3GPP2 S.R0038-0

Version 2.0

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Evolution Document

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Revision History

Version	Date and Description
1.0	March 14, 2001, based upon Chapter 5 of the Requirements for a 3G Network Based on Internet Protocol ("All-IP") with Support for TIA-41 Interoperability, revision 1.0.0, October 2000.
2.0	12 February 2004 – First point release.

No text.

Table of Contents

List of Figures

Notes

1. This document may use the following verbal forms: "Shall" and "shall not" identify requirements strictly to be followed 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 that (in the negative form) a certain possibility or course of action is discouraged but not prohibited. "May" and "may not" indicate a course of action permissible within the limits of this document.

2. For the purposes of this document, the following terms are defined:

Evolved cdma2000®[1] family of standards

Radio Interfaces defined in 3GPP2 C.S0001 – C.S0008, and C.S0024, including the Cross-mode, 1xEV-DO, and 1xEV-DV enhancements to cdma2000 interfaces.

[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.

1 SCOPE

This document describes the 3GPP2 phased evolution of the cdma2000 wireless networks towards the 3G Network Based on Internet Protocol ("All-IP"). The evolutionary phases are described in terms of the impacts to the core, access, and radio networks. The evolutionary phases do not imply a specific architecture. The network architecture model associated with each evolution phase and/or step is provided for illustration and reference only. The phases are intended to illustrate optional phasing of network capabilities.

2 REFERENCES

Documents referenced in this document are listed below. Because the requirements contained in this document do not constitute provisions of a standard per se, this list is provided for informational purposes only.

[1] 3GPP2 A.S0001, 3GPP2 Access Network Interfaces Interoperability Specification (also known as 3G-IOS

[2] 3GPP2 A.S0001-A ~ A.S0017-A, Interoperability Specification (IOS) for cdma2000 Access Network Interfaces (also known as 3G-IOS)

[3] 3GPP2 C.S0001-0 – C-Introduction to cdma2000 Spread Spectrum Systems - Release 0 – Release C

[4] 3GPP2 C.S0002-0 – C-Physical Layer Standard for cdma2000 Spread Spectrum Systems - Release 0 – Release C

[5] 3GPP2 C.S0003-0 – C-Medium Access Control (MAC) Standard for cdma2000 Spread Spectrum Systems, Release 0 – Release C

[6] 3GPP2 C.S0004-0 – C-Signaling Link Access Control (LAC) Standard for cdma2000 Spread Spectrum Systems, Release 0 – Release C

[7] 3GPP2 C.S0005-0 – C-Upper Layer (Layer 3) Signaling Standard for cdma2000 Spread Spectrum Systems, Release 0 – Release C

[8] 3GPP2 C.S0006-0 –C-Analog Signaling Standard for cdma2000 Spread Spectrum Systems Release 0 – Release C

[9] 3GPP2 C.S0007-0 - Direct Spread Specification for Spread Spectrum Systems on ANSI-41 (DS-41)

[10] 3GPP2 C.S0008-0 - Multi-Carrier Specification for Spread Spectrum Systems on GSM MAP (MC-MAP)

[11] 3GPP2 C.S0024-0– cdma2000 High Rate Packet Data Air Interface Specification

[12] 3GPP2 N.S0031 – LMSD Step 1

[13] 3GPP2 N.S0005 (ANSI/TIA/EIA-41-D) Cellular Radiotelecommunications Intersystem Operations

[14] 3GPP2 N.S0029-0, TIA/EIA-41-D Based Network Enhancements for CDMA Packet Data Service (C-PDS), Phase 1

[15] 3GPP2 P.R0001, Wireless IP Architecture Based on IETF Protocols

[16] 3GPP2 P.S0001-A, Wireless IP Network Standard

[17] 3GPP2 P.S0001-B, cdma2000 Wireless IP Network Standard

[18] 3GPP2 S.R0037-0, All-IP Network Architecture Model for cdma2000 Spread Spectrum Systems

[19] 3GPP2 S.R0005-B, Network Reference Model for cdma2000 Spread Spectrum Systems

[20] 3GPP2 S.R0057-0, IP Based Service Architecture System Requirements

[21] 3GPP2 S.R0058, IP Multimedia Domain System requirements

[22] 3GPP2 S.R0059-0, LMSD Step 1 System Requirements

[23] Reserved.

[24] 3GPP2 X.S0011-C, cdma2000 Wireless IP Network Standard

[25] 3GPP2 X.S0018, Legacy Mobile Station Domain (LMSD) Step 1

[26] Internet Engineering Task Force (IETF) RFC 3261 "SIP: Session Initiation Protocol", J. Rosenberg et al.

[27] IETF RFC 2396 "Uniform Resource Identifiers (URI): Generic Syntax", T. Berners-Lee et al.

[28] IETF RFC 2486 "The Network Access Identifier", B. Aboba et al.

[29] ITU-T Recommendation E.164 (I.331), Numbering Plan for the ISDN Era, 1991.

[30] 3GPP2 S.R0006 Wireless Features Description

3 DEFINITIONS AND ABBREVIATIONS

3.1 DEFINITIONS

This section provides definitions of some terms used within this document, as:

All-IP Network

The "All-IP" network is defined as a telecommunication system consisting of the core, access, and service subsystems supporting end-to-end multimedia services using Internet Protocol.

