Computing Delivery in Routing Network

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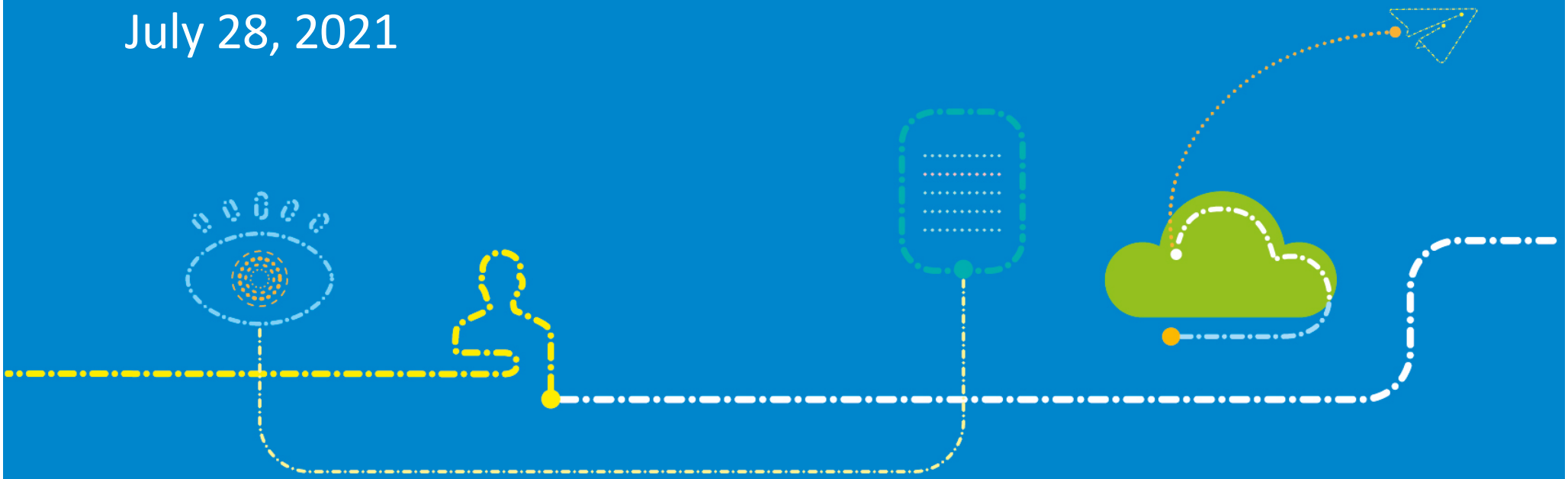
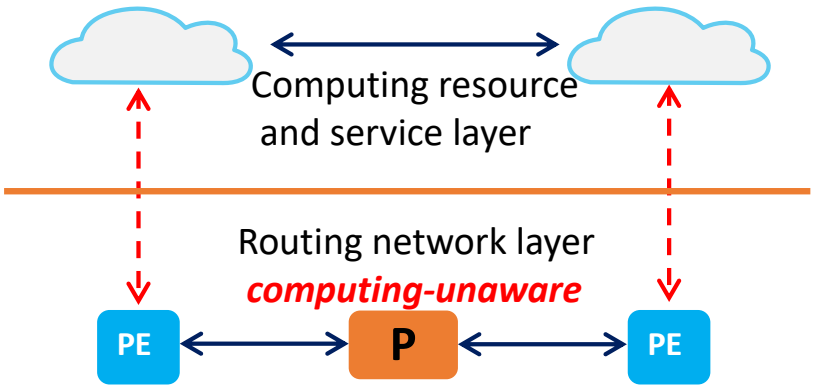
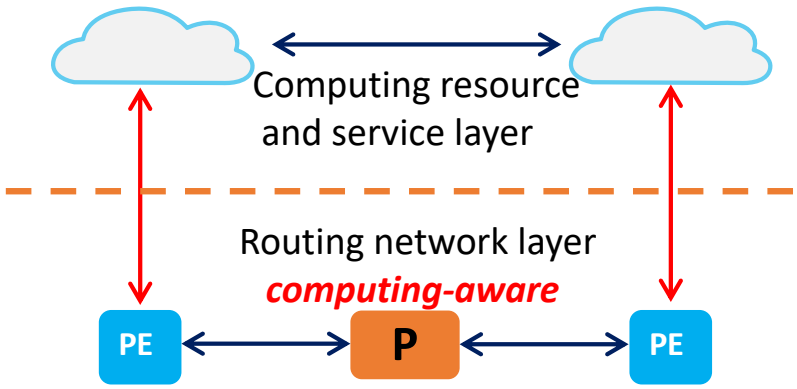


