# IPv6 Solution for 5G Edge Computing Sticky Service

draft-dunbar-6man-5g-edge-compute-sticky-service-01

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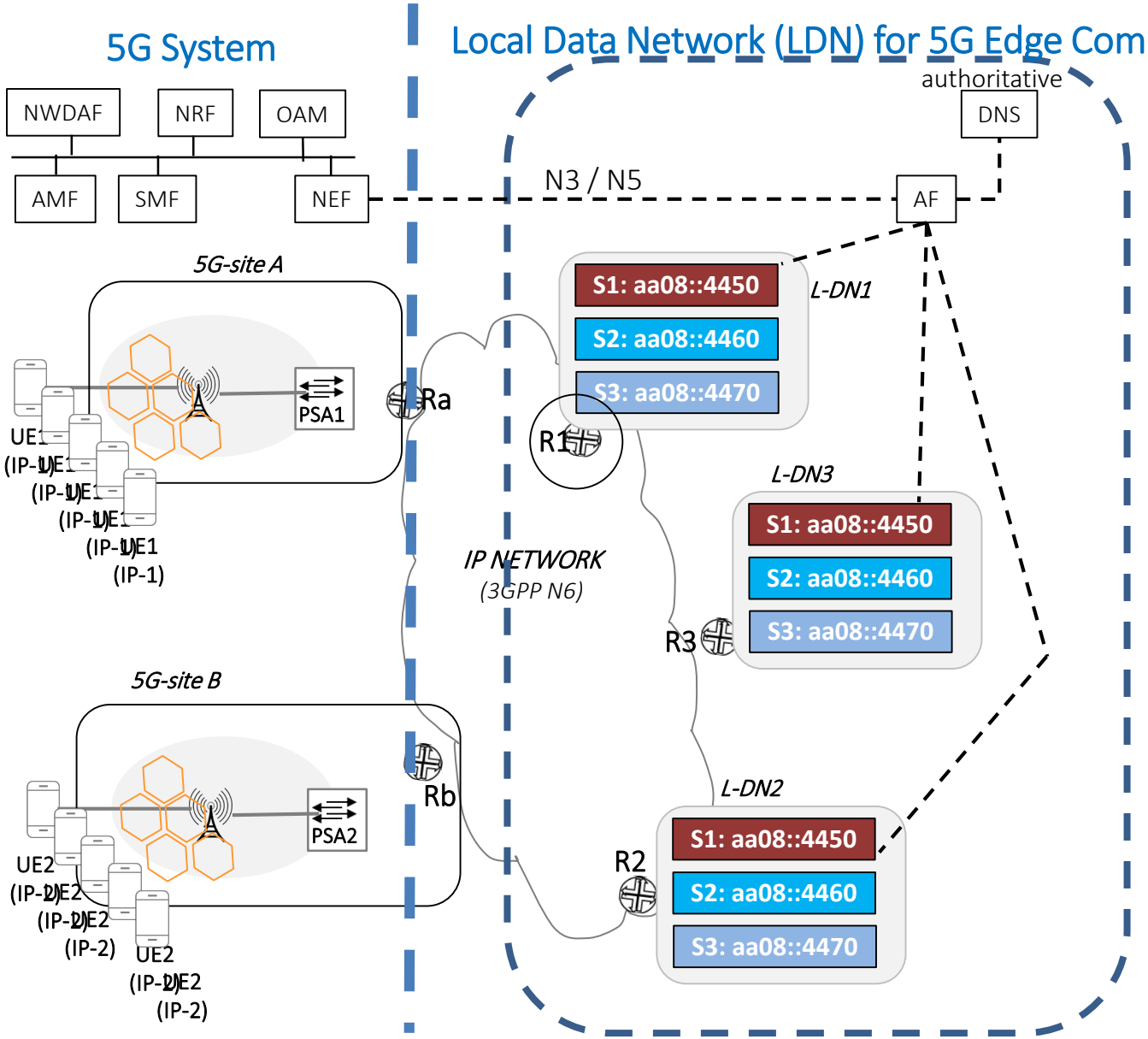
# 5G Edge Computing (3GPP TR23.748)

