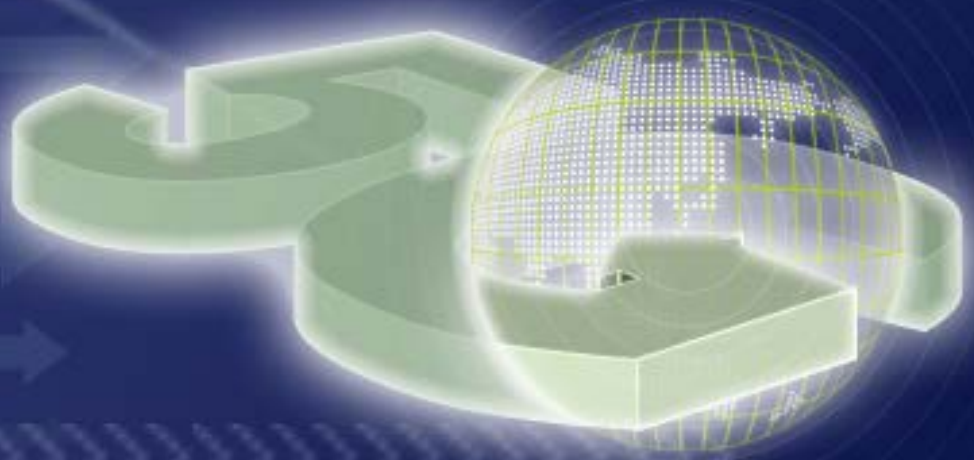
5GMF
The Fifth Generation Mobile Communications Promotion Forum

Outline of 5GMF White Paper



June 2016

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Structure of White Paper

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*)SP : Strategy & Planning Committee, TEC : Technical Committee,
APP : Service and Application Committee, NW : Network Architecture Committee

† : Main Committee

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Market and User Trends of ICT

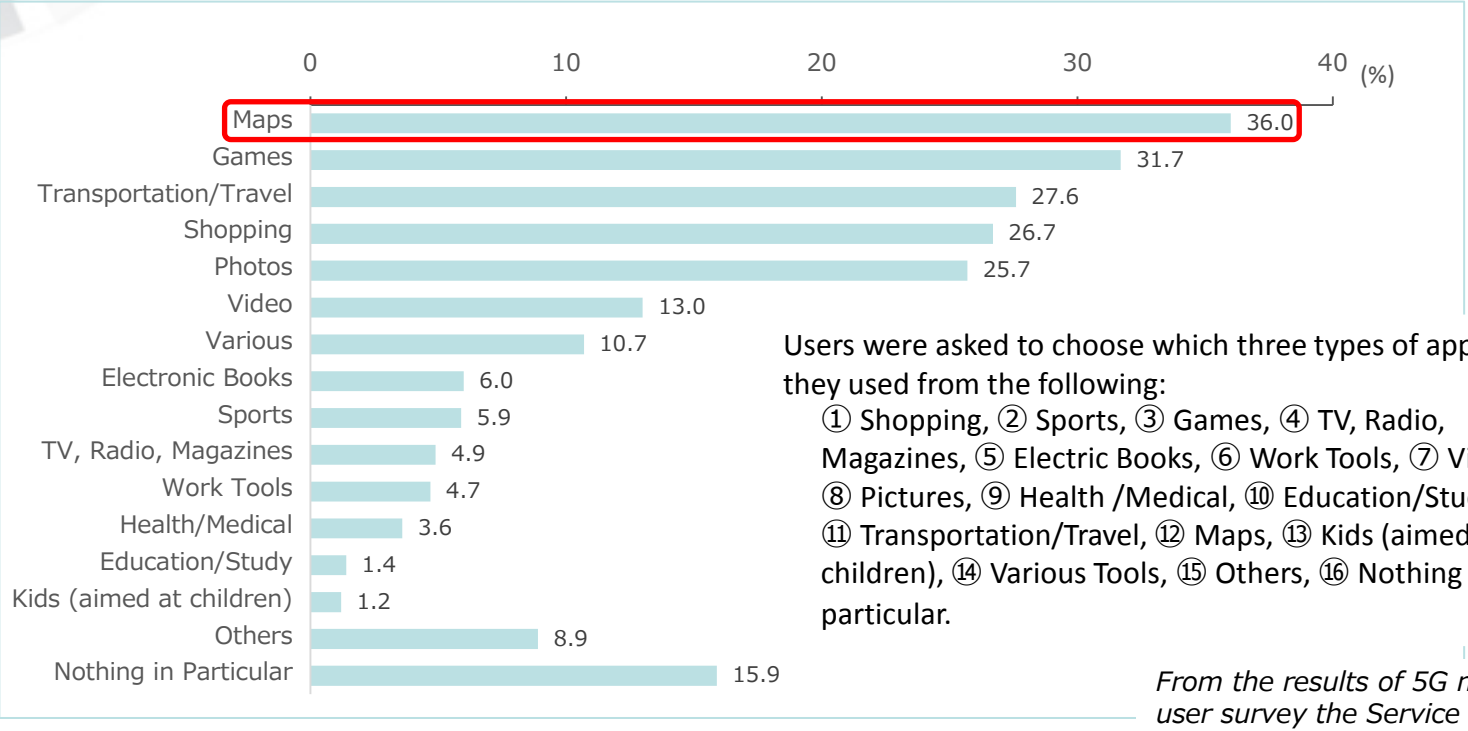
Overview of market and User Trends of ICT

Ten predictions on 5G usages by industries and consumers, derived from the current trends and the results of online surveys and group interviews

1. Shift of the devices people use from PCs to smartphones and tablets
2. An advanced use of maps and location information: services that utilize dynamic maps.
3. Increase in the use of smartphones by women
4. Introduction of the sharing model for objects: using 5G edge cloud
5. Introduction of AI and Robots, both connected by 5G
6. Self driving vehicles: implemented using 5G and connected to entertainment services by 5G
7. IoT～Factories, logistics, agriculture, health and welfare, wearables
8. Changes in the work style (society with no commuting)～An increase in mobile workspaces
9. Fintech penetration
10. Penetration of distributed processing～autonomous systems consisting of large amounts of IoT sensors

Increase in GPS/Digital Map use

In the future, dynamic maps that change in real time will be developed



Users were asked to choose which three types of apps they used from the following:

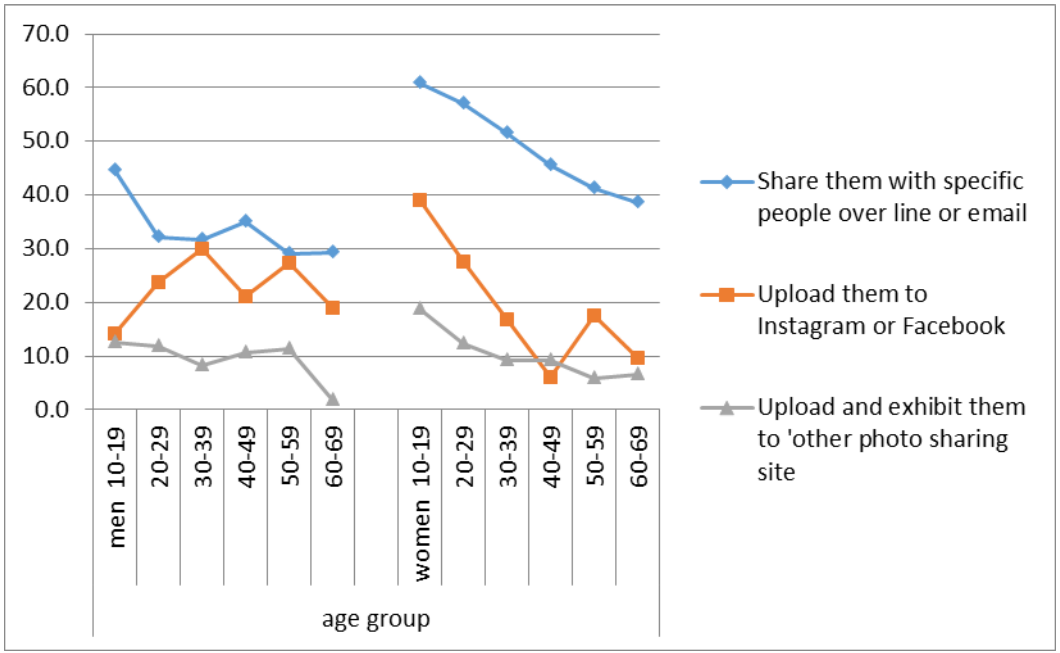
① Shopping, ② Sports, ③ Games, ④ TV, Radio, Magazines, ⑤ Electric Books, ⑥ Work Tools, ⑦ Video, ⑧ Pictures, ⑨ Health /Medical, ⑩ Education/Study, ⑪ Transportation/Travel, ⑫ Maps, ⑬ Kids (aimed at children), ⑭ Various Tools, ⑮ Others, ⑯ Nothing in particular.

From the results of 5G mobile user survey the Service & Application Committee done

Increase in the use of smartphones by women

The use of smartphones as a communication tool is driven by women: unique observation in the history

Answers to "How do you use your photos after taking them?

