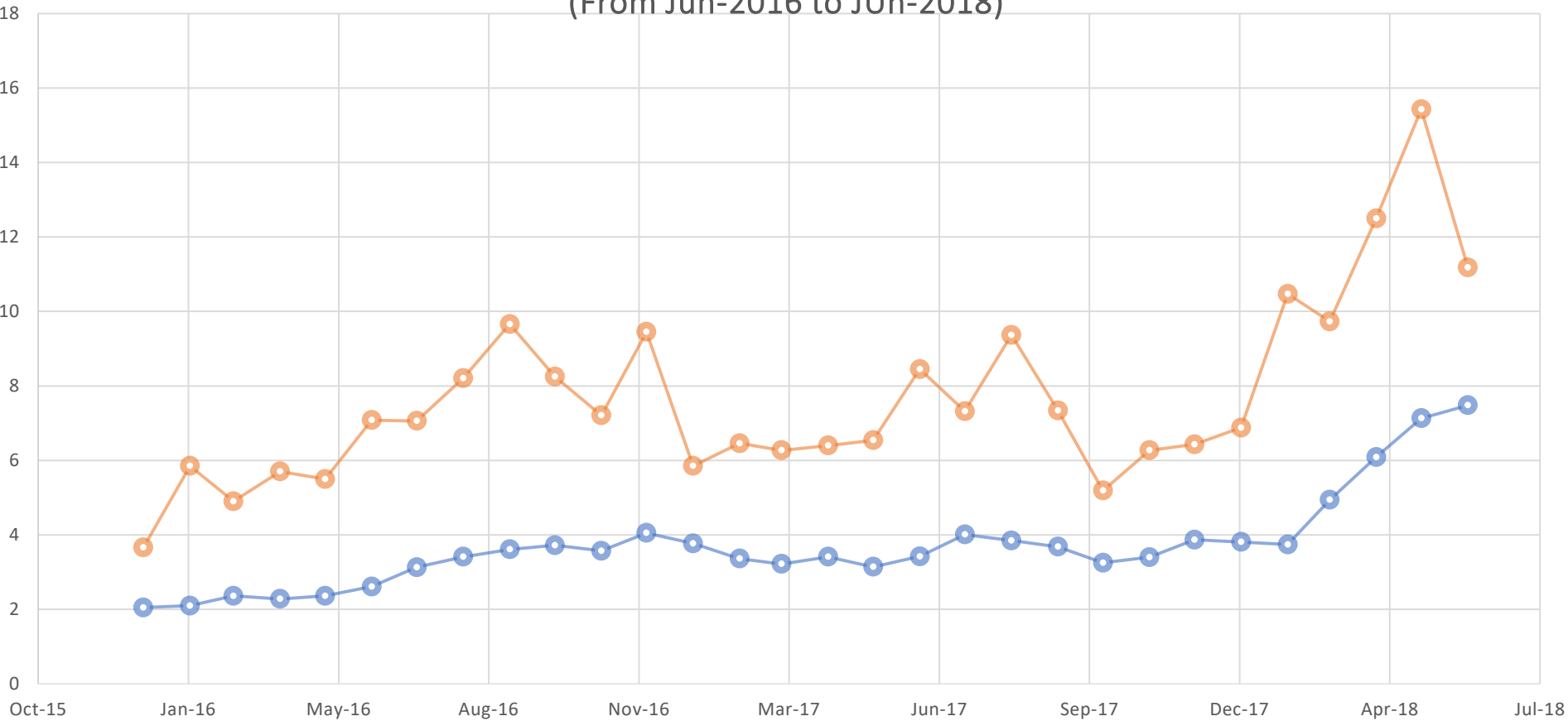
# Akamai statistics on IPv6 growth



# Global IPv6 Traffic by month



Akamai IPv6 percentage in Global Traffic Volume  
(From Jun-2016 to Jun-2018)



