5G Network Slicing: Use Cases & Requirements

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BUILDING A BETTER CONNECTED WORLD

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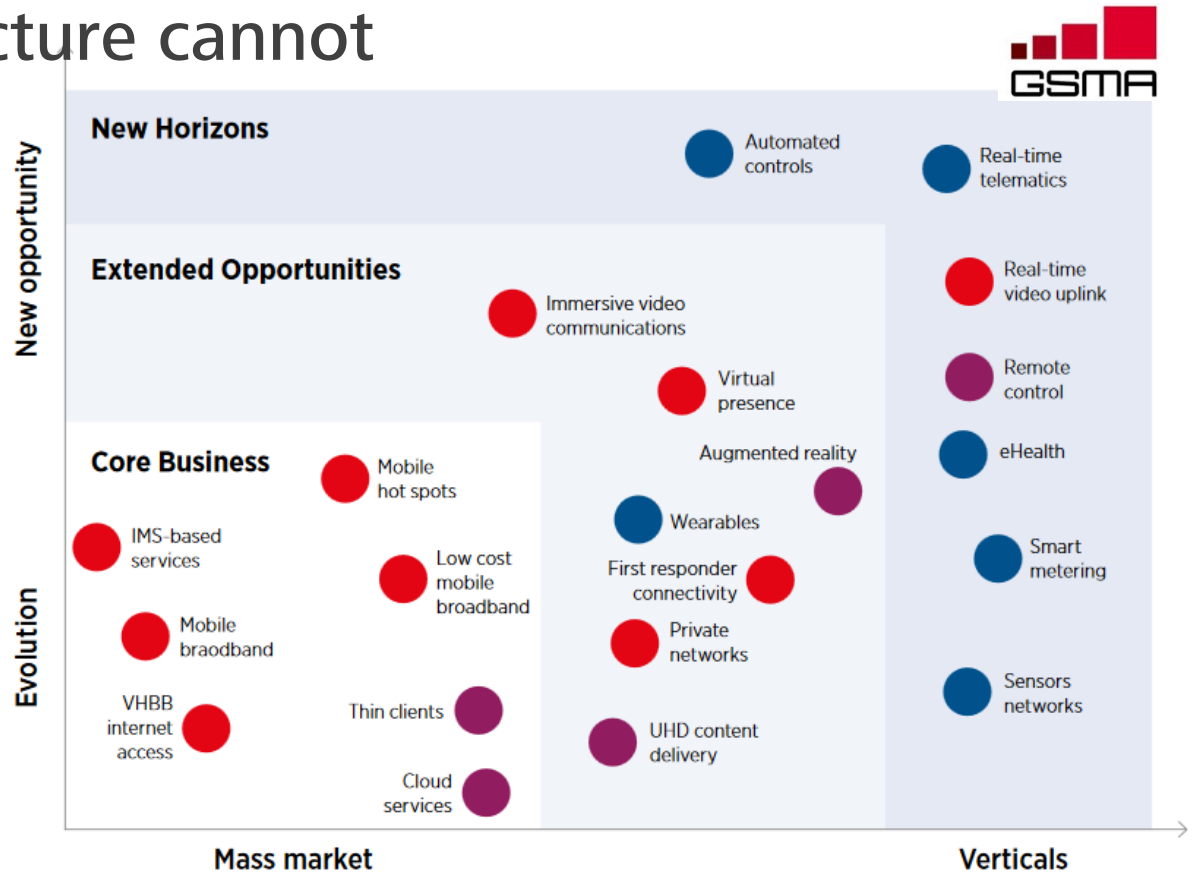
Outline

- Network Slicing Concept & Business
- Network Slicing Use Cases
- Key Technologies for enabling network slicing
- Conclusions & Deployment Remarks

