3GPP2 A.S0011-D v3.0

May 2011

Interoperability Specification (IOS) for cdma2000 Access Network Interfaces - Part 1 Overview

(3G-IOS v5.1.2)

Revision History		
Date	**Publication**	**Description**
June 2007	A.S0011-D v1.0	For features supported, refer to section 1.1.
August 2009	A.S0011-D v2.0	Updates to support 1x air interface enhancements, EVRC-WB on A2p, EVRC-NW on A2 and A2p and bug fixes.
May 2011	A.S0011-D v3.0	Support for callback of an emergency call origination, EVRC-NW capacity operating point 0, and bug fixes.

Table of Contents

List of Figures

List of Tables

Foreword

The foreword is not part of this standard.

This document was produced by TSG-A of the Third Generation Partnership Project 2. This document was developed in accordance with the procedural guidelines of 3GPP2 and its Organizational Partners, and represents the consensus position of these groups.

1.0 Introduction

1.1 Overview

This standard describes the overall system functions, including services and features required for interfacing a base station (BS) to a Mobile Switching Center (MSC), Mobile Switching Center Emulation (MSCe), Media Gateway (MGW), other BSs, and a Packet Control Function (PCF). It further describes the interface between a PCF and a Packet Data Service Node (PDSN). These interfaces are based on interoperation with the cdma2000®[1] air interface [1]~[6], the wireless IP network [8] and the ANSI-41 core network [9].

This standard is intended to provide sufficient specification of a set of interfaces to support the interoperability of one vendor's equipment with that of another. Which interface(s) a vendor chooses to implement is dependent on business decisions, and is up to each vendor. However conformance to any given interface specified within this standard requires all of the messages and procedures for supported features on that interface to be supported as specified within this standard. Establishing standard interfaces allows the BS, MSC MSCe, MGW, PCF, and PDSN equipment to evolve independently and to be provided by multiple vendors.

The following features have been added to this revision of the standard:

- 1x Enhancement support for:
  - Additional geographical location information
  - Flex-duplex channel
- A11 Capabilities indication
- Advanced Encryption Standard, Authentication and Key Agreement & message integrity support
- Event Notification
- PPP/IP packet boundaries using GRE segmentation
- Vocoder Support
  - Enhanced Variable Rate Codec rev. B (EVRC-B) on A2 and A2p
  - Enhanced Variable Rate Codec Wide Band (EVRC-WB) on A2 and A2p
  - Enhanced Variable Rate Codec Narrowband-Wideband (EVRC-NW) on A2 and A2p

1.1.1 Purpose

The purpose is to provide the standard for:

- interfacing a circuit switched MSC with one or more BSs,

[1] cdma2000® is the trademark for the technical nomenclature for certain specifications and standards of the Organizational Partners (OPs) of 3GPP2. Geographically (and as of the date of publication), cdma2000® is a registered trademark of the Telecommunications Industry Association (TIA-USA) in the United States.

- interfacing an MSCe with one or more BSs,
- interfacing an MGW with one or more BSs,
- interfacing a BS with one or more BSs,
- interfacing a PCF with one or more BSs,
- interfacing one or more PDSNs with one or more PCFs.

This document defines the functional capabilities, including services and features, of the specified interfaces. These services and features are the defining characteristics that are the basis for the overall system standard.

The MSC-BS interface provides telecommunications services access between a Mobile Switching Center and a base station. It specifically represents the demarcation point between the MSC and the BS which coincides with the Reference Point "A". This point establishes the technical interface and designates the test points and operational division of responsibility between the MSC and the BS. The MSC and BS interface is defined as the A1/A2/A5 interface shown in Figure 2.2-1.

The MSCe-BS interface provides telecommunications services access between an MSCe and a BS. It specifically represents the demarcation point between the MSCe and the BS, which coincides with the Reference Point 48 [18]. This point establishes the technical interface and designates the test points and operational division of responsibility between the MSCe and the BS. The MSCe and BS interface is defined as the A1p interface shown in Figure 2.2-2.

This standard fulfills the following criteria:

- supports current [1]~[6], [7] and [10] air interfaces;
- makes maximum use of existing standards from the TIA and other sources;
- promotes reliability enhancement, technical innovation, network product availability, and economic competition;
- allows connection of various manufacturers' BSs to the same MSC;
- supports future MSC and BS implementations;
- allows the separate evolution of MSC and BS technology.

The BS-MGW interface provides a bearer for traffic between a BS and an MGW. The BS and MGW interface, defined as the A2p interface (Reference Point 27), is shown in Figure 2.2-2.

The source BS - target BS interface provides for inter-BS soft/softer handoffs. It specifically represents the demarcation point between two BSs which coincides with the Reference Point "A_{ter}". This point establishes the technical interface and designates the test points and operational division of responsibility between the source BS and target BS. The source BS and target BS interface is defined as the A3/A7 interface shown in Figure 2.2-1 and Figure 2.2-2.

The BS-PCF interface provides access between the BS and the Packet Control Function for high speed packet data services. It specifically represents the demarcation point between the BS and the PCF which coincides with the Reference Point "$A_{quinter}$". This point establishes the technical interface and designates the test points and operational division of responsibility between the BS and the PCF. The BS-PCF interface is defined as the A8/A9 interface shown in Figure 2.2-1 and Figure 2.2-2.

The PCF-PDSN interface provides access between a Packet Control Function and a Packet Data Serving Node for high speed packet data services. It specifically represents the demarcation point between the PCF and the PDSN which coincides with the Reference Point "A_{quater}". This point establishes the technical interface and designates the test points and operational division of responsibility between the PCF and the PDSN. The PCF-PDSN interface is defined as the A10/A11 interface shown in Figure 2.2-1 and Figure 2.2-2.

