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https://datatracker.ietf.org/doc/draft-jia-flex-ip-address-structure/

# Flexible IP: An Adaptable IP Address Structure

## IETF 109 – Online

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# Gap Analysis

**Scenarios potentially prefer a flexible IP address structure**

- Internet of Things (IoTs)
- Satellite Network
- Dynamic Service and Resource
- Policy-based Traffic Control
- Robust Trust and Security
- … …

Based on the **rationality** of scenarios requirements

# Targeted Scenario

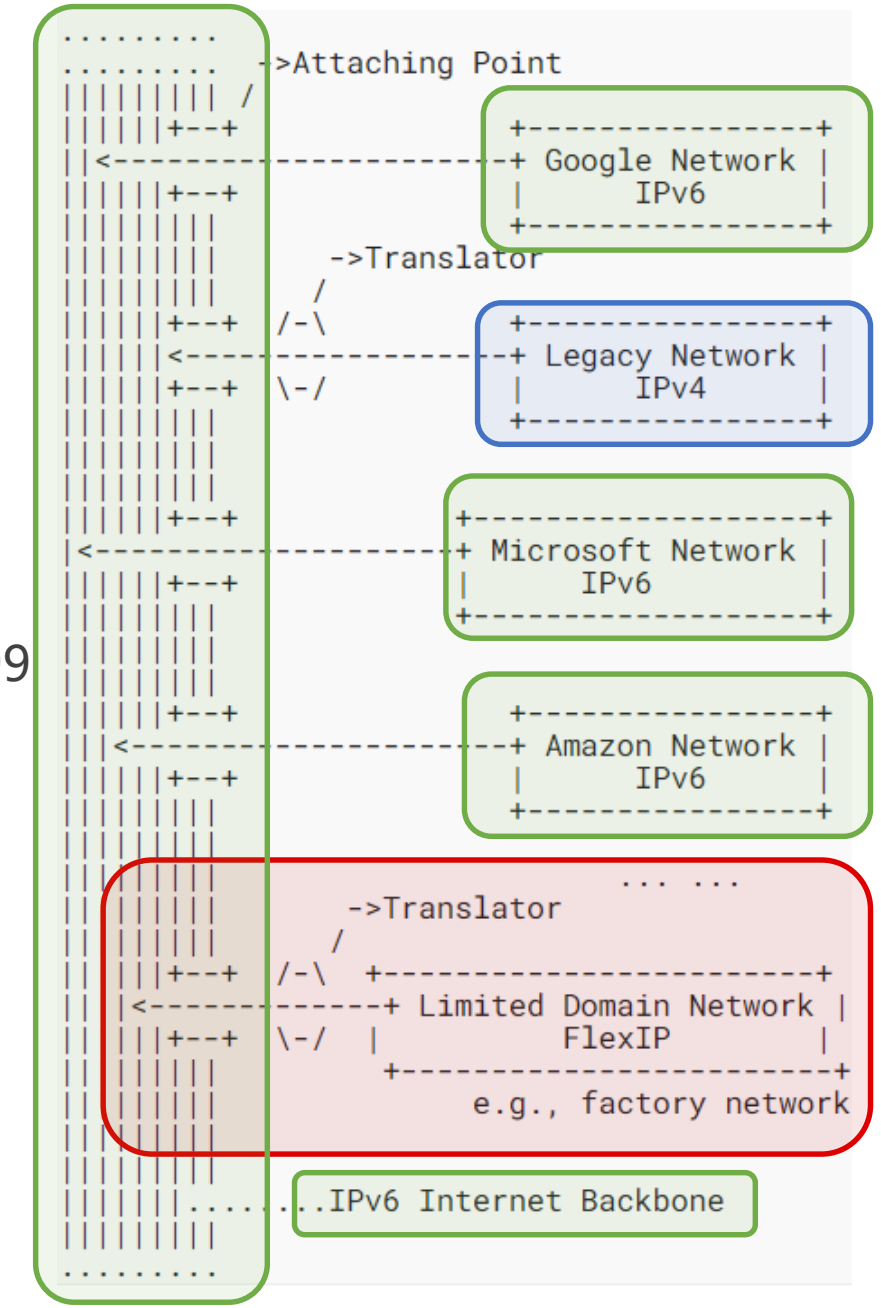
## Physical Location

- **IPv6** remains the mainstay of the Internet backbone
- Various network is supposed to evolve to **IPv6**, with only a small number of legacy **IPv4** networks

- New network scenario are located at the **edge** of Internet
- Edge Network can be depicted as **limited domain** in RFC8799
- **FlexIP** is expected to be used at limited domain **only**.

