Microchip Transparent Service v1.1

Abstract:

The Service is used for data exchange between Transparent Client and Transparent Server that intended for consumer burst application data exchange.

Revision History

Revision	Date (yyyy-mm-dd)	Comments
V1.0	2016-09-01	Initiate this document
V1.1	2020-07-14	Revised spec for Chimera and later BLE platforms.

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1. INTRODUCTION

The Transparent Service is used for Transparent Profile Client and Server roles for upper layer application burst data exchange with Credit Based flow control.

1.1 Conformance

If conformance to this profile is claimed, all capabilities indicated as mandatory for this profile shall be supported in the specified manner (process-mandatory). This also applies to 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 Microchip qualification program.

1.2 Service Dependency

This service is not dependent upon any other services.

1.3 Bluetooth Specification Release Compatibility

This specification is compatible with Bluetooth Core Specification 4.0 or later version of the Core Specification [1].

1.4 GATT Sub-Procedure Requirements

Requirements in this section represent a minimum set of requirements for a Server. Other GATT sub-procedures may be used if supported by both Client and Server.

Table 1.1 summarizes additional GATT sub-procedure requirements beyond those required by all GATT Servers.

GATT Sub-Procedure	Requirements
Write Characteristic Value	M
Notifications	M
Write Characteristic Descriptors	M

Table 1.1: GATT Sub-procedure Requirements

1.5 Byte Transmission Order

All characteristics used with this service shall be transmitted with the least significant octet first (i.e., little endian). The least significant octet is identified in the characteristic definitions in [2].

1.6 Error Codes

This service does not define any Attribute Protocol Application Error codes.

2. SERVICE DECLARATION

In most cases, the Transparent Service should be instantiated as a «Primary Service»; however, it can be refined by upper layer profile or specification.

The Service UUID is set to 《49535343-FE7D-4AE5-8FA9-9FAFD205E455》.

3. SERVICE CHARACTERISTICS

The following characteristics are exposed in the Transparent Service. Only one instance of each characteristic is permitted within this service. In its basic form, the Transparent Service exposes three characteristics:

- **Transparent Uplink Data (TUD)**: UUID 49535343-1E4D-4BD9-BA61-23C647249616
- **Transparent Downlink Data (TDD)**: UUID 49535343-8841-43F4-A8D4-ECBE34729BB3
- **Transparent Control Point (TCP)**: UUID 49535343-4C8A-39B3-2F49-511CFF073B7E

Support for the security permission within these three characteristics are optional.

3.1 Transparent Uplink Data (TUD) Characteristic

This characteristic is used for uplink data transmission from Server to Client via Characteristic Value Notify operation.

3.1.1 Transparent Uplink Data Characteristic Behavior

Once the Client Characteristic Configuration Descriptor of Transparent Uplink Characteristic is enabled by Client, Server can notify a Characteristic Value to Client without any Attribute Protocol layer acknowledgment though this attribute handle. That means Server could send burst of data to Client.

This CCCD should be enabled behind Uplink Credit Based Flow Control is enabled if Client would like to enable Uplink Credit Based Flow Control.

3.2 Transparent Downlink Data (TDD) Characteristic

This characteristic is used for downlink data transmission from Client to Server via Characteristic Value Write Command or Write Request.

3.2.1 Transparent Downlink Data Characteristic Behavior

While Downlink Credit Based Flow Control is enabled, Client can send burst data to Server by performing a Write Command with a Characteristic Value of this attribute handle.

If Downlink Credit Based Flow Control is not enabled, Client may just send data to Server by performing a Write Request Command with a Characteristic Value of this attribute handle.

3.3 Transparent Control Point (TCP) Characteristics

The structure of TCP characteristic is defined as below. To ensure the successful operation, this Client Characteristic Configuration Descriptor (CCCD) of Transparent Control Point (TCP) on Server should be enabled via Write Command by Client

	Op Code	Parameter
Octet Order	N/A	LSO...MSO
Data Type	UNIT 8	Variable
Size	1 Octet	Variable

Table 3.1: Structure of Transparent Control Point

3.3.1 Transparent Control Point Procedure Requirements

Table 3.2 shows the OP Code definition of TCP characteristic. Range from 0x04 to 0x13 and 0x16 to 0x1F are reserved for future used. Range from 0x20 to 0xFF are reserved for higher layer specification application.

