Optimizing Traffic Flow with Akamai

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Akamai Technologies

MYNOG-12

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Agenda

Akamai Deployment in Malaysia

- Akamai network deployment and Peering in Malaysia

How Akamai map traffic (and why most of the BGP Traffic Engineering doesn't work with Akamai)

- CDN Mapping: DNS versus Anycast
- AS Path Prepending
- MED
- More Specific Route

Best practices and recommendations

- Setup own DNS resolvers
- Maintain complete and consistent route announcements
- Do not filter traffic
- Avoid CGNAT and enable IPv6

CDN Evolution and IPv6 Traffic

Akamai Connected Cloud deployment in Malaysia

- Inside major ISP networks, located in 5 cities
  - Kuala Lumpur
  - Penang
  - Malacca
  - Kota Kinabalu
  - Kuching

- 2 infrastructure nodes
  - AIMS Kuala Lumpur
  - CSF CX1 / TelcoHub
- > 90% in-country traffic delivery

Akamai peering connections in Malaysia

Akamai is partnering with varies IX in Malaysia to send traffic to IX members

1. MyIX

- Connected since Dec 2013
- 200G + 300G

2. DE-CIX Kuala Lumpur

- Connected since Jun 2021
- 100G

This does not mean you will see all Akamai traffic

The Akamai node connecting to IX is aimed to serve major content to IX members.

How and why Akamai deployment and peering in Malaysia

- Malaysia is a large country, only KL is not enough, especially for East Malaysia where the capacity is usually less.
- Infrastructure nodes are selected based-on carrier-density for ease of interconnections
- Internet Exchanges are picked with the most connected members.

Name Management	CLLI NPA-NXX	City Country	State Postal Code	Networks
AIMS Kuala Lumpur AIMS Data Centre Sdn Bhd	- -	Kuala Lumpur MY	Wilayah Persekutuan 50200	100
CSF CX1 / TelcoHub1 Kuala Lumpur CSF Group	- -	Cyberjaya MY	Selangor Darul Ehsan 63000	37
CX2 / MY01 Cyberjaya Malaysia Bridge Data Centres	- -	Cyberjaya MY	Selangor 63000	26
CJ1 CYBERJAYA Mytelehaus	- -	Cyberjaya MY	- 63000	20
Open DC JB1 - Menara MSC Cyberport OPEN DC SDN BHD	- -	Johor Bahru MY	Johor 80300	14
NTT Cyberjaya Data Center (CBJ) NTT DATA's Global Data Centers division	- -	Cyberjaya MY	- 63000	11
TM ONE KVDC, Cyberjaya Telekom Malaysia Berhad (TM)	- -	Cyberjaya MY	Selangor 63000	9
AIMS Cyberjaya AIMS Data Centre Sdn Bhd	- -	Cyberjaya MY	Selangor 63000	8

Name	Country	City	Networks…
MyIX Malaysia Internet Exchange	MY	Kuala Lumpur	123
DE-CIX Kuala Lumpur	MY	Kuala Lumpur	33
DE-CIX Malaysia	MY	Kuala Lumpur, Cyberjay…	20
Penang IX Penang IX powered by DE-CIX	MY	Penang	8
irix Internet Exchange	MY	Kuching	3
Equinix Kuala Lumpur	MY	Kuala Lumpur	2
MYNAP Malaysia Network Access Point (MYNAP)	MY	Cyberjaya	1

How CDN and Akamai works?

- CDN mapping: DNS versus anycast
- Some facts
- Cluster types – Private and Public
- Cluster roles – Edge and Mid-tier

How CDN works? DNS versus anycast

CDN Mapping: Direct users to the optimal node.

Akamai CDN mapping is based-on DNS

- Unicast, assign IP addresses of the optimal node
- Performance-based
- Capacity-aware, bandwidth and servers

Some other CDNs

- Anycast, always assign the same IP addresses
- Depends on BGP routing, manual fine-tuning
- Challenges in monitoring and troubleshooting

How Akamai works: some facts

Are Akamai clusters connected to each other?

Most of the Akamai clusters are operated independent, and not talk to each others

-> Peer with Akamai in one single cluster would not get all the content

Where does the content Akamai serve come from?

Akamai operates a caching infrastructure

Some content customers uses multi-tiers cache layer

Each cluster has different Internet connectivity to obtain content from the origin

How does Akamai direct users to its cluster?

Akamai maps users based-on client's DNS, various network factors and other attributes