Emerging Business Opportunities

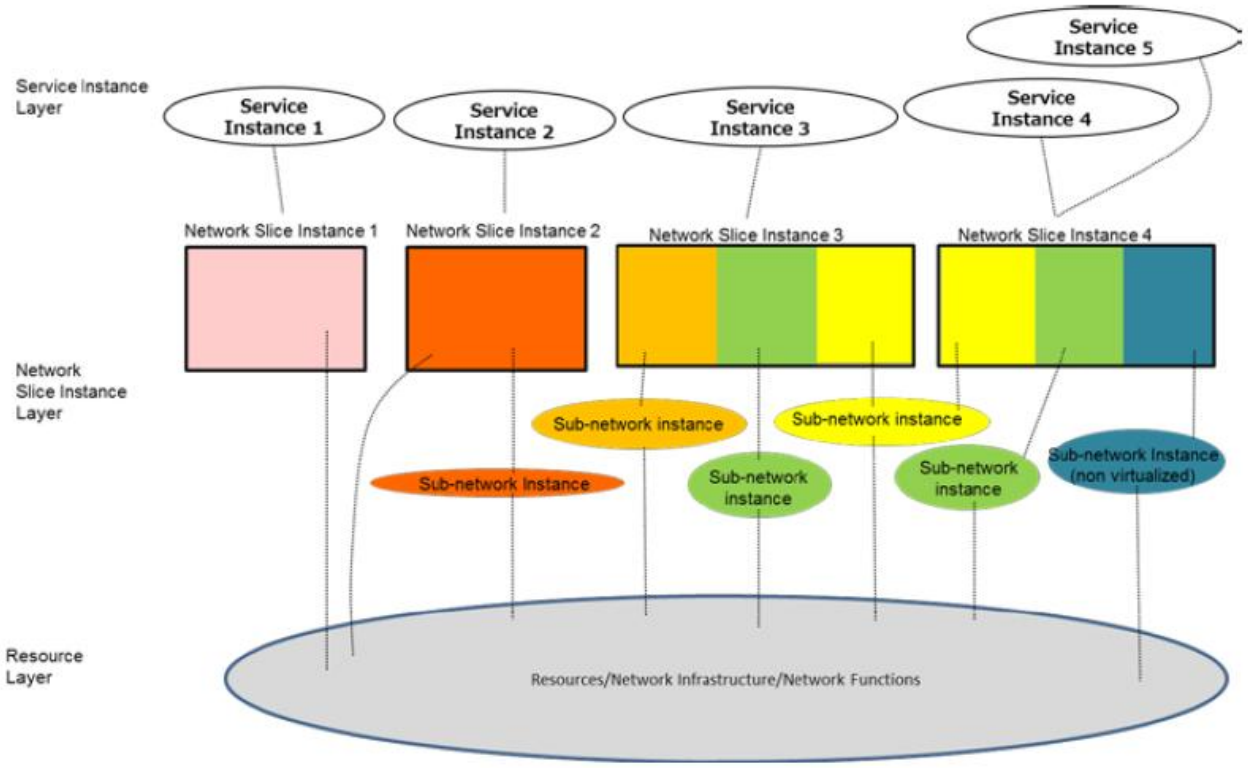
- Traditional voice/SMS business will eventually die
  - Footprint of data becomes significant but can operators monetize mobile data via the bit-pipe model?
- The monolithic “one-fit-all” 4G architecture cannot
  - Move towards a flexible network of capabilities
- Carrier interest on profit

  NOT on CAPEX/OPEX reduction
  - Create a market for new applications (Verticals)
  - Added value customer services (Accelerators)
  - Monetize edge-cloud services
    - Content/Processing/Storage closer to user
    - Bid data /RAN-awareness / App-awareness



