ATT Video about IPv6

http://www.att.com/esupport/ipv6.jsp#fbid=evN7qmJQr0u
Every computer on a network has an address.

Many competing protocols used in 1960’s and 70’s by Dept. of Defense, Schools, etc.

ARPANET, Aloha Network, ARCNET

TCPv1, TCPv2, TCPv3 and IPv3

TCPv4 and IPv4 (1977)

(IPv5 was a testing protocol not publicly used)

IPv6 or TCP/IPv6 (1995)
PACKET SWITCHING

- Packets ("Envelopes" in Video)
  - Header (different for different IPvs)
  - Data
- Addressing
- Routing
- Clients
## Comparing IPv4 and IPv6

<table>
<thead>
<tr>
<th>Item</th>
<th>IPv4</th>
<th>IPv6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address Length</td>
<td>32 bits</td>
<td>128 bits</td>
</tr>
<tr>
<td>Number of Addresses</td>
<td>4.3 Billion</td>
<td>340 Undecillion (3.4 X 10^{38})</td>
</tr>
<tr>
<td>Domain Name Services</td>
<td>DNS</td>
<td>DNS</td>
</tr>
<tr>
<td>Client Address Assignment</td>
<td>Static IP</td>
<td>Static IP</td>
</tr>
<tr>
<td></td>
<td>DHCP</td>
<td>DHCP6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stateless Address Autoconfiguration</td>
</tr>
<tr>
<td>Typical Addresses per Client</td>
<td>1</td>
<td>2+</td>
</tr>
</tbody>
</table>
IPv6 Addressing

- World Launch: June 6, 2012
- IPv6 addresses (Hexidecimal notation)
  - 0:0:0:0:0:0:0:0 to ffff:ffff:ffff:ffff:ffff:ffff:ffff:ffff
  - 128 bits in 8 “hextets”
  - Roughly $3.4 \times 10^{38}$ (340 undecillion) addresses
  - E.G. Google.com:
SHORTENING IPV6 ADDRESSES

- Initial address: 2001:0db8:0000:0000:0000:ff00:0042:8329
- After removing all leading zeroes: 2001:db8:0:0:0:ff00:42:8329
- After omitting consecutive sections of zeroes: 2001:0db8::ff00:0042:8329
- After doing both: 2001:db8::ff00:42:8329
ADDRESS FIELDS

- 128 bits
- Leftmost 48 bits generally assigned to company, etc.
- Next 16 bits for subnet designation
- Right 64 bits for individual devices.

<table>
<thead>
<tr>
<th>2607:f8b0:400a</th>
<th>:801</th>
<th>:0:0:0:1003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company, etc.</td>
<td>Subnet</td>
<td>Device</td>
</tr>
</tbody>
</table>

2607:f8b0:400a:801::1003
IPV6 ADDRESSING

- There are 3 ways of addressing:
  - unicast (single)
  - multicast (group)
  - broadcast (many, not implemented)
- Link-Scoped Unicast (Linked-Local) fe80:******
- Site-Local: fec0:******
- Loopback ::1 (like 127.0.0.1)
- Present Unicast Addresses: 2xxx: ....
ADVANTAGES OF IPV6

- So many addresses that everything can have it’s own address. You can have $2^{64}$ devices for an IP assignment.
- Useful for things like home automation from big companies like Comcast.
- Easy to address appliances, etc. (NAT port forwarding not necessary).
- Don’t need NAT any more (but can have it).
- Easier to route worldwide.
- IP packets have bigger header but faster in routing.
- IPSec built into IPv6
DISADVANTAGES OF IPV6

- Embryonic, “Version 1.0”
- Hard to get now and implementations vary.
- Firewall rules get to be interesting, especially without NAT.
- IT Pros, Tech supports, etc. don’t know much about it.
- Most existing home routers can’t deal with it, need to buy new equipment.
DISADVANTAGES OF IPV6

- Routers that can do IPv6 don’t do it uniformly (may or may not work with your isp’s IPv6).
- Many different ways of having a computer/device getting an address:
  - Static IP
  - DHCP6
  - SLAAC/RA (Router Advertisement)
Windows Vista, 7 and 8 give priority to IPv6, if available. (can be changed via registry hack)
Windows XP, can be implemented
iPhone (IOS 4.1 and higher)
Windows Phone (6.5, not 7.5)
Android (4.2 jellybean), partial (no DHCP6)
Mac OS X (10.7 Lion)
Most Linux and BSD versions.
HOW DO I GET IPV6?

- Provided by your ISP
  - Comcast, June 2013 (?), dual stack IPv4 and IPv6.
  - AT&T (It’ll be ready when you need it....)
- Several tunneling techniques (e.g. Hurricane Electric) that use IPv4 connection to carry IPv6 traffic
- Need router that supports IPv6 on your ISP
DOCSIS Device Compatibility and Capability

This site provides a list of all currently approved cable modems and EMTA devices. Use this site to ensure your device is compatible with the service level that you subscribe to. For additional information on End of Life (EOL) devices, please review the EOL FAQs.

Comcast strongly recommends customers only purchase devices that include a warranty and/or return policy. Cable modems and EMTAs operate with firmware/software and could make the device defective and inoperable if compromised in any way.

- Click here to purchase a new DOCSIS 3.0 modem
- Click here for details of where to purchase a new Telephony modem

Home Gateway Devices

The following list of devices are recommended by Comcast for use as part of our IPv6 enabled broadband services. These devices along with the corresponding firmware have been tested in Comcast labs and are known to be compatible. While other devices may also be compatible we strongly recommend the use of devices we have tested. This will help to ensure you have a consistent broadband experience throughout the IPv6 transition.

