Security Level:

RP-141293 Motivation of Rel-13 New Study Item proposal for Support of single-cell point-to-multipoint transmission in LTE

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Source: Huawei, HiSilicon
Document for: Information
Agenda Item: 14.1.2

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Use Cases

Examples of "Dynamic Multicast":

Mission Critical Push to Talk

Top videos, Popular apps download

Mobile Advertising

- Users located within a geographical area have a common interest on the service/content.
- Multicast area is dynamic.
- Users might not be evenly distributed over the geographical area.
- Multicast area may be a single cell.

Challenges for MBSFN to support dynamic multicast

In R12, GCSE (group communication) was specified based on MBSFN, however, there are several drawbacks:

- MBSFN area configuration is rather static (e.g. configured by O&M), broadcasting might happen in cells where no user exists.
- The MBSFN subframe configuration is rather static (e.g. configured by O&M), which can not be dynamically adjusted according to the traffic activities.
- eMBMS transmission will occupy the entire system bandwidth, and multiplexing with unicast in the same subframe is not allowed, even though not all the radio resources in frequency domain are utilized (e.g. because the traffic under broadcasting is of low data rate).
- MBSFN subframes might be unnecessarily wasted during the traffic inactive period (might not be fully used by unicast, consumed by periodically transmitted "empty" MSI).

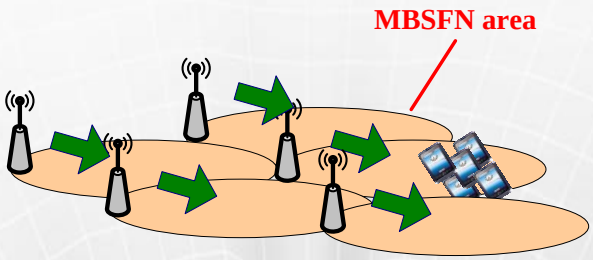

Fig: R12 MBSFN based GCSE

MBSFN was original designed for the provision of pre-planned media content (e.g. mobile TV), it is not efficient and flexible for MBSFN to support the dynamic multicast.

Concept of Single-cell PTM transmission

- Multicast over PDSCH on a per cell basis.
- Common Group-RNTI is assigned to a group of users to schedule traffic via shared radio resource.

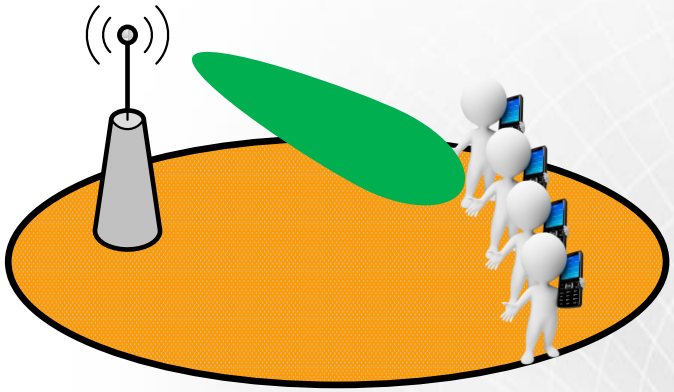

Fig: Single-cell PTM transmission

Advantages of Single-cell PTM transmission

Advantage as compared to MBSFN:

- Multicast only occurs on the cell that user locates.
- Radio resources could be flexibly shared between multicast and unicast, even within the same subframe.
- Radio resources could be freely adjusted for multicast based on traffic data rates and traffic activation/deactivation state.
- Short latency as compared to MBSFN.
- Benefit operators who have difficulties to make their whole network synchronized.

Single-cell PTM transmission could support the dynamic multicast in a flexible and efficient way. Operators' spectrum resources could be fully utilized.

A path of smooth evolution

- To allow the smoothly evolution from R12 GCSE (MBSFN based) to R13 Single-cell PTM transmission, the R12 eMBMS system architecture is kept.
- Enhancement will be focused on the radio efficiency improvement.
- User reports its location information and interest information (e.g. via application layer signalling or RRC/NAS signalling) to the network, whereby the traffic data could be routed to the cell that the user locates.

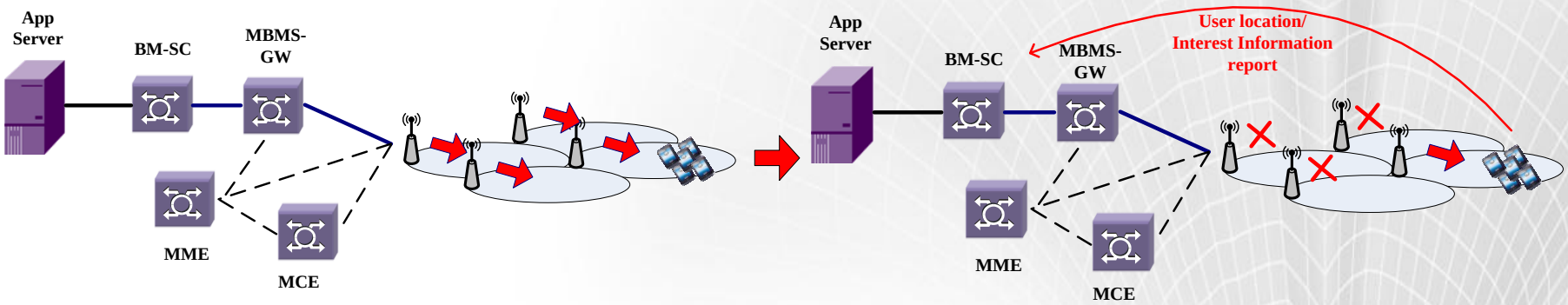

Fig: A path of smooth evolution

Single-cell PTM reception

- UE performs the single-cell PTM reception either in idle mode or in connected mode.
- No HARQ feedback and CSI report are expected from the eNB side.
- UE performs the single-cell PTM reception once it receives the corresponding configurations (i.e. Group-RNTI for the group of interest).

