

# Akamai CDN, Peering and IPv6

Kams Yeung  
Akamai Technologies  
HKNOG 0.1  
2<sup>nd</sup> Sep, 2013



# Agenda



## Akamai Introduction

- Who's Akamai?
- Intelligent Platform & Traffic Snapshot

## Basic Technology

- Akamai mapping
- Finding the IP address
- Downloading [www.example.com](http://www.example.com)

## Peering with Akamai

- Why Akamai peer with ISPs
- Why ISPs peer with Akamai

## Akamai & IPv6 World Launch Anniversary

- Akamai IPv6 Deployment and Observations

# Akamai Introduction



## Who is Akamai?

**Akamai is a leading provider of a Cloud platform, which delivers, accelerates and secure content and APPLICATIONS over the Internet. Our key differentiator is our highly distributed (intelligent) platform, made up of more than 137,000 servers in 87 countries.**

- Public company – symbol NASDAQ: AKAM
- Founded: 1998
- Headquarters: Cambridge, MA, USA
- 30+ worldwide offices, including Europe and Asia
- 3,400+ employees worldwide

# 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:

**137,000+**  
Servers

**2,000+**  
Locations

**1,150+**  
Networks

**700+**  
Cities

**87**  
Countries



### Typical daily traffic:

- More than **2 trillion** requests served
- Delivering over **13 terabits/second**
- **15-30%** of all daily web traffic



# Traffic Snapshot



Akamai Internet Visualization App

# Basic Technology

Akamai mapping



## How CDNs Work

When content is requested from CDNs, the user is directed to the optimal server

- This is usually done through the DNS, especially for non-network CDNs, e.g. Akamai
- It can be done through anycasting for network owned CDNs

Users who query DNS-based CDNs be returned different A (and AAAA) records for the same hostname

This is called “mapping”

The better the mapping, the better the CDN



# How Akamai CDN Work



## Example of Akamai mapping

- Notice the different A records for different locations:

```
[NYC]% host www.symantec.com
```

```
www.symantec.com    CNAME    e5211.b.akamaiedge.net.  
e5211.b.akamaiedge.net.  A        207.40.194.46  
e5211.b.akamaiedge.net.  A        207.40.194.49
```

```
[Boston]% host www.symantec.com
```

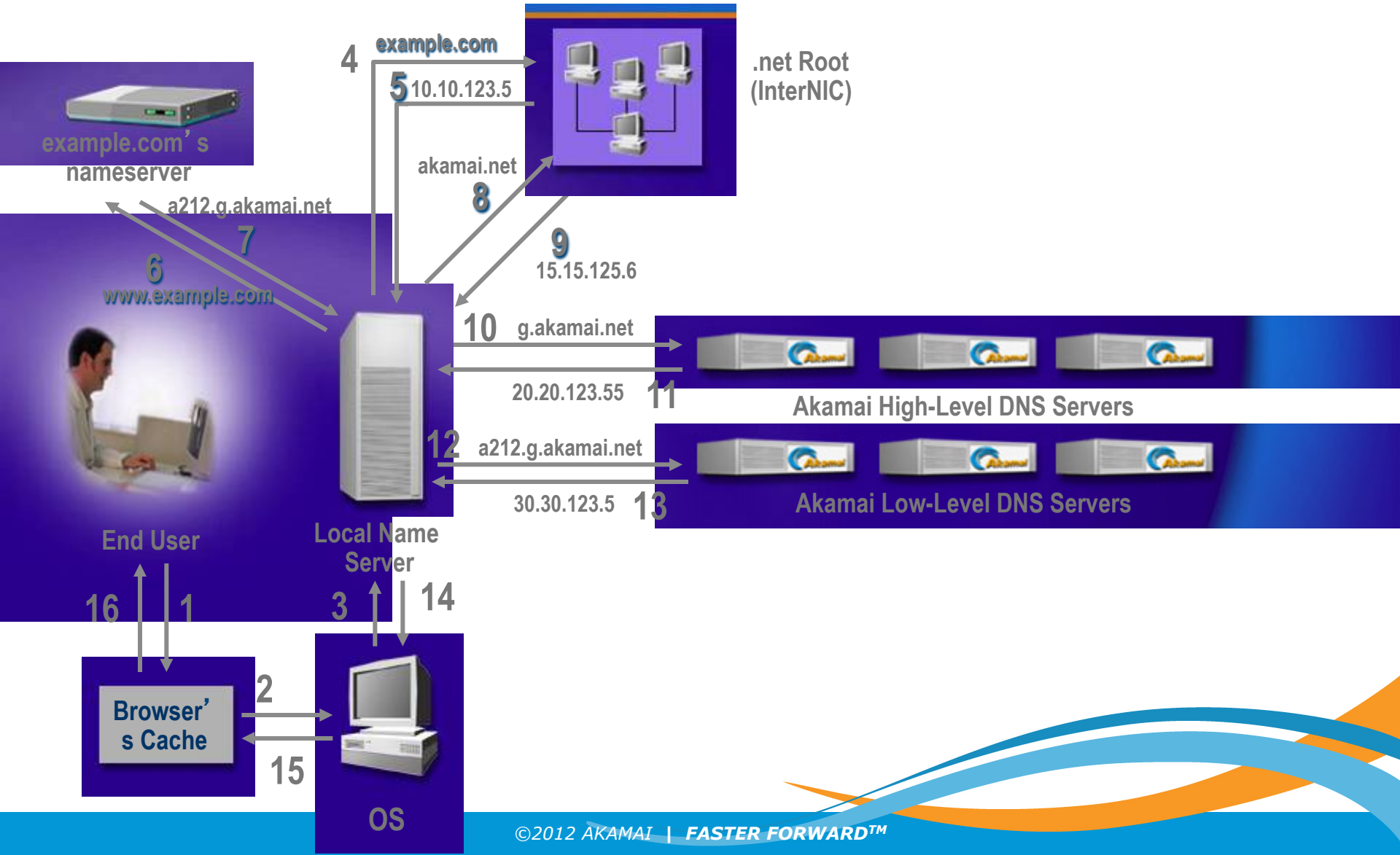
```
www.symantec.com    CNAME    e5211.b.akamaiedge.net.  
e5211.b.akamaiedge.net.  A        81.23.243.152  
e5211.b.akamaiedge.net.  A        81.23.243.145
```

