

3GPP TSG RAN Rel-18 workshop
Electronic Meeting, June 28 – July 2, 2021
Agenda: 4.1
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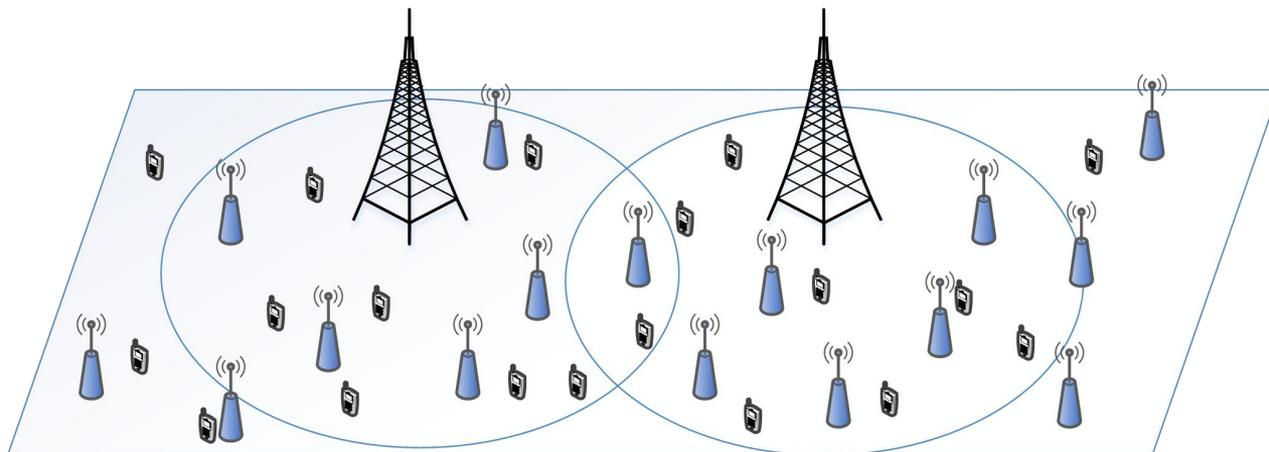
Further enhancement on NR mobility for Rel-18

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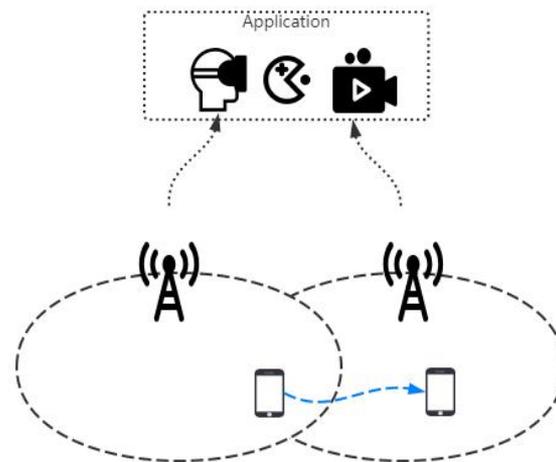
■ Background

- With increased frequency carrier in 5G evolution, the deployment of base stations will be more intensive and the cell coverage radius will be smaller. UE will experience more frequent cell selection/re-selection, handover or PScell change procedures in such scenarios (i.e. UDN, Ultra Dense Network). This will undoubtedly increase UE energy consumption, reduce mobility performance and cause high signaling overhead. Moreover, with the development of various emerging applications, higher mobility performance guarantee is needed.



■ Motivation

- The requirement of packet delay and data rate for new emerging applications (such as XR, 4K/8K video, cloud gaming, etc...) is much stringent, the network needs to provide high quality and consistent services for users especially when user is moving. Therefore, mobility enhancement should be studied in R18 to guarantee the consistency of user services.
- The motivation for this new WID will be illustrated as follow:
 - General Mobility Enhancement
 - Mobility Enhancement for MR-DC
 - Data forwarding optimization
 - Other aspects related to mobility enhancement

