Source: **TSG RAN**

Title: **Methods to handle early mobiles**
Document for: **Information**

Agenda Item: **8.2**

TSG-RAN Meeting #16   *RP-020449*
Marco Island, FL, USA, 4 - 7 June 2002

Title: **Methods to handle early mobiles**
Source: **Vodafone Group**
Document for: **Discussion**
Agenda: **12**

1. Introduction

During RAN #15 there was considerable debate over a change request proposing to introduce an "interim test marker" into the UE capability information that is sent to the network, and that, in the end, the CR was withdrawn. Subsequently, at RAN #16 an LS was received from SA WG2 asking RAN to consider the use of the IMEISV as part of a solution to this problem.

The stimulus for the debate is the concern that mobiles are unable to be fully tested against all of the mandatory features (or combinations of features) in the R'99 standard. Hence when one of the un-tested features is "switched on" in a network, there is a risk that some mobiles will not work with this feature (or particular combination of features).

The purpose of the following contribution is to facilitate discussion of the merits of solutions to handling early R'99 mobiles. The advantage of discussing this now is that it should speed up the process significantly when problems need to be resolved by:

1) Having potential solution methods already discussed (without added commercial pressure) and ready for implementation.
2) If changes are required to UTRAN or Uu interfaces (in order to have a smooth handling of faults) then these contingency changes can be agreed prior to existence of a particular fault.

The document does not intend to present one particular view but to be generic to all discussed solutions.

2. Current Status

The current situation where the UTRAN cannot determine the 'maturity' of the UE will force network manufacturers and operators to consider the worst performing UE when designing their network for the introduction of new functionality.

If a UE does not work correctly when the new functionality is introduced there can only be three basic reasons:

1) The UE manufacturer has deliberately not implemented the functionality
2) The UE manufacturer has tried to implement the functionality correctly but failed (normally due to no possibilities to test the functionality when UE was launched)
3) The standard has changed since the UE was launched (normally due to that an error was found). The solution is either costly network patches (if possible at all), even more costly UE updates or disable the functionality until there is sufficient penetration of the new behaviour.

A likely consequence is that network manufacturer will be less willing to spend resources developing new functionality that is likely not to be possible to use until "all" UEs correctly support the new functionality. When network manufacturers don't implement new functionality, UE manufacturers will not have any network to test their implementation against, making them less eager to spend time and resources to validate the new functionality. Hence, introducing new functionality will be costly for operators, network vendors and UE manufactures, the cost that has to be paid by the subscribers.

4. Proposals

The following section discusses the proposal and aims to provide some understanding of the relative benefits and costs.

4.1 Use methods employed using GSM

During the lifetime of GSM a number of problems has been discovered that needed to be addressed in order to ensure the proper behaviour of mobiles. These problems have either been solved through corrections to the standard, and where appropriate inclusion of restriction within 09.90. During RAN #14 it was agreed to create two empty TR's in preparation for problems arise.

4.1.1 Summary of Advantages

1. No changes are required to the UE to provide the smooth handling of early mobiles.

2. No changes are required to the UTRAN to provide the smooth handling of early mobiles.

3. No changes are required to the CN to provide the smooth handling of early mobiles.

4.1.2 Summary of Disadvantages

1. Can only offer limited help. Mostly likely outcome of UE fault discussion is non-use of feature (or combination of features) for all UE.

4.2 UE indication to UTRAN (high priority set indicator)

Introducing a "high priority set indicator", indicating the level of tests the UE has performed, in the UE capabilities would give UTRAN a 'feeling' of the UE's maturity. Previously, it has been proposed to indicate "high priority set" or "full set".

The indication in terms of the level needs to be considered carefully, depending of the level of granularity that is required of handling of early mobiles.

However, even if the UE indicates "high priority set", it may work with more functionality. The prerequisite for the smooth introduction of new functionality is that

a) all UEs support it or

b) the UE's indication of level of test can be changed

4.2.1 Summary of Advantages

1. Allows some crude handling of early mobile faults.

2. No change required to CN to provide the smooth handling of early mobiles.

4.2.2 Summary of Disadvantages

1. Changes are required to the UE to provide the smooth handling of early mobiles.

2. Changes are required to the UTRAN to provide the smooth handling of early mobiles.

3. Indication offers relatively course granularity, and may be result in the indication being worthless once problems are discovered with a large population of mobiles indicating "high priority set".

