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https://datatracker.ietf.org/doc/draft-jia-scenarios-flexible-address-structure/

Scenarios for Flexible Address Structure

IETF 109 – Online

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Overview

Gap Analysis

- **IPv6** becomes the **core protocol** of the entire communication system
- Increasingly network scenarios long for **TCP/IP** for **global reachability**.
- IP address is designed to hold the **topology semantics** only **(RFC0791)**
- New network scenarios may prefer **a flexible address structure** for advanced features and routing capabilities.

Main Purpose:

- A flexible address structure is expected to be adaptive to futuristic scenarios requirements
- unleash more network abilities and possibilities

Orientation

Potential orientation
(not deterministic definition)

Address Flexibility

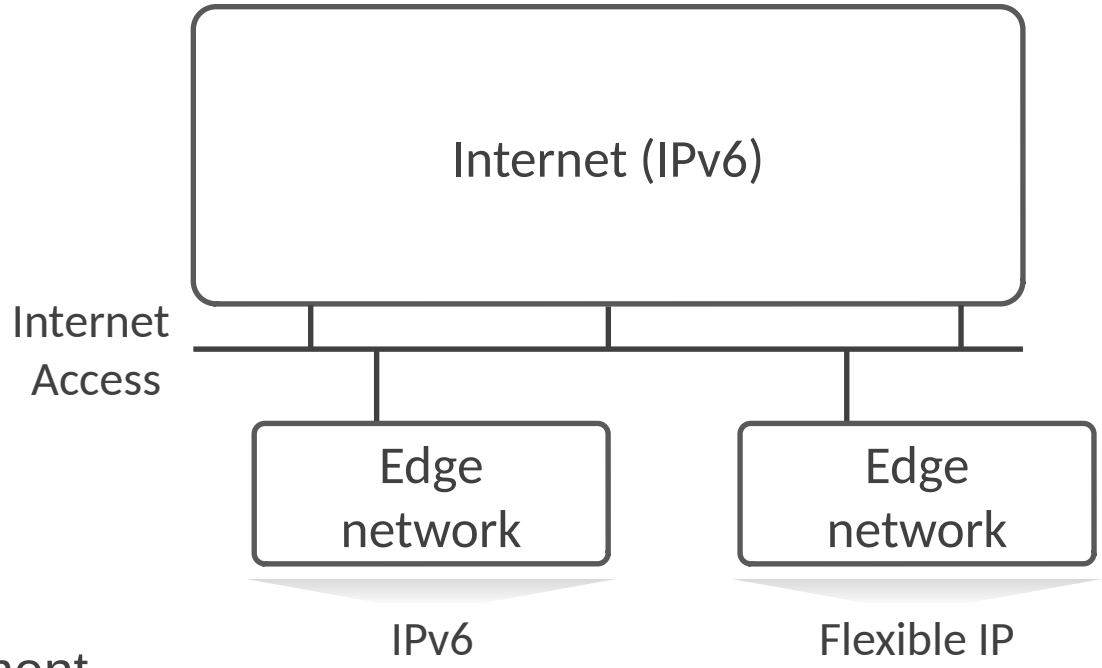
- Include multiple semantics
- Length variable

Physical location

- Edge network / Limited domain **(RFC8799)**

Logical Position

- A supplementary of the IPv6 address, not replacement



Scenario-1: Internet of Things (IoTs)

GAP Analysis

- IoTs is expected to use IPv6 for global end-to-end reachability
  - Myriad address space is huge enough to accommodate various IoT devices
- Energy consumption of standard IPv6 is unaffordable for constrained devices.
  - E.g., power requirements, computation requirements, memory requirements
- 6LowPan is a feasible but suboptimal solution
  - The compression and decompression still introduce extra energy and resource consumption
  - The (de)compression action at every forwarding node leads to network delay

Potentials under a flexible address structure

- A shorter address (and packet header) could contribute to energy saving
- A appropriate gateway can restore the global IPv6 address when packet flow into Internet backbone, and vice versa.

Scenario-2: Satellite Network

GAP Analysis

- The space-based Internet is expected to provide global Internet reachability
  - E.g., SpaceX Start-link
  - Be conductive to cruise ships, flights, or vehicles in deserts.
- The high dynamics of satellite network lead to low communication performance
  - Layer 3 routing protocol is designed for terrestrial network and statics topology
  - Bubble protocol (DTN WG) is an overlay solution, thus subject to drawbacks of the underlay.

Potentials under a flexible address structure

- Geolocation could be encoded in IP address (semantics refer to geolocation)
- Then satellite can forward packet by geolocation rather than table lookup
- Improve the underlay routing reliability and performance

Scenario-3: Dynamic Service and Resource

GAP Analysis

- Delay exist for mapping between resource/service and their IP address
  - E.g., DHCP service □□ IP, Google search service □□ IP
- Inflexible network forwarding for different resource/service
  - Routers can not offer differentiated service quality based on IP
  - QoS field is easy for spoofing

Potentials under a flexible address structure

- service/resource identifier can be embedded and marked by a fixed address, without mapping and its delay.
- In-network routers can offer differentiated network quality based on the identifiers that located in the address

Scenario-4: Policy-based Traffic Control

GAP Analysis

- Network itself is hard to directly conduct traffic control
  - End-to-end policy: network should not intervene upper layer business
  - Access allow/deny action is usually conducted at the end
- Policy-based traffic control can be indirectly conducted by sub-net partition
  - E.g., VLAN, VxLAN
  - Too much human cost: manual configuration and maintenance
  - small changes in reality could lead to a huge manual efforts

Potentials under a flexible address structure

- Address can explicitly depict objects identifier (users, devices)
- In-network routers can thus directly allow/deny traffic according to the identity that depicted in address

Scenario-5: Robust Trust and Security

GAP Analysis

- IP protocol itself cannot offer any authentication capability
  - IP address is easy to spoofing
  - Packets is easy to be detoured to anyone else
- IPsec offers authentication, but it is hard for keys distribution
- Specific address/protocol construction can contribute to authentication
  - E.g., Cryptographically Generated Addresses (CGA) **[RFC3972]**, Host Identity Protocol (HIP) **[RFC7401]**
  - Keys can only be used by a truncated sequence due to the limited space of IPv6

Potentials under a flexible address structure

- any secure-related keys could be integrally included inside the address
- Integrally key could contribute to authentication and security without key distribution.

Recap.

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Discuss

Are these scenarios **reasonable** for a **flexible** address structure?

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THANKS!

Questions / Comments?

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