



OMA Offline Charging Interface

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1. Scope

The charging architecture document [CHRG_AD] describes two different interfaces between the Charging Enabler User and the Charging Enabler: Offline charging interface (CH-1) and online charging interface (CH-2).

The scope of this document is to provide the technical specification of the CH-1 interface.

This document defines:

- The offline charging models, the logical messages, and messages types on the CH-1 interface.
- The OMA Charging Data Elements used in the logical messages with their descriptions.
- The flow of information exchanged between the Charging Enabler User and the Charging Enabler through time in different scenarios.
- Bindings of OMA CH-1 logical messages to a specific protocol (e.g. Diameter protocol) and its protocol messages.

2. References

2.1 Normative References

- [CHRG_AD] “Charging Architecture”, Open Mobile Alliance™. OMA-AD-Charging-V1_1, URL: <http://www.openmobilealliance.org/>
- [CHRG_DDS] “Charging Data”, Open Mobile Alliance™. OMA-DDS-Charging_Data-V1_0, URL: <http://www.openmobilealliance.org/>
- [CHRG_ONLINE] “OMA Online Charging Interface”, Open Mobile Alliance™. OMA-TS-Charging_Online-V1_1, URL: <http://www.openmobilealliance.org/>
- [IOPPROC] “OMA Interoperability Policy and Process”, Version 1.3, Open Mobile Alliance™, OMA-ORG-IOP_Process-V1_3-20050712, URL: <http://www.openmobilealliance.org/>
- [PSA RRP] “Parlay Service Access”, Version 1.0, Open Mobile Alliance™, OMA-RRP-PSA-V1_0, URL: <http://www.openmobilealliance.org/>
- [REST_TS_Payment] “RESTful bindings for Parlay X Web Services – Payment”, Version 1.0, Open Mobile Alliance™, OMA-TS-ParlayREST_Payment-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>
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- [RFC4005] “Diameter Network Access Server Application”, P. Calhoun, G. Zorn, D. Spence, D. Mitton. August 2005, URL: <http://www.ietf.org/rfc/rfc4005.txt>
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- [TS29.140] “Multimedia Messaging Service (MMS); MM10 Interface based on Diameter Protocol”, 3GPP TS29.140, URL: <http://www.3gpp.org>
- [TS29.199-6] “Open Service Access (OSA); Parlay X Web Services; Part 6: Payment”, 3GPP TS29.199-6, URL: <http://www.3gpp.org>
- [TS29.214] “Policy and Charging Control over Rx Reference Point”, 3GPP TS29.214, URL: <http://www.3gpp.org>
- [TS32.299] “Telecommunication management; Charging management; Diameter Charging Applications”, 3GPP TS32.299, URL: <http://www.3gpp.org>

2.2 Informative References

- [OMA-DICT] “Dictionary for OMA Specifications”, Open Mobile Alliance™, OMA-Dictionary, 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

For the purposes of this document, the definitions given in [OMA-DICT] apply if they are not stated below.

CH-1	Offline Charging Interface
CH-2	Online Charging Interface
Charging Correlation	See [OMA-DICT]
Charging Data Element	See [OMA-DICT]
Charging Enabler	A set of functions that enable other OMA enablers, applications, or other resources to charge service users.
Charging Enabler User	A Charging Enabler User invokes and interacts with the Charging Enabler
Charging Event	See [OMA-DICT]
Charging Request	The charging information carried from the Charging Enabler User to the Charging Enabler in one interaction, typically mapped on to a protocol message or a part of it.
Correlation	See Charging Correlation.
Resource	Any component, enabler, function or application that can send, receive, and process requests.

3.3 Abbreviations

3GPP	3 rd Generation Partnership Project
ACA	Accounting Answer
ACR	Accounting Request
API	Application Programming Interface
AVP	Attribute Value Pair
CHRG	Charging
DDS	Data Definition Specification
OMA	Open Mobile Alliance
RFC	Request for Comments
SCR	Static Conformance Requirements
SI	Service Information
TS	Technical Specification

4. Introduction

Offline charging is a process where charging information for resource usage is generated concurrently with usage of that resource. The charging information generated for offline charging does not have a real time effect on the service rendered nor does it affect service control.

The charging information is passed through a combination of logical charging functions that comprise the OMA Charging Enabler.

As a result of this process, charging information MAY be generated and transferred to a billing service provider e.g. for the purpose of subscriber billing, statistics etc and/or inter-operator settlement. A billing domain typically comprises post-processing systems such as the operator's billing system or billing mediation device.

The combination of the logical charging functions can be implemented by one or more physical entities.

5. Messages on CH-1

The offline charging interface supports two charging models, an Event-based charging model and a session-based charging model. In the Event-based charging model, the Charging Enabler User reports each service usage to the Charging Enabler with a single Charging Request. In the Session-based charging model, the Charging Enabler User sends several Charging Requests related to the same service usage to the Charging Enabler.

The messages in the offline charging interface are either requests or responses. Depending on the charging model, a request message reports either a one-time event (Event-based model), or a step in a series of events that correspond to a session (Session-based model). These result in four different types of request messages: EventRequest for the Event-based model, and StartRequest, InterimRequest, and StopRequest for the Session-based model (Figure 1). The type of the offline charging request is indicated by the value in OMA Charging Data Element “Request Type”.

Each request message is acknowledged by a response message, in which the value for the OMA Charging Data Element “Request Type” SHALL be the same as in the corresponding request message. The outcome of the request is indicated with a result code that SHALL be included in the corresponding response. The resulting hierarchy of messages on the CH-1 interface is illustrated in Figure 1 below.

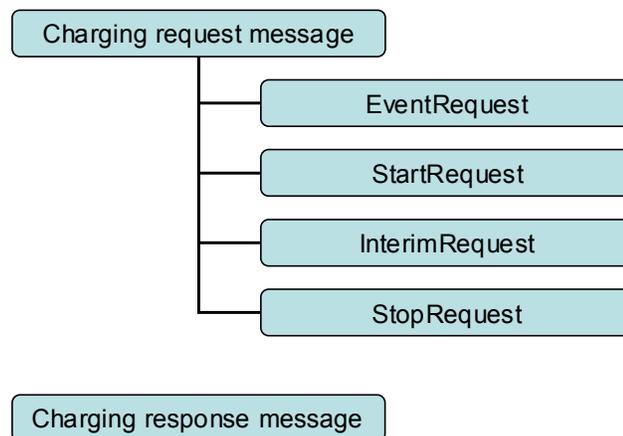


Figure 1: Messages

The request and response messages and their respective data elements are further described in Chapter 6.

The two offline charging models are described in more detail in Chapter 7. One set of flows describes the Event-based charging model, and another set describes the Session-based charging model.

6. Message Descriptions

6.1 Charging Request Message

The following table describes the data elements for the charging request message. Different request messages MAY carry different specific values in certain data elements. These specific values are described for each request type in clauses 6.1.1-5.

The “Category” column indicates whether the element is mandatory or optional.

The “Level” column allows the reader to clearly identify the hierarchy of data elements. Let’s take the example of a data element “A” (level n) followed by data elements “B” and “C” (both being on level n+1). This means that element A comprises of element B and element C.

