Location Protocols

Version 12-Sept-2001

Wireless Application Protocol
WAP-257-LOCPROT-20010912-a

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1. Scope

Wireless Application Protocol (WAP) is a result of continuous work to define an industry wide specification for developing applications that operate over wireless communication networks. The scope for the WAP Forum is to define a set of specifications to be used by service applications. The wireless market is growing very quickly and reaching new customers and providing new services. To enable operators and manufacturers to meet the challenges in advanced services, differentiation, and fast/flexible service creation, WAP defines a set of protocols in transport, session and application layers. For additional information on the WAP architecture, refer to “Wireless Application Protocol Architecture Specification” [WAPARCH].

Location based WAP services, i.e. services dependent on a geographical location, represent a class of applications with specific needs. The WAP location framework addresses these needs by providing a transparent and position procedure independent location application interface. It also provides guidelines for location related privacy.

This specification defines the services in the WAP location framework and the protocol mappings used to convey location information.

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2. References

2.1. Normative References

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[XML] "Extensible Markup Language (XML)", W3C Recommendation 10-February-1998, REC-xml-19980210", T. Bray, et al, February 10, 1998. URL: http://www.w3.org/TR/REC-xml

2.2. Informative References

[LOCFW] "WAP Location Framework Overview". WAP Forum™. WAP-256-LOCFW-20010912-d. URL:http//www.wapforum.org/

[WAPARCH] "WAP Architecture". WAP Forum™. WAP-210-WAPArch-20010712-a. URL:http//www.wapforum.org/

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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

Application An application, in the context of the WAP Location specifications, is the user of location information. An application may execute on a WAP Client or on a web server.

Application Server An application server, in the context of the WAP Location specifications, is a web server executing an application.

External location entity Entity in the network or in the terminal that can provide a location as a response to a given request information. External is to be interpreted as not being specified by WAP Forum.

Location Reference to position

Location Information Information related to a position, including both various location formats (different coordinate systems and datum), and other types of location information such as geo-codes, velocity, altitude, etc.

Position Coordinates in a reference system.

Position/Location dependent service Service that is only available within a certain geographical area.

Position/Location based service Service that uses information about the location of clients.

Terminal A device that holds the WAP client typically used by a user to request and receive information. Also called a mobile terminal or mobile station.

User Agent User agent (or content interpreter) is any software or device that interprets WML, WMLScript or other content. This may include textual browsers, voice browsers, search engines etc.

WAP Location Attachment Functionality Functionality implementing the Attachment Service, see [LOCFW].

WAP Client In the context of push, a WAP client is a device (or service) that can receive push content from a server. In the context of pull, a WAP client is a device that can initiate requests to a server for content.
In the context of the WAP Location specifications, a WAP Client may include WAP Query functionality or WAP Attachment functionality.

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WAP Location Network	Implementations of the WAP Location Functionalities, which do not reside in the WAP Client, see [LOCFW]
WAP Location Query Functionality	Functionality implementing the Immediate and/or the Deferred Query Service, see [LOCFW]
WAP Proxy	A WAP Proxy is a WAP feature enhancing or performance enhancing proxy [WAPARCH].

3.3. Abbreviations

DTD	Document Type Definition
HTTP	Hypertext Transfer Protocol
UAProf	User Agent Profile
URL	Uniform Resource Locator
PAP	Push Access Protocol
PPG	Push Proxy Gateway
OTA	Push Over the Air
WAP	Wireless Application Protocol
WSP	Wireless Session Protocol
XML	eXtensible Markup Language

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4. Introduction

The purpose of this document is to describe the WAP location services and define how different transport protocols are used to convey location related information within services. Throughout this document the term *location* will be used for both location and position.

The Location Framework [LOCFW] supports both applications executing on application servers and applications executing in terminals. It provides a set of location services to application developers, supporting a variety of applications. In all cases the application is independent of the actual positioning methods used to derive the location.

This specification addresses basic combinations of applications and services, but not all possible combinations. For example, this specifiation does not cover capability negotiations.

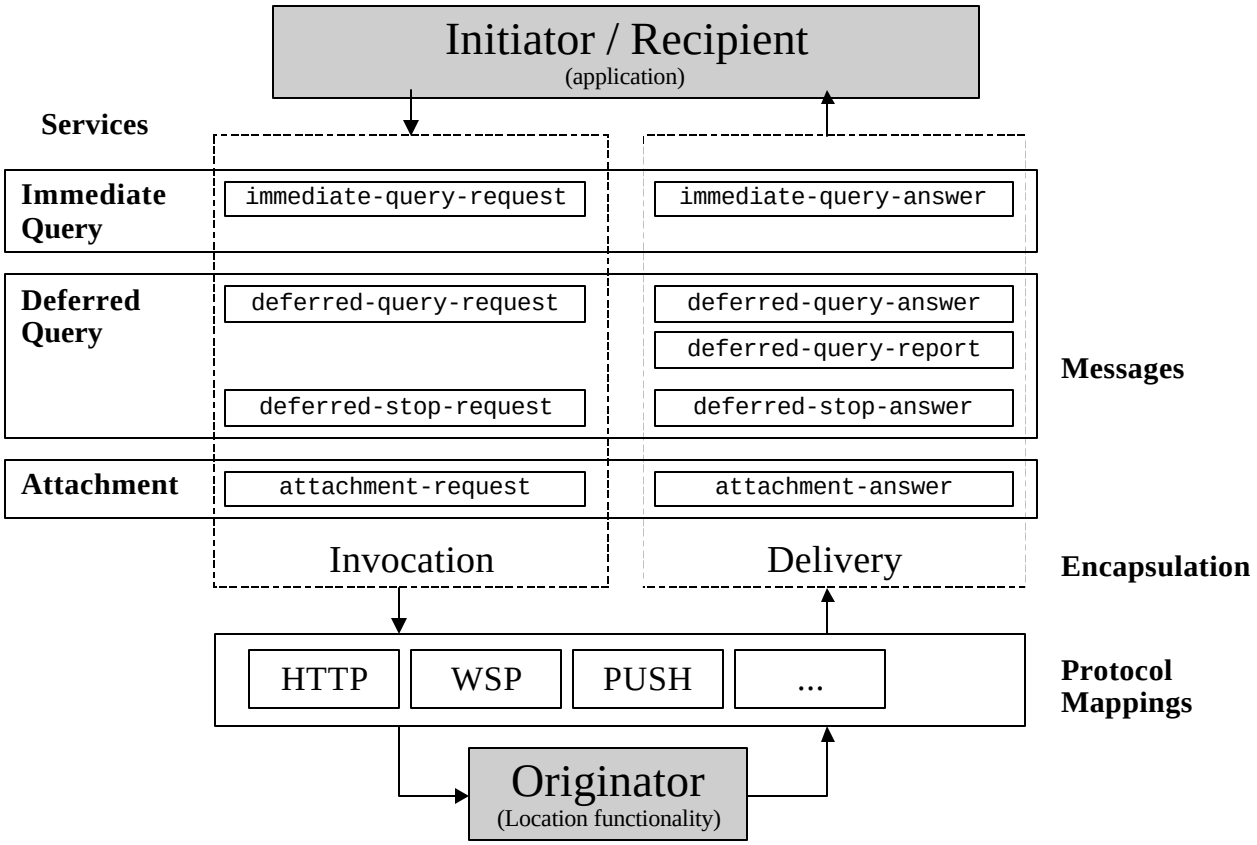

Figure 1: Overview of the Location Services

The above picture introduces the terminology used in this document. The Initiator/Recipient can use the services by sending/receiving messages, which are defined for each service. The messages are encapsulated within an Invocation or Delivery document (see [LOCFORM]). These documents can be transported to/from the originator by using different protocol mappings.

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Services

The WAP Location Framework defines the following services (for details, see chapter 5):

- **Immediate Query Service**
  This service is used when an application in the WAP client or in the application server wants location information of some WAP client immediately. The Immediate Query Service requires the server to identify the user for which location is needed. This client address must be either a network addressable ID such as a phone number, IPv4, IPv6 or a unique identifier which can be mapped to a network addressable ID. In case of e.g. HTTP, the querying entity sends an HTTP POST with the XML Location Invocation document [LOCFORM] in the message body. The response with location information is returned with the XML Location Delivery document in the body.