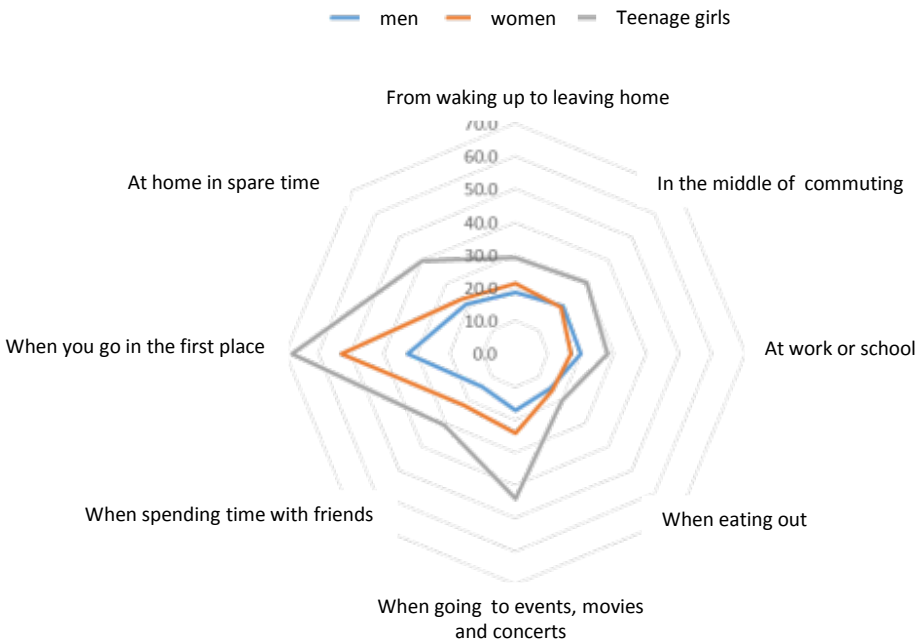


From the results of 5G mobile user survey the Service & Application Committee done

Especially High Reliance On Smartphones Among Teenage Girls

Overall, the feeling that not being able to use a smartphone is a problem is higher among women than men. The feeling that the inability to use a smartphone at any time is a problem is high among teenaged girls

Answers to "Not being able to use a smartphone is a problem"

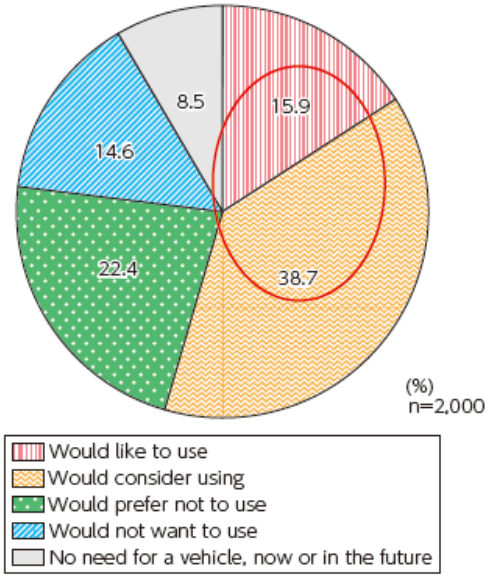


From the results of 5G mobile user survey the Service & Application Committee done

Self Driving Vehicles

In the future, all vehicles will be connected to a network

Expectations of Level 1-4 Self Driving Vehicles



Source : MIC "Research report on the consciousness of the people to ICT services and transportation"(2015)

+

New Uses of Level 4 Self Driving Vehicles

Riding in a self driving vehicle will be the same experience as flying in an airplane.

On demand services, such as 4K movies, that will be transmitted without interruption while moving.

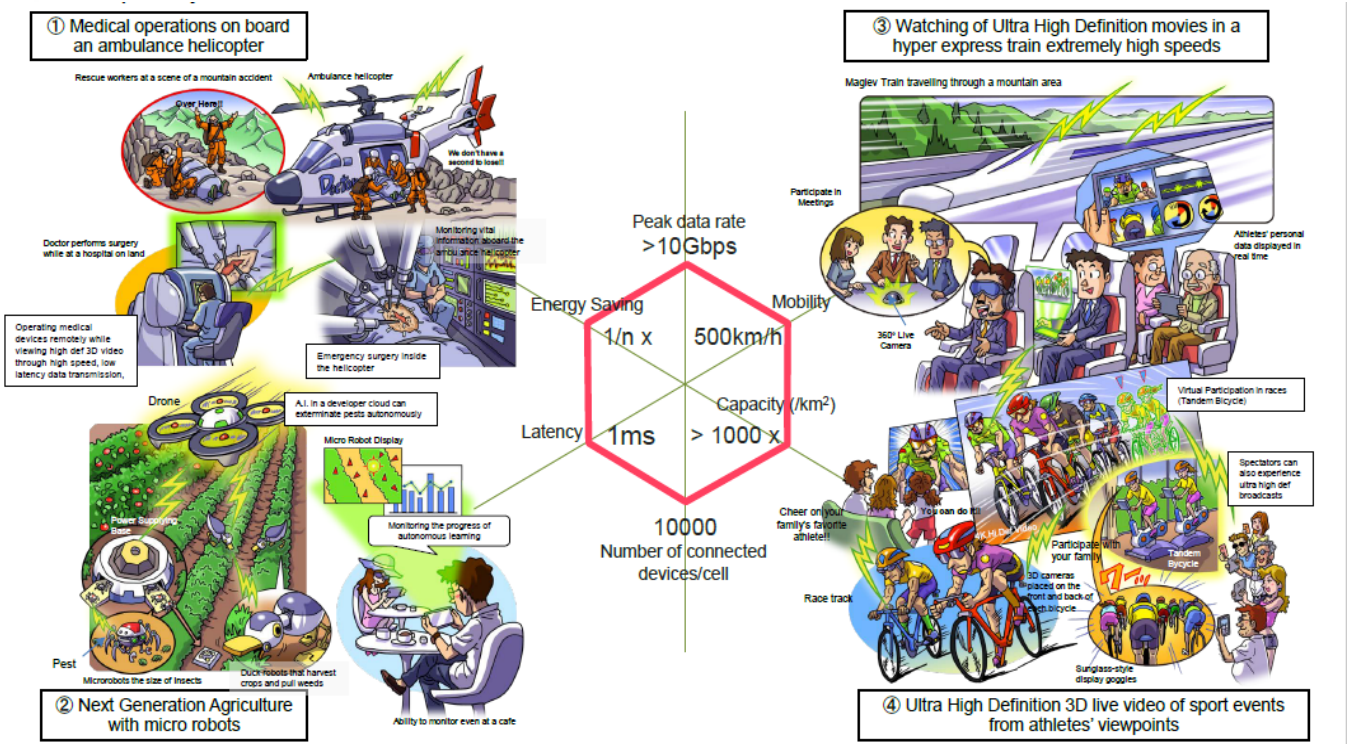
Level 1
Safety support systems such as break assistance
Level 2
Adaptable cruise control
Level 3
Normally self-driving, with human driver able to take control when needed
Level 4
Complete self-driving with no human involvement

3

Future Businesses and Services

Overview of Future Business and Services

The annex collects the results of open discussions about services and businesses that can be considered from the unique capabilities of 5G



User Perceptions of 5G

Adult Men

- Expectations are high for entertainment and telework. Although men were thought to have a strong antipathy towards self-driving vehicles, many have very positive opinions.
- While men had cautious opinions about the effects on people's lives, they had high hopes and expectations for uses in entertainment, such as being able to participate in live event broadcasts.

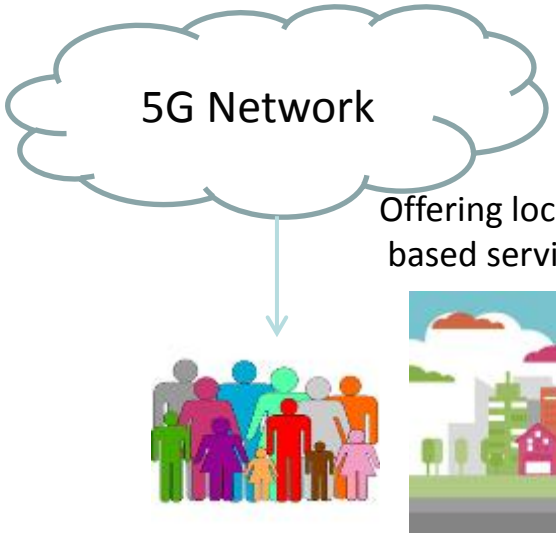
Adult Women

- Overall, there were many positive opinions about the vision of technical progress
- However, there was concern about society moving towards being endlessly online and virtual.
- Overall, many opinions about the future of mobile communication expressed the hope for greater convenience and ease of use.
- When asked about self-driving cars, there were many positive opinions based on concrete reasons with high hopes for its realization.
- There were also hopes expressed for machine translation, with a variety of uses in mind.
- Opinions were also given about SNS and 3D video.

Service Example:

Location Based-Services using Small Cell Technology

Plans to make available high quality location based services both outside and indoors that provides real time data while conserving power on not only through mobile terminals but through other IoT objects as well.



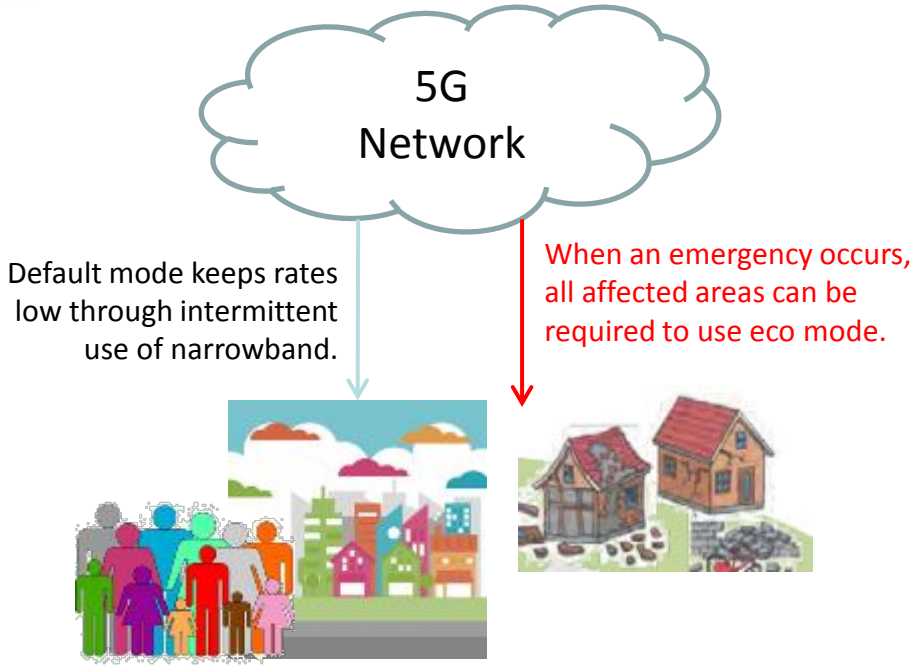
Working with other existing systems
(GPS, BLE/WiFi base measurements)

- Location services will be available indoors where GPS cannot be accessed due to the use of small cells.
- Users who opt-in will be able to have specific location services delivered to their devices while having their personal information removed and users will be able to receive timely services due to the special capabilities of digital beam forming.

Small cells will be deployed in high density areas such as shopping malls, airports, stadiums and office buildings, where they will be able to offer high level location based services.

Service Example: Eco Mode

Eco mode : Using no more bandwidth than needed, allowing surrounding users to use that unneeded bandwidth.
(Manner mode：Putting one's phone on vibrate mode, so surrounding people don't have to listen to unwanted sound.)



- The communications menu will offer low prices by having bandwidth and continuous connection times limited by default.
- Only when necessary will the device access 5G bandwidth its unique low latency capabilities.

