Content Management Interface Architecture

Candidate Version 1.0 – 01 December 2009

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1. Scope   (Informative)

This Architecture Document (AD) defines the architectural elements of the Content Management Interface (CMI) enabler. The CMI enabler provides mechanisms for the management of content by Content Providers and Service Providers.

This AD describes the CMI architecture in terms of its:

- functional components and the interfaces they provide

- reuse of existing technologies, including partial or full use of other OMA enablers

- security-related aspects

The CMI enabler addresses only the interfaces that can be used by entities for content management purposes. It does not cover the use of these interfaces in services built upon other OMA enablers, or any non-CMI functions provided by Service Providers and Content Providers.

2. References

2.1 Normative References

[CMI-RD]   "Content Management Interface Requirements", Open Mobile Alliance™, OMA-RD-CMI-V1_0,
                                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

2.2 Informative References

[CMR]   "Customized Multimedia Enabler Release Definition", Version 1.0, Open Mobile Alliance™, OMA-
                                ERELD-CMR-V1_0, URL:http://www.openmobilealliance.org/

[MobAd]   "Mobile Advertising Enabler Release Definition", Version 1.0, Open Mobile Alliance™, OMA-ERELD-
                                MobAd-V1_0, URL:http://www.openmobilealliance.org/

[OMADICT]   "Dictionary for OMA Specifications", Version x.y, Open Mobile Alliance™,
                                OMA-ORG-Dictionary-Vx_y, 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

Content Provider   See [CMI-RD]

For other definitions not listed here see [OMADICT]

3.3 Abbreviations

BCAST	Broadcast
BPC	Business Process Component
CMC	Content Management Component
CMI	Content Management Interface
CMR	Customized Multimedia Ringing
CMS	Content Management System(s)
CP	Content Provider
DCD	Dynamic Content Delivery
HTTPS	Hypertext Transfer Protocol Secure
OMA	Open Mobile Alliance
SLA	Service Level Agreement
SP	Service Provider
SSL	Secure Sockets Layer
VPN	Virtual Private Network

4. Introduction   (Informative)

The CMI architecture supports the content management needs of Service Providers (e.g. Network Operators, Web Portal Service Providers, or other Value-Added Service Providers) and Content Providers, as they deliver content-related services, e.g. Operator-provided services such as Customized Multimedia Ringing [CMR], Mobile Advertisement [MobAd], etc. Use of the term "services" in this document refers to such services offered by Service Providers and Content Providers.

These services require multiple interactions between the systems operated by the Service Provider and the Content Provider, for the overall purpose referred to in CMI as *content management*. While "content management" in specific contexts can refer to a broad set of functionality, e.g. management of work flows related to creation, storage, and publication of digital media and electronic text, content management in the context of OMA CMI means specifically:

- Coordinated actions across an interface between two entities, described as the Content Provider (source of the content) and Service Provider (provider of services within which the content is made available)

- Across that interface, actions related to specific content items and their use in services such as:
    - Upload content, primarily from the Content Provider to the Service Provider. This is also known as content ingestion.
    - Manage the uploaded content, e.g. remove or change its attributes, etc.
    - Purchasing actions: Purchase content, including selection of purchase terms, e.gpurchased content expiration, etc.
    - Statistics and report information: Content usage information, etc.

The CMI enabler supports the deployment of services that depend upon such interactions via a standardized set of functions and interfaces, improving service deployment flexibility, interoperability, cost, and time-to-market. This will further enable consistent deployment of services using a varierty of models for supplying content, including "on-deck" and "off-deck" as described in [CMI-RD].

Most common usages of the term content management (as in CMS) in the data services marketplace relate to the notion of content delivery suites / platforms that include functions like:

a) Aggregation and / or ingestion of of content via a portal

b) Management of content (approval, categorization, recommendations / campaigns), portal/catalogs of contents, logic to present (including sampling), sell (possibly recommended) content, content adaptation and delivery, content charging and revenue sharing

Many such mobile portal / content delivery suites have been deployed by Operators or are sold as product by vendors. CMI is positioned to be a key interface in support of these platforms / suites in a standardized manner. However CMI is focused on content ingestion and management, and not content delivery to users, e.g. as is supported by other OMA enablers such as CMR, DCD, Push, BCAST, etc. When CMI is utllized by these enablers it is expected to be exposed by the server-side components.

Within such CMS-type platforms, CMI enables entities to fulfill the specific roles of managing the uploading (also called publication) of content by a Content Provider to a Service Provider, the definition of content items' relation to specific services, execution of operations related to content access by specific users, and collection of content-use statistics which may be used for revenue sharing purposes.