- **Deferred Query Service**
  A Deferred Query Service is used e.g. for tracking a WAP client. It supports periodic positioning so that one request from an application can result in many location deliveries. The Deferred Query Service requires the server to identify the user for which location is needed. This client address must be either a network addressable ID such as a phone number, IPv4, IPv6 or a unique identifier which can be mapped to a network addressable ID.
  In case of e.g. HTTP, the querying entity sends an HTTP POST with the XML Location Invocation document in the message body. The initial HTTP response includes an XML document with an acknowledgement (e.g., 'request accepted and being processed', or 'network congested request denied'). This initial HTTP transaction is then followed by one or more HTTP POSTs with the XML Delivery document in the body, each followed by empty HTTP responses from the location recipient.

- **Attachment Service**
  An Attachment Service is used when a WAP client or some entity in the network attaches the location information to the WAP client request. The Attachment Service is triggered by the client, or by the receipt of an HTTP query at a network proxy. When location information is attached is implementation specific. It may be based on an internal set of predefined triggers or an explicit request message from the Application Server.

Each service has an Initiator, an Originator and a Recipient of location information. This is illustrated in the Service descriptions with:

- **Initiator**

  The Initiator invokes the location service, i.e. calls the functionality that gathers and delivers the requested location information

- **Originator**

  The Originator gathers and delivers the location information according to the invocation

- **Recipient**

  The Recipient receives location information provided by the Originator.

In the Immediate Query and the Attachment Service, the Recipient and the Initiator are the same entity. In the Deferred Query Service they may be different entities.

Messages

For each service the generic message sequences are defined. The term message is used to represent the passing of location related information within a service. Each message has a corresponding XML element defined in [LOCFORM].

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Encapsulation

One or more of message XML elements can be encapsulated within one root XML document (see [LOCFORM]). Two root XML documents are used:

- **Location Invocation** document

  This document is used for requesting location information, i.e. to send invocation messages to the location service

- **Location Delivery** document

  This document is used for returning delivery messages in response to invocations

Protocol Mappings

How the root XML documents, the Location Invocation and the Delivery document, are delivered between different entities depends on the used transport protocol. Chapter *6* defines how messages are mapped to the transport protocols.

This specification defines mappings to HTTP, WSP and PUSH. Other mappings are possible, but are not addressed within this specification.

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5. Service Descriptions, Informative

5.1. Immediate Query Service

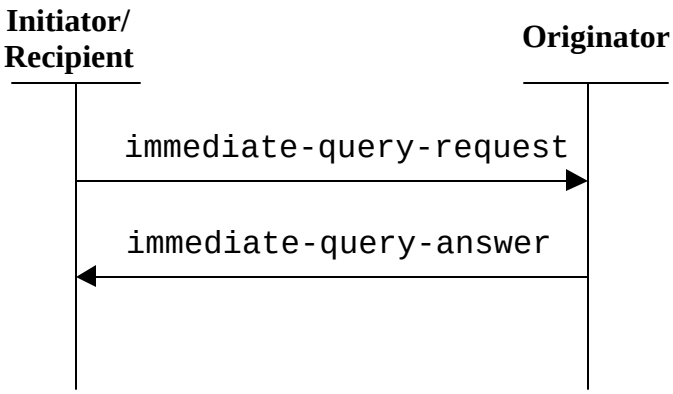

Figure 2: Message sequence for the Immediate Query

The Immediate Query is used when the Initiator wants to get location information of a WAP client(s) immediately as a response to the location request. In the Immediate Query the Initiator and the Recipient of the location information are always the same. The query can be initiated by an application in the WAP client or in the application server.

This query can be used only if the underlying transport protocol supports a response/request sequence, e.g. over HTTP. This is further defined in the protocol mappings.

There are two messages defined in the Immediate Query:

- `immediate-query-request`

  This message is used when the Initiator sends a request for location information to the Originator. The message is conveyed using the Location Invocation Document. The content of the message defines what kind of location information is requested on return (see [LOCFORM]).

- `immediate-query-answer`

  This message is used when the Originator returns a response to the `immediate-query-request` message in the Location Delivery Document. The message contains error information if the invocation was not successful. If the invocation was succesfull, it contains the location information.

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5.2. Deferred Query Service

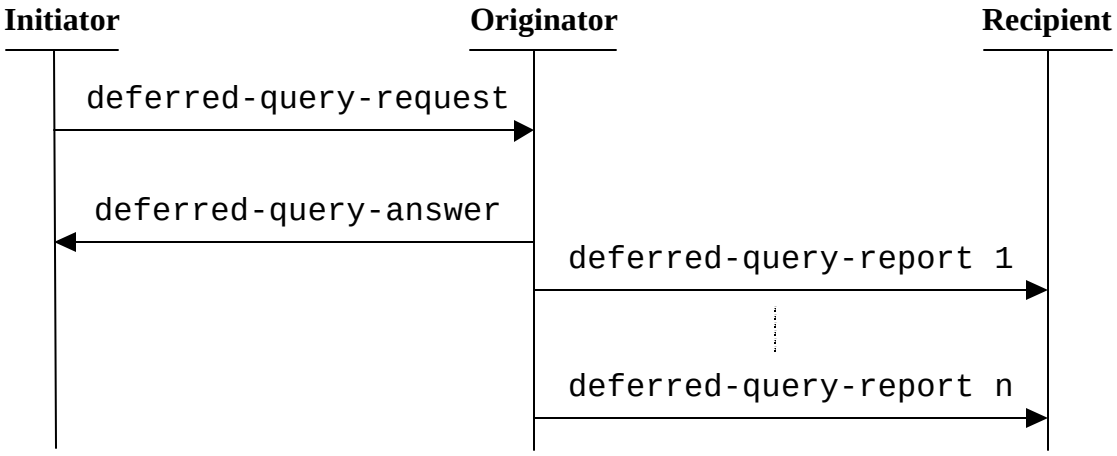

Figure 3: Message sequence for the Deferred Query

The Deferred Query is used when the Initiator wants the location information of a WAP client(s) to be delivered to a Recipient. The Initiator and the Recipient of the location information may be different.

The query can be initiated by an application in the WAP client or in the application server. The Recipient is given by a recipient address within the message, see [LOCFORM].

There are three messages defined in the Deferred Query:

- `deferred-query-request`

  The `deferred-query-request` message is used when the Initiator sends a request for location information to the Originator. The message is delivered using the Location Invocation Document. The content of the `deferred-query-request` message defines when, what kind of location information and to where the location information is sent (see [LOCFORM]).

- `deferred-query-answer`

  The `deferred-query-answer` message is used by the Originator to acknowledge the `deferred-query-request` message to the Initiator. The `deferred-query-answer` message contains the information if the invocation was successful or not.

  This message is returned only if the underlying transport protocol supports a response/request sequence, e.g. over HTTP. This is further defined in the transport mappings.

- `deferred-query-report`

  This message is used by the Originator to send location information to the Recipient. Depending on the content of the `deferred-query-request` message there may be one or more deliveries. E.g. if the type of the query is periodic then there will be several deliveries at defined intervals. See the details of different query types from [LOCFORM].

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5.2.1. Deferred Stop

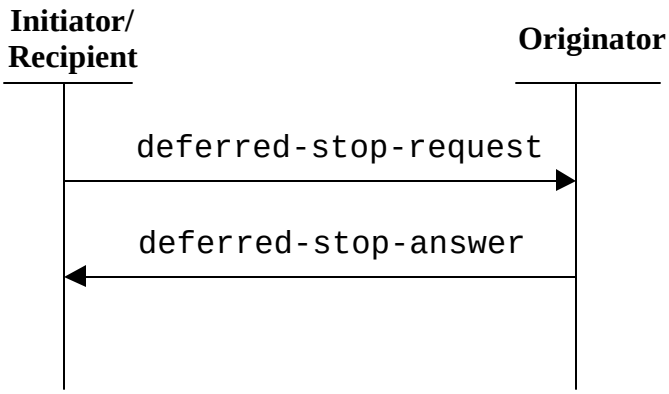

Figure 4: Message sequence for the Deferred Stop

The Deferred Stop is used when the Recipient or the Initiator of the Deferred Query wants to cancel the location information deliveries from the Originator.

