Solution B proposal for MBMS_enh Key Issue #1

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MOTOROLA SOLUTIONS

CONTENT

- **Intro and General**
- **Concerns with proposed Solution A (variants 1, 2a and 2b)**
- **Proposed Solution B**

CLARIFICATION OF GENERAL CONSIDERATIONS

- **Traditionally SA2/3GPP:**
  - LTE equipment vendor (supplier) -> network operator (customer)
- **For public safety (PS):**
  - Application vendor (supplier) -> public safety agency (customer)
- ***Note: in public safety, the network operator plays a crucial role and has legitimate interests, but it is NOT the ultimate "customer" and the network equipment is NOT the "product" that needs to be optimized (The entire system, starting with the <u>application</u>, is!).***

- **In general, when it comes to resources, the rule is that the application requests and the network approves or rejects**
  - It may also queue the request or counter-propose

- **The "application" can be:**
  - Bundled with GCS AS in a single AS, or
  - A separate AS, connected to BM-SC via a stand-alone GCS AS

GUIDING PRINCIPLES

- **1st principle: Maximum Enablement of the Application**
  - Maximum flexibility for the **application to choose** if it wants automatic/default treatment or if it wants to indicate specific preferences
  - Application needs to be and to **stay very well informed** of status and events
  - **Enable programmatic facility** (e.g. clarity of programming model, allow messages to be tagged with application specific information)
- **2nd principle: Fast is essential**
  - For mission critical even small optimizations are worth it, even for modest reductions of latency
- **3rd principle: Vendor and Network Operator independence and optimization**
  - The system should **work well enough** even if the network operator and the PS agency are not tightly coordinated (e.g. the application cannot make any assumptions about the SAI pre-configured by the operator)
  - If the network operator and the PS agency can coordinate well, then the system should **work optimally**

CONSIDERATIONS ON THE APPLICATION

- **Three deployment models that <u>all</u> need to be supported:**
  - Specialized PS network operator with dedicated resources (e.g. spectrum)
  - Commercial operator “hosting” PS on its network
  - PS-agencies run “localized”, minimal network

- **Both application models below have to be enabled:**
  - The application is an **expert system** (i.e. driven by heuristic rules, notifications and status reports) **working automatically**.
  - The application is **an interactive** (i.e. visual, quick reaction time) **system**, with a human operator (“dispatcher”) constantly aware of the situations and capable of **manually overriding the system decisions** and of specifying new parameters for the system.