# How Akamai CDN Work

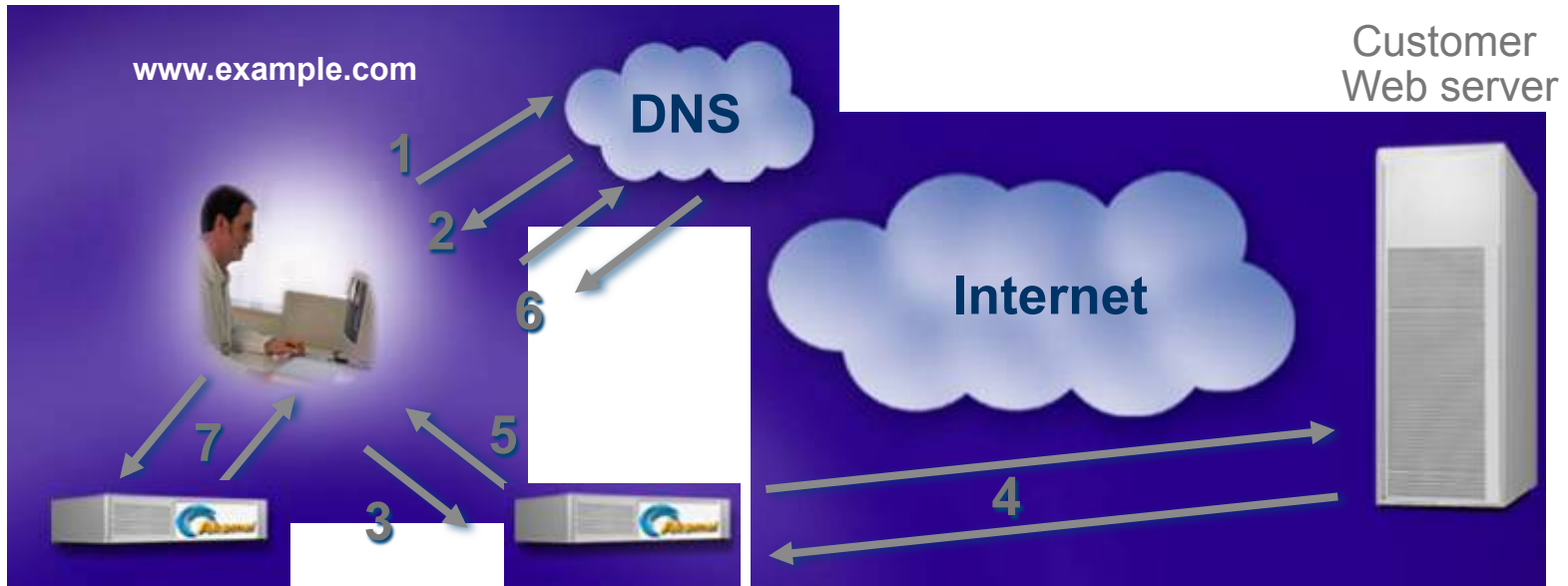
Akamai use multiple criteria to choose the optimal server

- These include standard network metrics:
  - Latency
  - Throughput
  - Packet loss
- These also include things like CPU load on the server, HD space, network utilization, etc.

