



3GPP TSG RAN Rel-19 workshop
Taipei, June 15 - 16, 2023

RWS-230462

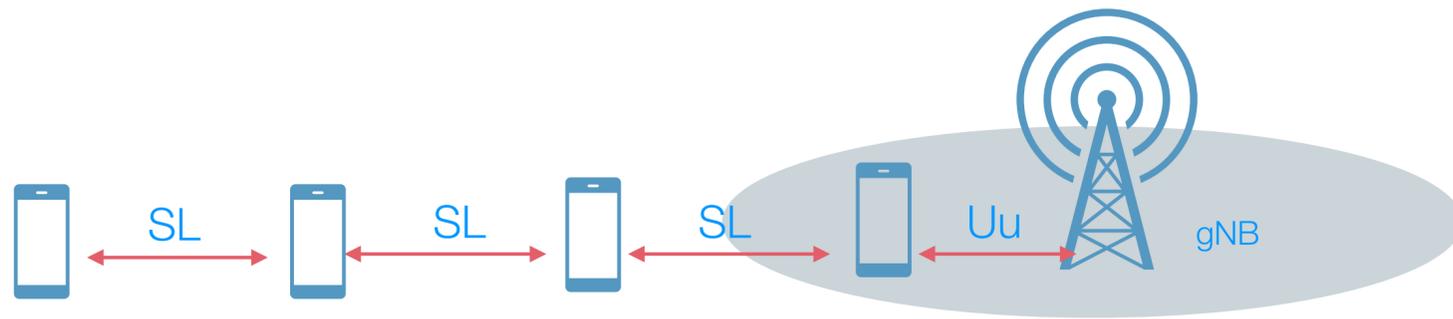
Source: Apple
Agenda Item: 5

View on Further enhancements on SL Relay in Rel-19

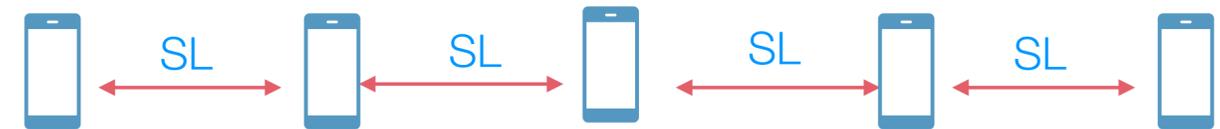
Apple

Sidelink Relay | Multi-hop Relay (1)

- To handle deep coverage holes, **multi-hop relays** need to be supported.
 - Crucial to public safety use case(s).
- **Design considerations:**
 - Both Layer 3-based and Layer-2 based designs can be considered.
 - Try to use R17/R18 single hop U2N and U2U relay solution as baseline(s)
 - Scalability of the multi-hop solution needs to be studied, in regards of number of hops
 - e.g. avoid the non-linear growth of signaling overhead with the linearly increasing number of hops.