Op Code	Description	Parameter	Response Code Triggered
0x00	Response Code for received success Op Code	Request Op Code (UINT8), Response Parameters.	No
0x01	Response Code for received Op Code but not supported	Request Op Code (UINT8)	No
0x02	Response Code for received Op Code with invalid parameter	Request Op Code (UINT8)	No
0x03	Response Code for received Op Code but operation Fail	Request Op Code (UINT8)	No
0x04-0x13	Reserved	N/A	N/A
0x14	Downlink Credit Based Flow Control enable.	None	Yes
0x15	Uplink Credit Based Flow Control enable	Credit Value (UNIT8)	No
0x16-0x1F	Reserved	N/A	N/A
0x20-0xFF	Reserved for higher layer specification	N/A	N/A

Table 3.2: Definition of Op Code in TRCP characteristic

Table 3.3 shows the of Response Parameters structure of Triggered Response Code. Recently, only 0x14 Op Code Client role asserted may induce Response code.

Request Op Code	Response Parameters	Description
Downlink Credit Based Flow Control enable (0x14)	MTU Value (UNIT16), Credit Value (UNIT8)	Server will send these Response Parameters by 0x00 Op Code to give Credit Value.

Table 3.3: Definition of Response Parameters structure

Credit Value field is given Credit number that data receiver returned to transmitter. One credit returned means transmitter can send one ATT packet to receiver. The default Credit Value is zero before Credit Base Flow Control is enabled.

MTU Value field is ATT_MTU value as the maximum size of any packet sent between a client and a server.

3.3.2 Transparent Control Point Characteristic Behavior

While the Transparent Control Point is used by a Client to control certain behaviors of the Server. The procedures are triggered by Write a Characteristic Value that includes an Op Code specifying the operation and the Server will Notify the result of the operations.

While the Transparent Control Point is used by a Server to control certain behaviors of the Client. The procedures are triggered by Notify a Characteristic Value that includes an Op Code specifying the operation and Client will Write the result of the operations.

For each of the procedures is described in the next sections.

3.3.2.1 Downlink Credit Based Flow Control (DCBFC)

The procedure is used by a Transparent Client to enable Downlink Credit Based Flow Control for the Transparent Server. Once it is enabled, Client role can only send data to Server while credit count greater than zero.