# Finding the IP Address: The Akamai Way



# Downloading www.example.com with Akamai's EdgeSuite



- User enters www.example.com
- 1. Browser requests IP address for www.example.com
- 2. DNS returns IP address of optimal Akamai server
- 3. Browser requests HTML
- 4. Akamai server assembles page, contacting customer Web server if necessary
- 5. Optimal Akamai server returns Akamaized HTML
- 6. Browser obtains IP address of optimal Akamai servers for embedded objects
- 7. Browser obtains objects from optimal Akamai servers

# Peering with Akamai





# Why Akamai Peer with ISPs



The first and foremost reason to peer is improved performance

- Since Akamai tries to serve content as “close” to the end user as possible, peering directly with networks (over non-congested links) obviously helps

Peering gives better throughput

- Removing intermediate AS hops seems to give higher peak traffic for same demand profile
- Might be due to lower latency opening TCP windows faster
- Might be due to lower packet loss

# Why Akamai Peer with ISPs



## Redundancy

- Having more possible vectors to deliver content increases reliability

## Burstability

- During large events, having direct connectivity to multiple networks allows for higher burstability than a single connection to a transit provider

## Burstability is important to Akamai

- One of the reasons customers use Akamai is for burstability

# Why Akamai Peer with ISPs



## Peering reduces costs

- Reduces transit bill

## Network Intelligence

- Receiving BGP directly from multiple ASes helps CDNs map the Internet

## Backup for on-net servers

- If there are servers on-net, the peering can act as a backup during downtime and overflow
- Allows serving different content types

# Why ISPs peer with Akamai



## Performance

- Akamai and ISPs are in the same business, just on different sides
  - we both want to serve end users as quickly and reliably as possible
- You know more about your network than Akamai ever will, so working with Akamai directly can help them deliver the content more quickly and reliably

