3GPP RAN Workshop on 5G
Phoenix, USA, September 17 – 18, 2015

RWS-150049

Sharp's 5G Views and Technologies

Sharp Corporation

Agenda Items

IMT-2020 and Sharp's View on 5G Requirements

Proposed Schedule for 5G Standardization

- Shorter Duration of each release
- Phase approach of 5G standardization
- Details of SIs/WIs

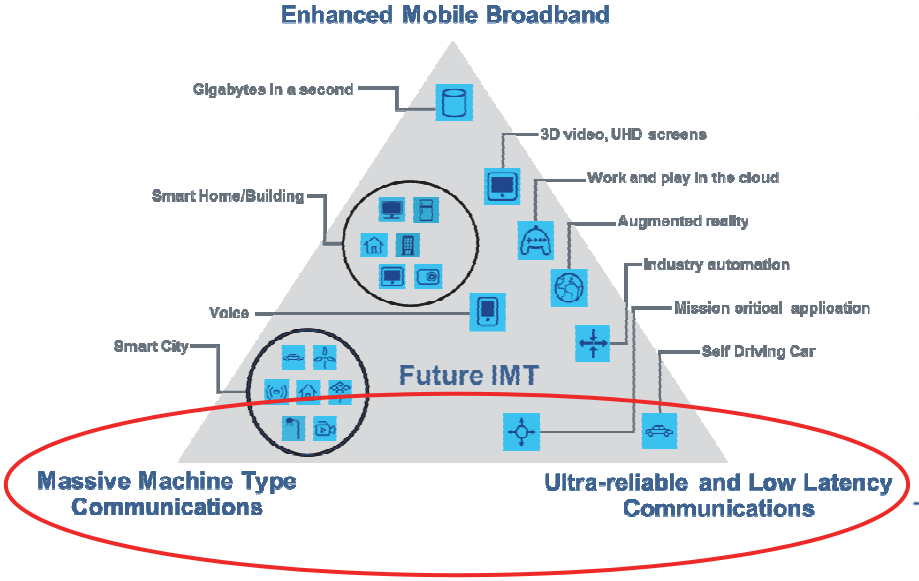
Specific Use Cases and Required Technical Enhancements

- To support future IoT businesses:
  - Massive MTC
  - Ultra-reliable/Ultra-realistic MTC
- eMBB enabled by Enhanced LTE and New RAT

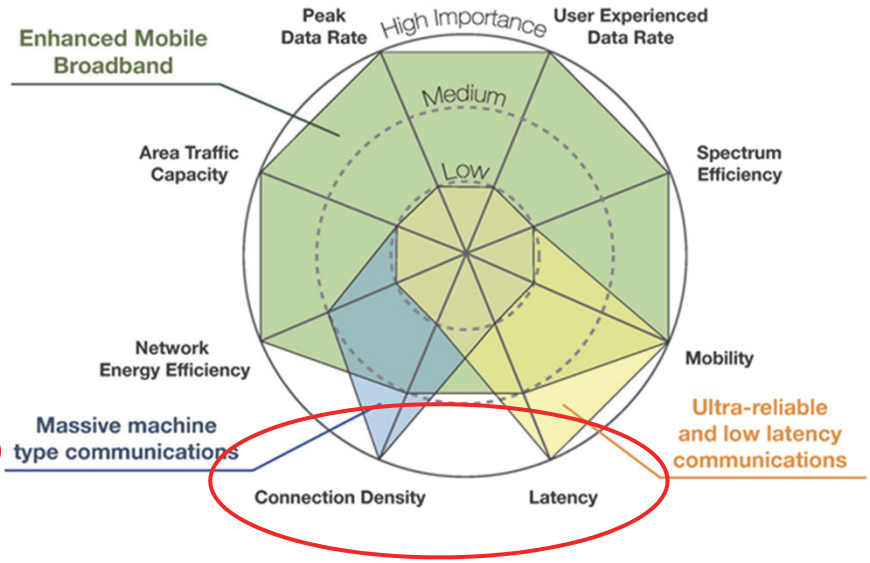
IMT-2020 and Sharp's view on 5G Requirements

Requirements for 5G (from ITU-R)

Usage scenarios



Key capabilities



Sharp's view on Use cases:

Not only eMBB but also

- Massive MTC
- Low Latency services
- Ultra-reliable comm.