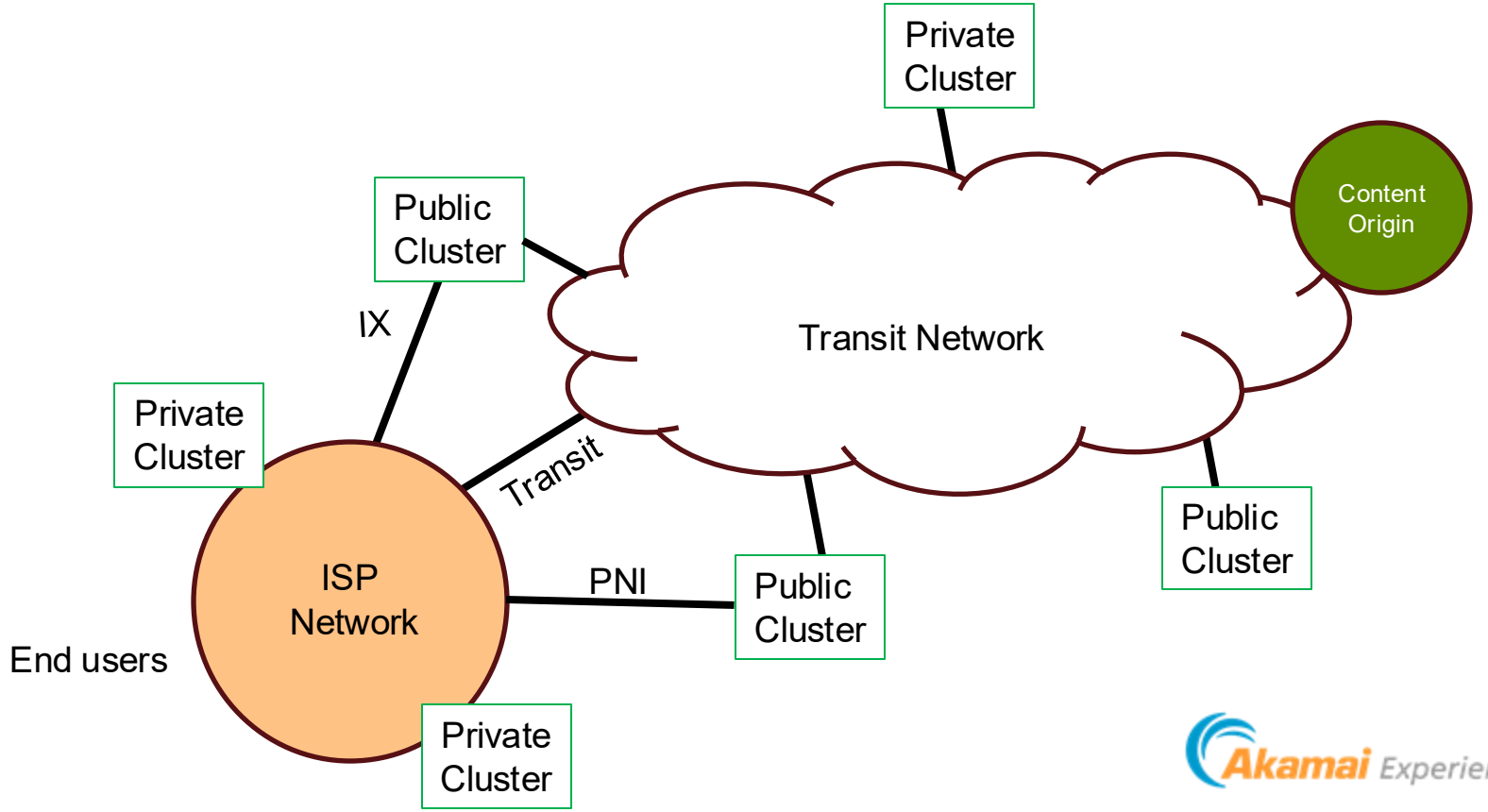
How Akamai works: Cluster types

Private: Clusters dedicated to specific networks or their downstream ISPs. Role: Edge

Clusters inside the network partners: AANP - Akamai Accelerated Network Partner

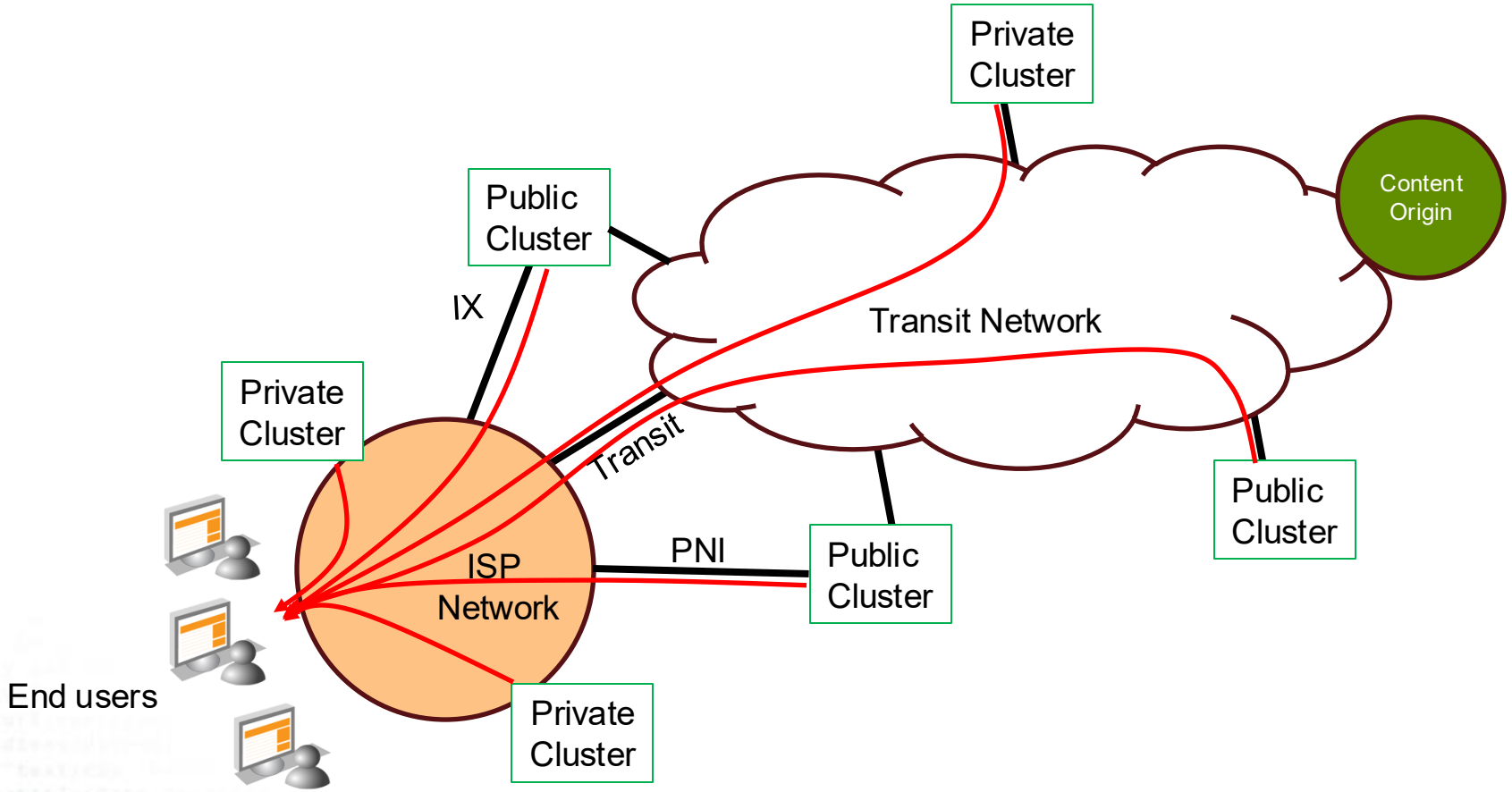
Public: Clusters shared by multiple networks. Role: Edge, Mid-Tier and Infrastructure

Clusters inside some public facility (e.g., AIMS KL, CSF CX1), connecting to multiple networks via PNI, IXs and Transit providers.



