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<Scoped IPv4 addresses: AS-local address class>
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Status of this Memo

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Abstract

A new IPv4 scoped address class is introduced: the AS-local addresses. AS-local addresses do not participate in the global routing and they are reusable in any Autonomous System. The recommended use of this address class includes the followings: walled garden IP based services (like IPTV), emergency handling and simulation of "no IPv4 address left" situations, IPv6 and IPv4 co-existence support.

In order to highlight the similarities and the differences, the other, previously defined IPv4 scoped address classes are also reviewed here.

Conventions used in this document

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119].

Table of Contents

1. Introduction

A new IPv4 scoped address class is introduced: the AS-local addresses. There are some similarities between Private IP addresses and AS-local addresses, however, important differences also exist. The AS-local address pool size should have equivalent size of 3-4 /8 prefixes. The minimal size of a prefix in the AS-local pool is /16.

AS-local address space is reusable in any Autonomous system. The routing information related to AS-local addresses can be exported within the AS.

The recommended use of this address class include the followings: walled garden IP based services (like IPTV), emergency handling of

"no IPv4 address left" situations, IPv6 and IPv4 co-existence support.

In order to highlight the similarities and the differences, the other, previously defined IPv4 scoped address classes are also reviewed here.

Procedures of creating and maintaining the AS-local address space are defined in this document.

Because the AS-local address pool should be created in the "soon no IPv4 address left" situations, the procedures of adding to and revoking from the AS-local address space should be dynamic, distributed, however, must maintain enough stability.

IANA, the Regional Internet registries and the Local Internet Registries of the AS owners should contribute in the creation and maintenance of the AS-local address space. Any Internet registry also could contribute.

1. 1. The hierarchy of the IPv4 address space and the routing

Global -> AS-local -> Site-local(Private) -> Link-local -> Node-local

Figure 1 Scope and routing

2. The history of scoped IP addresses

The notion of Scoping of IP addresses is an invention of IPv6. See [RFC4007] and its predecessors. However, the IPv4 Private Address pool [RFC1597] [RFC1918] already had some similar concept.

2. 1. Node-local (host-local) addresses

Host-local addresses (or: node-local addresses) can not be routed outside of a host (or node), however, it might be reused in any host (or node).

The well-known host-local address is the loop-back address: 127.0.0.1 It is also well-known, that IANA reserved the whole 127/8 address block. The 127/8 block forms the Node-local addresses. Some non-loop-back host-local addresses might be used for host-local

addressing of "IPv4 over IPv6" tunnel end-points. Some Network Time Protocol implementations also use addresses from this address block.

It is not discussed here how to share the node-local address pool between the different applications.

2. 2. Private address space

Private address space is a set of IPv4 addresses (including 10/8), reserved by IANA that must not be routed outside of a routing domain. However, Private Addresses might be reused inside any routing domain. Private address space had been introduced in [RFC1597] in 1994, and the concept had been refined in [RFC1918].

The typical use of the private address space is "site local". However, the scope of private address space is not well-defined, because private address space can be used within an internal routing domain (within a site), and can be used in the service provider network.

The concept of private address space had been criticized in [RFC1627].

The concept of private address space helped to formulate the concept of scoped addresses, and especially the concept of IPv6 site local addresses. Later, in [RFC3879] the original IPv6 site local address concept had been deprecated, because a more flexible method had benn found. Instead of reusing the same address pool at every site, a pseudo random "site local" address prefix creation defined in [RFC4193]. This way merging two sites typically do not provoke renumbering.

Despite all the valid argument against having private address space; using private address space is a must in the IPv4 Internet. Simply there are not enough IPv4 addresses to run a global IPv4 Internet without using private addresses today.

2. 3. Link-local addresses

The concept of link-local address space had been introduced in the first IPv6 architecture proposal [RFC1884].

Link-local IPv4 address space had been introduced by RFC 3927 as a non-routable address space. The RFC 3927 defines not only the address space itself; however, its ARP based allocation mechanism as well. Being non-routable and ARP based is essential.

In IPv6, there is an additional concept: the zone. A router might be attached to more than one link-local zones, and therefore it is possible to send packets between two routers attached to the same link-local zone. [RFC4007]

There is no similar mechanism defined in IPv4 [RFC3927].

3. The AS-local scoped addresses

The concept of AS-local address space is defined in this document. AS-local address space is a set of IPv4 address prefixes that are reusable in any Autonomous System. AS-local address space is routable within any Autonomous System, and may cross "site" boundaries.

AS-local addresses should be allocated dynamically.

The uniqueness of AS-local addresses is restricted to the appropriate Autonomous System (or: coalition of neighbors Autonomous Systems). The service provider running the given Autonomous System is responsible of the allocation of AS-local addresses.

It is possible to share parts of AS-local address space between neighbors Autonomous Systems, if all Autonomous Systems' owners agree. Sharing of AS local address space between a registered AS and private AS(s) is optional.

However, AS-local address space MUST NOT be announced to the public Internet.

4. Creation and maintenance the AS-local address space

The AS-local address pool is created by contribution.

Potential contributors are the registries of the IP address space: IANA, Regional and Local internet registries. A contributor can add a prefix to the AS-local pool if the prefix is part of the address space delegated to the given contributor and it is not in use.

In order to limit the administration overhead, the prefix size could not be too small. The minimal prefix size of a block that might be added to the AS local address space is /16.

