Look and Feel Customization Technical Specification

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Open Mobile Alliance

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1. Scope

This document defines the technical specification of Look and Feel Customization (LFC) Enabler.

Mechanisms defined in this document fulfil the functional capabilities needed to support LFC enabler as described in the LFC Requirement Document [OMA-LFC-RD] and comply with the architecture defined in LFC Architecture Document [OMA-LFC-AD].

2. References

2.1 Normative References

[DMPRO]	"OMA Device Management Protocol", Version 1.2, Open Mobile Alliance, OMA-TS-DM_Protocol-V1_2, URL:http://www.openmobilealliance.org/
[DMTND]	"OMA Device Management Tree and Description, Version 1.2". Open Mobile Alliance™. OMA-TS-DM-TND-V1_2, URL: http://www.openmobilealliance.org
[OMA-DLOTA-TS]	"Download Over the Air Specification", Open Mobile Alliance™, OMA-TS-DLOTA-V2_0, URL:http://www.openmobilealliance.org/
[OMA-LFC-AD]	"Look and Feel Customization Architecture", Open Mobile Alliance™, OMA-AD-LFC-V1_0, URL:http://www.openmobilealliance.org/
[OMA-LFC-RD]	"Look and Feel Customization Requirements", Open Mobile Alliance™, OMA-RD-LFC-V1_0, URL:http://www.openmobilealliance.org/
[OMA-SCOMO-TS]	"Software Component Management Object", Version 1.0, Open Mobile Alliance, OMA-TS-SCOMO-V1_0, URL:http://www.openmobilealliance.org/
[OMA-SCWS-TS]	"Smartcard-Web-Server", Open Mobile Alliance™, OMA-TS-Smartcard_Web_Server-1.1, URL:http://www.openmobilealliance.org/
[RFC2119]	"Key words for use in RFCs to Indicate Requirement Levels", S. Bradner, March 1997, URL:http://www.ietf.org/rfc/rfc2119.txt
[RFC4234]	"Augmented BNF for Syntax Specifications: ABNF". D. Crocker, Ed., P. Overell. October 2005, URL:http://www.ietf.org/rfc/rfc4234.txt
[SCRRULES]	"SCR Rules and Procedures", Open Mobile Alliance™, OMA-ORG-SCR_Rules_and_Procedures, URL:http://www.openmobilealliance.org/
[SSL 3.0]	The SSL Protocol, Version 3.0, <draft-freier-ssl-version3-02.txt>, Transport Layer Security Working Group, Alan O. Freier et al, November 18, 1996. URL: http://www.netscape.com/eng/ssl3/draft302.txt
[TLS 1.0]	"The TLS Protocol Version 1.0", T. Dierks, C. Allen, January 1999. URL: http://www.ietf.org/rfc/rfc2246.txt

2.2 Informative References

[OMADICT]	"Dictionary for OMA Specifications", Version x.y, Open Mobile Alliance™, OMA-ORG-Dictionary-Vx_y, URL:http://www.openmobilealliance.org/
[OMA-DM-AC_MO]	"White Paper on Provisioning Objects", Open Mobile Alliance, OMA-WP-AC_MO, URL:http://www.openmobilealliance.org/

3. Terminology and Conventions

3.1 Conventions

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119].

All sections and appendixes, except "Scope" and "Introduction", are normative, unless they are explicitly indicated to be informative.

3.2 Definitions

LFC Content Server	An entity that supports the delivery of LFC Packages to an LFC enabled device
LFC Element	One characteristic of a device's LFC (e.g. screen saver, incoming data message alert, ringtone per caller, etc).
LFC Element Settings	The combination of an LFC Element and an associated value for it
LFC Management Server	An entity that issues and handles the commands to perform Remote Management operations to an LFC enabled device
LFC Operations	Operations targeted on LFC Packages or LFC Element Settings which may be invoked on a LFC Client.
LFC Packages	Group of LFC Element Settings that are part of the device's Look and Feel. This package is used by a Service Provider to describe part or the whole Look and Feel Customization of the device.
Look and Feel	Appearance and behavior of the device's user interface.
Look and Feel Customization	Process by which all or part of a device's Look and Feel is modified
Management Object	A data model for information which is a logical part of the interfaces exposed by DM components.
Remote Management	LFC Operations originating from an entity residing on the network to be performed on an LFC capable device
Secure Removable Card	It refers to secure physical devices able to be inserted to and removed from terminal equipments. These devices must be able to protect not only logically but physically the data and/or applications they carry. Typical secure removable medias in the LFC are the UICC's (see [OMADICT])
Service Provider	See definition in [OMADICT].
User Agent	Any software or device that acts on behalf of a user, interacting with other entities and processing resources.

3.3 Abbreviations

DLOTA	DownLoad Over The Air
DM	Device Management
FTP	File Transfer Protocol
HTTP	HyperText Transfer Protocol
LFC	Look and Feel Customization
MO	Management Object
OMA	Open Mobile Alliance
SCOMO	Software Component Management Object
SRC	Secure Removable Card

4. Introduction

The LFC V1.0 enabler supports the Lightweight Model and Remote Management Model. The Lightweight Model is mandatory and the Remote Management Model is optional. Both models support LFC Package operations. The operations for LFC Element Setting are not supported in the LFC V1.0 enabler.

4.1   Version 1.0

This document provides the technical specification for the LFC Enabler Version 1.0, which provides the following main functionalities depending on the model applied:

- For the lightweight model which is the mandatory part of this enabler:

    o   Delivery of LFC Packages

    o   Installation of the LFC Package

    o   Activation and deactivation of LFC Package

    o   Removal of LFC Package

- For the Remote Management model which is optional in this release, the main functionalities in addition to those mentioned above are:

    o   Query of LFC Packages

    o   Inventory of LFC Packages

    o   Locking and unlocking LFC Packages

    o   Marking default LFC Package

5. Look and Feel Customization Framework

5.1 LFC Package Introduction

5.1.1 LFC Package Description

LFC Package is a group of LFC Element Settings for delivery and management purposes. One LFC Package MUST consists of at least one LFC Element Setting. The number of LFC Element Settings and categories of LFC Element Setting in one LFC Package is not restricted. It is possible to include more than one of LFC Element Settings, all associated to one characteristic of a device's look and feel.

