3GPP TSG-T#5

Kyongju, KOREA, 7-8 October 1999

TSGT#5(99)180

3G TR 27.903

Technical Report

3rd Generation Partnership Project; Technical Specification Group Terminals (TSG-T); Discussion of Synchronisation Standards (3G TR 27.903 version 1.0.0)

Reference

DTS/TSGT-0234925U

Keywords

<keyword[, keyword]>

3GPP

Postal address

3GPP support office address

650 Route des Lucioles - Sophia Antipolis

Valbonne - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Internet

http://www.3gpp.org

Contents

Foreword

This Report has been produced by the 3GPP.

The contents of the present document are subject to continuing work within the XXX and may change following formal XXX approval. Should the XXX modify the contents of this TR, it will be re-released by the XXX with an identifying change of release date and an increase in version number as follows:

Version 3.y.z

where:

x the first digit:

1 presented to XXX for information;

2 presented to XXX for approval;

3 Indicates XXX approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the specification;

1 Scope

The present document provides information on existing synchronisation protocols. It summarises proprietary and standard protocols relevant to current and future mobile communication devices.

The present document covers only synchronisation between end-user devices, desktop applications, and server-based information services. It does not refer to replication or synchronisation between enterprise databases.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

[1] Bluetooth Bluetooth SIG, Bluetooth Specifications, version 1.0, July 1999. (http://www.bluetooth.com/)

[2] Generic Binary Object Infrared Data Association, “IrWW IrDA for Wrist Watches”, “Generic Binary Object” Chapter 4, version 0.5, 12 July 1999. (members section of ftp://ftp.irda.org/)

[3] ICNIRP, "Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz)", International Commission on Non-Ionizing Radiation Protection (ICNIRP), Health Physics, vol. 74, pp 494-522, April 1998.

[4] IrLAP Infrared Data Association, ‘Serial Infrared Link Access Protocol (IrLAP)’, version 1.1, 16 June 1996, plus all applicable errata. (http://www.irda.org/)

[5] IrLMP Infrared Data Association, ‘Link Management Protocol’, version 1.1, 23 January 1996, plus all applicable errata. (http://www.irda.org/)

[6] IrMC Infrared Data Association, ‘Specifications for Ir Mobile Communications (IrMC)’, version 1.1, 01 March 1999, plus all applicable errata. (http://www.irda.org/)

[7] IrOBEX Infrared Data Association, ‘Ir Object Exchange Protocol IrOBEX’, version 1.2, April 1999, plus all applicable errata. (http://www.irda.org/)

[8] MNCRS Mobile Network Computing Reference Specification Consortium, Mobile Network Computing Reference Specification, Data Synchronisation Work Group, Application Programmer’s Guide to Mobile Network Computer Data Synchronisation, version 1.1, March 1999. (http://www.oadg.or.jp/activity/mncrs/mncrs03-99.html)

[9] MDSP - Mobile Data Synchronisation Protocol.

[10] Tiny TP Infrared Data Association, ‘’Tiny TP’: A Flow-Control Mechanism for use with , version 1.1, 20 October 1996, plus all applicable errata. (http://www.irda.org/)

[11] Various documents produced for ‘Synchronisation’.

[12] vCalendar the Internet Mail Consortium, “vCalendar - The Electronic Calendaring and Scheduling Exchange Format - Version 1.0”, 18 September 1996. (http://www.imc.org/pdi/vcal-10.doc)

[13] vCard the Internet Mail Consortium, "vCard - The Electronic Business Card - Version 2.1", 18 September 1996. (http://www.imc.org/pdi/vcard-21.doc)

[14] WAP WAP Forum, ‘WAP Technical Specifications Suite’, version 1.1, June 1999. (http://www.wapforum.com/)

3 Definitions and Abbreviations

3.1 Definitions

For the purposes of the present document, the following definitions apply.

Bluetooth: a technology specification[1] for short range radio links between mobile PCs, mobile phones and other portable devices. (http://www.bluetooth.com/)

bvCalendar: a compressed version of vCalendar as defined in the IrDA Generic Binary Object proposal[2].

bvCard: a compressed version of vCard as defined in the IrDA Generic Binary Object proposal[2].

GET: the operation of requesting that the server returns an object from to the client as defined in the IrDA IrOBEX specification[7].

IrDA: an industry consortium set up to define a set of short range Ir communications standards. (http://www.irda.org/)

Latency: time delay associated with the process of information exchange in a network.

Level 1: Minimum level support defined in the IrDA IrMC set of specifications[6].

Level 2: Access Level support defined in the IrDA IrMC set of specifications[6].

Level 3: Index Level support defined in the IrDA IrMC set of specifications[6].

Level 4: Sync Level support defined in the IrDA IrMC set of specifications[6].

