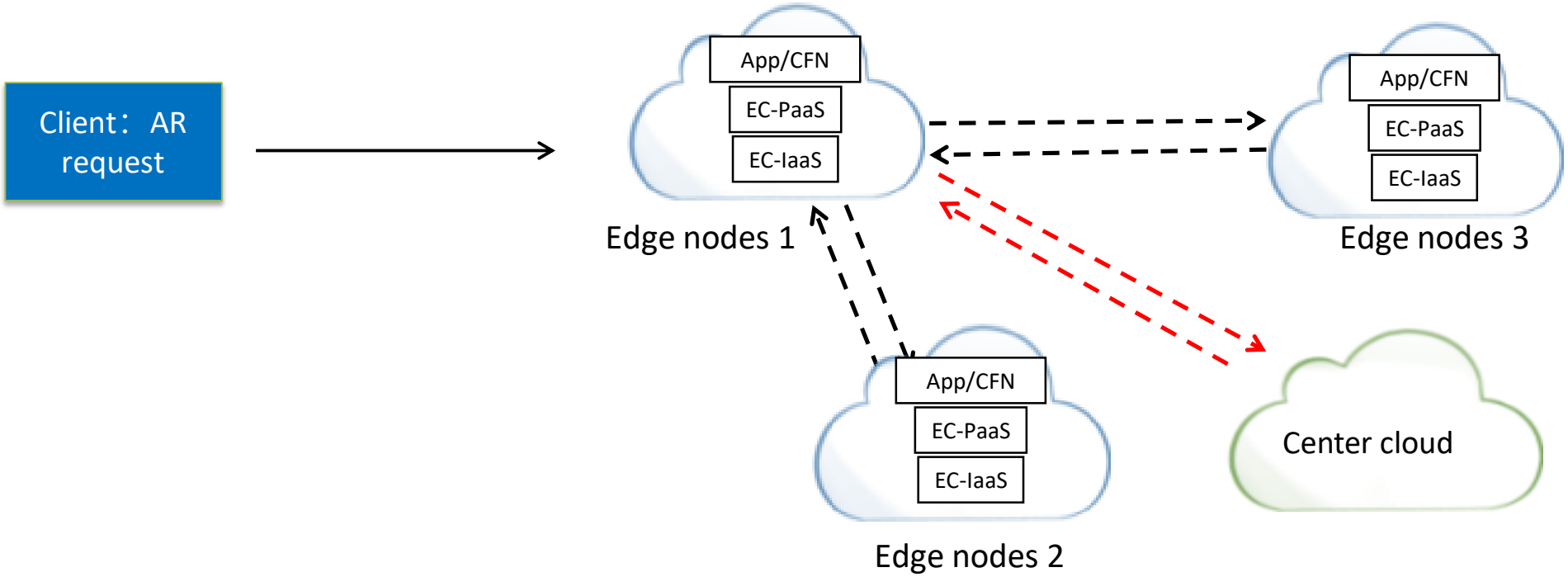
Side Meeting
Compute First Networking (CFN)

Use cases for edge, and an example

- Edge-Cloud Based Recognition in Augmented Reality (AR)



- What kinds of services are suitable for edge?
  Generally: low latency + high bandwidth

- Rely on center cloud to help edge(failover, load balancing)?
  Probably not!
  Edge helps edge

Requirements & Challenges

Requirement 1- Service equivalency: 100s of edge sites may provide equivalent services for clients

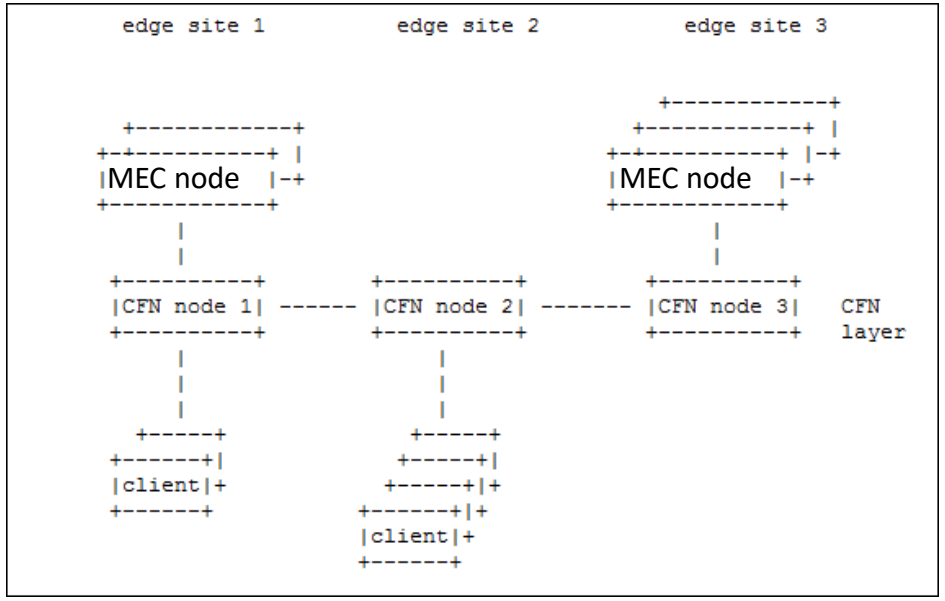
Requirement 2- Service dynamics: the optimal service instance for a specific request from a client may vary: subject to proximity, load, network conditions, service failure etc. One Edge has limited resources, e.g. up to 10 servers, and edge is also less reliable than cloud.