5.1.2 LFC Package Metadata Introduction

LFC Package metadata is a metadata associated to an LFC Package. The LFC Package metadata is part of the LFC Package and it provides the description and characteristic information for the LFC Package. The metadata consists of multiple attributes (e.g. name, description, etc.) as well as category description. The metadata MAY also consist of some information which will be used by the LFC Client to verify against the device capability. The metadata MUST be provided by the LFC Content Server and the same values MUST be placed in corresponding nodes of the LFC management tree by the LFC Client after installation of LFC Package if the LFC Remote Management is supported.

The LFC Package metadata is used by the device to identify the LFC Package and render the LFC Package.

The LFC Package metadata may also be used for LFC Package Delivery and Installation. It provides the information for the device to identify, retrieve, and install the LFC Package.

5.1.3 LFC Package Metadata Structure Overview

The LFC Package metadata is mandatory for both Lightweight Model and Remote Management Model.

The figure below shows the structure overview of the LFC Package Metadata. The elements with grey filling are only applicable in the Remote Management Model.
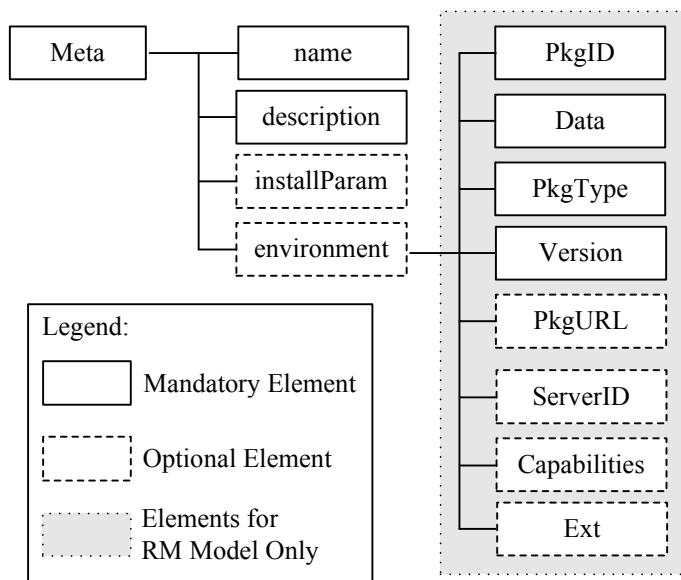

Figure 1: LFC Package Metadata Structure Overview

The table below describes the elements for LFC Package metadata.

Name	Format	Status	Description
name	String	Mandatory	A user readable name of the LFC Package.
description	String	Mandatory	A short textual description of the LFC Package.
installParam	String	Optional	An installation parameter associated with the downloaded LFC Package. The value is an opaque text string that is handed by the Delivery Client to the LFC Client. The syntax and semantics of the opaque string is relevant only to the LFC Client. The value is fully transparent to the Delivery Client.
environment	XML schema *any* and its XML attribute "envtype" is an URI [RFC3986]	Optional	Container of execution environment specific metadata needed for the LFC Package processing. This element wraps the environment specific meta information described by namespace qualified XML elements. The `envtype` value unambiguously identifies the information set that can be included inside the `environment` element and the Delivery Client and LFC Client. The possible values of `envtype`, syntax and semantics of the internal meta data structures depend on separate environment specific standards. Some elements can be extended within the Environment for Remote Management Model.

Table 1: LFC Package Metadata

5.1.4   LFC Package Metadata Usage in Lightweight Model

5.1.4.1   Usage in DLOTA

If DLOTA is used to download an LFC Package, the DLOTA Download Descriptor [OMA-TS-DLOTA] will be used.

Specifically, the LFC Package can be mapped as the *product* defined in DLOTA Download Descriptor, and the LFC Package actual information can be mapped as the *mediaObject* defined in DLOTA Download Descriptor. The LFC Package metadata can be mapped as the elements *meta* defined in DLOTA Download Descriptor. Especially, the elements *name*, *description*, *installParam*, *environment* defined in LFC Package metadata can be mapped as the elements *name*, *description*, *installParam*, *environment* inside Meta defined in DLOTA Download Descriptor.

The elements defined in LFC Package metadata can be reused as the elements in *meta* for the DLOTA Download Descriptor. The detailed descriptions about the elements and the usage of the elements are defined in [OMA-TS-DLOTA].

The elements and attributes which are defined in the DLOTA Download Descriptor and not mentioned in the table above are Optional and the usage of such elements and attributes are defined outside of this specification.

Examples of DLOTA Download Descriptor for LFC Package:

```
<media xmlns="urn:oma:xml:dl:dd:2.0" DDVersion="2.0">
  <product>
    <meta>
      <name>LFC Package Name</name>
      <description>LFC Package Description</description>
      <installParam>install parameter information</installParam>
    </meta>
    <mediaObject>
      <size>100</size>
      <type>vnd.oma.lfc.packagemetadata+xml</type>
      <objectID>cid:image@example.com</objectID>
      <objectURI>
          <server>http://download.example.com/LFCPackage.zip</server>
      </objectURI>
    </mediaObject>
  </product>
</media>
```

5.1.4.2   Usage in HTTP, FTP and other delivery mechanisms

Examples:

```
<meta xmlns="urn:oma:xml:lfc:packagemetadata:1.0">
      <name>LFC Package Name</name>
      <description>LFC Package Description</description>
      <installParam>install parameter information</installParam>
</meta>
```

5.1.5   LFC Package Metadata Usage in Remote Management Model

In Remote Management Model, if the LFC Package is delivered by OMA DM delivery mechanism, the LFC Management Server can use DM commands to create the LFCMO for the LFC Package. If the LFC Package is not delivered by OMA DM delivery mechanism, after receiving the delivered LFC Package, to facilitate the Remote Management, the LFC Client needs to create the LFCMO according to the LFC Package metadata information. The LFC Client extracts the LFC Package metadata information, and maps the LFC Package metadata information to the LFCMO tree. The LFC Client MAY store this mapping information.

For the LFC Package metadata, the *name* element can be mapped as the *Name* node in the LFC MO tree, and the *description* element can be mapped as the *description* node in the LFCMO tree. The *installParam* element can be used by the LFC Client to install the LFC Package. The "envtype" attribute in *environment* element can be mapped as the *EnvType* node in the LFCMO tree.

