JPOPM 47 議論用
IPv6 PA・PI のアーキテクチャーの維持
　～ IPv4の経験を経て ～

2024年11月19日

JPIX

中川あきら

はじめに
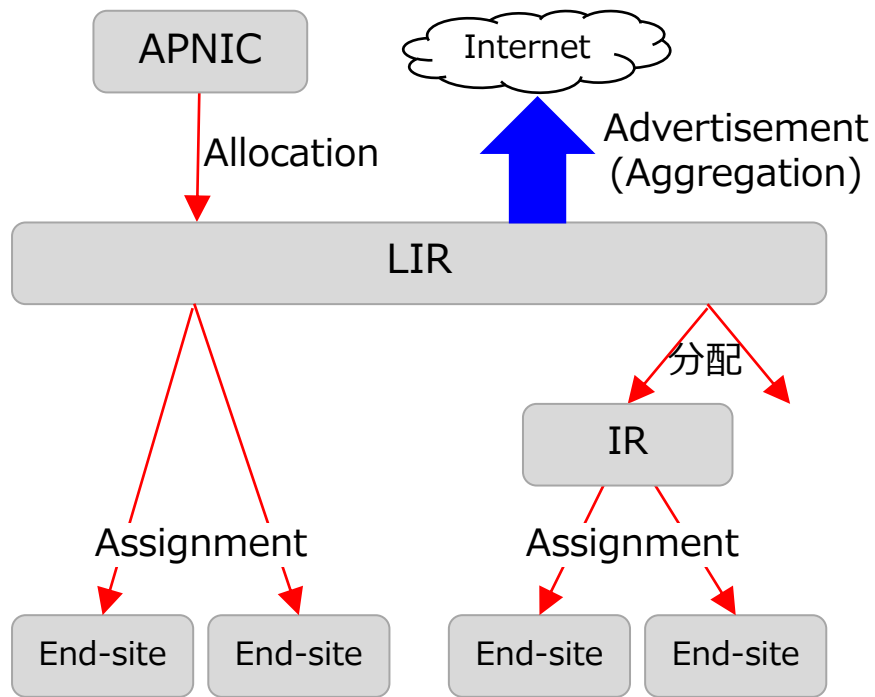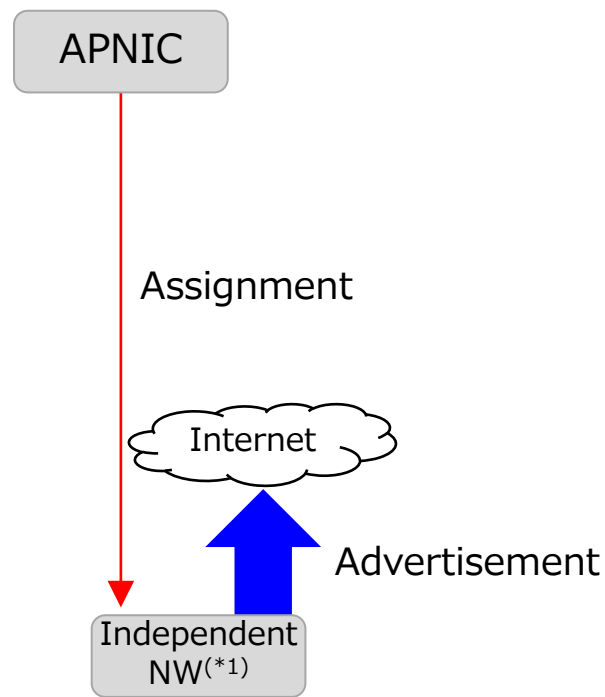
- 本資料における「Policy」は、
  断り書きが無い場合は、以下の APNIC の Policy を
  指します。

- APNIC Policy
  - APNIC Internet Number Resource Policies
  - https://www.apnic.net/community/policy/resources#a_h_5_2_3

