



# TrueFix<sup>®</sup> Wi-Fi Positioning System Server API

**Version 2.24**

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## 1 Introduction

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### 1.1 HIGH-LEVEL DESCRIPTION

The TrueFix Server exposes an XML-over-HTTPS 1.1 API with XML schema to describe its request/response messages.

The Location API end-point will be provided by TruePosition and includes at the end operation.

**Example:** <https://tf-dev.trueposition.com:8443/wps2/<operation>>

By convention the top-level element of an XML message describes the operation name.

Request messages are identified by appending "RQ" to the operation name, and responses are identified by appending "RS".

The TrueFix Server Location API provides access to positioning information derived from the analysis of Wi-Fi access points and cell IDs in known locations. The client applications make XML-over-HTTPS calls to the Location Server API providing a listing of observed access points and cell IDs within range of the client device, along with GPS information if available. The Location Server API returns a calculated geographic location based on those inputs.

Client-server connection is non-persistent. The client and the server must open a connection socket for each request/response exchange and then close it. Multiple concurrent requests are supported by having a separate thread of execution.

## 1.2 REQUESTS

Request messages follow the following generic XML schema:

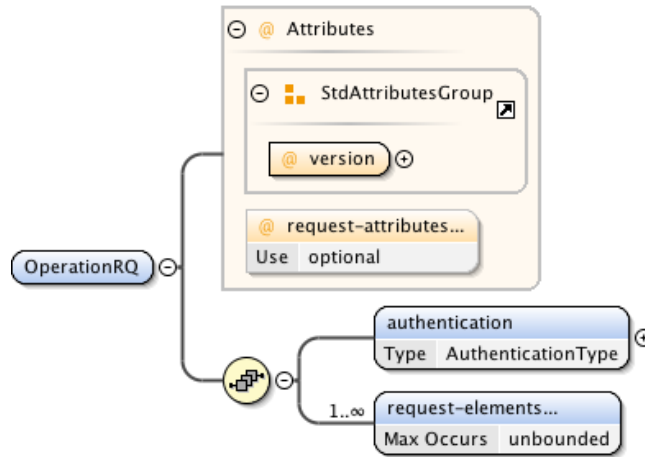


Figure 1: Request Message Schema

All requests require the client to be authenticated with the server and include authentication information passed in the `authentication` element.

Requests may pass information to the server as elements and/or as attributes. Those are defined by the schema for each operation.

All requests include a `version` attribute.

The client should post any requests (RQ) to TrueFix server as host and include content type of "text/xml".

## 1.3 RESPONSES

Successful responses will typically include elements containing the actual response from the server.

Unsuccessful responses will return an http error.

All responses include a `version` attribute, copied from the request.

## 1.4 VERSIONING

Versioning of the API is handled in two complementary ways:

- The request/response XML namespace defines a major revision number
- A version attribute of the top-level element of the request/response defines a revision number within the major revision defined by the namespace.

Version 2.3 of the API defines the major revision number as "<http://trueposition.com/truefix>" and "2.3" as the minor revision number.

Version 2.2 is backward compatible with version 2.1, itself backward compatible with version 2.0. Therefore, version 2.2 is backward compatible with version 2.0. However, version 2.0 is incompatible with version 1.0.

## 1.5 AUTHENTICATION

The client will use a key authentication method where it sends a secret (provided by TruePosition) key in each request. Server authentication will be supported via private certificate created and stored in the TrueFix server.