The PCF-PDSN interface definition fulfills the following criteria:

- allows connection of various manufacturers' PCFs to the same PDSN and vice versa;
- makes maximum use of existing standards from the Internet Engineering Task Force (IETF) and other sources;
- promotes quality of service and accounting information exchange between the PCFs and the PDSNs;
- promotes reliability enhancement, technical innovation, network product availability, and economic competition;
- supports future PCF and PDSN implementations;
- allows the separate evolution of PCF and PDSN technologies.

1.1.2 Scope

This standard provides the specification for the interfaces which coincide with the Reference Points "A", "A_{ter}", "A_{quater}", and "$A_{quinter}$" defined in the 3GPP2 Wireless Network Reference Model shown in [I-1] and Reference Points 27 and 48 for Legacy MS Domain Step 1 [18] and Reference Points A1, A1p, A2 and A2p for Legacy MS Domain Step 2 [19].

The scope of this standard includes the following topics:

- MSC-BS and BS-BS interfaces:
  - descriptions of the specified functional capabilities that provide wireless telecommunications services across the MSC-BS and BS-BS interfaces as defined in the 3GPP2 Wireless Network Reference Model;
  - descriptions of the specified functional capabilities that provide wireless tele-communications services across the MSCe-BS and the MGW-BS interfaces;
  - descriptions of the division of responsibility of the functions provided between the BS and the MSC, and between the source BS and the target BS, without prescribing specific implementations;
  - descriptions of the MSC-BS interface and the BS-BS interface standards that support DS-41 and cdma2000 systems.
- BS-PCF interfaces:
  - descriptions of the specified functional capabilities that provide packet data services across the BS-PCF interface;
  - descriptions of the division of responsibility of the functions provided between the BS and the PCF without prescribing specific implementations.
- PCF-PDSN interfaces:
  - descriptions of the specified functional capabilities that provide packet data services across the PCF-PDSN interface;

– descriptions of the division of responsibility of the functions provided between the PCF and the PDSN without prescribing specific implementations.

The interfaces defined in this standard are specified by a set of characteristics, including:

- physical and electromagnetic parameters;
- channel structures;
- message types and contents;
- network operating procedures;
- user data framing and transport.

1.2 References

References are either normative or informative. A normative reference is used to include another document as a mandatory part of a 3rd Generation Partnership Project 2 (3GPP2) specification. Documents that provide additional non-essential information are included in the informative references section. For consistency within IOS parts, the most commonly referenced documents [1]~[17] shall be the same as they appear here in this part, or left as "Reserved" if not used in a particular IOS part.

1.2.1 Normative References

The following standards contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

[1] 3GPP2 C.S0001-E v3.0, *Introduction to cdma2000 Standards for Spread Spectrum Systems*, June 2011.

[2] 3GPP2 C.S0002-E v3.0, *Physical Layer Standard for cdma2000 Spread Spectrum Systems*, June 2011.

[3] 3GPP2 C.S0003-E v3.0, *Medium Access Control (MAC) Standard for cdma2000 Spread Spectrum Systems*, June 2011.

[4] 3GPP2 C.S0004-E v3.0, *Signaling Link Access Control (LAC) Standard for cdma2000 Spread Spectrum Systems*, June 2011.

[5] 3GPP2 C.S0005-E v3.0, *Upper Layer (Layer 3) Signaling Standard for cdma2000 Spread Spectrum Systems*, June 2011.

[6] 3GPP2 C.S0006-D v2.0, *Analog Signaling Standard for cdma2000 Spread Spectrum Systems*, September 2005.

[7] 3GPP2 C.S0007 v2.0, *Direct Spread Specification for Spread Spectrum Systems on ANSI-41 (DS-41) (Upper Layers Air Interface)*, June 2000.

[8] 3GPP2 X.S0011-D v2.0, *Wireless IP Network Standard*, six parts, November 2008.

[9] 3GPP2 X.S0004-000-E v9.0, *Mobile Application Part (MAP)*, June 2009.

[10] TIA/EIA-95-B, *Mobile Station - Base Station Compatibility Standard for Wideband Spread Spectrum Cellular Systems*, March 1999.

[11] 3GPP2 A.S0011-D v3.0, *Interoperability Specification (IOS) for cdma2000 Access Network Interfaces – Part 1 Overview*, May 2011.

[12] 3GPP2 A.S0012-D v3.0, *Interoperability Specification (IOS) for cdma2000 Access Network Interfaces – Part 2 Transport*, May 2011.

[13] 3GPP2 A.S0013-D v3.0, *Interoperability Specification (IOS) for cdma2000 Access Network Interfaces – Part 3 Features*, May 2011.
[14] 3GPP2 A.S0014-D v3.0, *Interoperability Specification (IOS) for cdma2000 Access Network Interfaces – Part 4 (A1, A1p, A2, and A5 Interfaces)*, May 2011.
[15] 3GPP2 A.S0015-D v3.0, *Interoperability Specification (IOS) for cdma2000 Access Network Interfaces – Part 5 (A3 and A7 Interfaces)*, May 2011.
[16] 3GPP2 A.S0016-D v3.0, *Interoperability Specification (IOS) for cdma2000 Access Network Interfaces – Part 6 (A8 and A9 Interfaces)*, May 2011.
[17] 3GPP2 A.S0017-D v3.0, *Interoperability Specification (IOS) for cdma2000 Access Network Interfaces – Part 7 (A10 and A11 Interfaces)*, May 2011.
[18] 3GPP2 X.S0012-0 v2.0, *Legacy MS Domain Step 1*, March 2004.
[19] 3GPP2 X.S0025-0 v1.0, *Legacy MS Domain Step 2*, February 2006.
[20] IETF, *RFC 2002 – IP Mobility Support Specification*, 1996.