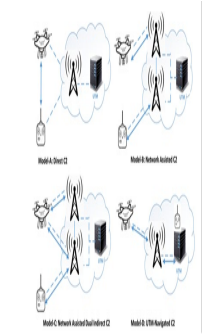



One Application has multiple Application Servers located in Edge Computing DCs

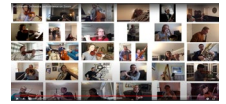
## Use Cases

- Unmanned Aerial Vehicles (Drones) <-> Controller, Traffic Management, and App Servers

  13 detailed use cases described in 3GPP TR22.829



- Virtual concert

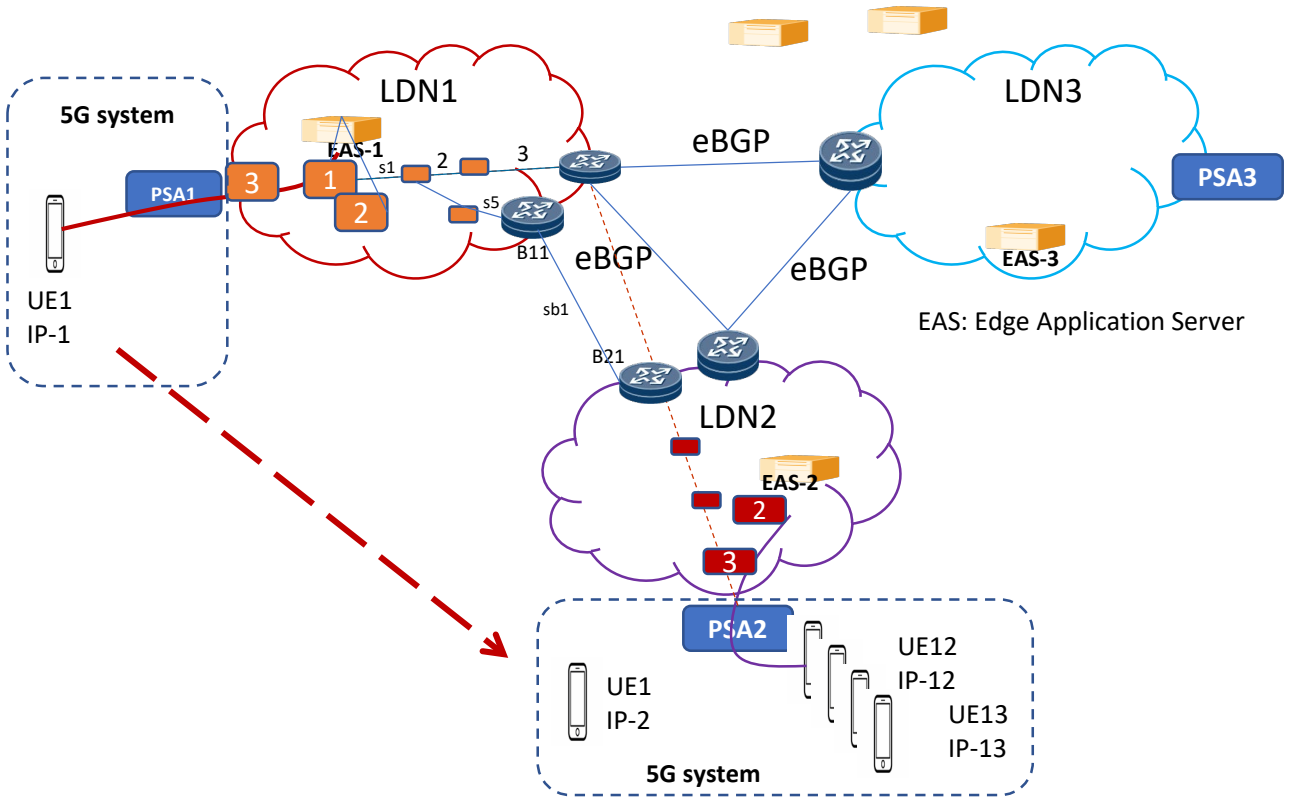


- Virtual Interactive Conference
  - Computing (e.g. the encoding, video stitching, compressing, etc.) can be processed by the server in the edge.

