

**4th SG13 Regional Workshop for Africa on
“Future Networks for a better Africa: IMT-2020,
Trust, Cloud Computing and Big Data”
(Accra, Ghana, 14-15 March 2016)**

**IMT2020/ 5G, much more
than pure Radio Aspects**

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Chairman of ITU-T Study Group 13**

Terms & Definition

- **IMT-2020 [ITU-R M-2083-0]:** systems, system components, and related aspects that support to provide far more enhanced capabilities than those described in Recommendation ITU-R M.1645.
- **IMT-2020 Radio:=** IMT evolution + new RAT revolution
- **IMT-2020 Network:=** flat architecture + white-box-hardware + Virtualization + LINP/ Slices + Softwarization + MEC + DAN (ICN/ CCN) + e-2-e VoLTE enabling + ...

Service Trends

Everything connected by wireless

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/cloths



Human interface (HI) 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/enrichment of wireless services

Deliver rich content in real-time & ensure safety

Video streaming



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

New types of terminal/HI



Glasses/Tactile Internet

Healthcare



Remote health check & counseling

Education



Distance (remote) learning
Any lesson anywhere/anytime

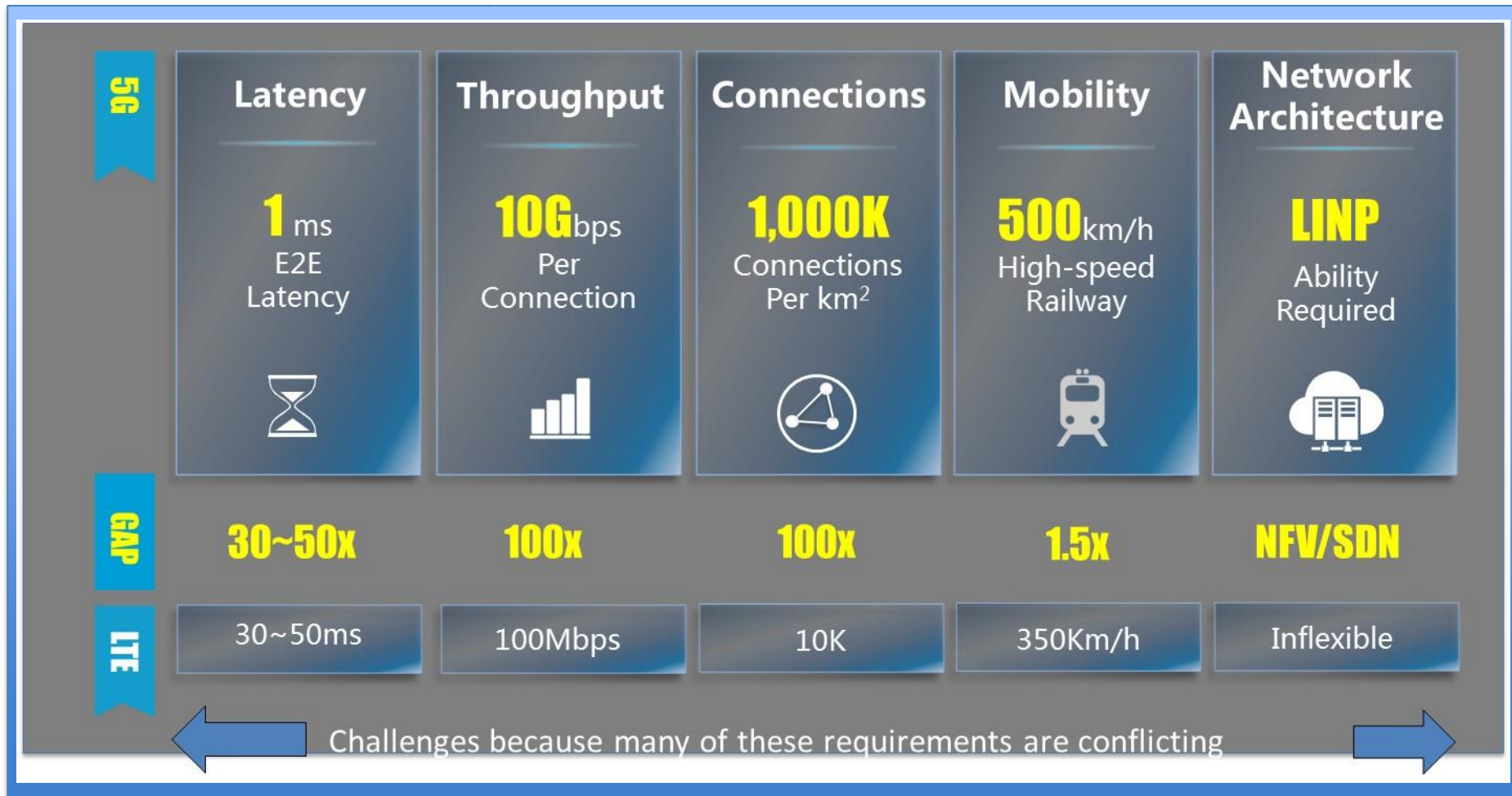
Safety and lifeline system



Prevention of accidents
Robustness to disasters

Source: NTTDocumo

Challenges & Gaps



Source: Huawei

Future network standards by SG13 ...

