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Traffic management and differentiation

BEREC technical workshop

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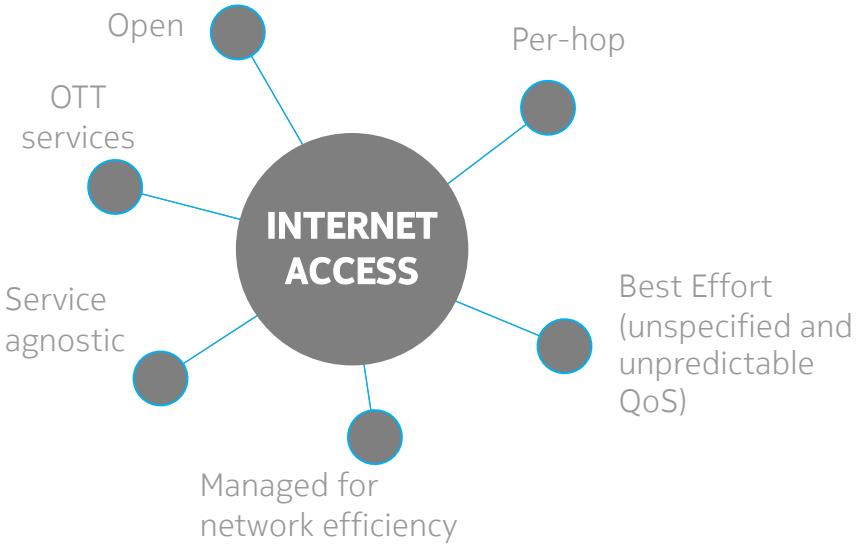
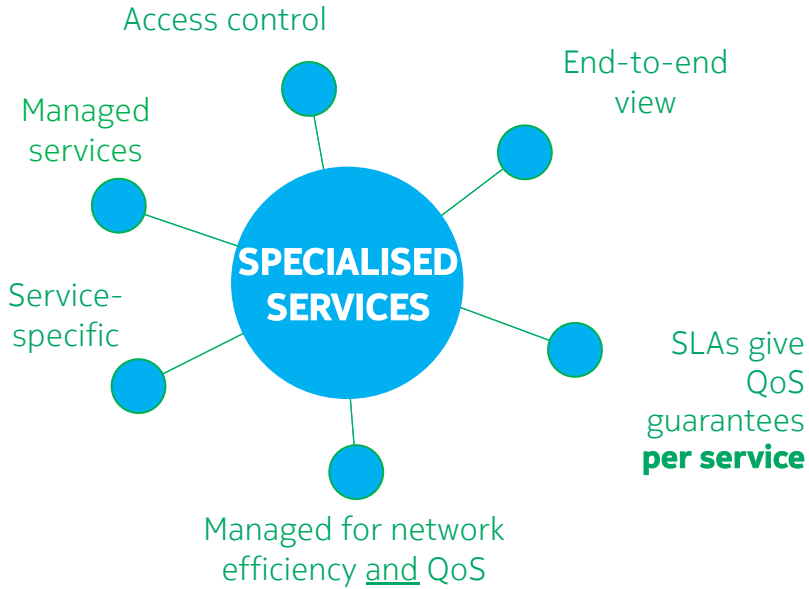
Today: IAS and Specialised services