3.2 ABBREVIATIONS

This section provides a definition of the abbreviations used within this document, as:

ALL-IP All (end-to-end) Internet Protocol.

4 ALL-IP NETWORK EVOLUTION PHASES

The evolution of existing networks to the All-IP network is likely to occur in different phases, with each phase introducing the technical building blocks that shall ultimately define the All-IP network. This section defines the roadmap to the All-IP network.

The following phase description defines near term standards development efforts to migrate existing standards towards those required to support the All-IP network. The final phase, Phase-3 describes, at a very high level, the All-IP network standards that meet the requirements described in S.R0058 and S.R0057.

4.1 MIGRATION TOWARD THE ALL-IP NETWORK

Migration of existing terminal equipment and telecommunication networks toward the All-IP network is a strong requirement of many network operators. The issues associated with such a migration include:

- protection of investment in existing infrastructure,

- continued support of existing users and Mobile Stations (MSs) within the Legacy MS Domain (e.g., interoperability between the Legacy MS Domain Support and legacy TIA-41 networks),
- the ability of Wireless Network Operators (WNOs) to migrate portions of their network functionality at a pace and in a manner that best meets their operational and economic goals,
- support for green field deployments,
- the ability of a subscriber to carry forward the E.164 number assigned to a legacy MS to the All-IP MS, and
- the ability to comply to regionally mandated features (e.g., lawful intercept, emergency services).

4.2 PHASED APPROACH TO EVOLUTION

In order to meet the requirements previously outlined, a series of All-IP phases have been defined. Aspects (e.g., core network, access network, radio) of each phase shall interoperate both within and across phases, allowing both comprehensive deployments and “mix and match” deployments. Support of mixed environments and co-existence of legacy TIA-41 networks implies that backwards and forwards compatibility is maintained between any phase or subsets of a phase. Figure 4.2a illustrates the capabilities of each phase. It also illustrates the Value Added Service (VAS) subsystem’s evolution from its current all “Legacy Network” services to the full “OSE (OMA Service Environment) Aligned” architecture. Note that the direction of the arrows outward indicates relative growth in a set of network capabilities. The direction of the arrows inward indicates relative shrinking of a set of network capabilities.

Figure 4.2a: Static View of the Phases of Evolution

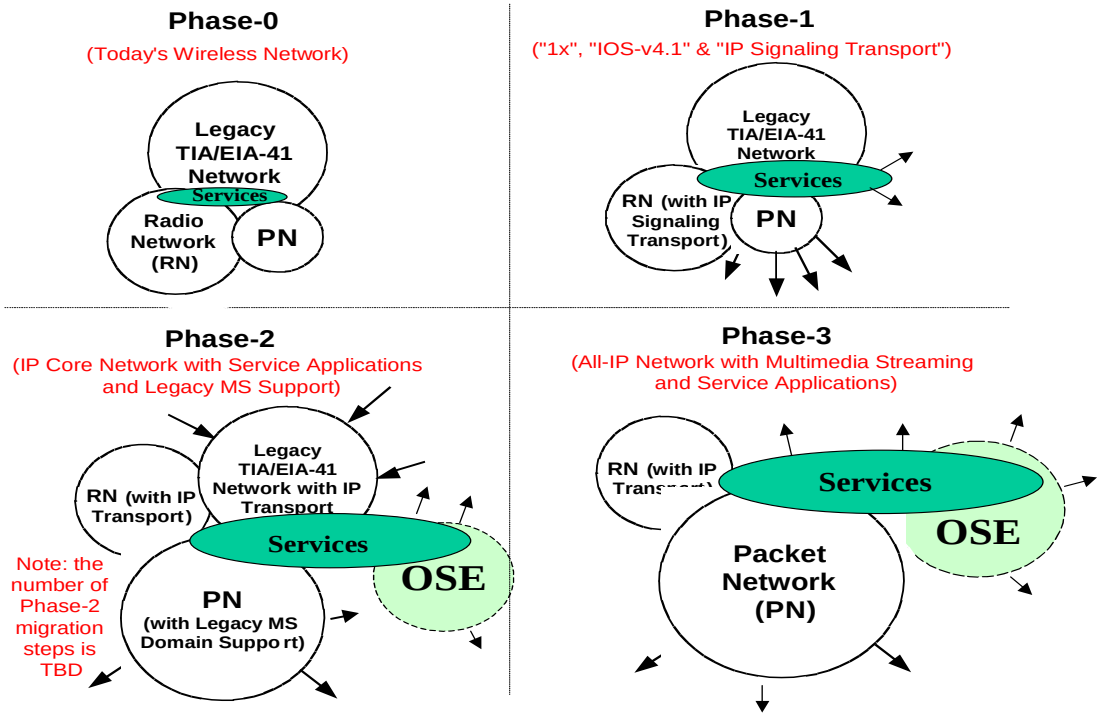

Figure 4.2b. illustrates a strictly sequential path on how a WNO may elect to transit through the phases, or portion thereof, defined below.