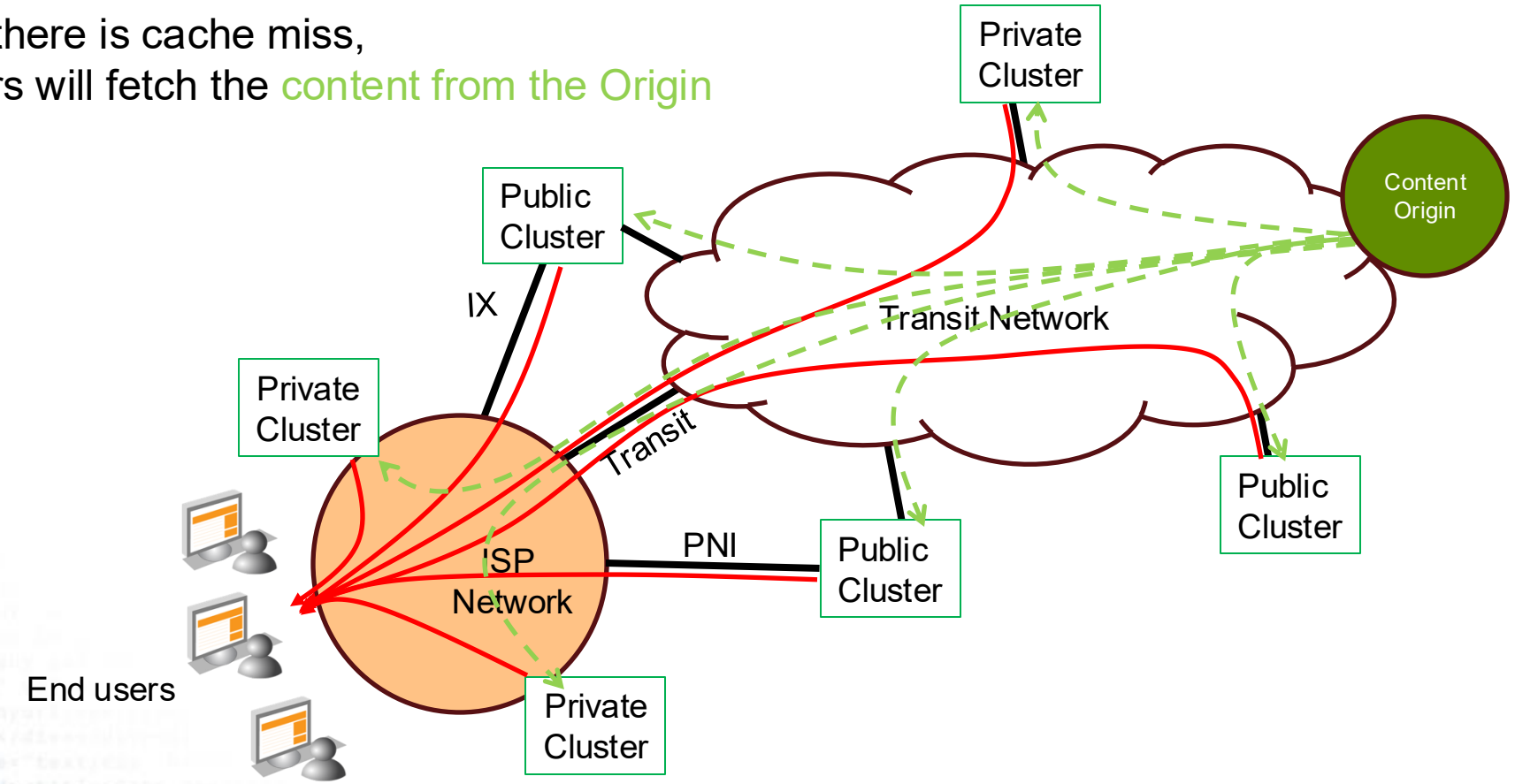
How Akamai works: Cluster roles - Edge

1. Edge: Cache the content and distribute to the end users



How Akamai works: Cluster roles - Edge

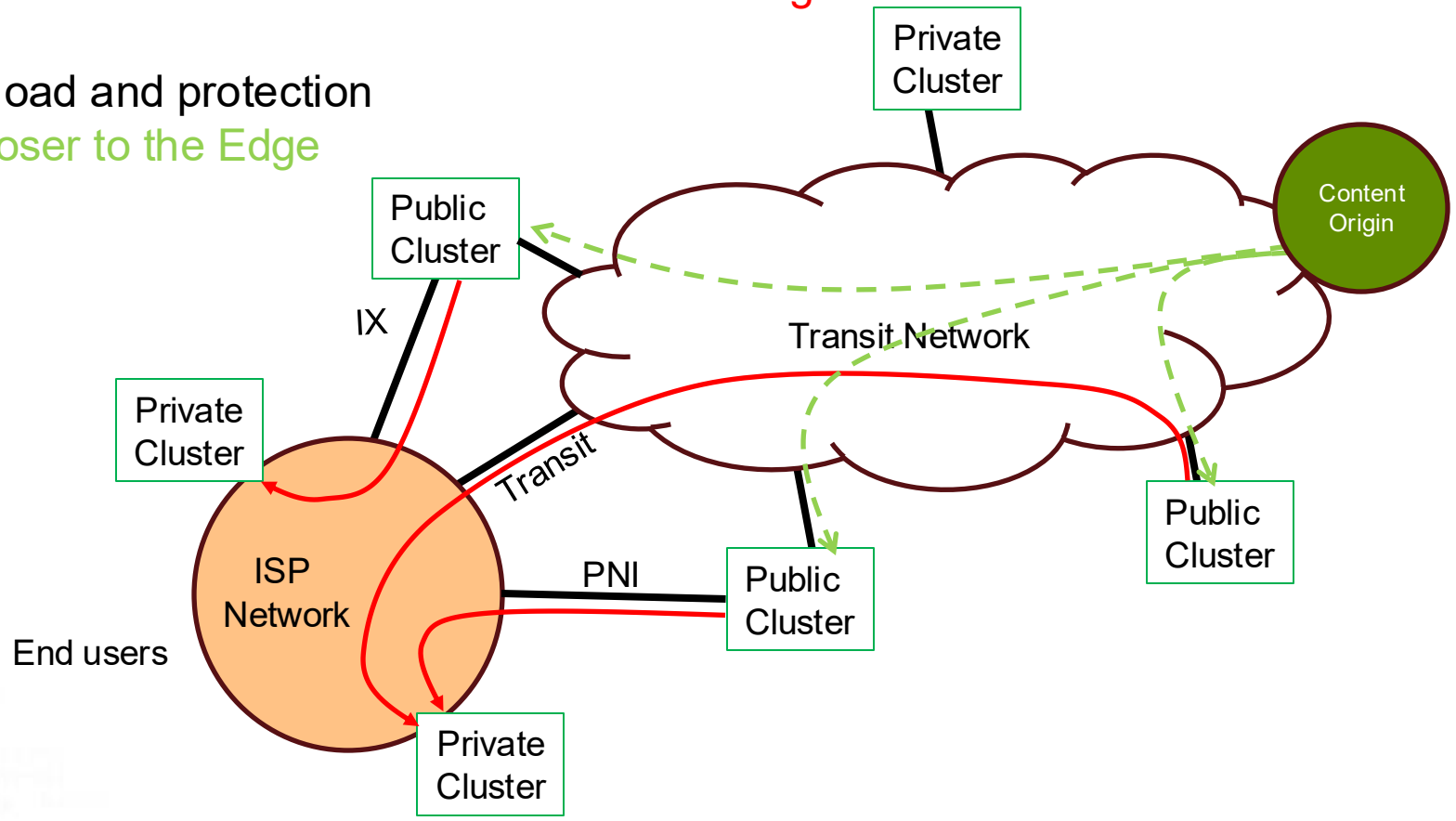
1. Edge: Cache the content and distribute to the end users
   when there is cache miss,
   clusters will fetch the content from the Origin