1.2.2 Informative References

[I-1] 3GPP2 S.R0005-B v2.0, *Network Reference Model for cdma2000 Spread Spectrum Systems*, May 2007.

1.3 Terminology

1.3.1 Acronyms

Acronym	Meaning
3GPP	Third Generation Partnership Project
3GPP2	Third Generation Partnership Project 2
ANSI	American National Standards Institute
BS	Base Station
BSC	Base Station Controller
BTS	Base Transceiver System
CDMA	Code Division Multiple Access
DS-41	Direct Spread (ANSI)-41
EHDM	Extended Handoff Direction Message
EIA	Electronic Industries Alliance
GHDM	General Handoff Direction Message
IETF	Internet Engineering Task Force
IOS	Interoperability Specification
IP	Internet Protocol
IS	Interim Standard
ISDN	Integrated Services Digital Network
IWF	Interworking Function

Acronym	Meaning
kbps	kilobits per second
MEID	Mobile Equipment Identifier
MGW	Media Gateway
MIP	Mobile Internet Protocol
MS	Mobile Station
MSC	Mobile Switching Center
MSCe	Mobile Switching Center Emulation
MTSO	Mobile Telephone Switching Office
PCF	Packet Control Function
PCM	Pulse Code Modulation
PCS	Personal Communications System
PDSN	Packet Data Serving Node
PSTN	Public Switched Telephone Network
RTO	Remote Transcoder Operation
SDU	Selection/Distribution Unit
TIA	Telecommunications Industry Association
TrFO	Transcoder Free Operation
UDI	Unrestricted Digital Information
UMTS	Universal Mobile Telecommunication System
UHDM	Universal Handoff Direction Message
VPOP	Voice Preference Over Packet
XC	Transcoder

1.3.2 Definitions

Base Station. An entity in the public radio telecommunications system used for radio telecommunications with MSs.

Base Station Controller. The control portion of the BS that includes call control logic and interconnections to the MSC, the MSCe, the MGW, the PCF, the BTSs that are part of the BS, other BSCs, and BTSs of neighboring BSs for purposes of soft/softer handoff.

Base Transceiver Station. A component of a BS that includes radio equipment. A BTS is sometimes equated with the physical cell site of a wireless network.

Bearer Connection. A connection intended to provide a path for user traffic.

Call Association. The totality of the active communication between the MS and the network, including all signaling and transfer of user information.

Cell. The unit of a BS having the ability to radiate in a given geographic area. In this standard, a Cell ID refers to a particular cell and sector.

Channel Assignment Message. Either a Channel Assignment Message or Extended Channel Assignment Message.

Circuit-Switched MSC. A circuit-switched MSC provides processing, control and bearer path for calls and services. The MSC provides signaling capability via an SS7-based connection to the BS on the A1 interface and bearer paths via terrestrial circuits on the A2 and A5 interfaces.

DS-41. An operational mode in which the BS and MS operate with the direct spread (DS) radio layers of the UMTS system defined by 3GPP, and the upper layers defined in [1]~[6] that conform to and interoperate with ANSI-41 based networks [9].

Dormant Handoff. A handoff that occurs when an MS with a dormant packet session determines that it has crossed a packet zone boundary. Dormant handoff results in A10 connection(s) being established between the target PCF and the target PDSN. A dormant handoff may require exchange of higher layer protocol messages between the MS and the PDSN, and thus, reactivation of the packet data session. Note that no air interface channels are handed off or re-configured as the result of a dormant handoff.

Fast Handoff. Fast handoff is a particular type of hard handoff that applies only to packet data sessions. Fast handoff allows the target PDSN to connect to an anchor PDSN where the packet data session was first established, eliminating the need to re-establish a PPP session while the packet data session is active. Fast handoff allows for early establishment of the A10 connections on the target side.

Handoff. Handoff is the process by which an air interface circuit between an MS and a BS is transferred from the current BS equipment and air interface channel to either a different BS equipment and air interface channel or a different air interface channel on the current BS equipment. Handoffs are an IOS consideration insofar as user traffic and signaling paths through the RAN need to be established, modified or released; information needs to be exchanged between the source and target BSs; and air interface changes may need to be signaled to the core network. Refer also to [13], section 3.19, for specific handoff considerations. The following types of handoffs are supported:

1. Hard Handoff: A handoff characterized by a temporary disconnection of the Traffic Channel. Hard handoffs occur when the MS is transferred between disjoint Active Sets, when the CDMA Frequency Assignment changes, when the frame offset changes, or when the MS is directed from a CDMA Traffic Channel to an analog voice channel. From an IOS perspective, a change in Selection Distribution Unit (SDU) across BSs is considered to be a hard handoff.

2. Soft Handoff: A handoff occurring while the MS is in the Mobile Station Control on the Traffic Channel State. This handoff is characterized by commencing communications with a new BTS on the same CDMA Frequency Assignment without terminating communications with an old BTS. For IOS considerations, the same SDU function is used before and after the handoff is performed.

3. Soft Handoff with Pre-Selection: The configuration achieved when a BS internally splits a single forward flow of coded user information from the frame selector to send it to two or more cells controlled by that BS. In the reverse direction, the BS joins the flows of coded user information frames from those cells, selects the best quality frame (preselection), and forwards only that selected frame to the frame selector.

