3GPP TSG RAN Rel-18 workshop
Electronic Meeting, June 28 - July 2, 2021
Agenda: 4.3
Document for: Discussion

RWS-210390

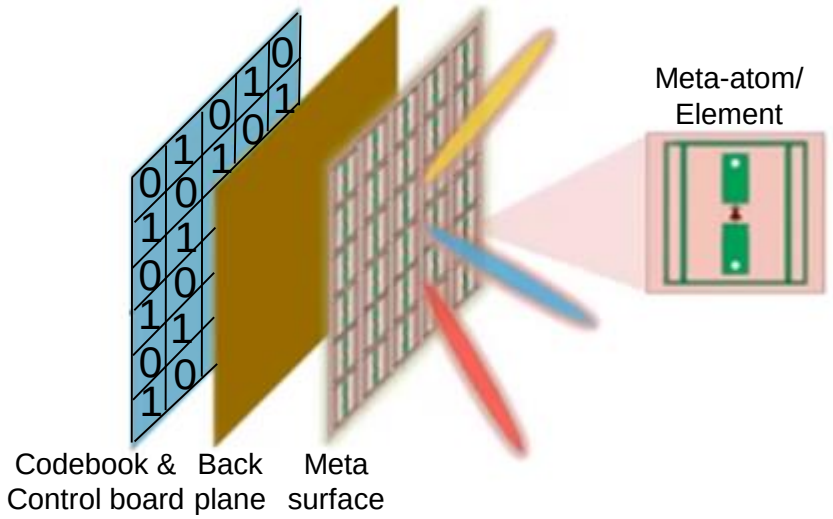
China unicom中国联通
创新·与智慧同行

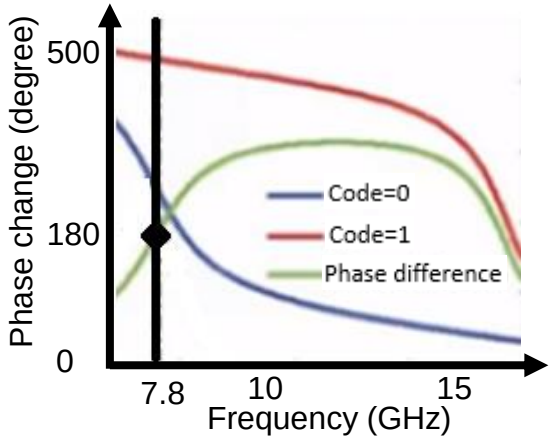
Motivation paper for RIS requirement in 5G-advanced