Users in disaster areas will receive location based relief information simultaneously Specific disaster relief information about missing family members or relevant information from national or local relief agencies can also be transmitted

4

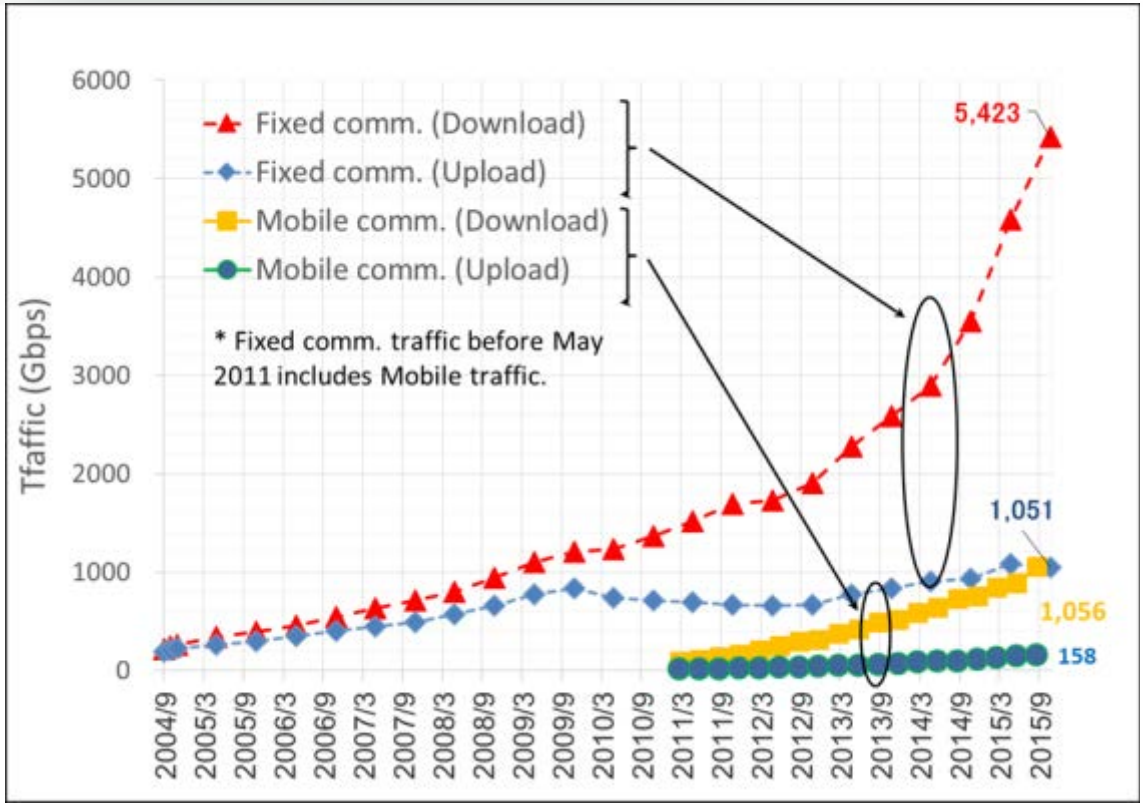
Traffic Trend

5G Traffic: Trend Analysis

Analysis of general communication traffic trends, including fixed lines, until 2014 as well as projections of communication traffic after 2014.

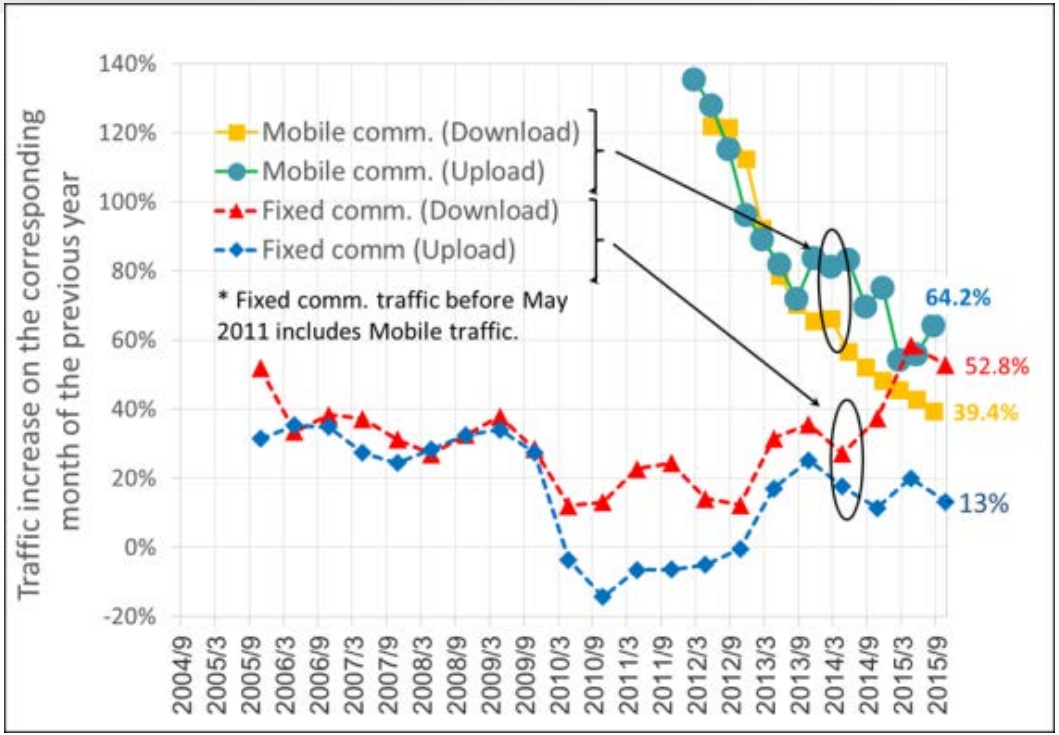
- Downstream fixed communication traffic has shown enormous growth in recent years while upstream traffic has also relatively increased.
- Mobile communication traffic as increased both upstream and downstream, three-fold in the past three years, and remained steady over the past 12 months
- Voice communication traffic has remained steady
- Traffic between objects, i.e. IoT, has seen a dramatic increase, and this trend looks to continue for the next decade. This increase should be supported by 5G.
- With the increase in various use cases of communication between objects, it will be necessary to deal effectively with the changes to the specific needs that these various kinds of traffic will have.

Communication traffic growth in Japan[1]



[1]"Mobile Communications Systems for 2020 and beyond," ARIB 2020 and Beyond Ad Hoc Group White Paper, Oct.2014.

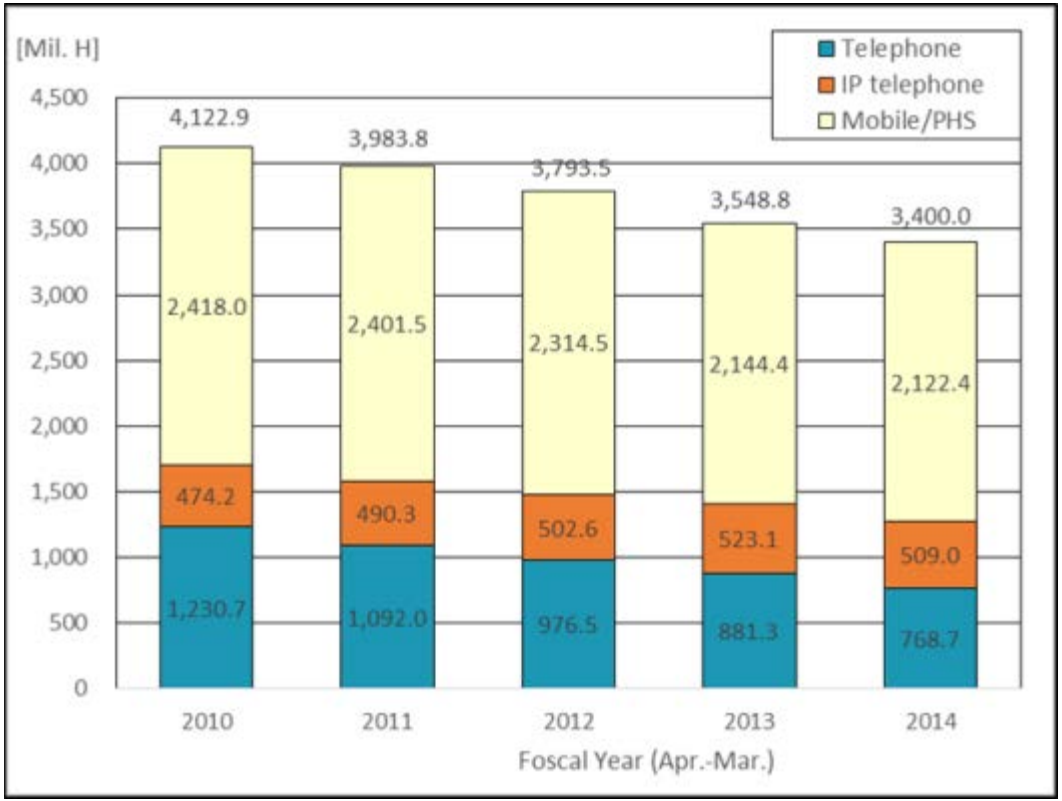
Communication traffic growth rates in Japan [2][3]



[2]"Status of the mobile communications traffic of Japan (Sep. 2015)," Information and Communications Statistics Database, Ministry of Internal Affairs and Communications, Nov. 2015.