In order to facilitate the contribution to the AS-local pool, a procedure of revoking of a previously added prefix is also defined. A prefix can be revoked only by its contributor.

In order to maintain the stability of the AS-local address pool, the revoking won't take immediate effect, however, after an expiration time elapsed.

Expiration time is expressed in months. The expiration time of the given prefix MUST be set at the time of adding the prefix to the AS-local pool. The default value is 24 months (two years). The minimum value is one month.

All prefixes in the AS-local address pool must be filtered at the Autonomous System (or: coalition of neighbored Autonomous System) boundaries. The life-cycle of an AS-local prefix can be seen at the following figure:

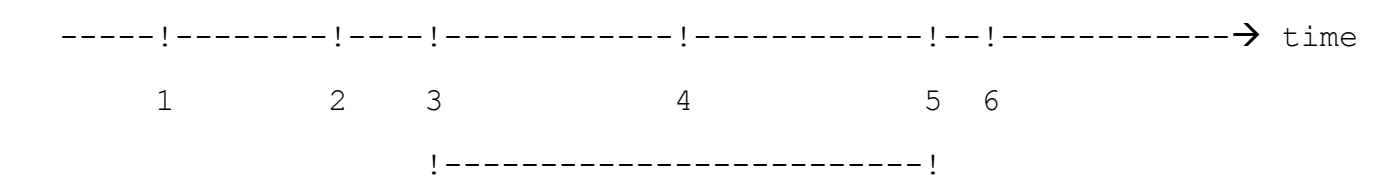

Figure 2 Status of a prefix in the AS-local pool

1: Time of adding address prefixes to the AS-local pool

2: Filtering of the prefix MUST start at all AS boundary within 14 days

3: Beginning of the next month (Greenich time): the prefix is VALID in the AS-local pool

4: Revoking initiated

5: Beginning of the next month after revoking had been initiated and the expiration time is over. The prefix is NOT VALID in the AS-local pool.

6: Filtering of the prefix should be stopped within 14 days after it is expired. Then the prefix should be treated as part of the global IP address space.

5. AS-local IPv4 address space and the Domain Name System

5. 1. in-addr.arpa

Mapping from IPv4 addresses to host names conventionally done by issuing DNS queries for names in the form "x.y.z.w.in-addr.arpa". In case of AS-local addresses, it is inappropriate to send such a DNS queries beyond the given AS. Therefore DNS name servers receiving queries from DNS clients within the "AS-local" reverse address domain, they MUST by default return RCODE 3, authoritatively asserting that no such name exist in the Domain Name System.

Since address space could be added to the AS-local address pool, it is also important, that any eventual previous registration under in-addr.arpa. must expire in time. Therefore the recommended expiration time of in_addr.arpa's entries is not more than two weeks.

5. 2. AS-local.net

The DNS is a good tool for providing status information of the prefixes in the AS-local pool.

There are 6 different statuses attachable to the prefix in the AS-local pool. (See figure 2)

These 6 statuses might be reflected in the DNS system, under a dedicated domain. When status x reached in the life-cycle of the abc.def/16 prefix in the AS-local pool, then a new entry should be added to the DNS tree.

```
$origin  def.abc.AS-local.net

x     PTR   something.anything
```

The purpose of this registration is nothing more than allow easy query of the membership status of the AS-local address space. If the given address is part of the AS-local pool, and the life-cycle status x is already reached then the answer of the reverse DNS query should be "entry exist".

5. 3. Local reverse address mapping

AS-local address block MUST not be included in the reverse mapping under in-addr.arpa. However, a special high level domain could be maintained for this purpose.

Example:

```
$origin def.abc.AS1-1.MyAS.net
```

```
x  PTR   foo.bar
```

The AS1-1 subdomain under the MyAS.net domain must be delegated to the owner of the Autonomous System Number 1.1

6. Leasing blocks to the AS-local pool from the "dark" address space

There are blocks of IP addresses that had been allocated once, however, no announcement of them could be observed in the public Internet in the last five years, end even the technical and administrative contact points of the address space are unreachable. These addresses often called "dark" address space. See also [UNADV].

The dark address space might not be in use, or might not be intended to use in the public Internet.

Blocks from the Dark address space could be added to the AS-local address space with very short expiration time (one month). The short expiration time is a guarantee that eventual return of the prefix to the original requestor (or its successor) will be possible within the shortest possible period of time (about two months).

Adding/revoking Dark address space to the AS-local address space is the responsibility of the Internet Registry to whom the address space had been delegated.

7. Security Considerations

AS-local address space must not be announced to the public internet.

Since blocks of the AS-local address space might be revoked, and revoked AS-local address space will expire, the list of addresses to be filtered off at the Autonomous System boundary should be maintained regularly.

8. IANA Considerations

IANA should reserve a /8 IPv4 block for the AS-local address space pool, in order to make the management of the AS-local pool easier. A /8 sized stable AS-local address space would be enough for ISP-s using small and medium-sized dynamic address pools.

The IANA allocated AS-Local address blocks MUST have at least 24 months (two years) expiration date.

9. Conclusions

<The introduction of AS-local address pool gives us a chance to provide minimal IPv4 based services in the IPv4->IPv6 transition period when no more global IPv4 unicast address is left.

The IPv6 transition is a MUST. The AS-local addresses could only reduce the pains of the shortage of the IPv4 addresses.>

10. Acknowledgments

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This document was prepared using 2-Word-v2.0.template.dot.

11. References

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