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**Source:** SA5 (Telecom Management)  
**Title:** Rel-5 draft TR 32.802 v104 (User Equipment Management UEM feasibility study), in co-operation with T2 - for the 2<sup>nd</sup> consecutive time for Information  
**Document for:** Information  
**Agenda Item:** 7.5.3

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3GPP TSG-SA5 (Telecom Management)  
Meeting #26, Miami / FL, USA, 25 February - 1 March 2002

S5-020140

### **Presentation of Technical Report to TSG SA**

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**Presentation to:** TSG SA Meeting #15  
**Document for presentation:** TR 32.802, Version 1.0.4  
User Equipment Management (UEM) Feasibility Study  
**Presented for:** Information

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**Abstract of document:** This is a draft Technical Report on the User Equipment Management (UEM) Feasibility Study.

Work done against the WID contained in SP-010286 (Work Item ID: UEM)..

#### **Changes since last presentation to TSG-SA Meeting #14:**

Most of the changes made to TR 32.802 at SA5#26 are of a minor nature and are enhancements to the TR for example by providing examples of requirements and enhancing the analysis of the UEM capabilities identified. Some editorial notes have been added to the document when there was insufficient time to complete changes agreed at SA5#26.

Some late comments were received from T2 that may affect the prioritisation of the UEM capabilities and also whether it is feasible to standardise one of the UEM capabilities (UE Software Update Capability) at all. Editorial notes have been added to the document to reflect these comments. A joint T2 SWG2/SA5 SWG-A meeting on UEM is being arranged (during SA5#27 in Cork, IRELAND, 2-5 April 2002) in order to resolve these comments. This has necessitated a delay in sending the document to TSG SA#15 meeting **for Approval**.

As a consequence, draft TR 32.802 is sent for the second consecutive time to SA **for Information** and it is expected to be sent to SA#16 (06/2002) **for Approval**.

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#### **Outstanding Issues:**

- Some comments from T2 may affect the prioritisation of the UEM capabilities and also whether it is feasible to standardise one of the UEM capabilities (UE Software Update Capability) at all.
- Also see TR 32.802 clause 9.

#### **Contentious Issues:**

None.

# 3GPP TR 32.802 V1.0.4 (2002-02)

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*Technical Report*

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

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Keywords

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UEM, User Equipment Management, UE  
Management

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## Foreword

This Technical Report has been produced by the 3<sup>rd</sup> 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.

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## 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; these requirements are included for information only.

The key UEM capabilities that have been identified are UE Configuration Query, UE Reconfiguration, UE Software Update and Remote UE Diagnostics.

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] 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

**User Equipment Management application:** is an application that executes on the UE to provide UEM functionality.

**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    | Shall be possible to easily make a clear/concise FAQ accessible to the user via the UE to solve common problems. For example this could be downloaded to the UE or a link could be sent to the UE which can then be browsed.. | ✓             |                    | ✓   |                 |
| 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. For example being able to remotely inspect the UE and remotely install applications.             | ✓             |                    | ✓   |                 |
| 26. | FM                  | Error/fault statistics | Identify and report on element failures   |               | ✓                  |     |                 |
| 58. | CM                  | User Equipment         | UE type (make, model, OS, version)<br>Firmware version /level<br>S/W Version<br>Applications embedded<br>Applications added/downloaded<br>Application version<br>Virus check history<br>Memory status                         | ✓             |                    |     |                 |
| 60. | SM                  | Application            | Support the collection of diagnostic information from applications on the UE.   | ✓             | ✓                  |     |                 |
| 62. | SM                  | Configuration          | Fast service set-up   | ✓             | ✓                  | ✓   | ✓               |

| Ref  | Management Function | Sub category           | Requirement  | Customer Care | Network Operations | CRM | UE Manufacturer |
|--|---------------------|------------------------|--|---------------|--------------------|-----|-----------------|
| 63.  | SM                  | Configuration – Remote | Set up services<br>Check service works<br>Upgrade services – trouble free<br>Download applications from operator to UE<br>OTA<br>Update UE software<br>Virus checks<br>Software bug fixes - trouble free | ✓             | ✓                  | ✓   |                 |
| 64.  | SM                  | Configuration – Remote | For specific customers must be able to remotely configure the UE.  | ✓             |                    | ✓   |                 |
| 66.  | SM                  | Customer Alerts        | The ability to inform users that a new version of a UE software component. Is available.   | ✓             |                    |     | ✓               |
| 67.  | SM                  | Customer Alerts        | The ability to inform users that a new service to the UE is available.<br><b>Provide an example.</b>   |               |                    | ✓   |                 |
| 72.  | SM                  | Customer assistance    | PC anywhere for mobiles – tuition, show users how to use their equipment e.g. video clip.  | ✓             |                    |     |                 |
| 74.  | SM                  | Customisation          | Remote access to view a corporate's personalised settings<br>Remote access to modify a corporate's personalised settings   | ✓             |                    |     |                 |
| 76.  | SM                  | Data management        | Manage customer data uploads<br>Manage customer data downloads   |               |                    | ✓   |                 |
| 85.  | SM                  | Proactive downloads    | Of apps, services, fixes etc to UE   | ✓             | ✓                  | ✓   | ✓               |
| 90.  | SM                  | UEM                    | For corporates<br><b>Text to be enhanced</b>   | ✓             |                    | ✓   |                 |
| Key to Management Function column:<br>SM: Service Management.<br>CM: Configuration Management.<br>FM: Fault Management.<br>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 UEM consumer needs to know:

- IMEI (equipment make, model build date and version...);Model);
  - UE Software version;

96. It should be possible for the operator to remotely audit user device information over the radio interface.

**UE Software Update**

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**

148. It shall be possible to collect diagnostic information from the UE. (Note there are different mechanisms by which this can be achieved including executing a built in diagnostic application, retrieving diagnostic data directly from the UE and download of the diagnostic application to the UE.).

**Remotely downloaded diagnostic applications**

The requirements in this section are applicable to remotely downloaded diagnostic applications and not to the situation where the diagnostic application is built into the UE.

99. The CC operator must be able to identify and locate the appropriate diagnostic/remedial application.

101. The CC operator must be informed whether the downloaded remedial application has been successfully installed in the MT.

102. The CC operator must be informed whether the application has completed its tasks successfully.

103. A downloaded 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.

117. The CC 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.

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. It shall be possible to recover to the device configuration and data state that existed prior to any new installation. This could be used for example to recover from a faulty installation.
139. An acknowledgement will be returned to the operator after installation.
141. A downloaded UEM application will uninstall and delete itself after completing its tasks unless explicitly instructed not to.
142. Authorised UEM applications shall have the access they need to complete their 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 user equipment management 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.

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## 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.

