



CREATING THE LIVING NETWORK™

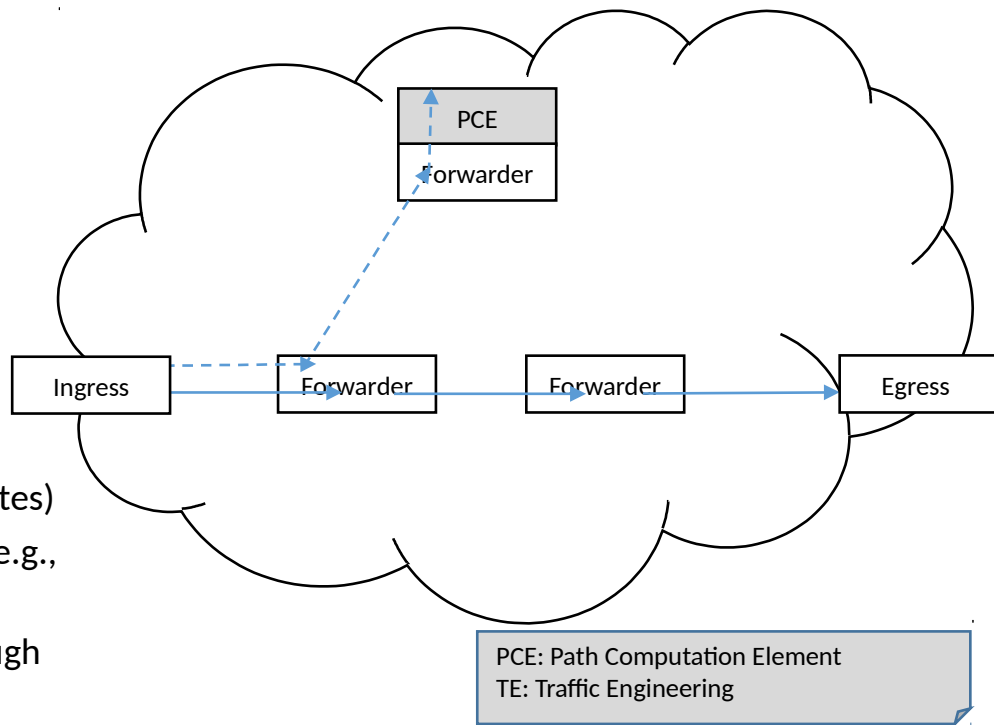
Service Routing over Path-based Forwarding

IETF-101 (London)



Starting Point

- Existing PCE/TE-based approaches with path-based forwarding, e.g.,
 - BIER-TE¹
 - SDN with bitfield-based wildcard matching
 - SDN with flow aggregation
- Possible benefits
 - Ad-hoc **multicast**
 - Direct path **mobility**
 - Predictive **mobility** (towards handover candidates)
 - Edge-to-edge **resource management** utilizing, e.g., network coding for multi-source/cast
 - Fast **redirection** of upper layer protocols (through path repointing)
- Existing work
 - ² • Applicability use cases in BIER, e.g., HTTP multicast