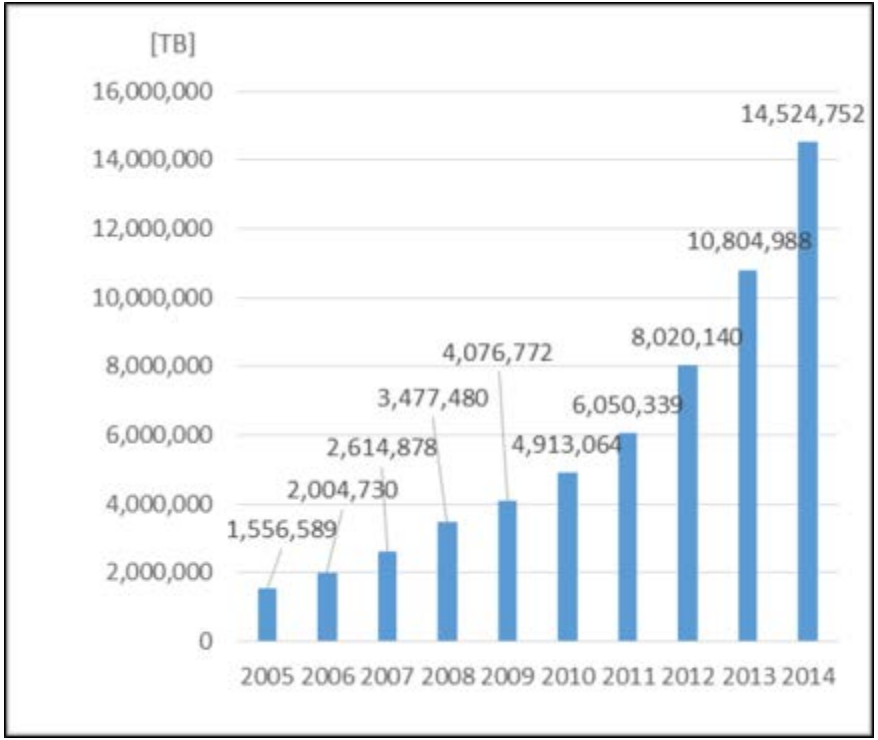
[3]"Aggregation and Provisional Calculation of Internet Traffic in Japan (as of Nov., 2015)," MIC of Japan, Mar. 2016.

Voice communication traffic trend [4]



[4]"Voice communication traffic trends," MIC of Japan, Dec. 2015.

Data traffic (Service industry, ICT, transport, real estate, money & securities, commercial services, utilities, construction and manufacturing) [5]



[5]"Traffic of big data flow estimation and investigations on usage of the big data," MIC of Japan, 2015.

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Cost Implications

Cost Implications

Analysis of the state of individual households changing expenditures related to mobile communications as well as communication carriers' revenues, looking at how the relative increase in data traffic will affect data transmission system infrastructure and use costs

- Data transmission traffic by itself will not simply lead to an increase in business growth
- Future mobile communication systems that are going to connect people and objects will need satisfy a greater demand for a wider range than previously known, so it will be important to use technologies to construct a system that is both flexible and scalable.

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5G Key Concepts

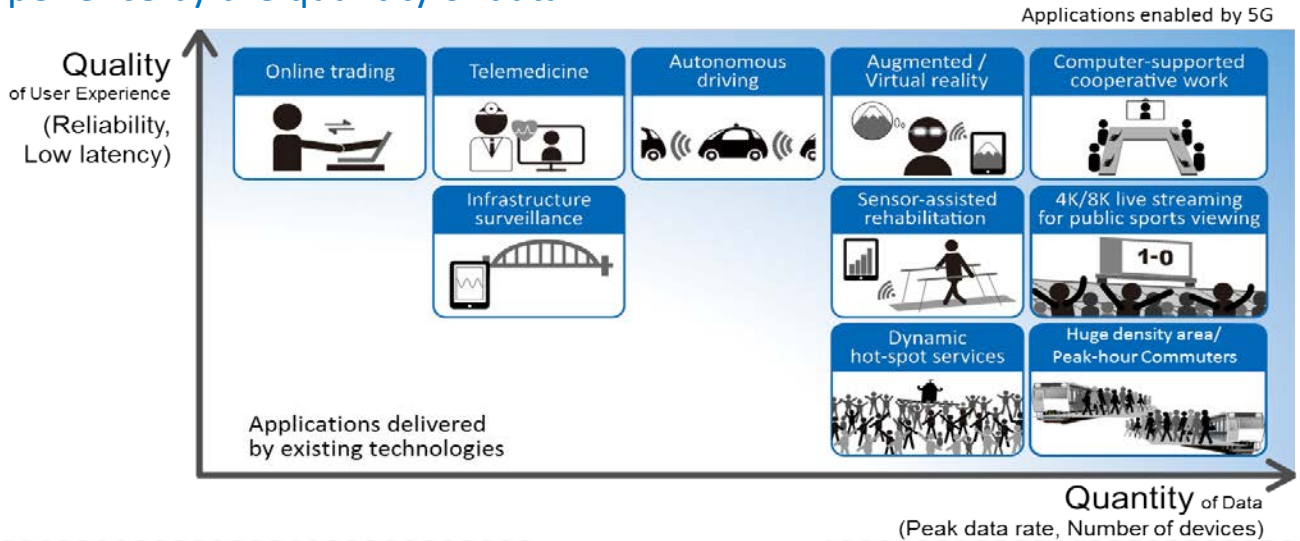
End-to-End Quality in the 5G era

- End-to-end (E2E) quality required by applications and/or users will be far more diversified in the 5G era than what we have seen in the preceding generations.

  For example, the ITU-R Vision recommendation [1] illustrates a number of usage scenarios in which the capabilities required are not identical but diversified depending on the expected E2E quality.

  [1] IMT Vision – "Framework and overall objectives of the future development of IMT for 2020 and beyond", ITU-R, Recommendation M.2083-0, Sep. 2015

- The following figure represents potential 5G applications mapped on a domain of the quality in user experience by the quantity of data.



Key Concepts of 5G

Two Key Concepts of 5G

1. Satisfaction of End-to-End Quality
   - 5G shall provide **satisfactory "End-to-End Quality"** required by any kind of application anytime, anywhere and any use scenes.
   - This conceptualization of **"Satisfaction of End-to-End Quality"** is **very different from previous generations** of mobile communication systems, for which best effort delivery was seen as sufficient.

2. Extreme Flexibility
   - 5G networks will be **required to provide "Extreme Flexibility"** In order **to produce this level of End-to-End Quality** for the many services 5G systems will be expected to support.

Key Concepts of 5G (Cont'd)

Extreme Flexibility is realized from the cooperation of radio access and core networks

- User demands and needs for E2E quality in the 5G era **will be much more diverse** when compared to previous generation systems. The dynamic ranges fluctuated by the temporal and spatial factors will also expand more dramatically
- These changes determine **a major requirement for 5G which is completely different from previous generation systems**, for which providing best effort quality was sufficient
- **Extreme flexibility through the coordination of networks will be needed** in order to provide the dynamically diverse and fluctuating E2E quality that users will demand (one example is the realization of ultra-low latency)
- The performance of **radio access networks alone is no longer the sole bottleneck**; the performance of radio access networks were limited by a number of constraints, such as radio propagation characteristics, available bandwidth, handset power, mobility, and so forth

Key Technologies for Key Concepts

Key Technologies Needed to Realize Key Concepts

1. Advanced Heterogeneous Networks

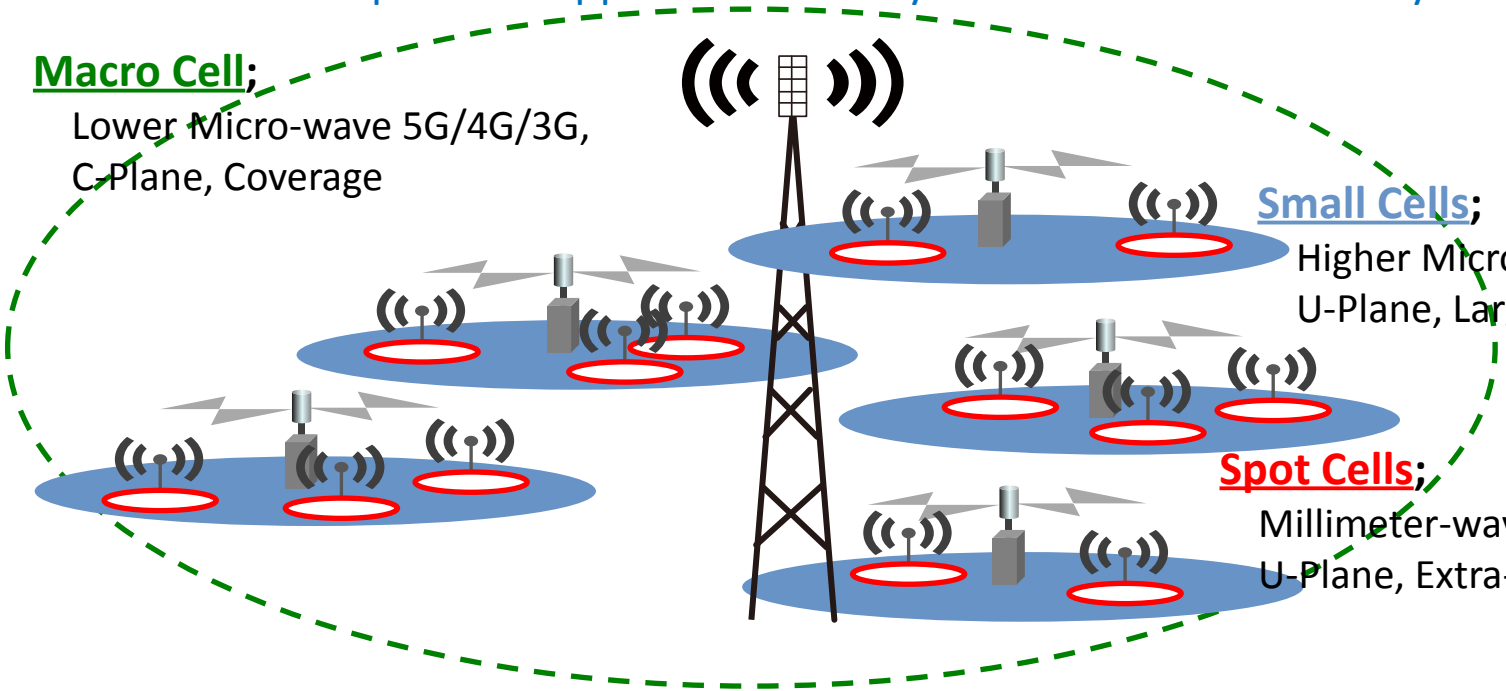
5G will **not** be made up of **a single network**, rather it will **use advanced heterogeneous networks**, where **5G radio access technologies** (RAT), already **existing 2G, 3G, LTE, WLAN** networks **to create an integrated system** that can provide support for a variety of services with flexibility.

2. Network Softwarization

Network Softwarization is an overall transformation trend in this industry. With network softwarization, network devices and components can be designed, introduced, maintained and administered with easily updated programmable software as well as ensuring that network devices and components can easily and flexibly be used and maintained.

