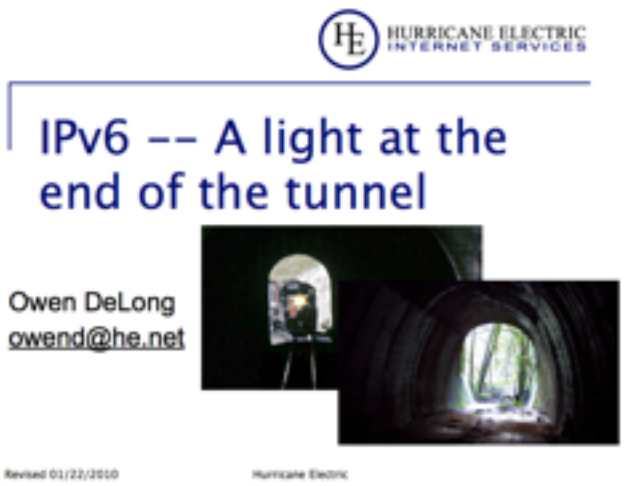
IPv6, the light at the end of the tunnel resource sheet



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Terminology and Definitions

/nn	A short-hand way to refer to the number of significant bits in a network prefix. For example, a /32 is a network prefix in which the first 32 bits must match exactly and the remaining 96 bits can be of any value and still be considered a match to the prefix.
Address Mobility	The ability to keep a consistent IP address and use it independent of topology. IPv6 provides for address mobility through the use of a "home gateway" and a semi-automatic tunneling protocol.
Anycast	A technology which provides for automatic selection of the topologically "closest" of a set of hosts providing identical services under limited circumstances.
Autonomous System	Usually a collection of networks under common administrative control. Technically, a collection of networks which share a common routing policy.
Backbone	The large aggregated network infrastructure components which provide long haul and inter-city connectivity.
Border	The point where two autonomous systems (zones of administrative control) meet. May include private peering, internet exchange points, etc.

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CGN	Carrier Grade NAT. Essentially the ISP implementing a second layer of NAT on top of the NAT implemented in the customer gateway. So far, attempts at using this solution tend to break most NAT traversal workarounds and disable applications such as instant messaging, voice over IP, etc.
Core	The main aggregation point and networks for a given site which act as an intermediary between the site and the backbone. Sometimes used to encompass the Core, Backbone, and/or external network border connections.
DHCP	Dynamic Host Configuration Protocol. In IPv4, a mechanism for hosts to dynamically learn their IP address and other configuration information. In IPv6, a mechanism for hosts to receive services information and possibly delegation of a routed prefix that the host can sub-divide among its other interfaces. Currently there is no support in IPv6 DHCP for direct address assignment.
FIB	Forwarding Information Base. The currently preferred subset of the RIB used for actually forwarding packets.
Header	The information at the beginning of each packet which includes source and destination information and other metadata about the packet.
IANA	Internet Assigned Numbers Authority. The top of the internet addressing food-chain, IANA assigns very large blocks of addresses and autonomous system numbers to Regional Internet Registries. The IANA is also responsible for assigning well known port numbers, protocol numbers, and other global numbers.
ICMP	Internet Control Message Protocol. Used for a wide variety of signaling, debugging, measuring, and other network “housekeeping” functions.

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IPSEC	Internet Protocol Security. A set of standards which define mechanisms for secure communications over internet protocol offering header authentication, payload authentication, payload security, or some combination of all three.
IPv6	The next generation of Internet Protocol comprising a vastly expanded address space and a number of additional features over traditional IPv4
ISP	Internet Service Provider. An organization which provides IP services to its customers.
Layer	A reference to one of the 7 layers in the ISO protocol stack model. Layer 1 is Physical (copper, fiber, etc.). Layer 2 is Data Link (MAC addresses, Frame Relay DLCI, ATM VPI/VCI, HDLC, PPP, etc.). Layer 3 is the Internetwork Layer (IPv4, IPv6, XNS, IPX, SS7, etc.).
LIR	Local Internet Registry. A registry which receives blocks of addresses from a superior LIR or an RIR and delegates blocks of addresses to its customers. Usually LIRs are ISPs.
MTU	Maximum Transmission Unit. The maximum number of octets in a single datagram, including headers and other overhead.
NAT	Network Address Translation. Usually used to overload multiple private IP addresses onto a single public IP address or small groups of public IP addresses.
Native IPv6	IPv6 delivered over the existing data link and physical layers without the use of tunnels or other interim transitional technologies.

