

Towards Network Softwarization For Service Centric 5G

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Context

I. Communication & Internet Lab.

II. 5G Services & Features

III. Current R&D Activities on Softwarization

IV. Network Softwarization for 5G

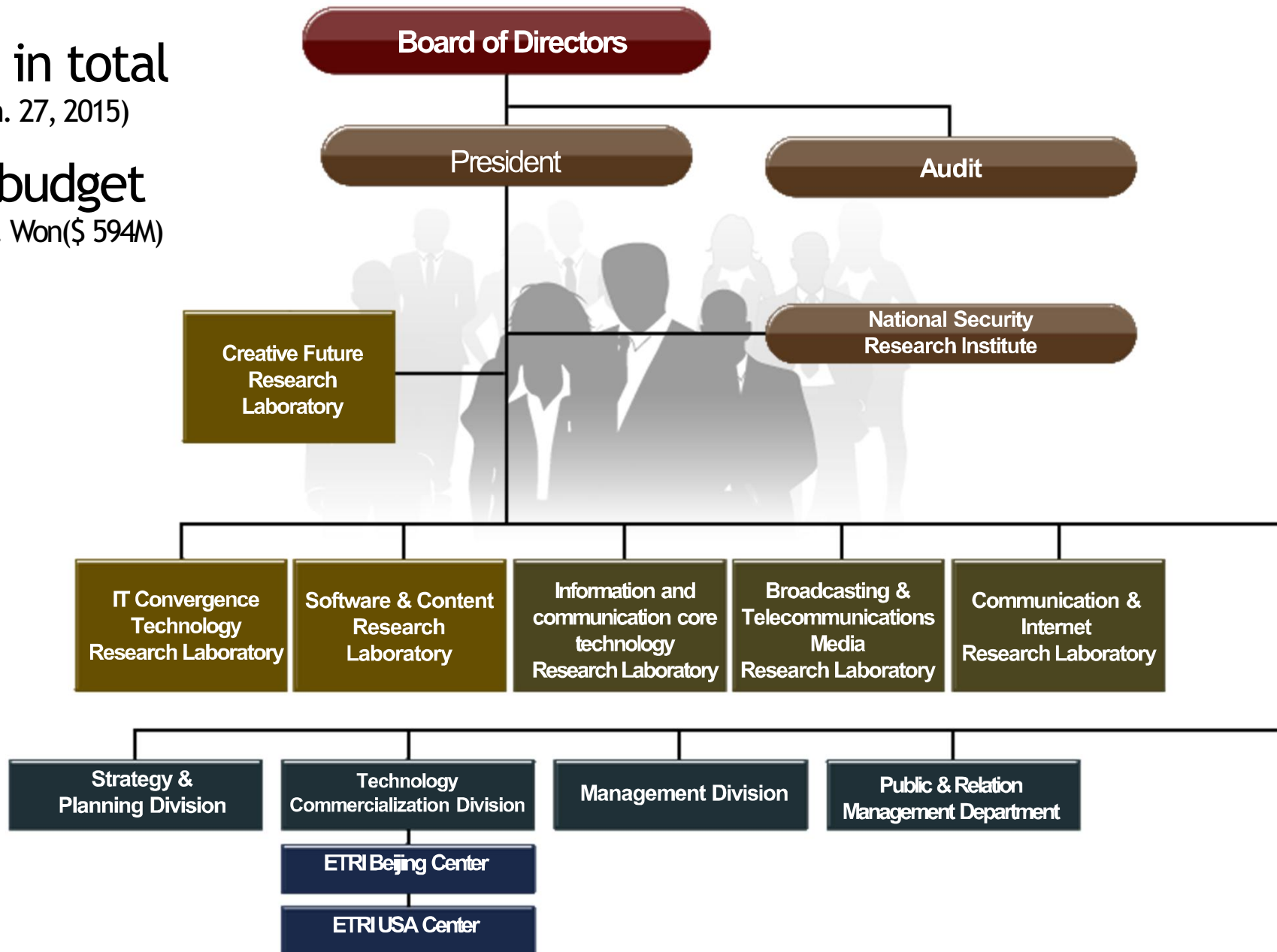
ETRI - Organization

2,004 in total

(As of Jan. 27, 2015)

2015 budget

641.1 bil. Won(\$ 594M)



ETRI – Major Achievements

Economic Effect

104.6 billion USD
(accumulative)