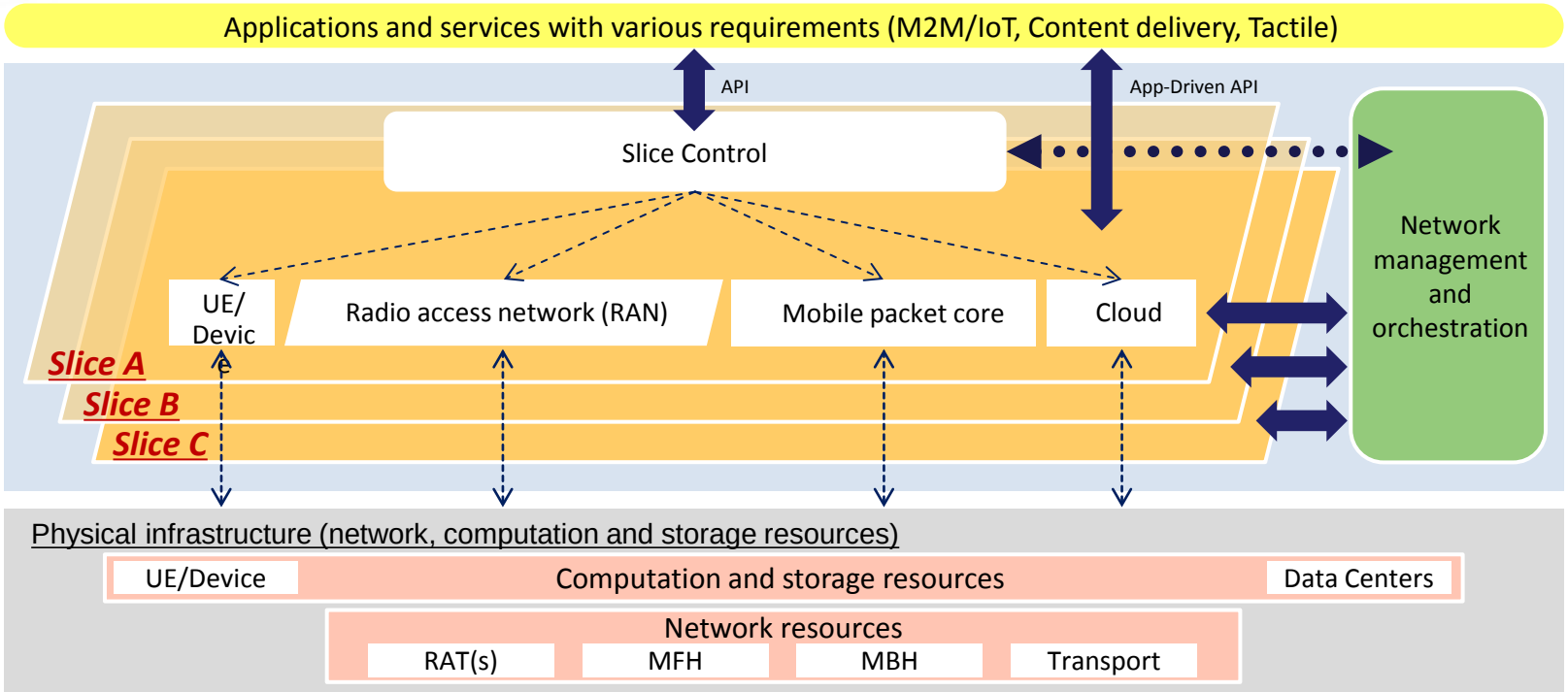
Advanced Heterogeneous Networks

In addition to 5G Radio Access Technologies (5G RAT), 5G will continue to use already existing 2G, 3G, LTE, WLAN to create an integrated system that can provide support for a variety of services with flexibility.



Network Softwarizasion and Slicing

Network softwarization and slicing will allow network devices and components to support a variety of services in a extremely flexible manner.



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Typical Usage Scenarios of 5G

Typical Usage Scenarios for 5G（1）

- 5G usage scenarios, which describe the way of utilizing 5G in various life scenes envisioned for a 5G era, are categorized into the following four typical facets, based on market and user trends

  1) Entertainment
  2) Transportation
  3) Industries/Verticals
  4) Emergency and disaster relief

- 5G capabilities required for individual usage scenarios as well as the key items of the capabilities for deriving 5G requirements are listed.
- Analysis of the dynamic nature of 5G capabilities, which may change dynamically corresponding to the wide variety of the 5G usage scenarios, is also provided

Typical Usage Scenarios for 5G（2）

1）Entertainment

- Provides individuals with unique and/or advanced experiences to enjoy their leisure time: watching sports games, playing games and travelling.
- Utilizes ultra-high definition video and high fidelity acoustics. Combination of comfortable communication environment even in highly congested area and advanced technologies for remote collaboration.

2）Transportation

- Advanced methods for the comfortable transportation of humans and devices.
- Autonomous vehicles that are able to drive themselves without any intervention by a human, driver assisting services that provide comfortable rides by avoiding traffic jams or other obstacles, and computer-aided management of crowds during popular events.
- Comfortable experiences of transportation ranging from automobiles to high-speed maglev trains.
- Mechanisms to assist human activities based on the analysis of data from various sensors.

Typical Usage Scenarios for 5G（3）

3）Industries/Verticals

- Reform and revolutionize current workflows through ICT in the industries/verticals, such as manufacturing and agriculture.
- Create new value for customers using ICT to improve upon previous production techniques, raise the production efficiency in other industrial fields, and create new business models.
- Pioneer new business models using robots, drones, instruments and machinery through the use of sensor networks, big data analysis, and ultra-low latent feedback to actuators.

4）Emergency and disaster relief

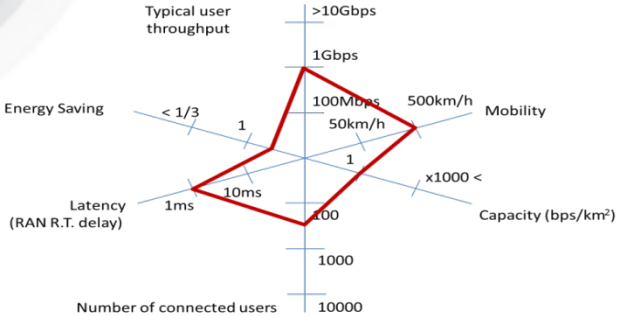
- Provide support during emergency situations from traffic accidents to disaster situations.
- Aid first responders, confirm safety of victims, provide evacuation guidance and rescue assistance.

Dynamicity of 5G capabilities

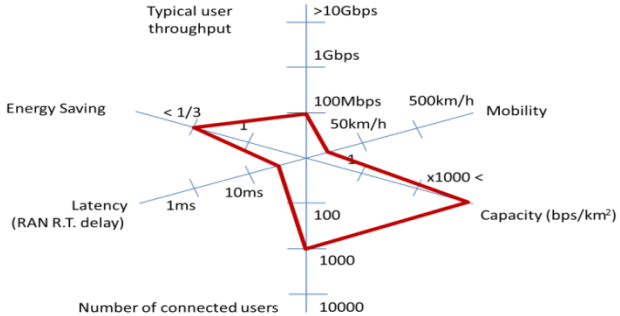
5G needs to be dynamically optimized to meet the dynamic variety of 5G requirements

- Not all 5G requirements are necessary to be simultaneously met when providing 5G services. 5G capabilities need to adapt to the wide and dynamic variety of 5G requirements for a particular time, space and situation.
- Advanced heterogeneous networks are a promising approach for this optimization which will allow 5G to have the ability to systematically work together in different RATs, including new 5G RAT(s), which have different capabilities.
- Network softwarization and slicing are crucial key factors to realize flexible end-to-end networks.

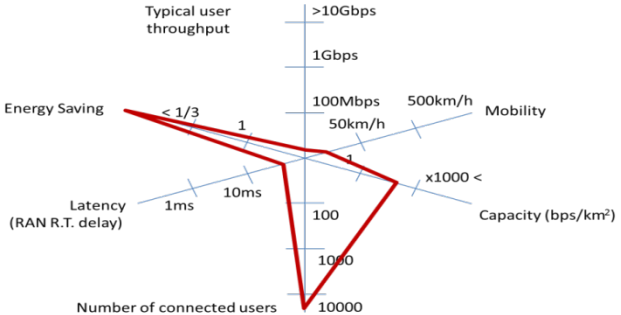
Requirements For User Scenes (Examples)



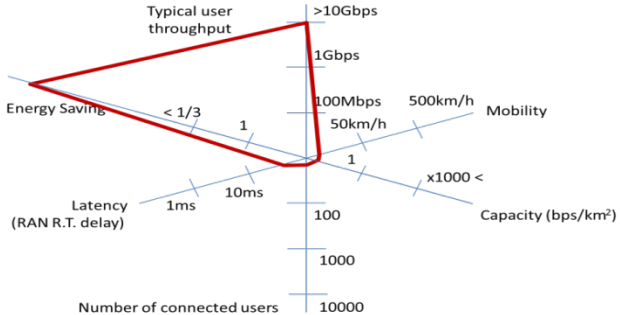
Example of High Mobility
in a usage scene of communications relating to emergency tasks



Example of High Capacity
in a usage scene of pedestrian navigations in a crowded building