4.3 IMEI-SV (existing procedure to CN, new procedure to provide IMEI-SV to RAN)

Giving UTRAN access to IMEI-SV would enable UTRAN to offer "special behaviour" for problem UEs – both for screening out UEs that don't work properly with new functionality, but could also be used for performance optimisations.

However, currently the IMEI is not available in UTRAN, but it is in the CN. One idea according is to send the IMEI together with the IMSI in the "Common Id" message over Iu. This message is sent after the RRC connection already has been established and therefore no "special behaviour" can be allowed until this message is received.

At first, this method seems very good. However, there are some disadvantages:

1) There is an increased burden on UTRAN to handle an additional database in the IMEI-SV will be complex to manage (say 40 UE manufacturers, 10 models each, 5 software versions per model gives 2000 entries, all with potential different treating). Not all versions and updates will be visible for network vendors and operators until after commercial launch.

4.3.1 Summary of Advantages

1. No changes are required to the UE to provide the smooth handling of early mobiles.

2. Offers a method to provide special handling at many different granularities (single mobile software build to entire mobile population).

4.3.2 Summary of Disadvantages

1. Changes are required to the UTRAN to provide the smooth handling of early mobiles.

2. UTRAN vendor can hide special behaviour designed for commercial advantage.

3. Additional database is required in RNC to map from IMEI-SV to fault handling.

4. Change required to CN to provide the smooth handling of early mobiles.

4.4 IMEI-SV (existing procedure to CN, new procedure to provide 'bitmap' to RAN)

Giving UTRAN access to a bitmap of 'known faults' provides the UTRAN with sufficient information to provide specific handling of known UE problems by the UTRAN.

By making the indication from the CN to the UTRAN a 'bitmap' this ensures

1) that known problems are documented within the standards, so that behaviour can be associated with a setting of a bit that is transmitted over Iu.

2) a UTRAN vendor cannot <u>hide</u> special behaviour designed for commercial advantage.

The disadvantage of this report is that 'special' behaviour is only possible after the bitmap has been received in the UTRAN.

This proposal requires some changes to the UTRAN only.

4.4.1 Summary of Advantages

1. No changes are required to the UE to provide the smooth handling of early mobiles.

2. Offers a method to provide special handling at many different granularities (single mobile software build to entire mobile population).

3. Associated special behaviour required to handle mobile fault has to be public before special handling bit would be allocated.

4.4.2 Summary of Disadvantages

1. Changes are required to the UTRAN to provide the smooth handling of early mobiles.

2. Database required in CN to map from IMEI-SV to mobile fault.

4.5 IMEI-SV (change to RRC to include IMEI-SV in an early message)

This proposal has the same advantages as contained in 4.3, with the additional advantage that 'special' behaviour in the UTRAN can take place as soon as the RRC (could be the first) message is received that contains the IMEI-SV.

However, there is a increased risk that a UTRAN vendor could <u>hide</u> special behaviour for commercial advantage.

This proposal requires some changes to the UE and the UTRAN.

4.5.1 Summary of Advantages

1. Special handling can take place as soon as the first RRC message (containing the IMEI-SV) has been received.

2. No change required to CN to provide the smooth handling of early mobiles.

4.5.2 Summary of Disadvantages

1. Changes are required to the UE to provide the smooth handling of early mobiles.

2. Changes are required to the UTRAN to provide the smooth handling of early mobiles.

3. Increased risk that a UTRAN vendor could <u>hide</u> special behaviour for commercial advantage.

4.6 Introducing indications on Uu of supported/not supported functionality when erroneous UEs are found

Introducing an indication of supported/not supported functionality in the UE capability when erroneous UEs are found don't seems like a suitable solution for the following reasons:

1) Both correctly functioning UEs and the erroneous UEs need to handle these indication(s). Therefore the changes need to be implemented in a backwards compatible manner.

The incentive for UE manufacturers to implement the full standard will be reduced; Vendors may rely on the ability to add a capability later.