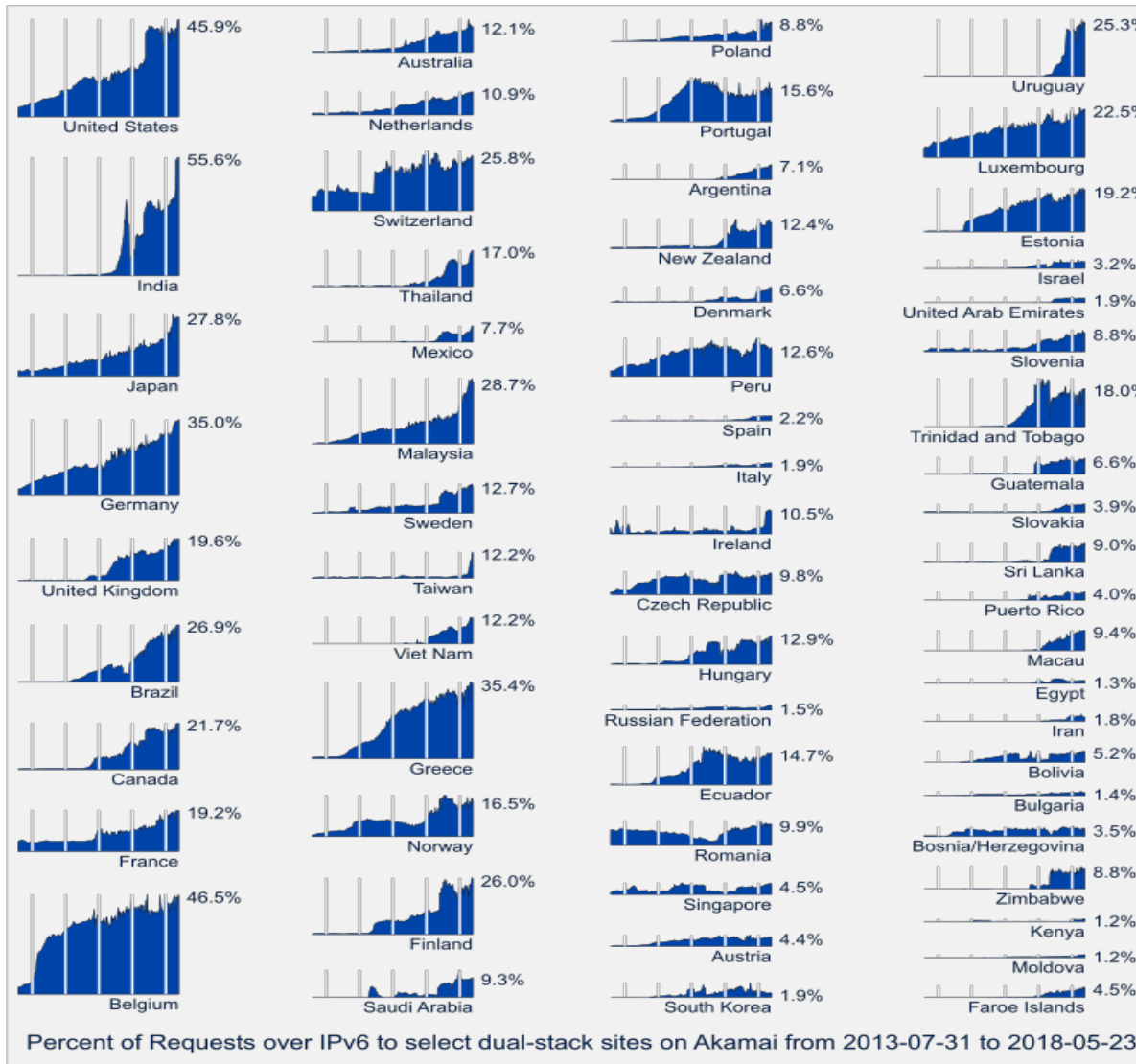
—●— Average IPv6 Pct    —●— Max IPv6 Pct



