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Proposal for a user-centric ran architecture towards beyond 5G

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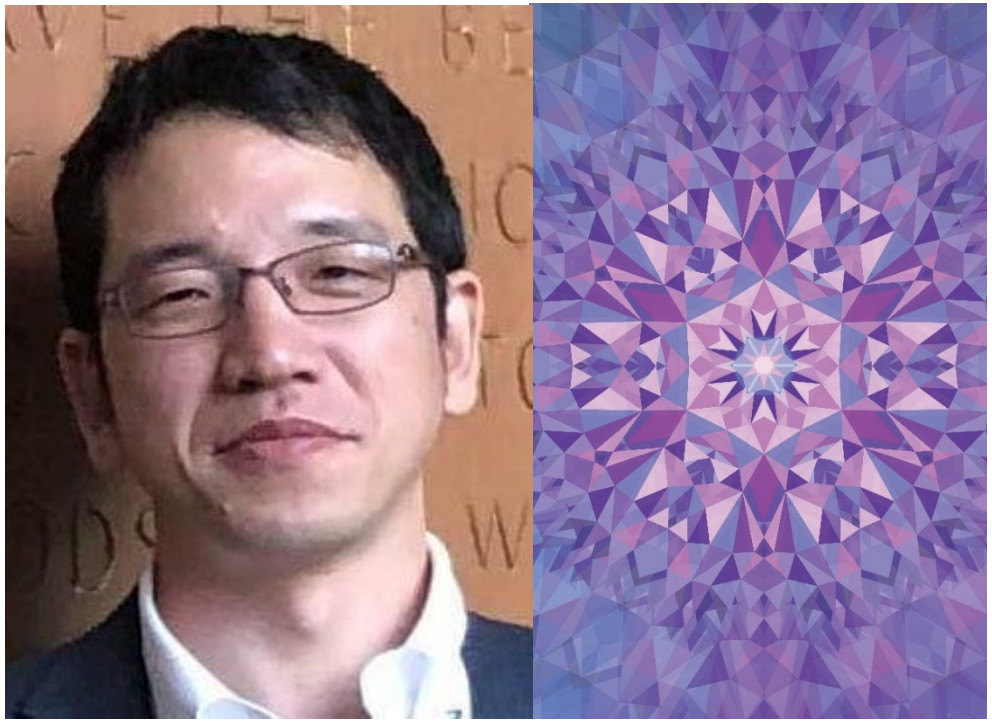


Session 1: Enabling future wireless communication systems

Paper S1.1: Proposal for a user-centric ran architecture towards beyond 5G

Introduction

Beyond 5G/6G realizes cyber-physical systems (CPS) through the bi-directional transfer of vast amounts of data.