Level	OMA Charging Data Element	Category	Description
1	Request Type	Mandatory	This data element indicates the type of the Charging Request message.
1	Event Timestamp	Optional	This data element records the time at which the reported event occurred.
1	Service Context Id	Mandatory	This data element contains a value to identify the service/enabler specification in the context of which the charging events are interpreted. Data elements such as Service Identifier, Service Specific Units, contain service specific values that are defined within a particular service context identified in this data element.
Information related to OMA service usage			
1	Application Server Id	Optional	This data element can be used to identify the application server providing the service and/or generating the charging information.
1	Application Session Id	Optional	This data element can be used to identify the application-level session to which the charging information relates. Note that the Session Id data element identifies the charging session between a charging enabler user and a charging enabler.
1	Delivery Status	Optional	This data element can be used to carry information related to the success status of service delivery.
1	Subscription Id	Optional	This data element identifies the end user’s subscription
2	Subscription Type	Mandatory	This data element identifies which type of identifier is carried by the subscription-Id e.g.: email, MSISDN, IMSI, SIP URI...
2	Subscription Data	Mandatory	This data element identifies the end user.
1	Correlation Id	Optional	This data element contains information to correlate offline charging requests generated by different service components of the application.
1	Time	Optional	This data element indicates the length of the used time in seconds.

Level	OMA Charging Data Element	Category	Description
1	Money	Optional	This data element specifies the monetary amount in the given currency. The Currency Code data element SHALL be included when this data element is included.
2	Unit Value	Mandatory	This data element describes a value for instance a monetary value. It consists of Value Digits and Exponent.
3	Value Digits	Mandatory	This data element contains the significant digits of a Unit Value without any decimal point.
3	Exponent	Optional	This data element contains the 10-x exponent that SHALL be applied to the Value Digits.
2	Currency Code	Optional	This data element specifies which currency is used in a monetary value described by the Money data element.
1	Input Octets	Optional	This data element contains the number of used octets that can be/have been received from the end user.
1	Output Octets	Optional	This data element contains the number of used octets that can be/have been sent to the end user.
1	Service Specific Units	Optional	This data element specifies the number of service-specific units (e.g., number of events, points) in a selected service. The service specific units always refer to the service identified in the Service Identifier data element
1	Service Identifier	Optional	This data element contains the identifier of a specific service within the given service context, e.g. operation type.
1	Service Key	Optional	This data element can be used to identify the particular service item delivered.
1	User Equipment Info	Optional	This data element indicates the identity and capability of the terminal the end-user is using.
2	User Equipment Info Type	Mandatory	User Equipment Info Type defines the type of user equipment information contained in User Equipment Info Value, e.g. IMEI or MAC.
2	User Equipment Info Value	Mandatory	This data element contains the identity of the user equipment.
1	Message Body	Optional	This grouped data element contains information related to content exchanged in a message.
2	Content Type	Mandatory	This data element identifies the type of content, for example using MIME types.
2	Content Length	Mandatory	This data element identifies the length of content.
2	Content Disposition	Optional	This data element indicates how the message body or a message body part is to be interpreted (e.g. session, render),
2	Originator	Optional	This data element indicates the originating party of the message body.
1	Participant Group	Optional	This grouped data element contains information on a participant to a service-level session.
2	Called Party Address	Optional	This data element identifies an individual participant to a service-level session.
1	Role of Node	Optional	This data element can be used to identify the role of the node generating the charging event in the service event, e.g. sending, receiving, controlling and participating.

Level	OMA Charging Data Element	Category	Description
1	Role of User	Optional	This data element can be used to identify the role of the user which the charging event relates to in the service event, e.g. session owner or participant.
1	Application Service Type	Optional	This data element can be used to differentiate between the different roles of a node within service events, e.g. the sending and receiving roles of participating and controlling functions.
1	Number Of Participants	Optional	This data element can be used to indicate the number of parties involved in the service event, e.g. participating a session.
1	Calling Party Address	Optional	This data element can be used to identify the party initiating the service event, e.g. the sender of a message. The initiating party is usually indicated in the Subscription Id data element in its role as the charged party. However, the charged party may also be some other party while the actual initiating party still needs to be identified.
1	Called Party Address	Optional	This data element can be used to identify the receiving party of a communication or the party that is the target of an operation (other than the initiator).
1	Group Name	Optional	This data element can be used to indicate the identifier of a group related to the event, e.g. a pre-defined distribution group in a messaging service.
1	Application Charging Identifier	Optional	This data element holds an identifier that enables the correlation of various records pertaining to the same session.
1	Inter-Operator Id	Optional	The IOI identifies both originating and terminating networks involved in a session/transaction.
2	Originating IOI	Mandatory	Identifies the originating network.
2	Terminating IOI	Mandatory	Identifies the terminating network.
1	Access Network Information	Optional	This data element can be used to carry information related to the access network used if available.
1	Total Number of Messages Sent	Optional	This data element can be used to indicate the number of individual messages sent by the user. However, the number does not necessarily correspond to the number of message actually delivered.
1	Total Number of Messages Exploded	Optional	This data element can be used to indicate the total number of messages exploded by the IM server.
1	Number of Messages Successfully Sent	Optional	This data element indicates the number of individual messages sent by the user that were successfully delivered to at least one recipient.
1	Number of Messages Successfully Exploded	Optional	This data element can be used to indicate the total number of messages exploded by the IM server that were successfully delivered.
1	SIP Method	Optional	This data element can be used to identify the SIP Method triggering the charging event.
1	Expires	Optional	The Expires data element indicates the relative time after which the SIP message expires.
1	Cause Code	Optional	This data element can be used to indicate the returned SIP status code for the service request.
1	Time Stamps	Optional	This data element can be used to carry timestamps of a service delivery operation.

Level	OMA Charging Data Element	Category	Description
2	SIP Request Timestamp	Optional	This data element can be used to carry a timestamp related to the start of a service delivery operation.
2	SIP Request Timestamp Fraction	Optional	This data element holds the miliseconds fraction in relation to SIP Request Timestamp.
2	SIP Response Timestamp	Optional	This data element can be used to carry a timestamp related to the end of a service delivery operation.
2	SIP Response Timestamp Fraction	Optional	This data element holds the miliseconds fraction in relation to SIP Response Timestamp.
1	Content ID	Optional	This data element will be used as identifier sets by the Content Provider, and unique within the DCD Service Provider's domain.
1	Content provider ID	Optional	This data element will be used as the globally unique identity of the content provider within the DCD Server Domain.

Table 1: Charging Request message

6.1.1 Event-based, and Session-based message descriptions

As implied earlier in Chapter 5, in the Event-based charging model, an EventRequest is generated for a one-time event, i.e. it is not a step in a series of events that correspond to a session. Thus, the Charging Enabler User utilizes EventRequest to report each service usage to the Charging Enabler with a single charging request, independent from any other charging request (see the flow in Section 7.1).

In contrast, in the Session-based charging model, a session consists of several events that are related with each other: StartRequest, InterimRequest and StopRequest are used when the Charging Enabler User is aware that the interaction with the Charging Enabler spans over a period of time, or consists of a predictable series of events. In the Session-based charging model a charging request always consists of one StartRequest, one StopRequest, and zero or more InterimRequests in-between (see the flow in Section 7.2).

6.1.2 EventRequest

The EventRequest is used in the Event-based charging model to describe a single, distinct event.

The message structure for the EventRequest is inherited from the Charging Request message description. For data elements, where specific values exist, these are listed in Table 2 below.

OMA Charging Data Element	Values
Request Type	EVENT_RECORD
Request Number	0

Table 2: EventRequest

6.1.3 StartRequest

The StartRequest message is used in the Session-based charging model to record an event that indicates the start of a charging session. The StartRequest is the first message in a charging session.