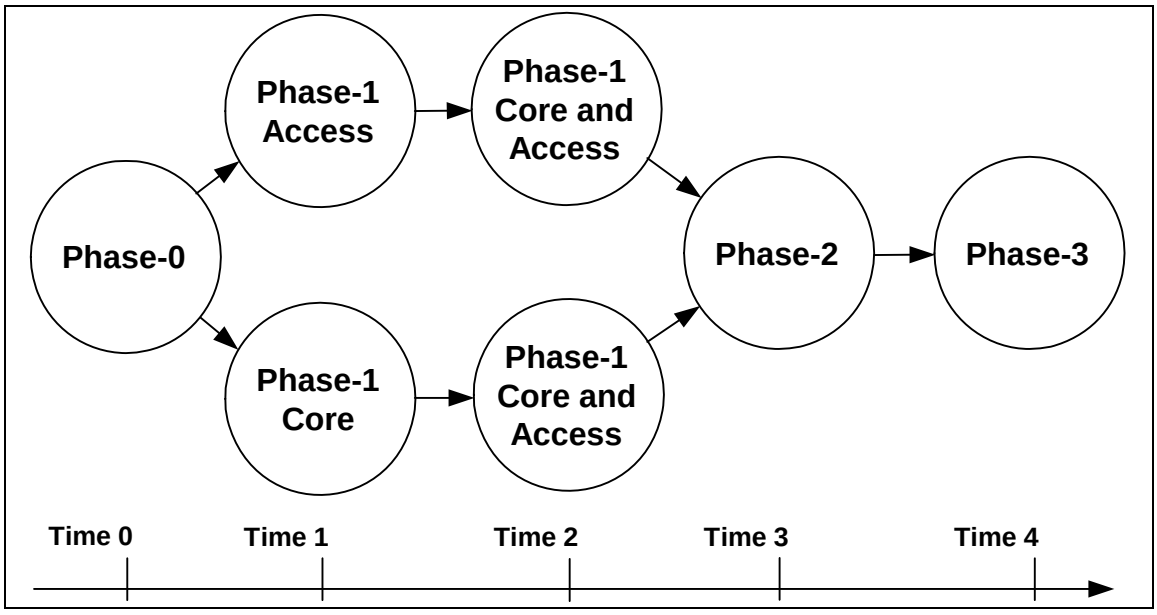

Figure 4.2b: Dynamic View of a Sequential Phase Evolution

Figure 4.2c illustrates a "mix and match" path on how a WNO may elect to transit through the phases, or portion thereof, defined below. In Figure 4.2c, WNOs are given complete freedom on how to evolve their network. Note: at a single point in time, many phases or portions of phases could coexist in a given geographic area.

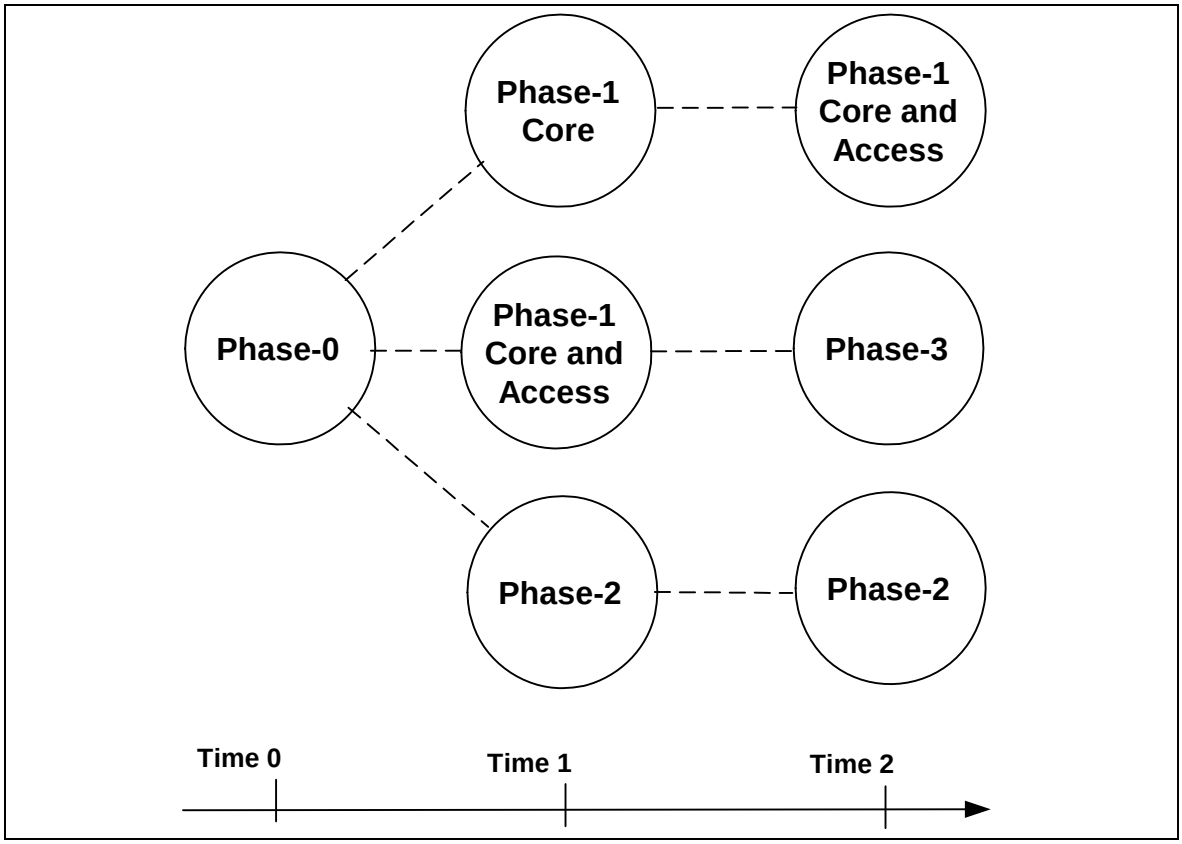

Figure 4.2c: Dynamic View of a "Mix and Match" Phase Evolution

5 PHASE-0

See Figure 4.2a. The starting point for migrating to the All-IP network is based on the legacy circuit mode wireless network that employs N.S0005, cdma2000 Release 0, and IOS Version 4.0 standards. These standards support both circuit switched and initial packet switched technologies. The specific Phase-0 characteristics are as follows:

5.1 CORE NETWORK

In Phase-0, the legacy TIA-41 network is defined by N.S0005 (that defines the network functional entities, their relationships, interfaces, and their communication and behavioral protocol).

In Phase-0, the packet data network is supported by the capabilities of Service Option-33, TIA/EIA/IS-707 and has no TIA-41 network based packet data handoff support. The packet data network is defined by P.R0001 that describes the overall packet architecture, its usage of simple and mobile IP as access methods, and its usage of AAA, and by P.S0001-A that describes the wireless IP network data standard for the cdma2000 packet network.

5.2 ACCESS NETWORK

In Phase-0, the Access Network is defined by IOS Version 4.0 that specifies the interface between the legacy TIA-41 network's MSC and BS, as well as the Packet Control Function (PCF) and its interfacing with the Packet Data Serving Node (PDSN) entity.

5.3 RADIO INTERFACE

In Phase-0, the air interface is defined by cdma2000 Release 0.

5.4 ALL LEGACY NETWORK VALUE ADDED SERVICE (VAS) SUBSYSTEM

In Phase-0, the VAS subsystem (e.g., WIN services) is contained well within the TIA-41 network that is defined by N.S0005 standards specifying the network functional entities, their relationships, interfaces, and their communication and behavioral protocol.

6 PHASE-1

See Figure 4.2a. Phase-1 constitutes the first Core Network based enhancement in the evolution towards the All-IP network. Phase-1 employs N.S0005, N.S0029-0, cdma2000 Release 0 or Release A, and IOS Version 4.1 standards. These standards support both circuit switched and initial network based packet switched technologies. The major focus of Phase-1 is network support for packet data session handoff, support for post circuit mode call handoff initiation of packet data sessions, plus support for post packet session handoff initiation and termination of a circuit mode call. Phase-1 also supports a circuit switched voice call and a packet switched session being active concurrently. The specific Phase-1 characteristics are as follows:

6.1 CORE NETWORK

In Phase-1, the legacy TIA-41 network is defined by N.S0005, plus N.S0029-0 (they define the legacy network functional entities, their relationships, interfaces, and their communication and behavioral protocol).

In Phase-1, the packet data network is defined by P.R0001 that describes the overall packet architecture, its usage of simple and mobile IP as access methods, and its usage of AAA, and by P.S0001-B that describes the wireless IP network data standard for the cdma2000 packet network.

6.2 ACCESS NETWORK

In Phase-1, the Access Network for both the legacy TIA-41 network and the packet data network shall use IP for signaling transport where signaling links are separable from bearer streams (e.g., A8, A9, A10, A11). Bearer transport shall remain as defined in the 3GPP2 A.S0001-A (IOS 4.1).

6.3 RADIO INTERFACE

From the All-IP perspective, in Phase-1, the radio interface evolves independently of the Core Network. It shall remain based on the cdma2000 Release 0 or Release A.

6.4 IMS-BASED VAS

In Phase-1, the basic wireless services such as Location Information, Emergency, and Presence will remain within the Radio and core network subsystems. However, the VAS subsystem will have new enablers in the IMS. IMS functional entities such as OSA SCS and SIP AS in conjunction with 3rd Party Service Providers' servers will form the new VAS environment of the cdma2000. These entities will have open interfaces (e.g., SIP) to the cdma2000 core network and its service enablers.

7 PHASE-2

Phase-2 constitutes the first evolution step towards the All-IP network including the independent evolution of signaling and bearer transport. Similarly, evolution of the Core Network and the Access Network shall also be independent. In Phase-2, the Core Network may continue to use existing bearer infrastructure and shall support applicable legacy TIA-41 network services. In "mix and match" deployments, legacy MSs may be supported by Core Network aspects of a Legacy MS Domain. TIA-41 network IN-based services may continue to be provided via the Wireless Intelligent Network (WIN) infrastructure.

Phase-2 systems fall under the Legacy MS Domain (LMSD). The LMSD provides support for existing MSs (e.g., analog, IS-95-A, IS-95-B, IS-2000) in an IP core network environment. The LMSD supports the features and capabilities of a legacy network in a manner transparent to the user. New features and capabilities supported by the IP core network may be made available to subscribers where they are supported by the MS capabilities.

Figures 7.1 (LMSD Step-1) and 7.3 (LMSD Step-N) present the LMSD network entities and associated reference points that comprise the steps in evolution toward the wireless All-IP network shown in Phase-3's Figure 8.1. The network entities are represented by squares and rectangles; the interfaces between network entities are reference points identified by numbers. The network architecture models in this document are the compilation of several architecture models currently in use in 3GPP2 wireless recommendations.