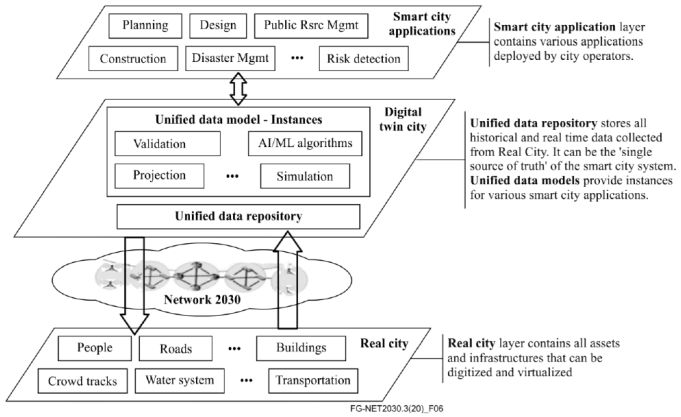
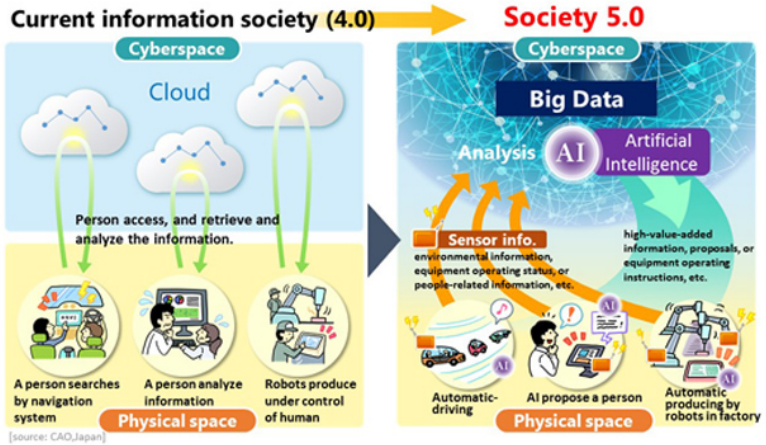
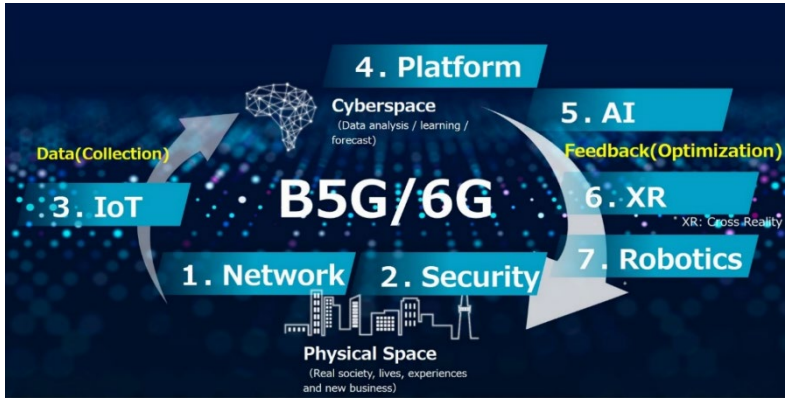


Figure 6 – Example reference framework of a digital twin city

ITU-T, FG-NET2030 – Focus Group on Technologies for Network 2030.

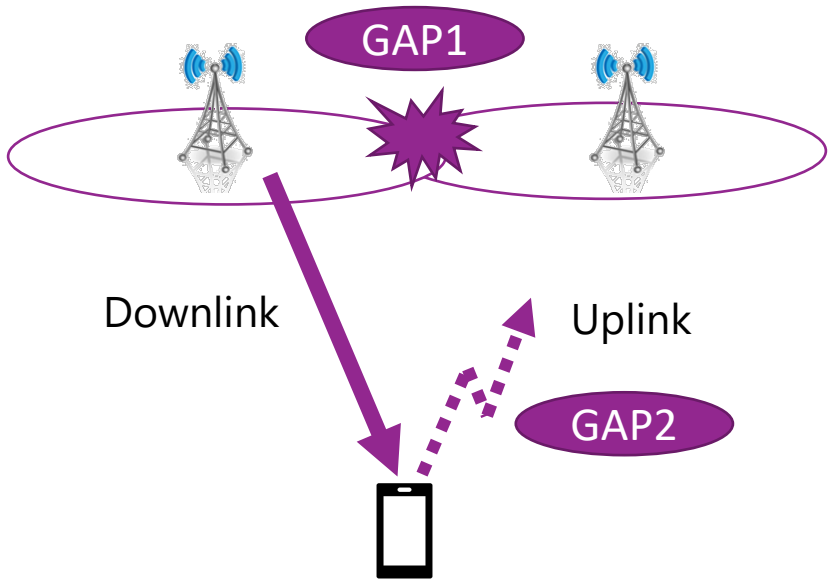


Cabinet Office in Japan
https://www8.cao.go.jp/cstp/english/society5_0/index.html



"Beyond 5G/6G White Paper ver.2.0"
KDDI Corporation, KDDI Research, Inc.

