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Use Cases for Multiple Provisioning Domain in Homenet
draft-geng-homenet-mpvd-use-cases-01

Abstract

This document describes the use cases of multiple provisioning domain (MPVD) in homenet. Although most residential networks nowadays are connected to a single ISP and normally subscribed to standard internet service, it is expected that much wider range of devices and services will become common in home networks. Homenet defines such home network topologies with increasing number of devices with the assumption that it requires minimum configuration by residential user. As described in the homenet architecture ([RFC7368]), multihoming and multi-service residential network will be more common in the near future. Nodes in such network may commonly have multiple interfaces or subscribe to multiple services. Potential types of PVD-aware nodes concerning interface and service specific provisioning domains are introduced in this document. Based on this, different MPVD configuration examples are given. These examples illustrate how PVD may be implemented in home network. PVDs provide independent provisioning domains for different interfaces and services, which enables robust and flexible network configuration for these networks.

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1. Introduction

It is believed that future residential network will more commonly be multihomed, which potentially provides either resilience or more flexible services. At the same time, more internal routing and multiple subnets are expected to commonly exist in such networks. For example, customer may want independent subnets for private and guest usages. Homenet describes such future home network involving multiple routers and subnets ([RFC7368]).

Multihoming and the increasing number of subnets bring challenges on provisioning of the network. As stated in [RFC6418], such multihomed scenarios with nodes attached to multiple upstream networks may experience configuration conflicts, leading to a number of problems. To deal with these problem, draft-ietf-mif-mpvd-arch-10 provides a framework which introduces Provisioning Domain (PvD), which associates a certain interface and its related network configuration information. Hence, corresponding network configuration can be used when packets are delivered through a particular interface.

This document focuses on the MPvD use cases in residential network, particularly the IPV6-based homenet. Based on the homenet topology, use cases of MPvD in homenet are described for both singlehomed and multihomed network configurations.

1.1. Requirements Language

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 RFC 2119 [RFC2119].

2. Terminology and Abbreviations

The terminology and abbreviations used in this document are defined in this section.

- ISP: Internet Service Provider. A traditional network operator who provides internet access to customers.

- VSP: Virtual Service Provider. An service provider who typically provides over-the-top services including but not limited to Internet of Things services (IoT).

3. Homenet with Multiple PvDs

In the most common multihoming scenarios, the home network has multiple physical connections to the ISP networks. Section 3.2.2.2 and 3.2.2.3 in [RFC7368] give the topology examples of such homenet. In the examples, homenet hosts are connected to a single or multiple customer edge routers (CE router), the CE routers are then connected to separate ISP networks. For the particular topology with a single CE router given in Section 3.2.2.3 in [RFC7368], the CE router is a mif node since it has two interfaces connected to individual service provider routers. Given that the CE router is a PvD-aware node, it may have a single PvD as it is connected to only one ISP and an additional PvD if connected to both.

Apart from the multihoming resulted from physical connections to different ISPs, the future residential network may also logically connected to multiple Over-the-top service providers(i.e. IoT service providers), who do not directly provide internet access service to customers. For example, one customer may subscribe to a traditional service ISP for basic internet service, whilst subscribe to other providers for Internet of Things service. The latter are likely to be VSPs as defined in Section 2 of this document, who are not bounded to any of the ISPs providing basic access service for the residential network. In this case, a particular VSP may also use PvDs for customized network configurations purposes. This enables the VSPs to provide independent and flexible provisioning between on its subscriber's network for different services. Meanwhile, VSPs may also want to use independent PvDs to avoid the configuration conflicts between each other as stated in RFC6418.

The following sections outline differenct types of PvD in homenet.

3.1. PvD associating an interface in homenet

One typical example of a PvD in home network is the one associating an interface with network configuration. As described in ([RFC7368]), a multihomed CE router in homnet connects with multiple ISPs. It may have several different uplink interfaces (i.e. PON and LTE). ISP can use PvDs to associate its network configurations with specific uplink interface the CE router provides to its subscriber. PvD information can be delivered by ISP through the corresponding uplink interface of the CE router.

Another scenario is when the interior routers and hosts in homenet have multiple uplink interfaces(i.e. LAN, WIFI, Zigbee). Depending on the actual network implementation, PvDs for these interfaces can be either configured by ISPs or VSPs. Since these devices connect with the internet through the CE router within homnnet, mechanism needs to be defined for PvD information delivery within homenet.

3.2. PvD associating a service in homenet

This type of PvD is useful in homenet when a provisioning domain is needed for a specific service that a homenet user subscribe to. Unlike the PvD associating an interface in homenet, this PvD associates the network configuration with a service. The service can be provided by any ISP or VSP that is available to the user.

In homenet, ISPs and VSPs can use this PvD for service-specific provisioning in CE routers, interior routers and hosts. Service providers could decide the number of PvDs they offer depending on the services a user subscribes to. This enables complete dependency

between the provisioning of different services provided by either same or different sources.

A good example of a device in homenet that may use such PvD is a IoT box provided by VSP. This box may be connected to a CE router as an interior router as demonstrated in section 3.2.2.1 of [RFC7368], or integrated with the CE router or the host in some circumstances.

