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Motivation for New WI Proposal: Support of single-cell point-to-multipoint transmission in LTE

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General

- Critical communications can be used for public safety applications and also for general commercial applications (e.g., utility companies and railways).
- The Single-cell PTM Study Item was approved at Dec, 2014, aims to increase the flexibility and efficiency for group communication.



- The feasibility and benefits of Single-cell PTM transmission were justified during the study phase (see TR R2-152920), and it is proposed to set up the corresponding Work Item at RAN#68.

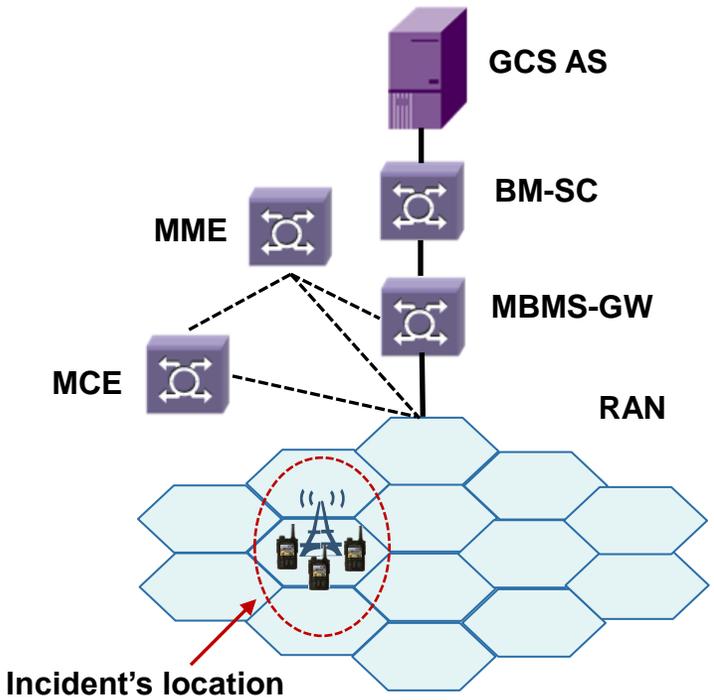
SC-PTM transmission is considered by cellular operators as a complementary tool over which to provide multicast transmissions.

Conclusions of the SC-PTM study (latency)

- For group communication over SC-PTM, the GCSE/MCPTT latency requirements can be satisfied (with the assumption on some SC-PTM configuration values), without the need to pre-establish MBMS bearers for receiving UEs. In particular:
 - The end-to-end setup time can be 220-250ms (shorter than MCPTT KPI1, which is 300ms).
 - The time to join an ongoing group communication, without application layer ciphering, can be 105ms-135ms in all cases (shorter than MCPTT KPI4a, which is 150ms). The time it takes for application layer ciphering is not in the scope of RAN.
 - The end to end delay for media transport can be 90ms (shorter than MCPTT KPI3, which is 300ms).
 - The end to end access time with acknowledgement from first receiving user can be 335-395 ms in the worst case (shorter than MCPTT KPI2, which is 1000ms).

Conclusions of the SC-PTM study (dynamic area)

- With SC-PTM, the broadcast area can be dynamically adjusted cell by cell to fit the dynamically defined geographic area (e.g. incident's physical location) for a group call, using the cell list provided by the Core Network, without the need to pre-establish the MBMS bearers over a pre-defined geographic area like for MBSFN.



Conclusions of the SC-PTM study (radio efficiency)

- When considering different transmission techniques, i.e. MBSFN/Unicast vs. SC-PTM with and without feedback, several factors influence which of these techniques performs better in terms of radio resource consumption.
 - SC-PTM transmission without UL feedback performs significantly better than MBSFN transmission in the following 3 cases: 1) when the network is not synchronized, 2) when users receiving a service are all in 1, 2 or 3 cells, 3) when the MBSFN area is pre-defined and contains a number of cells with no user receiving the service.
 - Link adaptation allowed by the availability of UL feedback provides significant gains when the number of receiving UEs is rather small and it converges to the efficiency of SC-PTM without UL feedback with increasing group size (i.e. >100% with 4 group users, and about 50% with 10 group users).
 - SC-PTM with UL feedback provides better spectral efficiency than unicast if the service needs to be delivered to two or more UEs per cell.
 - SC-PTM without UL feedback is not as efficient as SC-PTM with UL feedback, but it still provides better spectral efficiency than unicast if the service needs to be delivered to e.g. >5 UEs per cell.

Conclusions of the SC-PTM study (service continuity)



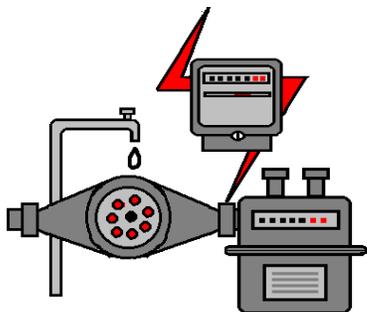
- SC-PTM service continuity for MCPTT services was analysed for two high priority scenarios:
 - moving between cells providing the service using SC-PTM transmission;
 - when the service is not provided in the target cell using SC-PTM, i.e. via unicast.
- SC-PTM transmission is considered to provide acceptable level of service continuity or solutions are specified to reduce the interruption time due to mobility between cells to a lower values.

Additional benefits of SC-PTM

- SC-PTM is assumed to provide more flexible resource allocation (due to dynamic scheduling via PDCCH). The more flexible resource allocation can improve SC-PTM spectral efficiency for certain services (e.g. bursty traffic).
- Compared to MBSFN transmission, SC-PTM transmission and unicast transmission can be multiplexed in the frequency domain, therefore unnecessary radio resources waste can be avoided.
- SC-PTM transmission is considered beneficial by cellular operators who have unsynchronized networks due to e.g. cost or other reasons.

Commercial use cases

- In addition to critical communications, SC-PTM transmission could also be used as a multicast technology for other commercial use cases, for example:



■ MTC software update



■ Over-the-top videos
■ Apps download



■ Traffic info (V2I)



■ Mobile advertising

Objectives of the SC-PTM Work Item

- SC-PTM transfers the MBMS session data over a single cell using PDSCH, and it is scheduled using a common RNTI (Group-RNTI) on PDCCH.
- A UE performing the SC-PTM reception might be either in RRC_IDLE or in RRC_CONNECTED.
- Specify air interface aspects to support the SC-PTM operation. In particular:
 - SC-PTM configuration (one Group-RNTI per TMGI), where a SC-PTM specific MCCH signals the SC-PTM configuration.
 - Efficient SC-PTM transmission assisted by the UL feedback from group users in RRC_CONNECTED.
 - As a baseline, support transmission schemes associated with Transmission Mode 1, 2 and 3 for the SC-PTM transmission.
- Specify necessary changes to the existing MBMS interfaces (i.e. M2/3) in order to support the SC-PTM operation.
- Specify necessary solutions to minimize the service interruption time when the UE leaves the cell where SC-PTM reception is ongoing.

NOTE: This work item will follow the design targets and recommendations of the FS_LTE_SC_PTMM study as documented in TR 36.890.

Thank you

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