The extra LFC Package metadata information related to the creation of LFCMO tree is defined inside the *environment* element, extended from *any* element.

The table below describes the elements extended inside the *environment* element for LFC Package metadata.

Name	Format	Status	Description
PkgID	String	Mandatory	The identification of the LFC Package. This element could be filled with the package's web download URI or the SP's domain name appended with the package serial number assigned by the SP or other ways to avoid duplication.
PkgType	String	Optional	The MIME media type of the LFC Package.
Version	String	Mandatory	The version of the LFC Package.
PkgURL	String	Optional	The downloadable URL of the LFC Package or its download descriptor.
ServerID	String	Optional	The identifier of the server which delivers the LFC Package to the device.
Capabilities	String	Optional	The required device capability information to facilitate the device to download and render the LFC Package.
Ext	XML Schema any	Optional	Reserved for platform or vendor specific extensions.

Table 2: Extended LFC Package Metadata for Remote Management Model

The ServerID information can be used for authorization and authentication. In the Remote Management Model, the authorization information for the LFC Operations from server is indicated in the ACL (Access Control List) attribute of the LFCMO node. After receiving the LFC Operation request from LFC Management Server, the LFC Client retrieves the LFC Operation initiator information, and compares the server identifier information with the authorization information indicated in the ACL attribute. If the LFC Operation request is authorized according to the comparison, the LFC Client executes the LFC Operation, and returns the result to the LFC Management Server.

The Capabilities information is used for the device to verify the device capabilities to download and render the LFC Package. Once the LFC Client receives the download descriptor file of one LFC Package, if it estimates that the device can meet the required capabilities, it will continue to download the LFC Package; otherwise, the LFC package download MAY be declined.

Examples:

```
<meta xmlns="urn:oma:xml:lfc:packagemetadata:1.0">
      <name>LFC Package Name</name>
      <description>LFC Package Description</description>
      <installParam>install parameter information</installParam>
      <environment envtype="environment type">
           <PkgID>LFC Package identifier <PkgID>
            <PkgType>vnd.oma.lfc.packagemetadata+xml</PkgType>
            <Version>LFC Package version</Version>
            <PkgURL>http://download.example.com/LFCPackage.zip</PkgURL>
            <ServerID>DM Server identifier</ServerID>
      </environment>
</meta>
```

5.2   LFC Package Life-Cycle and Operations

The following sections describe the life-cycle of the LFC Package and LFC Package Operations.

5.2.1   Life-Cycle of LFC Packages

LFC Package operations trigger transition from one state to another. If a state transition fails, the LFC Client MUST remain in the current state.

The following figure depicts the life-cycle and state transition triggered by LFC Package operations:
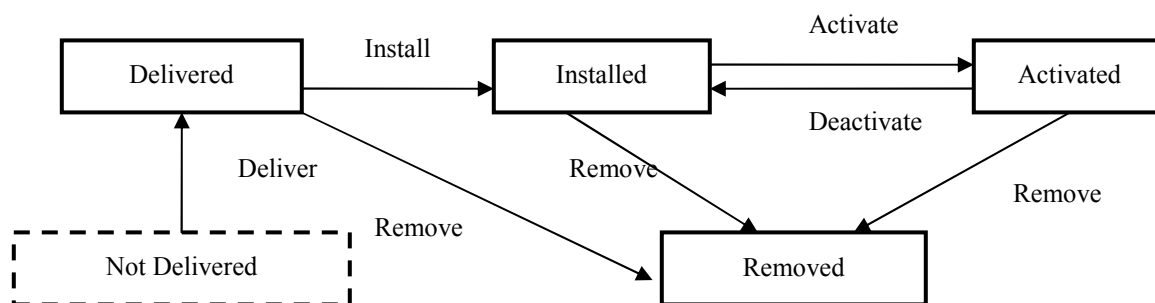
Figure 2: LFC Package Life-Cycle

The LFC 1.0 Enabler handles LFC Packages through a life-cycle.

- **LFC Package Delivered** – This is the state where an LFC Package is transferred to an LFC-enabled device.

- **LFC Package Installed** – This state is where the LFC Package is installed on the LFC-enabled device. Any needed validation or authentication of the data would be performed during this stage.

- **LFC Package Activated** – This state is where the Look and Feel specified in an installed LFC Package are rendered on the LFC-enabled device. Only one LFC Package in the device MUST be activated at one time.

- **LFC Package Removed** – This state is where an installed LFC Package is deleted and is no longer available for use. An attempt to remove an active LFC Package implies that it would be Deactivated and none of the LFC Elements would retain the values defined in the Package. This is an optional state in LFC 1.0 Enabler.

5.2.2   LFC Package Operations

Under Lightweight Model, the LFC Client receives the LFC Operation requests from the user, and then executes the corresponding LFC Operations.

Under Remote Management Model, the LFC Client receives the LFC Operation requests from the LFC Management Server, and then executes the corresponding LFC Operations. In the requests, the LFC Management Server MUST specify the targeted LFC Package by the identifier of the LFC Package, i.e., PkgID.

5.2.2.1   Mandatory Operations

Both the Lightweight Model and Remote Management Model MUST support all the following operations.

- Package Deliver–This operation delivers the LFC Package to the LFC Client.

- Package Install–This operation installs the LFC Package to the LFC Client.

- Package Activate–This operation renders the Look and Feel specified in an installed LFC Package on the LFC-enabled device. Package Activate may be done in the background or involve the user.

- **Package Deactivate** – This operation deactivates an activated an LFC Package on the LFC-enabled device. Package Deactivate may be done in the background or involve the user.

5.2.2.2   Optional Operations

Both the Lightweight Model and Remote Management Model MAY support the all following operations.

- Package Remove - This is an operation by which an installed or activated LFC Package is permanently removed from the device. When an activated LFC Package is removed, the Look and Feel of the device is rendered based on the default LFC Package.

Only the Remote Management Model MAY support the all following operations.

- **Package Lock** – This is an operation which prohibits Removal of the Installed LFC Package. The LFC Package must not be Removed without Manage Server firstly Unlocking it.

- **Package** Unlock – This is the reversal of the Lock operation and releases the Installed LFC Package permitting it to be Removed

- **Package Query** – This is an operation by which an LFC Management Server can get information about the LFC Packages available on the device. This includes Installed, Activated and Default LFC Packages.