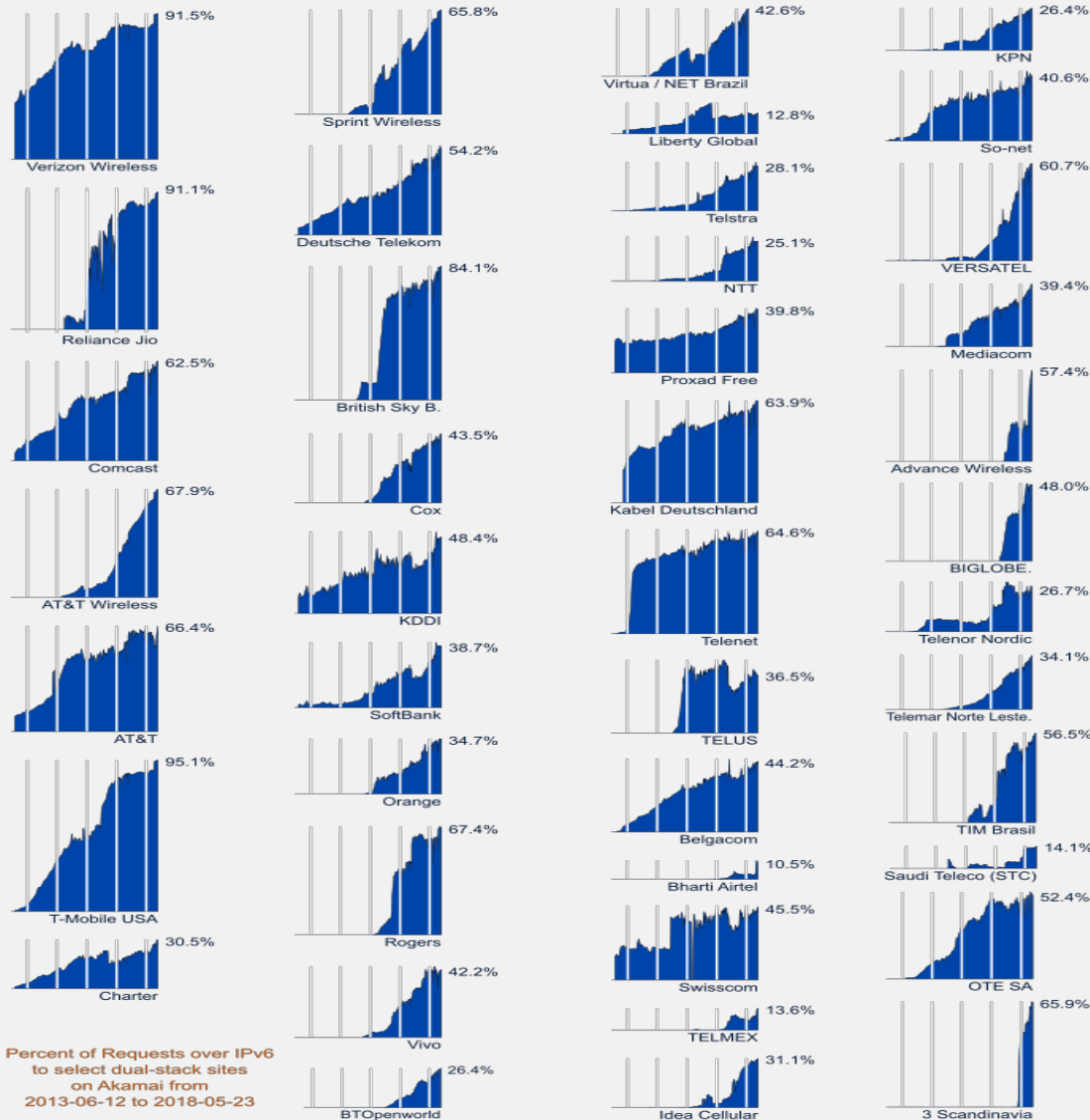


## Top – 10 Countries

1. India (55.6%)
2. Belgium (46.5%)
3. USA (45.9%)
4. Greece (35.4%)
5. Germany (35%)
6. Malaysia(28.7%)
7. Japan (27.8%)
8. Brazil (26.9%)
9. Finland (26.0%)
10. Switzerland (25.8%)



# IPv6 Adoption status in Global



### Top – 10 Networks

1. T-Mobile USA (95.1%)
2. Verizon Wireless (91.5%)
3. Reliance Jio (91.1%)
4. British Sky B. (62.5%)
5. AT&T Wireless (67.9%)
6. Rogers (67.4%)
7. AT&T (66.4%)
8. Sprint Wireless (65.8%)
9. Kabel Deutschland (63.9%)
10. Comcast (62.5%)

Percent of Requests over IPv6 to select dual-stack sites on Akamai from 2013-06-12 to 2018-05-23

