

IFAST

IMSI Problems in North America

Source:

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Abstract:

Only about 1 out of every 240 IMSI blocks assigned to North America can actually be used. This is because of the use of 2 digit MNCs by GSM and the use of E.214 mapping for message routing. This could result in exhaustion of the IMSI resource in North America, and its unavailability for non-GSM systems.

Recommendation:

Initiate a liaison with GGRF G95 (GSM Global Roaming Forum for CDMA interworking) along with 3GPP2 and CDG. Perhaps the US and Canadian IMSI administrator's should also be informed.

1 IMSI Problems in North America

IMSI (International Mobile Subscriber Identity) is the only MSID used by GSM, is required for cross-technology roaming (to GSM) and is optional for CDMA and TDMA systems. However, due to inefficient utilization of IMSI codes by GSM technologies it is possible that exhaustion of IMSI could result in North America.

The purpose of this contribution is to initiate a liaison to confirm that our understanding of the problem is correct, and work towards a solution.

1.1 First Problem: 2 Digit MNC

The ITU-T E.212 recommendation allows an MNC (Mobile Network Code) to be up to 3 digits long, but original GSM specifications restricted it to 2 digits. This was satisfactory for Europe (each country generally only having a handful of nationwide licenses) but not for the United States which has several thousand distinct wireless licenses. Maintaining a separate MNC for each license is useful to allow licenses to be transferred between carriers without reprogramming the IMSI. Even if multiple licenses are consolidated within a single MNC, there are still a large number of wireless carriers in the United States.

The question is whether GSM has initiated the transition from 2 to 3 digit MNCs, and when it can be assumed that all SIM cards in North America will use 3 digit MNCs (making this mandatory for SIM cards from other countries roaming into North America). Further, it is necessary whether the same problem exists in 3G standards (W-CDMA in particular).

1.2 Second Problem: E.214

ITU-T Recommendation is a mapping between E.212 IMSI and E.164 (phone numbers) that allows routing of GSM MAP signaling messages based on an IMSI (e.g. mobile registration) while utilizing the existing E.164 global title translations implemented for other purposes.

E.214 maps the E.212 MCC (Mobile Country Code), of which there are about 24 in North America (7 assigned to the 50 US states alone) to an E.164 country code ("1" for all of North American within the NANP). Consequently, in order for SS7 message routing to be unique, an MNC must be unique within the NANP. This means that, in effect, there is only one MCC for all of North America.

The question is whether GSM carriers have initiated a transition to native E.212 global title translation, or whether they have some other plan that will eliminate the E.214 reduction in available MNCs. Further, it appears that this transition will affect all GSM carriers that have roaming agreements with North American carriers, not just North American carriers. This is because they will be initiating signaling messages towards North American signaling points to support roaming.

1.3 Combined Impact

The two problems combine to reduce the number of available MNCs in North America by a factor of 240, from 24,000 to only 100.

1.4 Impact of Cross-Technology Roaming

CDMA and TDMA carriers interested in cross-technology roaming must provision an IMSI for use while GSM roaming. This IMSI must be GSM-compatible, which means that it must come from the 1/240th of the North American IMSI resource described above. Carriers may wish to assign a unique MNC to a region of their network, or perhaps even to an individual license area for maximum flexibility.

2 Draft Text of Letter

To: GGRF (G-95)

cc: 3GPP2, 3G Americas, CDG,

IFAST has identified two problems with the use of IMSI blocks by GSM mobiles in North America that may result in premature exhaustion of the IMSI resource. An IMSI block is defined by the MCC+MNC prefix (5 or 6 digits) that is used to identify a wireless system (e.g. HLR).

The first problem is that some, perhaps the majority of, GSM mobiles only support 2 digit MNCs. This reduces the number of MNCs per MCC by a factor of 10, from 1000 to only 100. This is supported by IMSI guidelines by only assigning MNCs with a 3rd digit of 0 to GSM carriers in North America, guaranteeing that two carriers will not have conflicts within the first two digits of the MNC. Note that theoretically an MNC should be assigned to a license (to allow trading of licenses between carriers without reprogramming or replacing SIM cards) and there are several thousand wireless licenses for Cellular and PCS in the United States.

The second problem arises from the use of the E.214 mapping from E.212 IMSI to E.164 for the purposes of SS7 routing (global title translation). Within the North American Numbering Plan (NANP) area this results in the about 24 MCCs being mapped onto a single E.164 country code ('1'). This means that each MNC must be unique by itself (without considering the MCC). This further reduces the available pool of IMSI's by a factor of 24.

The consequence of these two problems is that North America has not 2,400 distinct IMSI blocks but, in effect, 240 times fewer than that – only 100 unique carrier identifiers in the entire NANP area.

At first it was believed that non-GSM carriers (e.g. CDMA, TDMA) could utilize IMSI codes outside these limitations. However, with the increased interest in ANSI-41/GSM roaming, many non-GSM carriers may want to provision GSM-compatible IMSI codes.

We would like to know if you feel we have made any errors in our analysis of these problems.

We would like to know if GSM carriers have any plans to move to universal use of 3 digit MNCs (or perhaps already have), at least for SIM cards that will be provisioned within the NANP or will be used for roaming into the NANP. We would also like to know if GSM carriers have any plans for the complete elimination of the use of E.214 mapping (at least for carriers that have roaming agreements with North America). If so, we would like to know whether this migration will be towards true E.212 (IMSI) global title translation or some other solution.

Signed

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