IGP extension for
5G Edge Computing Service

draft-dunbar-lsr-5g-edge-compute-ospf-ext-04

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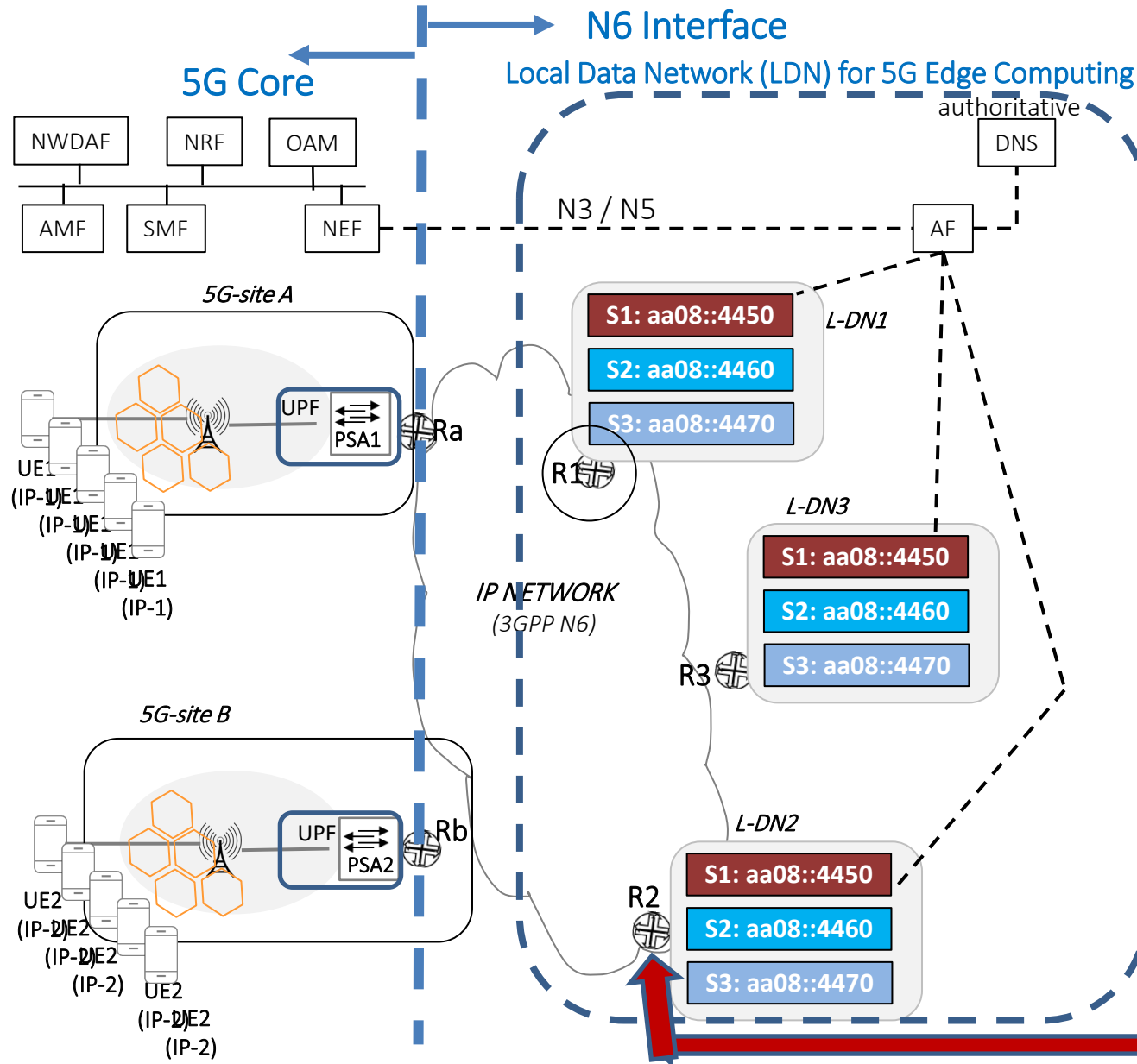
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Acknowledgment

- Many thanks to Peter Psenak's offline help to shape the content.
- Many thanks to others mailing list discussion.

