



HURRICANE ELECTRIC  
INTERNET SERVICES

# Lucy in the Sky with IPv6

Conversations of v6 solutions, trends,  
tests, & results.

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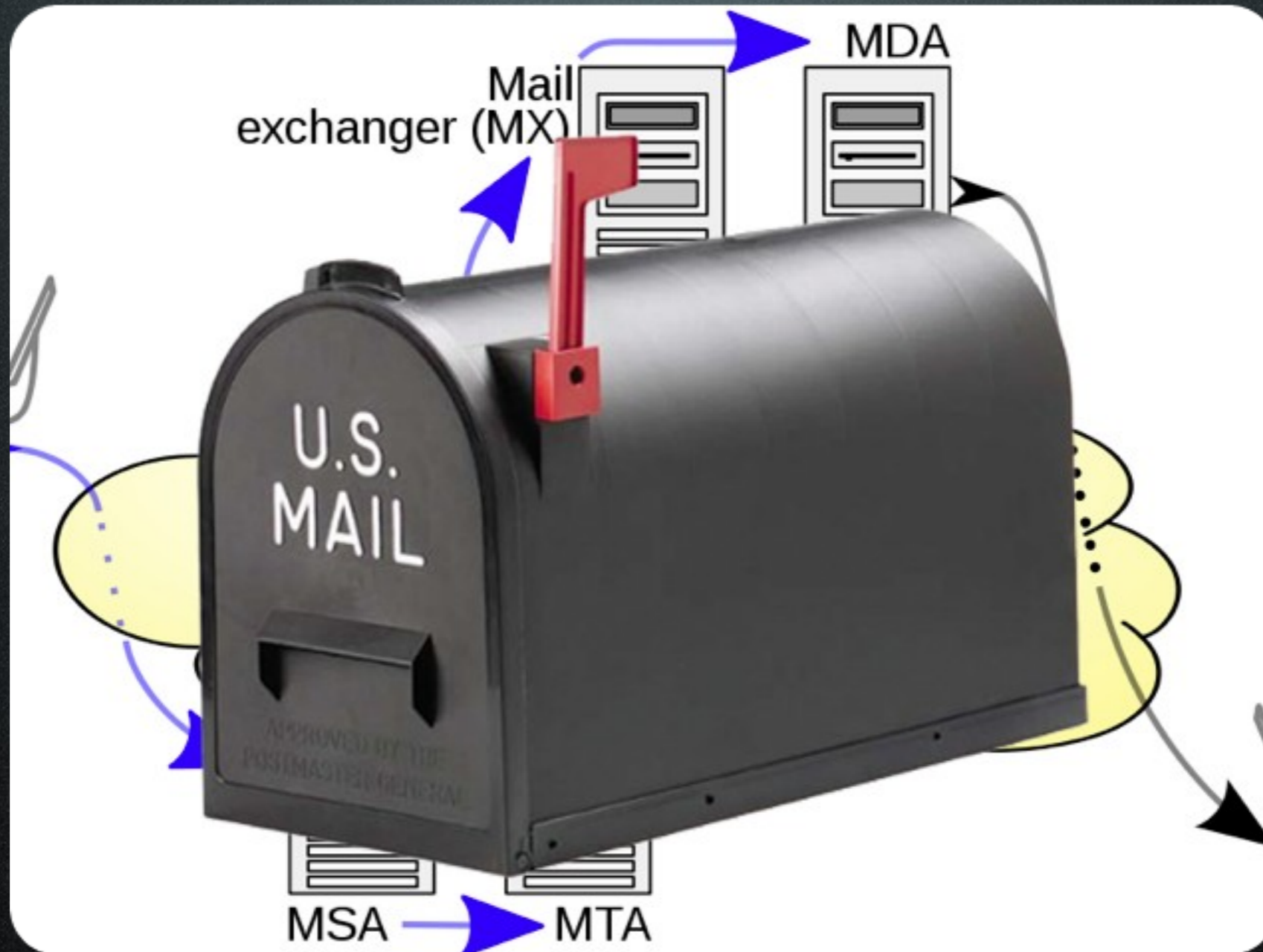


# hurricaneelectric hurricaneelectric hurricaneelectric

- IPv6 news and current affairs
- average 1500 views per webcast
- weekly videos for past 9 months
- enabled lots of **conversations**







SMTP on IPv6?