It is important that you pay close attention to the notes that pertain to each of the listed devices. We will document important information and recommendations for each in this area.

For more information about Comcast’s IPv6 transition planning please visit our IPv6 Information Center:

http://www.comcast6.net/

<table>
<thead>
<tr>
<th>Vendor</th>
<th>Model</th>
<th>Firmware</th>
<th>Vendor Link</th>
<th>User Guide</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>D-Link</td>
<td>DIR 555</td>
<td>2.63NA</td>
<td><a href="http://dlink.comus/en/home-s">http://dlink.comus/en/home-s</a>...</td>
<td>![ ]</td>
<td>![ ]</td>
</tr>
<tr>
<td>D-Link</td>
<td>DIR 325</td>
<td>2.06NA</td>
<td><a href="http://dlink.comus/en/home-s">http://dlink.comus/en/home-s</a>...</td>
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<td>![ ]</td>
</tr>
<tr>
<td>D-Link</td>
<td>DIR 327</td>
<td>v1.04</td>
<td><a href="http://www.dlink.com/us/enisu">http://www.dlink.com/us/enisu</a>...</td>
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<td>![ ]</td>
</tr>
<tr>
<td>D-Link</td>
<td>DIR 557</td>
<td>v1.01</td>
<td><a href="http://www.dlink.com/us/enisu">http://www.dlink.com/us/enisu</a>...</td>
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<td>![ ]</td>
</tr>
<tr>
<td>Linksys</td>
<td>E4200v2</td>
<td>2.0.36</td>
<td><a href="http://homestore.cisco.com/en">http://homestore.cisco.com/en</a>...</td>
<td>![ ]</td>
<td>![ ]</td>
</tr>
<tr>
<td>Netgear</td>
<td>WNR1000v2</td>
<td>1.12.54</td>
<td><a href="http://support.netgear.com/pr">http://support.netgear.com/pr</a>...</td>
<td>![ ]</td>
<td>![ ]</td>
</tr>
<tr>
<td>Netgear</td>
<td>WNDR4500</td>
<td>1.0.120</td>
<td><a href="http://support.netgear.com/pr">http://support.netgear.com/pr</a>...</td>
<td>![ ]</td>
<td>![ ]</td>
</tr>
<tr>
<td>Apple</td>
<td>Airport Extreme</td>
<td>7.5.2 or better</td>
<td><a href="http://www.apple.com/airports">http://www.apple.com/airports</a>...</td>
<td>![ ]</td>
<td>![ ]</td>
</tr>
<tr>
<td>Asus</td>
<td>RT-N66U Dark Knight</td>
<td>3.0.0.4.270</td>
<td><a href="http://www.asus.com/Networking">http://www.asus.com/Networking</a>...</td>
<td>![ ]</td>
<td>![ ]</td>
</tr>
<tr>
<td>Open Source</td>
<td>Tomato USB</td>
<td>Shibby or Toastman mods</td>
<td><a href="http://tomatousb.org">http://tomatousb.org</a></td>
<td>![ ]</td>
<td>![ ]</td>
</tr>
</tbody>
</table>
IPv6 Equipment Compatibility Table

- Windows 8

Note: You may need to take steps to enable IPv6 for your IPv6 compatible operating system. Contact the manufacturer for detailed instructions.

IPv6 compatible Modems, Routers, and Gateways

If you have one of the devices shown below, it will be IPv6-enabled through an automatic firmware update. These updates began in 2011 and are expected to continue through 2014.

AT&T DSL High Speed Internet
- Motorola 3360
- Netgear 6200 A90 (Compatible now)
- Netgear 7550 B90 (Compatible now)
- Pace 4111 N

* For DSL customers who do not have one of the devices listed above, IPv6-compatible devices are now available for purchase in the AT&T Equipment Shop.

AT&T U-verse High Speed Internet
- 2Wire/Pace 3600
- 2Wire/Pace 3800
- 2Wire/Pace 3801
- 2Wire/Pace i38HG
- Motorola NVG510 (Compatible now)

* If you have a Motorola 2210 or 2Wire 2701 device and you want to upgrade to an IPv6-capable device, visit the AT&T Equipment Shop.

Note: To determine your device's model number, consult the device information sticker on the back of your device. For non-AT&T provided modems/routers/gateways, please check with equipment manufacturer.
C:\Users\Don>ping google.com

Pinging google.com [2001:4860:4001:801::1006] with 32 bytes of data:
Reply from 2001:4860:4001:801::1006: time=18ms
Reply from 2001:4860:4001:801::1006: time=18ms
Reply from 2001:4860:4001:801::1006: time=18ms
Reply from 2001:4860:4001:801::1006: time=20ms

Ping statistics for 2001:4860:4001:801::1006:
   Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
   Minimum = 18ms, Maximum = 20ms, Average = 18ms

C:\Users\Don>
C:\Users\Don>ping -4 google.com

Pinging google.com [74.125.224.65] with 32 bytes of data:
Reply from 74.125.224.65: bytes=32 time=24ms TTL=53
Reply from 74.125.224.65: bytes=32 time=23ms TTL=53
Reply from 74.125.224.65: bytes=32 time=24ms TTL=53
Reply from 74.125.224.65: bytes=32 time=24ms TTL=53

Ping statistics for 74.125.224.65:
   Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
   Minimum = 23ms, Maximum = 24ms, Average = 23ms

C:\Users\Don>
WEB SITES

- http://www.att.com/ipv6
- http://www.comcast6.net/
- http://www.test-ipv6.com
- http://www.tunnelbroker.net/
- http://www.pfsense.org
- http://snapshots.pfsense.org/
- http://mydeviceinfo.comcast.net/