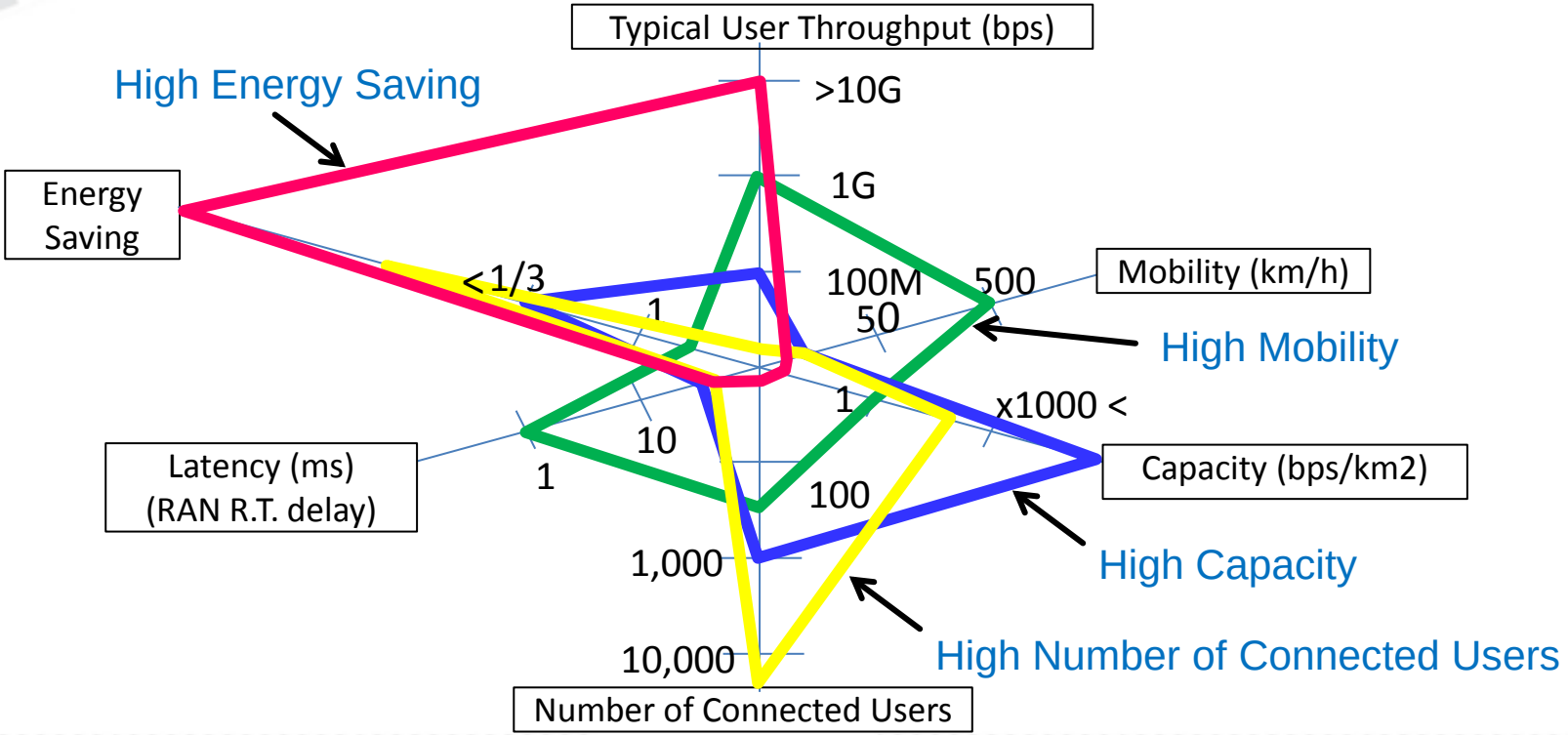
Example of High Numbers of Connected Users
in a usage scene of sensors network



Example of High Energy Saving
in a usage scene of near field communication

Requirements For User Scenes (Examples)

- 5G systems do not always need to achieve their maximum performance.
- 5G systems will be determined based on individual use scene requirements.



8

Requirements for 5G

5G Typical Use Cases (1)

Based on the IMT Vision recommendation ITU-R M.2083-0, 5G typical use cases and necessary enhancements in capabilities are described.

Ultra-reliable and low latency communications (URLLC)

- Applications for objects including machines, vehicles, and sensors will need to be more stringent in regards to latency and data loss as well as require with certainty that data packets be delivered to in a specified time period.
- Radio access networks, core networks and other part of the networks, which constitute E2E networks, should work closely to satisfy E2E quality. For example, in order to achieve required E2E latency, distribution of latency budget to each constituent part of networks, i.e., handsets, radio access networks, fronthaul/backhaul, or the core network should be considered.
- Typical use scenarios include: wireless control of industrial machinery or manufacturing processes, remote medical surgery, distribution automation in a smart grid, transportation safety.
- Mobile Edge Computing (MEC) is the concept to provide an IT service environment at a location considered to be the most lucrative point in mobile networks, characterized by proximity, ultra-low latency and high bandwidth.

5G Typical Use Case (2)

Massive Connection(mMTC)

- Provide coverage for applications used by objects such as sensor networks and infrastructure monitoring devices by providing the ability to accommodate massive multiple connections that are both cost and energy efficient for devices over a wide coverage area, including those with relatively small data generating capacity.

eMBB : enhanced Mobile Broadband (Data rate, Capacity, Mobility)

- Provide seamless, advanced user experiences with video communication employing augmented reality and virtual reality technologies.
- Expand fundamental network capabilities to satisfy user requirements in order to not make users feel frustrated by relaxing constraints and restrictions imposed in preceding generations
- Peak data rate and system capacity: availability of spectrum bandwidth
- Enhanced mobility
- Quality improvement by multi-antenna technologies

Requirements for 5G RAN

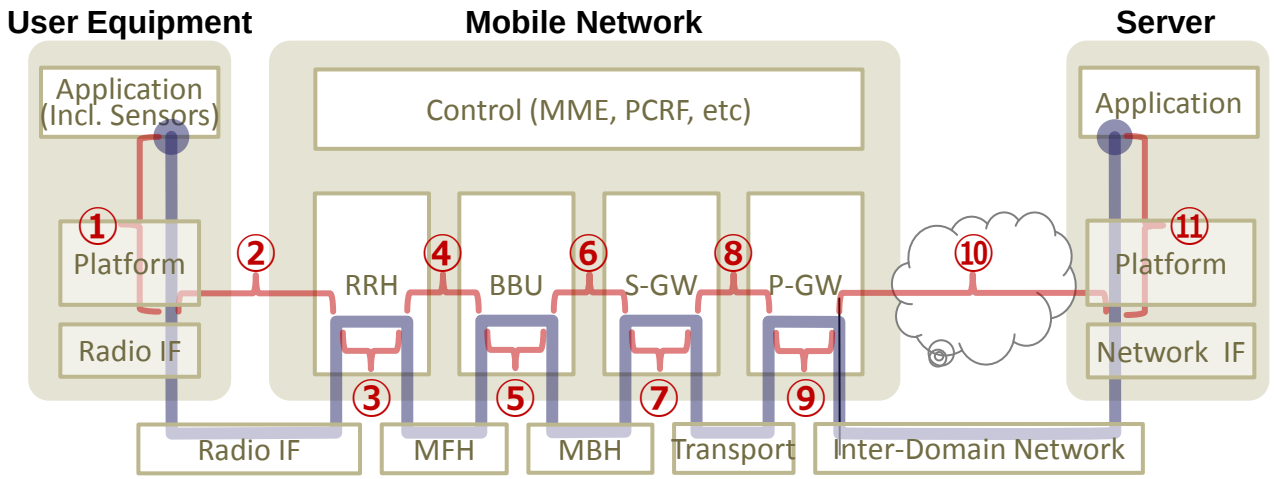
Mapping requirements for 5G RAN and 5G typical use cases (eMBB, URLLC, mMTC) in ITU-R Vision recommendation M.2083-0

Required Items	eMBB	URLLC	mMTC
Bandwidth	X	X	X
TRP spectral efficiency	X		X
Peak data rate	X		
Area traffic capacity	X		
Connection density			X
Latency	X	X	
Coverage			X
Mobility	X		
Mobility interruption times	X	X	
Energy efficiency	X		X
Reliability		X	

Note: ‘x’ denotes corresponding requirement in its row should be applied to the use case in its column. Applying relaxed or general requirements to the use cases that are not denoted by ‘x’ is not precluded.

5G requirements: overall networks

- An end-to-end scenario for latency-aware design
  The end-to-end user data path from UE to a Server is divided into 11 different segments for study design methodologies.



① UE Processing Delay
② Air Interface Delay
③ RRH Processing Delay
④ Fronthaul Transmission Delay
⑤ BBU Processing Delay
⑥ Backhaul Transmission Delay
⑦ S-GW Processing Delay
⑧ Transport Network Delay
⑨ P-GW Processing Delay
⑩ Inter-Domain Network Delay
⑪ Server Processing Delay

RRH (Remote Radio Head)
BBU (Base Band Unit)
S-GW (Serving Gateway)
P-GW (Packet Data Network Gateway)

MFH (Mobile FrontHaul)
MBH (Mobile BackHaul)
MME (Mobility Management Entity)
PCRF (Policy and Charging Rule Function)

Possible Contribution by radio access: ②＋③＋④＋⑤

An end-to-end scenario based on the current mobile (LTE) network

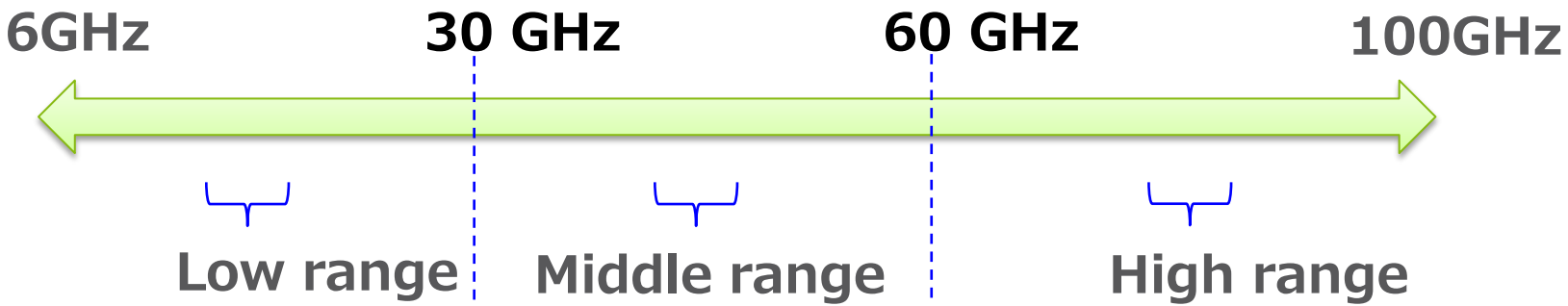
9

Spectrum Implications

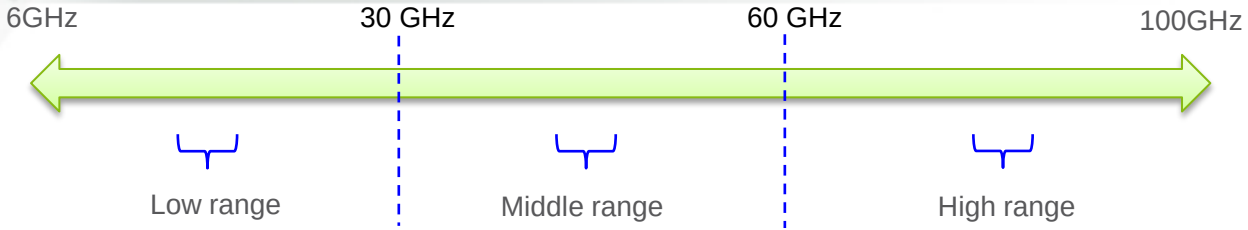
Evaluation of spectrum ranges above 6GHz

- Spectrum needs to be used based on the individual characteristics of each band, from low frequency to high frequency
- Evaluate frequency bands from 6GHz to 100GHz from the following viewpoints
  - Stage1 : Use cases and technology
  - Stage2 : Sharing or interacting with other systems
  - Stage3 : International cooperation

Classification of Spectrum Ranges above 6GHz in Stage 1



Spectrum ranges above 6GHz and characteristics



- Considering 5G applications (Mobile Broadband, M2M and so on), bandwidth of several 100MHz to several GHz is required per each individual application.
- It is desirable for the bandwidth to be contiguous in order for efficient use of spectrum and implementation.