# Dual-stacked MX records

- Publish AAAA records for *MX*?
- Anyone turn it on for World IPv6 Day?
- *How far away* from moving SMTP to IPv6 -- 1 year? 2 years? More?



# Dual-stacked MX records

- Hurricane Electric recommends moving SMTP to v6 **early on**.
- Grey-listing, black hole listing (RBLs), and filters can be effective spam management



# Dual-stacked MX records

- Lots of disagreement. Reasons to stay v4:
  - ✦ mail doesn't need a lot of IP addresses
  - ✦ doesn't need end-to-end connections
  - ✦ might be difficult to migrate services
- Wait till anti-spam & anti-abuse quality is “as reliable or better” than IPv4



# Dual-stacked MX records

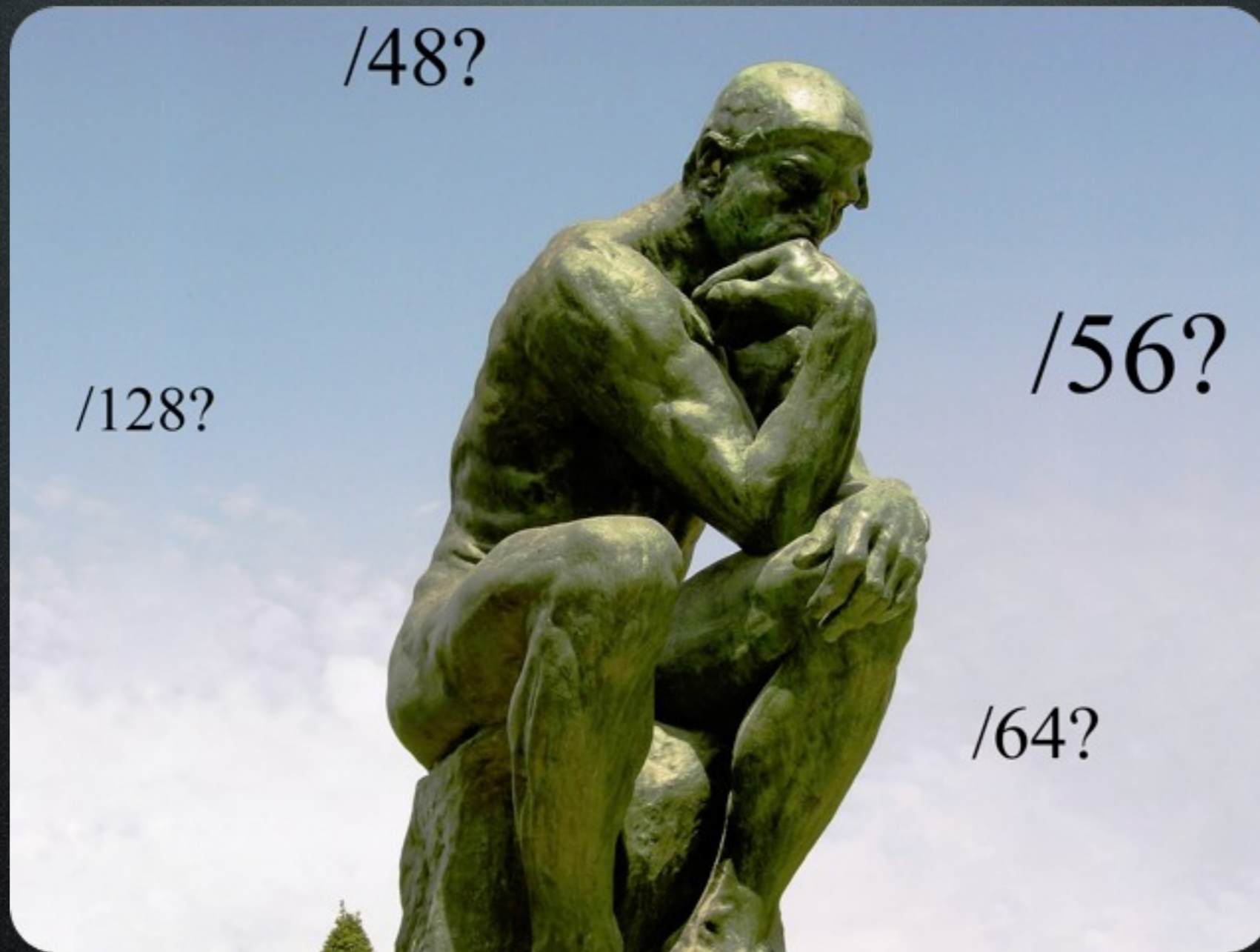
- RBL/IPv6 issues:
  - ✦ no production quality solution?
  - ✦ without drops from reputation-based RBLs, **will other filters suffer** performance issues?
- More requests from customer base.
  - ✦ Justifying /24 requests with “mail reputation” concerns now requesting /48s or /64s.
  - ✦ Still, most MXes **aren't listening** over IPv6.