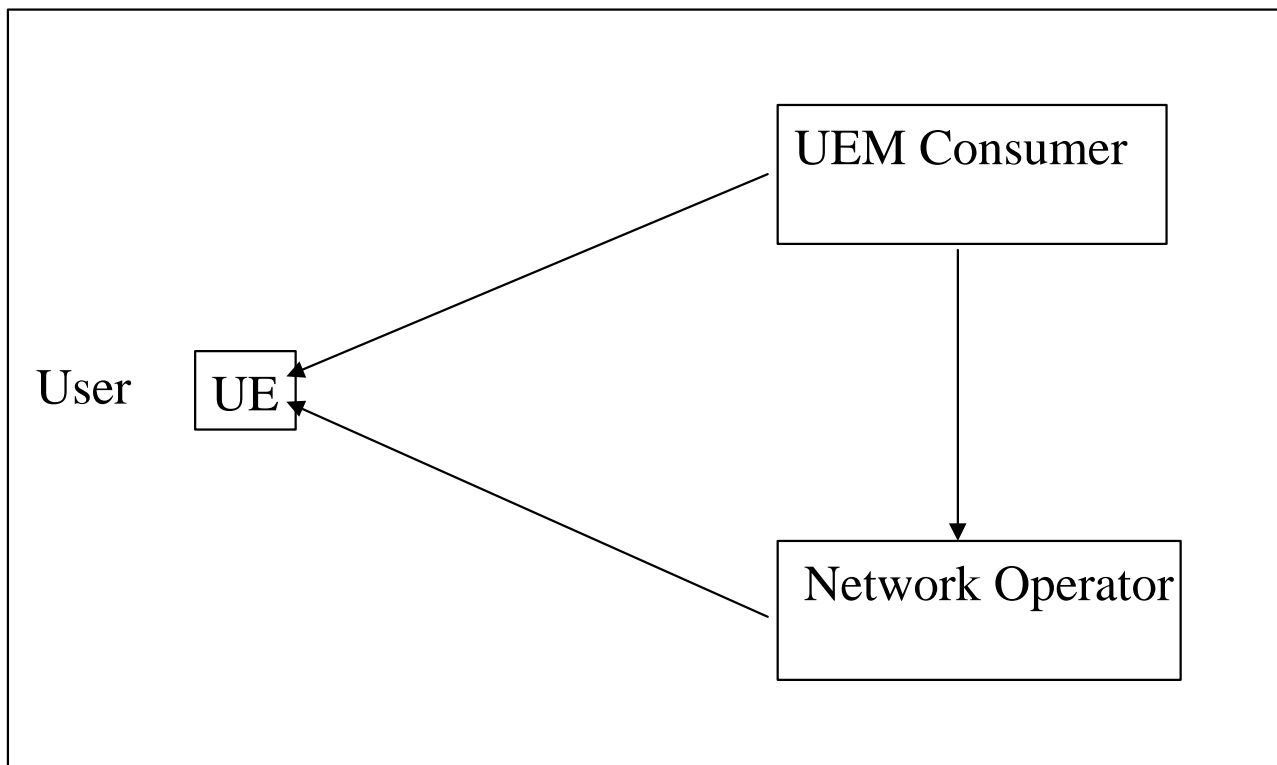


Figure 1: User Equipment Management (UEM) role model

## 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.

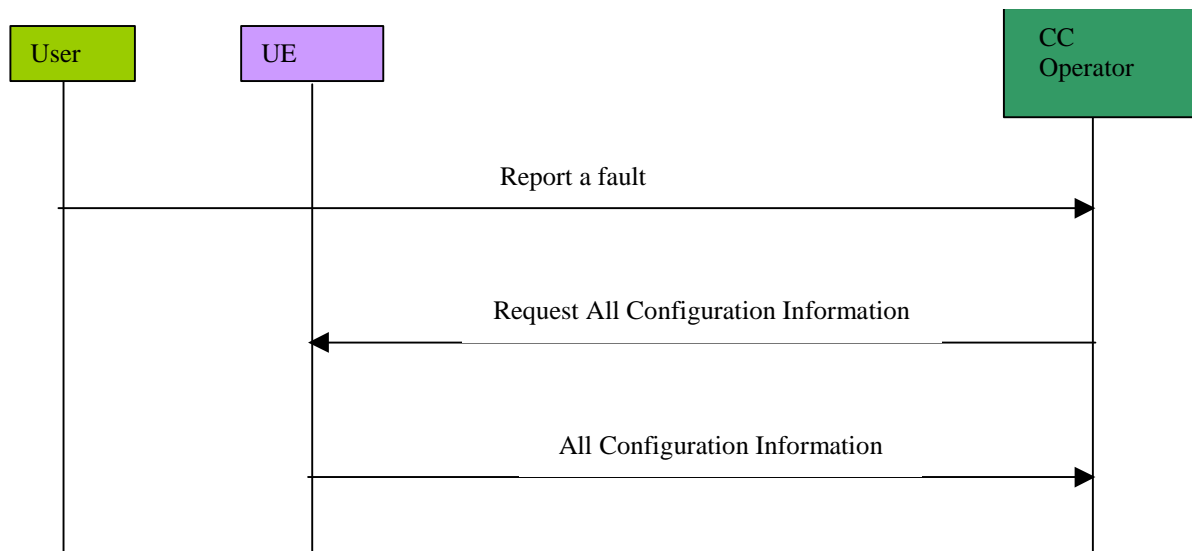
It is proposed that these UEM capabilities are standardised post 3GPP Release 5. The term “post 3GPP Release 5” means in 3GPP Release 6 or in subsequent Releases.

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...);  
**Check whether IMEI includes the version.**
- the UE software versions (IMEISV);
- the applications installed and their software version. At a minimum the list of applications returned shall be those which are remotely manageable (a list of the other non manageable applications could also be returned);
- the last error, time, date. The minimum is a single last error on the UE. It would be useful if the last errors for all the applications could be also returned.;
- configuration parameters, e.g. language settings, service related settings.

### 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.

Integrity protection of the messages on both the downlink and the uplink are required.

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. The Generic User Profile / Data Description Framework work is applicable for this, see [2], [3] and [4].

### 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

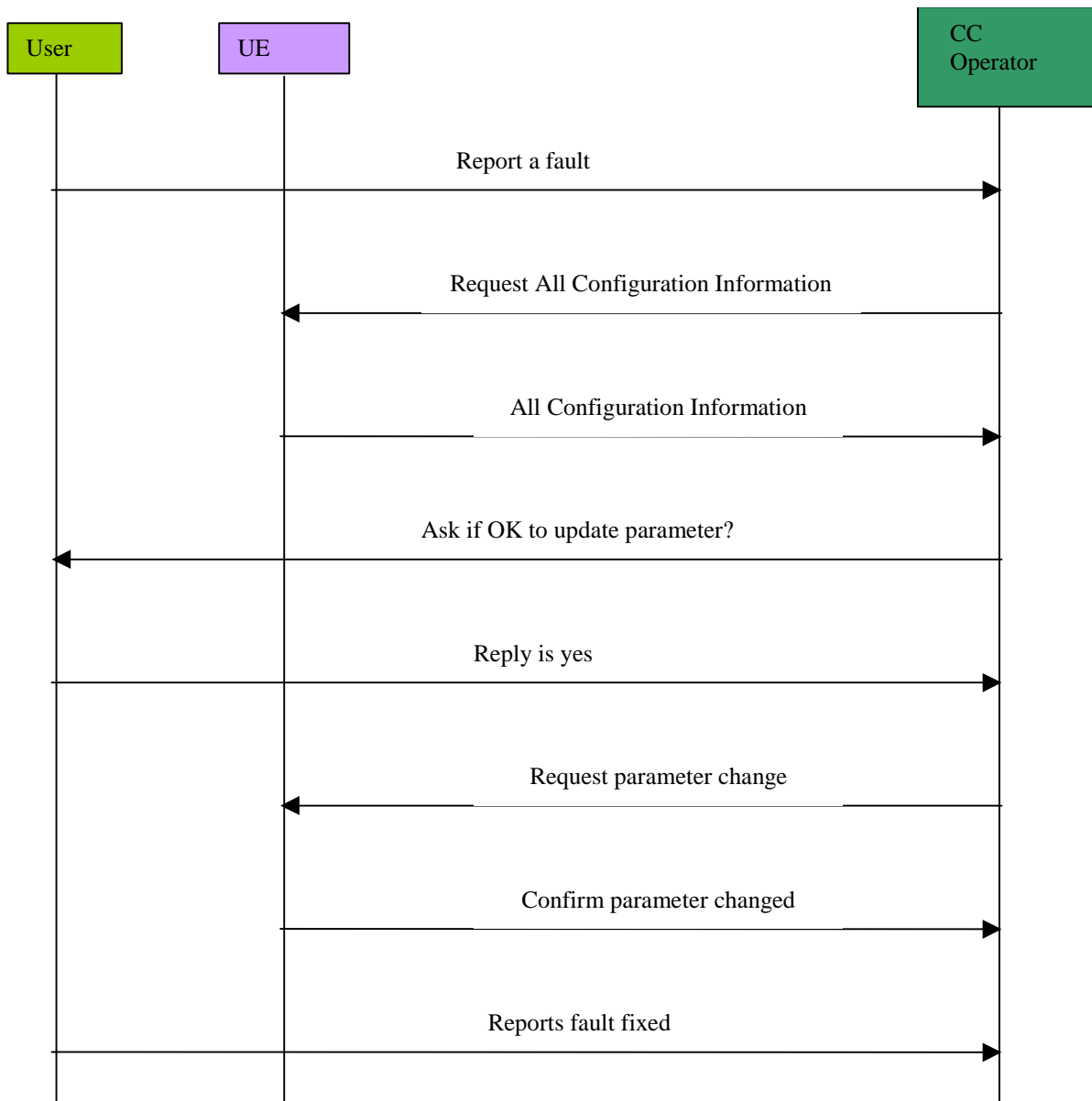
The Operator/Service Provider would be able to handle support calls more quickly and effectively.

#### 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. UE reconfiguration could be used as part of a fault resolution process to correct a problem on the UE and an example of 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). The last interaction is optional.

**Figure 3: UE Reconfiguration Sequence Diagram**

Perhaps CC Operator should be changed to UEM consumer.

### 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.

The CC Operator shall be able to undo the change.

Permission to update the parameter could be obtained by voice or the question could be displayed on the UE screen and the user key in the response.

### 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. Integrity protection of the messages on both the downlink and the uplink are required.

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

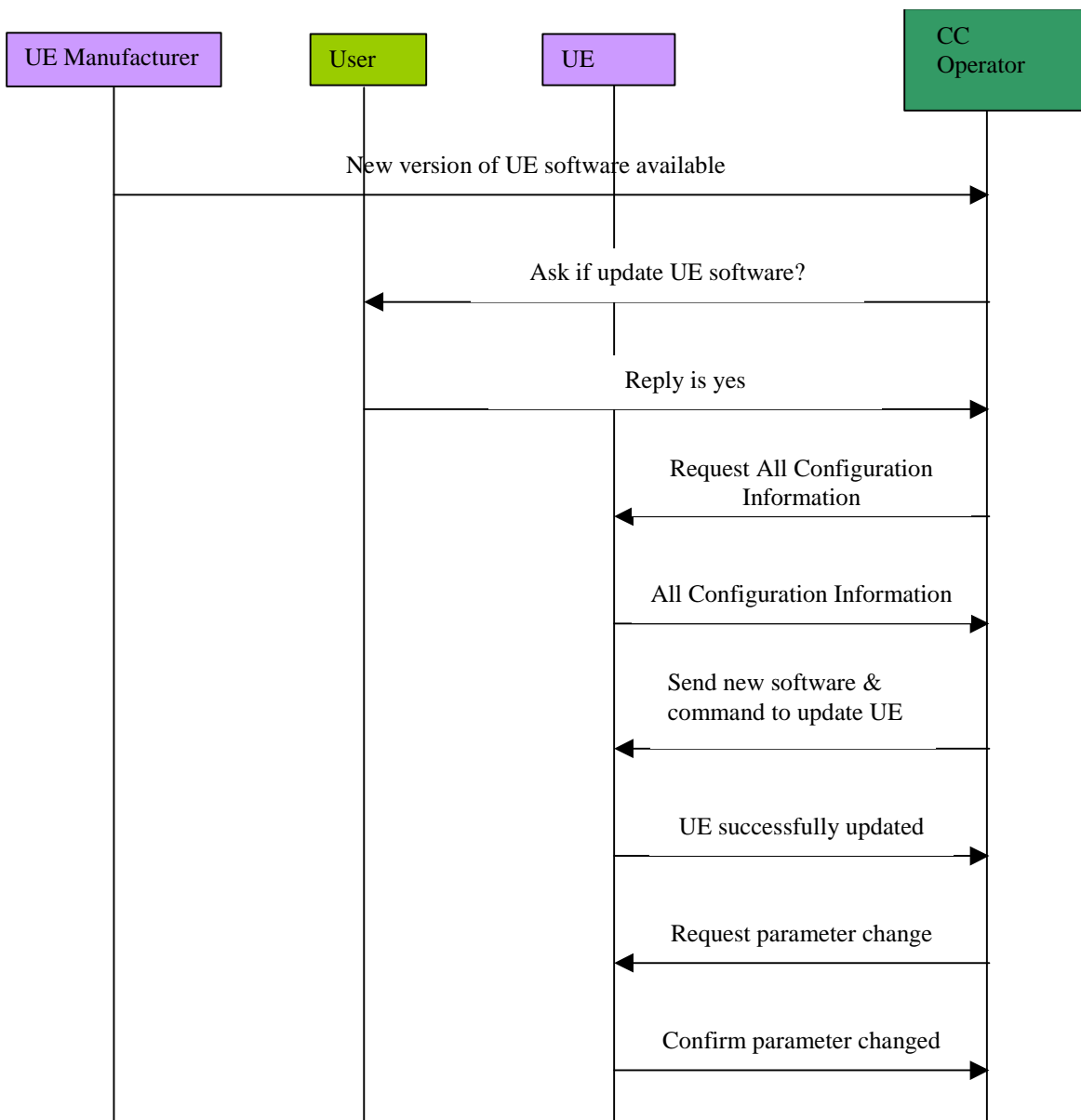
The User/subscriber would be happier with UE manufacturer/supplier as problems resolved quicker.

