MUP Architecture for DMM

draft-mhkk-dmm-mup-architecture-01

IETF121, DMM Working Group

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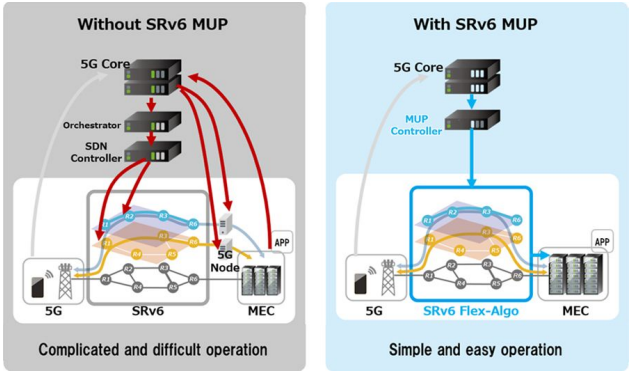
RECAP: What is the MUP Architecture?

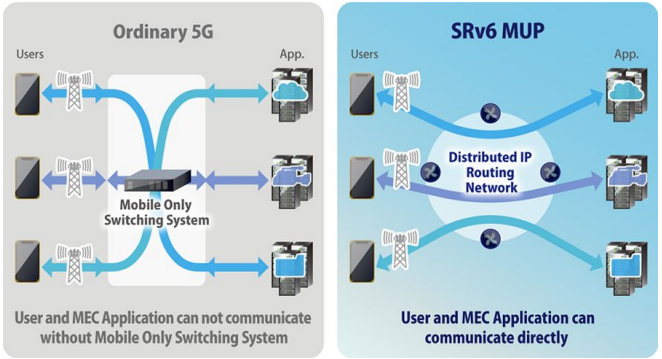
- Independent from specific mobile service architecture
  - MUP is consumable by any mobile service architectures
- Pluggable User Plane part of mobile service architecture
  - MUP can be co-exist with genuine user plane defined in each mobile service architecture
- Independent from specific dataplane protocols
  - MUP can be implemented with any dataplane protocols
  - SRv6 MUP is a MUP architecture implementation by using SRv6
    - GTP-U/SRv6 translation behaviors set defined in RFC9433 is one of the options.

What the MUP architecture are providing for?