# From IP Network Perspective…

**ANYCAST: IP Layer Application ID -> multiple App servers**
**Benefit of using ANYCAST:**

- ✓ **dynamically load balance across locations based on network conditions.**
- ✓ **leverages the proximity information present in the network (routing) layer and**
- ✓ **eliminates the single point of failure and bottleneck at the DNS resolvers and application layer load balancers.**
- ✓ **removes the dependency on UEs using their cached destination IP addresses for extended period**




Problem 1: Selecting 5G Edge Application Location

- ➢ Many mini data centers can be close in proximity, making it difficult to differentiate in Routing Hops for App servers hosted in them,
- ➢ Some data centers can have higher capacity than others,
- ➢ Some sites may be more preferred when a UE anchored to a new 5G Site

Problem #2: sticking to original App Server

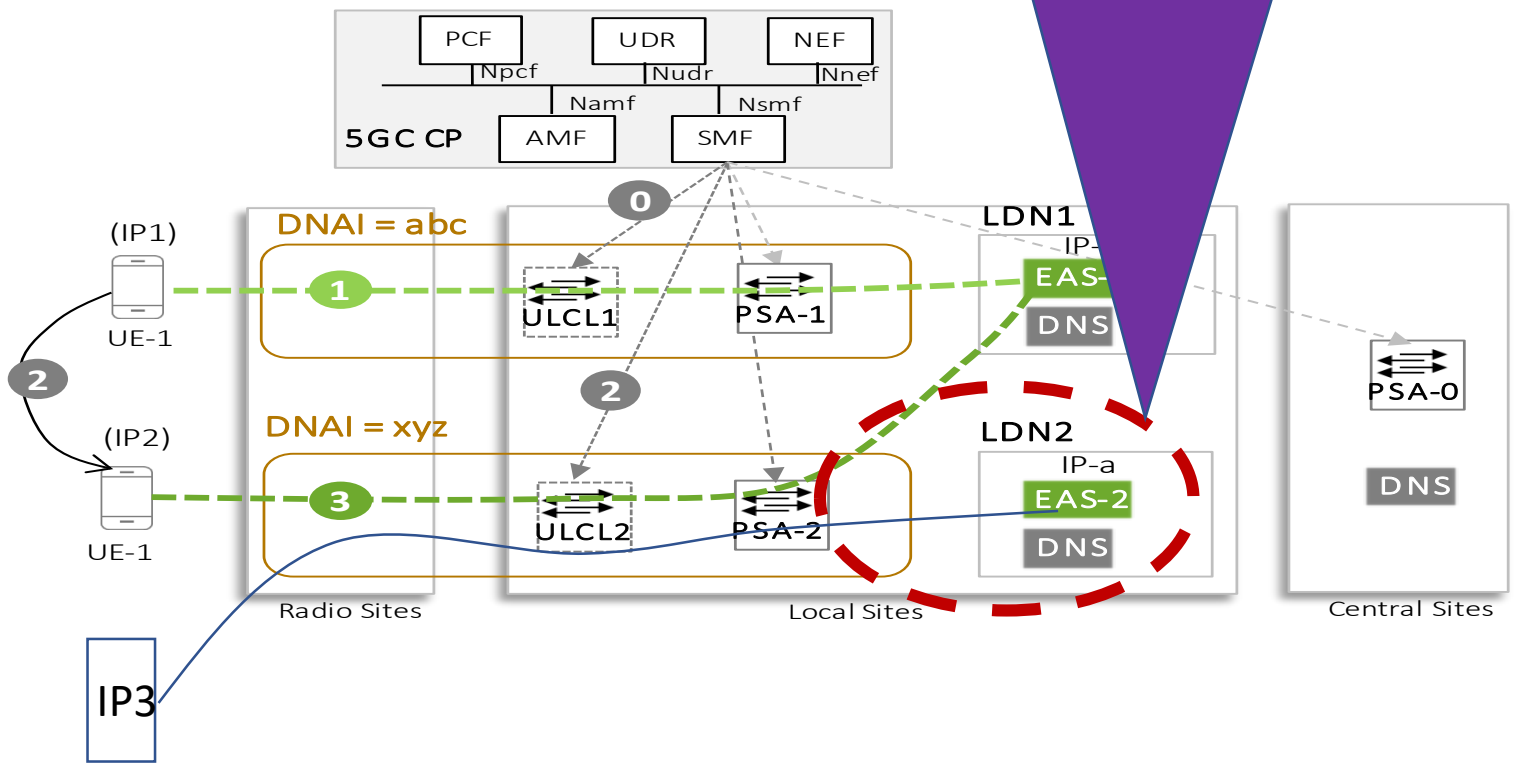
Problem #3: Application Server Relocation