The message structure for the StartRequest is inherited from the Charging Request message description. For data elements, where specific values exist, these are listed in Table 3 below.

OMA Charging Data Element	Values
Request Type	START_RECORD
Request Number	0

Table 3: StartRequest

6.1.4 InterimRequest

The InterimRequest is used in the Session-based charging model to record an event that is not the first or last event in a charging session. It MAY be sent on regular intervals or based on other triggers defined for the service. There MAY be multiple interim requests for the same ongoing session.

The message structure for the InterimRequest is inherited from the Charging Request message description. For data elements, where specific values exist, these are listed in Table 4 below.

OMA Charging Data Element	Values
Request Type	INTERIM_RECORD
Request Number	n>0

Table 4: InterimRequest

6.1.5 StopRequest

The StopRequest is used in the Session-based charging model to record an event that indicates the end of an ongoing charging session, i.e. an event that indicates that it is the last event in that charging session.

The message structure for the StopRequest is inherited from the Charging Request message description. For data elements, where specific values exist, these are listed in Table 5 below.

OMA Charging Data Element	Values
Request Type	STOP_RECORD
Request Number	n+1 (n = last InterimRequest)

Table 5: StopRequest

6.2 Charging Response Message

The Charging Response message is the acknowledgement message to one of the Charging Request messages described above. The type of the corresponding Charging Request message is indicated by the value of the OMA Charging Data Element "Request Type".

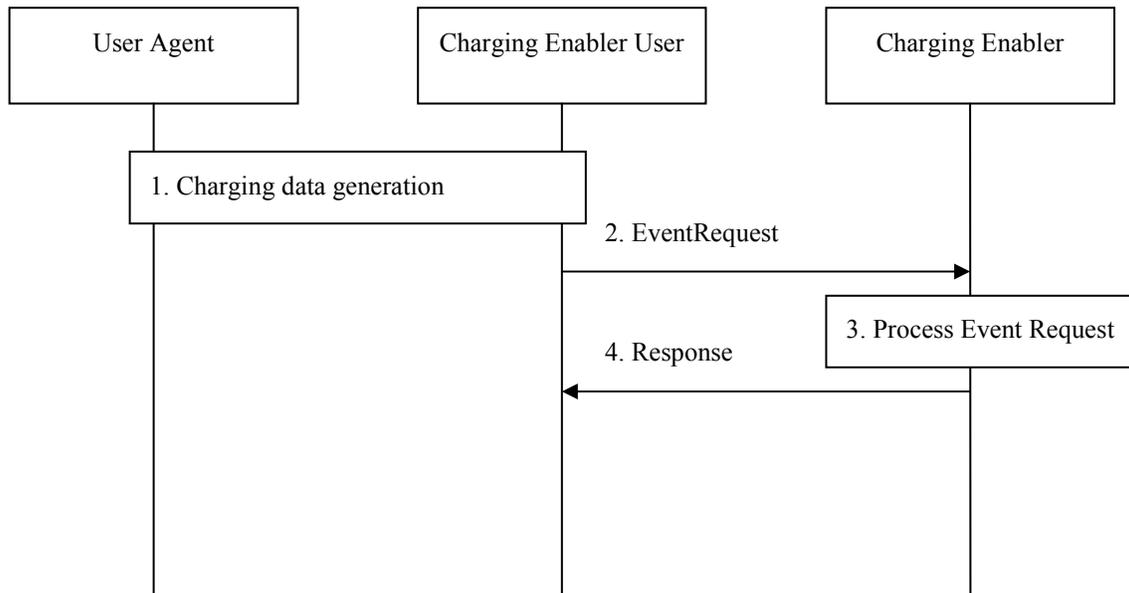
The following table defines the data elements for a Charging Response message.

Level	OMA Charging Data Element	Category	Description
1	Result Code	Mandatory	This data element indicates the result of a particular request.
1	Request Type	Mandatory	This data element indicates the type of the corresponding Charging request message.
1	Event Timestamp	Optional	This data element records the time at which the reported event occurred.

Table 6: Charging Response message

7. Flows

7.1 Event-based Charging Model

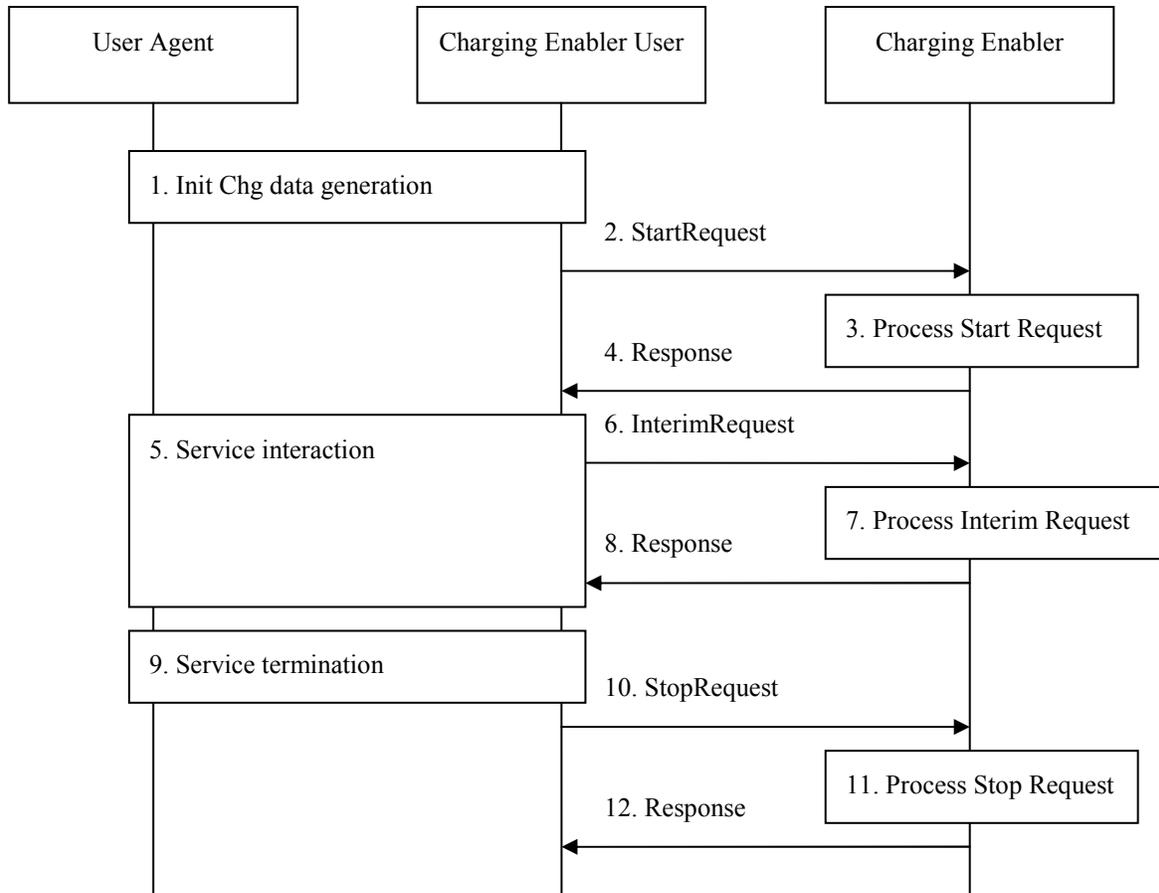


Flow 1: Event-based Offline Charging

The above flow depicts the Event-based charging model and the generation of the EventRequest message and a response to it. Here, each message sent by the Charging Enabler User towards the Charging Enabler is self contained, meaning that it contains enough information for the Charging Enabler to record a charge.

