Pulse Oximeter APIs

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Open Mobile Alliance

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1. Scope

Pulse Oximeters provide two vital signs measurements, oxygen saturation and pulse rate.

The GotAPI provides a multi-purpose web-based framework to enable interwork applications and external devices such as pulse oximeters. The GotAPI consists of the GotAPI Server and the Extension Plug-Ins. A smartphone application communicates with a specific Extension Plug-In through the GotAPI Server using Web technologies.

In the GotAPI framework, an Extension Plug-In interacts with the Pulse Oximeters and exposes interfaces to the GotAPI Server. Thanks to Extension Plug-Ins, smartphone applications can interact with many kinds of Pulse Oximeters using consistent APIs specified in this specification.

This is the technical specification part of the Plus Oximeter Device Web APIs whose requirements and architecture are defined in a separate document [DWAPI-PCH].

2. References

2.1 Normative References

[DWAPI-PCH]	Device WebAPI-PCH OMA-ER-Device_WebAPIs-V1_0-20160419-C URL:http://www.openmobilealliance.org/
[EventSource]	"Server-Sent Events", Worldwide Web Consortium (W3C), URL:http://dev.w3.org/html5/eventsource/ (latest working draft)
[GotAPI 1.1]	Generic Open Terminal API Framework (GotAPI), Candidate Version 1.1 – 15 Dec 2015 URL:http://www.openmobilealliance.org/
[HTTP/1.1]	"Hypertext Transfer Protocol -- HTTP/1.1", Internet Engineering Task Force (IETF), URL:http://tools.ietf.org/search/rfc2616
[HTTP/2.0]	"Hypertext Transfer Protocol version 2.0", Internet Engineering Task Force (IETF), URL:http://tools.ietf.org/search/draft-ietf-httpbis-http2-09 (latest working draft)
[JSON-RPC]	"JSON-RPC 2.0 Specification", JSON-RPC Working Group, URL:http://www.jsonrpc.org/specification
[RFC2119]	"Key words for use in RFCs to Indicate Requirement Levels", S. Bradner, March 1997, URL:http://www.ietf.org/rfc/rfc2119.txt
[SCRRULES]	"SCR Rules and Procedures", Open Mobile Alliance™, OMA-ORG-SCR_Rules_and_Procedures, URL:http://www.openmobilealliance.org/
[WebSocket]	"The WebSocket API, Worldwide Web Consortium (W3C), URL:http://dev.w3.org/html5/websockets/ (latest working draft)

2.2 Informative References

[OMADICT]	"Dictionary for OMA Specifications", Version 2.9, Open Mobile Alliance™, OMA-ORG-Dictionary-V2.9, URL:http://www.openmobilealliance.org/
[OMNA]	"OMA Naming Authority". Open Mobile Alliance™. URL:http://www.openmobilealliance.org/tech/omna.aspx

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.

Agent	A node that collects and transmits personal health data to an associated manager.
API Patterns	Design guidelines and requirements for definition of APIs
Browser Context	Web applications executing under a Web browser as Web runtime environment.
Datagram	An API providing access to UDP protocol based networking.
Device	A physical device implementing either an Agent or manager role.
ECMAScript	Use definition from [OMADICT].
Hybrid Native/Web App	An application designed to execute under the native OS / middleware environment of a device, and that use native APIs for the execution of web content in addition to native code.
JavaScript	Use definition from [OMADICT].
Manager	A node receiving data from one or more agent systems. Examples of managers include a cellular phone, health appliance, set top box, or computer system.
Native App	An application designed to execute under the native OS / middleware environment of a device.
Personal Health Device	A device used in personal health applications.
Pulse Oximeter Plug-In	An Extension Plug-In that is defined by the GotAPI specification. It interacts with pulse oximeters and provides Web APIs, exposing the features of pulse oximeters, for applications through the GotAPI Server.
Socket	An API providing access to TCP protocol based networking.
Uniform Resource Identifier	Use definition from [OMADICT].
User Agent	Use definition from [OMADICT].
Web	The World Wide Web, a content and application framework based upon hypertext and related technologies, e.g. XML, JavaScript/ECMAScript, CSS, etc.
Web Application	An application designed using Web technologies (e.g. HTML, CSS, and Javascript).
Web IDL	An IDL language for Web application APIs
Web Runtime Application	A client-side Web application that is executed in Web runtime environments.
Web Runtime Environment	Client software that supports the execution of Web applications (e.g. browsers or widget engines).
WebSocket	An API providing networking services per the WebSocket standard [WebSocket].
Widget Context	Web applications installed and executing under a W3C Widget [W3C-Widgets] engine as Web runtime environment.

Widget Engine   Software which supports the execution of Web applications running outside a browser context, e.g. with the same functional capabilities as browsers but without the user interface functions provided by a browser, including window frames, menus, toolbars and scroll bars.

3.2   Abbreviations

API   Application Programming Interface

EventSource   The EventSource API (Server-Sent Events)

HTTP   HyperText Transfer Protocol

IDL   Interface Definition Language

JSON   JavaScript Object Notation

MIME   Multipurpose Internet Mail Extensions

OMA   Open Mobile Alliance

REST   REpresentational State Transfer

RPC   Remote Procedure Call

SCR   Static Conformance Requirements

TS   Technical Specification

UA   User Agent

UE   User Equipment

URI   Uniform Resource Identifier

URL   Uniform Resource Locator

W3C   World Wide Web Consortium

WRAPI   The OMA Web Runtime API enabler

XML   eXtensible Markup Language

XSD   XML Schema Definition

4. Introduction

This is the technical specification part of the Pulse Oximeter Device Web APIs whose requirements and architecture are defined in a separate document [DWAPI-PCH].

Pulse oximeters report measurements of body oxygen saturation and pulse rate. They are connected to smartphones via physical media such as Bluetooth to Extension Plug-Ins that expose the pulse oximeter features to applications through the GotAPI 1.1 framework [GotAPI1.1]. Applications are able to use the pulse oximeter features through the GotAPI 1.1 framework as defined by GotAPI 1.1.

Pulse oximeters are typically accessed by streamed data (Asynchronous messaging). Pulse oximeters report measurements in several different manners. Data is often streamed at regular intervals (e.g., once per second) or reported over various 'sample' times. The latter cases are referred to as "spot modalities", and they can be fast, slow, or just 'spot'. The spot measurements represent a more 'robust' estimate of the actual value. The IEEE standards support several types of spot modality measurements. Spot measurements, being episodic, typically have time stamps whereas streaming measurements tend not to have time stamps.

The pulse oximeter Plug-Ins report at least one type of oxygen saturation and pulse rate. It may be further described as modality spot, modality fast spot, or modality slow spot.

Pulse oximeter devices supported in this specification are expected to be able to report the oxygen saturation and pulse rate. The description of the measurements reported by the Plug-In follows the definition of the IEEE 11073-10404 Pulse Oximeter specialization specification. Nonetheless, this does not mean the pulse oximeters themselves must be compliant to the IEEE 11073-10404 specification. The pulse oximeter APIs specified in this document can be used for pulse oximeters that support IEEE 11073-10404 as well as those that do not support IEEE 11073-10404. In the latter case, however, the pulse oximeters must provide the Plug-Ins with the necessary information such that the Plug-Ins can fulfil their reporting requirements as specified in this document

This document defines API specifications for

- Service Discovery

- One-shot messaging API

- Asynchronous messaging API

The architectural aspects of these APIs are defined in the AD section of [DWAPI-PCH]. This specification must adhere to the GotAPI 1.1 specification.