Personal Area Network: a short range wireless connection between two or more devices for the purpose of transferring information. Short range is typically defined as fifty meters or less in distance.

PUT: the operation of sending one object from the client to the server as defined in the IrDA IrOBEX specification[7].

Radio Frequency (RF): the frequency range between 300 Hz and 300 GHz (ICNIRP definition[3]).

Synchronisation: the process of exchanging information between multiple physical or virtual locations for the purpose of ensuring that each location's copy of that information reflects the same information content.

Ultra: a connectionless information transfer mechanism defined as part of the IrDA IrMC set of specifications[6].

vCalendar: a format defined by the IMC for electronic calendaring and scheduling exchange[12] with extensions as defined in the IrDA IrMC set of specifications[6].

vCard: a format defined by the IMC for electronic business card exchange[13] with extensions as defined in the IrDA IrMC set of specifications[6].

WAP: an industry consortium set up to define a set of standards[14] to empower mobile users with wireless devices to easily access and interact with information and services. (http://www.wapforum.com/)

Wide Area Devices: devices intended for use in 3G systems.

Wide Area Network: a geographically-large range wireless connection between two or more devices for the purpose of transferring information. Large geographical range is typically defined as one kilometer or more in distance.

Wireless Information Devices: wide area and short range devices intended for information transfer.

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

DID Database IDentifier
IAS Information Access Service
IBM International Business Machines
ICNIRP International Commission on Non-Ionizing Radiation Protection
IETF Internet Engineering Task Force
IMC Internet Mail Consortium
Ir Infrared
IrDA Infrared Data Association
IrLAP Infrared Link Access Protocol
IrLMP Infrared Link Management Protocol
IrMC Ir Mobile Communications
IrOBEX Ir Object EXchange
LUID Unique object IDentifier
MDSP Mobile Data Synchronisation Protocol
MNCRS Mobile Network Computer Reference Specification
OBEX Object Exchange
PDA Personal Digital Assistant
PIM Personal Information Manager
TTP Tiny TP
WAP Wireless Application Protocol

4 Summary of Standards Activities

4.1 IrMC

The IrMC standard[6] was developed as an extension to the IrDA standard for the purpose of providing an open standard for data exchange between mobile devices or between mobile devices and desktops or PDAs. Among other things, IrMC defines four levels of support for information exchange. By definition, each higher level must support all of the preceding levels. The four levels are: Level 1 (Minimum Level), Level 2 (Access Level), Level 3 (Index Level), and Level 4 (Sync Level). (Level 4 does not require Level 3) Level 2 and Level 4 are the most relevant for synchronisation. IrMC has been adopted by the IrDA and Bluetooth initiatives and has wide industry support.

4.2 Bluetooth

Bluetooth has adopted the IrMC standard[6] as the basis for their synchronisation specification.

4.3 WAP

WAP[14] has not specified a synchronisation standard. Attempts to form a work group last year were abandoned.

4.4 Other Standards Activities

4.4.1 MNCRS

The MNCRS[8] (Mobile Network Computer Reference Specification) specifies an application programming interface (API) providing data-synchronisation services focused on Java-enabled devices. MNCRS is promoted by a number of companies but has not been adopted by any formal standards body.

4.4.2 'Synchronisation'

A group met informally in early 1999 for the purpose of defining a synchronisation specification[11] to be presented to the 3GPP or WAP bodies. The parties involved - Symbian, Puma, Ericsson, Nokia, Motorola, Starfish, and Lotus - disbanded before any agreement was reached.

4.4.3 MDSP

MDSP[9] (Mobile Data Synchronisation Protocol) is a data synchronisation and data exchange protocol for networked devices promoted by IBM. It is designed primarily for use between mobile devices that are sporadically connected to the network and servers that are continuously connected to the network. In particular, MDSP is designed to handle the case where the server and device store the data they are synchronizing in different formats, using different software systems. MDSP can be used to exchange data elements, without attempting to synchronize the containers as used in a one-way synchronisation to a device with no editing capabilities. MDSP has not been adopted by any formal standards body.

5 Overview of Synchronisation Standards

5.1 Introduction

3G Wireless Information Devices will enable unprecedented access to information regardless of location. Information will continue to be stored on personal computers or servers, however users will also expect to be able to have access to that same information on handheld or palm-size devices and wireless devices.

To date, there is only one adopted standard that addresses synchronisation: IrMC. The IrMC standard[6] is also referenced in the Bluetooth specification. 3GPP has not yet adopted a standard for synchronisation.

The IrMC standard[6] is defined for personal area networks running either low or high bandwidth wireless links and may be used in connection-oriented or connectionless links such as IrDA or Bluetooth. It does not currently support a specifically optimized mode for wide area network synchronisation. Wide area network synchronisation presents a unique set of problems for efficient and accurate synchronisation.

