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SERIES Q: SWITCHING AND SIGNALLING

Signalling requirements and protocols for IMT-2000

IMT-2000 references (approved as of 11 July 2002) to ANSI-41 evolved core network with cdma2000 access network

ITU-T Recommendation Q.1742.2

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ITU-T Recommendation Q.1742.2

IMT-2000 references (approved as of 11 July 2002) to ANSI-41 evolved core network with cdma2000 access network

Summary

This Recommendation associates the published core network standards from the regional standards development organizations (SDOs) with those 3GPP2 specifications that were approved as of 11 July 2002 for the IMT-2000 family member "ANSI-41 evolved core network with cdma2000 access network".

3GPP2 specifications that were approved as of 17 July 2001 were associated with the published core network standards from the regional standards development organizations in ITU-T Rec. Q.1742.1. 3GPP2 specifications that are approved as of July 2003 will be associated with published core network standards in the future ITU-T Rec. Q.1742.3. The radio interface and radio access network and standards from the SDOs for this IMT-2000 family member are associated in ITU-R M.1457-1. The associations for other IMT-2000 family members are identified in the ITU-T Q.174x series.

This Recommendation combines and associates the regional standards for the core network of this IMT-2000 family member into a global Recommendation.

Source

ITU-T Recommendation Q.1742.2 was approved by ITU-T Study Group SSG (2001-2004) under the ITU-T Recommendation A.8 procedure on 29 July 2003.

Keywords

ANSI-41, cdma2000, core network, IMT-2000, third generation system.

FOREWORD

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The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

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1 Scope

This Recommendation identifies the IMT-2000 family member; "ANSI-41 evolved core network with cdma2000 access network". This set of referenced specifications includes those 3GPP2 specifications that were approved as of 11 July 2002.

The core network interfaces identified in this Recommendation, and the radio interfaces and radio access network interfaces identified in ITU-R Rec. M.1457-1 [1], constitute a complete system specification for the 3rd generation mobile system for terrestrial usage of this IMT-2000 family member.

It is the intent of the ITU-T that the references in this Recommendation are only to specifications that specify the network aspects of this IMT-2000 family member. In the event that a referenced specification also includes material that specifies any of the radio aspects of this IMT-2000 family member, Rec. ITU-R M.1457-1 [1], shall take precedence.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

- [1] Recommendation ITU-R M.1457-1 (2001), *Detailed specifications of the radio interfaces of International Mobile Telecommunications-2000 (IMT-2000)*.
- [2] ANSI; TIA/EIA-41D (1997), *Cellular radiotelecommunications intersystem operations (ANSI/TIA/EIA-41-D-97)*.
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- [13b] TTA; TTAT.3G-S.R0037-0v2.0 (2003), *IP network architecture model for cdma2000 spread spectrum systems*.
- [13c] TTC; TS-3GB-S.R0037-0v2.0 (2002), *IP network architecture model for cdma2000 spread spectrum systems*.
- [14] TIA/EIA TSB29-E (2002), *International implementation of wireless telecommunication systems compliant with TIA/EIA-41*.

3 Definitions

This Recommendation defines the following terms:

- 3.1 active:** The MS is available for call delivery. This state is maintained by the MSC, the VLR and the HLR. (See also Available, Inactive and Unavailable.)
- 3.2 access denial call treatment:** A tone, announcement, or call redirection applied as appropriate.
- 3.3 access network:** Network that connects access technologies (such as a Radio Access Network) to the core network.
- 3.4 adjunct MSC:** A Mobile Switching Centre (MSC) that is providing adjunct services such as voice response, voice recognition, DTMF tone detection, voice message storage, etc.
- 3.5 anchor MSC:** The Mobile Switching Centre (MSC), that is the first to assign a traffic channel to a call on origination or termination is called the Anchor MSC. For the duration of this call, this MSC shall be the anchor (fixed) point in the event that the Mobile Station (MS) should be handed off to other MSCs.
- 3.6 authentication:** The act of verifying the identity of an entity (e.g., a user, device).
- 3.7 available:** The MS can accept a call delivery (i.e., the MS is in a known location and it is in a state able to accept call deliveries). The availability of a MS to accept a call delivery is maintained only by the MSC. (See also Active, Inactive and Unavailable.)
- 3.8 base transceiver station:** A piece of radio access network equipment that contains the radios and serves a geographic area.
- 3.9 call delivery:** The process by which calls directed to the cellular subscriber are delivered to the subscriber while roaming in a visited system.
- 3.10 call delivery method:** Method by which a call is delivered to a subscriber in MSC-V.
- 3.11 call disconnect:** The process of requesting the release of a connection between two or more network addresses.