- **Package Inventory** – This is an operation by which an LFC Management Server can get a listing of all installed LFC Packages available on the device.

- **Package Mark Default** – This is an operation by which an LFC Management Server can mark an installed LFC Package as the default LFC Package on the device.

5.3   Lightweight Model

5.3.1   Delivery of LFC Package

The LFC Content Server delivers LFC Package to the Delivery Client by existing transport mechanisms, such as DLOTA (see [OMA-DLOTA-TS]), HTTP, FTP, etc.

Also, the LFC Package can be delivered from Secure Removable Card to the Delivery Client by existing transport mechanisms, such as OMA-SCWS (see [OMA-SCWS-TS]), HTTP, FTP, etc.

After receiving the LFC Package from the LFC Content Server or SRC, the Delivery Client forwards the received LFC Package to the LFC Client. The interaction between LFC Client and Delivery Client is the internal process of the device, and it is out of scope of this specification.

5.3.2   Installation of LFC Package

After receiving the LFC Package from the Delivery Client, the LFC Client installs the LFC Package.

If the LFC Package is delivered by DLOTA from the LFC Content Server, the LFC Client can install the LFC Package according to the installation request from the Delivery Client.

If the LFC Package is delivered by other mechanisms, the LFC Client can install the LFC Package according to the installation request from User Agent.

5.3.3   Activation, Deactivation and Removal of LFC Package

For the installed LFC Package, it can be activated or removed by the LFC Client according to the corresponding request from the user through the User Agent.

For the activated LFC Package, it can be deactivated or removed by the LFC Client according to the corresponding request from the user through the User Agent.

5.3.4   User Interaction

During the LFC Package delivery and installation, the user authorization is needed. The LFC Client sends the user authorization request to the User Agent, and according to the user's authorization result, the User Agent returns back the corresponding user authorization response to the LFC Client.

For the installed LFC Package, the user can activate or remove it through the User Agent.

For the activated LFC Package, the user can deactivate or remove it through the User Agent.

5.4   Remote Management Model

5.4.1   Delivery of LFC Package

The LFC Package delivery mechanisms described in Lightweight Model (see section 5.2.1) are also applied to Remote Management Model. In addition to that, the LFC Package can also be delivered from the LFC Management Server to LFC Client by using OMA SCOMO 1.0 enabler (see [OMA-SCOMO-TS]) or LFCMO.

5.4.2   Installation of LFC Package

The LFC Package installation mechanisms described in Lightweight Model (see section 5.2.2) are also applied to Remote Management Model. In addition to that, the LFC Package can also be installed by using OMA SCOMO 1.0 enabler (see [OMA-SCOMO-TS]) or LFCMO.

5.4.3   Other Operations of LFC Package

For the activation, deactivation and removal operations of the LFC Package, the mechanisms described in Lightweight Model (see section 5.2.2) are also applied to Remote Management Model. For the Remote Management, the table below shows the operations supported by LFCMO and OMA SCOMO 1.0:

	LFCMO	SCOMO
Activation	Y	Y
Deactivation	Y	Y
Remove	Y	Y
Inventory	Y	Y
Lock	Y	N
Unlock	Y	N
Mark default	Y	N
Query of the active package	Y	N
Query of the default package	Y	N

The utilization of SCOMO or LFCMO will be left to the implementation choice.

5.4.4　Look and Feel Customization Management Object

The OMA Look and Feel Customization Management Object is used to represent and manage LFC Packages for the LFC Client on a managed device.

The LFC MO is compatible with OMA DM protocol [DMPRO] version 1.2 or any later compatible version.

5.4.4.1   Figure of the Management Object   (Informative)
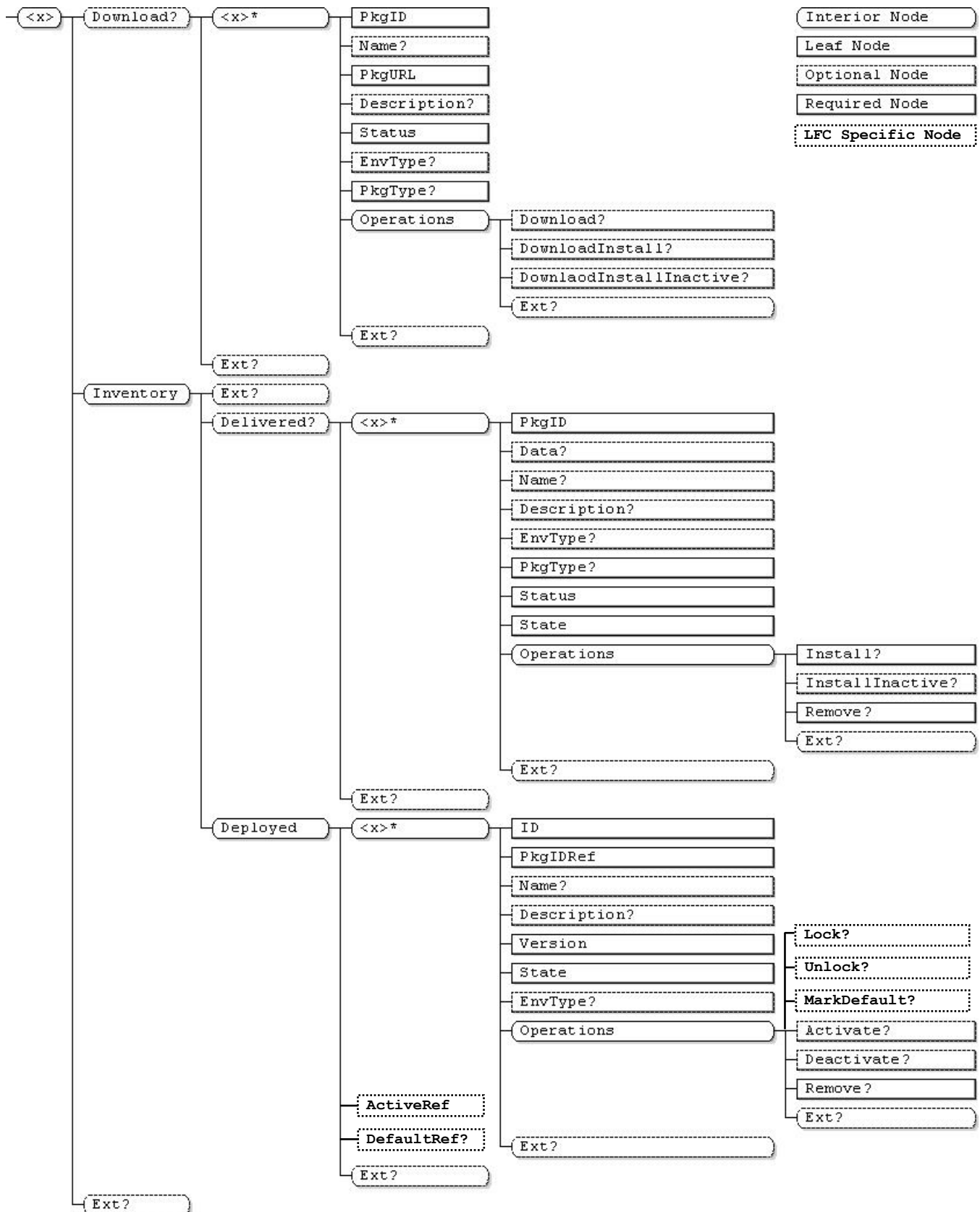
Figure 3: Look and Feel Customization Management Object