1. “**Charging Data generation**”: The user invokes a service that is supported by the Charging Enabler User, and charging data is generated.
2. “**EventRequest**”: As a result of the service usage, the Charging Enabler User invokes the CH-1 interface and calls the Charging Enabler.
3. “**Process Event Request**”: The Charging Enabler processes, and records the event
4. “**Response**”: The Charging Enabler answers the Charging Enabler User with a generated offline charging response.

7.2 Session-based Charging Model



Flow 2: Session-based Offline Charging

This is a possible flow for Session-based Offline Charging. In addition to the Event-based Offline Charging in Section 7.1, in this flow the Charging Enabler User MAY send a sequence of partial information which is then aggregated by the Charging Enabler into a final charge.

1. “**Init Chg data generation**”: the user invokes a service that is supported by the Charging Enabler User.
2. “**StartRequest**”: The Charging Enabler User invokes CH-1, and sends in the initial StartRequest a request indicating to start a logical session that is associated with the service interaction. The StartRequest charging request message MAY also convey information describing the service and identifying the subscriber.
3. “**Process Start request**”: The Charging Enabler starts the charging session, and records the event.
4. “**Response**”: The Charging Enabler responds with “received and recorded” or with information about failure.
5. “**Service Interaction**”: The subscriber is using the service.
6. “**InterimRequest**”: As the service usage proceeds, the Charging Enabler User sends the charging information it has collected so far using the CH-1 interface due to either intermediate timer expiry or charging condition changes recognized at the Charging Enabler User. The periodicity MAY be conveyed in a data element coming from the Charging Enabler. This message MAY occur zero or more times.

7. “**Process Interim request**”: The Charging Enabler processes and records the event.
8. “**Response**”: The Charging Enabler responds with “received and recorded” or with information about failure.
9. “**Service Termination**”: The subscriber decides to terminate the service.
10. “**StopRequest**”: The Charging Enabler User sends final charging information to the Charging Enabler. This message implies that the session opened by the initial StartRequest SHALL be closed.
11. “**Process Stop request**”: The Charging Enabler records the event and closes the session.
12. “**Response**”: The Charging Enabler responds with “received and recorded” or with information about failure.

8. Bindings of OMA CH-1 Interface to Protocols

This chapter describes the mapping of the OMA Charging Data Elements described in Chapter 6 to the actual protocol(s) utilized on the CH-1 interface.

8.1 Binding to Diameter

8.1.1 Basic Principles

The CH-1 interface is based on the re-use of the basic functionality of Diameter Accounting, as defined by the Diameter Base Protocol in IETF [RFC3588]. Any mandatory element of the RFC SHALL be supported.

The Charging Enabler User maps to the Diameter Client in the sense that it is the entity monitoring the service usage, generating charging data, and sending the charging requests to the Diameter Server. The client SHALL implement the accounting state machine as described in [RFC3588]. The Charging Enabler maps to the Diameter Server in the sense that it is the entity receiving and acknowledging the charging requests, and storing the charging records. The server SHALL implement the accounting state machine "SERVER, STATELESS ACCOUNTING" as specified in [RFC3588], i.e. there is no order in which the server expects to receive the accounting information.

In the definition of the Diameter Commands, the AVPs that are specified in the referenced specifications but not used by the OMA Charging Enabler are marked with strikethrough in grey, e.g. [~~Acct-Multi-Session-Id~~]. If such parameters are present, they will not constitute an error. The bracket conventions and the asterisk (*) below SHALL be used as described in [RFC3588].

8.1.2 Diameter Commands used on CH-1

On the CH-1 interface requests are sent from the Charging Enabler User to the Charging Enabler and responses are sent from the Charging Enabler to the Charging Enabler User. The Accounting Request (ACR) commands are used to communicate Event-based and Session-based requests. The Accounting Answer (ACA) commands are used to communicate Event-based and Session-based responses.

The following additional Diameter Base messages as specified in [RFC3588] SHALL also be supported by the Charging Enabler:

- Capability-Exchange-Answer (CEA);
- Device-Watchdog-Request (DWR) and Device-Watchdog-Answer (DWA);
- Disconnect-Peer-Request (DPR) and Disconnect-Peer-Answer (DPA);

and by the Charging Enabler User:

- Capability-Exchange-Request (CER);
- Device-Watchdog-Request (DWR) and Device-Watchdog-Answer (DWA);
- Disconnect-Peer-Request (DPR) and Disconnect-Peer-Answer (DPA).

8.1.2.1 Accounting Request Command

The ACR command is sent from the Charging Enabler User to the Charging Enabler in order to send charging information for the requested resource usage. This command is used for both Event-based and Session-based requests. The distinction is made accordingly to the value carried in the Accounting-Record-Type AVP: EVENT_RECORD (value 1) for an Event-based request, START_RECORD (value 2), INTERIM_RECORD (value 3) and STOP_RECORD (value 4) for a Session-based request.

The message format is the following:

```

<ACR> ::= < Diameter Header: 271, REQ, PXY >

    < Session-Id >
    { Origin-Host }
    { Origin-Realm }
    { Destination-Realm }
    { Accounting-Record-Type }
    { Accounting-Record-Number }
    [ Acct-Application-Id ]
[ Vendor-Specific-Application-Id ]
    [ User-Name ]
[ Accounting-Sub-Session-Id ]
[ Acct-Session-Id ]
[ Acct-Multi-Session-Id ]
    [ Acct-Interim-Interval ]
[ Accounting-Realtime-Required ]
    [ Origin-State-Id ]
    [ Event-Timestamp ]
* [ Proxy-Info ]
* [ Route-Record ]
    [ Service-Context-Id ]
    [ Service-Information ]
* [ AVP ]

```

8.1.2.2 Accounting Answer Command

The ACA command is sent from the Charging Enabler to the Charging Enabler User in response to an ACR command and is used in order to acknowledge the reception of the charging data. This command is used for both Event-based and Session-based responses. The distinction is made accordingly to the value carried in the Accounting-Record-Type AVP. The value of this AVP will be the same one contained in the same AVP of the corresponding request.

The message format is the following:

```

<ACA> ::= < Diameter Header: 271, PXY >

    < Session-Id >
    { Result-Code }
    { Origin-Host }
    { Origin-Realm }
    { Accounting-Record-Type }
    { Accounting-Record-Number }
    [ Acct-Application-Id ]
[ Vendor-Specific-Application-Id ]
    [ User-Name ]
[ Accounting-Sub-Session-Id ]
[ Acct-Session-Id ]
[ Acct-Multi-Session-Id ]
    [ Error-Reporting-Host ]
    [ Acct-Interim-Interval ]
[ Accounting-Realtime-Required ]
    [ Origin-State-Id ]
    [ Event-Timestamp ]
* [ Proxy-Info ]
* [ AVP ]

```

8.1.3 Mapping of OMA Charging Data Elements to AVPs

The following table describes the mapping of the OMA Charging Data Elements to the Diameter AVPs, which are re-used from [RFC3588], [RFC4005], [RFC4006] or [TS32.299]. Mapping of OMA Charging Data Elements to AVPs defined by OMA can be found from [CHRG_DDS].