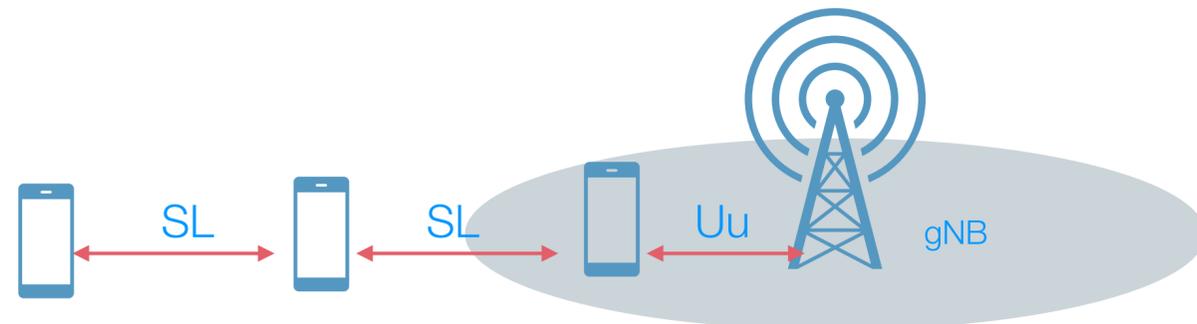
Multi-hop U2N



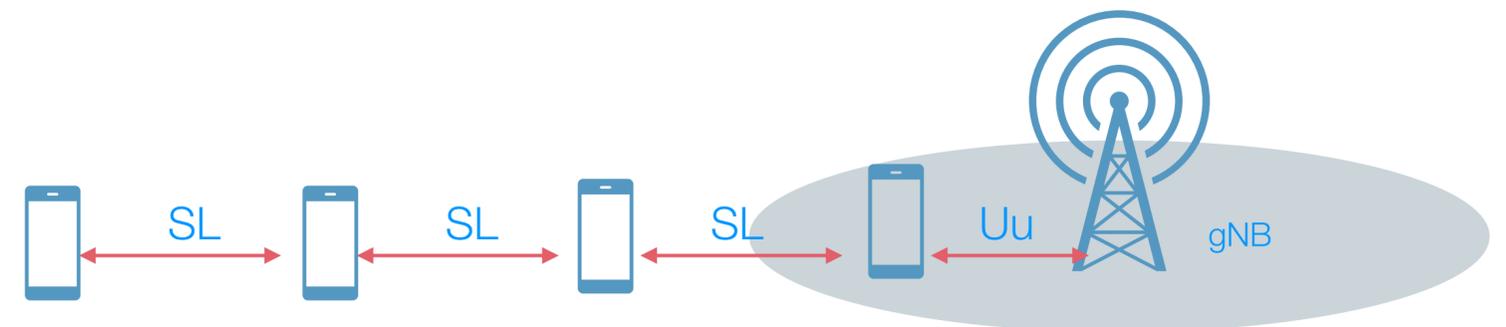
Multi-hop U2U

Sidelink Relay | Multi-hop Relay (2)

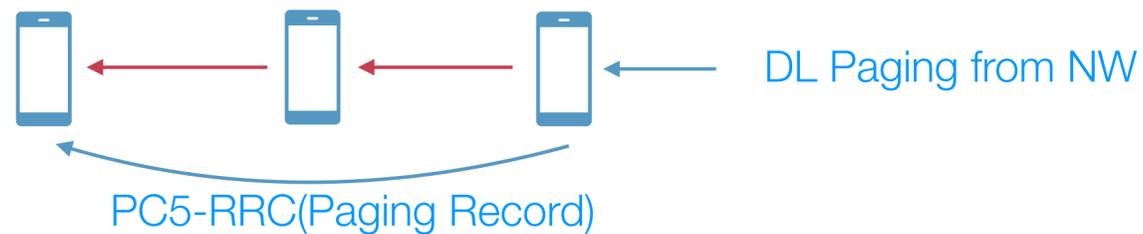
- Layer-2 Multi-hop UE-to-NW relay design depends on Layer 2 UE-to-UE relay
 - For an in-coverage UE-to-NW relay UE in multi-hop, it is responsible to deliver the SIB/Paging to a U2N remote UE multiple hops away.
 - End-to-end *PC5-RRC* message to deliver the SIB/Paging need use multi-hop L2 UE-to-UE relay mechanism.
- **Observation: Support of *N-1 hop* L2 UE-to-UE relay is needed for *N-hop* L2 UE-to-NW relay**
 - Both multi-hop UE-to-NW relay and UE-to-UE relay are considered in Rel-19.



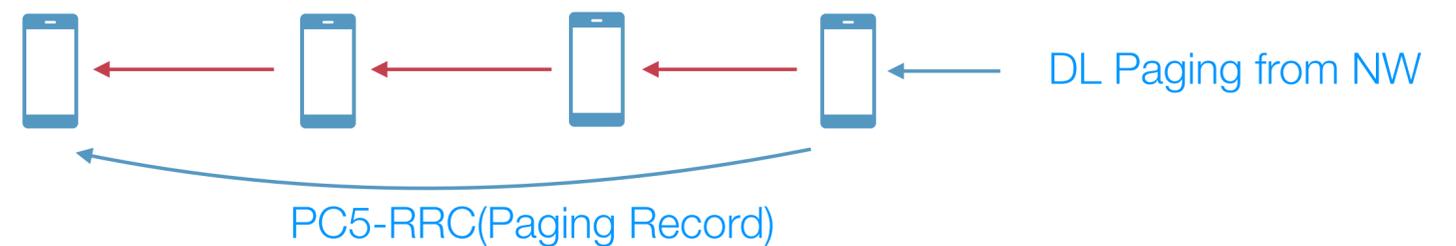
Rel-19 Two-hop U2N (Layer-2)



Rel-19 Three-hop U2N (Layer-2)



Rel-18 Single-hop U2U (Layer-2)