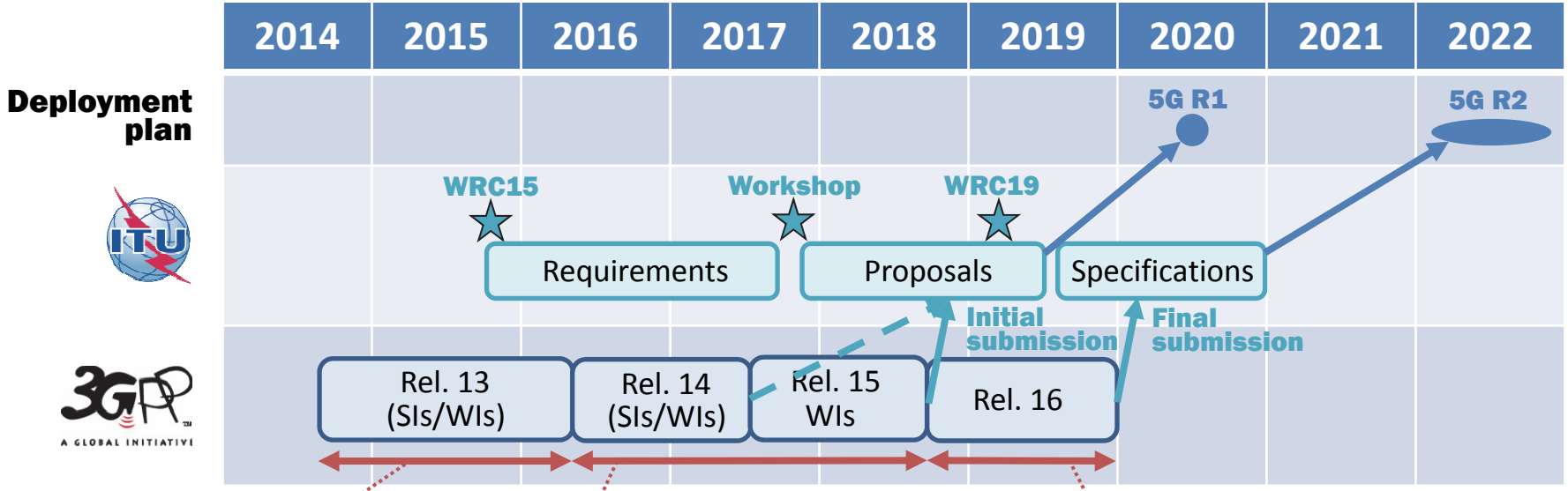
are the key 5G services

Sharp's view on 5G Key requirements

- High Connection Density
- Low Complexity and Energy Saving
- Latency Reduction

Proposed Schedule for 5G Standardization

–Phase approach and Shorter Duration



Phase 0

Several current SIs/WIs have close relation to 5G.

Phased approach is preferable considering the deployment plan in 2020 and the IMT-2020 specifications

Phase 1

WIs in Rel-14 and R-15 are the "5G R1 (Release 1)" **for initial submission** and the initial 5G deployment.

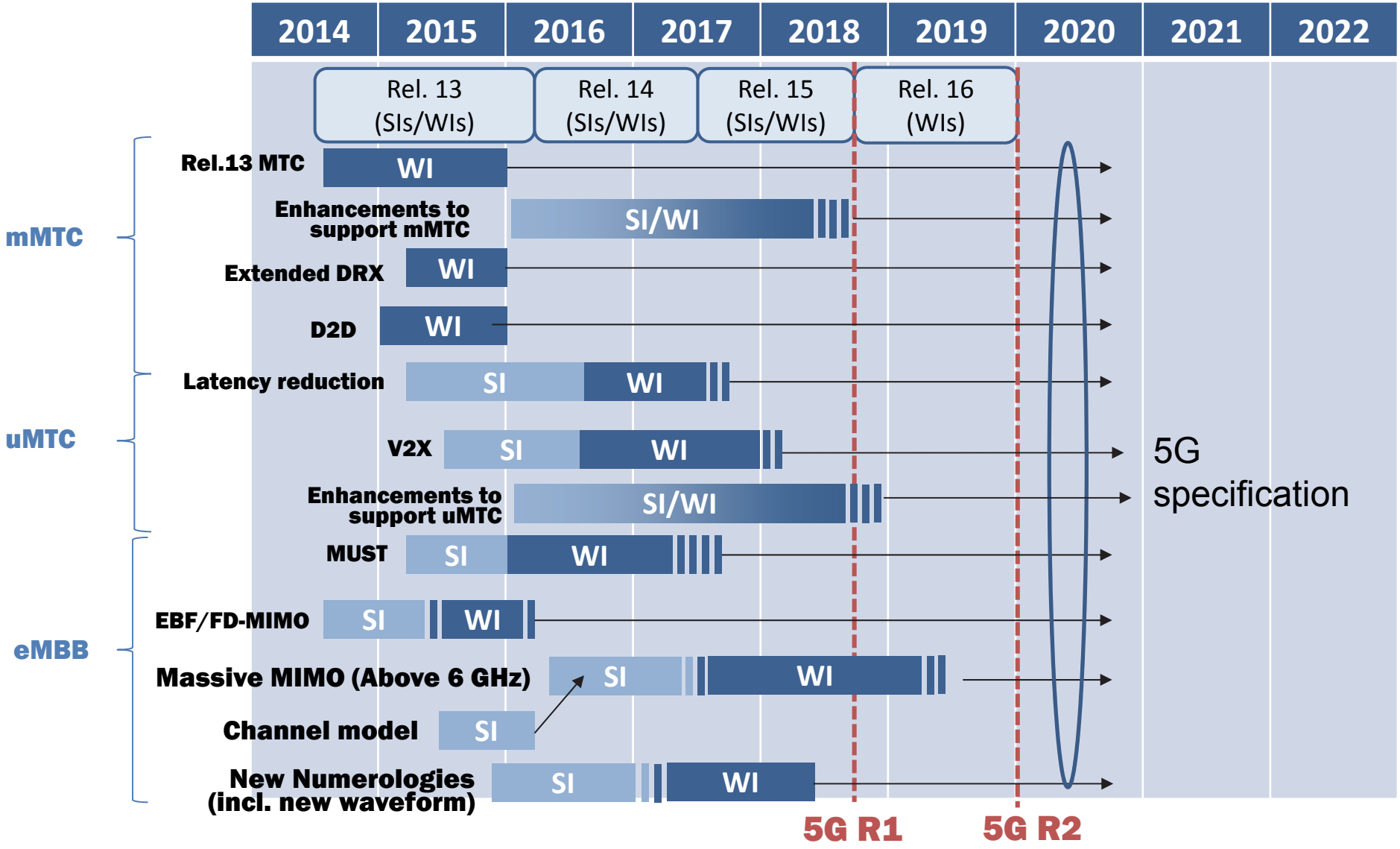
Sharp proposes to shorten the work time of each release to 15 **months**

