

# An operator's view on 5G network

## - Towards a flexible network architecture

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- Services in 2020
- Challenges for mobile operators
- New core network architecture
- Summary and the way forward

## Everything Connected

Monitor/collect information & control devices

### Multiple personal devices



Interaction across multiple devices

### Transportation (Car/Bus/Train)



Entertainment, Navigation  
 Traffic information

### Consumer electronics



Remote operation using personal terminal

### Watch/jewelry/cloth



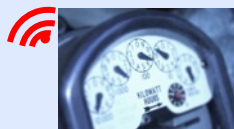
Human interface and healthcare sensors

### House



Remote control of facilities  
 House security

### Sensors



Smart power grid  
 Agriculture and farming  
 Factory automation  
 Weather/Environment

### Cloud computing



All kinds of services supported by the mobile personal cloud

## Extension of services

Deliver rich contents in real-time & ensure safety

### Video streaming



4K/8K video resolutions  
 Video on newspapers  
 Background video

### New types of terminal/HI



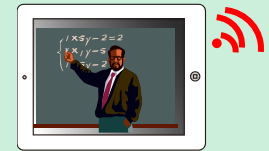
Glasses/Touch internet

### Healthcare



Remote health check & counseling

### Education



Distance (remote) learning  
 Any lesson anywhere/anytime

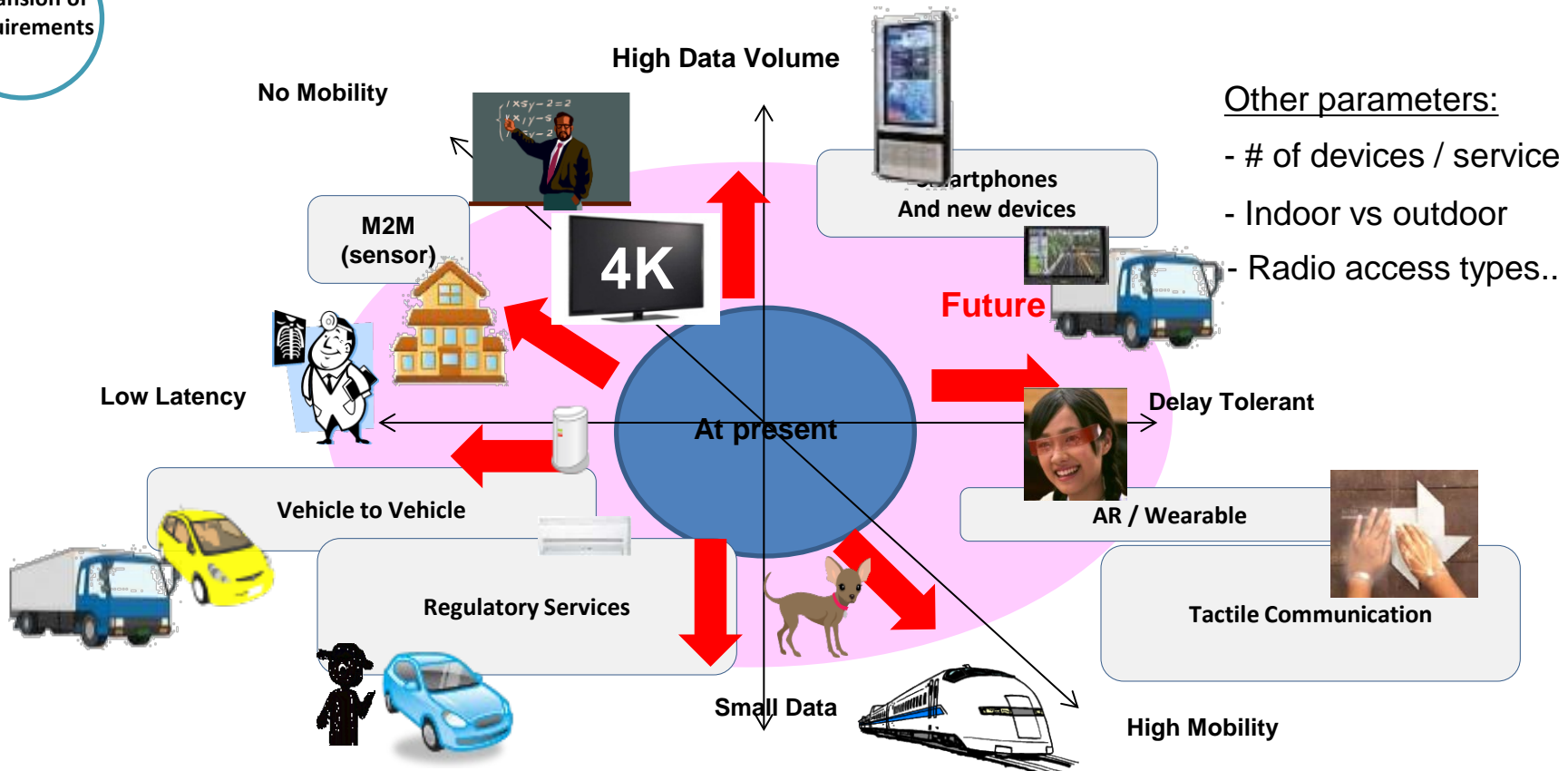
### Safety and lifeline system



Prevention of accidents  
 Robustness to disasters

### Requirement horizons are expanding in all directions

Expansion of Requirements



- Other parameters:
- # of devices / service
  - Indoor vs outdoor
  - Radio access types..

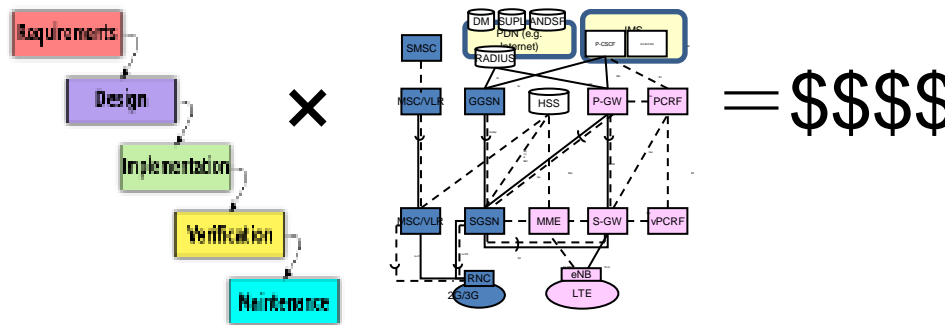
Current Model = Monolithic single architecture (one-fits-all)