5.4.4.2   Look and Feel Management Object Parameters

The Look and Feel Customization Management Object is compatible with the OMA SCOMO [OMA-SCOMO-TS] Version 1.0, and makes some extensions and restrictions based on OMA SCOMO V1.0.

The LFCMO extends some LFC specific nodes based on SCOMO V1.0. The LFC specific nodes are extended from the Ext nodes in SCOMO V1.0.

The LFCMO makes the extensions and restrictions to the following parameters:

<x>

Status	Tree Occurrence	Format	Min. Access Types
Required	One	node	Get

This interior node groups together the parameters of a Look and Feel Customization Management Object.

The type of this node MUST be the Look and Feel Customization Management Object ID "urn:oma:mo:oma-lfcmo:1.0".

Inventory/Deployed/<X>/State

Status	Tree Occurrence	Format	Min. Access Types
Required	One	int	Get

This leaf node specifies the State of a LFC Package in the Device. The value of this node is one of the following:

Integer Value	**State**	**Description**
10	Locked	The LFC Package is locked.
20	Unlocked	The LFC Package is unlocked.

Note that for all the LFC Packages on the device, there will be only one default LFC Package, and there will be only one active LFC Package. The active LFC Package can be queried from the Inventory/Deployed/ActiveRef node, and the default LFC Package can be queried from the Inventory/Deployed/DefaultRef node.

Inventory/Deployed/<X>/Operations/Lock

Status	Tree Occurrence	Format	Min. Access Types
Optional	ZeroOrOne	null	Exec

This node is used with Exec command to start the Lock operation; to lock the installed LFC Package from removal and lock the active LFC Package from deactivation.

It is assumed that the device implementation ensures that only the same server can unlock the previously locked LFC Package.

Inventory/Deployed/<X>/Operations/Activate

Status	Tree Occurrence	Format	Min. Access Types
Mandatory	One	null	Exec

This node is used with Exec command to start the Activate operation; to activate the installed LFC Package. In LFCMO, this node is Mandatory.

Inventory/Deployed/<X>/Operations/Deactivate

Status	Tree Occurrence	Format	Min. Access Types
Mandatory	One	null	Exec

This node is used with Exec command to start the Deactivate operation; to deactivate the active LFC Package. In LFC, this node is Mandatory.

Inventory/Deployed/<X>/Operations/Unlock

Status	Tree Occurrence	Format	Min. Access Types
Optional	ZeroOrOne	null	Exec

This node is used with Exec command to start the Unlock operation; to unlock the locked LFC Package.

Inventory/Deployed/<X>/Operations/MarkDefault

Status	Tree Occurrence	Format	Min. Access Types
Optional	ZeroOrOne	null	Exec

This node is used with Exec command to mark the LFC Package as the default package.

Inventory/Deployed/DefaultRef

Status	Tree Occurrence	Format	Min. Access Types
Optional	ZeroOrOne	Chr	Get

This node is used to indicate the PkgID for the default LFC Package.

Inventory/Deployed/ActiveRef

Status	Tree Occurrence	Format	Min. Access Types
Mandatory	One	Chr	Get

This node is used to indicate the PkgID for the active LFC Package.

For all the other parameters, the descriptions in [OMA-SCOMO-TS] are applied to LFCMO with the following clarifications:

- The Delivery Package in SCOMO is delivered LFC Package in LFC;
- The Deployment Component in SCOMO is installed LFC Package in LFC.

5.4.5 Behaviour Associated with the Management Object

The behaviour associated with the Management Object defined in [OMA-SCOMO-TS] is applied to LFCMO. This section describes the clarifications specific to LFCMO.

5.4.5.1 Alert Types for LFCMO

The following alert type MUST be used in a Generic Alert [DMPRO] message originating from a Look and Feel Customization Management Object. The alert type is used to identify the operation that was performed on the Device.

● org.openmobilealliance.dm.lookandfeel.OperationComplete

5.4.5.2 LFCMO Result Codes

The result codes defined in [OMA-SCOMO-TS] are applied to LFCMO with the following additional result codes:

Result Code	Result Message	Informative Description of Status Code Usage
1450	Lock failed	The LFC Package Lock operation failed
1451	Unlock failed	The LFC Package Unlock operation failed
1452	Mark default failed	The LFC Package Mark default operation failed

Note that for the informative description of the result codes, the Software Component should be replaced by LFC Package.

5.4.5.3 Requesting User Confirmation

The LFC Management Server MAY request user confirmation before performing LFC Operations within the Device. However it is important to ensure that the LFC Client supports the ability to handle the user confirmation request.

In particular the LFC Client:

• SHOULD support DISPLAY Alert as described in [DMPRO].

• SHOULD support CONFIRM OR REJECT Alert as described in [DMPRO].

• SHOULD support USER INPUT Alert as described in [DMPRO].

• SHOULD support USER CHOICE Alert as described in [DMPRO].

The LFC Management Server SHOULD support all these Alerts.

5.4.6 SCOMO Use in LFC Remote Management Model

This section describes how to use SCOMO for the Remote Management operations of LFC Packages in LFC Remote Management Model.