JPOPF-ST

ウォーミングアップ
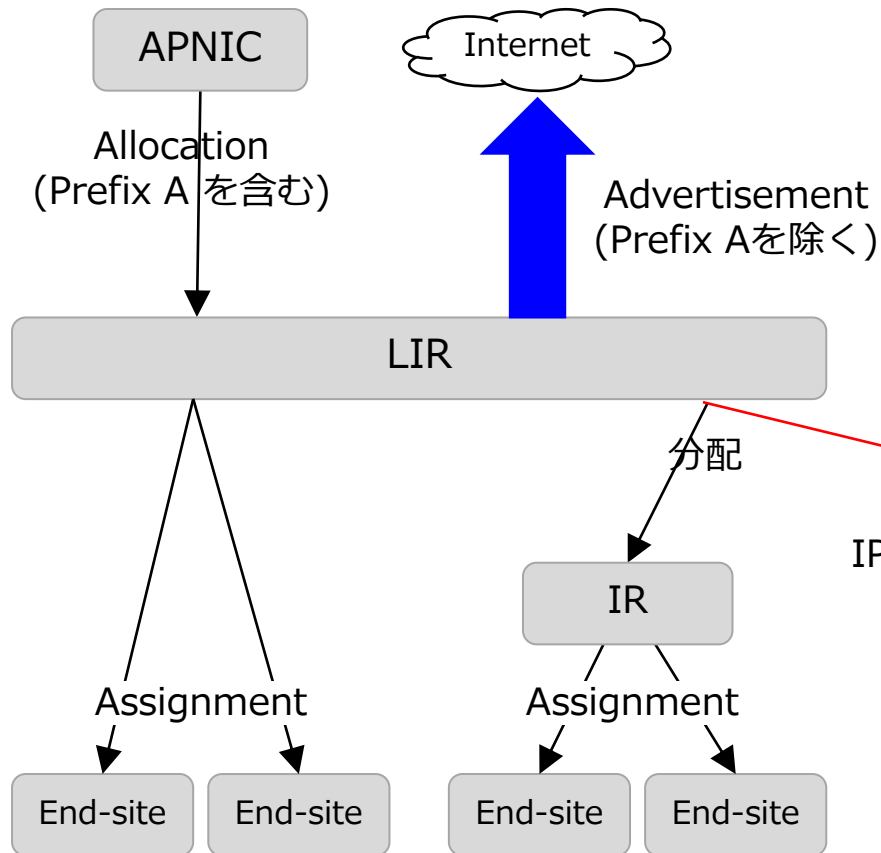
<PA Address>
(Provider Aggregatable Address)

<PI Address>
(Provider Independent Address)

APNIC

Internet

Advertisement
(Aggregation)

