

<i>BLUETOOTH</i> [®] DOC	Date / Year-Month-Day 2012-07-24	Approved Adopted	Revision V12	Document No SYNCH_SPEC
Prepared By BARB	E-mail Address barb-main@bluetooth.org			N.B.

SYNCHRONIZATION PROFILE

Abstract:

This application profile defines the application requirements for *Bluetooth*[®] devices necessary for the support of the Synchronization usage model. The requirements are expressed in terms of end-user services, and by defining the features and procedures that are required for interoperability between Bluetooth devices in the Synchronization usage model.

Revision History

Revision	Date	Comments
1.0	June20th1999	Updated service records, IrMC chapter updated. Chapter 1.2 updated, profile fundamentals clarified, recommended inquiry procedure added into Chapter 3 and service records updated. Security issues clarified in Profile Fundamentals chapter and some editorial changes. Change the 'Initialization' wording to 'Bonding', updated cross-references, and editorial changes. Remove Management entity, removed statement that IrMC client shall initiate the link establishment when bonding is not performed, and added a reference to the inquiry procedures of GOEP. Editorial changes. 1.0 Draft
1.0B	Dec 1st 1999	Revised from a linguistic point of view. Errata items previously published on the web have been included. These corrections and clarifications are marked with correction bars.
D12r01- D12r10	15 September 2005- 29 May 2012	Editorial Updates Formatting changes Editorial Updates Editorial Updates Input reviewer's comments Update for 2.1 + EDR; update to latest spec template ESR 05: E3085, Section 7.2 Addressed reviewers' (AB, HY) comments. Addressed additional comments. Spell checked. Added new hyperlink to [15] in References. Removed Fax Profile in Figure 1.1. Looked for macros; found none.
V12	24 July 2012	Adopted by the Bluetooth SIG Board of Directors

Contributors

Name	Company
David Kammer	3Com Corporation
Patrik Olsson	Ericsson Mobile Communication
David Suvak	Extended Systems
Brent Miller	IBM Corporation
Apratim Purakayastha	IBM Corporation
Aron Walker	IBM Corporation
Jon Inouye	Intel Corporation
Stephane Bouet (Section Owner)(PR53)	Nokia Mobile Phones
Riku MettŚlä (editor)	Nokia Mobile Phones
James Scales	Nokia Mobile Phones
Steve Rybicki	Puma Technology
Patrik Olsson	Telefonaktiebolaget LM Ericsson
Shaun Astarabadi	Toshiba Corporation
Katsuhiko Kinoshita	Toshiba Corporation

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Foreword

This document, together with the Generic Object Exchange profile and the Generic Access profile forms the Synchronization usage model.

Interoperability between devices from different manufacturers is provided for a specific service and usage model if the devices conform to a Bluetooth-SIG defined profile specification. A profile defines a selection of messages and procedures (generally termed *capabilities*) from the Bluetooth SIG specifications and gives an unambiguous description of the air interface for specified service(s) and usage model(s).

All defined features are process-mandatory. This means that if a feature is used, it is used in a specified manner. Whether the provision of a feature is mandatory or optional is stated separately for both sides of the Bluetooth air interface.

1 Introduction

1.1 Scope

The Synchronization profile defines the requirements for the protocols and procedures that shall be used by the applications providing the Synchronization usage model. This profile makes use of the Generic Object Exchange profile (GOEP) to define the interoperability requirements for the protocols needed by applications. The most common devices using these usage models might be notebook PCs, PDAs, and mobile phones.

The scenarios covered by this profile are:

- Usage of a mobile phone or PDA by a computer to exchange PIM (Personal Information Management) data, including necessary log information to ensure that the data contained within their respective Object Stores is made identical. Types of the PIM data are, for example, phonebook and calendar items.
- Use of a computer by a mobile phone or PDA to initiate the previous scenario (Sync Command Feature).
- Use of a mobile phone or PDA by a computer to automatically start synchronization when a mobile phone or PDA enters the RF proximity of the computer

1.2 Bluetooth Profile Structure

In [Figure 1.1](#), the Bluetooth profile structure and the dependencies of the profiles are depicted. A profile is dependent upon another profile if it re-uses parts of that profile, by implicitly or explicitly referencing it. Dependency is illustrated in the figure: a profile has dependencies on the profile(s) in which it is contained – directly and indirectly.