CMI can enhance or be used in the fulfilment of additional roles of a CMS, e.g. content aggregation, categorization, catalog management, etc. In these cases the use of the CMI functionality is per the design of the specific service using the CMI capabilities, and not an explicit function of CMI itself. For example in services supporting content aggregation, CMI could be used for the ingestion of the content to be aggregated, but does not directly support other aggregation actions e.g. content re-packaging.

4.1   Version 1.0

Version 1.0 of the CMI enabler architecture addresses all of the functional requirements marked for 1.0 in [CMI-RD].

The realization of other features that are mentioned in this AD (such as realization of CMI-2 interface or upload of CMI Component to CMI interface-using entity) are left for future versions.

5. Architectural Model

5.1 Dependencies

CMI has no dependencies upon other enablers.

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5.2 CMI Architectural Diagram

The following architecture diagram presents the main components and interfaces in CMI:
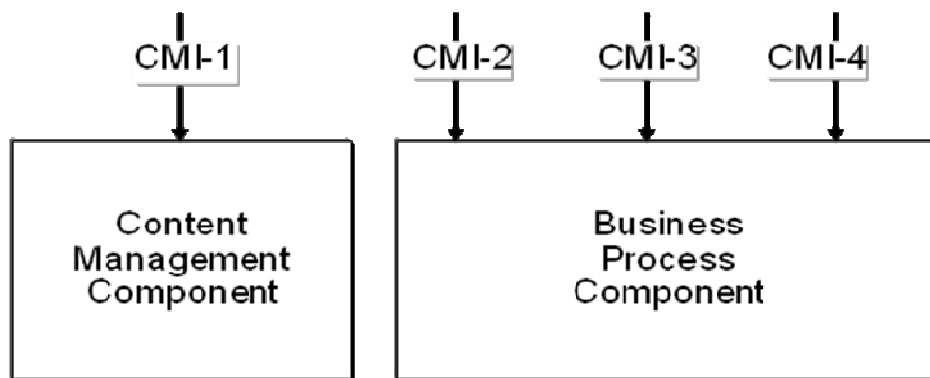
Figure 1: CMI Architectural Diagram

5.3 Functional Components and Interfaces

5.3.1 CMI Interfaces

5.3.1.1 CMI-1 - Content Management interface

CMI-1 interface is exposed by the Content Management Component (CMC) to support upload and management of content and its associated metadata. Metadata in the CMI context is any information about the content (e.g. who created the content, what category it belongs to, etc.).

Note: delivery of content to the end user is out of the scope of CMI.

Supported functionalities include:

- Upload content and associated metadata.

Manage content and metadata via actions such as:

- Delete content, modify metadata.

This interface allows the Content Provider to upload the content using HTTP or a combination of FTP and HTTP. For example, FTP could be used to upload the content to the CMC then HTTP could be used to request the CMC to process the uploaded information. Note that the CMI-1 interface may also be exposed by the Content Provider, to enable other entities, e.g. a Service Provider, other Content Provider, or user, to upload content.

The CMI-1 interface provides a basic set of operations for managing content items, and define content metadata of a general nature. To ensure extensibility of the CMI enabler for support of the requirements of specific services, CMI-1 interface operations support additional parameters and content metadata related to specific services.

5.3.1.2   CMI-2 – Service Management Interface

CMI-2 interface is exposed by the Business Process Component (BPC) and provides establishment and management of operations in suppot of specific services.

Supported functionalities include:

- Content Provider registration with the Service Provider, for basic access to the Service Provider via the CMI interface. Content Provider registration establishes a relationship between the Content Provider and the Service Provider. After registration, the Content Provider can interact with the Service Provider via the CMI enabler, using the various capabilities that associate the Content Provider to specific services and content management actions. The registration operations defined in CMI-2 may be supplemented by manual processes as necessary to fully establish a business relationship, according to Service Provider policies. Thus registration can operate as a request with immediate response, or a request which is responded to at some later time (e.g. after some Service Provider internal processing, e.g. Content Provider credentials validation). The end result of registration is the establishment of CMI enabler access for the Content Provider, including assignment of Content Provider identification/credentials usable in further CMI interface operations, e.g. an account or identity value.

- Service activation, including authorization of the Content Provider's ability to upload content and if needed relate it to specific services. Service activation establishes a Content Provider as the source of content for a specific CMI-enabled service offered by the Service Provider. After service activation, the Content Provider can manage content and use other CMI enabler functions in relation to the specific service. Like registration, CMI-2 operations may be supplemented by manual processes as necessary to fully establish a specific service activation, according to Service Provider policies. Thus service activation may operate as a request with immediate response, or a request which is responded to at some later time (e.g. after some Service Provider internal processing, e.g. establishment of billing arrangements for the specific service, or configuration of the service for support of the Content Provider). The end result of activation is the established ability of the Content Provider to manage content via CMI in relation to a specific service offered by the Service Provider.