## 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**

Note: 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

The CC Operator shall be able to undo the change.

It would be useful if the UE Software Update capability could be used both manually and automatically. Permission to update the UE software could be obtained by voice or the question could be displayed on the UE screen and the user key in the response.

### 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.

Integrity protection of the messages on both the downlink and the uplink are required.

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 planned using a phased approach. See 3GPP TS 23.057 [7] clause 4.14.

There are potential high risks in updating or replacing the terminal software. One way of overcoming this would be to create the concept of a recovery process in case the modification leads to an unstable and/or faulty mobile status.

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.

**T2 provides framework mechanisms for software download of “non-application” (or “native”) software, but in terms of detailed (Stage 3) specifications, the matter is considered so complex (and costly) that it has been left out of scope of standardisation. There are today no plans to include this in the T2 work plan and any solution is left to proprietary mechanisms. This means that T2 presently cannot offer any standardised solution to this requirement.**

### 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.

It is a goal of the UE Software Update capability to 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.

**It has been suggested that in the first phase this should focus on the features which can be remotely fixed in the UE.**

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.

**If the diagnostic application is running continuously then the diagnostic data may be already available on the UE so the data (from the UE file system or DB) is sent back to the network. This case is FFS.**

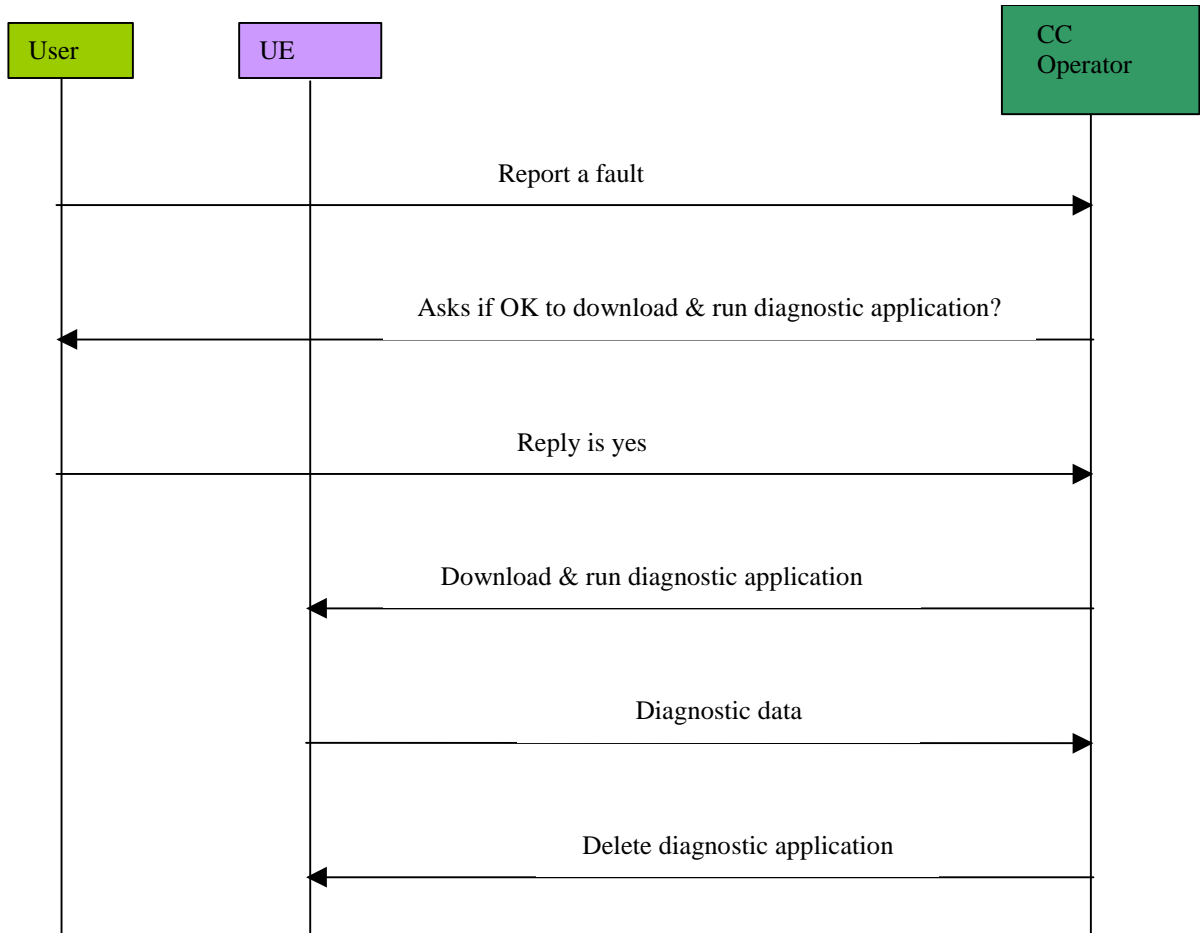


Figure 5: Remote UE Diagnostics Sequence Diagram including application download

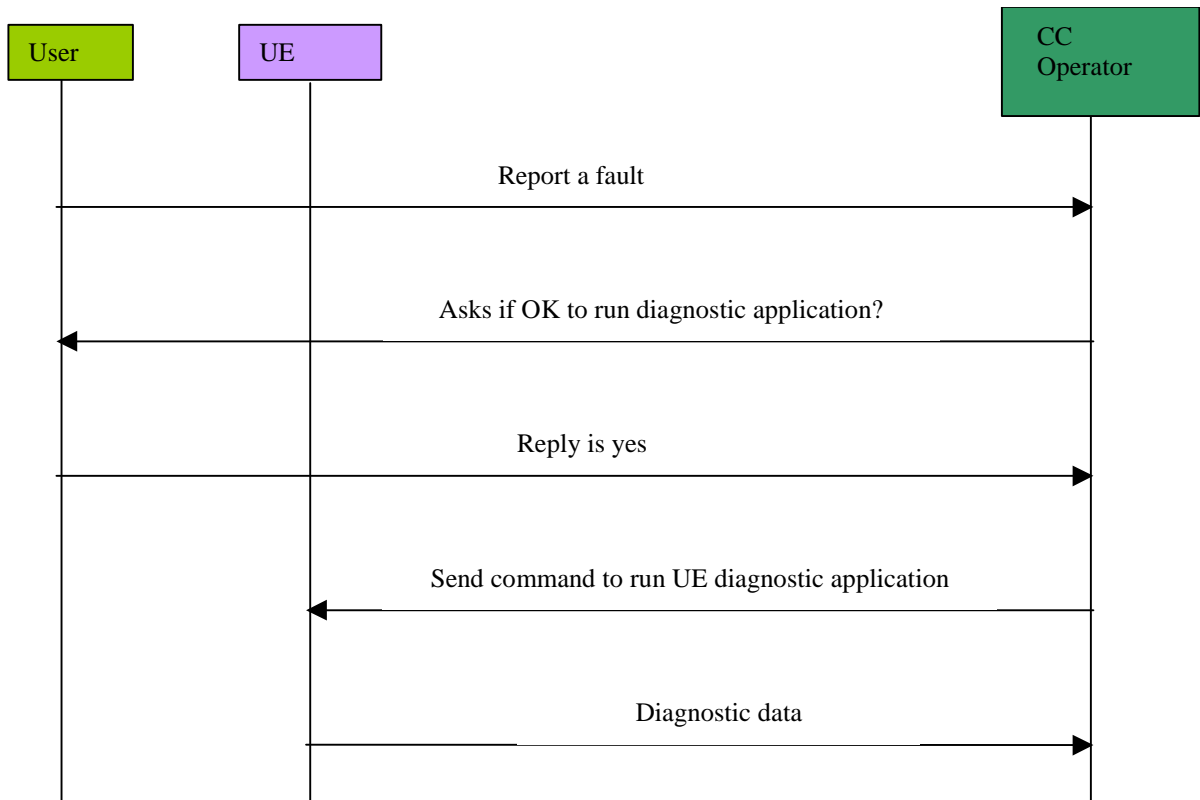


Figure 6: Remote UE Diagnostics Sequence Diagram utilising diagnostic application built in to UE

### 6.4.1 Service Aspects

The UE diagnostic software may identify network faults in addition to UE faults.

### 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. Permission could be obtained by voice or the question could be displayed on the UE screen and the user key in the response.

### 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 and Integrity protection of the messages on both the downlink and the uplink are required.

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.

A diagnostic application must be considered as native software; a generic such application would require an unrealistic degree of standardisation of the internal structure of the UE. This means that even if the issue of download had been solved, the operator would need to handle a number of proprietary applications. T2 suggests that SA5 instead consider applications at their support centre to analyse the responses received by the Configuration Query Capability for possible activation of the Reconfiguration Capability.