Technical Aspects

BACKGROUND AND ASSUMPTIONS ON CARDINALITY OF AREAS

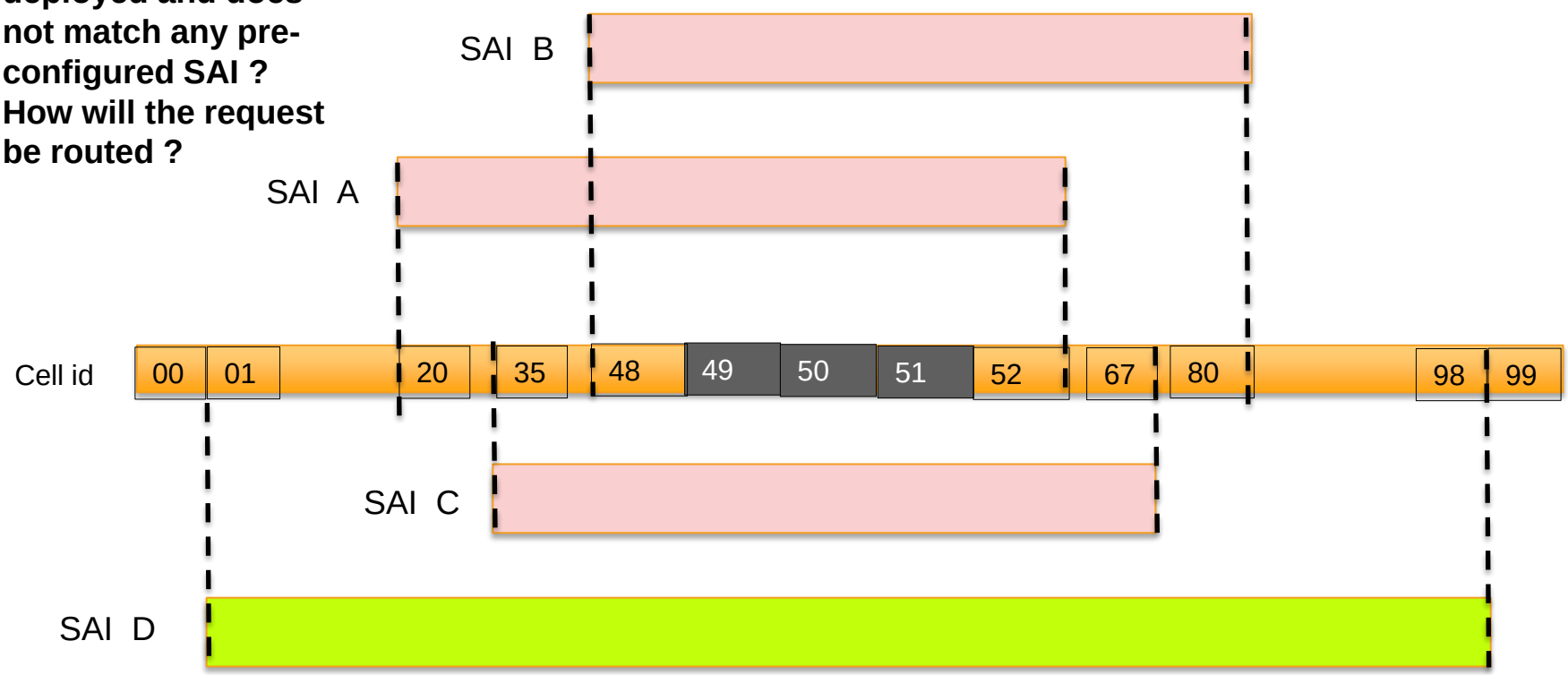
- **Cell**
  - For a small system: tens to hundreds
  - For a large system: thousands to tens of thousands
- **SAI = list of cells (no rules specified how to build it) = "fragments" of "service areas" and MBSFN Areas**
  - # can vary widely depending on configurations: anywhere from very few to very many: can reach thousands or even more
- **MBSFN Areas = RF-meaningful clustered list of cells:**
  - # can also vary widely depending on configurations: usually up to hundreds, but can be configured as small areas, leading to potentially more for a very large system
- **In general:**

  #_cells >> #_SAIs > #_ MBSFN Areas

  - Important because it may show what it <u>is</u> / <u>is not</u> practical to pre-configure and keep up-to-date in various network entities

CONCERN WITH AUTOMATIC MAPPING OF ECGI LISTS TO SAI (OR MBSFN AREAS)

- **Mapping of the ECGI list (cells 49,50,51) to one of the SAIs *which one?* (or even MBSFN area) , to be performed at the BM-SC and/or MCE is not unique. From an application point of view, the choice of one of the SAI by MBMS system looks arbitrary and non-deterministic.**
- **In case of congestion (unknown to the BM-SC) in one MBSFN area, could MCE choose another MBSFN area (differently than BM-SC)?**
- **What if cell is newly deployed and does not match any pre-configured SAI ? How will the request be routed ?**



CONCERN WITH MAPPING OF ECGI LISTS TO MBSFN AREAS (OR SAI) NOT DONE BY THE APPLICATION

Consider the following <u>example use cases</u>: the GCS AS sends the list of cells {49.50.51}, based on where the UEs are concentrated, but the application also may want to use "heuristics" or manual intervention, such as:

- For TMGI= 7 choose MBSFN Area D, because experience shows that it will be participating in citywide scan-groups (see 22.179).
- During 6 am and 7:30 am always choose MBSFN area B, because statistically there are likely to be more car accidents in that area in the subsequent 90 min
- If the incident is a chemical spill, choose MBSFN area A because that area has larger roads which can accommodate large equipment necessary for this type of incident.
- If TMGI=3 is already in area C, place new TMGI=4 in the same area because they almost always go together (e.g. intent to place there audio and video for same group)