There are two types of messages defined in Deferred Stop:

- `deferred-stop-request`

  The `deferred-stop-request` message is used when the Initiator or the Recipient of the Deferred Query wants to stop the location deliveries from the Originator. The `deferred-stop-request` message contains the information that is needed to identify the Deferred Query invocation to be cancelled, see [LOCFORM].

- `deferred-stop-answer`

  The `deferred-stop-answer` message is used when the Originator sends the status of the cancellation.

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5.3. Location Attachment Service

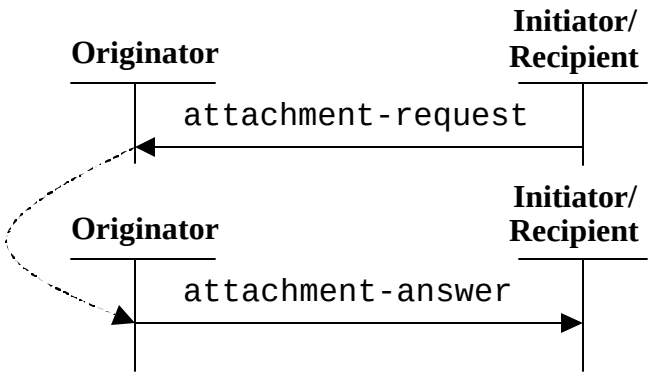

Figure 5: Message sequences for the Location Attachment Service.

The Attachment Service defines a mechanism by which the Location Attachment Functionality attaches location information to a request from the WAP client. When location information is attached is implementation specific. It may be based on an internal set of predefined triggers or an explicit `attachment-request` message from the Application Server.

The WAP Location Attachment Functionality may be implemented in the WAP client or in the WAP Location Network. If the Attachment Functionality is implemented in the Location Network, the location determination and/or processing may increase the latency seen by the user. In the Attachment Service the Initiator and the Recipient are always the same. The Attachment Service always applies to a single WAP client and thus does not require that the application server knows the client address, since the location information is appended to a WSP/HTTP request initiated by a WAP client.

There are two types of messages defined in the Attachment Service:

- `attachment-request`

  If an application, that can provide a better service based on location information, receives a request without location information or with inadequate location information, then it may return a normal response (e.g. an HTTP response with a WML deck), with an `attachment-request` message to indicate the need of location information.

  A Location Attachment Functionality that receives the `attachment-request` message may reissue the WAP client's request with the `attachment-answer` message attached. If there is no location information available or it is not allowed to be delivered, e.g. because of privacy reasons, the Attachment Functionality may ignore the `attachment-request` message and the WAP client may then use any content that came as a response. The content may e.g. contain a script that can be used to manually request a location from the user.

  Note that this does not require the Application Server to keep its state.

- `attachment-answer`

  An `attachment-answer` message is used to attach the location information to a WAP client request. The `attachment-answer` message can be used without any preceding `attachment-request` message.

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6. Location Functionalities

This section normatively defines the location functionalities that can be implemented according to Location Framework.

There are two location functionalities defined in Location Framework [LOCFW]. Each functionality provides one or more services (see chapter 5). Each service uses messages that are used to request, acknowledge and convey location information between the Initiator, the Originator and the Recipient (see chapter 5). The actual message flows are defined in chapter 7 for each protocol used as a transport mechanism for the messages.

The relation between location functionalities, services and messages can be shown with the tree-like structure as follows:

- Query Functionality
  This functionality provides two services:
  - Immediate Query Service (see 5.1)
    This services uses the messages:
    `immediate-query-request`
    `immediate-query-answer`
  - Deferred Query Service (see 5.2)
    This service uses the messages:
    `deferred-query-request`
    `deferred-query-answer`
    `deferred-query-report`
    `deferred-stop-request`
    `deferred-stop-answer`
- Attachment Functionality
  - Attachment Service (see 5.3)
    This service uses the messages:
    `attachment-request`
    `attachment-answer`

Both functionalities can be implemented either in the client or in the WAP Location Network, see [LOCFW]. To support the Location Framework the entity MUST support at least one functionality. To support some functionality, the entity MUST support at least one service in the functionality.

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7. Mappings to Transport Protocols

This section normatively defines how to convey service messages over HTTP, WSP and PUSH.

The term "transport" is used in this document not in the usual sense of "transport protocol", i.e. layer 4 in the OSI stack, but to denote the transport of location information on underlying protocol stacks.

7.1. Encapsulation of the Messages

Each message described in the service descriptions of chapter 5 has a corresponding DTD element defined in [LOCFORM].

Two root XML documents, Location Invocation document and Location Delivery document, are used as envelopes for service messages (see [LOCFORM]). The Location Invocation document is used to convey all request messages. The Location Delivery document is used to convey all answer and report messages. Both root XML documents can contain one or more message elements. All the mappings are defined for these two root XML documents.

7.2. Mapping to HTTP

The Location Invocation and the Delivery documents MUST be mapped to HTTP [RFC2616] as defined in this section.

The following table describes how to map a particular message to HTTP.

The name of the message is on the first column of the table. The mapping of the certain message is shown on the same row on which the message is. The column of the mapping shows the document type used to convey the message. The application MUST use that mapping and document type on HTTP.

Below the table is the reference to the chapter in which the corresponding mapping is defined.

	Location Invocation document on	**Location Delivery document on**
`immediate-query-request`	POST request body	
`immediate-query-answer`		POST response body
`deferred-query-request`	POST request body	
`deferred-query-answer`		POST response body
`deferred-query-report`		POST request body
`deferred-stop-request`	POST request body	
`deferred-stop-answer`		POST response body
`Attachment-request`	GET or POST response header	
`Attachment-answer`		GET or POST request header

Location Invocation on POST request body (see section 7.2.3)

Location Delivery on POST response body (see section 7.2.4)

Location Delivery on POST request body (see section 7.2.5)

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Location Invocation on GET or POST response header (see section 7.2.6)

Location Delivery on GET or POST request header (see section 7.2.7)

7.2.1. Message sequences on HTTP

Immediate Query Service

If the Immediate Query Service is supported, then the Location Query Functionality MUST support `immediate-query-request` and `immediate-query-answer` messages.

The `immediate-query-request` message MUST be followed by the `immediate-query-answer` message on the same HTTP request/response sequence.

Deferred Query Service

If the Deferred Query Service is supported, then the Location Query Functionality MUST support `deferred-query-request`, `deferred-query-answer`, `deferred-stop-request` and `deferred-stop-answer` messages.

The `deferred-query-request` message MUST be followed by the `deferred-query-answer` message on the same HTTP request/response sequence. If the invocation was successful, the `deferred-query-report` message MUST be delivered when the trigger condition given in the `deferred-query-request` message expires (see triggers from [LOCFORM]).

The `deferred-query-report` message MUST be followed by an empty HTTP response on the same HTTP request/response sequence.

The `deferred-stop-request` message MUST be followed by the `deferred-stop-answer` message on the same HTTP request/response sequence.

Attachment Service

If the Attachment Service is supported, then the Location Attachment Functionality MUST support `attachment-answer` message. The `attachment-request` message MAY be supported.

If supported, the `attachment-request` message MAY be followed by the `attachment-answer` message. In the case of e.g. privacy reasons the Location Attachment Functionality MAY ignore the `attachment-request` message.

7.2.2. HTTP error handling recommondation (informative)

The location functionalities should handle all HTTP error codes according to [RFC2616].