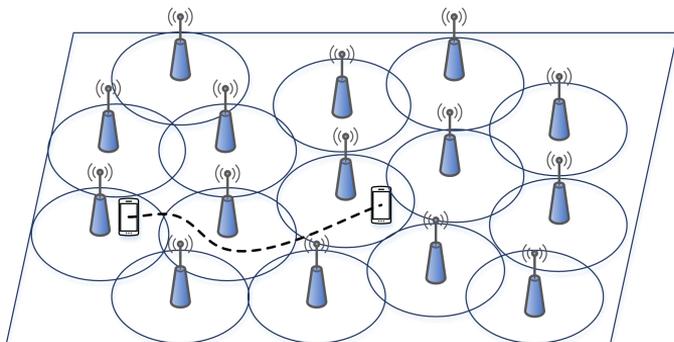


Consistent service guarantee during mobility procedure

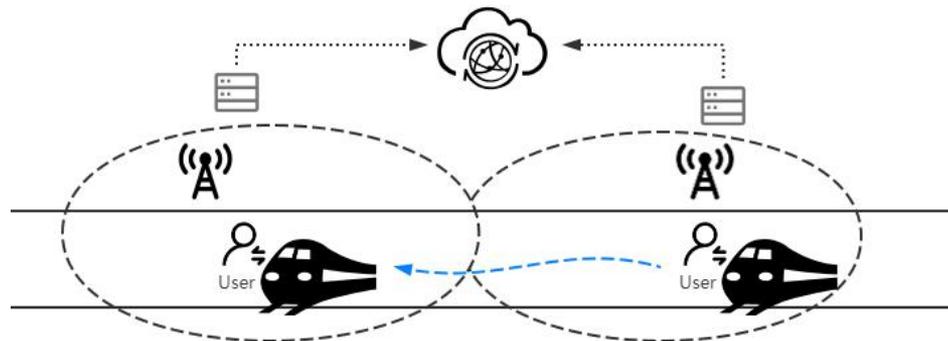
■ General Mobility Enhancement:

- In previous release, 3GPP has introduced CHO to increase the robustness and DAPS HO to achieve 0ms user plane interruption during handover procedures, however the above technologies cannot be supported in some use cases, following enhancements can be considered in the next release:
 - ✓ **Reduce data interruption in FR2:** With the deployment of FR2, users will experience more frequent handovers. In such scenario, the data interruption during the handover procedure will seriously affect the user's service experience. However, the DAPS handover for FR2 to FR2 case is not supported in current specification, this is mainly due to limitations related to UE capabilities. Therefore, other solutions to reduce the data interruption especially in FR2 is necessary, such as RACH-less HO, which was specified in LTE but not supported in NR, or multiple candidate target cell configuration with single active cell connection can be considered as the potential solution.

- ✓ **Ensure high reliability and 0ms interruption during HO procedure:** In previous release, CHO cannot be configured simultaneously with DAPS handover, but in some mobility cases, the HO robustness and 0ms interruptions may both desirable for the UE, in such scenarios, extend current handover procedure to fulfill the user requirement is worth to study.
- ✓ **Enhance robustness of NG-based Handover :** In previous release, only CHO for Xn interface is supported, but in actual deployment scenario, there is not necessarily an Xn interface between the base stations, such as in high speed train scenario, neighboring base stations may belong to different provinces and use NG interface to connect, in such scenarios, support CHO over NG interface to improve mobility robustness is worth to study.



UE Handover more frequent due to the high frequency deployment



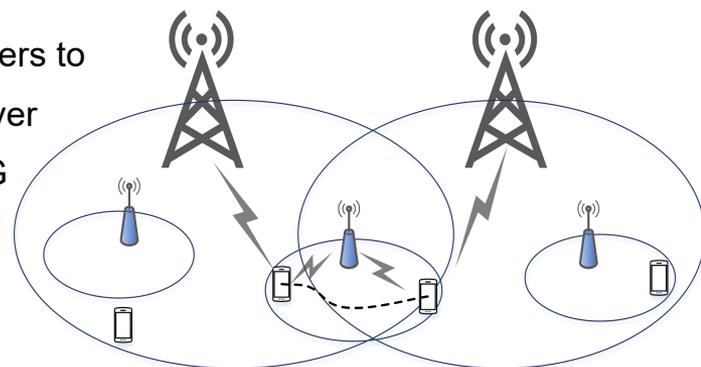
5 UE experience NG-based handover in high speed train scenario

■ Mobility Enhancement for MR-DC:

- MRDC architecture is widely deployed to ensure the data rate and continuous coverage of the UE, PScell change may happen more frequent due to the smaller coverage of higher frequency secondary cells. In order to guarantee consistent user data rate during mobility procedures, we need to further enhance existing procedures to reduce user data interruption.
- Following enhancements can be considered in the next release:

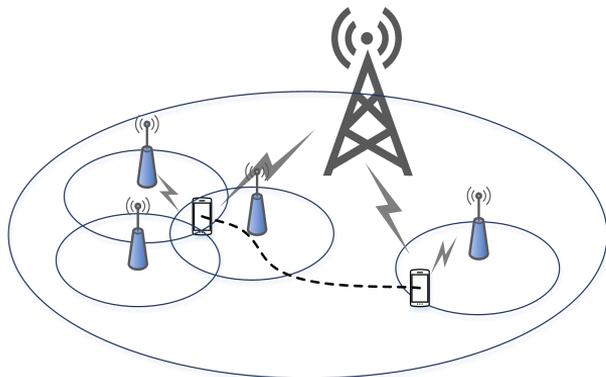
✓ Reduce data interruption for inter-MN handover without SN

change: For high data rate businesses, it is necessary for the users to maintain the connection of the secondary node when MN handover occurs, but in current specification, the UE needs to release SCG before perform DAPS HO, which limits the usage of the DAPS handover and may cause data interruption. Support DAPS HO in MRDC scenarios can reduce interruption for inter-MN handover without SN change.