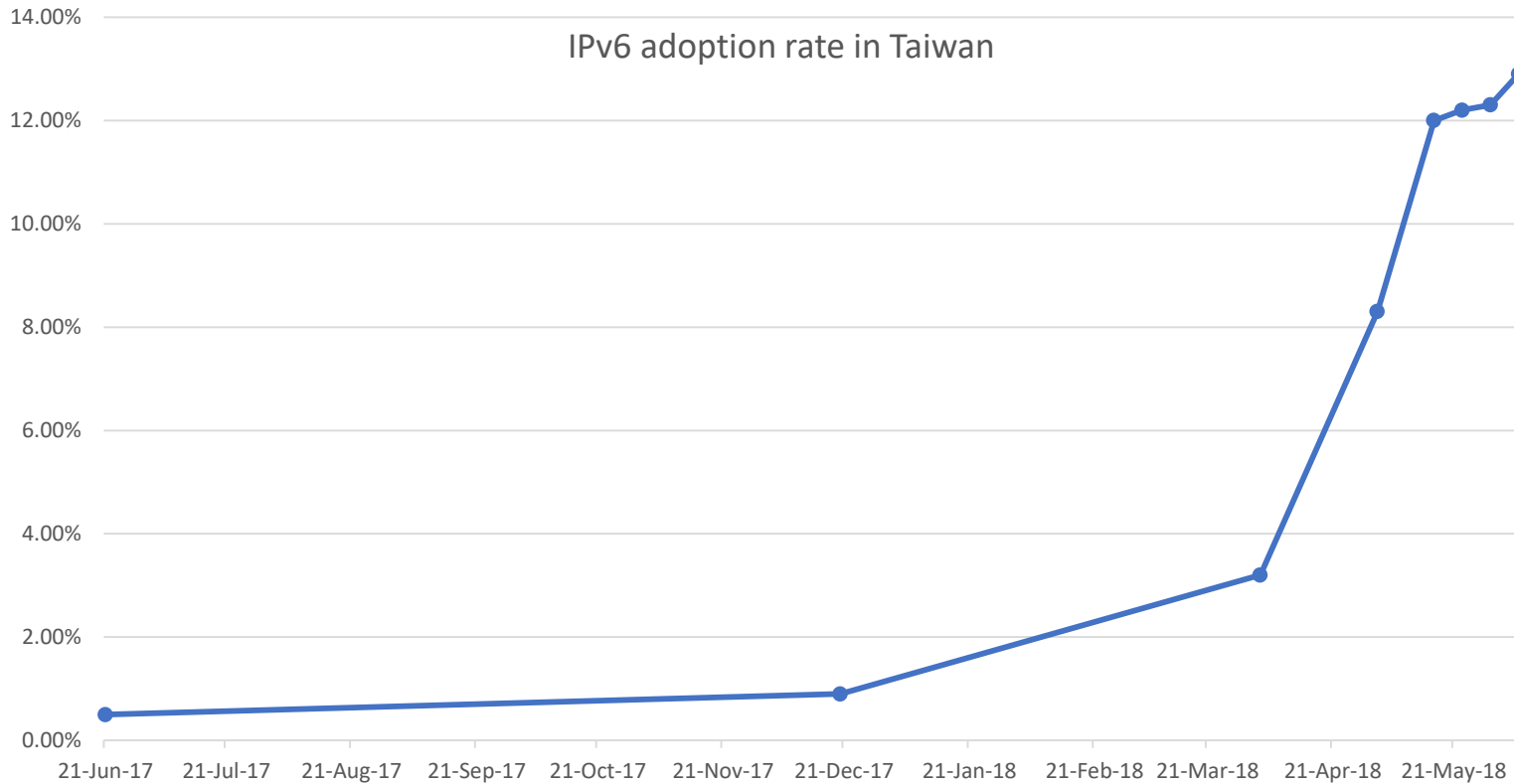
# IPv6 Adoption status in Network

# Countries with < 3% IPv6 adoption



- Russia
- China
- Hong Kong
- Italy
- Spain
- Indonesia
- Turkey
- South Korea

# How about Taiwan?



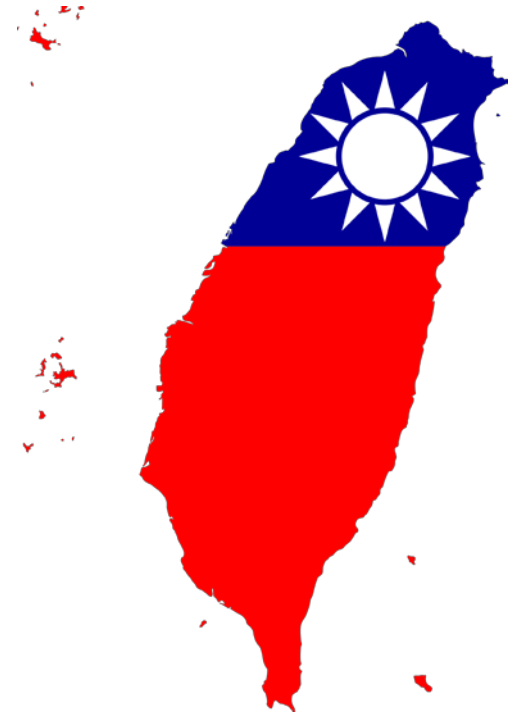
Date	21-Jun-17	20-Dec-17	3-Apr-18	2-May-18	16-May-18	23-May-18	30-May-18	6-Jun-18