5G Edge Computing (3GPP TR23.748)

N6 Interface

Local Data Network (LDN) for 5G Edge Computing

5G Core

NWDAF | NRF | OAM

AMF | SMF | NEF

N3 / N5

authoritative DNS

AF

5G-site A

UPF / PSA1

Ra

R1

L-DN1
- S1: aa08::4450
- S2: aa08::4460
- S3: aa08::4470

L-DN3
- S1: aa08::4450
- S2: aa08::4460
- S3: aa08::4470

R3

UE1 (IP-1)

IP NETWORK (3GPP N6)

5G-site B

UPF / PSA2

Rb

R2

L-DN2
- S1: aa08::4450
- S2: aa08::4460
- S3: aa08::4470

UE2 (IP-2)

One Application has multiple Application Servers located in Edge Computing DCs

Use Cases:
- Unmanned Aerial Vehicles (Drones) <-> Controller, Traffic Management, and App Servers [3GPP TR22.829]
- Virtual concert
- Virtual Interactive Conference
- Computing (e.g. the encoding, video stitching, compressing, etc.) processed by the servers in the edge DCs

Network Assumption:
All the servers are directly attached to the egress routers,
The servers and the egress routers are co-located.
May have a layer of Virtual Switch or ToR between the egress routers and the servers

ANYCAST in 5G EC

Benefits of ANYCAST

➢ Leverages the network layer,
➢ Eliminates the single point of failure and bottleneck at the DNS resolvers and application layer load balancer
➢ Avoid stale cache of some UEs

Problems of ANYCAST in 5G EC

➢ Small differences in routing distance to edge servers

➢ Unbalanced ANYCAST distributions due to UE mobility

Solution Overview

➢ **advertise the "Site-Cost" via IP prefix reachability TLV associated with the (anycast) prefix**

Type types of Site-Cost:

a) The IP Layer App related metrics, such as the Load Measurement, the Capacity Index, and the Preference Index that are collected by the egress routers

b) The aggregated cost associated with an EC server (i.e., ANYCAST prefix),

  ▪ computed based on the Load Measurement, the Capacity Index, the Preference Index, and other constraints by a consistent algorithm across all A-ERs

➢ **Using a Flag in the Flexible Algorithm TLV to indicate that "site-cost" needs to be included for the constrained SPF to reach the Prefix**
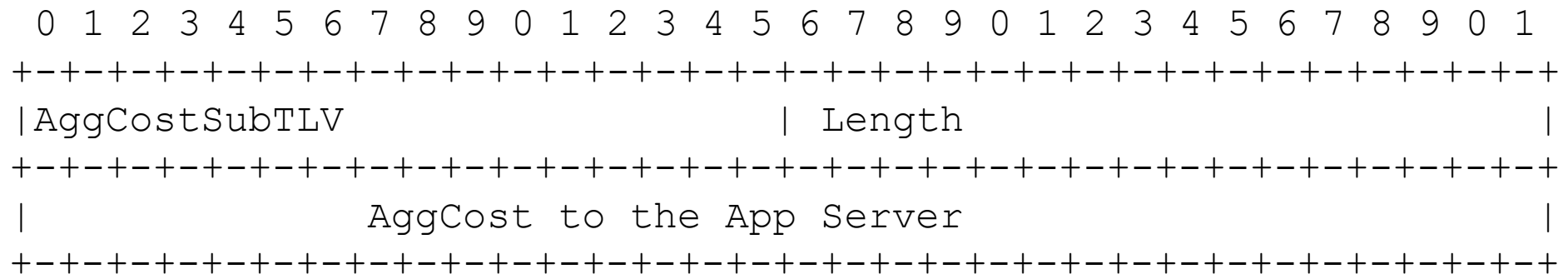
New prefix metric added to FAD Flags Sub-TLV

```
 0 1 2 3 4 5 6 7...
+-+-+-+-+-+-+-+-+...
|M|P| | | ...
+-+-+-+-+-+-+-+-+...
```

P-flag: Site-Cost Metrics is included in deriving
Constrained IGP path to the prefix

Aggregated Cost Advisement in OSPF

- **IPv4: OSPFv2**
  - A new Aggregated Cost Sub-TLV needs to be added to OSPFv2 Extended Prefix TLV [RFC7684]

- **IPv6: OSPFv3 LSA to carry the Aggregated Cost**
  - A new sub-TLV can be appended to the E-Intra-Area-Prefix-LSA, E-Inter-Area-Prefix-LSA, E-AS-External-LSA, and E-Type-7-LSA [RFC8362].

```
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|AggCostSubTLV                       | Length                   |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                 AggCost to the App Server                     |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Next Step

- Need more feedback from the LSR WG.
- Solicit more contributions.