- Definition of CMI enabler policies, e.g. number of upload operations allowed per day via the CMI-1 interface, related to access to the CMI enabler or specific services; note that support of specific policies by a Service Provider is not mandated, but CMI supports the ability of the Service Provider to communicate unsupported policies to the Content Provider

- Service discovery and/or notifications of available features related to CMI content,via which the CMI-2 requester (Content Provider) can obtain important information related to services e.g.

    o Association of services (e.g. by assigned identifier and description) to specific content types and/or other content characteristics (e.g. media codecs) that are supported for the service; this can aid Content Providers to match their content offerings to services provided by a Service Provider

- Identification of content types available for purchase through the Service Provider

The CMI-2 interface provides a basic set of operations for managing the relationship of Content Providers to the CMI capabilities offered by a Service Provider.

To ensure extensibility of the CMI enabler for support of the requirements of specific services, CMI-2 interface operations support inclusion of additional parameters related to specific services.

5.3.1.3   CMI-3 – User Access Control Interface

CMI-3 interface is exposed by the Business Process Component and provides user access control functionalities. Some of these capabilities are related to a specific content item or a collection of content items for a particular user.

- Exchange information to facilitate purchase of content by specific user(s).

    o Authorizing a principal to access content (activate/deactivate/extend the time period of authorization to access the content)

The CMI-3 interface provides a basic set of operations for managing the relationship of specific users to specific content items related to specific services.

To ensure extensibility of the CMI enabler for support of the requirements of specific services, CMI-3 interface operations support inclusion of additional parameters related to specific services.

5.3.1.4   CMI-4 - Service Metrics Interface

CMI-4 interface is exposed by the CMI Component and provides the following functionalities:

- Delivery of content usage reports, including any metrics about CMI, e.g. interaction time

The CMI-4 interface provides a basic set of operations for managing the delivery of service metrics to the Content Provider, via request/response or subscribe/notify models. To ensure extensibility of the CMI enabler for support of the requirements of specific services, CMI-4 interface operations support inclusion of additional parameters and service metrics related to specific services.

5.3.2 CMI Functional Components

The CMI enabler includes 2 functional components, the CMC and the BPC.

The CMC exposes one interface, CMI-1 - Content Management interface.

It provides the following high level functional capabilities to a CMI interface-using entity:

- New content and associated metadata upload

- Processing of uploaded content and metadata. Processing can include validation of content.

- Update of previously uploaded content and associated metadata

- Removal of content and associated metadata

- Management of content status, e.g. availability for use in services

- Management of content items individually or in bulk (multiple content items).

- Content upload from CMI Component to CMI interface-using entity, e.g. for user-generated content (this functionality is deferred for future version).

The BPC exposes three interfaces, the Service Management Interface (CMI-2), the User Access Control Interface (CMI-3) and the Service Metrics Interface (CMI-4).

It provides the following high level functional capabilities to the CMI interface-using entity:

- SLA establishment via the CMI-2 interface as described in section 5.3.1.2, or via out of band mechanisms;

- CMI enabler policy enforcement, e.g. CMI interface security requirements, limitations on CMI interface operation rates;

- Service discovery and/or notifications of available features related to CMI content via the CMI-2 interface;

- Content item purchase operations via the CMI-3 interface;

- Delivery of reports related to content, e.g. purchase, usage, upload, either on-demand (synchronous) or on a triggered/scheduled basis (asynchronous) via the CMI-4 interface;

5.4   Security Considerations

CMI interfaces are expected to be provided over secure connections, e.g. as secured by SSL (e.g. HTTPS) or VPN (e.g. over an IPSEC tunnel or other secure virtual private networking protocol), to ensure that the interface operations are only visible to the Content Provider or Service Provider.

CMI allows the Service Provider's deployment to delegate the specific security features below:

- mutual authentication of the CMI interface requestor and CMI interface provider

- non-repudiation, e.g. ability to obtain a operation confirmation where necessary, to ensure a verifiable record of the operation

- ability to ensure or validate content integrity after transfer

- ability to ensure confidentiality of all operations across the CMI interfaces

Although the consumption model for content accessed through services is outside CMI's scope, CMI provides the ability to associate consumption operations (e.g. content purchase/access requests) with specific users. This association may be used by the Service Provider and/or Content Provider for various other security purposes, e.g. user confirmation for operations.