# Dual-stacked MX records

- One of the tests for HE's IPv6 certification is to send and receive mail over v6.
- Anecdotally, many success stories regarding enabling AAAA records and [not experiencing issues](#) fighting spam.
- Spamhaus released IPv6 blocklist strategy on June 6th for DNSBL
- The future of legitimate mail vs. spam is hard to anticipate; such little use of SMTP over IPv6 as of yet.





What size netblock to  
assign end users?



# Residential End User Allocation

- How many delegate /48s?  
/56s?  
/64s?  
/128s?
- RFC 3177 vs. RFC 6177



# Residential End User Allocation

- RFC 6177:
  - ✦ Addresses must aggregate and **scale well**.
  - ✦ No one should have to use address **conservation** techniques like bridging for v6 unless they want to.
  - ✦ Shorter prefix sizes allow for **ease of renumbering** (without renumbering into a smaller subnet).
  - ✦ **rDNS management** is simpler when all links have the same subnet IDs.
  - ✦ Must support any type of **growth**.



# Residential End User Allocation

- Problem #1:

Is giving out /48s  
really **wasteful**?



# Residential End User Allocation

- There are **eight /3s** of v6 space. We're using one of them.
- **512 /12** netblocks for the RIRs.
- Each RIR /12 block gives us a **million /32s**.
- There are **65.000 /48** netblocks in each /32.
- Each /12 to an RIR can give /48s to over **68 billion end sites** or residential end users.



# Residential End User Allocation

- For this /3 we're using, assume each of the 5 RIRs gets an average of about 100 /12s.
- Each RIR then gets about 7 trillion /48s (1600 times the size of the entire v4 address space).
- That's **just the first /3**; can adjust policy later if need be.
- Much more will be possible with an automatic, more complex network topology. Don't use v4 thinking with v6.



# Residential End User Allocation

- Problem #2:

Does giving out /48s  
increase the potential  
for **spam** over v6?





Dual-stack timeout  
solution: turn off v6?



# Help fix my IPv6

- Microsoft FixIt [de-preferences](#) IPv6 until after World IPv6 Day.
- Facebook help page recommends [turning off](#) IPv6 if you can't access FB.
- Even ARIN's v6 wiki ends with turning off v6.



# Help fix my IPv6

- Dual-stacking white screen of death.
- he.net probably sees more than the average amount of timeouts. Why? Tunnel Broker users.
- “Turning off IPv6” in Mac OSX doesn’t affect a tunnel.



# Help fix my IPv6

- Update, update, update (OS, browser, gateway). Disable tunnels.
- Switch to [Google Chrome](#)?
  - ✦ reduces brokenness by 80%
  - ✦ implements a variant of parallel connect that reduces latency of broken IPv6 connections.
  - ✦ fallback socket connect - 300ms to connect to IPv6, launches second v4 connect. Uses socket that connects first.



```
Terminal — bash — 87x34
Chris-Van-Fossens-MacBook:~ Chris$ dig aaaa www.ipv6.apple.com +short
www.ipv6.apple.com.edgesuite.net.
a123.dsg1.akamai.net.
2001:680:12:320::3e29:1222
2001:680:12:320::3e29:1230
Chris-Van-Fossens-MacBook:~ Chris$
```

Multiple AAAAs?