IPv6%	0.50%	0.90%	3.20%	8.30%	12%	12.20%	12.30%	12.90%

# How about Taiwan?



IPv6 traffic percentage of Akamai Dual-stacked hostname delivered to Taiwan ISPs

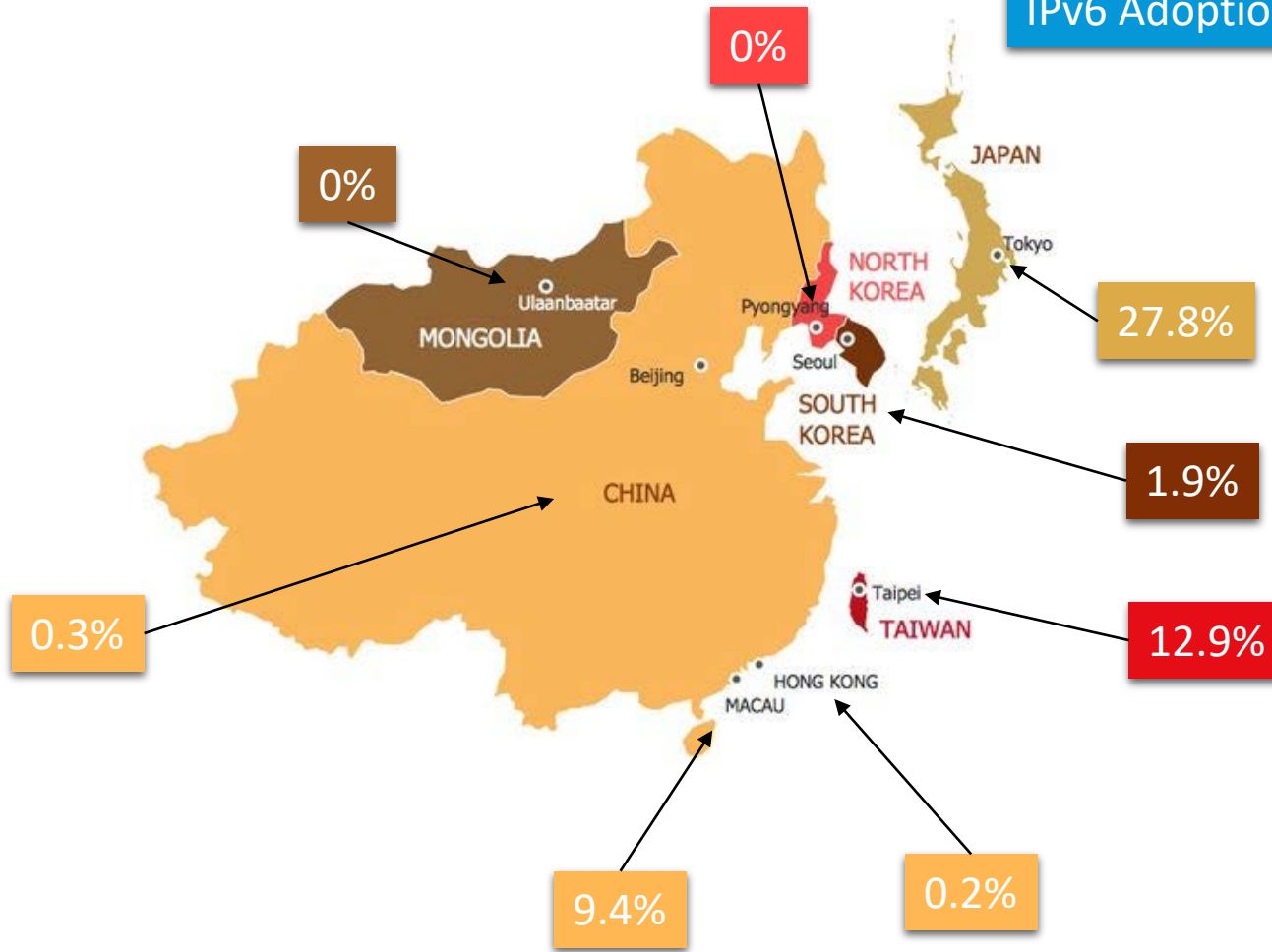
網絡供應商	IPv6 百分比
中華電信 (Mobile)	50.04%
教育網	25.56%
中華電信 (HiNet)	12.50%
台灣固網	0%
台灣大哥大	0%
遠傳 (Mobile)	0%
遠傳 (SeedNet)	0%
亞太電信	0%
台灣之星	0%
中嘉禾網	0%



