Akamai's V6 Rollout Plan and Experience from a CDN Point of View

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The Akamai System

The world's largest on-demand, distributed computing platform delivers all forms of Web content and applications for over 3,400 customers and 20,000 domains

The Akamai EdgePlatform:

90,000+ Servers	1,700+ POPs	950+ Networks	660+ Cities	72+ Countries

Resulting in traffic of:

5.4 Tbps peak traffic
31 petabytes / day
690+ billion hits / day
411+ million unique clients IPs / day

General IPv6 transition technologies

- Tunneling
  - encapsulates IPv6 packets inside of IPv4 packets
  - Tunneling is used to connect v6 islands with no connectivity together
  - Can cause performance and reliability issues
- CGN/NAT64
  - NAT64 provides connectivity between IPv6 hosts and IPv4 hosts by translating between IPv6 and IPv4 packet streams
  - Might cause performance issues or be a single point of failure
- Dual Stack
  - running both the IPv4 and IPv6 protocol stacks at the same machine
  - Must be supported by hard- and software
  - Requires enough IPv4 address space for all dual-stacked devices
- Each transition technology has its limitations and drawbacks, but they are necessary until the long IPv6 migration is complete.

Challenges of reaching IPv6 users via transition technologies

- Broken location-aware services
  - Caused by CGN's and Tunneling
  - Licensing content under geographic restrictions
  - *abuse mitigation*—IP blacklisting or whitelisting
  - Web site analytics relying on geo-location
- Broken applications
  - VoIP
  - Peer to Peer traffic
  - Complex troubleshooting
- Poor performance
  - Because of limited CGN deployments (latency, congestions)
  - Because of tunneling (MTU, latency)
- Worst case scenario, multiple NAT and CGN in a row

Challenges of reaching IPv6 users natively

- Delivering IPv6 natively during the transition phase will face several key challenges:
  - Often lower performance, because of less direct routes and tunnels
  - Reliability issues, because of fewer network interconnections and less monitoring
  - Denial-of-service because of browser and OS bugs, broken home gateways
    V6 end-user asks for a AAAA but has no working v6 connectivity
  - Whitelists create management and scalability challenges
    Restricting AAAA responses can cause issues, as there is no direct correlation between DNS IPv6 support and end user IPv6 connectivity.
  - Lack of IPv6 reporting and analytics
  - IPv6 "support" often does not mean performance parity with IPv4

Challenges of reaching IPv6 users natively – Performance Examples

- A test with more than 9k name servers worldwide showed:
  - For North America tests showed a median IPv4 latency of 48 ms compared to a median IPv6 latency of 87 ms
  - For tunneled IPv6 traffic, the difference in latencies was even more significant
- Download tests from www.akamai.com showed similar results:
  - The median speed via IPv4, was almost 2x faster than via IPv6.
  - Of the 4000+ clients who were able to reach us via IPv6 in this test:
    - only 10.6% of them had a native IPv6 addresses
    - the rest came over tunnels.

Akamai IPv6 Engineering: Mapping, EdgePlatform, Back End, etc.

- Native IPv6 Support in the EdgePlatform Servers and throughout the system
  - Including for example log files for our customer
- Mapping the IPv6 Internet
  - Significant effort in making the mapping system v6 capable
  - The evolving topology of the IPv6 Internet required iterative surveying and mapping efforts
- Understanding the performance differences between IPv4 and IPv6
  - Real-time mapping topology for IPv6 is independent of IPv4
  - End-user will get the content via v4 or v6 depending on which protocol has a better performance
- Making the IPv6 Internet Reliable