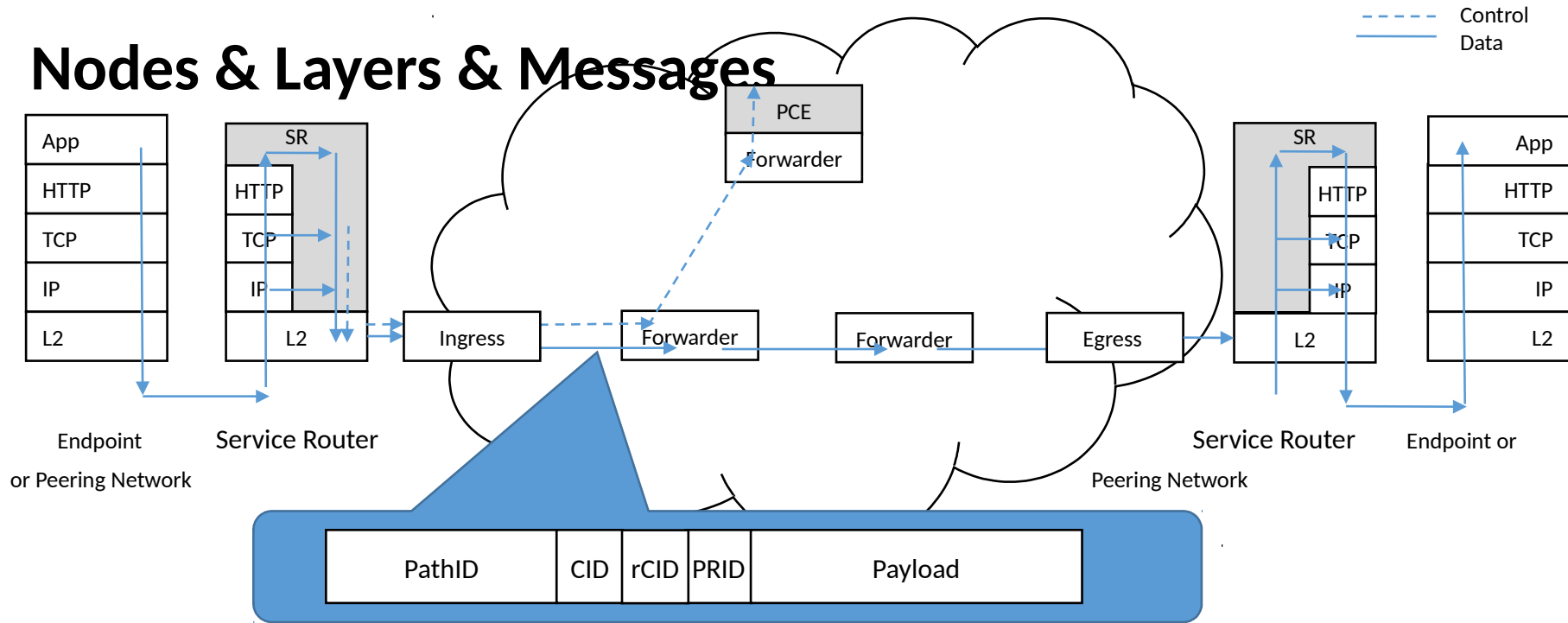
¹: <https://www.ietf.org/archive/id/draft-eckert-bier-te-arch-06.txt>

Problem Statement

Realize service request routing on top of these path-based technologies (BIER-TE, SDN), providing quantitative and qualitative benefits from doing so?

- Utilize wide definition of **service**, ranging from HTTP/CoAP (L7) to IP multicast/unicast (L3), to apply benefits across a number of services, such as HTTP, CoAP, as well as IP multicast/unicast
- Identify architecture components that would require standardization