### 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.

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## 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.

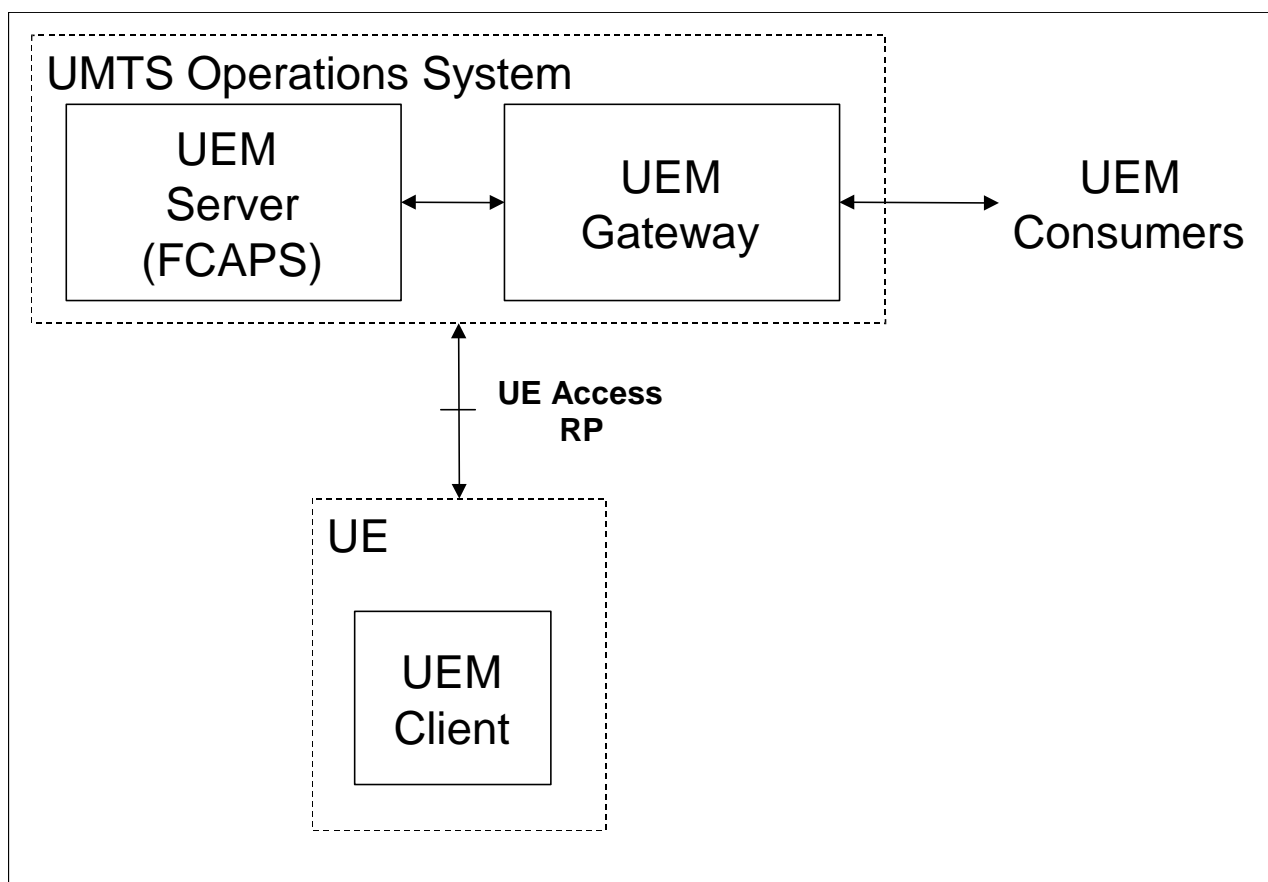


Figure 7: User Equipment Management (UEM) architecture

## 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;
- 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. The UEM Gateway will control the access available to the 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

SyncML Device Management is a strong candidate for the interface between the UE and the UEM server.

# 8 Project Planning

## 8.1 Collaboration

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

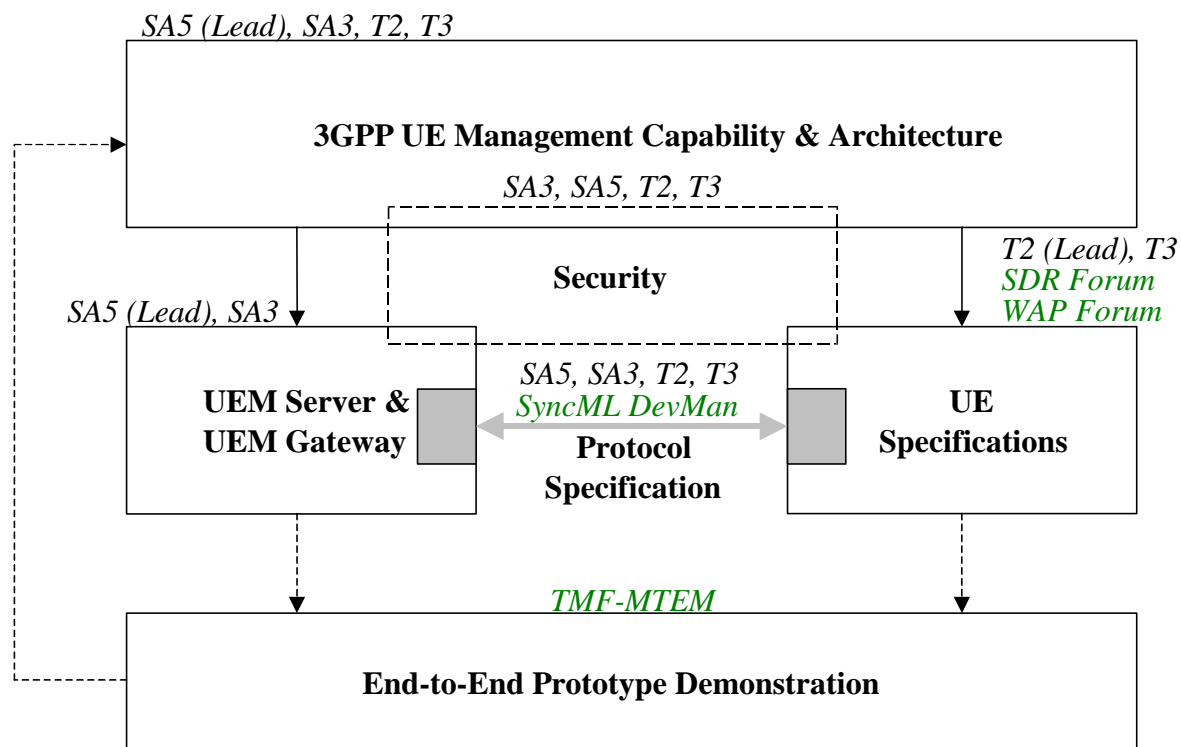


Figure 8: Proposed Structure of the User Equipment Management (UEM) work

## 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. This would also imply that the remote UE diagnostic capability utilising 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]: A trusted relationship is needed between the UEM client and server. If syncML is selected as the protocol the content must be specified. 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]: A trusted relationship is needed between the UEM client and server, the requestor as well as the UE needs to be authenticated.
- USIM work (e.g. parameter definition) [T3 BB]

More details on the planning/scheduling have been requested.

The GUP work is planned for completion within Release 6, but from the present time scales it is today unclear if all of the needed work, such as transport mechanisms and security, based on the GUP concept, also can be completed within that time frame.

The SyncML is an available standard; however, for maximum efficiency of the solutions, T2 might request some amendments. The time scales for this is dependent on both the total GUP related work plan and up to the discretion of the SyncML Initiative.

T2 asks SA5, in the light of their comments in LS S5-020146 (T2-020116), to consider the prioritisation of the UEM requirements.

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## 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. Charging for the case when recovery mechanisms need to be performed also needs to be considered.
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.
8. Technically the UE Software Update Capability for OS/firmware is very difficult to implement and this work would need to be carefully planned using a phased approach. See 3GPP TS 23.057 [7] clause 4.14.
9. The effect of roaming on UEM needs to be considered.

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## 10 Risks

None identified.

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# 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. These requirements are included for information only and the present document does not contain UEM capabilities for these requirements.

| 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 3 <sup>rd</sup> party applications)<br>Once an application has been downloaded (e.g. a K-Java game), how often is it used? How is it used, etc.?<br>Include 3 <sup>rd</sup> 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   | ✓             |                    | ✓   |                 |

| Ref | Management Function | Sub category           | Requirement   | Customer Care | Network Operations | CRM | UE Manufacturer |
|-----|---------------------|------------------------|---|---------------|--------------------|-----|-----------------|
|     |                     |                        | (voice, video...)?  |               |                    |     |                 |
| 24. | PM                  | Error/fault statistics | Failed calls details (# dialled, time...)                           | ✓             |                    |     |                 |
| 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<br>Voice<br>Video<br>Data<br>C/S<br>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                  |               | ✓                  |     |                 |

| Ref | Management Function | Sub category    | Requirement  | Customer Care | Network Operations | CRM | UE Manufacturer |
|-----|---------------------|-----------------|--|---------------|--------------------|-----|-----------------|
| 48. | PM                  | Service         | Monitor service performance  |               | ✓                  |     |                 |
| 49. | PM                  | Service         | Service availability report  |               | ✓                  |     |                 |
| 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<br>Success rates<br>How is he using the service?<br>What key did he press when...?<br>Problems encountered<br>How often do people turn their mobile on/off<br>When do they leave it on/off?<br>How often/when do user charge batteries, etc.<br>Key sequences – Configuration (e.g. WAP)<br>Key sequences - Usage behaviour (e.g. using phonebook, messages, SIM – toolkit, etc)<br>Key sequences – Idiosyncratic behaviour?<br>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<br>UE performance by UE type<br>UE performance data by customer<br>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   |               |                    | ✓   |                 |

| Ref | Management Function | Sub category                | Requirement   | Customer Care | Network Operations | CRM | UE Manufacturer |
|-----|---------------------|-----------------------------|---|---------------|--------------------|-----|-----------------|
| 69. | SM                  | Customer assistance         | Support users setting up their UE (e.g. from web interface)                           | ✓             |                    |     |                 |
| 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<br>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 3 <sup>rd</sup> 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:<br>SM: Service Management.<br>CM: Configuration Management.<br>FM: Fault Management.<br>PM: Performance Management. |                     |              |             |               |                    |     |                 |

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



- 100. Requirement removed.
- 116. Requirement removed.
- 120. Requirement removed.

