3GPP TSG SA WG3 Security — S3#22 **S3-020039**

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Bristol, UK

3GPP TSG-SA5 (Telecom Management) **S5-020027**
Meeting #25, Sophia Antipolis, France 14 - 18 January 2002

Title: Liaison Statement on User Equipment Management Feasibility Study (SA5's TR 32.802)
Source: **SA5 SWG-A**
To: T2, T3 and SA3

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Attachments: Draft TR 32.802 v1.0.~~0~~2

NOTE: S5-020027 replaces S5-020017
The text of this LS remained unchanged only a newer version of the Draft TR 32.802 v1.0.2 was attached.

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1. Overall Description:

This LS concerns the Release 5 User Equipment Management (UEM) Feature (see TSGS#12(01)0286 for the WID) and is for ACTION. An updated version of the UEM TR is attached and SA5 SWG-A welcomes your feedback on it. The completed TR is scheduled to be submitted to TSG#15 (starts 5 March 2002) for approval, thus SA5 SWG-A must have received feedback on the TR by 24 February 2002 at the very latest. In SA5 SWG-A's view the UEM feature is feasible for Release 6.

2. Actions:

To T2, T3 and S3 groups.

ACTION: SA5 SWG-A asks the T2, T3 and S3 groups to confirm to SA5 SWG-A by 24 February 2002:

1. That the User Equipment Management Feature, as described in TR 32.802, is feasible for Release 6. In particular see clause 8 in the document which is on UEM Project Planning.
2. That TR 32.802 can be sent to TSG-SA for approval. If not, what changes need to be made to the TR before submitting it for approval?

SA5 SWG-A would like to emphasise that any other feedback on UEM and/or TR 32.802 would be welcome.

3. Date of Next SA5 Meetings:

Meeting	Date	Location	Host
SA5#26	25 Feb - 1 Mar 2002	Miami, FL / USA (T1M1/TMF)	NA Friends
SA5#27	2-5 Apr 2002	Cork, IRELAND	Motorola
SA5#28	20-24 May 2002	Sophia Antipolis, France	ETSI
SA5#29	24-28 Jun 2002	Beijing, CHINA	Nortel Networks
SA5#30	19-23 Aug 2002	TBD	TBD
SA5#31	7-11 Oct 2002	Phoenix, AZ, USA	NA Friends
SA5#32	18-22 Nov 2002	TBD	TBD

3GPP TR 32.802 V1.0.2 (2002-01)

Technical Report

3rd Generation Partnership Project;
Technical Specification Group Services and System Aspects;
3G Telecom Management:
User Equipment Management (UEM) Feasibility Study
(Release 5)

Keywords

UEM, User Equipment Management, UE Management

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Contents

Foreword

This Technical Report has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

- x the first digit:
  - 1 presented to TSG for information;
  - 2 presented to TSG for approval;
  - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

Introduction

The present document is a feasibility study on User Equipment Management (UEM). UEM is a capability which will allow the Operator, Service Provider and/or UE Manufacturer to remotely manage User Equipment.

The capabilities of the user equipment in 3G are becoming and will continue to become ever more sophisticated and integrated (high definition colour screens, faster processors, built in cameras, integrated media players etc.). The sophisticated capabilities of 3G User Equipment will require a flexible means to support management of the UE satisfying the end-customers, service providers, network operators and UE manufacturers' need. The purpose of the feasibility study is to progress this new management capability.

The present document outlines aspects of UEM which it would be valuable to standardise in post 3GPP Release 5. The present document identifies some UEM requirements, proposes a UEM role model, identifies some key UEM capabilities that map to the requirements, performs some analysis of those capabilities and proposes an architecture for UEM. A proposal is made for the co-ordination and planning of the UEM standardisation work and the conclusions section makes some recommendations on UEM. Annex A contains a list of additional UEM requirements not directly related to the UEM capabilities identified..

UEM will assist in maximising the user experience and quality of service, maximise subscriber usage, minimise costs and help ensure that faults are promptly resolved.

1 Scope

The scope of the present document is a Release 5 feasibility study to show that there are aspects of User Equipment Management (UEM) which would be beneficial to standardise post Release 5. For Release 5 the present document does not have a factual impact on other WIs.

User Equipment (UE) includes both the USIM and Mobile Equipment (ME) domains and so it is emphasised that the scope of UEM includes both the USIM and ME domains.

This direct interface between the UEM Consumers and the UE is outside the scope of this document (see clause 5).

The user interface will be important in delivering UEM however the user interface is both outside the scope of this document and outside the scope of the standardisation of UEM.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document.*

[11] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 22.240: "3GPP Generic User Profile requirements; Stage 1".

[3] 3GPP TS 23.240: "3GPP Generic User Profile requirements; Stage 2; Architecture".

[4] 3GPP TS 23.241: "3GPP Generic User Profile requirements; Stage 2; Data description framework".

[5] 3GPP TS 24.241: "3GPP Generic User Profile requirements; Stage 3; Access; Common objects".

[6] 3GPP TS 22.057: "Mobile Execution Environment (MExE); Service description, Stage 1".

[7] 3GPP TS 23.057 (V4.3.1): "Mobile Execution Environment (MExE); Functional description; Stage 2".

[8] 3GPP TS 32.140: "Services Operations Management; Subscription Management; Stage 1".

[9] GSM TS 04.02: "GSM Public Land Mobile Network (PLMN) access reference configuration".

NOTE: It is possible that one or more of these references may not be approved in Release 5.

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

Customer Care Operator (CC Operator): is a role which provides support to customers

User Equipment Management (UEM): is a capability which will allow the Operator, Service Provider and/or User Equipment Manufacturer/User Equipment Supplier to remotely manage User Equipment

UMTS IC Card: an IC card (or 'smartcard') of defined electromechanical specification which contains at least one USIM

Universal Subscriber Identity Module (USIM): an application residing on the UICC used for accessing services provided by mobile networks, which the application is able to register on with the appropriate security

User Equipment: device allowing a user access to network services

NOTE: For the purpose of 3GPP specifications the interface between the UE and the network is the radio interface. A User Equipment can be subdivided into a number of domains, the domains being separated by reference points. Currently defined domains are the USIM and ME Domains. The ME Domain can further be subdivided into several components showing the connectivity between multiple functional groups. These groups can be implemented in one or more hardware devices. An example of such a connectivity is the TE – MT interface. Further, an occurrence of a User Equipment is an MS for GSM as defined in GSM TS 04.02 [9].

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

CC	Customer Care
CRM	Customer Relationship Management
FCAPS	Fault, Configuration, Accounting, Performance, and Security management
ME	Mobile Equipment
UE	User Equipment
UEM	User Equipment Management
UICC	Universal Integrated Circuit Card

4 UEM Requirements

This clause contains the identified User Equipment Management (UEM) requirements which are applicable to the subsequent clauses of the present document. Annex A contains additional UEM requirements. Each requirement has a unique number.

Ref	Management Function	Sub category	Requirement	Customer Care	Network Operations	CRM	UE Manufacturer
1.	FM	Customer assistance	Lists of clear/concise FAQ that are downloadable to the UE to solve common problems.	✓		✓	
4.	FM	Fault	Provide support for fault resolution.	✓			
5.	FM	Fault	Provide support for fault diagnosis.	✓			
6.	FM	Fault	Remote service fault diagnosis (remote)		✓		
9.	FM	UE	Self-health check on UE	✓			
11.	FM	UE	Remote diagnosis on UE	✓			
13.	FM	UE	Provide a service for UE similar to that available today for managing corporate PC networks, particularly for fault finding.	✓		✓	
26.	FM	Error/fault statistics	Identify and report on element failures		✓		
58.	CM	User Equipment	UE type (make, model, OS, version) Firmware version /level S/W Version Applications embedded Applications added/downloaded Application version Virus check history Memory status	✓			
60.	SM	Application	Support the collection of diagnostic information from applications on the UE.	✓	✓		
62.	SM	Configuration	Fast service set-up	✓	✓	✓	✓
63.	SM	Configuration – Remote	Set up services Check service works Upgrade services – trouble free Download applications from operator to UE OTA	✓	✓	✓	

Ref	Management Function	Sub category	Requirement	Customer Care	Network Operations	CRM	UE Manufacturer
			Update UE software Virus checks Software bug fixes - trouble free				
64.	SM	Configuration – Remote	For specific customers must be able to remotely configure the UE.	✓		✓	
66.	SM	Customer Alerts	New O/S versions	✓			✓
67.	SM	Customer Alerts	New services to the UE			✓	
72.	SM	Customer assistance	PC anywhere for mobiles – tuition, show users how to use their equipment	✓			
74.	SM	Customisation	Remote access to view a corporate's personalised settings Remote access to modify a corporate's personalised settings	✓			
76.	SM	Data management	Manage customer data uploads Manage customer data downloads			✓	
85.	SM	Proactive downloads	Of apps, services, fixes etc to UE	✓	✓	✓	✓
90.	SM	UEM	For corporates	✓		✓	

Key to Management Function column:
SM: Service Management.
CM: Configuration Management.
FM: Fault Management.
PM: Performance Management.

The function that needs each requirement is indicated by the last 4 columns of the table.

Tracking Hardware

95. The following is the minimum set of the user device information that the operator needs to know:
    - Manufacturer;
    - Model;
    - Software version;
    - Applications resident on the terminal.
96. It should be possible for the operator to remotely audit user device information over the radio interface.

Tracing Errors

99. The operator must be able to identify and locate the appropriate diagnostic/remedial application.
100. The operator must be able to remotely download the remedial application to the Mobile Terminal.
101. The operator must be informed whether the remedial application has been successfully installed in the MT.
102. The operator must be informed whether the application has completed its tasks successfully.
103. The remedial application must uninstall and delete itself after completing its tasks unless explicitly instructed not to.
104. User data in the MT must remain unaffected.
105. Device configuration must remain unaffected unless otherwise required by the remedial application.

Configuring Terminals

107. The operator before updating the MT software version must have received the customer's agreement.
108. The operator must be able to remotely download new software version to the MT.
109. User data in the MT must remain unaffected.
110. Device configuration information should only be updated as required by the new software version.

Downloading Application & Services

111. The operator must be able to remotely download applications to the MT.
112. The operator must be informed whether the remedial application has been successfully installed in the MT.
113. User data in the MT must remain unaffected.
114. Device configuration information should only be updated as required by the new application.
115. The operator before updating the MT with new applications must have received the customer's agreement.

Remote Terminal Diagnostics

116. The operator must be able to remotely download applications to the MT.
117. The operator must be informed whether the remedial application has been successfully installed in the MT.
118. Execution of the application must be possible using certain triggering events.
119. The data gathering application must be under full control of the network operator.
120. The application must not, in any way, degrade the quality of service or service functionality expected by the user.
121. The operator must be able to remotely uninstall and delete the application from the customer's MT.
122. User data in the MT must remain unaffected.

123. Device configuration information should only be updated as required by the new application.

124. The operator before updating the MT with new applications must have received the customer's agreement.

Miscellaneous Requirements

135. The operator must be able to easily search for and discover the appropriate application to fit the purpose for particular equipment.

136. The downloading mechanism should be able to identify and locate the target device quickly and accurately.

137. Security mechanisms should be in place to authenticate the source and target of the application. In addition all data must be encrypted and applications only allowed to execute in an expected and non-harmful manner.

138. The current device configuration and data must be backed up, prior to any new installation.

139. An acknowledgement will be returned to the operator after installation.

141. A UEM application will uninstall and delete itself after completing its tasks unless explicitly instructed not to.

142. The Network Operator Domain shall provide the application with all the access it requires to complete it's tasks.

143. The user's private data and configuration settings must be stored prior to installation of any new software, to enable the new patch or application to be installed with the previous configuration settings.

144. The application must not, in any way, degrade the quality of service or service functionality expected by the user.

145. The scope of UEM could be extend to cover not only the conventional voice plus User Equipment but also "dumb" terminals such as drinks machines, monitoring equipment etc.

5 UEM Role Model

This clause contains a UEM role model in figure 1. The roles identified are:

- user of the UE
- UEM consumer
- network operator

UEM consumers access the UE in order to manage the UE. Some examples of the UEM consumers are service provider, UE manufacturer, customer care operator, content provider.

The network operator would have equipment (eg UEM server and UEM gateway) to provide access from the UEM consumers to the UE.

The role model shows a potential direct relationship between the UEM Consumer and the User/UE. For example a user may be able to upgrade the operating system in their UE by taking it to the UE manufacturer's service centre. The direct interface between the UEM Consumers and the UE is outside the scope of this document.

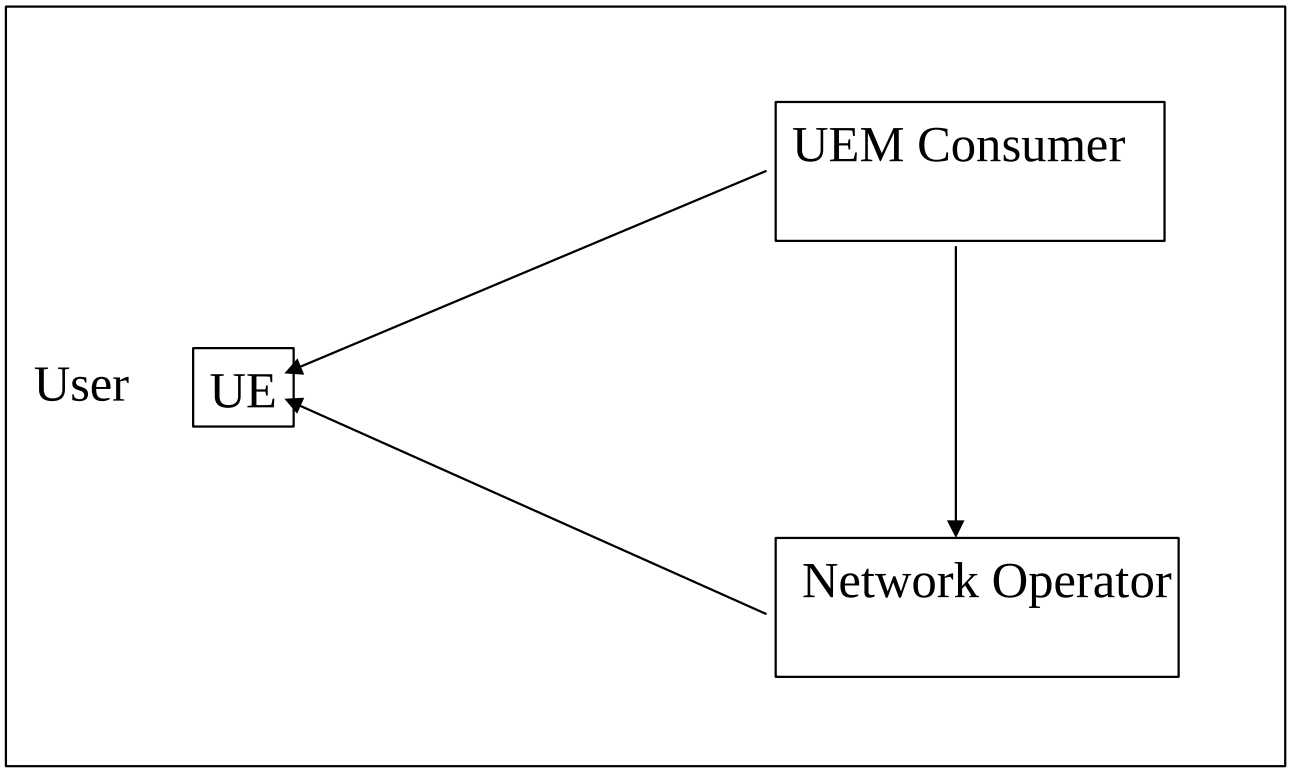


Figure 1: User Equipment Management (UEM) role model

6 UEM Capabilities

With the arrival of the 3G services, more sophisticated mobiles with download capability and the growth of 3rd party applications and content on the Internet, more and more users will use the user equipment as a mobile and limited incarnation of their desktop PC. Therefore, it is reasonable to assume that the user will download 3rd party applications to the UE. We then have the situation where an application could actually cause faults on the UE. This raises the complexity of user equipment fault resolution to a higher level compared with traditional 2G user equipment. In addition, it is more than likely that the user will contact the network operator or service provider to register the fault and it will be left to the customer care (CC) operator to handle the query. If mechanisms were available for the CC operators to identify and fix faults, then huge savings could be made in manpower, equipment and revenue loss.

