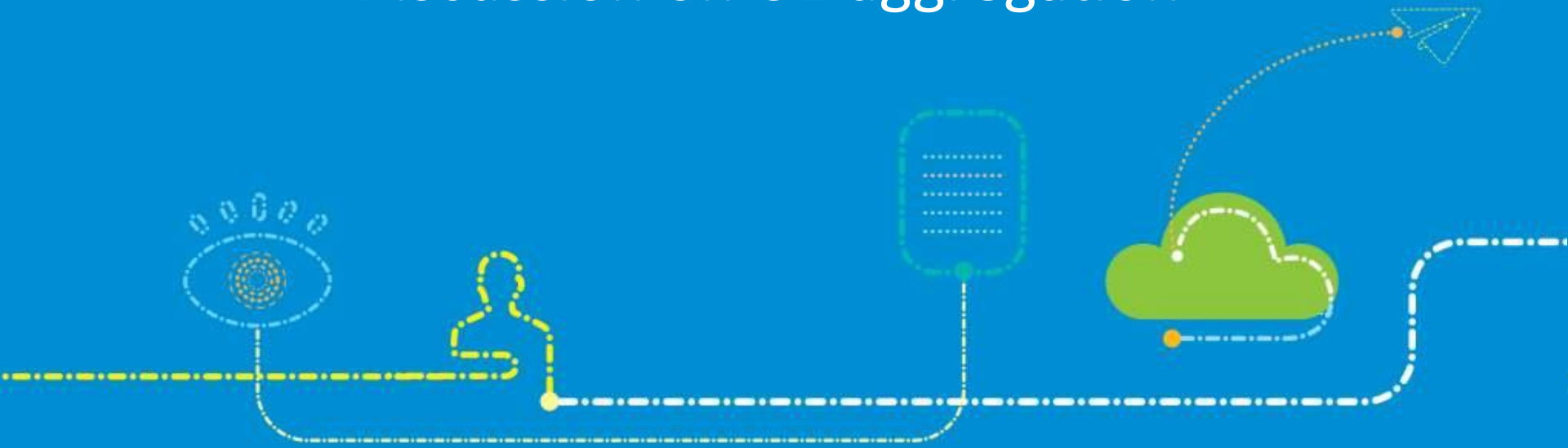
3GPP TSG RAN #93-e
Electronic Meeting, September 13 - 17, 2021

RP-212399

ZTE
Tomorrow never waits

Source: ZTE, Sanechips
Agenda: 9.0.3

Discussion on UE aggregation



Background

- UE aggregation was proposed and discussed in Rel-18 June workshop, and it was listed as one topic under additional RAN1/2/3 candidate topics Set 3.
- The following scope and justification for UE aggregation are summarized in RP-211666 according to the email discussion for RAN#93-e Rel-18 preparation.
  - UE aggregation scope
    - Determine the level of coordination between the UEs and the assumptions for the interconnect link (e.g. non-specified high performance link). Determine if / to what extent the multiplicity of UEs is handled by / is visible to the Core Network / higher layers. (RAN2)
    - UP operation and architecture, e.g. PDCP aggregation. (RAN2)
    - CP AS coordination and handling for the multiple connections (e.g. Setup/Modification/Release procedures for the UE aggregation and mobility in coordination manner), (RAN2)
  - Justification
    - Break through the UE capability to improve the UL performance and DL performance
    - More flexibility and efficiency

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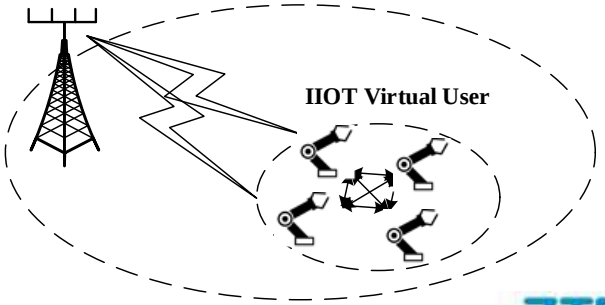
UE aggregation - Use case