## Cost Reduction

- Transit savings
- Possible backbone savings

# Why ISPs peer with Akamai



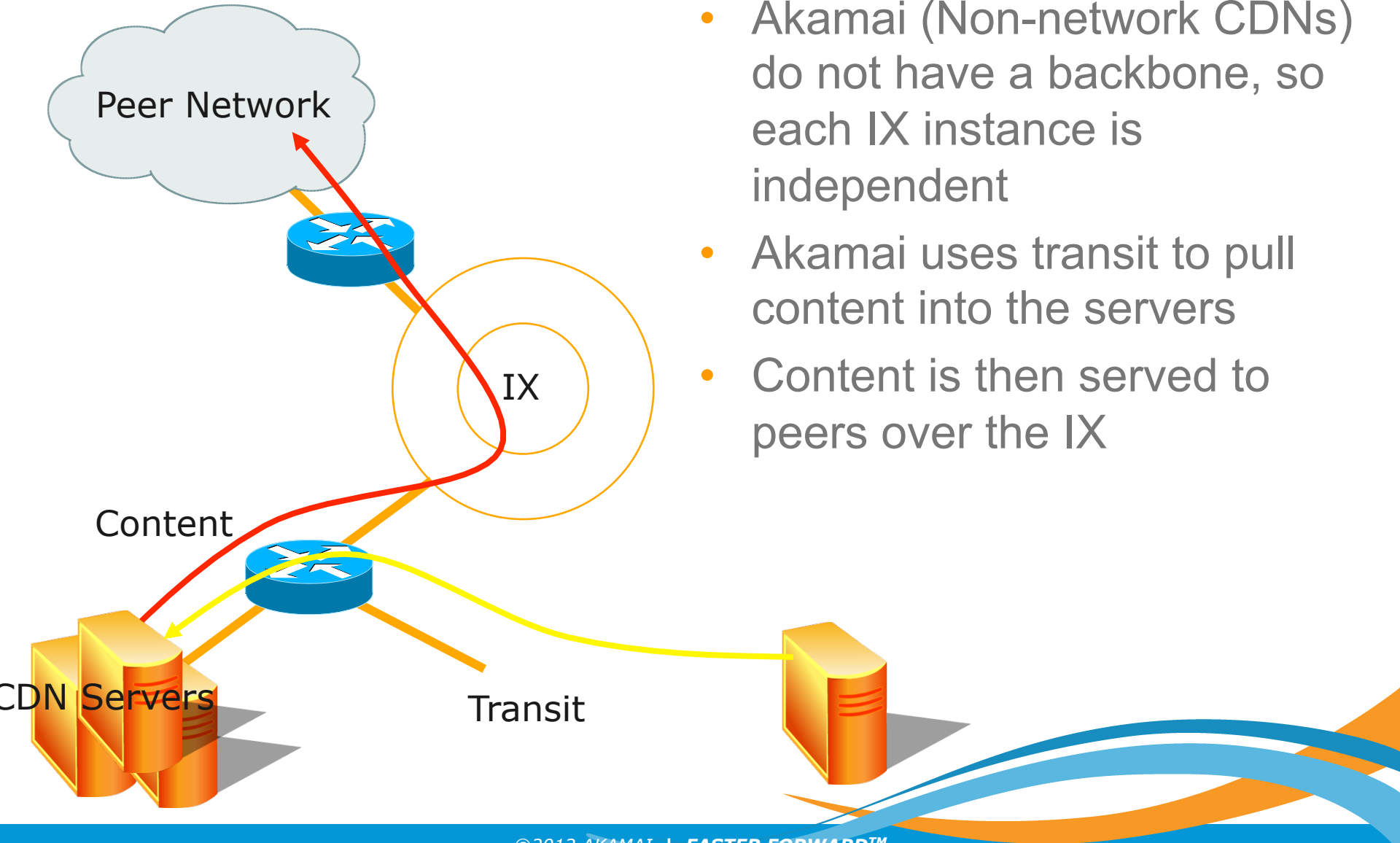
## Marketing

- Claim performance benefits over competitors
- Keep customers from seeing “important” web sites through their second uplink

Because you are nice :-)



# How Akamai use IXes



- Akamai (Non-network CDNs) do not have a backbone, so each IX instance is independent
- Akamai uses transit to pull content into the servers
- Content is then served to peers over the IX

## How Akamai use IXes

Akamai usually do not announce large blocks of address space because no one location has a large number of servers

- It is not uncommon to see a single /24 from Akamai at an IX

This does not mean you will not see a lot of traffic

- How many web servers does it take to fill a gigabit these days?

# Akamai & IPv6

World IPv6 Launch Anniversary



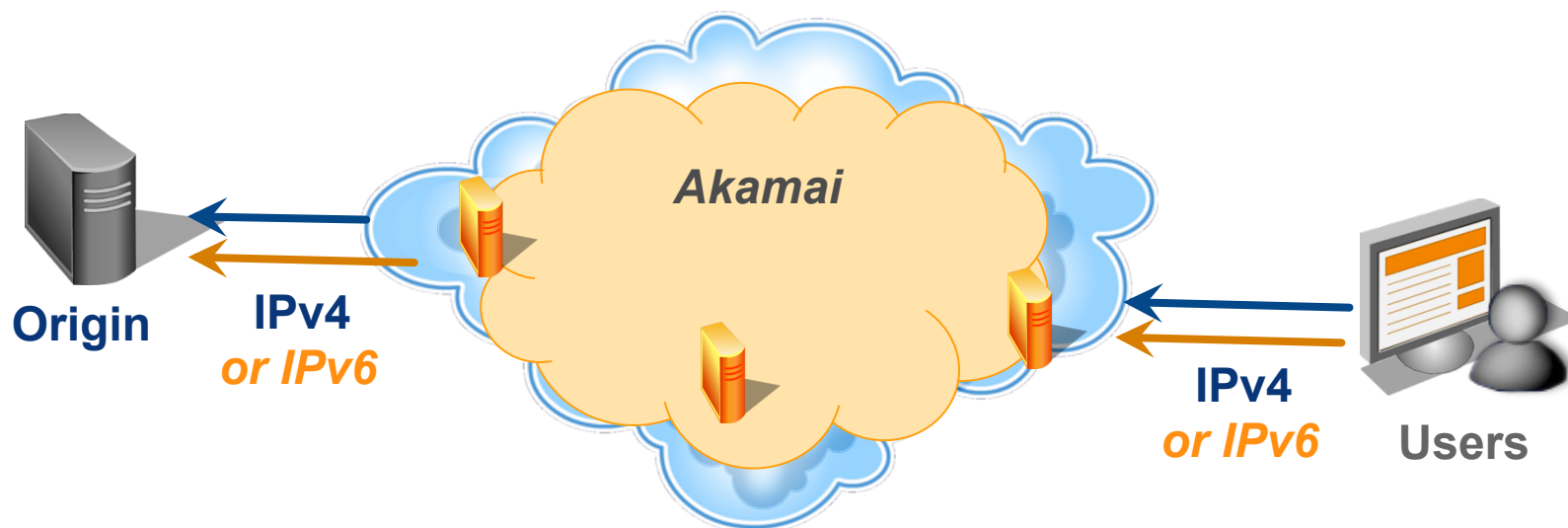
# How we enable IPv6



Dual-stacking edge servers

Customer properties can be dual-stacked

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



# World IPv6 Launch Day: deployment status



In-production serving HTTP over IPv6 to users, tried to dual-stack every server everywhere

As of 2012-06-06, IPv6 now live in...