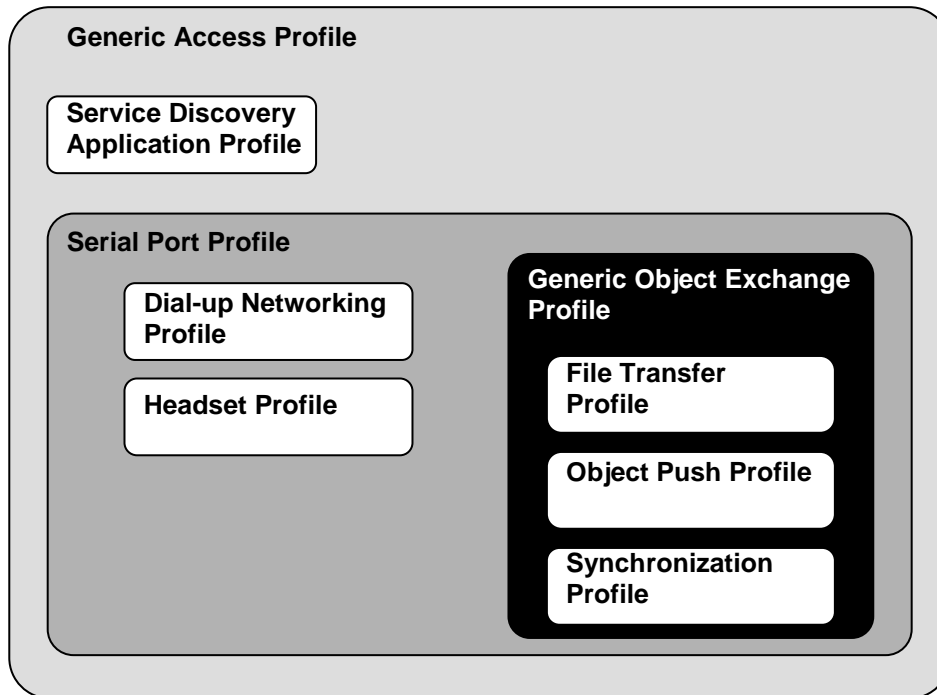


Figure 1.1: Bluetooth Profiles

1.3 Bluetooth OBEX Related Specifications

Bluetooth Specification includes five separate specifications for OBEX and applications using OBEX.

1. Bluetooth IrDA Interoperability Specification [11].
 - Defines how the applications can function over both Bluetooth and IrDA.
 - Specifies how OBEX is mapped over RFCOMM and TCP.
 - Defines the application profiles using OBEX over Bluetooth.
2. Bluetooth Generic Object Exchange Profile Specification [2].
 - Generic interoperability specification for the application profiles using OBEX.
 - Defines the interoperability requirements of the lower protocol layers (e.g., Baseband and LMP) for the application profiles.
3. Bluetooth Synchronization Profile Specification (This Specification)
 - Application Profile for Synchronization applications.
 - Defines the interoperability requirements for the applications within the Synchronization application profile.
 - Does not define the requirements for the Baseband, LMP, L2CAP, or RFCOMM.
4. Bluetooth File Transfer Profile Specification [3].

- Application Profile for File Transfer applications.
- Defines the interoperability requirements for the applications within the File Transfer application profile.
- Does not define the requirements for the Baseband, LMP, L2CAP, or RFCOMM.

5. Bluetooth [Object Push Profile](#) Specification [4]

- Application Profile for Object Push applications.
- Defines the interoperability requirements for the applications within the Object Push application profile.
- Does not define the requirements for the Baseband, LMP, L2CAP, or RFCOMM.

1.2 Symbols and Conventions

1.2.1 Requirement status symbols

In this document, the following symbols are used:

- ‘M’ for mandatory to support (used for capabilities that shall be used in the profile);
- ‘O’ for optional to support (used for capabilities that can be used in the profile);
- ‘C’ for conditional support (used for capabilities that shall be used in case a certain other capability is supported);
- ‘X’ for excluded (used for capabilities that may be supported by the unit but shall never be used in the profile);
- ‘N/A’ for not applicable (in the given context it is impossible to use this capability).