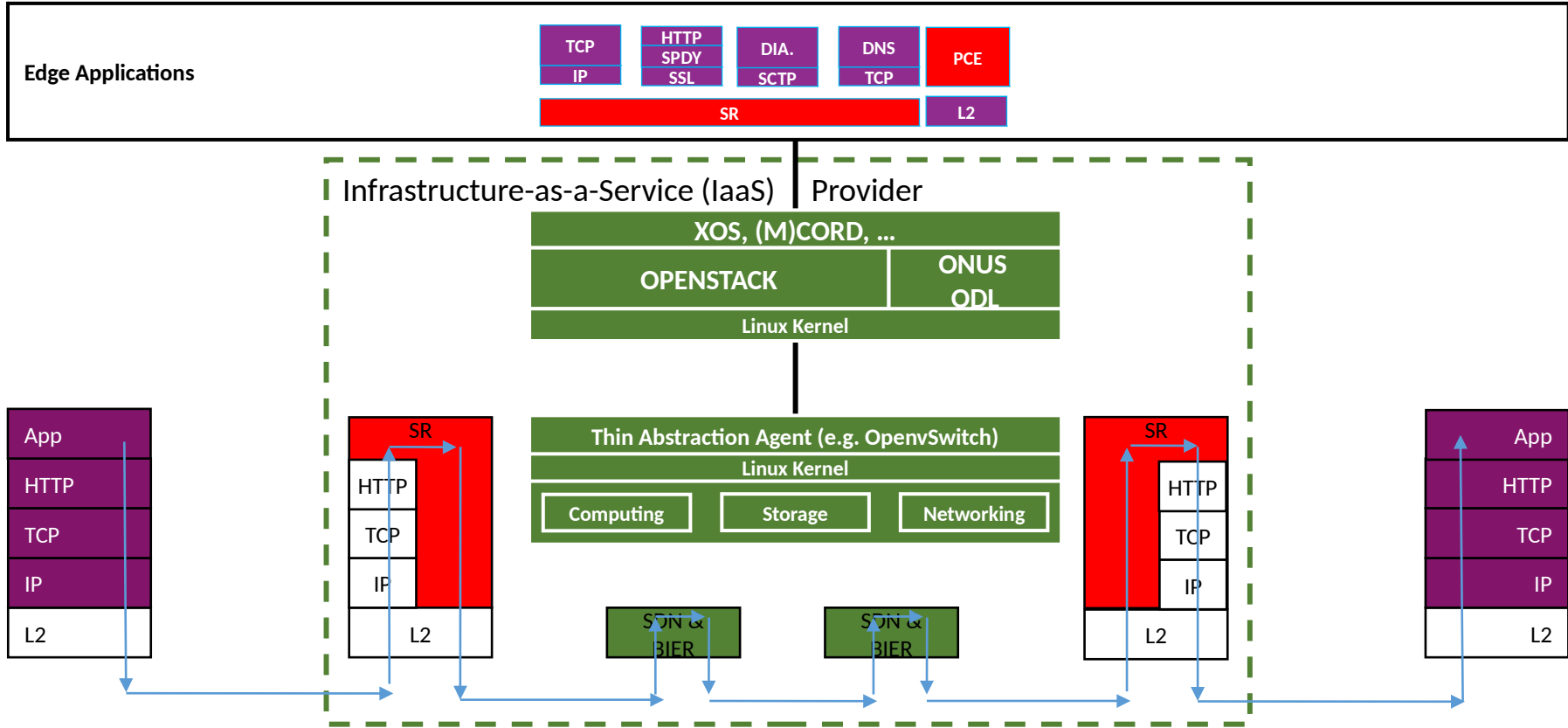
Nodes & Layers & Messages



- PathID : path identifier (depending on transport technology)
- CID : hash(service identifier)
- rCID: : hash(return service identifier) - optional
- PRID : hash(request identifier)
- Payload: : service fragment