#### **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.

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## 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 |       |
| Mar 2002       | S_15  | SP-020011 | -- | --  | Submitted to TSG SA #15 for the 2 <sup>nd</sup> time for Information | 1.0.0 | 1.0.4 |
|                |       |           |    |     |  |       |       |
|                |       |           |    |     |  |       |       |
|                |       |           |    |     |  |       |       |

# 3GPP TR 32.802 V1.0.4 (2002-02)

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*Technical Report*

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

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Keywords

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UEM, User Equipment Management, UE  
Management

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## Foreword

This Technical Report has been produced by the 3<sup>rd</sup> 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; [these requirements are included for information only](#).

⇨

[The key UEM capabilities that have been identified are UE Configuration Query, UE Reconfiguration, UE Software Update and Remote UE Diagnostics.](#)

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] 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

**User Equipment Management application:** is an application that executes on the UE to provide UEM functionality.

**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    | <del>Shall be possible to easily make a List</del> of clear/concise FAQ <del>accessible to the user via the UE that are downloadable to the UE</del> to solve common problems. <del>For example this could be downloaded to the UE or a link could be sent to the UE which can then be browsed.</del> | ✓             |                    | ✓   |                 |
| 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. <u>For example being able to remotely inspect the UE and remotely install applications.</u>  | ✓             |                    | ✓   |                 |
| 26. | FM                  | Error/fault statistics | Identify and report on element failures   |               | ✓                  |     |                 |
| 58. | CM                  | User Equipment         | UE type (make, model, OS, version)<br>Firmware version /level<br>S/W Version<br>Applications embedded<br>Applications added/downloaded<br>Application version<br>Virus check history<br>Memory status   | ✓             |                    |     |                 |
| 60. | SM                  | Application            | Support the collection of diagnostic information from applications on the UE.   | ✓             | ✓                  |     |                 |
| 62. | SM                  | Configuration          | Fast service set-up   | ✓             | ✓                  | ✓   | ✓               |

| Ref  | Management Function | Sub category           | Requirement  | Customer Care | Network Operations | CRM | UE Manufacturer |
|--|---------------------|------------------------|--|---------------|--------------------|-----|-----------------|
| 63.  | SM                  | Configuration – Remote | Set up services<br>Check service works<br>Upgrade services – trouble free<br>Download applications from operator to UE<br>OTA<br>Update UE software<br>Virus checks<br>Software bug fixes - trouble free | ✓             | ✓                  | ✓   |                 |
| 64.  | SM                  | Configuration – Remote | For specific customers must be able to remotely configure the UE.  | ✓             |                    | ✓   |                 |
| 66.  | SM                  | Customer Alerts        | <a href="#">The ability to inform users that a nNew O/S-version of a UE software component. Is available.s</a>   | ✓             |                    |     | ✓               |
| 67.  | SM                  | Customer Alerts        | <a href="#">The ability to inform users that a nNew services to the UE is available. Provide an example.</a>   |               |                    | ✓   |                 |
| 72.  | SM                  | Customer assistance    | PC anywhere for mobiles – tuition, show users how to use their equipment <a href="#">e.g. video clip.</a>  | ✓             |                    |     |                 |
| 74.  | SM                  | Customisation          | Remote access to view a corporate's personalised settings<br>Remote access to modify a corporate's personalised settings   | ✓             |                    |     |                 |
| 76.  | SM                  | Data management        | Manage customer data uploads<br>Manage customer data downloads   |               |                    | ✓   |                 |
| 85.  | SM                  | Proactive downloads    | Of apps, services, fixes etc to UE   | ✓             | ✓                  | ✓   | ✓               |
| 90.  | SM                  | UEM                    | For corporates<br><a href="#">Text to be enhanced</a>  | ✓             |                    | ✓   |                 |
| Key to Management Function column:<br>SM: Service Management.<br>CM: Configuration Management.<br>FM: Fault Management.<br>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~~ UEM consumer needs to know:

- IMEI (Manufacturer; equipment make, model build date and version...);

~~Model);~~

- UE 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.~~

## UE Software Update ~~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

148. It shall be possible to collect diagnostic information from the UE. (Note there are different mechanisms by which this can be achieved including executing a built in diagnostic application, retrieving diagnostic data directly from the UE and download of the diagnostic application to the UE.).

## Remotely downloaded diagnostic applications

The requirements in this section are applicable to remotely downloaded diagnostic applications and not to the situation where the diagnostic application is built into the UE.

99. The CC operator must be able to identify and locate the appropriate diagnostic/remedial application.

- 101. The CC operator must be informed whether the downloaded remedial application has been successfully installed in the MT.
- 102. The CC operator must be informed whether the application has completed its tasks successfully.
- 103. A downloaded 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.
- ~~116. The operator must be able to remotely download applications to the MT.~~
- 117. The CC 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. It shall be possible to recover to the device configuration and data state that existed prior to any new installation. This could be used for example to recover from a faulty installation. ~~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 downloaded 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 its tasks.~~ Authorised UEM applications shall have the access they need to complete their 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 user equipment management 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.

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.

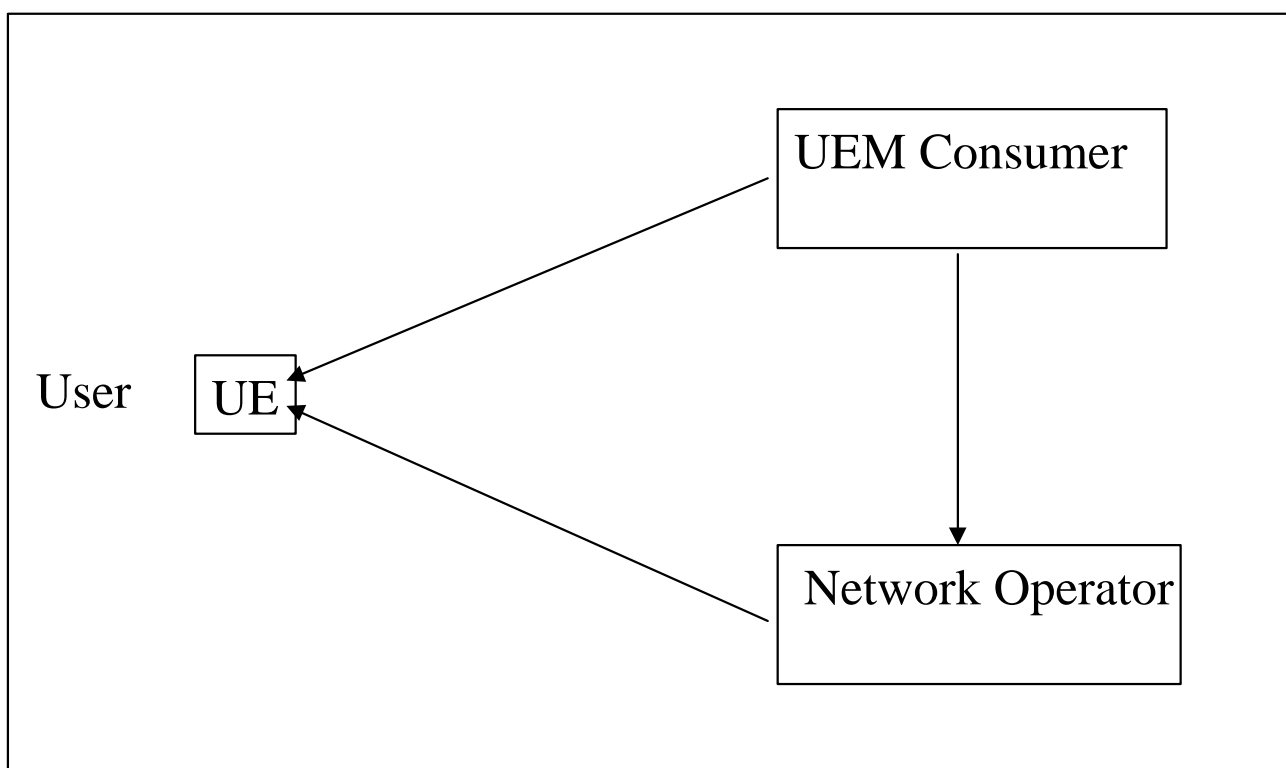


Figure 1: User Equipment Management (UEM) role model

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## 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.

