IPv6 Resource Management - RIR Proposal

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*

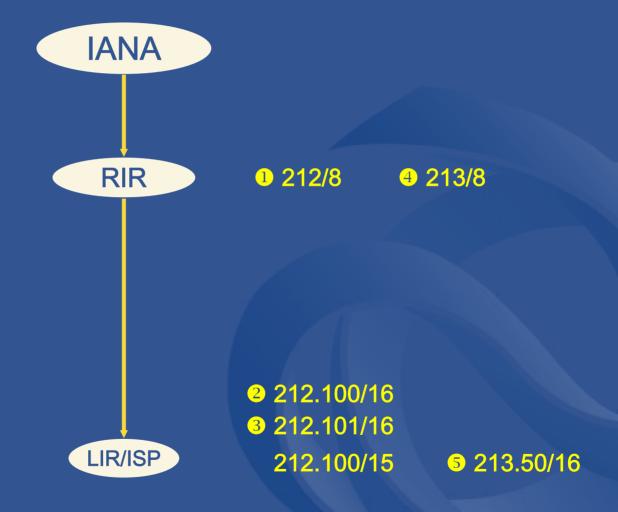Asia Pacific Network Information Centre

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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)

IANA

RIR   ❶ 212/8   ❹ 213/8

❷ 212.100/16
❸ 212.101/16

LIR/ISP   212.100/15   ❺ 213.50/16

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

Proposal

- "Sparse Allocation" system
  - Maximise "distance" between separate portable allocations
  - Maximise chance of aggregation of subsequent allocations
  - Implemented as list of address prefixes to be allocated in order

- For example…

ISP A	ISP E	ISP C	ISP G	ISP B	ISP F	ISP D	ISP H
❶	❺	❸		❷	❻	❹	

Available IPv6 address pool

Proposal

- Sparse allocation system will maximise aggregation
  - Simple system, easily understood
    - Otherwise known as "binary chop"
  - Used in practice by RIRs already (IPv4)
    - Within large address blocks (e.g. /8)
  - Used in other allocation systems
    - e.g. dynamic memory allocation

Proposal

- Benefits increase as 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

- So…
  - IANA to allocate 2000::/3 (FP001) for CAP
    - For management by CRS
    - This 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 initially very large
  - "Dumb" algorithm can be used initially
- However, some ISP allocations will grow faster
  - Threatening to "collide" with neighbour
- "Smarter" algorithm 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

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Avoiding Fragmentation

- "Smarter" algorithm…

ISP A	ISP E	ISP C	ISP B	ISP D	ISP G
❶	❺	❸	❷	❹	

ISP F

❻

However note that this is a far future scenario…

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 Registry Service (CRS)
  - 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

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Further information

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

- APNIC IPv6 SIG
  - http://www.apnic.net/meetings
  - http://www.apnic.net/lists

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