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-AD-CMI-V1_0	17 Dec 2008	All	Initial baseline.
	10 Feb 2009	5.2, 5.3, C	Based on the follwing approved INPs: OMA-CD-CMI-2009-0001R01-INP_CMI_architecture_diagram OMA-CD-CMI-2009-0002R01-INP_CMI_architecture_informative_diagram OMA-CD-CMI-2009-0004R01-INP_CMI_Interfaces
	02 Mar 2009	5.3.2	Based on the following approved CR: OMA-CD-CMI-2009-0006R01-CR_CMI_Functional_Components
	19 Mar 2009	5.3.1, 5.3.2	Based on the following approved CRs: OMA-CD-CMI-2009-0014R01-CR_Update_CMI_arch OMA-CD-CMI-2009-0016R01-CR_Mar_11_Call_Changes_to_0009R01
	10 Apr 2009		Based on the following approved CRs: OMA-CD-CMI-2009-0018-CR_AD_Edits OMA-CD-CMI-2009-0021-CR_Security_Considerations
	23 Apr 2009	B, 5.1, 5.3	Based on the following approved CR: OMA-CD-CMI-2009-0024R02-CR_AD_edits_flows_examples
	05 May 2009	5.3.1.2 5.3.2	Updated per comments in informal review: OMA-CD-CMI-2009-0027-MINUTES_05May2009CDCMI_Confcall

	06 May 2009	2
		3
		App B
			Editorial fixes:
			  References and Definitions sorted
			  Cover page
			  History box
			  2009 template
			  Headers in App B
			  Figure header styles

	7 May 2009	2.1	Editorial - removed unused reference
	10 June 2009	All	OMA-CD-CMI-2009-0036R01
	23 June 2009	All	OMA-CD-CMI-2009-0037R01 OMA-CD-CMI-2009-0038R02 OMA-CD-CMI-2009-0040R01
	24 June 2009	5.2, 5.3.* App B	OMA-CD-CMI-2009-0049R01
	12 July 2009	4, 5.3.1, 5.4, B.1, B.2	OMA-CD-CMI-2009-0050R01
	22 July 2009	App C	OMA-CD-CMI-2009-0065R01
	23 July 2009	App C	OMA-CD-CMI-2009-0065R01 (fixed diagram)
	29 July 2009	All	OMA-CD-CMI-2009-0058R01 Editorial: interface names in diagrams
	30 July 2009	Figure 13	OMA-CD-CMI-2009-0065R01 (added missing line)
	5 Aug 2009	5.3.1.1 5.4, App C	OMA-CD-CMI-2009-0073 OMA-CD-CMI-2009-0074 OMA-CD-CMI-2009-0075
	12 Aug 2009	5.3.1.1	OMA-CD-CMI-2009-0082
	17 Aug 2009	All	OMA-CD-CMI-2009-0085R01
	16 Oct 2009	3.3, 4, 5.3.1.2, 5.3.2, B.3.1	Add abbreviations, fixed typos and editorial comments raised in CONR

Document Identifier	Date	Sections	Description
	19 Oct 2009	4 ,4.1, 5.3.1.1, 5.3.2	OMA-CD-CMI-2009-0124R01 OMA-CD-CMI-2009-0129R01
	20 Oct2009		OMA-CD-CMI-2009-0135
Candidate Versions OMA-AD-CMI-V1_0	01 Dec 2009	All	Status changed by TP: TP ref# OMA-TP-2009-0527- INP_CMI_V1_0_ERP_for_Candidate_Approval

Appendix B.   Flows (Informative)

Note: The following flows and message examples are intended to be illustrative only. In particular:

- They do not show all parameters, or are necessarily complete/correct in every parameter.

- They are not meant to reflect any specific deployment scenario

- They are informative, and are not meant to represent normative requirements, either explicitly or implicitly. The normative requirements if any are addressed in the technical specifications.