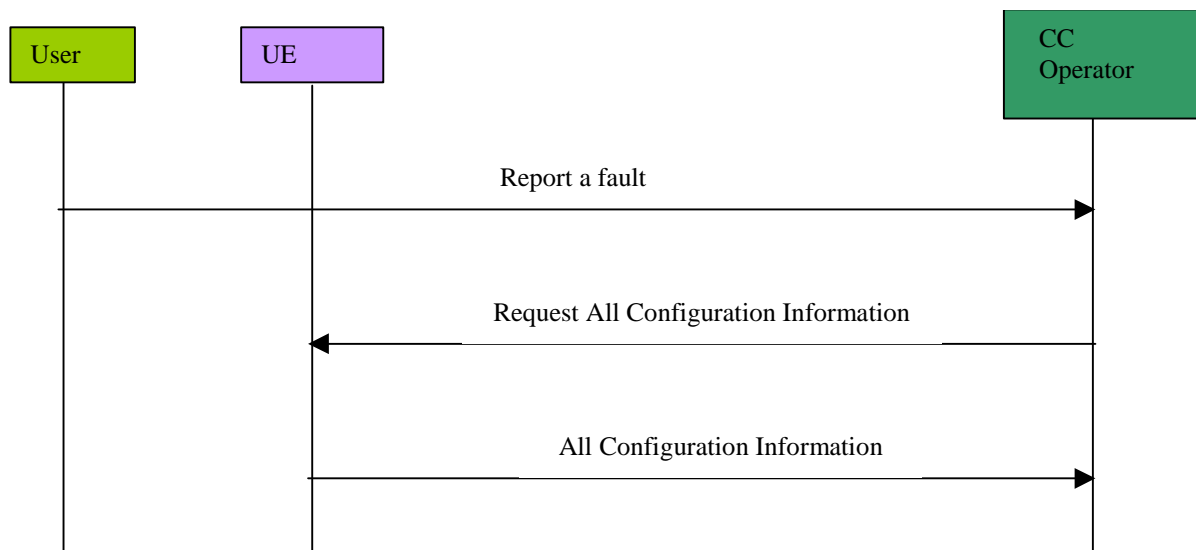
It is proposed that these UEM capabilities are standardised post 3GPP Release 5. [The term “post 3GPP Release 5” means in 3GPP Release 6 or in subsequent Releases.](#)

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...);

[Check whether IMEI includes the version.](#)

- the [UE](#) software versions ([IMEISV](#));
- the applications installed [and their software version. At a minimum the list of applications returned shall be those which are remotely manageable \(a list of the other non manageable applications could also be returned\);](#)
- the last error, time, date. [The minimum is a single last error on the UE. It would be useful if the last errors for all the applications could be also returned.;](#)
- configuration parameters, [e.g.:- language settings, service related settings.](#)



## 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.

[Integrity protection of the messages on both the downlink and the uplink are required.](#)

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. [The Generic User Profile / Data Description Framework work is applicable for this, see \[2\], \[3\] and \[4\].](#)

## 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

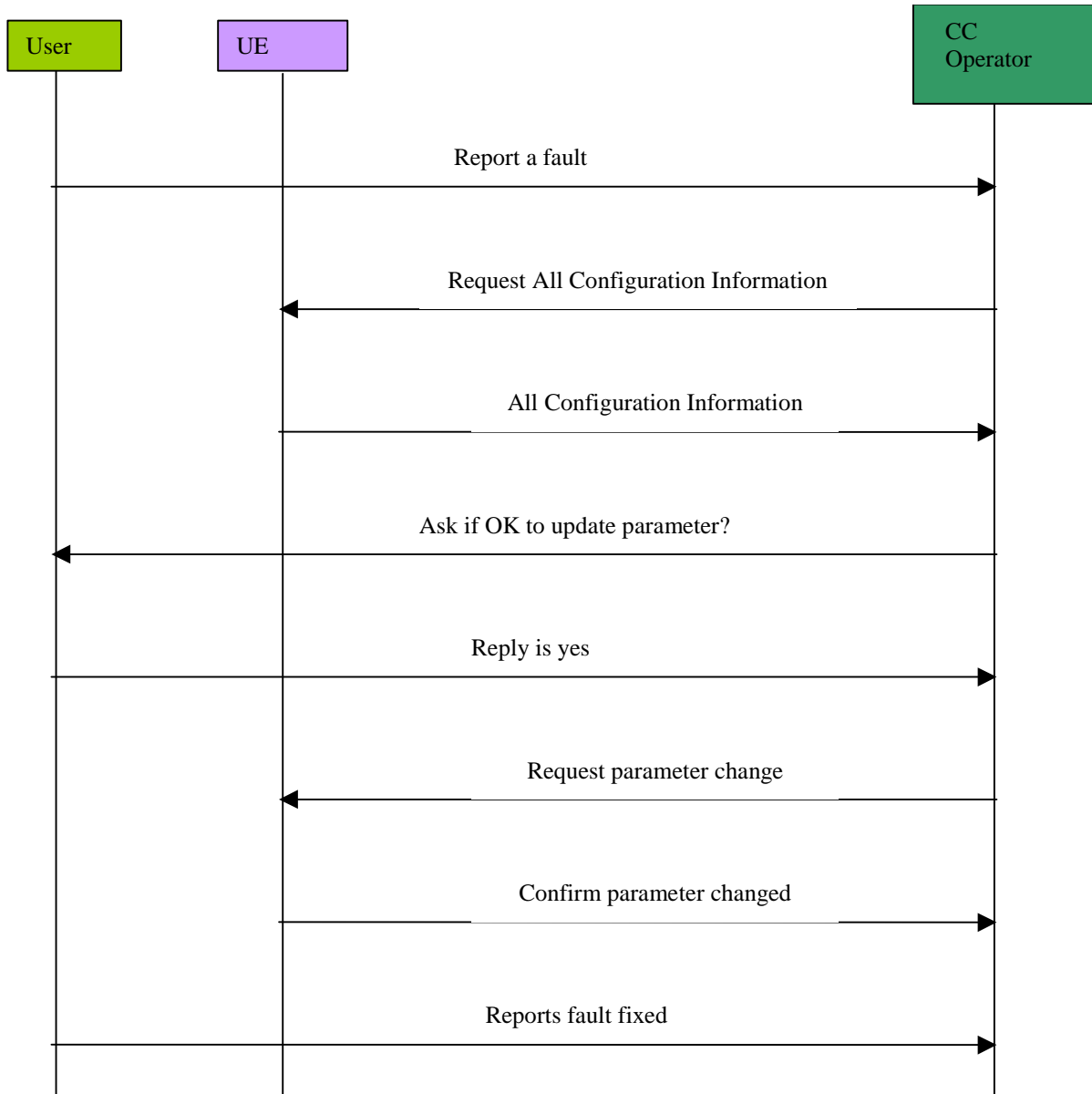
The Operator/Service Provider would be able to handle support calls more quickly and effectively.

### 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 ~~an example of~~ 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). [The last interaction is optional.](#)

**Figure 3: UE Reconfiguration Sequence Diagram**

[Perhaps CC Operator should be changed to UEM consumer.](#)

### 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.

The CC Operator shall be able to undo the change. ~~It shall be possible to undo the change.~~

Permission to update the parameter could be obtained by voice or the question could be displayed on the UE screen and the user key in the response.

### 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. [Integrity protection of the messages on both the downlink and the uplink are required.](#)

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.

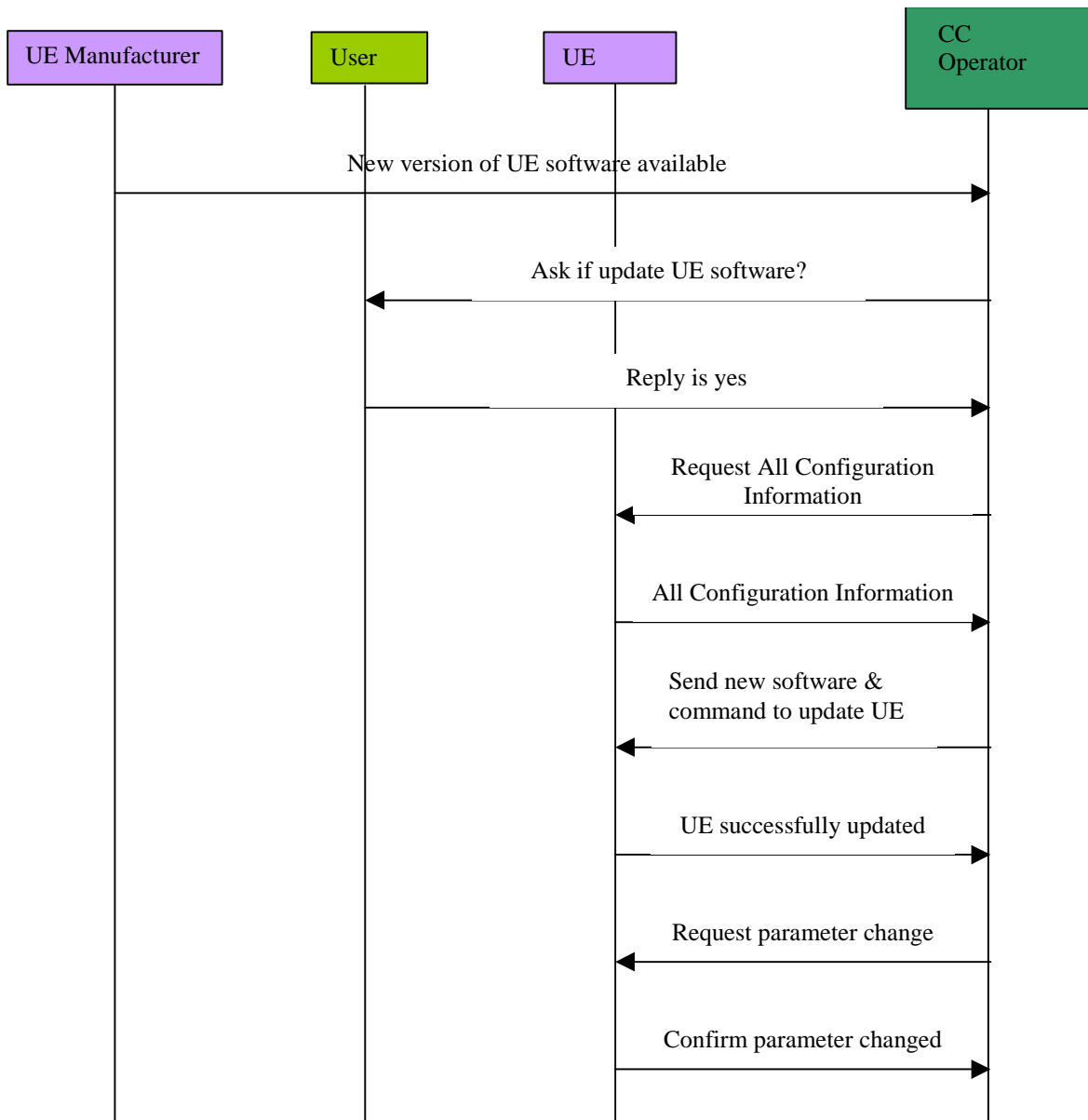


Figure 4: UE Software Update Sequence Diagram

**Note:** 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

The CC Operator shall be able possible to undo the change.