This clause identifies some key UEM capabilities and performs some analysis of those capabilities.

The following key UEM capabilities have been identified:

1) UE Configuration Query;
2) UE Reconfiguration;
3) UE Software Update;
4) Remote UE Diagnostics.

It is proposed that these UEM capabilities are standardised post 3GPP Release 5.

The remainder of clause 6 describes these capabilities and performs some analysis on them. Sequence diagrams are used to provide examples of interactions that could use the UEM capabilities. For simplicity the role of the user is not subdivided into end user and owner.

6.1 UE Configuration Query Capability

UE Configuration Query allows UE configuration information to be remotely requested and retrieved. The UE configuration information would include the equipment make, model, software versions, configuration parameters. This

is valuable information in for example fault finding; end users often find it difficult to correctly report UE configuration information.

An example of how the UE Configuration Query capability could be used is illustrated in the sequence diagram in figure 2.

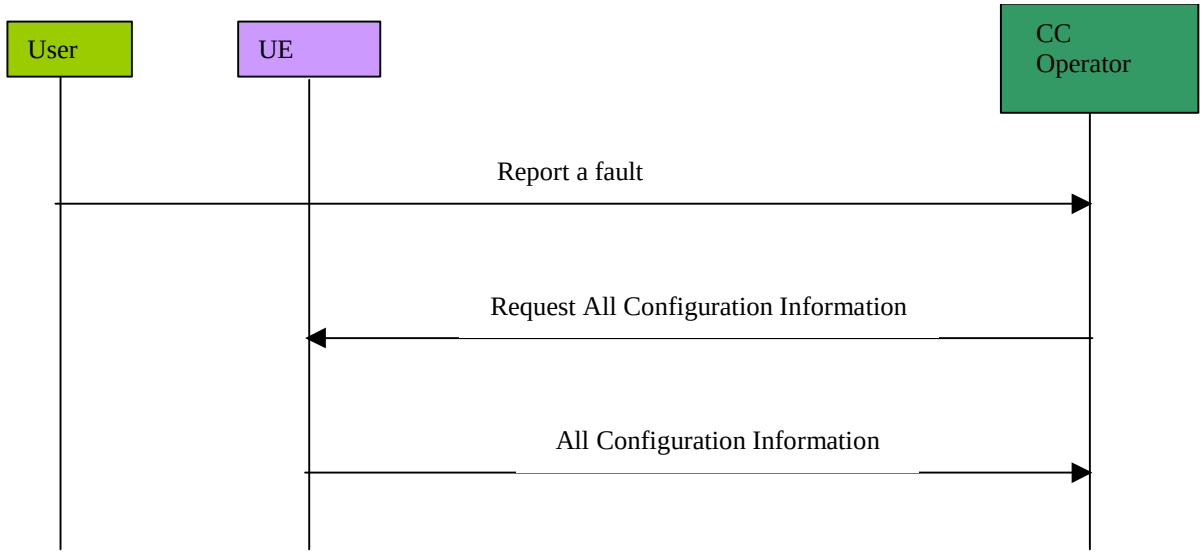


Figure 2: UE Configuration Query Sequence Diagram

The configuration information returned by the UE should include:

- IMEI (equipment make, model build date and version...);
- the software versions;
- the applications installed;
- the last error, time, date;
- configuration parameters.

6.1.1 Service Aspects

The CC Operator (authorised to use this capability for a particular UE) is able to send the command to a particular UE and receive the configuration information in response.

6.1.2 MMI Aspects

It is expected that the CC Operator will have a GUI interface to initiated this activity and would have some tools for viewing and analysing the response. It would be useful if this capability could be initiated by manual involvement and also automatically.

6.1.3 Charging aspects

Who should pay for the interaction, the user, service provider, network operator or some other party? Flexibility is probably required.

6.1.4 Security Aspects

The requesting party shall be authenticated. There shall be a valid relationship between the requesting party and the UE owner, for example explicit permission granted to perform the UE Configuration Query.

The UE Configuration Query capability does not change the configuration of the UE.

NOTE: The security checks have been omitted from the sequence diagram.

6.1.5 UMTS Operations System Aspects

The UMTS Operations System shall be able to send a command to a UE and receive a response back.

6.1.6 User Equipment Aspects

There are UE aspects for both the terminal and the USIM. Some sort of client is required on the user equipment. There needs to be a way of receiving the command on the UE. It would be useful if the names/parameters and data structures are standardised.

6.1.7 Network Aspects

No changes to the core network have been identified at this time.

6.1.8 Benefits

6.1.8.1 User/subscriber

The user/subscriber often lack the knowledge of how to view parameters so this would remove the need for an explanation for how to view a parameter(s) and save time in reading out the configuration over a voice call. The user would receive an improved service.

6.1.8.2 Network Operator/Service Provider

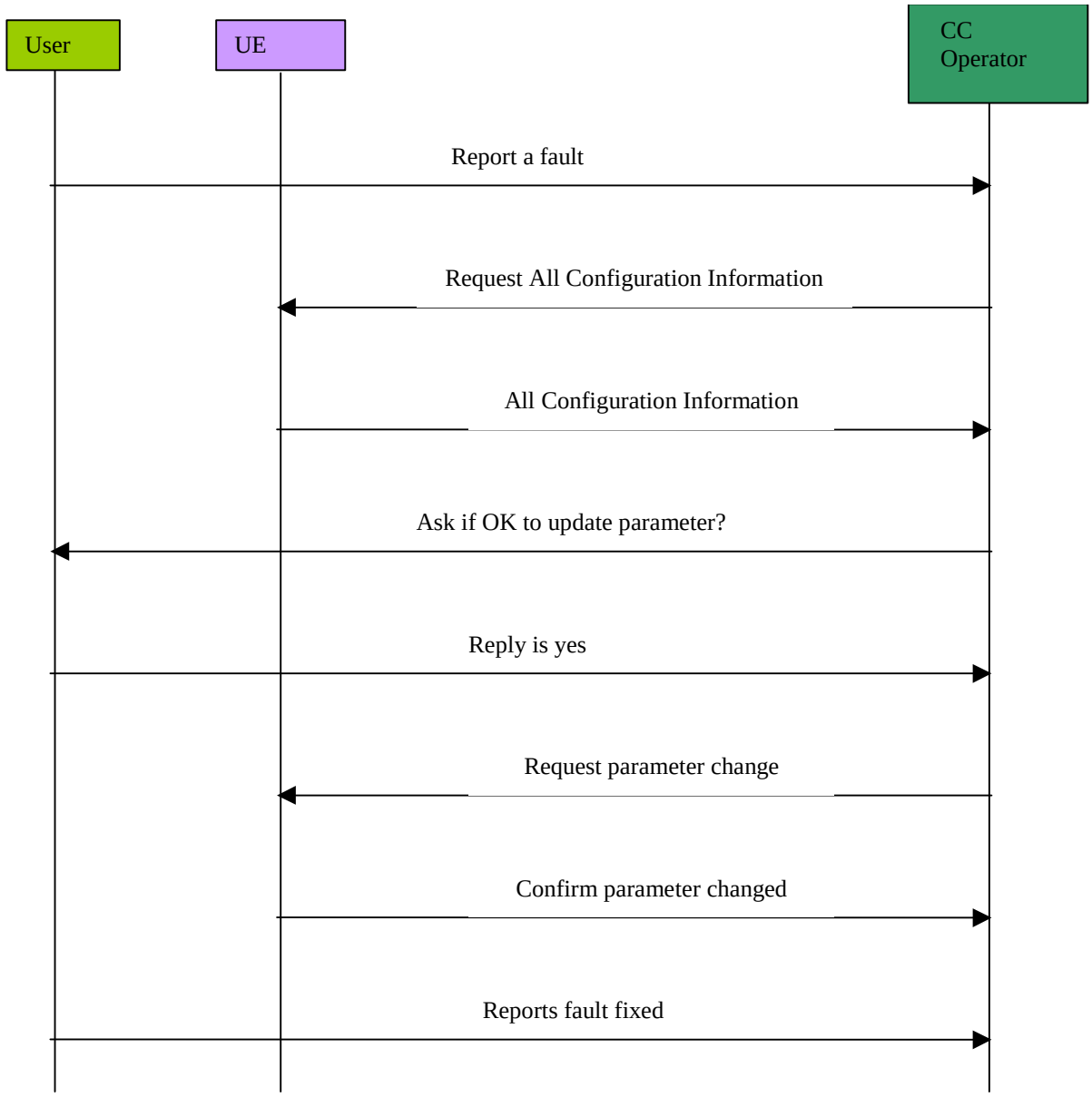
The Operator/Service Provider would be able to handle support calls more quickly and effectively.

6.1.8.3 UE Manufacturer

The User/subscriber would be happier with UE manufacturer/supplier as problems resolved quicker.

6.2 UE Reconfiguration Capability

The UE Reconfiguration capability builds upon the UE Configuration Query capability in that it allows configuration changes to be made to the UE remotely. So, for example, UE reconfiguration could be used as part of a fault resolution process to correct a problem on the UE and this is shown in figure 3. Once the cause of the fault has been identified (which in this example is an incorrect parameter) then the UE Reconfiguration capability is used to correct the fault.



NOTE: The first three interactions in this diagram are identical to the UE Configuration Query sequence diagram (figure 2).

Figure 3: UE Reconfiguration Sequence Diagram

6.2.1 Service Aspects

6.2.2 MMI Aspects

The CC Operator needs to be able to obtain permission from the user to change the parameter.

It shall be possible to undo the change.

6.2.3 Charging aspects

Who should pay for the interaction, the user, service provider, network operator or some other party? Flexibility is probably required.

6.2.4 Security Aspects

The requesting party shall be authenticated. There shall be a valid relationship between the requesting party and the UE owner, for example explicit permission granted to perform the UE Configuration Query.

Security is even more important for this capability than the UE Configuration Query capability as the UE is being modified. The approach to security could include signing and/or encryption.

NOTE: The security checks have been omitted from the sequence diagram.

6.2.5 UMTS Operations System Aspects

The UMTS Operations System shall be able to:

- send a command to a UE and receive a response back
- query the user if it is OK to update a parameter

6.2.6 User Equipment Aspects

There are UE aspects for both the terminal and the USIM. There needs to be a way of receiving the command on the UE. It would be useful if the names/parameters and data structures are standardised.

6.2.7 Network Aspects

No changes to the core network have been identified at this time.

6.2.8 Benefits

6.2.8.1 User/subscriber

The user/subscriber often lack the knowledge of how to change parameters so this would remove the need for an explanation for how to change a parameter(s) and would reduce the risk of the wrong parameter being changed or the correct parameter being changed to the wrong value. The user would receive an improved service and ideally the fault would be fixed.

6.2.8.2 Network Operator/Service Provider

The Operator/Service Provider would be able to handle support calls and fix the problem more quickly and effectively.

6.2.8.3 UE Manufacturer

The User/subscriber would be happier with UE manufacturer/supplier as problems resolved quicker.

6.3 UE Software Update Capability

Being able to update the UE software remotely would enable a fault in the UE software to be fixed without an expensive recall and the latest version of the UE software could be obtained without difficulty.

Figure 4 is a sequence diagram that shows an example of how UE Software Update could be usefully applied.

An example of how the UE Software Update capability could be used is illustrated in the sequence diagram in figure 4.

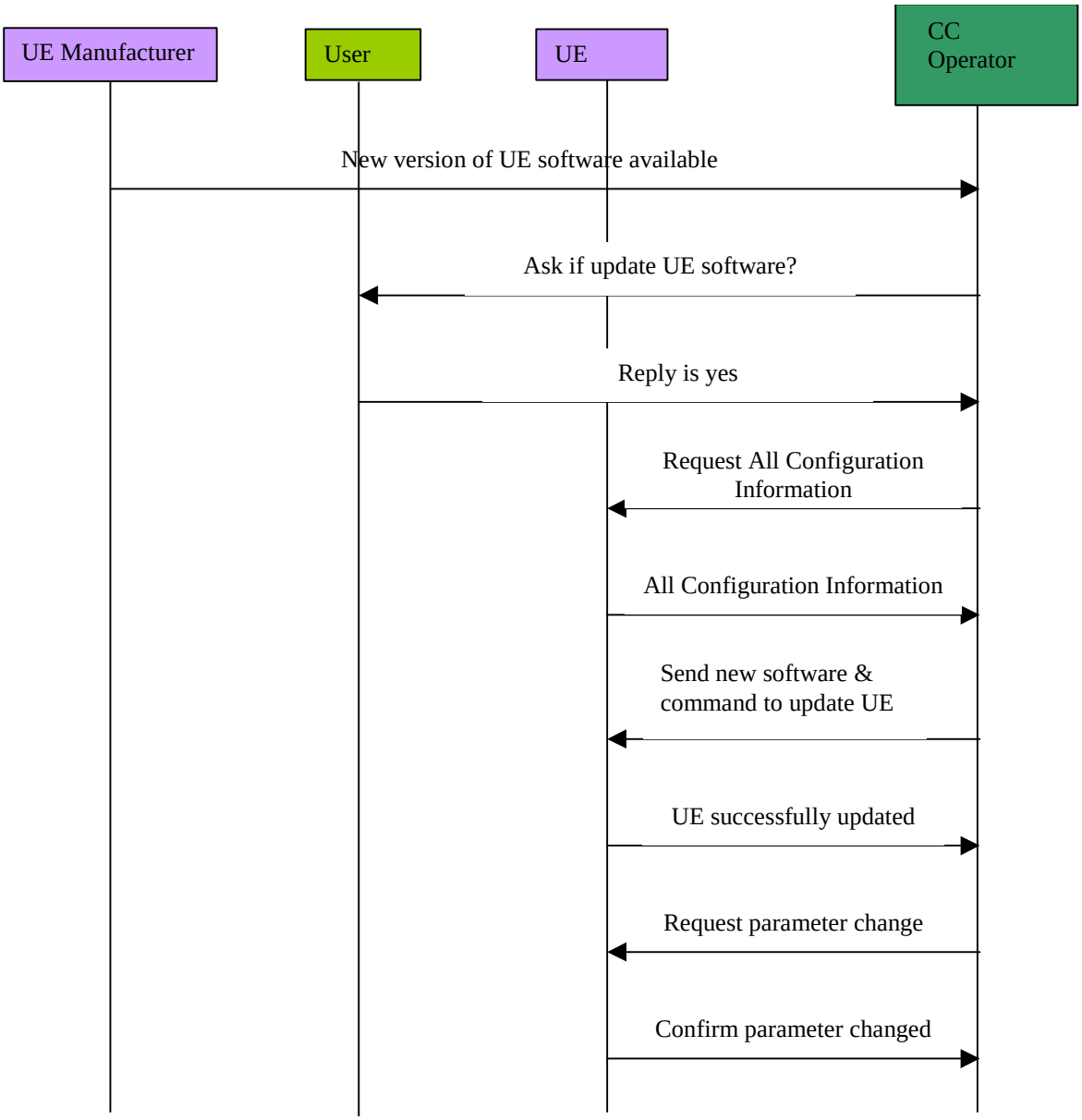


Figure 4: UE Software Update Sequence Diagram

A number of parameters may need to be updated in which case the "Request parameter change" and "confirm parameter changed" messages would just be repeated.