TDX



DRAM



CDMA

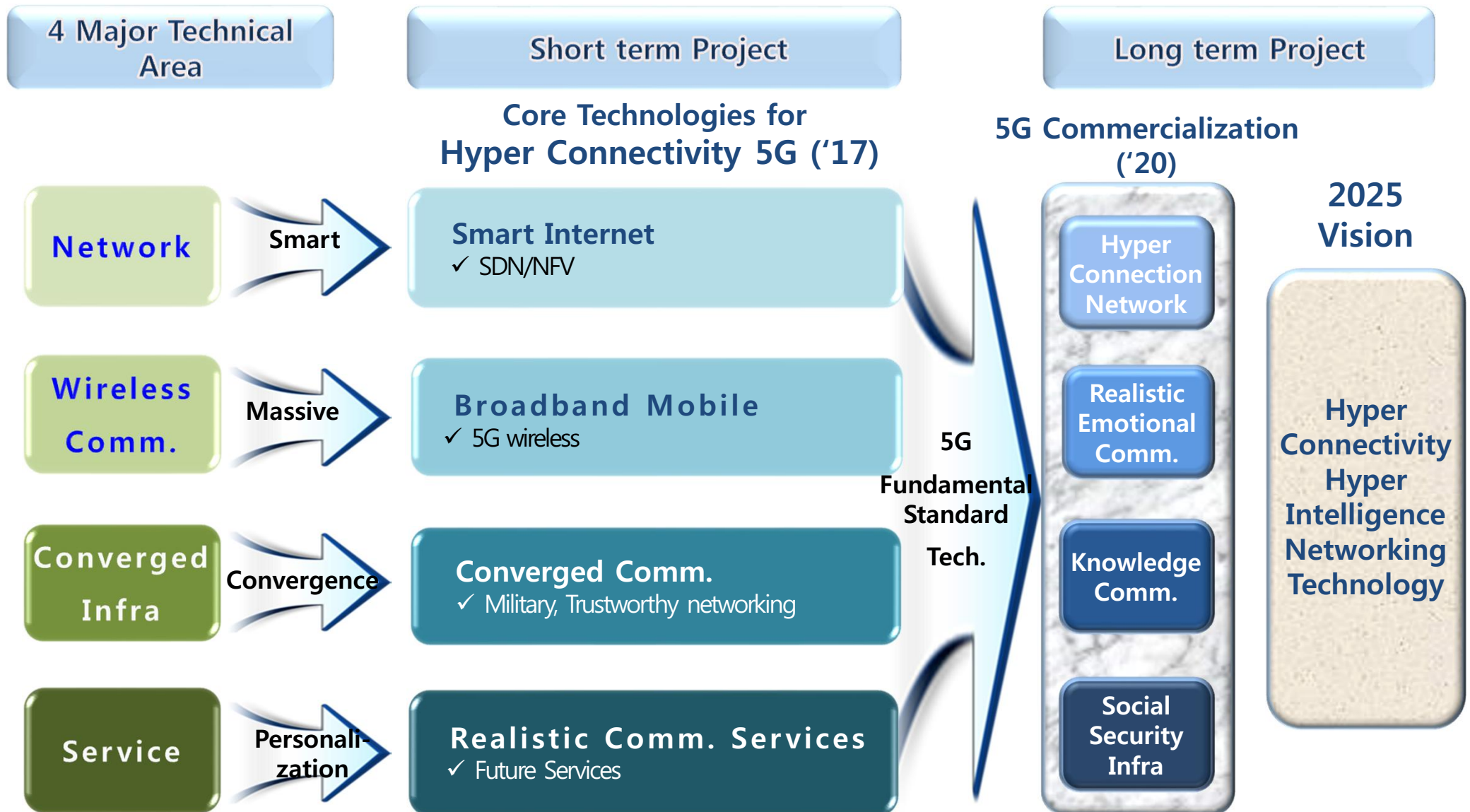


WiBro
Terrestrial DMB



4G LTE
4G
(LTE, WiBro ADV)

Strategy of Communication and Internet Research Lab..



NFV: Network Function Virtualization, SDN: Software Defined Networking

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5G Key Services

Enhanced Mobile Broadband

High data rate

 4K/8K UHD  Hologram



 VR/AR(Virtual/Augmented Reality)



Demanding conditions

Broadband Access
in Dense Areas



High-speed Mobility



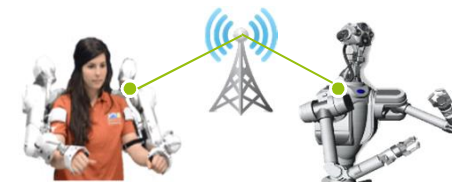
Low Latency Services

Ultra-high reliability/low latency

 Tactile Internet



 Remote-control robot/machines



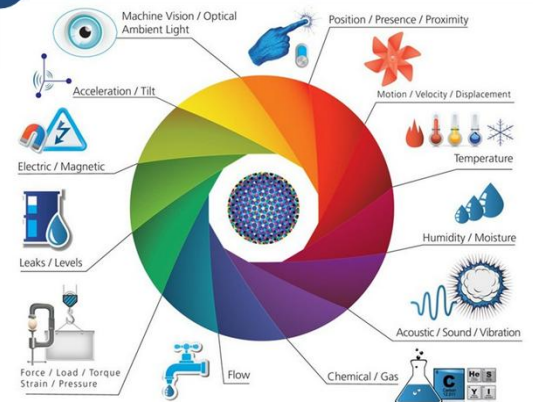
 Connected cars (V2X)