Example Deployment at Edge Network

- Edge Cloud provider
- Service/app provider
- IaaS provider



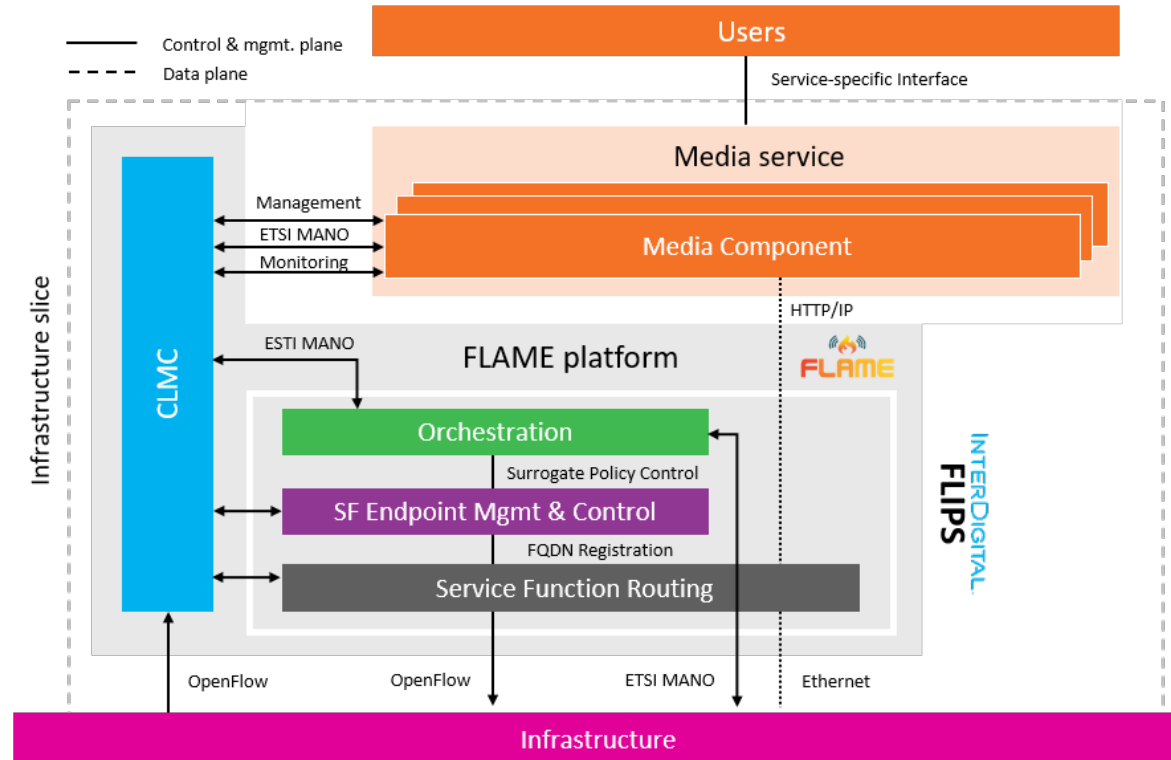
EU H2020 FLAME Service Delivery Platform

- **A fully orchestrated platform**

- Deployed in minutes over a municipal scale infrastructure
- Uses SDN-based infrastructure
- Openstack for compute deployment
- Utilizes benefits of service routing approach

- **Deployed in municipal networks in Bristol & Barcelona**

- 25 trials planned, starting 2Q2018

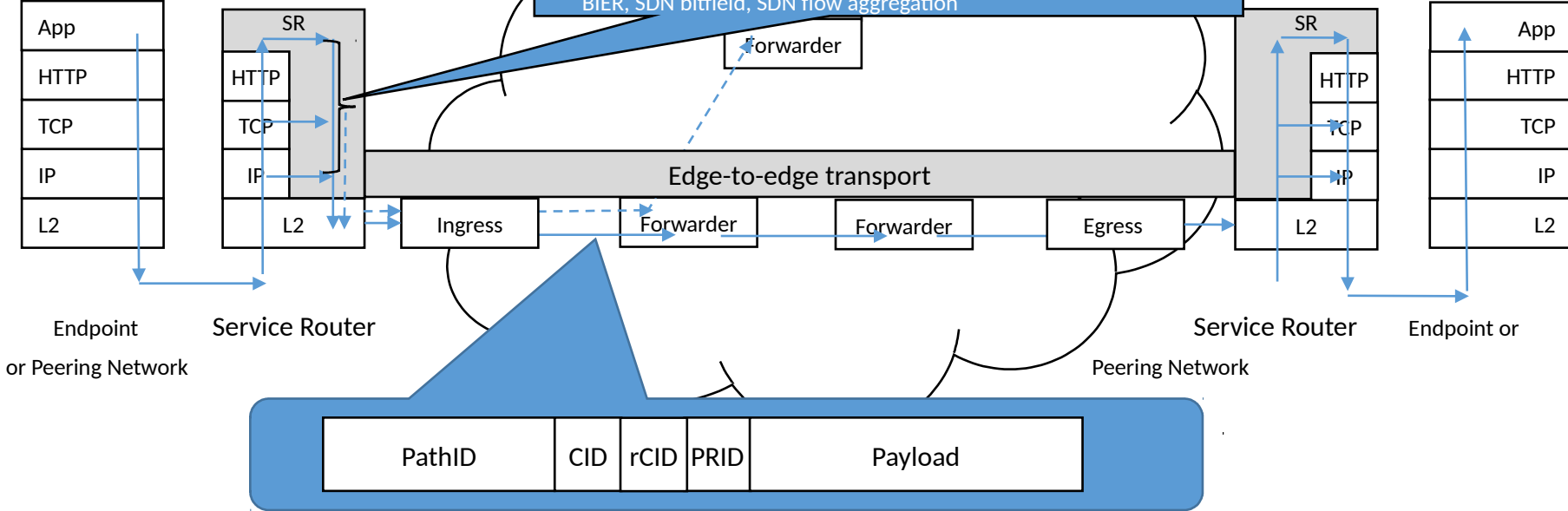


*EUH2020 funded under grant #731677

Interop Needs (1)