6.3.1 Service Aspects

The UE Software Update Capability can be subdivided into UE patch download and UE image download.

6.3.2 MMI Aspects

It shall be possible to undo the change.

It would be useful if this capability could be used both manually and automatically. How will the management activity be initiated?

6.3.3 Charging aspects

Who should pay for the interaction, the user, service provider, network operator or some other party? Flexibility is probably required.

6.3.4 Security Aspects

Security even more important for the UE Software Update than the UE Reconfiguration Capability as the UE is altered. It shall be ensured that the stated UE manufacturer is the true source of the software update. The integrity of the software must be ensured.

The requesting party shall be authenticated. There shall be a valid relationship between the requesting party and the UE owner. It must ensure that UEM is properly authorised, that the UE is satisfactorily protected, that IPR of the UE manufacturers' is protected, that downloads are virus free etc. The software would need to be encrypted by the UE manufacturer and decrypted on the UE. It shall be authenticated that the UE manufacturer has certified the software.

NOTE: The security checks have been omitted from the sequence diagram.

6.3.5 UMTS Operations System Aspects

The UMTS Operations System shall be able to:

- send a command to a UE and receive a response back
- query the user if it is OK to update the UE software
- send the UE both the new software and a command to update the UE

6.3.6 User Equipment Aspects

Technically the UE Software Update Capability for OS/firmware is very difficult to implement and this work would need to be carefully planed using a phased approach. See 3GPP TS 23.057 [7] clause 4.14.

Some sort of client is required on the UE and the UE must be able to update itself while in some form of operation. It would be useful if the download mechanisms, file formats, names/parameters and data structures are standardised.

6.3.7 Network Aspects

No changes to the core network have been identified at this time.

6.3.8 Benefits

6.3.8.1 User/subscriber

The user would be able to easily obtain the latest version of software for the UE and so use any new functionality, bug fixes etc.

The user may have a specific problem that is fixed by the software update.

The UE Software Update capability should improve user satisfaction.

6.3.8.2 Network Operator/Service Provider

The Operator/Service Provider would be able to handle support calls and fix the problem more quickly and effectively.

Instead of having to handle user equipment being recalled the UE could be upgraded immediately.

6.3.8.3 UE Manufacturer

The User/subscriber would be happier with UE manufacturer/supplier as problems resolved quicker.

Customers are more likely to buy equipment that is has additional future proofing.

Expensive recalls could be avoided.

6.4 Remote UE Diagnostics Capability

The network operator, service provider or manufacturer could use the Remote UE Diagnostics capability to run diagnostic applications on the user equipment to aid fault resolution.

Below are two examples of the Remote UE Diagnostics Capability:

- Figure 5 is an example of the UE Diagnostics capability that includes downloading a diagnostic application to the UE.
- Figure 6 is an example of the UE Diagnostics capability utilising a diagnostic application built in to the UE.

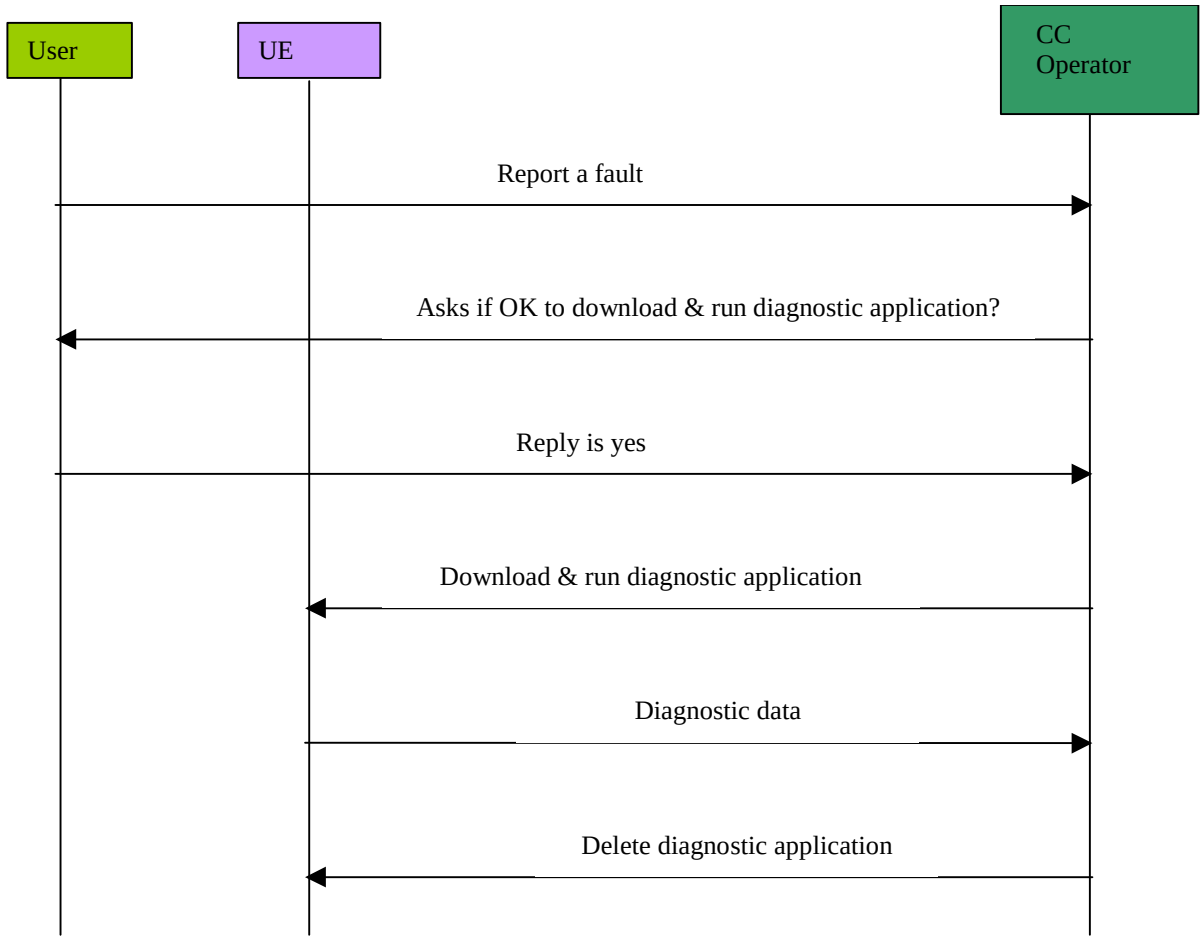


Figure 5: Remote UE Diagnostics Sequence Diagram including application download

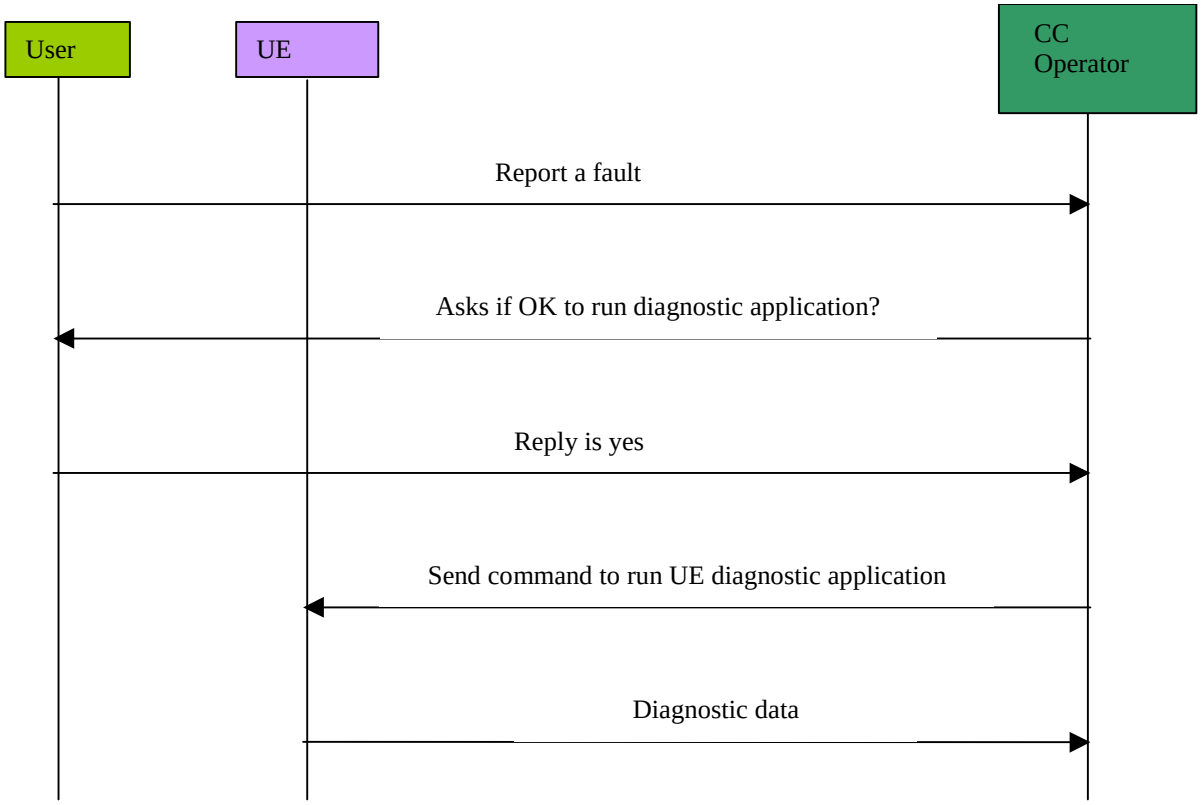


Figure 6: Remote UE Diagnostics Sequence Diagram utilising diagnostic application built in to UE

6.4.1 Service Aspects

6.4.2 MMI Aspects

The CC Operator needs to be able to obtain permission from the user to run and if necessary also download the diagnostic software.

6.4.3 Charging aspects

Who should pay for the interaction, the user, service provider, network operator or some other party? Potentially there could be a large volume of diagnostic data. Flexibility is probably required.

6.4.4 Security Aspects

The requesting party shall be authenticated. There shall be a valid relationship between the requesting party and the UE owner, for example explicit permission granted to perform the UE Diagnostics Capability. It must ensure that UEM is properly authorised, that the UE is satisfactorily protected, that IPR of the UE manufacturers' is protected, that downloads are virus free etc. The downloaded software would need to be encrypted by the UE manufacturer and decrypted on the UE. It shall be authenticated that the UE manufacturer has certified the downloaded software. The integrity of the software must be ensured.

NOTE: The security checks have been omitted from the sequence diagram.

6.4.5 UMTS Operations System Aspects

The UMTS Operations System shall be able to:

- send a command to a UE and receive a response back
- query the user if it is OK to run a diagnostic application

- if necessary it shall also be possible to download diagnostic applications to the UE

6.4.6 User Equipment Aspects

It shall be possible to execute diagnostic applications on the UE. If necessary it shall also be possible to download diagnostic applications to the UE and to delete the executables on completion. It would be useful if the names/parameters and data structures are standardised.

6.4.7 Network Aspects

No changes to the core network have been identified at this time.

6.4.8 Benefits

6.4.8.1 User/subscriber

The fault should be fixed faster and so the user would receive an improved service. The user would be less likely to have to return the UE for analysis.

6.4.8.2 Network Operator/Service Provider

The Operator/Service Provider would be able to handle support calls and fix the problem more quickly and effectively.

The problem could be diagnosed remotely rather than have the user return the UE.

6.4.8.3 UE Manufacturer

The User/subscriber would be happier with UE manufacturer/supplier as problems resolved quicker.

7 UEM Architecture

The User Equipment Management (UEM) architecture provides a collaborative framework to exchange information with a UEM client function to enable the remote management of the Mobile UE.

7.1 System component entities and connectivity

Figure 7 provides the basic elements of this architecture and associated interfaces.

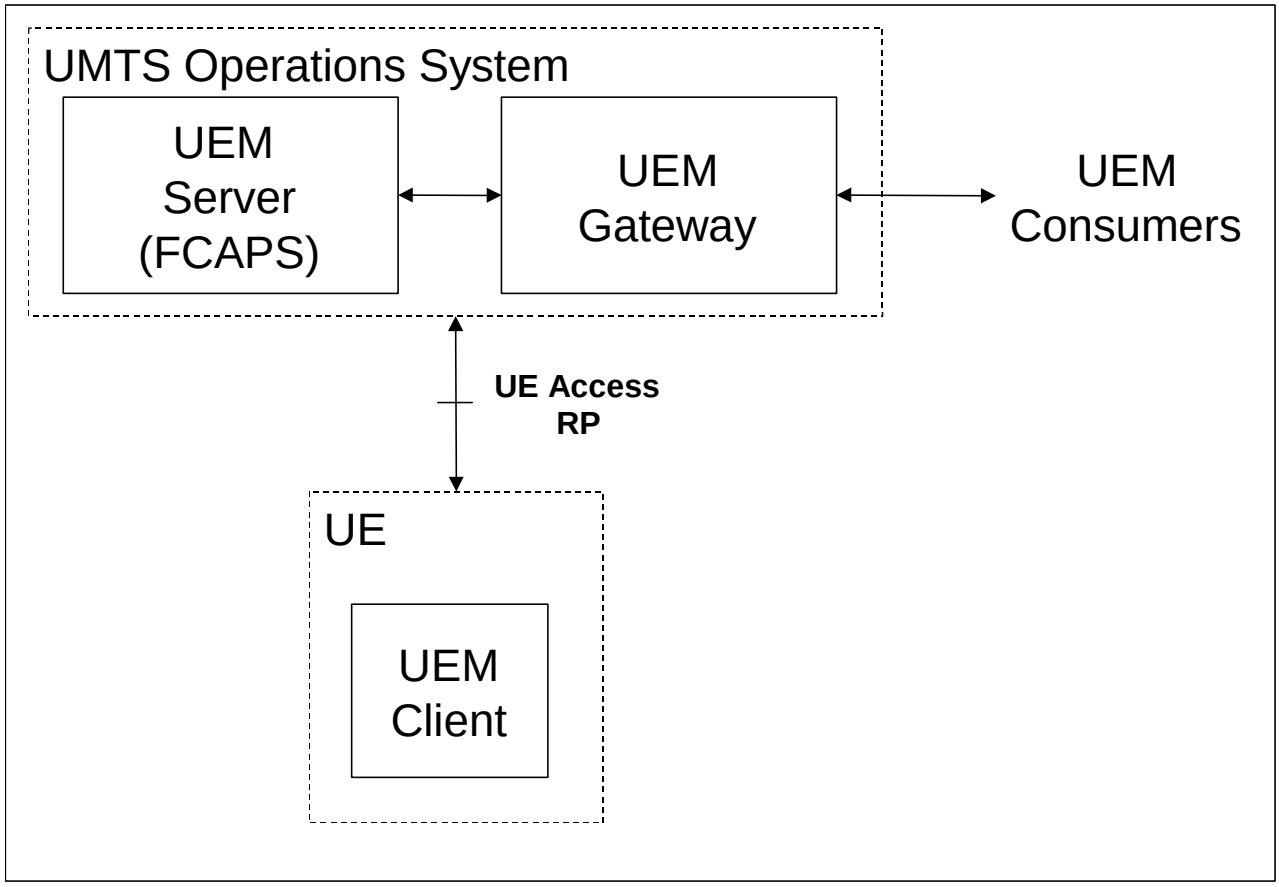


Figure 7: User Equipment Management (UEM) architecture

7.1.1 Definition of Entities

This clause describes the entities listed in the architecture.

