3GPP TSG SA WG 2 Meeting #160
Chicago, USA, 13 – 17 November 2023

S2-2312798

Architecture assumptions on UE-satellite-UE communications

FS_5GSAT_ARCH_Ph3

Agenda Item: 19.1

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Outline

- **Answer the following questions**
  - Which kind of services can be supported/optimized via UE-satellite-UE communication?
  - Which kind of satellite is considered for providing this UE-satellite-UE communication?
  - How to consider feeder link's usage in UE-satellite-UE communication?
  - How to consider UE's subscriptions when UE1 and UE2 use UE-satellite-UE communication?
- **Summary and proposal**

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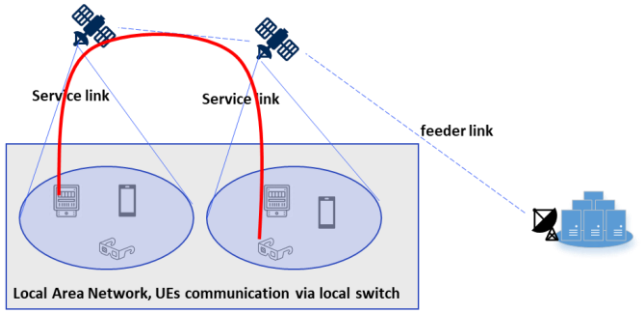
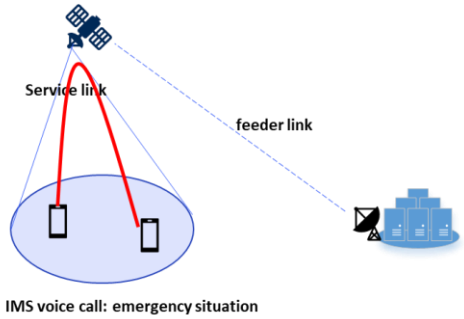
Which kind of services can be supported/optimized via UE-satellite-UE communication?

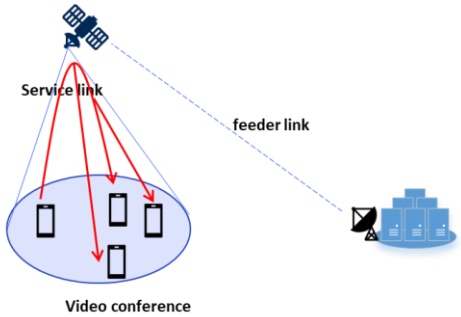
- Satellite communication typically experiences extended delays, which result from not only the satellite's orbital altitude but also the doubled latency involving both the space-to-UE link, and the ground-station-to-space link. Such obstacles are viewed as restrictions for satellite providing higher bitrate, low latency services.
- UE-satellite-UE communication presents an opportunity for **optimization** aimed at reducing the “ground-station-to-space " latency.
- Several services as introduced in SA1 in TR22.865 can be benefit from such UE-satellite-UE communication optimization. Nonetheless, achieving every service may not always be feasible, and optimizing UE-satellite-UE communication might necessitate the incorporation of various core network functionalities. Introducing or activating these core network functionalities onboard can result in increased. It is reasonable to only evaluate the most commercial-proof valuable service in this Release 19.



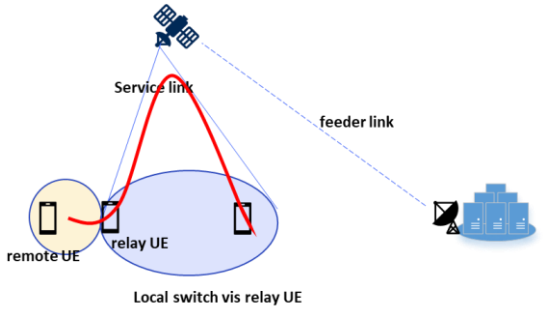
Use case 5.5, 5.6 in TR22.865: LAN service