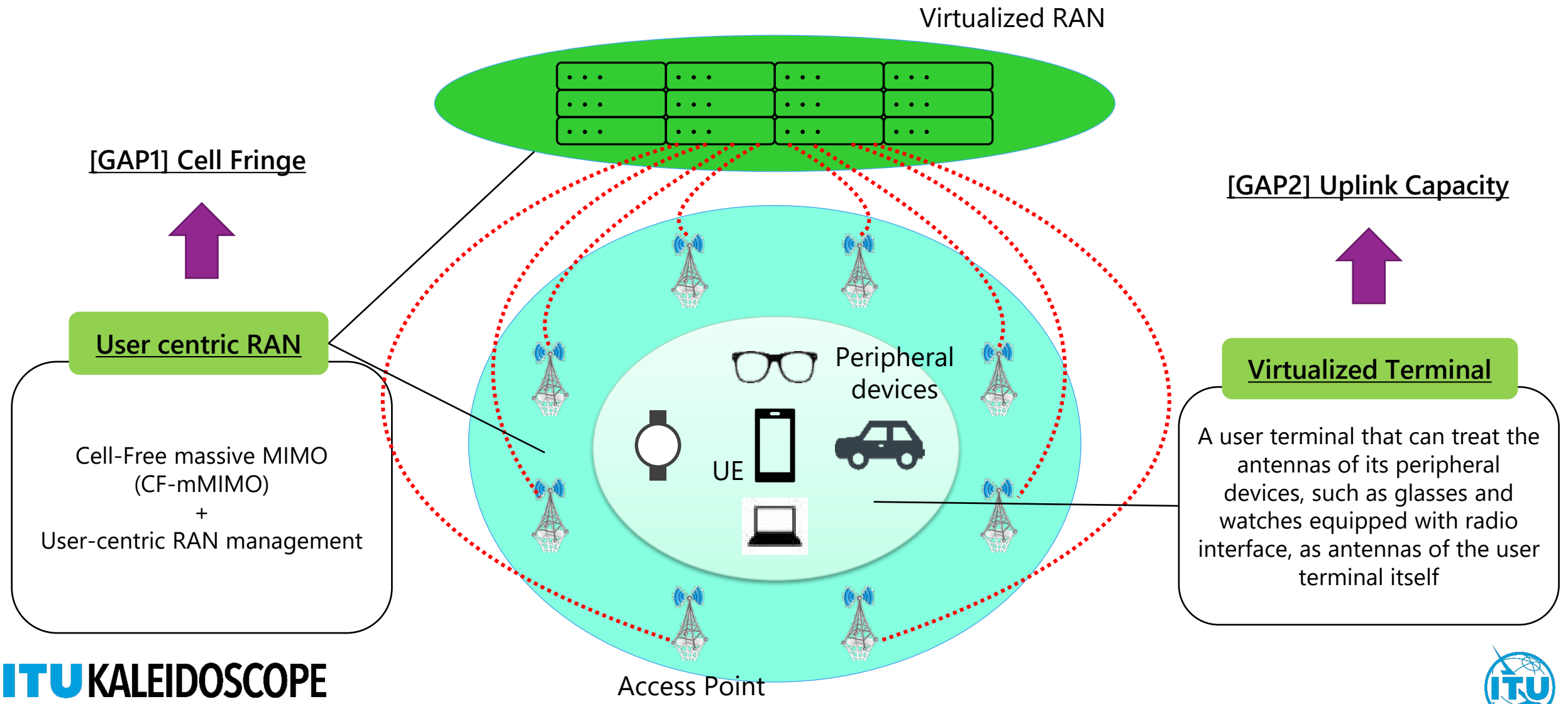
GAP Analysis



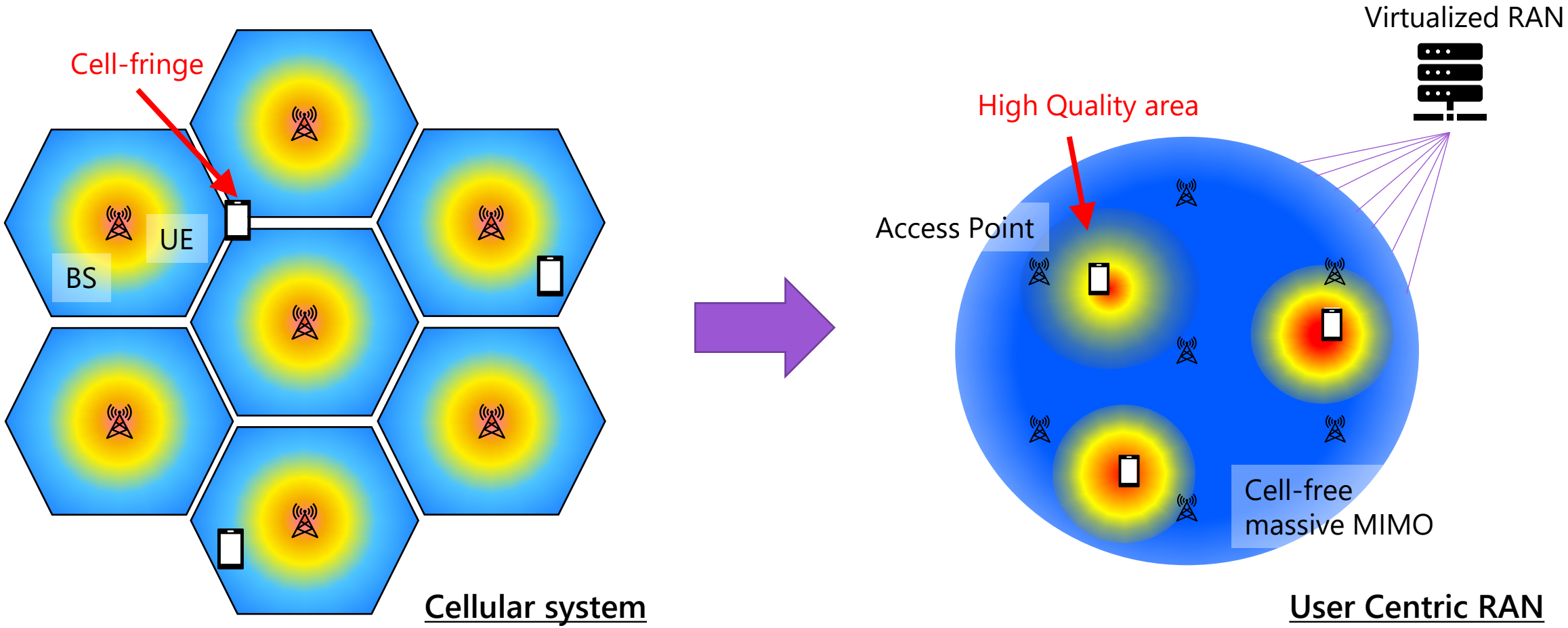
[GAP1] Cell Fringe
the radio coverage is determined by the location of base stations. In this case, the communication quality is greatly affected by the distance from the base station and the user's location, and it is not possible to provide high radio quality everywhere.

[GAP2] Uplink Capacity
5G mobile terminals have severe limitations in terms of size and power compared to base stations, which limits the number of antennas and transmission power that can be installed, and the quality of the uplink is greatly degraded compared to the downlink.

