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Introduction.

This contribution introduces the discussion of having the mobile network call control residing in the Mobile Terminal (MT) component of the User Equipment. The contribution also introduces the concept of a 'back to back' call control stack highlighting the advantages and disadvantages of such an approach to the UE split discussion.

Definitions

The definitions used within this document are purely for the purposes of this document and in no way relate to other definitions used else where in 3GPP.
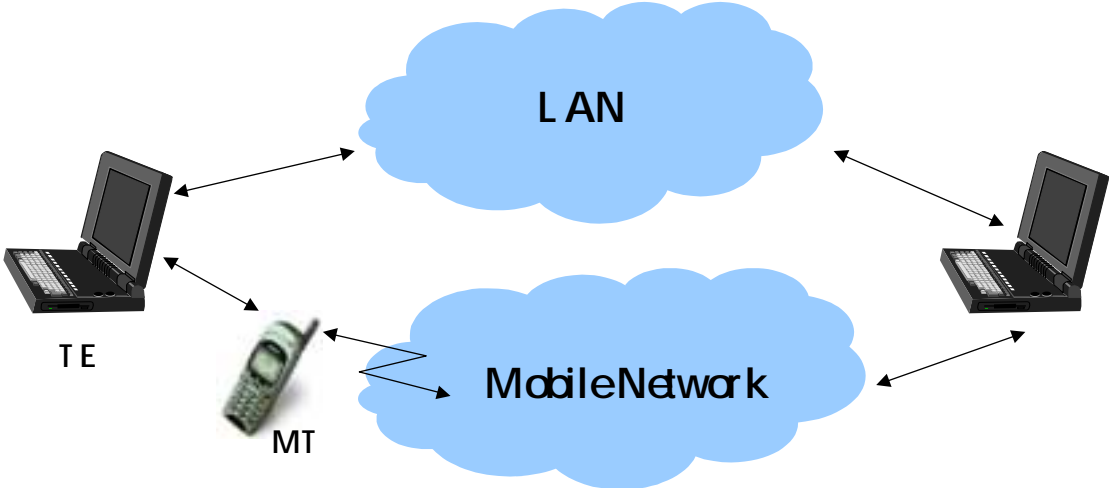
UE	User Equipment.
	Consists of the MT and the TE
MT	Mobile Terminal
	The component of the UE that communicates with the network using the radio interface. Also used to set-up the radio connections as requested by the call control, irrespective of where the call control resides.
TE	Terminal Equipment
	The component that is used to provide services to the end user.
SIP	The standard IETF call control
enhanced SIP	The SIP based call control used within the 3GPP mobile network.
SIM	Subscriber identity Module (The chip card that contains certain security and identity information)

GSM Today

In GSM today the UE consists of a TE and a MT that co-consist in the same device. This device can be used for voice calls as well as data calls. However in the case of the data calls the device that is attached to the UE, (normally some form of a PC) sends AT commands to the mobile which translates them into the 04:08 call control in order that a connection can be established. In this example the call control used to communicate with the network to establish the connection resides in the MT together with the SIM from which authentication can take place. Therefore the network operator is not concerned with the device connected to the UE. So long as the AT commands can be translated by the UE, there is no concern as to the call control being used as it will always be 04:08. The MT also contains the SIM card complete with associated security and identity aspects. This allows the operator to gain confidence that the (entities connected with the) MT is who it claims to be, and also that the SIM is an authenticated/secure platform to enable charging and associated security aspects.

However with the introduction of the UE split new issues are introduced into the equation. There has already been long discussions over the issues surrounding the authentication of the TE if split from the UE, however it is not the intention of this document to try and solve these issues at this stage. This document concentrates more on the call control issues that are of concern to network operators, especially in which component, the TE or the MT, the call control will reside.
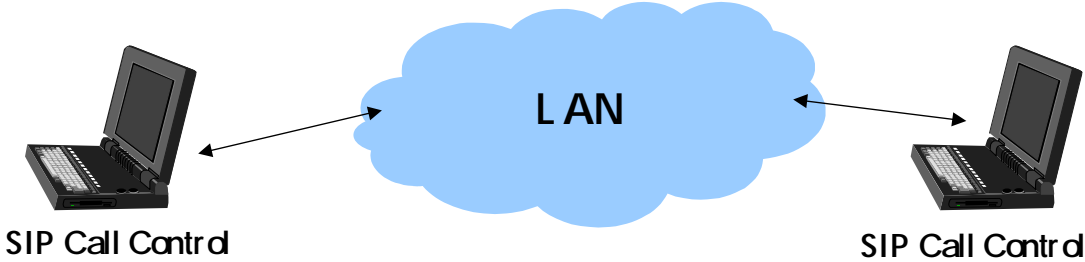
Split UE

