Asymmetric IPv6

draft-jiang-asymmetric-ipv6-02

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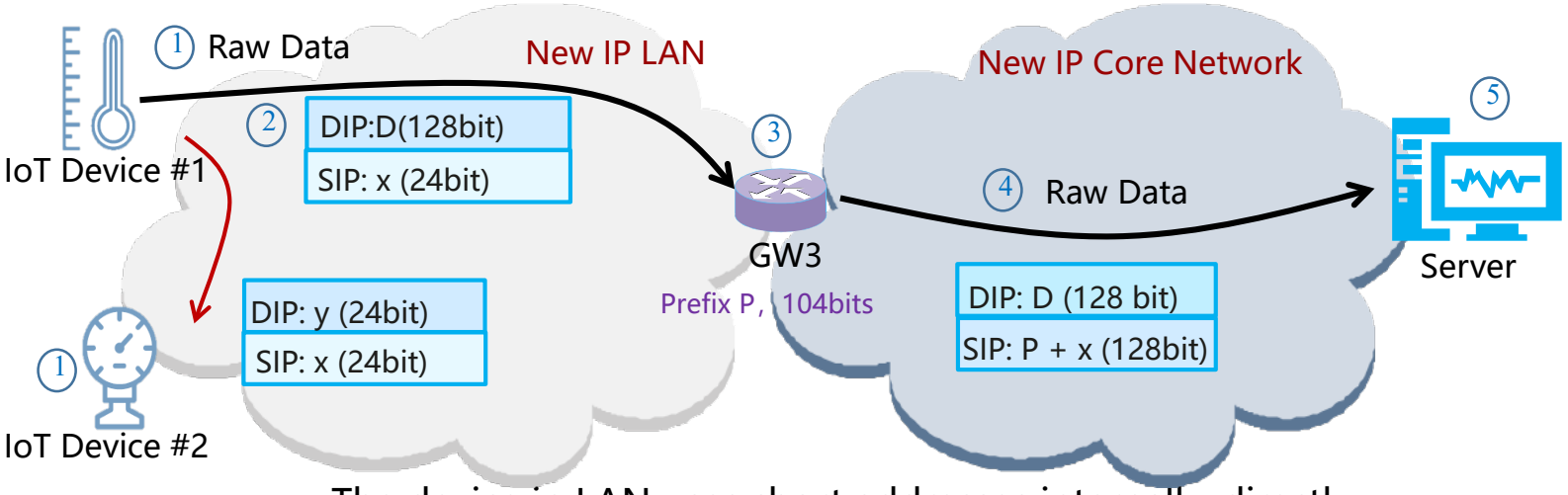
Motivation and Approach

- 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



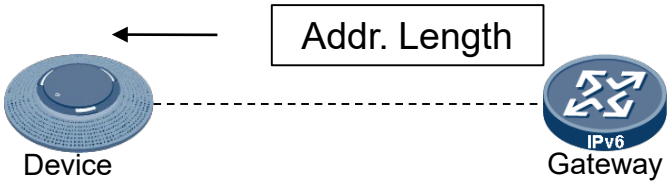
The device in LAN uses short addresses internally, directly communicate with devices in external address space (long addresses)

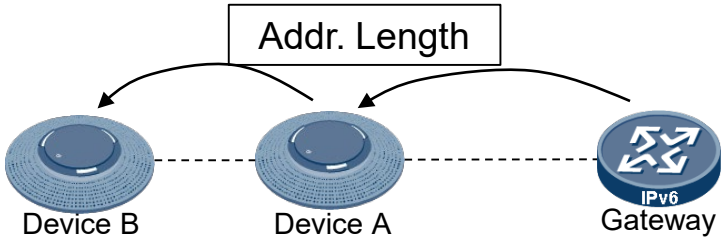
Method

- 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”

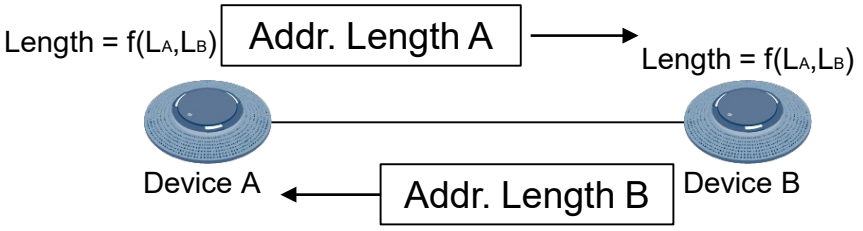
How to determine address length within a domain