It would be useful if the [UE Software Update](#) is capability could be used both manually and automatically. [How will the management activity be initiated? Permission to update the UE software could be obtained by voice or the question could be displayed on the UE screen and the user key in the response.](#)

### 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.

[Integrity protection of the messages on both the downlink and the uplink are required.](#)

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 planned using a phased approach. See 3GPP TS 23.057 [7] clause 4.14.

[There are potential high risks in updating or replacing the terminal software. One way of overcoming this would be to create the concept of a recovery process in case the modification leads to an unstable and/or faulty mobile status.](#)

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.

[T2 provides framework mechanisms for software download of “non-application” \(or “native”\) software, but in terms of detailed \(Stage 3\) specifications, the matter is considered so complex \(and costly\) that it has been left out of scope of standardisation. There are today no plans to include this in the T2 work plan and any solution is left to proprietary mechanisms. This means that T2 presently cannot offer any standardised solution to this requirement.](#)

### 6.3.7 Network Aspects

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



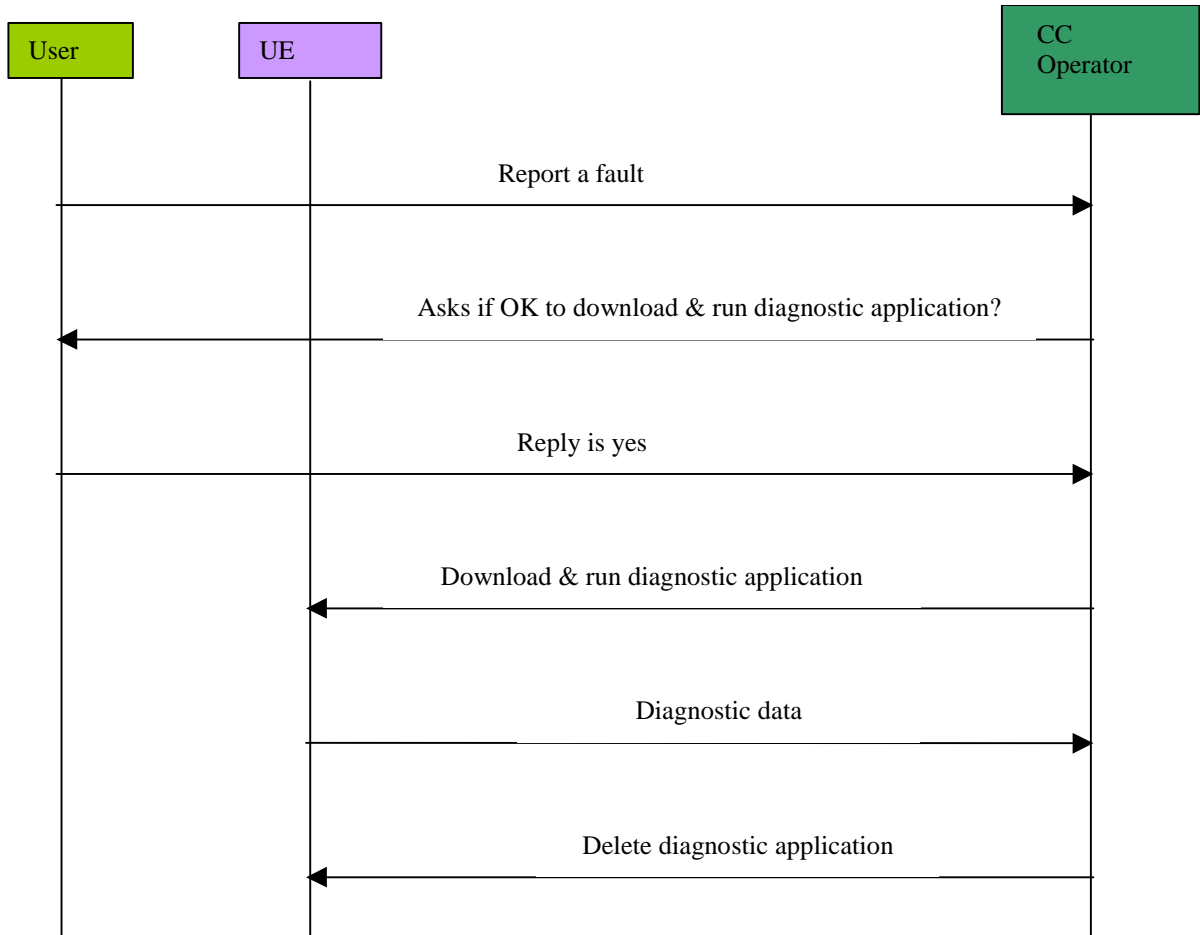


Figure 5: Remote UE Diagnostics Sequence Diagram including application download

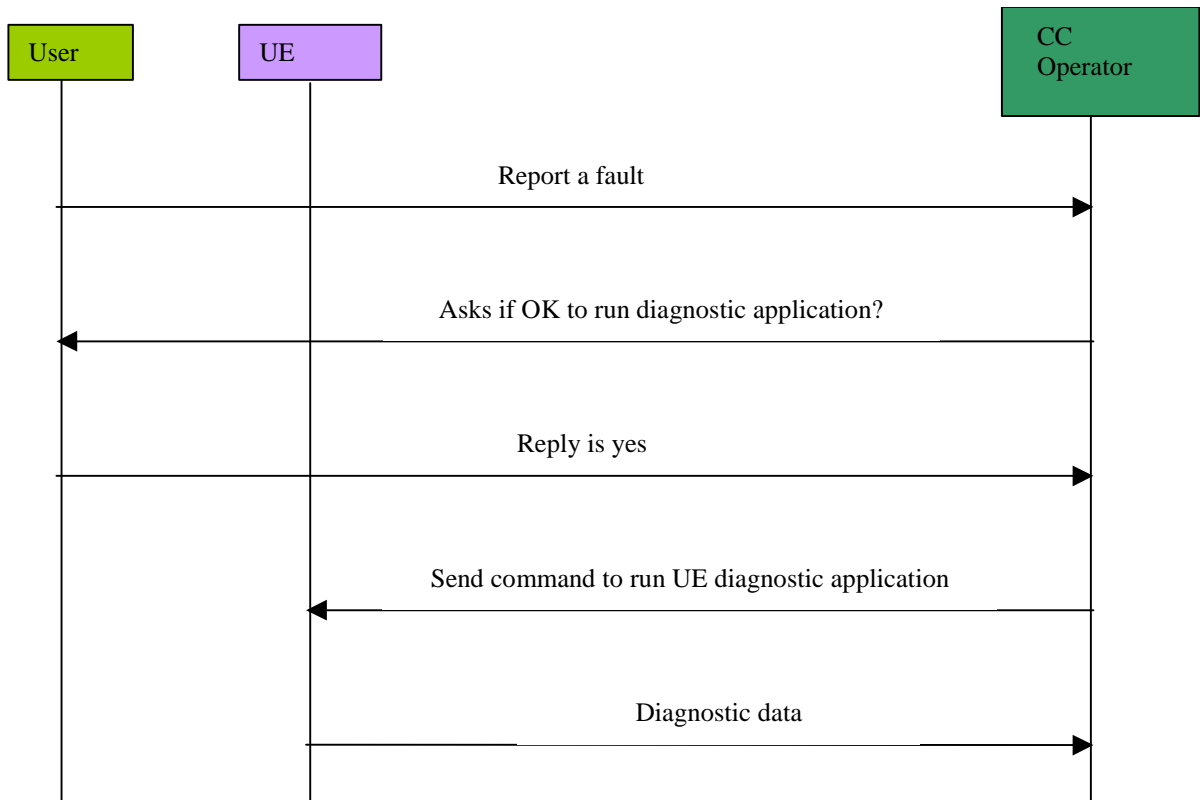


Figure 6: Remote UE Diagnostics Sequence Diagram utilising diagnostic application built in to UE

## 6.4.1 Service Aspects

[The UE diagnostic software may identify network faults in addition to UE faults.](#)

## 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. [Permission could be obtained by voice or the question could be displayed on the UE screen and the user key in the response.](#)

## 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 [and Integrity protection of the messages on both the downlink and the uplink are required.](#)

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.

[A diagnostic application must be considered as native software; a generic such application would require an unrealistic degree of standardisation of the internal structure of the UE. This means that even if the issue of download had been solved, the operator would need to handle a number of proprietary applications. T2 suggests that SA5 instead consider applications at their support centre to analyse the responses received by the Configuration Query Capability for possible activation of the Reconfiguration Capability.](#)