Source: China Unicom, ZTE

Overview of RIS

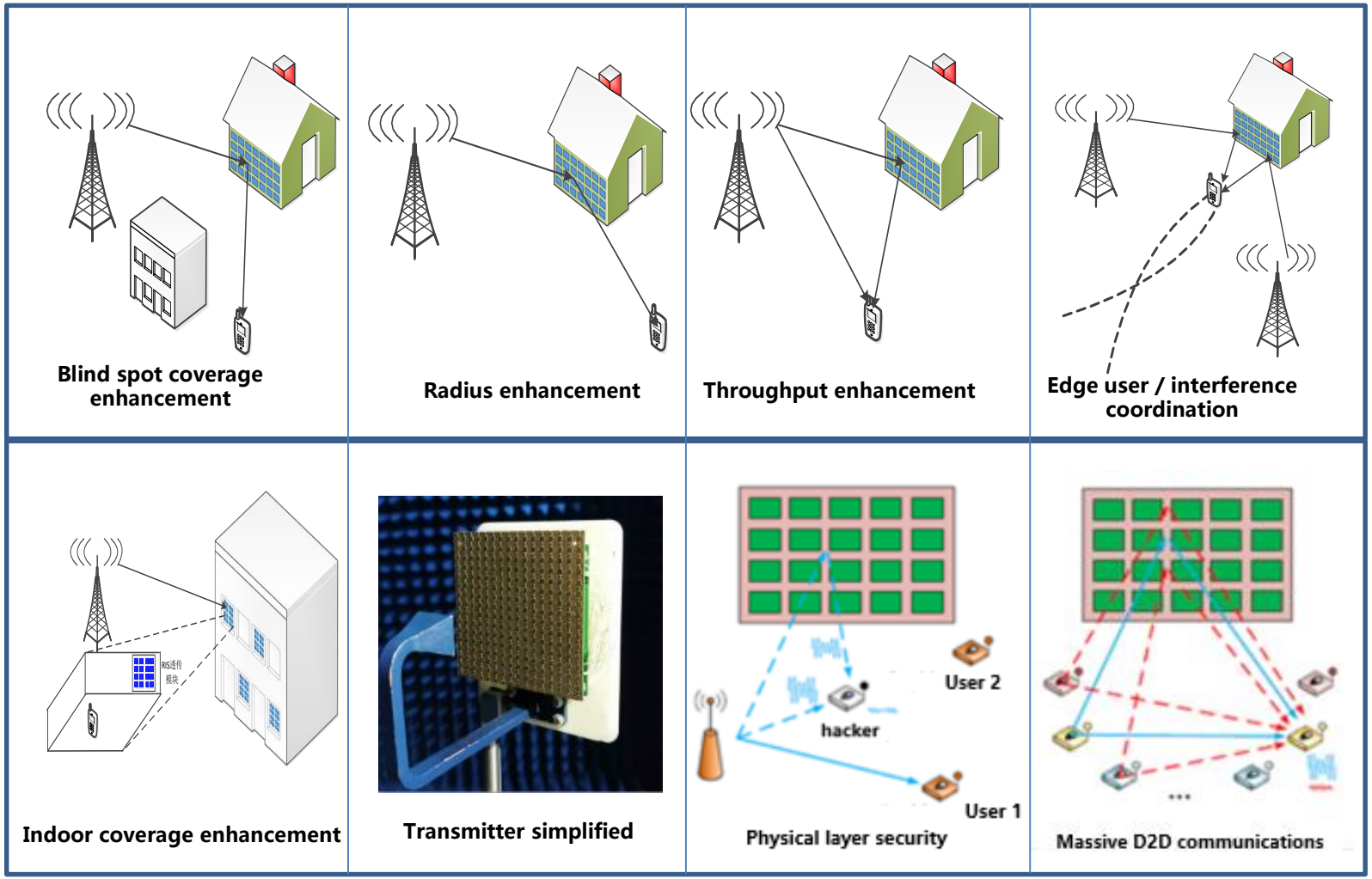
- RIS(Reconfigurable Intelligent Surface) is a kind of digitally-controlled meta surface with massive low-cost meta-atoms (elements).
- Each element may induce different amplitude/phase/frequency/polarization change in the incident signal with different codebook on control board.





Scenarios

- Typical reflection scenarios of RIS:
  - Coverage enhancement
    - Blind spot coverage enhancement
    - Interference coordination
    - User at cell edge
  - Throughput improvement
  - Indoor coverage enhancement
  - Physical layer security
  - Low cost and power transmitter
  - Others：
    - D2D communications
    - High precision positioning



Motivation

- Higher frequency band may cause some issues for NR, including extra blockage loss, a smaller coverage radius, high energy consumption, increment of CAPEX and OPEX, etc.

- RIS is a novel technology to construct radio environment by deploying a programmable surface.
  - NLOS paths are constructed to reduce blind coverage when LOS path is blocked.
  - RIS works similar as relay to extend coverage radius.
  - Multiple paths are constructed to obtain distributed MIMO gain.
  - Transmitter is simplified with less antennas.
  - Compared with base station and relay, RIS is deployed with less energy consumption, higher data volume, relative low cost, etc.

