

IPv6 Overview and Procedures

INET 2000
Network Training Workshop

- ◆ Rationale
- ◆ Addressing
- ◆ Features of IPv6
- ◆ Current Status
- ◆ Allocation policy

- ◆ Address depletion concerns
 - ◆ Squeeze on available addresses space
 - ◆ Emphasis on efficient addressing
 - ◆ Probably will never run out, but will be harder to obtain
 - ◆ Address conservation techniques
 - ◆ Dial up customers do not have permanent IP addresses
 - ◆ Widespread use of NAT and 'private' addressing with large end sites

- ◆ Scalability
 - ◆ Hierarchical routing (CIDR)
 - ◆ Grew out of need to keep Internet routing working
 - ◆ Providers 'aggregate' their routes
 - ◆ In IPv6 still a concern
- ◆ IPv6 designers
 - ◆ Concerned about lack of global addressability
 - ◆ Robustness and scalability of the Internet

Rationale

- ◆ Design goals
 - ◆ Availability of address space, autoconfiguration, security, real-time flow support, scalability
- ◆ Opportunity
 - ◆ To optimise on years of IPv4 deployment experience
- ◆ Protocol
 - ◆ In principle should remain similar to IPv4

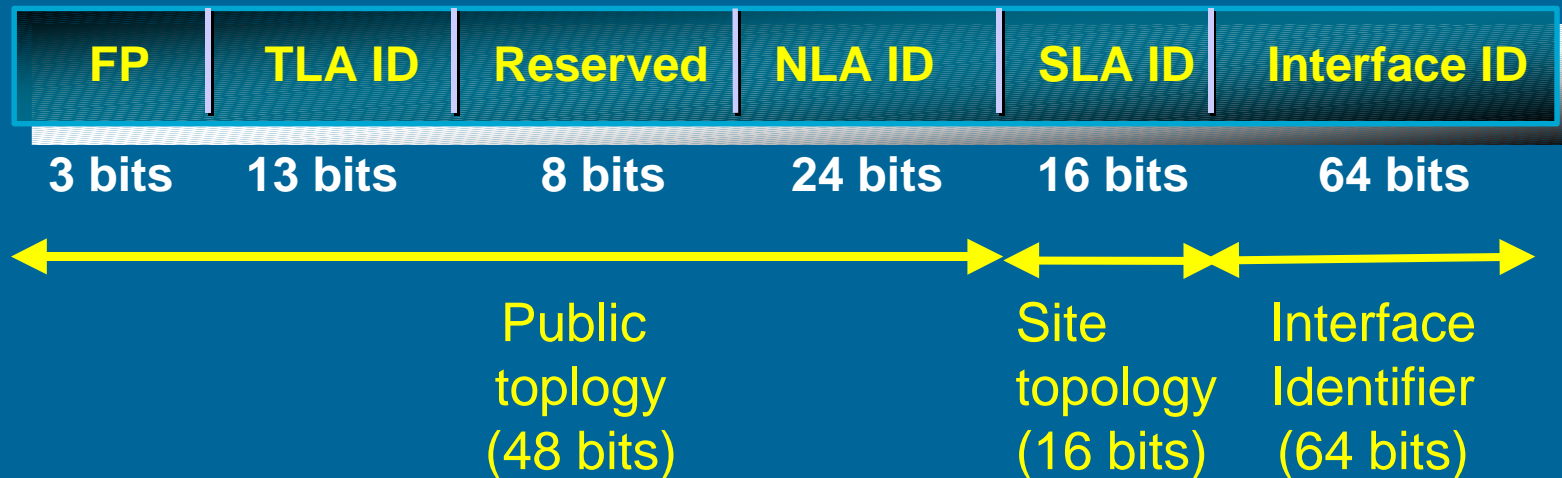
- ◆ Address types
 - ◆ Unicast (one-to-one)
 - ◆ Global
 - ◆ Link-local
 - ◆ Site-local
 - ◆ Compatible
 - ◆ Multicast (one-to-many)
 - ◆ Anycast (one-to-nearest)
 - ◆ Reserved

◆ Terminology

- ◆ Node A protocol that implements IPv6
- ◆ Router A node that forwards IPv6 packets not explicitly addressed to itself
- ◆ Host Any node that is not a router
- ◆ Link A communication facility or medium over which nodes can communicate at the link layer ie. the layer immediately below IPv6
- ◆ Neighbours Nodes attached to the same link
- ◆ Interface A node's attachment to a link
- ◆ Address An IPv6 layer identifier for an interface or set of interfaces