# Need UE to Stick to the App server in the Old LDN:

- Not all UE mobility requires LDN relocation.
- It may be that the old LDN is close enough, or
- the closer LDNs may be overloaded, or that each LDN may not host every application

Note, not all edge computing services need to be sticky service. Using ACL can greatly reduce the processing on the routers.

Routers within the LDN2 needs to forward the communication from IP2 to EAS1 in LDN 1. However, for other UEs, the traffic to the same application goes to the EAS 2 within LDN2.




0 PDU session setup *
if session breakout, SMF installs traffic filter in ULCL (IP-a, PSA-1)

1 Application flow (initial)

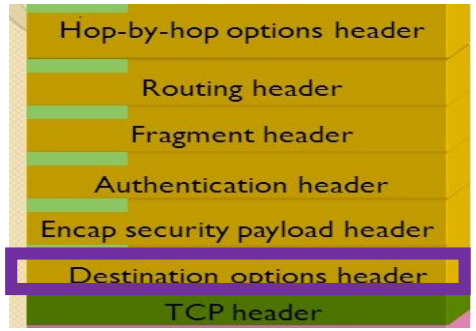
2 Handover process;
if session breakout, SMF installs traffic filter in ULCL (IP-a, PSA-2)

3 Application flow (after HO)

* routes for IP-a = (IP-a, {LDN1, LDN2})

# IPv6 based solution

# Achieve Sticky Service with the DEST Extension Header




**EC Sticky Service Management System**

Configure the Sticky Service ID S1, S2, S3 (i.e. ANYCAST address)

3 **Processing at the Egress Router:**
a) Use ACL to filter packets belonging to the EC Services that need Sticky Service.
b) Build Sticky-Dst-SubTLV using Egress address and insert the Sticky-Dst-TLV into the IPv6 Dst Extension Header.

*5G-site A*

UE1 (IP-1)

PSA1

Ra

1 Src= UE-1 & DST= S1

2 Src= UE-1 & DST= S1
Dst Extension Header with Sticky-Dst-SubTLV

In GTP tunnel

*L-DN1*

S1: aa08::4450
S2: aa08::4460
S3: aa08::4470

R1

4 **Processing at the UE:**
Copy the Dst Extension Header in the IPv6 header received from the EC Server to the header of the subsequent packets in the flow that need Sticky service

*5G-site B*

UE2 (IP-2)

PSA2

Rb

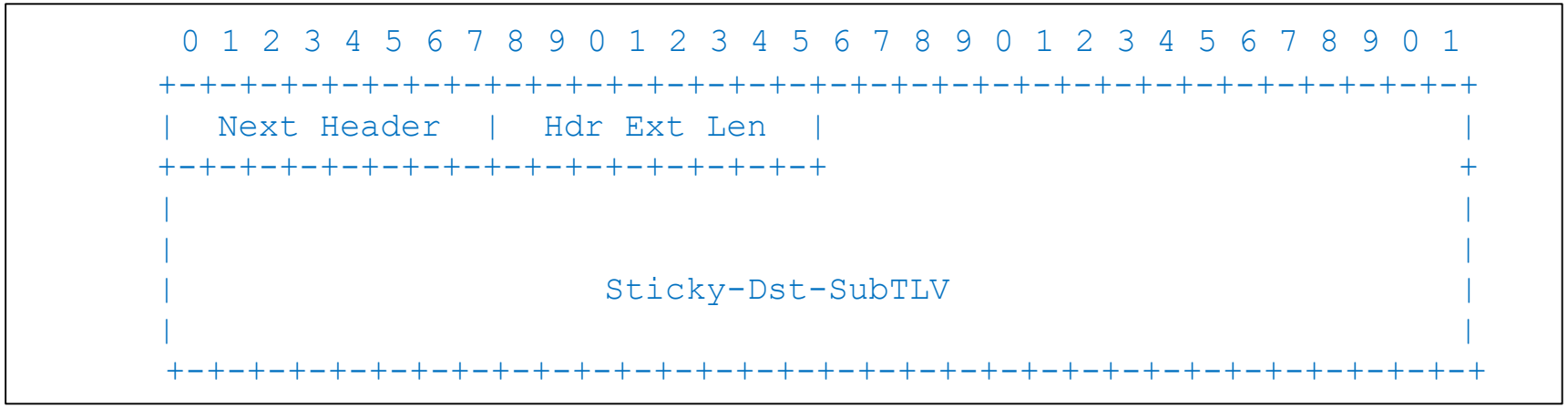
5 **Processing at the new Ingress Router:**
a) Use ACL to filter out the next-hop router address from the IPv6 Dst Extension Header.
b) Use Tunnel encapsulation with Outer DEST = next-hop router filtered from a).
or SRv6 to make the packets destined towards the Next-Hop router filtered from the Step a).

