

Asymmetric IPv6

draft-jiang-asymmetric-ipv6

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Motivation and Approach

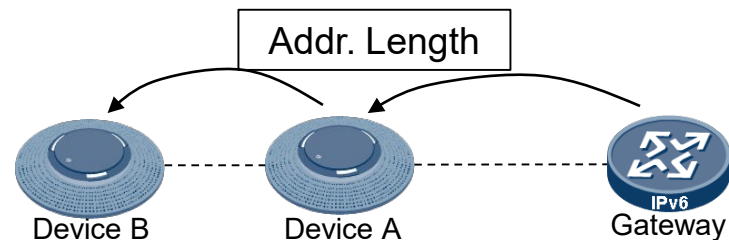
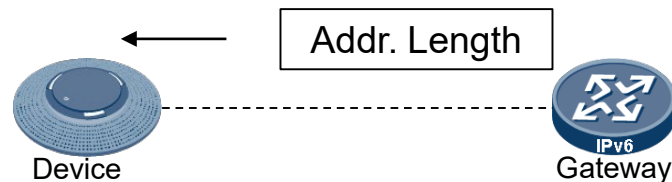
- In edge IoT deployments, physical MTU and bit rate may be very low, so packet size needs to be minimized
- Also, the edge routers may be constrained
 - compression/decompression algorithms use resources
 - 128 bit addresses consume memory
- The proposed approach is
 - Shorten addresses inside IPv6 packets
 - Route on shortened addresses
 - Don't transmit unnecessary bytes
 - Avoid compression/decompression algorithms

Method

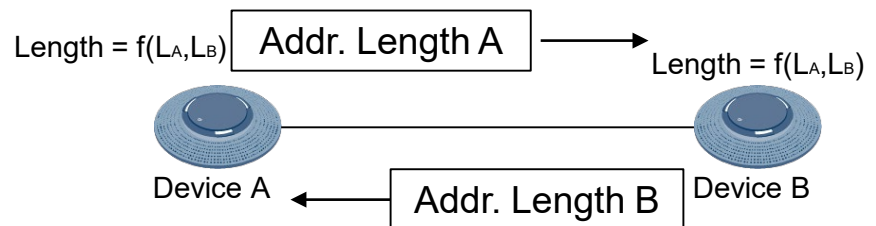
- Define an address length N within a domain
- All addresses inside the domain are assumed to have a common prefix of $(128-N)$ bits
- RIB/FIB can use short addresses for intra-domain forwarding, full addresses outside
- Unnecessary header bytes are elided
- Use a “flexible header encoding”

How to determine address length within a domain

- Each node must be configured with address length
 - By manufacturers
 - By network operators
 - By endpoint users
- Get address length as a parameter from gateway when attaching



- Negotiate address length with neighbors
 - ✓ Use function f to determine the address length



RA Message with modified prefix option

- RFC 4861 defines RA message and prefix information option
- Define one more flag S to indicate that asymmetric IPv6 can be used.

— (128-Prefix) length will be short address length



RA

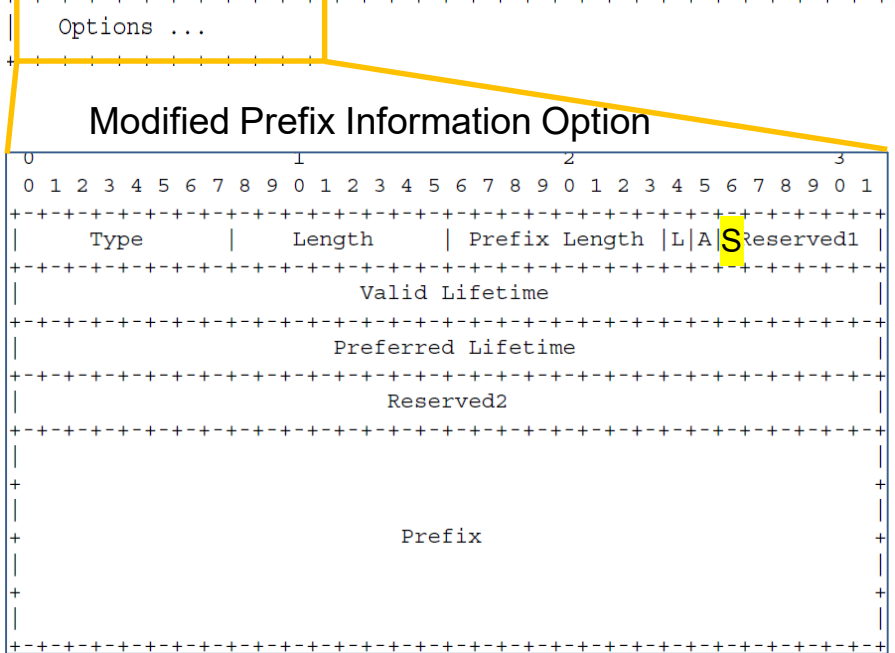
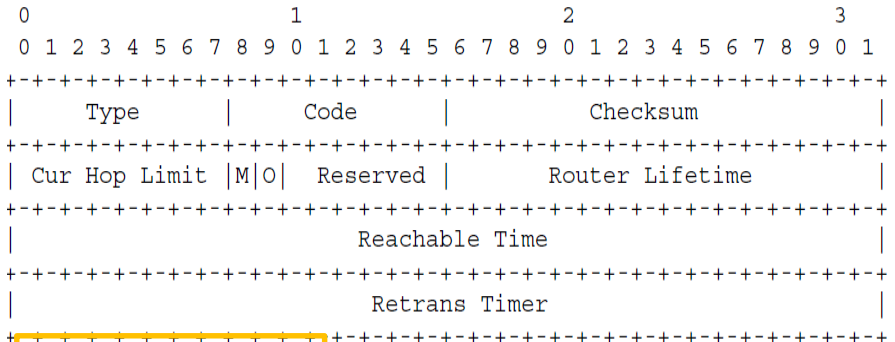