On the Deferred Query service and especially in case of periodic updates, there might be error situations that can't be solved. If the functionality tries to solve the error situation but doesn't succeed and it is expected that the following periodic reports are not successfull either, the functionality should stop/cancel the periodic reports to the application.For example, if the application returns HTTP error code 404, "Not Found", the functionality should cancel all the periodic reports to the application, because it is unlikely that the error condition changes. There are also HTTP error conditions when the functionality can try to resolve the error condition, e.g. error code 401, "Unauthorized", meaning that the request requires user authentication. If the credentials are known the functionality can try again, this time with WWW-Authenticate header field containing a challenge applicable to the requested resource. If this doesn't work the functionality should cancel the periodic reports to the application.

In the case of 300 series error codes, i.e redirection, the deployment should ensure that all the needed privacy checks are done like in the normal case. If, for example, the delivery address of the location changes in the attachment service, there might be a need for privacy check.

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7.2.3. Location Invocation on POST request body

The Location Invocation document MUST be delivered in the body of the POST request. The format of the Location Invocation document is defined in [LOCFORM].

The Content-Type header defined in HTTP [RFC2616] MUST be used with the Location Invocation. The value of the Content-Type header MUST be a MIME type [RFC2045] of *application/vnd.wap.loc+xml*.

Example HTTP POST:

```
POST /loc-service HTTP/1.1
Host: www.loc-query-func.com
Content-Type: application/vnd.wap.loc+xml
Content-Length: 300

<?xml version = "1.0" ?>
<!DOCTYPE invocation PUBLIC
  "-//WAPFORUM//DTD LOC INV 1.0//EN"
  "http://www.wapforum.org/DTD/loc/invocation-1.0.dtd">
<invocation>
  <!-- invocation data … !>
</invocation>
```

7.2.4. Location Delivery on POST response body

The Location Delivery document MUST be delivered in the body of the POST response. The format of the Location Delivery document is defined in [LOCFORM].

The Content-Type header defined in HTTP [RFC2616] MUST be used with the Location Delivery document. The value of the Content-Type header MUST be *application/vnd.wap.loc+xml*.

The HTTP response codes are used only for HTTP layer conditions. All the codes in the location query services are conveyed through XML documents. When a message has been received by the Location Query Functionality, the HTTP response code 200 is returned, even if the Location Invocation Document can not be parsed or is not well formed. Information on these failure conditions is returned in the response contained in the Location Delivery document.

Example HTTP POST response with Location Delivery document:

```
HTTP/1.1 200 OK
Content-Type: application/vnd.wap.loc+xml
Content-Length: 400

<?xml version = "1.0" ?>
<!DOCTYPE delivery PUBLIC
  "-//WAPFORUM//DTD LOC DEL 1.0//EN"
  "http://www.wapforum.org/DTD/loc/delivery-1.0.dtd">
<delivery>
  <!-- delivery data … !>
</delivery>
```

7.2.5. Location Delivery on POST request body

The Location Delivery document MUST be delivered in the body of the POST request. The format of the Location Delivery document is defined in [LOCFORM].

The Content-Type header defined in HTTP [RFC2616] MUST be used with the Location Delivery. The value of the Content-Type header MUST be *application/vnd.wap.loc+xml*.

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In case there are no HTTP level errors, the response for the HTTP request with Location Delivery MUST be an empty HTTP POST response with HTTP response code 204.

Example HTTP POST request with Location Delivery Document:

```
POST /loc-service HTTP/1.1
Host: www.loc-query-func.com
Content-Type: application/vnd.wap.loc+xml
Content-Length: 400

<?xml version = "1.0" ?>
<!DOCTYPE delivery PUBLIC
  "-//WAPFORUM//DTD LOC DEL 1.0//EN"
  "http://www.wapforum.org/DTD/loc/delivery-1.0.dtd">
<delivery>
  <!-- delivery data … !>
</delivery>
```

Example empty HTTP POST response:

```
HTTP/1.1 204 No Content
```

7.2.6. Location Invocation on GET or POST response header

The Location Invocation document MUST be conveyed in a header of the HTTP GET or POST response. The header MUST follow the HTTP header syntax defined in [RFC2616] section 4.2.

Note: If the Location Invocation or Location Delivery Documents are formatted over multiple lines, then the rules for header folding [RFC2616] must be obeyed when the document is inserted into a header. Alternatively, the documents may be formatted into a single line [XML].

The following rule specifies the syntax of the header in augmented BNF defined by [RFC2234]:

X-Wap-Loc-Invocation-value = "X-Wap-Loc-Invocation" ":" *TEXT

The *TEXT is used to denote the Location Invocation document in plain text format. The format of the Location Invocation Document is defined in [LOCFORM].

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Example HTTP GET response with Location Invocation document:

```
HTTP/1.1 200 OK
X-Wap-Loc-Invocation: <?xml version = "1.0" ?>
  <!DOCTYPE invocation PUBLIC
    "-//WAPFORUM//DTD LOC INV 1.0//EN"
    "http://www.wapforum.org/DTD/loc/invocation-1.0.dtd">
  <invocation>
    <!-- invocation data … !>
  </invocation>
Content-Type: text/vnd.wap.wml
Content-Length: 1200

<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
  "http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
  <!-- deck for manual input …!>
</wml>
```

7.2.7. Location Delivery on GET or POST request header

The Location Delivery document MUST be conveyed in a header of the HTTP GET or POST request. The header MUST follow the HTTP header syntax defined in [RFC2616] section 4.2.

The following rule specifies the syntax of the header in augmented BNF defined by [RFC2234]:

X-Wap-Loc-Delivery-value = "X-Wap-Loc-Delivery" ":" *TEXT

The *TEXT is used to denote the Location Delivery document in plain text format. The format of the Location Delivery document is defined in [LOCFORM

Example HTTP GET request with Location Delivery document attached:

```
GET /loc-service HTTP/1.1
Host: www.nearest-restaurant.com
X-Wap-Loc-Delivery: <?xml version = "1.0" ?>
  <!DOCTYPE delivery PUBLIC
    "-//WAPFORUM//DTD LOC DEL 1.0//EN"
    "http://www.wapforum.org/DTD/loc/delivery-1.0.dtd">
  <delivery>
    <!-- delivery data … !>
  </delivery>
```

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7.3. Mapping to WSP

This section describes how the messages are mapped to the Wireless Session Protocol [WSP].

The WSP mapping follows the same semantics as the HTTP mapping. The difference is that the Invocation and Delivery documents are Wireless Binary XML [WBXML] encoded as defined in [LOCFORM].

The following table describes how to map a particular message on WSP.

The name of the message is on the first column of the table. The mapping of the certain message is shown on the same row on which the message is. The column of the mapping shows the document type used to convey the message. The application MUST use that mapping and document type on WSP.

Below the table is the reference to section where the mapping is defined.

	Location Invocation document on	**Location Delivery document on**
`immediate-query-request`	POST request body	
`immediate-query-answer`		POST response body
`deferred-query-request`	POST request body	
`deferred-query-answer`		POST response body
`deferred-query-report`		POST request body
`deferred-stop-request`	POST request body	
`deferred-stop-answer`		POST response body
`attachment-request`	GET or POST response header	
`attachment-answer`		GET or POST request header

Location Invocation on POST request body (see section 7.3.2)

Location Delivery on POST response body (see section 7.3.3)

Location Delivery on POST request body (see section 7.3.4)

Location Invocation on GET or POST response header (see section 7.3.5)

Location Delivery on GET or POST request header (see section 7.3.6)

7.3.1. Message sequences on WSP

Immediate Query Service

If the Immediate Query Service is supported, then the Location Query Functionality MUST support `immediate-query-request` and `immediate-query-answer` messages.

The `immediate-query-request` message MUST be followed by the `immediate-query-answer` message on the same WSP request/response sequence.

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Deferred Query Service

If the Deferred Query Service is supported, then the Location Query Functionality MUST support `deferred-query-request`, `deferred-query-answer`, `deferred-stop-request` and `deferred-stop-answer` messages.

The `deferred-query-request` message MUST be followed by the `deferred-query-answer` message on the same WSP request/response sequence. If the invocation was successful, the `deferred-query-report` message MUST be delivered when the trigger condition given in the `deferred-query-request` message expires (see triggers from [LOCFORM]).