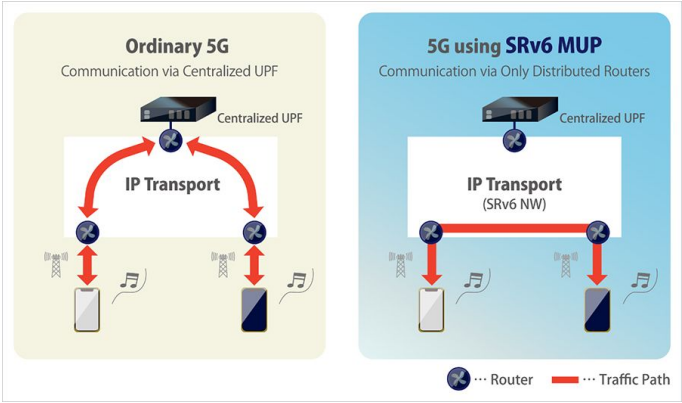
E2E Network Slicing w/o hussles



Optimal datapath for MEC

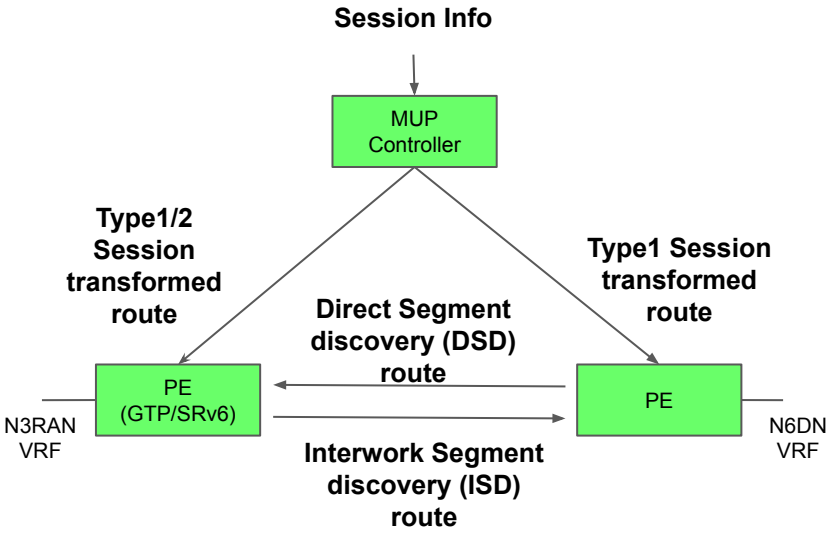


Optimal datapath for D2D

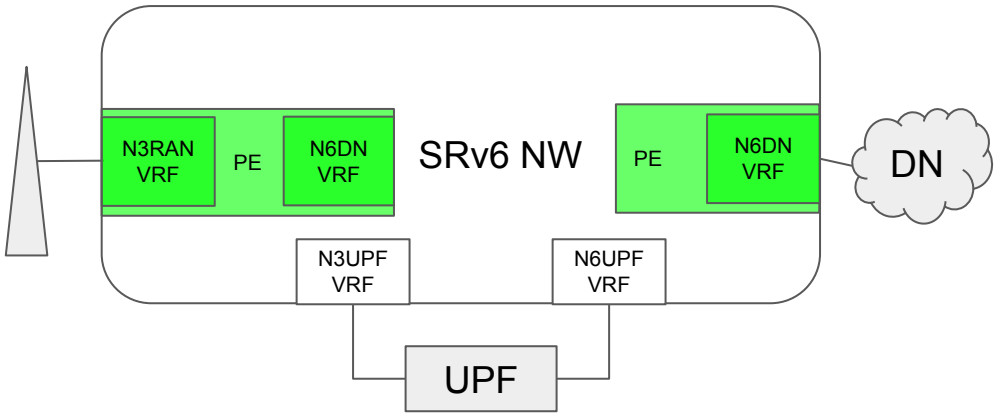


MUP architecture with 3GPP 5G over SRv6 implementation

Control Plane (BGP)



Data Plane (in 3GPP 5G case)



RECAP: Architecture Principles (1)

- “Segment” defined in MUP Architecture
  - Defined as the mobile user plane abstraction in MUP architecture
  - Two types of MUP Segment defined in the draft (Section 4):
    - Interwork Segment
    - Direct Segment

  - NOTE: “Segment” can be seen in many technologies, and is defined in each technology context:
    - “Segment” in Ethernet
    - “Segment” in (Multi-Segment) Pseudo-Wire (RFC5659)
    - “Segment” in EVPN (RFC7432)
    - “Segment” in Segment Routing Architecture (RFC8402)
    - “Segment” in Network Slicing (RFC9543)
    - “Segment” in MUP Architecture (This I-D)

RECAP: Architecture Principles (2)

- MUP Segment Auto-Discovery
  - MUP PE should be able to discover MUP Segments in the remote MUP PEs
    - MUP PE advertises auto-discovery route for hosted MUP Segments

  - MUP Segment Auto-Discovery Route (Section 5)
    - Interwork Segment Discovery (ISD) route
    - Direct Segment Discovery (DSD) route
    - Dataplane independent
    - Any dataplane specific attributes should be able to attach to the auto-discovery route
      - Service-SID in BGP Prefix-SID Attribute for SRv6MUP
      - BGP Tunnel-encap Attribute allows many dataplane options