Massive Internet of Things

Massive connectivity

 Remote sensors/actuators



 Smart city-home

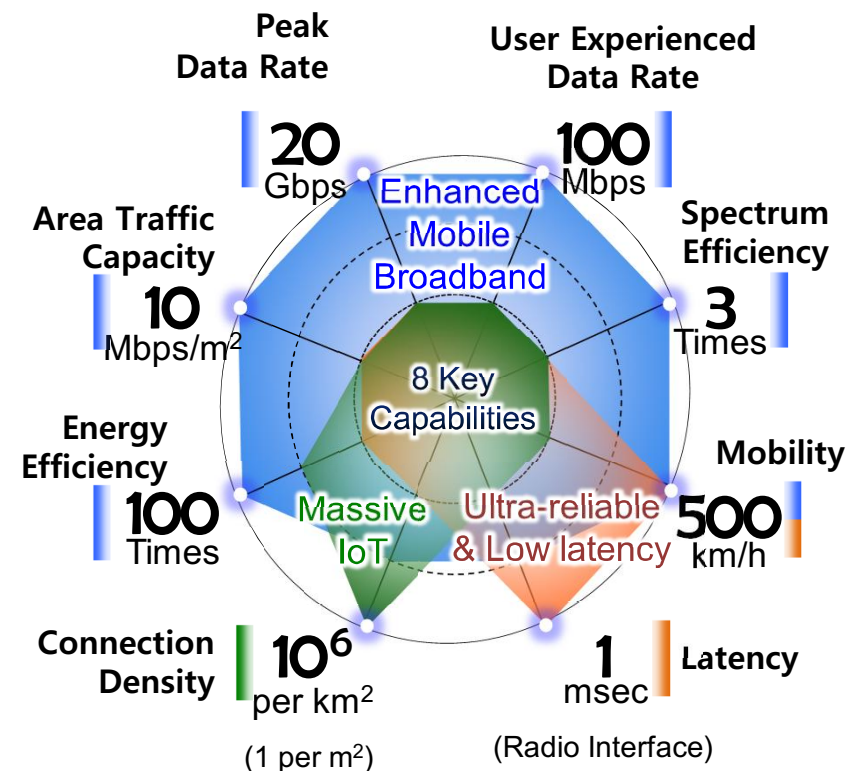
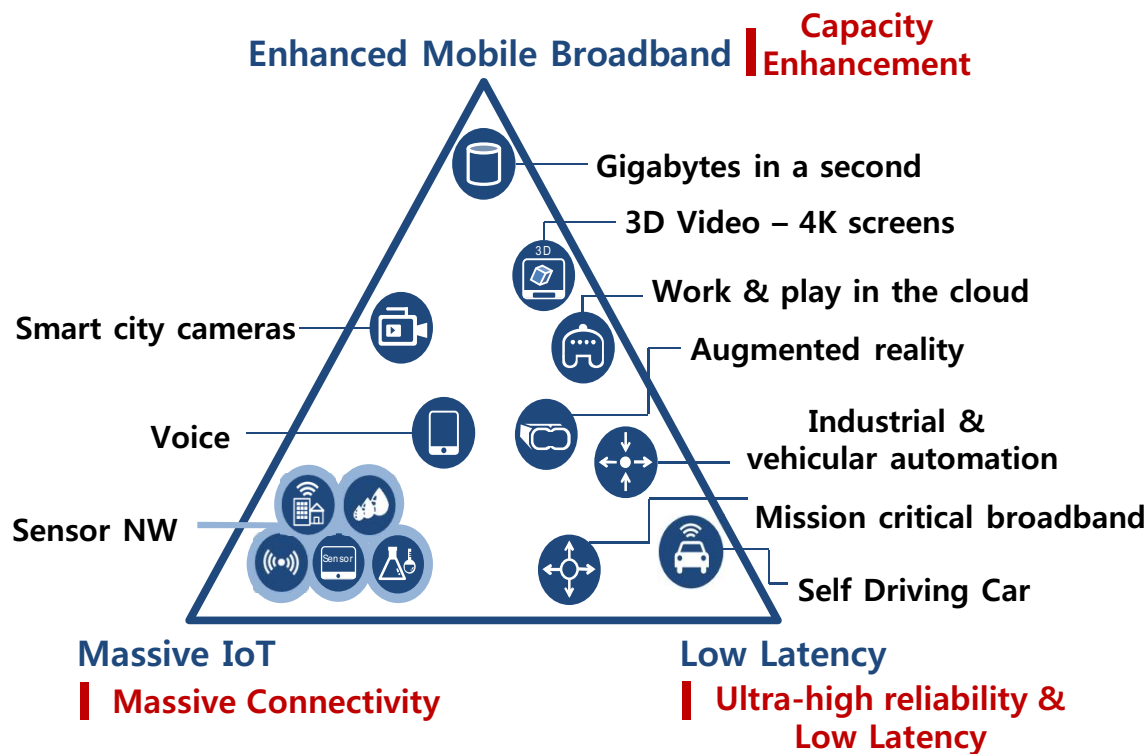


 IoT 5G IoT



Usage Scenarios & Key Capabilities for IMT-2020(5G)