The automatic mapping of ECGI lists at the BM-SC and MCE to SAIs and subsequent MBSFN Area selection deprives the application of the capability to choose and to know the exact area of distribution for a MBMS bearer. <u>This is a "take away" from Rel-12, where the application was allowed to build a "service area" by combining SAIs.</u>

COMMENTS ON SOLUTION A

- **Deprives application of the capability to influence the selection of the MBSFN Area, capability present indirectly in Rel-12**
- **Ambiguous which MBSFN Area will be chosen in the end by MCE**
- **After the MBSFN was chosen, the application will not know all the cells where the bearer is distributed.**
  - It may not know to order UEs from unicast to MBMS reception in cells where it does not know that MBMS is active
  - It may try to start the same TMGI where it is already distributed, creating a partial failure to start bearer on grounds of overlap
- **Not clear if the cells in the ECGI list are clustered and if not, how is the Flow Identifier handled ?**
- **Potential delays introduced by new mapping process in BM-SC and MCE, proportional with the number of cells in ECGI list times the average number of SAIs per cell times the average number of cells per SAI**
- **Routing between BM-SC and MCE(s) requires (either / or):**
  - Mapping of list of ECGI to list of SAIs : How will you map a newly added cell to preconfigured SAIs ?
  - Additions of extra messages on Sm and Sgi interfaces and “per cell” storage of info for the entire PLMN