- 3.12 call release:** The process of relinquishing the facilities and circuits used for a call.
- 3.13 call termination:** The process of connecting a subscriber to an incoming call.
- 3.14 candidate MSC:** This term is used during the handoff measurement request by the current serving MSC to reference the MSC that is being requested to provide its best CELL ID and SIGNAL QUALITY values.
- 3.15 cell site:** The physical location of a cell's radio equipment and supporting systems. This term is also used to refer to the equipment located at the cell site.
- 3.16 clearinghouse:** A service used for the exchange and management of information.
- 3.17 data communications:** The digital transmission of information (other than voice).
- 3.18 dialogue:** A user interaction sequence composed of tones and announcements that may gather information.
- 3.19 gateway MSC:** See MSC-G.
- 3.20 home system:** The system which is transmitting the System Identifier (SID) (refer to *EIA/TIA-553*) which is recognized by the MS as the "Home" SID.
- 3.21 inactive:** The MS is not available for call delivery. The MS may not be registered. The MS may be registered, but is out of radio contact (e.g., missing autonomous registrations) or is intentionally inaccessible for periods of time (e.g., slotted mode, paging frame class, or sleep mode). An inactive MS may accept SMS message deliveries. This state is maintained by the MSC, the VLR and the HLR. (See also Active, Available, and Unavailable.)
- 3.22 market identification (MarketID):** A unique market identifier that is specified by the service provider (e.g., FCC assigned SID, CIBERNET assigned BID – see *TIA/EIA TSB29*).
- 3.23 mobile assisted handoff (MAHO):** A process where handoff measurements are done by the MS under the control of the MSC and Base Station. The MSC and Base Station retain the control over when the handoff actually occurs.
- 3.24 mobility:** The ability to access services from any point in the network. The degree of service availability may depend on the access network capabilities, as well as any service level agreements between the user's home network and the visited network. Types of mobility include personal mobility, service mobility, and terminal mobility.
- 3.25 mobility management:** The set of functions used to manage a mobile user accessing a network other than that user's home network. These functions include communication with the home network for purposes of authentication, authorization, location updating and download of user information.
- 3.26 MSC-G:** An MSC that is capable of the Intersystem procedures, defined in this Recommendation, between entities in the network reference model so as to provide service.
- 3.27 MSC-H:** The "home" MSC of an MS which is broadcasting the SID that is recorded in the MS's Security and Identification memory, and to which the MS's Directory Number is assigned.
- 3.28 MSC-V:** A "visited" MSC in whose service area a roamer is operating.
- 3.29 network reference model:** The functional entities and the associated interface reference points that may logically comprise a cellular network. (See clause 6.)
- 3.30 number portability:** A mechanism that allows a user to retain the same directory number, regardless of the subscribed-to service provider. Number portability may be limited to specific geographical areas. In the context of the All-IP network, the term "number portability" refers specifically to E.164 numbers used for telephony.