4. Softer Handoff: A handoff involving two or more traffic channels on a call such that in the forward direction the BS splits a single flow of traffic channel frames into two or more forward flows to be sent to the MS with the power control combined bit set to indicate that the same reverse power control information is to be used. In the reverse direction the BS combines the traffic channel frames that are received from two or more cells/sectors and forms a single reverse flow from this combination.

IMSI_M. MIN-based IMSI using the lower 10 digits to store the MIN.

IMSI_T. True IMSI not associated with MIN. This could be 15 digits or fewer.

Interworking Function. The Interworking Function (IWF), used in the context of this standard, provides a translation of the user traffic on a circuit data call between the fixed network and the air interface.

Logical Channel. A logical path that can carry signaling, user traffic, or a combination of the two between two entities such as the network and the MS. A logical channel can be instantiated over one or more physical channels. Logical channels may also share physical channels.

MC-41. An operational mode in which the BS and MS operate with the multi-carrier (MC) radio layers and the upper layers defined in [1]~[6] that conform to and inter-operate with ANSI-41 based networks [9].

Media Gateway. The MGW provides an interface between the packet environment of the core network and the circuit switched environment of the Public Switched Telephone Network (PSTN) for bearer traffic, when equipped with circuit capabilities. The MGW may provide transcoding functions to the bearer traffic. The MGW may also provide modem functions to convert digital byte streams to and from audio modem tones placed on circuits. It also provides policy enforcement relative to its activities and resources. The MGW provides a bearer path to the BS. The MSCe controls the MGW.

Mobile Equipment Identifier (MEID). A 56-bit number assigned by the MS manufacturer, uniquely identifying the MS equipment.

Mobile Station. An entity in the public cellular radio telecommunications service intended to be used while in motion or during halts at unspecified points. Mobile stations include portable units (e.g., hand-held personal units) and units installed in vehicles.

Mobile Switching Center. The MSC switches MS-originated or MS-terminated traffic. An MSC connects to one or more BS . It may connect to other public networks (PSTN, ISDN, etc.), other MSCs in the same network, or MSCs in different networks. (It has been referred to as Mobile Telephone Switching Office, MTSO.) It provides the interface for user traffic between the wireless network and other public switched networks, or other MSCs.

In this document, for signaling, the term MSC refers to either a circuit-switched MSC or an MSCe. For bearer path, the term MSC refers to either a circuit-switched MSC or a MGW. In situations where a statement applies to either the circuit-switched or packet-based MSC exclusively, the type of MSC will be specifically identified (i.e. “circuit-switched MSC” or “MSCe”).

Mobile Switching Center Emulation. The MSCe provides processing and control for calls and services. The MSCe provides signaling capabilities equivalent to a circuit-switched MSC on the A1p interface. The MSCe connects to a BS via IP based protocols.

origination message. In this document, “origination message” is used to indicate either an Origination or Enhanced Origination air interface message.

ORYX. A wireless data encryption and decryption algorithm.

Packet Control Function. An entity in the radio access network that manages the relay of packets between the BS and the PDSN.

Packet Data Session. The set of one or more packet data service instances in use at any time at the RAN/PDSN. A packet data session starts when the first service instance transitions out of the Null/Inactive State, and ends when the last service instance transitions to the Null/Inactive State.

Packet Data Serving Node. An entity that routes MS originated or MS terminated packet data traffic. A PDSN establishes, maintains and terminates link layer sessions to MSs.

Physical Channel. A physical path between the SDU function and the MS that consists of any connecting A3 traffic channel(s) and radio channel(s). Depending on the radio technology in use, a physical channel may be in soft handoff between the MS and the SDU function.

Remote Transcoder Operation: A network capability for endpoints with incompatible codecs. RTO attempts to enable the bearer by matching the incompatible codecs with a single transcoder (XC). For circumstances where a single transcoder is not available to enable the bearer, two tandem transcoders may be required to find a match between the endpoints.

SDU Function. The SDU function (Selection/Distribution Unit function) provides bearer termination within the BS. An example SDU implementation may include the following functions:

- Signaling Layer 2: This function performs the layer 2 functionality of the air interface signaling protocol and is responsible for the reliable delivery of layer 3 signaling messages between the BS and the MS. This functionality may be in the BTS in some situations.
- Multiplex Sublayer: This function multiplexes and demultiplexes user traffic and signaling traffic for the air interface.
- Power Control: This function administers parts of the forward and reverse link power control in a CDMA system. This function and the channel elements provide power control functionality. This function generates or utilizes the power control information in whole or in part that is exchanged over the air interface or with the channel elements.
- Frame Selection/Distribution: This function is responsible for selecting the "best" incoming air interface reverse link frame from the channel elements involved in the soft handoff. It also distributes forward air interface frames to all channel elements involved in a call.
- Backhaul Frame Handler: This function demultiplexes the control information and the air interface reverse frame from the frame received over the backhaul network. It also multiplexes the control information and the air interface frames in the forward direction.
- Intra-BS Frame Handler: This function exchanges backhaul frames with channel elements involved in intra-BS soft handoff.
- Inter-BS Frame Handler: This function exchanges backhaul frames with channel elements involved in inter-BS soft handoff.

Sector. A face of a physical radio equipment implementation.

Service Instance. An instance of a higher level communication service between the MS user and various other endpoints.

Service Provider Network. A network operated by either the home service provider or the visited service provider. The home service provider maintains the customer business relationship with the user. The visited service provider provides access services through the establishment of a service agreement with the home service provider.

Serving Network. The network that provides access services to the user.

Signaling Connection. A connection intended to provide a path for signaling traffic.