Some excluded capabilities are capabilities that, according to the relevant Bluetooth specification, are mandatory. These are features that may degrade operation of devices following this profile. Therefore, these features shall never be activated while a unit is operating as a unit within this profile.

1.2.2 Signaling Diagram Conventions

The following arrows are used in diagrams describing procedures:

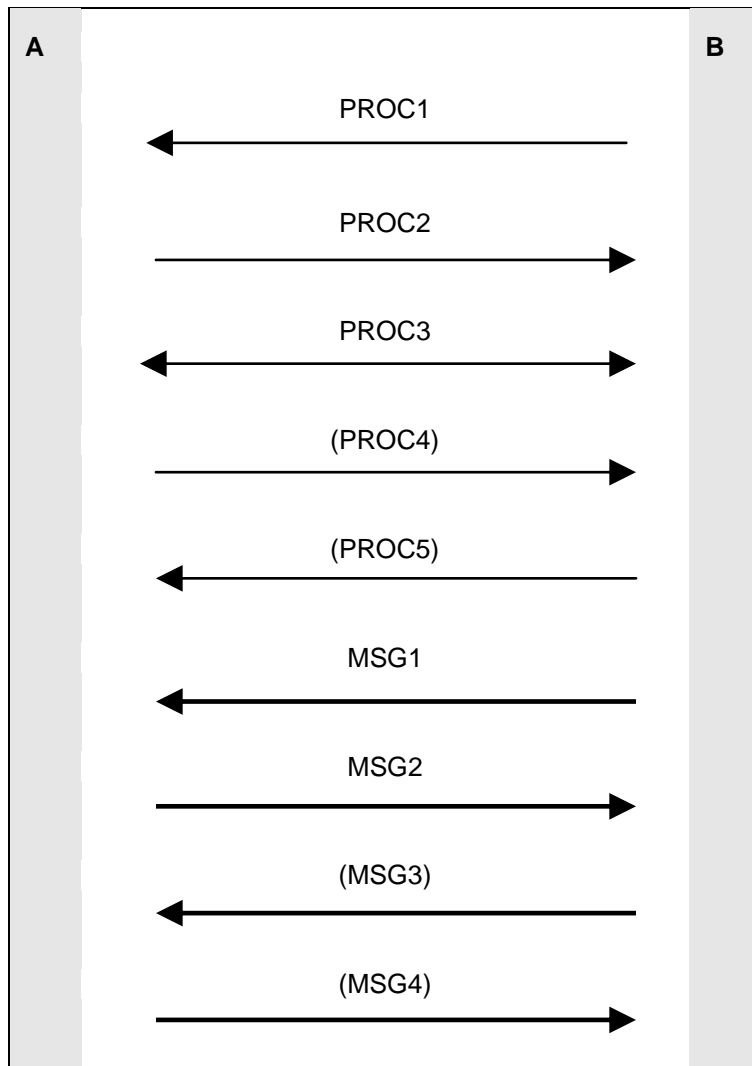


Table 1.1: Arrows used in signaling diagrams

In [Table 1.1](#), the following cases are shown: PROC1 is a sub-procedure initiated by B. PROC2 is a sub-procedure initiated by A. PROC3 is a sub-procedure where the initiating side is undefined (may be both A and B). PROC4 indicates an optional sub-procedure initiated by A, and PROC5 indicates an optional sub-procedure initiated by B. MSG1 is a message sent from B to A. MSG2 is a message sent from A to B. MSG3 indicates an optional message from A to B, and MSG4 indicates an optional message from B to A.

2 Profile Overview

2.1 Profile Stack

Figure 2.1 shows the protocols and entities used in this profile.