Phase 2 should also support IMS-OMA (Open Mobile Alliance) Inter-operable VAS. As OMA service architecture begins to gain stronger footholds in the mobile telecommunication industry, as more open standard interfaces are specified by OMA and as IMS enablers are logically integrated into OMA's architecture, the cdma2000 VAS subsystem will become interoperable with OMA Service Environment (OSE). Necessitated by the needs for resource sharing as well as outsourcing, the cdma2000 – OSE interoperability will be the main characteristic of this phase of cdma2000 VAS subsystem.

7.1 PHASE-2, STEP-1: LMSD STEP-1

The LMSD Step-1 provides support for legacy MS such that they can receive the same features using the LMSD that they receive in legacy systems. Such features include, but are not limited too, the features defined in S.R0006 and beyond.

Network architecture enhancements beyond legacy systems include:

- separation of the MSC into a MSCe and a MGW-and-MRFP, and
- specification of interfaces xx, yy, zz, and 39 (see Figure 7.1).

The Figure 7.1 entities not in bold are network components that exist in legacy networks. Interfaces marked with unbolded lines indicate interfaces that presently exist in legacy networks and are based entirely on existing legacy standards. The Figure 7.1 entities in bold (i.e., LMSDS, MGW-and-MRFP) are being introduced by Phase-2, Step-1 as the LMSD. Figure 7.1 interfaces identified by bold lines (i.e., 39, xx, yy, zz) indicate new interfaces in the LMSD. These new interfaces may be based on existing standards and are identified in this document.

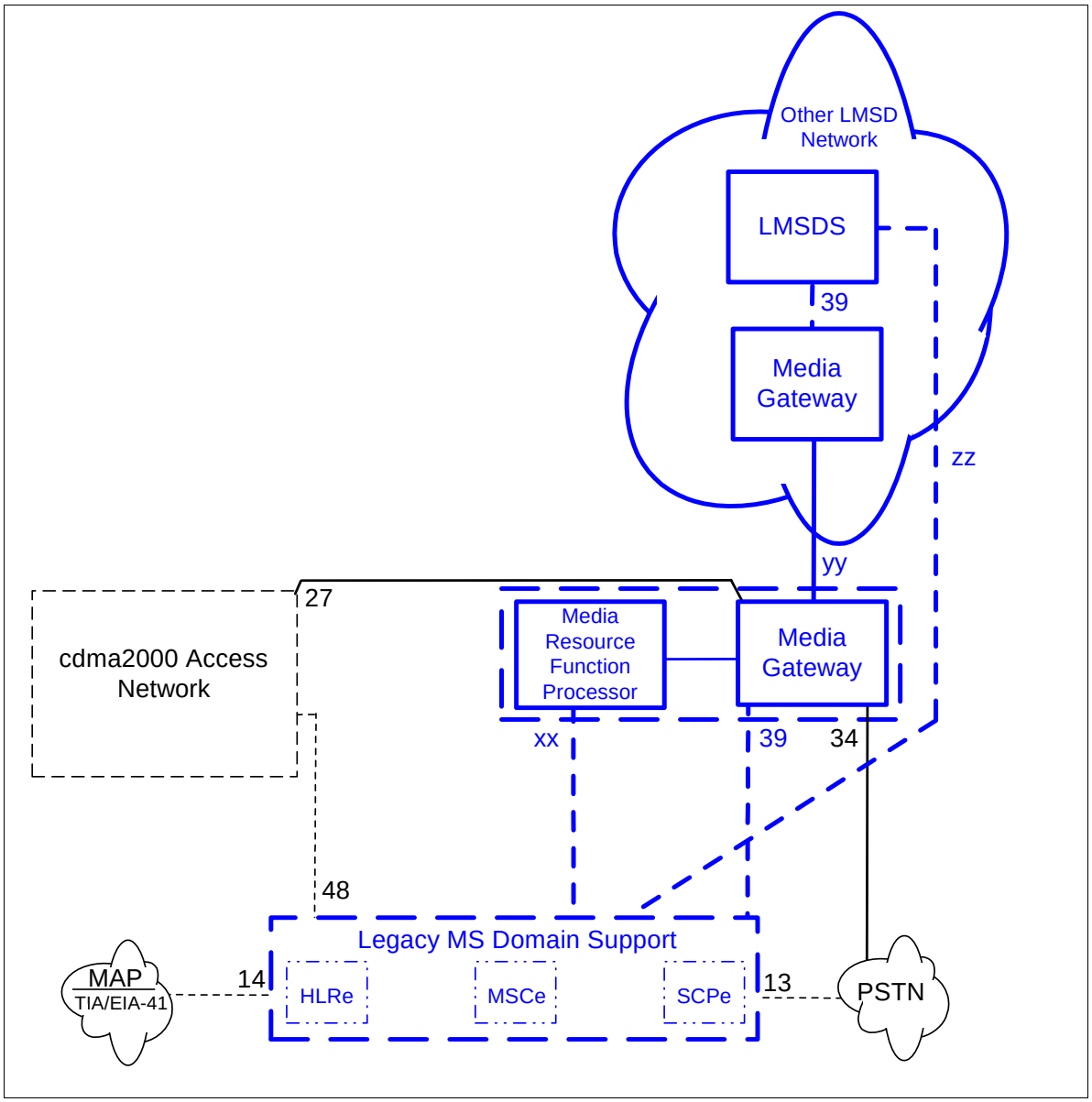

Figure 7.1: Phase-2, Step-1: Legacy MS Domain (LMSD) Step-1

7.2 PHASE-2 STEP-2: LMSD STEP-2

The LMSD Phase-2 Step-2 is the next step in the evolution of LMSD Support that begins with LMSD Phase-2 Step-1 [X.S0018-0]. The LMSD Step-2 builds upon the work of LMSD Step-1. Similar to Step-1, the LMSD Step-2 provides support for legacy MS such that they can receive the same features using the LMSD that they receive in legacy systems.