Why computing delivery in routing network





Centralized computing

- Sensing and scheduling of computing by cloud system makes more sense.
- Coordination between cloud and network could be cost-effective because of the scalability and intensity.
- The use case sits perfect within the computing-unaware routing architecture.

Distributed computing

- DC/MEC interconnection is in different shape.
- Distributed and isolated computing nodes need to be coordinated in a way beyond connection.
- Computing-aware routing network layer enables more valuable services and connects the computing more efficiently.

Challenges, problems and requirements

Problems

- Routing is an inherently addressing system in terms of topology and decoupled from computing in the cloud.
- Routing without aggregation is actually nothing while computing is not deployed in such a way that it could be aggregated.
- Computing interconnection and coordination in the application level lacks fine-grained networking service.

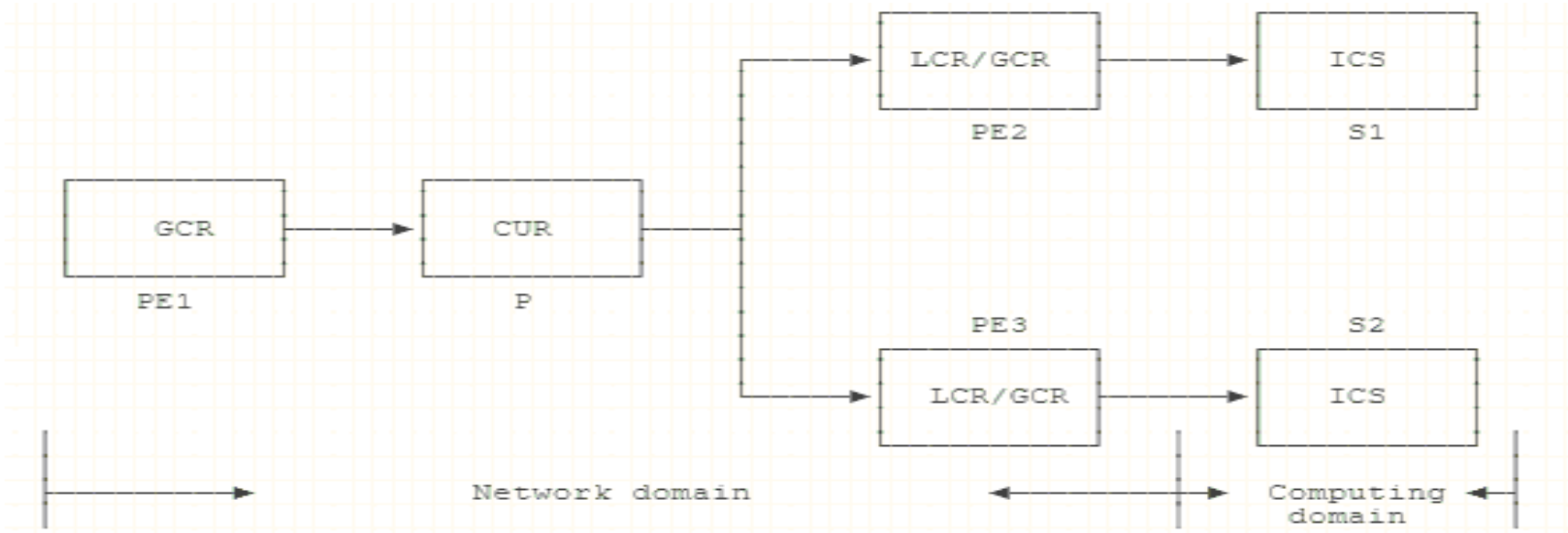
Challenges

- Full-granularity computing status in routing network could be a disaster.