- ... over 53 countries
- ... over 175 cities (in all continents except Antarctica)
- ... over 225 networks
- ... over 600 Akamai server locations
- ... over 37,000 Akamai servers

Compare to a total of 1070 networks in 83 countries

*(many network providers don't have working IPv6 yet, not all networks have full IPv6 routing table)*



## Current deployment status



In-production serving HTTP over IPv6 to users, tried to dual-stack every server everywhere

As of Jun 2013, IPv6 now live in...

- ... over 64 countries
- ... over 240 cities (in all continents except Antarctica)
- ... over 300 networks
- ... over 800 Akamai server locations
- ... over 70,000 Akamai servers

Compare to a total of 1150+ networks in 87 countries

*(many network providers don't have working IPv6 yet, not all networks have full IPv6 routing table)*

# World IPv6 Launch Anniversary: A closer look from Akamai

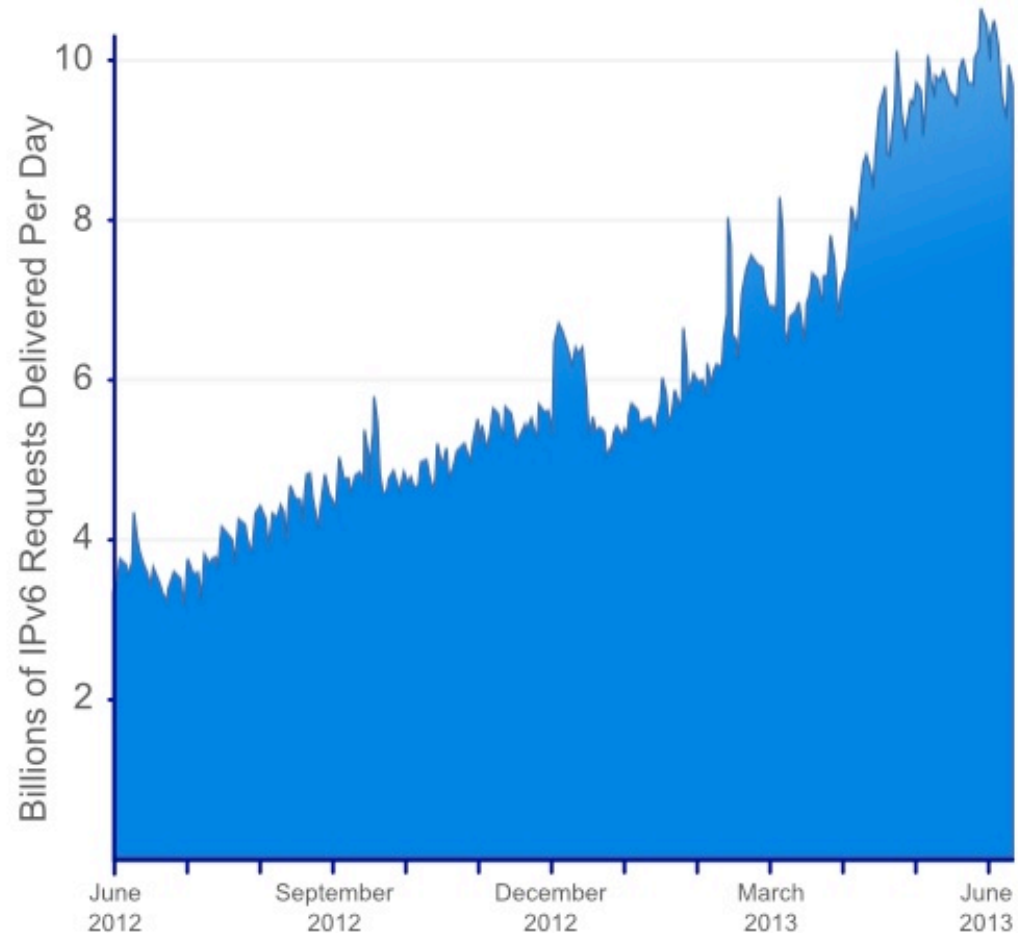


## IPv6 Addresses

- 2011: 280,229
- 2012: 18,899,253
- **67x**
- 2013: 200m – 300m
- **10x**

## IPv6 Requests/Day

- 2011: 8,343,590
- 2012: 3,394,971,156
- **460x**
- 2013: >10 billions
- **2.5x**