Due to the nature of the data arising from pulse oximeters, not all the use cases may be supported by one-shot messaging. But there are use cases that can be supported by one-shot messaging. One-shot messaging allows developers simpler and convenient access, while asynchronous messaging enables versatile use cases.

4.1   Version 1.0

Pulse Oximeter APIs version 1.0 includes the functionality:

- Device Web API specifications for DWAPI-PCH, with device classes from IEEE 11073-10404 Pulse Oximeter specialization based on the GotAPI 1.1 framework

- Device Web APIs for Service Discovery, and asynchronous measuring

- Requirements and architecture documents [DWAPI-PCH]

5. Technical Specifications

This specification must adhere to the GotAPI 1.1 specification. This document specifies certain aspect of GotAPI 1.1 as the basis and introduces new elements, which are necessary for pulse oximeters supporting IEEE 11073-10404 Pulse Oximeter specialization.

In order to increase readability, the specification described below uses the same tables as defined in GotAPI 1.1, describing the necessary features including those of the general procedures of any GotAPI 1.1 uses as well as those specific to the Pulse Oximeter APIs. Those specifications that are specific to the Pulse Oximeter APIs are colored in green in the following tables, in order to increase readability, to make identity distinction easily. Those rows that are not colored in green are merely copies from the GotAPI 1.1 specification [GotAPI 1.1]

5.1 The Service Discovery on the GotAPI-4 Interface

Service Discovery API enables applications to discover available services as define in the Section 7.2.1[DWAPI-PCH]. Service Discovery API specification adheres to that of GotAPI 1.1.

Here is the Service Discovery based on what is defined in GotAPI 1.1. After the application obtains authorization for access to GotAPI-based APIs using the GotAPI-2 Interface, the application sends the Service Discovery request to the GotAPI Server. Then the GotAPI Server sends the Service Discovery request to all of the installed Extension Plug-Ins. The message flow of the Service Discovery is shown in Fig. 1.
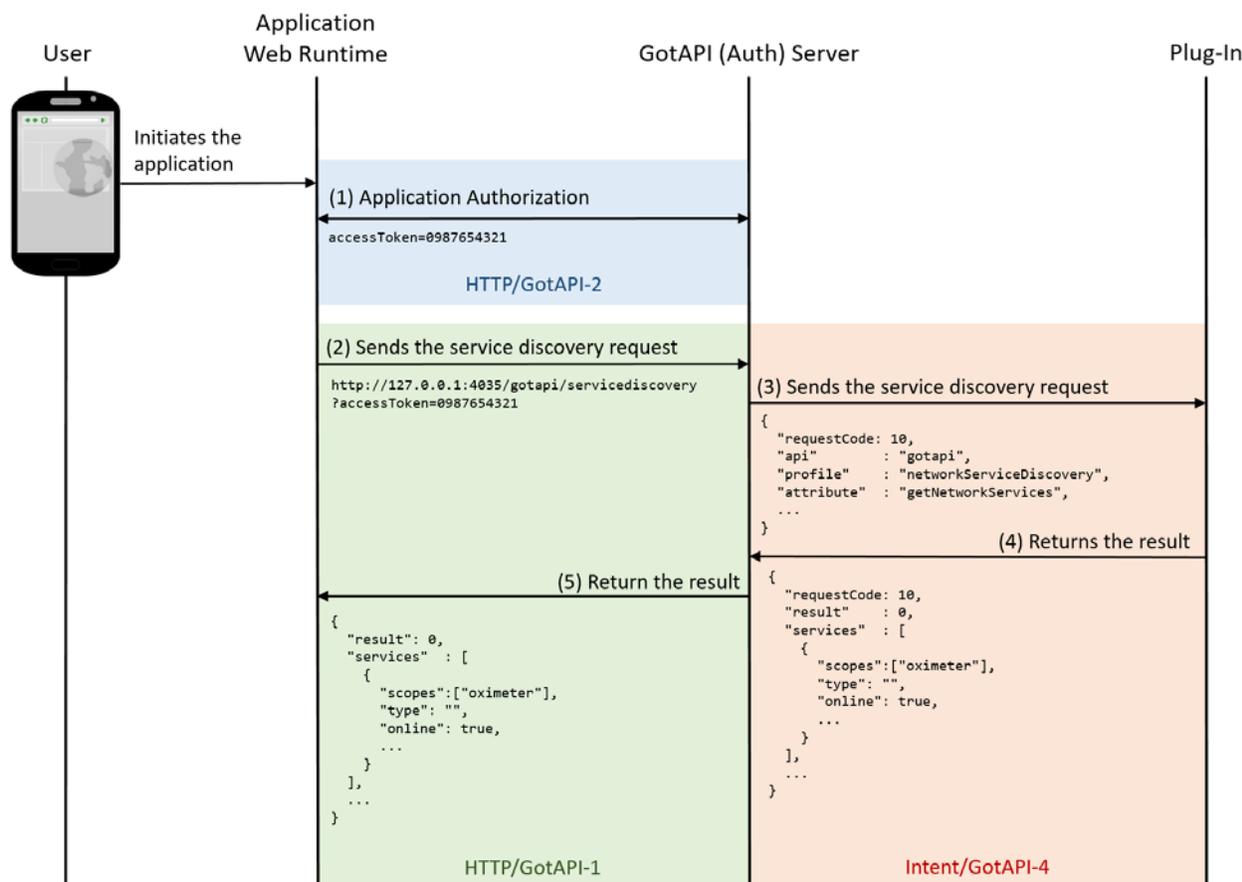
Figure 1: Message flow of the Service Discovery

The specific data in the message flows labelled (4) in the figure above are defined as follows. The other message flows SHALL be consistent to what are defined in the GotAPI 1.1 specification:

When the GotAPI Server receives the request of the Service Discovery API from an application, the GotAPI Server sends the Plug-In discovery request to the installed Plug-Ins as defined in the GotAPI specification. When the Pulse Oximeter Plug-In receives the Plug-In discovery request from the GotAPI Server, the Pulse Oximeter Plug-In SHALL return the message as follows:

Definition of the data object for the Plug-In discovery response

Name	Sub name	Type	Definition of value	Mandatory/Optional
requestCode		int	The request code coming from the GotAPI Server.	Mandatory
result		int	If success, the value is 0, otherwise an integer other than 0, which indicates an error code. This specification doesn't define error codes.	Mandatory
services		Array		Mandatory
	serviceId	String	The service identifier. The id could be "com.example.plugin".	Mandatory
	name	String	The name of the targeted pulse oximeter.	Mandatory
	manufacturer	String	The manufacturer of the targeted pulse oximeter.	Optional
	version	String	The version of the targeted pulse oximeter.	Optional
	type	String	This value represents the type of the network used to connect to the pulse oximeter. The value must be any one of "WiFi", "BLE", "NFC", "Bluetooth" or "USB".	Optional
	online	Boolean	If the service is available, this value SHALL be true. Otherwise (e.g. the Pulse Oximeter Plug-In has not yet detect any pulse oximeters or the Plug-In is not allowed to access to any devices), this value SHALL be false.	Mandatory
	scopes	Array	This value SHALL be an array including a string "oximeter" as an array element (["oximeter" ...]).	Mandatory

The Pulse Oximeter Plug-In MAY append additional data in the data object as needed.

This data object is sent to the Plug-Ins in an OS specific mechanism, .e.g., Intents for Android.