- 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



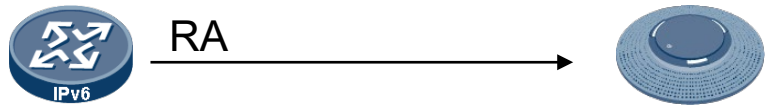


- Negotiate address length with neighbors
  - ✓ Use function f to determine the address length



RA Message with modified prefix option

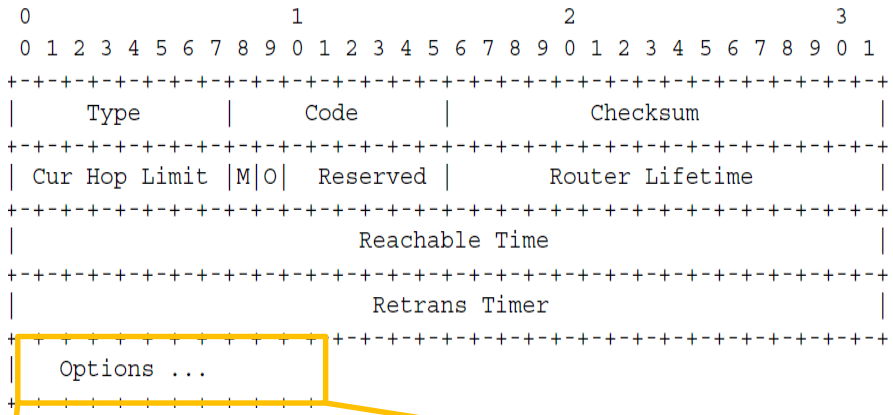
- Reuse RA message
- But define new flag bit for short address mode