Source Base Station. The BS that is in control of the call.

System Identification. The System Identification (SID) is a number that uniquely identifies a network within a cellular or Personal Communications System (PCS) system.

Target Base Station. Any BS that supports the call other than the source BS.

Transcoder. A function that converts from one speech encoding format to another speech encoding format.

Transcoder Free Operation: A network capability for MS-to-MS calls, where the MSs have identical codecs. TrFO enables the bearer path without introducing vocoders in the bearer path. Compressed speech is passed between the MS endpoints.

1.4 Organization

This section outlines the relationship of the current specification with neighboring elements (air interface, packet data network and the core network) as well as with older versions of the IOS itself. The cross reference of IOS specifications in section 1.4.1 is provided for information and is not intended to indicate additional requirements for the IOS.

1.4.1 Overall IOS Specifications

When addressing previous revisions of the IOS, this revision of the specification uses a common (historical) identifier, IOS v x.y.z, which can be cross referenced as shown in Table 1.4.1-1.

Table 1.4.1-1 IOS Cross References

Common[2]	CDG	3GPP2	TIA	Air Interface[3]
-	-	-	IS-634 December 1995	IS-95 July 1993
-	-	-	IS-634-A July 1998	IS-95-A May 1995
-	-	-	IS-634-B April 1999	TIA/EIA-95-B March 1999
IOS v2.0.1	IOS v2.0.1 Dec 1998	-	-	-
IOS v2.2	IOS v2.2 June 1999	-	-	-
IOS v2.3	IOS v2.3 Feb 2000	-	-	-
IOS v2.4	IOS v2.4 March 2000	-	-	-
IOS v3.0	IOS v3.0 Nov 1998	-	-	-

2 The Common identifier aligns with numbering used in the Software Version Information Element.

3 The relationship between air interface and IOS releases is provided for information and is not intended to be an absolute indication of features supported by an IOS release.

Table 1.4.1-1 IOS Cross References

Common[2]	CDG	3GPP2	TIA	Air Interface[3]
IOS v3.1.1	IOS v3.1.1 Aug 1999	-	-	-
IOS v3.2	IOS v3.2 March 2001	-	-	-
IOS v4.0	-	A.S0001 v0.1 June 2000	IS-2001 December 2000	C.S0001~6 v3.0 July 2001
IOS v4.1	-	A.S0001-A v2.0 June 2001	IS-2001-A August 2001	C.S0001~6-A v5.0 July 2001
IOS v4.2	-	A.S0011~17 v2.0 May 2002	TIA-2001-B May 2002	C.S0001~6-B v1.0 April 2002
IOS v4.3	-	A.S0011~17-A v2.0.1 July 2003	TIA-2001-C July 2003	C.S0001~6-B v1.0 April 2002
IOS v4.3.1	-	A.S0011~17-B v1.0 April 2004	TIA-2001-C-1 December 2003	C.S0001~6-C v2.0 August 2004
IOS v5.0	-	A.S0011~17-C v1.0 February 2005	TIA-2001-D February 2005	C.S0001~6-D v1.0 March 2004
IOS v5.0.1	-	A.S0011~17-C v2.0 December 2005	TIA-2001-D-1 December 2005	C.S0001~6-D v2.0 October 2005
IOS v5.0.2	-	A.S0011~17-C v3.0 September 2010	TIA-2001-D-2 October 2010	C.S0001~6-D v2.0 October 2005
IOS v5.1		A.S0011~17-D v1.0 June 2007	TIA-2001-E June 2007	C.S0001~6-D v2.0 October 2005
IOS v5.1.1		A.S0011~17-D v2.0 August 2009	TIA-2001-E-1 September 2009	C.S0001~6[4]-E v1.0 June 2009
IOS v5.1.2		A.S0011~17-D v3.0 May 2011	TIA-2001-E-2 May 2011	C.S0001~6-E[4] v2.0 June 2010

1.5 Document Layout

The IOS is organized into seven parts, each published in a separate document:

[11] Overview, general overview

[12] Transport, protocol definitions and transport requirements

[13] Features, descriptions of features

[14] A1/A1p/A2/A2p/A5 Interfaces, definition of the interfaces

[15] A3/A7 Interfaces, definition of the interfaces

[16] A8/A9 Interfaces, definition of the interfaces

[17] A10/A11 Interfaces, definition of the interfaces

The interface documents define the individual interfaces – this includes message procedures, message bitmaps, information element definitions, and the definitions of timers that are related to the interface. Note that some information elements are used on multiple interfaces; in this situation, the information element is defined in each of the associated interface documents. Changes to the definition of an information element in one interface

4 The Analog Signaling Standard remains C.S0006-D v2.0, October 2005.

document do not imply changes to its definition in other interface documents. However, insofar as possible, the same Information Element Identifier shall be used in all definitions of the same information element.

The Features document provides descriptions of the features supported in the IOS and Stage 2 text (e.g. call flows) for these features, which interfaces are used, which messages are used, and how the feature is implemented using these messages.

1.6 Documentation Conventions

"Shall" and "shall not" identify requirements to be followed strictly to conform to the standard and from which no deviation is permitted. "Should" and "should not" indicate that one of several possibilities is recommended as particularly suitable, without mentioning or excluding others; that a certain course of action is preferred but not necessarily required; or (in the negative form) that a certain possibility or course of action is discouraged but not prohibited. "May" and "need not" indicate a course of action permissible within the limits of the standard. "Can" and "cannot" are used for statements of possibility and capability, whether material, physical, or causal.

The scenarios and examples in this specification are not meant to be exhaustive, but are only used to help explain some of the important procedures of the protocol.