# Eastern Asia Summary



IPv6 Adoption rate in Eastern Asia



Sample date: Maximum value between 23<sup>rd</sup> May – 6<sup>th</sup> Jun 2018

# Akamai status of IPv6



- Almost all products support IPv6 for end-users to Akamai
  - New configurations default to dual-stack for most products
  - Some experiments have shown IPv6 performs better than IPv4
- Most Akamai DNS zones have AAAA authorities
- IPv6 support from Akamai to origin fetching
- IPv6 live on Akamai servers around the world in:
  - 112 countries, 680+ cities, 2200+ locations, 800+ networks

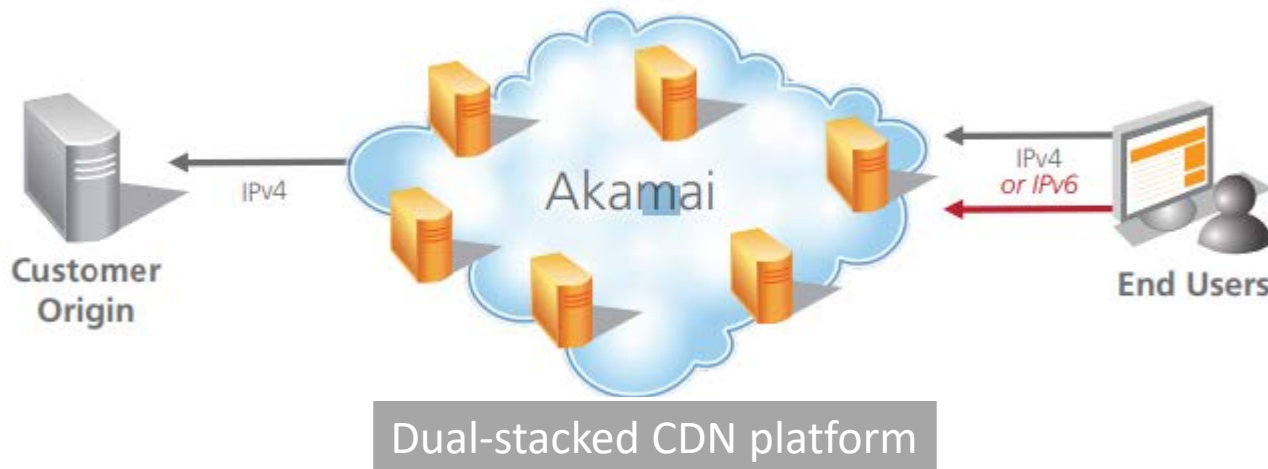
# How Akamai enable IPv6 (Dual-stack ready by default)