Motivation

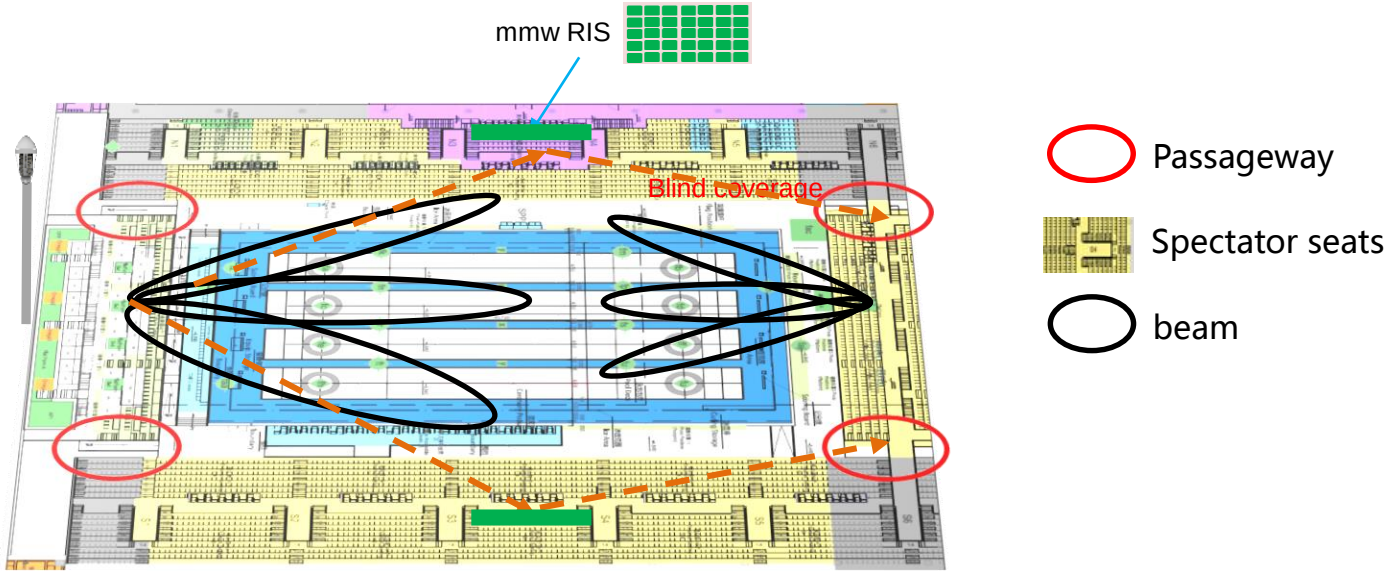
- According to TR 38.901, the path loss of 28GHz mmWave is ~18dB larger than 3.5GHz with the same assumption.
- Transmission loss blocked by concrete, tree, body and glass are
  - Above 10dB for mmWave, above 5dB for 3.5G except glass
  - Average reflection loss is about 5dB

Material	3GPP transmission loss model	mmWave loss[dB]	mmWave test value[dB]	3.5G test value[dB]
Concrete	$L_{concrete}=5+4f$	125-1205	>30-40	23
Tree	——	——	16-20	7.4
Body	——	——	11-28	10.6
Glass	$L_{glass}=23+0.3f$	32-113	17-23	2.7
Note: *f*(GHz)				

Reflection	mmWave[dBm]	3.5G[dBm]
baseline	-70.8	-49.7
1st	-75.0	-55.2
2nd	-80.7	-56.1
3rd	-83.4	-63.7

Motivation

- mmw trail scenarios in the stadium cooperated with RIS:
  - mmw gNBs are deployed to ensure the coverage of racetrack and media interview area.
  - Passageway are blind coverage area with deep blockage.
  - RIS is deployed to extend the coverage of mmw.



Objective

- The objectives of the motivation paper are listed as follows:
  - Study typical scenarios of RIS applied in 5G-advanced.
    - e.g., indoor, dense urban, etc.
  - Study methodology for channel modeling, etc.
  - Other potential impacts
    - e.g., beam management, CSI enhancement, control interface between gNB and RIS, RACH enhancement, interference coordination.