

BLUETOOTH® DOC	Date / Year-Month-Day 2014-10-07	Approved Adopted	Revision V1.1.0	Document No CTS_SPEC
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CURRENT TIME SERVICE

Abstract:

This *Bluetooth®* service defines how the current time can be exposed using the Generic Attribute Profile (GATT).

Revision History

Revision	Date (yyyy-mm-dd)	Comments
V1.1.0	2014-10-07	Adopted by the Bluetooth SIG BoD

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The word *shall* is used to indicate mandatory requirements strictly to be followed in order to conform to the standard and from which no deviation is permitted (*shall* equals *is required to*).

The use of the word *must* is deprecated and shall not be used when stating mandatory requirements; *must* is used only to describe unavoidable situations.

The use of the word *will* is deprecated and shall not be used when stating mandatory requirements; *will* is only used in statements of fact.

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1 Introduction

Many Bluetooth devices have the ability to store and show date and time information. This service defines how a Bluetooth device can expose date and time information to other Bluetooth devices. The term “server device” in this specification refers to the device that exposes date and time information by implementing this specification. A device that uses the exposed information is referred to as a “client device”.

1.1 Conformance

If a server claims conformance to this Service, all capabilities indicated as mandatory for this Service shall be supported in the specified manner (process-mandatory). This also applies for all optional and conditional capabilities for which support is indicated. All mandatory capabilities, and optional and conditional capabilities for which support is indicated, are subject to verification as part of the Bluetooth qualification program.

1.2 Service Dependency

This service is not dependent on any other services.

1.3 Bluetooth Specification Release Compatibility

This specification is compatible with Bluetooth Core Specification 4.0 or later [\[1\]](#).

1.4 GATT Sub-Procedure Requirements

Additional GATT Sub-Procedures requirements beyond those required by the GATT are indicated in [Table 1.1](#).

GATT Sub-Procedure	Requirements
Notification	M
Read Characteristic Descriptors	M
Write Characteristic Descriptors	M
Write Characteristic Value	O

Table 1.1: GATT Sub-Procedure Requirements

1.5 Transport Dependencies

There are no transport restrictions imposed by this service specification..

Where the term BR/EDR is used throughout this document, this also includes the use of AMP.

1.6 Error Codes

This service defines the following Attribute Protocol Application Error codes:

Name	Error Code	Description
------	------------	-------------

Data field ignored	0x80	The server ignored one or more fields
--------------------	------	---------------------------------------

1.7 Byte Transmission Order

All characteristics used with this service shall be transmitted with the least significant octet first (i.e., little endian). In the characteristic definitions in the Assigned Numbers [\[2\]](#) the least significant octet is the lowest numbered offset.

2 Service Declaration

The Current Time service shall be a «Primary Service» and the service UUID set to «Current Time Service» as defined in [\[2\]](#).

There shall be only one instance of the Current Time Service in a device.

3 Service Characteristics

The Current Time Service exposes Current Time characteristic. It optionally exposes Local Time Information characteristic and Reference Time Information characteristic. All these characteristics are defined in [2].

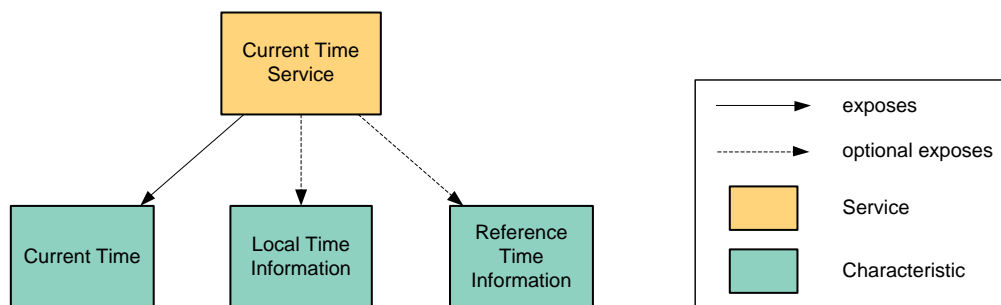


Figure 3.1: Characteristics for Current Time Service

The following characteristics are exposed in an instance of Current Time service.

Characteristic	Ref.	Mandatory / Optional
Current Time	3.1	M
Local Time Information	3.2	O
Reference Time Information	3.3	O

Table 3.2: Service characteristics

In Table 3.2, characteristics that are mandatory or characteristics that are optional that are implemented shall comply with the properties in Table 3.3:

	Broadcast	Read	Write without Response	Write	Notify	Indicate	Signed Write	Reliable Write	Writable Auxiliaries
Current Time	X	M	X	O	M	X	X	X	X
Local Time Information	X	M	X	O	X	X	X	X	X
Reference Time Information	X	M	X	X	X	X	X	X	X

Table 3.3: Characteristic properties

Requirements marked with 'M' are mandatory, 'O' are optional, and 'X' are excluded (not permitted).