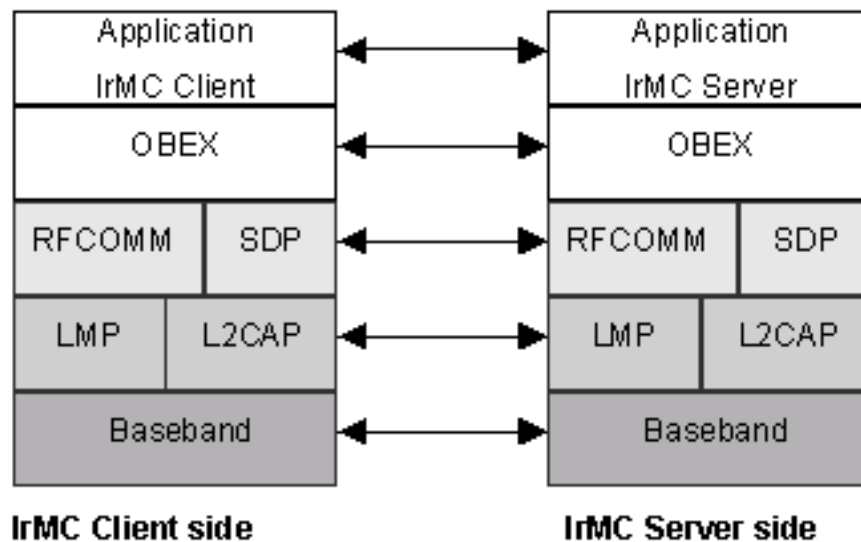


Figure 2.1: Protocol model

The Baseband [5], LMP [6], and L2CAP [7] are the OSI layer 1 and 2 Bluetooth protocols. RFCOMM [8] is the Bluetooth adaptation of GSM TS 07.10 [9]. SDP is the Bluetooth Service Discovery Protocol [10]. OBEX IrDA Interoperability Profile is the Bluetooth adaptation of IrOBEX [11].

The IrMC Client layer shown in Figure 2.1 is the entity processing the synchronization according to the IrMC specification [12], and the IrMC server is the server software compliant to the IrMC specification.

The RFCOMM, L2CAP, LMP, and Baseband interoperability requirements are defined in Section 6 in [2].

2.2 Configurations and Roles

Figure 2.2 depicts a synchronization example in which a mobile phone acts as an IrMC server and a PC notebook as an IrMC Client. The IrMC Client (PC) pulls the PIM data from the IrMC server and synchronizes this data with data stored in the IrMC client. After that, the IrMC client puts this synchronized data back to the IrMC server.

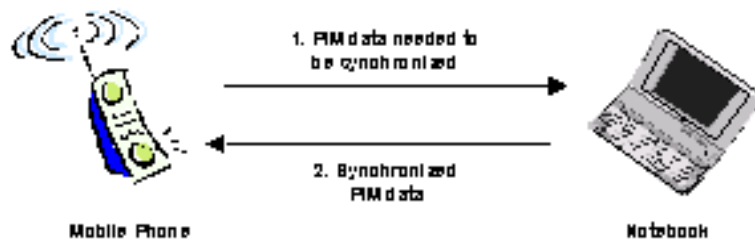


Figure 2.2: Synchronization Example with Mobile Phone and Computer

The following roles are defined for this profile:

IrMC Server – This is the IrMC server device that provides an object exchange server. Typically, this device is a mobile phone or PDA. In addition to the interoperability requirements defined in this profile, the IrMC server shall comply with the interoperability requirements for the server of the GOEP, if not defined to the contrary.

If the IrMC Server also provides the functionality to initiate the synchronization, then it shall act as a client temporarily. In this case, it shall also comply with the requirements with the client of the GOEP if not defined in the contrary.

IrMC Client – This is the IrMC client device, which contains a sync engine and pulls and pushes the PIM data from and to the IrMC Server. Usually, the IrMC Client device is a PC. Because the IrMC Client shall also provide functionality to receive the initialization command for synchronization, sometimes it shall temporarily act as a server. In addition to the interoperability requirements defined in this profile, the IrMC server shall also comply with the interoperability requirements for the server and client of the GOEP if not defined to the contrary.

2.3 User Requirements and Scenarios

The scenarios covered by this profile are:

- Usage of an IrMC Server by an IrMC Client to pull the PIM data needed to be synchronized from the IrMC Server, to synchronize this data with the data on the IrMC Client, and to push this synchronized data back to the IrMC Server.
- Usage of an IrMC Client by an IrMC Server to initiate the previous scenario by sending a sync command to the IrMC Client.
- Automatic synchronization initiated by the IrMC client.