Requirements for OS-specific response channel and data container

OS	Description
Android	The GotAPI Server must use Explicit Intents for the response. The data object must be mapped to the Extra directly.

Example of the data object of the Android Explicit Intents

Name		Example of value	Note
Action		"org.deviceconnect.action.RESPONSE"	This value is defined by the GotAPI Server application.
Component		"org.deviceconnect"	This value is the package name of the GotAPI Server application.
Extra			
	requestCode	1	
	result	0	

| | services | *[Array Object]* | This value is an example. Note that this is "not" a JSON string. This value must be an Array object whose content is the same as the following JSON example:

`[`
  `{`
    `"id": "org.example.plugin.12345",`

    `"name": "Coolest Pulse Oximeter",`

    `"manufacturer": "ABC Health Care Inc.",`

    `"version": "3.0",`

    `"type": "Bluetooth",`

    `"online": true,`

    `"scopes": ["oximeter"]`

  `},`

  `...`

`]` |
| | *config* | *"additional parameters"* | *This name-value pair is an additional data which is not defined by this specification.* |

5.2   One-shot measuring API

One-shot API enables applications to receive measured data from pulse oximeters by one HTTP request/response transaction as define in the Section 7.2.2 [DWAPI-PCH]. One-shot measuring API specification adheres to that of GotAPI 1.1.

As defined by GotAPI 1.1, after the application obtains authorization to access GotAPI-based APIs using the GotAPI-2 Interface and completes the Service Discovery, the application can use the service (so called "One-shot measuring API") provided by the Plug-In through the GotAPI Server.

The One-shot measuring API offers a measurement result reported by the targeted device in response to a request. The message flow of this API is as shown blow.
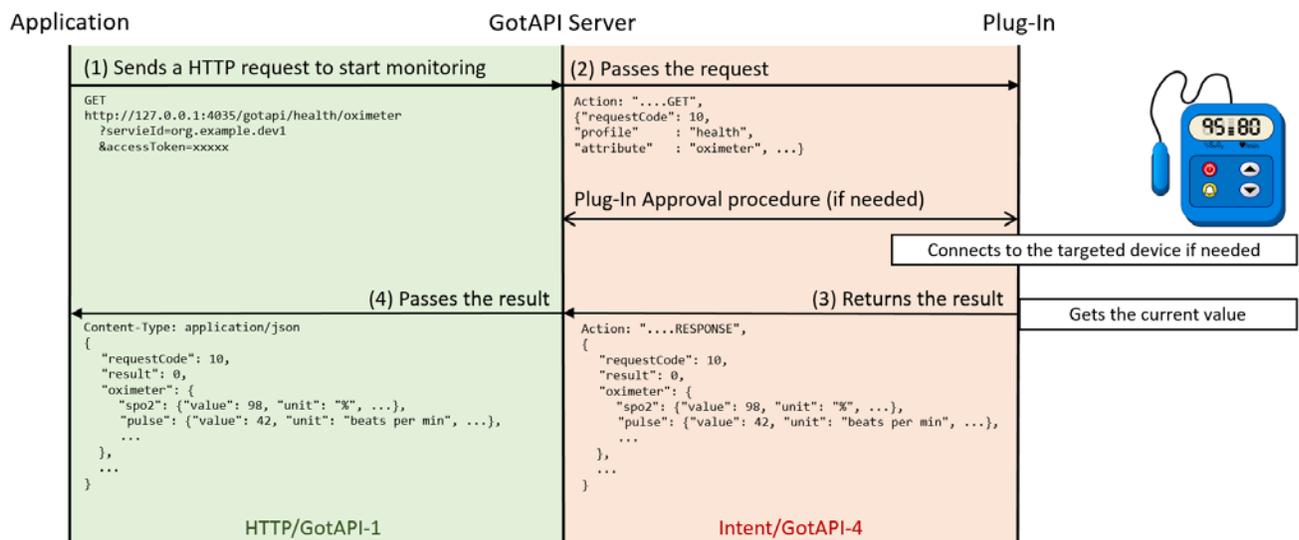
Figure 2: Message flow of the One-shot measuring API

This section defines the data object for all the message flows described in the figure above.

5.2.1　Request for one-shot measuring on the GotAPI-1 Interface

When the application uses the one-shot measuring it sends a request to the GotAPI Server on the GotAPI-1 Interface as follows:

Definition of the HTTP request

	Definitions
Method	HTTP PUT
Request URL	http://127.0.0.1:4035/gotapi/health/oximeter https://127.0.0.1:4036/gotapi/health/oximeter

Definition of the request parameters

Parameter name	Definition of value	Mandatory/Optional
serviceId	The identifier of the targeted service. This value is available from the Service Discovery API on the GotAPI-1 Interface.	Mandatory
accessToken	The access token obtained from the GotAPI Auth Server through the GotAPI-2 Interface.	Mandatory
nonce	A nonce generated by the application, which is described in the section "7.3.3.3 HMAC server authentication using trusted Application ID for the Server spoofing attack" in the GotAPI specification.	Optional

Example of the request URL

http://127.0.0.1:4035/gotapi/health/oximeter?serviceId=abcdefg123&accessToken=0987654321&nonce=93b3a219347

5.2.2　Request for one-shot measuring on the GotAPI-4 Interface

When an application sends a request to the GotAPI Server on the GotAPI-1 Interface, the GotAPI Server passes the request to the Plug-In on the GotAPI-4 Interface. The request includes the data object as follows:

Definition of the data object for request

Name		Type	Definition of value	Mandatory/Optional
method		String	This value SHALL be "GET".	Mandatory if the OS is not Android. Otherwise, optional. If the OS is Android, the "Action" value SHALL include this information as described below.
receiver		String	The address of the GotAPI Server application used by Plug-Ins. Generally, it is the application ID recognized by the OS, such as a package name.	Mandatory
requestCode		int	A request code identifying the request. This value could be any number but must MUST be an integer greater than 0, and unique for each open request, to ensure responses can be correlated.	Mandatory

serviceId		String	The identifier of the targeted Service. This value is provided by the application over the GotAPI-1 Interface.	Mandatory
api		String	The value must be "gotapi".	Mandatory
profile		String	The value must be "health".	Mandatory
attribute		String	The value must be "oximeter"	Mandatory
clientId		String	The identifier of the application, which is generated by the Plug-In when the Plug-In Approval procedure defined in the GotAPI specification.	Mandatory
accessToken		String	The access token for the application, which is generated by the Plug-In when the Plug-In Approval procedure defined in the GotAPI specification.	Mandatory

This data object is sent to the Plug-Ins in an OS specific mechanism, .e.g., Intents for Android.

Requirements for OS-specific request channel and data container

OS	Description
Android	The GotAPI Server must use Explicit Intents for the request. The data object must be mapped to the Extra directly.