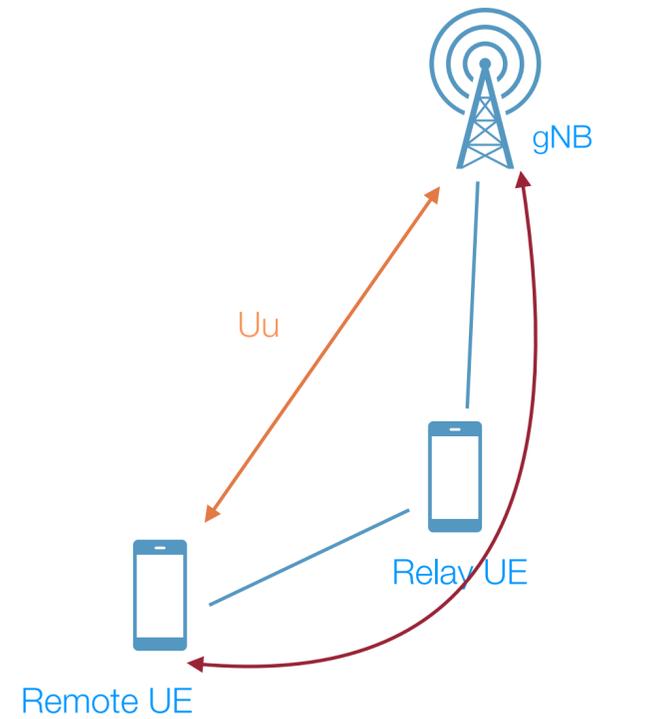


Rel-19 Two-hop U2U (Layer-2)

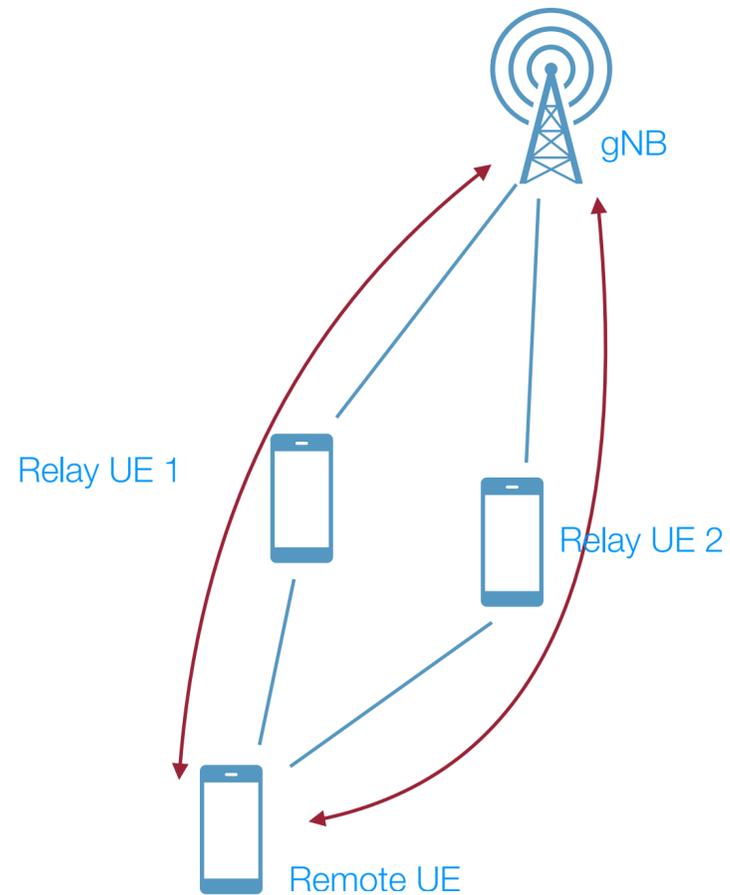
Sidelink Relay | Multi-path Relay (1)

- Rel-19 **Scenarios** for further work on **multi-path relaying** on top of Rel-18 scenario 1 on MP:
 - To specify mechanism and procedures of multi-path support for “indirect path + indirect path”
 - Further extension with more than 2 paths (e.g., one direct path + two or more indirect paths) for in-coverage UEs
 - Consider inter-gNB “direct + indirect” case