Network Slicing Concept

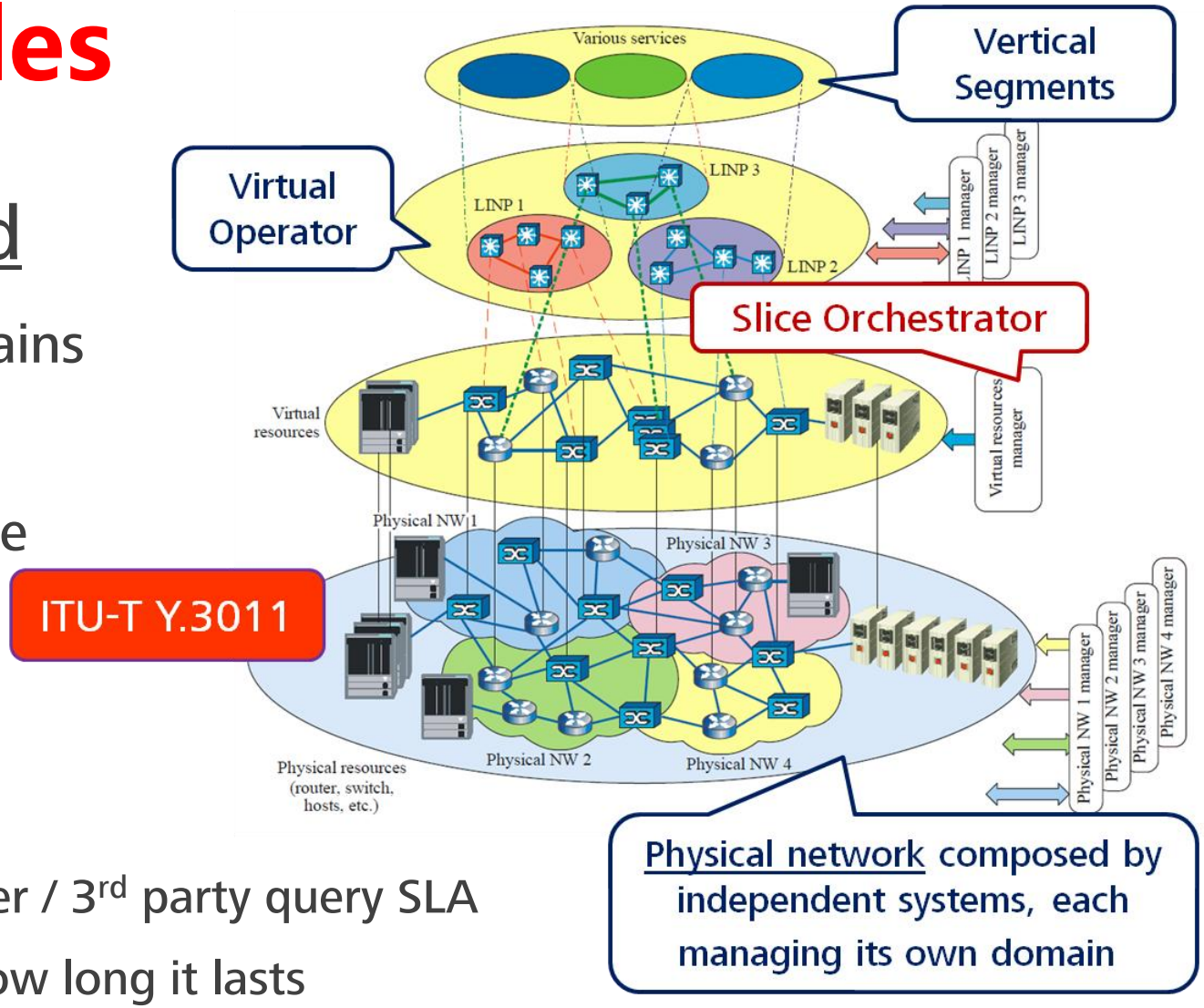
- **Network slicing** – A new value creation opportunity
  - Allows **multiple logical**, **self-contained networks** on a common physical infrastructure supporting **diverse business demands**
  - Offers **service customization** - provides the most suitable resources and network topology to different types of services
  - A **"smart" data pipe** – beyond connectivity – **service assurance**



- **A slice reflects a service**
  - **Beyond VPN** - access and connectivity
  - Facilitates a **continuous evolving process**

Network Slicing Priciples

- Network Slicing is End-to-End
  - Across different administrative domains and technologies (incl. Fixed - FMC)
  - Hierarchical recursive business nature
- Slicing facilitates
  - Automation and programmability
    - A signaling based solution – Customer / 3rd party query SLA
    - Time flexibility – when it starts for how long it lasts
  - Isolation: Control/Data plane – Shared resources
  - Customization/Softwarization: VNFs, policy, protocols, services, etc.