The LMSD Step-2 architecture permits Transcoder Free Operation (TrFO) and Remote Transcoder Operation (RTO) by optionally placing trancoders outside of the cdma2000 radio access network as part of the Media Gateway (MGW). The MSCe functions as a Media Gateway Controller (MGC). The LMSD Step-2 architecture diagram is the same as that specified for LMSD Step-1 in terms of interface reference points (i.e., 27, 48, 39, yy, and zz) and network entities. The enhancements beyond LMSD Step-1 include:

- New packet based transport support for the 3GPP2 NAM reference point 48 (signaling between the cdma2000 Access Network and the LMSD MSCe).
- New transport support for the 3GPP2 NAM reference point 27 (bearer traffic between the cdma2000 Access Network and the Media Gateway).
- Possible extensions to reference point 39 to support signaling between the MSCe and MGW to setup wireless codecs (e.g., 13K, EVRC, SMV, etc.).
- New alternative transport support for the 3GPP2 NAM yy (e.g., ATM).
- Extensions to 3GPP2 NAM reference point zz to provide priority for signaling messages.
- Support for packet-based Remote Transcoder Operation (RTO) for efficient packet Core Network transport. RTO enables the transcoders to be outside the RAN (BSC) in order to carry native wireless voice (i.e., not vocoded) through the packet network, and realize bandwidth gains.
- Support for packet-based Transcoder Free Operation (TrFO) for efficient transport and improved voice quality of mobile-mobile calls. TrFO enables the bypassing of transcoders on a mobile to mobile call where both mobiles are using the same vocoder type.
- Legacy services that is all service features provided by the legacy network architecture, should be supported in an existing manner or in a manner suitable to packet transport in the LMDS Step 2 architecture.

7.3 PHASE-2, STEP-N: FOR FURTHER STUDY

Phase-2, Step-N introduces the Legacy MS Domain and provides a migration path to the Phase-3 (see Section 8) IP Multimedia Domain by introducing network entities that will be common to both Domains. The Phase-2, Step-N architecture being recommended is illustrated in Figure 7.3. The Phase-2, Step-N Legacy MS Domain supports appropriate legacy services (e.g., voice and circuit data).

The Phase-2, Step-N Legacy MS Domain (LMSD) supports packet data service for the legacy MS. The specific Phase-2, Step-N characteristics are as follows:

7.3.1 CORE NETWORK

In Phase-2, Step-N, the Legacy MS Domain supports new signaling and bearer interfaces having IP transport within the Core Network. Evolved legacy TIA-41 Network services are supported for voice services as well as interactions between voice services and other data services (e.g., call waiting interactions). There is support for interoperability between the Legacy MS Domain Support and the legacy TIA-41 Network (e.g., roaming and handoff). In Phase-2, Step-N, the Legacy MS Domain supports appropriate legacy voice services as well as N.S0029 TIA/EIA-41-D Based Network Enhancements for CDMA Packet Data Service (C-PDS), Phase 1, Revision: 0.

The Phase-2, Step-N Core Network evolves network functionality, as:

- separation of signaling and bearer paths, and
- migration of signaling and bearer paths toward IP transport.

An open service architecture may be supported in the Phase-2, Step-N Legacy MS Domain. This Phase-2, Step-N service architecture provides new IP-based services accessible by legacy MSs (MS capabilities permitting).

The Phase-2, Step-N architecture provides (home system authorized and serving system supported) network-based services from both domains.

7.3.2 ACCESS NETWORK

In Phase-2, Step-N, the Access Network supports the LMSD.

In Phase-2, Step-N, the Access Network for the LMSD should have separate reference points for the signaling link and bearer stream transport. The signaling and bearer links should evolve toward IP transport.

7.3.3 RADIO INTERFACE

In Phase-2, Step-N for access to the Legacy MS Domain Support, the radio interface shall continue to be based on the evolved cdma2000 family of standards.

7.3.4 PHASE-2: IMS-OMA INTER-OPERABLE VAS

As OMA service architecture begins to gain stronger footholds in the mobile telecommunication industry, as more open standard interfaces are specified by OMA and as IMS enablers are logically integrated into OMA's architecture, the cdma2000 VAS subsystem will become interoperable with OMA Service Environment (OSE).