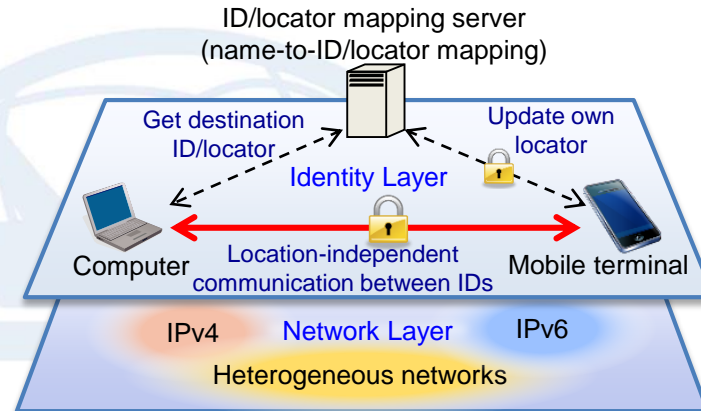
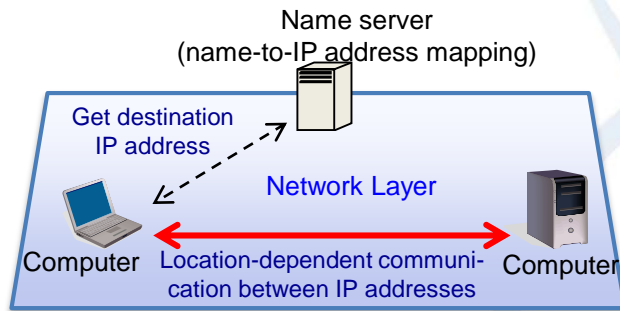
Awareness	Approved Recommendations
Service	<p>Y.3011: Framework of network virtualization for future networks</p> <p>Y.3012: Requirements of network virtualization for future networks</p> <p>Y.3300: Framework of software-defined networking</p> <p>Y.3320: Requirements for applying formal methods to software-defined networking</p> <p>Y.3321: Requirements and capability framework for NICE implementation making use of software-defined networking technologies</p>
Data	<p>Y.3031: Identification framework for future networks</p> <p>Y.3032: Configuration of node IDs and their mapping with locators in future networks</p> <p>Y.3033: Framework of data aware networking</p> <p>Y.3034: Architecture for interworking of heterogeneous component networks in FNs</p>
Environment	<p>Y.3021: Framework of energy saving for future networks</p> <p>Y.3022: Measuring energy in networks</p>
Socio-Economic	<p>Y.3013: Socio-economic assessment of future networks by tussle analysis</p> <p>Y.3035: Service universalization in future networks</p>
Smart Ubiquitous Net.	Y.3041, Y.3042, Y.3043, Y.3044, Y.3045