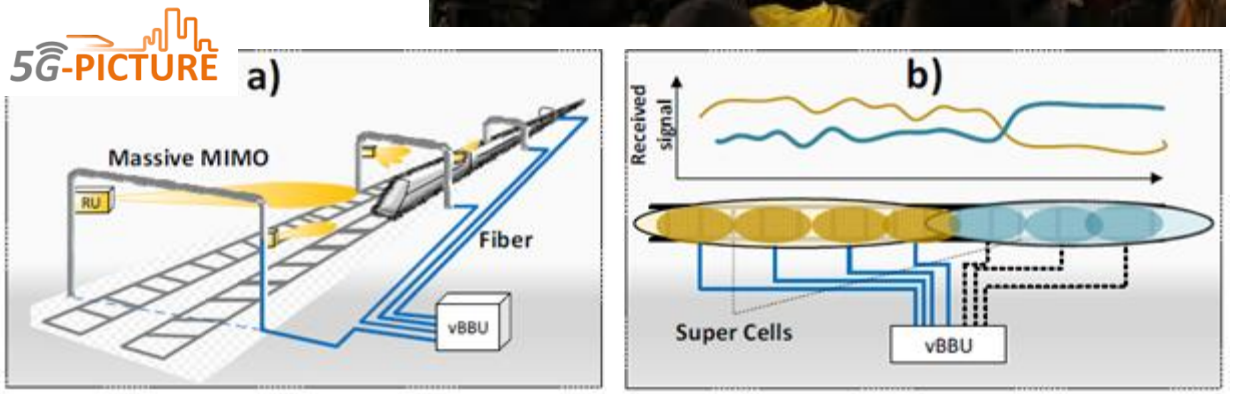


enhanced Mobile Broadband (eMBB)

- AR/VR – City Tourism
  - Ultra-low latency e2e delay < 10ms - Bandwidth > several GB depending
  - flexible creation of a localized eMBB slice considering user mobility
  - real-time interactive service

- Broadband in Dence areas:
  - Broadband access with up to 10GBps bandwidth enabling multimedia services
  - Edge-cloud /C-RAN/drones to enhance capacity

- Service continuity at high speeds
  - Massive MIMO and C-RAN can enhance the converge and reduce handover rates
  - Local content/services at edge cloud (vBBU) can enhance further user performance



Operators to Service Providers (mIoT)

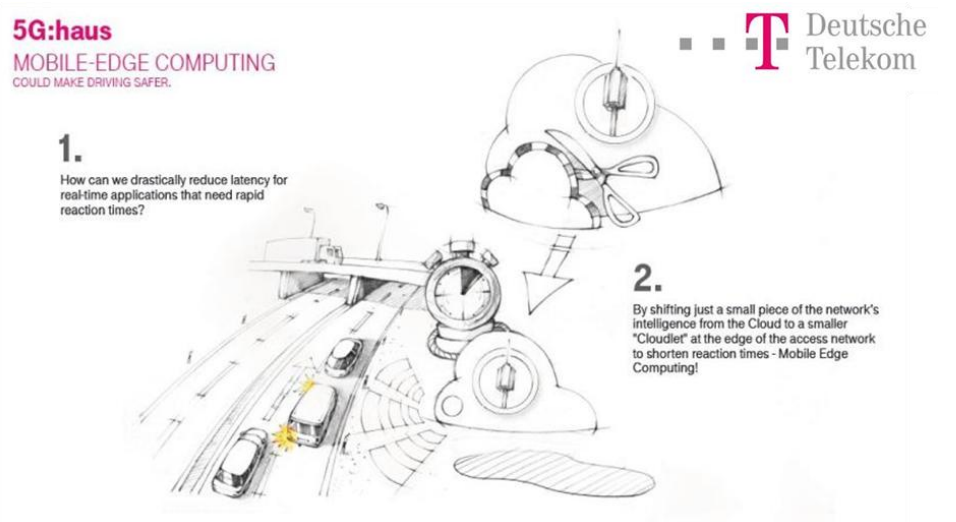
- Operators will step-up to new roles enable IoT services and offer business solutions
  - Security APP-solutions for home (AT&T Digital Life)
  - Metering - Electricity/Water/Heating

    (reduce cost – accurate and timely billing)
- Logistics enabling tacking and assisting object delivery systems
  - Prevent item lose – customer notification
- eHealth via wearables – health monitoring
  - Health care application - on-demand measurements