Figure 1.6-1 is provided as an example of the call flow conventions used in this specification.

Several points within the diagram are worthy of note. The circled numbers in the following figure correspond to the numbered items below.

1. Horizontal dotted lines are used to indicate messaging that is not part of defined interfaces specified in this specification. Not all air interface messages are shown, and names may be generic. For example, the phrase "handoff direction message" is meant to include Extended Handoff Direction Message (EHDM), General Handoff Direction Message (GHDM), and Universal Handoff Direction Message (UHDM).
2. Vertical dotted lines between messages are used to indicate the span of timers. The timer name is placed as close as possible to the line. Timer names begin with a capital "T" followed by digits or alphabetic characters. If a timer expires prior to reception of a message that stops the timer, the expiration is shown with an 'x' at the end of the vertical dotted line.
3. Horizontal solid lines are used to indicate messaging that is part of the interfaces specified in this standard.
4. Lower case letters are associated with individual messaging instances in the diagram in alphabetical order arranged vertically. These letters correlate the text below the diagram with portions of the diagram.
5. Procedures that may involve the exchange of several messages are shown as an open block arrow with the name of the procedure inside.
6. Comments related to parts of the diagram are located in a comment column on the right side of the diagram.

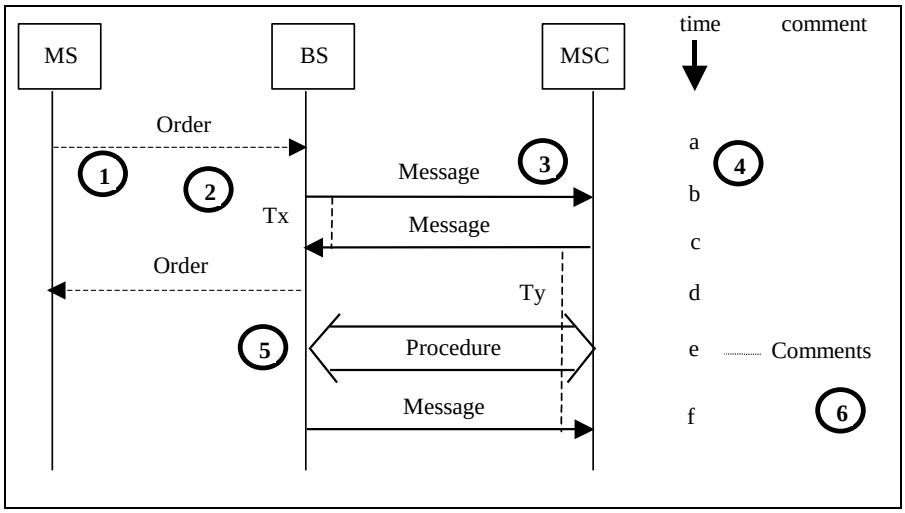

Figure 1.6-1 Document Convention Example

a. The MS transmits an Order over the reverse link.

b. The BS sends a message to the MSC. The BS starts timer T_x.

c. The MSC sends a message to the BS and starts timer T_y. The BS stops timer T_x.

d. The BS acknowledges the MS message by returning an Order over the forward link.

e. The BS and MSC execute the procedure.

f. The BS returns a message to the MSC. The MSC stops timer T_y.

1.6.1 Procedural Descriptions

The procedural descriptions are broken into sections where each section describes one of the messages in the procedure. The description for each procedure is written to flow through each section devoted to the messages that make up the procedure. Each of these sections has the following subsection breakdowns (as appropriate):

1. Successful Operation: this section is used to describe what the message is for, why the sender is sending it, and what the receiver is expected to do with the message. It may also provide a brief tutorial on the overall impact of this message regarding the particular procedure. It includes invocation of any pertinent timers or discussion of timing constraints. It may also provide subsections that describe the uses of the elements within the message, particularly if they are not obvious.

2. Failure Operation: if applicable, this section is used to describe the actions of the sender if the expected response is not received by the sender. This includes treatment of timer expiration or receipt of failure messages stemming from the message that was sent.

3. Abnormal Operation: if applicable, this section is used to describe out of sequence events that could possibly occur and the treatment by the receiver of the message.

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2.0 Interface Model

The logical reference model used for this standard is a combination of the 3GPP2 Wireless Network Reference Model as shown in [I-1], [18] and the architecture defined in [19].

2.1 Reference Points A, A_{ter}, $A_{quinter}$, A_{quater}, 48 and 27

The 3GPP2 Wireless Network Reference Model contains reference points A, A_{ter}, $A_{quinter}$, A_{quater}, 48 and 27 that are implemented by the protocols and interfaces of this standard.

- The A reference point is implemented by the A1, A2 and A5 interfaces.
- Reference point 48 is implemented by the A1p interface.
- Reference point 27 is implemented by the A2p interface.
- The A_{ter} reference point is implemented by the A3 and A7 interfaces.
- The A_{quater} reference point is implemented by the A10 and A11 interfaces.
- The $A_{quinter}$ reference point is implemented by the A8 and A9 interfaces.

2.2 Interface Reference Model

The interfaces defined in this standard are described below.

A1 — The A1 interface carries signaling information between the call control and mobility management functions of the circuit-switched MSC and the call control component of the BS (BSC).

A1p — The A1p interface carries signaling information between the call control and mobility management functions of the MSCe and the call control component of the BS (BSC).

A2 — The A2 interface is used to provide a path for user traffic. The A2 interface carries 64/56 kbps PCM information (for circuit-oriented voice) or 64 kbps Unrestricted Digital Information (UDI, for ISDN) between the Switch component of the circuit-switched MSC and the Selection/Distribution Unit (SDU) function of the BS.