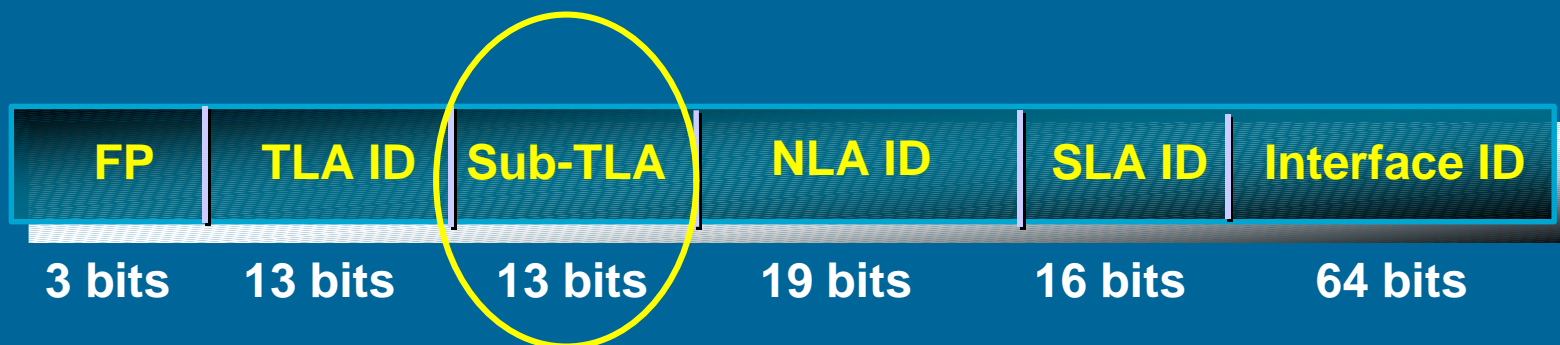
- ◆ Address hierarchy matches ISP hierarchy
 - ◆ TLA = Top Level Aggregator
 - ◆ Transit ISP
 - ◆ NLA = Next Level Aggregator
 - ◆ ISP
 - ◆ SLA = Site Level Aggregator
 - ◆ Customer

- ◆ Aggregatable Global Unicast Format
 - ◆ RFC2374 (FP001)
 - ◆ 128 bit addresses



Addressing

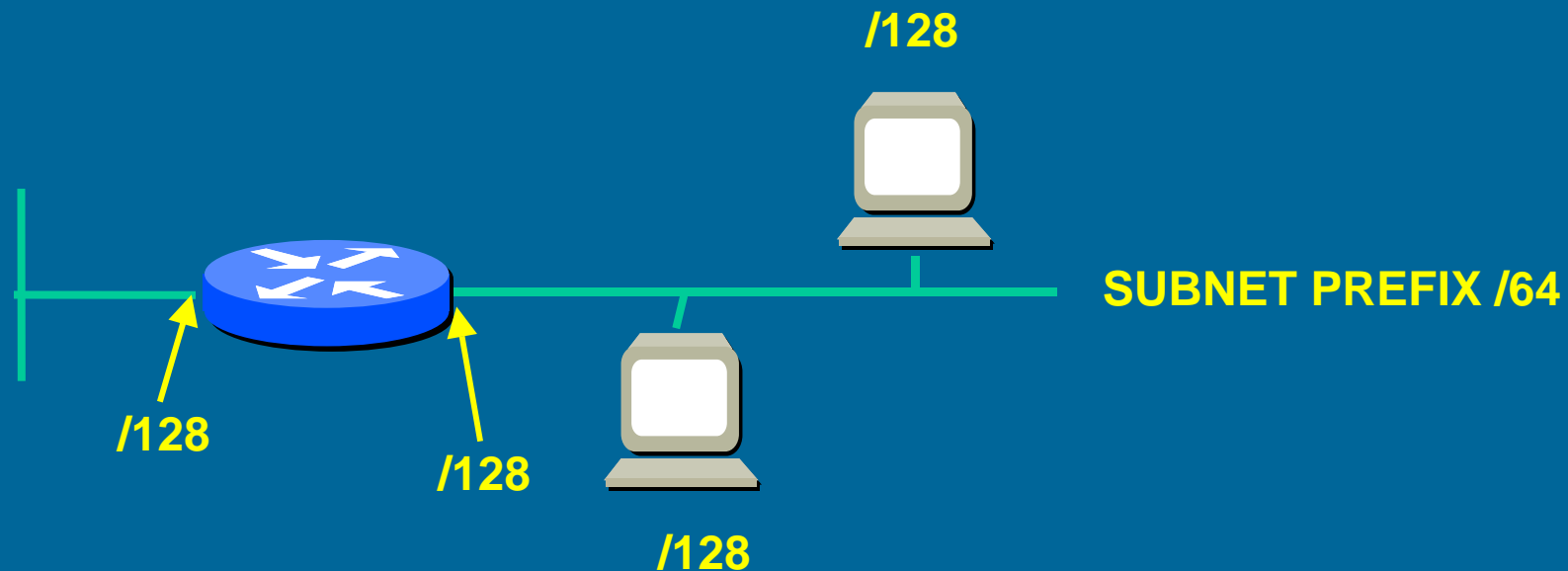
- ◆ Bootstrap process (rfc2450)
 - ◆ TLA - special TLA 0x0001