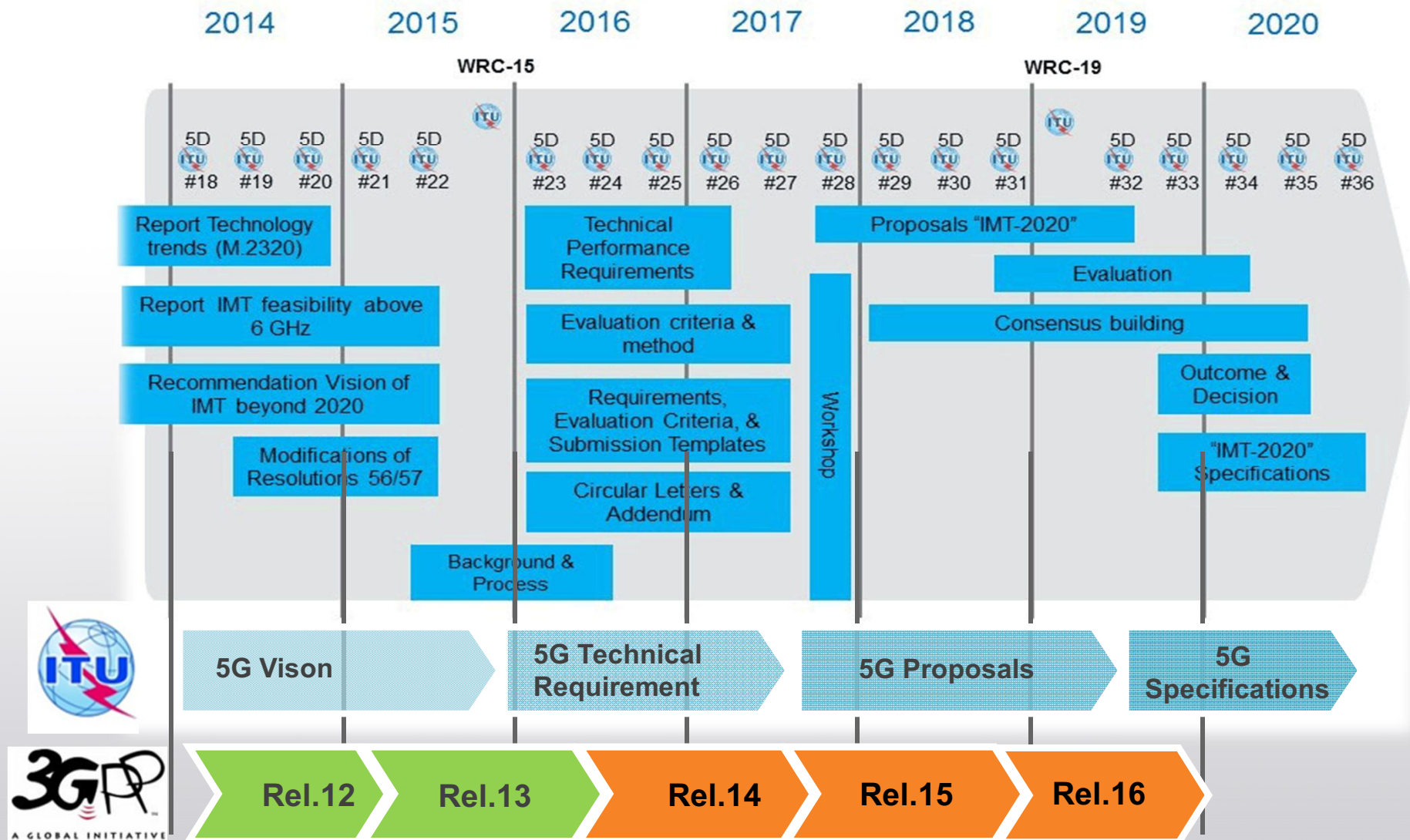
- Improve of 4G : Enhanced MBB (eMBB)
- New use cases : MTC (machine type communications)
 - Massive MTC (mMTC): Massive connectivity, Low energy
 - Ultra-reliable & low latency MTC (uMTC): Low latency, Ultra reliability



Timeline for IMT development and deployment

IMT Vision – “Framework and overall objectives of the future development of IMT for 2020 and beyond”