*L-DN2*

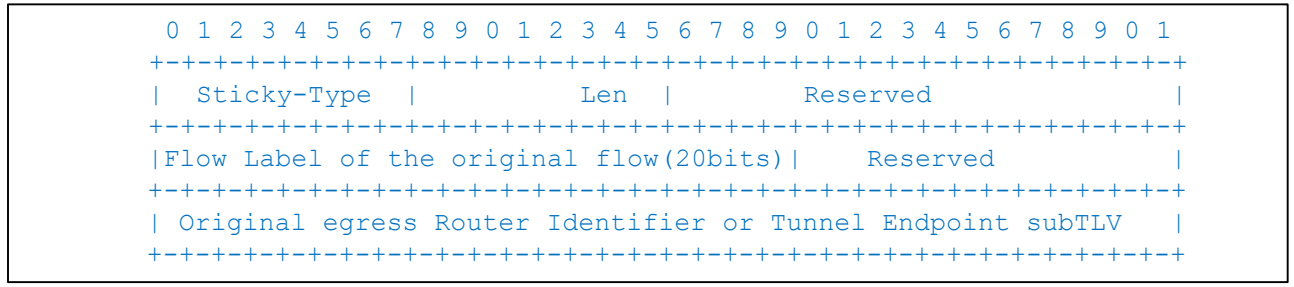
S1: aa08::4450
S2: aa08::4460
S3: aa08::4470

R2

# Using Destination Extension Header



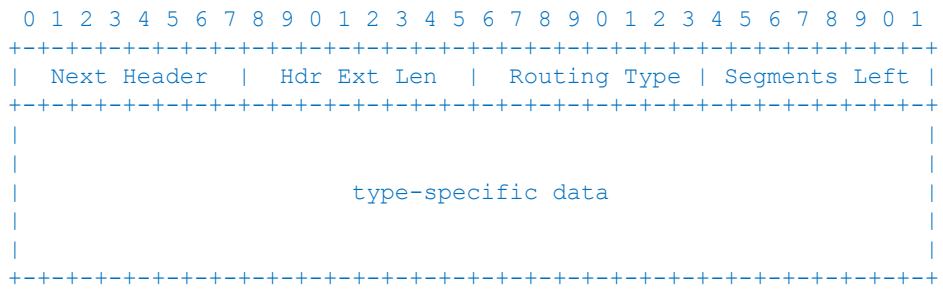

Sticky-Dst-SubTLV is specified as:




Sticky-Type = 1: indicate the 32 bits identifier is used to represent the Egress Router.
Original egress Router Identifier: assume that 5G Edge computing environment, all the routers have a 32 bits identifier even though they might use IPv6 address.
Sticky-Type = 2: indicate Tunnel Endpoint SubTLV [Tunnel-Encap] used to represent the Egress router from the original site before the UE moves to the new site.