- ◆ Sub-TLA field /29

- ◆ Assignments
 - ◆ Minimum assignment to end-site or customer is a /48 prefix (SLA)
 - ◆ 16 bits for subnetworks
 - ◆ 65535 subnetworks per site
 - ◆ 64 bits for hosts
 - ◆ 18446744073710 million hosts per subnetwork!!

- ◆ LAN addressing



- ◆ Subnet prefix + MAC address = /128

Features of IPv6

- ◆ Server-less auto-configuration (plug-&-play)
- ◆ Streamlined header format and flow identification
- ◆ Expanded addressing capability
- ◆ More efficient mobility options
- ◆ IP layer privacy and authentication
- ◆ Improved support for options/extensions

◆ Specifications

- ◆ Core IPv6 specifications are IETF draft standards and are well tested
 - ◆ IPv6 base spec, ICMPv6, Neighbor Discovery, Multicast, Listener Discovery, PMTU Discovery, IPv6 over Ethernet....
- ◆ Others further behind but progressing
 - ◆ Mobile IPv6, header compression, A6 DNS support, IPv6-over-NBMA, multihoming support
- ◆ For status
 - ◆ <http://playground.sun.com/ipng>

- ◆ Deployment
 - ◆ 6BONE experimental infrastructure
 - ◆ For testing and debugging IPv6 protocols and operations
 - ◆ Should be 'production quality'
 - ◆ Many participants worldwide
 - ◆ 200 sites in 39 countries
 - ◆ More information
 - ◆ <http://www.6bone.net>
 - ◆ Anyone can join!

◆ Deployment

◆ 6REN

- ◆ Production infrastructure in support of education and research
 - ◆ CAIRN, Canarie, CERNET, Chunghwa Telecom, DANTE, Esnet, Internet2, IPFNET, NTT, Renater, Singren, Sprint, SURFnet, vBNS, WIDE
- ◆ Mixture of native and tunneled paths

◆ More information

- ◆ <http://www.6ren.net>
- ◆ <http://www.6tap.net>

Current Status

- ◆ Deployment assistance
 - ◆ <http://www.ipv6.org>
 - ◆ Contributed FAQ's and other info
- ◆ Deployment advocacy
 - ◆ <http://www.ipv6forum.com>
- ◆ Address allocations
 - ◆ Test address space - 6BONE
 - ◆ Production address space - APNIC, ARIN, RIPE NCC

Allocation Policy

- ◆ Global Policy Document

- ◆ <http://www.apnic.net/policies.html>

- ◆ Request Forms

- ◆ APNIC

- ◆ <http://www.apnic.net/apnic-bin/ipv6-subtla-request.pl>

- ◆ ARIN

- ◆ <http://www.arin.net/regserv/ipv6/ipv6-regserv.html>

- ◆ RIPE NCC

- ◆ <http://www.ripe.net/ripe/docs/ripe-195.html>

- ◆ FAQ

<http://www.apnic.net/drafts/ipv6/IPv6-FAQ.html>

Allocation Policy

Peering with ≥ 3 subTLAs

AND either

Plan to provide IPv6 services within 12
months

OR

≥ 40 SLA customers

Allocation Policy

◆ Bootstrap

Peering with ≥ 3 ASes

AND

Plan to provide IPv6 services in 12 months

AND either

≥ 40 IPv4 customers

OR

6bone experience

Allocation Policy

◆ 'Slow start'

- ◆ First allocation to a TLA Registry will be a /35 block
 - ◆ Representing 13 bits of NLA space
- ◆ Entire /29 reserved (aggregatable)

◆ IANA allocations

- ◆ APNIC: 2001:0200::/23
- ◆ ARIN: 2001:0400::/23
- ◆ RIPE NCC: 2001:0600::/23



Questions?