Detailed Timeline & Process for IMT-2020 in ITU-R



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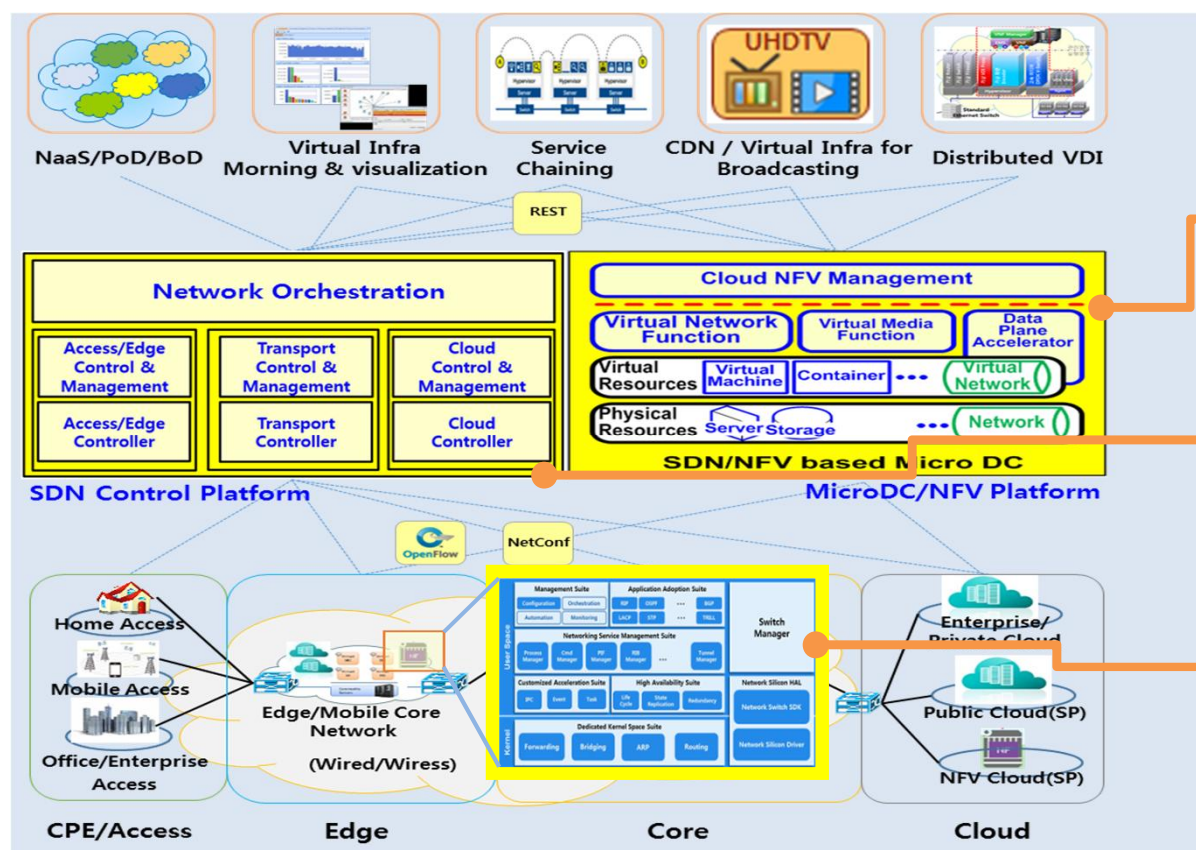
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OpenCom: Open real-time Programmable Infrastructure for various applications

※ OpenCom: Open Communication

- Agile and programmable platform supporting various ICT services
- Optimized orchestration and flexible positioning for tailored services (10 times efficiency & 1000 times faster)
- Activating open innovative eco-system (vendor & technologies Independent)



Key Enabling Tech

Network Programmability (Cloud, NFV)

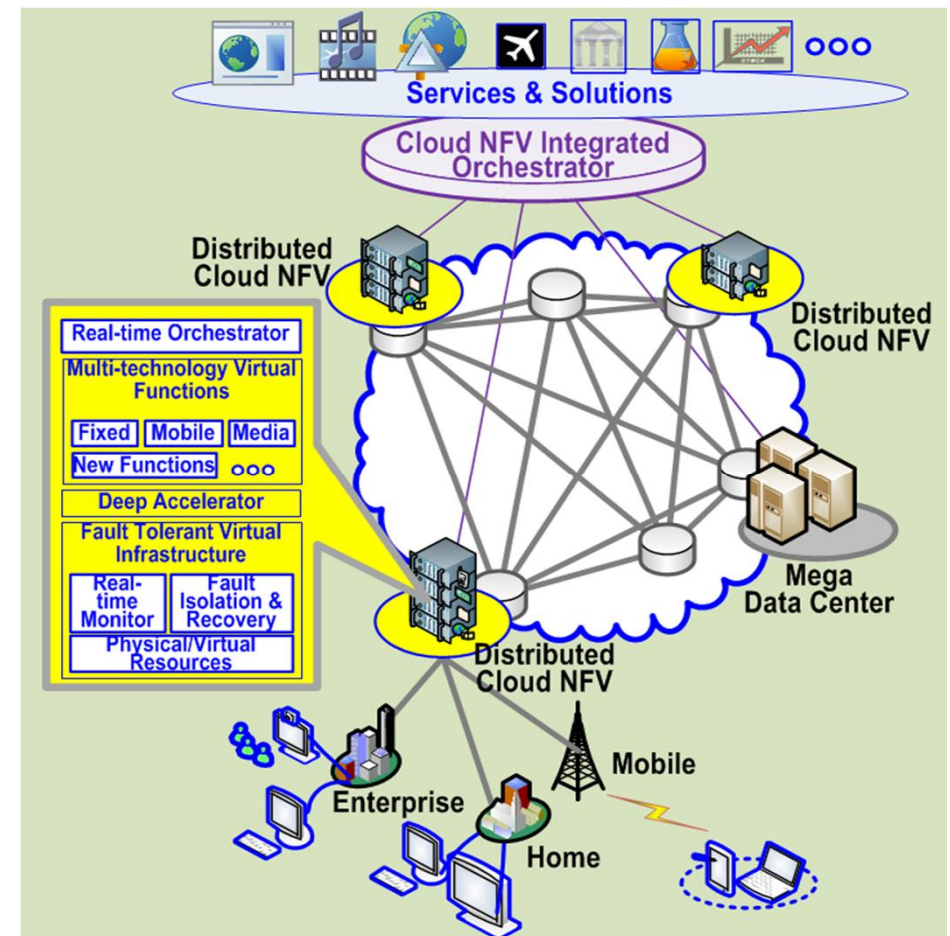
Service Oriented E2E Network Slicing (SDN)

Open Comp-Net Convergence Platform (Platform)