B.1   Content Provider Registration

Content Provider registration establishes a relationship between the Content Provider and the Service Provider. As described in section 5.3.1.2, registration may be a partially or wholly manual process, which uses CMI-2 messages per the policies of the Service Provider.
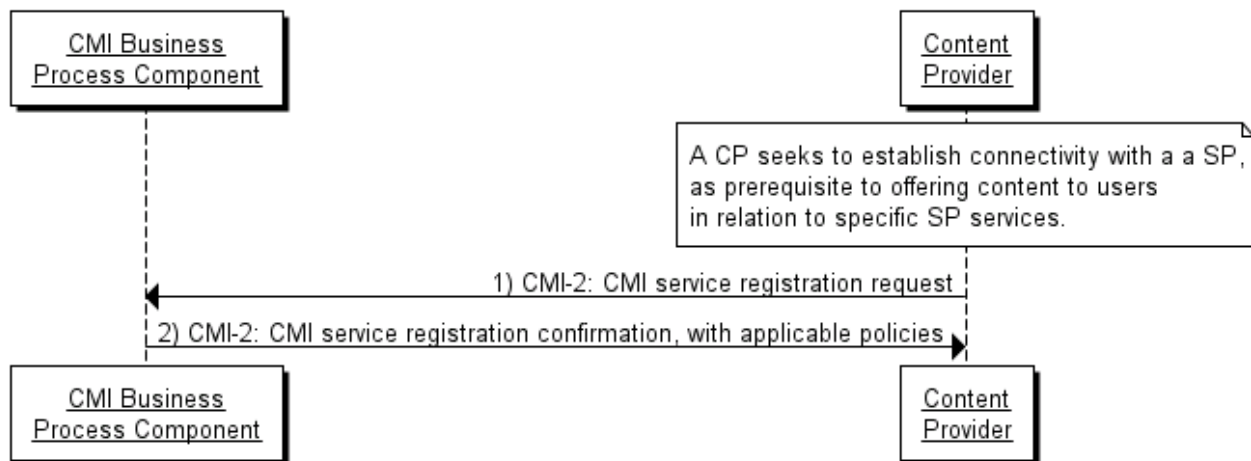

Figure 2 Content Provider Registration

1. CP requests registration for access to the CMI capabilities of an SP. The request contains basic information for establishing a relationship between the CP and SP, including selections for CMI service options as offered by the SP.
2. CMI-BPC confirms establishment of registration, with registration attributes and basic policy properties applicable to the CP.

B.2   Content Management Service Activation

Service activation establishes a Content Provider as the source of content for a CMI-enabled service offered by the Service Provider. As described in section 5.3.1.2, service activation may be a partially or wholly manual process, which uses CMI-2 messages per the policies of the Service Provider.
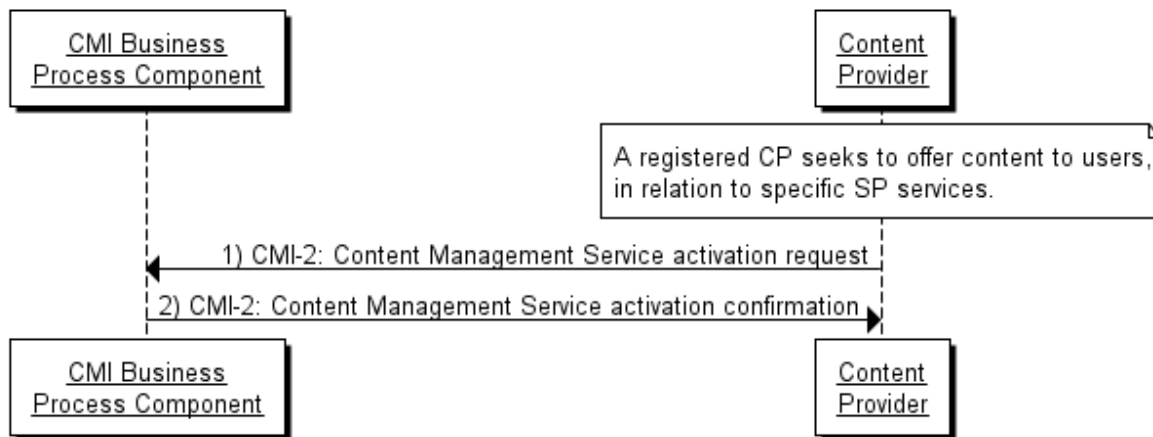
Figure 3 Content Management Service Activation

1. CP requests activation of a specific content management service. The request identifies the service for which content will be managed, and selections for service options related to the specific service.
2. CMI-BPC confirms establishment of the content management service, with service attributes enabling association of further CMI operations to the specific service, and policy properties applicable to the CP for the specific service.

B.3   Content Upload by Content Provider

Content upload is one of the core functions of the CMI enabler, via which the Content Provider can upload content for use in the context of one or more services offered by the Service Provider. Various options may be used in content upload, e.g. association of the content with metadata, upload in bulk (i.e. more than one content item), and upload confirmation by the Service Provider.