- 3.31 originating MSC:** The MSC-H or MSC-G that initiates the call delivery procedures defined in this Recommendation.
- 3.32 originating SMS supplementary service:** Services or features that affect SMS message originations and are requested on a per message basis as supported by a particular teleservice, for example, delayed delivery or message distribution to a list of destinations.
- 3.33 personal mobility:** The ability of users to change their association with one or more terminals at any point and time. The user should continue to receive subscribed and otherwise authorized services as supported by the current MS and access network.
- 3.34 personalized services:** Services that need access to the subscriber profile and/or are dependent on the overall call/session state (of the user) for reasons of service interaction. An example: a call termination service such as TIA/EIA-41's "Call Forward on Busy".
- 3.35 protocol extension:** A mechanism provided to allow systems with a common bilateral agreement to extend the *TIA/EIA-41* protocol. There is a range of reserved Error Codes, Operation Codes, Parameter Identifiers (in addition to PRIVATE Parameter Identifiers), and ranges of values in enumerated parameter types and data fields. The only mechanism to resolve conflicting uses of protocol extension is to standardize their usage. The Protocol Extension mechanism is used at the risk of the implementation. Protocol Extensions should not be used unless the message recipient is known to support them.
- 3.36 radio access network:** The network that connects radio base stations to the core network. The RAN provides and maintains radio-specific functions which may be unique to a given radio access technology that allow users to access the core network.
- 3.37 registered:** The HLR has a pointer to a system serving an MS. A registered MS may be active or inactive.
- 3.38 registration:** The procedure by which a MS becomes listed as being present in the service area of an MSC.
- 3.39 remote feature control port (RFC Port):** A terminating directory number supporting service profile modification.
- 3.40 roamer port:** A terminating directory number supporting call delivery to mobile stations.
- 3.41 roamer service profile:** The specific set of features, capabilities and/or operating restrictions, other than financial accountability, associated with the subscriber.
- 3.42 roamer validation:** That aspect of roamer service qualification dealing with financial accountability. Also, the general procedure by which a roamer's financial accountability is established.
- 3.43 Roaming:** Action whereby users access services while outside of their subscribed home network.
- 3.44 service qualification:** The service capabilities, features and privileges to which an MS is entitled. Also, the general procedure by which such service capabilities, features and privileges become established in an MSC.
- 3.45 serving MSC:** The MSC which currently has the MS obtaining service at one of its cell sites within its coverage area.
- 3.46 signalling:** The information exchanged between the mobile station and the network or within the network, for the purposes of service provision (e.g., connection establishment).
- 3.47 switch number (SWNO):** A number uniquely identifying a particular switch (i.e., a group of cell sites and the associated switch resources) within a group of switches associated with a common MarketID.

3.48 target MSC: The MSC which was selected from the candidate list as having the cell site with the best signal quality value for the MS during the location request function.

3.49 temporary local directory number (TLDN): A network address temporarily assigned for call setup.

3.50 terminating SMS supplementary service: Services or features that affect SMS message terminations, for example, screening, forwarding, delivery to an MS, delayed delivery while roaming or distribution to a group based upon a destination address.

3.51 termination address: One or more digits, as determined by the Home System, which identify the Terminating Party. This could include Speed Call Codes (when supported by the Home Service Provider), other Mobile Telephone Numbers or any valid World Telephone Number.

3.52 traffic: The information generated by the subscriber that is transported on the network (i.e., user voice or data).

3.53 unavailable: The MS cannot accept a normal call delivery (i.e., the MS is in an unknown location or it is in a state unable to accept call deliveries). The availability of an MS to accept a call delivery is maintained only by the MSC. (See also Active, Available and Inactive.)

3.54 unregistered: A state where the MS is unavailable for any type of termination event and the HLR pointer is not directed to any visited system.

3.55 visited network: The visited network is a carrier's network where a subscriber is currently roaming. The term "visited network" is more business significant, than geographically significant.