Use case 5.7 in TR22.865: IMS emergency call



Use case 5.8 in TR22.865: video conference



Use case 5.9, 5.10 in TR22.865: relay UE

- **Proposal 1: It is proposed to proceed only IMS service as an optimization objective in UE-satellite-UE communication.**

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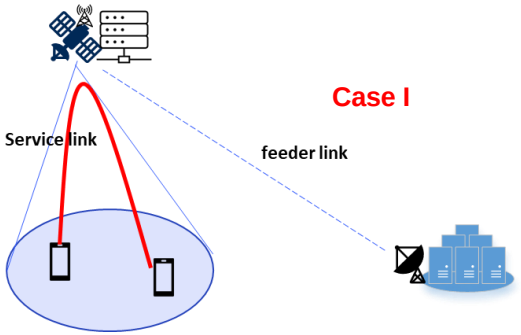
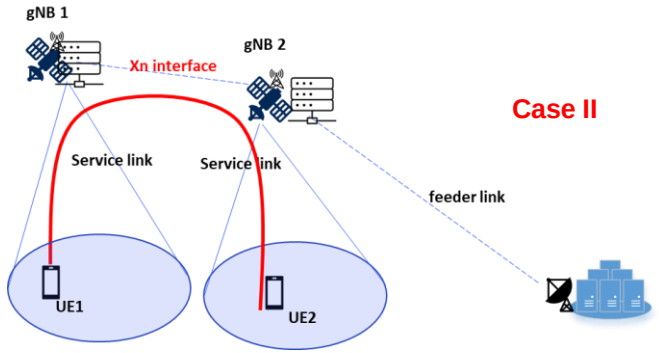
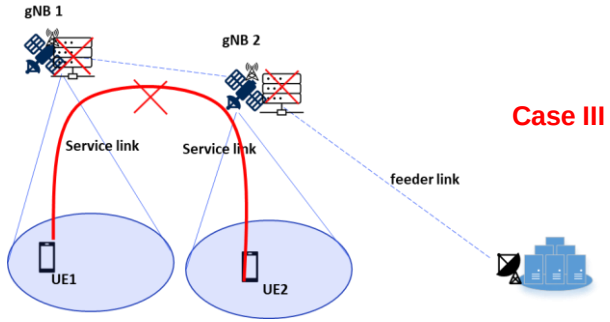
Which kind of satellite is considered for providing this UE-satellite-UE communication?

- There are 3 main orbital satellites are discussed in 3GPP: GEO, NGSO (MEO, LEO). Because of **GEO**'s orbital altitude (approximately 35,786 km), limited transmission power and antenna gain, and the available bandwidth (remained for communication service) , it is foreseen that supporting 4.75bps AMR codec(the minimum required SMR codec for IMS voice call, as in TS 26.071) for IMS service is **challenging**.
- **Proposal 2: It is proposed to only consider NGSO in this Release. GEO is not in scope of this Release for optimizing IMS service.**
- When considering NGSO (gNB by default onboard), considering CN functionality onboard, there are 3 cases:
  - **Case I:** UE1 and UE2 communicate under same satellite coverage, every satellite has same CN functionality onboard
  - **Case II**: UE1 and UE2 communicate under different satellite coverages via ISL, and every satellite has CN functionality onboard
  - **Case III**: UE1 and UE2 communicate under different satellite coverages via ISL , but only a few satellite has CN functionality onboard.
- In Case III, there is situation that UE1 and UE2 cannot communicate because their serving satellites happen to have **no** minimum set of core networks onboard.







- **Proposal 3: It is proposed to only consider Case I and Case II in this release.**

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How to consider feeder link's usage in UE-satellite-UE communication?