Allocation

LIR

分配

IR

Assignment

Assignment

End-site   End-site   End-site   End-site

APNIC

Assignment
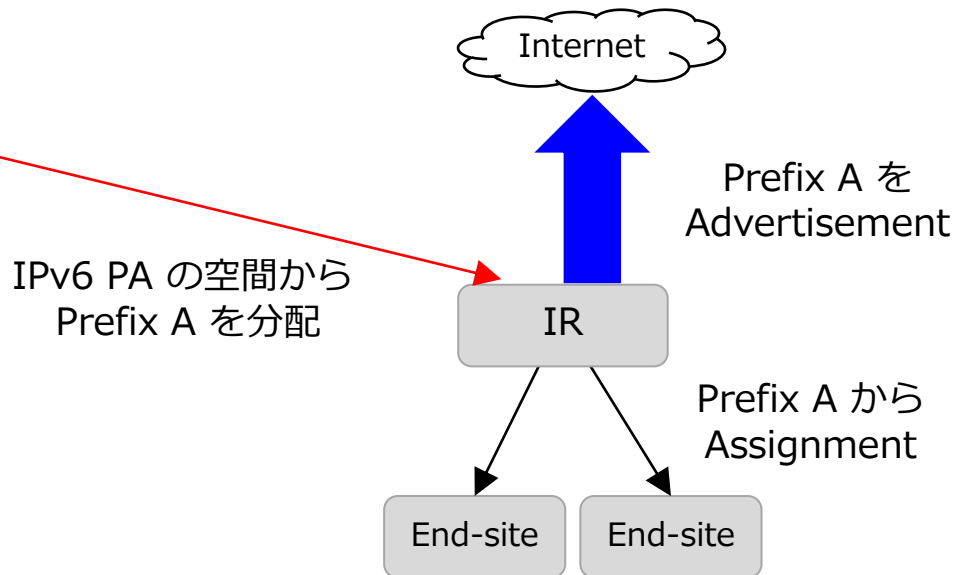
Internet

Advertisement

Independent
NW(*1)

(*1) Policyに、PI Address 割り当て先のNWを表現する用語が定義されていないため、
本資料では「Independent NW」と表現します。

2

JPOPF-ST

Summary

APNIC(=JPNIC) の Policy において、
誰が読んでも IPv6で
これが禁止されていると解釈できるように
表現を改めるべきではないか。

JPOPF-ST

PA Address の分配　　　(カッコ内)はAPNICポリシーの項番号

本議論に関わる部分のみを抜粋。

APNIC

Internet

Allocation

Aggregation(*5)
(3.1.3)

LIR

IPv4:Delegation(*3) (5.2.2)
IPv6:Lir-to-ISP allocation(*4)(5.2.3.1)

IR

Assignment(*1)(2.1.3)

Assignment(*1)(2.1.3)

End-site(*2)
(2.6)

End-site(*2)
(2.6)

End-site(*2)
(2.6)
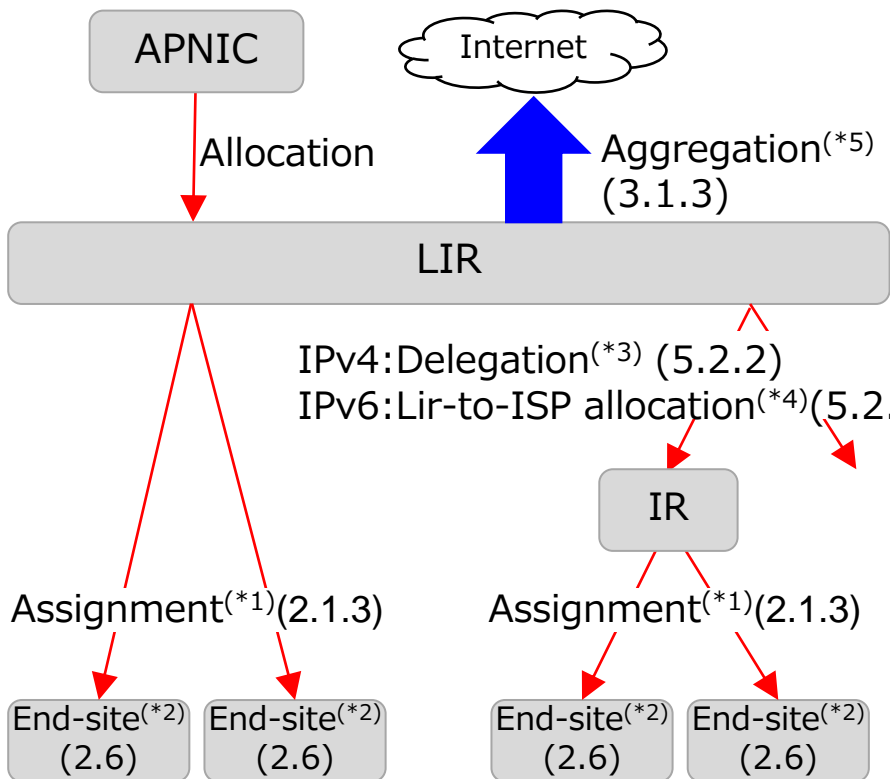
End-site(*2)
(2.6)