Example of the data object of the Android Explicit Intents

Name		Example of value	Note
Action		org.deviceconnect.action.**GET**	This value is defined by the GotAPI Server application. But the last part SHALL be "**GET**".
Component		org.example.plugin	This value is the package name of the Plug-In application.
Extra			
	receiver	org.deviceconnect	
	requestCode	10	
	servcieId	dev1.example.org	
	api	gotapi	
	profile	health	
	attribute	oximeter	
	clientId	1234567890	
	accessToken	0987654321	

5.2.3   Response for one-shot measuring on the GotAPI-4 Interface

When the Plug-In receives the request, it SHALL respond to the GotAPI Server as follows:

Definition of the data object for the response

Name			Type	Definition of value	Mandatory/Option al
method			String	This value SHALL be "RESPONSE".	Mandatory if the OS is not Android. Otherwise, optional. If the OS is Android, the "Action" value SHALL include this information as described below.
requestCode			int	The request code coming from the GotAPI Server.	Mandatory
result			int	If success, the value is 0, otherwise an integer greater than 0, which indicates an error code. This specification doesn't define error codes.	Mandatory
oximeter					Mandatory
	device		Object		Mandatory
		productName	String	The product name of the targeted pulse oximeter. If the Plug-In cannot obtain this information from the targeted pulse oximeter, it SHALL create a name for the pulse oximeter using an arbitrary algorithm. The algorithm is up to the Plug-In implementation, and this specification does not define any algorithms.	Mandatory
		manufacturerName	String	The manufacturer name of the targeted pulse oximeter. If the Plug-In cannot obtain this information from the targeted pulse oximeter, this value SHALL be an empty string.	Mandatory
		modelNumber	String	The model number of the targeted pulse oximeter. If the Plug-In cannot obtain this information from the targeted pulse oximeter, this value SHALL be an empty string.	Mandatory

		firmwareRevision	String	The firmware revision of the targeted pulse oximeter. If the Plug-In cannot obtain this information from the targeted pulse oximeter, this value SHALL be an empty string.	Mandatory
		serialNumber	String	The serial number of the targeted pulse oximeter. If the Plug-In cannot obtain this information from the targeted pulse oximeter, this value SHALL be an empty string.	Mandatory
		softwareRevision	String	The software revision of the targeted pulse oximeter. If the Plug-In cannot obtain this information from the targeted pulse oximeter, this value SHALL be an empty string.	Mandatory
		hardwareRevision	String	The hardware revision of the targeted pulse oximeter. If the Plug-In cannot obtain this information from the targeted pulse oximeter, this value SHALL be an empty string.	Mandatory
		partNumber	String	The part number of the targeted pulse oximeter. If the Plug-In cannot obtain this information from the targeted pulse oximeter, this value SHALL be an empty string.	Mandatory
		protocolRevision	String	The protocol revision of the targeted pulse oximeter. If the Plug-In cannot obtain this information from the targeted pulse oximeter, this value SHALL be an empty string.	Mandatory
		systemId	String	The system id of the targeted pulse oximeter. This value SHALL be a 16-character HEX string without a '0x' prefix (e.g. "ABCDEF0123456789"). If the Plug-In cannot obtain this information from the targeted pulse oximeter, this value SHALL be "0000000000000000" (a string of 16 '0' characters).	Mandatory

		batteryLevel	Float	The battery level of the targeted pulse oximeter. This value must be a float number in a range from 0.0 to 1.0. The value 0.0 represents that the targeted pulse oximeter is completely out of charge. The value 1.0 represents that the targeted pulse oximeter is fully charged. Even if the targeted pulse oximeter reports this value in percent in a range from 1 to 100, the Plug-In SHALL convert it to a float number in a range from 0.0 to 1.0. If the Plug-In can't obtain battery level from the targeted pulse oximeter, this value SHALL be -1.0.	Mandatory
	spo2		Object		Mandatory if the "pulse" object below does not exest.
		value	Float	This value represents the SpO_2 measured by the targeted pulse oximeter.	Mandatory
		mderFloat	String	This value represents the SpO_2 measured by the targetd pulse oximeter, which is a hexadecimal string of a MDER FLOAT, such as "FFFFC8E".	Mandatory
		type	String	This value represents the TYPE attribute as a human readable string and as its 32-bit MDC code such as "Oxygen Saturation". If the Plug-In can't obtain the type, this value SHALL be an empty string.	Mandatory
		typeCode	String	This value represents the TYPE attribute, which is expressed by a code such as "150456" (This code means "Oxygen Saturation"). If the Plug-In can't obtain the type, this value SHALL be an empty string.	Mandatory
		supType	String	This value represents the Supplemental types attribute as a human readable string and as its 32-bit MDC code such as "Spot (average) measurement". If the Plug-In can't obtain the type, this value SHALL be an empty string.	Mandatory
		supTypeCode	String	This value represents the Supplemental types attribute, which is expressed by a code such as "150588" (This code means "Spot (average) measurement "). If the Plug-In can't obtain the type, this value SHALL be an empty string.	Mandatory
		unit	String	This value represents the unit of the reported SpO_2, which is expressed by a human readable string such as "%".	Mandatory
		unitCode	String	This value represents the unit of the reported SpO_2, which is expressed by a code such as "262688" (This code means "%").	Mandatory

		timeStamp	int	This value represents the measurement time when the mesurement was done. If the measurement time is reported from the targeted pulse oximeter, the Plug-In SHALL convert it to a unix time stamp in millisecond. Otherwise, the Plug-In set this value to the unix time when the Plug-In receives the measurement value from the Plug-In based on the clock of the underlying operating system.	Mandatory
		timeStampString	String	This value represents the same time stamp as "timeStamp". The format is "YYYYMMDDHHMMSS.sss+/-HHMM", such as "20150504135813.220-0400"	Mandatory
	pulse		Object		Mandatory if the "spo2" object above does not exest.
		value	Float	This value represents the pulse rate measured by the targeted pulse oximeter.	Mandatory
		mderFloat	String	This value represents the SpO$_2$ measured by the targetd pulse oximeter, which is a hexadecimal string of a MDER FLOAT, such as "FFFFC8E".	Mandatory
		type	String	This value represents the TYPE attribute as a human readable string and as its 32-bit MDC code such as "Pulse Rate". If the Plug-In can't obtain the type, this value SHALL be an empty string.	Mandatory
		typeCode	String	This value represents the TYPE attribute, which is expressed by a code such as "149530" (This code means "Pulse Rate"). If the Plug-In can't obtain the type, this value SHALL be an empty string.	Mandatory
		supType	String	This value represents the Supplemental types attribute as a human readable string and as its 32-bit MDC code such as "Spot (average) measurement". If the Plug-In can't obtain the type, this value SHALL be an empty string.	Mandatory
		supTypeCode	String	This value represents the Supplemental types attribute, which is expressed by a code such as "150588" (This code means "Spot (average) measurement "). If the Plug-In can't obtain the type, this value SHALL be an empty string.	Mandatory
		unit	String	This value represents the unit of the reported pulse rate, which is expressed by a human readable string such as "beats per min".	Mandatory
		unitCode	String	This value represents the unit of the reported pulse rate, which is expressed by a code such as "264864" (This code means "beats per min").	Mandatory

| | | timeStamp | int | This value represents the measurement time when the mesurement was done. If the measurement time is reported from the targeted pulse oximeter, the Plug-In SHALL convert it to a unix time stamp in millisecond. Otherwise, the Plug-In set this value to the unix time when the Plug-In receives the measurement value from the Plug-In based on the clock of the underlying operating system. | Mandatory |
| | | timeStampString | String | This value represents the same time stamp as "timeStamp". The format is "YYYYMMDDHHMMSS.sss+/-HHMM", such as "20150504135813.220-0400" | Mandatory |

The Plug-In MAY append additional data in the data object as needed.

This data object is sent to the GotAPI Server in an OS specific mechanism, .e.g., Intents for Android.

Requirements for OS-specific response channel and data container

OS	Description
Android	The GotAPI Server must use Explicit Intents for the request. The data object must be mapped to the Extra directly.