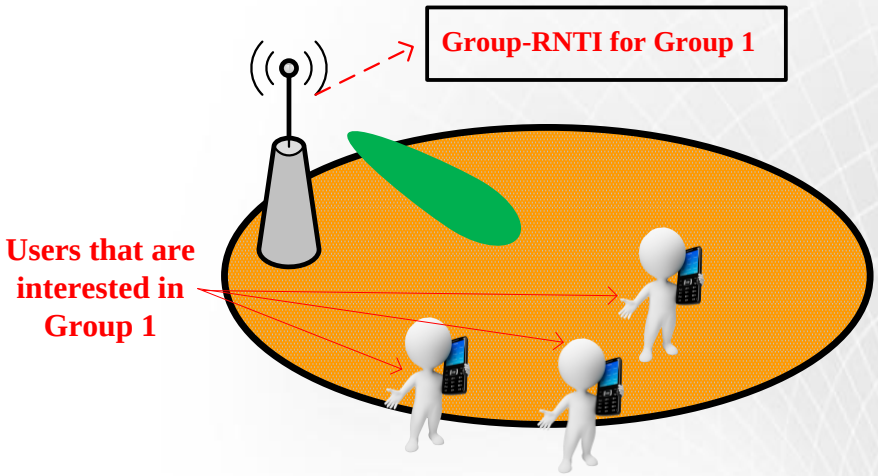

Fig: Single-cell PTM reception

Gains comparing to MBSFN

- **MBMS configuration:** FDD, 1 MCH, 1 MBSFN area, 2 MBSFN subframe/frame, MSP= 80ms

- **Case 1**: Due to no available MBMS traffic data, 100% configured MBSFN subframes are free. There are no sufficient TM9/10 capable UEs in the cell as a consequence only 25% MBSFN subframes could be used for unicast scheduling.

- **Case 2**: Due to low MBMS traffic data rate, 75% configured MBSFN subframes are free. There are no sufficient TM9/10 capable UEs in the cell as a consequence only 25% MBSFN subframes could be used for unicast scheduling.

Fig: Gains on radio efficiency comparing to eMBMS

With Single-cell PTM transmission, radio efficiency can be significantly improved comparing to eMBMS.

Gains comparing to Unicast

Carrier Frequency	ISD	Bandwidth	Antennas	Multicast Tx mode	Unicast Tx mode	Multicast target
2.0GHz	500m	FDD: 10MHz	2X2	TxD	SU-MIMO	95% coverage with 1% BLER

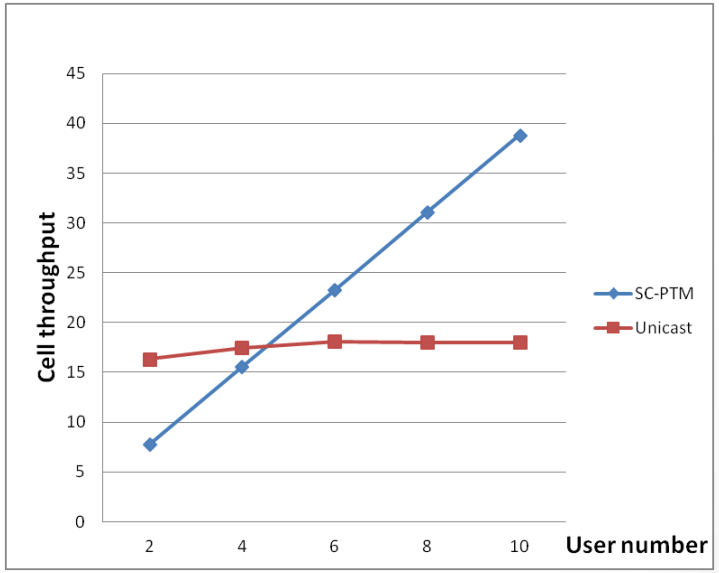

Fig: Cell throughput

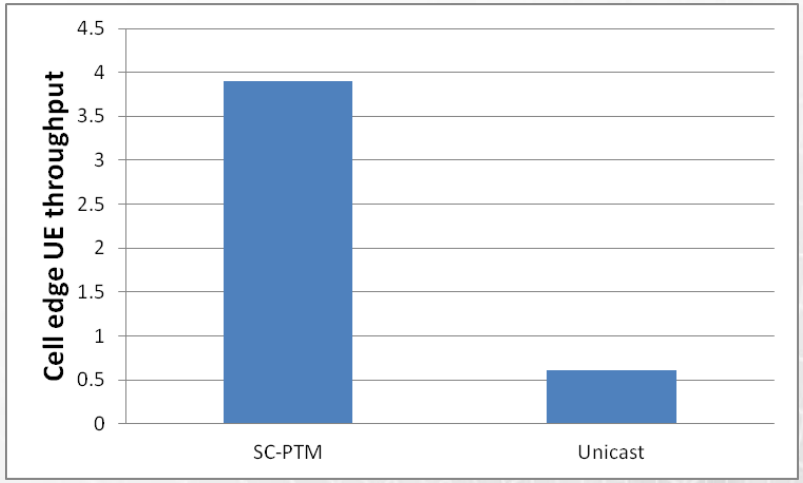

Fig: Cell edge UE throughput (User number=10)

With single-cell PTM transmission:

- ***when the number of users in a group >4, gain on cell throughput could be achieved.***
- ***significant gain on cell edge UE throughput can be achieved. The gain increases when the number of users in a group grows.***

Thank you

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