

Protocol Specification

Combain Positioning Service

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1. Background

Combain positioning service is a web service API that enables developers and mobile service providers to locate mobile phones and other mobile devices connected to the GSM, WCDMA, CDMA, LTE and Wifi networks.

The cell information is sent via the API, and Combain returns the most likely position by look-up in the positioning database and using positioning algorithms. The database is global with very good coverage and includes cells-id from more than 200 countries and more than 1000 operators. The Wifi database can also be used, mainly in urban areas, and will drastically improve the accuracy of the positions. The database together with Combain's global hybrid positioning technology give best coverage, accuracy and performance possible.

This is a specification of the protocol to use Combain positioning service through the web service API.

2. Combain Positioning Service

2.1 Initiate the service - Key

The service can be initiated by obtaining a key from Combain. This key is unique and must be kept confidential to avoid misuse.

Depending on license, the key will enable cell id positioning and/or wifi positioning. If key is only for cell ID positioning and arguments for wifi is submitted, the wifi arguments are disregarded.

2.2 URL

<http://location-api.com/cps>

2.3 Request format

The format of the request is:

```
http://location-api.com/cps/?  
key=<key>&id=<id>&nr=<nr>&gps=<gpsobj>&reqCity=<0or1>&fb=<0or1>&reqCredits=<0or1>  
&cell=<scell>;<ncell1>; <ncell2>;<ncell3>... &wifi=<wifi1>;<wifi2>;<wifi3>...
```

2.4 Arguments

key The unique key for the account, received from Combain. Mandatory parameter.

- id A unique device id. Recommended to be the IMEI number, but can be something else. Possible to submit to Combain a range of allowed device id's. Important to be truly unique for the account, otherwise devices may not receive correct position. Optional parameter, max 20 characters in length.

- nr Request number set by the device. First request should have 1 and then value should be increased by 1 for each request. Optional parameter, integer.

- gps Latest GPS information. Optional parameter. Improves positioning requests with latest GPS position, for example indoor. If GPS position is older than 600s, it does not add any value and should be omitted.

- <gpsobj> GPS object. Information about latest GPS position. Optional, can be omitted.

- reqCity Request City. Disregarded if omitted or 0. If set to 1, the request returns closest populated city in text form, country and country code. If set to 1 and any indoor wifi submitted the response will also include building, floor and room. Optional parameter.

- reqCredits Check number of credits left for prepaid keys. The number of credits will returned in the parameter credits in the response.

- cell Information about the mobile cells in range. Optional parameter. Can be omitted if only wifi positioning is used, but improves performance even for wifi positioning.

- <scell> Serving cell object. Information about the cell the device is connected to. Can only be one cell and must be first cell object in the cell list.

- <ncellX> Neighbouring cell X object. Information about other cells within range but not connected to. Can be several cells.

- wifi Information about the wifi access points in range.
 Note: For privacy reasons, minimum 2 valid wifis must be submitted in the request to return a position.
 Optional parameter, can be omitted if only cell positioning is used.

- <wifiX> Wifi access point object X. Information about a wifi access point.

GPS object

Each GPS object (<gpsobj>) has the following parameters separated by a ',':

<lat>,<lon>,<hAcc>,<posAge>,<elev>,<vAcc>,<heading>,<speed>

<lat> Latitude of the position in decimal degrees (+/-XXX.YYYYYY).
 Mandatory parameter. WGS84.

<lon> Longitude of the position in decimal degrees (+/-XXX.YYYYYY).
 Mandatory parameter. WGS84.

<hAcc> Horizontal accuracy of the position in meters (integer). Mandatory
 parameter.

<posAge> Time in seconds since the GPS position was valid (integer). Mandatory
 parameter.

<elev>	Elevation of the position in meters (integer). Optional parameter.
<vAcc>	Vertical accuracy of the position in meters (integer). Optional parameter.
<heading>	The heading in degrees when the position was calculated (integer). Optional parameter.
<speed>	Speed in m/s (integer). Optional parameter.