The `deferred-query-report` message MUST be followed by an empty WSP response on the same WSP request/response sequence.

The `deferred-stop-request` message MUST be followed by the `deferred-stop-answer` message on the same WSP request/response sequence.

Attachment Service

If the Attachment Service is supported, then the Location Attachment Functionality MUST support `attachment-answer` message. The `attachment-request` message MAY be supported.

If supported, the `attachment-request` message MAY be followed by the `attachment-answer` message. In the case of e.g. privacy reasons the Location Attachment Functionality MAY ignore the `attachment-request` message.

7.3.2. Location Invocation on POST request body

The Location Invocation document MUST be delivered in the body of the POST request. The Location Invocation document MUST be [WBXML] encoded as defined in [LOCFORM].

The Content-Type header defined in HTTP [RFC2616] MUST be used. The value of the Content-Type header MUST be *application/vnd.wap.locc+wbxml*.

7.3.3. Location Delivery on POST response body

The Location Delivery document MUST be delivered in the body of the POST response. The Location Delivery document MUST be [WBXML] encoded as defined in [LOCFORM].

The Content-Type header defined in HTTP [RFC2616] MUST be used. The value of the Content-Type header MUST be *application/vnd.wap.locc+wbxml*.

7.3.4. Location Delivery on POST request body

The Location Delivery document MUST be delivered in the body of the POST request. The Location Delivery document MUST be [WBXML] encoded as defined in [LOCFORM].

The Content-Type header defined in HTTP [RFC2616] MUST be used. The value of the Content-Type header MUST be *application/vnd.wap.locc+wbxml*.

7.3.5. Location Invocation on GET or POST response header

The Location Invocation document MUST be conveyed in a header of the WSP GET or POST response. The header MUST follow the syntax defined in [WSP] for *X-Wap-Loc-Invocation* header.

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7.3.6. Location Delivery on GET or POST request header

The Location Delivery document MUST be conveyed in a header of the WSP GET or POST request. The header MUST follow the syntax defined in [WSP] for *X-Wap-Loc-Delivery* header.

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7.4. Mapping to PUSH

7.4.1. Location User Agent for PUSH

The PUSH [PUSH] uses the term User Agent. In the Location framework the Location User Agent for Push corresponds to the Location Query Functionality in the WAP client. The only service that can be used with PUSH mapping is the Deferred Query Service.

7.4.2. Mapping to content PUSH

The [PUSH] framework defines the means to push content directly to the WAP client. The Location Invocation document is not different from the Service Loading [PUSHSL] or Service Indication [PUSHSI] XML documents in the way it is conveyed from the PUSH Initiator to the WAP client. This chapter defines how direct content PUSH is used to convey the Location Invocation document to the WAP client. In the PUSH case, no location related answer message from the WAP client is returned, since PUSH does not provide any response mechanism from the WAP client. The Location Delivery document is transported to the recipient using an HTTP/WSP POST as described in section 7.2.5 and 7.3.4.

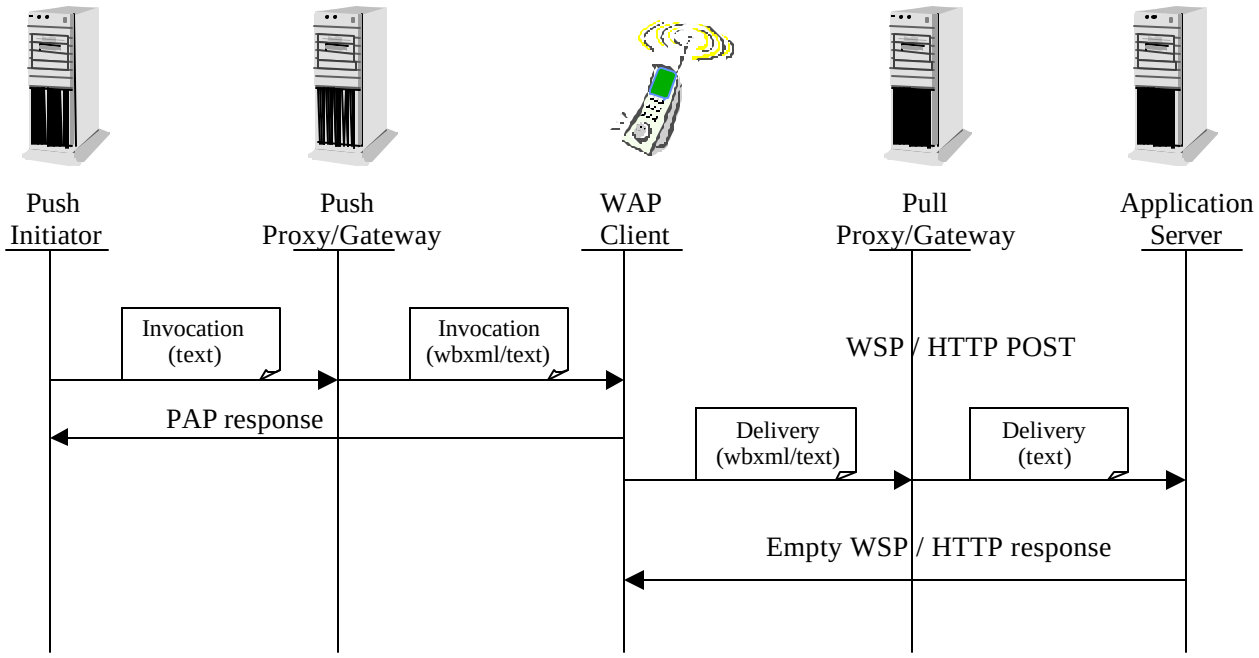

Figure 6: Deferred Query Service with content PUSH

The above figure shows an informative example how an Initiator can request the location of the WAP client by sending a Location Invocation document directly to the WAP client using PUSH. The following steps are involved:

1. The Push Initiator, in this case the Initiator of the Deferred Query Service, instructs the Push Proxy/Gateway to push a Location Invocation document to the WAP client using the Push Access Protocol [PUSHPAP]. The Push Initiator provides the Location Invocation document including the recipient address where to deliver the location. The normal PAP response indicating initial acceptance or failure is returned to the Initiator. The PAP response does not carry a *deferred-query-answer* message.

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2. The Push Proxy/Gateway [PUSHPPG] sends the Location Invocation document to the WAP client using the Push OTA Protocol [PUSHOTA].

3. The WAP client receives the push containing the Invocation document.

4. The WAP client processes the Location Invocation document and decides to post the Location Delivery document to the recipient address defined in the Location Invocation document.

5. The application returns an empty HTTP/WSP response.

Note that at step 4 the processing of the Location Invocation document may include privacy negotiations with the user. How this is done is implementation specific (see [LOCFW]). Note also that the Pull Proxy/Gateway may not be needed.

The following table describes how to map a particular message on content PUSH.

The name of the message is on the first column of the table. The mapping of the certain message is shown on the same row on which the message is. The column of the mapping shows the document type used to convey the message. The application MUST use that mapping and document type on PUSH.

Below the table is the reference to section where the mapping is defined.

	Location Invocation document	**Location Delivery document on**
`deferred-query-request`	as a content of Push Message	
`deferred-query-answer`		Not used
`deferred-query-report`		WSP/HTTP POST request body
`deferred-stop-request`	as a content of Push Message	
`deferred-stop-answer`		Not used

Location Invocation document

- as a content of Push Message (see 7.4.2.1)

Location Delivery document on

- WSP POST request body (see 7.3.4)
- HTTP POST request body (see 7.2.5)

7.4.2.1. Push Message

The Invocation Document MUST be delivered in the body of the PUSH message.

The push message MUST contain the X-Wap-Application-Id header with the application ID defined for the Location User Agent for Push (see [PUSHOTA]). The application ID URI for Location User Agent for Push is *urn:x-wap-application:loc.ua* and the code is *0x06*.