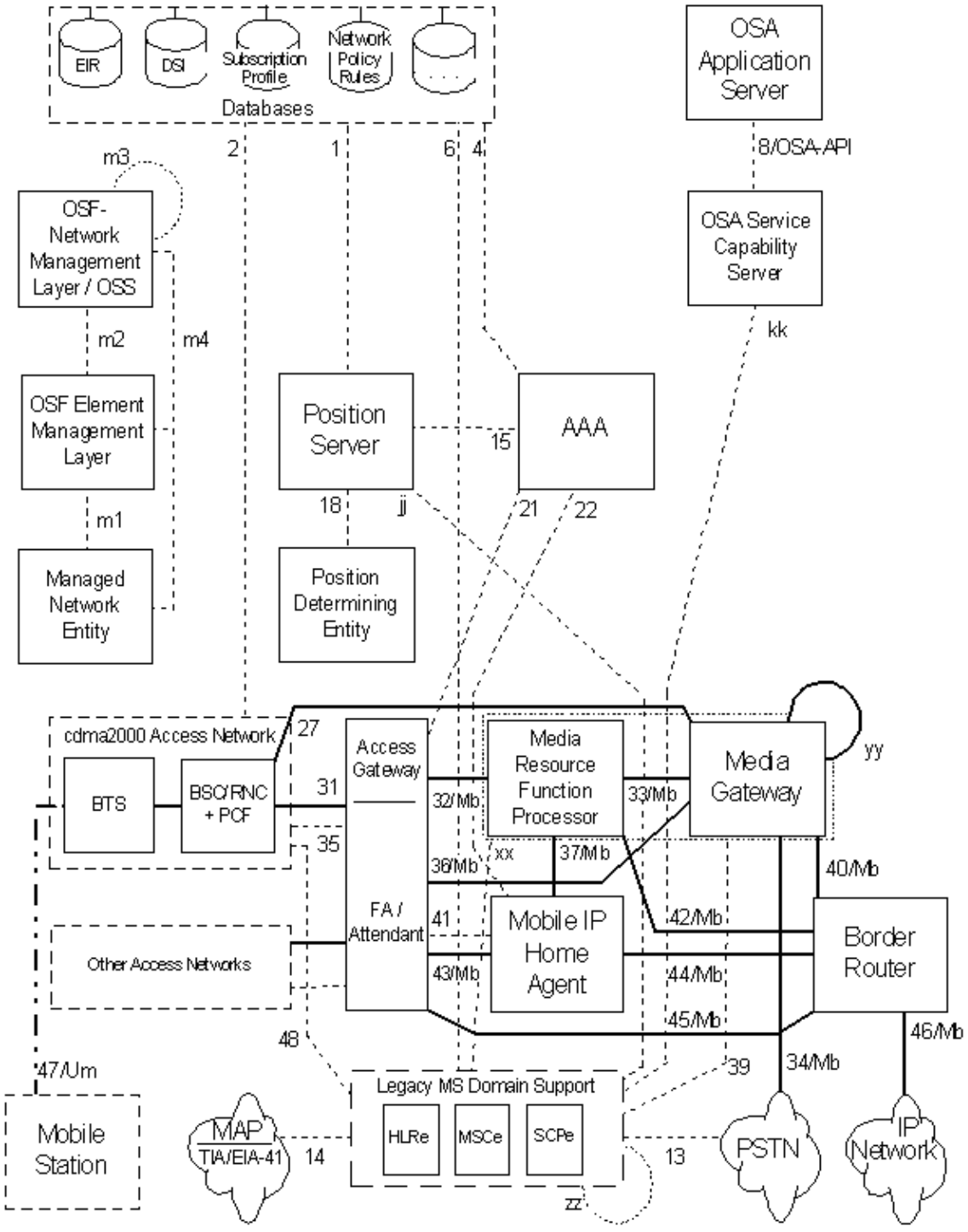

Figure 7.3: Phase-2 Step-N: Legacy MC Domain (LMSD)

8 PHASE-3

Phase-3 is the culmination of the evolution process towards an All-IP environment. This phase is marked by extension of IP over the radio interface. This phase may also be realized in multiple steps, e.g., Phase-3 Step-1 (see Figure 8.1) and Phase-3 Step-N.

Phase-3 should also achieve an OMA Aligned VAS. The culmination of the cdma2000 evolution process towards an All-IP network environment will be realized in Phase 3 of its evolution. In this phase, there will be the dominant ALL-IP network technology that will support new and enhanced IP Multimedia services. For the VAS subsystem of the All-IP system, this phase of the evolution will signify full alignment of the cdma2000 VAS subsystem with the OMA Service Environment (OSE) that is expected to have the following characteristics:

> *". . . OMA Architecture and Specifications must be network technology agnostic and must be applicable across a wide range of underlying network technologies such as wireless networks (e.g. GSM, CDMA, IMT-2000, 802.11) and other networks. . . "*[2]

8.1 PHASE-3 STEP-1: MMD STEP-1

The specific Phase-3 Step-1 characteristics are as follows:

8.1.1 CORE NETWORK

The Phase-3 Step-1 (MMD Step-1) evolutionary step will support the initial release of the 3GPP2 MMD/IMS specifications. In "mix and match" deployments, legacy MSs may continue to be supported by a Phase-2 (or earlier) Legacy MS Domain Support in conjunction with a Phase-3 Step-1 IP Multimedia Domain.

In Phase-3 Step-1, the IP Multimedia Domain shall be the dominant network technology supporting new and enhanced IP Multimedia services.

8.1.2 ACCESS NETWORK

In Phase-3 Step-1, the Access Network for the Legacy MS Domain shall support IP transport for both signaling links and bearer streams.

In Phase-3 Step-1, the Access Network for the IP Multimedia Domain shall support enhanced capabilities in terms of services and QoS.