IPv6 Requests/Day on Akamai from June 2012 to June 2013

# World IPv6 Launch Anniversary: Observations



## Top 10 IPv6 by Geo

Country	IPv6 as % of Requests
Switzerland	10.4%
Romania	7.7%
France	4.6%
Luxembourg	3.6%
Belgium	3.3%
United States of America	3.2%
Germany	2.9%
Japan	2.1%
Peru	2.1%
Norway	1.4%

# World IPv6 Launch Anniversary: Observations



## Top 10 IPv6 by Network Provider

Network Operator	IPv6 as % of Requests	Primary Country
Verizon Wireless	34.9%	U.S.A.
Brutele (VOO)	29.7%	Belgium
Free/Proxad	18.9%	France
RCS & RDS	18.5%	Romania
Swisscom	15.8%	Switzerland
KDDI	9.9%	Japan
AT&T	8.4%	U.S.A.
Comcast	3.2%	U.S.A.
Deutsche Telekom AG	3.4%	Germany
Telefonica del Peru	2.6%	Peru

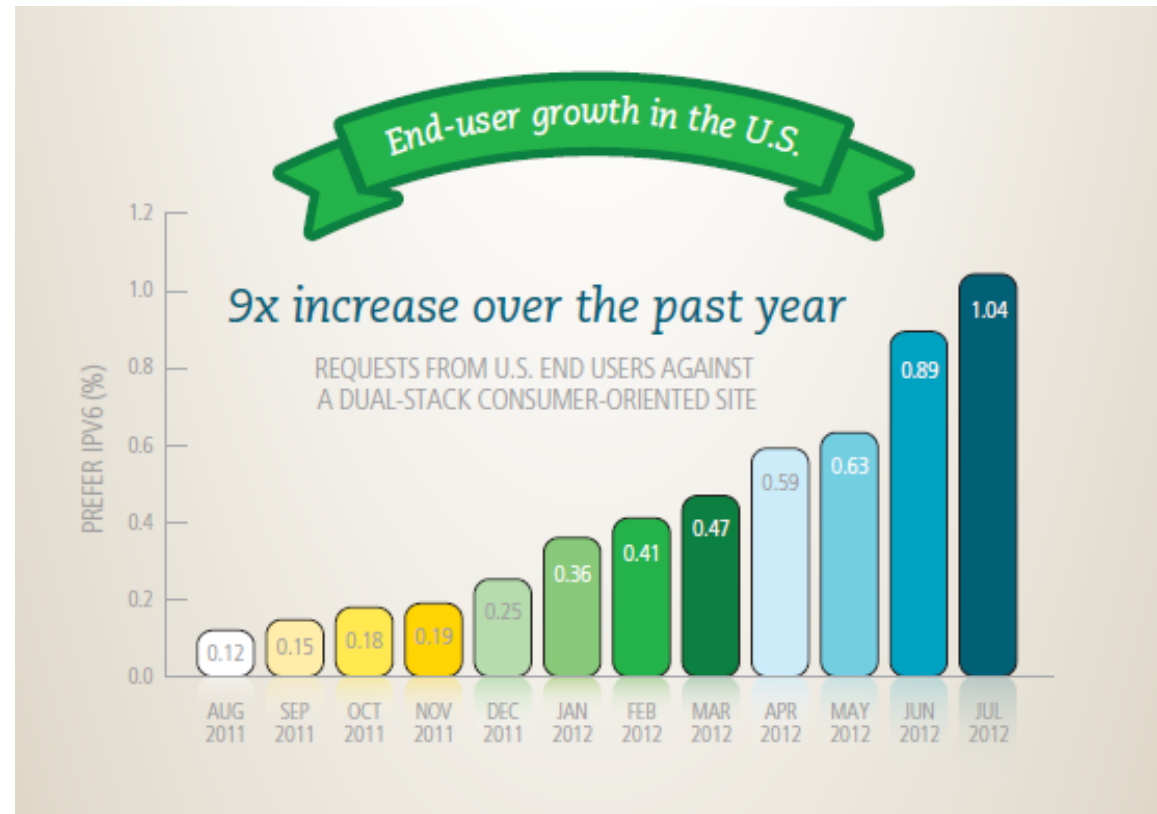
# World IPv6 Launch Anniversary: End-user growth



IPv6 requests from U.S. end users against a dual-stack consumer-oriented site.