Challenging Tech: Network Programmability

Cloud-NFV Integrated Highly Available Infrastructure

- Cloud-NFV Integrated Real-time Orchestration
 - Selective objectives - Efficiency vs. Availability/Performance
-
- Real-time cloud-NFV Orchestration
 - Distributed Cloud NFV
 - Enhanced Service Agility
 - Virtual Functions for Multi-technologies
 - Multi-technologies: Multi-layer(L2-L7) & Multi-domain(Cloud, Fixed/Mobile, Media)
 - Fault Tolerant Virtual Infrastructure
 - Advanced Data/Control Plane Acceleration for high performance



Challenging Tech: Network Slicing

Service-oriented E2E Network Slicing

- Real-time on-demand configuration of network slices
- E2E network virtualization for multi-domain and multi-layer

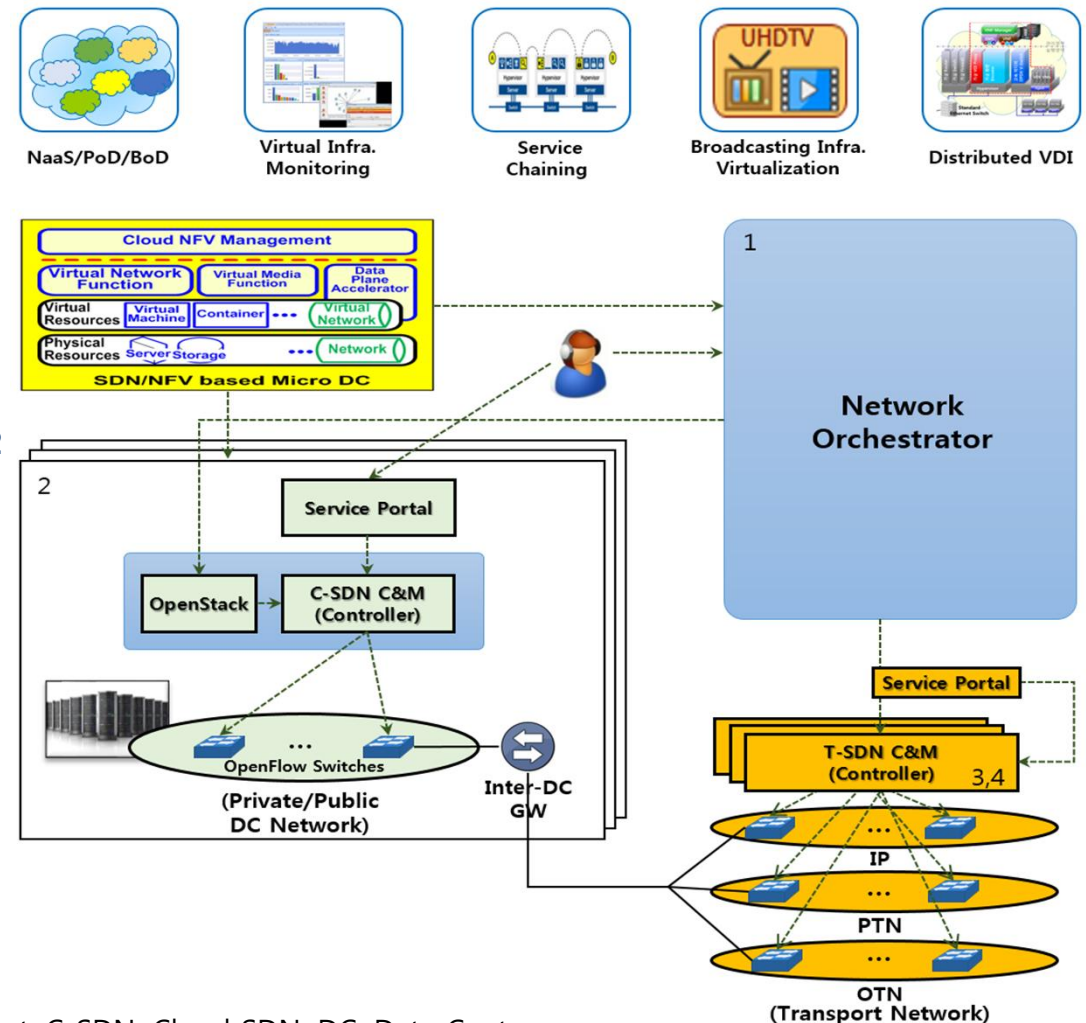
- multi-domain/multi-layer Network Orchestration¹