Content upload via the CMI enabler is considered complete when the upload operation completes. If required, upload confirmation may be provided in an immediate response to the content upload request, or be provided as a notification later.
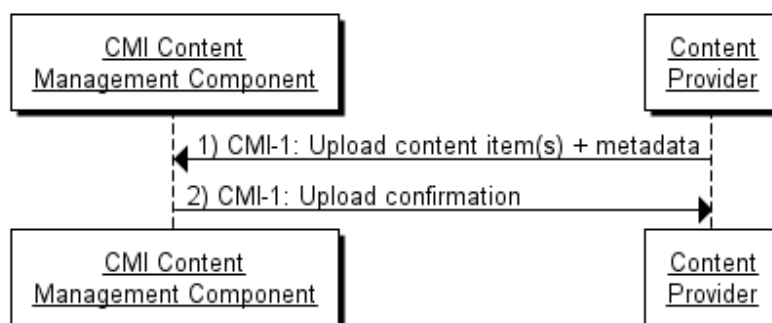

Figure 4 Content Upload by Content Provider

1. CP uploads one or more content items and related metadata to CMI-CMC.
2. CMI-CMC acknowledges reception of the content.

B.3.1   User-Generated Content Upload example 1

This example shows the use of the Content Provider-initiated content upload capability to upload user-generated content to the Service Provider.
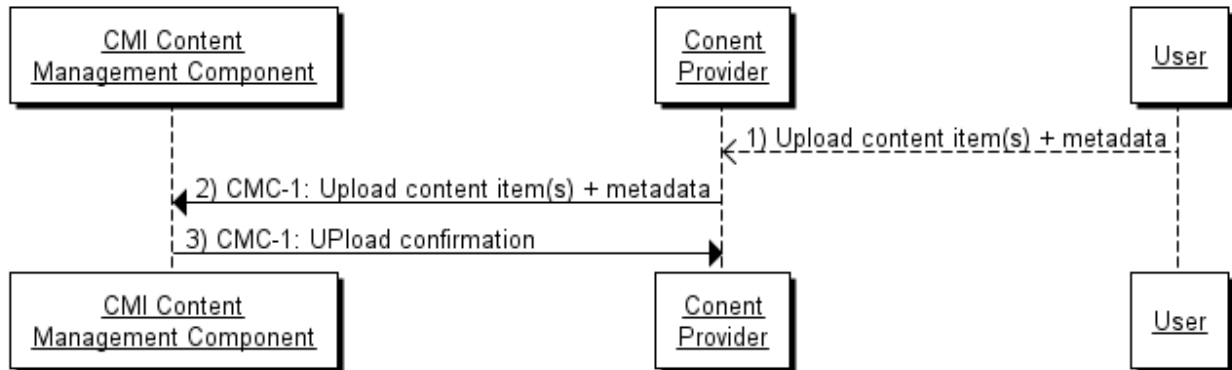

Figure 5 User-Generated Content Delivery example 1

1. User uploads one or more content items and related metadata to CP, via the CMI-1 interface or via an interface out of CMI scope. Note in this case the CP is exposing a CMI-1 interface for the purpose of enabling content upload by users, and this step occurs prior to any content management actions over CMI interfaces between the CP and CMC.
2. CP uploads the user-generated content items and related metadata to CMC. Note the content may remain at the Content Provider, and be referenced for retrieval by the CMI component when needed. Note this subsequent retrieval is outside the scope of the CMI enabler.
3. CMI-CMC acknowledges reception of the content.

B.4   Content Metadata Update

Content metadata update enables the Content Provider to manage the attributes of content items, e.g. status, tags (e.g. search filter strings), lifetime.
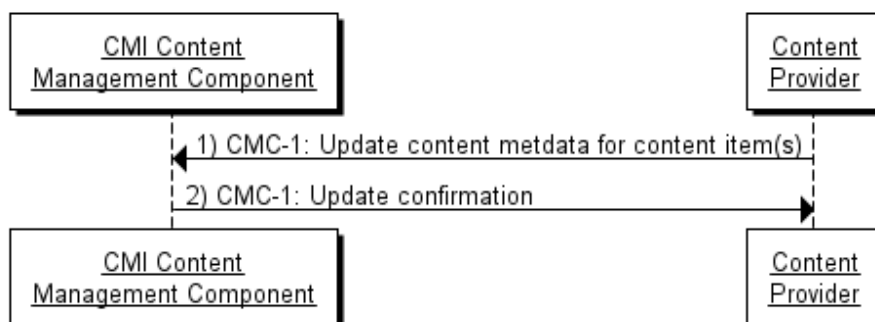

Figure 6 Content Metadata Update

1. CP requests update of content metadata (add/delete/modify) for one or more content items, e.g. to categorize, approve, activate, de-activate the content.