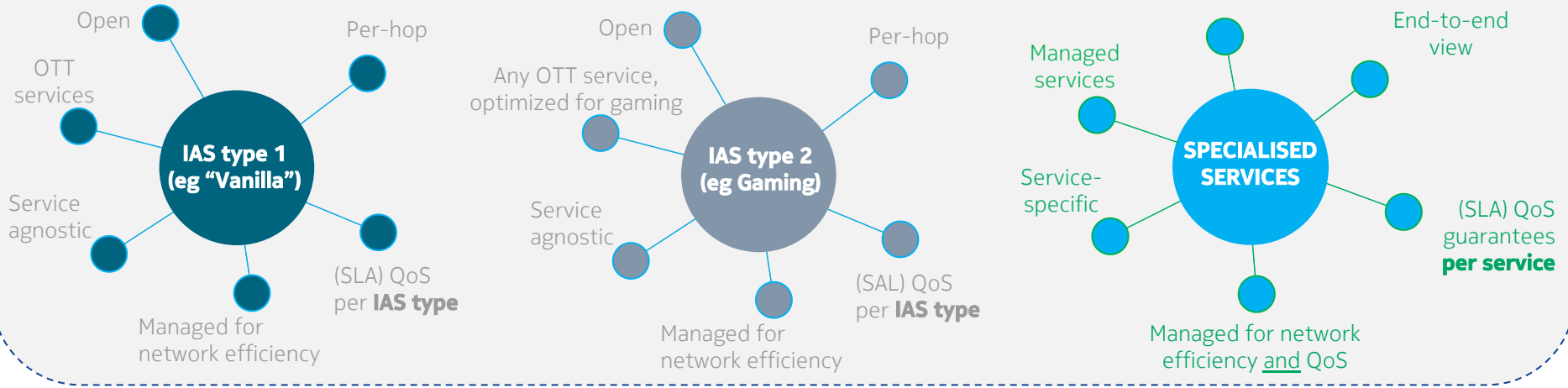




Any application can run as a specialised or non-specialised service
Not all applications need Quality guarantees.
Specialised services are associated with quality guarantees (SLAs).

Extension to different IAS types

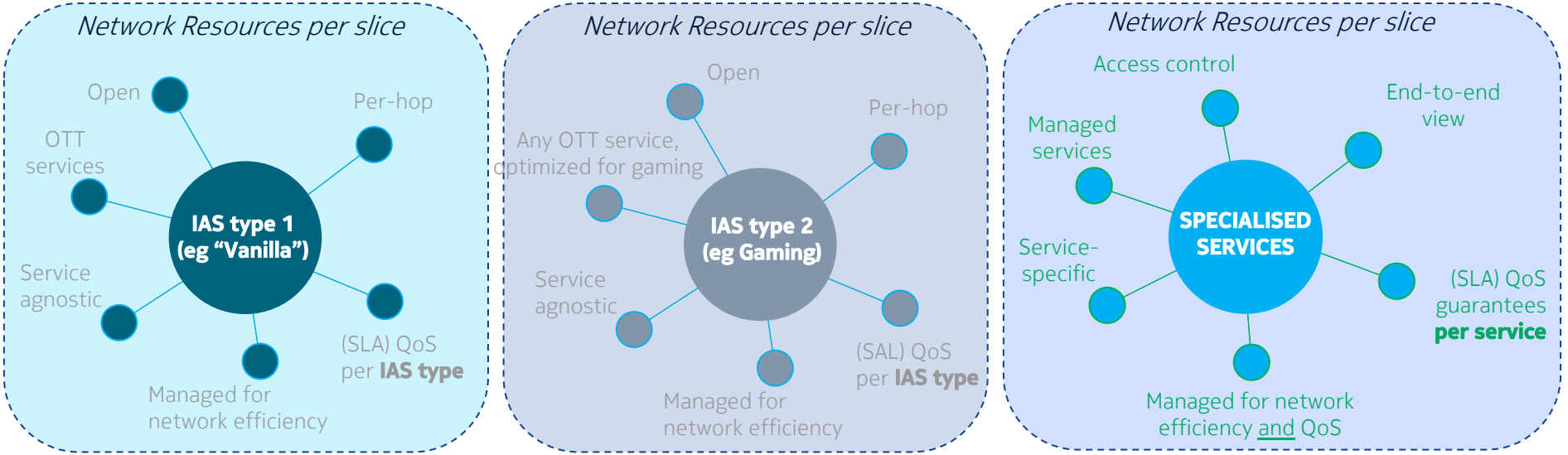
Network Resources shared by all services



Different IAS types can have different QoS guarantees (independently of the carried applications)
Specialised services are associated with QoS guarantees per service

Extension to different IAS types, using slicing

Common Network Resources shared by all services



If used, slicing partitions the network resources in per-slice part and common part.
Slices can be arranged per service or per group of services or per provider.