# Multiple AAAAs

- Multiple DNS records (A & AAAA) is fairly common
- Some clients (Opera 11.10 & newer, some of IE 6/7/8) break, sleep, timeout, or give up with multiple AAAAs in certain networks.
- Occasionally doesn't fall back to IPv4.



# Multiple AAAAs

- The goal of W6D is to test **long-term**, permanent solutions.
- Whatever is turned on today should be **capable of being left on** (no lower MTU, no DNS whitelist, no limit of AAAA records returned).
- Common part of load balancing solutions that include DNS, so CDNs not anticipating future limits.



OH MY WORD,  
I DON'T THINK YOU UNDERSTAND...



I FREAKING **LOVE** IPV6

Full additions

to the v6 space

to the v6 space

to the v6 space



# ipv6.blizzard.com



The screenshot shows the top navigation bar of the Blizzard Entertainment website. The logo is on the left, and navigation links for GAMES, COMPANY, COMMUNITY, SUPPORT, and STORE are on the right. A search bar is also present. Below the navigation bar, the page title "IPV6 DAY FAQ" is displayed. The main content area contains five FAQ items, each with a question and an answer. The answers provide details about World IPv6 Day, the challenges of IPv6 adoption, and the specific Blizzard games and services that will be accessible on that day.

**BLIZZARD**  
ENTERTAINMENT

Search Blizzard.com

GAMES COMPANY COMMUNITY SUPPORT STORE

## IPV6 DAY FAQ

**Q: What is World IPv6 Day?**  
A: World IPv6 Day, taking place on June 8, 2011, is a day when many companies that have a major presence on the Internet are going to allow people to connect to their networks using IPv6, a next-generation Internet protocol. Blizzard will be participating in this event by enabling a select number of World of Warcraft realms to be accessible using IPv6. For more information on World IPv6 Day, see <http://iaoc.org/wp/worldipv6day/>.

**Q: What does Blizzard hope to accomplish by taking part in IPv6 day?**  
A: Before the Internet can fully support IPv6, a great deal of preparation and effort is required to deploy the infrastructure upgrades necessary. Internet providers will need to update routers and back-end services, software companies will need to update their software, and consumers will need to update their home routers. Since the number of available IP addresses under IPv4 has reached its limit, adoption of IPv6 is likely to accelerate significantly over the next year. World IPv6 day is designed as a small step toward upgrading to IPv6, and we view it as an opportunity to learn about some of the issues and challenges we'll be facing along the road to upgrading the entire Internet to IPv6.

**Q: Why is Blizzard participating in IPv6 day?**  
A: As a company that relies heavily on the Internet, we want to do everything we can to prepare for IPv6 and learn about what sorts of issues we can expect to face as IPv6 becomes widely used. We also think IPv6 is cool, and want to do our part in supporting getting the Internet upgraded.

**Q: What is IPv6?**  
A: IPv6 is the next-generation protocol for driving the Internet. The world has run out of IPv4 addresses, and while there are workarounds and various ways to continue to work with the existing protocol in the meantime, IPv6 provides a much better long-term solution.

**Q: Which Blizzard systems are going to be participating in World IPv6 Day?**  
A: On World IPv6 Day, players will have the option to connect to the following North American World of Warcraft realms using IPv6. All other Blizzard games services, including StarCraft II, all other World of Warcraft realms, authentication services, and our websites, will still be accessible using IPv4 only.