7.1.1.1 UEM Client

The UEM client is the component required in the UE to collaborate with the management server. Collaboration sessions may include several simultaneous management tasks as instructed by the server.

7.1.1.2 UEM Server

The UEM Server co-ordinates the various UEM functions (FCAPS) that may be performed on clients within its domain. It maintains the management clients' session information and forwards the results to the different UEM consumers. Example UEM Server functions are:

- UE Reconfiguration;
- Application and Service Reconfiguration;
- UE Error Tracing;
- Application Error Tracing;
- Remote UE Diagnostics;
- Remote Application Diagnostics;
- Performance Measurements; and
- Virus Detection and Prevention.

Not that not all these functions are proposed for Release 6.

7.1.1.3 UEM Gateway

UEM consumers use the UEM Gateway to provide transparent access to the UE client from various UEM consumers.

7.1.1.4 UEM Consumers

UEM consumers use the UEM Gateway to access the UEM clients. Some examples of possible UEM consumers are:

- Network Operator;
- Network Equipment Provider;
- Service Provider;
- Content Provider;
- User Equipment Manufacturer;
- Application Service Provider;
- Enhanced Service Provider;
- IT-Support Provider;
- Corporate Administrator;
- Customer Care Operator.

7.2 Interfaces

This clause identifies the interface reference points.

7.2.1 UE Access Reference Point

Realization of this reference point enables the information exchange between the UEM Server and clients. Based on the extent of UE equipment capability, this interface may be realized using various connection media and protocols.

7.3 Protocols

Identification of the protocols to support UEM across the different interfaces.

8 Project Planning

8.1 Collaboration

Figure 8 is the proposal for how the UEM work will be structured.

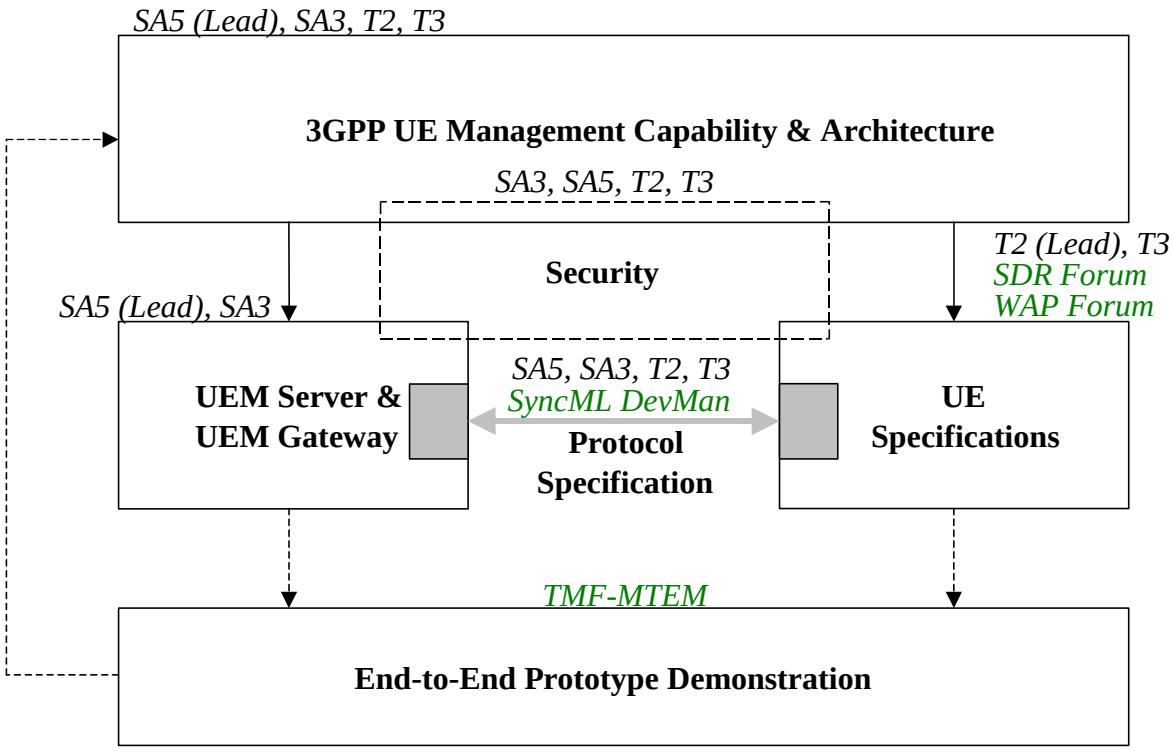


Figure 8: Proposed Structure of the User Equipment Management (UEM) work

8.2 Plan for Post Release 5 UEM Work

The plan for UEM work shall be phased. It is expected that the UE Software Update Capability would be beyond Release 6.

The high level UEM plan consists of:

- Produce WIDs [SA5 Feature]
- Produce requirements & architecture [SA5 BB]
- Protocol Specification, GUP & GAP analysis [T2 BB]: It is expected that much of the technology required for UEM is becoming available. A gap analysis task needs to be performed to determine where there are gaps between the available technology and that required for UEM.
- UEM security [SA3 BB]
- USIM work (e.g. parameter definition) [T3 BB]

9 Open Issues

The following issues have been identified:

1. The CC operator must have some means of identifying the user if user's IMSI is not forwarded (e.g. if the user contacts CC via the internet).
2. More work is required to analyse the charging implications of UEM.

3 Customer self care needs to be mentioned specifically in the present document.

4 If UE is expanded for example by plugging in an additional module then how will this be handled? How will the UEM server determine that an additional module has been plugged in? What about PDAs, notebook computers and other devices connected to the mobile equipment?

5 The UE IMEI in some UE may have been subject to unauthorised changes. How will UEM handle this?

6 What should be the scope of virus management activities, should virus management apply to all users or a subset?

7 Can a particular UE or set of UEs be remotely shut down if they are behaving in a way that is detrimental to network performance? The network operator must be able to isolate the faulty user equipment from the network if it is harming the network; if possible it would be useful to still allow restricted radio and core network access for remedial applications to be downloaded.

10 Risks

None identified.

11 Conclusions

This feasibility study shows that User Equipment Management (UEM) is a very worthwhile area for standardisation and it would bring a number of benefits to the users/subscribers, network operators/service providers and the UE manufacturers/suppliers.

UEM capabilities vary greatly in how easy it will be to implement them so it is recommended that a phased approach be used for planning the UEM standardisation. It should be possible for UE manufacturers to implement the capabilities described in the present document independently of one another.

Technology that is becoming available seems to be appropriate for UEM. A gap analysis needs to be performed to identify where there are gaps between what is needed to support UEM and the available technology.

Annex A:
Additional UEM Requirements

This annex contains requirements related to UEM that are in addition to those in clause 4 and are not directly related to the UEM capabilities identified in clause 6.

Ref	Management Function	Sub category	Requirement	Customer Care	Network Operations	CRM	UE Manufacturer
2.	FM	Fault	Support the identification of faults.	✓			✓
3.	FM	Fault	Provide support for the analysis of faults.	✓			✓
7.	FM	Resolution tracking	Show customers the fault process from report of problem to resolution			✓	
8.	FM	Service	Video - be able to see what the customer sees on their UE	✓			
10.	FM	UE	Ability to "ping" UE for healthcheck/status	✓			
12.	FM	UE	Remote control of UE by CSA/second line support:	✓			
14.	CM	UE	Upgrades - targeted at "problem" models			✓	
15.	PM	Service	Highlight capacity levels on the various bearer services to customers		✓	✓	
16.	PM	Application	Application Performance	✓			
17.	PM	Application	Application history		✓		
18.	PM	Application	Which applications/products has he/she selected/downloaded (including 3rd party applications) Once an application has been downloaded (e.g. a K-Java game), how often is it used? How is it used, etc.? Include 3rd party services/products	✓	✓	✓	
19.	PM	Customer	Customer location	✓			
20.	PM	Customer	Historical customer location	✓			
21.	PM	Customer	Coverage experience	✓			
22.	PM	Customer	Customer perceptions of new services			✓	
23.	PM	Customer	What services/products did he/she use (voice, video…)?	✓		✓	
24.	PM	Error/fault statistics	Failed calls details (# dialled, time…)	✓			

Ref	Management Function	Sub category	Requirement	Customer Care	Network Operations	CRM	UE Manufacturer
25.	PM	Error/fault statistics	UE Faults to N/W Ops		✓		
27.	PM	Error/fault statistics	Report failure to connect to service(s)		✓		
28.	FM	Error/fault statistics	Produce fault logs		✓		
29.	FM	Error/fault statistics	Retain fault logs files for fault investigation		✓		
30.	PM	Error/fault statistics	Coverage problems – no signal… (location, time)		✓		
31.	PM	Error/fault statistics	Return reason for dropped calls/session		✓		
32.	PM	Network	Level of radio coverage	✓			
33.	PM	Network	Radio performance Voice Video Data C/S P/S	✓	✓		
34.	PM	Network	Radio availability		✓		
35.	PM	Network	Radio coverage (signal strength)	✓			
36.	PM	Network	Data speed probability	✓			
37.	PM	Network	Report slow 'data' speeds although signal strength OK		✓		
38.	PM	Network	Capacity availability	✓			
39.	PM	Network	Capacity experienced		✓		
40.	PM	Network	Interference/noise		✓		
41.	PM	Network	Get network performance data from user equipment	✓			
42.	PM	Network	Cell performance from UE - relate to cell site s/ware versions		✓		
43.	PM	Network	PS v CS, different bearers, different speeds ↑ and ↓		✓		
44.	PM	Network	Historical coverage information for user equipment over all bearers	✓			
45.	PM	Network	Cell overlap/multiple cell profiles		✓		
46.	PM	Service	Service performance from UE	✓			
47.	PM	Service	Provide a regionalised view of service performance		✓		
48.	PM	Service	Monitor service performance		✓		
49.	PM	Service	Service availability report		✓		

Ref	Management Function	Sub category	Requirement	Customer Care	Network Operations	CRM	UE Manufacturer
50.	PM	Service	Service outage report		✓		
51.	PM	Service	SLA reports		✓		
52.	PM	Transaction	For transactions over an earlier period transactions (48 hours?) remotely accessible	✓	✓		
53.	PM	Transaction	For previous "x" transactions		✓		
54.	PM	UE	Battery efficiency	✓			
55.	PM	Usage	Time of day/frequency/duration Success rates How is he using the service? What key did he press when…? Problems encountered How often do people turn their mobile on/off When do they leave it on/off? How often/when do user charge batteries, etc. Key sequences – Configuration (e.g. WAP) Key sequences - Usage behaviour (e.g. using phonebook, messages, SIM – toolkit, etc) Key sequences – Idiosyncratic behaviour? How does usage behaviour vary by type of user equipment, etc?	✓	✓	✓	
56.	PM	Usage	Which bearer was used		✓		
57.	PM	Usage	Faster response to usage trends – real-time collection of usage stats via user equipment			✓	
59.	PM	User Equipment	UE performance – application UE performance by UE type UE performance data by customer UE performance by geographic		✓		
61.	SM		Capacity to support volume customers			✓	
65.	SM	Customer Alerts	Maintenance schedule locally	✓			
68.	SM	Customer Alerts	Send questions on new services to UE for customer feedback			✓	
69.	SM	Customer assistance	Support users setting up their UE (e.g. from web interface)	✓			

Ref	Management Function	Sub category	Requirement	Customer Care	Network Operations	CRM	UE Manufacturer
70.	SM	Customer assistance	Interactive help "don't press that key, press the one above it"			✓	
71.	SM	Customer assistance	Applications that show what to do next			✓	
73.	SM	Customer assistance	PC anywhere for mobiles – help customers to add complex services	✓			
75.	SM	Customisation	Modify the user interface to match ***owner***			✓	
77.	SM	Element management	Be able to manage all the elements involved in delivering an application	✓			
78.	SM	Monitoring	Monitor the quality of service delivered to customers (Video telephony, voice etc			✓	
79.	SM	Monitoring	Monitor actual coverage as experienced by user		✓		
80.	SM	Monitoring	Monitor service delivered to corporates		✓		
81.	SM	Monitoring	Monitor service as experienced by user		✓		
82.	SM	Monitoring	Ability to recognise degradation of service (ideally before the customer contacts us)		✓		
83.	SM	Monitoring	UE monitoring of performance and alert the operator when the SLA is being broken		✓		
84.	SM	Prioritise level of support	Based on customer priority	✓	✓	✓	
86.	SM	Proactive SM	By service Customer specific			✓	
87.	SM	Proactive UE CCare	"Mr Smith, did you know that your battery is only working at 30% efficiency…"	✓			
88.	SM	Service	Offer trials of services			✓	
89.	SM	Services	Add value through experience of 3rd party applications			✓	
91.	SM	UEM	Set performance thresholds on UE		✓		
92.	SM	UEM	Re-calibrate/re-tune UE over the air	✓			
93.	SM	UEM	There shall be charging mechanisms for UEM.			✓	
94.			The confidentiality of customer personal information must not be violated.			✓	

Ref	Management Function	Sub category	Requirement	Customer Care	Network Operations	CRM	UE Manufacturer
Key to Management Function column: SM: Service Management. CM: Configuration Management. FM: Fault Management. PM: Performance Management.							

The function that needs each requirement is indicated by the last 4 columns of the table.

Tracking Hardware

97. It should be possible for the operator to retrieve the user device information from at least two sources:

- The Mobile Terminal;
- A source other than the MT, e.g. subscriber profile database.

98. All existing instances of user device information must always be up to date and consistent to each other.

Tracing Errors

106. The operator must be able to isolate the faulty device from the network but still allow restricted remote access for remedial applications to be downloaded.