Impact of end-end networks on QoS: dealing with congestion

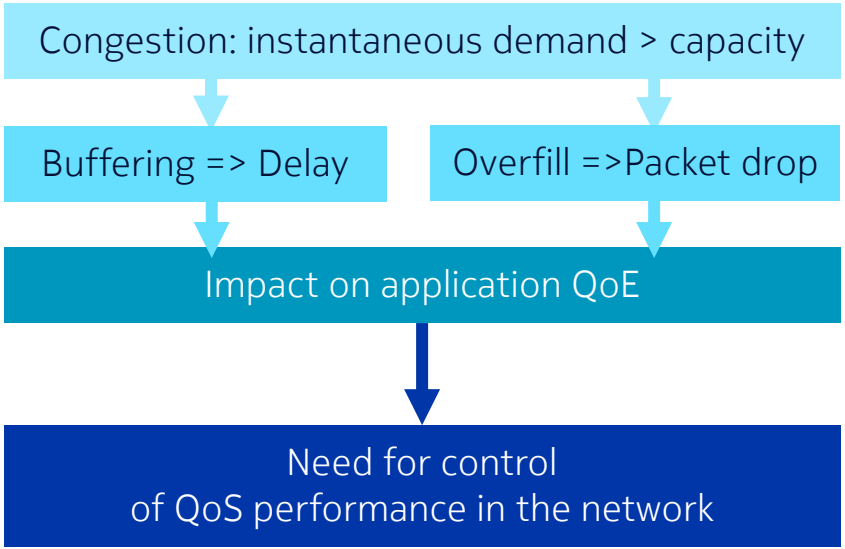
Protocol specifics (eg TCP dynamics)

Economically viable network dimensioning (below total peak demand)