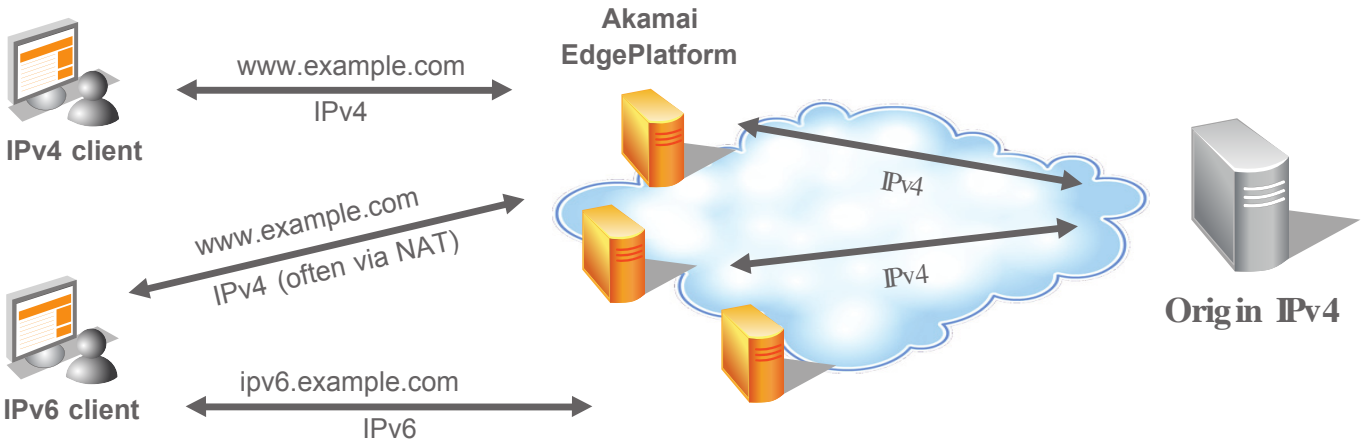
Akamai's IPv6 development: Network

- Dualstack for all IX router
  - 39 out of 48 IX routers globally are dual stack.
- Requesting IPv6 blocks from all network partners
  - Already started

Akamai's IPv6 Early Adoption Phase

- Early Adoption Phase – Q1 2011
  - Selected set of customer
  - IPv6 only site and/or beacon
  - Customers who are interested in joining should contact us.
- Akamai will enable early adopters to offer IPv6 content through a separate hostname, without changing their IPv4 networking infrastructure and without affecting existing users.
  - For example: http://ipv6.akamai.com
  - This allows customers to ensure that client IPv6 addresses work end-to-end: in their reporting, IDS, log processing, etc.
  - prior to enabling it for their full production site, but without needing IPv6 connectivity at the network level.
- Customers can offer their services on IPv6 immediately
  - Without spending time or money on training, software, hardware, etc.
  - For what is currently a small percentage of the user base
  - Gives customer time to build up expertise on IPv6 in a controlled manner

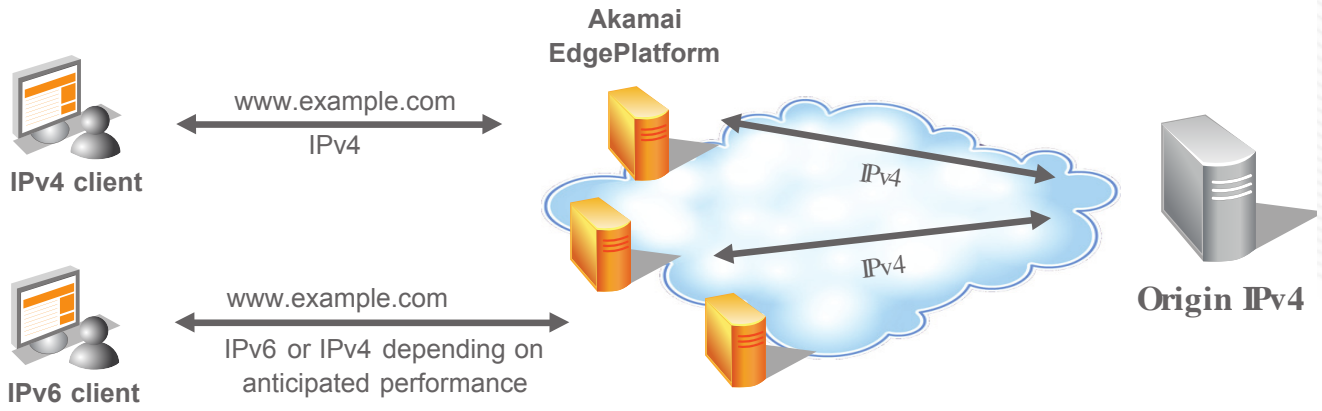
Akamai's IPv6 Early Adoption Phase



Akamai's IPv6 End User Transition Phase

- We anticipate having Beta service available in 2H 2011, with Limited Availability in 1H 2012.
- Customers will be able to deliver optimized experiences to all of their users across the hybrid Internet on a single hostname, without changing their IPv4 network infrastructure.
- Avoid CGN, tunnels, indirect routes, and other performance and reliability bottlenecks
- Example:
  - Dual stacked user makes a request to a customer site
  - Mapping system will determine if the user can be served via IPv6 or via IPv4
  - IPv6: User will receive an IPv6 or an IPv4 address of an optimal server
  - IPv4: Only an IPv4 addresses will be returned
  - customer can choose how aggressively they prefer v6 over v4