3.56 visited system: From the MS's perspective, a system which is transmitting a SID which is not recognized by the MS as the "Home" SID. From a network perspective, the system in which an MS is currently registered.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations:

μ	Microsecond (10^{-6} second)
3G	Third Generation
3GPP2	Third Generation Partnership Project (ANSI driven)
AC	Authentication Centre
ADDS	Application Data Delivery Service
ADPCM	Adaptive Differential Pulse Code Modulation
ADS	Asynchronous Data Service
AH	Answer Hold
AMPS	Advanced Mobile Phone System
ANSI	American National Standards Institute
AoC	Advice of Charge
ARIB	Association of Radio Industries and Businesses (Japan)
BS	Base Station
BSC	Base Station Controller
BTS	Basic Transceiver System
CDCP	Call Data Collection Point

CDGP	Call Data Generation Point
CDIS	Call Data Information Source
CDMA	Code Division Multiple Access
CDRP	Call Data Rating Point
CNAP	Calling Name Presentation
CNAR	Calling Name Restriction
CNIP	Calling Number Identification Presentation
CSC	Customer Service Centre
CWTS	China Wireless Telecommunication Standard Group
DCCH	Dedicated Control CHannel
DMH	Data Message Handler
DP	Detection Point
DTMF	Dual Tone Multi-Frequency
EIA	Electronics Industry Association
EIR	Equipment Identity Register
ESN	Electronic Serial Number
ESP	Encapsulating Security Payload
FCC	Federal Communications Commission
FPH	FreePHone
FPLMTS	Future Public Land Mobile Telecommunication Systems (now IMT-2000)
GECO	Global Emergency Call Origination
GSM	Global System for Mobile Communications (Formerly: Group Special Mobile)
HA	Home Agent
HLR	Home Location Register
IETF	Internet Engineering Task Force
IMSI	International Mobile Subscriber Identity
IMT	International Mobile Telecommunications
IMT-2000	International Mobile Telecommunications-2000
IP	Intelligent Peripheral
IP	Internet Protocol
IPE	In Path Equipment
IS	Interim Standard
ISDN	Integrated Services Digital Network
ISLP	InterSystem Link Protocol
ISO	International Standards Organization
ITU	International Telecommunication Union
ITU-R	International Telecommunication Union – Radiocommunication Sector

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ITU-T	International Telecommunication Union – Telecommunication Standardization Sector
IWF	InterWorking Function
LBSS	Location-Based Services System
MAP	Mobile Application Part
MC	Message Centre
MC	Multi-Carrier
MDN	Mobile Directory Number
MHz	Megahertz (10 ⁶ Hertz)
MS	Mobile Station
MSC	Mobile Switching Centre
MSID	Mobile Station Identifier
NAM	Number Assignment Module
NAMPS	Narrowband Advanced Mobile Phone Service
NDSS	Network Directed System Selection
NRM	Network Reference Model
OAM&P	Operations, Administration, Maintenance and Provisioning
OTAF	Over-the-Air Function
OTAPA	Over-the-Air Parameter Administration
OTASP	Over-the-Air Service Provisioning
PCF	Packet Control Function
PCS	Personal Communications Service
PCS	Personal Communications System
PDE	Positioning Determining Element
PDSN	Packet Data Serving Node
PL	Preferred Language
PN	Project Number
PPC	Pre-Paid Charging
PPP	Point-to-Point Protocol
PRC	Premium Rate Charging
RAN	Radio Access Network
RUAC	Rejection of Undesired Annoying Calls
R-UIM	Removable User Identity Module
SC	Subscriber Confidentially
SCF	Service Call Forwarding
SCP	Service Control Point
SID	System Identifier
SME	Short Message Entity



SMS	Service Management System
SMS	Short Message Service
SN	Service Node
SS7	Signalling System No. 7
SSG	Special Study Group
TFO	Tandem Free Operation
TIA	Telecommunications Industry Association
TMSI	Temporary Mobile Station Identification
TR	Transmit-Receive (as in TR45)
TRAU	Transcoder and Rate Adaptor Unit
TSB	Telecommunications Systems Bulletin
TTA	Telecommunications Technology Association (Korea)
TTC	Telecommunication Technology Committee (Japan)
UIM	User Identity Module
USCF	User Selective Call Forwarding
VLR	Visitor Location Register
WIN	Wireless Intelligent Network
WLL	Wireless Local Loop
WNP	Wireless Number Portability

5 Introduction

The Core Network for cdma2000 is based on an evolved ANSI-41 2nd generation mobile system. The core network technical specifications have been developed in a third generation partnership project (approved in 3GPP2 as of 11 July 2002) and transposed to the involved regional Standards Development Organizations (SDOs). The system will support different applications ranging from narrow-band to wide-band communications capability with integrated personal and terminal mobility to meet the user and service requirements.