- Currently, the core network is designed to meet the “most extreme”
- Greater resource efficiency could be achieved, if NW could be optimized for each service

Time-to-Market

### Very complex network with a lot of features

- Many types of logical entities = physical entities
  - For each purpose one NE: a lot of interaction between NEs
- A huge waterfall deployment process runs for each NE



### The Problem:

1. Complexity = **High cost + long time for adding new functions and services.**
2. NFV is effective for HW side to lower CAPEX/OPEX, but doesn't reduce SW/NE complexity running on top of it

Need to redesign (simplify) the logical architecture

# Challenges for mobile operators (3)

## - Key for the new core

### Challenges

#### Expansion of Requirements

#### Heterogeneous requirements

- Data volumes, real time, mobile profile
- New usages: driving aid, interaction, wearable

#### RAN Evolution

#### 5G RAN evolution

- Different modes of communication (MTC, D2D, C2C)
- impact on Core Network

#### Number of Devices

#### New threats and opportunities

- Fog Networks, D2D
- New business models, cost of infrastructure

#### Revenue Generation Strategy

#### Cloud support as a technological enabler

- CAPEX&OPEX reduction: requires reducing complexity
- Business expansion through open APIs

#### Time-to-Market

#### Network Complexity

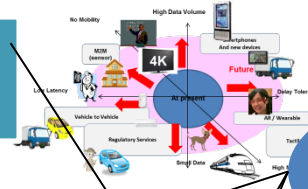
- Service provis. dependency to technology abstractions
- Monitoring, troubleshooting, SLA automation

#### System Reliability and Resilience

#### Centralized vs. Distributed

- Cloud not carrier class
- Backhauling and data center interconnection could be bottlenecks