A2p — The A2p interface provides a path for packet-based user traffic sessions. The A2p interface carries voice information via IP packets between the MGW and the BS.

A3 — The A3 interface is used to transport user traffic and signaling for inter-BS soft/softer handoff when a target BS is attached to the frame selection function within the source BS. The A3 interface carries coded user information (voice/data) and signaling information between the source BS SDU function and the channel element component (BTS) of the target BS. This is a logical description of the endpoints of the A3 interface. The physical endpoints are beyond the scope of this specification. The A3 interface is composed of two parts: signaling and user traffic. The signaling information is carried across a separate logical channel from the user traffic channel, and controls the allocation and use of channels for transporting user traffic.

A5 The A5 interface is used to provide a path for user traffic for circuit-oriented data calls between the source BS and the circuit-switched MSC. The A5 interface carries a full duplex stream of bytes between the switch component of the circuit-switched MSC and the SDU function of the BS.

A7 The A7 interface carries signaling information between a source BS and a target BS for inter-BS soft/softer handoff.

A8 The A8 interface carries user traffic between the BS and the PCF.

A9 The A9 interface carries signaling information between the BS and the PCF.

A10 The A10 interface carries user traffic between the PCF and the PDSN.

A11 The A11 interface carries signaling information between the PCF and the PDSN.

This is a logical architecture that does not imply any particular physical implementation. For this standard the IWF for circuit-oriented data calls is assumed to be located at the circuit-switched MSC, and the SDU function is considered to be co-located with the source BSC. Figure 2.2-1 and Figure 2.2-2 show the relationship among network components in support of MS originations, MS terminations, and direct BS-to-BS soft/softer handoff operations.

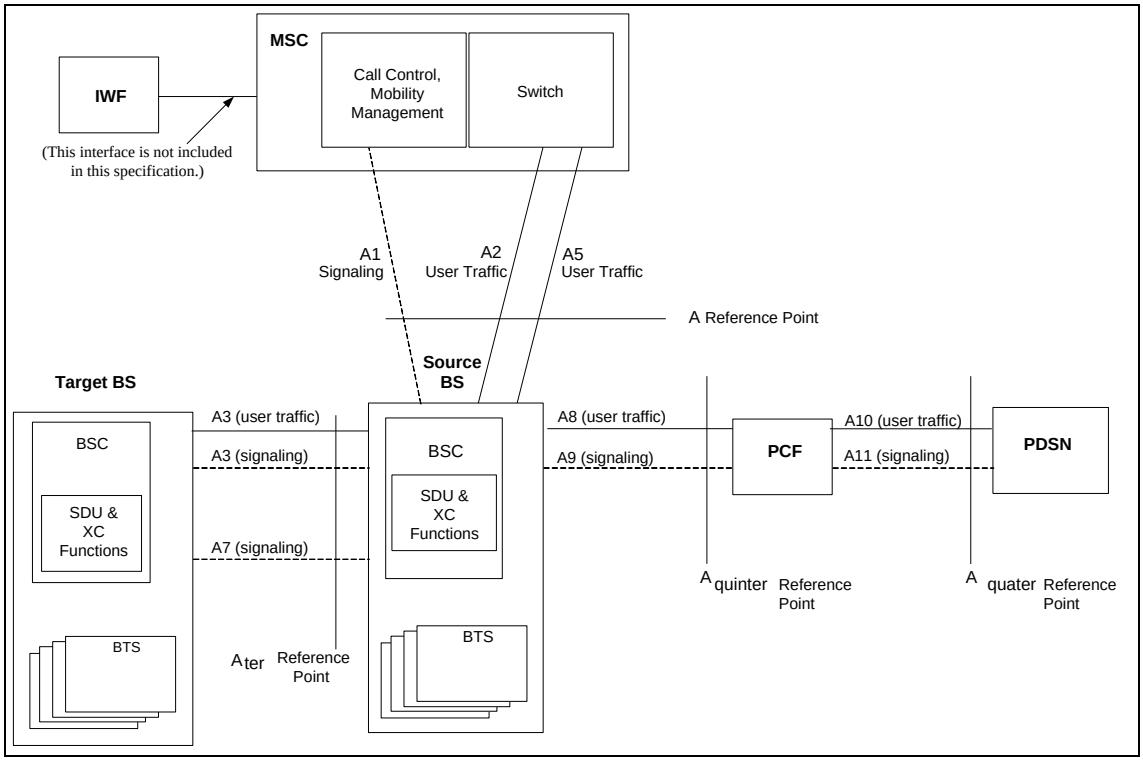

Figure 2.2-1 Reference Model for Circuit Switched cdma2000 Access Network Interfaces