How Akamai works: Cluster roles – Mid-Tier

2. Mid-Tier: Parent Cache the content and distribute to Edge clusters

Improve origin offload and protection
Bring the origin closer to the Edge

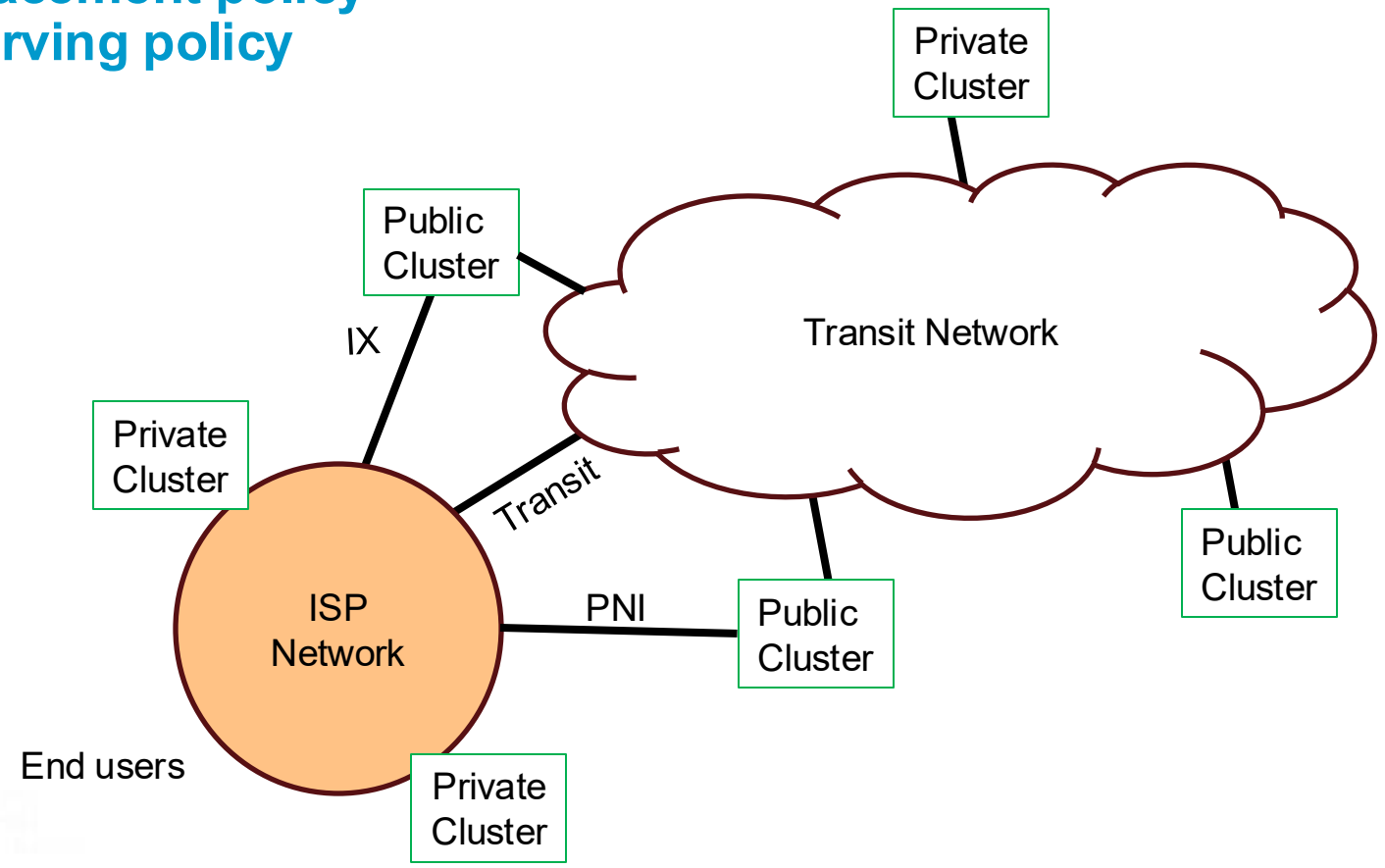


Why most of the BGP Traffic Engineering techniques don’t work with Akamai?

