Microchip Transparent Credit Based Profile (v1.0)

Abstract:
This profile defines fundamental requirements to connect and interact with Transparent Credit Based Profile intended for higher application layer to exchange control command and data between Client and Server roles.

Revision History

Revision	Date (yyyy-mm-dd)	Comments
V1.0	2020-08-20	Initiate this document
V1.0 r1	2020-12-02	Revise the spec for the updated mechanism

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1 Introduction

The Transparent Credit Based Profile (TRCBP) defines fundamental requirements to enable higher layer application data exchange between TRCBP Client and Server devices.

1.1 Profile Dependencies

This profile requires the Generic Attribute Profile (GATT) and LE L2CAP connection-oriented channels (L2CAP CoC) with flow control using a credit based scheme for L2CAP data.

1.2 Bluetooth Specification Release Compatibility

This specification is compatible with Bluetooth Core Specification v4.1 [3].

2 Configuration

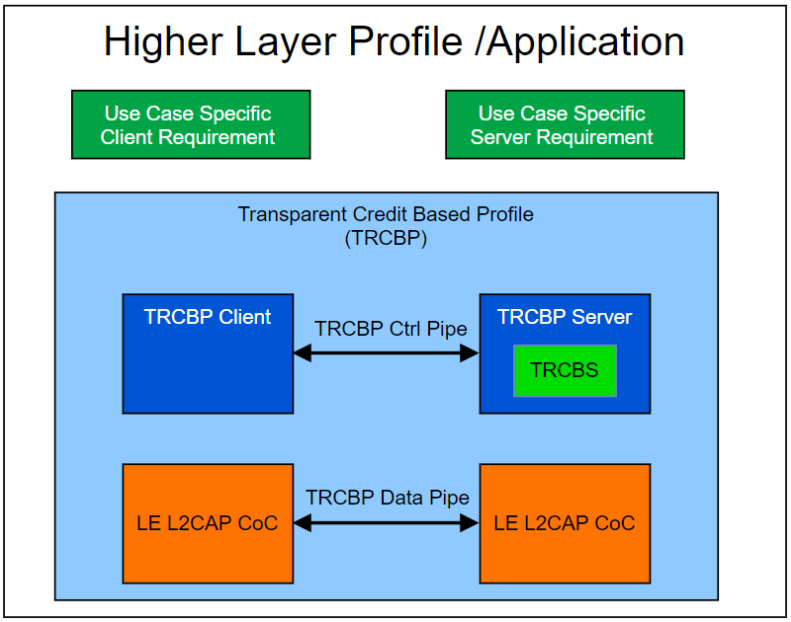
2.1 Roles

The profile defines two roles: Transparent Credit Based Server and Transparent Credit Based Client. Both of them can transfer data to each other.

- The Transparent Credit Based Server shall be a GATT Server and L2CAP CoC Acceptor role.
- The Transparent Credit Based Client shall be a GATT Client and L2CAP CoC Initiator role.

2.2 Role/Service Relationships

The following diagram illustrates the relationships between service and profile roles.



A Transparent Credit Based Server shall instantiate the Transparent Credit Based Service (TRCBS) [1]. As shown above, a higher layer specification is required to provide additional requirements on top of TRCBP that are specific to the need of the use case.

2.3 Transport Dependencies

The transport must be Bluetooth Low Energy because TRCBP is based on LE L2CAP CoC with Credit Based flow control.

3 Transparent Credit Based Server Role Requirements

The Transparent Credit Based Server shall instantiate one Transparent Credit Based Service [1]. A higher layer specification may impose additional requirements on the service declaration of the Transparent Credit Based Service (e.g., «Primary Service») as well as other additional requirements. There shall not be more than one instance of the Transparent Credit Based Service that is declared as a «Primary Service».

Service	Transparent Server
Transparent Credit Based Service	M

Table 3.1: Service Requirements for Transparent Credit Based Server

3.1 Additional Requirements for Low Energy Transport

This section describes the additional Transparent Credit Based Server requirements beyond those defined in the Transparent Credit Based Service when using this profile over Low Energy transport.

