

Picture Transfer Service Description

Version: 1.0.1

Date: 2020-11-05

Abstract

This service provides an interface for capturing and transmission of image files between two devices.

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Introduction

The Picture Transfer Service (PTS) exposes image data captured by a camera and allows to trigger image capture.

The PTS uses multiple characteristics to control camera, receive status and feature information and to transfer image data.

Service Dependencies

This service is not dependent upon any other services.

GATT Sub-Procedure Requirements

Additional GATT sub-procedures requirements beyond those required by GATT are indicated in table below:

GATT Sub-Procedure	Requirements
Write Characteristic Value	C.1
Write Without Response	C.2
Notifications	C.3
Write Characteristic Descriptors	C.4
Read Characteristic Descriptors	C.5

C.1: Mandatory if the "write" characteristic property is supported for any characteristic.

C.2: Mandatory if the "write without response" characteristic property is supported for any characteristic.

C.3: Mandatory if the "notify" characteristic property is supported for any characteristic.

C.4: Mandatory if the writable characteristic descriptor is supported for any characteristic.

C.5: Mandatory if a characteristic descriptor is supported for any characteristic.

Application Error Codes

This service defines the following Attribute Protocol Application Error codes:

Name	Error Code	Description
Notification Disabled	0x80	An attempt was made to start image capture without enabling notifications on Info Characteristic. An attempt was made to start image data transfer without enabling notifications on Image Data Characteristic.
Procedure in Progress	0x81	An attempt was made to start one-shot or continuous image capture while a capture operation is already in progress.
Data Transfer Disallowed	0x82	An attempt was made to request Image Data transmission before starting image capture or before Image Info for ongoing capture is available.

Byte Transmission Order

All characteristics used with this service shall be transmitted with the least significant octet first (i.e., little endian).

Service Declaration

The Picture Transfer Service is recommended to be instantiated as a Primary Service.

The Service UUID shall be set to «*Picture Transfer Service*» as defined in List of used UUIDs.

Service Characteristics

The following characteristics shall be exposed by this service.

Characteristic Name	Requirement	Mandatory Properties	Optional Properties	Security Permissions
Control Point	C.1	Write Without Response	Write	None
Info	C.1	Notify		None
Image Data	C.1	Notify		None



C.1: Exactly one instance of Control Point, Info or Image Data characteristics shall be supported.

Note:

- Security permissions set to 'None' means that the service does not impose any requirements.

Control Point Characteristic

The Control Point characteristic is used to issue commands to the device to either take a picture or to query for additional information.

This characteristic allows only Write Without Response property or optionally also Write property.

For each issued request that is written into Control Point a response will be sent back over the Info characteristic as single or multiple notifications.

The characteristic UUID shall be set to «*Control Point*» as defined in List of used UUIDs.

Characteristic Behavior

The Control Point characteristic value consists of 1 octet opcode that defines what kind of request is being made followed by 0 or more octets with command specific arguments. Number of octets to transmit is specified for each request type.

Table: List of available request opcodes.

Opcode	Request Type	Value length
0x00	RFU	N/A
0x01	Capture One-Shot Request	1 octet
0x02	Capture Continuous Request	1 octet
0x03	Capture Cancel Request	1 octet
0x04	Image Data Transfer Request	1 octet
0x05 - 0xFF	RFU	N/A

Capture One-Shot Request

This request is used to start image capture process to capture single image.

Typically the image processing sub-system of the device is powered only for the duration of the capture and data transfer and then immediately powered down to save power.