## 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.

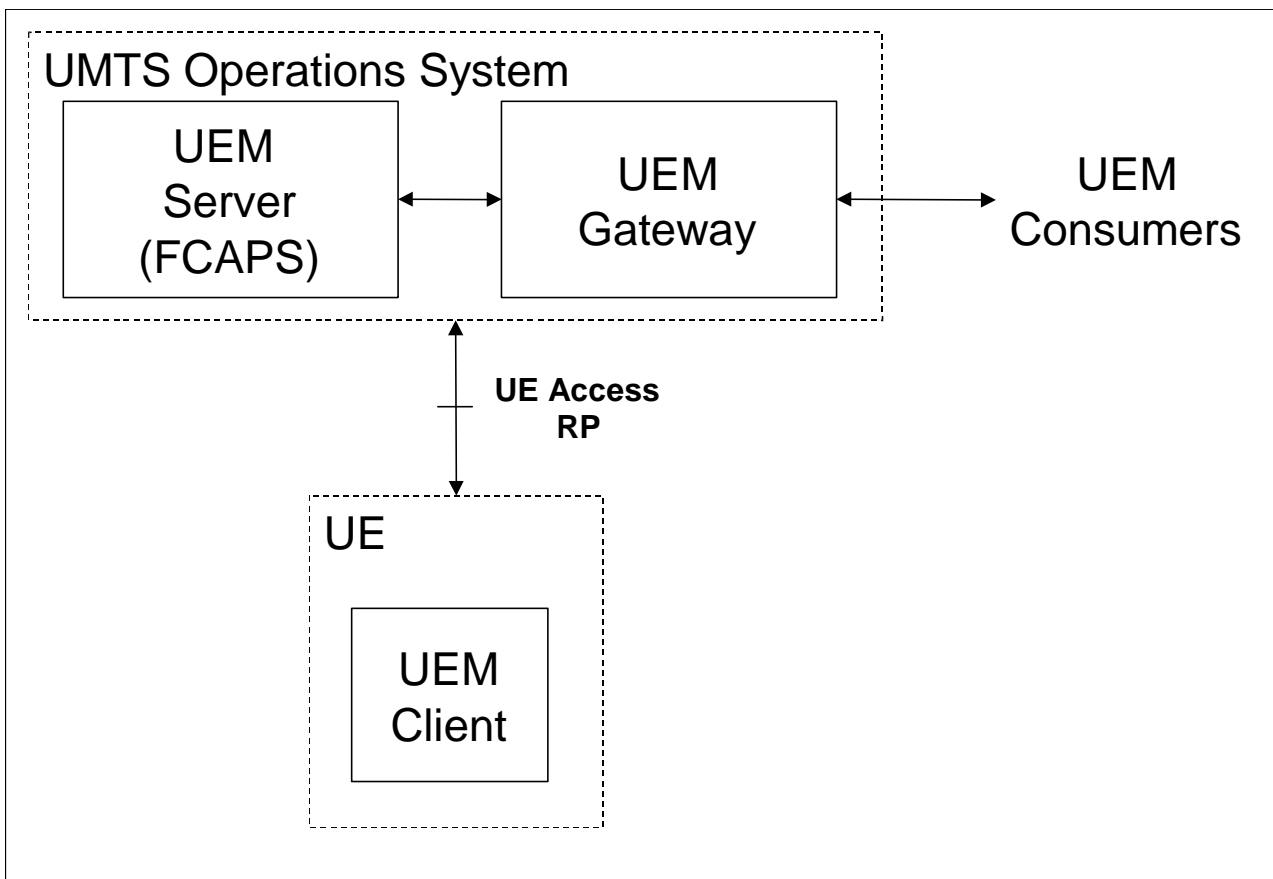


Figure 7: User Equipment Management (UEM) architecture

## 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. The UEM Gateway will control the access available to the 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. SyncML Device Management is a strong candidate for the interface between the UE and the UEM server.

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# 8 Project Planning

## 8.1 Collaboration

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

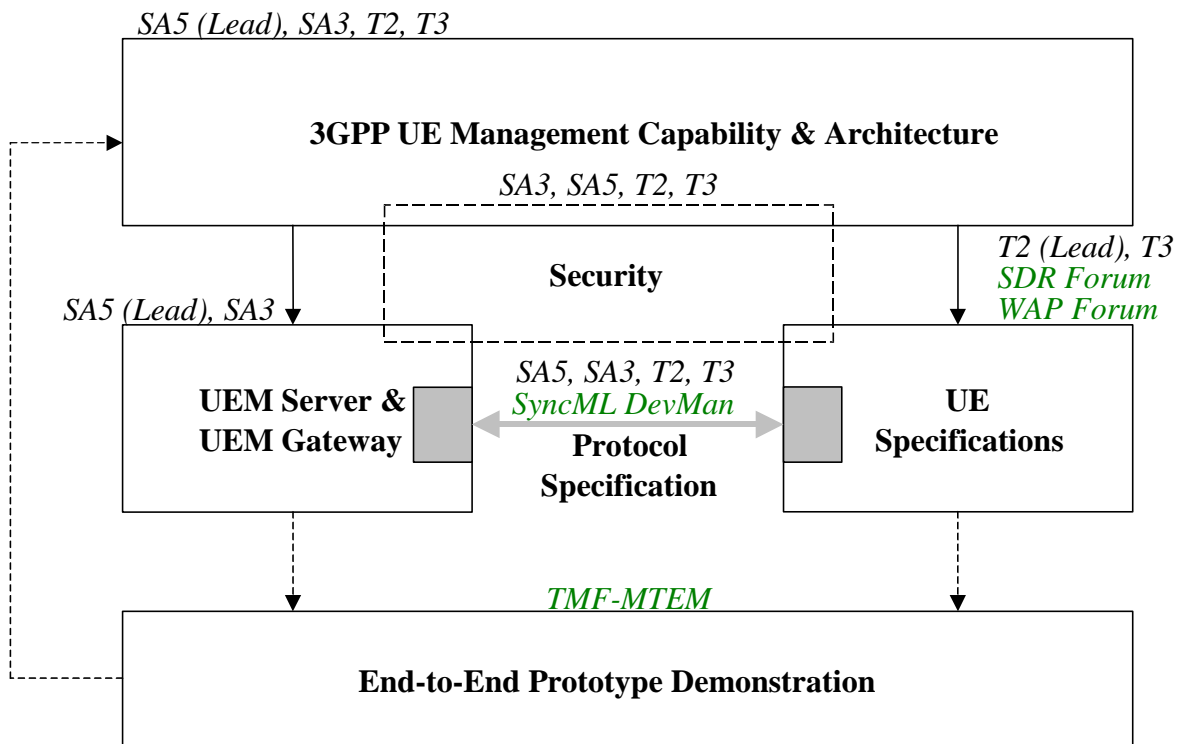


Figure 8: Proposed Structure of the User Equipment Management (UEM) work

## 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. This would also imply that the remote UE diagnostic capability utilising 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]: [A trusted relationship is needed between the UEM client and server. If syncML is selected as the protocol the content must be specified.](#) 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]: [A trusted relationship is needed between the UEM client and server, the requestor as well as the UE needs to be authenticated.](#)
- USIM work (e.g. parameter definition) [T3 BB]

[More details on the planning/scheduling have been requested.](#)

[The GUP work is planned for completion within Release 6, but from the present time scales it is today unclear if all of the needed work, such as transport mechanisms and security, based on the GUP concept, also can be completed within that time frame.](#)

[The SyncML is an available standard; however, for maximum efficiency of the solutions, T2 might request some amendments. The time scales for this is dependent on both the total GUP related work plan and up to the discretion of the SyncML Initiative.](#)

[T2 asks SA5, in the light of their comments in LS S5-020146 \(T2-020116\), to consider the prioritisation of the UEM requirements.](#)

---

## 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. [Charging for the case when recovery mechanisms need to be performed also needs to be considered.](#)
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. ~~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.
8. [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.](#)
9. [The effect of roaming on UEM needs to be considered.](#)

---

## 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. [These requirements are included for information only and the present document does not contain UEM capabilities for these requirements.](#)

| 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 3 <sup>rd</sup> party applications)<br>Once an application has been downloaded (e.g. a K-Java game), how often is it used? How is it used, etc.?<br>Include 3 <sup>rd</sup> 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   | ✓             |                    | ✓   |                 |

| Ref | Management Function | Sub category           | Requirement   | Customer Care | Network Operations | CRM | UE Manufacturer |
|-----|---------------------|------------------------|---|---------------|--------------------|-----|-----------------|
|     |                     |                        | (voice, video...)?  |               |                    |     |                 |
| 24. | PM                  | Error/fault statistics | Failed calls details (# dialled, time...)                           | ✓             |                    |     |                 |
| 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<br>Voice<br>Video<br>Data<br>C/S<br>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                  |               | ✓                  |     |                 |

| Ref | Management Function | Sub category    | Requirement  | Customer Care | Network Operations | CRM | UE Manufacturer |
|-----|---------------------|-----------------|--|---------------|--------------------|-----|-----------------|
| 48. | PM                  | Service         | Monitor service performance  |               | ✓                  |     |                 |
| 49. | PM                  | Service         | Service availability report  |               | ✓                  |     |                 |
| 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<br>Success rates<br>How is he using the service?<br>What key did he press when...?<br>Problems encountered<br>How often do people turn their mobile on/off<br>When do they leave it on/off?<br>How often/when do user charge batteries, etc.<br>Key sequences – Configuration (e.g. WAP)<br>Key sequences - Usage behaviour (e.g. using phonebook, messages, SIM – toolkit, etc)<br>Key sequences – Idiosyncratic behaviour?<br>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<br>UE performance by UE type<br>UE performance data by customer<br>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   |               |                    | ✓   |                 |



| Ref | Management Function | Sub category                | Requirement   | Customer Care | Network Operations | CRM | UE Manufacturer |
|-----|---------------------|-----------------------------|---|---------------|--------------------|-----|-----------------|
| 69. | SM                  | Customer assistance         | Support users setting up their UE (e.g. from web interface)                           | ✓             |                    |     |                 |
| 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<br>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 3 <sup>rd</sup> 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.            |               |                    | ✓   |                 |

Release 5

[3GPP TR 32.802 V1.0.4 \(2002-02\)](#)~~[3GPP TR 32.802 V1.0.4 \(2002-02\)](#)~~~~[3GPP TR 32.802 V1.0.42 \(2002-02\)](#)~~~~[3GPP TR 32.802 V1.0.2 \(2002-01\)](#)~~

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

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

[100. Requirement removed.](#)

[116. Requirement removed.](#)

[120. Requirement removed.](#)

### **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.

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## 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                 |                       |
| <a href="#">Mar 2002</a> | <a href="#">S_15</a> | <a href="#">SP-020011</a> | -- | --  | <a href="#">Submitted to TSG SA #15 for the 2<sup>nd</sup> time for Information</a> | <a href="#">1.0.0</a> | <a href="#">1.0.4</a> |
|                          |                      |                           |    |     |   |                       |                       |
|                          |                      |                           |    |     |   |                       |                       |