- Jun 2012
- 900% increase over the past year (0.12%)
- 1.04% prefer IPv6

- Jun 2013
- US: 3.2%
- Global average: 1.5%
- Mobile sites: 4-9%





# World IPv6 Launch Anniversary: IPv6 and Mobile



Mobile Operating System	IPv6 as % of Requests
Windows Phone OS 8	12%
BlackBerry OS 10	5.9%
Android 4.1/4.2 ("JellyBean")	10.8%
Android 4.0 ("Ice Cream Sandwich")	3.2%
Android 2.3 ("Gingerbread")	1.6%
Apple iOS 6	1.8%
Apple iOS 5	1.4%
Apple iOS 3/4	1.1%

- using Akamai's Mobile Browser Detection for categorization
- Within Android, there are individual device types where well over 50% of the traffic to dual-stacked websites arrived over IPv6.

# World IPv6 Launch Anniversary: IPv6 and Desktop/Laptop Operating Systems



Operating System	Browser	IPv6 as % of Requests
Microsoft Windows 8		4.1%
Microsoft Windows Vista		3.3%
Microsoft Windows 7		2.5%
Microsoft Windows XP		0.5%
Mac OS X 10.5 & 10.6	Chrome & Firefox	3.4%
Mac OS X 10.5 & 10.6	Safari	3.3%
Mac OS X 10.7 & 10.8	Chrome & Firefox	3.3%
Mac OS X 10.7 & 10.8	Safari	2.1%

- Happy Eyeballs

# World IPv6 Launch Anniversary:

## Three drivers of IPv6 growth



### 1. Content availability

- Customers opting in to have their sites, content, and applications permanently available dual-stacked.

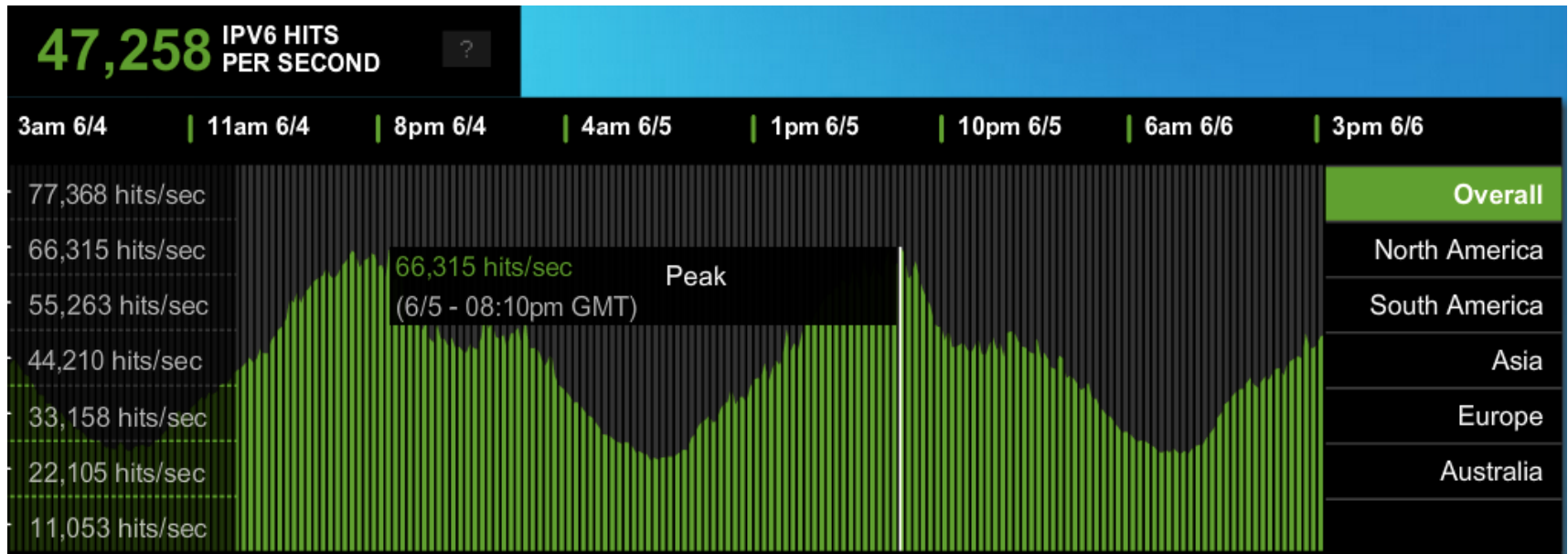
### 2. Availability of IPv6 from access network providers

- IPv6 in production networks, e.g. Verizon Wireless, AT&T, and Comcast.
- Some ISPs, Universities and Research Labs in Europe and Asia that have had IPv6 deployed

### 3. End-user device support

- Recent desktop and laptop OS and client software supports IPv6
- Many home routers / gateways start to support IPv6 recently.
- 4G LTE smart phones.