... and IMT2020/ 5G relations

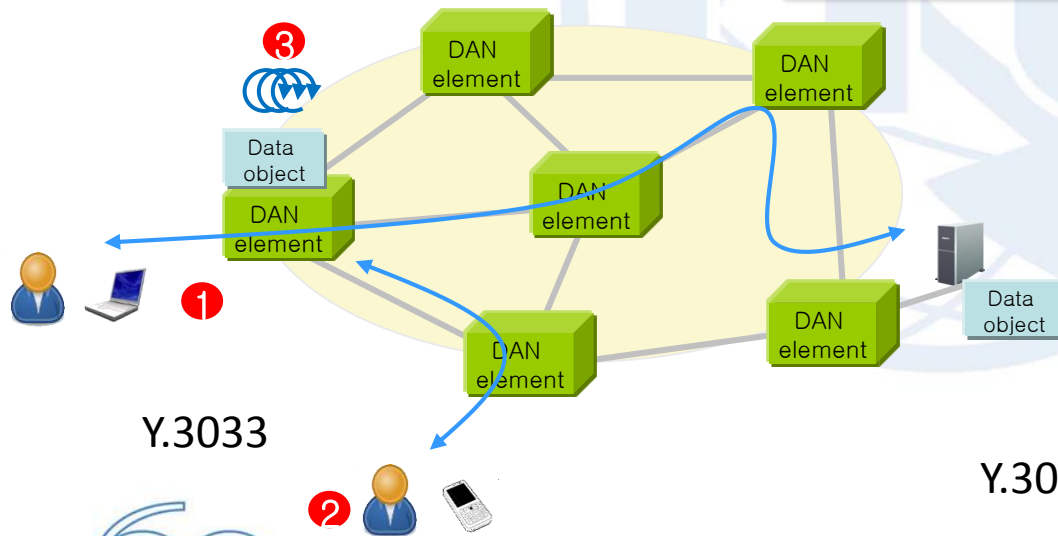
5G

Location-based Communication in the Internet

ID-based Communication in Future Networks

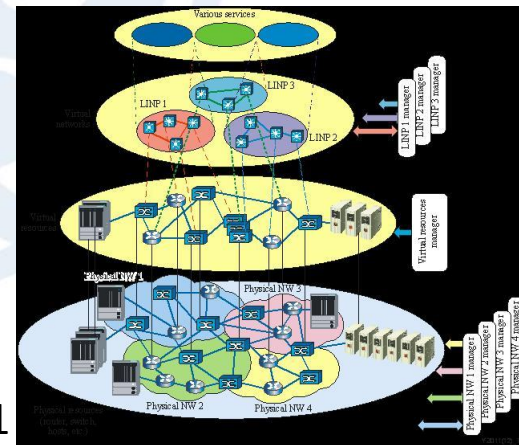


Y.3032



Y.3033

Y.3011



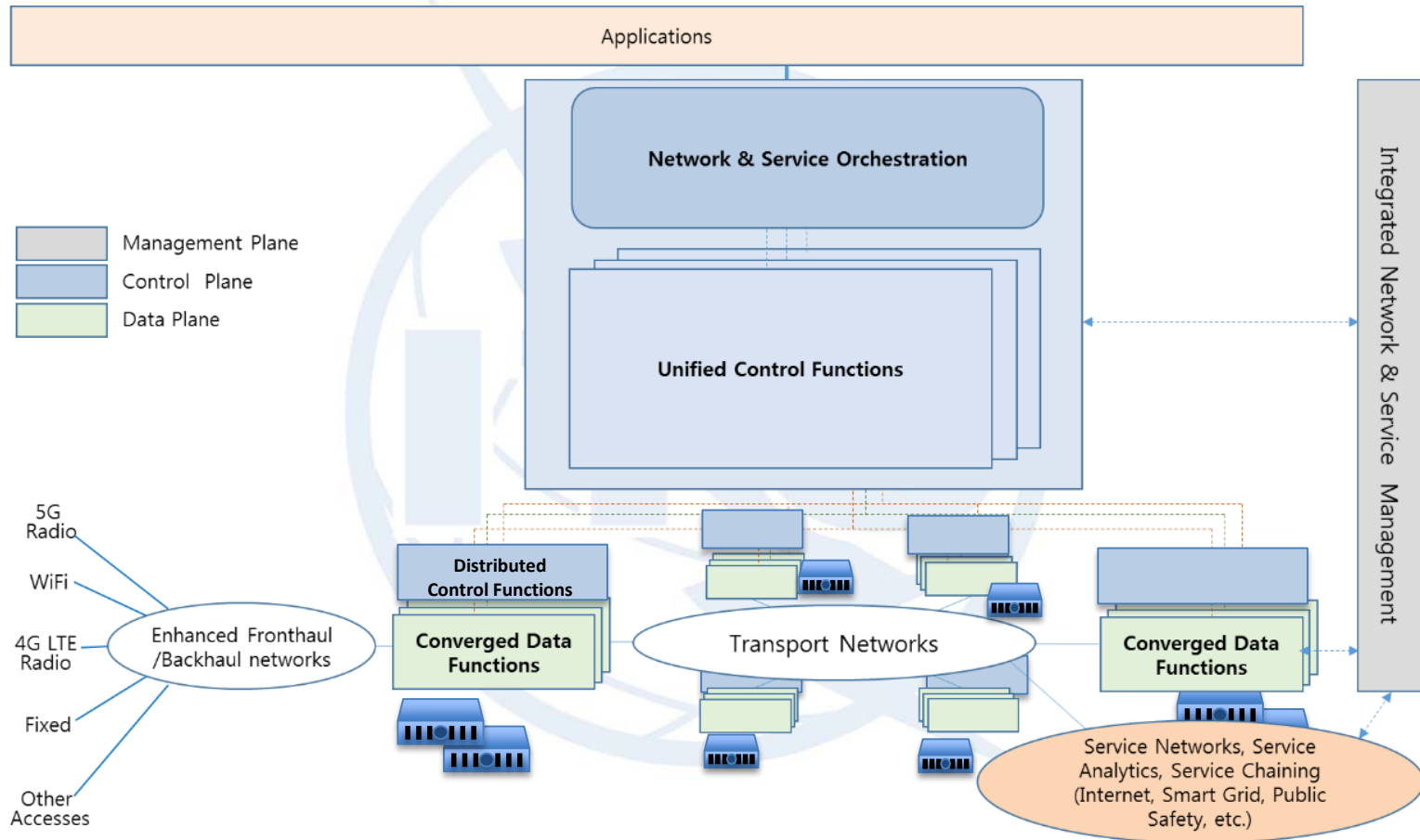
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Identified topics (gaps) by FG- IMT2020

- **IMT2020 network architecture (high level)**
- **Softwarization**
- **Front Haul/ Back Haul**
- **E-2-E Connectivity**
- **Emerging Network Technologies**