OMA Charging Data Element	Diameter AVP
Access Network Information	Access-Network-Charging-Identifier-Value
Input Octets	Accounting-Input-Octets
Output Octets	Accounting-Output-Octets
Request Number	Accounting-Record-Number
Request Type	Accounting-Record-Type
Time	Acct-Session-Time
Application Server Id	Application-Server-Id
Application Service Type	Application-Service-Type
Application Session Id	Application-Session-Id
Correlation Id	Billing-Information
Money	CC-Money
Service Specific Units	CC-Service-Specific-Units
Called Party Address	Called-Party-Address
Calling Party Address	Calling-Party-Address
Cause Code	Cause-Code
Content Disposition	Content-Disposition
Content ID	Content-ID
Content Length	Content-Length
Content provider ID	Content-provider-ID
Content Type	Content-Type
Currency Code	Currency-Code
Delivery Status	Delivery-Status
Event Timestamp	Event-Timestamp
Expires	Expires
Exponent	Exponent
Application Charging Identifier	IMS-Charging-Identifier
Inter-Operator Identifier	Inter-Operator-Identifier
Message Body	Message-Body
Number of Messages Successfully Exploded	Number-of-Messages-Successfully-Exploded
Number of Messages Successfully Sent	Number-of-Messages-Successfully-Sent
Number of participants	Number-of-Participants
Originating IOI	Originating-IOI
Originator	Originator
Participant Group	Participant-Group
Group Name	PoC-Group-Name
Role of Node	PoC-Server-Role
Role of User	PoC-User-Role
Result code	Result-Code
Service Context Id	Service-Context-Id
Service Identifier	Service-Identifier
Service Key	Service-Key
SIP Method	SIP-Method
SIP Request Timestamp	SIP-Request-Timestamp

OMA Charging Data Element	Diameter AVP
SIP Request Timestamp Fraction	SIP-Request-Timestamp-Fraction
SIP Response Timestamp	SIP-Response-Timestamp
SIP Response Timestamp Fraction	SIP-Response-Timestamp-Fraction
Subscription Id	Subscription-Id
Subscription Data	Subscription-Id-Data
Subscription Type	Subscription-Id-Type
Terminating IOI	Terminating-IOI
Time Stamps	Time-Stamps
Total Number of Messages Exploded	Total-Number-of-Messages-Exploded
Total Number of Messages Sent	Total-Number-of-Messages-Sent
Unit Value	Unit-Value
User Equipment Info	User-Equipment-Info
User Equipment Info Type	User-Equipment-Info-Type
User Equipment Info Value	User-Equipment-Info-Value
Value Digits	Value-Digits

Table 7: Mapping to Diameter AVPs

8.1.4 Summary of AVPs used on CH-1

The following table lists the Diameter AVPs specifically re-used by OMA for the Offline Charging interface (CH-1).

The table contains the following information:

- AVP Name: The name used in Diameter.
- AVP Code: The AVP Code used in the Diameter AVP Header.
- Used in ACR: Indicates if it is mandatory, optional or not used in the ACR command.
- Used in ACA: Indicates if it is mandatory, optional or not used in the ACA command.
- Used in SI: Indicates if it is mandatory, optional or not used in the Service Information parameter.
- AVP Defined: A reference to where this AVP is defined.
- Value Type: The Diameter format of the AVP data as defined in Basic or Derived AVP Data Format.
- AVP Flag Rules: The rules for how the AVP Flags in the AVP Header may be set.
- May Encr.: Indicates if the AVP may be encrypted or not.

AVP Name	AVP Code	Used in			AVP Defined	Value Type	AVP Flag Rules				May Encr.
		ACR	ACA	SI			Must	May	Should Not	Must Not	
Access–Network–Charging–Identifier–Value	503	-	-	O	[TS29.214]	OctetString	V,M	P	-	-	Y
Accounting-Input-Octets	363	-	-	O	[RFC4005]	Unsigned64	M	P	-	V	Y
Accounting-Output-Octets	364	-	-	O	[RFC4005]	Unsigned64	M	P	-	V	Y
Accounting-Record-Number	485	M	M	-	[RFC3588]	Unsigned32	M	P	-	V	Y
Accounting-Record-Type	480	M	M	-	[RFC3588]	Enumerated	M	P	-	V	Y
Acct-Application-Id	259	O	O	-	[RFC3588]	Unsigned32	M	P	-	V	N

AVP Name	AVP Code	Used in			AVP Defined	Value Type	AVP Flag Rules				May Encr.
		ACR	ACA	SI			Must	May	Should Not	Must Not	
Acct-Interim-Interval	85	O	O	-	[RFC3588]	Unsigned32	M	P	-	V	Y
Acct-Session-Time	46	-	-	O	[RFC4005]	Unsigned32	M	P	-	V	Y
Application-Server-Id	2101	-	-	O	[CHRG_DDS]	UTF8String	V,M	P	-	-	Y
Application-Service-Type	2102	-	-	O	[CHRG_DDS]	Enumerated	V,M	P	-	-	Y
Application-Session-Id	2103	-	-	O	[CHRG_DDS]	Unsigned32	V,M	P	-	-	Y
Billing-Information	1115	-	-	O	[TS29.140]	UTF8String	V,M	P	-	-	Y
Called-Party-Address	832	-	-	O	[TS32.299]	UTF8String	V,M	P	-	-	N
Calling-Party-Address	831	-	-	O	[TS32.299]	UTF8String	V,M	P	-	-	N
Cause-Code	861	-	-	O	[TS32.299]	Integer32	V,M	P	-	-	N
CC-Money	413	-	-	O	[RFC4006]	Grouped	M	P	-	V	Y
CC-Service-Specific-Units	417	-	-	O	[RFC4006]	Unsigned64	M	P	-	V	Y
Content-Disposition	828	-	-	O	[TS32.299]	UTF8String	V,M	P	-	-	N
Content-ID	2116	-	-	O	[CHRG_DDS]	UTF8String	V,M	P	-	-	Y
Content-Length	827	-	-	O	[TS32.299]	Unsigned32	V,M	P	-	-	N
Content-provider-ID	2117	-	-	O	[CHRG_DDS]	UTF8String	V,M	P	-	-	Y
Content-Type	826	-	-	O	[TS32.299]	UTF8String	V,M	P	-	-	N
Currency-Code	425	-	-	O	[RFC4006]	Unsigned32	M	P	-	V	Y
Destination-Realm	283	M	-	-	[RFC3588]	DiamIdent	M	P	-	V	N
Delivery-Status	2104	-	-	O	[CHRG_DDS]	UTF8String	V,M	P	-	-	Y
Error-Reporting-Host	294	-	O	-	[RFC3588]	DiamIdent	-	P	-	V,M	N
Event-Timestamp	55	O	O	-	[RFC3588]	Time	M	P	-	V	N
Expires	888	-	-	O	[TS32.299]	Unsigned32	V,M	P	-	-	N
Exponent	429	-	-	O	[RFC4006]	Integer32	M	P	-	V	Y
IMS-Charging-Identifier	841	-	-	O	[TS32.299]	UTF8String	V,M	P	-	-	N
Inter-Operator-Identifier	838	-	-	O	[TS32.299]	Grouped	V,M	P	-	-	N
Message-Body	889	-	-	O	[TS32.299]	Grouped	V,M	P	-	-	N
Number-of-Messages-Successfully-Exploded	2111	-	-	O	[CHRG_DDS]	Unsigned32	V,M	P	-	-	N
Number-of-Messages-Successfully-Sent	2112	-	-	O	[CHRG_DDS]	Unsigned32	V,M	P	-	-	N
Number-of-Participants	885	-	-	O	[TS32.299]	Unsigned32	V,M	P	-	-	N
Originating IOI	839	-	-	O	[TS32.299]	UTF8String	V,M	P	-	-	N
Origin-Host	264	M	M	-	[RFC3588]	DiamIdent	M	P	-	V	N
Origin-Realm	296	M	M	-	[RFC3588]	DiamIdent	M	P	-	V	N
Origin-State-Id	278	O	O	-	[RFC3588]	Unsigned32	M	P	-	V	N
Originator	864	-	-	O	[TS32.299]	UTF8String	V,M	P	-	-	N
Participant-Group	1260	-	-	O	[TS32.299]	Grouped	V,M	P	-	-	N
PoC-Group-Name	859	-	-	O	[TS32.299]	UTF8String	V,M	P	-	-	N
PoC-Server-Role	883	-	-	O	[TS32.299]	Enumerated	V,M	P	-	-	Y
PoC-User-Role	1252	-	-	O	[TS32.299]	Grouped	V,M	P	-	-	Y
Proxy-Info	284	O	O	-	[RFC3588]	Grouped	M	-	-	P,V	N
Proxy-Host	280	M	M	-	[RFC3588]	DiamIdent	M	-	-	P,V	N
Proxy-State	33	M	M	-	[RFC3588]	OctetString	M	-	-	P,V	N
Result-Code	268	-	M	-	[RFC3588]	Unsigned32	M	P	-	V	N
Route-Record	282	O	-	-	[RFC3588]	DiamIdent	M	-	-	P,V	N

