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
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

1. 212/8
2. 212.100/16
3. 212.101/16
4. 213/8
5. 213.50/16

LIR/ISP

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…
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
Avoiding Fragmentation

• “Smarter” algorithm…

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 1024\textsuperscript{th} 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
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