<http://www.itu.int/en/ITU-T/focusgroups/imt-2020/Pages/default.aspx>

High Level IMT2020 network architecture



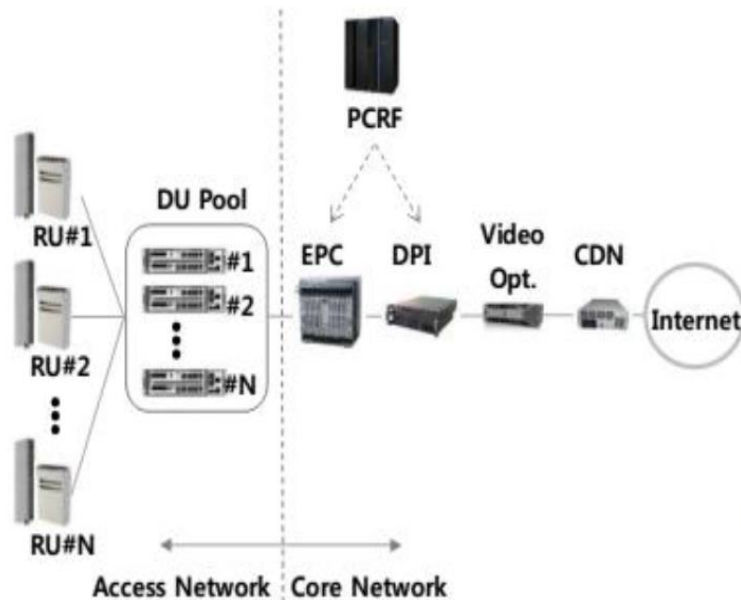
High Level IMT2020 network architecture

- Multiple access technologies (IMT2020, IMT, WiFi, fix networks)
- Distributed flat network by converged data plane functions (IP flow management, Multi-RAT coordination, computing & storage) and control functions (access control) at the edge of access agnostic common core with unified control functions (e.g. session, mobility management, QoS)
- Edge Cloud support (MEC), distributed content and services
- Inclusion of «TRUST» as design principle
- Flexibility by «software-based network»

Transition towards SW based

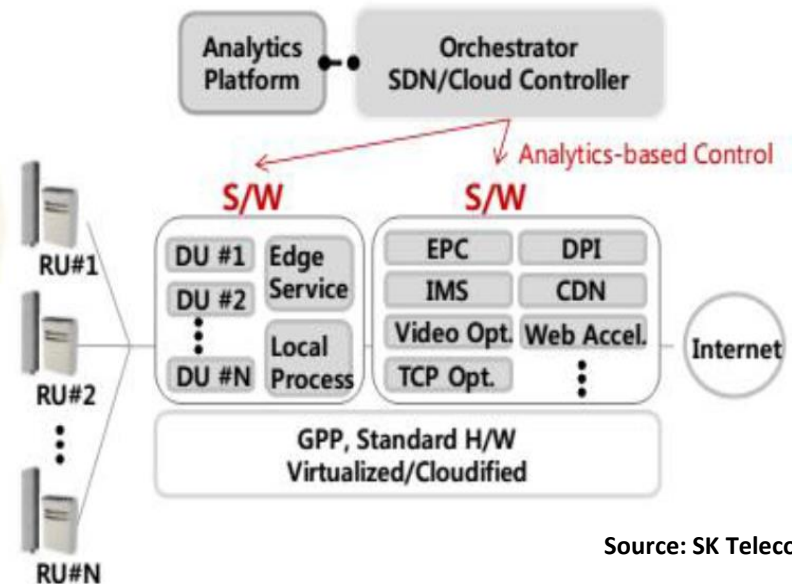
Legacy Network

“Vendor-specific Hardware,
Low Scalability, Simple Policy-based Operation”



Software-based Network

“Virtualized,
Service-Oriented and Flexible Network”