Example of the data object of the Android Intents

Name					Example of value	Note
Action					org.deviceconnect.action.**RESPONSE**	This value is defined by the GotAPI Server application. But the last part SHALL be "**RESPONSE**".
Component					org.deviceconnect	This value is the package name of the GotAPI Server application.
Extra						
	requestCode				10	
	result				0	
	oximeter					
		device				
			productName		ABC Pulse Oximeter Pro	
			manufacturerName		ABC Inc.	
			modelNumber		TP-001	
			firmwareRevision		rev.1.001.003	
			serialNumber		01234-5678-9ABCD-EF01	
			softwareRevision		rev.2.000.000	
			hardwareRevision		rev.1.0	
			partNumber		002	
			protocolRevision		rev.3.1	

			systemId	ABCDEF0123456789	
			batteryLevel	0.5	
		spo2			
			value	98	
			mderFloat	00000062	
			type	Oxygen Saturation	
			typeCode	150456	
			supType	Spot (average) measurement	
			supTypeCode	150588	
			unit	%	
			unitCode	262688	
			timeStamp	1431856940275	
			timeStampString	20150517100220.000-0000	
		pulse			
			value	42	
			mderFloat	0000002A	
			type	Pulse Rate	
			typeCode	149530	
			supType	Spot (average) measurement	
			supTypeCode	150588	
			unit	beats per min	
			unitCode	264864	
			timeStamp	1431856940275	
			timeStampString	20150517100220.000-0000	

> **Editor's note:**
>
> The extra data of Android is just a key-value structure. How should such structured data above be expressed? JSON string?
>
> ```
> intent.putExtra("oximeter", "{\"deviceProductName\":\"ABC Pulse Oximeter Pro\", ...}");
> ```

5.2.4   Response for one-shot measuring on the GotAPI-1 Interface

When GotAPI Server receives the response from the Plug-In, the GotAPI Server passes it to the application as follows:

Definition of the HTTP response

Definitions	
MIME-Type	application/json
HTTP status	200 OK

Definition of the data object for the response

Name			Type	Definition of value	Mandatory/Optional
product			String	The name of the GotAPI Server (e.g. "ABConnect")	Mandatory
version			String	The version of the GotAPI Server (e.g. "1.0").	Mandatory
result			Number	If success, the value is 0, otherwise an integer greater than 0, which indicates an error code. This specification doesn't define error codes.	Mandatory
oximeter					Mandatory
	device		Object		Mandatory
		productName	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		manufacturerName	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		modelNumber	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		firmwareRevision	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		serialNumber	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		softwareRevision	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		hardwareRevision	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		partNumber	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		protocolRevision	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		systemId	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		batteryLevel	Number	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
	spo2		Object	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory if the "pulse" object below does not exest.
		value	Number	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		mderFloat	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		type	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory

		typeCode	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		supType	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		supTypeCode	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		unit	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		unitCode	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		timeStamp	Number	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		timeStampString	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
	pulse		Object	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory if the "spo2" object above does not exest.
		value	Number	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		mderFloat	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		type	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		typeCode	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		supType	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		supTypeCode	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		unit	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		unitCode	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		timeStamp	Number	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		timeStampString	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
hmac			String	An HMAC generated for the counter measure against the GotAPI Server spoofing attack. If the application includes a key for HMAC calculation in the API request, the GotAPI Server adds this value in the API response. Evaluating whether the HMAC is identical to the result of calculation of HMAC from the key, the application can ensure that the response is genuine.	Mandatory if the application provide a key to the GotAPI Server

The GotAPI Server SHALL serialize the data structure above as a JSON formatted stream (i.e. JSON string).

Example of the response

```
{
  "product"    : "ABCConnect",
  "version"    : "1.0",
  "requestCode" : 10,
  "result"     : 0,
  "oximeter"   : {
    "device": {
      "productName"     : "ABC Pulse Oximeter Pro",
      "manufacturerName" : "ABC Inc.",
      "modelNumber"     : "TP-001",
      "firmwareRevision" : "rev.1.001.003",
      "serialNumber"    : "01234-5678-9ABCD-EF01",
      "softwareRevision" : "rev.2.000.000",
      "hardwareRevision" : "rev.1.0",
      "partNumber"      : "002",
      "protocolRevision" : "rev.3.1",
      "systemId"        : "ABCDEF0123456789",
      "batteryLevel"    : 0.5
    },
    "spo2"  : {
      "value"         : 98,
      "mderFloat"     : "00000062",
      "type"          : "Oxygen Saturation",
      "typeCode"      : "150456",
      "supType"       : "Spot (average) measurement",
      "supTypeCode"   : "150588",
      "unit"          : "%",
      "unitCode"      : "262688",
      "timeStamp"     : 1431856940275,
      "timeStampString" : "20150517100220.000-0000"
    },
    "pulse" : {
      "value"         : 42,
      "mderFloat"     : "0000002A",
      "type"          : "Pulse Rate",
      "typeCode"      : "149530",
      "supType"       : "Spot (average) measurement",
      "supTypeCode"   : "150588",
      "unit"          : "beats per min",
      "unitCode"      : "264864",
      "timeStamp"     : 1431856940275,
      "timeStampString" : "20150517100220.000-0000"
    }
  },
  "hmac"       : "0123456789"
}
```

5.3   Asynchronous messaging API

Asynchronous messaging API enables applications to receive measured data from pulse oximeters asynchronously using WebSocket as define in the Section 7.2.3 [DWAPI-PCH]. Asynchronous messaging API specification adheres to that of GotAPI 1.1.

As defined by GotAPI 1.1, after the application obtains authorization to access GotAPI-based APIs using the GotAPI-2 Interface and completes the Service Discovery, the application can use the service (so called "Asynchronous messaging API") provided by the Plug-In through the GotAPI Server.

The asynchronous messaging API offers a series of measurement values reported by the targeted device to an application in real time as the measurement values become available. The timing when and the reasons why such measurement values become available is determined by the Plug-Ins and connected devices, and is out of the scope of this specification.

This API uses WebSocket protocol to handle asynchronous event messages. The message flow of this API is shown blow:

Figure 3: Message Flow of the Asynchronous messaging API

This section defines the data object for the message flows labelled from (1) to (4) and from (8) to (13) described in the figure above.

5.3.1   Request for asynchronous messaging on the GotAPI-1 Interface

When the application uses the API in order to receive asynchronous messages, it sends a request to the GotAPI Server on the GotAPI-1 Interface as follows:

Definition of the HTTP request

	Definitions
Method	HTTP PUT
Request URL	http://127.0.0.1:4035/gotapi/health/oximeter
	https://127.0.0.1:4036/gotapi/health/oximeter

Definition of the request parameters

Parameter name	Definition of value	Mandatory/Optional
serviceId	The identifier of the targeted service. This value is available from the Service Discovery API on the GotAPI-1 Interface.	Mandatory
accessToken	The access token obtained from the GotAPI Auth Server through the GotAPI-2 Interface.	Mandatory
nonce	A nonce generated by the application, which is described in the section "7.3.3.3 HMAC server authentication using trusted Application ID for the Server spoofing attack" in the GotAPI specification.	Optional

Example of the request URL

```
http://127.0.0.1:4035/gotapi/health/oximeter?serviceId=abcdefg123&accessToken=0987654321&nonce=93b3a219347
```

5.3.2   Request for asynchronous messaging on the GotAPI-4 Interface

When an application sends a request to the GotAPI Server on the GotAPI-1 Interface, the GotAPI Server passes the request to the Plug-In on the GotAPI-4 Interface. The request includes the data object as follows:

Definition of the data object for request

Name		Type	Definition of value	Mandatory/Optional
method		String	This value SHALL be "PUT".	Mandatory if the OS is not Android. Otherwise, optional. If the OS is Android, the "Action" value SHALL include this information as described below.
receiver		String	The address of the GotAPI Server application used by Plug-Ins. Generally, it is the application ID recognized by the OS, such as a package name.	Mandatory
requestCode		int	A request code identifying the request. This value could be any number but must MUST be an integer greater than 0, and unique for each open request, to ensure responses can be correlated.	Mandatory

serviceId		String	The identifier of the targeted Service. This value is provided by the application over the GotAPI-1 Interface.	Mandatory
api		String	The value must be "gotapi".	Mandatory
profile		String	The value must be "health".	Mandatory
attribute		String	The value must be "oximeter"	Mandatory
clientId		String	The identifier of the application, which is generated by the Plug-In when the Plug-In Approval procedure defined in the GotAPI specification.	Mandatory
accessToken		String	The access token for the application, which is generated by the Plug-In when the Plug-In Approval procedure defined in the GotAPI specification.	Mandatory

This data object is sent to the Plug-Ins in an OS specific mechanism, .e.g., Intents for Android.

Requirements for OS-specific request channel and data container

OS	Description
Android	The GotAPI Server must use Explicit Intents for the request. The data object must be mapped to the Extra directly.

Example of the data object of the Android Explicit Intents

Name		Example of value	Note
Action		org.deviceconnect.action.PUT	This value is defined by the GotAPI Server application. But the last part SHALL be **"PUT"**.
Component		org.example.plugin	This value is the package name of the Plug-In application.
Extra			
	receiver	org.deviceconnect	
	requestCode	10	
	servcieId	dev1.example.org	
	api	gotapi	
	profile	health	
	attribute	oximeter	
	clientId	1234567890	
	accessToken	0987654321	

5.3.3   Response for asynchronous messaging on the GotAPI-4 Interface

When the Plug-In receives the request, it SHALL respond to the GotAPI Server as follows:

Definition of the data object for the response

Name			Type	Definition of value	Mandatory/Optional
method			String	This value SHALL be "RESPONSE".	Mandatory if the OS is not Android. Otherwise, optional. If the OS is Android, the "Action" value SHALL include this information as described below.
requestCode			Number	The request code coming from the GotAPI Server.	Mandatory
result			Number	If success, the value is 0, otherwise an integer greater than 0, which indicates an error code. This specification doesn't define error codes.	Mandatory
oximeter					Mandatory
	device		Object		Mandatory
		productName	String	The product name of the targeted pulse oximeter. If the Plug-In cannot obtain this information from the targeted pulse oximeter, it SHALL create a name for the pulse oximeter using an arbitrary algorithm. The algorithm is up to the Plug-In implementation, and this specification does not define any algorithms.	Mandatory
		manufacturerName	String	The manufacturer name of the targeted pulse oximeter. If the Plug-In cannot obtain this information from the targeted pulse oximeter, this value SHALL be an empty string.	Mandatory
		modelNumber	String	The model number of the targeted pulse oximeter. If the Plug-In cannot obtain this information from the targeted pulse oximeter, this value SHALL be an empty string.	Mandatory

		firmwareRevision	String	The firmware revision of the targeted pulse oximeter. If the Plug-In cannot obtain this information from the targeted pulse oximeter, this value SHALL be an empty string.	Mandatory
		serialNumber	String	The serial number of the targeted pulse oximeter. If the Plug-In cannot obtain this information from the targeted pulse oximeter, this value SHALL be an empty string.	Mandatory
		softwareRevision	String	The software revision of the targeted pulse oximeter. If the Plug-In cannot obtain this information from the targeted pulse oximeter, this value SHALL be an empty string.	Mandatory
		hardwareRevision	String	The hardware revision of the targeted pulse oximeter. If the Plug-In cannot obtain this information from the targeted pulse oximeter, this value SHALL be an empty string.	Mandatory
		partNumber	String	The part number of the targeted pulse oximeter. If the Plug-In cannot obtain this information from the targeted pulse oximeter, this value SHALL be an empty string.	Mandatory
		protocolRevision	String	The protocol revision of the targeted pulse oximeter. If the Plug-In cannot obtain this information from the targeted pulse oximeter, this value SHALL be an empty string.	Mandatory
		systemId	String	The system id of the targeted pulse oximeter. This value SHALL be a 16-character HEX string without a '0x' prefix (e.g. "ABCDEF0123456789"). If the Plug-In cannot obtain this information from the targeted pulse oximeter, this value SHALL be "0000000000000000" (a string of 16 '0' characters).	Mandatory

The Plug-In MAY append additional data in the data object as needed.

This data object is sent to the GotAPI Server in an OS specific mechanism, .e.g., Intents for Android.

Requirements for OS-specific response channel and data container

OS	Description
Android	The GotAPI Server must use Explicit Intents for the request. The data object must be mapped to the Extra directly.

Example of the data object of the Android Intents

Name				Example of value	Note
Action				org.deviceconnect.action.**RESPONSE**	This value is defined by the GotAPI Server application. But the last part SHALL be "**RESPONSE**".
Component				org.deviceconnect	This value is the package name of the GotAPI Server application.
Extra					
	requestCode			10	
	result			0	
	oximeter				
		device			
			productName	ABC Pulse Oximeter Pro	
			manufacturerName	ABC Inc.	
			modelNumber	TP-001	
			firmwareRevision	rev.1.001.003	
			serialNumber	01234-5678-9ABCD-EF01	
			softwareRevision	rev.2.000.000	
			hardwareRevision	rev.1.0	
			partNumber	002	
			protocolRevision	rev.3.1	
			systemId	ABCDEF0123456789	

> **Editor's note:**
>
> The extra data of Android is just a key-value structure. How should such structured data above be expressed? JSON string?
>
> intent.putExtra ("oximeter", "{\"deviceProductName\":\"ABC Pulse Oximeter Pro\", ...}");

5.3.4   Response for asynchronous messaging on the GotAPI-1 Interface

When GotAPI Server receives the response from the Plug-In, the GotAPI Server passes it to the application as follows:

Definition of the HTTP response

	Definitions
MIME-Type	application/json
HTTP status	200 OK

Definition of the data object for the response

Name			Type	Definition of value	Mandatory/Optional
product			String	The name of the GotAPI Server (e.g. "ABConnect")	Mandatory
version			String	The version of the GotAPI Server (e.g. "1.0").	Mandatory
result			Number	If success, the value is 0, otherwise an integer greater than 0, which indicates an error code. This specification doesn't define error codes.	Mandatory
oximeter			Object		Mandatory
	device		Object		Mandatory
		productName	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		manufacturerName	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		modelNumber	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		firmwareRevision	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		serialNumber	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		softwareRevision	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		hardwareRevision	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		partNumber	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		protocolRevision	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		systemId	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
hmac			String	An HMAC generated for the counter measure against the GotAPI Server spoofing attack. If the application includes a key for HMAC calculation in the API request, the GotAPI	Mandatory if the application provide a key to the GotAPI Server

				Server adds this value in the API response. Evaluating whether the HMAC is identical to the result of calculation of HMAC from the key, the application can ensure that the response is genuine.	

The GotAPI Server SHALL serialize the data structure above as a JSON formatted stream (i.e. JSON string).