- AS Path Prepending
- MED
- More/less Specific Route advertisement
- Impacts and our suggestions

Akamai maps end users demand based on …

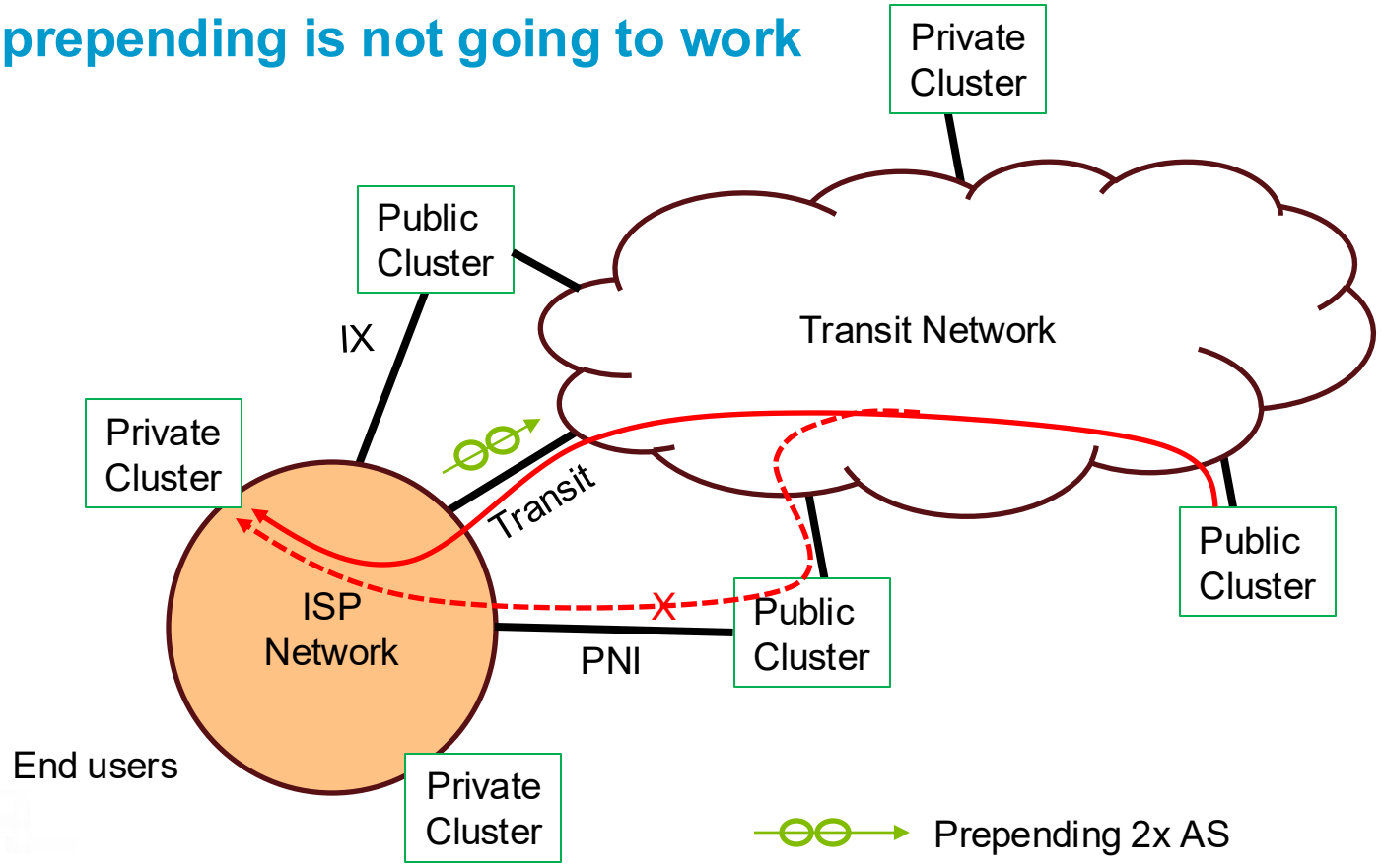
1. Network performance (Latency, packet drops, link utilizations)
2. Server capacity
3. Cache placement policy
4. Cache serving policy



Akamai map end users demand based on …

but not AS path length

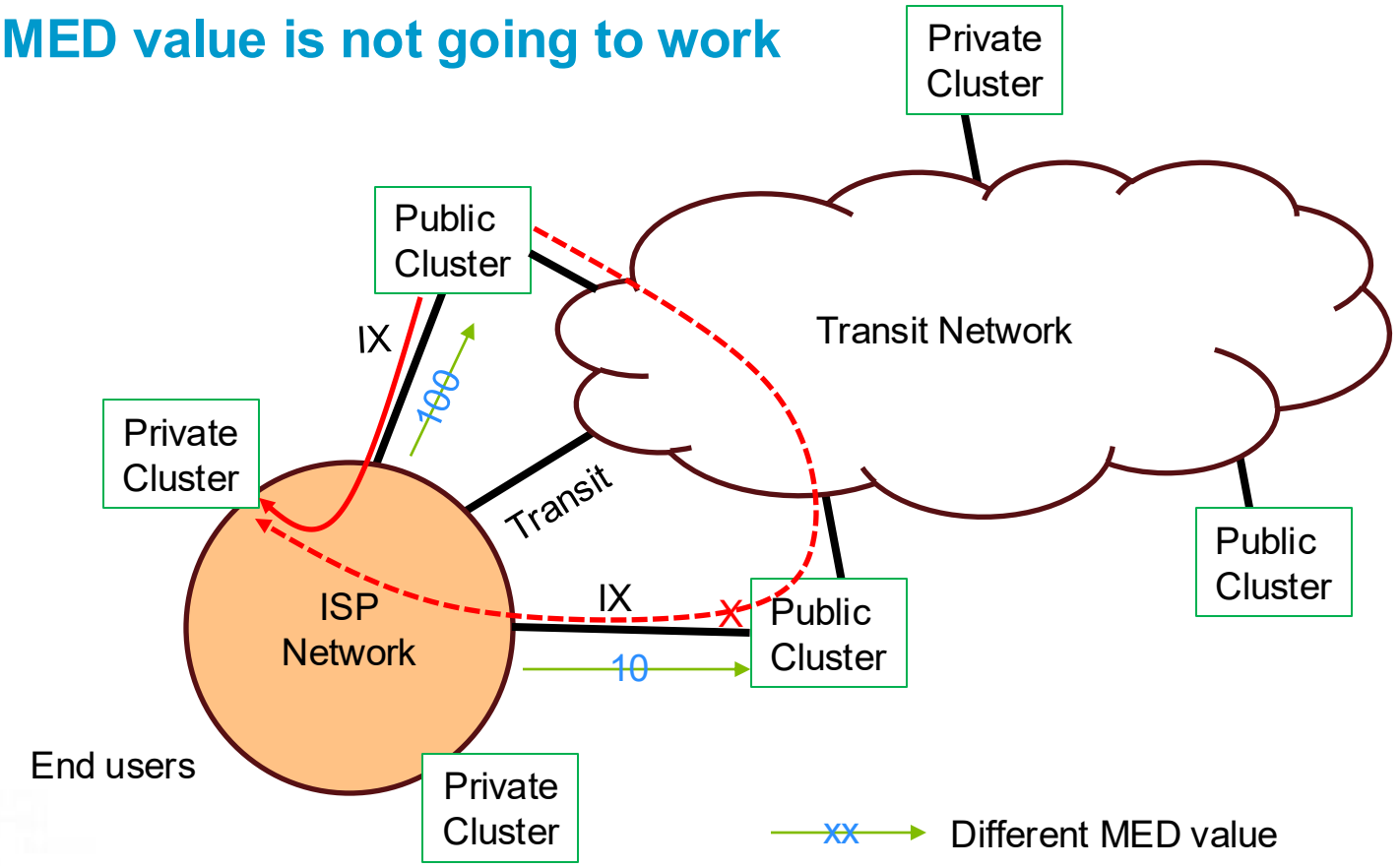
So AS Path prepending is not going to work