- Use case 1: Capability extension
  - A virtual user formed by the aggregated devices has a higher capability, in terms of # of RF chains, supported bandwidth, transmission power and processing capability etc.
  - A high capability device forwards the data for another low capability device such that the latter has a higher capability.
- Use case 2: Data rate improvement
  - A device forwards the data of another device belonging to the same user to improve the transmission data rate.
  - Individual devices connect with each other via wireline in industrial factory. It can be assumed that there are tight coordination among different devices.
    - Physical layer coordination is feasible to further improve the data rate of the virtual user.



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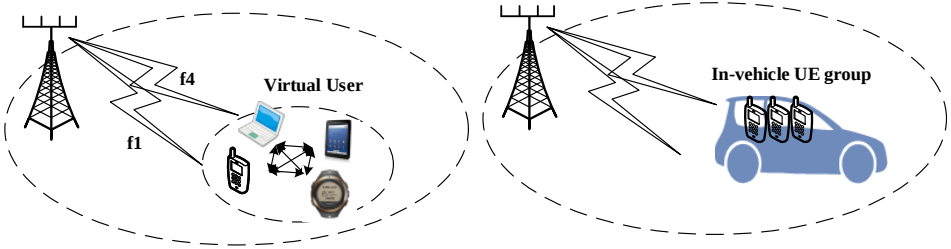
UE aggregation - Use case

- Use case 3: Coverage enhancement
  - A device inside the coverage forwards the data for a device outside the coverage to improve the coverage.
    - NOTE: This is used for the aggregation link other than sidelink.
- Use case 4: Robustness improvement
  - Path switching in the case of multiple links with gNB.
  - A device can still work with the help of the other device even if its Uu link is broken.



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UE aggregation - Assumption

- Aggregation link between devices via 3GPP protocol or non-3GPP protocol
  - Both of them can be considered under a unified mechanism.
  - The discussion of UE aggregation should focus on the non-3GPP protocol to extend the applicable scenarios, e.g., industrial factory, personal IoT network, where the devices are connected by wireline or Wifi instead of sidelink.
- Aggregation devices from the same vendor or from different vendors
  - The aggregation link operation can be handled by UE implementation in the case of the same vendor.
  - The standardization work are needed for the aggregation link operation in the case of different vendors.
  - The same vendor can be assumed at the first version of UE aggregation for simplicity.

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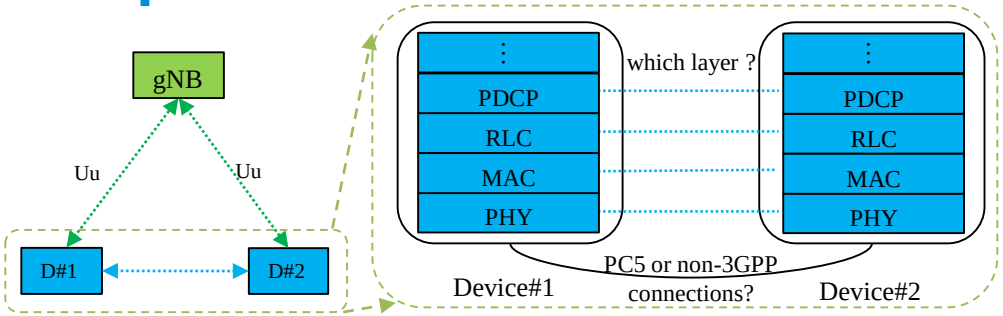
UE aggregation - Potential impact



- Which layer coordination
  - Application level solution
    - Applicable scenarios are limited and the efficiency is low.
  - PDCP layer coordination can be a candidate solution due to the wide application.
  - Physical layer coordination can also be considered.
    - PDCP layer coordination and lower layer coordination are more efficient and flexible.
- How to group the aggregation devices in the case of multiple candidate UEs?
  - It can be up to UE implementation or reuse the existing mechanism, e.g, grouping based on the discovery signal in sidelink relay.
  - If physical layer coordination is supported, group scheduling of multiple devices can be considered.
- Network coding can be considered to improve the performance further.
    - Note: More details for network coding can be found in our companion contribution in RP-212396.