Critical Communications

- Mission critical communications – Regulation
  - Service assurance - On-demand/flexible resource provision
  - Edge-cloud/Fast processing and data analytics
- Tactile Internet
  - Service assurance – 1ms latency
  - Edge-cloud/Fast Forwarding/Programmable data -plane
- V2X slice - edge-cloud assisted
  - <u>Autonomous driving</u>
    - low latency 1ms and consistent high bi-directional throughput
  - <u>V2X communication</u>
    - Macro-level coordination - Multi-operator enhancements
    - Road infrastructure analytics



Network Slicing OS

Deployment options:
1. Logical PNF per Inf provider/MNO
2. Third party local PNF

Network Slice Request: formed to describe the desired service (SLA, group of users, location, timing, duration, service type etc.)

Slice Templates

Collection of type of network slices

Slice Info Base

Slice Broker

Once a request arrives:
1. Admission control – Resource negotiation
2. Service Mapping – Assigns Slice Template
3. Create Virtual Network Graph

Resource Graph

Policy Provision

SDN deployment options:
1. (i) OSS/BSS or (ii) tenant VNF
2. (i) VIM or (ii) NFVI

Resource Life-Cycle Management

QoE Provision

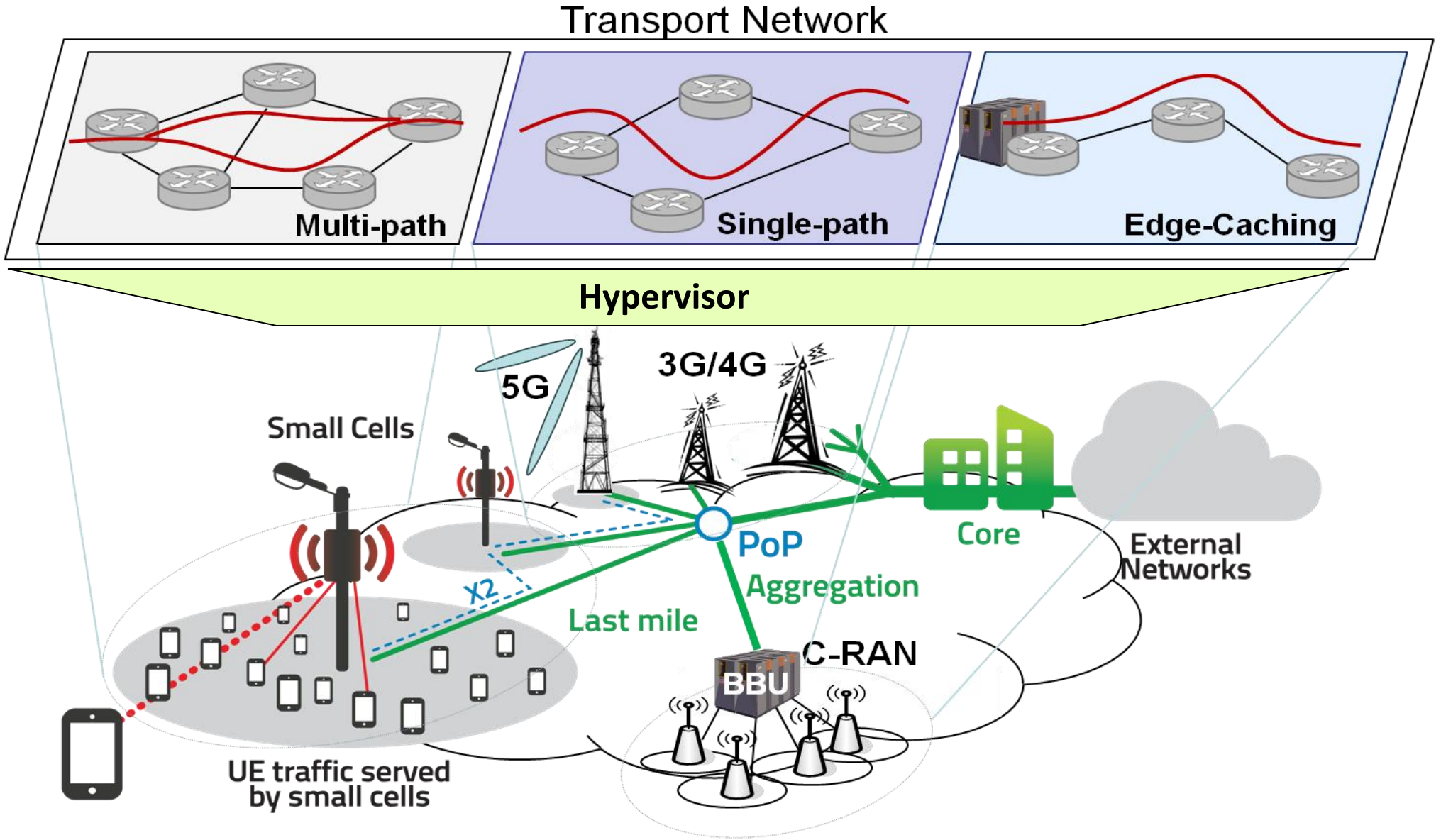
Resource Control

Resource Controller

1. (De-)compose and allocate network resources
2. Instantiates network functions and VNFs
3. Interact with MEC / service

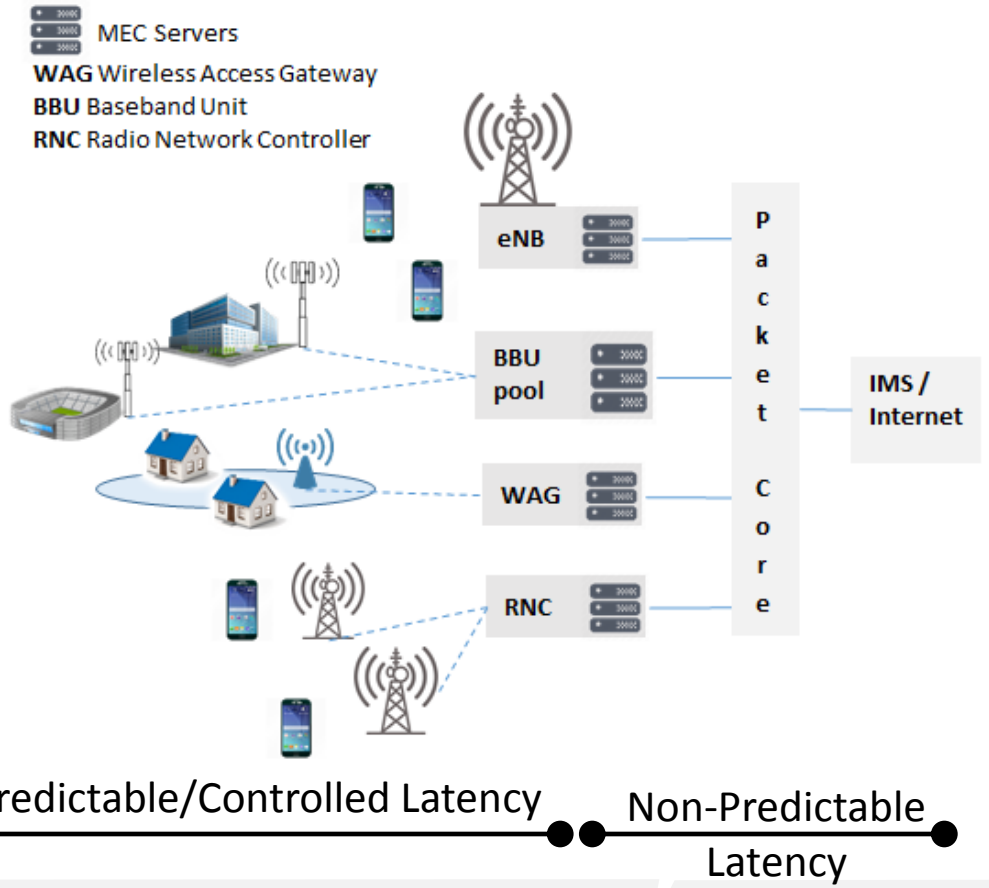
1. Creates Flexible Service Chaining
2. Operates Service, e.g. assure QoE, interacts with resource life-cycle management