- Antonidas
- Anub'arak
- Blackwater Raiders
- Bladefist
- Borean Tundra



updated 9:23 p.m. EDT, Mon June 6, 2011

Make CNN Your Homepage



### Rep. Weiner admits lying about tweet, won't resign

Rep. Anthony Weiner apologized for falsely claiming his Twitter account was hacked after a lewd photo showed up. He admitted other inappropriate online relationships. [FULL STORY](#)

- "Don't know what I was thinking"
- Democrats turn up pressure on Weiner
- Send reaction | 16 political sex scandals
- Comedian: Weiner 'creepy'

### Unrest in the Arab world

- Clashes in Yemen; Saleh fate uncertain
- Syrian TV: 129 security forces killed
- Alleged Libya rape victim in Romania

### Other news

- Santorum announces presidential bid
- Romney: Palin was 'best thing' for me
- Ticker: Obama economist back to class
- Winds may blow fires across Arizona
- 3 Japan nuclear reactors melted down
- Children die from mystery 'nodding'
- Scientist testifies in Anthony trial
- Obama to pay traffic congestion fee?
- Opinion: U.S. can break oil addiction
- Will Katie Couric kill 'General Hospital'?
- Witherspoon slams 'sex tape' stars
- 'Golden Girls' theme writer dies
- Live analysis of MLB draft
- USC stripped of 2004 BCS title
- This Just In: CNN's news blog

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### Congress not riding to the rescue

More Americans are looking for jobs, and the housing market is in a confirmed double dip. In another time, lawmakers might have responded with economic stimulus measures, CNNMoney reports. [FULL STORY](#) | [ZAKARIA: ACT FAST](#)

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 Anticipating the tastes of summer	 Sister: Kim bloated, not pregnant	 Microsoft to put live TV on Xbox 360

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# www.xbox.com

The screenshot shows the Xbox.com website homepage. At the top, there is a navigation bar with the Xbox logo on the left, a search bar in the center, and links for 'United States', 'Support', 'Free XBOX LIVE', 'Join Now', and 'Sign In' on the right. Below this is a secondary navigation menu with links for 'Xbox 360 + Accessories', 'Xbox LIVE', 'Games + Marketplace', 'Community', 'My Xbox', and 'KINECT'. The main content area is dominated by a large banner for 'XBOX @ E3' with the dates 'June 6-9, 2011' and the slogan 'The future of entertainment starts TODAY!'. Below the banner is a video player with a 'Download Silverlight' button and a note about upgrading to the latest version of Silverlight. Underneath the video player are four promotional tiles: 'Xbox @ E3', 'New on Xbox LIVE', 'Halo CE Anniversary', and 'Out Now!'. Each tile includes a brief description and a 'Learn More' link. At the bottom of the page, there is a footer with links for 'Support', 'Press', 'For Developers', 'Games for Windows', 'Jobs', and 'Feedback', along with 'Privacy Statement', 'Xbox.com Terms of Use', 'Code of Conduct', and 'About Our Ads'. The Microsoft logo is visible in the bottom right corner.

United States • Support

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## XBOX @ E3

June 6-9, 2011

The future of entertainment starts TODAY!

Download Silverlight To view this video upgrade to the latest version of Silverlight.

Xbox @ E3

New on Xbox LIVE

Halo CE Anniversary

Out Now!

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Available Holiday 2011.

