Provider Independent
vs
Provider Aggregatable
Address Space

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Scope

This memo provides guidance to European Internet registries concerning the assignment of Internet address space allocated by the RIPE NCC.

Introduction

One can currently distinguish two kinds of globally unique, unicast IPv4 addresses: provider independent (PI) and provider aggregatable (PA) addresses. These addresses are assigned to end-users by Internet Registries (IRs).

There are also non globally unique e.g. private unicast addresses as described in RFC1597 which are suitable for many applications.

Provider Aggregatable Address Space

With the introduction of classless interdomain routing (CIDR) [RFC1519] in the Internet, address space is typically assigned by an Internet service provider (ISP) to a customer. The service provider assigns this address space in such a way that routing information for many customers can be aggregated once it leaves the provider’s routing domain. This keeps the number of routes and state changes in the interdomain routing system at an acceptable level. The cost of propagating a relatively small number of aggregated routes is much lower than that of propagating each end-site's individual routes throughout the whole interdomain routing system.

After a customer leaves the service provider who assigned the address space, it can be assigned to another customer. As a consequence the customer will have to reconfigure all their hosts and routers if they continue to require globally unique address space. This requires a clear, preferably contractual, understanding between the assigning service provider and the customer, that the assignment of the address space ends when the provider no longer provides Internet connectivity to the customer or soon thereafter.

The goal of this arrangement is to minimise the load on the interdomain routing system. If the customer used the address space assigned by and aggregatable by their previous service provider when connecting to another service provider, their routing information could not be aggregated and would have to be propagated separately throughout the whole interdomain routing system.

Provider Independent Address Space

Contrary to PA address space, PI address space remains assigned to its user as long as the criteria for the original assignment are met independently of the use of a particular provider's services. Frequently PI addresses are not even assigned by providers but by other Internet registries. The apparent advantage of PI address space is that the user does not have to reconfigure their hosts and routers if they decide to leave a particular service provider. However, PI addresses are expensive to route because no use can be made of aggregation. All early Internet address space assignments were provider independent. Many assignments made by ISPs are also formally provider independent because they lack the clear prior understanding between ISP and customer that the assignment will end with the termination of the service.

Current Issues

At the time of this writing there is growing concern among the operators of major transit routing domains in the Internet that the number of individual routes and their associated information is growing faster than the deployed routing technology will be able to handle. Parts of the interdomain routing system are already operating at capacity.

It has been argued that PI addresses will quickly become be totally useless since the Internet routing system will not be able to support them any longer.

Consequently it has been suggested that the regional IRs should immediately stop allocating and assigning PI space and only allocate PA space to service providers.

The RIPE NCC cannot do this because it would have to determine who is a service provider and who is not as well as refusing address space allocations to anyone not meeting minimum size criteria. This would amount to nothing less than the RIPE NCC regulating Internet service provision in Europe. So far no practical policies for these determinations have been suggested let alone met with community consensus. If possible at all, the process to define such policies and to establish Internet community consensus is expected to take considerable time.

On the other hand the RIPE NCC receives an increasing amount of requests for guidance on these issues from European Internet registries. This memo is intended to provide that guidance by spelling out a number of policies. It does not represent a major change in policy, but refinement and clarification.

Assignment Policies

European Internet Registries continue to assign both PA and PI address space to users.

IRs will clearly warn users about the issues w.r.t. their choice of a particular type of address space.

IRs will promote the use of PA address space as much as possible.

Assignment criteria for both kinds of address space will be exactly identical w.r.t. the amount of address space assigned, the registration requirements etc.. This also implies that assigning PI space prefixes longer than 24 bits is perfectly acceptable if the request does not merit 8 bits of address space to be assigned.

IRs will mark all PA space assignments in the RIPE database. See below for details.

It is then up to the service providers to decide whether they will route particular prefixes or not. The way this determination is made is beyond the scope of this document, but we expect that accepting and charging routing announcements based on whether or not they can be aggregated is a distinct possibility.

We therefore urgently recommend that service providers shall inform their current and prospective customers as clearly as possible about the issues involved in using PI vs PA space with their service offerings. It is recommended that ISPs clearly specify present and future differences in their service offerings w.r.t. usage of PI vs PA addresses.

Detailed Recommendations

The remainder of this document spells out some of the details concerning the policy.

IRs will give those customers requesting PA space this or a similar warning:

> Assignment of this address space is valid as long as the criteria for the original assignment are still met and only for the duration of the service agreement between yourself and ISP XXXX who will have the right to re-assign the address space to another user upon termination of the agreement or an agreed period thereafter. This means that you will have to re-configure the addresses of all equipment using this address space if you continue to require global uniqueness of those addresses. Note that some Internet services do not require globally unique addresses if accessed through a NAT or application layer gateway/firewall.

IRs will give those end-users requesting PI space this or a similar warning:

> Assignment of this address space is valid as long as the criteria for the original assignment are still met. However, assignment of address space does NOT imply that this address space will be ROUTABLE ON ANY PART OF THE INTERNET. It is expected that users will have to pay a premium for actual routing of PI addresses as opposed to PA addresses. It may eventually become impossible to get relatively small amounts of PI space routed on most of the Internet. We strongly suggest you contact any prospective service provider for information about the possibility and pricing of service when using PI addresses.

IRs will recommend that end-users use PA space as much as possible.

IRs will register the type of any assigned address space using the "status:" attribute of the "inetnum" object in the RIPE database. The possible values of this attribute are

ASSIGNED PA
: This address space has been assigned to an end-user and is Provider Aggregateable.

ASSIGNED PI
: This address space has been assigned to an end-user and is Provider Independent.

ALLOCATED PA
: This address space has been allocated to an IR and all assignments made from it are Provider Aggregateable.

ALLOCATED PI
: This address space has been allocated to a local IR and all assignments made from it are Provider Independent.

ALLOCATED UNSPECIFIED
: This address space has been allocated to an IR and assignments made from it are either Provider Aggregateable or Provider Independent. This is intended to document past allocations from with assignments of both types or unknown type. It should be avoided for new allocations.

Address space without an explicit type in the status attribute is assumed to be PI space.

IRs will clearly mark all new assignments of address space in the RIPE database with either PA or PI as appropriate.

Wherever possible IRs will work to mark all past assignments in the assignment database(s) with either PA or PI as appropriate. Priority should be given to mark all PA space as such.

IRs will inform end-users about private address space as defined in RFC1597 where appropriate. They will advise them to carefully consider the potential advantages and possible problems as discussed in RFCs 1597 and 1627.

Local IRs may decide which kind they of address space they will assign: PA, PI or both.

If an end-user requests address space of a type which an IR does not assign, the IR will refer the end-user to an appropriate registry. In particular ISP IRs not offering PI space shall support the IR that does assign this space to their customers concerning assignments to those customers. This support includes supporting the customer in preparing a properly documented request and furnishing background information to the IR.

Local IRs which do not normally assign large amounts of a particular type of address space need not hold an allocation of that type of address space. They can get it as needed from the RIPE NCC. These assignments will typically be not aggregateable. Local IRs will make it clear to the user which type of address space is assigned. Clear contractual arrangements are recommended in general and mandatory for PA space.

IRs have assigned address space in the past which is de-facto aggregated but not formally PA type because there are no clear contractual arrangements about termination of the assignment. IRs will ask leaving customers to voluntarily release this address space upon termination of service. Where possible IRs will work to make contractual arrangements to convert PI addresses into PA addresses.