3GPP RAN#84
Newport Beach/US, 3rd – 7th May 2019

RP-190953

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Views on Release-17

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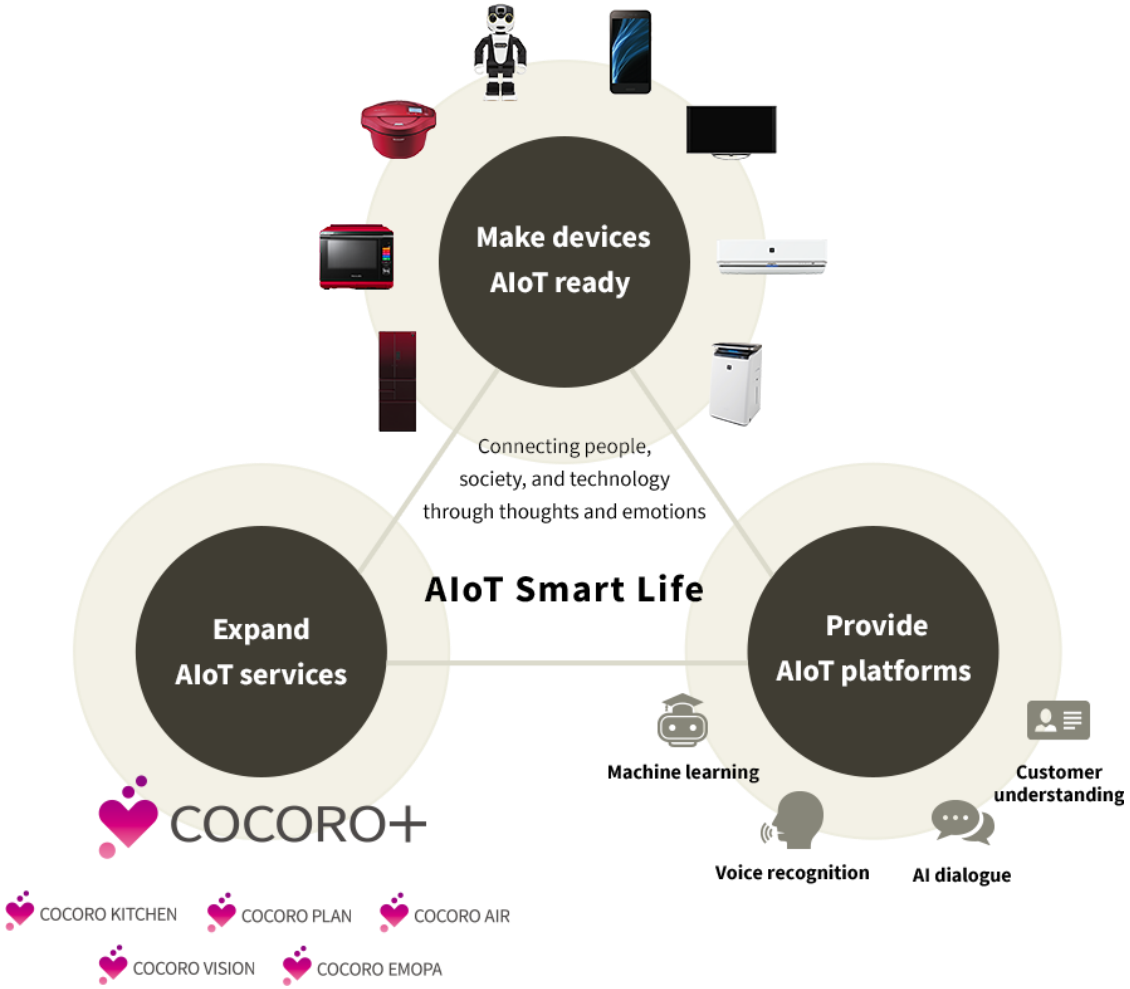
Changing the World with 8K and AIoT

- ✓ Further 5G expansion & efficiency should be targeted, that would cover wider use cases for UHD video and People-Oriented IoT

http://www.sharp-world.com/corporate/8k/



http://www.sharp-world.com/brand/vision/aiot/about/

Potential topics for Release-17

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Continuation works from Release-16 WIs

- Enhanced V2X
- eURLLC/IIoT evolution
- Enhanced positioning
- Enhanced NR-U
- Enhanced MIMO
- Enhanced UE power saving
- IAB evolution

Continuation works from Release-16 SIs

- Beyond 52.6 GHz
- NTN

New topics

- NR based mMTC
- Multicast/ broadcast
- NW energy efficiency
- AI for RAN
- Multi-Usim
- Sidelink for non-V2X

Legend: Vertical | eMBB | Green | Misc.

