

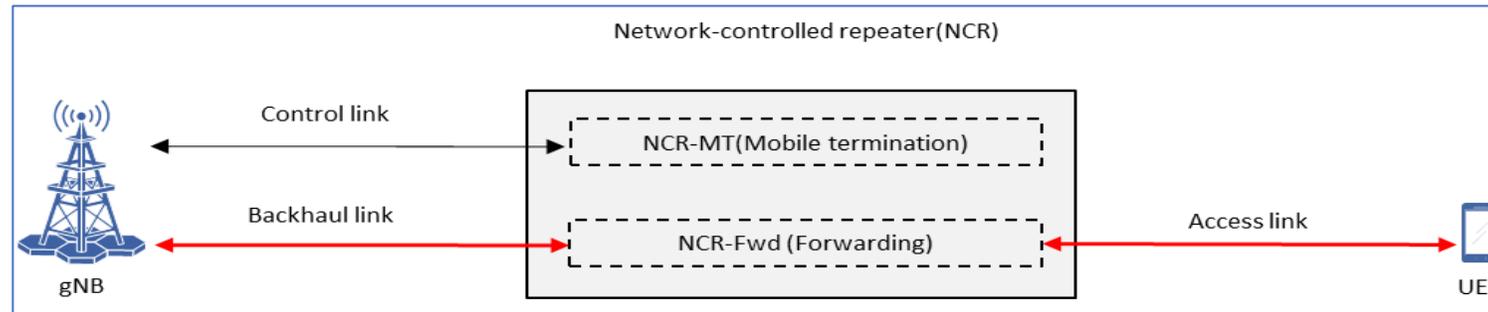
Additional RAN2-led Topics: NCR Enhancements



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Motivation and Summary for NCR enhancements in Release-19



System model of Network-controlled repeater (source: 3GPP TR 38.867 v1.0.0, 5th September 2022)

- A basic version of Network Controlled Repeater (NCR) was standardized in Rel-18.
- However, there were some constraints imposed and some features were not discussed due to shortage of time units.
- Various companies proposed enhancements to NCR in Release-19 workshop and RAN#101 meeting.
- Based on Moderator's summary in the RAN#101 meeting, we propose to have the following enhancements to NCR in Release-19.
- However, given the enhancements required and company proposals, it should be **RAN1-led item**

Proposals for NCR enhancements



- **Proposal 1: NCR enhancements should be RAN1-led item**
- Multi-Carrier and Frequency selective operation of NCR-Fwd
 - Release-18 NCR is inband repeater and complete carrier bandwidth is constrained over a single beam.
 - For efficient scheduling of multiple users in frequency domain, beam configuration and On-OFF configuration should have flexibility to be configured for per sub-band within a carrier.
 - E.g., Single backhaul beam receives complete carrier, and different beams from NCR to UE for different frequency sub-bands.
 - Multiple (13) companies support multi-carrier operation of NCR in RAN#101 meeting:
 - For the multi-carrier support for NCR-Fwd, NCR-MT will operate in a single carrier, but it should be configured to apply side-control information (SCI) for different carriers of NCR-Fwd.
 - **Proposal 2: Enable NCR to support sub-band beam configuration and On-OFF configuration.**
 - **Proposal 3: Enable NCR to support multi-carrier operation.**
- Feedback of SCI from NCR to gNB
 - Feedback of dynamic SCI received in PDCCH is essential for efficient operation of NCR.
 - E.g., if NCR fails to decode dynamic SCI, then the UEs served by the NCR will suffer
 - **Proposal 4: Enable NCR to support feedback of dynamic SCI received using PDCCH**
- Dynamic OFF state of NCR-Fwd
 - Release-18 NCR deprioritized discussion for dynamic OFF state due to shortage of TU
 - Indicating dynamic OFF for NCR-Fwd is essential to save power when the scheduled periodic/semi-static signals are not required.
 - **Proposal 5: Enable NCR to support Dynamic OFF indication**

Proposals for NCR enhancements (continued..)



- UE detection ambiguity problem
 - With Release-18 NCR, there is no mechanism to detect which UEs are in coverage of NCR. This leads to restricted scheduling by the gNB.
 - Consider the given figure: A gNB is broadcasting n SSBs beams. There are two UEs, one in the coverage area of gNB but not the NCR, and the other in the coverage area of NCR. Both these UEs report the measurements for SSB-k.
 - However, the SSB-k transmitted by gNB and the SSB-k forwarded by NCR can be in a different direction.
 - The gNB has no way of knowing where the UEs are located.
 - Time-frequency resource scheduling and beam configuration of signals intended for different UEs will be restricted.
 - **Proposal 6: Enhancements to NCR configuration to resolve UE detection ambiguity problem.**

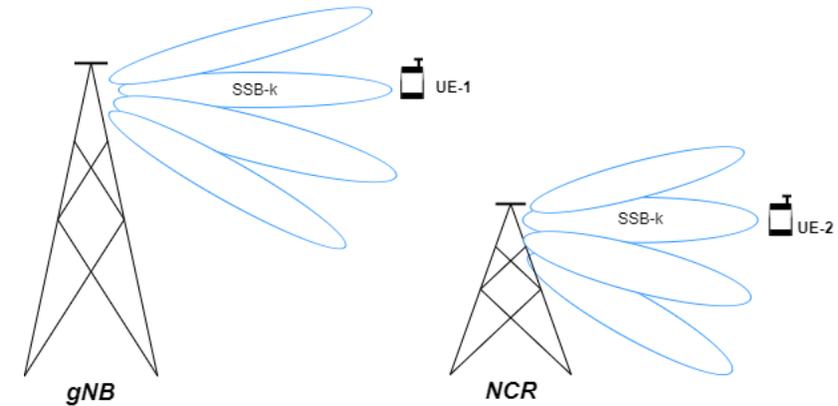


Figure 1: UE connection ambiguity problem

Conclusion



Below is a summary of proposals for NCR enhancements in Release-19:

- **Proposal 1: NCR enhancements should be RAN1-led item**
- **Proposal 2: Enable NCR to support sub-band beam configuration and On-OFF configuration.**
- **Proposal 3: Enable NCR to support multi-carrier operation.**
- **Proposal 4: Enable NCR to support feedback of dynamic SCI received using PDCCH**
- **Proposal 5: Enable NCR to support Dynamic OFF indication**
- **Proposal 6: Enhancements to NCR configuration to resolve UE detection ambiguity problem.**