



Finding national IMSI numbering space

Rabión Consultancy BV

In various countries numbering plans administrators are confronted with questions related to a more widespread use of Mobile Network Codes (MNCs). MNCs form part of IMSI numbers, used primarily to identify mobile subscribers. Potential solutions to prevent running out of stock are often clouded by technical complex arguments. What are the risks and how big are they really?

Similar to the international numbering plan for telephony, the IMSI numbering plan to uniquely identify subscribers and networks, has a hierarchical assignment procedure. On the top of the pyramid, the Telecommunication Standardization Bureau TSB of the International Telecommunication Union ITU assigns so called Mobile Country Codes (MCCs): the first three digits of the IMSI. The successive two or three digits represent the Mobile Network Code (MNC) that is assigned on a national level. Depending on the length of the MNC, the assignee can use up to ten billion unique Mobile Subscription Identification Numbers (MSINs). In particular in Europe national numbering plan administrators started issuing MNCs in a time when only a two digit length was used. These two digits limit the total number of MNCs within an MCC to one hundred. For various reasons explained below, administrators may have concerns if this pool size will be sufficient in the long run. For a national administrator, Rabión Consultancy has investigated consequences resulting from a specific solution: mixed assignment of two and three digit MNCs under one MCC. This paper highlights some of the findings of the investigation.

Developments contributing to scarcity

In some countries, e.g. India, the number of mobile network operators (MNOs) is the sole reason for scarcity. Depending on national circumstances, other parties than just mobile network operators may apply for MNCs. Also Mobile Virtual Network Operators (MVNOS)

often use their own IMSI range. Large telecommunication users may often be heard pleading for their own IMSI ranges, in order to prevent operator lock-in. The aim is to prevent costs and hassle resulting from swapping SIM cards in a business environment, when changing operator. Even more complicated is replacement of machine to machine (M2M) SIMs. A different development is the use of private mobile networks. E.g. in the UK, Sweden and the Netherlands, spectrum in the 1800 MHz band, also known as the 'DECT guard band', can be assigned to (unlicensed) private mobile networks. Finally also extra-territorial use of IMSIs can lead to exhaustion of MNCs under the MCC from which it has been assigned.

Barriers and solutions

Three approaches that can contribute to broadening the numbering space are: applying for an additional MCC, shifting towards three digit use of the existing MNC range, and sharing MNCs among stakeholders. None of these approaches are free from barriers: ranging from technical impact and therefore costs to conflicting international recommendations and specifications. Due to international roaming partnerships, the potential global impact of changing national MNC assignment procedures should be considered carefully. The most important issue is that the ITU-T recommendation outlining the IMSI numbering plan, the E.212, is not explicit defining the mixing of two and three digit MNCs under the same MCC. There is a risk that vendors of either network



elements or IT business systems have made the assumption that only two or only three digit MNCs reside under a particular MCC. Following the literal text of the recommendation, such assumption is incorrect. Interestingly enough, decisions that should have been left to the ITU, seem to have made in standardization committees. The 3GPP partnership responsible for specifications of GSM, UMTS and LTE defines that 'A country is identified by a single MCC value, with the exception that MCC values 310 through 316 identify a single country (USA) and MCC values 404 through 406 identify a single country (India).' In other words: using an additional MCC, like the UK, would be in violation with 3GPP specifications? Compliancy to specifications can be crucial to determine who is liable for the costs of changing implementations in operator systems. User equipment is also confronted with both two and three digits MNCs. In contrast to suggestions we received from the market, the specification are not an obstacle in practice. Also at this point 3GPP specifies what should have been left to the ITU: it does not permit mixing of two and three digit MNCs outside the USA. More importantly the specification still holds and 3GPP compliant user equipment handles both number lengths. Obviously implementation errors can always occur. Uncommon situations add to this risk. However, mixed usage under a single MCC is already daily practice in India, and does not seem to lead to problems. It seems unlikely that equipment manufacturers would have implemented for one country only, and thus also in other countries mixing of different length MNCs seems feasible.

In practice not all MNCs are used outside the home network. In most cases, only the MNCs assigned to MNOs are used for international roaming. In the case of MNOs, roaming hubs are sometimes used. In such solutions, the IMSI is temporary replaced by one from a

hubbing provider, or from another MNO. For these 'national-only' MNCs different solutions might be considered. Why not reserve one or a few MNCs to be shared among private mobile networks? Apart from the ITU recommendation that not yet accounts for this kind of application, there is no technical risk involved. Even the technical risks of reserving three digit MNCs in an otherwise two digit MCC are close to theoretical. The M2M market is anxiously anticipating the introduction of embedded SIMs, known as eUICC. An international approach is more appropriate. National M2M MNCs are not needed to accommodate this. In anticipation of eUICCs, it could be part of an interim or alternative solution. When combined with a sharing restriction, as is the case in the Netherlands, this would mean a technical solution is required to differentiate between the users.

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