The key element of the `AuthenticationType` is defined by the following schema:

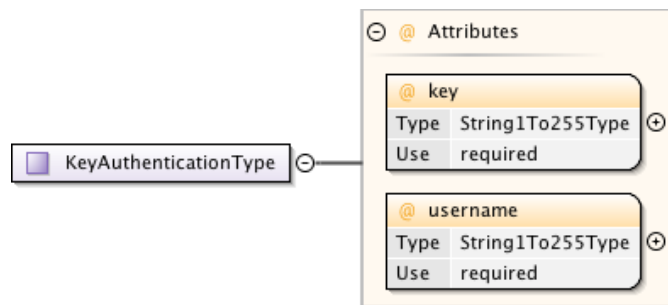


Figure 2: Authentication Type Schema

Example:

```

<authentication xmlns=http://skyhookwireless.com/wps/2005 version="2.2">
  <key key="eJwz5DTkLM6u1234567PLerNSS0u1kvOzwUAWu8IWA"
  username="001A1EDE45E0"/>
</authentication>
  
```

Definitions:

- key – authentication key (provided by TruePosition)
- username – the username identifying the user. It is recommended to include in the user name the MAC Address of the device (or other unique device identifier).

## 1.6 TRANSACTION ID

Each request may include a TrueFix Transaction ID <tftid> element in the xml. The transactionID is generated by the client and shall allow to uniquely identify a session globally. If transactionID is available in the request, TrueFix server will send it back in the response message. The tftid format is a string of up to 60 ascii characters. Example:

```
<tfparams>
```

```
    <tftid>8bbbd2e-7760-462e-8e09-5ebccfd9588c-00000000-00</tftid>
```

```
</tfparams>
```

## 1.7 ERROR HANDLING

An unsuccessful request to the server returns an HTTP response with appropriate status code.

## 2 Location Request

**Description:** Requests geographic location of a device based on observed access points, cell IDs and GPS locations.

**End-point:** The Location API end-point will be provided by TruePosition. The operation is "location".

**Example:** <https://tf-dev.trueposition.com:8443/wps2/location>

### 2.1 REQUEST SCHEMAS

#### 2.1.1 Overall Request Schema

Location request messages are defined by the following schema:

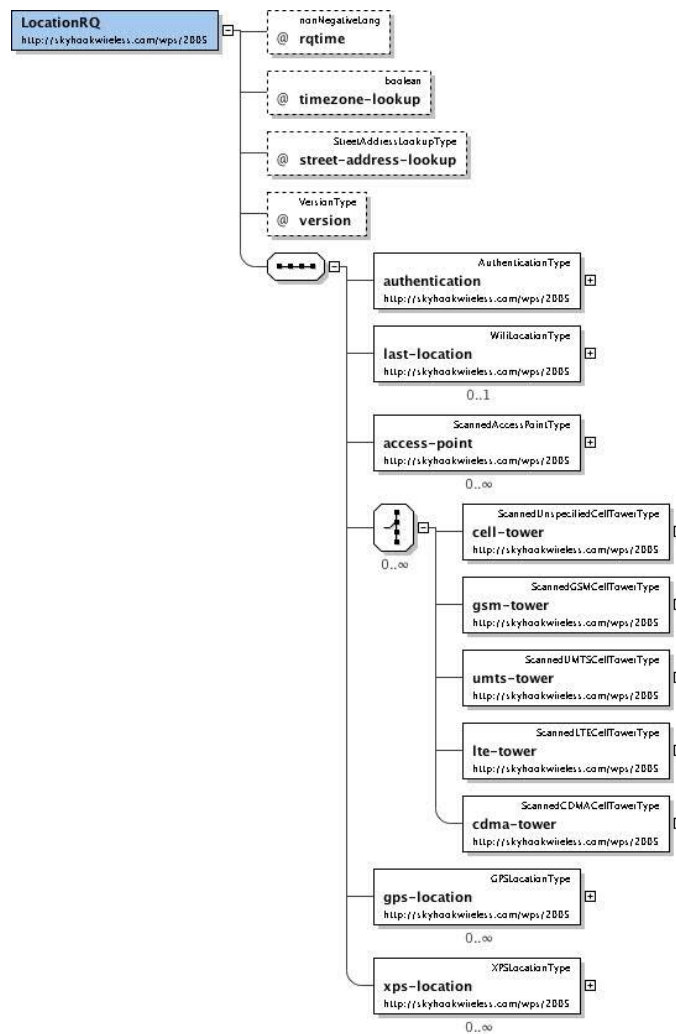


Figure 3: Location Request Schema

Definitions:



- `access-point` – list of access-points observed during a scan, provided as a list of access-point elements
- `cell-tower` – list of cell towers observed, provided as a list of cell-tower elements
- `gsm-tower` – list of GSM cell towers observed, provided as a list of gsm-tower elements
- `umts-tower` – list of UMTS cell towers observed, provided as a list of umts-tower elements
- `lte-tower` – list of LTE cell towers observed, provided as a list of lte-tower elements
- `cdma-tower` – list of CDMA cell towers observed, provided as a list of cdma-tower elements
- `gps-location` – list of GPS points observed during a scan, provided as a list of gps-location elements
- `last-location` – last known location, if available
- `gps-location` – list of GPS locations gathered during the measurement scan, provided as a list of gps-location elements
- `XPS-location` – reserved
- `rqtime` – timestamp of when measurements in request were collected
- `timezone-lookup` – reserved
- `street-address-lookup` – reserved

## 2.1.2 Element Definition

Some elements are reserved for future or TruePosition internal use and not detailed below.

### 2.1.2.1 Access-point

The `access-point` element is defined by the following schema:

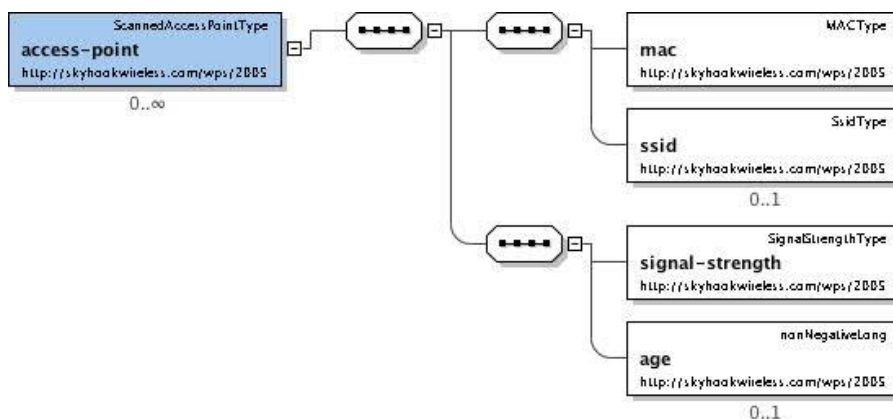


Figure 4: access-point Element Schema

## Definitions:

- `mac` – MAC address of the access point. MAC address must be a complete and valid MAC address. Each character should be capitalized and separators (colons, dashes, etc.), if any, should be removed. For example: 000C4182D88C.
- `ssid` – SSID of the access point, if available
- `signal-strength` – observed signal strength of the access point, in decibels (dBm)
- `age` – relative age of the measurement (relative to other measurements in the message), in milliseconds (if available)

## 2.1.2.2 Cell-tower

The `cell-tower` element is defined by the following schema:

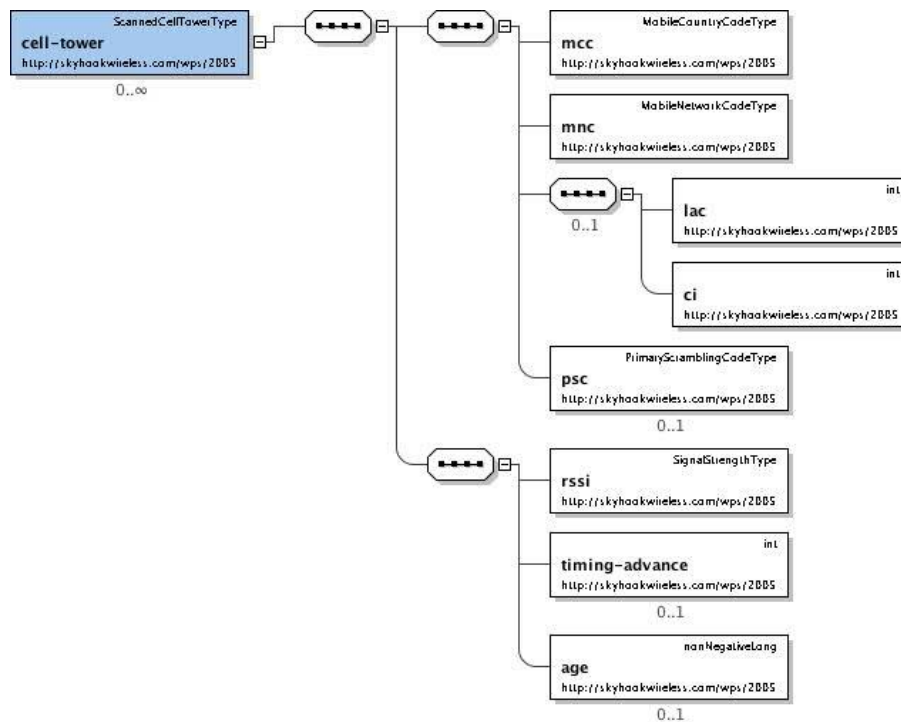


Figure 5: cell-tower Element Schema

## Definitions:

- `mcc` – mobile country code
- `mnc` – mobile network code
- `lac` – local area code (if available)
- `ci` – cell id (if available)
- `psc` – primary scrambling code (if available)

- `rss` – received signal strength from the tower, in decibels (dBm)
- `timing-advance` – timing advance (if available)
- `age` – relative age of the measurement, in milliseconds (if available)

### 2.1.2.3 GSM-tower

The `gsm-tower` element is defined by the following schema:

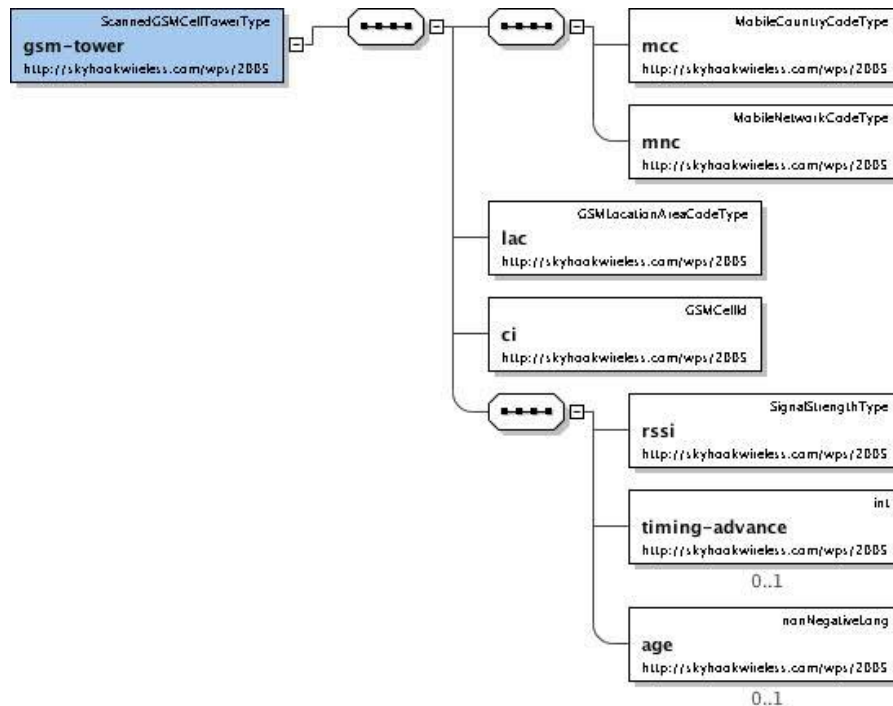


Figure 6: `gsm-tower` Element Schema

Definitions:

- `mcc` – mobile country code
- `mnc` – mobile network code
- `lac` – local area code (if available)
- `ci` – cell id (if available)
- `rss` – received signal strength from the tower, in decibels (dBm)
- `age` – relative age of the measurement, in milliseconds (if available)

## 2.1.2.4 UMTS-tower

The `umts-tower` element is defined by the following schema:

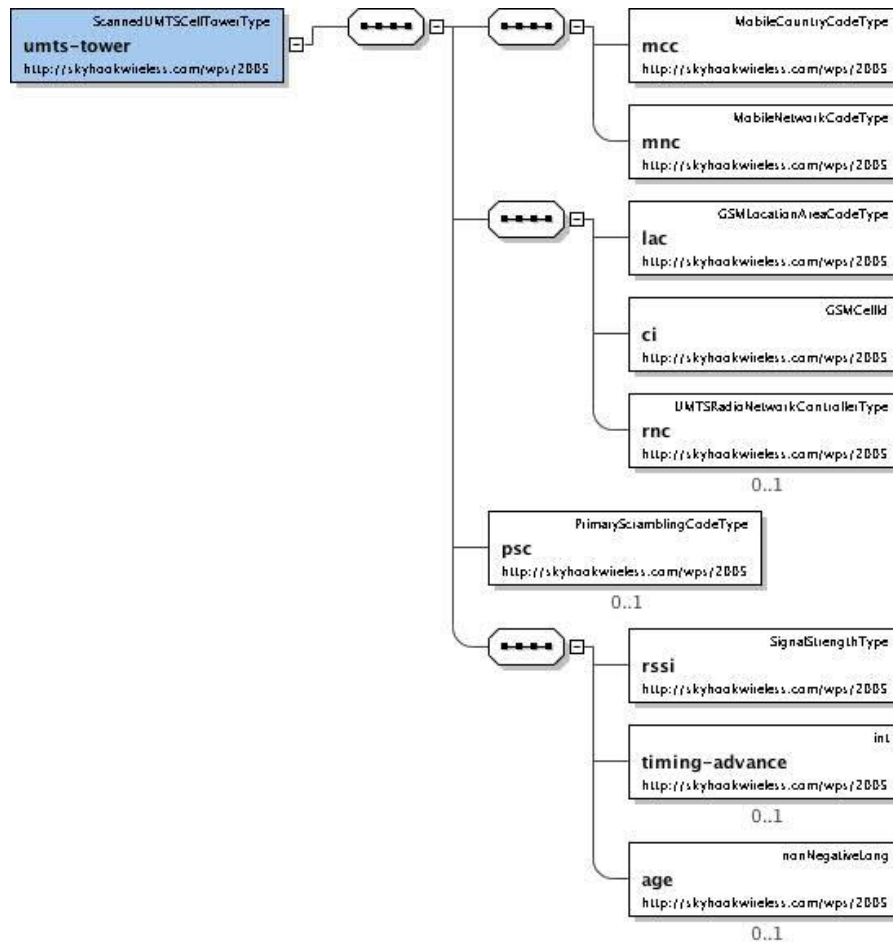


Figure 7: `umts-tower` Element Schema

Definitions:

- `mcc` – mobile country code
- `mnc` – mobile network code
- `lac` – local area code
- `ci` – cell id
- `rnc` – radio network controller (if available)
- `rsi` – received signal strength from the tower, in decibels (dBm)
- `age` – relative age of the measurement, in milliseconds (if available)

## 2.1.2.5 LTE-tower

The `lte-tower` element is defined by the following schema:

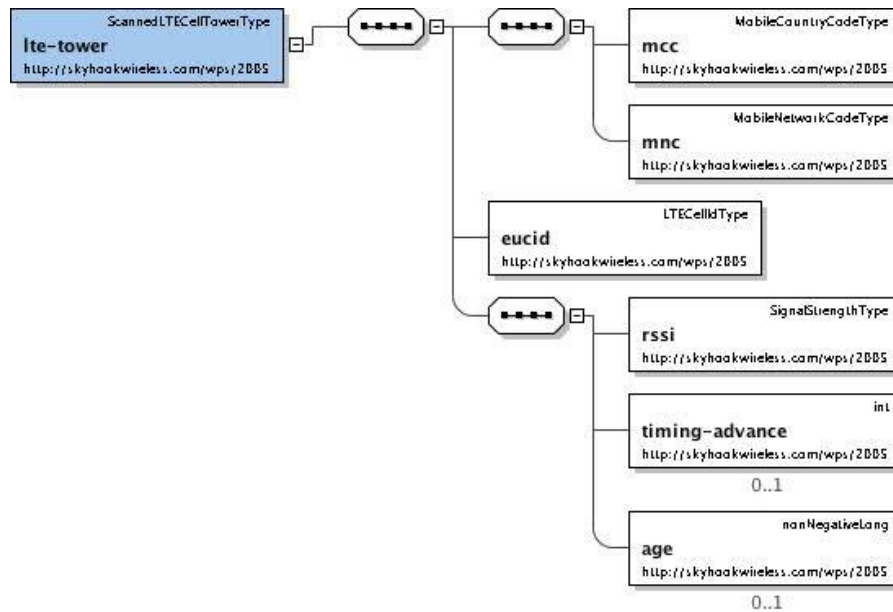


Figure 8: lte-tower Element Schema

Definitions:

- `mcc` – mobile country code
- `mnc` – mobile network code
- `euclid` – cell id
- `rssti` – received signal strength from the tower, in decibels (dBm)
- `age` – relative age of the measurement, in milliseconds (if available)

## 2.1.2.6 CDMA-tower

The cdma-tower element is defined by the following schema:

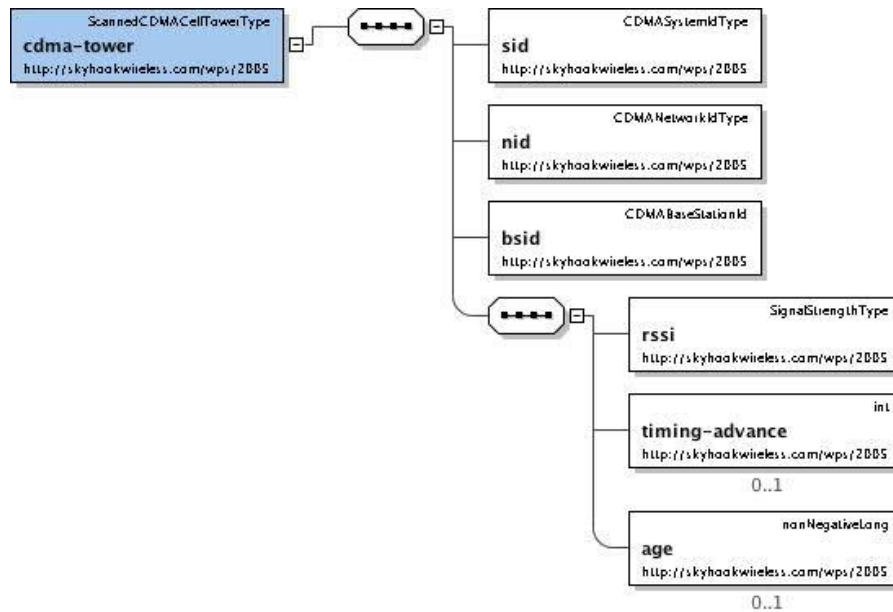


Figure 9: cdma-tower Element Schema

Definitions:

- `sid` – system identifier
- `nid` – network identifier
- `bsid` – base system identifier
- `rssti` – received signal strength from the tower, in decibels (dBm)
- `age` – relative age of the measurement, in milliseconds (if available)

2.1.2.7 GPS-location

The gps-location element is defined by the following schema:

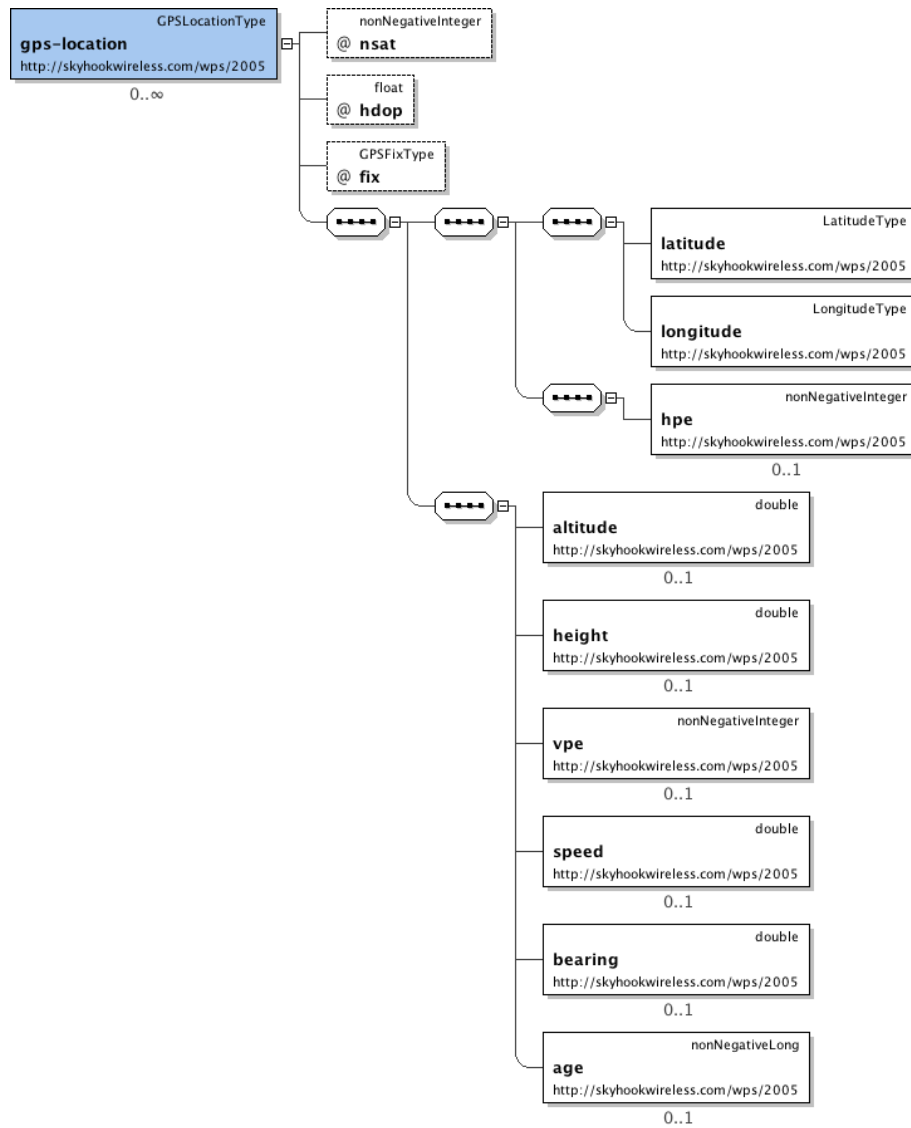


Figure 10: gps-location Element Schema

Definitions

- nsat – number of satellites used to calculate the location
- hdop – Horizontal DOP (Dilution of Precision), as reported by the GPS unit
- fix – type of fix:
  1. GPS (default)
  2. DGPS
  3. PPS