The Core Network interfaces identified in this Recommendation, and the radio interfaces and radio access network interfaces identified in Rec. ITU-R M.1457-1 [1], constitute a complete system specification for the 3rd generation mobile system for terrestrial usage of this IMT-2000 family member.

The descriptions in clauses 6, 7 and 8 and the descriptions of the technical specifications listed in clause 10 are for informative purposes only. Normative information is in the tables for the respective specification.

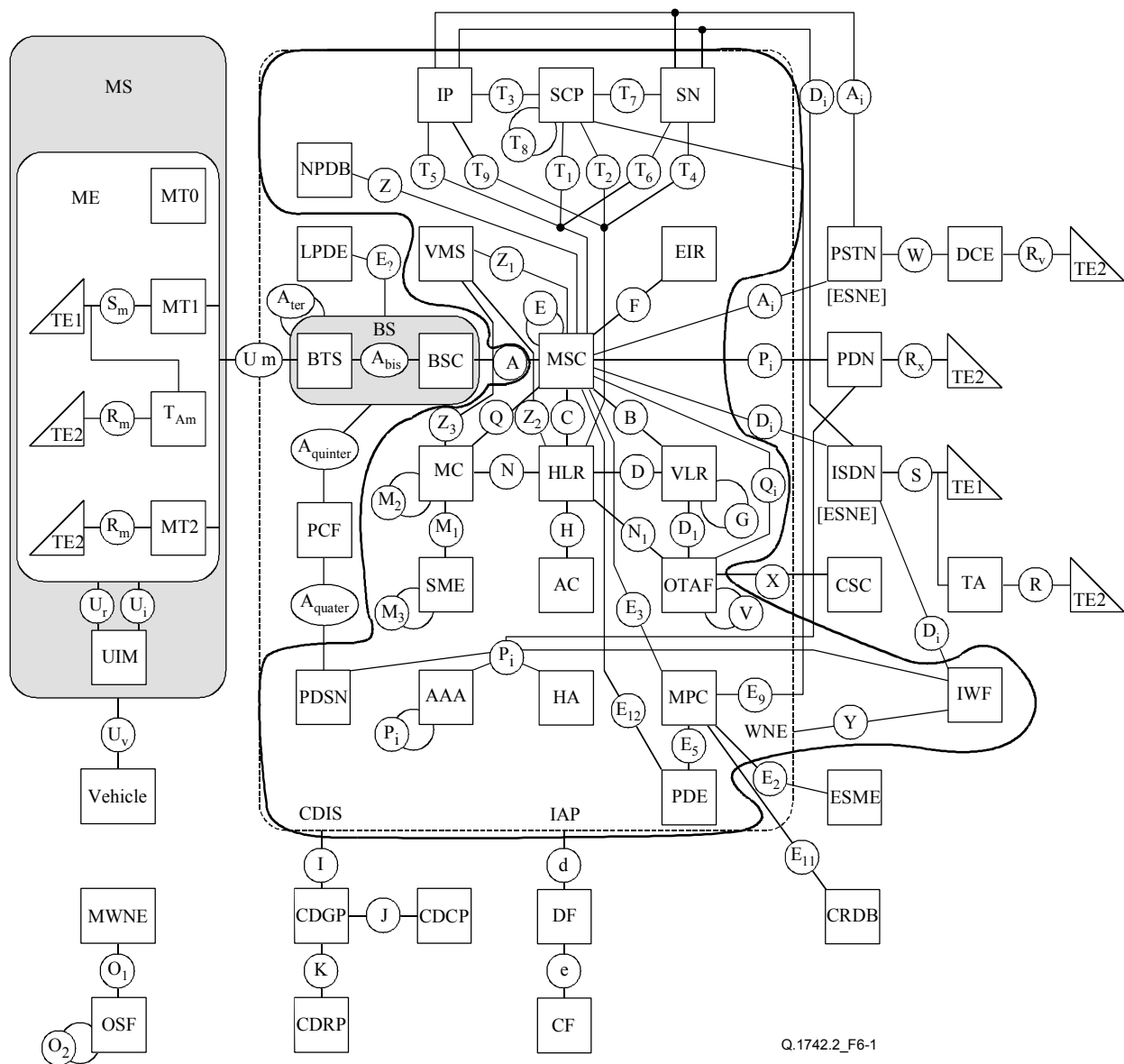
6 Basic architecture for the ANSI-41 evolved core network with cdma2000 access network family member

