CURRENT TIME SERVICE

Abstract:

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

Revision History

Revision	Date (yyyy-mm-dd)	Comments
D09r01	2010-11-11	Initial draft
D09r02	2010-12-10	Followed the new template
D09r03	2011-01-06	Remove "Indication", Change security policy.
D09r04	2011-01-23	Add the GATT procedure to fit the Time Profile with some fix.
D09r05	2011-02-02	Remove "Secondary Time" related part
D09r06	2011-02-04	Updated during F2F in Las Vegas
D09r07	2011-02-08	Fix property again and add the explanation for Result Reason
D09r08	2011-03-14	Change the word for DST. Update the accuracy definition.
D09r10	2011-04-27	The section of byte transmission order was added.
D09r11	2011-06-11	Deleted BR/EDR and added clarity to CT Time date and time
D09r12	2011-07-18	Clean version including responses to all Barb commenters (not yet changed CT Time into something else)
V09r00	2011-07-26	Adopted by the Bluetooth SIG Board of Directors
D10r01	2011-08-10	First Draft D10
D10r02	2011-08-10	Changed name of characteristic "CT Time" to "Current Time"
D10r03	2011-08-14	Removed PS disclaimer
V10r00	2011-09-15	Adopted by the Bluetooth SIG Board of Directors

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Document Terminology

The Bluetooth SIG has adopted Section 13.1 of the IEEE Standards Style Manual, which dictates use of the words ``shall'', ``should'', ``may'', and ``can'' in the development of documentation, as follows:

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.

The word *should* is used to indicate that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required; or that (in the negative form) a certain course of action is deprecated but not prohibited (*should* equals *is recommended that*).

The word *may* is used to indicate a course of action permissible within the limits of the standard (*may* equals *is permitted*).

The word *can* is used for statements of possibility and capability, whether material, physical, or causal (*can* equals *is able to*).

Contents

1   Introduction

Many *Bluetooth* devices have the ability to store and show time information. This service defines how a *Bluetooth* device can expose time information to other *Bluetooth* devices.

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 has no dependencies on other GATT-based services.

1.3 *Bluetooth* Specification Release Compatibility

This service is compatible with any *Bluetooth* core specification host that includes the Generic Attribute Profile (GATT).

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

Table 1.1: GATT Sub-Procedure Requirements

1.5 Transport Dependencies

The service shall operate over LE transport only.

1.6 Error Codes

No error codes are defined in this service.

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].
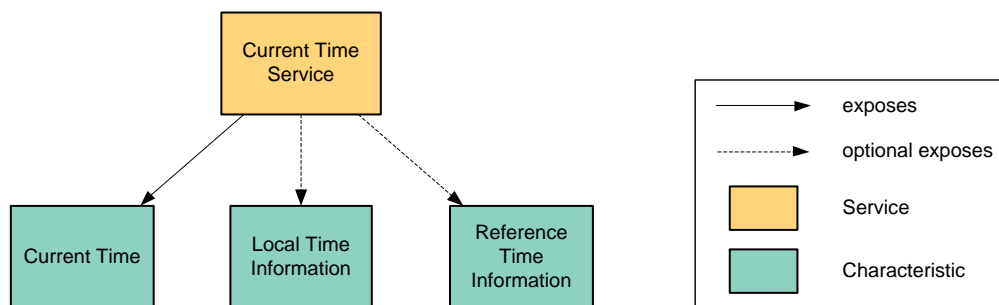

Figure 3.1: Characteristics for Current Time Service

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	X	M	X	X	X	X
Local Time Information	X	M	X	X	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

3.1.1 Characteristic Behavior

The Current Time characteristic returns the current date and time in the Current Time Server when read 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 Current Time Server shall set the Exact Time 256 field in the Current Time characteristic to the current local date and time. If the Current Time Server does not support the 1/256th of seconds, it shall set the Fractions256 field to zero and set the Accuracy field of Reference Time Information characteristic accordingly (see Section 3.3).

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

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 Current Time Server shall notify this characteristic to this Service Client depending on the value of *Client Characteristic Configuration descriptor* when the time of the Current Time Server is adjusted. The events that can cause the local time in the Current Time Server 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 Current Time Server is changed because of reference time update, then no notifications shall be sent to the Current Time Service Client 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 Current Time Server time previous to the update.

2. The update was caused by the client (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 immediately.

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

After initialization or in any other case when the reason for the last change update of time in the Current Time Server is not known, all the bits in the Adjust Reason field shall be set to zero. When time is updated in the Current Time Server, and the reason is known, the bits in the Adjust Reason field shall be set according to section 3.1.1.1, 3.1.1.2, 3.1.1.3, and 3.1.1.4 (The format of the Adjust Reason field is defined in [2]).

3.1.1.1   Manual Time Update

If the time information on the Current Time Server 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.

3.1.1.2   External Reference Time Update

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

3.1.1.3   Change of Time Zone

If the time information on the Current Time Server was set / adjusted because of change of time zone, the "Change of Time Zone" bit shall be set. Note: Following 3.1.1.1, if the time zone was changed manually the "Manual Time Update" bit will also be set.

3.1.1.4   Change of DST offset

If the time information on the Current Time Server was set / adjusted because of change of DST offset, the "Change of DST offset" bit shall be set. Note: Following 3.1.1.1, if the DST offset was changed manually, the "Manual Time Update" bit will also be set.

3.1.2 Characteristic Descriptors

3.1.2.1   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

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 Current Time Server 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 Current Time Server may set the fields to the values defined as 'time zone unknown' [2] or 'DST offset unknown' [2].

3.2.1 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 Current Time Server shall set the Time Source field of the Reference Time Information characteristic to the value that represents the best source of its current time information.

The Current Time Server 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 Current Time Server 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. For example, a Current Time Server with a real-time clock that is rated to drift a maximum 750 ms a day, and that received 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 Current Time Server does not know the accuracy of its time information, it shall set the Accuracy field to 255 ($\rightarrow$ Accuracy unknown).

A Current Time Server that does not support 1/256th field in Current Time shall set the Time Accuracy field to the larger 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 Acronyms and Abbreviations

Acronyms and Abbreviations	Meaning
DST	Daylight Saving Time
UTC	Coordinated Universal Time
UUID	Universally Unique Identifier

Table 4.1: Acronyms and Abbreviations

5 References

[1]   *Bluetooth* Core Specification v4.0
[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]