5.2 IrMC Overview

The IrMC version 1.1 specification[6] was driven by leading handset manufacturers to provide a standard means for exchanging data between mobile devices and between mobile devices and desktop, handheld PCs, and Printers of various kinds. The focus of the original specification was to extend the IrDA standard to include extensions for transferring Personal Information Manager (PIM) data, files, and isochronous voice between cooperating IrMC devices. The current IrMC specification[6] supports data exchange with Phone Book, Calendar, Messaging and Note applications on mobile devices.

The specification was recently updated (version 1.1[6]) to better support synchronisation features requested by the Bluetooth initiative, which is also committed to using IrMC version 1.1[6] and its supporting IrOBEX[7] object exchange layer for satisfying its data exchange needs over short-distance radio links.

The scope of the IrMC specification[6] encompasses more than synchronisation. Components of IrMC deal with Call Control (for mobile handsets), real time audio transmission, and permissions for getting and setting the real time clock on the mobile device. IrMC also defines four (4) distinct levels of support for information exchange, where each higher level is expected to support the preceding levels (with some exceptions, see above). For purposes of synchronisation, Level 2 (Access Level) and Level 4 (Sync Level) are the only information exchange levels required to address our stated requirements.

The IrMC specification[6] and its supporting IrOBEX[7] object exchange layer is layered on top of the pre-existing IrDA stack. Since the IrMC synchronisation component requires either the Connection Oriented Service or the Connectionless Oriented Service, this means that IrMC and IrOBEX, when used in an IrDA application, sit atop of the IrDA layers IrLAP[4], IrLMP[5], and possibly TTP[10] and IAS[5]. Thus, the IrMC specification[6] is a natural extension of the IrDA stack. When used in Bluetooth, IrMC and IrOBEX sit atop the Bluetooth equivalent of these layers. The object is to swap transport and below layers while keeping a common set of applications.

The information exchange levels of IrMC prescribe the text-based data formats that must be exchanged between two mobile devices. Wherever possible, industry-standard data formats are used. Where no pre-existing data format exists, IrMC defines new formats that must be supported by implementers. Required data formats include IMC's vCard[13] and vCalendar[12] plus the similarly defined constructs vMessage[6] and vNote[6]. In addition, custom data formats are prescribed for exchanging data objects (such as change logs, information logs, error logs and device information). IrMC is currently evaluating allowing the use of the IETF versions of these constructs, the binary versions called bvCard[2] and bvCalendar[2], plus a completely generic Generic Binary Object[2].

IrMC effectively addresses the synchronisation needs of PIM applications residing on mobile devices, and operating in a connected or connectionless environment. At the highest level (Level 4), IrMC specifies core functionality such as database identifiers (DID), unique object identifiers (LUID), change logs and change counters or time stamps which are essential to ensure fast and reliable synchronisation. The specification also includes a rich set of features for exchanging PIM data. Included in this is an Information Log that describes the characteristics of each database, a Device Information block that identifies each device with capabilities, an optional Error Log that returns record-level error codes, a mechanism for detecting new items entered while synchronisation is in progress, and a means for detecting device resets.

5.3 IrMC 1.1 Limitations for Wide Area Synchronisation

IrMC was written to address the exchange of PIM data in a personal area network or peer-to-peer environment. However, the current IrMC specification[6] has not yet addressed synchronisation in a wide area wireless network environment such as that which would exist in a 3GPP scenario.

The limitations of IrMC in a 3G environment are as follows:

5.3.1 Level 4 Dependent on Connection-based Transport Protocol

IrMC Level 4 (Sync Level) requires either a Connection Oriented Service, when using IrDA involves components such as IrLAP[4] and IrLMP[5]. By its nature, IrOBEX[7] involves establishing an explicit connection between devices, performing the necessary data exchange, and then disconnecting. A persistent connection between devices is difficult to maintain in some Wide Area Network environments. Latency can slow the transactions to an unacceptable level, or worse, cause synchronisation to be stopped due to timeouts.

5.3.2 Inefficient Data Exchange

Data exchanges between an IrMC client and server tend to be chatty and quite inefficient. In particular, each object sent between devices requires a separate request/response pair using IrOBEX[7] commands. For example, GET operations entail a request and response for each object. PUT Operations can be more efficient in an Ultra[6] environment since no response is expected.

6 Recommendations

To address the limitations of IrMC Level 4 synchronisation in a Wide Area Network, one of two actions must occur.

1) Modifications to the IrMC Level 4 to address the above limitations within the Wide Area Network must be made.

2) An extension to IrMC Level 4 for Wide Area Network Synchronisation must be created. Ideally, this extension would operate on top of existing stacks and would use as much existing code base as possible.

7 History

Document history		
V 1.0.0	October 1999	Presented to TSG-T#5 for information and approval