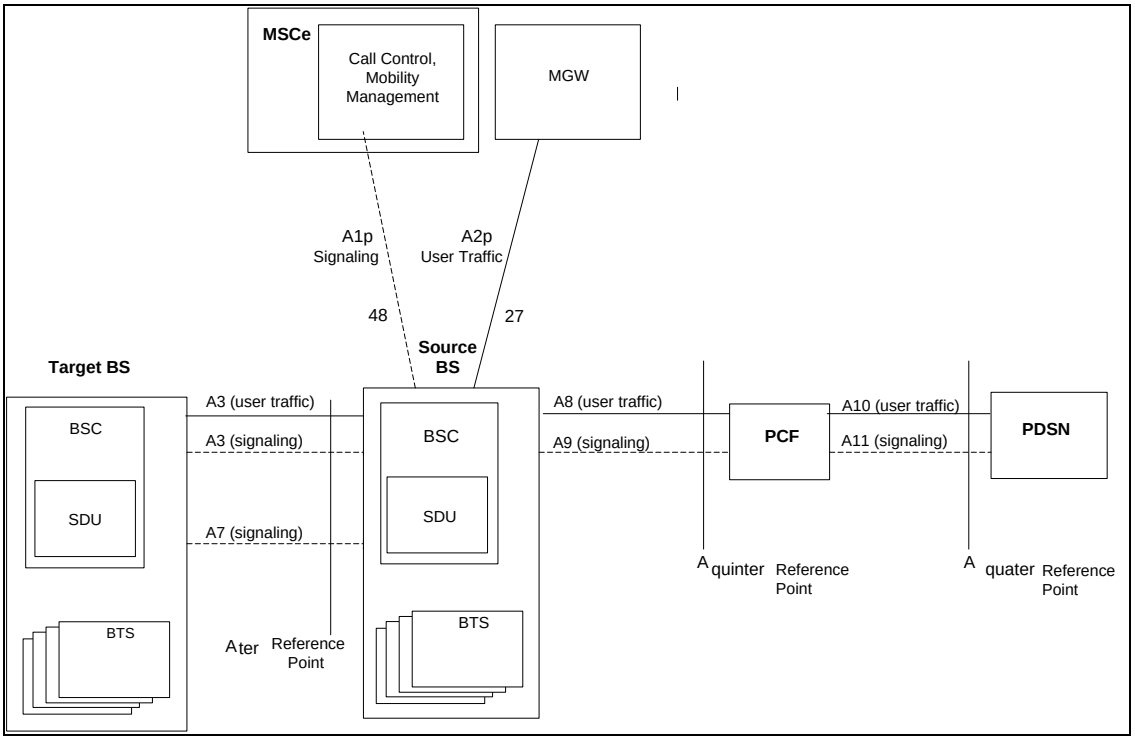

Figure 2.2-2 Reference Model for Packet-based cdma2000 Access Network Interfaces

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3.0 Information Flows

The interfaces defined in this standard provide:

- bearer (user traffic) connections (A2, A2p, A3 (traffic), A5, A8, and A10);
- a signaling connection between the channel element component of the target BS and the SDU function in the source BS (A3 signaling);
- a direct BS to BS signaling connection (A7);
- a signaling connection between the BS and the circuit-switched MSC (A1);
- a signaling connection between the BS and the MSCe (A1p);
- a signaling connection between the BS and PCF (A9); and
- a signaling connection between a PCF and PDSN pair (A11). A11 signaling messages are also used for passing accounting related and other information from the PCF to the PDSN.

In general, the functions specified on the interfaces are based on the premise that the interfaces carry signaling information that traverses the following logical paths:

- between the BS and MSC only (e.g., BS management information);
- between the MS and the MSC via the BS (e.g., the BS maps air interface messages to the A1 or A1p interface);
- between the BS and other network elements via the MSC;
- between the source BS and the target BS;
- between the BS and the PCF;
- between the PCF and the PDSN; and
- between the MS and the PDSN (e.g., authorization information and Mobile Internet Protocol (MIP) signaling).

These logical paths define all of the traffic that can exist on the defined interfaces.

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4.0 MS Mobility for Packet Data Service

The Figure 4-1 provides a conceptual view of levels of packet data mobility.

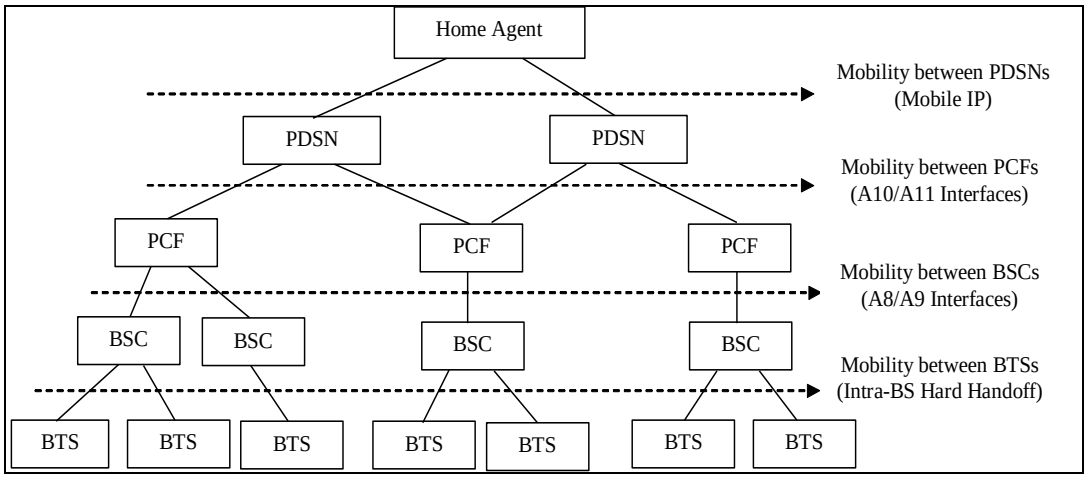

Figure 4-1 Levels of Packet Data Mobility

- MIP [20] supports MS mobility between PDSNs under the same Home Agent. The PDSN provides the functionality of the Foreign Agent.
- The A10/A11 interfaces support MS mobility between PCFs under the same PDSN.
- The A8/A9 interfaces support MS mobility between BSCs under the same PCF.
- Hard handoff, fast handoff, dormant handoff and soft handoff procedures realize MS mobility between BTSs.

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