The restrictions applying to this profile are the same as in the GOEP. In addition to these restrictions, the peer-to-peer synchronization is not supported by the BT synchronization.

2.4 Profile Fundamentals

The profile fundamentals are the same as defined in [Section 2.4](#) in GOEP [2], the addition of the requirements that bonding, link level authentication, and encryption (Fundamentals 1 and 3 in GOEP) shall always be used for this profile. The OBEX

authentication (Fundamental 2 in GOEP) as an application-level security mechanism shall be supported by the devices providing this profile, but this profile does not mandate that it shall be used.

In this profile, because both the IrMC Client and IrMC Server can act as a client (IrMC Server temporarily), both can initiate link and channel establishments; i.e. create a physical link between these two devices.

This profile does not mandate the IrMC server or client to enter any discoverable or connectable modes automatically, even if they are able to do so. This means that the end-user intervention may be needed on both the devices when, for example, the synchronization is initiated on the IrMC client device.

3 User Interface Aspects

3.1 Mode Selection

There are two modes associated with the Synchronization profile.

- Initialization Sync mode
- General Sync mode

In the **Initialization Sync** mode, the IrMC Server is in the Limited discoverable (or the General discoverable mode, see [Section 6.5.1](#) in GOEP [2]), Connectable, and Pairable modes (See [Section 4](#) in GAP [16]). The IrMC Client does not enter this mode in this profile. It is recommended that the Limited Inquiry procedure ([Section 6.2](#) in GAP [16]) is used by the IrMC Client when discovering the IrMC server. Requirements on inquiry procedures are discussed in [Section 6.5.1](#) of the GOEP [16] .

In the **General Sync** mode, the device is in the Connectable mode. Both the IrMC Client and Server can enter this mode. For the IrMC Server, this mode is used when the IrMC Client connects the server and starts the synchronization at the subsequent times after pairing. For the IrMC Client, the mode is used when the synchronization is initiated by the IrMC server.

The devices are not required to enter these modes automatically without user intervention, even if they can do so. When entering either of these modes, IrMC Server and Client shall ensure that the Object Transfer bit is set in the CoD (See [Error! Reference source not found.](#)[4]), and register a service record in the SDDb (See [10]).

3.2 Application Usage Events

In the following sections ([Synchronization Scenario](#) - Automatic Synchronization Scenario), the presented scenarios work as examples and variations in the actual implementations are possible and allowed.

3.2.1 Synchronization Scenario

When an IrMC Client wants to synchronize with an IrMC Server for the first time, the following scenario ([Table 3.1](#)) can be followed:

Step	IrMC Client	IrMC Server
1		The IrMC server device shall be in the General Sync mode. If the device is not in this mode, the user shall activate this mode on the device.
2	The user activates an application for synchronization.	
3	A list of devices in the RF proximity of the IrMC client is displayed to the user.	
4	The user selects a device to be connected and synchronized.	
5	The user is alerted if the device does not support the Synchronization feature, and the user may select another possible device (Step 4).	
6	The Bluetooth PIN code is requested from the user and entered on both devices.	
7	If OBEX authentication is used, the user enters the password for the OBEX authentication on both devices.	
8	The first synchronization is processed.	
9	The user may be notified of the result of the operation.	

Table 3.1: Usage Events for First Time Synchronization

At subsequent times, when the bonding is done, the scenario below ([Table 3.2](#)) can be followed.

Step	IrMC Client	IrMC Server
1		The IrMC server device shall be in the General Sync mode. If the device is not in this mode, the user shall activate this mode on the device.
2	The user of the IrMC Client selects the Synchronization feature on the device, or another event triggers the synchronization to start in the IrMC client.	
3	The synchronization is processed.	
4	The User may be notified of the result of the operation.	