5.4.6.1 SCOMO Introduction

The Software Component Management Object (SCOMO) enables remote Software Component management within a Device. Management operations defined in SCOMO for the purpose of Software Component management on the Device support delivery, download, installation, removal, activation & de-activation. In addition, retrieval of inventory of Software Components on the Device is also supported.

A Software Component is a resource utilized by the Device software platform. Examples of Software Components can be executables, applications, libraries, UI-elements, certificates, licenses etc. An LFC Package is one example of Software Component.

5.4.6.2   Rationale of SCOMO Use

There are overlaps between SCOMO operations and LFCMO operations, and to avoid duplicate implementation, reuse SCOMO in LFC can avoid repeated work to design Management Object (MO).

If SCOMO is already deployed on the device, the reuse of SCOMO will reduce the development effort.

5.4.6.3   SCOMO Use Approach

(1) Operations

For LFC Remote Management Model, SCOMO is used for the following operations:

> ➢ Delivery: Use DM delivery mechanism to deliver an LFC Package

> ➢ Download: Use alternative download mechanism to download an LFC package

> ➢ Install: Install an LFC package

> ➢ Activate: Activate an installed LFC Package

> ➢ Deactivate: Deactivate an active LFC Package

> ➢ Remove: Remove an installed LFC Package

> ➢ Inventory: Query the inventory information of the installed LFC Package

> ➢ Combined Operations: DownloadInstall, DownloadInstallInactive, InstallInactive an LFC Package

(2) LFC Package Mapping in SCOMO

SCOMO is used in LFC Remote Management Model to download and install LFC Packages.

In LFC, an LFC Package delivered to the Device corresponds to the Delivery Package in SCOMO. An LFC Package installed on the Device and its meta-data correspond to the Deployment Component in SCOMO. One delivered LFC Package contains one installed LFC Package. The delivered LFC Package and the corresponding installed LFC Package share the same Package Identifier.

(3) LFCMO Tree

LFCMO is based on SCOMO and makes some extensions according to its specific usage. If LFCMO is to be deployed, SCOMO MUST be deployed on the Device.

For the not delivered LFC Package, it will be reflected by not having any subtree for the LFC Package, or having it in the Download branch.

For the delivered LFC Package, it will be reflected in the Delivered branch.

For the installed LFC Package, it will be reflected in the Deployed branch.

(4) Mapping State Machine to SCOMO

For LFC Package, it has five states:

   a)   Not Delivered state

This is a logical state, reflected by not having any subtree for the package, or having it in the Download branch.

   b)   Delivered state

 This is a logical state, reflected in the State node in the Delivered branch.

   c)   Installed state

This is a logical state, reflected in the Deployed branch.

For the installed LFC Package, independently, it can be set as default/non-default LFC Package, or locked/unlocked LFC Package.

On the Device, there can be only one default LFC Package. The default LFC Package is indicated by Inventory/Deployed/DefaultRef node.

On the Device, there can be multiple locked or unlocked LFC Packages. The locked/unlocked LFC Package is indicated by Inventory/Deployed/State node. Only the installed LFC Packages can be locked.

    d)   Activated state

This is a logical state, reflected in the Deployed branch.

On the Device, there can be only one active LFC Package. The active LFC Package is indicated by Inventory/Deployed/ActiveRef node.

For the active LFC Package, independently, it can be set as default/non-default LFC Package, or locked/unlocked LFC Package.

On the Device, there can be only one default LFC Package. The default LFC Package is indicated by Inventory/Deployed/DefaultRef node.

On the Device, there can be multiple locked or unlocked LFC Packages. The locked/unlocked LFC Package is indicated by Inventory/Deployed/State node.

If the active LFC Package is removed from the Device, the default LFC Package will become the active LFC Package.

    e)   Removed state

This is a logical state, reflected by deleting the <x> subtree representing the LFC Package from the Download, Delivered and/or Deployed branch.

If the default LFC package is removed from the Device, the device should mark another package as default, e.g., the current active package or the previous default package, depending on the implementation.

For a locked LFC package, it cannot be removed from the Deployed branch.

For an unlocked LFC Package, it can be removed. When the Device removes a delivered LFC Package, the <x> subtree representing the LFC Package on the Download branch is removed. When the Device removes an installed or activated LFC Package which is unlocked, the <x> subtree representing the LFC Package on the Download, Delivered, and Deployed branches should be removed.

5.5   SRC-1 interface

If Smart Card Web Server [OMA-SCWS-TS] is used over SRC-1, terminal SHALL access to following URL to retrieve LFC package:

http://127.0.0.1:3516/LFC/index.html	When BIP transport protocol is used
https://127.0.0.1:4116/LFC/index.html	When BIP transport protocol is used
http://<smart card IP address>/LFC/index.html	When TCP/IP transport protocol is used
https:// <smart card IP address>/LFC/index.html	When TCP/IP transport protocol is used

Where <smart card IP address> is the IP address that is given to the smartcard.

6. Security Considerations

Security for delivery and management of LFC Packages is of paramount importance.

For the Lightweight Model, the security MUST be ensured by the adopted delivery and install mechanisms. During the LFC Package delivery and installation, the LFC Client SHOULD send the user authorization request and get the user authorization result through the User Agent.

For the Remote Management Model, it is envisioned that authentication mechanisms supported by OMA DM protocol [DMPRO] will be used to ensure that authenticated entities can deliver/perform management operations on LFC Packages on the Device. Similarly, authorization for management operations on LFC Packages under the purview of this enabler will be based on the ACL mechanisms defined by OMA DM TND [DMTND].

The LFC enabler does not mandate nor restrict any mechanism to guarantee authenticity, confidentiality and integrity of LFC Packages delivered to the Device. It is envisioned that existing security mechanisms for this purpose such as Digital Signatures, SSL [SSL3.0], TLS [TLS1.0], etc. can easily work in conjunction with LFCMO.

7. Look and Feel Customization Usage

This section describes some common flows for the purpose of Look and Feel Customization.

7.1   Lightweight Model

This section describes some common flows for the purpose of Look and Feel Customization in Lightweight Model.

7.1.1   Delivery of LFC Packages

This section describes the steps to deliver the LFC Package to the Device using alternate download mechanisms such as [DLOTA].

Step 1: User Agent asks the LFC Client to download LFC Package from the LFC Content Server.