User Centric Architecture



User-centric RAN

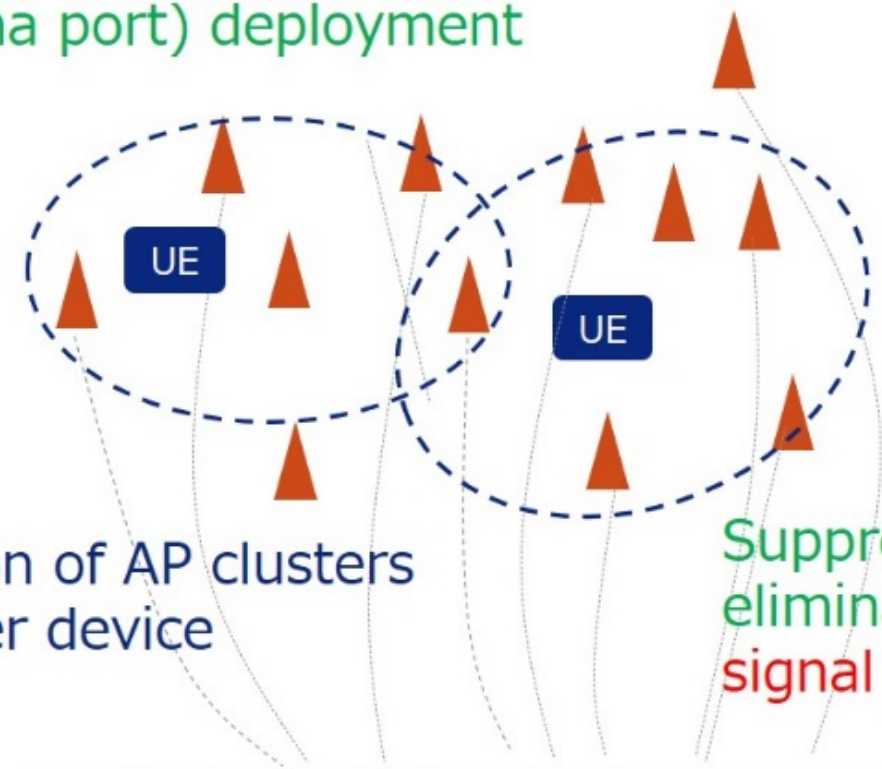


Cellular system

User Centric RAN

Cell-Free massive MIMO (CFmMIMO)

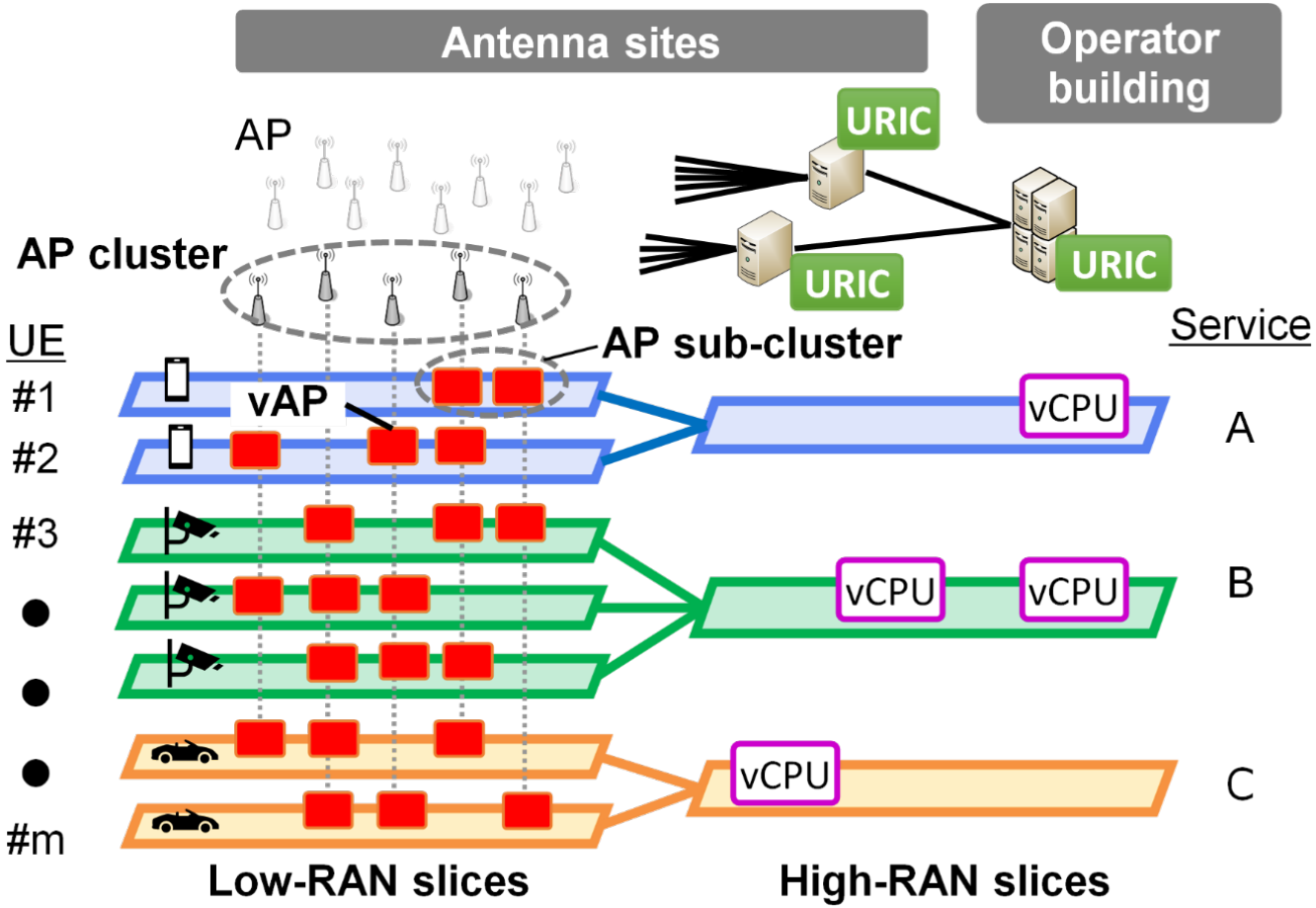
Dense base station antenna
(AP: antenna port) deployment