(*1) 割り当てとは、LIR又は end-user が独占的に自社運用するインフラで使うための分配。(2.1.3)
(*2) End site とは、SP と以下を含む契約等の関係を持つ End user のロケーション。(2.6)
- End user locationにアドレスを割り当てる。
- End user locationにトランジットを提供
- End user locationのトラフィックを運ぶ
- End user location の経路を集約する。
(*3) IRへのIPv4の分配 (5.2.2) :
- 分配は non-portable であること。
→ Independent IR への分配は不可能
(*4) IRへのIPv6の分配 (5.2.3.1) :　　サイズに関するポリシーのこと?
- 「LIRから配下のIRへの分配ポリシーは無い」
- non-portable に関する記載無し
- End site への全ての/48の割り当ては LIR 又は配下の ISP(IR) によって登録されること。
→ Independent IR への分配は不可能か。
(*5) 本ポリシーのゴール (3.1.3) :
アドレス空間は階層的に分配されるべき。
このゴールはIPv6においては特に重要である。

JPOPF-ST

改訂が必要な場合の具体的な案

5.2.3.1. LIR-to-ISP allocation（LIR から下位 IR(ISP)への IPv6割り振り）
に、以下を追記すると明示的に禁止できる。

Delegations are non-portable and must be returned to the LIR if the
downstream customer ceases to receive connectivity from the LIR.

上記2行は、

5.2.2. IPv4 Delegations to downstream IRs
に書かれている文と同じもの。

案の全文 (5.2.3.1 LIR-to-ISP allocation 全文)

5.0. Resource Management
5.2. LIR address space management
5.2.3. Policies for LIR IPv6 allocation and assignment
5.2.3.1. LIR-to-ISP allocation

現ポリシー

There is no specific policy for an LIR to allocate address space to subordinate ISPs. Each LIR may develop its own policy for subordinate ISPs to encourage optimum utilization of the total address block allocated to the LIR. However, all /48 assignments to end sites are required to be registered either by the LIR or its subordinate ISPs in such a way that the RIR/NIR can properly evaluate the HD-Ratio when a subsequent allocation becomes necessary.

追加

Delegations are non-portable and must be returned to the LIR if the downstream customer ceases to receive connectivity from the LIR.

JPOPF-ST

JPNICにおける「IPアドレス割り当て等に関する規則」

IPアドレス割り当て等に関する規則
https://www.nic.ad.jp/doc/jpnic-01292.html
第5章 IPアドレスの返却
第27条（返却）
IP指定事業者は、 エンドユーザもしくは再割り振り先の事業者との間に存する接続が終了した場合、 別に定める手続に従いその者からIPアドレスの返却を受けなければならない。

上記規則は IPv6・IPv4 の両方に適用
・IP指定事業者とエンドユーザー間
もしくは
・IP指定事業者と再割り振り先の事業者間
に接続が必要。(という解釈)

JPOPF-ST

JPNICにおける「IPv4割り当て報告申請について」

IPv4割り当て報告申請について(ユーザネットワーク用)
https://www.nic.ad.jp/doc/jpnic-01283.html
1. 割り当てガイドライン
　本文書はJPNICポリシーにもとづいて記述されております。 IPv4アドレスにおける
JPNICポリシーについては以下の文書を参照してください。
『JPNICにおけるアドレス空間管理ポリシー』
IP指定事業者に割り振られるアドレス空間はJPNICから委託されたIP割り当て管理業務を
遂行するためのものです。 このため、以下の点に留意してください。
•<省略>
•IP指定事業者と接続しているネットワークに対してのみ割り当てを行う。
•<省略>

上記ガイドラインは IPv4 のみに適用
・IP指定事業者と接続していれば、割り当て可能。
・IP指定事業者は、再割り振り事業者の先のエンドサイトに IPv4 を
　割り当てできない。(元々 IPv4 には再割り振りの概念がなかった)

JPOPF-ST

JPNICのIPv6ポリシー

エンドサイトの定義や
IP指定事業者から下位ISPへの割り振り等、
前述の APNIC のポリシーと同じ。

https://www.nic.ad.jp/doc/jpnic-01272.html

JPOPF-ST

以下、参考
APNIC Policy より抜粋

2.1. Address space

2.1.3. Assigned address space

Assigned address space is address space that is delegated to an LIR, or end-user, for exclusive use within the Internet infrastructure they operate.