Table 3.2: Usage Events after First Time Synchronization

3.2.2 Sync Command Scenario

When an IrMC Server wants to initiate synchronization, and when the bonding and the possible OBEX initialization are done, the scenario below (Usage Events of Sync Command Scenario) can be followed:

Step	IrMC Client	IrMC Server
1	The IrMC Client should be in the General Sync mode, without user intervention. Otherwise, this operation is not applicable.	
2		The user selects the Sync Command feature in the IrMC Server, and the synchronization is initiated with the IrMC client. On the IrMC Server device, the user has earlier configured the IrMC Client to which the sync command is sent.
3	The synchronization is processed.	
4		The User may be notified of the result of the operation.

Table 3.3: Usage Events of Sync Command Scenario

3.2.3 Automatic Synchronization Scenario

When it is desired that an IrMC Server and Client synchronize automatically, and when the bonding and (possible) OBEX initialization are done, the scenario below (Usage Events of Automatic Synchronization Scenario) can be followed.

Step	IrMC Client	IrMC Server
1	The IrMC Server enters the RF proximity of the IrMC Client. The Client notices it, and starts the synchronization without any notification to the User. The IrMC Server shall be constantly in the General Sync mode so that the IrMC Client can notice the presence of the server in its RF vicinity.	
2	The synchronization is processed.	
3	The User may be notified of the result of the operation on both the devices.	

Table 3.4: Usage Events of Automatic Synchronization Scenario

4 Application layer

This section describes the feature requirements on units active in the Synchronization use case.

4.1 Feature Overview

Table 4.1 shows the required services:

	Features	Support in IrMC Client	Support in IrMC Server
1.	Synchronization of one or more of the following cases:	M	M
	Synchronization of phonebooks		
	Synchronization of calendars		
	Synchronization of emails		
	Synchronization of notes		
2.	Sync Command	M	O
3.	Automatic Synchronization	O	M

Table 4.1: Application layer features

4.2 Synchronization Feature

The support of Synchronization with IrMC level 4 functionality is mandatory for both IrMC Clients and IrMC Servers. The requirements for IrMC Synchronization are defined in the IrMC spec (See also IrMC Synchronization Requirements). Bluetooth Synchronization shall support at least one of the following cases (i.e. the application classes):

1. Synchronization of phonebooks
2. Synchronization of calendars
3. Synchronization of messages
4. Synchronization of notes

To achieve application level interoperability, the content formats are defined for Bluetooth Synchronization. The content formats are dependent on the application classes, which are designed for the different purposes. The supported application classes shall be identified in terms of the data stores in the SDDB of the IrMC Server (See Synchronization Service). For the application classes the content format requirements are:

- Phone Book applications shall support data exchange using the vCard 2.1 content format specified in Section 7 of [12] includes extensions to vCard2.1, which shall also be supported by the actual implementations.
- Calendar applications shall support data exchange using the vCalendar 1.0 content format specified in [14].

- Messaging applications shall support data exchange using the vMessage content format in Section 9 of [12].
- Notes applications shall support data exchange using the vNote content format specified in Section 10 of Infrared Data Association, IrMC (Ir Mobile Communications) Specification [12].

The above requirements are the minimal requirements, and the application utilizing any of these classes may store its objects in any internal content format the implementer chooses.

The support for the various mandatory and optional fields of the content formats listed above shall be in accordance with the IrMC Specification [12] .

4.3 Sync Command Feature

This feature means that the IrMC client device works temporarily as a server and is able to receive a Sync Command from the IrMC server, which in this case acts temporarily as a client. This Sync Command orders the IrMC client to start synchronization with the IrMC Server.

After sending the sync command and getting the response for it, the IrMC Server shall terminate the OBEX session and the RFCOMM data link connection.

This feature shall be supported by the IrMC Client and it can optionally be supported by the IrMC Server. The formal requirements for this feature are defined in Section 5.8 in [12].

4.4 Automatic Synchronization Feature

In this feature, the IrMC Client can start the synchronization when the IrMC Server enters the RF proximity of the IrMC Client. Basically, this means that, on the Baseband level, the IrMC Client pages the IrMC Server at intervals and, when it finds that the IrMC Server is in the range, the IrMC Client can begin synchronization.

The support of this feature is optional for the IrMC Client but mandatory for the IrMC Server. This means that the IrMC Server shall offer a capability to put the server device into the General Sync mode so that it does not leave this mode automatically.