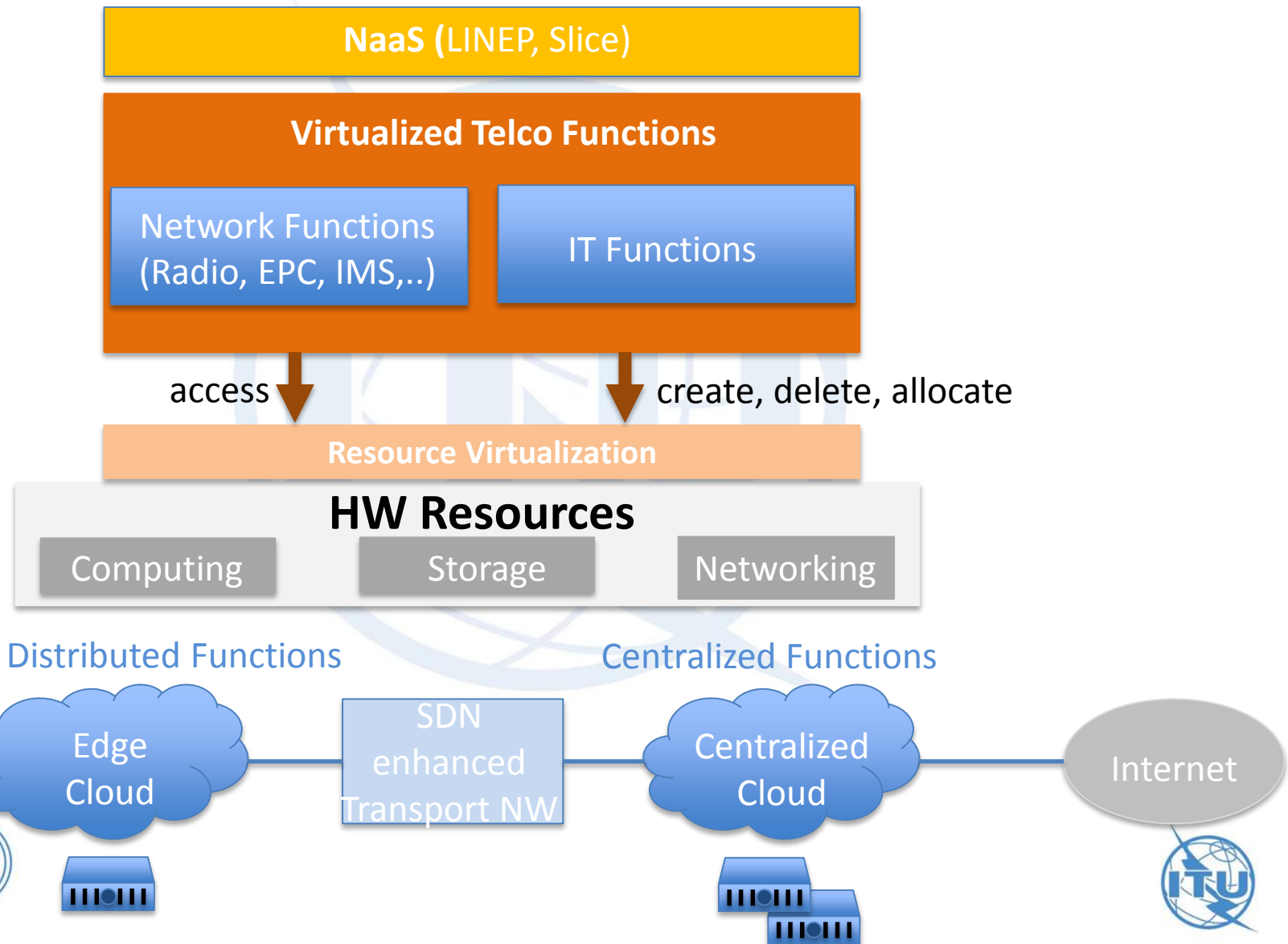
Source: SK Telecom

From dedicated NW components towards
deployment of «white-box»-HW by NFV/SDN

Network Softwarization

- **Automation mechanism for the configuration and maintaining of network equipment and network components.**
- **Rationale: optimization of costs and processes; enabling of self-management.**
- **Related Terms: NFV, NaaS, LINEP, Slice**

