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This a NetMan Task Group P802.16g Baseline Document.  
This is not an IEEE Draft Standard.

**Draft Amendment to IEEE Standard for  
Local and metropolitan area networks**

**Part 16: Air Interface for Fixed and Mobile  
Broadband Wireless Access Systems**

**Amendment to IEEE Standard for Local and  
Metropolitan Area Networks - Management Plane  
Procedures and Services**

Sponsor

**LAN MAN Standards Committee**  
of the  
**IEEE Computer Society**

and the

**IEEE Microwave Theory and Techniques Society**

**Abstract:** This document defines Management Procedures as enhancements to the IEEE 802.16 air interface standard for fixed and mobile broadband wireless systems. It specifies the management functions, interfaces and protocol procedures.

**Keywords:** fixed broadband wireless access network, mobile broadband wireless access network, metropolitan area network, microwave, millimeter wave, management, WirelessMAN™ standards

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11 **Baseline document for Draft Amendment to IEEE Standard for**  
12 **Local and metropolitan area networks**

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14 **Part 16: Air Interface for Fixed and**  
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34 NOTE-The editing instructions contained in this amendment define how to merge the material contained  
35 herein into the existing base standard IEEE Std 802.16-2004.  
36

37 The editing instructions are shown *bold italic*. Four editing instructions are used: *change*, *delete*, *insert*, and  
38 *replace*. *Change* is used to make small corrections in existing text or tables. The editing instruction specifies  
39 the location of the change and describes what is being changed by using strike through (to remove old mate-  
40 rial) and underscore (to add new material). *Delete* removes existing material. *Insert* adds new material with-  
41 out disturbing the existing material. Insertions may require renumbering. If so, renumbering instructions are  
42 given in the editing instruction. *Replace* is used to make large changes in existing text, subclauses, tables, or  
43 figures by removing existing material and replacing it with new material. Editorial notes will not be carried  
44 over into future editions because the changes will be incorporated into the base standard.  
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48

49 **1. Introduction**  
50  
51

52 **Scope:** This document provides enhancements to the MAC and PHY management entities of IEEE Standard  
53 802.16-2004, as amended by P802.16e, to create standardized procedures and interfaces for the management  
54 of conformant 802.16 devices.  
55

56 **Purpose:** The purpose of this project is to provide conformant 802.16 equipment with procedures and ser-  
57 vices to enable interoperable and efficient management of network resources, mobility, and spectrum, and to  
58 standardize management plane behavior in 802.16 fixed and mobile devices.  
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## 2. References

This standard shall be used in conjunction with the following publications. When the following specifications are superseded by an approved revision, the revision shall apply.

IEEE 802.16-2001, "IEEE Standard for Local and Metropolitan area networks - Part 16: Air Interface for Fixed Wireless Access Systems".

IEEE 802.16a-2003, "IEEE Standard for Local and Metropolitan area networks - Part 16: Air Interface for Fixed Wireless Access Systems - Amendment 2: Medium Access Control Modifications and Additional-Physical Layer Specifications for 2-11 GHz.

IEEE 802.16-2004, "IEEE Standard for Local and Metropolitan area networks - Part 16: Air Interface for Fixed Broadband Wireless Access Systems", October, 2004

IEEE P802.16e-D5, "Draft IEEE Standard for Local and Metropolitan area networks - Part 16: Air Interface for Fixed and Mobile Broadband Wireless Access Systems", October, 2004

## 3. Definitions

*[Insert the following definitions as specified below]*

U Interface - The management and control interface that exists between the SS and the BS over the air interface.

## 4. Abbreviations and acronyms

*[Insert the following abbreviations and acronyms into the the text as specified below]*

GPCS - Generic Packet Convergence Sublayer

IRP - Integration Reference Point

NRM - Network Reference Model

MIB - Management Information Base

RRM - Radio Resource Management

RRC - Radio Resource Controller

RRA - Radio Resource Agent

## 5. Service-Specific CS

### 5.2 Packet CS

*[Insert new subclause 5.2.7 and subsequent text below]*

#### 5.2.7 Generic Packet Convergence Sublayer (GPCS)

The Generic Packet CS supports multiple protocols over 802.16 air interface.

##### 5.2.7.1 Generic Packet CS SDU Format from the higher layer service entity to 802.16 GPCS

It required that the higher layer service entity indicate to the 802.16 GPCS the Protocol Type (PT) of each SDU. In addition, the higher layer entity may also indicate its perception of the class of service and the logical Link layer ID.