When enable Downlink Credit Based Flow Control, Client shall write CTP characteristic handle with "Downlink Credit Based Flow Control Enable" Op Code (0x14) to the Transparent Control Point on Transparent Server. And the Transparent Server shall send the MTU value and available credit to Transparent Client by Response Parameters of 0x00 Op Code. Transparent Client will check the credit count to know how many data can be transmitted to the Transparent Server by performing Write Command operation to TDD Characteristic handle. The Credit count will be decreased by the number of ATT data sending by Transparent Client. Transparent Client can send data only while the credit count is greater than zero. Transparent Server shall return the credit to Transparent Client after finish dealing with the received data.
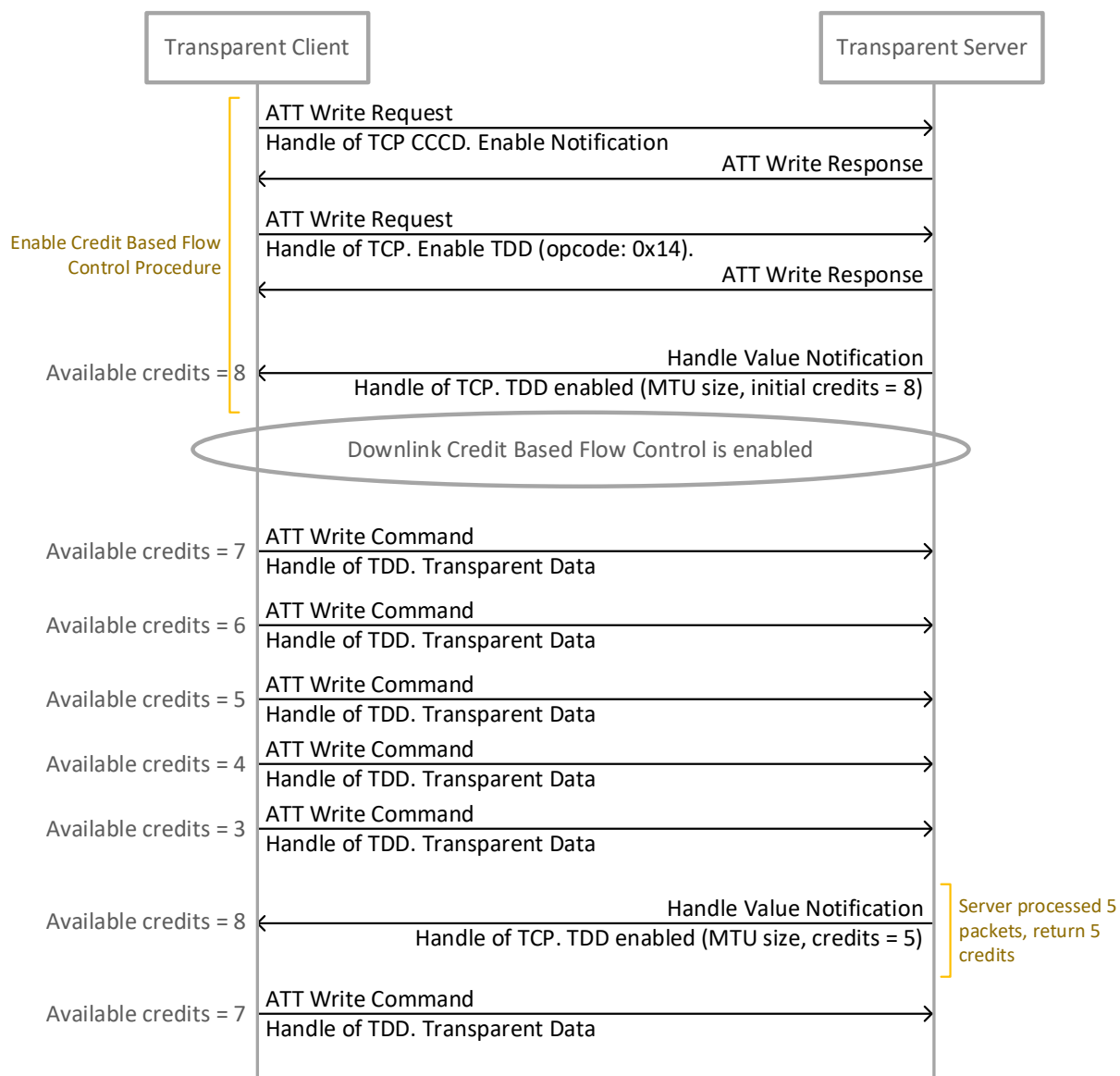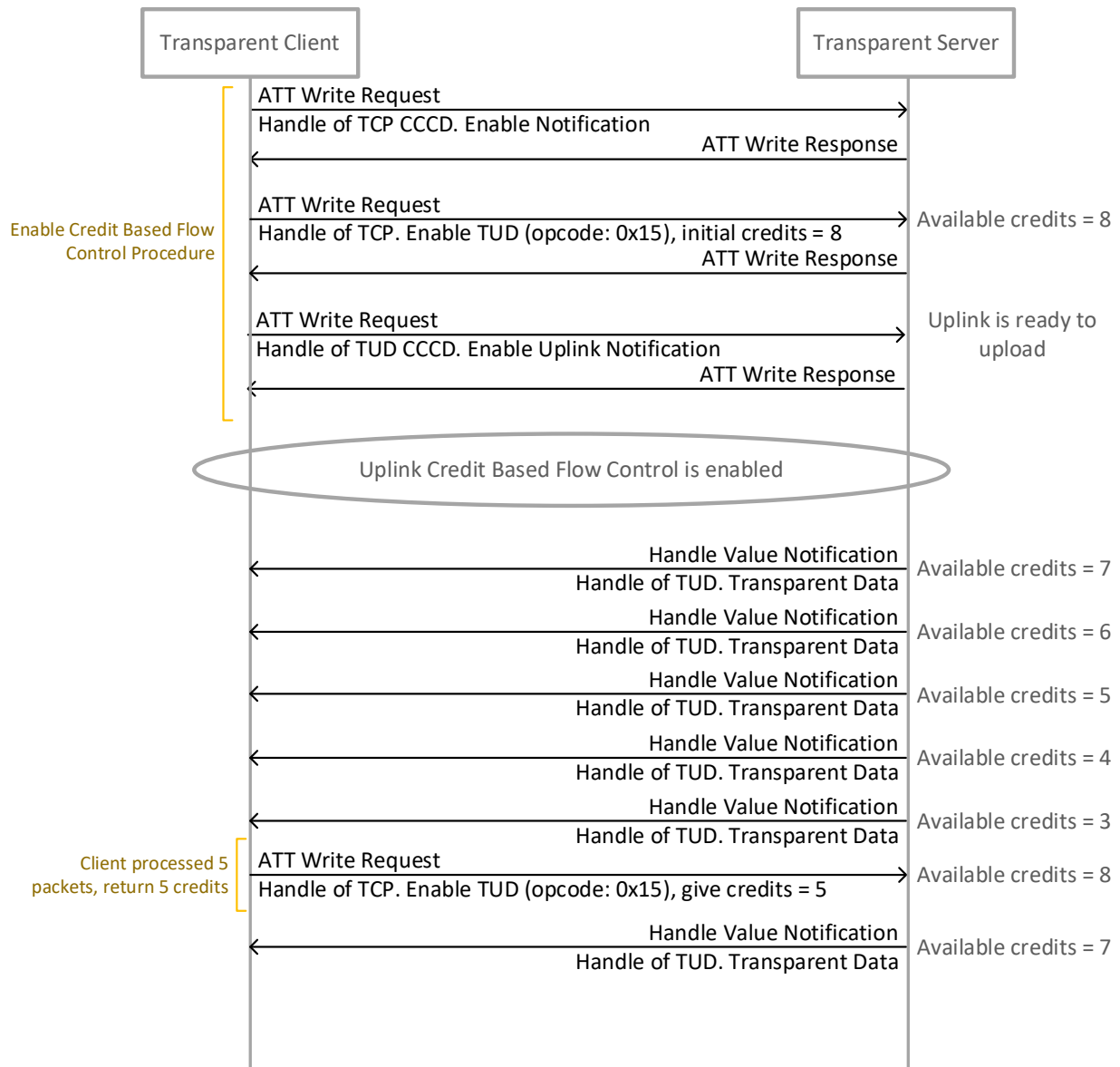
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Figure 3.1 Example MSC of Downlink Credit Based Flow Control usage. Initial credit number is 8 and credits-given threshold is 5.