- **Use Anycast for Service equivalency**
- **But make it dynamic : be adaptive to conditions to get to optimal service instances**

Challenge 1- Flow Affinity: it should be avoided to route different packets in the same flow to different service instances

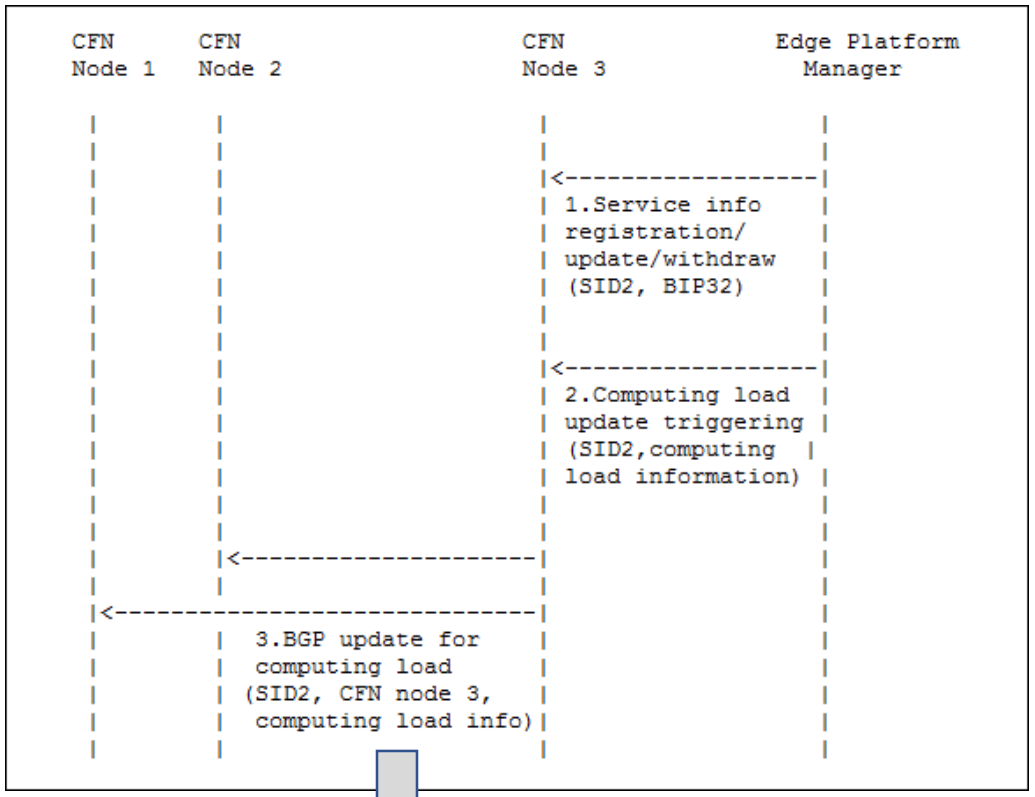
Challenge 2- Incremental change: minimize the change to current routers, especially the data plane, e.g avoiding huge flow tables in routers: e.g. 100K users * 100 services = 10M flows

Framework



- Clients use Anycast IP address to access an MEC service
  - More than one edge are reachable with it
  - Choose the binding edge to serve the request upon the first packet
  - Keep binding edge same for subsequent requests of the flow
- CFN nodes exchange info
  - Computing load for MEC
  - Network cost
- CFN ingress & egress can be the same node