- Computing parameter upon the routing process could incur an uncomfortable price.
- Routing in terms of computing is in a different scenario the routing is originally designed to address.

Requirements

- Computing status in routing network in an engineeringly acceptable way;
- Computing routing mechanism decoupled from ongoing routing;
- Select and limited routing nodes are computing-aware while the rest remains as they are.

Aggregation of computing



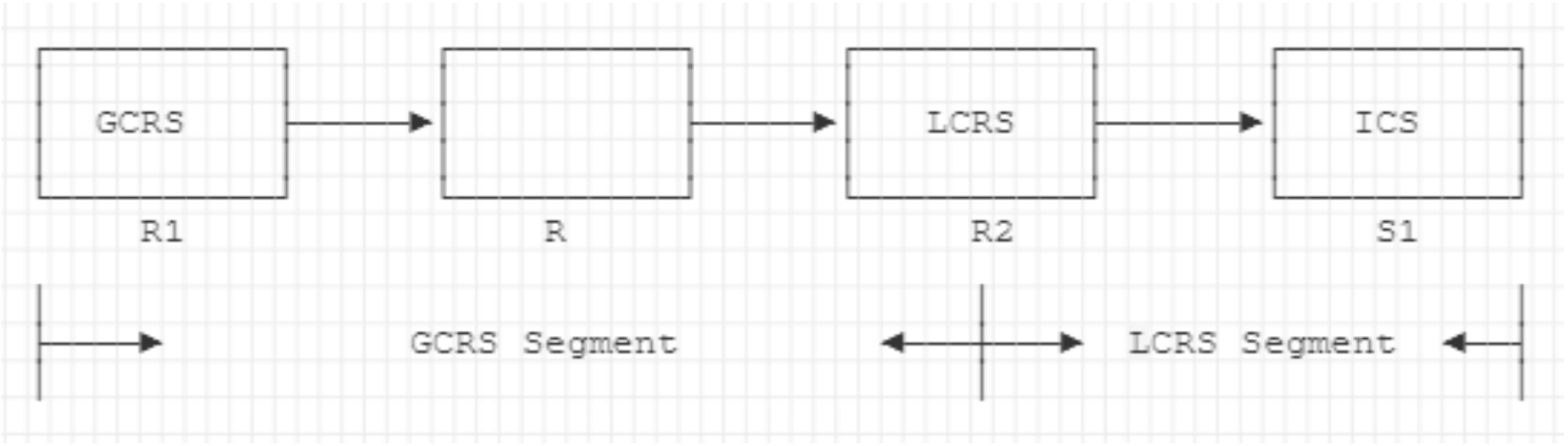
Global Computing Routing Node

- General computing resource and service status from remote cloud sites.
- Global computing status categorized to be as comparatively stable as possible, overall CPU/GPU occupation and service types available etc.
- Egress associated with the service should be selected as the destination rather than the specific host.

Local Computing Routing Node

- Dynamic computing service status from the local cloud sites.
- A specific instance is selected at this stage in terms of the status as well as the policies configured locally in the node.