5 IrMC Synchronization Requirements

The IrMC specification [12] specifies IrMC Synchronization, which is utilized by this profile. The sections of the IrMC specification, with which this profile complies, are defined in IrMC Specification Dependencies .

Chapter	Name	Informative Sections	Mandatory Sections*	Optional Sections	Not Applicable Sections
1	Introduction	All	-	-	-
2	IrMC Framework	2.1-3, 2.5.1, and 2.6-7	2.8.1-2, 2.8.4, and 2.9 (except 2.9.2)	2.8.3, and 2.9.2	2.4 and 2.5.2-3
3	Data Transmissions Services	3.3	3.1	-	3.2
4	OBEX Information Access and Indexing	4.1, 4.4.2, and 4.7	4.1.2, 4.2-3, 4.6, and 4.8	4.1.1 and 4.5	4.4.1
5	Synchronization	5.1 and 5.7	5.2-6 (except 5.5.3), and 5.8	5.5.3	-
6	Device Information	-	6.1-2	-	-
7	Phone Book	7.1	7.3, 7.5, 7.7.1, 7.7.3, 7.7.5, 7.8.1, and 7.8.2	7.4, 7.6, 7.7.4, 7.7.6, and 7.8.3-5	7.2 and 7.7.2
8	Calendar	8.1	8.3, 8.5, 8.6.1, 8.6.3, 8.6.5, and 8.7	8.4 and 8.6.4	8.2, and 8.6.2
9	Messaging	9.1	9.3, 9.5, 9.8.1, 9.8.3, 9.8.6, and 9.9-10	9.4, 9.6-7, 9.8.4, and 9.8.5	9.2, and 9.8.2
10	Notes	10.1	10.3, 10.5, 10.6.1, 10.6.3, 10.6.5, and 10.7	10.4 and 10.6.4	10.2, and 10.6.2
11	Call Control	-	-	-	ALL
12	Audio	-	-	-	ALL
13	IrMC Applications IAS Entry and Service Hint Bit	-	-	-	ALL

Table 5.1: IrMC Specification Dependencies

- * Some of these sections may not be mandatory if the applications do not support all of the applications classes

This profile does not mandate that the functionality of IrMC level 1 shall be supported for the different personal data objects (vCard, vCal, vMessage and vNote), although the IrMC specification requires its support. However, it is worth mentioning that the Push command of IrMC requires the level1 functionality for a text message. Thus, the IrMC client shall be able to receive this command into its Inbox and the IrMC server shall be able to send this command, if support for the Sync Command feature is claimed. For Bluetooth, the object push functionality and requirements are defined in the Object Push profile.

6 OBEX

6.1 OBEX Operations Used

Table 6.1 shows the OBEX operations which are required in the Synchronization profile.

Operation no.	OBEX Operation	Ability to Send		Ability to Respond	
		IrMC Client	IrMC Server*	IrMC Client*	IrMC Server
1	Connect	M	O	M	M
2	Disconnect	M	O	M	M
3	Put	M	O	M	M
4	Get	M	X	X	M
5	Abort	M	O	M	M
6	SetPath	X	X	X	X

Table 6.1: OBEX Operations

The columns marked with ‘*’ refer to the Sync Command feature for which support in the IrMC Server is optional.

6.2 OBEX Headers

Table 6.2 shows the specified OBEX headers which are required in the Synchronization profile.

Header No.	OBEX Headers	IrMC Client	IrMC Server
1	Count	X	X
2	Name	M	M
3	Type	X	X
4	Length	M	M
5	Time	O	O
6	Description	O	O
7	Target	M	M
8	HTTP	O	O
9	Body	M	M
10	End of Body	M	M
11	Who	M	M
12	Connection ID	M	M
13	Authenticate Challenge	M	M
14	Authenticate Response	M	M
15	Application Parameters	M	M
16	Object Class	X	X

Table 6.2: OBEX Headers

6.3 Initialization of OBEX

OBEX authentication shall be supported by the devices implementing the Synchronization profile. The initialization procedure for OBEX is defined in [Section 5.3](#) in GOEP Generic Object Exchange Profile.