The basic architecture for the ANSI-41 evolved core network with cdma2000 access network family member includes a circuit-based and packet-based core network and an all-IP multimedia domain.

The following text is based on references [12a] to [12d].

Figure 6-1 presents the network entities and associated reference points that comprise the ANSI-41 evolved core network with cdma2000 access network. The network entities are represented by squares, triangles and rounded corner rectangles; circles represent the reference points. The network reference model in this Recommendation is the compilation of several reference models currently in use.

- The network reference model is a functional block diagram.
- A network entity represents a group of functions, not a physical device. For example, a Mobile Switching Centre (MSC) is a physical device; it comprises frames, shelves, circuit packs, etc. The physical device may comprise a single network entity such as the MSC, or it may comprise some combination such as the MSC, the Visitor Location Register (VLR), the Home Location Register (HLR) and the Authentication Centre (AC). The physical realization is an implementation issue; a manufacturer may choose any physical implementation of network entities, either individually or in combination, as long as the implementation meets the functional requirements. Sometimes, for practical reasons, the functional network entity is a physical device. The Mobile Station (MS) is an excellent example.
- A reference point is a conceptual point that divides two groups of functions. It is not necessarily a physical interface. A reference point only becomes a physical interface when the network entities on either side of it are contained in different physical devices.
- A "Collective Entity" contains encompassed network entities that are an instance of the collective.
- A "Composite Entity" contains encompassed network entities that are part of the composite.



Key:

- ▴ ▢ ▴ Specific Network Entity
- ▭ Composite Entity
- ▭ Collective Entity

- (H)— Interface Reference Point
- (X)— Interface to Another Instance of Same Network Entity
- +— Line Intersection