The push message MUST contain the Content-Type header with the MIME type [RFC2045] *application/vnd.wap.loc+xml* when in textual form and *application/vnd.wap.locc+wbxml* when in wireless binary encoded [WBXML] form. If the PUSH OTA protocol is WSP, the Invocation document MUST be Wireless Binary encoded [WBXML], see [LOCFORM]. If the protocol is HTTP then the Invocation document is in textual form.

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7.4.2.2. Behaviour of the Location User Agent for Push

The Location user Agent for Push MAY ignore the Location Invocation document. For example, a user may disable the WAP Location functionality temporarily.

The Location user agent for Push MUST ignore the received content unless the Content-Type header is either *application/vnd.wap.locc+wbxml* or *application/vnd.wap.loc+xml*.

Note: Processing of the `deferred-query-request` message includes determining the value of the recipient address (see [LOCFORM]) and privacy negotiations, which may result to user-intrusive behaviour. Any user privacy negotiations should be done before location information is released.

Note: The number of outstanding deferred query messages for a WAP Client is implementation specific.

7.4.2.3. Message sequences

Deferred Query Service

The `deferred-query-request` message will not be followed by the `deferred-query-answer` message since PUSH does not have a direct response mechanism. Note that the *deferred-query-request* message delivery is followed by normal PAP response which doesn't contain any location protocol related information.

The `deferred-query-report` message MUST be followed by the empty HTTP/WSP response. The Location User Agent for Push MUST ignore any content.

The WAP client address for [PUSHPAP] may be different than the WAP client address in the `deferred-query-request` (see [LOCFORM]). In such case the client will copy the client address from the `deferred-query-request` message to corresponding `deferred-query-report` message sent with the HTTP/WSP response.

The `deferred-stop-request` message will not be followed by the `deferred-stop-answer` message since PUSH does not have a direct response mechanism. Note that the *deferred-stop-request* message delivery is followed by normal PAP response which doesn't contain any location protocol related information.

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7.5. Examples on Combining the Mappings, Informative

7.5.1. Deferred Query Example

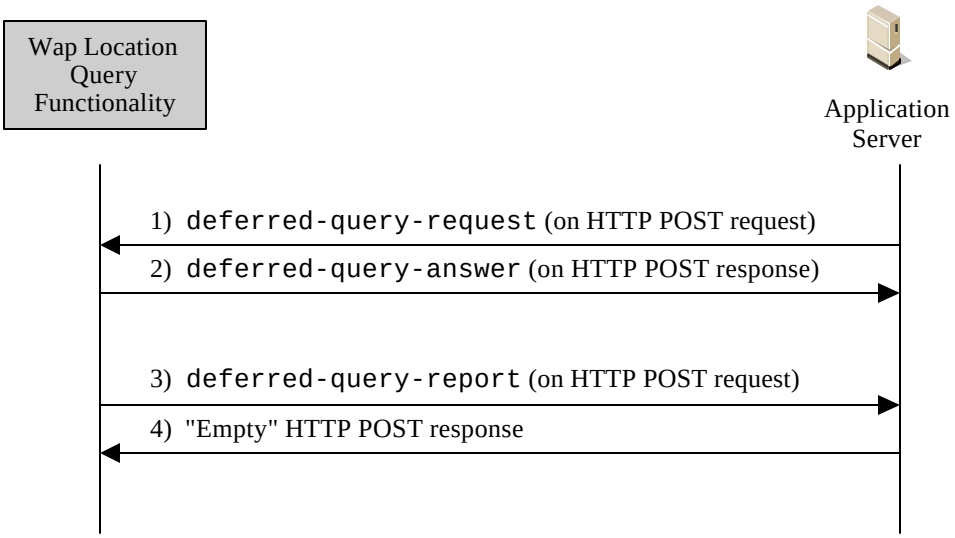

Figure 7: Example message sequence on Deferred Query over HTTP.

The picture above shows message flows in the Deferred Query Service example. This example is essentially the same that is given in the Location Framework Overview document [LOCFW] as a tracking example. In this example the Application Server acts as an Initiator of the Deferred Query Service.

The flow of messages is explained below.

(1) The Application Server sends a HTTP POST request to the Location Query Functionality with the Location Invocation Document in the body (`deferred-query-request` message):

```
POST /loc-service HTTP/1.1
Host: www.loc-query-func.com
Content-Type: application/vnd.wap.loc+xml
Content-Length: 120

<?xml version = "1.0" ?>
<!DOCTYPE invocation PUBLIC
  "-//WAPFORUM//DTD LOC INV 1.0//EN"
  "http://www.wapforum.org/DTD/loc/invocation-1.0.dtd">
<invocation>
  <!-- invocation data with interval trigger … !>
</invocation>
```

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(2) The Location Query Functionality responses with the `deferred-query-answer` message that it has accepted the service invocation

```
HTTP/1.1 200 OK
Content-Type: application/vnd.wap.loc+xml
Content-Length: 220

<?xml version = "1.0" ?>
<!DOCTYPE delivery PUBLIC
  "-//WAPFORUM//DTD LOC DEL 1.0//EN"
  "http://www.wapforum.org/DTD/loc/delivery-1.0.dtd">
<delivery>
  <!-- delivery data with the status … !>
</delivery>
```

(3) The trigger event (interval elapsed) has been generated so the Location Query Functionality sends a `deferred-query-report` message to the application server:

```
POST /loc-service HTTP/1.1
Host: www.service.com
Content-Type: application/vnd.wap.loc+xml
Content-Length: 220

<?xml version = "1.0" ?>
<!DOCTYPE delivery PUBLIC
  "-//WAPFORUM//DTD LOC DEL 1.0//EN"
  "http://www.wapforum.org/DTD/loc/delivery-1.0.dtd">
<delivery>
  <!-- delivery data with the location information … !>
</delivery>
```

(4) The application server returns an empty HTTP POST response

```
HTTP/1.1 204 No Content
```

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7.5.2. Location Attachment Examples

7.5.2.1. The Attachment Functionality on proxy

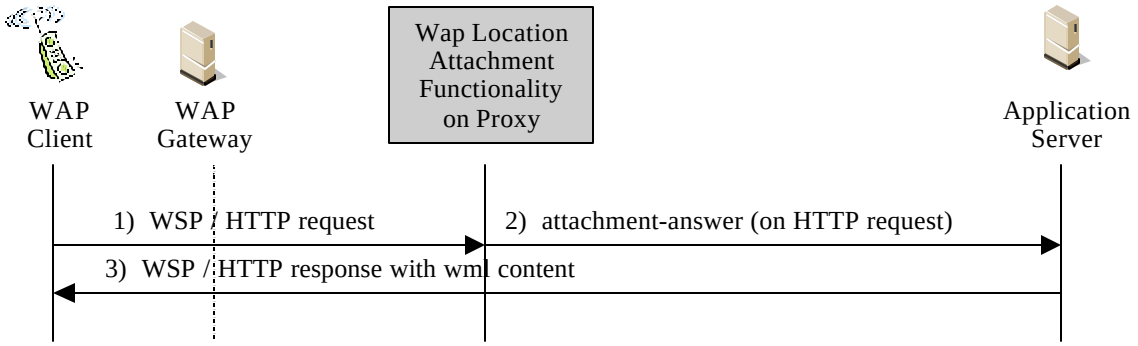

Figure 8: Example of message flows in Attachment Service.

The picture above shows message flows in the Attachment Service when the Location Attachment Functionality is located on the proxy between WAP client and the application server. This example is essentially the same that is given in the Location Framework Overview document [LOCFW] as a "Find Nearest Restaurant" example. In this example the WAP client, without location capabilities, makes a requests to http://www.nearest-restaurant.com/nearest.

The flow of messages is explained below.