Mapping Transport Network in RAN



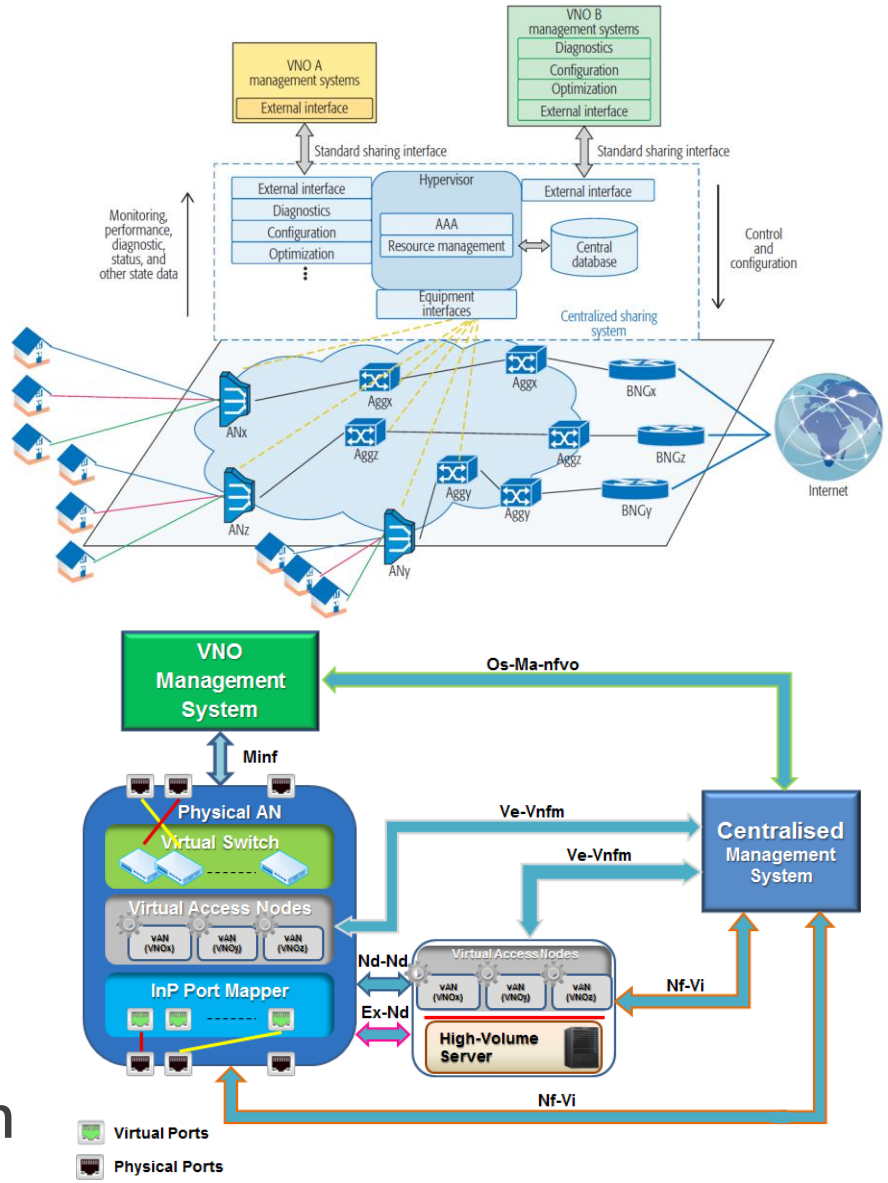
Edge-Cloud Slice Provision

- Provide function softwarization - added value services at the edge
  - C-RAN/distributed core – flexible RAN/Core Network de-composition and allocation
  - 1ms and high BW can be met by edge-cloud:
    - Predictable performance /content – close distance
    - RAN analytics and context-awareness
- Relax end-to-end service requirements
  - Intermediate edge-cloud
    - Store / Collect user-context information
    - React to changing conditions, e.g. codec
- Key technology - Edge-cloud Orchestration