Phase 2

WIs in Rel-16 is the "5G R2 (Release 2)" **for final submission** to "IMT-2020".

Work time of this release is also 15 months considering the deadline of submission to ITU-R

High Level Schedule for 5G specification



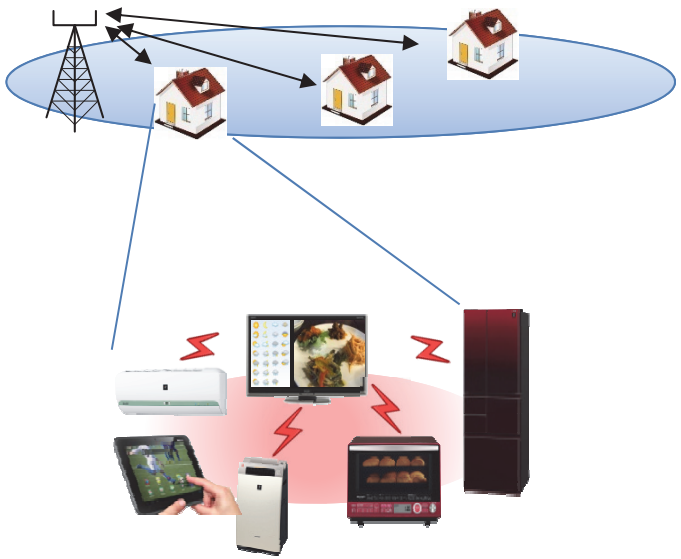
Specific Use Cases and Required Technical Enhancements

Massive MTC - mMTC

Massive MTC

Use cases

- Home appliance connectivity



- Smart meters

Requirements

- Further Low complexity
- Connectivity with minimum UE cost
- Massive device connectivity

Candidates for Tech. enhancements

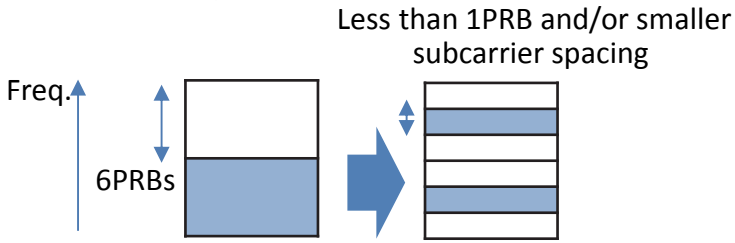
- Further Low complexity MTC

DL

-Narrower downlink bandwidth transmission (e.g., 1PRB)

UL

-Narrower uplink bandwidth transmission and lower max. TX power



- Non-Public Safety D2D

Ultra-reliable/Ultra-realistic MTC - uMTC

Ultra-reliable/Ultra-realistic MTC

Use case 1:

