3GPP TSG RAN Meeting #101
Bangalore, India, September 11-15, 2023

RP-232583

Channel Modelling

Agenda item: 8A.2.11
Sourced by: **CEWiT, IIT-K, IIT-H**, IIT-M

Reconfigurable Intelligent Surface (RIS)

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Background

- RIS is a reflecting surface capable of performing passive beamforming
  - Surface comprises of many passive reflecting elements (meta-elements)
  - Reflects the incident radio frequency (RF) beam in a desired direction depending on a beamforming weight matrix
  - Low-cost solution (cost lower than repeaters) primarily for coverage extension
  - Other use cases comprises energy saving/transmit power reduction at gNB, interference mitigation, etc.
  - Other advantages are low energy consumption, ease of deployment, etc.

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Motivation

- RIS is an effective solution for extending coverage especially in blockage scenarios
- Extensive research, both hardware and implementation, has been conducted
- The Rel. 18 work on Network Controlled Repeater (NCR) can be taken as baseline for studying RIS

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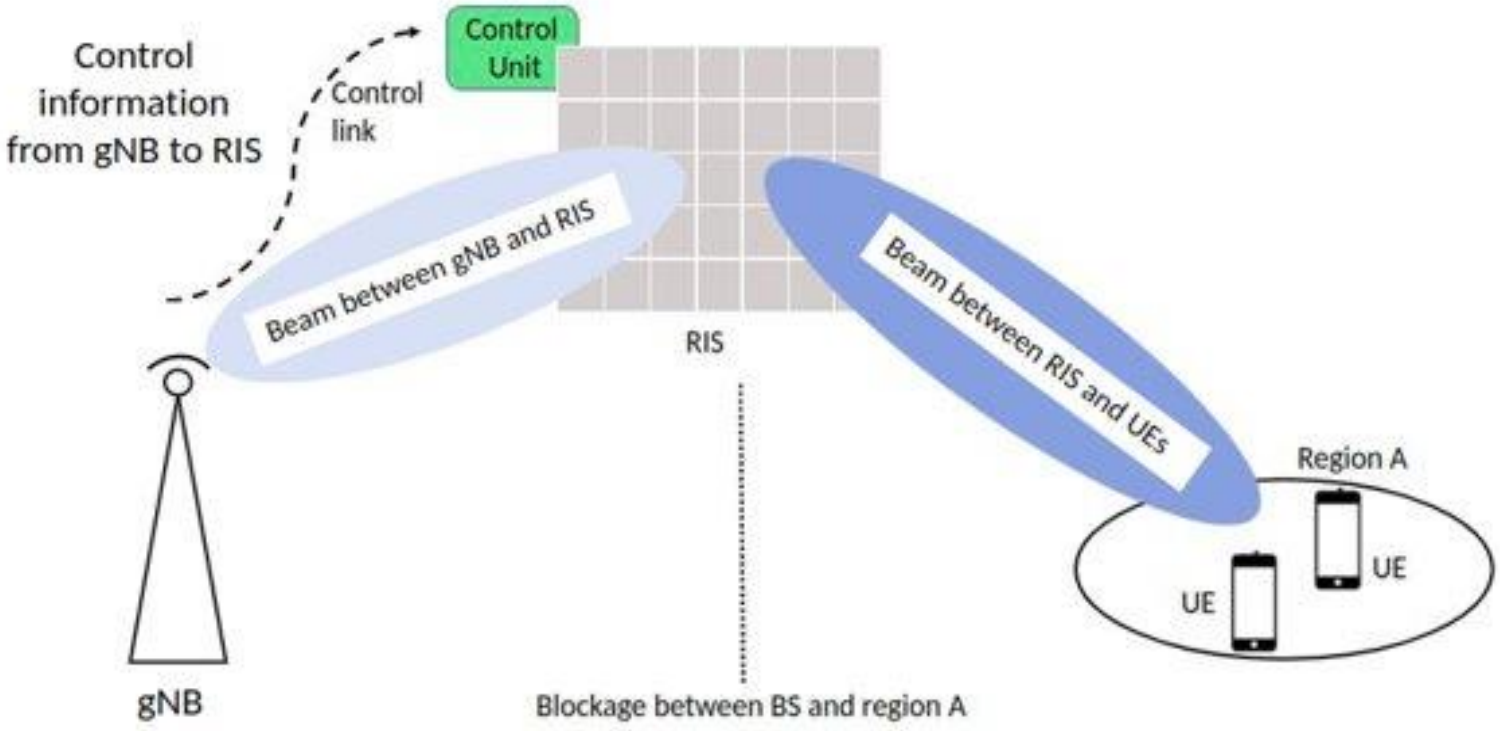
Architecture of RIS

- The architecture of NCR, agreed in Rel. 18, can be the base line for defining architecture of RIS

- RIS comprises
  - Control unit: Receives control information from the gNB and controls the beamforming and reflections at the meta-surface
  - Meta-surface: Comprising meta elements that can passively beamform in certain direction and reflect the RF signals incident on it



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Channel Modelling for RIS

- Channel model in TR 38.901 is not sufficient to capture the following
  - RIS consists of passive reflective elements unlike active antenna arrays
  - RIS can be considered as a “controlled cluster” in the environment
  - Channel model can vary based on far field and near field considerations

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Proposals for RIS

- A Study Item on channel modeling for RIS is proposed for Rel. 19
  - Impact of far/near field, indoor/outdoor scenario
  - Performance gains in different scenarios (e.g., indoor/outdoor)
  - Interference in multi-operator scenario

- In addition, a study on following aspects of RIS is proposed for Rel. 19
  - Architecture of RIS
  - Cost effectiveness and complexity
  - Identification of RIS in a network
  - Capabilities of RIS
  - Identification of control information required for RIS Configuration

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Joint Sensing and Communications (JSAC)

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Motivation

- JSAC increase efficiency
  - Using same spectrum -> improves spectral efficiency
  - Reuse (fully/partially) existing hardware
  - Reuse same transmit signals

- High bandwidth availability and employing multiple antennas improve accuracy of measurements in sensing

- Potential use cases
  - v2X, Smart city, Smart home, HAPS

- Sensing and communication can aid each other

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Channel model for JSAC

- Sensing involves two way links
  - Sounding device to target
  - Target to sounding device
- Amplitude of reflected echo depends on Radar Cross Section (RCS) of the target
- Clutter in the environment needs to be modelled
- Channel model depend on use case of interest
  - Detection of a device requires coarse channel estimate
  - Identification of a device require precise channel estimate
- TR 38.901 does not capture the above aspects

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Channel model for JSAC

- Channel parameters depend on
  - Sensing mode: mono static sensing or bi static sensing
  - Downlink based sensing or uplink based sensing
  - RCS of the target
  - Use case of interest

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Proposals for JSAC

- Proposal 1: Support study of potential channel models for JSAC that consider the sensing mode, characteristics of transmitting node, target, use case and the clutters in environment.

- Proposal 2: Channel model in TR 38.901 to be considered as a baseline

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Summary of Proposals

- A Study Item on channel modeling for RIS is proposed for Rel. 19
  - Impact of far/near field, indoor/outdoor scenario
  - Performance gains in different scenarios (e.g., indoor/outdoor)
  - Interference in multi-operator scenario
- In addition, a study on following aspects of RIS is proposed for Rel. 19
  - Architecture of RIS
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  - Identification of RIS in a network
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  - Proposal 1: Support study of potential channel models for JSAC that consider the sensing mode, characteristics of transmitting node, target, use case and the clutters in environment.
  - Proposal 2: Channel model in TR 38.901 to be considered as a baseline

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Thank you