Since some services may need provisioning domain in multiple devices in homenet(i.e. Both IoT service gateway and host need to be provisioned), PvDs associated with the same service in different devices should ideally be managed by a single provider. Hence, necessary collaboration can be taken care of by the VSP/ISP.

3.3. PvD for hybrid purposes in home network

The coexistence of multiple interfaces and services is possible when a device in homenet is both multihomed with more than one ISPs and subscribed to multiple services. Assuming that a service provider has access to the interface of the device on which its service is provided, a provisioning domain associating both the service and corresponding interface can be used for a simpler set-up. For example, instead of separately maintaining a WIFI interface PvD and an IoT service PvD, an VSP can merge the information of these to PvD and only use a single PvD for hybrid provisioning. It is always preferred that PvD for hybrid provisioning is used when possible, since it offers better network configuration flexibility for service provider and enables seamless coordination between interface and the service runs on it.

4. Examples of MPvD Configurations in Home Network

This section gives some examples of MPvD configurations in home network.

4.1. Homenet Connected to a Single ISP

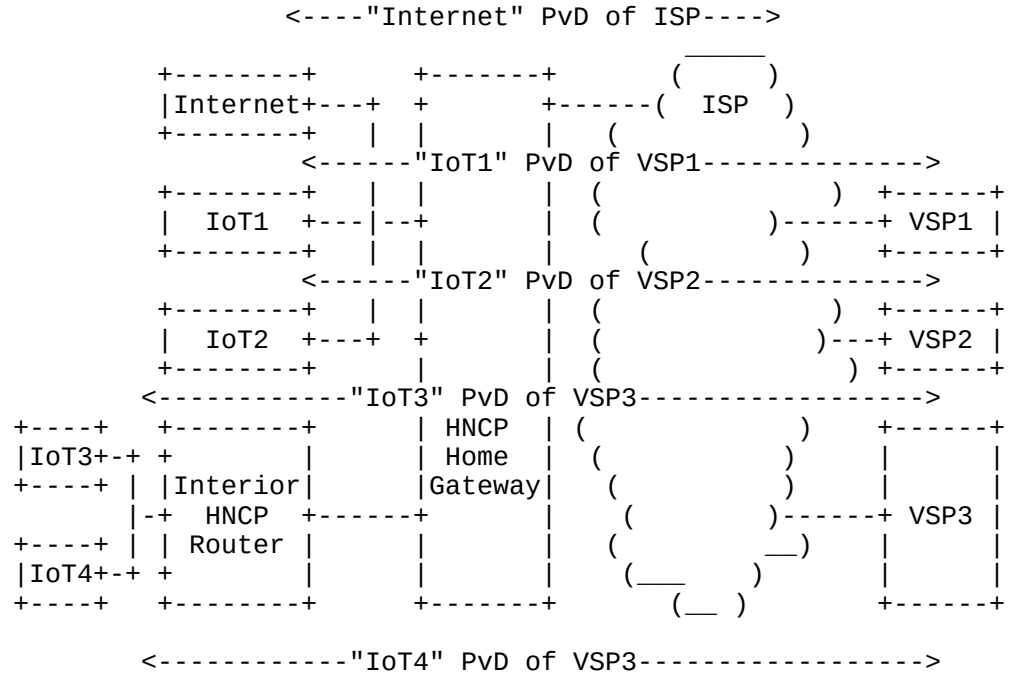

Figure 1

A homenet home gateway (CE router) is singlehomed with a single ISP as seen in Figure 1. In this scenario, basic internet service is provided by this ISP, IoT services are provided by 3 different VSPs. Multiple PvDs are created for the CE router for the purpose of service provisioning. The home gateway, connected with multiple service providers, receives basic internet PvD information from the connected ISP, IoT1 PvD information from VSP1 and IoT2 PvD information from VSP2.

Additionally, an HNCP-enabled interior router is connected to the home gateway and provides another 2 IoT services from VSP3 to the user. VSP3 may create 2 PvDs associating IoT3 and IoT4 respectively for the interior router, subject to the user’s subscription.

In this example, ISP provides basic internet service through a homenet home gateway and VSPs provides multiple IoT services through both the HNCP home gateway and the interior HNCP router. Since none of the gateway devices are multihomed, all of the PvDs associate corresponding network configuration with a specific service. The PvD information is delivered by ISP and VSPs through the corresponding singlehomed interface.