Two-segment routing and forwarding



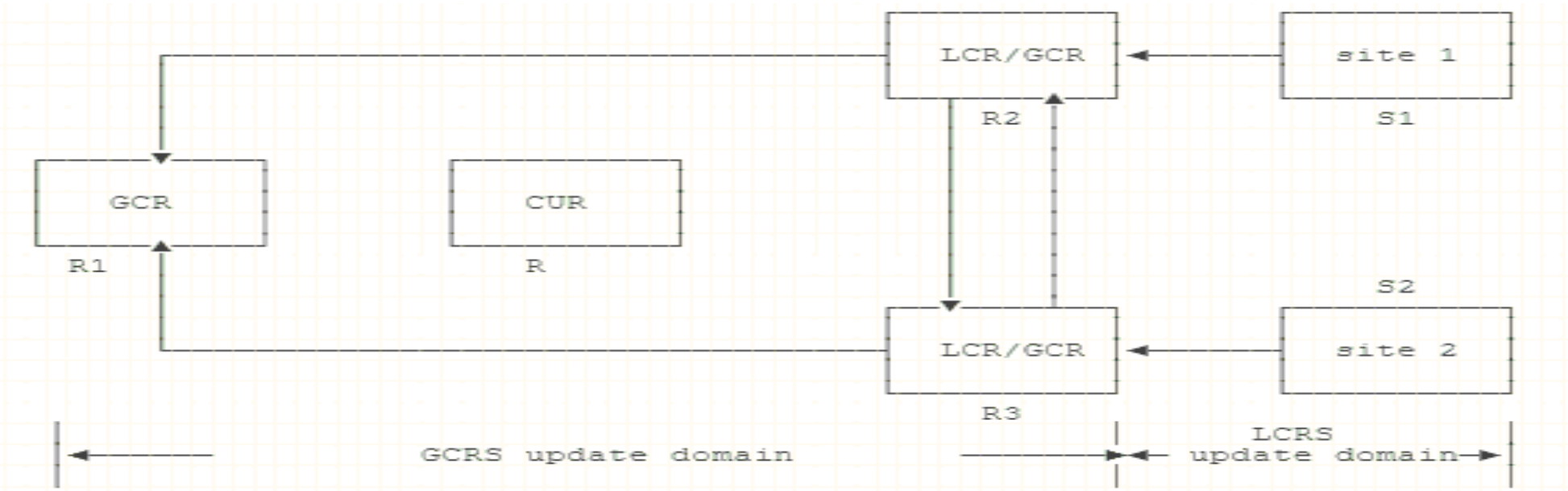
Global Computing Routing Segment

- R1 as ingress selects the egress in terms of the global computing status.
- an in-band encapsulation of computing service and resource is delivered to egress in an overlay tunnel.
- traffic affinity is guranteed by combining the 5 tuple and the egress.

Local Computing Routing Segment

- Through the in-band computing encapsulation and the local computing status is a service instance selected at R2.
- Traffic affinity is again guranteed by combining the 5 tuple and the service host.

Computing aggregation work flow



Computing aggregation work flow

- A full-granularity computing status is notified from cloud site to the local edge nodes which would maintain the local computing status while update the global part to the remote nodes.
- The global computing status update domain actually overlaps with the tradional routing network domain, the computing routing table size thus would be reduced and the update frequency would reside in a controlled and acceptable range.

Control plane and data plane

Control plane

- **Centralized control plane**: global computing status is collected and maintained at controller which delivers the routing policy from ingress to egress, while local computing status should be better maintained at the egress locally.
- **Distributed control plane**: global computing status only is propagated among edge nodes by routing protocol. while local computing status could be notified through ways beyond routing protocols.
- **Hybrid control plane**: distributed control plane for limited network area while centralized control plane aggregates them in hierarchical way.

Data plane

- Computing service and resource identification encapsulation and decapsulation in ingress and egress respectively.
- The nodes between ingress and egress stay computing-unaware.

Security considerations

- Both global and local computing status information are updated and integrated into the routing network process as third party resources.
- The security and credibility of the computing have to be guranteed and addressed.
- Details of security and credibility consideration would be either proposed in the future updated version or standalone draft.

What's next

- Comments, suggestions and contributions both online and offline would be welcome and appreciated.
- Trial test is ongoing and would be sync with the group as soon as possible.

Thanks for your time