An example characteristic database is shown in Appendix A.

3.1 Current Time

In this section, the term “local date and time” refers to the internal representation of date and time which is maintained by the server device. During read or notify GATT operations, the fields of the Current Time characteristic are set to values derived from the local date and time. During write GATT operation, the local date and time is optionally set to values derived from the fields of the Current Time characteristic.

3.1.1 Characteristic Behavior – Read

The Current Time characteristic returns the current date and time in the server device when read by a client device using the *GATT Read Characteristic Value* sub-procedure. The date and time values returned shall be the local date and time of the server device (the time the server device would display to the user, which is normally the correct time for the location adjusted for time zone and DST).

The server device shall set the Exact Time 256 field to the current local date and time. If the server device does not support the 1/256th of seconds, it shall set the Fractions256 field to 0.

If the information about the date or day of week is not available, the server device shall set the values of the fields Year, Month, Day, and/or Day of Week to 'unknown' [2].

3.1.2 Characteristic Behavior – Notification

This characteristic can be configured for notification using the *GATT Write Characteristic Descriptors* sub-procedure on the *Client Characteristic Configuration* descriptor. When configured for notification, this characteristic can be notified while in a connection.

A server device shall notify this characteristic to the client device depending on the value of *Client Characteristic Configuration descriptor* when the time of the server device is adjusted. The events that can cause the local time in the server device to change are user interaction (setting time via UI), time zone change, DST offset change, or reference time change. These events are not exclusive.

If the time of the server device is changed because of reference time update, then no notifications shall be sent to the client device within the 15 minutes from the last notification, unless one or both of the two statements below are true:

1. The new time information differs by more than 1 minute from the server device time previous to the update.
2. The update was caused by the client device (interacting with another service).

Notifications caused by other events, like the change of time zone or DST offset and adjustment by the user, shall be conveyed to the client device immediately.

The server device shall set the Adjust Reason field in the Current Time to reflect the reason for the last adjustment of the local time on the server device.

After initialization or in any other case when the reason for the last change update of time in the server device is not known, all the bits in the Adjust Reason field shall be set to zero. When time is updated in the server device, and the reason is known, the bits in the Adjust Reason field shall be set according to section 3.1.2.1, 3.1.2.2, 3.1.2.3, and 3.1.2.4 (The format of the Adjust Reason field is defined in [2]).

3.1.2.1 Manual Time Update

If the time information on the server device was set / changed manually, the “Manual Time Update” bit shall be set.

Note: If the time zone or DST offset were changed manually, this bit shall also be set.

3.1.2.2 External Reference Time Update

If the server device received time information from an external time reference source, the External Reference Time Update bit shall be set.

3.1.2.3 Change of Time Zone

If the time information on the server device was set / adjusted because of change of time zone, the “Change of Time Zone” bit shall be set.

Note: Following 3.1.2.1, if the time zone was changed manually the “Manual Time Update” bit will also be set.

3.1.2.4 Change of DST Offset

If the time information on the server device was set / adjusted because of change of DST offset, the “Change of DST offset” bit shall be set.

Note: Following 3.1.2.1, if the DST offset was changed manually, the “Manual Time Update” bit will also be set.

3.1.3 Characteristic Behavior – Write

When the Current Time characteristic is written using the *GATT Write Characteristic Value* sub-procedure, the server device may adjust the local date and time of the server device to a value derived from the value in the Current Time characteristic. The server device may choose to ignore fields in the values written to its Current Time characteristic. If one or more fields are ignored, the server device shall return an error code as defined in Section 1.6.

3.1.4 Characteristic Descriptors

3.1.4.1 Client Characteristic Descriptor

The *Client Characteristic Configuration* descriptor shall be included in this characteristic.

This descriptor shall be readable and writable.

This descriptor can be read using the *GATT Read Characteristic Descriptors* sub-procedure.

This descriptor can be written using the *GATT Write Characteristic Descriptors* sub-procedure.

3.2 Local Time Information

In this section, the terms “current time zone” and “current DST offset” refer to the internal representation of information about local time which is maintained by the server device. During read GATT operation, the fields of the Local Time Information characteristic are set to values derived from the current time zone and current DST offset. During write GATT operation, the current time zone and current DST offset are optionally set to values derived from the fields of the Local Time Information characteristic.