4. RTK
5. FRTK
6. Estimated
7. MIM
8. SM

- `latitude` and `longitude` – calculated physical geographic location, expressed in decimal degrees using floating point values using the WGS84 datum
- `uncertainty` – estimated horizontal error of the location, in meters with 68% confidence
- `altitude` – altitude above mean sea level, in meters
- `height` – height above WGS84 ellipsoid, in meters
- `vpe` (vertical positioning error) – estimated vertical error of the altitude, in meters with 67% confidence
- `speed` – speed in meters/sec
- `bearing` – bearing as degree from North counterclockwise (+90 is West)
- `age` – relative age of the measurement, in milliseconds (if available)



### 3 Location Response

Location response messages are defined by the following schema:

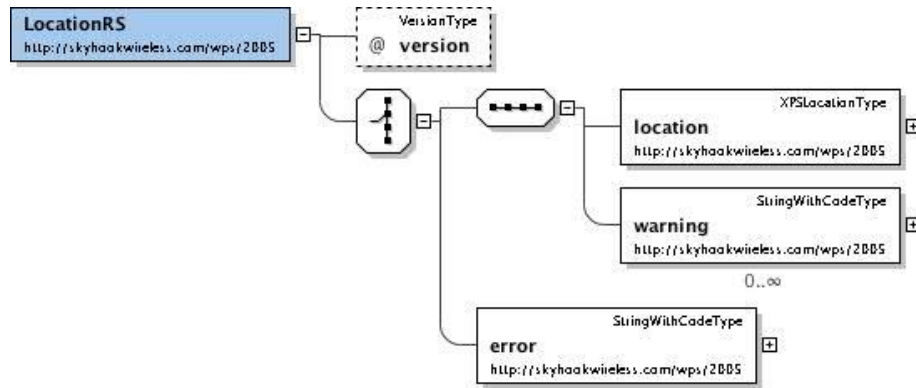


Figure 11: Location Response Schema

If a geographical location can be devised from the access-points, cell towers and GPS locations, the Location Server API will respond with a successful location response including location or error element.

#### 3.1.1 Location Elements:

- `age` – relative age of the location, in milliseconds
- `latitude` and `longitude` – calculated physical geographic location, expressed in decimal degrees using floating point values using the WGS84 datum
- `hpe` – estimated horizontal error of the location (uncertainty), in meters with 90% confidence

## 4 Example

---

```
<?xml version="1.0" encoding="UTF-8"?>
<LocationRQ xmlns="http://trueposition.com/truefix" version="2.24">
  <authentication version="2.2">
    <key key='effVwUESABAIAMCzxxzRTUepI8inj78YuFcKvNvNyUiZKBMKMxoGYF5imAYkrexbUe8DEZkLDQ'
username ='001A1EDE45E0' />
  </authentication>
  <tfparams>
    <tftid>8bbbd2e-7760-462e-8e09-5ebccfd9588c-00000000-00</tftid>
  </tfparams>
  <access-point>
    <mac>14D64DF3990E</mac>
    <ssid>MyAP</ssid>
    <signal-strength>-50</signal-strength>
    <age>9000</age>
  </access-point>
  <access-point>
    <mac>00045A0E272B</mac>
    <signal-strength>-50</signal-strength>
    <age>149</age>
  </access-point>
  <cell-tower>
    <mcc>310</mcc>
    <mnc>410</mnc>
    <lac>6010</lac>
    <ci>5462</ci>
    <rssi>-38</rssi>
    <age>10582</age>
  </cell-tower>
  <gps-location fix="1" nsat="6">
    <latitude>42.2970025</latitude>
    <longitude>-71.2333229</longitude>
    <hpe>9</hpe>
    <altitude>43</altitude>
    <height>-41</height>
    <vpe>10</vpe>
    <age>987</age>
  </gps-location>
</LocationRQ>
```

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<LocationRS version="2.24" xmlns="http://trueposition.com/truefix">
  <tfparams>
    <tftid>8bbbd2e-7760-462e-8e09-5ebccfd9588c-00000000-00</tftid>
  </tfparams>
  <location age="987">
    <latitude>42.297003</latitude>
    <longitude>-71.233323</longitude>
    <hpe>9</hpe>
  </location>
</LocationRS>
```