In this scenario the owner or user of the TE expects the same operation irrespective of the network that they are connect to. Therefore if they are connecting over a wireless/mobile network, they would expect the same look and feel to their applications as when connected over the wired LAN.
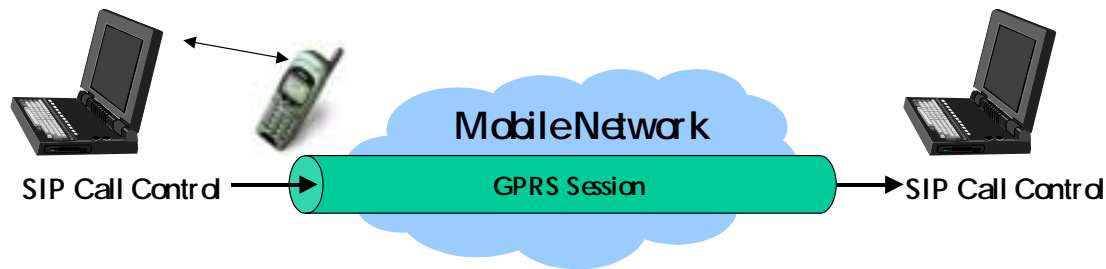
TE to TE over wired LAN

Take the example of the user setting up a video conference using SIP as the call control mechanism. In this scenario the SIP call control within the TE is identical to that used in the PC connected to the corporate LAN i.e. SIP as defined by the IETF. The SIP can be used to set-up the video conference session across the LAN with the TE talking directly to the PC.

However, now consider the scenario where the same user wants to set up a conference call to the PC User over a mobile network. There are basically two ways in which this can be achieved.

The first method is for the TE to negotiate a GPRS session in order that the call control can directly be sent to the PC. This is shown in the following diagram.

However, there are several areas of concern over this solution, although as a network operator it is fully

Expected that this approach will be used by some applications.

The advantage of this approach is that the user can upgrade the call control at both ends at any time and ensure that the experience is unchanged whether on the wired LAN or the mobile network. The disadvantage is that the mobile network is not aware of the type of traffic being carried Therefore the first disadvantage is that the all traffic (including signalling) will be charged for. This is a significant disadvantage for the user, especially is the PC on the corporate LAN can not be contacted. Also there is little synergy with the user experience when considering the identity or service aspects that the use of the mobile network offers (both from an end user and mobile operator perspective).
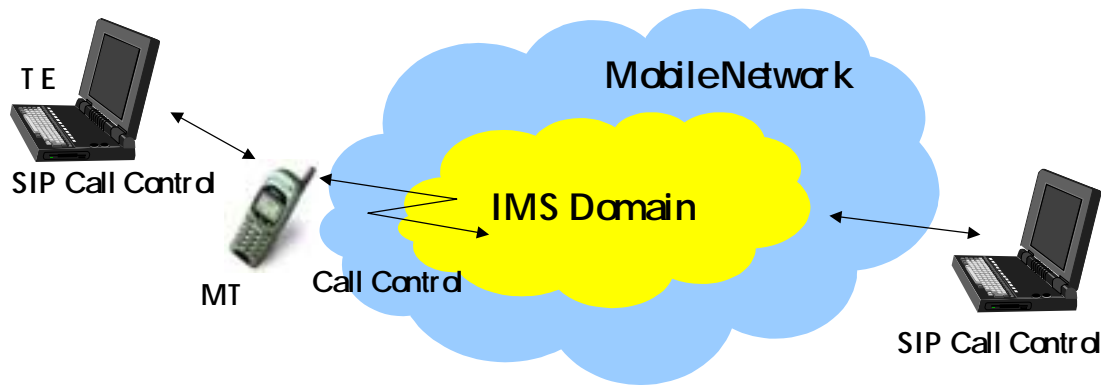
A further disadvantage is the control over the radio interface. Since the call control is not terminated within the network it will not be possible to optimise the efficiency of the radio connection, end users will be charged purely on a volume basis. Again this is a serious concern for the network operator as they cannot offer optimisations for certain appliucations which tend to be 'bandwidth hungry'..