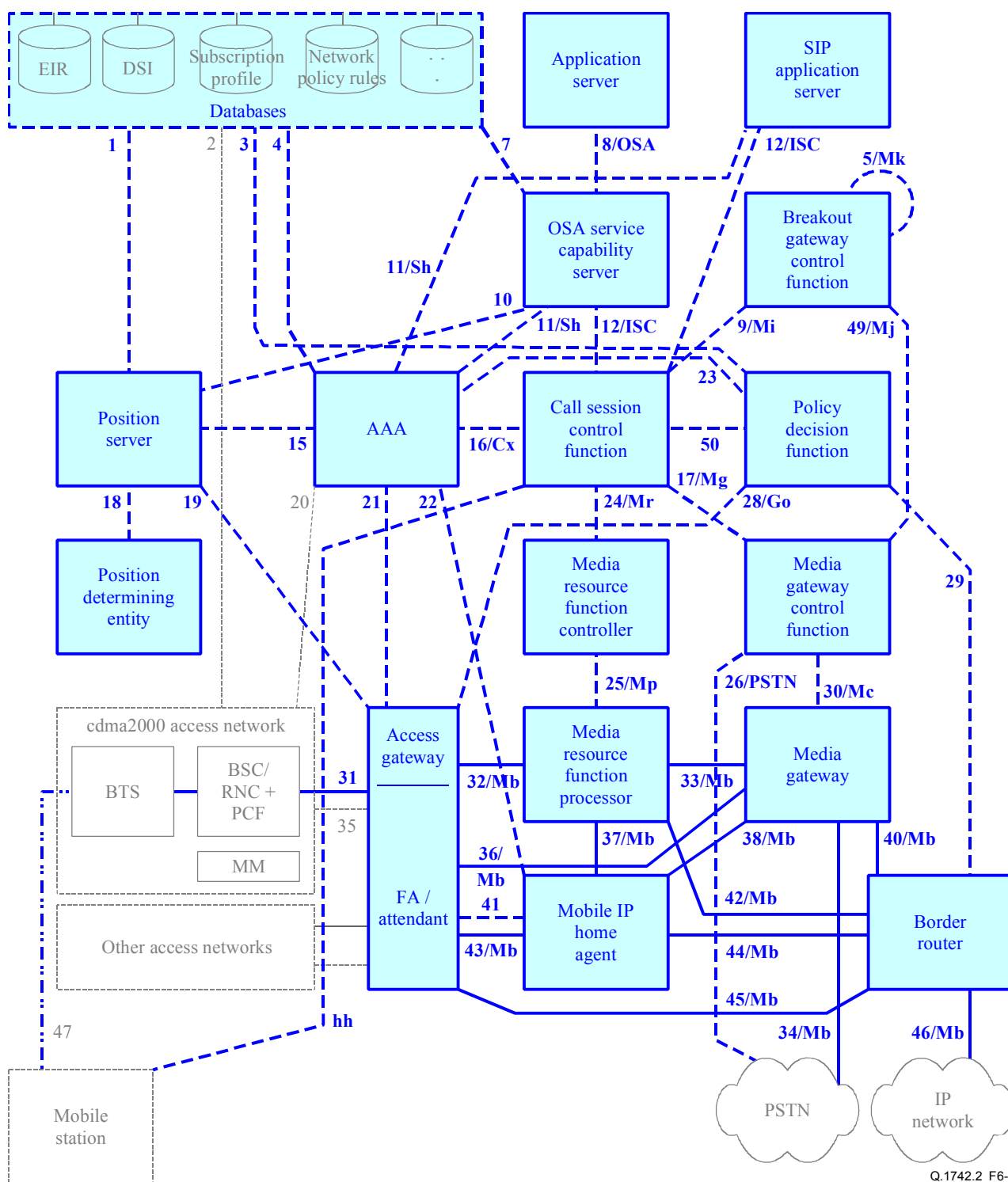
NOTE – The portion of the figure within the solid line is the Core Network.

Figure 6-1/Q.1742.2 – ANSI-41 evolved core network with cdma2000 access network reference model

The basic architecture for the ANSI-41 evolved core network with cdma2000 access network family member also includes an all-IP multimedia domain. The following text is based on references [13a] to [13c].

All-IP MMD Core Network Architecture:

Figure 6-2 presents the core network entities and associated reference points that comprise the Multimedia Domain (MMD) of the wireless All-IP Network Architecture Model. The network entities are represented by squares and rectangles; the interfaces between network entities are reference points identified by numbers. Figure 6-2 includes several reference points that have dual labels. Either of these labels may be used in the specifications relating to these reference points.