AVP Name	AVP Code	Used in			AVP Defined	Value Type	AVP Flag Rules				May Encr.
		ACR	ACA	SI			Must	May	Should Not	Must Not	
Service-Context-Id	461	O	-	-	[RFC4006]	UTF8String	M	P	-	V	Y
Service-Generic-Information	1256	-	-	O	[TS32.299]	Grouped	V,M	P	-	-	Y
Service-Identifier	439	-	-	O	[RFC4006]	UTF8String	M	P	-	V	Y
Service-Information	873	O	-	-	[TS32.299]	Grouped	V,M	P	-	-	N
Service-Key	1114	-	-	O	[TS29.140]	UTF8String	V,M	-	-	-	Y
Session-Id	263	M	M	-	[RFC3588]	UTF8String	M	P	-	V	Y
SIP-Method	824	-	-	O	[TS32.299]	UTF8String	V,M	P	-	-	N
SIP-Request-Timestamp	834	-	-	O	[TS32.299]	Time	V,M	P	-	-	N
SIP-Request-Timestamp-Fraction	2301	-	-	O	[TS32.299]	Unsigned32	V,M	P	-	-	N
SIP-Response-Timestamp	835	-	-	O	[TS32.299]	Time	V,M	P	-	-	N
SIP-Response-Timestamp-Fraction	2302	-	-	O	[TS32.299]	Unsigned32	V,M	P	-	-	N
Subscription-Id	443	-	-	O	[RFC4006]	Grouped	M	P	-	V	Y
Subscription-Id-Data	444	-	-	M	[RFC4006]	UTF8String	M	P	-	V	Y
Subscription-Id-Type	450	-	-	M	[RFC4006]	Enumerated	M	P	-	V	Y
Terminating-IOI	295	-	-	O	[RFC3588]	Enumerated	V,M	P	-	-	N
Time-Stamps	833	-	-	O	[TS32.299]	Grouped	V,M	P	-	-	N
Total-Number-Of-Messages-Exploded	2113	-	-	O	[CHRG_DDS]	Unsigned32	V,M	P	-	-	Y
Total-Number-Of-Messages-Sent	2114	-	-	O	[CHRG_DDS]	Unsigned32	V,M	P	-	-	Y
Unit-Value	445	-	-	M	[RFC4006]	Grouped	M	P	-	V	Y
User-Equipment-Info	458	-	-	O	[RFC4006]	Grouped	-	P,M	-	V	Y
User-Equipment-Info-Type	459	-	-	M	[RFC4006]	Enumerated	-	P,M	-	V	Y
User-Equipment-Info-Value	460	-	-	M	[RFC4006]	OctetString	-	P,M	-	V	Y
User-Name	1	O	O	-	[RFC3588]	UTF8String	M	P	-	V	Y
Value-Digits	447	-	-	M	[RFC4006]	Integer64	M	P	-	V	Y

Table 8: Summary of Diameter AVPs used on CH-1

For the usage of Service-Context-ID AVP and Service-Information AVP please refer to the [CHRG_ONLINE]. Since the application uses Acct-Application-ID, the AVP SHALL contain the value of 3 as defined in [RFC3588].

8.2 Binding to Payment API

This section specifies how the OMA CH-1 interface MAY be exposed as a Web Service compliant with either the SOAP protocol binding of Parlay X Web Services Payment API as specified in [TS29.199-6] transferred to OMA [PSA RRP] or with the HTTP protocol binding of ParlayREST Web Services Payment API as specified in [REST TS Payment].

This mapping covers only part of the Charging Enabler's functionality.

8.2.1 Binding to Web Services SOAP Payment API used on CH-1

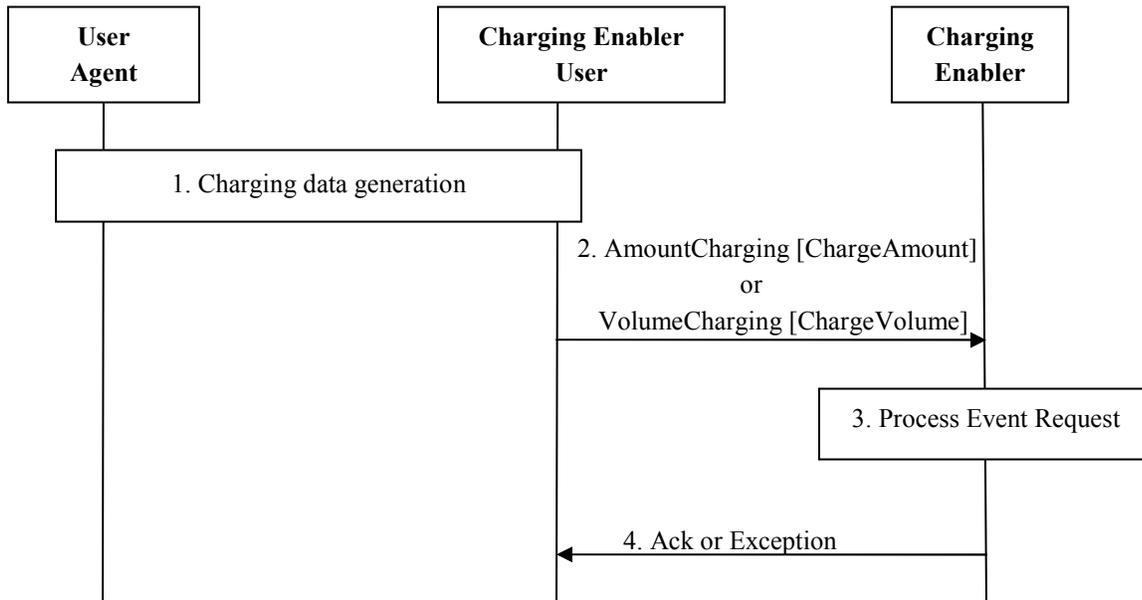
8.2.1.1 Interfaces and Operations

Charging Enabler Message Type	Payment API Interface/Operation
Event Request	When decentralized rating is used: <ul style="list-style-type: none"> Interface: AmountCharging Operation: ChargeAmount Inclusion of service information except for ‘description’, ‘currency’, ‘amount’ and ‘code’ is not supported When centralized rating is used: <ul style="list-style-type: none"> Interface: VolumeCharging Operation: ChargeVolume Rating parameters and other service information may be included in the “parameters” part
Start Request Interim Request Stop Request	Sessions for offline charging are not supported. Instead, the functionality specified in Section 7.2 can be fulfilled by using Event-based Charging.