Preventing and Detecting Viruses

125. The operator must be able to verify and guarantee that a downloadable piece of software/application is virus free.

126. The operator must be able to remotely download the anti-virus application to the Mobile Terminal.

127. The operator must be informed whether the anti-virus application has been successfully installed in the MT.

128. The operator must be informed whether the anti-virus application has completed its tasks successfully.

129. The anti-virus application must uninstall and delete itself after completing its tasks unless explicitly instructed not to.

130. It must be possible for an anti-virus application that has already been installed in a MT to automatically check each application and piece of software that is being downloaded to the terminal.

131. It must be possible for the operator to remotely trigger an anti-virus application within a MT.

132. User data in the MT must remain unaffected if not affected by virus.

133. Device configuration must remain unaffected unless otherwise required by the anti-virus application.

Miscellaneous Requirements

134. Operator position must be able to retrieve the user device profile from the subscriber profile or customer relationship database based on IMSI or MSISDN.

140. Any collected performance data shall be returned to the network operator for processing.

146. Execution of the application must be possible using certain triggering events.

147. It is desirable to be able to manage data on behalf of the customer. Currently SIM card crashes mean the customer has to re-enter all their data. This will be a bigger problem in the future as more data sits on the UE.

Annex B:
Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
Dec 2001	S_14	SP-010652	--	--	Submitted to TSG SA #14 (and TSG T #14) for Information	1.0.0	

3GPP TR 32.802 V1.0.21 (2002-01)

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Contents

Foreword

This Technical Report has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

- x the first digit:
  - 1 presented to TSG for information;
  - 2 presented to TSG for approval;
  - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

Introduction

The present document is a feasibility study on User Equipment Management (UEM). UEM is a capability which will allow the Operator, Service Provider and/or UE Manufacturer to remotely manage User Equipment.

The capabilities of the user equipment in 3G are becoming and will continue to become ever more sophisticated and integrated (high definition colour screens, faster processors, built in cameras, integrated media players etc.). The sophisticated capabilities of 3G User Equipment will require a flexible means to support management of the UE satisfying the end-customers, service providers, network operators and UE manufacturers' need. The purpose of the feasibility study is to progress this new management capability.

The present document outlines aspects of UEM which it would be valuable to standardise in post 3GPP Release 5. The present document identifies some UEM requirements, proposes a UEM role model~~proposes an architecture for UEM~~, identifies some key UEM capabilities that map to the requirements, ~~and~~ performs some analysis of those capabilities and proposes an architecture for UEM. A proposal is made for ~~how~~ the co-ordination and planning of the UEM standardisation work and ~~can be co-ordinated.~~ the conclusions section makes some recommendations on UEM. Annex A contains a list of additional UEM requirements not directly related to the UEM capabilities identified.~~, most of which were identified from a brainstorming session~~.

UEM will assist in maximising the user experience and quality of service, maximise subscriber usage, minimise costs and help ensure that faults are promptly resolved.

1 Scope

The scope of the present document is a Release 5 feasibility study to show that there are aspects of User Equipment Management (UEM) which would be beneficial to standardise post Release 5. For Release 5 the present document does not have a factual impact on other WIs.

User Equipment (UE) includes both the USIM and Mobile Equipment (ME) domains and so it is emphasised that the scope of UEM includes both the USIM and ME domains.

This direct interface between the UEM Consumers and the UE is outside the scope of this document (see clause 5).

The user interface will be important in delivering UEM however the user interface is both outside the scope of this document and outside the scope of the standardisation of UEM.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document.*

[1~~1~~] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 22.240: "3GPP Generic User Profile requirements; Stage 1".

[3] 3GPP TS 23.240: "3GPP Generic User Profile requirements; Stage 2; Architecture".

[4] 3GPP TS 23.241: "3GPP Generic User Profile requirements; Stage 2; Data description framework".

[5] 3GPP TS 24.241: "3GPP Generic User Profile requirements; Stage 3; Access; Common objects".

[6] 3GPP TS 22.057: "Mobile Execution Environment (MExE); Service description, Stage 1".

[7] 3GPP TS 23.057 (V4.3.1): "Mobile Execution Environment (MExE); Functional description; Stage 2".

[8] 3GPP TS 32.140: "Services Operations Management; Subscription Management; Stage 1".

[9] GSM TS 04.02: "GSM Public Land Mobile Network (PLMN) access reference configuration".

NOTE: It is possible that one or more of these references may not be approved in Release 5.

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

Customer Care Operator (CC Operator): is a role which provides support to customers

User Equipment Management (UEM): is a capability which will allow the Operator, Service Provider and/or User Equipment Manufacturer/User Equipment Supplier to remotely manage User Equipment

UMTS IC Card: an IC card (or 'smartcard') of defined electromechanical specification which contains at least one USIM

Universal Subscriber Identity Module (USIM): an application residing on the UICC used for accessing services provided by mobile networks, which the application is able to register on with the appropriate security

User Equipment: device allowing a user access to network services

NOTE: For the purpose of 3GPP specifications the interface between the UE and the network is the radio interface. A User Equipment can be subdivided into a number of domains, the domains being separated by reference points. Currently defined domains are the USIM and ME Domains. The ME Domain can further be subdivided into several components showing the connectivity between multiple functional groups. These groups can be implemented in one or more hardware devices. An example of such a connectivity is the TE – MT interface. Further, an occurrence of a User Equipment is an MS for GSM as defined in GSM TS 04.02 [9].

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

CC	Customer Care
CRM	Customer Relationship Management
FCAPS	Fault, Configuration, Accounting, Performance, and Security management
ME	Mobile Equipment
UE	User Equipment
UEM	User Equipment Management
UICC	Universal Integrated Circuit Card

4 UEM Requirements

This clause contains the identified User Equipment Management (UEM) requirements which are applicable to the subsequent clauses of the present document. Annex A contains additional UEM requirements. Each requirement has a unique number.

Ref	Management Function	Sub category	Requirement	Customer Care	Network Operations	CRM	UE Manufacturer
1.	FM	Customer assistance	Lists of clear/concise FAQ that are downloadable to the UE to solve common problems.	✓		✓	
4.	FM	Fault	Provide support for fault resolution.	✓			
5.	FM	Fault	Provide support for fault diagnosis.	✓			
6.	FM	Fault	Remote service fault diagnosis (remote)		✓		
9.	FM	UE	Self-health check on UE	✓			
11.	FM	UE	Remote diagnosis on UE	✓			
13.	FM	UE	Provide a service for UE similar to that available today for managing corporate PC networks, particularly for fault finding.	✓		✓	
26.	FM	Error/fault statistics	Identify and report on element failures		✓		
58.	CM	User Equipment	UE type (make, model, OS, version) Firmware version /level S/W Version Applications embedded Applications added/downloaded Application version Virus check history Memory status	✓			
60.	SM	Application	Support the collection of diagnostic information from applications on the UE.	✓	✓		
62.	SM	Configuration	Fast service set-up	✓	✓	✓	✓
63.	SM	Configuration – Remote	Set up services Check service works Upgrade services – trouble free Download applications from operator to UE OTA	✓	✓	✓	

Ref	Management Function	Sub category	Requirement	Customer Care	Network Operations	CRM	UE Manufacturer
			Update UE software Virus checks Software bug fixes - trouble free				
64.	SM	Configuration – Remote	For specific customers must be able to remotely configure the UE.	✓		✓	
66.	SM	Customer Alerts	New O/S versions	✓			✓
67.	SM	Customer Alerts	New services to the UE			✓	
72.	SM	Customer assistance	PC anywhere for mobiles – tuition, show users how to use their equipment	✓			
74.	SM	Customisation	Remote access to view a corporate's personalised settings Remote access to modify a corporate's personalised settings	✓			
76.	SM	Data management	Manage customer data uploads Manage customer data downloads			✓	
85.	SM	Proactive downloads	Of apps, services, fixes etc to UE	✓	✓	✓	✓
90.	SM	UEM	For corporates	✓		✓	

Key to Management Function column:
SM: Service Management.
CM: Configuration Management.
FM: Fault Management.
PM: Performance Management.

The function that needs each requirement is indicated by the last 4 columns of the table.

Tracking Hardware

95. The following is the minimum set of the user device information that the operator needs to know:
    - Manufacturer;
    - Model;
    - Software version;
    - Applications resident on the terminal.
96. It should be possible for the operator to remotely audit user device information over the radio interface.

Tracing Errors

99. The operator must be able to identify and locate the appropriate diagnostic/remedial application.
100. The operator must be able to remotely download the remedial application to the Mobile Terminal.
101. The operator must be informed whether the remedial application has been successfully installed in the MT.
102. The operator must be informed whether the application has completed its tasks successfully.
103. The remedial application must uninstall and delete itself after completing its tasks unless explicitly instructed not to.
104. User data in the MT must remain unaffected.
105. Device configuration must remain unaffected unless otherwise required by the remedial application.

Configuring Terminals

107. The operator before updating the MT software version must have received the customer's agreement.
108. The operator must be able to remotely download new software version to the MT.
109. User data in the MT must remain unaffected.
110. Device configuration information should only be updated as required by the new software version.

Downloading Application & Services

111. The operator must be able to remotely download applications to the MT.
112. The operator must be informed whether the remedial application has been successfully installed in the MT.
113. User data in the MT must remain unaffected.
114. Device configuration information should only be updated as required by the new application.
115. The operator before updating the MT with new applications must have received the customer's agreement.

Remote Terminal Diagnostics

116. The operator must be able to remotely download applications to the MT.
117. The operator must be informed whether the remedial application has been successfully installed in the MT.
118. Execution of the application must be possible using certain triggering events.
119. The data gathering application must be under full control of the network operator.
120. The application must not, in any way, degrade the quality of service or service functionality expected by the user.
121. The operator must be able to remotely uninstall and delete the application from the customer's MT.
122. User data in the MT must remain unaffected.

123. Device configuration information should only be updated as required by the new application.

124. The operator before updating the MT with new applications must have received the customer's agreement.

Miscellaneous Requirements

135. The operator must be able to easily search for and discover the appropriate application to fit the purpose for particular equipment.

136. The downloading mechanism should be able to identify and locate the target device quickly and accurately.

137. Security mechanisms should be in place to authenticate the source and target of the application. In addition all data must be encrypted and applications only allowed to execute in an expected and non-harmful manner.

138. The current device configuration and data must be backed up, prior to any new installation.

139. An acknowledgement will be returned to the operator after installation.

141. A UEM application will uninstall and delete itself after completing its tasks unless explicitly instructed not to.

142. The Network Operator Domain shall provide the application with all the access it requires to complete it's tasks.

143. The user's private data and configuration settings must be stored prior to installation of any new software, to enable the new patch or application to be installed with the previous configuration settings.

144. The application must not, in any way, degrade the quality of service or service functionality expected by the user.

145. The scope of UEM could be extend to cover not only the conventional voice plus User Equipment but also "dumb" terminals such as drinks machines, monitoring equipment etc.

5 UEM Role Model

This clause contains a UEM role model in figure 1. The roles identified are:

- user of the UE
- UEM consumer
- network operator

UEM consumers access the UE in order to manage the UE. Some examples of the UEM consumers are service provider, UE manufacturer, customer care operator, content provider.

The network operator would have equipment (eg UEM server and UEM gateway) to provide access from the UEM consumers to the UE.

The role model shows a potential direct relationship between the UEM Consumer and the User/UE. For example a user may be able to upgrade the operating system in their UE by taking it to the UE manufacturer's service centre. The direct interface between the UEM Consumers and the UE is outside the scope of this document.

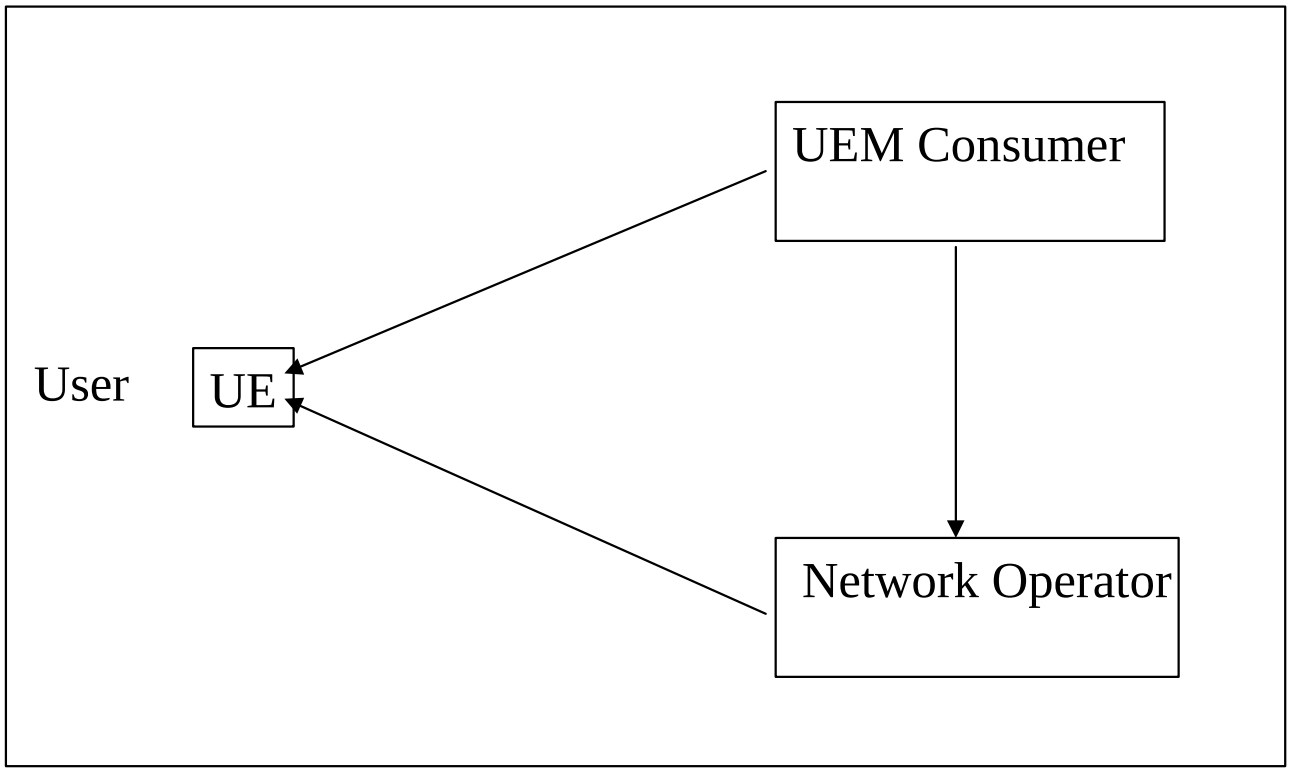


Figure 1: User Equipment Management (UEM) role model

6 UEM Capabilities

With the arrival of the 3G services, more sophisticated mobiles with download capability and the growth of 3rd party applications and content on the Internet, more and more users will use the user equipment as a mobile and limited incarnation of their desktop PC. Therefore, it is reasonable to assume that the user will download 3rd party applications to the UE. We then have the situation where an application could actually cause faults on the UE. This raises the complexity of user equipment fault resolution to a higher level compared with traditional 2G user equipment. In addition, it is more than likely that the user will contact the network operator or service provider to register the fault and it will be left to the customer care (CC) operator to handle the query. If mechanisms were available for the CC operators to identify and fix faults, then huge savings could be made in manpower, equipment and revenue loss.