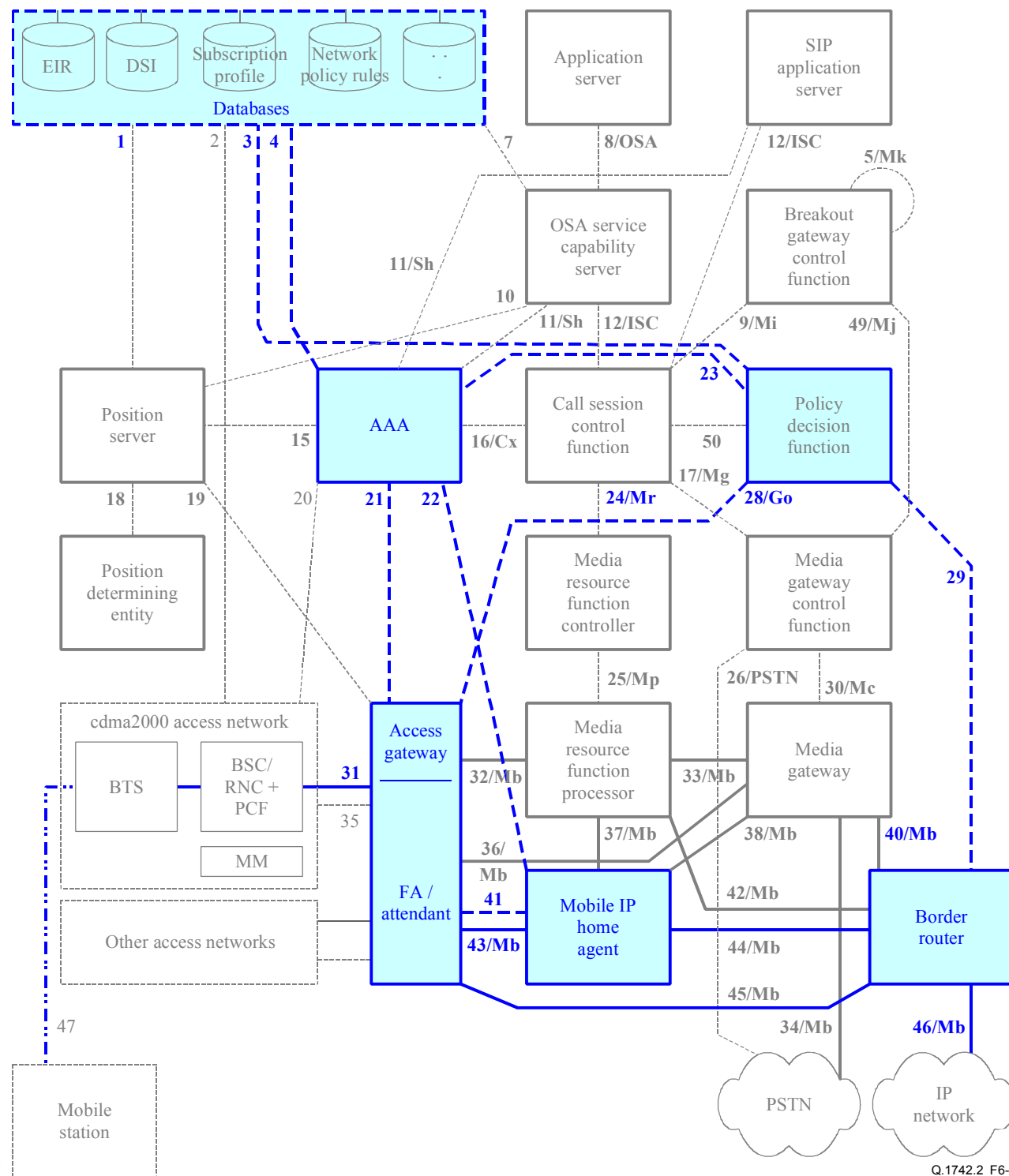
Q.1742.2_F6-2

NOTE – In Figure 6-2 the network elements and reference points, in bold and shaded (in "blue"), identify the "IP MMD Core Network".

Figure 6-2/Q.1742.2 – ANSI-41 evolved core network with cdma2000 access network IP MMD core network architecture model

The MMD of the All-IP network offers both general packet data support and multimedia session capabilities. The multimedia session capabilities are built on top of the general packet data support capabilities. The general packet data capabilities may be deployed without the multimedia session capabilities. Some network entities are common to providing both capabilities.

Figure 6-3 shows the entities that comprise the general packet data support portion of the MMD core network. These are known collectively as the Packet Data Subsystem (PDS). Figure 6-3 includes several reference points that have dual labels. Either of these labels may be used in the specifications relating to these reference points.



Q.1742.2_F6-3

NOTE – In Figure 6-3 the network elements and reference points, in bold and shaded (in blue), identify the "Packet Data Subsystem".

Figure 6-3/Q.1742.2 – ANSI-41 evolved core network with cdma2000 access network packet data subsystem core network architecture model