Step 2: LFC Client sends download request to Delivery Client.

Step 3: Delivery Client downloads the metadata of the requested LFC Package from source location.

Step 4: Delivery Client sends user authorization request to the LFC Client and forwards the metadata of the LFC Package.

Step 5: LFC Client evaluates metadata received from the Delivery Client to verify against the device capability.

Step 6: LFC Client forwards user authorization request to User Agent.

Step 7: User Agent sends user authorization result to LFC Client.

Step 8: LFC Client forwards authorization result to Delivery Client.

Step 9: Delivery Client downloads the LFC Package and makes it available to LFC Client.

Note that in the above steps, steps 2 ~ 8 are optional and can be omitted.

7.1.2   Installation of LFC Packages

This section describes the steps to install the LFC Package to the Device.

7.1.2.1   Delivery Client Initiated Installation

If the LFC Package is delivered by using DLOTA, the LFC Package installation process can be initiated by the Delivery Client.

Step 1: Delivery Client asks the LFC Client to install the delivered LFC Package.

Step 2: LFC Client sends user authorization request to User Agent.

Step 3: User Agent sends user authorization result to LFC Client.

Step 4: LFC Client installs the LFC Package on the Device.

7.1.2.2   User Agent Initiated Installation

After the LFC Package is delivered to the Device, the LFC Package installation process can be initiated by the User Agent.

Step 1: User Agent asks the LFC Client to install the delivered LFC Package.

Step 2: LFC Client installs the LFC Package on the Device.

7.1.3   Activation/Deactivation of LFC Packages

After the LFC Package is installed on the Device, the LFC Package activation/deactivation process can be initiated by the User Agent.

Step 1: User Agent asks the LFC Client to activate/deactivate the installed LFC Package.

Step 2: LFC Client activates/deactivates the LFC Package on the Device.

7.1.4   Removal of LFC Packages

After the LFC Package is installed on the Device, the LFC Package removal process can be initiated by the User Agent.

Step 1: User Agent asks the LFC Client to remove the installed LFC Package.

Step 2: LFC Client removes the LFC Package from the Device.

7.2   Remote Management Model

This section describes some common flows for the purpose of Look and Feel Customization in Remote Management Model.

7.2.1   Delivery of LFC Packages

LFCMO allows a LFC Package to be delivered either via OMA DM delivery mechanism or using an alternate download mechanism such as [DLOTA].

7.2.1.1   OMA DM Delivery

OMA DM delivery is achieved by the LFC Management Server sending a Replace command containing the actual LFC Package data to the /Inventory/Delivered/<X>/Data node. The DM Large Object mechanism MAY be used.

7.2.1.2   Alternate Download

Step 1: LFC Management Server sets the appropriate values in Download/<X>/ sub-tree.

Step 2: LFC Management Server performs an Exec on one of the nodes under Download/<X>/Operations.

Step 3: The Device returns an appropriate Generic Alert indicating status of the requested operation.

7.2.2   Installation of LFC Packages

Step 1: The LFC Management Server performs an Exec on one of the supported installation nodes such as Inventory/Delivered/<X>/Operations/Install or Inventory/Delivered/<X>/Operations/InstallInactive

Step 2: The LFC Package installation process is initiated on the Device and upon completion an appropriate status is returned to the LFC Management Server using a Generic Alert.

7.2.3   Activation of LFC Packages

Step 1: The LFC Management Server performs an Exec on Inventory/Deployed /<X>/Operations/Activate node.

Step 2: The LFC Package activation process is initiated on the Device and upon completion an appropriate status is returned to the LFC Management Server using a Generic Alert.

Step 3: The Device sets the value of the Inventory/Deployed/ActiveRef node as the identifier of the active LFC Package.

7.2.4   De-activation of LFC Packages

Step 1: The LFC Management Server performs an Exec on Inventory/Deployed /<X>/Operations/Deactivate node.

Step 2: The LFC Package deactivation process is initiated on the Device and upon completion an appropriate status is returned to the LFC Management Server using a Generic Alert.

Step 3: The Device sets the value of the Inventory/Deployed/ActiveRef node as the identifier of the new active LFC Package. The default LFC Package will become the new active LFC Package or based on the implementation choice.

7.2.5 Lock/Unlock of LFC Packages

Step 1: The LFC Management Server performs an Exec on Inventory/Deployed /<X>/Operations/Lock or Inventory/Deployed /<X>/Operations/Unlock depending on whether locking or unlocking is desired.

Step 2: The LFC Package locking or unlocking process is initiated on the Device and upon completion an appropriate status is returned to the LFC Management Server using a Generic Alert.

Step 3: The Device sets the value of the Inventory/Deployed/<X>/State node as the Lock/Unlock state depending on whether locking or unlocking is executed.

7.2.6 Marking Default of LFC Packages

Step 1: The LFC Management Server performs an Exec on Inventory/Deployed /<X>/Operations/MarkDefault.

Step 2: The LFC Package marking default process is initiated on the Device and upon completion an appropriate status is returned to the LFC Management Server using a Generic Alert.

Step 3: The Device sets the value of the Inventory/Deployed/DefaultRef node as the identifier of the default LFC Package.

7.2.7 Removal of LFC Packages

Step 1: The LFC Management Server performs an Exec on Inventory/Deployed /<X>/Operations/Remove or Inventory/Delivered /<X>/Operations/Remove.

Step 2: The LFC Package removal process is initiated on the Device and upon completion an appropriate status is returned to the LFC Management Server using a Generic Alert.

Step 3: If the active LFC Package is removed from the device, the default LFC Package will become the new active LFC Package or based on the implementation choice.

7.2.8 Retrieving Inventory of LFC Packages

Step 1: The LFC Management Server performs a GET on the Inventory node (or the Inventory/Delivered or Inventory/Deployed nodes directly) to find out what LFC Packages are delivered or installed on the Device.

Step 2: The Device returns the LFC Package inventory information to the LFC Management Server.

7.2.9 Querying Default LFC Package or Active LFC Package

Step 1: The LFC Management Server performs a GET on the Inventory node Inventory/Deployed /DefaultRef or Inventory/Deployed/ActiveRef to find out what LFC Package is the default LFC Package or the active LFC Package on the Device.

Step 2: The Device returns the default LFC Package or the active LFC Package to the LFC Management Server.