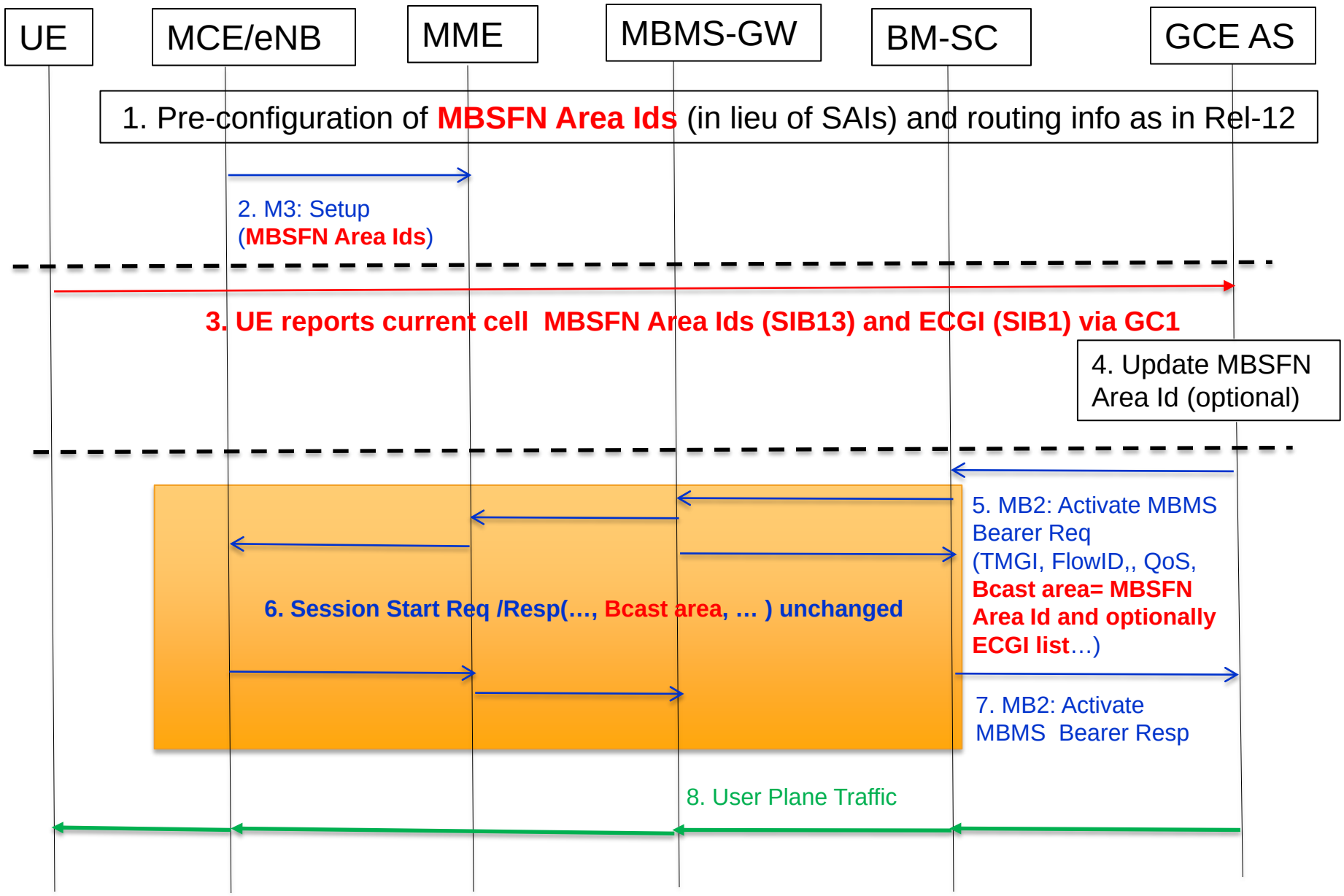
THE ECGI LIST AND SC-PTM ANGLES

- **“List of cells” is clearly necessary for SC-PTM**
- **What benefit does “list of cell” bring to non-SC-PTM?**
  - Advantages: no need to pre-configure SAIs at the GCS AS
  - Any other advantages ????
  - Disadvantages: Introduced (new!) problems as per entire previous slide
- **Given that many network operators have not deployed Rels 9-12 MBMS at all (or not on a large scale), should pre-configuration of SAIs (at BM-SC per Solution A or at GCS AS per Rels 9-12) be mandatory especially for (new Rel-13+) PS systems ?**
- **It is intuitively unclear why a (new!) SC-PTM system using “list of cells” needs to have the BM-SC configured with SAIs in order to route its messages.**
- **The application may want some level of control on whether to start existing MBMS bearers or SC-PTM bearers: e.g. at beginning of PS incident start a MBSFN; as the incident winds down replace MBSFN by “pocket coverage” via SC-PTM, to save capacity and cost.**
  - Transparency between SC-PTM and non-SC-PTM bearers is useful, but so is the ability of the application to express a preference.