6.4 Establishment of OBEX session

The Target header shall be used when the IrMC client establishes the connection (See [Section 5.4](#) in the Generic Object Exchange Profile [\[2\]](#)). The Target header value is 'IRMC-SYNC'.

6.5 Pushing Data to Server

See [Section 5.5](#) in the Generic Object Exchange Profile [\[2\]](#)

6.6 Pulling Data from Server

See [Section 5.6](#) in the Generic Object Exchange Profile [\[2\]](#)

6.7 Disconnection

See [Section 5.7](#) in the Generic Object Exchange Profile [\[2\]](#)

7 Service Discovery

7.1 SD Service Records

There are two separate services related to the Synchronization profile. The first is the actual synchronization server (i.e. IrMC server), and the second is the sync command server (i.e. IrMC Client).

7.1.1 Synchronization Service

In this case, the service is the IrMC server. The following information (i.e. service records) shall be put into the SDDB.

Item	Definition:	Type/ Size:	Value:*	AttrID:	Status:	Default Value:
Service Class ID List				See [15]	M	
Service Class #0		UUID	IrMCSync		M	
Protocol Descriptor list				See [15]	M	
Protocol ID #0		UUID	L2CAP		M	
Protocol ID #1		UUID	RFCOMM		M	
Param #0	CHANNEL	UInt8	Varies		M	
Protocol ID #2		UUID	OBEX		M	
Service name	Displayable Text name	String	Varies	See [15]	O	'IrMC Synchronization'
BluetoothProfile DescriptorList	Supported profiles and versions			See [15]	O	
Profile #0		UUID	IrMCSync			IrMC-Sync
Version #0		UInt16	0x0102			0x0102
Supported Data Stores List	Data stores may be phonebook, calendar, notes, and messages.	Data Element Sequence of UInt8	Data stores: 0x01 = Phonebook 0x03 = Calendar 0x05 = Notes 0x06 = Messages	See [15]	M	

Table 7.1: Synchronization Service Record

* Values that are of the type UUID are defined in the Assigned Numbers specification [15].

7.1.2 Sync Command Service

The Sync Command service is used for initiating the synchronization from the IrMC server device. The following service records shall be put into the SDDB by the application which provides this service.

Item	Definition:	Type/ Size:	Value: *	AttrID:	Status:	Default Value:
Service Class ID List				See [15]	M	
Service Class #0		UUID	IrMCSyncComm and		M	
Protocol Descriptor list				See [15]	M	
Protocol ID #0		UUID	L2CAP		M	
Protocol ID #1		UUID	RFCOMM	See [15]	M	
Param #0	CHANNEL	UInt8	Varies		M	
Protocol ID #2		UUID	OBEX		M	
Service name	Displayable Text name	String	Varies		O	'Sync Command Service'
BluetoothProfileDescriptorList	Supported profiles and versions			See [15]	O	
Profile #0		UUID	IrMCSync			IrMC-Sync
Version #0		UInt16	0x0102			0x0102

Table 7.2: Sync Command Service Record

* Values that are of the type UUID are defined in the Assigned Numbers specification [15]

8 References

8.1 Normative References

- [1] IrDA Interoperability Profile
- [2] Generic Object Exchange Profile
- [3] File Transfer Profile
- [4] Object Push Profile
- [5] Baseband Specification v1.2 or later
- [6] LMP Specification v1.2 or later
- [7] L2CAP Specification v1.2 or later
- [8] RFCOMM with TS 07.10
- [9] ETSI, TS 101 369 V07.10, GSM 07.10 version 6.3.0 Release 1997
- [10] SDP Specification v1.2 or later
- [11] Infrared Data Association, IrDA Object Exchange Protocol (IrOBEX) with Published Errata, Version 1.2, April 1999
- [12] Infrared Data Association, IrMC (Ir Mobile Communications) Specification with Published Errata, Version 1.1, February 1999
- [13] The Internet Mail Consortium, vCard – The Electronic Business Card Exchange Format, Version 2.1, September 1996
- [14] The Internet Mail Consortium, vCalendar – The Electronic Calendaring and Scheduling Exchange Format, Version 1.0, September 1996
- [15] [Bluetooth Assigned Numbers](#).
- [16] Generic Access Profile Specification