(1) The WAP client sends a WSP GET request that is converted to a HTTP GET request by the WAP Gateway:

```
GET /nearest HTTP/1.1
Host: www.nearest-restaurant.com
Accept: text/vnd.wap.wml
```

(2) In this exa mple (other cases shown later), the Location Attachment Functionality located in a proxy already knows that the addressed application needs location information. It attaches a Location Delivery Document, containing an `attachment-answer` message, to the request:

```
GET /nearest HTTP/1.1
Host: www.nearest-restaurant.com
Accept: text/vnd.wap.wml
X-Wap-Loc-Delivery: <?xml version = "1.0" ?>
  <!DOCTYPE delivery PUBLIC
    "-//WAPFORUM//DTD LOC DEL 1.0//EN"
    "http://www.wapforum.org/DTD/loc/delivery-1.0.dtd">
  <delivery>
    <!-- delivery data with the location information … !>
  </delivery>
```

(3) The Application server returns the content that has been generated according to the location of the WAP client:

```
HTTP/1.1 200 OK
Content-Type: text/vnd.wap.wml
Content-Length: 1200

<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
  "http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
  <!-- …!>
```

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```
</wml>
```

7.5.2.2. The Attachment Functionality on WAP Client

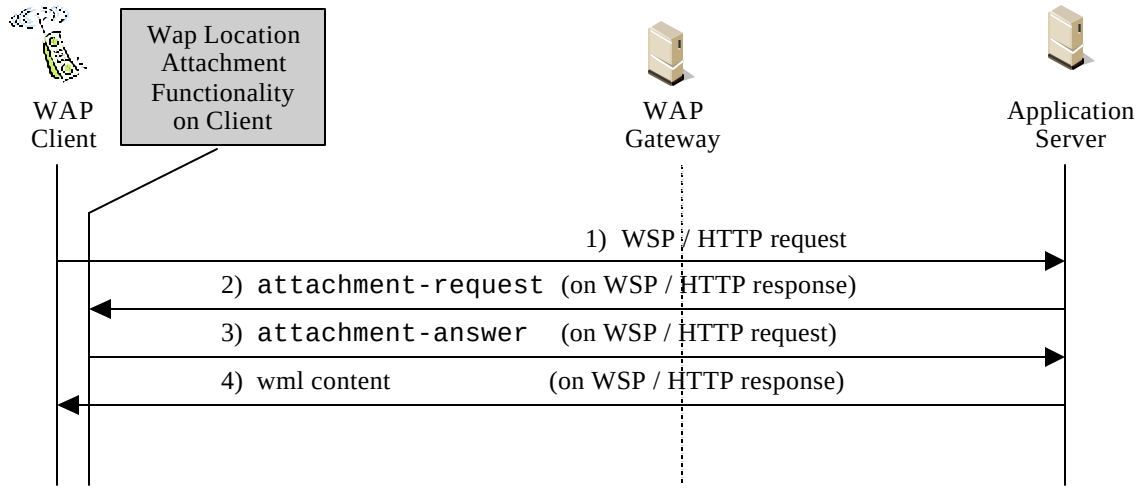

Figure 9: Example of message flows in Attachment Service.

The picture above shows message flows in the Attachment Service using `attachment-request` message when the Location Attachment Functionality is on the WAP client. This example is essentially the same that is given in the Location Framework Overview document [LOCFW] as a "Find Nearest Restaurant" example. In this example the WAP client with location capabilities makes a requests to http://www.nearest-restaurant.com/nearest.

(1) The WAP client sends a WSP GET request that is converted to HTTP GET request by the WAP Gateway

```
GET /nearest HTTP/1.1
Host: www.nearest-restaurant.com
Accept: text/vnd.wap.wml
```

(2) The Application server detects from the request that it doesn't include the location data that is used for generating the content. It then creates a WML page so that a user can manually input the location in case there are no location capabilities in the WAP client or in the network. The application also attaches the Location Invocation document to the response (`attachment-request` message):

```
HTTP/1.1 200 OK
X-Wap-Loc-Invocation: <?xml version = "1.0" ?>
  <!DOCTYPE invocation PUBLIC
    "-//WAPFORUM//DTD LOC INV 1.0//EN"
    "http://www.wapforum.org/DTD/loc/invocation-1.0.dtd">
  <invocation>
    <!-- request data … !>
  </invocation>
Content-Type: text/vnd.wap.wml
Content-Length: 500

<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
  "http://www.wapforum.org/DTD/wml_1.1.xml">

<wml>
  <!-- deck for manual input!>
</wml>
```

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(3) The Location Attachment Functionality in the WAP client detects the Location Invocation document and is able to locate itself. It then reissues the request to the Application with the Location Delivery Document attached (`attachment-answer` message), ignoring the default content.

```
GET /nearest HTTP/1.1
Host: www.nearest-restaurants.com
Accept: text/vnd.wap.wml
X-Wap-Loc-Delivery: <?xml version = "1.0" ?>
  <!DOCTYPE delivery PUBLIC
    "-//WAPFORUM//DTD LOC DEL 1.0//EN"
    "http://www.wapforum.org/DTD/loc/delivery-1.0.dtd">
  <delivery>
    <!-- delivery data with the location information … !>
  </delivery>
```

(4) The application server returns the content that has been generated according the location of the client

```
HTTP/1.1 200 OK
Content-Type: text/vnd.wap.wml
Content-Length: 1200

<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
  "http://www.wapforum.org/DTD/wml_1.1.xml">