Protocol Type indicates the outermost protocol of the SDU. The protocol type may be used by the Generic Packet CS to inspect packets to further classify the SDU to a particular CID.

The Logical Link ID identifies a logical interface on the receiver side. The Logical Link identifier must be unique within the scope of the Generic Packet CS. The 802.16 GPCS may use the Logical Link ID to perform the classification.

The Class of Service ID indicates the class of service as perceived by the higher application. The 802.16 GPCS may use the COS ID to perform the classification.

Figure 17c shows the Generic Packet CS SDU format. Note that the prepend information (indicated by dotted line) is communicated between the transmitter side and the receiver side for the connection through TLVs in DSx messages, but it shall not be transmitted over the air with each SDU.

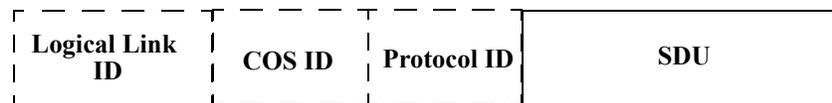


Figure 17c—SDU format between the higher layer entity and the 802.16 layer

## 11. TLV Encodings

*[Insert new subclause 11.8.9]*

### 11.8.9 Service Information Query (SIQ) TLV

Service Information Query is included by MS in SBC-REQ to request the Service Network Provider Identifiers supported by the Operator Network that includes the current BS.

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Name	Type	Length	Value	Scope
SIQ	4	1	bit 0: indicates that SS/MS queries the mapping relation between 24-bit format NSP ID and NSP realm;  bit 1: indicates that SS/MS queries the Service Network Provider Identifiers supported by the Operator Network that includes the current BS;  bit 2 -7: reserved	SBC-REQ

*[Insert new subclause 11.8.10]*

**11.8.10 NSP List TLV**

NSP LIST TLV is a compound TLV that contains one or more Network Service Provider Identifiers, and it may be included in a SBC\_RSP message. When an SBC\_REQ message with an SIQ TLV is received, the BS should respond with an SBC\_RSP message with an NSP LIST TLV

Name	Type	Length	Value	Scope
NSP List TLV	5	3*n	Including n, 24 bit Network Service Provider IDs, n is greater than or equal to 1.	SBC-RSP

*[Insert new subclause 11.8.11]*

**11.8.11 NSP Count TLV**

NSP Count TLV is an optional TLV that indicate the change of the NSP list. It will be increased by one (modulo 256) by the Operator Network whenever the NSP list changes. NSP Count TLV should be sent with NSP List TLV in the SBC-RSP message.

Name	Type	Length	Value	Scope
------	------	--------	-------	-------

NSP Count TLV	6	1	Increment by one (modulo 256) by the Operator Network whenever the list of the NSP changes.	SBC-RSP
---------------	---	---	---	---------

*[Insert new subclause 11.8.12]*

**11.8.12 NSP Mapping List TLV**

NSP Mapping List is an optional compound TLV that contains one or more mapping relations between 24-bit format NSP Identifier(s) and NSP realm(s), and it may be included in a SBC-RSP message.

Name	Type	Length	Value	Scope
NSP Mapping List TLV	7	variable	Compound (the compound field contains sub-attributes as defined in Table 449)	SBC-RSP, SII-ADV

**Table 449—NSP mapping List sub-attributes field**

Type	Length	Value
NSP Identifier	3	24-bit format NSP identifier
NSP realm	variable	NSP realm, the fully qualified domain name