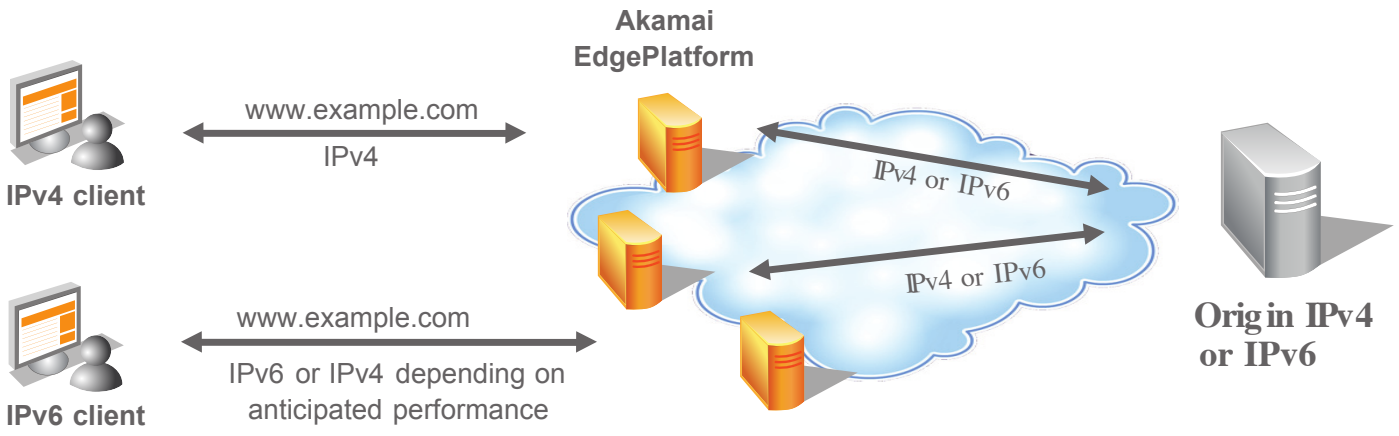
Akamai's IPv6 End User Transition Phase



Akamai's IPv6 Origin Transition Phase

- Akamai will support dual stack or IPv6 only origin infrastructures so that customers may transition their origin infrastructures when they are ready to.
- Provide seamless origin server transition to IPv6—no impact to end users

Akamai's IPv6 Origin Transition Phase



Current status

- Akamai is already delivering IPv6 traffic out of some clusters for testing purposes
  - deployment is limited but growing
  - Some advanced features are not ready yet
- IPv6 beacon on www.akamai.com to check for IPv6 capable end-users
- Supporting ISOC's IPv6 day for selective customer wishing to participate.

Experience with IPv6 – DNS / Mapping

- Handling an "IP" in our software as an abstraction
  - rather than have separate data types or separate fields for IPv4 vs IPv6).
  - This is more work up-front, but it often ends up being cleaner in the end.
- Still finding v6 bugs in Client-OS but not yet on our underlying Linux Server OS.

Experience with IPv6 – Network

- Router OS
  - No big problem with current OS version
- Configurations
  - Standard configurations
  - A lot of examples and best practices are online available
- Network Interconnects
  - Still not every transit provider can offer v6 in every pop.
  - Present at 46 IX in the world with thousands of sessions, a lot of admin / manual work to get the same connectivity like in v4.

Experience with IPv6 – IP allocation

- ARIN space:
  - 2600:1400::/27
  - Multiple discrete network policy
  - Announcing a /32 per peering or transit cluster
- RIPE space
  - 2a02:26f0::/32
  - Announcing a /48 per peering or transit cluster
- This will have an impact on the v6 routing table size
- Using a /64 - /48 per on-net deployment from the partner network

- Credits: David Belson, Erik Nygren, Matthew Levine
- URL: http://www.akamai.com/ipv6
- Questions: ck@akamai.com