<wml>
  <!-- …!>
</wml>
```

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Appendix A. Static Conformance Requirements (Normative)

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

A.1. Location Functionalities on the WAP Client

Item	Function	Reference	Status	Requirement
LOCPROT-LF-C-001	Support for Location Framework	6	M	LOCPROT-LF-C-002 OR LOCPROT-LF-C-004
LOCPROT-LF-C-002	Support for Query Functionality	6	O	LOCPROT-LF-C-003
LOCPROT-LF-C-003	Support for Deferred Query Service	6	O	LOCPROT-DQS-C-001
LOCPROT-LF-C-004	Support for Attachment Functionality	6	O	LOCPROT-LF-C-005
LOCPROT-LF-C-005	Support for Attachment Service	6	O	LOCPROT-ASH-C-001 OR LOCPROT-ASW-C-001

A.1.1 Deferred Query Service on PUSH

Item	Function	Reference	Status	Requirement
LOCPROT-DQS-C-001	Support for Deferred Query Service on PUSH	7.4.2	O	PushMessage: MCF AND PushOTA: MCF AND PushMessage: MSG-GEN-C-003 AND LOCPROT-DQS-C-002 AND LOCPROT-DQS-C-003 AND LOCPROT-DQS-C-004
LOCPROT-DQS-C-002	Message sequences	7.4.2.3	O	LOCPROT-DQS-C-006 AND LOCPROT-DQS-C-010
LOCPROT-DQS-C-003	User Agent behaviour	7.4.1 7.4.2.2	O	
LOCPROT-DQS-C-004	Push message	7.4.2.1	O	LOCPROT-DQS-C-005
LOCPROT-DQS-C-005	Support for at least one message element in the Invocation document	7.4.2.1	O	
LOCPROT-DQS-C-006	Support for deferred-query-request message	7.4.2.3	O	LOCFORM-DQRQ-C-001 AND (LOCPROT-DQS-C-008 OR LOCPROT-DQS-C-009)
LOCPROT-DQS-C-007	Support for deferred-stop-request message	7.4.2.3	O	LOCFORM-DSR-C-001 AND (LOCPROT-DQS-C-008 OR LOCPROT-DQS-C-009)
LOCPROT-DQS-C-008	Location Invocation document on PUSH OTA over WSP	7.3.4	O	LOCFORM-INV-C-002
LOCPROT-DQS-C-009	Location Invocation document on PUSH OTA over HTTP	7.3.4	O	LOCFORM-INV-C-001
LOCPROT-DQS-C-010	Deferred-query-report message	7.3.4 7.4.2.3	O	LOCPROT-DQS-C-011 OR LOCPROT-DQS-C-012
LOCPROT-DQS-C-011	Location Delivery document on body of WSP POST request	7.3.4	O	LOCFORM-DQRP-C-001 AND LOCFORM-DEL-C-002

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LOCPROT-DQS-C-012	Location Delivery document on body of HTTP POST request	7.2.5	O	LOCFORM-DQRP-C-001 AND LOCFORM-DEL-C-001

A.1.2 Attachment Service on HTTP

Item	Function	Reference	Status	Requirement
LOCPROT-ASH-C-001	Support for Attachment Service on HTTP	7.2	O	LOCPROT-ASH-C-002
LOCPROT-ASH-C-002	Message sequences	7.2.1	O	LOCPROT-ASH-C-005
LOCPROT-ASH-C-003	Support for Attachment-request message	6 7.2.1	O	LOCPROT-ASH-C-004 AND LOCFORM-AR-C-001
LOCPROT-ASH-C-004	Attachment-request message in Location Invocation document on header of response	7.2.6	O	LOCFORM-INV-C-001
LOCPROT-ASH-C-005	Support for the attachment-answer message	6 7.2.1	O	LOCPROT-ASH-C-006 AND LOCFORM-AA-C-001
LOCPROT-ASH-C-006	Attachment-answer message in Location Delivery document on header of request	7.2.7	O	LOCFORM-DEL-C-001

A.1.3 Attachment Service on WSP

Item	Function	Reference	Status	Requirement
LOCPROT-ASW-C-001	Support for Attachment Service on WSP	6 7.3	O	LOCPROT-ASW-C-002
LOCPROT-ASW-C-002	Message sequences	7.3.1	O	LOCPROT-ASW-C-005
LOCPROT-ASW-C-003	Support for Attachment-request message	6 7.3	O	LOCPROT-ASW-C-004 AND LOCFORM-AR-C-001
LOCPROT-ASW-C-004	Attachment-request message in Location Invocation document on header of response	7.3.5	O	LOCFORM-INV-C-002
LOCPROT-ASW-C-005	Support for Attachment-answer message	6 7.3	O	LOCPROT-ASW-C-006 AND LOCFORM-AA-C-001
LOCPROT-ASW-C-006	Attachment-answer message in Location Delivery document on header of request	7.3.6	O	LOCFORM-DEL-C-002

A.2. Location Functionalities on the Location Network

Item	Function	Reference	Status	Requirement
LOCPROT-LF-S-001	Support for Location Framework	6	M	LOCPROT-LF-S-002 OR LOCPROT-LF-S-005

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LOCPROT-LF-S-002	Support for Query Functionality	6	O	LOCPROT-LF-S-003
LOCPROT-LF-S-003	Support for Immediate Query Service	6	O	LOCPROT-IQSH-S-001
LOCPROT-LF-S-004	Support for Deferred Query Service	6	O	LOCPROT-DQSH-S-001
LOCPROT-LF-S-005	Support for Attachment Functionality	6	O	LOCPROT-LF-S-006
LOCPROT-LF-S-006	Support for Attachment Service	6	O	LOCPROT-ASH-S-001

A.2.1 Immediate Query Service on HTTP

Item	Function	Reference	Status	Requirement
LOCPROT-IQSH-S-001	Support for Immediate Query Service on HTTP	6 7.2	O	LOCPROT-IQSH-S-002
LOCPROT-IQSH-S-002	Message sequences	7.2.1	O	LOCPROT-IQSH-S-003 AND LOCPROT-IQSH-S-004
LOCPROT-IQSH-S-003	Immediate-query-answer message in Location Delivery document on body of POST response	7.2.4	O	LOCFORM-IQA-S-001 AND LOCFORM-DEL-S-001
LOCPROT-IQSH-S-004	Immediate-query-request in Location Invocation document on body of POST request	7.2.3	O	LOCFORM-IQR-S-001 AND LOCFORM-INV-S-001

A.2.2 Deferred Query Service on HTTP

Item	Function	Reference	Status	Requirement
LOCPROT-DQSH-S-001	Support for Deferred Query Service on HTTP	6 7.2	O	LOCPROT-DQSH-002
LOCPROT-DQSH-S-002	Message sequences	7.2.1	O	LOCPROT-DQSH-003 AND LOCPROT-DQSH-004 AND LOCPROT-DQSH-005 AND LOCPROT-DQSH-006 AND LOCPROT-DQSH-007
LOCPROT-DQSH-S-003	Deferred-query-request message in Location Invocation document on body of POST request	7.2.3	O	LOCFORM-INV-S-001 AND LOCFORM-DQRQ-S-001
LOCPROT-DQSH-S-004	Deferred-query-answer in Location Delivery document on body of POST response	7.2.4	O	LOCFORM-DEL-S-001 AND LOCFORM-DQA-S-001
LOCPROT-DQSH-S-005	Deferred-query-report message in Location Delivery document on body of POST request	7.2.5	O	LOCFORM-DEL-S-001 AND LOCFORM-DQRP-S-001
LOCPROT-DQSH-S-006	Deferred-stop-request in Location Invocation document on body of POST request	7.2.3	O	LOCFORM-INV-S-001 AND LOCFORM-DSR-S-001
LOCPROT-DQSH-S-007	Deferred-stop-answer in Location Delivery document on body of POST response	7.2.4	O	LOCFORM-DEL-S-001 AND LOCFORM-DSA-S-001

A.2.3 Attachment Service on HTTP

Item	Function	Reference	Status	Requirement
LOCPROT-ASH-S-001	Support for Attachment Service on HTTP	7.2	O	LOCPROT-ASH-S-002
LOCPROT-ASH-S-002	Message sequences	7.2.1	O	LOCPROT-ASH-S-005

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LOCPROT-ASH-S-003	Support for Attachment-request message	6 7.2.1	O	LOCPROT-ASH-S-004 AND LOCFORM-AR-S-001
LOCPROT-ASH-S-004	Attachment-request message in Location Invocation document on header of response	7.2.6	O	LOCFORM-INV-S-001
LOCPROT-ASH-S-005	Support for the attachment-answer message	6 7.2.1	O	LOCPROT-ASH-S-006 AND LOCFORM-AA-S-001
LOCPROT-ASH-S-006	Attachment-answer message in Location Delivery document on header of request	7.2.7	O	LOCFORM-DEL-S-001

A.3. Push Proxy Gateway Features

A.3.1 Predicates

Item	Function	Reference	Status	Requirement
LOCPROT-PPGPRE-S-001	The PPG supports PUSH OTA over WSP in the scope of WAP Class Conformance.		O	PushOTA:MSF AND WSP:MSF AND PPGService:MSF AND LOCPROT-PPG-S-001
LOCPROT-PPGPRE-S-002	The PPG supports PUSH OTA over HTTP in the scope of WAP Class Conformance.		O	PushOTA:MSF AND PPGService:MSF AND LOCPROT-PPG-S-002

A.3.2 PPG

Item	Function	Reference	Status	Requirement
LOCPROT-PPG-S-001	Support for delivery of the Invocation document using PUSH OTA over WSP	7.4.2	O	LOCFORM-INV-S-002
LOCPROT-PPG-S-002	Support for delivery of the Invocation document using PUSH OTA over HTTP	7.4.2	O	LOCFORM-INV-S-001

A.4. Pull Gateway Features

A.4.1 Predicates

Item	Function	Reference	Status	Requirement
LOCPROT-GWPRE-S-001	The Gateway supports WSP in the scope of WAP Class Conformance.		O	WSP:MSF AND LOCFORM-GW-S-001 AND LOCFORM-GW-S-002 AND LOCFORM-GW-S-003 AND LOCFORM-GW-S-004 AND LOCFORM-GW-S-005

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A.4.2 Gateway requirements

Item	Function	Reference	Status	Requirement
LOCPROT-GW-S-001	The Invocation document over WSP on POST request body	7.3.2	O	LOCFORM-INV-S-002
LOCPROT-GW-S-002	The Delivery document over WSP on POST request body	7.3.4	O	LOCFORM-DEL-S-002
LOCPROT-GW-S-003	The Delivery document over WSP on POST response body	7.3.3	O	LOCFORM-DEL-S-002
LOCPROT-GW-S-004	The Invocation document over WSP in the header of the response	7.3.5	O	LOCFORM-INV-S-002
LOCPROT-GW-S-005	The Delivery document over WSP in the header of the request	7.3.6	O	LOCFORM-DEL-S-002

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Appendix B. Change History (Informative)

Type of Change	Date	Section	Description
Class 0	2001-09-12		Current

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