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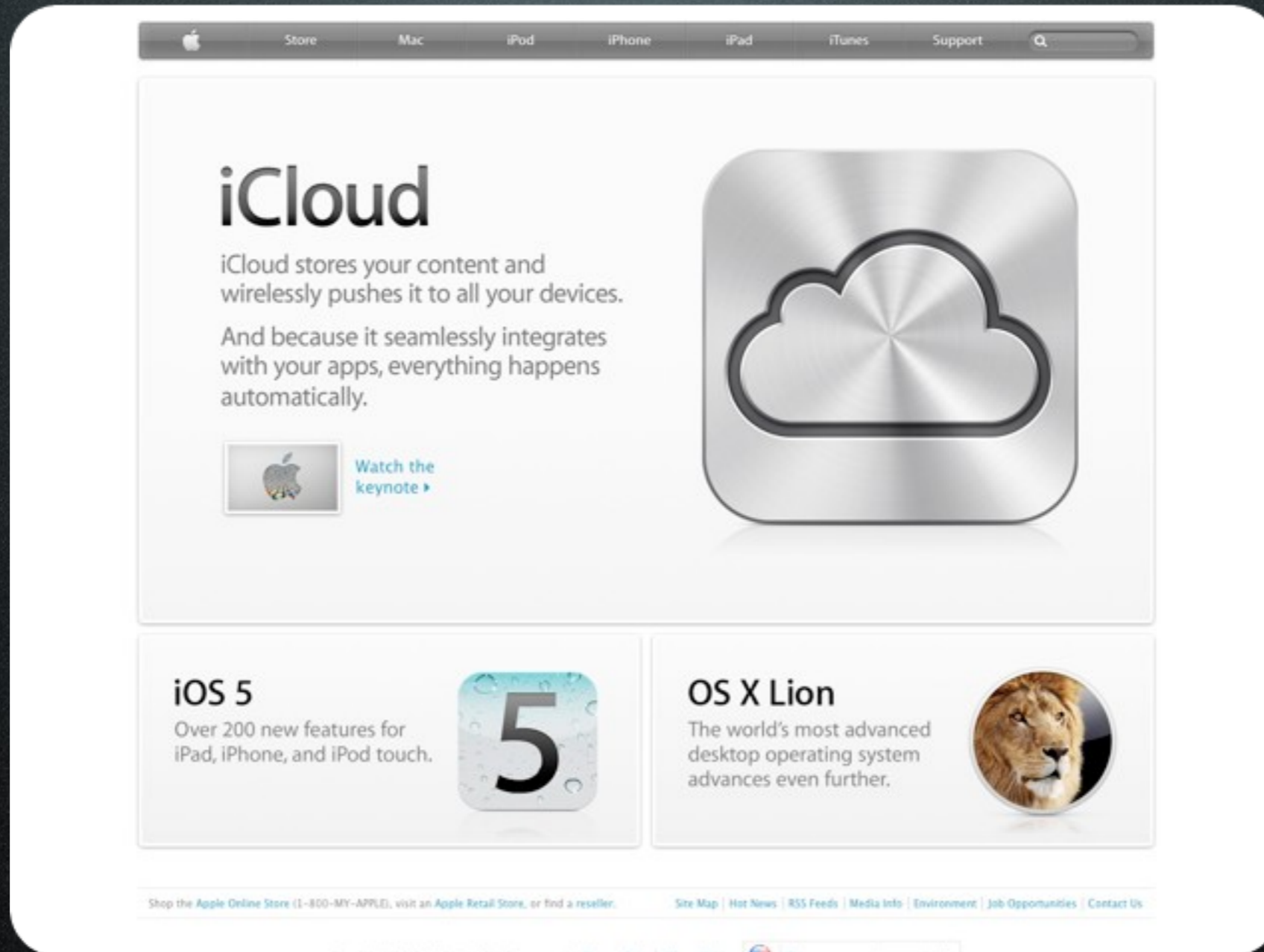
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Microsoft





www.ipv6.apple.com



# dlink.com

The image shows a screenshot of the D-Link website homepage. At the top left is the D-Link logo. To its right are navigation links: "Build Your Network", "Find Your Product", and a "Product Quick Find" dropdown menu. Further right is a search bar labeled "Search D-Link". On the far right of the top navigation bar is a language selector for "United States (change)".

Below the top navigation is a secondary menu with categories: "Home & Home Office", "Small & Medium Business", "Large Business", "Government & Education", "Support", and "Company & Press".

The main content area features a large banner for the "D-Link ShareCenter™" network storage device. The banner includes an image of the device (model DNS-325) on the left, with the text "D-Link ShareCenter™" and a "Learn More >" link on the right. The background of the banner is dark with glowing yellow musical notes and a photo of a family.

Below the banner is a horizontal navigation bar with six categories: "Networking", "Network Storage", "Home Networking", "Switching", "Network Cameras", and "Internet S...". Each category has a corresponding icon.

At the bottom of the page is a footer with social media icons (Facebook, Twitter, YouTube) and the text "Connect:". To the right of the social media icons is the copyright notice: "Copyright © 2011 D-Link Corporation/D-Link Systems, Inc. | Terms of use | Privacy Policy | Contact Us | Careers".



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is about

**content** over v6

not

**access** over v6





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