### Architecture Requirements



Simple

Flexible

Scalable



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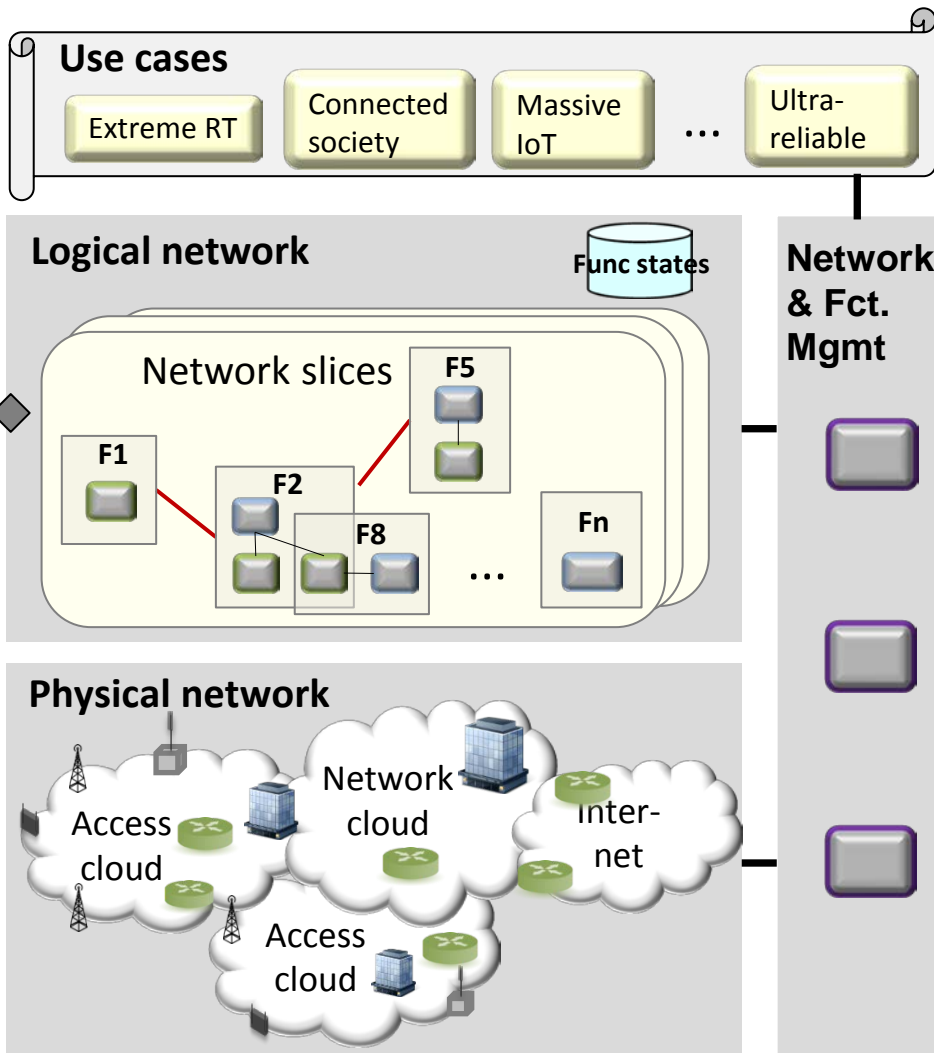
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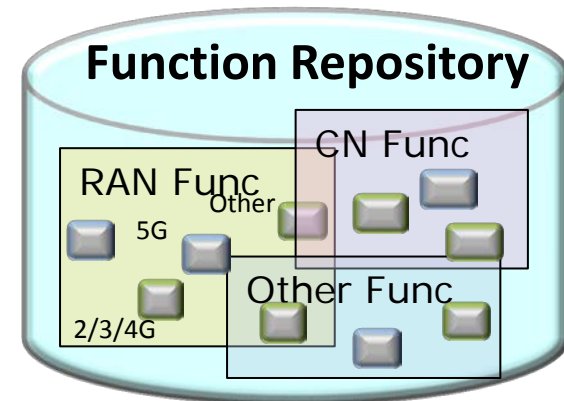


### Solution:

- Not one monolithic network that supports all extreme requirements, but a flexible set of functionality adapted for the traffic at hand