Example of the response

```
{
  "product"    : "ABCConnect",
  "version"    : "1.0",
  "requestCode" : 10,
  "result"     : 0,
  "oximeter" : {
    "device": {
      "productName"      : "ABC Pulse Oximeter Pro",
      "manufacturerName" : "ABC Inc.",
      "modelNumber"      : "TP-001",
      "firmwareRevision" : "rev.1.001.003",
      "serialNumber"     : "01234-5678-9ABCD-EF01",
      "softwareRevision" : "rev.2.000.000",
      "hardwareRevision" : "rev.1.0",
      "partNumber"       : "002",
      "protocolRevision" : "rev.3.1",
      "systemId"         : "ABCDEF0123456789"
    }
  },
  "hmac"        : "0123456789"
}
```

5.3.5   Asynchronous message from the Plug-In to the GotAPI Server on the GotAPI-4 Interafce

The Plug-In sends an asynchronous message as follows:

Definition of the data object for request

Name			Type	Definition of value	Mandatory/Optional
method			String	This value SHALL be "EVENT".	Mandatory if the OS is not Android. Otherwise, optional. If the OS is Android, the "Action" value SHALL include this information as described below.
requestCode			int	The request code coming from the GotAPI Server.	Mandatory
result			Number	If success, the value is 0, otherwise an integer greater than 0, which indicates an error code. This specification doesn't define error codes.	Mandatory

oximeter			Object		Mandatory
	device		Object		Mandatory
		batteryLevel	Float	The battery level of the targeted oximeter. This value must be a float number in a range from 0.0 to 1.0. The value 0.0 represents that the targeted oximeter is completely out of charge. The value 1.0 represents that the targeted oximeter is fully charged. Even if the targeted oximeter reports this value in percent in a range from 1 to 100, the Plug-In SHALL convert it to a float number in a range from 0.0 to 1.0. If the Plug-In can't obtain battery level from the targeted oximeter, this value SHALL be -1.0.	Mandatory
	spo2		Object	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory if the "pulse" object below does not exest.
		value	Number	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		mderFloat	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		type	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		typeCode	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		supType	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		supTypeCode	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		unit	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		unitCode	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		timeStamp	Number	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		timeStampString	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
	pulse		Object		Mandatory if the "spo2" object above does not exest.
		value	Float	This value represents the pulse rate measured by the targeted pulse oximeter.	Mandatory
		mderFloat	String	This value represents the SpO$_2$ measured by the targetd pulse oximeter, which is a hexadecimal string of a MDER FLOAT, such as "FFFFC8E".	Mandatory

		type	String	This value represents the TYPE attribute as a human readable string and as its 32-bit MDC code such as "Pulse Rate". If the Plug-In can't obtain the type, this value SHALL be an empty string.	Mandatory
		typeCode	String	This value represents the TYPE attribute, which is expressed by a code such as "149530" (This code means "Pulse Rate"). If the Plug-In can't obtain the type, this value SHALL be an empty string.	Mandatory
		supType	String	This value represents the Supplemental types attribute as a human readable string and as its 32-bit MDC code such as "Spot (average) measurement". If the Plug-In can't obtain the type, this value SHALL be an empty string.	Mandatory
		supTypeCode	String	This value represents the Supplemental types attribute, which is expressed by a code such as "150588" (This code means "Spot (average) measurement "). If the Plug-In can't obtain the type, this value SHALL be an empty string.	Mandatory
		unit	String	This value represents the unit of the reported pulse rate, which is expressed by a human readable string such as "beats per min".	Mandatory
		unitCode	String	This value represents the unit of the reported pulse rate, which is expressed by a code such as "264864" (This code means "beats per min").	Mandatory
		timeStamp	int	This value represents the measurement time when the mesurement was done. If the measurement time is reported from the targeted pulse oximeter, the Plug-In SHALL convert it to a unix time stamp in millisecond. Otherwise, the Plug-In set this value to the unix time when the Plug-In receives the measurement value from the Plug-In based on the clock of the underlying operating system.	Mandatory
		timeStampString	String	This value represents the same time stamp as "timeStamp". The format is "YYYYMMDDHHMMSS.sss+/-HHMM", such as "20150504135813.220-0400"	Mandatory

The Plug-In MAY append additional data in the data object as needed.

This data object is sent to the Plug-Ins in an OS specific mechanism, .e.g., Intents for Android.

Requirements for OS-specific request channel and data container

OS	Description
Android	The GotAPI Server must use Explicit Intents for the request. The data object must be mapped to the Extra directly.

Example of the data object of the Android Explicit Intents

Name	Extra key name		Example of value	Note
Action			org.deviceconnect.action.**EVENT**	This value is defined by the GotAPI Server application. But the last part SHALL be "**EVENT**".
Component			org.example.plugin	This value is the package name of the Plug-In application.
Extra				
	requestCode		10	
	result		0	
	oximeter			
		device		
			deviceBatteryLevel	0.5
		spo2		
			value	98
			mderFloat	00000062
			type	Oxygen Saturation
			typeCode	150456
			supType	Spot (average) measurement
			supTypeCode	150588
			unit	%
			unitCode	262688
			timeStamp	1431856940275
			timeStampString	20150517100220.000-0000
		pulse		
			value	42
			mderFloat	0000002A
			type	Pulse Rate
			typeCode	149530
			supType	Spot (average) measurement
			supTypeCode	150588
			unit	beats per min
			unitCode	264864
			timeStamp	1431856940275
			timeStampString	20150517100220.000-0000

Editor's note:

The extra data of Android is just a key-value structure. How should such structured data above be expressed? JSON string?

```
intent.putExtra ("oximeter", "{\"deviceProductName\":\"ABC Pulse Oximeter Pro\", ...}");
```

## 5.3.6	Asynchronous message from the GotAPI Server to the application on the GotAPI-5 Interface

When the GotAPI Server receives an asynchronous message from the Plug-In, the GotAPI Server passes it to the application on the GotAPI-5 Interface. The format of the data is a JSON string as follows:

Definition of the data object

Name	Sub name		Type	Definition of value	Mandatory/Optional
serviceId			String	The identifier of the targeted Service. This value is provided by the application when the application send the originated API request on the GotAPI-1 Interface.	Mandatory
oximeter			Object		Mandatory
	device		Object		Mandatory
		batteryLevel	Number	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
	spo2		Object	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory if the "pulse" object below does not exest.
		value	Number	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		mderFloat	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		type	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		typeCode	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		supType	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		supTypeCode	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		unit	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		unitCode	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		timeStamp	Number	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		timeStampString	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
	pulse		Object	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory if the "spo2" object above does not exest.
		value	Number	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		mderFloat	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory

		type	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		typeCode	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		supType	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		supTypeCode	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		unit	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		unitCode	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		timeStamp	Number	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
		timeStampString	String	This value SHALL be the same as that which the GotAPI Server received from the Plug-In.	Mandatory
hmac			String	An HMAC generated for the counter measure against the GotAPI Server spoofing attack.\n\nIf the application includes a key for HMAC calculation in the API request, the GotAPI Server adds this value in the API response. Evaluating whether the HMAC is identical to the result of calculation of HMAC from the key, the application can ensure that the response is genuine.	Mandatory if the application provide a key to the GotAPI Server