Router

Device

ICMP type = 134
 Src = router link-local address
 Dst = all-nodes multicast address(FF02::1)
 Data = Router lifetime, Cur hop limit, Autoconfig flag,
 Options(prefix(Prefix Length, S), MTU)

Router Advertisement Message



Stateless short address configuration

- When S is set to 1:

1. Device get unique local address of router's interface.
2. If length of unique local address is not equal to (128-prefix length), calculate unique local address according to source address and prefix length
3. If not exceed retry times, generate new address according to router's address. Many algorithms can be used, e.g. random
4. Execute DAD, if succeed, bind the address to interface, or back to step 3



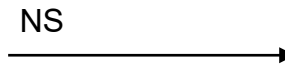
ICMP type = 134
 Src = ~~router link-local address~~ **unique local address**
 Dst = all-nodes multicast address(FF02::1)
 Data = Router lifetime, Cur hop limit, Autoconfig flag,
 Options(prefix(Prefix Length=**n**, **S=1**), MTU)

Duplicate Address Detection



Device A

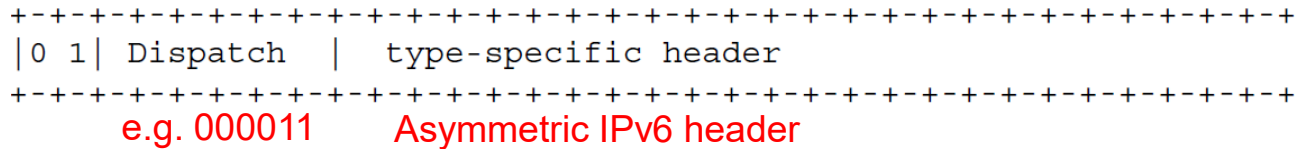
ICMP type = 135
 Src = ::
 Dst = solicited-nodes multicast address
 (FF02::1:FF + target(lower 24 bit))
 Target = **domain address**



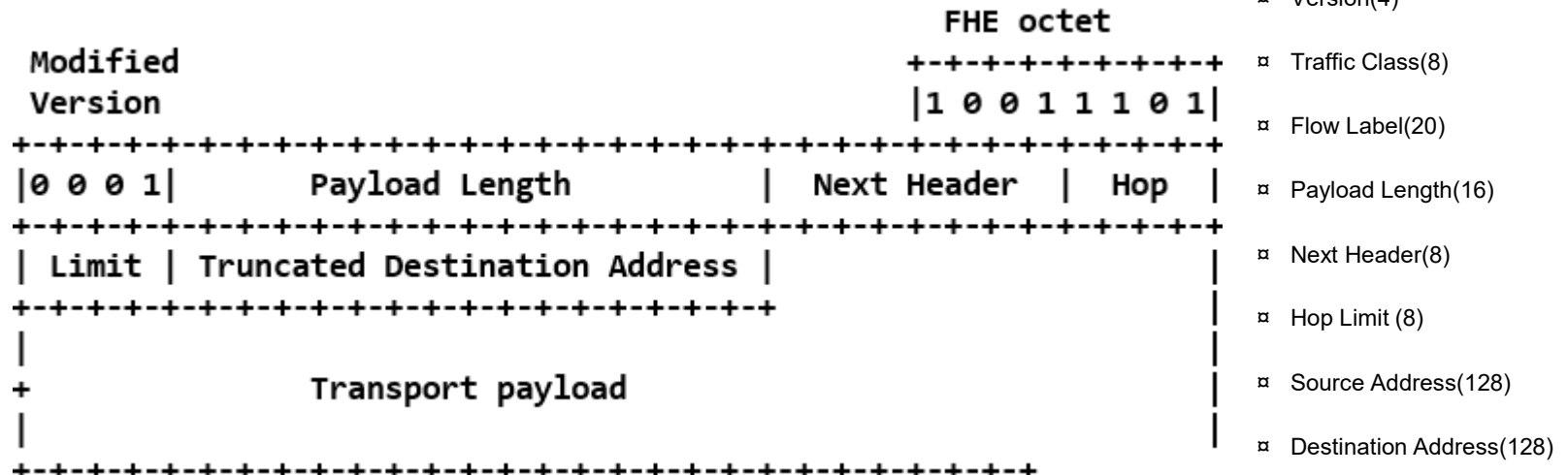
ICMP type = 136
 Src = **domain address**
 Dst = all-nodes multicast address(FF02::1)
 Target = **domain address**