*[Insert new subclause 11.13.19]*

**11.13.19 CS specific service flow encodings**

*[Insert new subclause 11.13.19.1]*

**11.13.19.1 CS specification**

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[145/146].28	1	<p>0: No CS                  1: Packet, IPv4                  2: Packet, IPv6                  3: Packet, 802.3/Ethernet                  4: Packet, 802.1Q VLAN                  5: Packet, IPv4 over 802.3/Ethernet                  6: Packet, IPv6 over 802.3/Ethernet                  7: Packet, IPv4 over 802.1Q VLAN                  8: Packet, IPv6 over 802.1Q VLAN                  9: ATM                  10: Packet, IPv4 with Header Compression (ROHC)                  11: Packet, IPv4 with Header Compression (ECRTP)                  12: Packet, IPv6 with Header Compression (ROHC)                  13: Packet, IPv6 with Header Compression (ECRTP)                  14: Packet, IPv4 over 802.3/Ethernet with Header Compression (ROHC)                  15: Packet, IPv4 over 802.3/Ethernet with Header Compression (ECRTP)                  16: Packet, IPv6 over 802.3/Ethernet with Header Compression (ROHC)                  17: Packet, IPv6 over 802.3/Ethernet with Header Compression (ECRTP)                  18: Packet, IPv4 over 802.1Q VLAN with Header Compression (ROHC)                  19: Packet, IPv4 over 802.1Q VLAN with Header Compression (ECRTP)                  20: Packet, IPv6 over 802.1Q VLAN with Header Compression (ROHC)                  21: Packet, IPv6 over 802.1Q VLAN with Header Compression (ECRTP)                  22: <u>GPCS (Generic Packet Convergence Sublayer)</u>                  23~255: reserved</p>
--------------	---	---

*[Insert new subclause 11.13.19.2]*

**11.13.19.2 CS Parameter encoding rules**

CST	CS
98	No CS
99	ATM
100	Packet, IPv4
101	Packet, IPv6
102	Packet, 802.3/Ethernet
103	Packet, 802.1Q VLAN
104	Packet, IPv4 over 802.3/Ethernet
105	Packet, IPv6 over 802.3/Ethernet
106	Packet, IPv4 over 802.1Q VLAN
107	Packet, IPv6 over 802.1Q VLAN

108	Packet, IPv4 with header compression (ROHC)
109	Packet, IPv4 with header compression (ECRTP)
110	Packet, IPv6 with header compression (ROHC)
111	Packet, IPv6 with header compression (ECRTP)
112	Packet, IPv4 over 802.3/Ethernet with header compression (ROHC)
113	Packet, IPv4 over 802.3/Ethernet with header compression (ECRTP)
114	Packet, IPv6 over 802.3/Ethernet with header compression (ROHC)
115	Packet, IPv6 over 802.3/Ethernet with header compression (ECRTP)
116	Packet, IPv4 over 802.1Q VLAN with header compression (ROHC)
117	Packet, IPv4 over 802.1Q VLAN with header compression (ECRTP)
118	Packet, IPv6 over 802.1Q VLAN with header compression (ROHC)
119	Packet, IPv6 over 802.1Q VLAN with header compression (ECRTP)
<u>120</u>	<u>Packet, Generic Packet CS (GPCS)</u>

### 11.13.19.2.1 Protocol Type Encoding

The encoding of the value field is that defined by the IANA document "Protocol Numbers".

Type	Length	Value	Scope
[1445/146].est.3.3	2	Protocol number as defined by IANA (Internet Assigned Numbers Authority)	DSx-REQ, DSx-REP

For IPv4, the value of the field specifies a matching value for the IP Protocol field. If this parameter is omitted, then the comparison of the IP header Protocol field for this entry is irrelevant.

For IPv6 (IETF RFC 2460), this refers to next header entry in the last header of the IP header chain. If this parameter is omitted, then the comparison of the IP header Protocol field for this entry is irrelevant.

For "no CS", the value field specifies the protocol type of the MAC SDUs that are transported over the no-CS connection. This parameter shall be specified for a no-CS connection.

For a Generic Packet CS, this TLV shall be used to indicate the protocol carried over the CID connection.

### 11.13.19.2.2 Logic Link Identifier

For a Generic Packet CS, this TLV may be used to identify a logical interface within the scope of the Generic Packet CS when it has more than one interface. An example of a logical interface is an embedded management channel between an SS and an external management entity. A logical interface may be addressed using IP/Ethernet addressing thus allowing routers and bridges to learn the existence of such interface, but the addressing scheme of the interface is above the scope of the 802.16 standard.

Type	Length	Value	Scope
[1445/146].cst.3.19	1	Logical Link Identifier	DSx-REQ, DSx-REP

#### 11.13.19.2.2.1 Class of Service (CoS) Identifier

For a Generic Packet CS, this TLV may be used to indicate the class of service as perceived by the higher application, and the 802.16 GPCS may use it to perform the classifications. If it's not, the 802.16 layer can perform its own classification to determine the 802.16 CoS. The encoding of CoS for a Generic Packet CS is left for vendors' implementation and is beyond the scope of the standard.

Type	Length	Value	Scope
[1445/146].cst.3.20	1	Class of Service ID	DSx-REQ, DSx-REP

*[Insert new subclause 11.18.2]*

### 11.18.2 NSP List TLV

NSP List is an optional compound TLV that contains one or more Network Service Provider Identifiers, and it may be included in a MAC message transmitted on a broadcast CID.