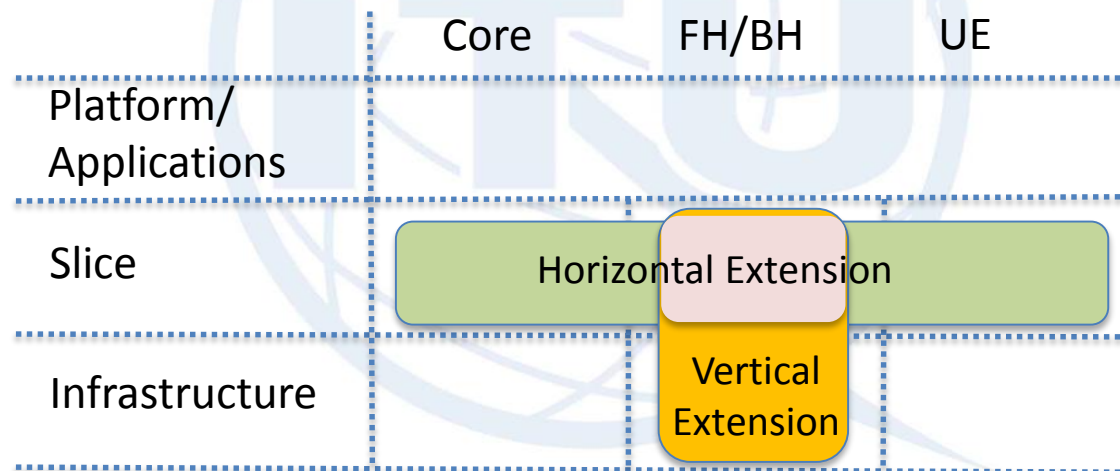
Virtualization of Functions & Resources



Slice

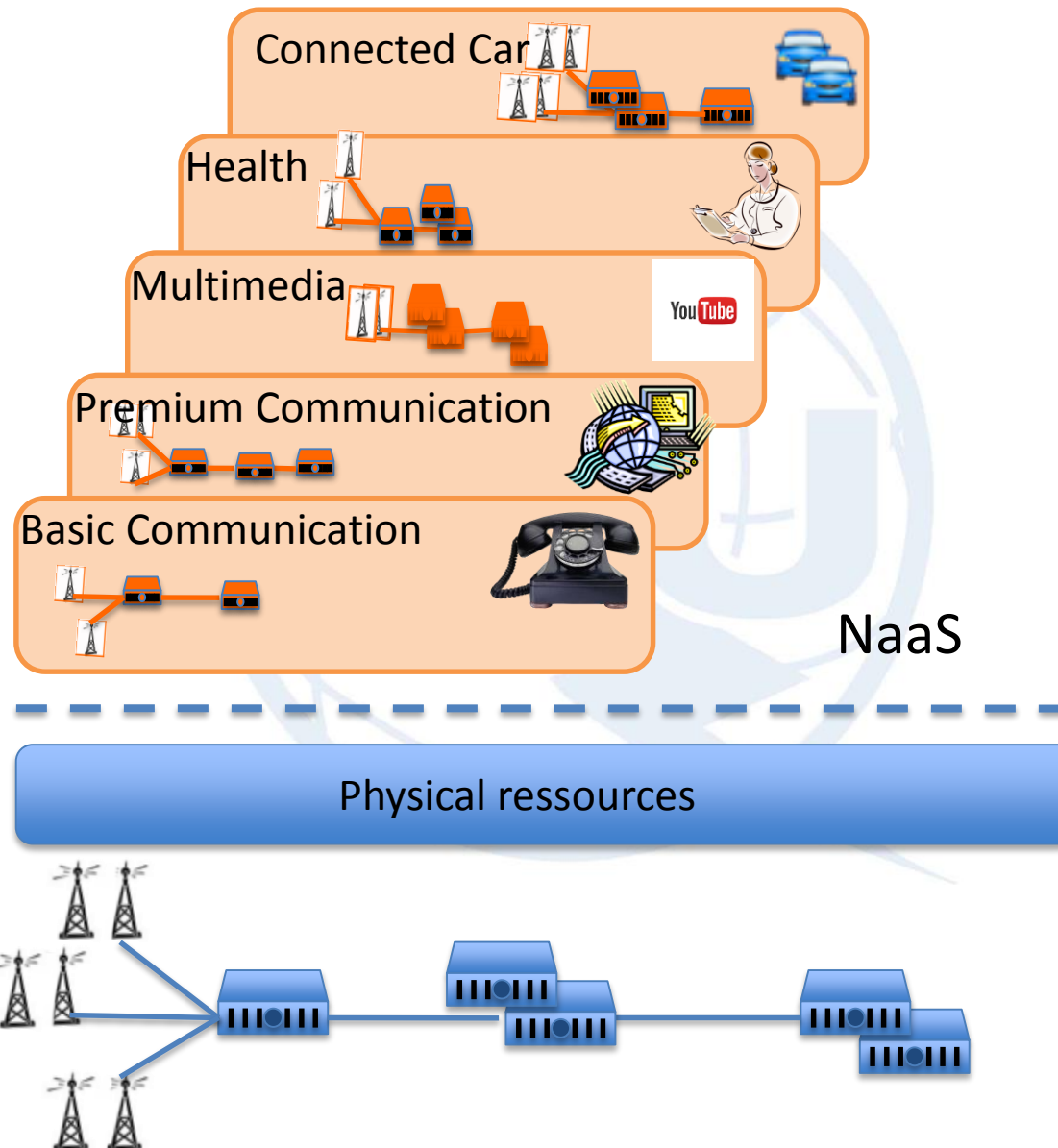
A **slice** is the collection of virtual or physical network functions connected by links to create an end-to-end networked system. A slice provides an isolated environment to efficiently accommodate individual applications meeting specific requirements

Logically Isolated Network Partition (LINP): A network that is composed of multiple virtual resources which is isolated from other LINPs (ITU-T Y.3011)