Table: Capture One-Shot Request value

Octet	Field Name	Value
1	Opcode	0x01

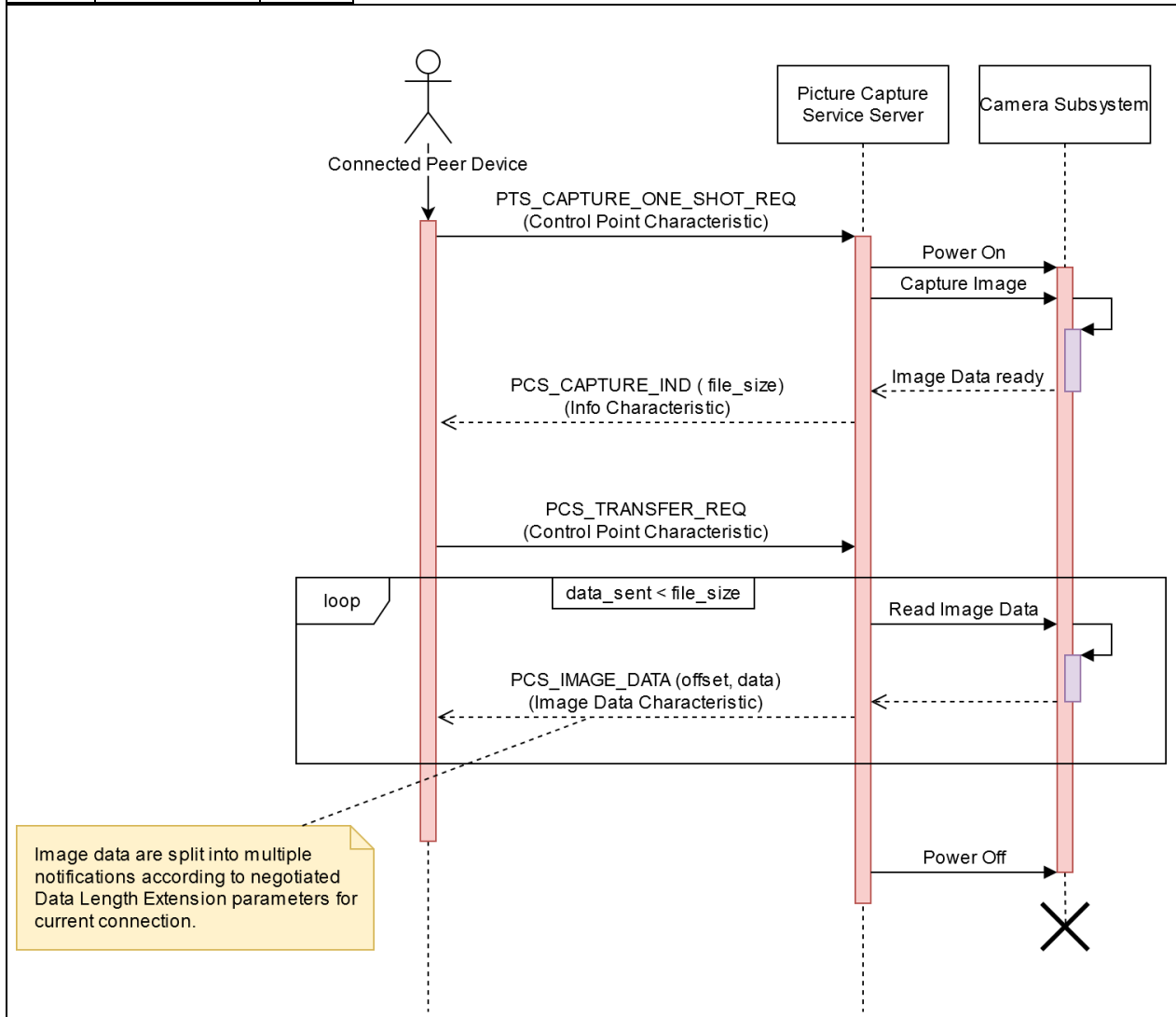


Image data are split into multiple notifications according to negotiated Data Length Extension parameters for current connection.

Figure 2. Typical Sequence diagram of single image capture request.

Capture Continuous Request

This command is used to capture and transmit images in quick succession to create image stream.

The image transfer can be stopped by issuing Capture Cancel Request or by disconnecting from the device.