Cell objects for GSM, WCDMA and LTE

Each cell object (<scell> and <ncellX>) has the following parameters separated by a ‘,’:

<rat>,<mcc>,<mnc>,<lac>,<cid>,<rxLev/sCode>,<tA/rscp>

<rat>	Radio access technology. ‘G’ for GSM, ‘W’ for WCDMA and ‘L’ for LTE. Mandatory parameter.
<mcc>	Mobile Country Code. Integer, 200 – 901. Mandatory.
<mnc>	Mobile Network Code. Integer, 0 – 999. Mandatory.
<lac>	Location Area Code. Hexadecimal number. Length is always 4. Mandatory.
<cid>	Cell ID. Hexadecimal number. Length is 4 for GSM, 8 for WCDMA and LTE. Mandatory.
<rxLev/sCode/rssi>	Received signal strength level in dBm (-110 <= rxLev <= -40) for GSM and (-140 <= rssi <= -44) for LTE. sCode is the primary scrambling code for WCDMA networks Optional, but improves performance of positioning. Integer.
<tA/rscp>	Timing advance (0 <= tA <= 63) for GSM networks. Received signal code power in dBm (-120 <= rscp <= -25) for WCDMA. Optional but improves performance of positioning. Integer.

Cell objects for CDMA

Each cell object (<scell> and <ncellX>) has the following parameters separated by a ‘,’:

<rat>,<sid>,<nid>,<bid>,<rssi>

<rat>	Radio access technology. ‘C’ for CDMA Mandatory parameter.
<sid>	System ID. Integer, 0 – 32767. Mandatory.
<nid>	Network ID. Integer, 0 – 65535. Mandatory.
<bid>	Basestation ID. Integer, 0-65535. Mandatory.

<rss> Received signal strength level in dBm (-110 <= rss <= -40) for CDMA. Optional, but improves performance of positioning. Integer.

Wifi objects

Each wifi object (wifiX) has the following parameters separated by a ',':

<bssid>,<ssid>,<rss>

<bssid> MAC address, for example 00:1a:a2:82:aa:60. Mandatory.

<ssid> Service Set Identifier. Name of the wifi access point. Since it is a string that contain comma (,), it is advised to put SSID always within quotes ("ssid"). Still SSID without quotes is accepted. Optional, but strongly advised to include for accurate wifi positioning. Max 32 characters in length.

<rss> The received signal strength in dBm. Optional but improves performance of positioning. Integer.

2.5 Response

Response format

The response is in semicolon separated format:

status=<status>;nr=<nr>;lat=<lat>;lon=<lon>;acc=<acc>;cc=<cc>;cn=<cn>;city=<city>;dist=<dist>

<status> '0' = successful positioning
 '1' = unsuccessful positioning, cells and wifi access points not found
 '2' = request quota exceeded
 '3' = invalid key
 '4' = invalid device id
 '5' = invalid request number
 '6' = invalid input parameters (e.g. mcc in hex or mcc out of valid range)

<nr> The request number for the corresponding request

<lat> The latitude of the estimated position. WGS84.

<lon> The longitude of the estimated position. WGS84.

<acc> Horizontal accuracy of the position in meters.

confidence The accuracy, as the radius in a circle, creates a circle with 95% level.

If the accuracy can not be determined, the accuracy is returned as zero.

Following parameters are only returned if the reqCity parameter is set to 1.

<cc>	Country code of the country (e.g. "SE" for Sweden). Surrounded by quotes.
<cn>	Country name in text format (e.g. "Sweden"). Surrounded by quotes.
<city>	Closest city with population. Surrounded by quotes.
<dist>	District, part of city, etc. Surrounded by quotes.

Following parameters are only returned if the reqCity parameter is to 1 and if any submitted wifi is marked as indoor wifi.

<building>	Name of building for indoor location (e.g. "Lund Hospital"). Surrounded by quotes.
<floor>	Integer value of floor plan for indoor location (e.g. 2). Surrounded by quotes.
<room>	Name of room for indoor location (e.g. "Room 262"). Surrounded by quotes.