Akamai map end users demand based on …

but not MED value

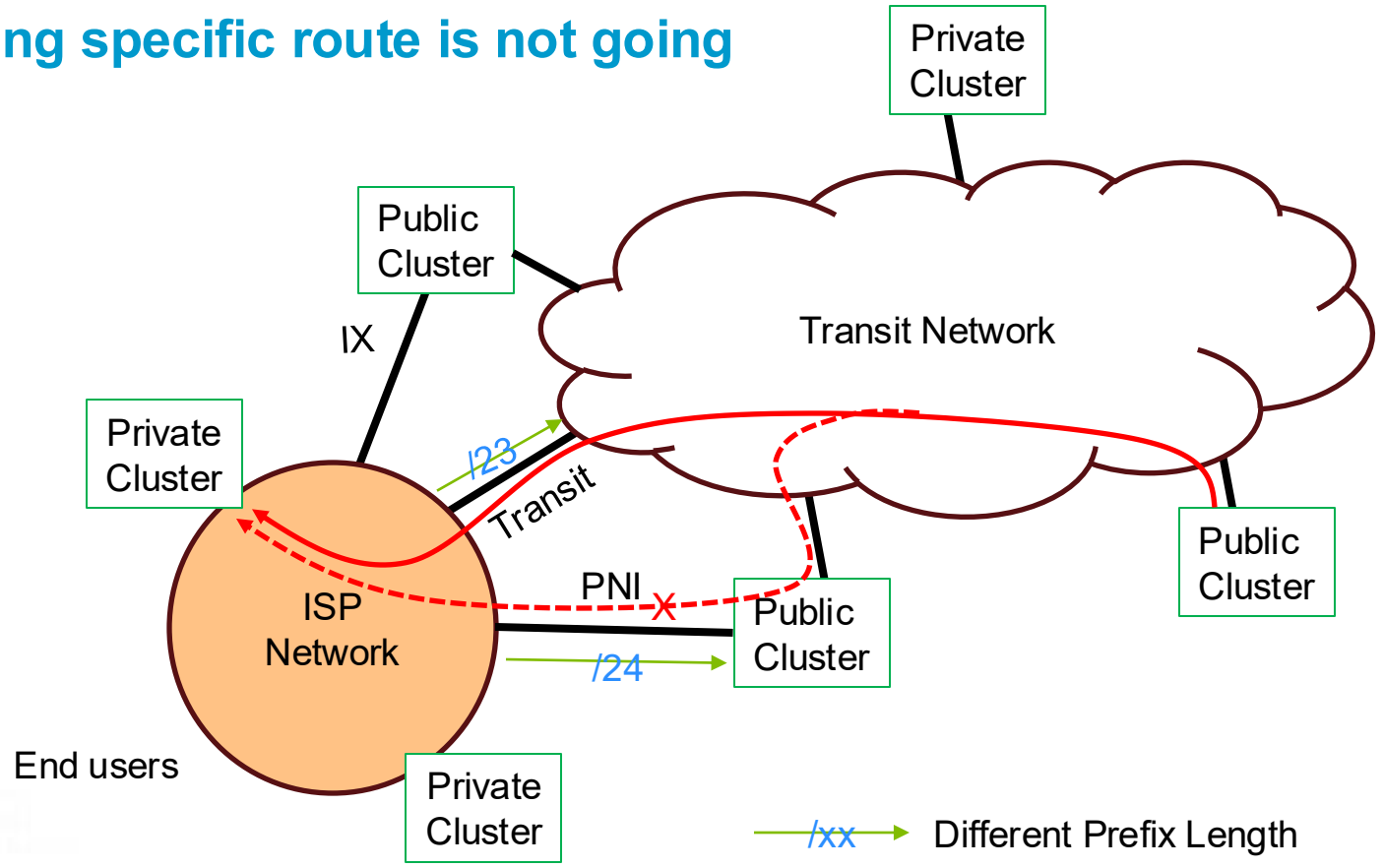
So change MED value is not going to work



Akamai map end users demand based on …

but not prefix length

So advertising specific route is not going to work



Why doesn’t these have the usual effect?