2. CMI-CMC acknowledges update of the content metadata.

B.5 Content Management Service Discovery Request

Service discovery enables the Content Provider to learn about new Service Provider services for which the Content Provider may be able to offer content, or changes to existing services. This flow shows an on-demand service discovery operation, which is initiated by the Content Provider as needed. The Service Provider response can contain various information related to the current services offered by the Service Provider, which are visible to the Content Provider. For example, the information could identify, for specific services, the status of the service, types of content that can be managed via CMI, the types of service metrics and reporting arrangements supported, and other service metadata aiding the Content Provider in effective use of the CMI enabler for the specific service.Based upon the service discovery information, the Content Provider can activate content delivery for a specific service, or take necessary actions based upon changes to services already activated (e.g. for terminated services, no longer deliver content for the service).
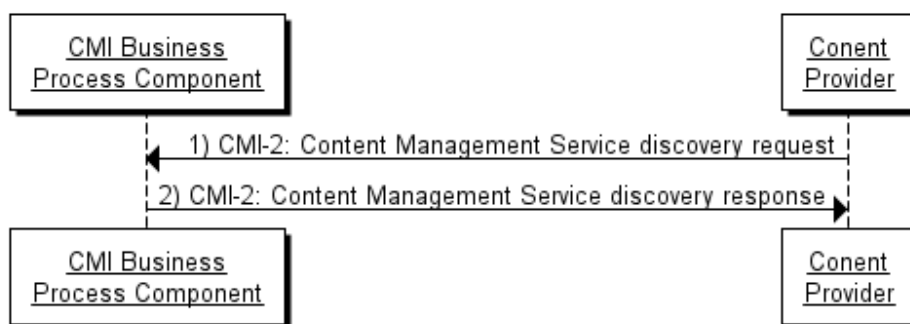

Figure 7 Content Management Service Discovery Request

1. CP requests information about content management services available though the CMI enabler from this Service Provider.
2. CMI-BPC provides the content management service information as requested, which may be limited per the policy applicable to the CP.

B.6 Content Management Service Discovery Notification

Service discovery notification enables the Content Provider to obtain service discovery information without polling the Service Provider for updates. The notification can contain the same types of information as described for the "Content Management Service Discovery Request" , i.e. service metadata related to services for which content can be managed via CMI. For example, a Content Provider could be informed when a new content type is supported for a service, or a service's status has changed.

Figure 8 Content Management Service Discovery Notification

1. CMI-BPC delivers a notificaton about available or active content management services to registered CP.

B.7   Content Purchase Request

This flow shows the purchase of a content item by a user, e.g. for use in a Service Provider service or download to the user's device. In this example the CP is acting as a storefront for the user, and requesting, on behalf of the user, that a content item (which has already been uploaded to the CMI Component) be authorized for use/delivery in whatever means applies to the related service. The purchase confirmation may be provided immediately, or sometime later (e.g. after credit check or confirmation with the user of the charges for purchasing the content). The operation may also be used to authorize access to a content item under an existing purchase agreement.

Figure 9 Content Purchase Request

1. CP requests purchase of a content item on behalf of a user.
2. CMI-BPC acknowledges purchase of the item.

B.8   Content Purchase Notification

This flow shows the case in which a content item has been purchased by a user through the Service Provider, and the Content Provider is notified of the event.
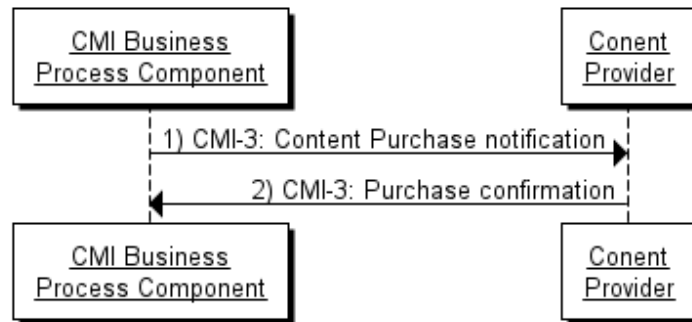
Figure 10 Content Item Access Notification

1. CMI-BPC notifies CP of the purchase of a content item.
2. CP acknowledges the notification.

B.9   Service Metrics Report Notification

This flow shows the delivery of a service metrics report under a subscribe/notify model, as prior arranged, e.g. during "Content Management Service Activation".
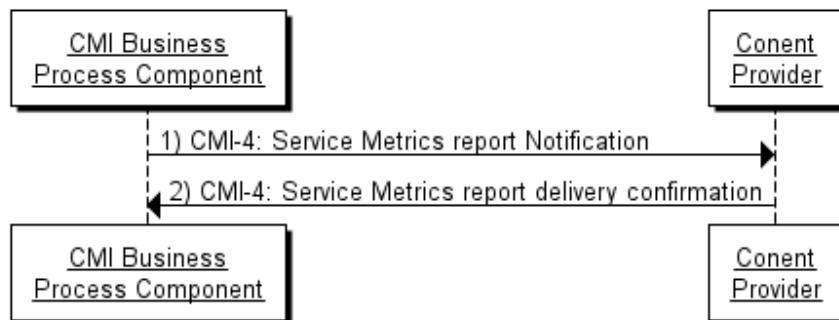

Figure 11 Service Metrics Report Notification

1. CMI-BPC reports service metrics related to one or more services and/or content items.
2. CP acknowledges delivery of the service metrics.