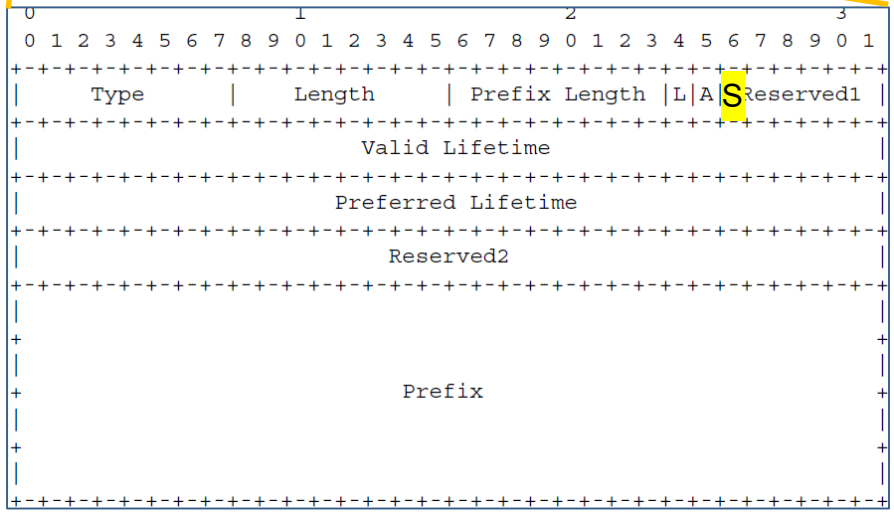
Router → Device

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

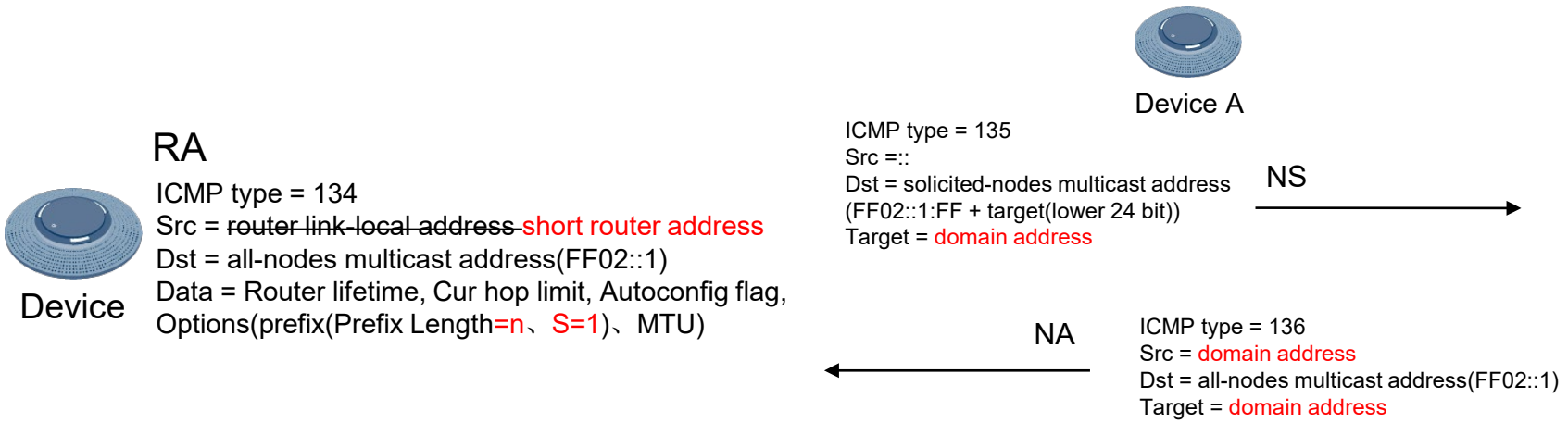


Modified Prefix Information Option



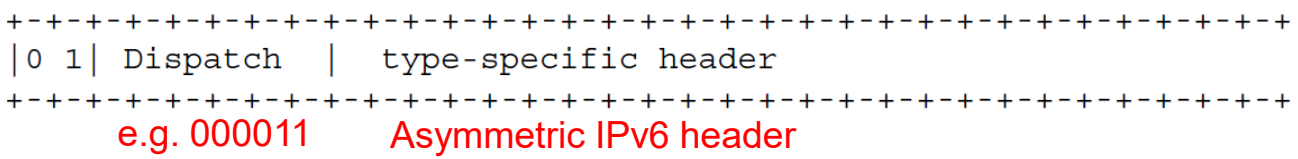
Stateless short address configuration

- Device get SRA（Short Router Address） from RA message
- Generate a short address according to SRA
- Validate the address with revised DAD(Duplicate Address Detection)

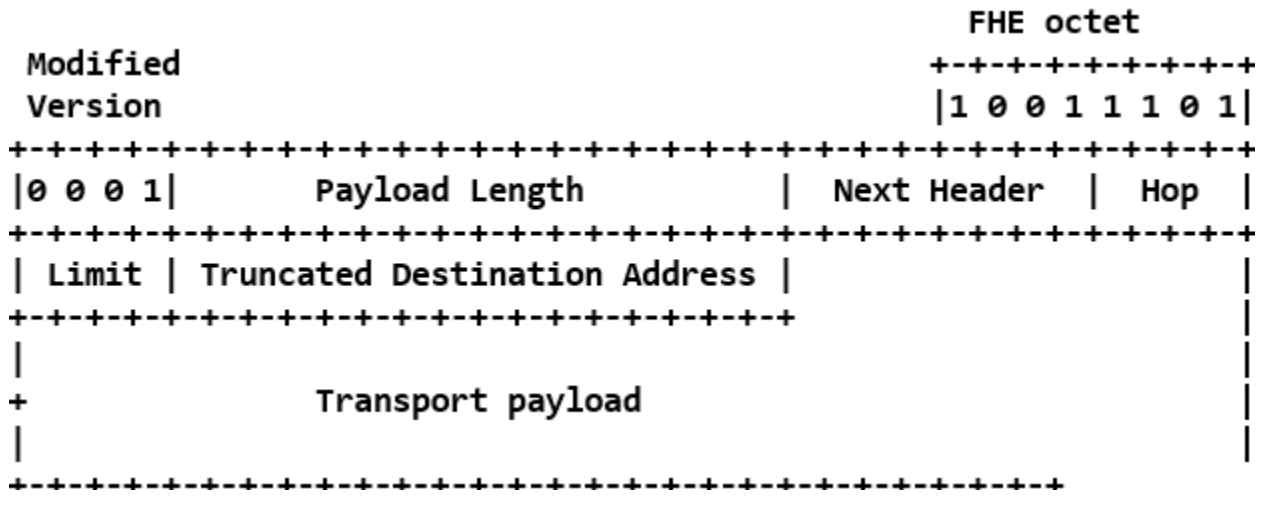


Encapsulation of Asymmetric IPv6

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



- Use a “flexible header encoding”