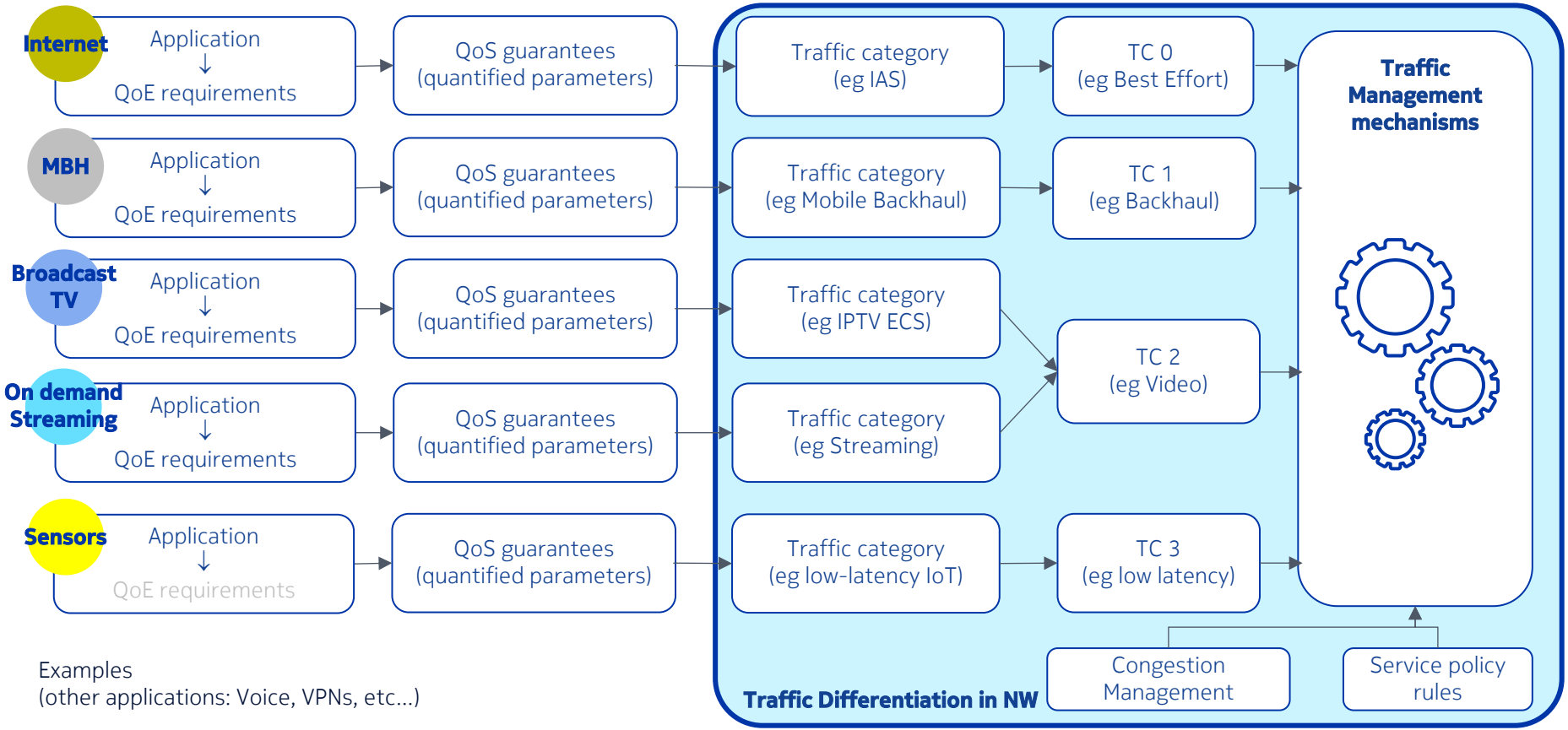
Node / link failures

Last mile PHY limitation

WiFi interference



Concepts for enforcing QoS performance

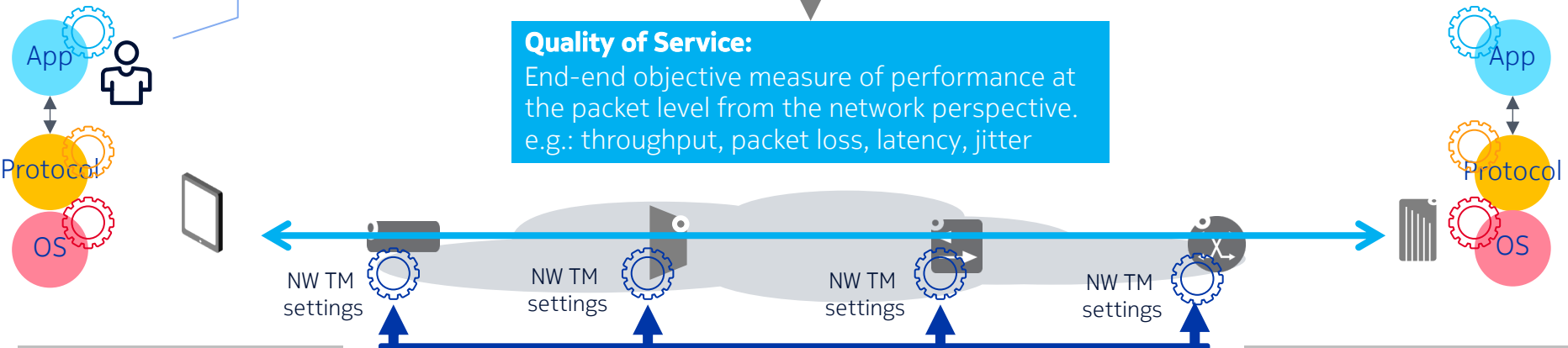


Examples
(other applications: Voice, VPNs, etc...)

Offering guarantees: Traffic Management based on Traffic Differentiation

Application ➔ Quality of Experience
perspective of the end user

Quality of Service:
End-end objective measure of performance at the packet level from the network perspective.
e.g.: throughput, packet loss, latency, jitter



Service Policy rules:

Classification rules + action rules, for differentiated treatment of network traffic (CoS)

Traffic Management mechanisms:

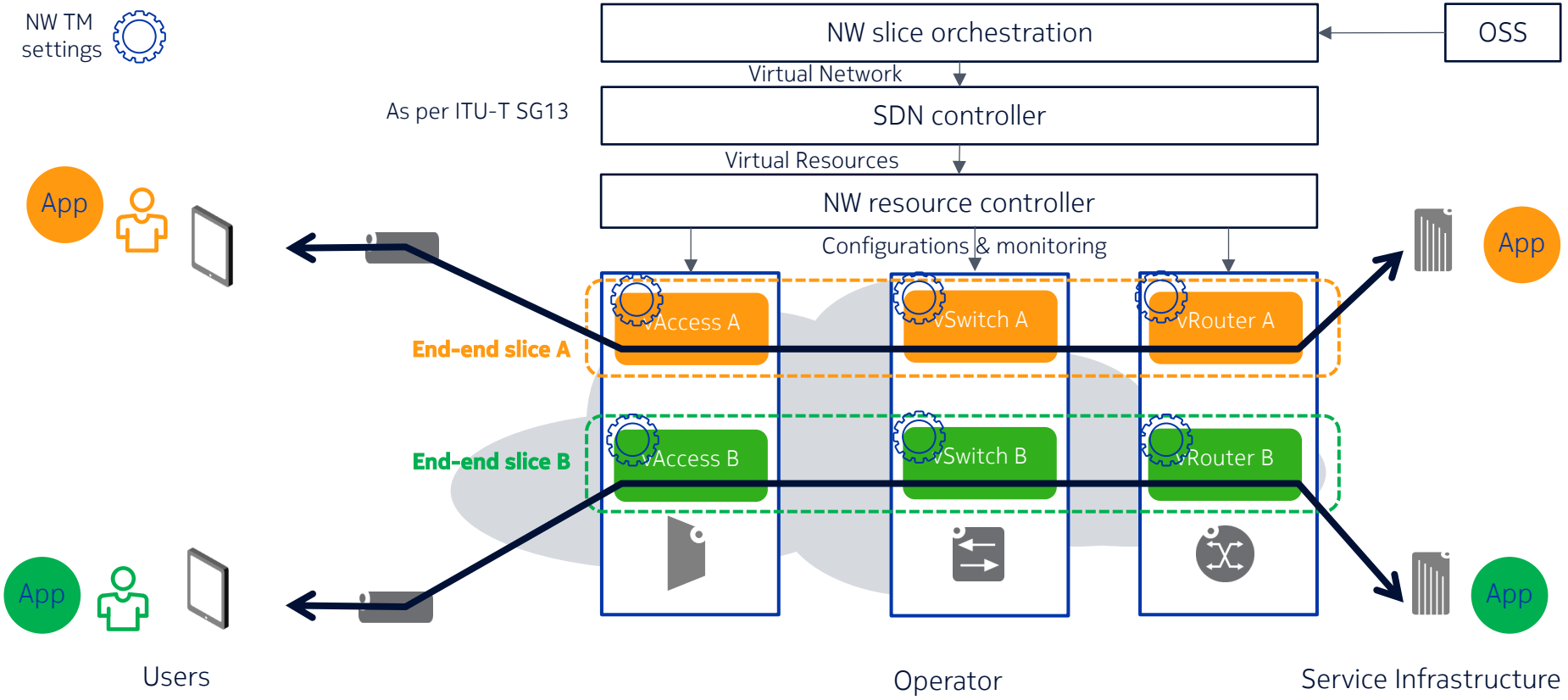
Managing the effects of congestion on application performance
Providing differentiated service to selected network traffic flows or to selected users

(e.g.: prioritization by Queuing & scheduling, shaping, rerouting, ...)

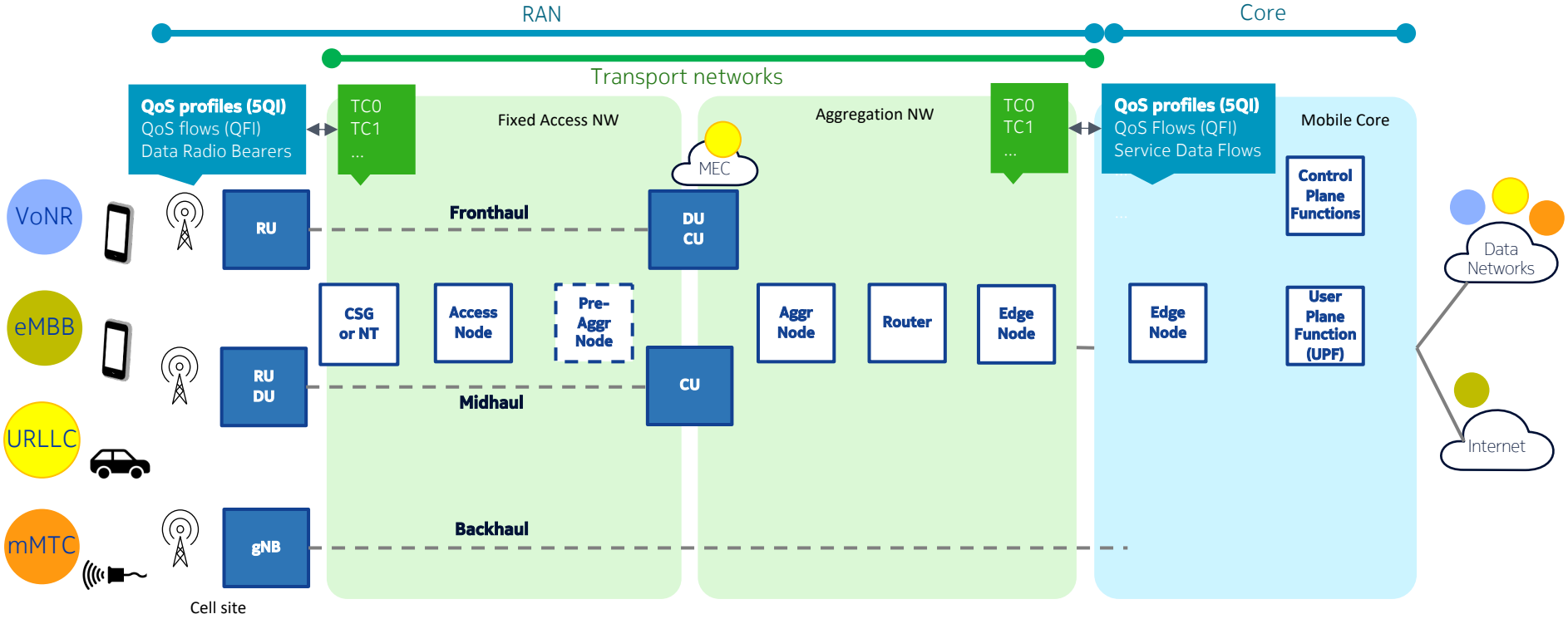
Congestion Management Practice:

Goals set by operator for its use of Traffic Management (e.g.: per-user handling, rate capping, AC, CoS differentiation, ...)

Efficiently offering more control: TM + Slicing based on traffic differentiation



Mobile X-Haul over Fixed Networks (case: 5G)



Mapping of Mobile QoS flows to Transport QoS TCs (eg at Layer 2 or Layer 3) for transport in Fixed networks
Same TM toolset in Fixed network for X-Haul and Fixed services

Conclusions

Traffic Management is widely used in fixed and mobile networks

- It is techno-economically impossible to avoid congestion in the networks, but the effects must be mitigated.
- Traffic Management is the standard practice to support both specialised and Internet access services with sufficient QoS guarantees, in an economically sustainable way.
- Traffic Management is based on differentiation (Traffic Classes and/or flows), and does not require content inspection or discrimination between applications

Additionally, slicing brings more isolation between different traffic types

- Slicing is not required to support multiple IAS and Specialised Services
- But allows operator to have deeper level of resource reservation (eg bandwidth on links, processing power in nodes) in the infrastructure for providing guarantees (eg #users supported, latency limits) to individual slices
- (Slicing typically used by VNOs to reach users via Infrastructure Provider, with more control over the deployment of their services)

Both IAS and Non-IAS are relevant. TM and slicing are enablers for both, using Traffic Differentiation

- Best Effort IAS is the basic connectivity for all users and must be preserved.
- Creating multiple IAS services help operators in adapting their offers to additional customer requirements (eg gaming, back-ups, IoT).
- Specialised services are used to support those users and services that require advanced end-to-end QoS per service.
  Such services require a level of interaction with and control by the operator network (eg VoIP ECS, IPTV ECS).

Background: Possible Traffic Management mechanisms and impact on QoS

	Latency	Jitter (PDV)	Packet loss	Availability	Throughput	Optimization for protocol (eg TCP)
Classification and (re)marking	Marking can help for better decisions in other congestion points (in same or other nodes) Can also notify congestion to the sender				See L4S	
Queuing and Buffer Acceptance Control	Shallower queues => lower delay and jitter, higher loss				Depends on traffic pattern vs buffer depth	L4S improves TCP goodput when mix with low latency
Traffic Policing, Traffic Shaping	Policing protects resources of other TCs and hence their performance. Shaping reduces jitter and packet loss but adds delay.				Policing limits max throughput	Shaping improves TCP goodput
Priority scheduling	The higher the priority of a TC, the better its performance (latency, jitter, loss, throughput) in times of congestion					
(Resource) Admission Control					Protection of nw resources. Enforcement of SLAs	
Resource Reservation	Per flow or per virtual network. Eg MPLS, TSN, Slicing					
Equipment protection (node, link)				Provides redundancy		
Content caching, Edge cloud	The closer, the lower the latency	Side benefit		protect against temporary unavaila-bility of server	Less bottlenecks, Better nw efficiency	
Use of multicasting transmission					More efficient use of nw resources	
QoS-aware (re)routing	Planned / Adaptative: new path if QoS parameters degrade (or if failure)					
QoS monitoring	Statistics and SLA monitoring					

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