BGP Tunnel Encapsulation Attribute Tunnel Types

Registration Procedure(s)
First Come First Served
Reference
[RFC9012]
Available Formats

csv

Value	Description	Reference
0	Reserved	[RFC9012]
1	L2TPv3 over IP	[RFC9012]
2	GRE	[RFC9012]
3	Transmit tunnel endpoint (DEPRECATED)	[RFC9012]
4	IPsec in Tunnel-mode (DEPRECATED)	[RFC9012]
5	IP in IP tunnel with IPsec Transport Mode (DEPRECATED)	[RFC9012]
6	MPLS-in-IP tunnel with IPsec Transport Mode (DEPRECATED)	[RFC9012]
7	IP in IP	[RFC9012]
8	VXLAN Encapsulation	[RFC8365]
9	NVGRE Encapsulation	[RFC8365]
10	MPLS Encapsulation	[RFC8365]
11	MPLS in GRE Encapsulation	[RFC8365]
12	VXLAN GPE Encapsulation	[RFC8365]
13	MPLS in UDP Encapsulation	[RFC7510][RFC Errata 4350]
14	IPv6 Tunnel	[Martin_Djernaes]
15	SR TE Policy Type	[draft-ietf-idr-segment-routing-te-policy]
16	Bare	[Nischal_Sheth]
17	SR Tunnel (DEPRECATED)	[RFC9125]
18	Cloud Security	[Ramesh_Babu_Yakkala]
19	Geneve Encapsulation	[RFC8926]
20	Any-Encapsulation	[draft-ietf-bess-bgp-multicast-controller-06]
21	GTP Tunnel Type	[Keyur_Patel][Tetsuya_Murakami]
22	Dynamic Path Selection (DPS) Tunnel Encapsulation	[Venkit_Kasiviswanathan]
23	Originating PE (OPE)	[draft-heitz-bess-evpn-option-b-01]
24	Dynamic Path Selection (DPS) Policy	[https://eos.arista.com/eos-4-26-2f/dps-vpn-scaling-using-bgp][Sarah_Chen]
25	SDWAN-Hybrid	[draft-ietf-idr-sdwan-edge-discovery-04]
26	X-over-UDP	[Jeffrey_Haas]
27-65535	Unassigned	

https://www.iana.org/assignments/bgp-tunnel-encapsulation/bgp-tunnel-encapsulation.xhtml

RECAP: Architecture Principles (3)

- Transforms Session to Routing
  - To leverage dataplane protocol to optimize the datapath for DMM

- Session Transformed (ST) Route (Section 6)
  - MUP Controller (MUP-C) advertises following ST routes:
    - Type1 ST (ST1) Route
    - Type2 ST (ST2) Route
  - Auto-discovery route should be used to resolve reachability for the ST routes
  - ST routes should be dataplane independent as well

Reminder: DMM Requirements (RFC7333)

MUP Architecture Principles guide DMM design and operation to fulfill the Reqs

- **REQ1: Distributed mobility management**
  - *IP mobility, network access solutions, and forwarding solutions provided by **DMM MUST enable traffic to avoid traversing a single mobility anchor far from the optimal route**. It is noted that the requirement on distribution **applies to the data plane only**.*
- **REQ3: IPv6 deployment**
  - *DMM solutions **SHOULD target IPv6 as the primary deployment environment** and **SHOULD NOT be tailored specifically to support IPv4**, particularly in situations where private IPv4 addresses and/or NATs are used.*
- **REQ4: Existing mobility protocols**
  - *A DMM solution **MUST first consider reusing and extending IETF standard protocols** before specifying new protocols.*
- **REQ5: Coexistence with deployed networks/hosts and operability across different networks**
  - *A DMM solution may require loose, tight, or no integration into existing mobility protocols and host IP stacks. Regardless of the integration level, DMM implementations **MUST be able to coexist with existing network deployments, end hosts, and routers** that may or may not implement existing mobility protocols. Furthermore, **a DMM solution SHOULD work across different networks, possibly operated as separate administrative domains**, when the needed mobility management signaling, forwarding, and network access are **allowed by the trust relationship between them**.*