Example of the JSON string

```
{
  "serviceId" : 0,
  "oximeter"  : {
    "device": {
      "batteryLevel"    : 0.5
    },
    "spo2"  : {
      "value"          : 98,
      "mderFloat"      : "00000062",
      "type"           : "Oxygen Saturation",
      "typeCode"       : "150456",
      "supType"        : "Spot (average) measurement",
      "supTypeCode"    : "150588",
      "unit"           : "%",
      "unitCode"       : "262688",
      "timeStamp"      : 1431856940275,
      "timeStampString" : "20150517100220.000-0000"
    },
    "pulse" : {
      "value"          : 42,
      "mderFloat"      : "0000002A",
      "type"           : "Pulse Rate",
      "typeCode"       : "149530",
      "supType"        : "Spot (average) measurement",
      "supTypeCode"    : "150588",
```

```
      "unit"          : "beats per min",
      "unitCode"      : "264864",
      "timeStamp"     : 1431856940275,
      "timeStampString" : "20150517100220.000-0000"
    }
  },
  "hmac"      : "0123456789"
}
```

5.3.7   Stop request from the application to the GotAPI Server on the GotAPI-1 Interface

When the application wants to stop receiving asynchronous messages, it sends a request to the GotAPI Server on the GotAPI-1 Interface as follows:

Definition of the HTTP request

	Definitions
Method	HTTP DELETE
Request URL	http://127.0.0.1:4035/gotapi/health/oximeter
	https://127.0.0.1:4036/gotapi/health/oximeter

Definition of the request parameters

Parameter name	Definition of value	Mandatory/Optional
serviceId	The identifier of the targeted service. This value is available from the Service Discovery API on the GotAPI-1 Interface.	Mandatory
accessToken	The access token obtained from the GotAPI Auth Server through the GotAPI-2 Interface.	Mandatory
nonce	A nonce generated by the application, which is described in the section "7.3.3.3 HMAC server authentication using trusted Application ID for the Server spoofing attack" in the GotAPI specification.	Optional

Example of the request URL

```
http://127.0.0.1:4035/gotapi/health/oximeter?serviceId=abcdefg123&accessToken=0987654321&nonce=93b3a219347
```

5.3.8   Stop request from the GotAPI Server to the Plug-In on the GotAPI-4 Interface

When the GotAPI Server receives a stop request from the application on the GotAPI-1 Interface, the GotAPI Server sends a stop request to the Plug-in on the GotAPI-4 Interface. The request includes the data object as follows:

Definition of the data object for request

Name		Type	Definition of value	Mandatory/Optional
method		String	This value SHALL be "DELETE".	Mandatory if the OS is not Android. Otherwise, optional. If the OS is Android, the "Action" value SHALL include this information as described below.

receiver		String	The address of the GotAPI Server application used by Plug-Ins. Generally, it is the application ID recognized by the OS, such as a package name.	Mandatory
requestCode		int	A request code identifying the request. This value could be any number but must MUST be an integer greater than 0, and unique for each open request, to ensure responses can be correlated.	Mandatory
serviceId		String	The identifier of the targeted Service. This value is provided by the application over the GotAPI-1 Interface.	Mandatory
api		String	The value must be "gotapi".	Mandatory
profile		String	The value must be "health".	Mandatory
attribute		String	The value must be "oximeter"	Mandatory
clientId		String	The identifier of the application, which is generated by the Plug-In when the Plug-In Approval procedure defined in the GotAPI specification.	Mandatory
accessToken		String	The access token for the application, which is generated by the Plug-In when the Plug-In Approval procedure defined in the GotAPI specification.	Mandatory

This data object is sent to the Plug-Ins in an OS specific mechanism, .e.g., Intents for Android.

Requirements for OS-specific request channel and data container

OS	Description
Android	The GotAPI Server must use Explicit Intents for the request. The data object must be mapped to the Extra directly.

Example of the data object of the Android Explicit Intents

Name		Example of value	Note
Action		org.deviceconnect.action.**DELETE**	This value is defined by the GotAPI Server application. But the last part SHALL be **"DELETE"**.
Component		org.example.plugin	This value is the package name of the Plug-In application.
Extra			
	receiver	org.deviceconnect	
	requestCode	10	
	servcieId	dev1.example.org	
	api	gotapi	
	profile	health	
	attribute	oximeter	
	clientId	1234567890	
	accessToken	0987654321	

5.3.9   Stop response from the Plug-In to the GotAPI Server on the GotAPI-4 Interface

When the Plug-In receives the stop request, it SHALL respond as follows:

Definition of the data object for the response

Name		Type	Definition of value	Mandatory/Optional
method		String	This value SHALL be "RESPONSE".	Mandatory if the OS is not Android. Otherwise, optional. If the OS is Android, the "Action" value SHALL include this information as described below.
requestCode		Number	The request code coming from the GotAPI Server.	Mandatory
result		Number	If success, the value is 0, otherwise an integer greater than 0, which indicates an error code. This specification doesn't define error codes.	Mandatory

The Plug-In MAY append additional data in the data object as needed.

This data object is sent to the GotAPI Server in an OS specific mechanism, .e.g., Intents for Android.

Requirements for OS-specific response channel and data container

OS	Description
Android	The GotAPI Server must use Explicit Intents for the request. The data object must be mapped to the Extra directly.

Example of the data object of the Android Intents

Name	Sub name	Example of value	Note
Action		org.deviceconnect.action.**RESPONSE**	This value is defined by the GotAPI Server application. But the last part SHALL be **"RESPONSE"**.
Component		org.deviceconnect	This value is the package name of the GotAPI Server application.
Extra			
	requestCode	10	
	result	0	

5.3.10 Stop response from the GotAPI Server to the application on the GotAPI-1 Interface

When the GotAPI Server receives the stop response, the GotAPI Server passes the response to the application follows:

Definition of the HTTP response

	Definitions
MIME-Type	application/json
HTTP status	200 OK

Definition of the data object for the response

Name		Type	Definition of value	Mandatory/Optional
product		String	The name of the GotAPI Server (e.g. "ABConnect")	Mandatory
version		String	The version of the GotAPI Server (e.g. "1.0").	Mandatory
result		Number	If success, the value is 0, otherwise an integer greater than 0, which indicates an error code. This specification doesn't define error codes.	Mandatory
hmac		String	An HMAC generated for the counter measure against the GotAPI Server spoofing attack. If the application includes a key for HMAC calculation in the API request, the GotAPI Server adds this value in the API response. Evaluating whether the HMAC is identical to the result of calculation of HMAC from the key, the application can ensure that the response is genuine.	Mandatory if the application provide a key to the GotAPI Server

The GotAPI Server SHALL serialize the data structure above as a JSON formatted stream (i.e. JSON string), then send it to the originating application on the GotAPI-5 (WebSocket connection).

Example of the response

```
{
  "product": "ABCConnect",
  "version": "1.0",
  "result" : 0,
  "hmac"   : "0123456789"
}
```

Appendix A.   Change History   (Informative)

A.1   Approved Version History

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

A.2   Draft/Candidate Version 1.0 History

Document Identifier	Date	Sections	Description
Draft Versions	26 Aug 2015	All	First Draft
OMA-TS-Pulse_Oximeter_APIs-V1_0	06 Nov 2015	5	Incorporated CR: OMA-CD-DWAPI-2015-0031-CR_Pulse_Oximeter_API_Baseline
Candidate Version OMA-TS-Pulse_Oximeter_APIs-V1_0	19 Apr 2016	n/a	Status changed to Candidate by TP TP Ref # OMA-TP-2016-0057- INP_DWAPI_V1_0_ERP_for_Candidate_approval