Sharp's focus

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- Continuation work from Rel-16 Work Items: **eURLLC/IIoT, NR-U, V2X, IAB**
  - ✓ Due to limited time for Rel-16 specification (i.e. squeezed by Rel-15 maintenance), there remains many left-over issues with justified scope
    - In particular, evolution of eURLLC/IIoT should be targeted to accommodate industry network related requirements identified in Rel-16 SA1 work (i.e. cyberCAV)

- Continuation work from Rel-16 Study Items: **Beyond 52.6 GHz**
  - ✓ Wider bandwidth support (e.g. > 400 MHz per CC or > 2 GHz with CA) is necessary for
    - Over-dimensioning system resources in support of URLLC
    - Providing data rates > tens Gbps for High-definition multimedia (e.g. 8K UHD video)
    - Offloading of Low Mobility/High Rate data from macro cell to hot spots
    - Enhanced positioning accuracy at the beam level

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- New Topics for Rel-17: **NR based mMTC**
  - ✓ TSG-RAN #79 decided that NR based solution would not be studied for LPWA use cases. However, industry verticals have shown a desire for NR based mMTC
    - NR based mMTC would provide the IoT platforms that connect AIoT ready devices, resulting in additional value to enterprise, industrial and consumer products and service sectors.

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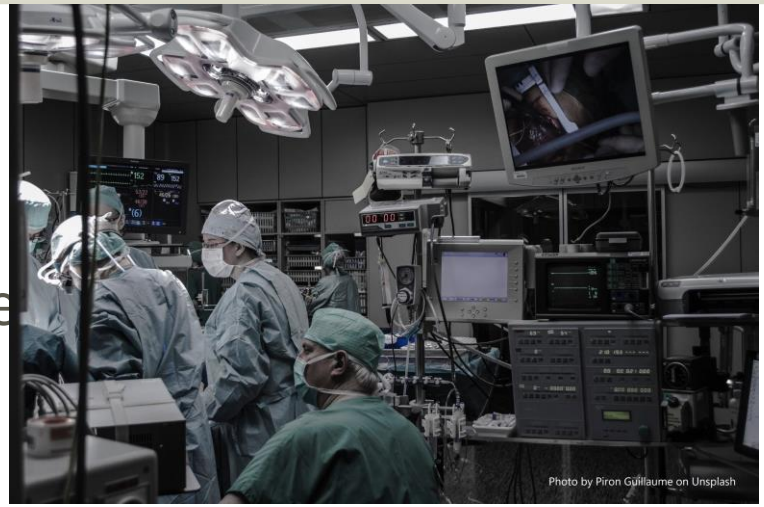
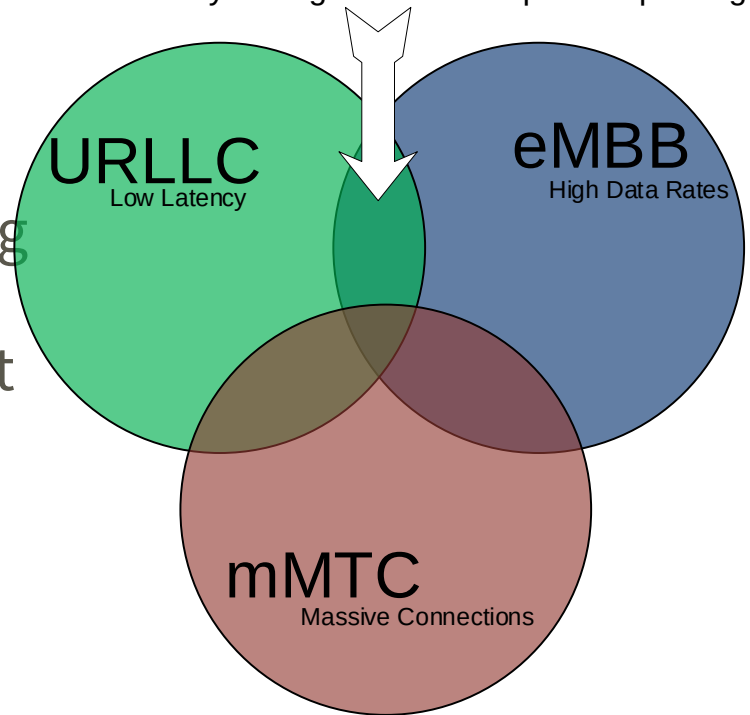
- New Topics for Rel-17: **AI for RAN**
  - ✓ As NR evolves to provide simultaneous support for the primary usage scenarios (i.e. eMBB, URLLC, mMTC), contention in dimensioning the NW resources to serve the overlapping requirements for will need to be addressed.
    - ✓ For example, of 8K- based medical applications require *both* low latency and 10xGBps throughput.
  - ✓ Dimensioning the NR resources to service orthogonal requirements will involve both automatization and optimization of base station processes.
  - ✓ Artificial Intelligence and the associated Machine Learning applied toward the dimensioning of RAN resources can reduce congestion and provide the required QoS of target applications (UHD video streaming in particular).
  - ✓ AI for RAN is necessary for the prediction and detection of localized congestion, and the optimize management of resources towards multiple overlapping use cases.