Table: Capture Continuous Request value

Octet	Field Name	Value
1	Opcode	0x02

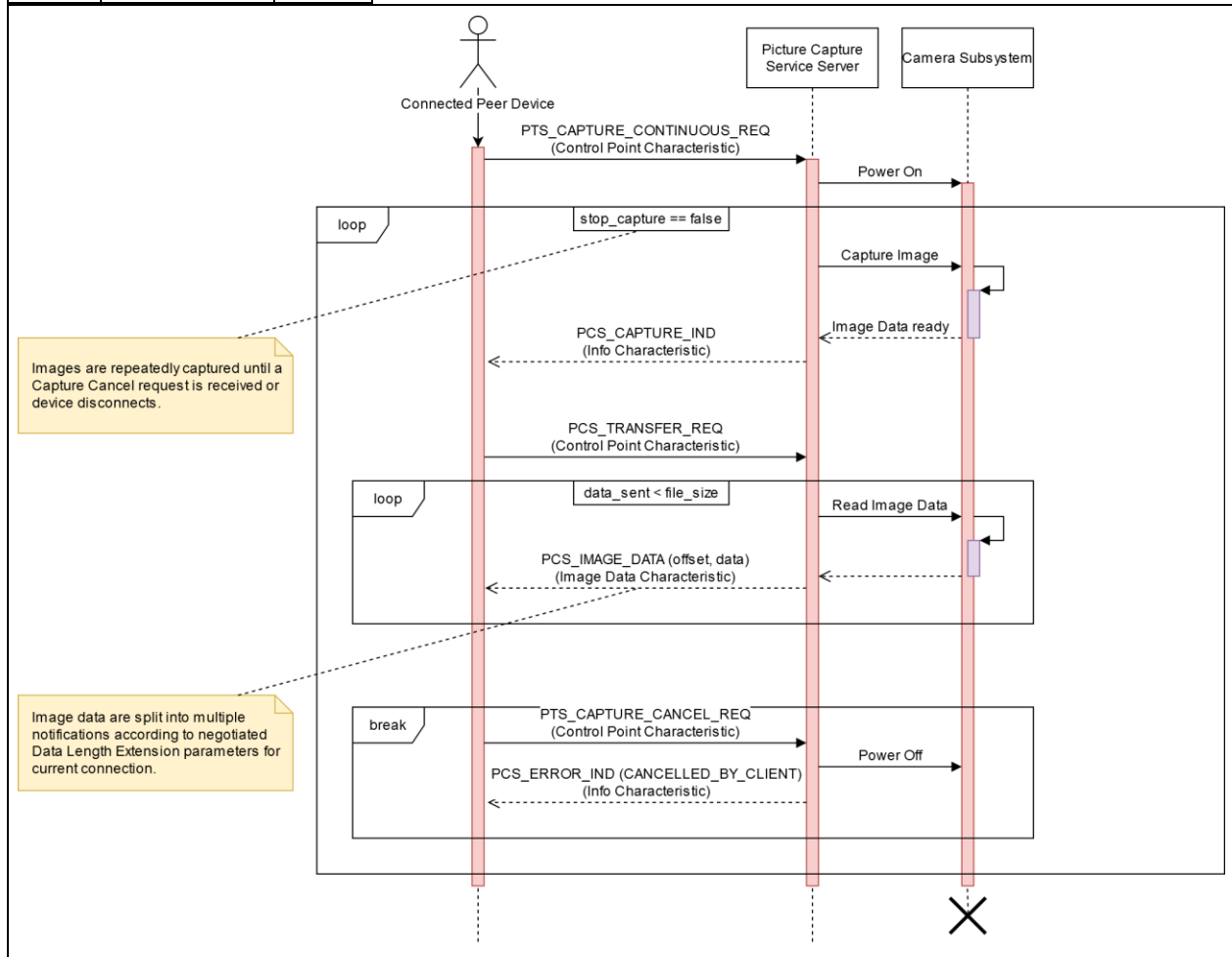


Figure 3. Typical Sequence diagram of continuous image capture request.

Capture Cancel Request

This request can be used to cancel ongoing capture operation. The device will reply with an error indication after this request is issued.

This request can be issued at any point of either One-Shot or Continuous Image Capture to cancel the capture & transfer.