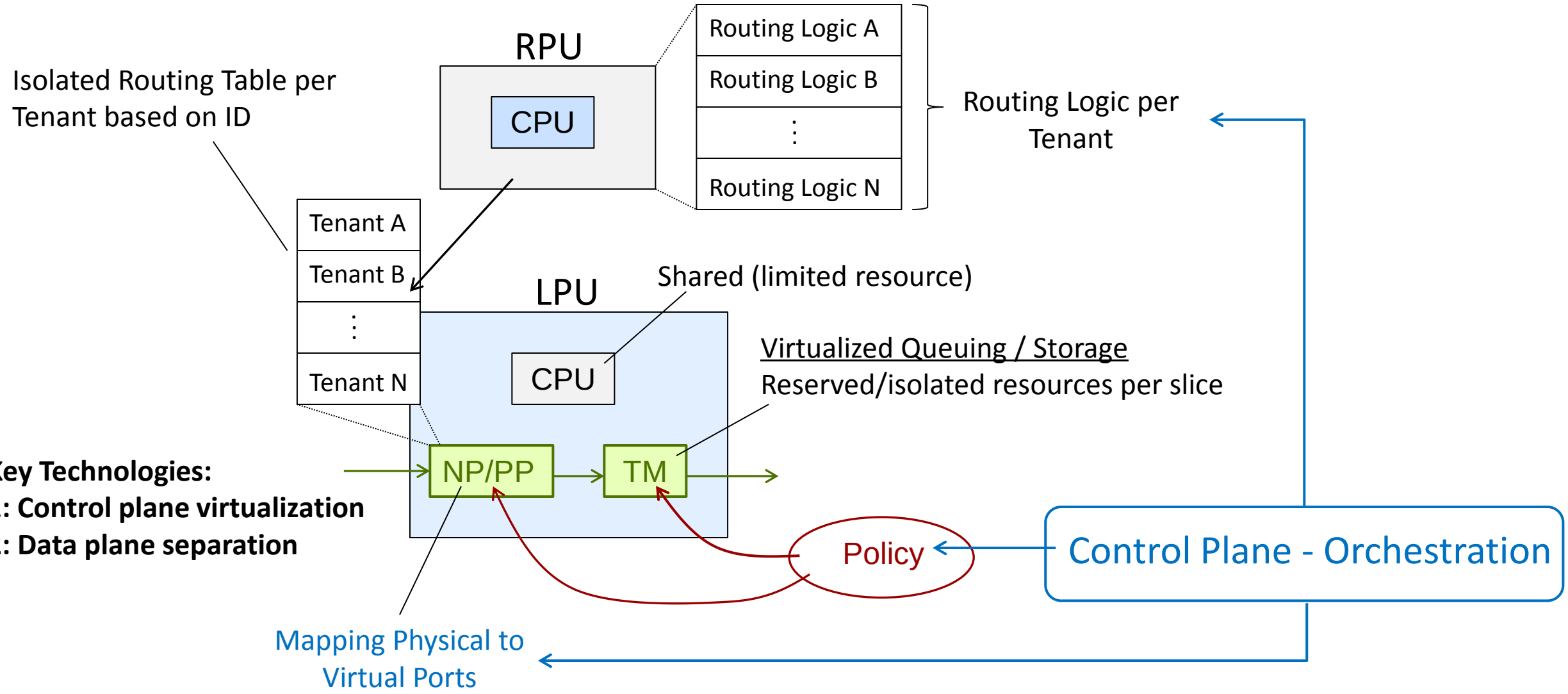
Virtual Operator Models

- Two solution models:
  - Management System: policy-based legacy approach in centralized manner
  - Virtual Access Node: MANO-based
    - Physical equipment – introduce hypervisor to isolate resources
    - Date centre – introduce VM to host VNFs and hypervisor to manage resource allocation



vAN in Physical Equipment & Data Centers

Virtualization in Router



Conclusions

- On network slicing provision
  - Resource virtualization: Combine physical equipment and cloud resources
  - Inter-slicing: Isolation, policy and control of slice resources
  - Intra-slicing: Perform programmability – allowing flexibility – tenant control
  - Orchestration: Reflects a service closed-loop orchestration and service management means

- On business value of network slicing
  - Service isolation considering both data and control plane – Security/privacy and performance
  - Allow resource customization to accommodate SLA requirements
    - Forwarding of traffic – considering service requirements
    - Traffic steering considering physical condition of links - for wireless links, e.g. microWave
    - Combining cloud and network capacity resources

THANK YOU