The Access Network for the IP Multimedia domain shall support access registration, authentication, and authorization.

8.1.3 RADIO INTERFACE

In Phase-3 Step-1, the radio interface shall support IP transport of both signaling and bearer.

8.1.4 PHASE-3: OMA ALIGNED VAS

The culmination of the cdma2000 evolution process towards an All-IP network environment will be realized in Phase 3 of its evolution. This phase will include the dominant ALL-IP network technology that will support new and enhanced IP Multimedia services. For the VAS subsystem of the All-IP system, this phase of the evolution will signify full alignment of the cdma2000 VAS subsystem with the OMA Service Environment (OSE) as characterized by OMA below:

> *". . . OMA Architecture and Specifications must be network technology agnostic and must be applicable across a wide range of underlying network technologies such as wireless networks (e.g. GSM, CDMA, IMT-2000, 802.11) and other networks. . . "*[3]

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[2] OMA-ARC-2003-0032-ArchitecturePrinciples-V1_1-20030209-D.zip, Page 9, Section 5.1

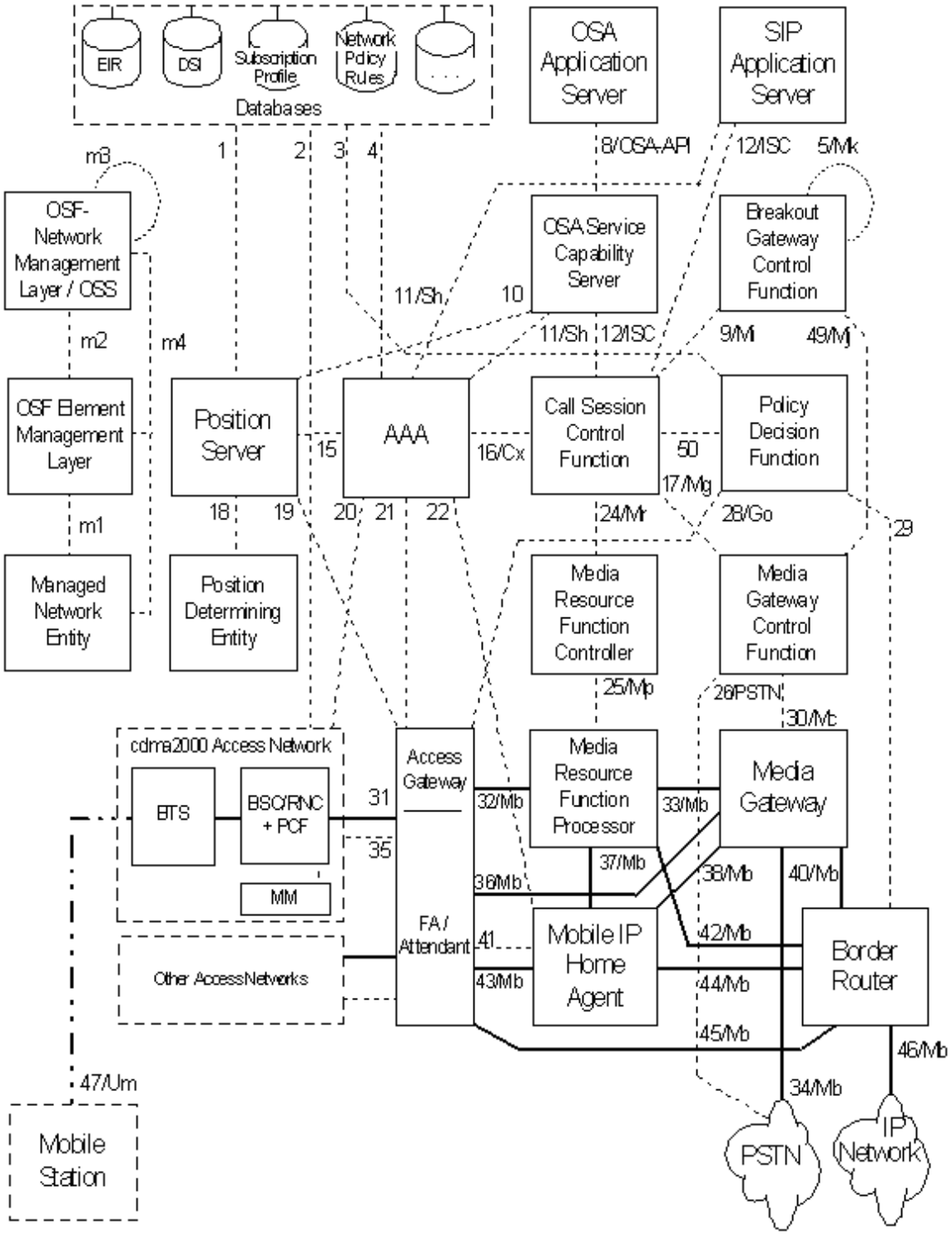

Figure 8.1: Phase-3 Step-1: Multimedia Domain (MMD)

[3] OMA-ARC-2003-0032-ArchitecturePrinciples-V1_1-20030209-D.zip, Page 9, Section 5.1

8.2 PHASE 3-STEP-N – FOR FURTHER STUDY

In Phase-3 Step-N, it is anticipated that the Legacy MS Domain Support will not have instantiation(s) in the 3GPP2 networks. This step is For Further Study.

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