**Table: Capture Cancel value**

Octet	Field Name	Value
1	Opcode	0x03

Image Data Transfer Request

This command is used by client to start the transfer of image data after it received Image Info notification and is ready to process image data.

The Image Data will be transmitted as notification over Image Data Characteristic.

Table: Image Data Transfer value

Octet	Field Name	Value
1	Opcode	0x04

Characteristic Descriptors

Descriptor Name	Requirement	Mandatory Permissions	Optional Permissions
Characteristic User Description	Optional	Read	

Info Characteristic

This characteristic is used to send responses to commands issued using the Control Point Characteristic and to notify client of any events that occurred as a result of a command.

The characteristic UUID shall be set to «Info» as defined in List of used UUIDs.

Characteristic Behavior

This characteristic uses notifications to inform client about status of image capture or to report errors.

All notifications start with 1 octet opcode that defines what kind of message is contained in this message followed 1 or more octets with operation specific data.

Table: List of opcodes send by Info Characteristic.

Opcode	Request Type
0x00	Error Indication
0x01	Image Captured Indication

Error Indication

This message can be used to inform the client of any errors that might occur during the image capture & transfer processes.

If an error indication is transmitted then any ongoing capture operation is cancelled on both client and server side.

Table: List of error codes

Error code	Description
0x00	Capture operation cancelled due to server side error.
0x01	Capture operation cancelled after client issued Capture Cancel Request.

Table: Error Indication value

Octet	Field Name	Value
1	Opcode	0x00
2	Error code	One of values listed in List of error codes table.

Image Captured Indication

This message is used during image capture process to inform the client that image data are ready to be transmitted.

Table: Image Captured Indication value

Octet	Field Name	Value
1	Opcode	0x01
2	Image File Size[0] (LSB)	Image file size in bytes.
3	Image File Size[1]	
4	Image File Size[2]	
5	Image File Size[3] (MSB)	



Characteristic Descriptors

Descriptor Name	Requirement	Mandatory Permissions	Optional Permissions
Characteristic User Description	Optional	Read	
Client Characteristic Configuration	Mandatory	Read, Write	

The client must enable characteristic Notifications using Client Characteristic Configuration descriptor before issuing any commands to Control Point Characteristic to enable reception of command responses.

Image Data Characteristic

This characteristic is used to transmit image file data from server to client using variable length notifications.

The characteristic UUID shall be set to «*Image Data*» as defined in List of used UUIDs.

Transmission of image data is triggered by Image Data Transfer Request as illustrated in Figure 2.

Characteristic Behavior

Image data are transmitted sequentially and are split over multiple notifications until all image data was transferred.

Each Image Data notification starts with *Data Offset* followed by *Image Data*.

Data Offset is 4 byte value that indicates the offset of first *Image Data* byte from start of image file.

Image Data can have variable length depending on negotiated Data Length Extension (DLE) parameters of current connection and amount of data left. Typically the *Image Data* size is up to 16 bytes with DLE disabled or up to 242 bytes with DLE enabled.

Table: Image Data Characteristic Value



Octet	Field Name	Value
1	Data Offset [0] (LSB)	Image data offset from start of file.
2	Data Offset [1]	
3	Data Offset [2]	
4	Data Offset [3] (MSB)	
5	Image Data	Image file data.
...		
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Characteristic Descriptors

Descriptor Name	Requirement	Mandatory Permissions	Optional Permissions
Characteristic User Description	Optional	Read	
Client Characteristic Configuration	Mandatory	Read, Write	

The client must enable characteristic Notifications using Client Characteristic Configuration descriptor before issuing any commands to Control Point Characteristic to enable reception of image data.

List of used custom UUIDs

Service Name	Characteristic Name	UUID
Picture Transfer Service		00000004-0001-0362-B5DA-012DD27485F8
	Control Point	00000004-0002-0362-B5DA-012DD27485F8
	Info	00000004-0003-0362-B5DA-012DD27485F8
	Image Data	00000004-0004-0362-B5DA-012DD27485F8