- Akamai uses Mapping, on top of the BGP routing
- Akamai Mapping is different from BGP routing
- Akamai nodes are mostly islands, there are no backbone between them
- Akamai uses multiple criteria to choose the optimal node / server
- These include standard network metrics:
  - Latency
  - Throughput
  - Packet loss

Impacts and our suggestions

Impacts:

- Sub-optimal routing
- High cost – traffic via transit
- Performance degradation

Our suggestions:

- Talk to us if we are sending too much / too few traffic on your preferred link(s)
- Accommodate our best practices and recommendations
- We can work together for traffic engineering

Best Practices and Recommendations

- Setup own DNS resolvers
- Maintain complete and consistent route announcements
- Do not filter traffic
- Avoid CGNAT and enable IPv6

Setup own DNS resolvers

Akamai CDN map traffic based-on DNS resolvers external IPs

- Use anycast IPs for user-facing DNS resolver IPs
- Use different external IPs for users in different locations
- Setup ACL to only allow your own users to use your DNS resolvers
- Do not modify Akamai hostnames TTL value

If not possible to setup your own DNS resolvers, then

- Use Google DNS (8.8.8.8 / 8.8.4.4, 2001:4860:4860::8888 / 2001:4860:4860::8844)
- Use OpenDNS (208.67.222.222 / 208.67.220.220, 2620:119:35::35 / 2620:119:53::53)
- Akamai support EDNS Client Subnet (ECS) for Google DNS and OpenDNS
- Publish GeoFeed IP location information in RFC8805 format

Maintain good Internet connectivity to your DNS resolvers

- Akamai may use your DNS resolvers external IPs for performance monitoring
- Alternatively, you may provide Akamai with your desire IPs for performance monitoring

Maintain Complete and Consistent Route Announcements

Announce complete prefixes to Akamai

- Includes both DNS and end user IPs
- Akamai map traffic based-on DNS to the optimal node, then send user traffic from there
- Discuss with your downstreams to announce all prefixes to you

If not possible to announce all prefixes, then

- Akamai may block your whole ASN prefixes, to avoid suboptimal performance

Maintain consistent route announcement to your peers / upstream providers

- Akamai may send overflow traffic from your upstream providers

Do not filter traffic

Carry traffic that you announce

- If you promised to carry the traffic of an IP block (e.g., /20), you should not have any holes (e.g.,/24) or drop any part of the traffic
- Akamai routers may not have the full Internet routing table
- The end user's connectivity will be impacted!!!

Performance monitoring

- Akamai uses IPs in your network as performance monitoring
- If possible, do not filter / rate-limit ICMP to your network
- Send return traffic to Akamai closet location to maintain lowest latency

Avoid CGNAT and enable IPv6

Avoid the use of CGNAT

- When possible, try to avoid using CGNAT, this will improve performance
- If necessary
  - Use the standard CGNAT IP address block 100.64.0.0/10 [RFC 6598]
  - Place Akamai nodes outside of CGNAT
- Akamai uses client IPs for different purposes, e.g., global traffic management

Enable IPv6

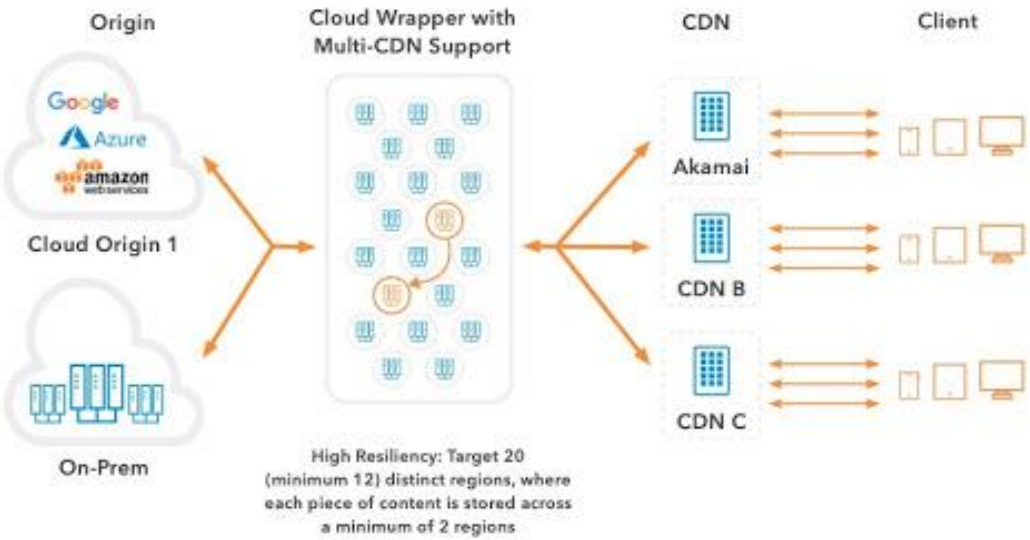
- Malaysia IPv6 capability is 71.75%
- If you have an Akamai cache node
  - assign IPv6 address block to Akamai clusters
  - send your IPv6 prefixes to Akamai BGP collectors
- If you have peering with Akamai, enable both IPv4 and IPv6 sessions
- Akamai has made IPv4+IPv6 dual-stack the default for new customer configurations