Intersection of Low Latency and Throughput is demonstrated by 8K high-definition laparoscope surgery



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eURLLC/IIoT evolution

- Enhancement to support remaining Rel-16 service performance requirement in TS22.104, e.g.
  - ✓ Motion control, particularly the one for “control-to-control communication”;
    Reliability 99.99999 to 99.999999%, Latency <=10 ms, Message size 1K byte
  - ✓ Mobile robots;
    Reliability >99.9999%, Latency <=100ms, Message size 15K to 250K byte

Introduce wider support of vertical use cases including industrial and medical applications that cover UHD video

Enhanced NR-U

- Enhancement in support of / related to FR2 and beyond 52.6 GHz bands
  - ✓ E.g., 37-40 GHz band, 64-71 GHz band
- Enhancements enabling NR-U operations to support other Rel-16 features
  - E.g. MR-DC, eURLLC/IIoT, NPN, etc.

The goal is to enable the operation of more applications in unlicensed bands (e.g. Rel-16 features such as IAB)

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Enhanced V2X

- CSI acquisition enhancement, including CQI/RI reporting and/or support of codebook based precoding
- Support beam management at least for FR2, e.g. beam indication / beam reporting / beam failure recovery
- Enhanced cross-RAT management
  - ✓ LTE Uu control of NR SL mode 1
  - ✓ NR Uu control of LTE SL mode 3 (dynamic grant)
- Sidelink for eMBB
  - ✓ Sidelink based relay
  - ✓ Sidelink based coordination at terminals

Enhanced CSI acquisition and improved support for FR2.

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IAB evolution

- Multi IAB-donor routing
  - ✓ Architecture and protocol stack to support multi-routing paths served by multiple donors, and/or route switching between donors.

- IAB-node mobility
  - ✓ Improvements for fast routing/topology adaptation to accommodate node mobility (e.g. nodes deployed in vehicles, trains, etc.)

Enhance deployment flexibility and support new use cases for IAB

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Beyond 52.6 GHz

- Rel-16 study item 'Study on NR beyond 52.6GHz' ongoing
  - ✓ The study includes identification of potential use cases and deployment scenarios, that cover :
    - A) High data rate eMBB: Ultra-High Definition display, multi-view High Definition display, immersive video conferencing, etc.
    - B) Short-range high-data rate D2D communications: monitor 8K UHD docking
    - C) AR/VR headsets and other high-end wearables with uncompressed UHD
    - D) Wireless Display Transfer: AR/VR headsets, video distribution screens

Cf) Rel-17 stage-1 is ongoing as well, for some new services including:

- Communication Services for Critical Medical Applications (FS_CMED)
- Network Controlled Interactive Services (NCIS)

<u>Observation:</u> Strong demand on 8K UHD, including uncompressed case that result in **tens Gbps data rate**

ex) Video uncompressed streams 4320p(8K) requires the order of 40 Gbps (*1)

(*1) TR26.925v0.3.0, table2 indicates 36.103 / 43.280 Gpbs for uncompressed bitrate (50/60 fps with YcbCr 4:2:2 10b)

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Beyond 52.6 GHz (cont'd)

- Determined potential of NR through assessment on self-evaluation:
  - ✓ In theory, NR achieves IMT-2020 requirement for peak data rate i.e. DL 20 Gbps / UL 10 Gbps using around 1GHz bandwidth
  - ✓ To realize the order of 40 Gbps, it requires roughly **2 GHz** bandwidth or more
- Rel-16 supports band-combination with 1.6 GHz as maximum aggregated bandwidth (*2)
  - ✓ Even with FR2, to support 2 GHz aggregated bandwidth is quite challenging
    - For some application, visually lossless compression for UHD like Display Stream Compression (DSC) can be applied with compression ratio of 1/3, however that needs further study in SA4
  - ✓ Introduce bands beyond 52.6 GHz ease the situation, it makes RF component implementation as manageable level

    ex) for 2GHz, relative bandwidth to 60 GHz carrier bandwidth equals roughly 3.3 %

Introduce wider bandwidth support by NR beyond 52.6 GHz, targeting tens Gbps data rate for 8K UHD

(*2) TS38.101-2v15.5.0, table 5.5A.2-1 indicates CA_n260(4A) with 120 kHz SCS enables 1600 MHz

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NR based mMTC

- Low cost
  - ✓ Bandwidth reduction for RF and baseband; cf) mandatory bandwidth for Release 15 UE is 100 MHz in FR1
  - ✓ Decreased number of Antenna ports ; e.g. 1 port is supported by LTE MTC / NB-IoT
- Power consumption reduction
  - ✓ WUS will be specified for C-DRX in Rel-16
  - ✓ WUS for mMTC UE in idle state
- Coverage enhancement
  - ✓ Enhanced reception of SSB
  - ✓ Repetition for Random access/PDCCH/PDSCH/PUCCH/PUSCH
  - ✓ Potential support for FR2 or bandwidth beyond 52.6 GHz

Provide cost/power efficient access using NR, to respond strong demand by industry verticals

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- Initial RAN specification should be limited to measurements and control signaling
  - ✓ The goal is to optimally dimension NW resources
    - Adaptive cell construction/deconstruction
    - Adaptive optimal resource allocation
    - Adaptive process that is agnostic to mix of eMBB, URLLC, mMTC

3GPP should adopt new trends in Information and Computer Technology to enhance the scope of NR