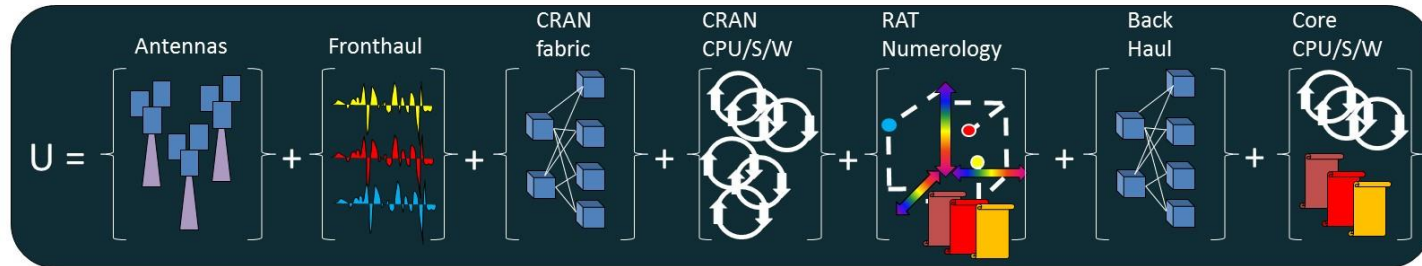


FG IMT2020

Network Slices Example

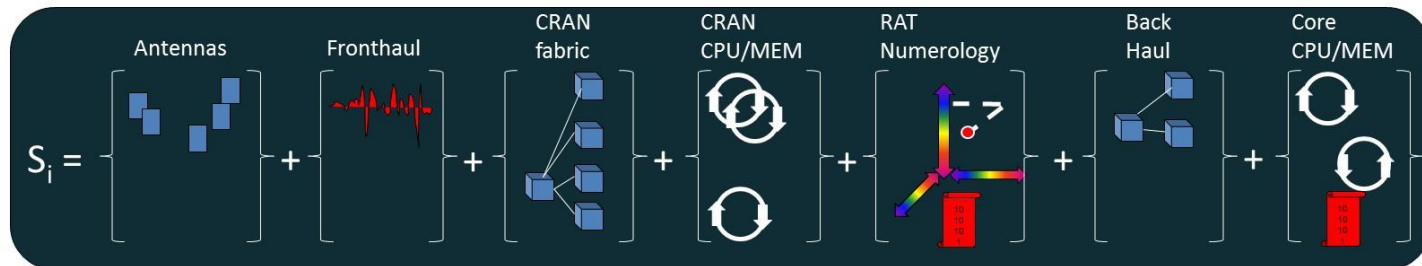


FH/BH Slice Example



If U is the set of all resource sets { Antennas, Fronthaul, .. } then

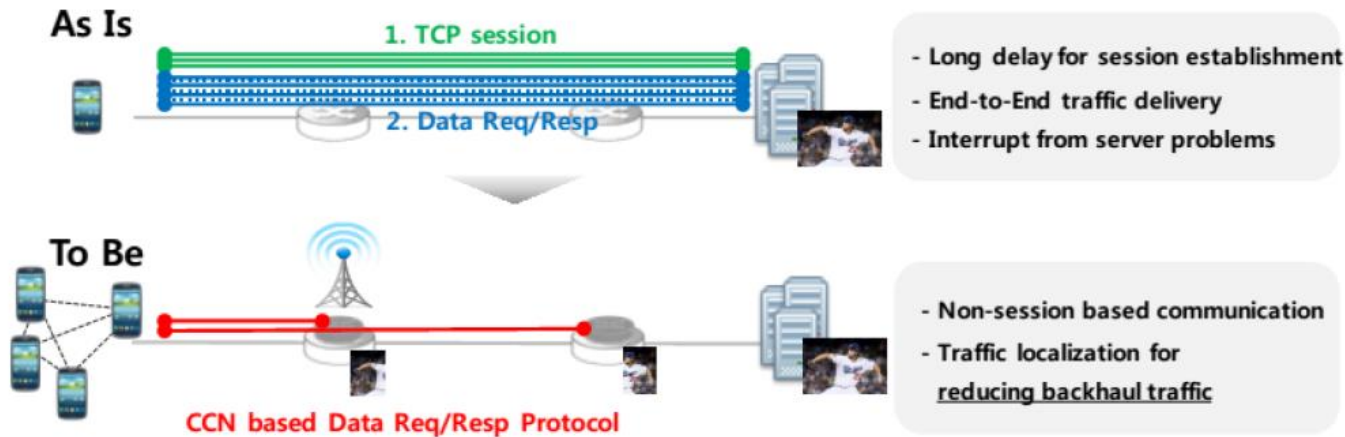
Slice S_i is a set of resource subsets taken from resource sets { Antennas, Fronthaul .. }



Source: Huawei

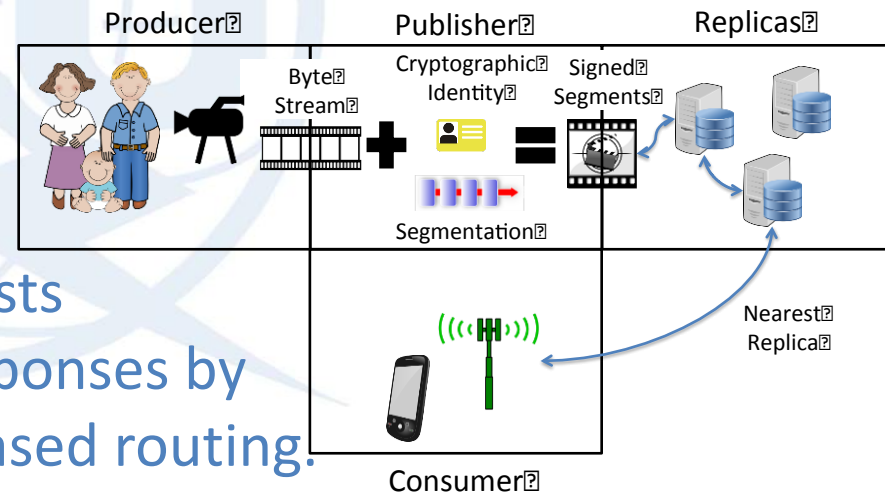
Logically Isolated Network Partition (LINP): A network that is composed of multiple virtual resources which is isolated from other LINPs (ITU-T Y.3011)