B.10 Service Metrics Report Request

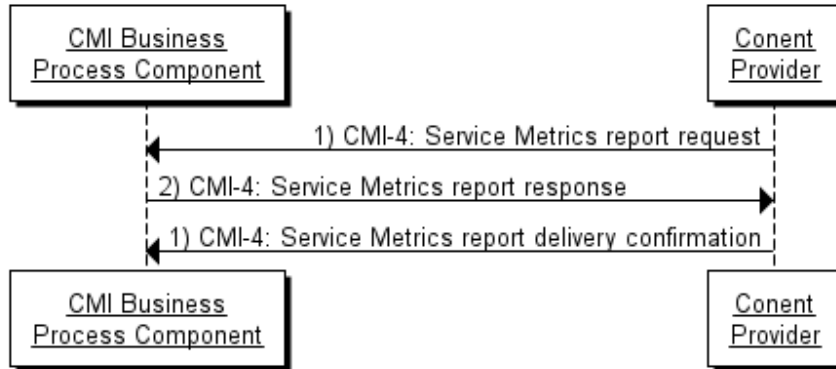This flow shows an on-demand service metrics report.

Figure 12 Service Metrics Report Request

1. CP requests delivery of service metrics related to one or more services and/or content items.
2. CMI-BPC provides the requested report.
3. CP acknowledges delivery of the service metrics.

Appendix C.   CMI Deployment Example (Informative)

The following diagram presents an illustrative example of CMI in the deployment context of a specific service. The diagram demonstrates how the Service Provider exposes the CMI interfaces to the Content Provider

Within the Service Provider domain there are specific service(s) or system(s) which may interact with CMI components, however such service(s) or system(s) and interfaces used for interaction with CMI components are out of scope of CMI. An example of specific service could be Customized Multimedia Ringing.

End users purchase and/or access the content via the Service Provider domain and/or via the Content Provider domain, however the interfaces used for these interactions are also out of scope of CMI.
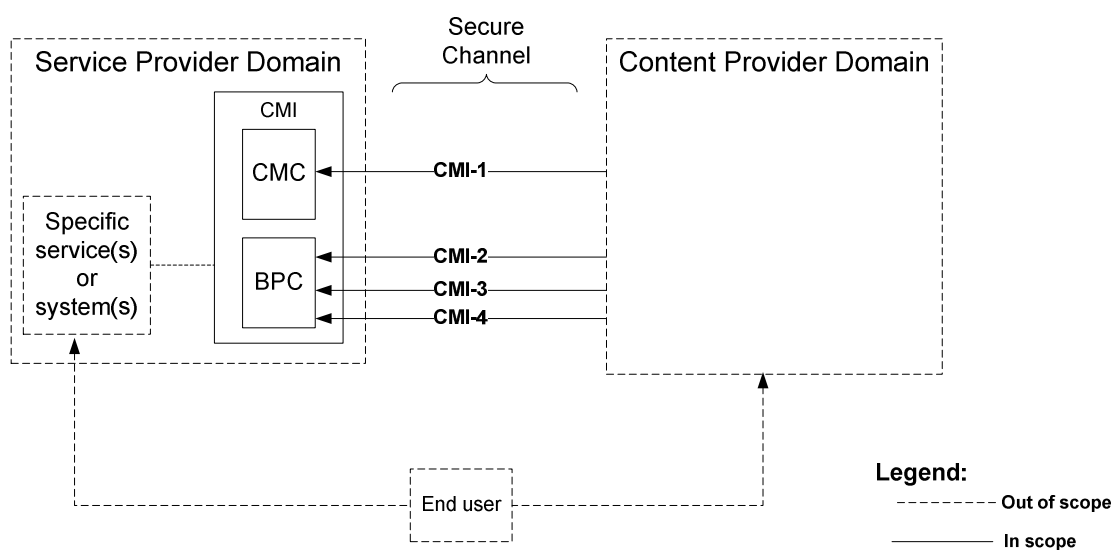
Figure 13 - Example of CMI deployment context