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Openv6 Architecture for IPv6 Deployment
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Abstract

IPv6 transition leads to costly end-to-end network upgrades and poses new challenges in terms of device management with a variety of transitional protocols.

This document provides a cost-effective and flexible unified IPv6 deployment by describing an architecture of a standard and programmatic manner for IPv6 deployment.

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1. Introduction

The exhaustion of the IPv4 address space has been a practical problem that network carriers are facing today. Existing solutions such as IPv4 re-addressing and address reusing fail to fundamentally solve this problem. Instead, IPv6 is regarded as a complete and thorough solution to this problem.

To date, the adoption of IPv6 is progressing slowly. [Google-IPv6-Statistics] shows the statistics of IPv6 adoption. On one hand, IPv6 lacks support from applications. As a result, end users are reluctant to transition to IPv6 due to lack of attractive applications and competitive prices on IPv6. On the other hand, a large-scale IPv6 network as well as a stable and large IPv6 user group are the fundamental driving forces for evolving to IPv6.

The key to the above deadlock is that network carriers should take the initiative in constructing and developing an IPv6-friendly infrastructure, thus providing IPv6-based service access capabilities and actively nurturing the IPv6 adoption. The Openv6 and this document are focused on flexibly unifying the IPv6 transition mechanisms. The Openv6 provides an IPv6-friendly infrastructure to let the users decide for themselves when and how to start the IPv6 transition.

2. Terminology

3. Motivation for OpenV6 Architecture

Several motivations for the Openv6 are listed below. This list is not meant to be exhaustive and is provided for the sake of illustration.

It should be highlighted that the aim of this section is to provide some application examples for which the OpenV6 may be suitable: this also clearly states that such a model does not aim to replace existing IPv6 transition mechanisms but would apply to specific existing or future situations.

The Openv6 does not replace the existing IPv6 transition mechanisms in the network. Instead, it is compatible (or accommodate) existing and future IPv6 transition mechanisms.

Not all networks, servers and users will upgrade to IPv6 at the same pace along IPv6 transition. There will be many different scenarios, among which we can highlight the following ones:

Some regions will stay as IPv4-only networks (whenever transition is too costly or there are compelling technical reasons for not upgrading), and some regions will start as IPv6-only networks.

IPv6 end users accessing the IPv6 Internet via a service provider's IPv4 network infrastructure.

IPv4 end users accessing the IPv4 Internet via a service provider's IPv6 network infrastructure.

IPv6 end users accessing the IPv4 Internet.

According to these (and many others) different scenarios, and to the current status of network infrastructure, a number of different IPv6 transition technologies have been defined. For any device it becomes extremely hard to support them all at the same time, so addressing all the potential situations can become extremely costly, both in terms of CAPEX and OPEX.

The Openv6 provides an opportunity to build a unified approach to the different IPv6 transition technologies. With unified devices on the forwarding plane, packets are processed according to flow tables, in a way completely oblivious to the transition technology particular aspects.

4. Overview of the OpenV6 Architecture

This section gives an overview of the architecture of the Openv6.

The figure in Figure 1 shows the basic architecture of Openv6.

```
                                  +------------------------+
                                  |       Applications     |
                                  | (Lw4over6, NAT64, etc.)|
                                  |                        |
                                  |    +----------------+  |
                                  |    |  Openv6 Agent  |  |
                                  |    +----------------+  |
                                  +----------- ^ ----------+
                                               |
                                               |
                                               |
                                  +----------- v ----------+
                                  |   +---------------+    |
                                  |   |               |    |
                                  | +-----+       +-----+  |
                                  | |Agent|  ...  |Agent|  |
                       +-------+  | +-----+       +-----+  |
                       |       |  |   |               |    |
+----+  +-----------+  |       |  |   +---------------+    |
|Host|--|Unified    |--|       |  |            ^           |
+----+  |v6Trans CPE|  |       |  |            |           |  +--------+
        +-----------+  |       |  |            v           |  |        |
                       |IPv4/  |  |     +---------------+   |  |IPv4/   |
                       |IPv6   |--|     |               |   |--|IPv6    |
                       |Network|  |     |  Unified      |   |  |Internet|
+----+  +-----------+  |       |  |     |  Flow Table   |   |  |        |
|Host|--|Unified    |--|       |  |     |               |   |  +--------+
+----+  |v6Trans CPE|  |       |  |     +---------------+   |
        +-----------+  |       |  |                        |
                       |       |  |Unified Forwarding Node |
                       +-------+  +------------------------+
```

Figure 1: Architecture of OpenV6

Unified Forwarding Node: A forwarding node that handles incoming packets basing on the flow table. Examples of Forwarding Nodes can include:

A router that has an extended function module. The extended module handles incoming packets basing on the flow table of the module.

A server that runs vRouter or vSwitch.

A CGN that runs NAT, Tunnel En/De-capsulation functions.

A Forwarding Node may be locally managed, whether via CLI, SNMP, or NETCONF.

Unified Flow Table: The flow table is used for handling incoming packets of the forwarding node. The flow table can be updated by the application. If an incoming packet does not match any entry of the flow table, the packet will be delivered to the agent for generating new entries.

OpenV6 Agent: The OpenV6 agent interacts with the forwarding node to provide specified behavior for incoming packets via the flow table.

Application: A network application that needs to manipulate the network to achieve its service requirements. Various IPv6 transition mechanisms are are considered to be a variety of applications in OpenV6. The application can communicate with multiple forwarding node.

Agent: The agent interacts with the applications and the forwarding nodes. It can be implemented in the forwarding node for policies driven provisioning. There may be multiple agents in an forwarding node. Each agent executes a specific policy(for example, one agent for App-Lw4over6, one agent for NAT64, etc.)

5. OpenV6 Considerations

6. Manageability Considerations

7. Security Considerations

8. IANA Considerations

9. Acknowledgements

N/A.

10. References

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