A further disadvantage is that the IETF standardisation of SIP is far from prescriptive about what the end to end actions maybe and there could well be some degree of discrepancy and inefficient use of capacity through selection of codecs not optimised for this session. This would mean users paying a premium and being 'put-off' from certain services which potentially could be optimised for mobile delivery.

Finally, and probably of most significance to the user is that it is not clear how the TE will negotiate the set-up of the GPRS (PS Domain) bearers. Clearly it is beneficial that one form of QOS is applied to the signalling and that different QOS GPRS bearers would be better suited to whatever the medium type is being used. With the external end to end scenario, it could be assumed that one QOS is set up at outset and maintained no matter what the media type is to be transferred perhaps causing very poor communication results for user. Otherwise there would need to be specific TE developments to enable GPRS bearer selection based on media types in use.

Back-2-Back MT

An alternative approach, and one favoured by BT would be to introduce the concept terminating the call control within the MT. This is more commonly know as the 'Back to Back' MT where there are two protocol stacks within the MT; one to communicate with the TE, and one to communicate with the mobile network. This is shown in the following diagram.

TE

SIP Call Control

MobileNetwork

IMS Domain

MT   Call Control

SIP Call Control

In this scenario the MT translates the SIP call control held within the TE into the enhanced call control used to connect and converse with the network. This is then translated back into the SIP call control at the edge of the mobile network in order that the PC on the corporate LAN can accept the SIP call control. As the enhancements being made to SIP within 3GPP (CN1) are also being integrated into the IETF standard SIP, it is likely that the deltas between enhanced SIP (3GPP) and standard SIP will be minimal or zero.

The advantages of this approach inclue the following:

1) The operator has the ability to add value to services within the network, where it eases or simplifies the user experience, and not to become just a bit pipe between an end point and a third party. An example of this is Supplementary Services.

2) Greater control over the use of the Radio Interface. For example, if an application requests a 64kbit connection for a voice call the MT can translate the call control into a more efficient data rate (for example AMR (all R5 IM compatible UE shal support AMR coding)) as opposed to the 'bit pipe' example where the MT and/or the Network are not aware of the type of service requested.

3) Since the TE uses the same call control as the PC on the corporate LAN, the mobile network appears to be identical to the LAN to which it is connected to in the first scenario. Therefore this has the advantage that the user experience is seemingly identical. However it is recognised that extensions to the IETF SIP Call Control may not be supported by the enhanced SIP call control used within the network.

4) The network operator has full control of the sessions that are being established. Therefore the network will have improved knowledge of the type of traffic being handled and be able to charge accordingly.

5) Within the call control and GPRS bearer maintained within the MT then it is a much easier process in matching GPRS bearer to application type in use, thus ensuring good communication with no change to the TE.

6) Users can still run sessions that use proprietary applications, these will be mapped straight through at a session level with the provision of basic connectivity via the SIP signalling and GPRS bearer.

This is just an example of the types of advantages in the Back-2-Back call control approach.

Upgrade to TE (back-2-back MT)

In the Back-2-Back scenario it is important to understand the issues if the call control within the TE is changed, (the latest version of the IETF SIP Call Control is loaded onto the TE). In this example it is likely that the MT will not be able to translate all of the SIP commands into the enhanced SIP commands to provide expect service. However, it is important that the basic SIP call control is

supported both within the TE and the network to provide a standardised way in which a session can be set up.

Security and identification

With the use of seperated TE and MT, the USIM will enable secure unique identification of the MT, which can be used to link subscription aspects between the CS, PS Domains and IM. This gives operators a common identity (IMSI/(IM)Private User Identity (possibly containing the IMSI)) to unquely identify the users. Within the IM Domain the unique identity (Private user identity) is stored on the USIM along with security information. This information is used for authentication to give operators confidence that IM users are who they claim to be, thus giving added confidence regarding charging and user service provision. The interaction between external TE and the MT need to be considered, however the USIM must be involved to enable IM capability to be delivered in a sound secure, authenticated and secure manner.

Summary

This contribution has highlighted some of the issues raised over the requirement to be able to split the UE into a TE and a MT. This contribution has also introduced to concept of the Back-2-Back MT and the advantages that this brings. It is understood that there are disadvantages to this approach, not least being the fact that this solution raises the cost of the MT. However, as an operator this issues is outweighed by the advantage of being able to maintain and increase our revenue by adding value to services within the network, where it eases or simplifies the user experience, and not to become just a bit pipe between an end point and a third party The advantage to the user is that it will offer much more effective and better quality communications without necessitating mobile specific changes to the TE.