JPOPF-ST

End site

2.6. End-site

An end site is defined as the location of an end-user who has a business or legal relationship (same or associated entities) with a service provider that involves:

- that service provider assigning address space to the end-user location
- that service provider providing transit service for the end-user location to other sites
- that service provider carrying the end-user's location traffic
- that service provider advertising an aggregate prefix route that contains the end-user's location assignment

JPOPF-ST

IPv4 Delegation

5.2. LIR address space management

5.2.2. IPv4 Delegations to downstream IRs

LIRs may delegate address space to their downstream customers, which are operating networks, such as ISPs, subject to the following conditions:

•Delegations are non-portable and must be returned to the LIR if the downstream customer ceases to receive connectivity from the LIR.

•The downstream customer is not permitted to further allocate the address space.

5.2.2.1. Effect of delegation to downstream IRs on upstream LIR's usage rate

For the purposes of evaluating the LIR's usage rate, address space delegated to downstream LIRs will be considered as "used". However, APNIC will give careful consideration to the registration of delegations made by the downstream LIR to their customers and may request supporting documentation as necessary.

JPOPF-ST

5.2. LIR address space management
5.2.3. Policies for LIR IPv6 allocation and assignment
5.2.3.1. LIR-to-ISP allocation
There is no specific policy for an LIR to allocate address space to subordinate ISPs. Each LIR may develop its own policy for subordinate ISPs to encourage optimum utilization of the total address block allocated to the LIR. However, all /48 assignments to end sites are required to be registered either by the LIR or its subordinate ISPs in such a way that the RIR/NIR can properly evaluate the HD-Ratio when a subsequent allocation becomes necessary.

JPOPF-ST

Aggregation

3.1. Goals of resource management

3.1.3. Aggregation

Address policies should seek to avoid fragmentation of address ranges. Wherever possible, address space should be distributed in a hierarchical manner, according to the topology of network infrastructure. This is necessary to permit the aggregation of routing information by network operators, and to limit the expansion of Internet routing tables.

This goal is particularly important in IPv6 addressing, where the size of the total address pool creates significant implications for both internal and external routing. It is a condition of all delegations made under initial or subsequent LIR delegation criteria, that the address space is aggregated by the LIR within a minimum number of routes announcements (preferably one).

LIRs must only delegate addresses to customers who will be using those addresses in relation to network connectivity services provided by the LIR.

LIRs are expected to enter into agreements with their customers specifying that the end-user will hold the addresses only for so long as the end-user remains a customer of that LIR. Such agreements should also be consistent with the license under which the address space is being used by the LIR.

JPOPF-ST

Registration requirements

5.3. Registration requirements

5.3.1. Requirements for Autonomous System Numbers (ASNs) and Addresses

IRs are responsible for promptly and accurately registering their ASN and address space use with APNIC as follows:

All ASNs assigned must be publicly registered in the APNIC, or relevant NIR, Whois database, for which APNIC or NIR will create the aut-num object.
All the attributes of the aut-num object, must be registered in accordance with APNIC or NIR Whois database documentation.
All delegations from APNIC to the IR must be registered.
All delegations to downstream IRs must be registered.
Delegations made to networks greater than a /30 for IPv4 and /48 for IPv6 must be registered.
Delegations made to networks of a /30 for IPv4 and /48 for IPv6 or less may be registered, at the discretion of the IR and the network administrator.
Delegations to hosts may be registered, at the discretion of the IR and the end-user.

JPOPF-ST