Example: Control Plane

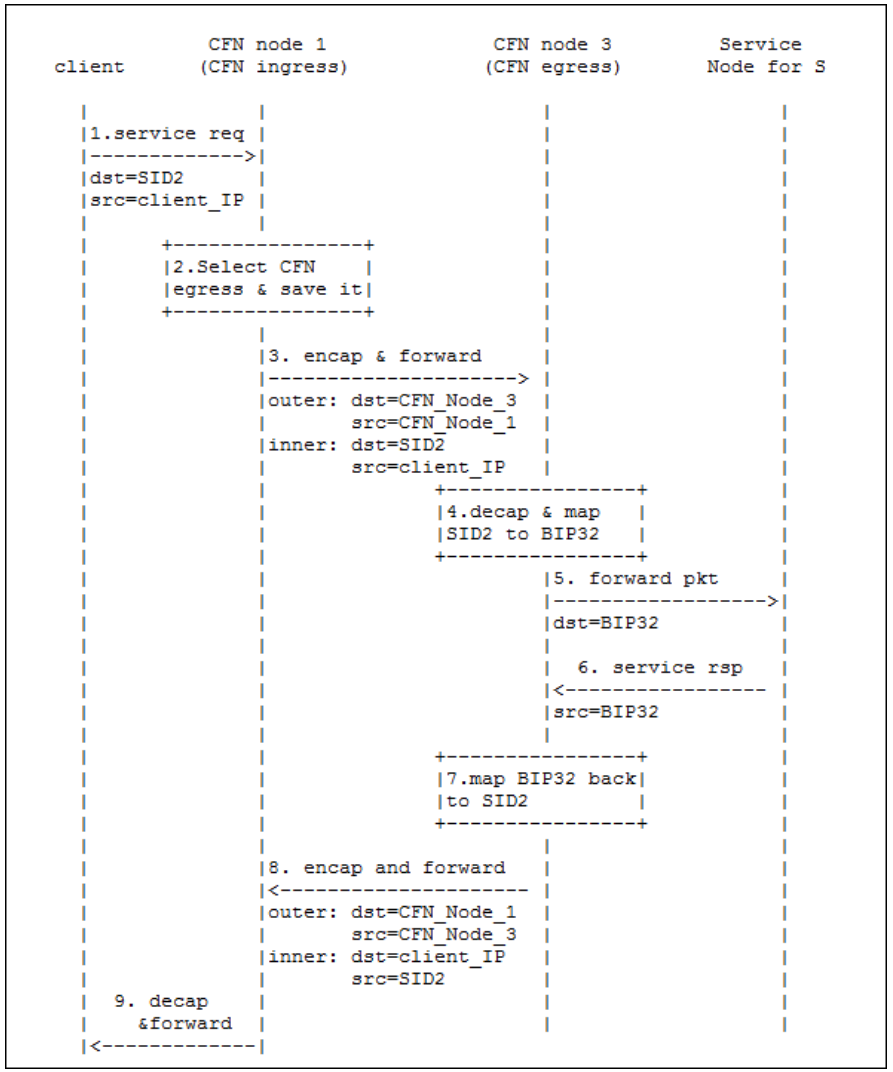


Destination	Computing Load	Network Cost	Next Hop
SID 2	30	50	CFN Egress node 3

- CFN nodes exchange computing load info
- Metrics to be defined
  - capacity, number of connections being served…
  - quantized value, boolean…
- CFN ingress select the egress based on computing load info + network info
- CFN ingress & egress can be the same node

SID – IP anycast address for an MEC service
BIP – binding IP, i.e. real IP, for an MEC service instance