4.6.1 Summary of Advantages

1. Special handling can take place as soon as the first RRC message (containing the indication) has been received.

2. No change required to CN to provide the smooth handling of early mobiles.

4.6.2 Summary of Disadvantages

1. Changes are required to the UE to provide the smooth handling of early mobiles.

2. Changes are required to the UTRAN to provide the smooth handling of early mobiles.

3. Incentive for UE manufacturers to implement the full standard will be reduced; Vendors may rely on the ability to add a capability later

4.7 Introducing a time stamp

Introducing a time stamp in the UE capabilities indicating the production quarter of the UE would give UTRAN the possibility to set a date that a UE should have been produced after before using a new functionality. The drawback is that the last UE to support the new functionality correctly will set the date.

This proposal requires some changes to the UE and the UTRAN.

4.7.1 Summary of Advantages

1. Special handling can take place as soon as the first RRC message (containing the time-stamp) has been received.

2. Special behaviour is independent to UE vendor.

4.7.2 Summary of Disadvantages

4. Changes are required to the UE to provide the smooth handling of early mobiles.

5. Changes are required to the UTRAN to provide the smooth handling of early mobiles.

6. Granularity will be of the order of timestamp.

4.8 Introducing a time stamp plus UE vendor name

Introducing a time stamp plus the UE vendor name in the UE capabilities indicating both the production date of the UE and the brand name would give UTRAN the possibility, per UE vendor, to set a date that the UE should have been produced after before using a new functionality. The number of entries in the database would be less than in the IMEI-SV solution since it is likely that a brand has corrected functionality at the same time for all models. A potential drawback with this proposal is the administration of allocating UE vendor names. However, the same administration as for IMEI allocations could be used.

4.8.1 Summary of Advantages

1. Special handling can take place as soon as the first RRC message (containing the time-stamp and UE vendor name) has been received.
2. No change required to CN to provide the smooth handling of early mobiles.

4.8.2 Summary of Disadvantages

1. Changes are required to the UE to provide the smooth handling of early mobiles.
2. Changes are required to the UTRAN to provide the smooth handling of early mobiles.
3. UTRAN vendor can hide special behaviour designed for commercial advantage.

4.9 Introducing network vendor specific fields

The idea behind this proposal is to allocate a number of bits to each network vendor where each network vendor instructs the UE vendor how to set the bits of the network vendor. This would allow every network vendor to know what the UE can or cannot do in its networks. This proposal does not seem feasible since it requires each UE manufacturer to test with each network vendor. Furthermore, the incentive to implement more than what is currently available in the networks are low since the pain of updating UE capabilities when new network releases are available will be too big. Hence, new functionality cannot will not be supported by "old" UEs.

4.9.1 Summary of Advantages

1. Special handling can take place as soon as the first RRC message (network vendor specific fields) has been received.
2. Encourages UE vendors to perform IOT.
3. No change required to CN to provide the smooth handling of early mobiles.

4.9.2 Summary of Disadvantages

1. Changes are required to the UE to provide the smooth handling of early mobiles.
2. Changes are required to the UTRAN to provide the smooth handling of early mobiles.

4.10 Introducing UE indications (hooks) that can be utilised later

The idea behind this proposal is provide a number of defined bits that can be allocated when critical problems are found. The need to ensure that these bits are available early is so that these bits do not impact extensions that have been included into later releases. Once a problem is found, it would have to be declared and could only be set once the 'special' behaviour has been agreed within RAN.

In this proposal the aim is to include these bits to an early RRC message. The proposal is not at present to define any use to the bits, and clearly document in standards that they should always be set to 0 and should be ignored in the UTRAN.

4.10.1 Summary of Advantages

1. Special handling can take place as soon as the first RRC message (containing hook) has been received.
2. Associated special behaviour required to handle mobile fault has to be public before special handling bit would be allocated.
3. No change required to CN to provide the smooth handling of early mobiles.

4.10.2 Summary of Disadvantages

3. Changes are required to the UE to provide the smooth handling of early mobiles.
4. Changes are required to the UTRAN to provide the smooth handling of early mobiles.