# Using IPv6 Routing Extension Header

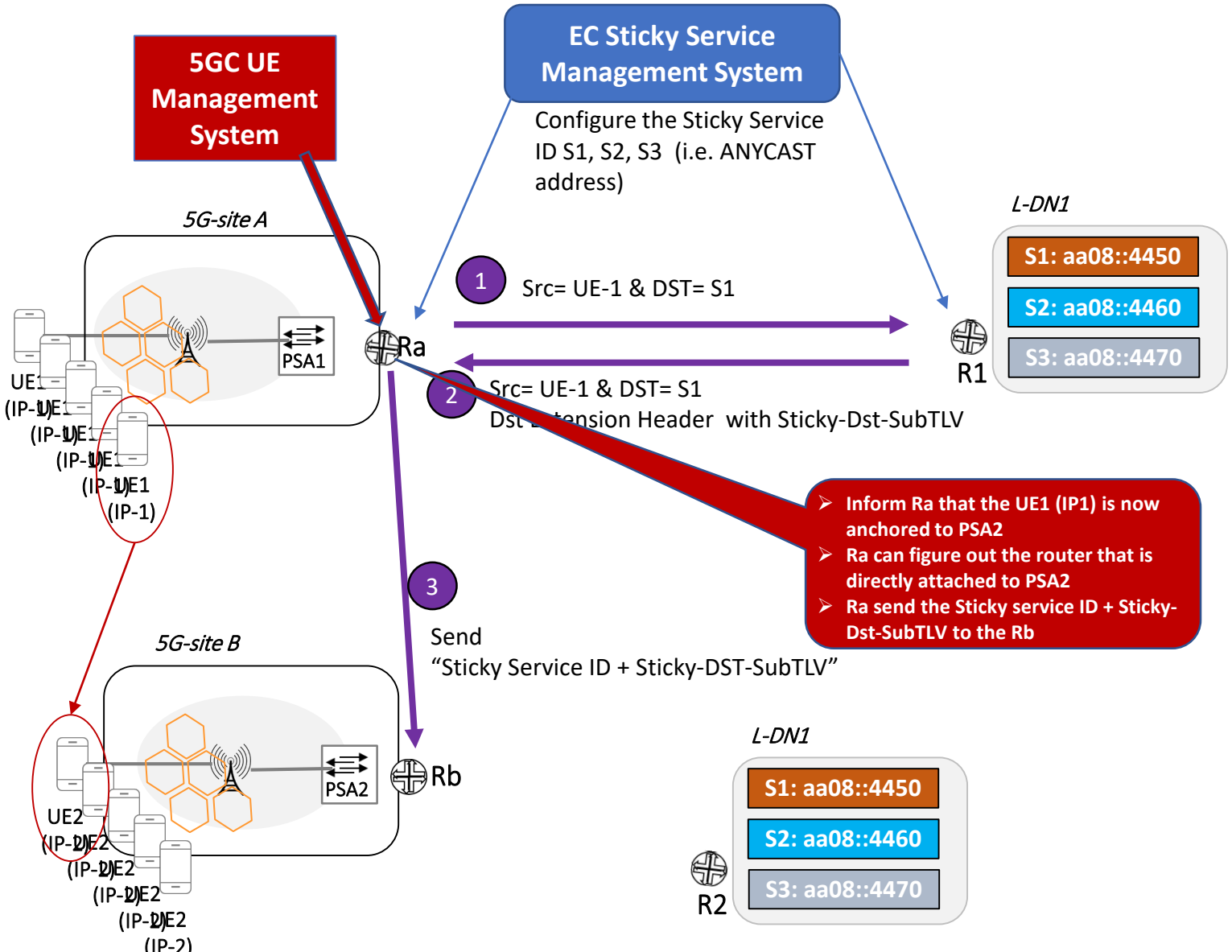
- Under this option, the Sticky-Dst-SubTLV is inserted into Type-Specific Data field of the Routing Extension Header of the IPv6 Header.
  - RFC8200 describes the Routing header as used by an IPv6 source to list one or more intermediate nodes to be "visited" on the way to a packet's destination. The Routing header is identified by a Next Header value of 43 in the immediately preceding header and has the following format:




- All the process for Egress router, Ingress router and UE are the same as using Destination Extension Header.