Dual-stacking edge servers

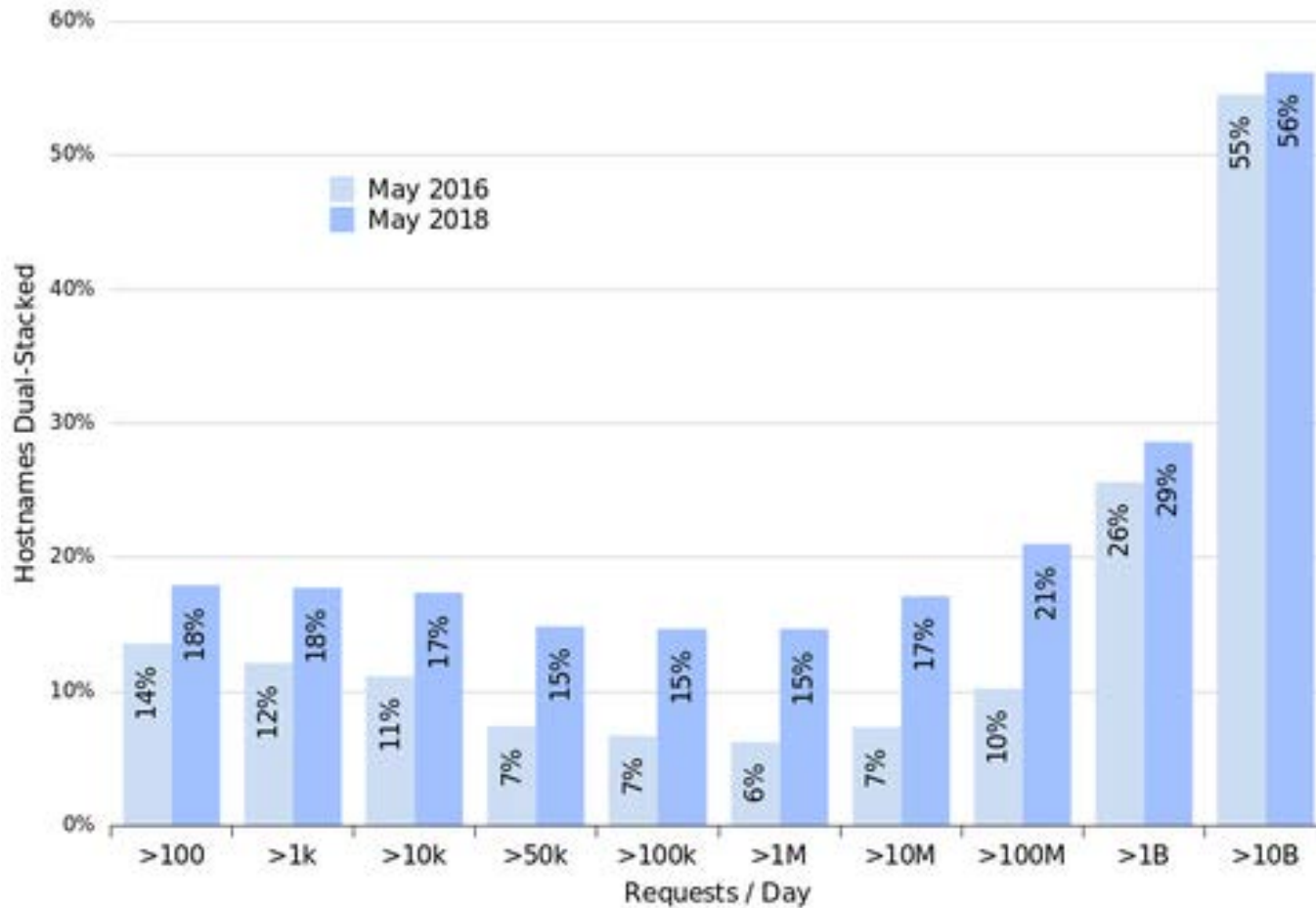
Akamai Customer properties can be dual-stacked

- Terminate IPv4 and IPv6 connections in server software
- Can go forward to our customer origin via IPv4 (or IPv6)





# Growth on Dual-stacked content available in Akamai customers (2016 vs 2018)



# Summary and Suggestion



- Content owner
  - Enable IPv6 caching function / with your CDN provider
  - It is easy for customer to adopt IPv6 in Akamai
- ISPs
  - Extend IPv6 connectivity to subscriber
  - Deploy v6 DNS facilities for AAAA Record for end users

# Q&A



- Tonie Wong : [shwong@akamai.com](mailto:shwong@akamai.com)
- More information:
- Peering: <http://as20940.peeringdb.com>  
<http://as32787.peeringdb.com>
- SOTI Quarterly Report
- <https://www.stateoftheinternet.com>
- IPv6 Adoption Visualization:  
[www.stateofinternet.com/ipv6](http://www.stateofinternet.com/ipv6)

End