This clause identifies some key UEM capabilities and performs some analysis of those capabilities.

The following key UEM capabilities have been identified:

1) UE Configuration Query;
2) UE Reconfiguration;
3) UE Software Update;
4) Remote UE Diagnostics.

It is proposed that these UEM capabilities are standardised post 3GPP Release 5.

The remainder of clause 6 describes these capabilities and performs some analysis on them. Sequence diagrams are used to provide examples of interactions that could use the UEM capabilities. For simplicity the role of the user is not subdivided into end user and owner.

6.1 UE Configuration Query Capability

UE Configuration Query allows UE configuration information to be remotely requested and retrieved. The UE configuration information would include the equipment make, model, software versions, configuration parameters. This

is valuable information in for example fault finding; end users often find it difficult to correctly report UE configuration information.

An example of how the UE Configuration Query capability could be used is illustrated in the sequence diagram in figure 2.

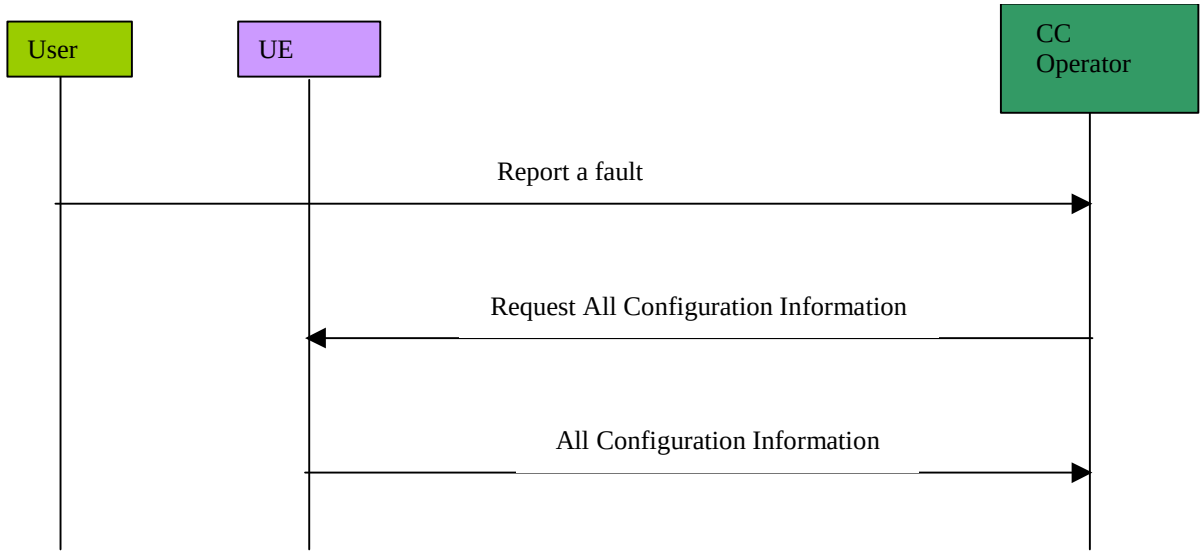


Figure 2: UE Configuration Query Sequence Diagram

The configuration information returned by the UE should include:

- IMEI (equipment make, model build date and version...);
- the software versions;
- the applications installed;
- the last error, time, date;
- configuration parameters.

6.1.1 Service Aspects

The CC Operator (authorised to use this capability for a particular UE) is able to send the command to a particular UE and receive the configuration information in response.

6.1.2 MMI Aspects

It is expected that the CC Operator will have a GUI interface to initiated this activity and would have some tools for viewing and analysing the response. It would be useful if this capability could be initiated by manual involvement and also automatically.

6.1.3 Charging aspects

Who should pay for the interaction, the user, service provider, network operator or some other party? Flexibility is probably required.

6.1.4 Security Aspects

The requesting party shall be authenticated. There shall be a valid relationship between the requesting party and the UE owner, for example explicit permission granted to perform the UE Configuration Query.

The UE Configuration Query capability does not change the configuration of the UE.

NOTE: The security checks have been omitted from the sequence diagram.

6.1.5 UMTS Operations System Aspects

The UMTS Operations System shall be able to send a command to a UE and receive a response back.

6.1.6 User Equipment Aspects

There are UE aspects for both the terminal and the USIM. Some sort of client is required on the user equipment. There needs to be a way of receiving the command on the UE. It would be useful if the names/parameters and data structures are standardised.

6.1.7 Network Aspects

No changes to the core network have been identified at this time.

6.1.8 Benefits

6.1.8.1 User/subscriber

The user/subscriber often lack the knowledge of how to view parameters so this would remove the need for an explanation for how to view a parameter(s) and save time in reading out the configuration over a voice call. The user would receive an improved service.

6.1.8.2 Network Operator/Service Provider

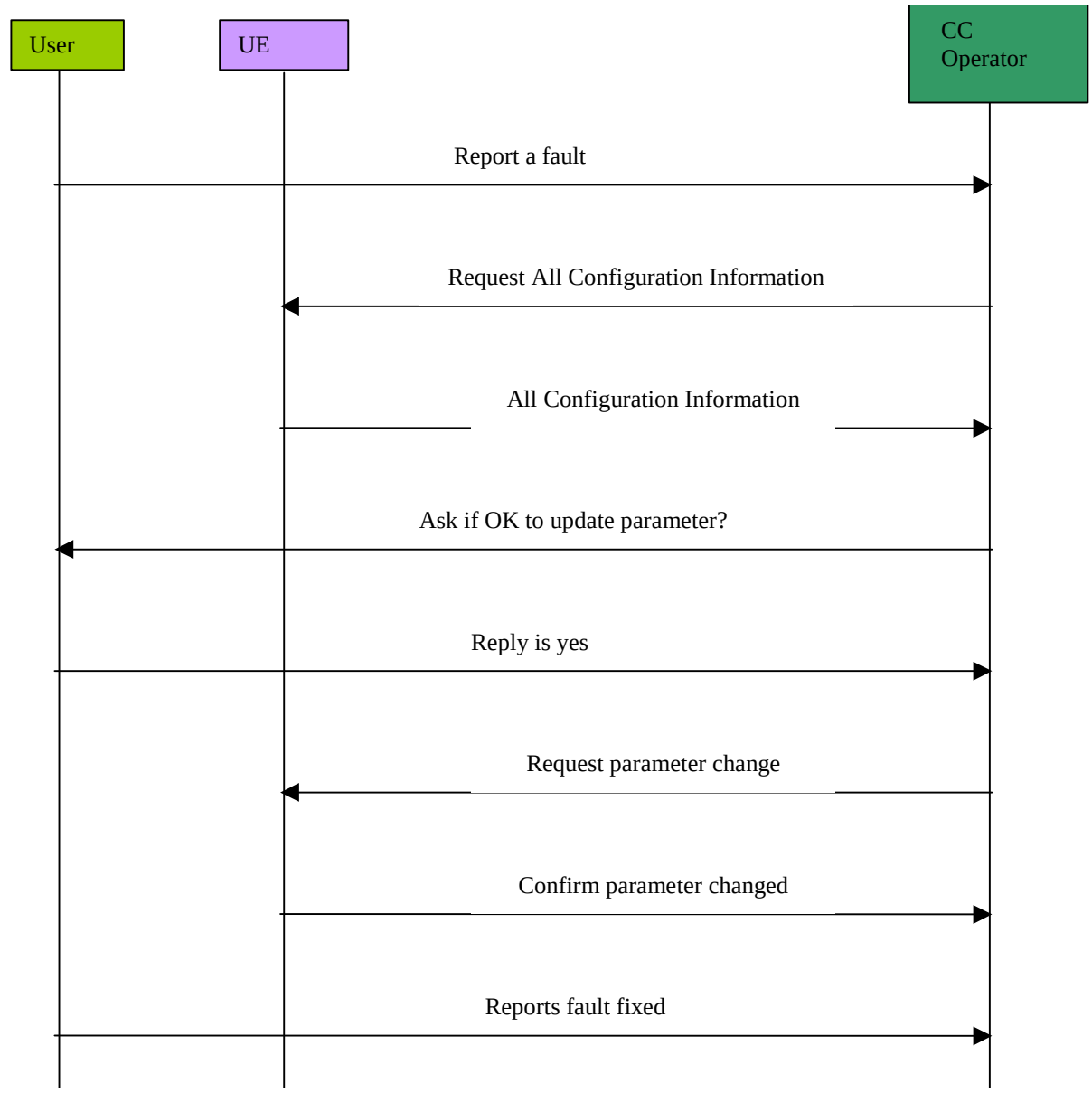
The Operator/Service Provider would be able to handle support calls more quickly and effectively.

6.1.8.3 UE Manufacturer

The User/subscriber would be happier with UE manufacturer/supplier as problems resolved quicker.

6.2 UE Reconfiguration Capability

The UE Reconfiguration capability builds upon the UE Configuration Query capability in that it allows configuration changes to be made to the UE remotely. So, for example, UE reconfiguration could be used as part of a fault resolution process to correct a problem on the UE and this is shown in figure 3. Once the cause of the fault has been identified (which in this example is an incorrect parameter) then the UE Reconfiguration capability is used to correct the fault.



NOTE: The first three interactions in this diagram are identical to the UE Configuration Query sequence diagram (figure 2).

Figure 3: UE Reconfiguration Sequence Diagram

6.2.1 Service Aspects

6.2.2 MMI Aspects

The CC Operator needs to be able to obtain permission from the user to change the parameter.

It shall be possible to undo the change.

6.2.3 Charging aspects

Who should pay for the interaction, the user, service provider, network operator or some other party? Flexibility is probably required.

6.2.4 Security Aspects

The requesting party shall be authenticated. There shall be a valid relationship between the requesting party and the UE owner, for example explicit permission granted to perform the UE Configuration Query.

Security is even more important for this capability than the UE Configuration Query capability as the UE is being modified. The approach to security could include signing and/or encryption.

NOTE: The security checks have been omitted from the sequence diagram.

6.2.5 UMTS Operations System Aspects

The UMTS Operations System shall be able to:

- send a command to a UE and receive a response back
- query the user if it is OK to update a parameter

6.2.6 User Equipment Aspects

There are UE aspects for both the terminal and the USIM. There needs to be a way of receiving the command on the UE. It would be useful if the names/parameters and data structures are standardised.

6.2.7 Network Aspects

No changes to the core network have been identified at this time.

6.2.8 Benefits

6.2.8.1 User/subscriber

The user/subscriber often lack the knowledge of how to change parameters so this would remove the need for an explanation for how to change a parameter(s) and would reduce the risk of the wrong parameter being changed or the correct parameter being changed to the wrong value. The user would receive an improved service and ideally the fault would be fixed.

6.2.8.2 Network Operator/Service Provider

The Operator/Service Provider would be able to handle support calls and fix the problem more quickly and effectively.

6.2.8.3 UE Manufacturer

The User/subscriber would be happier with UE manufacturer/supplier as problems resolved quicker.

6.3 UE Software Update Capability

Being able to update the UE software remotely would enable a fault in the UE software to be fixed without an expensive recall and the latest version of the UE software could be obtained without difficulty.

Figure 4 is a sequence diagram that shows an example of how UE Software Update could be usefully applied.

An example of how the UE Software Update capability could be used is illustrated in the sequence diagram in figure 4.

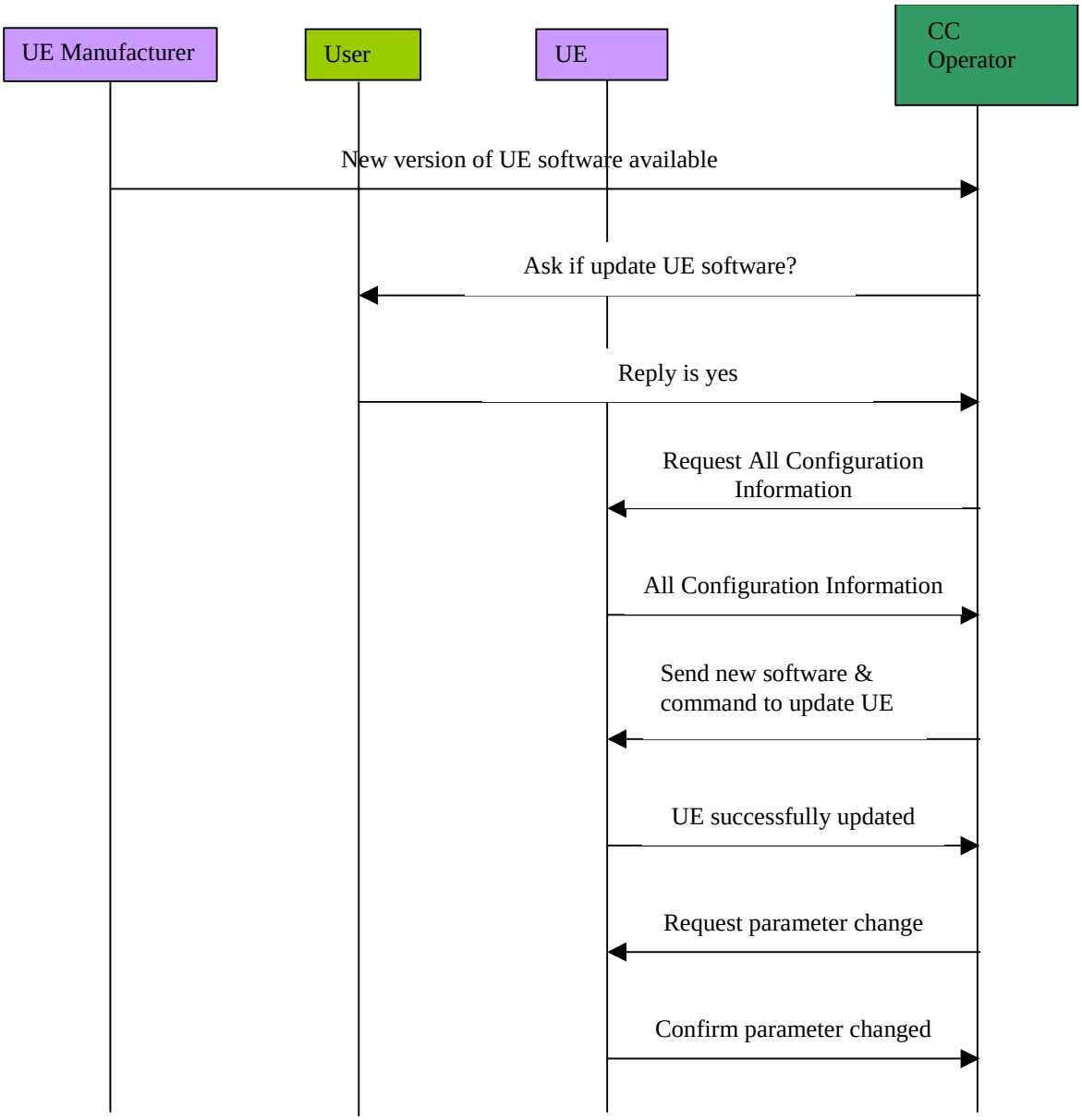


Figure 4: UE Software Update Sequence Diagram

A number of parameters may need to be updated in which case the "Request parameter change" and "confirm parameter changed" messages would just be repeated.