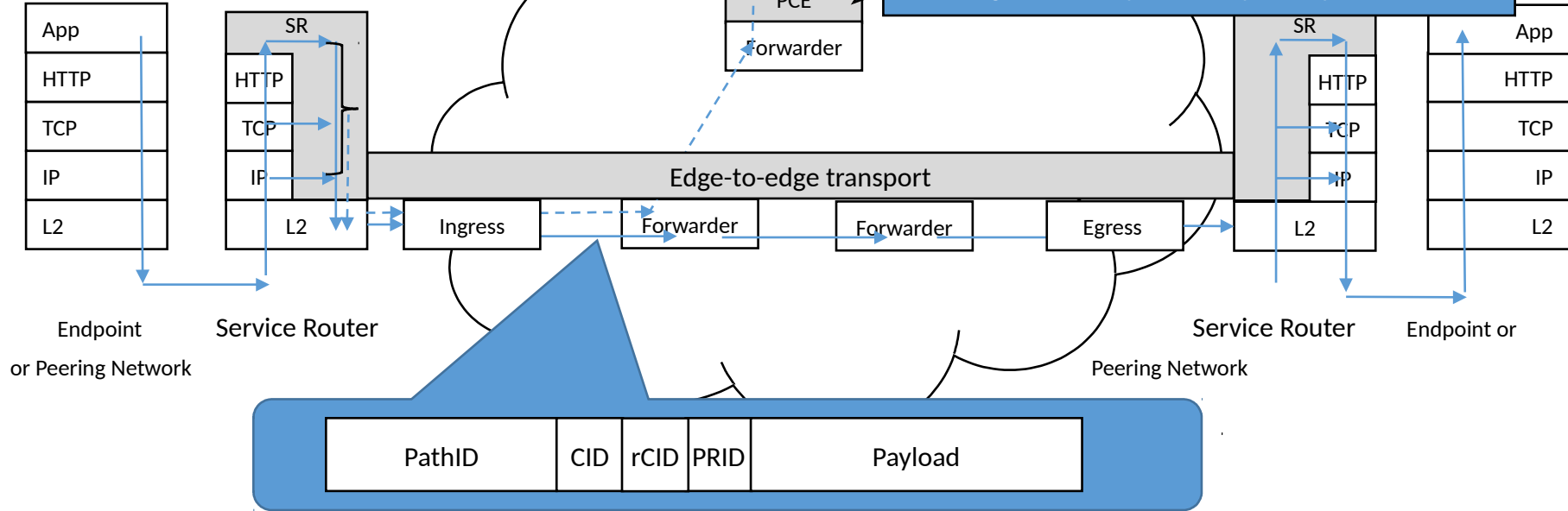
- Mapping of service(s) onto path exchange:**
- General message format
 - Applicability for specific services, e.g., HTTP, IP multicast, CoAP, ...
 - PathID mappings onto path-based forwarding technologies, e.g., BIER, SDN bitfield, SDN flow aggregation