Emerging Technologies

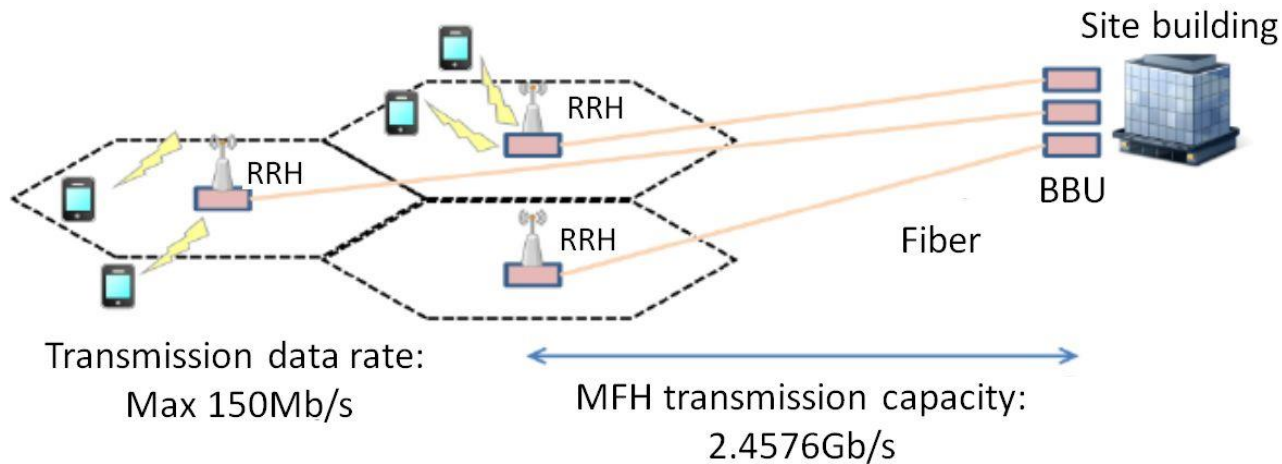


Information/-Content- Centric Networking (ICN, CCN)

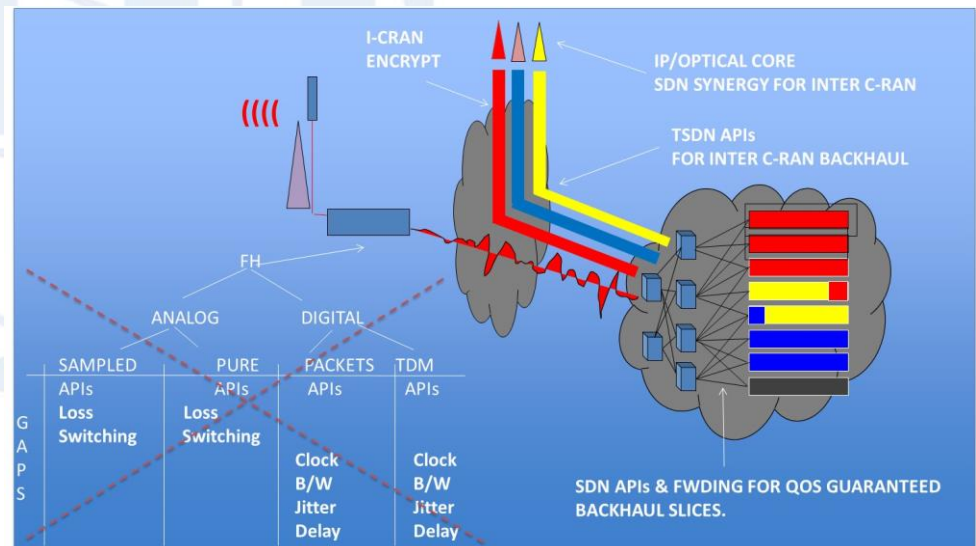
- Recognition of user requests and their corresponding responses by networks due to its name based routing.
 - Overlay/ native transport
- See also DAN (Y.3032)



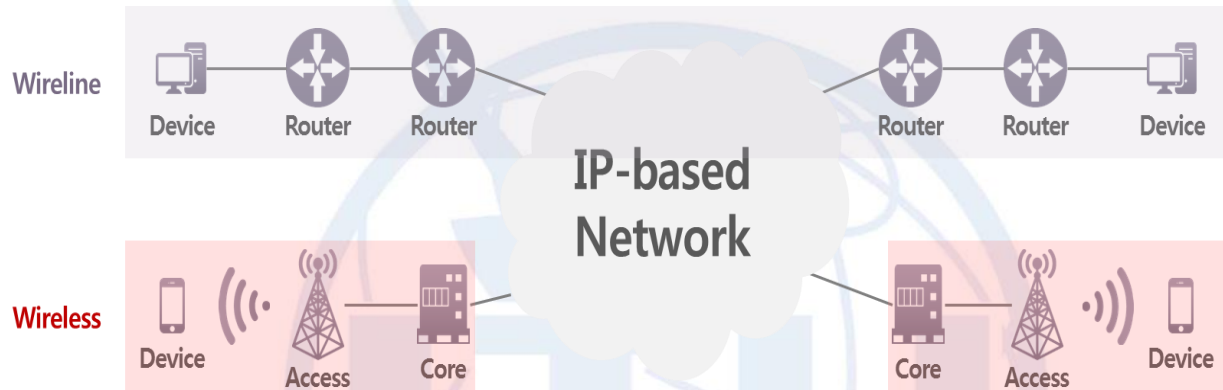
Front Haul/ Back Haul



- Low latency
- Reliability and resiliency
- Diversified types of terminals
- Diversified types of traffic
- Power saving by resource optimization



E-2-E Connectivity



- E-2-E Definition
- E-2-E VoLTE
- Different QoS classification among mobile and fixed networks
- Overall QoS study applicable to IMT-2020

IMT2020 Goals of SG13

- Definition of IMT2020 Roadmap based on FG results begin 2017
- First IMT2020 related recommendations in spring 2017 as
 - Softwarization Framework
 - Softwarization General Requirements
 - Framework on emerging network technologies

Contacts

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Media:

<https://www.youtube.com/watch?v=PlLdNxgBfpY#t=20>

<https://www.youtube.com/watch?v=j4OtGJvNTzg>

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