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PA Addresses	Provider Assigned Addresses. Addresses which were assigned to the end-user by an LIR and which accompany service from said LIR. When the end-user terminates service with the LIR, the addresses revert to the LIR's available address pool rather than staying with the end-user. The end-user must renumber with new addresses either from a new LIR or with PI addresses obtained from an RIR.
Payload	The information in a packet which is passed to the application software. Usually everything except the header.
PI Addresses	Provider Independent Addresses. Addresses which are assigned directly to an end-user by an RIR and which can be serviced by any consenting ISP. When the end-user terminates services with the ISP in question, the addresses remain with the end-user rather than reverting to the ISP.
PMTU	Path Maximum Transmission Unit. The smallest MTU on an entire end-to-end path.
PMTU-D	Path MTU Discovery. A method for determining the Path Maximum Transmission Unit
POP	Point Of Presence. A location where a network has facilities and connectivity used to serve geographically proximate customers.
RIB	Routing Information Base. The full superset of everything a given router knows about layer 3 reachability. Some routers divide IPv4 and IPv6 into separate RIBs.
RIR	Regional Internet Registry. The five RIRs (ARIN, APNIC, RIPE-NCC, LACNIC, and AfriNIC) assign "portable" or "provider independent" addresses to ISPs (LIRs) and in some cases end users.

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Routing Table	A loose term referring to a superset of the Forwarding Information Base (FIB), Routing Information Base (RIB), or both contained in a router. These tables contain information about all known layer 3 destinations and the next hop to reach said destination.
SLAAC	StateLess Address Automatic Configuration. A mechanism by which a host may determine it's IPv6 address. This differs from DHCP in that no state is maintained outside of the host and it has no ability to provide information about servers, services, or other bootstrapping information common in DHCP.
TCP	Transmission Control Protocol, a way of implementing reliable connection oriented services on a packet switched connectionless network
Tunnel	A mechanism by which the internet between two routers can be treated as if it were a point-to-point link between those two routers. This is accomplished by wrapping the entire original IP datagram, including header in an additional tunnel datagram with its own header.
UDP	User Datagram Protocol, a connectionless datagram protocol
Undecilion	10^{36} A really big big number.

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References

Making a business case for IPv6 – http://businessv6.he.net

HE Tunnel Broker – http://www.tunnelbroker.net

Hurricane Electric – http://www.he.net

Application Porting – http://owend.corp.he.net

ARIN IPv6 Wiki – http://www.getipv6.info

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Key IPv6 Facts

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What is IPv6

- Vastly larger address space
  - 128 bits (IPv4 is 32 bits)
- What does that mean?
- IPv4 4,294,967,296 addresses
- IPv6 340,282,366,920,938,463,463,374,607,431,768,211,456 addresses
- Graphically (if each IP address were a unit of mass):

7 liters of water (IPv4)
Earth 5.9742x10^{24} kg (IPv6)

(1kg = 2.2 Pounds,
15 Pounds of water)

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Network Size and Number of networks (graphically)

One IPv4 /24 – 254 M&Ms

One IPv6 /64 – Enough M&Ms to fill all 5 of the great lakes.

Full Address Space, One M&M per /24 covers 70% of a football field

Full Address Space, One M&M per /64 fills all 5 great lakes.

Comparison based on Almond M&Ms, not plain. Caution! Do not attempt to eat a /64 worth of any style of M&Ms.

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