Table 9: Summary of Web Service Interfaces and Operations used on CH-1

8.2.1.2 Binding-specific Flows

The flow diagram below clarifies the mapping of the Event-based Charging model defined in Section 7.1 to the Web Services and Operations used with the Parlay X binding.



Flow 3: Event-based Offline Charging with Parlay X binding

The steps of the Event-based Charging flow in the case of Parlay X binding are the following:

1. “**Charging data generation**”: The user invokes a service that is supported by the Charging Enabler User, and charging data is generated.
2. The Charging Enabler User sends an Event Request using either **Interface: AmountCharging, Operation: ChargeAmount** or **Interface: VolumeCharging, Operation: ChargeVolume** to the Charging Enabler.
3. “**Process Event Request**”: The Charging Enabler processes, and records the event
4. “**Ack or Exception**”: The Charging Enabler answers the Charging Enabler User with either an empty message (Charge Amount Response or Charge Volume Response) or with an exception.

8.2.1.3 Mapping of OMA Charging Data Elements to Message Parts

The following table lists the OMA Charging Data Elements defined in this specification and the mapping of these elements to message parts in the Payment API messages.

As a general rule, any additional OMA Charging Data Elements created to convey charging information and listed in [CHRG_DDS] SHALL be mapped to the “parameters” part in the Payment API messages and SHALL use a parameter name derived from the name of the corresponding OMA Charging Data Element by removing spaces and starting all words with a capital letter except for the first word, for example Service Key -> serviceKey.

OMA Charging Data Element	Payment API Part Name
Correlation Id	parameters:correlationId
Currency Code	charge:currency(Note 1)
Event Timestamp	parameters:eventTimestamp
Exponent	charge:amount(Note 1)
Input Octets	parameters:inputOctets
Money	charge:amount
Output Octets	parameters:outputOctets
Request Number	NOT USED
Request Type	Indicated by using different Interfaces of the Web Service
Result Code	Indicated with exceptions
Service Context Id	parameters:service
Service Identifier	parameters:operation
Service Key	parameters:serviceKey
Service Specific Units	volume; additionally parameters:unit MAY indicate the unit of measure used, parameters:service and parameters:operation SHALL carry the necessary information on the service context needed to interpret the service specific units
Subscription Id	endUserIdentifier
Subscription Data	endUserIdentifier
Subscription Type	endUserIdentifier
Time	volume; additionally parameters:unit SHALL indicate a time unit

OMA Charging Data Element	Payment API Part Name
Unit Value	charge:amount(Note 1)
User Equipment Info	NOT USED
User Equipment Info Type	parameters:userEquipmentInfoType
User Equipment Info Value	parameters:userEquipmentInfoValue
Value Digits	charge:amount(Note 1)

Note 1: Only used for “Amount Charging”

Table 10: Mapping to Web Services message parts

8.2.2 Binding to RESTful http Payment API used on CH-1

8.2.2.1 Operations and Resources used on CH-1

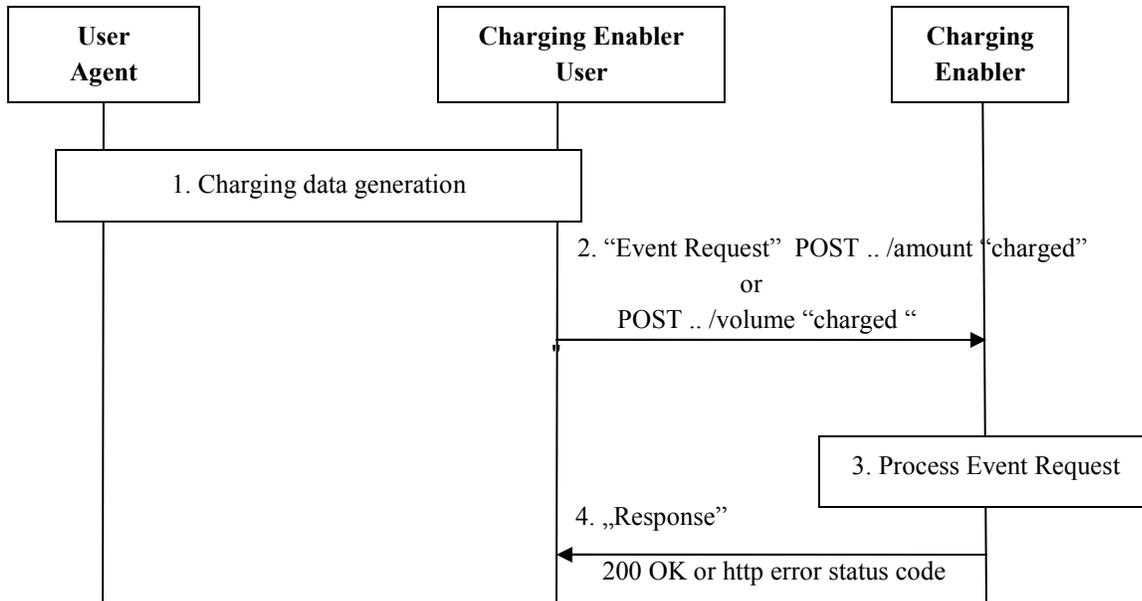
Note: The common part of the resource URL is `http://{serverRoot}/{apiVersion}/payment/{endUserId}/transactions`

Charging Enabler Message Type	Payment API Operation/Resource
Event Request	<p>When decentralized rating is used:</p> <ul style="list-style-type: none"> • http method: POST • TransactionOperationStatus: “Charged” • Resource URL: <code>../amount</code> • Inclusion of service information except for ‘description’, ‘currency’, ‘amount’ and ‘code’ is not supported <p>When centralized rating is used:</p> <ul style="list-style-type: none"> • http method: POST • TransactionOperationStatus: “Charged” • Resource URL: <code>../volume</code> • Rating parameters and other service information may be included in the “ratingParameter” part
Start Request Interim Request Stop Request	<p>Sessions for offline charging are not supported. Instead, the functionality specified in Section 7.2 can be fulfilled by using Event-based Charging.</p>

Table 11: Summary of REST Operations and Resources used on CH-1

8.2.2.2 Binding-specific Flows

The flow diagram below clarifies the mapping of the Event-based Charging model defined in Section 7.1 to the REST Operations and Resources used with the Parlay RESTful http binding.



Flow 4: Event-based Offline Charging with REST binding

The steps of the Event-based Charging flow in the case of REST binding are the following:

1. **“Charging data generation”**: The user invokes a service that is supported by the Charging Enabler User, and charging data is generated.
2. The Charging Enabler User sends an “Event Request” using **http POST to either**
resource: `http://{serverRoot}/{apiVersion}/payment/{endUserId}/transactions/amount`
 or
resource: `http://{serverRoot}/{apiVersion}/payment/{endUserId}/transactions/volume`
 with TransactionOperationStatus set to **“charged”** to the Charging Enabler.
3. **“Process Event Request”**: The Charging Enabler processes and records the event.
4. **“Response”**: The Charging Enabler answers the Charging Enabler User with either HTTP 200 OK or with http error status code and optionally an exception in the body.

