



World IPv6 Day :
The CDN Perspective.
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Limelight's CDN Network

- *A Massively Provisioned, Global IP Backbone and CDN*
 - Over 100 data centers in 40+ markets
 - 40Gb/s fully-redundant backbone
 - >5Tb/s egress capacity delivering >2.5Tb/s daily
 - ~900 peers
 - Tens of thousands of content servers
 - ~10PB of storage

World IPv6 Day 2011

- A planned 24 hours *test-flight* of IPv6 on the Internet
 - DNS resolution for primary domains (e.g. www.facebook.com; www.google.com; et al) to IPv6 addresses
 - No IPv6 DNS *whitelisting*
 - June 8th, 2011 GMT 00:00-23:59
 - Participation by major Internet companies
 - Content providers (Google, Facebook, Yahoo, etc)
 - Subscriber networks (Comcast, Time Warner)
 - CDNs (Limelight and competitor)

World IPv6 Day

Why is it just one day? Why not leave it on?

- Facing *IPv6 Brokenness*:
 - Broken homes (so sad)...
 - Client applications are now often designed to have an affinity for IPv6 (thanks developers!) But what about:
 - Problem applications (non-conformance to critical RFCs like RFC3484)
 - User resolvers retrieving AAAA records while actually having no (or shabby) IPv6 connectivity
 - Home gateways configuring 6to4 connections leading to suboptimal routing
 - Rogue RAs on the LAN

World IPv6 Day (cont.)

Why is it just one day? Why not leave it on?

- *More IPv6 Brokenness:*
 - Broken networks
 - LSN: Large Scale NAT (the specter formerly known as CGN or Carrier Grade NAT)
 - Geo-location
 - TCP port exhaustion
 - The challenge of measuring IPv6 brokenness in the CDN
 - Who owns and manages the end-to-end transaction?
 - The potential CDN value proposition of detecting brokenness

The Internet's First IPv6-Ready CDN

- Limelight's Core IP Backbone as Adoption Advantage
 - Dual-stack in the core (since 2008)
 - Transit and Peering partners
 - Direct connectivity to subscriber networks
 - Globally distributed *and* site interconnected
- IPv6 at the Server Edge
 - Dual-stack at the edge since 2009
- Success! June of 2009, Netflix *Watch Instantly* over IPv6

Limelight's Participation in World IPv6 Day

(Phase 1: Making the most of the available runway)

- Architectural initiatives to achieve IPv6 parity with the IPv4 network
 - Expanding the IPv6 footprint
 - Dual-stack everywhere
 - Some address abstraction permitted given proxy caching architectures
 - Integrating an isolated IPv6 DNS architecture
 - Improving IPv6 performance
 - New or additional private interconnects with subscriber networks
 - Shortest path to content-requesting IPv6 clients

Limelight's Participation in World IPv6 Day

(Phase 1: Making the most of the available runway)

- Identifying interested customers – both existing and new
- The planning and non-intrusive provisioning of IPv6 services
 - Delivering AAAA records for *sidecar* domains (e.g. ipv6.acme.com/earthquakepills)
- Preliminary testing
 - Methodologies and measuring infrastructure to determine performance variance

Limelight's Participation in World IPv6 Day

(Phase 2: Maximizing the value of flight time)

- Anticipating issues
 - Performance at scale
 - The CEO's cable modem
 - Asymmetrical routing
- Bugging out: preparing for the worst
 - Panic button: "Stop the World [IPv6 Day], I want to get off."
 - AAAA record TTL tuning
- Measure, measure, measure...
 - Volumes of traffic and subsequent load on infrastructure – both logical and physical

Limelight's Participation in World IPv6 Day

(Phase 3: Analyzing the outcome and next steps)

- ISOC
 - LLNW hosted the ISOC v6 day site
 - v6 as % of v4 : 0.53% on v6 day,
 - Compared with 0.46% prior
- NASA (caib.nasa.gov)
 - v6 as % of v4 : 22% on v6 day,
 - Compared with 0% prior, and about ~20% subsequently
 - Universities ? R&E ?
- Overall
 - 200K v6 http object requests, (about 0.0003% of total requests)
 - 3 Mbps sustained traffic with a peak at 9Mbps

Limelight's Participation in World IPv6 Day

(Phase 3: Analyzing the outcome and next steps)

- Some specific Problems on the Day
 - MTU Hole in a carrier (server sends ACK but no data) – possibly related to their 6PE use ?
 - Some Asymmetrical Routing
 - Some external software not patched
 - A router missing a default route
- Before the Day
 - All edge machines (Linux, Windows) verified to dual stack (not just the network)

Limelight's Participation in World IPv6 Day

(Phase 3: Analyzing the outcome and next steps)

- The scale problem revisited
 - Identifying validated systems that failed or performed suboptimally
 - Network hardware
 - Stateful devices: load balancers/ALGs/firewalls
 - Addressing IPv6 routing performance
 - Addressing suboptimal routing
- Organizational focus
 - Identifying organizational critical path(s)
 - Preparing for longer/permanent adoption interval
 - Opt-out for v6 on the customer side.

Questions?

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