3.3.2.2 Uplink Credit Based Flow Control (UCBFC)

The procedure is used by a Transparent Client to enable Uplink Credit Based Flow Control on the Transparent Server. Once it is enabled, Server role can only send data to Client while credit count greater than zero.

When enable Uplink Credit Based Flow Control, Client shall write "Uplink Credit Based Flow Control Enable" Op Code (0x15) to the Transparent Control Point on Transparent Server. There are given Credit value parameter in this Op Code. Transparent Server will check the credit count to know how many data can be uploaded to the Transparent Client by performing Notify ATT operation to TUD Characteristic handle. The Credit count will be decreased by the number of ATT data sending by Transparent Server. Transparent Server can send data only while the credit count is greater than zero. Transparent Client shall return the credit value to Transparent Server after finish dealing with the received data.

When enable Credit Based Flow Control Uplink and available credits on Client shall be written to the Transparent Control Point on Transparent Server. Transparent Server will check the number of credit to know how many available data list can transmit to the Transparent Client. The number of credit is decrease by the list of data sending by Transparent Server. Transparent Server is able to send data only while the number of credit is non-zero. Transparent Client shall return the credit to Transparent Server after Transparent Client finish dealing with the received data.

Example MSC of Uplink Credit Based Flow Control usage. Initial credit number is 8 and credits-given threshold is 5.

4. ACRONYMS AND ABBREVIATIONS

Acronyms and Abbreviations	Meaning
AD	Advertising Data
GATT	Generic Attribute Profile
LE	Low Energy
MTU	Maximum Transmission Unit
RFU	Reserved for Future Use

Table 4.1: Acronyms and Abbreviations

5.   REFERENCES

[1] Bluetooth Core Specification v4.0 or later version of the Core Specification.

[2] Characteristic and Descriptor descriptions are accessible via the Bluetooth SIG Assigned Numbers.