- Feeder link carries the link between satellite and earth station. In case of UE-satellite-UE communication, the feeder link has 3 different situations, we take IMS service as an example:
  - **Scenario 1**: the feeder link is **ALWAYS** available, both the control plane and user plane can be established without interruption, when IMS session is established, the IMS voice call between UE 1 and UE 2 can be shifted to UE-satellite –UE communication link, which can reduce the delay between them and increase the as the QoE.
  - **Scenario 2**: the feeder link is **ONLY** available for a **longer** period (enough to establish IMS session), which means the feeder link needs to be available and valid for the period to establish the control plane, user plane, and SIP messages exchange to establish IMS sessions, and just after this, IMS call is shifted via UE-satellite-UE communication.
  - **Scenario 3**: the feeder link is **ONLY** available for a **very short** period (NOT enough to establish IMS session), just like what has been described in S&F operation, i.e. feeder link is NOT available for maybe a longer period, this will definitely lead to a long long waiting time for a successful IMS session between UE to UE.
- Scenario 2 is a corner case, which is hard to measure the chance, i.e. the feeder link connection time is only suitable for completing IMS signalling.
- Scenario 3 is same as S&F operation, but S&F operation is only for delay tolerant service, which is not suitable for this case.

- **Proposal 4: It is proposed to only consider feeder link is ALWAYS available in this release.**

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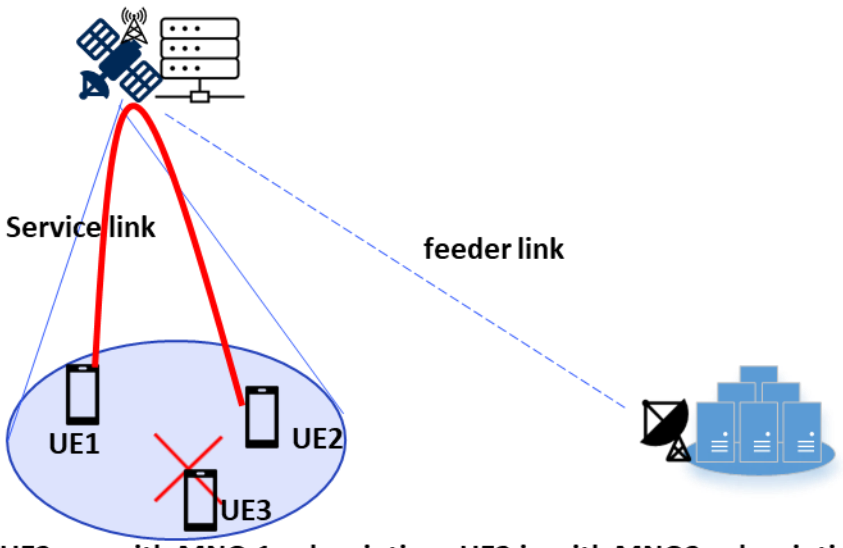
How to consider UE's subscriptions when UE1 and UE2 use UE-satellite-UE communication?

- Under same satellite coverage, there is situation that UEs have different subscriptions, as blow figure described. UE 1 and UE 2 have same subscriptions from MNO1, UE 3 comes from MNO 2 subscription. The gNB and CN functionality onboard also belong to MNO1 subscription, as the traffic needs home PLMN control, UE3's traffic cannot be shifted via UE-satellite-UE communication.



UE1 and UE2 are with MNO 1 subscription, UE3 is with MNO2 subscription
UE3 cannot communicate with UE1 or UE2 via UE-satellite-UE communication link

- **Proposal 5: It is proposed to only consider communication of UEs from same subscription can be shifted to UE-satellite-UE communication.**

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Summary

- It is proposed to make the UE-satellite-UE communication as an optimization to increase the service quality of experience, and the following architecture assumptions are needed:
  - *Only **IMS service** is considered in UE-satellite-UE communication*
  - *It is proposed to only consider **NGSO** in this Release. GEO is not in scope of this Release for optimizing IMS service.*
  - *In NGSO case, only CN functionality **evenly** distributed onboard is considered.*
  - *It is proposed to only consider feeder link is **ALWAYS** available in UE-satellite-UE communication*
  - *It is proposed to only consider communication of UEs from **same** subscription can be shifted to UE-satellite-UE communication*

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