Encapsulation of Asymmetric IPv6

- Use adaption layer like 6lowpan, new dispatch should be assigned.



- Use a “flexible header encoding”

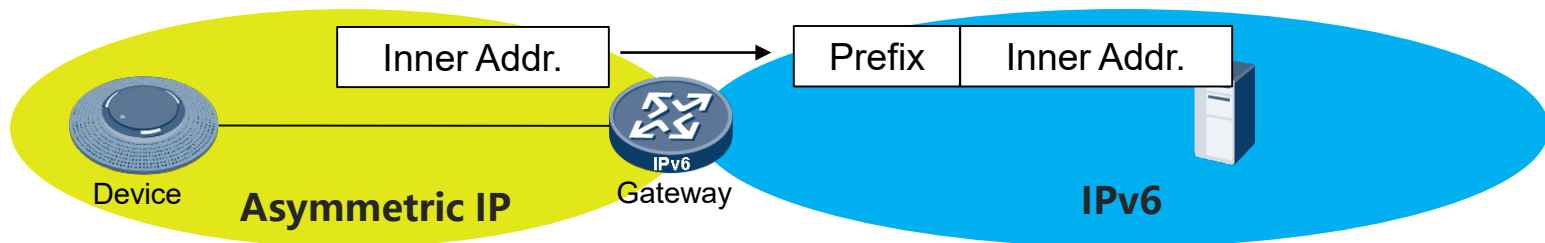


- Modified version field

0000: The length of source address is domain-specified and the destination address is normal(128 bit)
 0001: The source address is normal (128 bit) and the length of destination address is domain-specified
 0010: The length of both source and destination address is domain-specified
 0011 ~ 1111: Reserved

Communication with short address

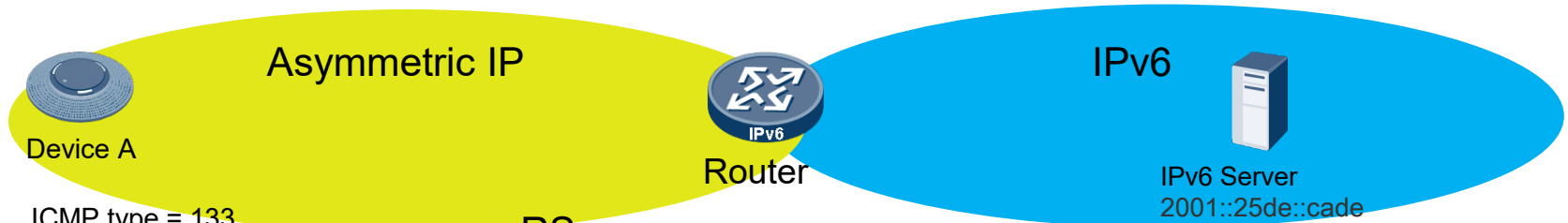
- From inner node to outer node and vice versa
 - Gateway must add prefix to form standard IPv6 address



- Intra-domain communication uses inner address only

Delegation of outer nodes' address

- Define new options of destination proxy request and response.
- Use RS/RA message to run delegation process



ICMP type = 133
 Src = Self interface address
 Dst = all-router multicast address(`FF02::2`)
 Data = options(**Dst proxy req**(`2001::25de::cade`))

RA

ICMP type = 134
 Src = router **unique local** address
 Dst = all-nodes multicast address(`FF02::1`)
 Data = Router lifetime, Cur hop limit, Autoconfig flag,
 Options(**Dst proxy rsp**)

Dst proxy req格式

Type(8)	Length(8)	Dst address list (128 * n)	Padding
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Dst proxy rsp格式

Type (8)	Length (8)	Dst address (128)	Domain Address	Other address pairs	Padding
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Address Pair List

Discussion

- Comments? Questions?
- Side meeting discussion:

Wednesday 08:30-09:45 in Notre Dame
(also draft-jiang-service-oriented-ip)