- Ultra-realistic communication

4K/8K Movie

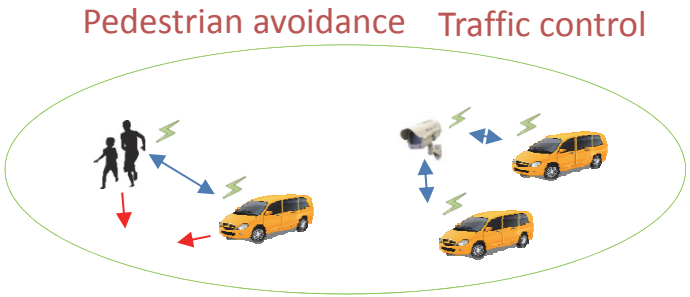
40~70Mbps@8K

"Virtual" exceeds "Real" with 1ms latency

- Remote operation
- Medical robot
- Video surveillance

Use case 2:

- Enhanced V2X
  - Pedestrian avoidance
  - Traffic control
  - Autonomous/self driving vehicles

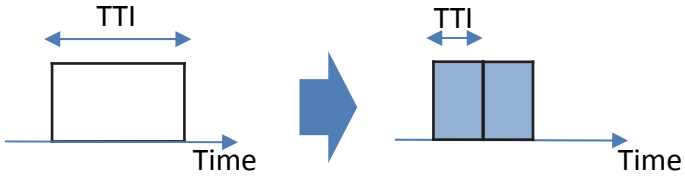


Requirements

- Low latency with Low - Middle data rate
- High quality/reliability

Candidates for Tech. enhancements

- Wider band & Shorter TTI support



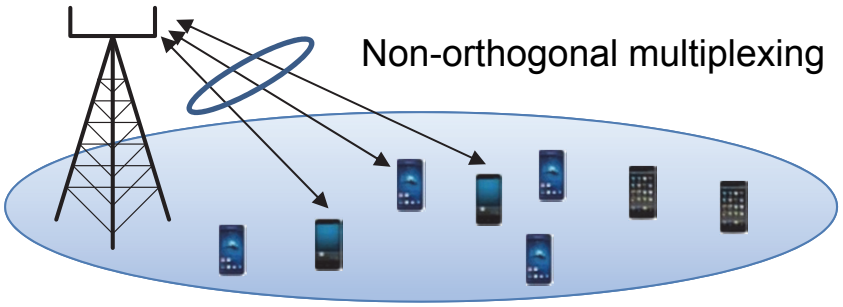
- Enhanced V2X

eMBB enabled by Enhanced LTE and New RAT

To meet 5G requirement, Integrated use of "Enhanced LTE" and "New RAT" should be the first target

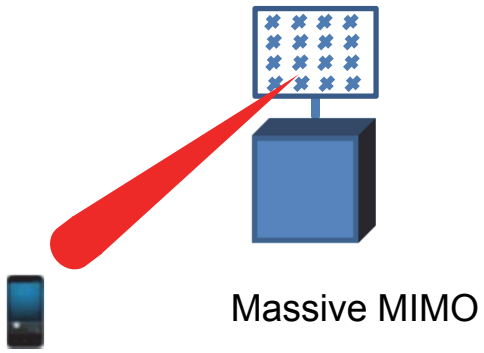
Enhanced LTE

- **Non-orthogonal multiple access**
  Rel.13 MUST is a candidate
  Uplink non-orthogonal multiple access
- **EBF/FD-MIMO**



New RAT

- **Scalable TTI based on the frequency band**
  Wider/smaller subcarrier spacing
- **New Numerologies (i.e., PHY parameters)**
  New waveform (Filter-bank multicarrier (FBMC), etc.)
  Shorter CP, Zero-padding OFDM, etc.
- **Massive MIMO in higher frequency band**



Conclusions

Sharp's priorities for 5G

- Support of IoT related functionalities
  - Massive device connectivity
  - Minimal UE complexity
  - Ultra-reliable/realistic communications
  - Low latency at low - middle data rates

Proposed Schedule for 5G standardization

- Phase 0: Forward compatibility in Rel. 13 works
- Phase 1: Rel. 14 and Rel. 15
  5G phase 1 for initial submission to ITU-R
- Phase 2: Rel. 16
  5G phase 2 for the final submission to ITU-R

Main Technical Enhancements

- Enhancements to support of both mMTC and uMTC
  - For mMTC:
    - Further enhancements from Rel.13 MTC, eDRX
    - Non-Public Safety D2D
  - For uMTC:
    - Low latency with low-middle data rate
    - Enhanced V2X
- "Enhancements of LTE" and "new RAT" for eMBB

SHARP