3.1.1 Manufacturer Specific Data or Service Data AD Types

While in a GAP Discoverable Mode for initial connection to a Transparent Credit Based Client, the Transparent Credit Based Server may include the Manufacturer Specific Data or Service Data defined in [3] AD type field of the advertising data. This enhances the user experience since a Transparent Credit Based Server may be identified by the Transparent Credit Based Client before initiating a connection.

3.1.2 TRCBP Data Pipe

The L2CAP LE Credit Based Flow Control Mode shall be supported.

4 Transparent Credit Based Client Role Requirements

Table 4.1 describes the discovery requirements for a Transparent Credit Based Client

Discovery Requirement	Section	Support in Transparent Credit Based Client
Transparent Credit Based Service Discovery	4.2	M
Transparent Credit Based Service Characteristic Discovery	4.3.1	M

Table4.1 Discovery Requirements for Transparent Credit Based Client

Table 4.2 describes the characteristic support requirements for a Transparent Credit Based Client.

Characteristic Support Requirements	Support in Transparent Credit Based Client
L2CAP PSM Value (L2PSM	M
Transparent Credit Based Control Point (TRCBCP)	M

Table 4.2Characteristic Support Requirements for Transparent Credit Based Client.

4.1 GATT Sub-Procedure Requirements

Requirements in this section represent a minimum set of requirements for a Transparent Credit Based Client. Other GATT sub-procedures may be used if supported by both of Transparent Credit Based Client and Server. The below table summarizes additional GATT sub-procedure requirements beyond those required by all GATT clients.

GATT Sub-Procedure	Transparent Client Requirements
Discover All Characteristics of a Service	M
Discover All Characteristics Descriptors	M
Read Characteristic Value	M
Write Characteristic Value	M
Write Characteristic Descriptors	M

Table 4.3: Additional GATT Sub-Procedure Requirements

4.2 Service Discovery

The Transparent Credit Based Client shall discover the service in Transparent Credit Based Server by performing primary service discovery, the Client shall use either the GATT

Discover All Primary Services sub-procedure or the GATT Discover Primary Services by Service UUID sub-procedure.
When performing secondary service discovery, the Client shall use the GATT Find Included Services sub-procedure to discover the Transparent Credit Based Service.

4.3 Characteristic Discovery

As required by GATT, the Client shall be tolerant of additional optional characteristics in the service records of services used with this profile. Where a characteristic is discovered that can be indicated or notified, the Transparent Credit Based Client shall also discover the associated Client Characteristic Configuration descriptor.

4.3.1 TRCBS Characteristic Discovery

The Client shall use either the GATT Discover All Characteristics of a Service sub-procedure or the GATT Discover Characteristics by UUID sub-procedure to discover the characteristics of the service. The Transparent Credit Based Client shall use the GATT Discover All Characteristic Descriptors sub-procedure to discover the characteristic descriptors.

4.4 TRCBS Characteristics

4.4.1 L2PSM Characteristic

Before L2CAP CoC connection establishment, Client may get L2CAP PSM values for the TRCBP Data Pipe by reading this characteristic from Server role.

4.4.2 Transparent Credit Based Control Point (TRCBCP) Characteristic

To ensure the data transmission throughput of Data Pipe over LE L2CAP CoC with Credit Based flow control, TRCBCP characteristic can be utilized as a Control Pipe. Both of Transparent Credit Based Client and Server can send the control command/response via TRCBCP characteristic.
Before performing a Transparent Credit Based Control Point procedure, the Transparent Credit Based Client shall configure the Transparent Credit Based Control Point (TRCBCP) characteristic for notifications (i.e., via the *Client Characteristic Configuration Descriptor*).
When Transparent Credit Based Client would like to send the control command to Transparent Credit Based Server, the Transparent Client shall Write a Characteristic Value to the TRCBCP Characteristic.
When Transparent Credit Based Server would like to reply the control command to Transparent Credit Based Client, the Transparent Credit Based Server shall perform a Notification with a Characteristic Value to the TRCBCP Characteristic.

4.5 Open Data Pipe

To open TRCBP Data Pipe for higher layer profile/application, Client should initiate L2CAP CoC connection procedure with LE Credit Based Flow Control Mode.

5 Connection Establishment Procedures

5.1 Data Pipe

Before creating the L2CAP CoC connection, Client obtains the L2CAP PSM value for the TRCBP Data Pipe by reading the L2PSM characteristic from Server role. Then Client issues the L2CAP CoC connection request with LE Credit Based Flow Control Mode based on the L2CAP PSM value.