6.3.1 Service Aspects

The UE Software Update Capability can be subdivided into UE patch download and UE image download.

6.3.2 MMI Aspects

It shall be possible to undo the change.

It would be useful if this capability could be used both manually and automatically. How will the management activity be initiated?

6.3.3 Charging aspects

Who should pay for the interaction, the user, service provider, network operator or some other party? Flexibility is probably required.

6.3.4 Security Aspects

Security even more important for the UE Software Update than the UE Reconfiguration Capability as the UE is altered. It shall be ensured that the stated UE manufacturer is the true source of the software update. The integrity of the software must be ensured.

The requesting party shall be authenticated. There shall be a valid relationship between the requesting party and the UE owner. It must ensure that UEM is properly authorised, that the UE is satisfactorily protected, that IPR of the UE manufacturers' is protected, that downloads are virus free etc. The software would need to be encrypted by the UE manufacturer and decrypted on the UE. It shall be authenticated that the UE manufacturer has certified the software.

NOTE: The security checks have been omitted from the sequence diagram.

6.3.5 UMTS Operations System Aspects

The UMTS Operations System shall be able to:

- send a command to a UE and receive a response back
- query the user if it is OK to update the UE software
- send the UE both the new software and a command to update the UE

6.3.6 User Equipment Aspects

Technically the UE Software Update Capability for OS/firmware is very difficult to implement and this work would need to be carefully planed using a phased approach. See 3GPP TS 23.057 [7] clause 4.14.

Some sort of client is required on the UE and the UE must be able to update itself while in some form of operation. It would be useful if the download mechanisms, file formats, names/parameters and data structures are standardised.

6.3.7 Network Aspects

No changes to the core network have been identified at this time.

6.3.8 Benefits

6.3.8.1 User/subscriber

The user would be able to easily obtain the latest version of software for the UE and so use any new functionality, bug fixes etc.

The user may have a specific problem that is fixed by the software update.

The UE Software Update capability should improve user satisfaction.

6.3.8.2 Network Operator/Service Provider

The Operator/Service Provider would be able to handle support calls and fix the problem more quickly and effectively.

Instead of having to handle user equipment being recalled the UE could be upgraded immediately.

6.3.8.3 UE Manufacturer

The User/subscriber would be happier with UE manufacturer/supplier as problems resolved quicker.

Customers are more likely to buy equipment that is has additional future proofing.

Expensive recalls could be avoided.

6.4 Remote UE Diagnostics Capability

The network operator, service provider or manufacturer could use the Remote UE Diagnostics capability to run diagnostic applications on the user equipment to aid fault resolution.

Below are two examples of the Remote UE Diagnostics Capability:

- Figure 5 is an example of the UE Diagnostics capability that includes downloading a diagnostic application to the UE.
- Figure 6 is an example of the UE Diagnostics capability utilising a diagnostic application built in to the UE.

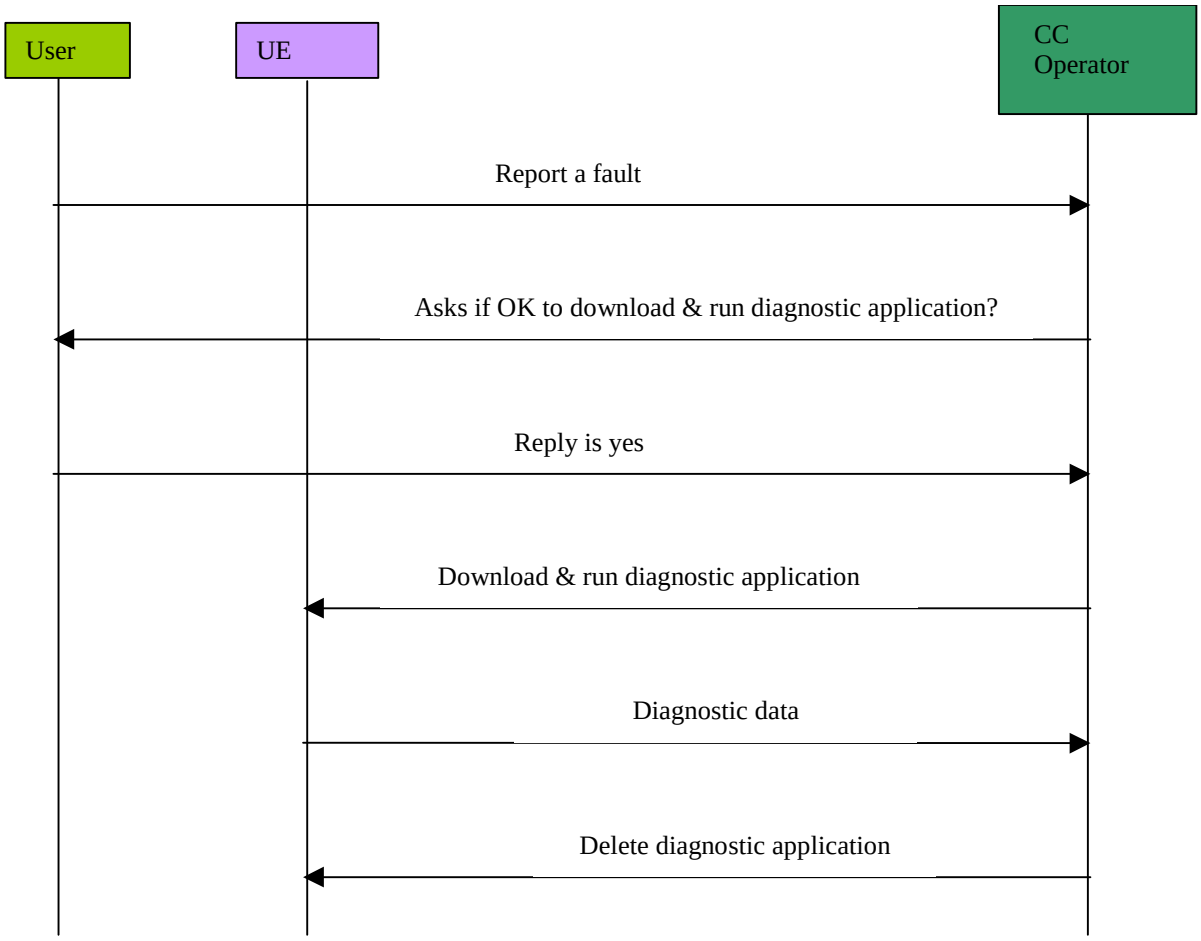


Figure 5: Remote UE Diagnostics Sequence Diagram including application download

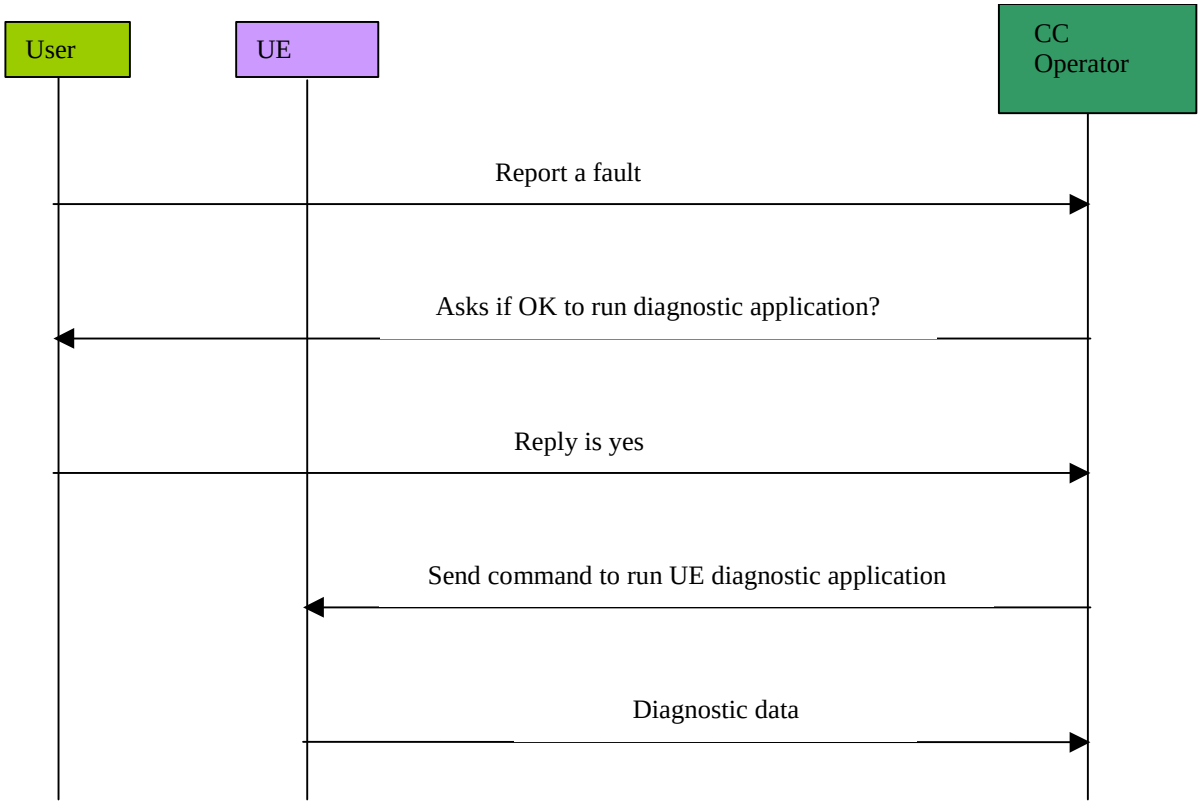


Figure 6: Remote UE Diagnostics Sequence Diagram utilising diagnostic application built in to UE

6.4.1 Service Aspects

6.4.2 MMI Aspects

The CC Operator needs to be able to obtain permission from the user to run and if necessary also download the diagnostic software.

6.4.3 Charging aspects

Who should pay for the interaction, the user, service provider, network operator or some other party? Potentially there could be a large volume of diagnostic data. Flexibility is probably required.

6.4.4 Security Aspects

The requesting party shall be authenticated. There shall be a valid relationship between the requesting party and the UE owner, for example explicit permission granted to perform the UE Diagnostics Capability. It must ensure that UEM is properly authorised, that the UE is satisfactorily protected, that IPR of the UE manufacturers' is protected, that downloads are virus free etc. The downloaded software would need to be encrypted by the UE manufacturer and decrypted on the UE. It shall be authenticated that the UE manufacturer has certified the downloaded software. The integrity of the software must be ensured.

NOTE: The security checks have been omitted from the sequence diagram.

6.4.5 UMTS Operations System Aspects

The UMTS Operations System shall be able to:

- send a command to a UE and receive a response back
- query the user if it is OK to run a diagnostic application

- if necessary it shall also be possible to download diagnostic applications to the UE

6.4.6 User Equipment Aspects

It shall be possible to execute diagnostic applications on the UE. If necessary it shall also be possible to download diagnostic applications to the UE and to delete the executables on completion. It would be useful if the names/parameters and data structures are standardised.

6.4.7 Network Aspects

No changes to the core network have been identified at this time.

6.4.8 Benefits

6.4.8.1 User/subscriber

The fault should be fixed faster and so the user would receive an improved service. The user would be less likely to have to return the UE for analysis.

6.4.8.2 Network Operator/Service Provider

The Operator/Service Provider would be able to handle support calls and fix the problem more quickly and effectively.

The problem could be diagnosed remotely rather than have the user return the UE.

6.4.8.3 UE Manufacturer

The User/subscriber would be happier with UE manufacturer/supplier as problems resolved quicker.

7 UEM Architecture

The User Equipment Management (UEM) architecture provides a collaborative framework to exchange information with a UEM client function to enable the remote management of the Mobile UE.

7.1 System component entities and connectivity

Figure 7 provides the basic elements of this architecture and associated interfaces.

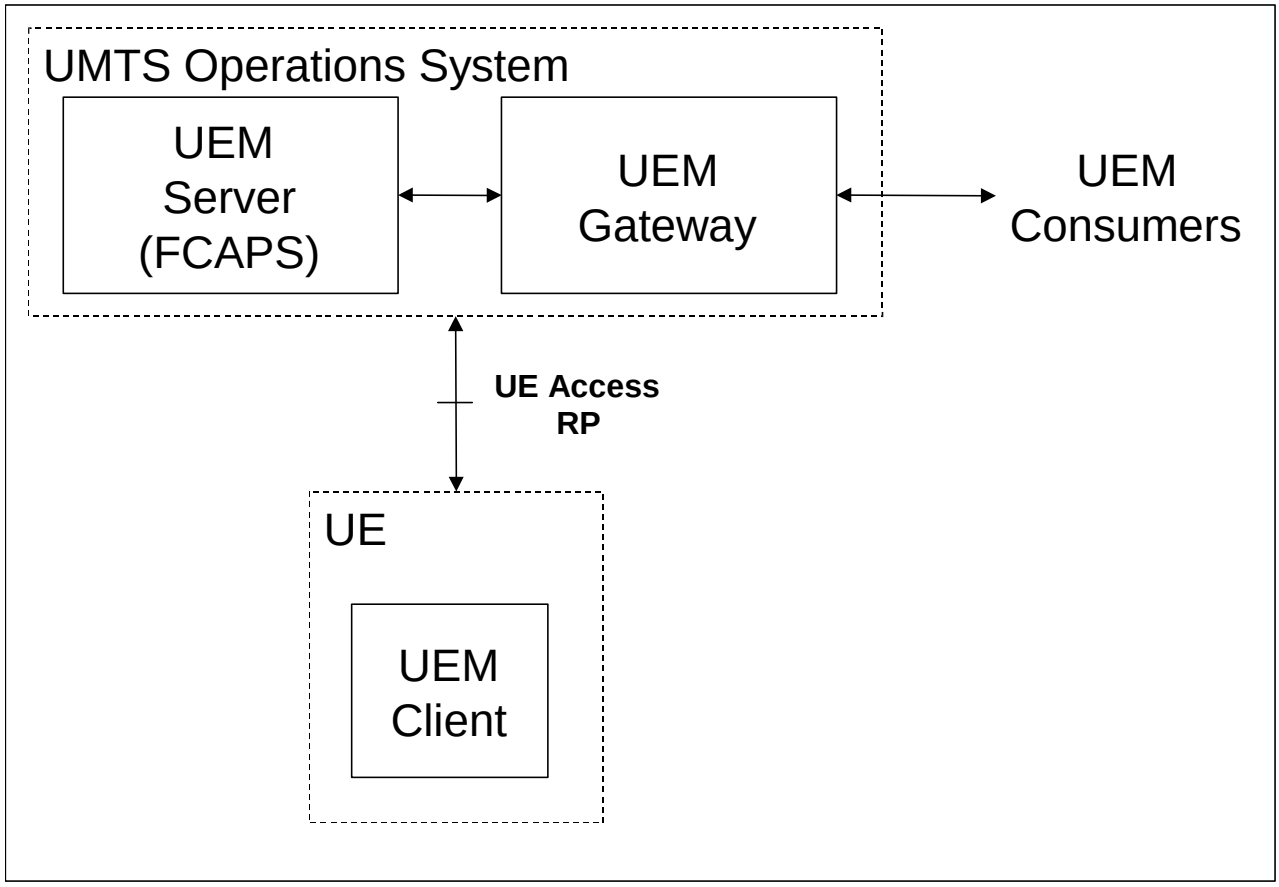


Figure 7: User Equipment Management (UEM) architecture

7.1.1 Definition of Entities

This clause describes the entities listed in the architecture.