# Observations from World IPv6 Launch

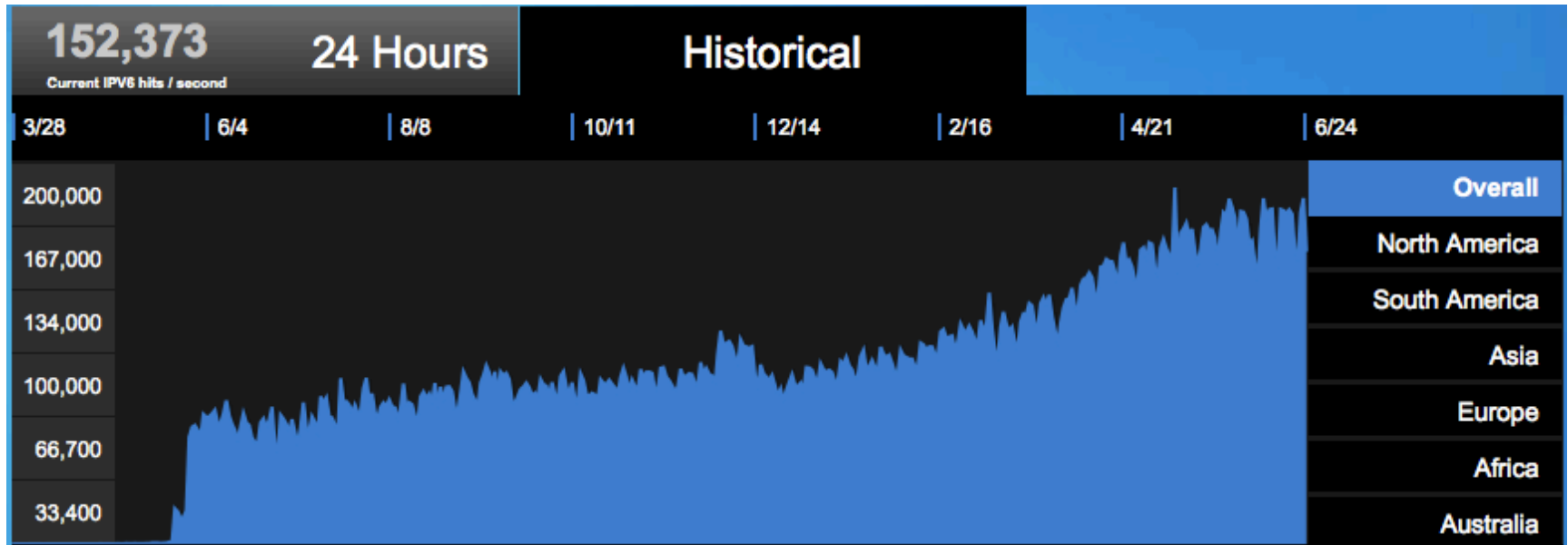


Akamai has a lot of customers on IPv6

- Over 700 US government hostnames
- Over 20 US government agencies
- 1/3 of top-30 World IPv6 Launch Day participants (by Alexa rank), etc.

Those customers who were dual-stacked before World IPv6 Launch show 0.3% to 1.5% of their traffic on IPv6

# Observations from World IPv6 Launch Anniversary



IPv6 traffic continue to growth steadily after World IPv6 Launch

- 2x customers
- 2.5x daily IPv6 requests
- 2.5x dual-stack hostnames (over 1,600 US government hostnames)
- Users upgrade their devices over the next few years
- **We really running out of IPv4!**

# Conclusions

## Summary



- **Akamai Intelligent Platform**
  - Highly distributed edge servers
  - Akamai mapping is different than BGP routing
- **Peering with Akamai**
  - Improve user experience
  - Reduce transit/peering cost
- **IPv6 traffic is still small today, but catching up**
  - Dual-stack approach
  - IPv4 is really running out!



# Questions?



Kams Yeung <[kams@akamai.com](mailto:kams@akamai.com)>

More information:

Peering: <http://as20940.peeringdb.com>

IPv6: <http://www.akamai.com/ipv6>