2.6 Request and response examples

Single GSM cell:

[http://location-api.com/cps?key=x4dis16xuo6wd87s90e2&id=35780303-044733-4&nr=1&cell=G,240,01,1397,3ab6,-74,](http://location-api.com/cps?key=x4dis16xuo6wd87s90e2&id=35780303-044733-4&nr=1&cell=G,240,01,1397,3ab6,-74)

status=0;nr=1;lat=55.719176;lon=13.201968;acc=2541

Single GSM cell and reqCity:

[http://location-api.com/cps?key=x4dis16xuo6wd87s90e2&id=35780303-044733-4&nr=2&reqCity=1&cell=G,240,01,1397,3ab6,-74,](http://location-api.com/cps?key=x4dis16xuo6wd87s90e2&id=35780303-044733-4&nr=2&reqCity=1&cell=G,240,01,1397,3ab6,-74)

status=0;nr=2;lat=55.719176;lon=13.201968;acc=2541;cc="SE";cn="Sweden";city="Lund"

Check credits left:

<http://location-api.com/cps/?key=x4dis16xuo6wd87s90e2&id=35780303-044733-4&nr=1&cell=G,240,01,1397,3ab6,-74,&reqCredits=1>

status=0;nr=1;lat=55.716813;lon=13.204179;acc=2074;credits=510

WCDMA serving cell with one neighbor cell:

<http://location-api.com/cps?key=x4dis16xuo6wd87s90e2&id=35780303-044733-4&nr=3&cell=W,240,05,0019,00195f73,-64;W,240,05,0019,0019061b,-80>

status=0;nr=3;lat=55.709895;lon=13.217595;acc=628

WCDMA serving cell with one neighbor cell using sCode (sCode = 4):

<http://location-api.com/cps/?key=x4dis16xuo6wd87s90e2&id=35780303-044733-4&nr=3&cell=W,240,5,71,71ea76,-50;W,240,5,,,4,-89>

status=0;nr=3;lat=61.302832;lon=17.067262;acc=589

Two wifi access points:

<http://location-api.com/cps?>

key=x4dis16xuo6wd87s90e2&id=35780303-044733-4&nr=4&wifi=00:1b:2f:
47:8d:c6,"combain",-70;00:19:5b:88:72:93,"perspektiv",-90

status=0;nr=4;lat=55.713514;lon=13.215013;acc=103

Combined cell and wifi request:

<http://location-api.com/cps?> key=x4dis16xuo6wd87s90e2&id=35780303-044733-4&nr=5&cell=W,
240,05,001F,001F02AB,-64;W,240,05,001F,001F02A1,-80&wifi=00:1b:2f:
47:8d:c6,"combain",-70;00:19:5b:88:72:93,"perspektiv",-90

status=0;nr=5;lat=55.713514;lon=13.215013;acc=103

Valid new GPS position in request:

<http://location-api.com/cps?>

key=x4dis16xuo6wd87s90e2&id=35780303-044733-4&nr=6&gps=55.71123,13.2141
2,8,0,72,10,272,10&cell=G,240,01,1397,3abb,-74,

status=0;nr=6;lat=55.71123;lon=13.21412;acc=8

Old GPS position in request:

<http://location-api.com/cps?>

key=x4dis16xuo6wd87s90e2&id=35780303-044733-4&nr=7&gps=55.71123,13.2141
2,8,600,72,10,272,0&cell=G,240,01,1397,3ab6,-74,

status=0;nr=7;lat=55.719176;lon=13.201968;acc=2541

Cell and wifis not found in data base or error in request:

<http://location-api.com/cps?> key=x4dis16xuo6wd87s90e2&id=35780303-044733-4&nr=8&cell=G,
240,01,ffff,ffff,-74,

status=1;nr=8

Invalid key:

<http://location-api.com/cps?>key=xinvalid&id=35780303-044733-4&nr=9&cell=G,
240,01,1397,3abb,-74,

status=3;nr=9

Indoor multi wifi request:

<http://location-api.com/cps/?>

key=x4dis16xuo6wd87s90e2&id=35780303-044733-4&nr=2&wifi=00:26:3e:0c:71:44,-74;00:26:3e:
0c:71:45,-78&reqCity=1

status=0;nr=2;lat=55.710834;lon=13.206724;acc=5;cc="SE";cn="Sweden";dist="Lund";building="M
H";floor=4;room="corridor N"

3. Document history

Version	Date	Changes description
B	2010-11-18	Response update
C	2011-07-31	Added w4f and nr parameters.
D	2012-01-13	GPS support, clarification of parameters
E	2012-01-25	Minor updates
F	2012-05-22	Updated examples, > 1 wifi required for wifi positioning
G	2012-07-04	GPS parameters order change, updated examples
H	2013-09-30	Updated accuracy description.
I	2014-12-03	Added CDMA,LTE. Added quotes (") around all strings in response.