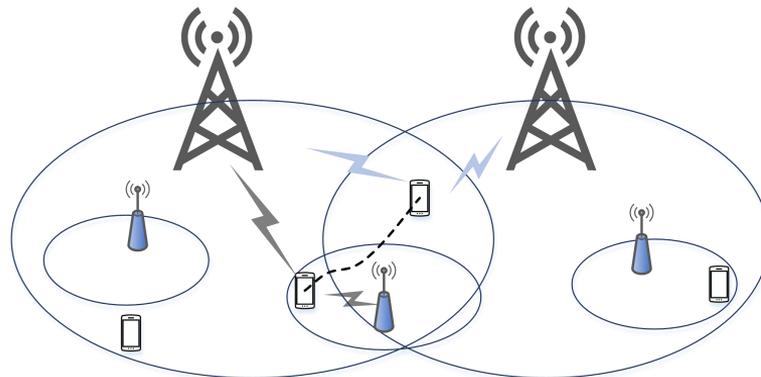


Inter-MN handover without SN change

- ✓ **Ensure 0ms interruption for PScell change procedure:** In previous release, only Conditional PScell change has been introduced in MRDC scenarios to enhance robustness, the DAPS-based PScell change or multiple SCG configuration with single active PScell can be further studied as the potential solution reduce the data interruption for PScell change procedure.
- ✓ **Support inter-RAT PScell Change:** Inter-RAT SN change procedure with single RRC reconfiguration is not supported in current specification (i.e. no transition from EN-DC to DC), support inter-RAT PScell change procedure can reduce data interruption and ensure service continuity for the users.



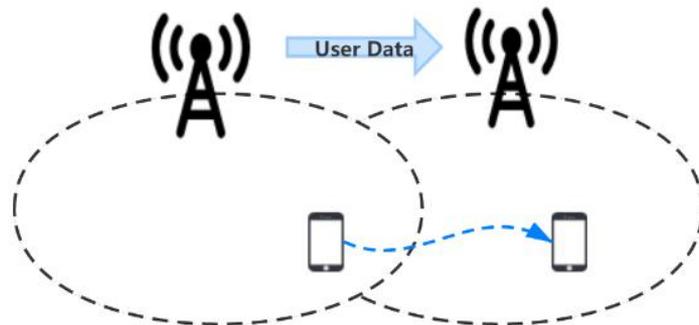
Intra-MN inter SN PScell change



Inter-RAT SN change

■ Data forwarding optimization:

- When DAPS HO or CHO/CPAC is configured for a UE, the early data forwarding mechanism may be used to reduce data interruption in user plane. However, this needs the (candidate) target node(s) to cache the user data in advance, which will increase the base station's traffic load and may cause data loss due to the overload. It is necessary to enhance current early data forwarding procedure to reduce base station's cache pressure in time.
- In case of HO to wrong cell (or too early HO), if the HO failed before UE set up connection to the target cell, it will report the source cell as the last serving cell. Thus, the re-establishment node will request context from the source cell, which has already forwarded data to the original target cell and dropped the data due to the high traffic load, then the re-establishment node has no mean to retrieve the UE data context. In this kind of scenario, we can design the data acquisition procedures to help the base station retrieve the UE context.



- Following enhancements for the data forwarding procedure can be considered in the next release:
 - ✓ **Early data forwarding enhancement:** Enhance current data forwarding procedure to release the data which has been successfully transmitted timely can help the BS reduce the cache pressure.
 - ✓ **Exception handling:** Design the data acquisition procedures to help the base station retrieve the UE context when necessary, which can reduce data interruption due to failure cases.

■ Other aspects related to mobility enhancement:

- In addition to the above technologies, other aspects related to mobility enhancement can also be considered:
 - ✓ **Reduce UE power consumption or network signaling:** UE will experience more frequent cell selection/re-selection, handover and SN change procedures due to the high frequency deployment, the signaling interaction between the network and users will also become more frequent, which will undoubtedly cause high signaling overhead and increase UE power consumption. Thus, solutions to reduce network signaling and UE power consumption should be studied.
 - ✓ **Fast failure detection and recovery:** Given that fast failure recovery is an essential procedure which provides transmission reliability, enhancement of fast failure recovery especially for FR2 should be an important part for mobility procedures, in addition, fast failure recovery mechanism used in MRDC scenario can also be enhanced.

■ Scope

- Ensure higher mobility performance in current handover procedures, such as:
 - Reduce data interruption in FR2 [RAN2,RAN3,RAN4]
 - Ensure high reliability and 0ms interruption during HO procedure [RAN2,RAN3]
 - Enhance robustness of NG-based handover [RAN3,RAN2]
- Reduce data interruption for mobility procedures in MRDC scenario, such as:
 - Reduce data interruption for inter-MN handover without SN change procedure [RAN2,RAN3]
 - Ensure 0ms interruption for PScell change procedure [RAN2,RAN3,RAN4]
 - Support inter-RAT PScell Change [RAN2,RAN3]
- Optimize data forwarding procedure to enhance data continuity and reduce BS load. [RAN3]
- Other aspects related to mobility enhancement, such as reduce UE power consumption or network signaling, fast failure detection and recovery, etc... [RAN2,RAN3]

Thanks!