3GPP Rel-18

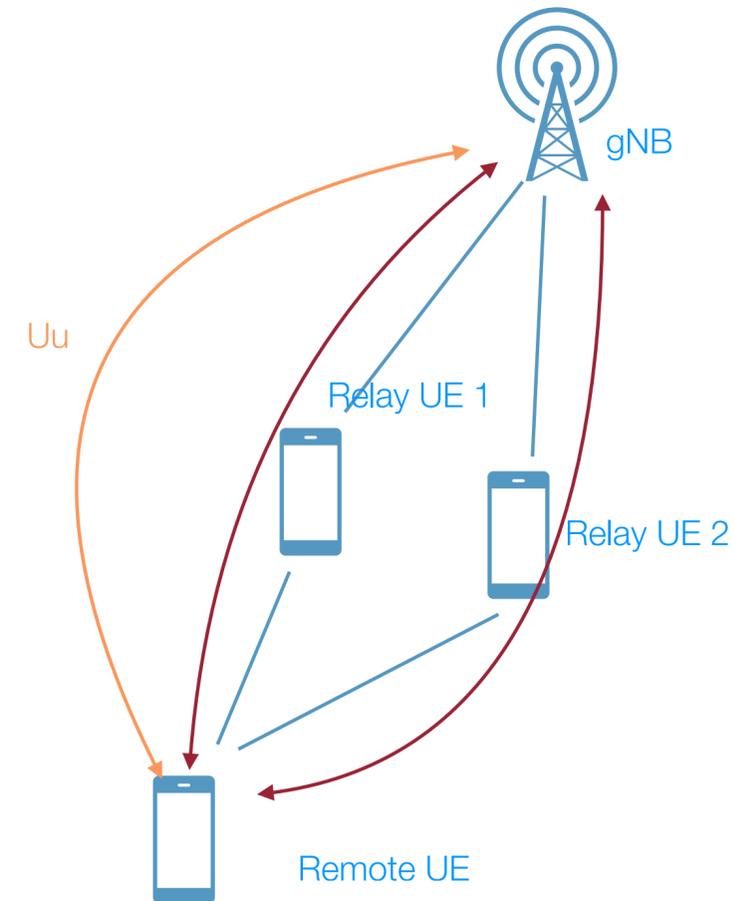


Multi Path (direct + indirect)

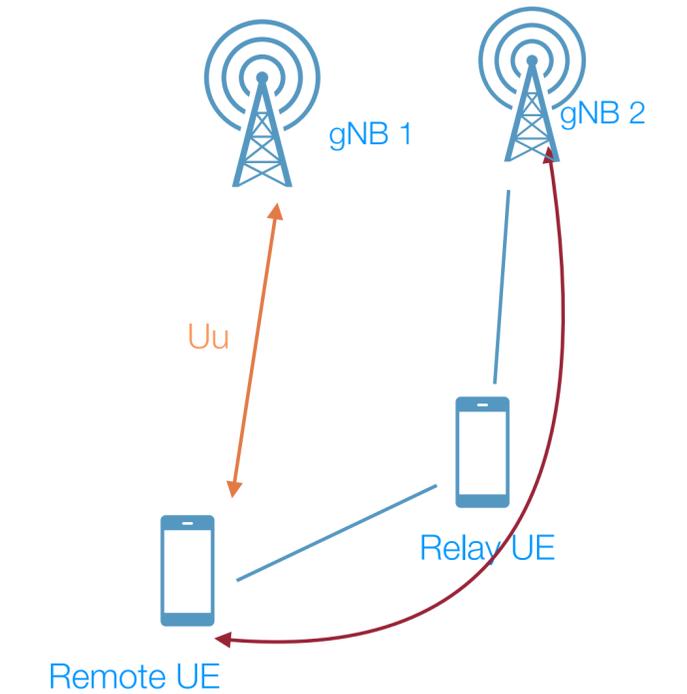


Multi Path (indirect + indirect)
Case 1 (out-of-coverage)

3GPP Rel-19



Multi Path (direct+ indirect + indirect)
Case 2 (in-coverage)



Multi Path (direct + indirect)
Case 3 (in-coverage)

Sidelink Relay | Multi-path Relay (2)

- Advanced AS layer techniques to be considered for Multi-path relay in 3GPP R19.
- **Example 1:**
 - Rel-18 adopted **DC-like** modeling for multi-path: Traffic split/duplicate at PDCP layer on a per-bearer basis
 - For multi-path relaying, **CA-like** approach can be considered in 3GPP Rel-19
 - It could be beneficial for MAC layer scheduler to decide transmission path for a MAC PDU
- **Example 2:**
 - Rel-17/Rel-18 only support unicast traffic relaying for UE-to-NW relay.
 - Broadcast/groupcast traffic can take advantage of path diversity to improve efficiency and reliability.

- **Motivation**

- In Rel-18, a UE Aggregation solution with ideal non-3GPP link between two UEs has been supported with a similar architecture as multi-path sidelink relay.
- Rel-19 can consider further enhancements on UE-aggregation, which is more suitable for the “ideal D2D” link characteristics rather than Sidelink

- **Further enhancements on UE Aggregation**

- Consider Uu UL enhancements with enhanced efficiency/reliability with optimized Uu scheduling for both remote UE and relay UE.
- Study the lower-layer (under PDCP-layer) packet duplication mechanisms
- Control plane signaling enhancements to enable the optimized NW scheduling.