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UE aggregation - Potential objectives

- Study the use cases and performance evaluation of UE aggregation [RAN1,RAN2].
- Study coordination level/layer at RAN level [RAN2, RAN1].
- Study potential protocol stacks enhancements to support UE aggregation [RAN2].

- *Note: Depending on the discussion outcome of the other SI/WI, network coding can be considered to improve the UE aggregation performance*

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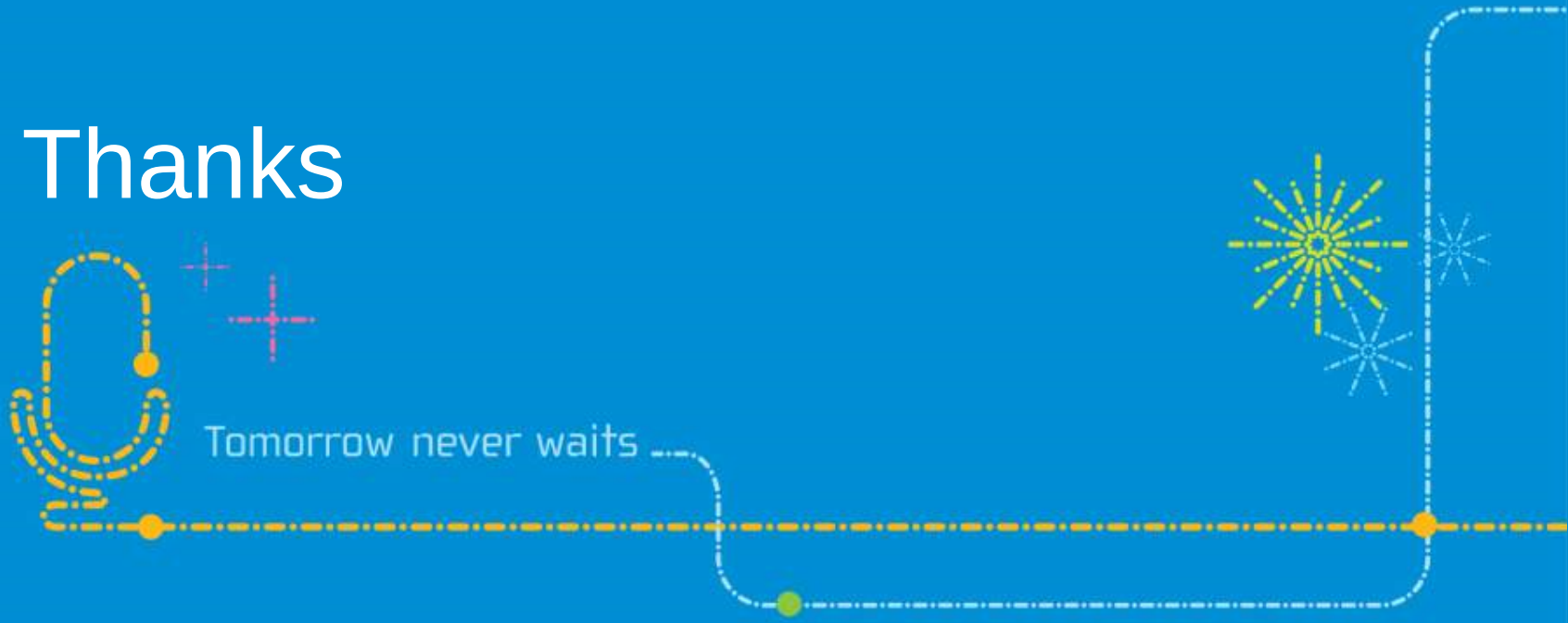
Thanks