CDN Trend and Looking Ahead

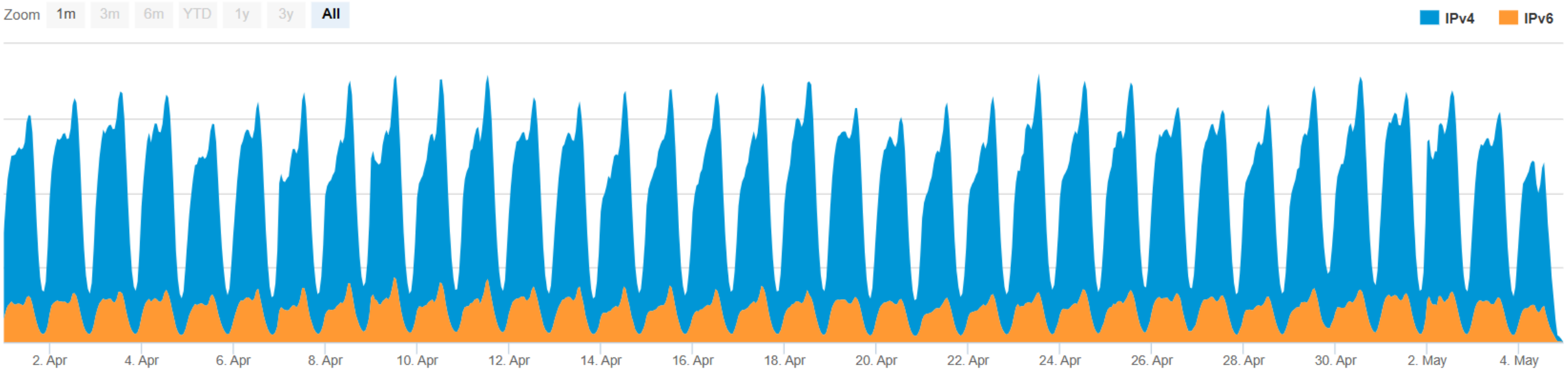
- CDN Evolution
- IPv6 Trend

CDN Evolution

- **CDN and Origin Infrastructure**
  - Connection with various cloud services
  - Reduce cloud egress traffic
- **Infrastructure between CDNs**
  - Origin offload, Multi-CDNs
- **Direct connection with customers**
  - Improve first mile connectivity
  - Secure connection
- **Building an Akamai backbone network**
  - Better Akamai internal traffic connectivity
- **Metro / city > between cities, within regions > between regions**
  - Extended Akamai backbone network, improve node-to-node traffic



Akamai IPv6 Traffic – Malaysia



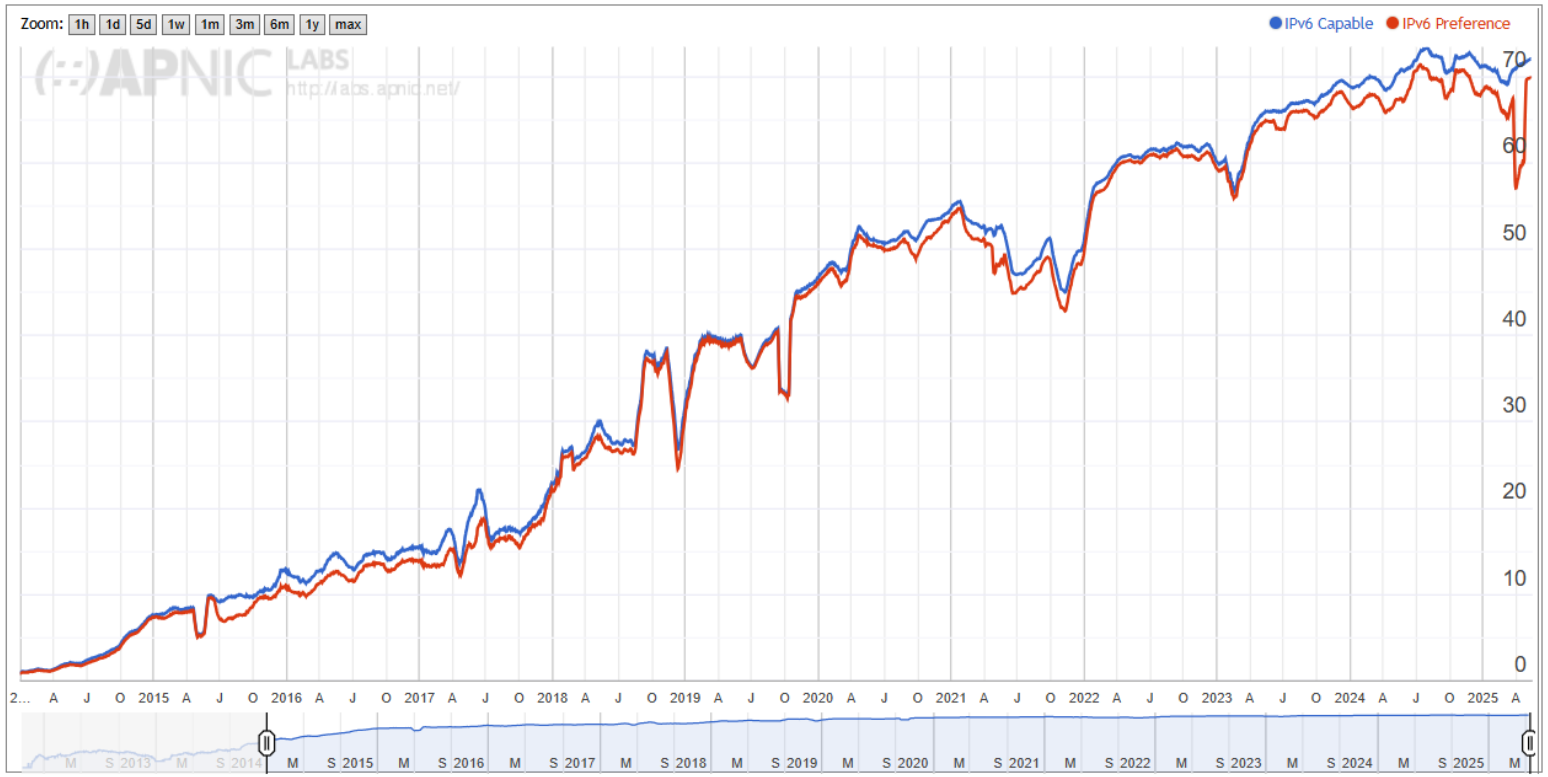
- **IPv6 Traffic Adoption**
  - ~20% of total traffic, across TM, Maxis, Digi Celcom
  - Depends on customer configurations

IPv6 Adoption Trends - Malaysia

IPv6 traffic is growing

- APNIC measurement:
- 70% users are IPv6 capable

- Other measurement:
  - Google: 67.85% IPv6 adoption



Summary

Akamai Connected Cloud

- Akamai Deployment and Peering in Malaysia

Traffic Engineering

- CDN mapping: DNS versus Anycast
- Typical BGP traffic engineering techniques doesn’t work

Best practices and Recommendations

- Setup your own DNS resolvers
- Maintain complete and consistent route announcements
- Do not filter traffic
- Avoid CGNAT and enable IPv6

CDN Trend and IPv6

- CDN Evolution
- IPv6 Traffic Trend

Questions?

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More peering information:

- CDN: https://as20940.peeringdb.com
- Prolexic DDoS Mitigation: https://as32787.peeringdb.com
- Linode: https://as63949.peeringdb.com

Terima Kasih!
(Thank You!)