Spectrum range	Low (6 – 30GHz)	Middle (30 – 60GHz)	High (60 – 100GHz)
Continuous spectrum bandwidth (Note 1)	Approx. 300MHz - 1.5GHz	Approx. 1.5GHz - 3GHz	Approx. 3 – 5GHz
Coverage example (Note 2)	Several 100m – Approx. 1km ⟷		Several 10m – Approx. 100m
Deployment scenario	Different scenarios for mobile communication are possible (Outdoor, Indoor, Outdoor to indoor, Hotspot and so on) ⟷		Scenarios for wider bandwidth and dense deployment (Indoor, Hotspot and so on)

(Note 1) These values are contiguous spectrum bandwidth assuming that the fractional bandwidth is 5% and referring to the spectrum and bandwidths of the existing 3GPP bands, and not required spectrum bandwidth (spectrum demand).
(Note 2) The coverage values can vary depending on radio propagation condition, deployment scenario, applicable radio technologies and so on .

Stage 2: Sharing or Interacting with Other Systems

Evaluate and categorize frequency bands between 6GHz - 100GHz for the possibility of sharing between IMT systems and existing systems in operation in Japan using the following four levels as criteria

Level 1 : No possibility for sharing

a) Bands listed in Footnote 5.340 of ITU-R Radio Regulation or in Footnote J107 of national allocation in Japan, where all emissions are prohibited.

b) Systems which are related to safety of human life and are always in use (e.g. Aeronautical radio navigation)

Level 2 : Difficult for sharing

Level 3 : Possible for sharing under certain conditions and worth considering for sharing

a) The incumbent radio system has already been shared with land mobile communication systems in other bands.

b) Sharing may be possible under certain operation conditions.
(The incumbent radio system is also operated by the mobile communication operator, e.g. wireless entrance for IMT, etc.)

c) Sharing is possible technically by introducing a certain sharing technology, mitigation technique, and/or geographical/allochronic isolation.
(e.g. The incumbent radio system is in use only when a disaster occurs, etc.)

Level 4 : Possible for sharing

(e.g. No radio license is found in the public data base, or only radio stations for experimental or temporary operations are assigned.)

(Note)

・Unlicensed ISM (Industry - Science - Medical) bands were not evaluated such as 24-24.25GHz, and 57-66GHz.

Stage 2 Evaluation Results

Desirable Frequency Bands for 5G Found after Stage 2 Evaluation

Frequency Band (GHz)	Bandwidth (GHz)	Level of sharing possibility
5.925 – 7.25	1.325	3, 4
7.375 – 8.75	1.375	3, 4
10 – 10.5	0.5	3
10.55 – 10.68	0.13	3
10.7 – 11.7	1.0	3
14.5 – 15.35	0.85	3
15.4 – 21.4	6.0	3, 4
22 – 23.6	1.6	3
Frequency Band (GHz)	**Bandwidth (GHz)**	**Level of sharing possibility**
31 – 31.3	0.3	4
31.5 – 42.5	11	3, 4
45.3 – 47	1.7	4
47 – 50.2	3.2	3, 4
50.4 – 52.6	2.2	3, 4
54.25 – 57	2.75	3
Frequency Band (GHz)	**Bandwidth (GHz)**	**Level of sharing possibility**
66 – 76	10	3, 4
81 – 86	5	3
92 – 100	8	4

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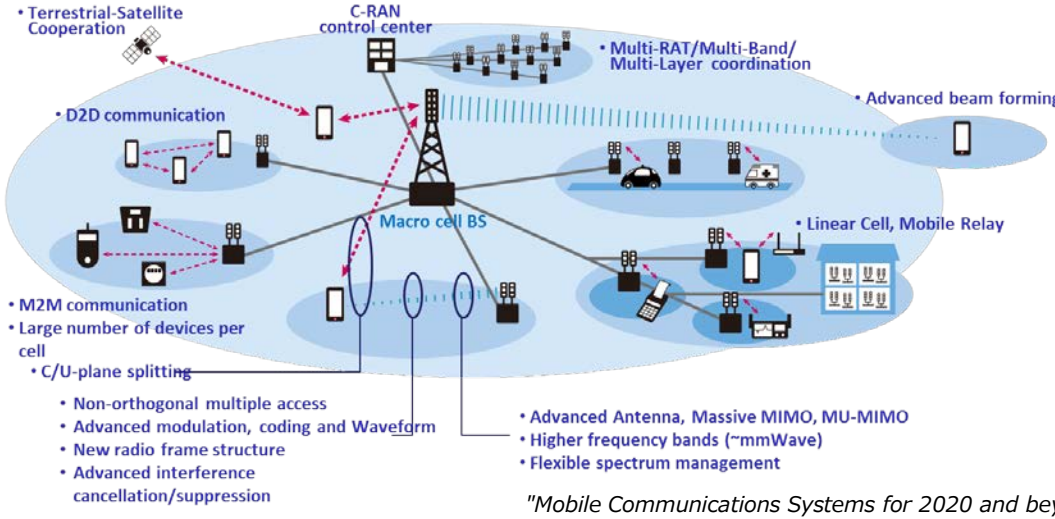
5G Radio Technologies

5G Radio Technologies

- Based also on the contents of the ARIB 2020 and Beyond AdHoc White Paper, new research shows **there are many promising new radio technologies that can be used realize a working 5G network.**

- These new technologies have been sorted and organized in order to understand how they will be used to support the necessary requirements of 5G, including high speed, high capacity, massive numbers of devices with simultaneous connections, and high reliability and efficiency.



"Mobile Communications Systems for 2020 and beyond", ARIB 2020 and Beyond Ad Hoc Group White Paper, October 2014.