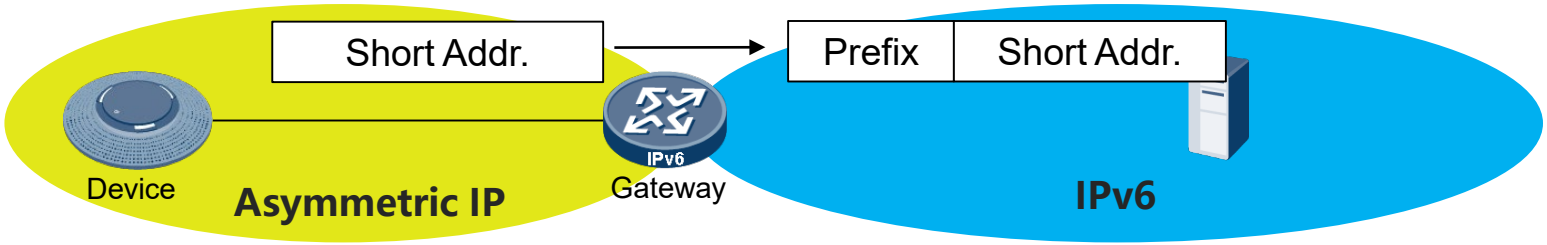


- ¤ Version(4)
- ¤ Traffic Class(8)
- ¤ Flow Label(20)
- ¤ Payload Length(16)
- ¤ Next Header(8)
- ¤ Hop Limit (8)
- ¤ Source Address(128)
- ¤ Destination Address(128)

- Modified version field
  - 0b0000: The source address (if exist) has pre-determined length inside the domain and the destination address (if exist) uses standard 128-bit IPv6 address. (Outward traffic)
  - 0b0001: The source address (if exist) uses standard 128-bit IPv6 address and the destination address (if exist) has pre-determined length inside the domain. (Inward traffic)
  - 0b0010: The source address and destination address have the same length inside the domain. The address length will be pre-determined.
  - 0b0110: Reserved for IPv6 compatible case.
  - 0b0100: Reserved for IPv4 compatible case.
  - 0b0011~0b1111(except 0b0110, 0b0100): Reserved.

Communication with short address

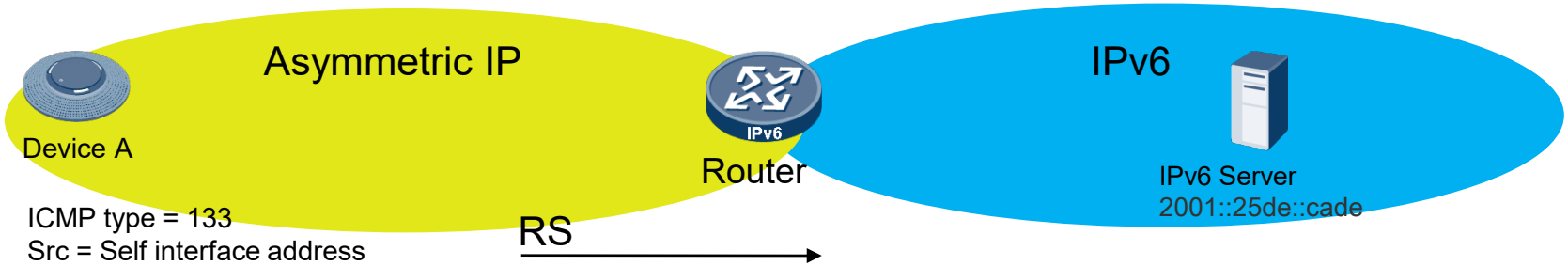
- From inner node to outer node (outward)
  - Gateway must add prefix to form standard IPv6 address



- Intra-domain communication uses short address only

Delegation of outer nodes' address

- Use short address as delegation of the IPv6 address inside domain.
- Use RS/RA message to run delegation process



Dst proxy req格式

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

Dst proxy rsp格式

Type (8)	Length (8)	Dst address（128）	Domain Address	Other address pairs	Pad ding

Address Pair List

Discussion

- Comments? Questions?