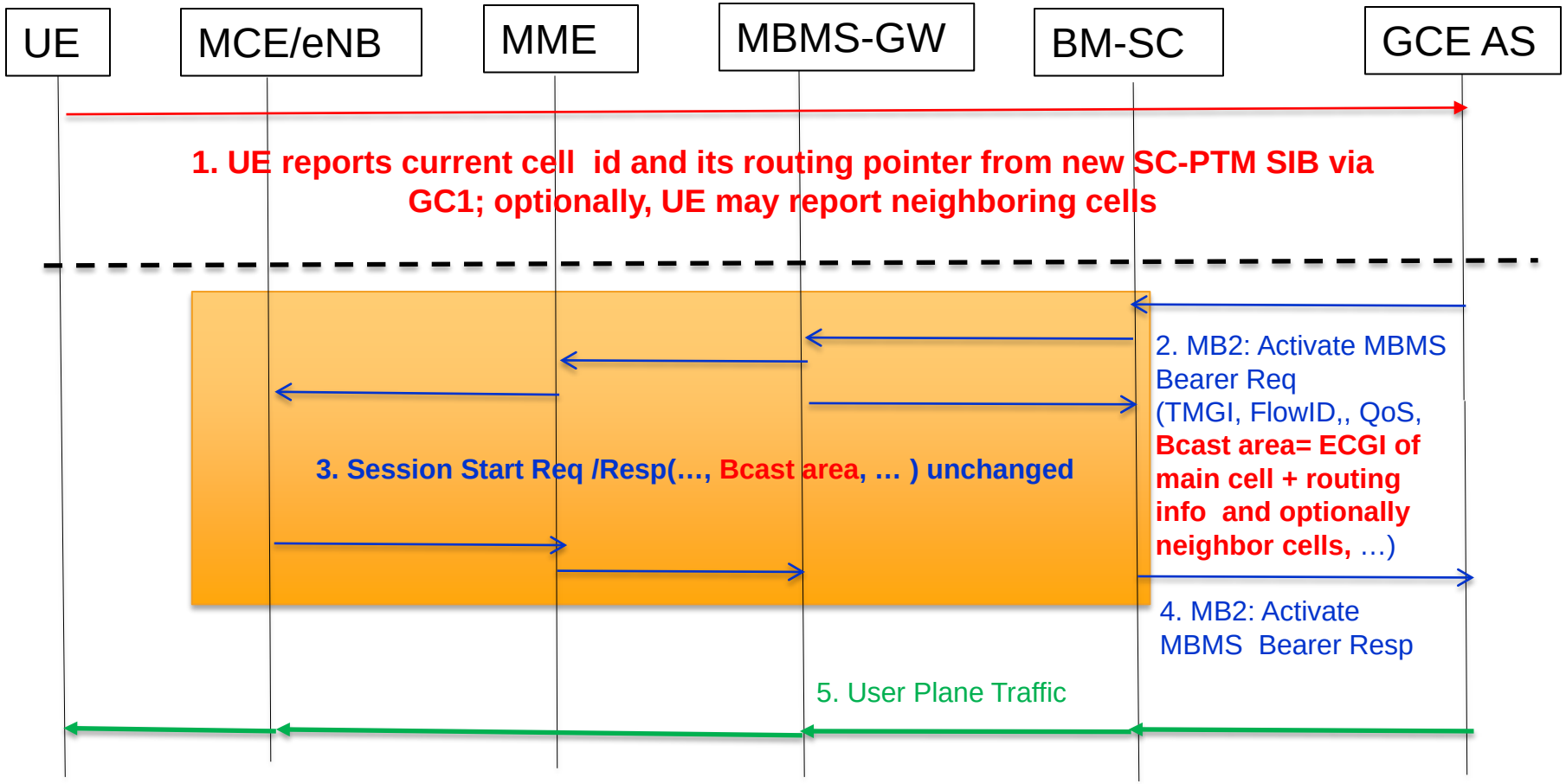
SOLUTION B PROPOSED TO ADDRESS THE EXPRESSED CONCERNS

- **GCS AS preconfigured with MBSFN Area ids in lieu of (the potentially much more numerous) SAIs.**
  - MBMS entities may also require less configuration, as there will likely be fewer MBSFN Areas than SAIs (Note: also M3:Setup message might change)
- **Application / GCS AS decides which MBSFN Area or list of cells to ask service for.**
  - Application-aware decision, and <u>before and after</u> knowledge of <u>exactly</u> where the service is provided
- **GCS AS requests** *a classic MBMS bearer by providing a MBSFN Area id* **<u>OR</u>** *a SC-PTM bearer by providing a cell id (list)* **<u>OR</u>** *either type of bearer (don't care which) by providing both a MBSFN Area Id and a cell id list* **and ultimately letting the MCE decide.**
  - No automatic mapping issues
- **UE reports to GCS AS via GC1 the MBSFN Ids (from SIB13) and/o ECGI of the serving cell (from SIB1)**
  - In case of newly added cell(s), the GCS AS may update the pre-configured MBSFN Area(s)
- **Routing between BM-SC and MCE(s):**
  - For MBSN Area ids w or w/o ECGIs: same as for SAI (no change in the Rel-12 routing:)
  - For ECGIs only: use cell specific routing (see proposal on slide #14)

SOLUTION B INFORMATION FLOW FOR CURRENT MBMS BEARERS:



FYI: SOLUTION B INFORMATION FLOW FOR SC-PTM



- New SIB for SC-PTM to contain routing pointer (e.g. MME id) for the cell
- **Application chooses** which additional cells from among the neighboring cells with same SC-PTM routing pointer to request SC-PTM service for
- No support of current MBMS bearers required for SC-PTM: routing based on SC-PTM SIB info, not on SAI

SOME DIFFERENCES BETWEEN PROPOSALS A AND B

- **In Solution B, application chooses (and keeps information about) the exact MBSFN Area where service will be (and ends up actually being) provided**
  - No automatic ECGI to SAI mapping like in Solution A
- **In solution B, application chooses between current eMBMS, SC-PTM or either ("transparent mode").**
- **In Solution B, the ECGI list as a parameter is used only for SC-PTM or for "transparent mode"**
  - ECGI is not used for current eMBMS, unlike in Solution A
- **In solution B, ECGI list can be routed independently of SAI:**
  - Routing of SC-PTM does not depend on current eMBMS methods
- **In solution B, UE provides support by reporting information from SIBs (e.g. SAI) to the GCS AS, via the GC1 interface**

OPTIONAL: APPLICATION-LEVEL ZONES (1)

- PS application sees world in term of zones: e.g. *jurisdictions* (static, relatively large) and *incident areas* (adhoc, widely variable in size and shape), which in general, may not fully overlap with network-level coverage areas (a cell, set of cells, SAI or MBSFN Areas)
- It is reasonable for the application to assign "location tags" to those zones
- In principle, ALZI consists of a "location tag" (zone id) and a network level coverage area id, where the latter fully covers the former

ALZI	Zone id	Network-level coverage area id

- An application-level zone has **one or more** ALZIs associated with it. For example, the gray area on slide 8, may have 4 ALZI:

ALZI_A	12	MBSFN Area id = A
ALZI_B	12	MBSFN Area id = B
ALZI_C	12	MBSFN Area id = C
ALZI_D	12	MBSFN Area id = D

- When service is requested over zone 12, the Application/GCS AS chooses one of the 4 ALZIs to ask service for.

OPTIONAL: APPLICATION-LEVEL ZONES (2)

- The parameter “broadcast area” in *Session Create Req/Resp* and *Session Update Req/Resp* is set to ALZI
- The BM-SC **extracts** the *network-level coverage area id* from the ALZI and uses it for routing. The *zone id* part of the ALZI is opaque to the BM-SC
- Only the GCS AS and BM-SC “see” the ALZI. All other entities use MBSFN Area Id.

- At the time of drafting, the SA2 has not made a final decision on whether to allow “location tagging” of BM2-C messages, initial proposed in the FlowID parameter (subject to name change) in a Rel-12 CR.
  - **If “location tagging” is approved, the use of ALZI may not be needed**
- Example of use: if several different TMGIs cover the same zone they will all have the same location tag, as logically expected by the application
- The exact format for ALZI when “cell lists” are used is FFS pending information on SC-PTM design from RAN (e.g. content of SC-PTM SIB and ability of UE to report it on GC1). However, at a minimum, will contain the zone id, the cell id, and routing information

OPTIONAL: VIRTUAL CELLS

- Pre-defining **virtual cells** are a potential solution to the problem of keeping GCS AS aware when cells are added/removed by the operator:
  - **Virtual cellss are not needed if the UE application client is able to report info from SIB13 (MBSFN area ids) to the GCS AS via GC1 interface**
- Since MBSFN Area Ids (and SAIs) are lists of cells, non-existent (i.e. not deployed) cells with uniquely new ECGIs can be pre-added to the cell lists that will be provisioned at the GCS AS.
  - When a cell is deployed in an MBSFN area, is assigned one of the pre-allocated ECGI.
  - When the UE reports the ECGI (from SIB1) of the new cell to the GCS AS via GC1, the GCS AS recognizes the cell id as being part of the MBSFN Area(s) where the cell id was pre-added and then it can select one of the MBSFN Aresa for service
- If the addition of the cell induces major changes in the topology of a MBSFN area, then it will have to be re-configured at the GCS AS. This would be a very rare case.

Thank You!

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