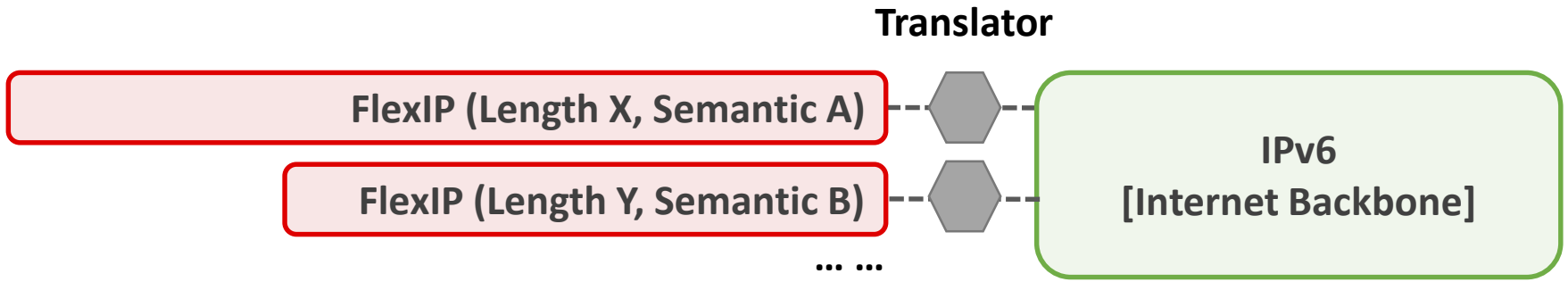
## Logical Position

- FlexIP is a replacement of the global IPv6 address system, but only a **supplementary** of it.



# Design Considerations

- **Multi-Semantics**
  - According to the gap analysis, a semantic enabled address structure can enrich advanced network functions, e.g., semantics-based routing.
- **Elastic Address Space**
  - Different semantics may require different address length, while a short address is a dramatic energy saving for constrained devices.
- **Scalability**
  - Boundless space may lead to routing table explosion. To makes the address practically values, balance must be reached between expansive address space and efficient routing performance.
- **Interoperability**
  - Since such address should only act as a supplementary of the global IPv6 address system, transformation must be conducted at the boundary of IPv6 and the new address structure.



# FlexIP Address Structure

## CH: (1) hierarchical (2)self-explanatory

**For short address length only**
- length: 1-byte (0-239)
- One segment, topology semantic

**For extendable address length**
- length: Any-byte
- One segment, topology semantic

**For multi-segment address**
- length: accord with each segment
- Multiple segments, topology semantic

**For non-topology semantic address**

| Index | Type | Structure (default by topology semantic and 1 segment) |
|---|---|---|
| 0x01 | Restrained Space | topology address - address 1 |
| 0x02 | Restrained Space | topology address - address 2 |
| ... | ... | ... |
| 0xEF | Restrained Space | topology address - address 239 |
| 0xF0 | Extendable Space | followed by address with 16-bit length |
| 0xF1 | Extendable Space | followed by address with 32-bit length |
| 0xF2 | Extendable Space | followed by address with 64-bit length |
| 0xF3 | Extendable Space | followed by address with 128-bit length |
| 0xF4 | Extendable Space | followed by address with 256-bit length |
| 0xF5 | Extendable Space | followed by address with X-bit length |
| 0xF6 | Hierarchical Segments | followed by address with 2 segments |
| 0xF7 | Hierarchical Segments | followed by address with 3 segments |
| 0xF8 | Hierarchical Segments | followed by address with Y segments |
| 0xF9 | Multi-Semantics | followed by Non-topological semantic address |
| 0xFA - 0xFF | None | reserved |

# FlexIP Examples and Text Representation

| Formal Representation | Text Representation |
|---|---|
| C8 | [1]C8 |
| F1/2A00012F | [4]2A::12F |
| F5/07/3B3A297F50C24F | [7]3B:3A29:7F50:C24F |
| F6/C8/F2/2001000000012F | [1]C8[8]2001::12F |
| F8/04/F0/2F5B/F0/6A3C/F0/9C2B/F0/735D | [2]2F5B[2]6A3C[2]9C2B[2]735D |
| F9/01/F2/A32F84C981002E9B | [8]<GEO>A32F84C981002E9B |

hexadecimal

*Table 2: Examples of Flexible IP Address Text Representation*

"/" is for readability only and must be omitted in practical use.