MUP Running Codes and Interop

IETF Hackathon

BGP-MUP SAFI Implementation and Interop

IETF 116

25-26 March 2023

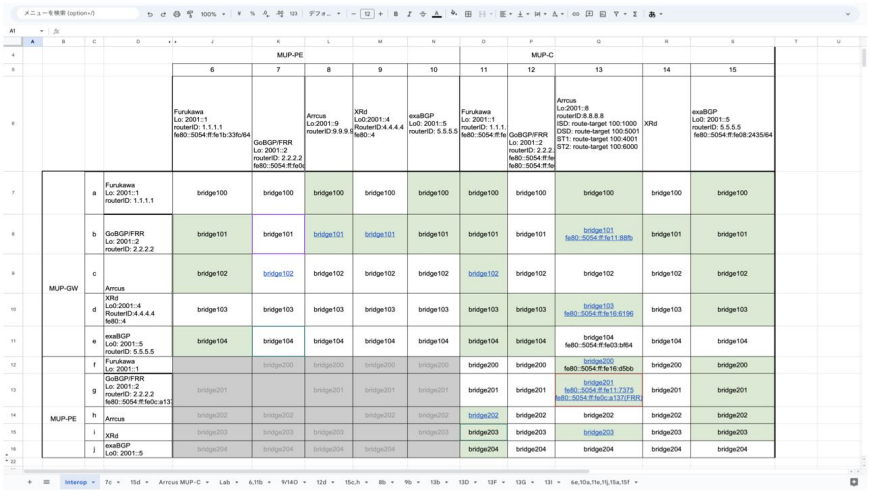
Yokohama

Hackathon Plan

Let's implement a new BGP SAFI and do the Interop togethe

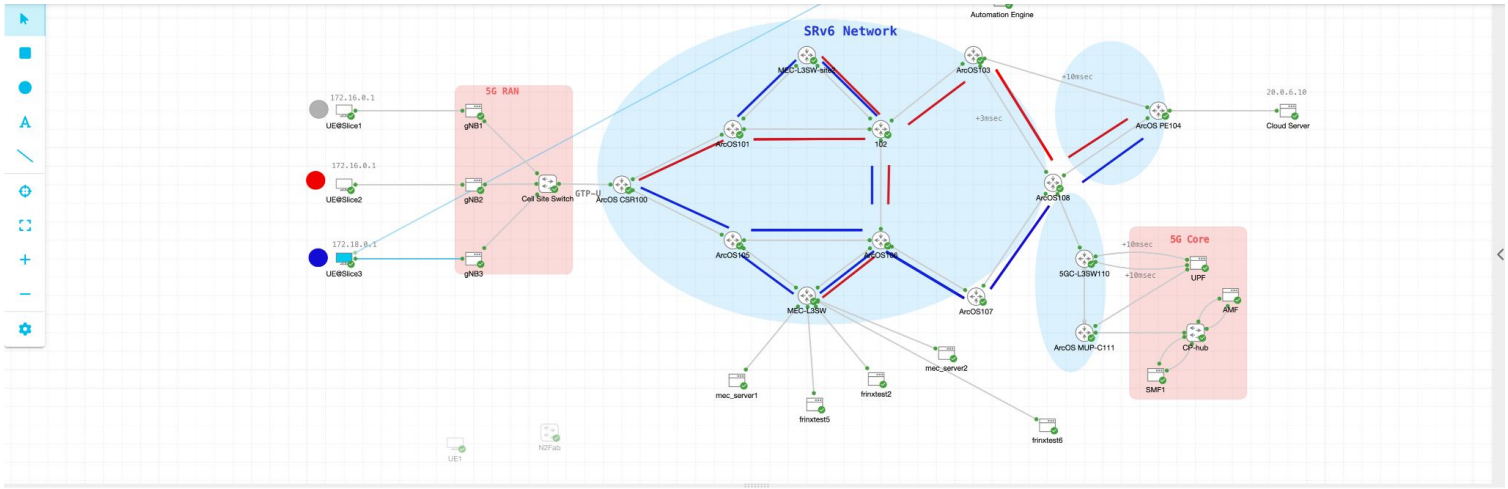
- MUP Architecture and BGP-MUP SAFI
  - https://datatracker.ietf.org/doc/draft-mhkk-dmm-sr architecture/
  - https://datatracker.ietf.org/doc/draft-mpmz-bess-mu
- Participated BGP developers
  - Arrcus
  - Cisco
  - ExaBGP
  - FRR
  - Furukawa
  - GoBGP
  - (Open BMP)

