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IPv6 Address Space Management

> LIR Working Group RIPE-45 Barcelona, May 2003

Background and Motivation

 IANA-RIR allocation system – Unchanged in 10+ years – Major IPv4 address space fragmentation • Many ISPs have many separate prefixes – IPv6 should not go the same way Proposal for new system for IPv6 - Designed to minimise fragmentation Most ISPs will have 1 prefix for many years Document development - Document jointly authored by RIRs - Published as ripe-261

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Current Allocation System

- IANA allocates to RIR
 - -RIR maintains a pool of addresses
 - Attempts to maximise aggregation within pool
 - Short-term reservations
 - Sparse allocation
- RIRs allocate to LIRs/ISPs
 - When pool runs low, RIR receives more from IANA
 - Subsequent allocations to existing ISPs cannot be aggregated



Current Allocation System (v4)



ISP has 2 prefixes after 3 requests!

Current Allocation System

• IPv4

– IANA to RIR allocation unit: /8

- RIR to LIR/ISP: /20... /10...

- Many ISPs have multiple prefixes

• IPv6

IANA to RIR allocation unit: /23 (64 x /29)
RIR to LIR/ISP: /32 minimum
IPv6 swamp is being created already

Maximum reservation per ISP is /29



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Proposal

"Sparse Allocation" system

- Maximise "distance" between allocations to distinct ISPs
- Maximise chance of aggregation of subsequent allocations
- Sometimes knows as "Binary Chop"
- For example...

Available address pool

ISP A	ISP E	ISP C	ISP G	ISP B	ISP F	ISP D	ISP H
1	5	3		2	6	4	

Proposal

- "Sparse allocation" system will maximise aggregation
 - Simple system, easily understood
 - -Used in practice by RIRs already (IPv4)
 - within allocated /8 blocks
 - Used in other allocation systems
 - e.g. dynamic memory allocation

Proposal

- Benefits increase as size of address pool increases
 - System breaks down in "overflow condition"
 - i.e. where pool becomes too crowded or full and another pool must be allocated
 - Therefore RIRs propose to share a single global pool
 - Known as Common Address Pool (CAP)
 - Managed by RIRs jointly, under "Common Registry Service" (CRS)

Proposal

CAP needs to be as large as possible

 To ensure long life of single pool
 To avoid unaggregatable allocations

• Therefore...

- -IANA to allocate 2000::/3 (FP001) for CAP
 - For management by CRS
 - Address space already designated by IETF as Global Unicast, for allocation by RIRs

Allocation Request Process

- 1. First IPv6 allocation to ISP
 - RIR sends request to CRS for new block of specified size
 - CRS allocates next entry from list of start addresses
- 2. Subsequent allocation to ISP
 - RIR sends request to CRS for expansion of existing allocation for that ISP (to certain specified size)
 - CRS provides extension of existing allocation
 - If extension is not available, new prefix must be allocated

Avoiding Fragmentation

- Distance between neighboring allocations is very large initially
 - Simple method can be used initially
- However, some ISP allocations will grow faster
 Threatening to "collide" with neighbour
- "Smarter" method may be developed for new allocations
 - e.g If existing preceding allocation has grown to occupy more than a certain % of address space available to it, select next start address from the list

Avoiding Fragmentation

• Possible "Smarter" algorithm...



Other Details

- Review of allocation process
 - Initial set of allocations limited to 2048
 - Providing each ISP with up to /14 (!)
 - Commence review after 1024th entry (2-3 years?)
- Common Registration Service Implementation
 - Function to rotate between RIRs
 - 'Master' server at one RIR
 - Mirror servers elsewhere
- Reverse DNS requirements (ip6.arpa)
 - CRS administers master DNS server
 - Other RIRs will be mirrors of master

Disadvantages?

- Requires single large allocation
 - -Maybe "Putting all our eggs in one basket"
 - RIR proposal is to utilise very large block, only one-eighth of IPv6 address space
- Not possible to identify specific blocks allocated to specific RIRs/regions
 - -e.g. for filtering purposes
 - RIRs note that this is not possible in IPv4 due to historical allocations

Further information

Document available from

http://www.ripe.net/ripe/docs/ipv6-sparse.html

• APNIC IPv6 SIG

- http://www.apnic.net/meetings
- <u>http://www.apnic.net/lists</u>