- Multi-domain: Cloud, Transport
- Multi-layer: IP, PTN, OTN

- Policy-based cloud networking control²

- Flexible X-SDN architecture based Transport control³

- Highly scalable & available SDN control⁴



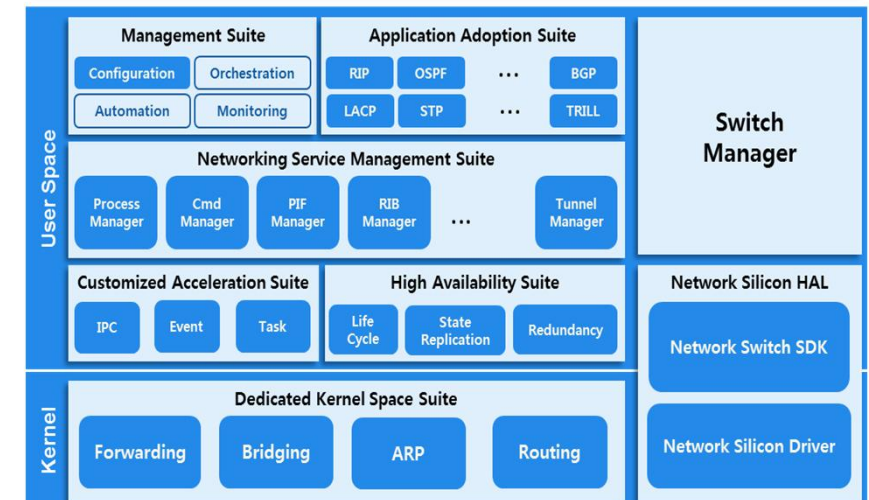
Challenging Tech: Open Comp-Net Convergence Platform

Programmable Comp-Net OS

- Maximize Hardware Abstraction for Network Softwarization
 - Automated Network Provisioning using Network Resource Management
-
- Non-Stop Networking Service Framework
 - 99.999% High Availability
 - Scalable Networking Service Framework
 - Lego type architecture for flexible addition of new networking service
 - HW agnostic networking equipment development Framework
 - One-Source-Multi-Switching development platform (BroadCom, Intel etc.)



High Performance Network Operating(N2OS) Framework Architecture



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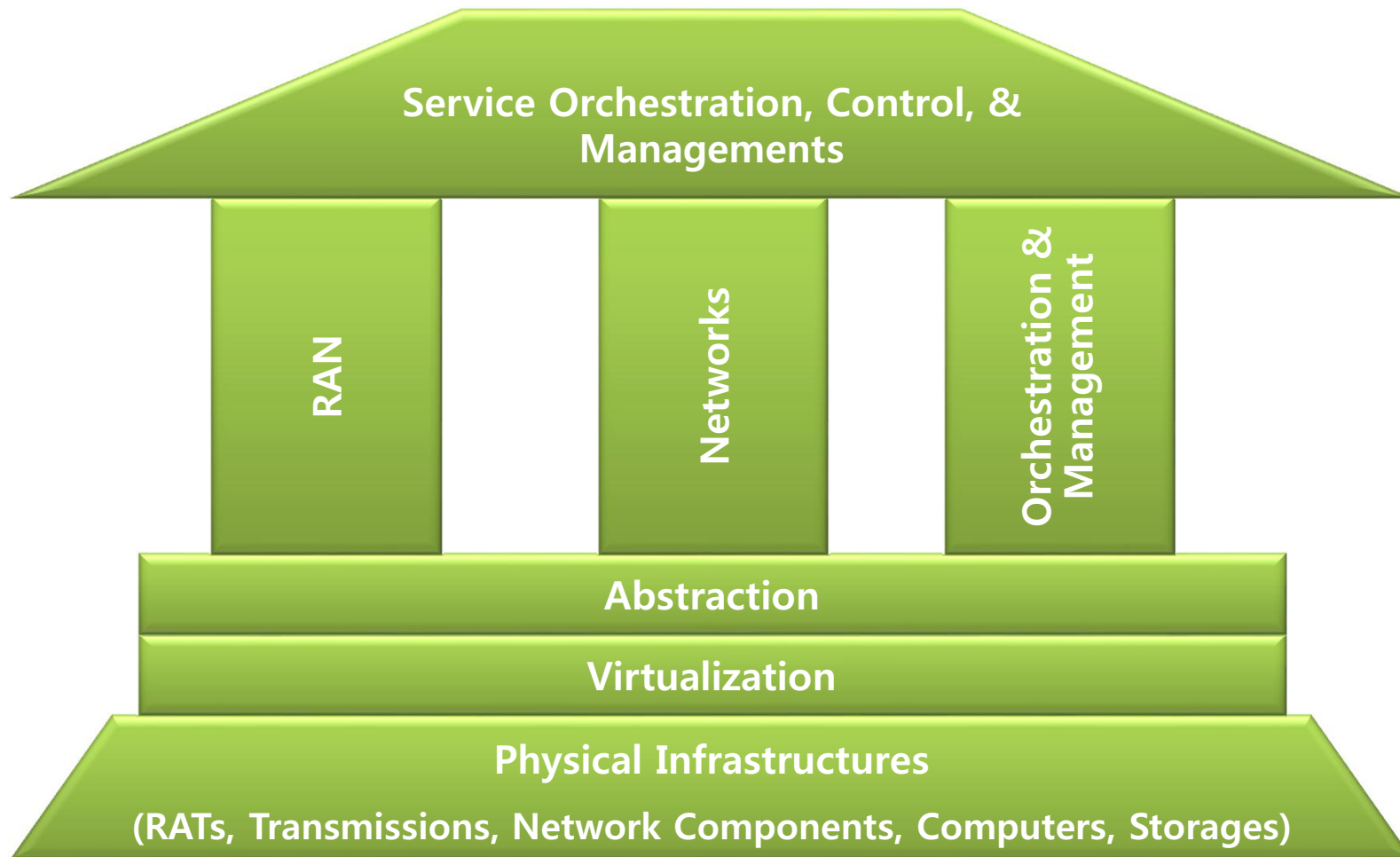
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Softwarization Strategy: Toward One Target