Configuration of AP clusters
for each user device

Suppressing interference between users and eliminating cell boundaries using coordinated signal processing by multiple APs

User-centric RAN structure



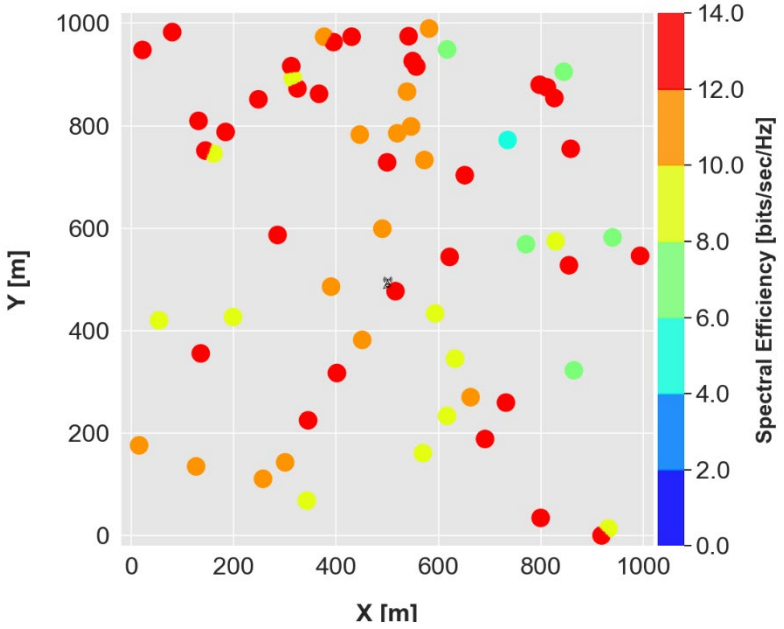
URIC : user-centric RIC

Initial Study for CFmMIMO

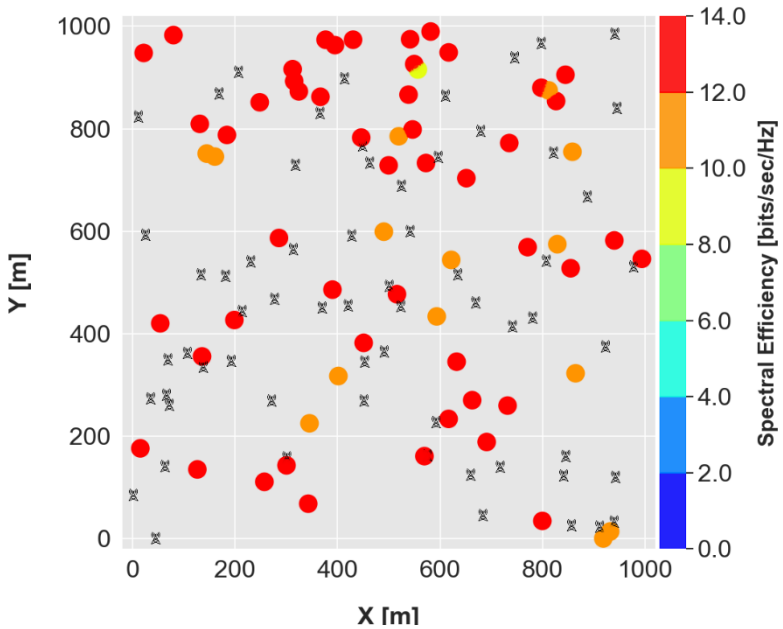
TYPE	VALUE
Carrier frequency	3.5 GHz
Bandwidth	20 MHz
Transmission power	23 dBm
Simulation area	1km square

TYPE	VALUE
Number of antennas	256（Number of APs “L” x Number of antennas per AP “N”）
Number of users multiplexed	16
Signal detection	Zero Forcing
Channel estimation	Least Square Estimation