--- Control
 — Data



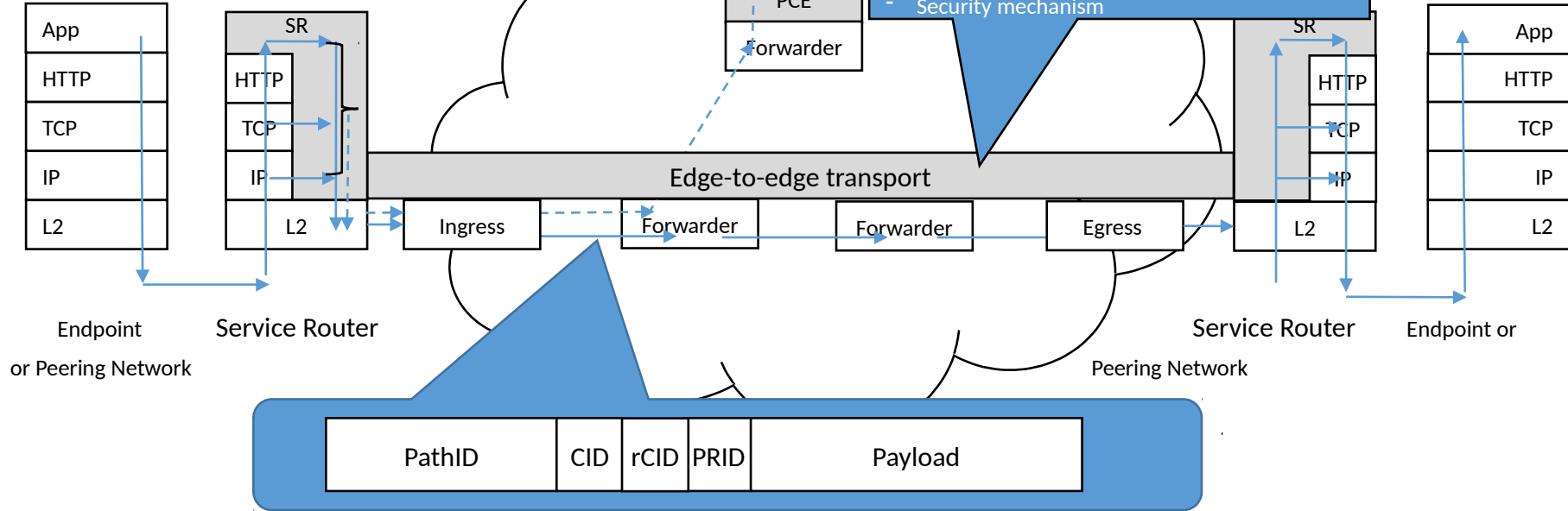
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Interop Needs (2)



- PathID : path identifier (depending on transport technology)
- CID : hash(service identifier)
- rCID: : hash(return service identifier) - optional
- PRID : hash(request identifier)
- Payload: : service fragment

Interop Needs (3)



Demonstrated Benefits from Service Routing over Path-Based Forwarding

- Edge-to-edge resource management
 - Service router allows for optimized (edge-to-edge) resource mgmt while being (E2E) TCP friendly
 - Network coding with multi-source retrieval and other more advanced L2 level NC solutions possible
- Multicast for HTTP response delivery
 - Realized through ad-hoc per-response delivery via path-based multicast
 - Use cases could be video delivery, DB synchronization, SW downloads
 - Could also be used for server load reduction
- Fast service request routing
 - Using PCE-level service registration for ms-level routing between (e.g., virtual) service instances
- Indirection for HTTP-level services
 - Allows for partial replication while maintaining full reachability overall
- Direct path mobility
 - Repointing path information in mobility case
- Seamless HTTP session transfer
 - Switching to service surrogate continues HTTP session to reduce download/chunk waste
- Secure content delegation without triangular routing
 - Split name from content authority
- Simple southbound integration
 - No flow-dependent state, e.g., constant TCAM requirement in intermediary SDN switches
- QoS support
 - QoS classes supported through linear increase of forwarding rules, e.g., QoS class specific TCAM entries

Next Steps

- Feedback from RTG WG on
 - Motivation (sound need for interop?)
 - Activities (mapping of service(s), PCE protocol, resource management)
 - Place of work
- Establish identified relations and continue with existing ones
 - SFC WG, BIER WG, ...
- Continue implementation efforts, e.g.,
 - Deployment in Bristol & Barcelona for EC-funded trials in 2H2018
 - 5G UK trial in Bristol & Bath, UK
 - Working in 3GPP SA2 on service-based architecture with Deutsche Telekom, Huawei, NEC