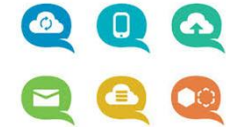
- **Scope of 5G : Wireless Comm. + Fixed Comm. + Cloud + Service**



Softwarization Scope for Service-Oriented 5G

- Composable Network for 5G Services
- Cognitive Network Services
- 3rd Party Interworking Services

Service



- Fixed & Mobile Convergence
- User Centric Network
- Autonomous Network Management

Control & Management



RAN



- New RAT (Low latency, Broadband, MTC)
- Multiple RAT
- Multi Layer Connectivity
- Ultra Dense Network (SON, xHaul)
- Cloud RAN
- Dynamic RAN
- D2D

Network



- Mobility on Demand
- Flat Networking
- Edge Computing
- Access Agnostic
- Network Flexibility

Cloud & Virtualization



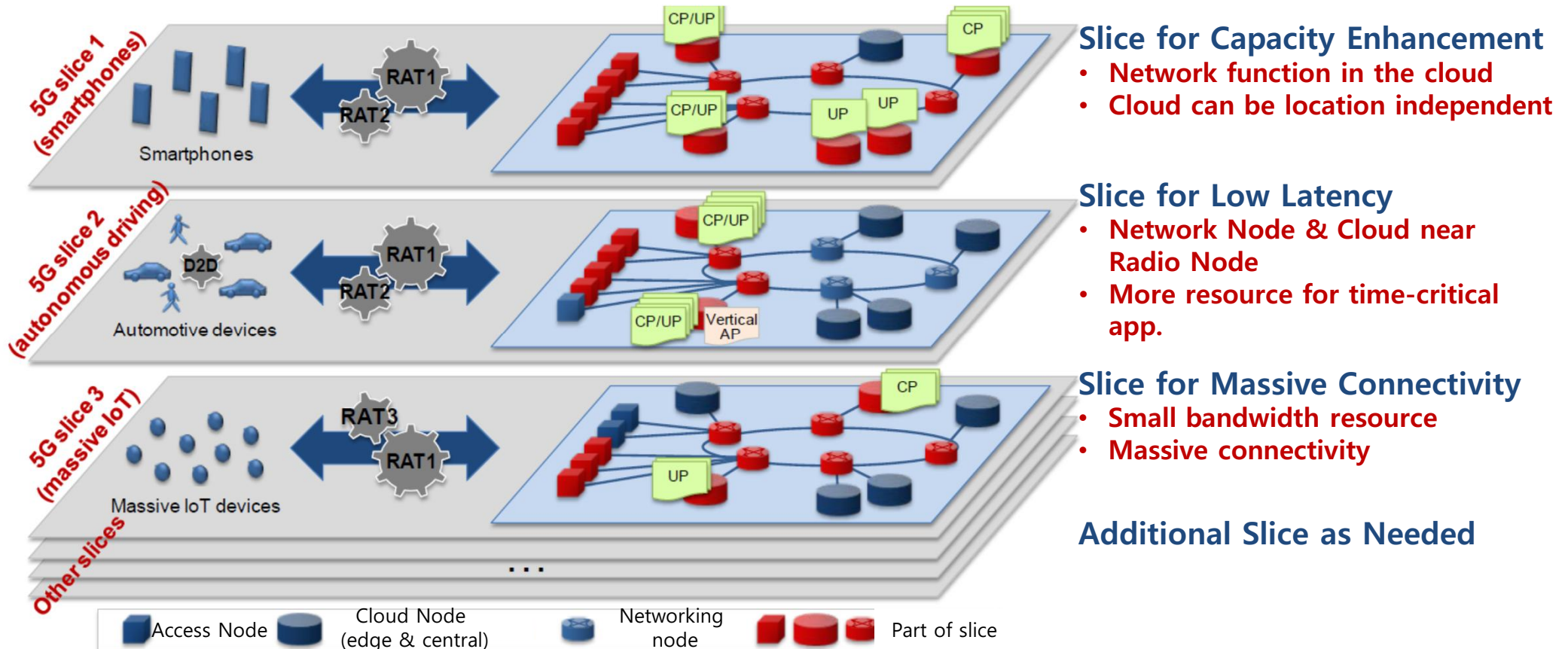
- SDN/NFV Virtualization
- Programmability
- Scalability
- Performance

RAN: Radio Access Network, RAT:Radio Access Technology, MTC: Machine Type Communication,

D2D: Device to Device, SDN: Software Defined Networking, NFV: Network Function Virtualization

Network Slicing for Softwarization

End-to-End Slicing : Device + RAN + Network + Service



Ref) NGMN 5G White paper

Slice for Capacity Enhancement

- Network function in the cloud
- Cloud can be location independent

Slice for Low Latency

- Network Node & Cloud near Radio Node
- More resource for time-critical app.

Slice for Massive Connectivity

- Small bandwidth resource
- Massive connectivity

Additional Slice as Needed

Objectives : Modular, Programmable, Scalable Design



Thank you

ETRI will contribute to the creation of a rich,
convenient world for people beyond technology



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Communications & Internet Research Lab.

Electronics and Telecommunications Research Institute