4.2. Multihomed Homenet

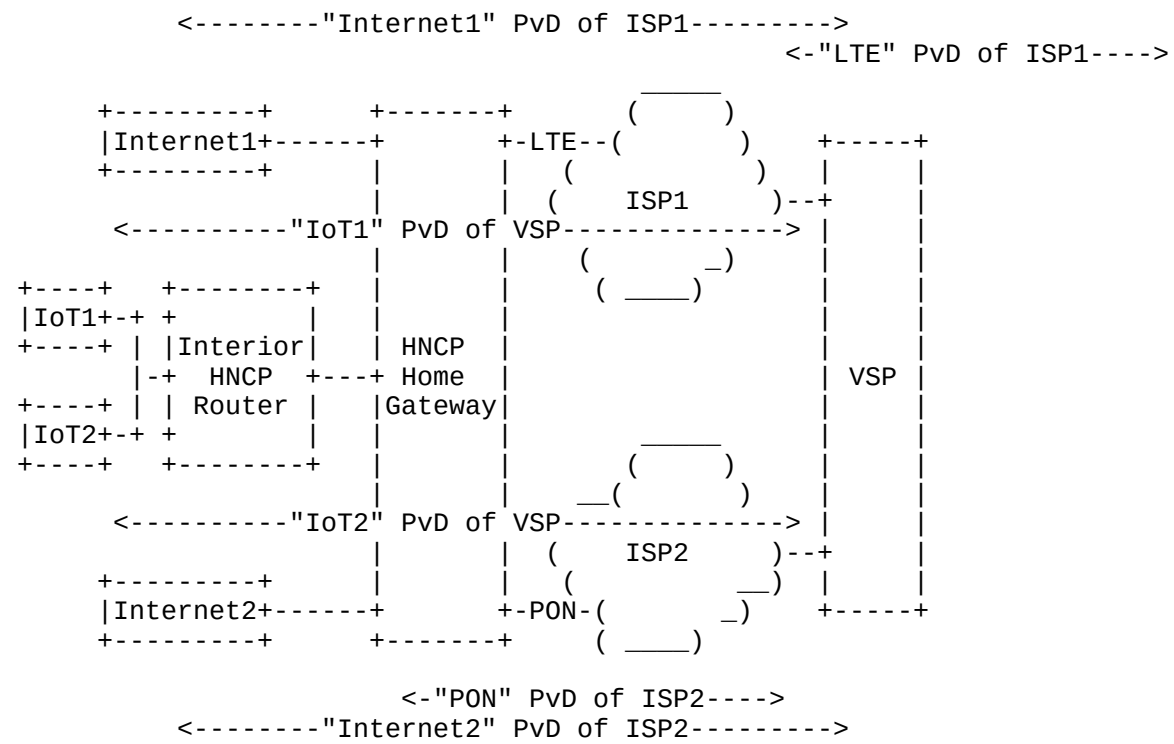

Figure 2

Figure 2 illustrates an example of multihomed HNCP home gateway. In this example, two ISPs are connected with the HNCP home gateway and both provide internet services. The interfaces used by the HNCP home gateway for these 2 ISPs are LTE and PON, which are provisioned within the LTE PvD of ISP1 and PON PvD of ISP2. Another 2 PvD for individual internet service are also created by ISP1 and ISP2 respectively. In principle, it is preferred in this example that the 2 PvDs of the same ISP should be merged as one hybrid PvD, which associates the complete set of network configuration with both the internet service and the corresponding uplink interface.

The interior HNCP router in this example are similiar to the one in the previous example, providing 2 IoT services provisioned separately by VSP. However, it is worth mentioning that the IoT1 and IoT2 PvDs information is not necessarily delivered from a fixed ISP because of

the nature of multihomed gateway. It is upto the VSP to make the decision according to the available network resources.

Although not shown in Figure 2, the HNCP home gateway may also directly provide IoT service from VSP. Since VSP is normally homed with multiple ISPs, the multihomed HNCP home gateway may receive PvD information from different ISPs for the IoT service. PvD configuration conflicts need to be avoided in this case.

5. PvD-aware node in homenet

PvD-aware node is the device where the provisioning domains and associated network configuration are set up. In the examples given in Section 4, the HNCP home gateways and Interior HNCP routers are all PvD-aware nodes. The HNCP home gateway receives MPvD identity and associated network configuration from the network and forward the MPvD information belonging to interior routers. It is worth mentioning that a PvD-aware node may also be a host in homenet,which is not shown in the given examples. For instance, a mobile device connected with the interior router may have MPvDs for it’s Wifi and cellular interfaces, or for multiple services it subscribed to.

As introduced in RFC7556, typical information a PvD-aware node learned from network by a provisioning domain including source address prefixes for use by the connected hosts within the PvD,IP address(es) of the DNS server(s) and default gateway address. While these information is maintained in the PvD-aware node, it needs to assign prefixes to the connected hosts within homenet using homenet-defined approaches.

6. Conveying PvD information

The PvD associated with an VSP service may be directly provided by VSP using application layer approach, or provided by the the ISPs in which the VSP is homed if there are collaboration between ISPs and VSPs.

At the time this document was written, the conveying of PvD information was still under discussion in mif working group. Popular choices include DHCP and Route Advertisement. For PvD information provided from ISPs and VSPs to the CE routers, the approaches for PvD information delivery defined by mif may be directly used. For PvD information delivery within homenet between HNCP-enabled routers and hosts, HNCP-related approach need to be concerned. The detail of how homenet could support the delivery of PvD information is subjected to further discussions and will be addressed in a separate document.

7. Acknowledgements

The author would like to thank Ted Lemon for valuable initial discussions of this document.

8. IANA Considerations

This memo includes no request to IANA.

9. Security Considerations

TBA

10. References

10.1. Normative References

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10.2. Informative References

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