8.2.2.3 Mapping of OMA Charging Data Elements to Message Parts

The following table lists the OMA Charging Data Elements defined in this specification and the mapping of these elements to message parts in the Payment API transactions.

As a general rule, any additional OMA Charging Data Elements created to convey charging information and listed in [CHRG_DDS] SHALL be mapped to the “ratingParameter” part in the Payment API transactions and SHALL use a parameter name derived from the name of the corresponding OMA Charging Data Element by removing spaces and starting all words with a capital letter except for the first word, for example Service Key -> serviceKey.

OMA Charging Data Element	REST Type Element
Correlation Id	ratingParameter:correlationId
Currency Code	charge:currency (Note 1)
Event Timestamp	ratingParameter:eventTimestamp
Exponent	charge:amount (Note 1)
Input Octets	ratingParameter:inputOctets
Money	charge:amount (Note 1)
Output Octets	ratingParameter:outputOctets
Request Number	NOT USED
Request Type	Indicated by using different resources and TransactionOperationStatus parameter
Result Code	Indicated with http error status codes and optionally exceptions in the response body
Service Context Id	ratingParameter:service
Service Identifier	ratingParameter:operation
Service Key	ratingParameter:serviceKey
Service Specific Units	volume; additionally ratingParameter:unit MAY indicate the unit of measure used, ratingParameter:service and ratingParameter:operation SHALL carry the necessary information on the service context needed to interpret the service specific units
Subscription Id	endUserId
Subscription Data	endUserId
Subscription Type	endUserId
Time	volume; additionally ratingParameter:unit SHALL indicate a time unit
Unit Value	charge:amount (Note 1)
User Equipment Info	NOT USED
User Equipment Info Type	ratingParameter:userEquipmentInfoType
User Equipment Info Value	ratingParameter:userEquipmentInfoValue
Value Digits	charge:amount (Note 1)

Note 1: Only used for “AmountCharging”, i.e. resource URL: .../amount.

Table 12: Mapping to REST Type Element parts

Appendix A. Change History

A.1 Approved Version History

Reference	Date	Description
n/a	n/a	No prior version

A.2 Draft/Candidate Version 1.1 History

Document Identifier	Date	Sections	Description
Draft Version OMA-TS-Charging_Offline-V1_1	12 June 2007		Initial revision based on version 1.0
	27 Feb 2008	8.2	Incorporated following CRs: OMA-MCC-2008-0019 OMA-MCC-2007-0144R01 OMA-MCC-2007-0143
	24 Jun 2008	3.2, 8.1.3, 8.2.3	Incorporated following CRs: OMA-MCC-2008-0036 OMA-MCC-2008-0051
	19 Aug 2008	2.1, 5, 6.1, 6.2, 7.1, 7.2, 8, App B	Incorporated following CRs: OMA-MCC-2008-0071 OMA-MCC-2008-0072
	23 Oct 2008	6.1, 6.2, 8.1.2, 8.1.3, 8.2.3	Incorporated following CRs: OMA-MCC-2008-0078R01 OMA-MCC-2008-0081R01 OMA-MCC-2008-0084R01
	16 Dec 2008	6.1, 7.2	Icorporated following CRs: OMA-MCC-2008-0109
Candidate Version OMA-TS-Charging_Offline-V1_1	13 Feb 2009	n/a	Status changed by TP TP ref# OMA-TP-2009-0062- INP_Charging_V1_1_ERP_for_Candidate_Approval
Draft Version OMA-TS-Charging_Offline-V1_1	16 Jun 2009	2.1, 6.1, 6.2, 8.1.2.2, 8.1.3, 8.1.4	Incorporated agreed changes: OMA-MCC-2009-0020R01- CR_Parameter_cleansing_in_Offline_Charging.
Candidate Version OMA-TS-Charging_Offline-V1_1	28 Jul 2009	All	Status changed to Candidate by TP: OMA-TP-2009-0320- INP_Charging_V1_1_ERP_for_Candidate_re_Approval
Draft Versions OMA-TS-Charging_Offline-V1_1	15 Jun 2010	6.1 8.1.3 8.1.4	Implemented agreed changes: OMA-MCC-2010-0006R01-CR_Updates for Offline Charging Editorial: 2010 template applied
	16 Jul 2010	2.1, 8.2, 8.2.3	Implemented agreed changes: OMA-ARC-MCC-2010-0011R01- CR_Binding_to_Payment_API_in_Offline_Charging
	20 Sep 2010	8.2	Implemented agreed changes: OMA-ARC-MCC-2010-0014R01- CR_Binding_to_REST_Payment_API_in_Offline_Charging
	21 Sep 2010	8.2	Implementation of OMA-ARC-MCC-2010-0014R01 fixed
Candidate Version OMA-TS-Charging_Offline-V1_1	01 Oct 2010	All	Status changed to Candidate by TP: OMA-TP-2010-0429-INP_Charging_V1_1_ERP_for_Notification

Appendix B. Static Conformance Requirements (Normative)

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

B.1 SCR for the Charging Enabler User

B.1.1 Generic SCR

Item	Function	Reference	Status	Requirement
Offline-C-001	Implement the client-side state machine for at least one of the specified bindings	RFC 3588, TS29.199-6	M	
Offline-C-002	Support of Event Charging	Section 7.1	M	
Offline-C-003	Support of Session Charging	Section 7.2	O	
Offline-C-004	Error handling is dealt with as specified for the supported bindings	RFC 3588 (sect.7), TS29.199-6 (sect. 9)	M	

B.1.2 SCR for Event-based Charging

Item	Function	Reference	Status	Requirement
Offline-Event-C-001	Support an Event Request.	Section 6.1.2	M	

B.1.3 SCR for Session-based Charging

Item	Function	Reference	Status	Requirement
Offline-Session-C-001	Support a Start Request	Section 6.1.3	M	
Offline-Session-C-002	Support an Interim Request	Section 6.1.4	O	
Offline-Session-C-003	Support a Stop Request	Section 6.1.5	M	

B.2 SCR for the Charging Enabler

B.2.1 Generic SCR

Item	Function	Reference	Status	Requirement
Offline-S-001	Implement the server-side state machine for at least one of the specified bindings	RFC 3588, TS29.199-6	M	For the Diameter binding: Implement the accounting state machine "SERVER, STATELESS ACCOUNTING"
Offline-S-002	Support of Event-based Charging	Section 7.1	M	
Offline-S-003	Support of Session-based Charging	Section 7.2	M	Not applicable for the Parlay X binding
Offline-S-004	Error handling is dealt with as specified for the supported bindings	RFC 3588 (sect.7), TS29.199-6 (sect. 9)	M	

B.2.2 SCR for Event-based Charging

Item	Function	Reference	Status	Requirement
Offline-Event-S-001	Support a response to an Event Request	Section 6.2	M	

B.2.3 SCR for Session-based Charging

Item	Function	Reference	Status	Requirement
Offline-Session-S-001	Support a response to a Start Request	Section 6.2	M	
Offline-Session-S-002	Support a response to an Interim Request	Section 6.2	M	
Offline-Session-S-003	Support a response to a Stop Request	Section 6.2	M	