RAN: Radio Access Network CN: Core Network



■ / ■ C/U-Plane func ■ Mgmt func

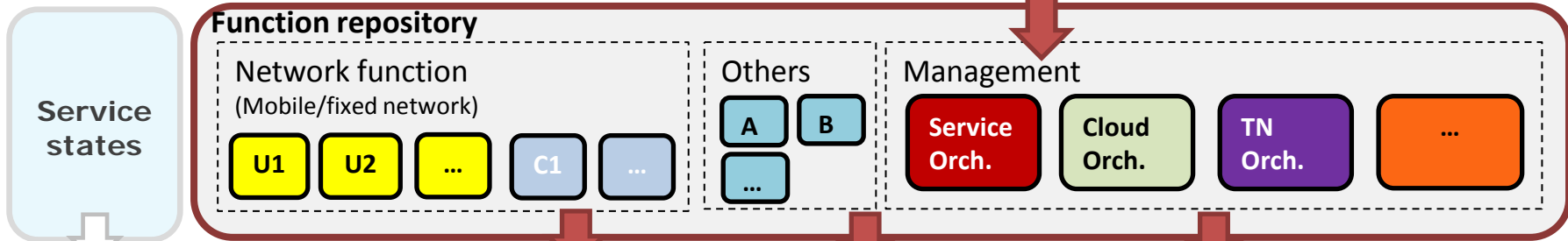
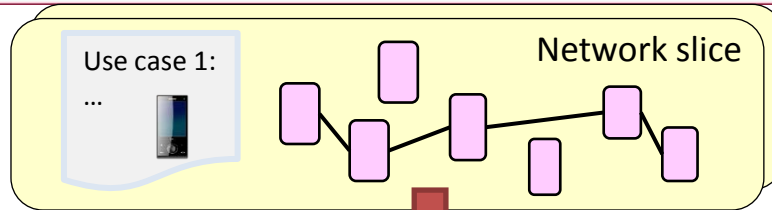
## SW based network architecture

- Use case based network slices
- Modular C/U-plane function components
- Separated function states
- Service/network orchestration via Network & Function Mgmt entity
- New business models enabled by open APIs (e.g., big data, XaaS)

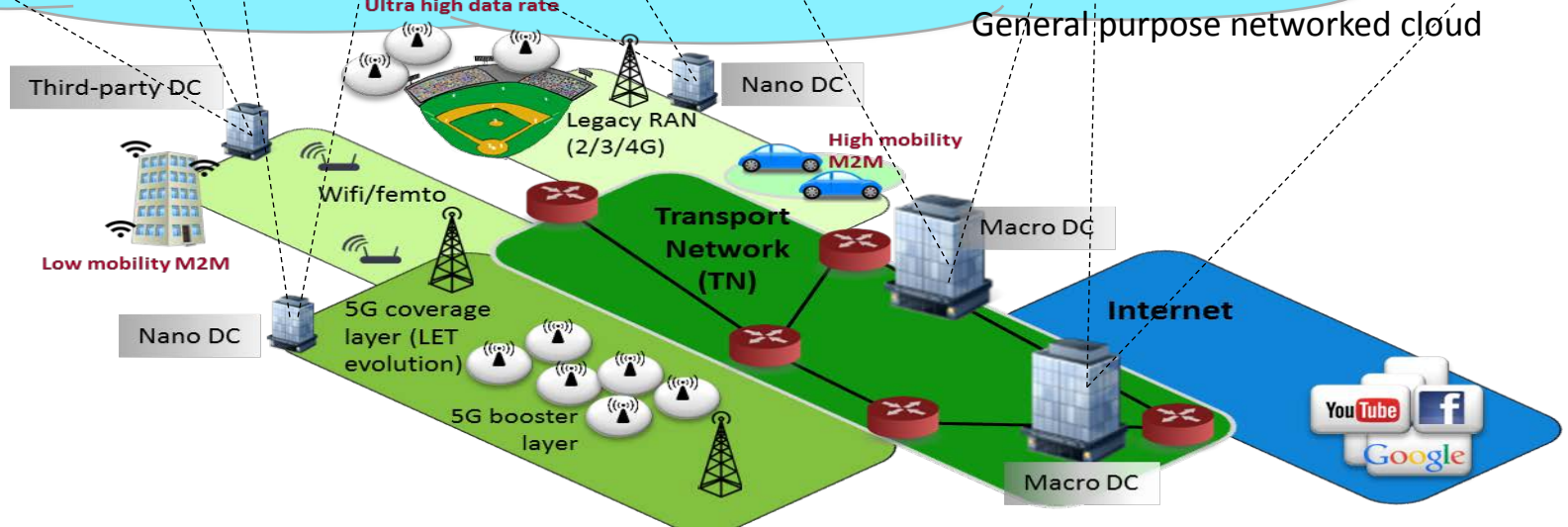
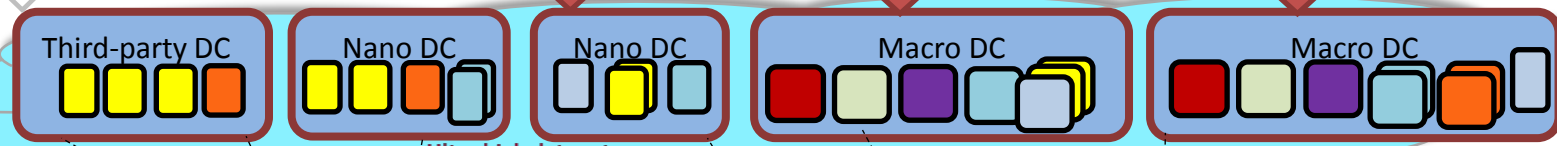