Name	Type	Length	Value	Scope
NSP List	6	3*n	Including n, 24 bit Network Service Provider IDs, n is greater than or equal to 1.	SII-ADV Message

*[Insert new subclause 11.18.3]*

### 11.18.3 NSP Count TLV

NSP Count TLV is an optional TLV that indicate the change of the NSP list. It will be increased by one (modulo 256) by the Operator Network whenever the NSP list changes. NSP Count TLV should be sent in a more frequent manner than NSP List TLV.

Name	Type	Length	Value	Scope
NSP Count	7	1	Increment by one (modulo 256) by the Operator Network whenever the list of the NSP changes.	SII-ADV Message

1 *[Insert a new chapter 14 and then insert the text specified below]*  
2  
3  
4

## 5 **14. Management Interfaces and Procedures**

### 6 **14.1 Overview**

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9  
10 The 802.16 devices within the purview of this specification can include 802.16-2004 subscriber stations  
11 (SS) or 802.16e mobile subscriber stations (MS) or base stations (BS). As the 802.16 devices may be part of  
12 a larger network and therefore would require interfacing with entities for management and control purposes,  
13 this document assumes a Network Control and Management System (NCMS) abstraction that interfaces  
14 with the base stations. The NCMS abstraction allows the PHY/MAC/CS layers specified in 802.16 to be  
15 independent of the network architecture, the transport network, and the protocols used at the backend and  
16 therefore allows greater flexibility on the network side. Any necessary inter-BS coordination is handled  
17 through the NCMS. This specification will only describe procedures for management and control interac-  
18 tions between the MAC/PHY/CS layers of the 802.16 devices and the NCMS. The details of the various  
19 entities that form the Network Control and Management System are outside the purview of this specifica-  
20 tion. An abstracted network reference model is presented to clearly depict the interfaces that are assumed to  
21 be in scope of the specification.  
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### 26 **14.2 Requirements**

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28  
29 <Section Notes: This section describes the functional requirements that need to be addressed by the 802.16g  
30 specification. However this section is purely informational and meant to guide the development of this doc-  
31 ument.>  
32

#### 33 **14.2.1 Architectural Requirements**

34  
35 These are requirements that impact the FS, MS or BS from an air interface management and control perspec-  
36 tive. These requirements do not assume a specific radio access network architectural topology and any  
37 implied physical connectivity model (eg. Routed vs Switched).  
38  
39

- 40  
41 a) Data, Control and Management Plane separation shall be maintained for all protocol procedures  
42 specified.  
43  
44 b) The protocol procedures shall not tie a service to the access network.  
45  
46 c) The communication mechanisms assumed between BSes shall be protocol agnostic.  
47

#### 48 **14.2.2 Configuration Requirements**

- 49  
50 a) BS shall be able to manage FS/MS configuration parameters individually or as a group.  
51  
52 b) BS shall be able to request parameters from neighboring BSes, including information about MSes  
53 attached to it.  
54  
55 c) FS/MS shall be able to override some of the configuration parameters that are managed by the BS  
56 when they do not impact the network.  
57  
58 d) BS should provide an interface for reading configuration parameters.  
59  
60 e) BS should provide the ability to update software and service capabilities on the mobile station.  
61

#### 62 **14.2.3 Security Requirements**

- 63  
64 a) BS shall be able to request FS/MS re-authentication at anytime.  
65

- 1           b) The security capabilities of the weakest FS/MS or BS should not compromise the security of the  
2           other devices.  
3  
4           c) BS should support faster HO re-authentication.  
5

#### 6 **14.2.4 Mobility Requirements**

- 7  
8           a) MS and BS shall support primitives for enabling upper layer mobility management protocols  
9           b) HO capabilities at varying levels should be exposed appropriately to the upper layers.  
10          c) Location determination shall be supported within the accuracy as determined by the laws and regu-  
11          lations of the geographical area.  
12          d) Location servers may request location information on demand. Primitives for a loss less handoff  
13          shall be supported for non real time traffic (e.g. HTTP.) A loss less handoff is characterized by no  
14          frame loss during the handoff. The MAC frames could be buffered at the source BS and delivered to  
15          the target after the handoff completion.  
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19