Figure 5.1 illustrates the example of opening Transparent Credit Based Profile Data Pipe.

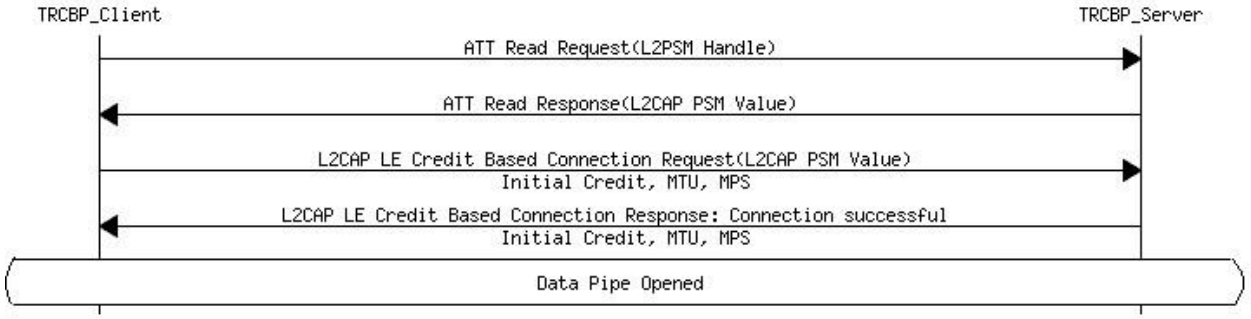


Figure 5.1 Example of Opening Transparent Credit Based Profile Data Pipe

5.2 Control Pipe

To enable the Control Pipe of Transparent Credit Based Profile, Client shall configure the Transparent Credit Based Control Point (TRCBCP) characteristic for notifications (i.e., via the *Client Characteristic Configuration Descriptor*). Then Client can send the control command to Server by writing a Characteristic Value to the TRCBCP Characteristic. And Server can reply the control command to Client by performing a Notification with a Characteristic Value to the TRCBCP Characteristic.

Figure 5.2 illustrates the example of opening Transparent Credit Based Profile Control Pipe.

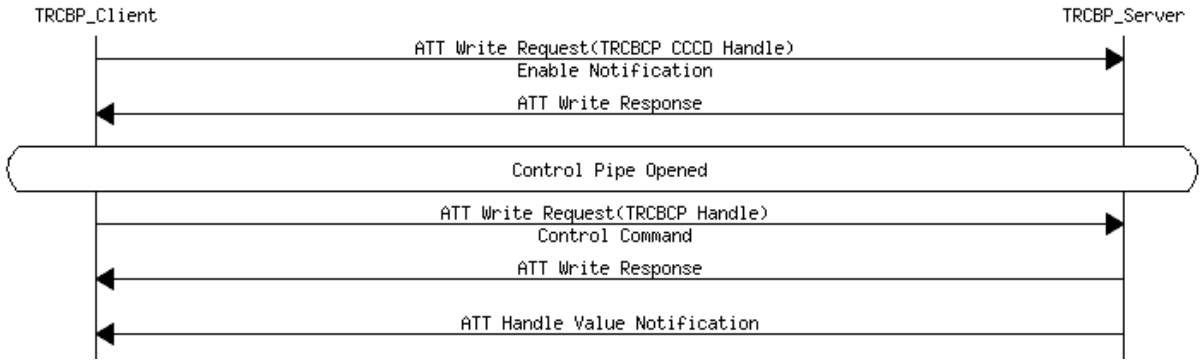


Figure 5.2 Example of Opening Transparent Credit Based Profile Control Pipe

6 Security Considerations

Security requirements may be defined by the higher layer specification.

7 Acronyms and Abbreviations

Acronyms and Abbreviations	Meaning
GATT	Generic Attribute Profile
LE	Low Energy
L2CAP CoC	L2CAP Connection oriented Channels
L2CAP PSM	L2CAP protocol/service multiplexer
TRCBP	Transparent Credit Based Profile
TRCBS	Transparent Credit Based Service
GATT	Generic Attribute Profile

Table 7.1: Abbreviations and Acronyms

8 References

[1] Transparent Credit Based Service v1.0.

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

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