3.2.1 Characteristic Behavior – Read

The Local Time Information characteristic returns the local time information that includes time zone and DST offset when read using the *GATT Read Characteristic Value* sub-procedure.

If the Local Time Information characteristic exists, the server device shall set the Time zone field of the Local Time Information to the offset of the local standard time compared to UTC and the DST offset field of Local Time Information to the current DST offset. If time zone and DST offset information are currently unavailable, the server device may set the fields to the values defined as 'time zone unknown' [2] or 'DST offset unknown' [2].

3.2.2 Characteristic Behavior – Write

When the Local Time Information characteristic is written using the *GATT Write Characteristic Value* sub-procedure, the server may adjust the current time zone and/or the current DST offset to the values in the Local Time Information characteristic. The server device may choose to ignore fields in the values written to its Local Time Information characteristic. If one or more fields are ignored, the server device shall return an error code as defined in Section 1.6.

3.2.3 Characteristic Descriptors

No characteristic descriptors are required beyond those defined in the characteristic specification.

3.3 Reference Time Information

The Reference Time Information characteristic returns the information about the reference time source when read using the *GATT Read Characteristic Value* sub-procedure.

If Reference Time Information exists, the server device shall set the Time Source field of the Reference Time Information characteristic to the value that represents the source of its current time information. It is assumed that the server device will use its best

source available (at a given time), but it is outside the scope of this service to specify how the server device uses its reference time sources.

The server device shall set the Days Since Update and Hours Since Update fields of Reference Time Information characteristic to the time span that passed since the Time was updated successfully from the source specified in Time Source field. If the last update was more than 254 days and 23 hours ago, both values shall be set to 255.

The server device shall set the Accuracy field of the Reference Time Information characteristic to the estimated accuracy (drift) of its time information compared to the original time source (e.g., a server device with a real-time clock that is rated to drift a maximum 750 ms a day, and that acquired the last time update 48 hours ago might have drifted 1.5s, thus it will set the Accuracy field to 12 ($12/8=1.5$ s). If a server device does not know the accuracy of its time information, it shall set the Accuracy field to 255 (Accuracy unknown).

A server device that does not support the Fractions256 field in Current Time characteristic shall set the Time Accuracy field to the larger value of the actual accuracy and 1 second.

3.3.1 Characteristic Descriptors

No characteristic descriptors are required beyond those defined in the characteristic specification.

4 SDP Interoperability

If this service is exposed over BR/EDR then it shall have the following SDP record.

Item	Definition	Type	Value	Status
Service Class ID List				M
Service Class #0		UUID	«Current Time Service»	M
Protocol Descriptor List				M
Protocol #0		UUID	L2CAP	M
Parameter #0 for Protocol #0	PSM	Uint16	PSM = ATT	M
Protocol #1		UUID	ATT	M
Parameter #0 for Protocol #1	GATT Start Handle	Uint16	First handle of this service in the GATT database	M
Parameter #1 for Protocol #1	GATT End Handle	Uint16	Last handle of this service in the GATT database	M
BrowseGroupList			PublicBrowseRoot*	M

Table 4.1: SDP Record

* PublicBrowseRoot shall be present; however, other browse UUIDs may also be included in the list.

5 Acronyms and Abbreviations

Acronyms and Abbreviations	Meaning
AMP	Alternate MAC PHY
BR/EDR	Basic Rate / Enhanced Data Rate
DST	Daylight Saving Time
LE	Low Energy
UTC	Coordinated Universal Time
UUID	Universally Unique Identifier

Table 5.1: Acronyms and Abbreviations

6 References

- [1] Bluetooth Core Specification v4.0 or later
- [2] Characteristic and Descriptor descriptions are accessible via the [Bluetooth SIG Assigned Numbers](#)

Appendix A Example Attribute Database

An example attribute database for Current Time Service is shown as follows:

UUID [2]	Permissions	Mandatory / Optional	Value (Default)
<<Primary Service>>	Read	M	<<Current Time Service>>
<<Characteristic>>	Read	M	Properties = 0x12 (read, notify), Handle = Handle of Current Time, UUID = <<Current Time>>
<<Current Time>>	Read, Notify	M	ref [2]
<<Client Characteristic Configuration>>	Read, Write	M	0x0000
<<Characteristic>>	Read	O	Properties = 0x02 (read), Handle = Handle of Local Time Information, UUID = <<Local Time Information>>
<<Local Time Information>>	Read	O	ref [2]
<<Characteristic>>	Read	O	Properties = 0x02 (read), Handle = Handle of Reference Time Information, UUID = <<Reference Time Information>>
<<Reference Time Information>>	Read	O	ref [2]