Example: Data Plane

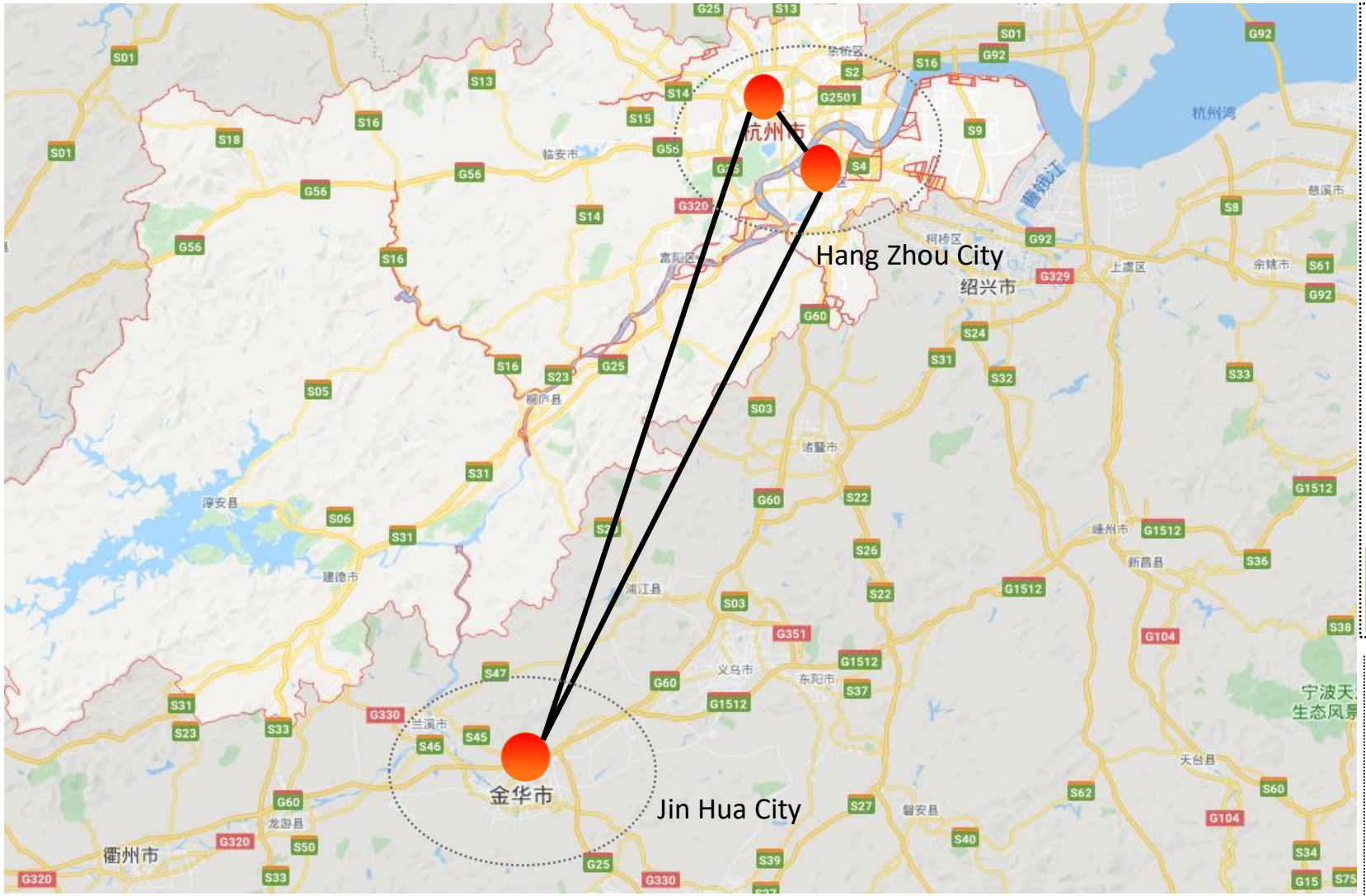


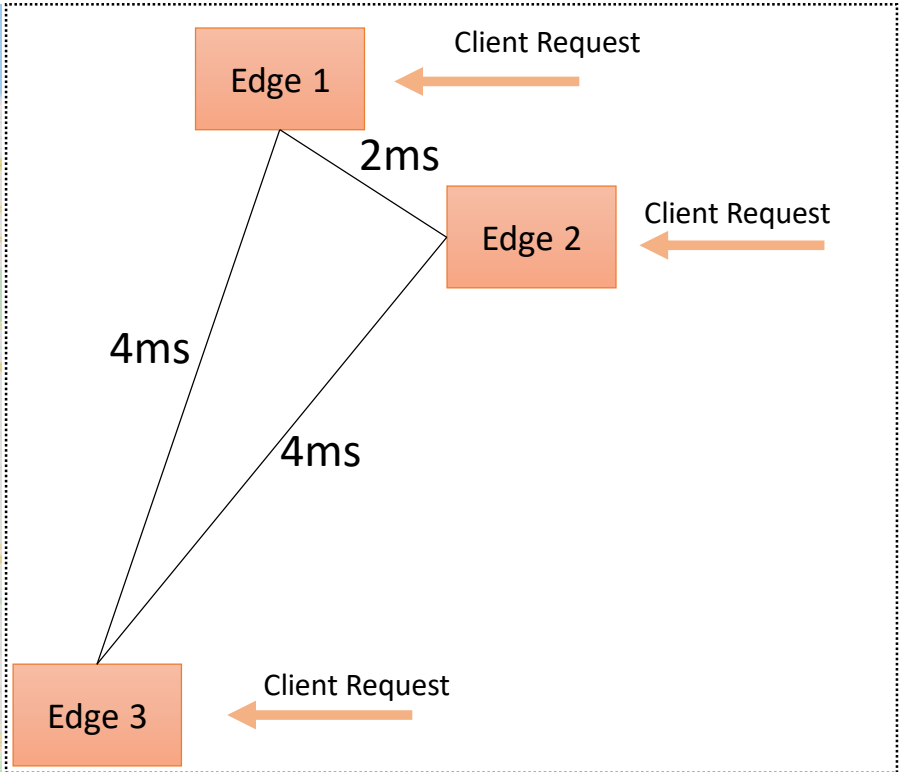
Data plane for the first request

- CFN ingress selects the egress based on upon receiving the 1st packet
- Save binding table about (anycast IP, CFN egress) for active flows
- Binding table can be saved closer to clients, e.g. at UPF
- Flow affinity: subsequent packets from the flow always sent to the same egress
- Overlay or SR based encap

SID – IP anycast address for an MEC service
BIP – binding IP, i.e. real IP for an MEC service instance

Proof-of-Concept





Setup

- Service randomly accessed from 3 Edges
- 10~30 request per client
- 2~5 ms processing time for each service

Objective

- Use JCT (**J**ob **C**ompletion **T**ime) as key KPI for comparison

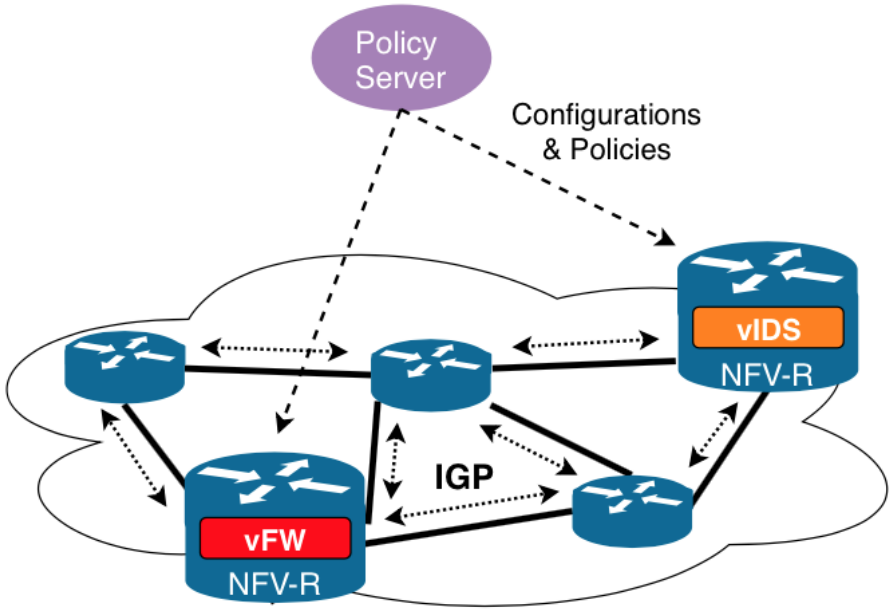
Some preliminary tests

- Case 1: Scheduling Multi MEC traffic considering of **Network Metric**
- Case 2: Scheduling Multi MEC traffic considering of **Computing Metric**
- Case 3: Centric VS Distributed resolution
- Case 4: Sync interval impact

- Gain during dynamic changing status (e.g.: changing server capacity, dynamic service traffic etc.)
- To achieve good performance, fast sync of status change is important

Presentation from **Luigi Iannone, Telecom Paris**

- Leveraging anycast in context of SFC/NFV,
  - but could be also extended to others e.g. edge computing
- Control Plane:
  - Implemented on OSPF (BGP planned)



- Experiment: Successfully distribute load
  - Metric: link cost + NVF load
  - Topologies with hundred of nodes selected from: https://sites.uclouvain.be/defo/
  - Topologies reproduced on Grid'5000 large-scale and flexible testbed using VxLAN
    - https://www.grid5000.fr/w/Grid5000:Home

Summary

- Two-D feature: Dynamic & Distributed
- Dynamic anycast (Dyncast)
  - Identify a service at network layer
  - Consider computing load info, not always least cost
  - Dispatch on-the-fly, late binding of egress edge
  - Ensure flow affinity
- Control plane: BGP/IGP extension, any other protocol?
- Data plane: binding table, data encap/forwarding

Q & A during the side meeting

- Q: What is “service”? Is service placement in the scope?
- A: Service placement and selecting path to which service instance are separate, this proposal is mainly emphasizing on the latter

- Q: Relationship with COINRG
- A: Will present to COINRG on Friday
- A: This proposal is focusing on routing optimization

Thank you!