Appendix A. Change History (Informative)

A.1 Approved Version History

Reference	Date	Description
n/a	n/a	No prior version –or- No previous version within OMA

A.2 Draft/Candidate Version 1.0 History

Document Identifier	Date	Sections	Description
Draft Versions OMA-TS-LFC-V1_0	07 Mar 2008	All	Initial TS baseline
	21 Apr 2008	All	OMA-LFC-2008-0025-CR_TS_Skeleton
	3 Jul 2008	5.1	OMA-LFC-2008-0061-CR_LFC_Operation_Instruction_Description
	17 Jul 2008	5.1, 5.3.5	OMA-LFC-2008-0064R01-CR_SCOMO_use OMA-LFC-2008-0056R03-CR_LFC_Package_Description
	27 Oct 2008	5.4	OMA-LFC-2008-0075R01-CR_Smart_Card_Web_Server
	25 Dec 2008	2, 3, 4, 5.2, 5.3, 5.5	OMA-LFC-2008-0080R02-CR_Introduction OMA-LFC-2008-0081R02-CR_Lightweight_Model OMA-LFC-2008-0082R01-CR_Package_Delivery_Installation_in_RM OMA-LFC-2008-0083R01-CR_LFCMO OMA-LFC-2008-0088R01-CR_LFC_Package_Remote_Management_Concept
	17 Feb 2009	all	OMA-LFC-2009-0001-CR_Introduction_Update OMA-LFC-2009-0002-CR_LFC_Package OMA-LFC-2009-0003R01-CR_Lightweight_Model OMA-LFC-2009-0004R01-CR_Remote_Management_Model OMA-LFC-2009-0005R01-CR_Section_Reordering OMA-LFC-2009-0006R03-CR_LFCMO OMA-LFC-2009-0007R01-CR_SCOMO_Use
	26 Mar 2009	all	OMA-LFC-2009-0008R04-CR_LFC_Usage OMA-LFC-2009-0009-CR_Security_Considerations OMA-LFC-2009-0012R01-CR_SCR_Table
	24 Apr 2009	all	OMA-LFC-2009-0013R04-CR_Package_Metadata OMA-LFC-2009-0024R01-CR_Package_Operations

	29 Apr 2009	All	Editorial fixes:
			  References sorted
			  Styles
			  Contents table
			  History table

Candidate Version: OMA-TS-LFC-V1_0	26 Jun 2009	All	Status changed to Candidate by TP: OMA-TP-2009-0269-INP_LFC_V1_0_ERP_for_Candidate_Approval

Appendix B.   Static Conformance Requirements   (Normative)

The notation used in this appendix is specified in [SCRRULES].

B.1   SCR for LFCMO Tree Structure

Item	Function	Reference	Requirement
LFC-T-001-M	Use of appropriate Management Object identifier for the LFCMO node	Section 5.4.4	
LFC-T-002-M	Support for SCOMO tree structure	Section 5.4.4	
LFC-T-003-M	Support for <x>/Inventory/Deployed/ActiveRef node	Section5.4.4	
LFC-T-004-O	Support for <x>/Inventory/Deployed/DefaultRef node	Section 5.4.4	
LFC-T-005-O	Support for <x>/Inventory/Deployed/<x>/Operations/Lock node	Section 5.4.4	
LFC-T-006-O	Support for <x>/Inventory/Deployed/<x>/Operations/Unlock node	Section 5.4.4	
LFC-T-007-O	Support for <x>/Inventory/Deployed/<x>/Operations/MarkDefault node	Section 5.4.4	
LFC-T-008-M	Support for <x>/Inventory/Deployed/<x>/Operations/Activate node	Section 5.4.4	
LFC-T-009-M	Support for <x>/Inventory/Deployed/<x>/Operations/Deactivate node	Section 5.4.4	

B.2   SCR for LFC Client

Item	Function	Reference	Requirement
LFC-C-001-M	Support for Lightweight Model	Section 5.3	LFC-C-003-M and LFC-C-004-M and LFC-C-005-M and LFC-C-006-M and LFC-C-007-O and LFC-C-008-M
LFC-C-002-O	Support for Remote Management Model	Section 5.4	LFC-C-003-M and LFC-C-004-M and LFC-C-005-M and LFC-C-006-M and LFC-C-007-O and LFC-C-008-M and LFC-C-009-M and LFC-C-010-O and LFC-C-011-O and LFC-C-012-O and LFC-C-013-O and LFC-C-014-M and LFC-C-015-O and LFC-C-016-M
LFC-C-003-M	Support for delivery of LFC Package	Section 5.2	
LFC-C-004-M	Support for installation of LFC Package	Section 5.2	
LFC-C-005-M	Support for activation of LFC Package	Section 5.2	
LFC-C-006-M	Support for deactivation of LFC Package	Section 5.2	
LFC-C-007-O	Support for removal of LFC Package	Section 5.2	
LFC-C-008-M	Support for user interaction and user confirmation	Section 5.2	
LFC-C-009-M	Support for using SCOMO functionalities	Section5.4.6	
LFC-C-010-O	Support for locking of Installed LFC Package	Section5.4	
LFC-C-011-O	Support for unlocking of Installed LFC Package	Section5.4	

Item	Function	Reference	Requirement
LFC-C-012-O	Support for marking default of Installed LFC Package	Section 5.4	
LFC-C-013-O	Support for inventory of LFC Packages	Section 5.4	
LFC-C-014-M	Support for query of active LFC Package	Section 5.4	
LFC-C-015-O	Support for query of default LFC Package	Section 5.4	
LFC-C-016-M	Support for mapping package metadata to LFCMO	Section 5.1	

B.3   SCR for LFC Management Server

Item	Function	Reference	Requirement
LFC-MS-001-M	Support for LFCMO	Section 5.4	
LFC-MS-002-O	Support triggering of DISPLAY Alert	Section 5.4.5	
LFC-MS-003-O	Support triggering of CONFIRM OR REJECT Alert	Section 5.4.5	
LFC-MS-004-O	Support triggering of USER INPUT Alert	Section 5.4.5	
LFC-MS-005-O	Support triggering of USER CHOICE Alert	Section 5.4.5	

B.4   SCR for LFC Content Server

Item	Function	Reference	Requirement
LFC-CS-001-M	Support for delivery of LFC Package	Section 5.3	