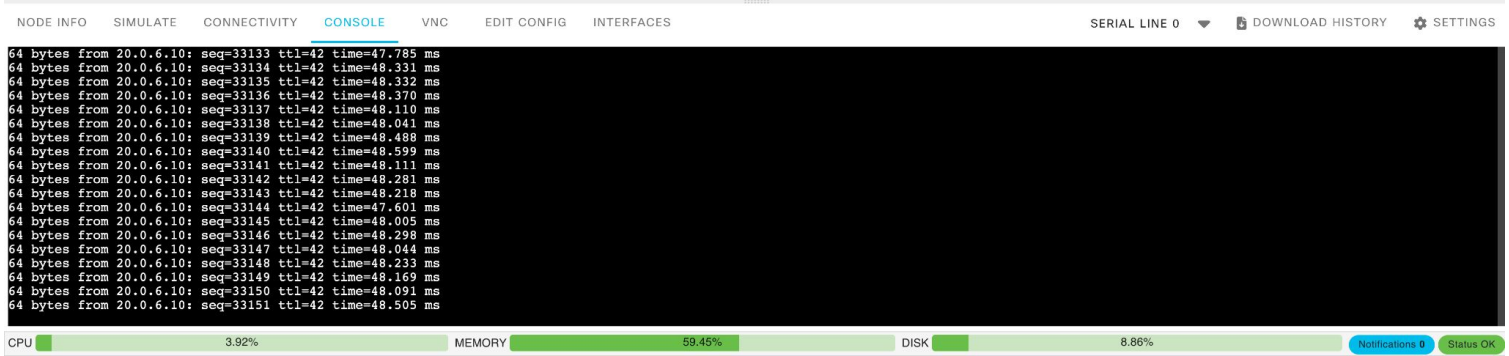
The Interop Matrix



https://github.com/IETF-Hackathon/ietf116-project-presentations/blob/pdfs-from-html/ietf-116-hackathon-bgp-mup-safi-interop.pdf

MUP Working Code and Demo





Updates from *v00* to *v01*

- Clarification on Session Transformed Route
  - add text in Section 3

    *"... **Assuming session information for a UE or a MN includes a pair of endpoints between the entities of the mobile user plane,** a MUP Controller (MUP-C) advertises MUP PE(s) routing information for the UE or the MN, transformed from the input of corresponding session information in mobility management systems. In MUP architecture, it is called session-transformed route."*

- ST2 Route and MUP Ext-community Semantics to be clear
  - *"... **a BGP MP-NLRI attribute with the nature of tunnel endpoint base packet handling.** [..snip..] The MUP-C advertises **the Type 2 Session Transformed route with a Direct Segment extended community to indicate corresponding Direct Segment and tunnel decapsulation** in addition to the Route Target extended communities"*

Notice to I-D Authors

- *"draft-mhkk-dmm-srv6mup-architecture"* is superseded by ***"draft-mhkk-dmm-mup-architecture"***, with a lot of improvements, and won't be updated anymore.

- If your I-D still refers the obsoleted draft, please update your draft with the ***draft-mhkk-dmm-mup-architecture"*** as a reference.
  - it is observed in some active I-Ds:
    - draft-dcn-dmm-cats-mup,
    - draft-zzhang-dmm-mup-evolution,
    - draft-mpmz-bess-mup-safi,
    - draft-ietf-dmm-srv6mob-arch.

FAQ

Q. Isn't RFC9433 SRv6 MUP itself?

A. RFC9433 defines SRv6 Mobile User Plane behaviors ***under the 3GPP 5G architecture,*** which is not adopted by 3GPP.

Q. What does RFC9433 contribute MUP Architecture?

A. As MUP Architecture designed as pluggable User Plane for any mobile service systems, RFC9433 provides a dataplane option in SRv6 case ***under the MUP architecture.***

Next Step

- Requests WG adoption