Used by Computer program

Used by human being

First Segment, Segment length: 1-byte, Segment: C8

[1]C8[8]2001::12F

Second Segment, Segment length: 8-byte, Segment: 2001::12F

[2]2F5B[2]6A3C[2]9C2B[2]735D

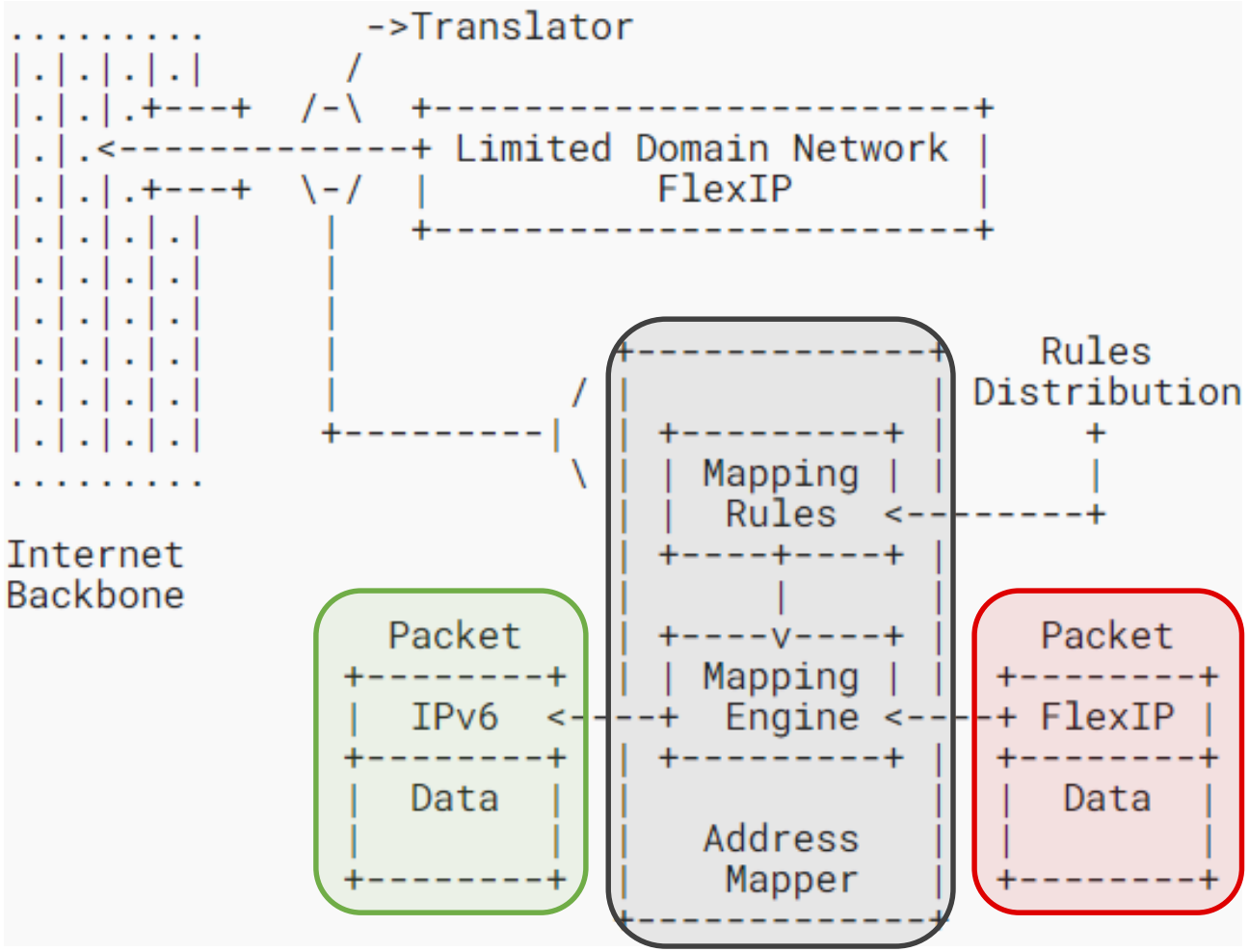
4 Segments, 2-byte length for each Segment length

[8]<GEO>A32F84C981002E9B

1 Segments, Segment length: 8-byte, Segment semantic: Geolocation

# Interoperability

- A **translator** is deployed at the **boundary** of the FlexIP limited domain.
- The translator is mainly constructed by a **address mapper**
- For packet transiting address mapper, the address will be **transformed** between **IPv6** and **FlexIP**.




- Till now, only **address structure** is discussed.
- **Header structure** is leave to future consideration.

- Example:

**IPv6**

**2001:A:5F:2C:A2F7::12F**

**Mapping**

**FlexIP**

**[8]A2F7::12F**

# Recap. FlexIP

- **Gap analysis:**
  - Increasingly network scenarios long for **TCP/IP** for **global reachability**.
  - New network scenarios → **advance network features** <GAP> IPv6 capability
- **Target scenario location**
  - **Limited domain** (edge network)
- **Logic Position**
  - a **supplementary** of the IPv6 address, not replacement
- **Draft includes:**
  - FlexIP **address structure**: hierarchical, self-explanatory
  - FlexIP **Text Representation**: [8]<GEO>A32F84C981002E9B[2]5A
  - FlexIP-IPv6 **Interoperability**: an address mapper
- **Draft excludes:** (not yet)
  - **FlexIP packet header**: to be designed and discussed in the future

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# THANKS!

## Questions / Comments?

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