# Physical Implementation Example

**Service provisioning template repository**  
 Use case dependent service chaining topology



Service states

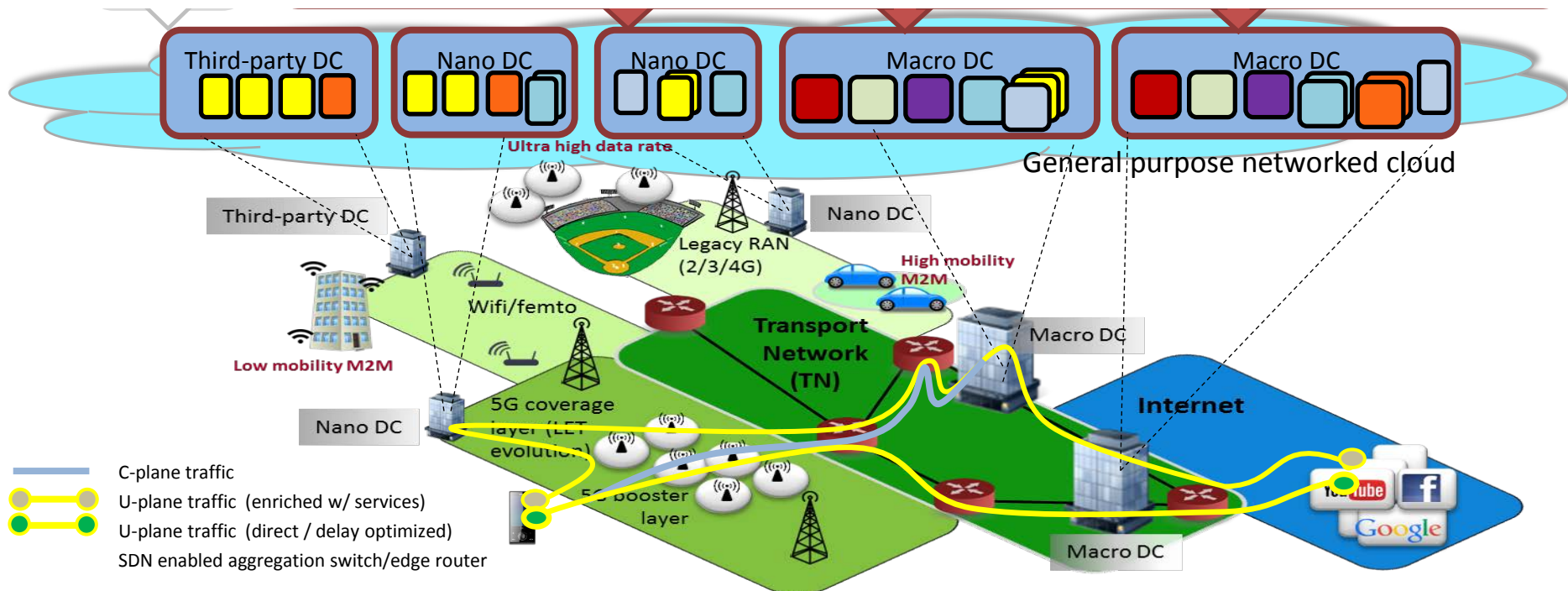


Leverage NFV and SDN capability

## Scenario dependent function distribution

### Individual traffic paths

- For different services, C/U-plane traffic



- Discuss the issues for future mobile communications in the 5G era
- Envision a flexible network architecture based on NFV and SDN technology
  - Leverage the power and flexibility of software!
- Next step
  - How should the actual network functions be designed?
    - What will be the right granularity? API?
  - What dynamics is expected to compose the network slices?
    - Is the existing NFV platform/concept enough to cover the network slices composition?



“One fits all”?

→ No! Everybody has their own flavor

**Harmonize** Social contribution beyond borders, across generations

**Evolve** Evolution of service and network

**Advance** Advance industries through convergence of service

**Relate** Creating joy through connections

**Trust** Support for safe, secure and comfortable living

**HEART**

Thank you!

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