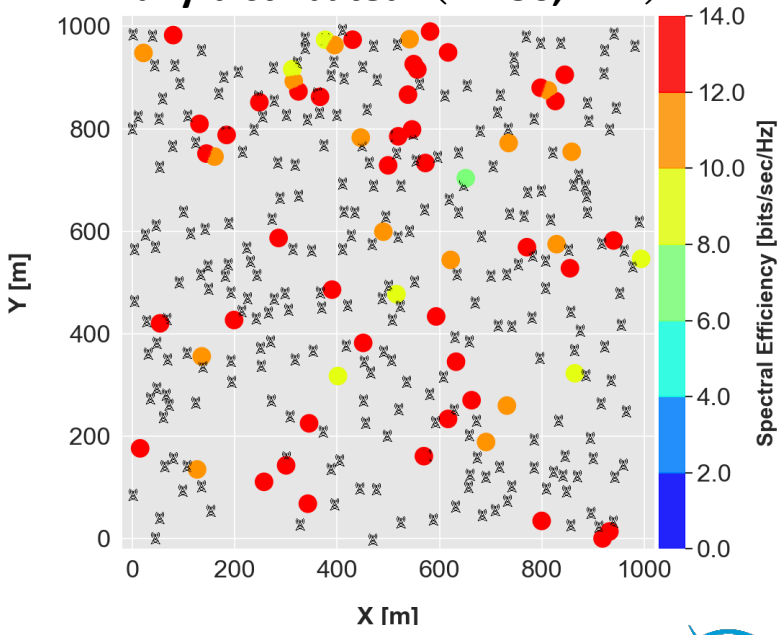
Centralized（L=1, N=256）



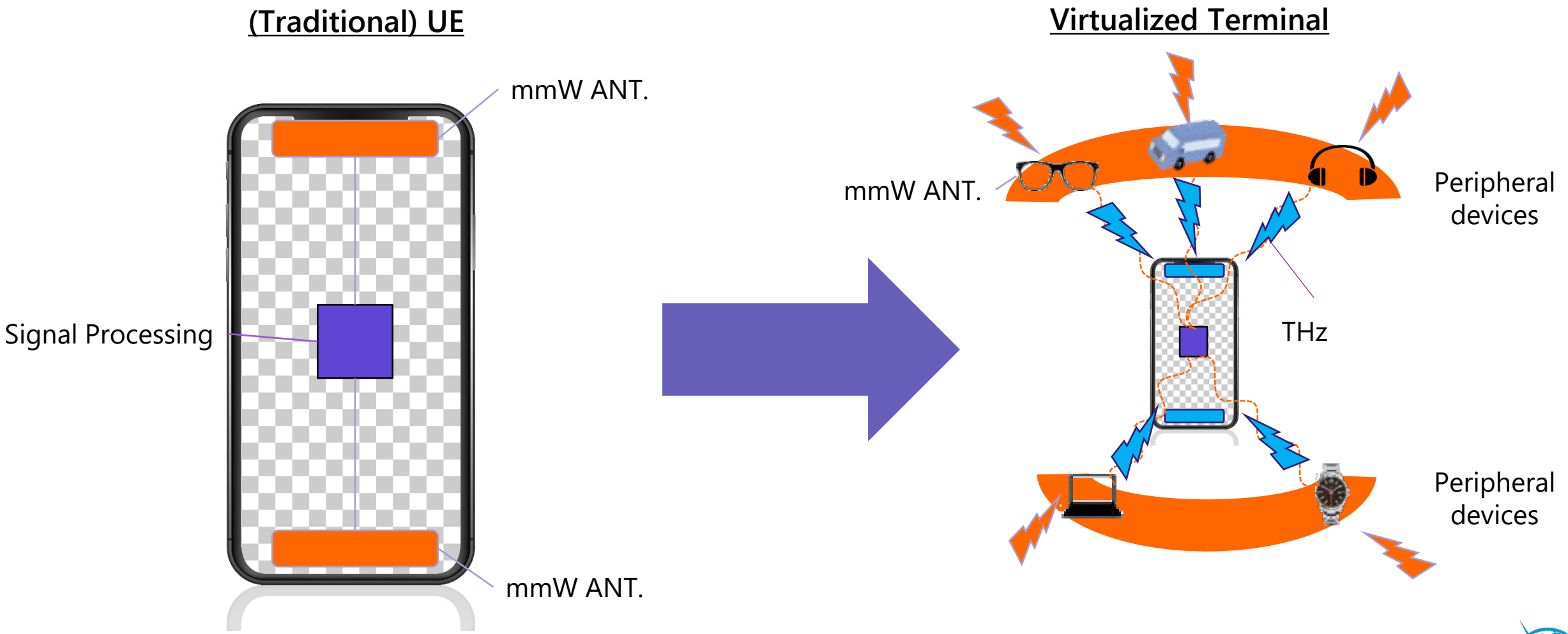
Semi-distributed（L=64, N=4）



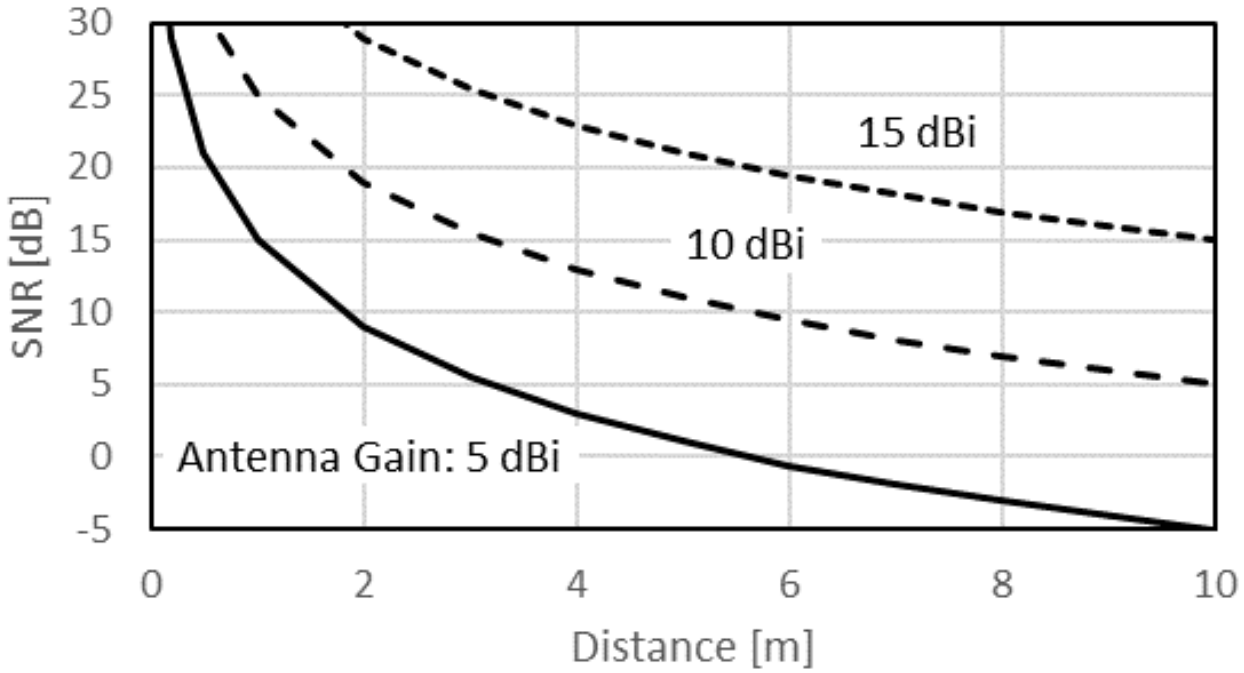
Fully-distributed（L=256, N=1）



Virtualized terminal



Distance characteristics in the terahertz link



Parameter	Value
Carrier frequency	300 GHz
Bandwidth	5 GHz / Peripheral device
Tx power	10 dBm
Propagation Loss	Free-space path loss, Atmospheric and rain attenuation
Noise	Thermal noise (290 K)

Summary

- A new network architecture “User Centric Architecture” has been proposed
  - Cell-free massive MIMO
  - User-centric RAN management
  - Virtualized terminal
- As a next step
  - Feasibility study of above three technologies should be progressed toward 2030

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Thank you!