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Network Technologies for 5G

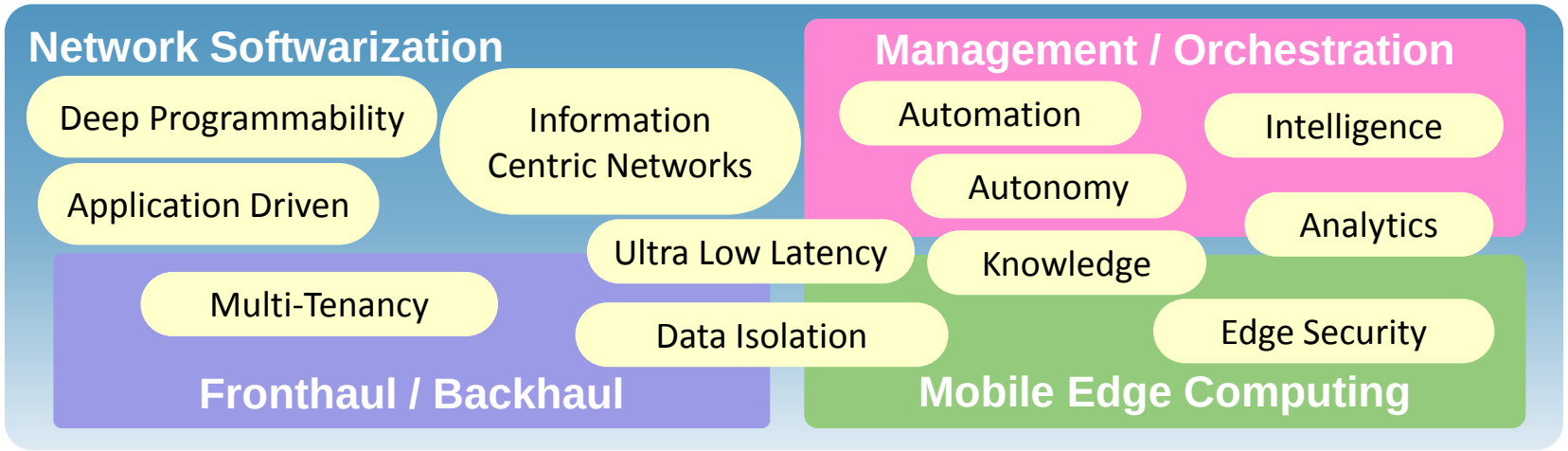
Technology Focus Area

Requirements

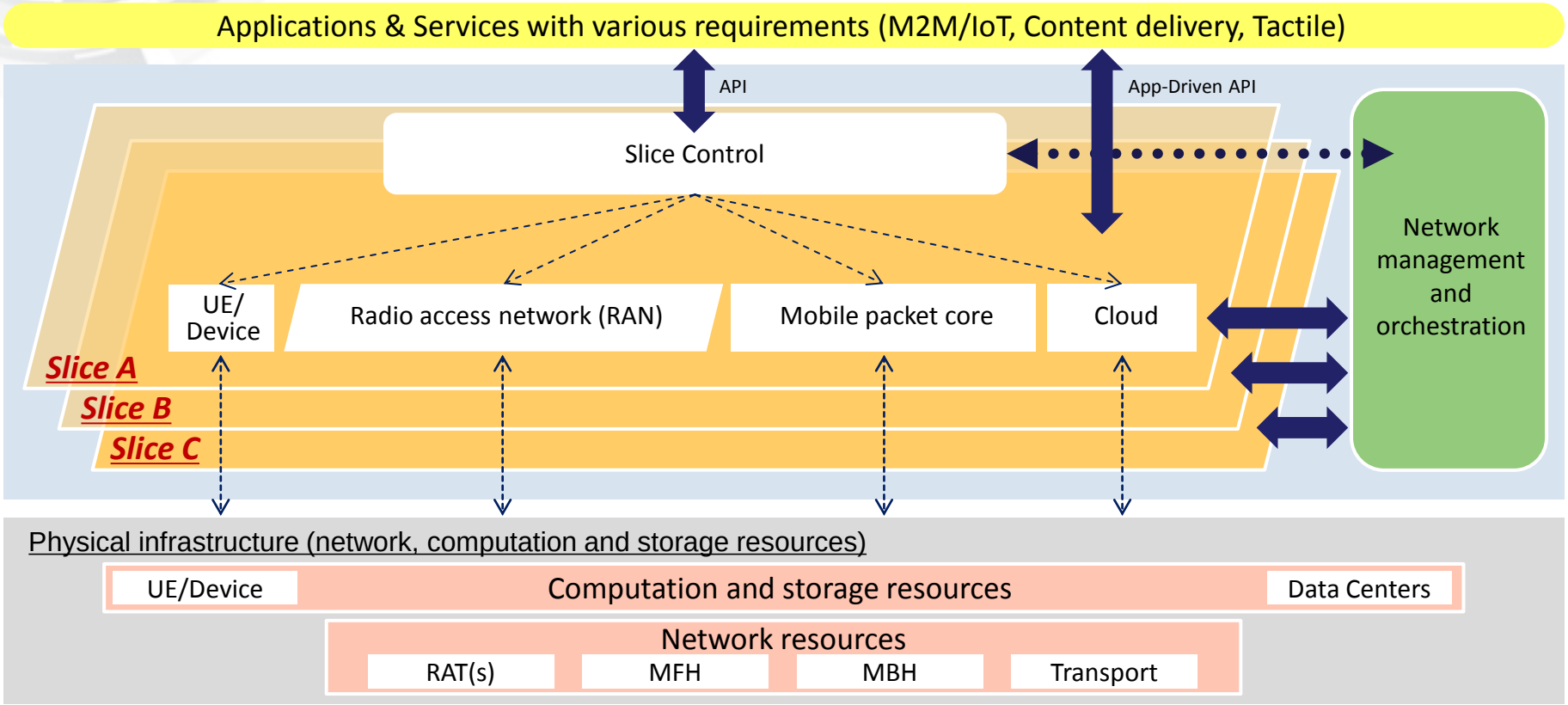
End-to-end Quality of 5G Applications

Extreme Flexibility — Latency | Data rate | Number of Devices

Technology Focus Area



Network Softwarization and Slicing



Network Softwarization

Definition of Network Softwarization

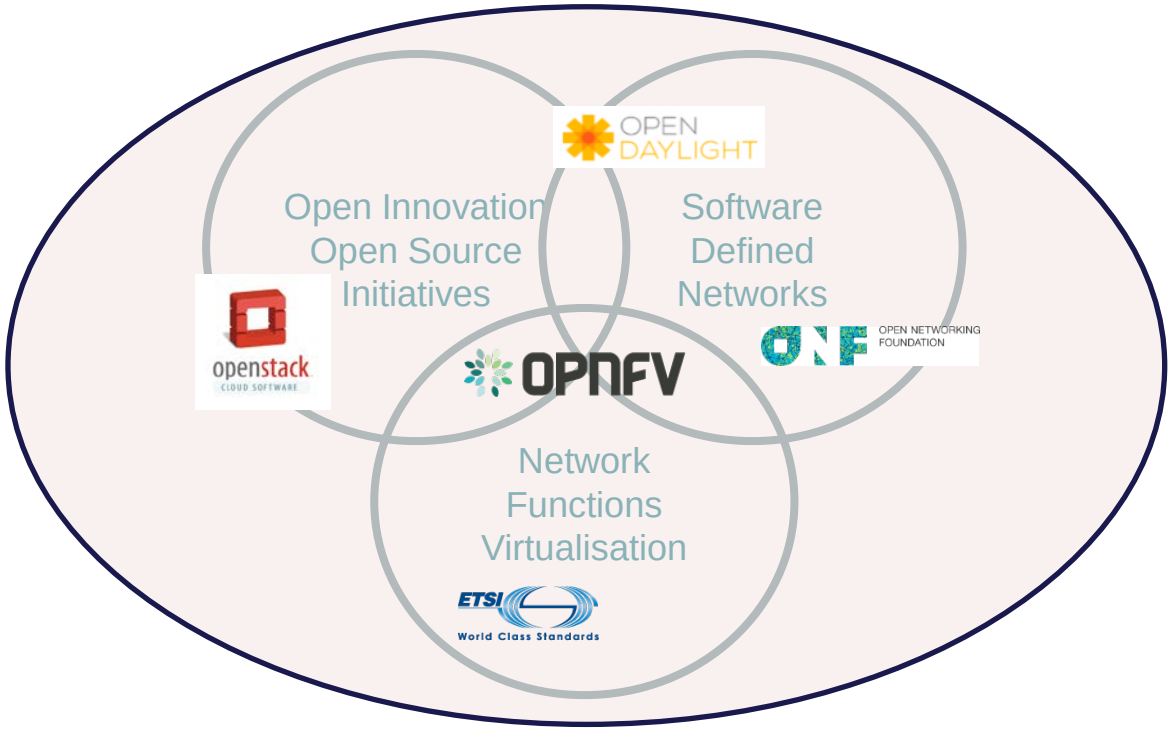
Network Softwarization is an overall transformation trend for designing, implementing, deploying, managing and maintaining network equipment and/or network components by software programming, exploiting the natures of software such as flexibility and rapidity all along the lifecycle of network equipment / components, for the sake of creating conditions enabling the re-design of network and services architectures, optimizing costs and processes, enabling self-management and bringing added values in network infrastructures.

From FG IMT-2020 "Report on Standards Gap Analysis"

The term was first introduced at the academic conference NetSoft 2015, the First IEEE Conference on Network Softwarization, in order to include broader interests regarding:

- **Software Defined Networking (SDN)**
- **Network Functions Virtualisation (NFV)**
- Network Virtualization
- Mobile Edge Computing (MEC)
- Cloud and IoT technologies.

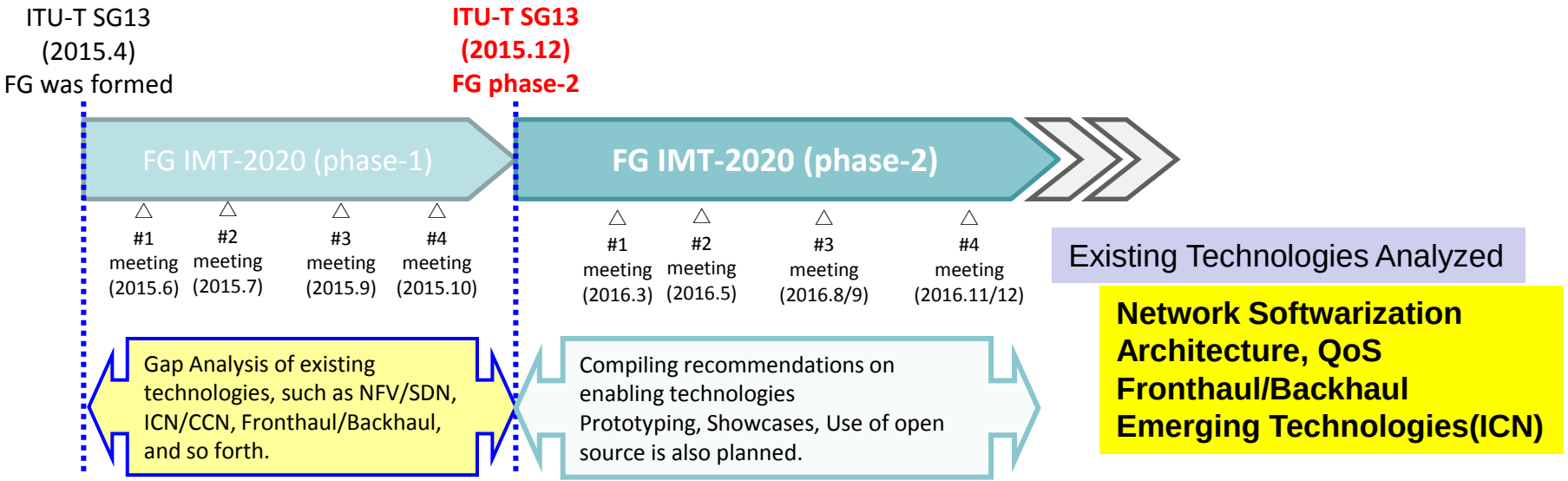
NFV/SDN and Network Softwarization



To be harmonized under the concept of Network Softwarization

ITU-T SG13 FG IMT-2020

- FG (Focus Group) IMT-2020 was formed under ITU-T SG13 in Apr. 2015.
- FG IMT-2020 (Phase-1) did a gap analysis of existing technologies against the requirements of IMT-2020, and delivered its report in Dec. 2015.
- Based on the outcome of Phase-1, FG IMT-2020 (Phase-2) has begun with the goal of compiling recommendations on enabling technologies for IMT-2020, to be completed by the end of 2016.



Technical Challenges

- Network Softwarization
  - Information Centric Networking (ICN)
- Network Management and Orchestration
  - Management and orchestration for Intelligent mobile network
  - Forward to providing service function in network from data-transmission network
  - Management evolution for application handlings in 5G networks

- Fronthaul and Backhaul
- Mobile Edge Computing
  - Ultra-low latency networking
  - Control and Management for low latency and resilient networks

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Conclusion

Summary of the White Paper

- **Provides information** on research into the **everyday uses of mobile applications**, including the use scenes in industry, transportation, education, logistics, medical, health and welfare services, safety, emergency, and disaster relief.
- **Looks at mobile applications** from **many different viewpoints**, and **clarifies the technical requirements** for the mobile communication systems as a fundamental part of society.
- **Reports on high quality and cutting-edge services demanded** by consumers, and results of research and analysis into the trends of society and markets.
- **Predicts of the use scene of the 2020s and applications** that will be needed in that decade.
- Discusses the **key concepts** of 5G, **requirements, capabilities, architecture, and key technology** for 5G , and **the desirable radio frequencies** for 5G.

Key concepts and Key technologies of 5G

- Two 5G Key concepts
  1. **Satisfaction of End-to-End Quality**
  2. **Realization of systems with Extreme Flexibility**

- Two 5G Key Technologies
  1. **Advanced Heterogeneous Network**
  2. **Network Softwarization and Slicing**

Looking Towards the future

- 5GMF will continue the following activities going forward
  - Contributing to the **ITU and 3GPP** on **frequency allotment** and the **development of standards**;
  - Building **relationships with 5G related organizations internationally**;
  - **Promoting** 5G for **potential users in industry**.

- 5GMF hopes discussions on following actions are successful in order to speed up the introduction of the necessary standards and requirements:
  - **Hold 5G Verification Trials** under actual conditions in order to **attract relevant industries to utilize 5G**;
  - **Give demonstrations of 5G characteristics** collaborating **with domestic and international partners**;
  - **Consider a platform** where **service providers** will be able to **easily offer 5G related services to their customers**;
  - **Consider the necessary frequency bands for 5G** both **domestically and internationally**, on which 5G's success depends.

5GMIF
The Fifth Generation Mobile Communications Promotion Forum

End