7.1.1.1 UEM Client

The UEM client is the component required in the UE to collaborate with the management server. Collaboration sessions may include several simultaneous management tasks as instructed by the server.

7.1.1.2 UEM Server

The UEM Server co-ordinates the various UEM functions (FCAPS) that may be performed on clients within its domain. It maintains the management clients' session information and forwards the results to the different UEM consumers. Example UEM Server functions are:

- UE Reconfiguration;
- Application and Service Reconfiguration;
- UE Error Tracing;
- Application Error Tracing;
- Remote UE Diagnostics;
- Remote Application Diagnostics;
- Performance Measurements; and
- Virus Detection and Prevention.

Not that not all these functions are proposed for Release 6.

7.1.1.3 UEM Gateway

UEM consumers use the UEM Gateway to provide transparent access to the UE client from various UEM consumers.

7.1.1.4 UEM Consumers

UEM consumers use the UEM Gateway to access the UEM clients. Some examples of possible UEM consumers are:

- Network Operator;
- Network Equipment Provider;
- Service Provider;
- Content Provider;
- User Equipment Manufacturer;
- Application Service Provider;
- Enhanced Service Provider;
- IT-Support Provider;
- Corporate Administrator;
- Customer Care Operator.

7.2 Interfaces

This clause identifies the interface reference points.

7.2.1 UE Access Reference Point

Realization of this reference point enables the information exchange between the UEM Server and clients. Based on the extent of UE equipment capability, this interface may be realized using various connection media and protocols.

7.3 Protocols

Identification of the protocols to support UEM across the different interfaces.

8 Project Planning

8.1 Collaboration

Figure 8 is the proposal for how the UEM work will be structured.

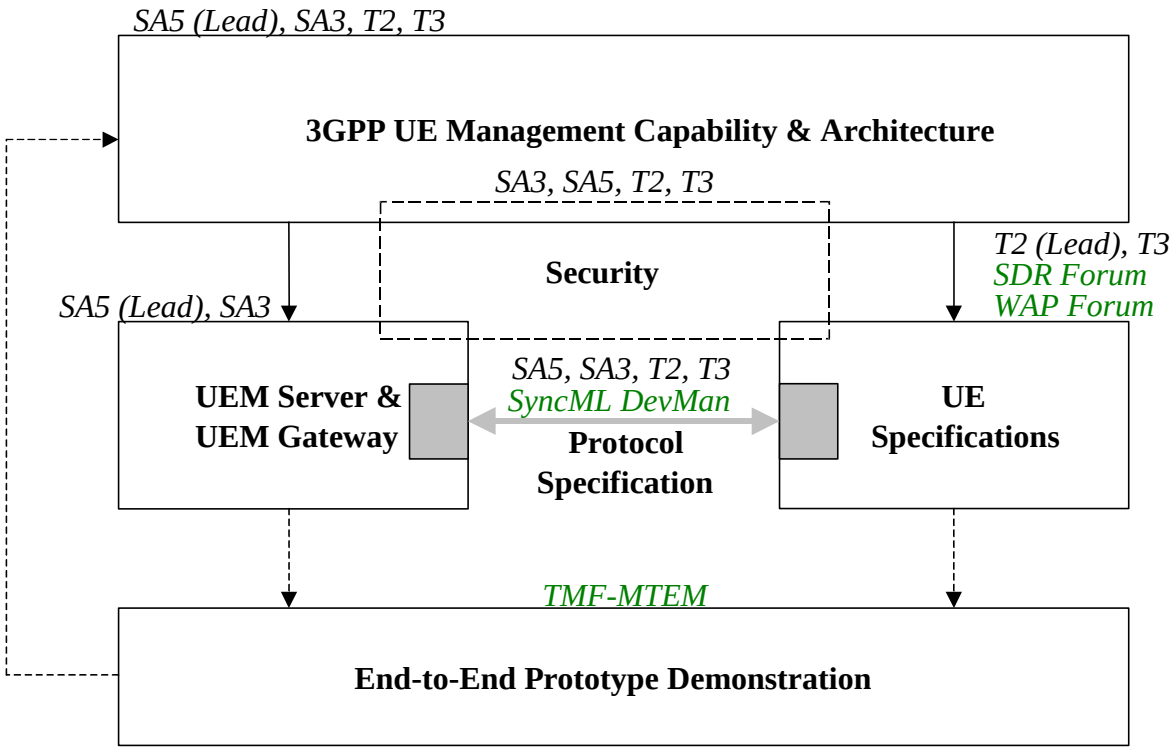


Figure 8: Proposed Structure of the User Equipment Management (UEM) work

8.2 Plan for Post Release 5 UEM Work

The plan for UEM work shall be phased. It is expected that the UE Software Update Capability would be beyond Release 6.

The high level UEM plan consists of:

- Produce WIDs [SA5 Feature]
- Produce requirements & architecture [SA5 BB]
- Protocol Specification, GUP & GAP analysis [T2 BB]: It is expected that much of the technology required for UEM is becoming available. A gap analysis task needs to be performed to determine where there are gaps between the available technology and that required for UEM.
- UEM security [SA3 BB]
- USIM work (e.g. parameter definition) [T3 BB]

9 Open Issues

The following issues have been identified:

1. The CC operator must have some means of identifying the user if user's IMSI is not forwarded (e.g. if the user contacts CC via the internet).
2. More work is required to analyse the charging implications of UEM.

3 Customer self care needs to be mentioned specifically in the present document.

4 If UE is expanded for example by plugging in an additional module then how will this be handled? How will the UEM server determine that an additional module has been plugged in? What about PDAs, notebook computers and other devices connected to the mobile equipment?

5 The UE IMEI in some UE may have been subject to unauthorised changes. How will UEM handle this?

6 What should be the scope of virus management activities, should virus management apply to all users or a subset?

7 Can a particular UE or set of UEs be remotely shut down if they are behaving in a way that is detrimental to network performance? The network operator must be able to isolate the faulty user equipment from the network if it is harming the network; if possible it would be useful to still allow restricted radio and core network access for remedial applications to be downloaded.

10 Risks

None identified.

11 Conclusions

This feasibility study shows that User Equipment Management (UEM) is a very worthwhile area for standardisation and it would bring a number of benefits to the users/subscribers, network operators/service providers and the UE manufacturers/suppliers.

UEM capabilities vary greatly in how easy it will be to implement them so it is recommended that a phased approach be used for planning the UEM standardisation. It should be possible for UE manufacturers to implement the capabilities described in the present document independently of one another.

Technology that is becoming available seems to be appropriate for UEM. A gap analysis needs to be performed to identify where there are gaps between what is needed to support UEM and the available technology.

Annex A:
Additional UEM Requirements

This annex contains requirements related to UEM that are in addition to those in clause 4 and are not directly related to the UEM capabilities identified in clause 6.

Ref	Management Function	Sub category	Requirement	Customer Care	Network Operations	CRM	UE Manufacturer
2.	FM	Fault	Support the identification of faults.	✓			✓
3.	FM	Fault	Provide support for the analysis of faults.	✓			✓
7.	FM	Resolution tracking	Show customers the fault process from report of problem to resolution			✓	
8.	FM	Service	Video - be able to see what the customer sees on their UE	✓			
10.	FM	UE	Ability to "ping" UE for healthcheck/status	✓			
12.	FM	UE	Remote control of UE by CSA/second line support:	✓			
14.	CM	UE	Upgrades - targeted at "problem" models			✓	
15.	PM	Service	Highlight capacity levels on the various bearer services to customers		✓	✓	
16.	PM	Application	Application Performance	✓			
17.	PM	Application	Application history		✓		
18.	PM	Application	Which applications/products has he/she selected/downloaded (including 3rd party applications) Once an application has been downloaded (e.g. a K-Java game), how often is it used? How is it used, etc.? Include 3rd party services/products	✓	✓	✓	
19.	PM	Customer	Customer location	✓			
20.	PM	Customer	Historical customer location	✓			
21.	PM	Customer	Coverage experience	✓			
22.	PM	Customer	Customer perceptions of new services			✓	
23.	PM	Customer	What services/products did he/she use (voice, video…)?	✓		✓	
24.	PM	Error/fault statistics	Failed calls details (# dialled, time…)	✓			

Ref	Management Function	Sub category	Requirement	Customer Care	Network Operations	CRM	UE Manufacturer
25.	PM	Error/fault statistics	UE Faults to N/W Ops		✓		
27.	PM	Error/fault statistics	Report failure to connect to service(s)		✓		
28.	FM	Error/fault statistics	Produce fault logs		✓		
29.	FM	Error/fault statistics	Retain fault logs files for fault investigation		✓		
30.	PM	Error/fault statistics	Coverage problems – no signal… (location, time)		✓		
31.	PM	Error/fault statistics	Return reason for dropped calls/session		✓		
32.	PM	Network	Level of radio coverage	✓			
33.	PM	Network	Radio performance Voice Video Data C/S P/S	✓	✓		
34.	PM	Network	Radio availability		✓		
35.	PM	Network	Radio coverage (signal strength)	✓			
36.	PM	Network	Data speed probability	✓			
37.	PM	Network	Report slow 'data' speeds although signal strength OK		✓		
38.	PM	Network	Capacity availability	✓			
39.	PM	Network	Capacity experienced		✓		
40.	PM	Network	Interference/noise		✓		
41.	PM	Network	Get network performance data from user equipment	✓			
42.	PM	Network	Cell performance from UE - relate to cell site s/ware versions		✓		
43.	PM	Network	PS v CS, different bearers, different speeds ↑ and ↓		✓		
44.	PM	Network	Historical coverage information for user equipment over all bearers	✓			
45.	PM	Network	Cell overlap/multiple cell profiles		✓		
46.	PM	Service	Service performance from UE	✓			
47.	PM	Service	Provide a regionalised view of service performance		✓		
48.	PM	Service	Monitor service performance		✓		
49.	PM	Service	Service availability report		✓		

Ref	Management Function	Sub category	Requirement	Customer Care	Network Operations	CRM	UE Manufacturer
50.	PM	Service	Service outage report		✓		
51.	PM	Service	SLA reports		✓		
52.	PM	Transaction	For transactions over an earlier period transactions (48 hours?) remotely accessible	✓	✓		
53.	PM	Transaction	For previous "x" transactions		✓		
54.	PM	UE	Battery efficiency	✓			
55.	PM	Usage	Time of day/frequency/duration Success rates How is he using the service? What key did he press when…? Problems encountered How often do people turn their mobile on/off When do they leave it on/off? How often/when do user charge batteries, etc. Key sequences – Configuration (e.g. WAP) Key sequences - Usage behaviour (e.g. using phonebook, messages, SIM – toolkit, etc) Key sequences – Idiosyncratic behaviour? How does usage behaviour vary by type of user equipment, etc?	✓	✓	✓	
56.	PM	Usage	Which bearer was used		✓		
57.	PM	Usage	Faster response to usage trends – real-time collection of usage stats via user equipment			✓	
59.	PM	User Equipment	UE performance – application UE performance by UE type UE performance data by customer UE performance by geographic		✓		
61.	SM		Capacity to support volume customers			✓	
65.	SM	Customer Alerts	Maintenance schedule locally	✓			
68.	SM	Customer Alerts	Send questions on new services to UE for customer feedback			✓	
69.	SM	Customer assistance	Support users setting up their UE (e.g. from web interface)	✓			

Ref	Management Function	Sub category	Requirement	Customer Care	Network Operations	CRM	UE Manufacturer
70.	SM	Customer assistance	Interactive help "don't press that key, press the one above it"			✓	
71.	SM	Customer assistance	Applications that show what to do next			✓	
73.	SM	Customer assistance	PC anywhere for mobiles – help customers to add complex services	✓			
75.	SM	Customisation	Modify the user interface to match ***owner***			✓	
77.	SM	Element management	Be able to manage all the elements involved in delivering an application	✓			
78.	SM	Monitoring	Monitor the quality of service delivered to customers (Video telephony, voice etc			✓	
79.	SM	Monitoring	Monitor actual coverage as experienced by user		✓		
80.	SM	Monitoring	Monitor service delivered to corporates		✓		
81.	SM	Monitoring	Monitor service as experienced by user		✓		
82.	SM	Monitoring	Ability to recognise degradation of service (ideally before the customer contacts us)		✓		
83.	SM	Monitoring	UE monitoring of performance and alert the operator when the SLA is being broken		✓		
84.	SM	Prioritise level of support	Based on customer priority	✓	✓	✓	
86.	SM	Proactive SM	By service Customer specific			✓	
87.	SM	Proactive UE CCare	"Mr Smith, did you know that your battery is only working at 30% efficiency…"	✓			
88.	SM	Service	Offer trials of services			✓	
89.	SM	Services	Add value through experience of 3rd party applications			✓	
91.	SM	UEM	Set performance thresholds on UE		✓		
92.	SM	UEM	Re-calibrate/re-tune UE over the air	✓			
93.	SM	UEM	There shall be charging mechanisms for UEM.			✓	
94.			The confidentiality of customer personal information must not be violated.			✓	

Ref	Management Function	Sub category	Requirement	Customer Care	Network Operations	CRM	UE Manufacturer
Key to Management Function column: SM: Service Management. CM: Configuration Management. FM: Fault Management. PM: Performance Management.							

The function that needs each requirement is indicated by the last 4 columns of the table.

Tracking Hardware

97. It should be possible for the operator to retrieve the user device information from at least two sources:

- The Mobile Terminal;
- A source other than the MT, e.g. subscriber profile database.

98. All existing instances of user device information must always be up to date and consistent to each other.

Tracing Errors

106. The operator must be able to isolate the faulty device from the network but still allow restricted remote access for remedial applications to be downloaded.

Preventing and Detecting Viruses

125. The operator must be able to verify and guarantee that a downloadable piece of software/application is virus free.

126. The operator must be able to remotely download the anti-virus application to the Mobile Terminal.

127. The operator must be informed whether the anti-virus application has been successfully installed in the MT.

128. The operator must be informed whether the anti-virus application has completed its tasks successfully.

129. The anti-virus application must uninstall and delete itself after completing its tasks unless explicitly instructed not to.

130. It must be possible for an anti-virus application that has already been installed in a MT to automatically check each application and piece of software that is being downloaded to the terminal.

131. It must be possible for the operator to remotely trigger an anti-virus application within a MT.

132. User data in the MT must remain unaffected if not affected by virus.

133. Device configuration must remain unaffected unless otherwise required by the anti-virus application.

Miscellaneous Requirements

134. Operator position must be able to retrieve the user device profile from the subscriber profile or customer relationship database based on IMSI or MSISDN.

140. Any collected performance data shall be returned to the network operator for processing.

146. Execution of the application must be possible using certain triggering events.

147. It is desirable to be able to manage data on behalf of the customer. Currently SIM card crashes mean the customer has to re-enter all their data. This will be a bigger problem in the future as more data sits on the UE.

Annex B:
Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
Dec 2001	S_14	SP-010652	--	--	Submitted to TSG SA #14 (and TSG T #14) for Information	1.0.0	