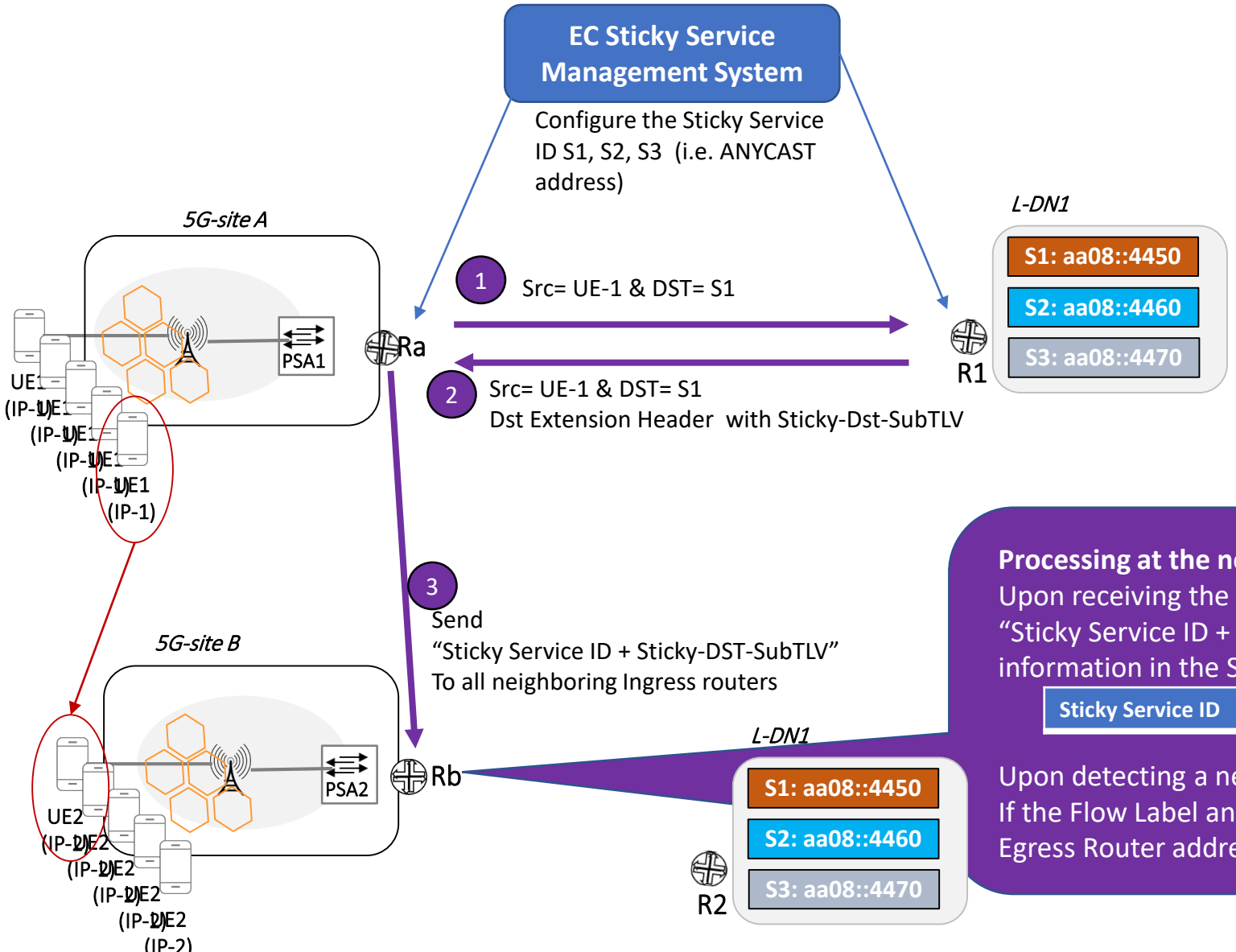
# Achieve Sticky Service without dependence on UE behavior

**Case 1: Ingress router notified by 5GC, either by the directly connected PSA, or by 5G traffic management system, of UE being moved to the new location**



# Achieve Sticky Service without dependence on UE behavior

## Case 2: without any assistance from 5G Core




**Processing at the new Ingress router:**

Upon receiving the message from adjacent Ingress routers of the "Sticky Service ID + Sticky-DST-SubTLV", store the following information in the Sticky Service Record

| Sticky Service ID | Flow Label | Sticky Egress Router |
|---|---|---|

Upon detecting a new flow matching an identified Sticky Service: If the Flow Label and the Sticky Service ID match, use the Sticky Egress Router address as the destination

# Next step:

- Purpose of the draft
  - To demonstrate to 3GPP of the IPv6 solution
- Need your feedback