#### 20 **14.2.5 Data Traffic Requirements**

##### 21 **14.2.5.1 Traffic Policies**

- 22  
23           a) Traffic Policies may be advertised during network entry and handover and may be enforceable by  
24           the BS.  
25           b) QoS differentiation shall be supported through primitives to enable proper traffic prioritization by  
26           upper layer protocols.  
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##### 31 **14.2.5.2 Traffic filters**

32 <Tbd>  
33  
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35

#### 36 **14.2.6 Performance Requirements**

##### 37 **14.2.6.1 Network Performance Requirements**

- 38           a) Protocol primitives defined shall maximize the MS battery lifetime.  
39           b) Protocol primitives for fast and seamless handoff shall be supported for real time traffic (e.g. VoIP).  
40           A fast and seamless handoff is characterized by low latency and tolerance for few frame drops with-  
41           out any noticeable glitch to the end user.  
42           c) The following values must be made available in real-time with redisplay intervals of no less than  
43           1000 msec, with the option to be displayed in both cumulative and delta modes:  
44           1) State transitions  
45              -Timing/ delay  
46           2) Registrations  
47              -Successful and failed  
48              -Forward Traffic Channel Delivery  
49              -Total and Per user  
50           3) MAC retries  
51           4) PHY retries  
52           5) MAC latency  
53           6) Total blocks/PDU assigned and delivered  
54           7) Uncorrectable Errors  
55  
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- 1           8) Signal Strength (RSSI)
- 2
- 3           9) CINR
- 4           10) Reverse Traffic Channel Reception
- 5                 -Total and Per user
- 6
- 7           11) UL & DL Power Measurements
- 8                 -Total and per user
- 9

#### 14.2.6.2 User Performance Requirements

Mobility creates a dynamic environment for the network that will require constant monitoring and optimization. To accomplish these tasks it is important that the network has a reasonable idea of how mobile stations are performing while moving through the network. Therefore, the air interface shall support the collection of the following metrics so that a network operator can effectively monitor the performance of the 802.16 air interfaces.

CDLs are generally used to answer questions about a specific call that has completed, used to spot large numbers of call failures or short duration calls that are associated with specific equipment and to provide an indication as to why specific types of call failures (e.g. RF Losses) occurred. Performance management statistics provide an overall view of system performance (e.g. number of calls, equipment usage) and aggregate failures so that problem areas can be spotted. Call processing exception reports provide information about failures associated with a specific call. Information from both the CDL and from exception reports may be necessary to diagnose a call. A Call Detail Log (CDL) is generated by the access point (AP) or anchor point if soft handoff is used, when its participation in a call ends with the generation of one of a set of designated call final classes (CFCs). The CDL are sent up to the OMC periodically. These statistics should be made available via PM data forwarding mechanisms as defined by 3GPP (32-series) & 3GPP2 (S.S0028)

##### **Access information**

- Network details – access serving BS ID
- RF details -
  - first MOB\_SCAN-REPORT,
  - first REP-RSP,
  - total timing adjustment
- Access system time

##### **Device information**

- Entry type – origination / termination, hard hand-in, cell update
- QoS Class – Best Effort, Gaming, VoIP, ...
- CC status
- Service level prediction
- SS ID (mac id?)
- IP address

##### **Summary call quality information**

- Forward /Reverse packet retransmission (error) rate
- Forward / Reverse average throughput
- Constellation usage
- Average latency
- Average jitter

##### **RF information**

- Last REP-RSP
- Last MOB\_SCAN-REPORT

##### **Last sector information**

1 BS Transmit power

2 BS Reverse RSSI

3 **Last sector vector (NOTE: not sure what to call this but with smart antennas the location of**  
 4 **the user to build a traffic distribution map is very useful.)**

5 Direction

6 Distance

7 RTT

8 **Call release information**

9 Release system time

10 Call final class

### 11 14.2.6.3 HO Latency

- 12 a) FBSS - BS transition latency < (tbd)
- 13 b) Hard-HO - BS transition latency < (tbd)

### 14 14.2.7 Resource Management Requirements

- 15 a) Procedures for Emergency services shall be supported also for unidentified/unauthorized user.  
 16 These procedures shall be given priority in resource allocation so as to increase the chance of suc-  
 17 cess in connection initiation and handoffs.
- 18 b) Primitives for sharing available Resource/Traffic Load information dynamically among the neigh-  
 19 bor BSs for the efficient use of radio resources.
- 20 c) Flexible bandwidth allocation shall be supported to fulfill the QoS requirement with any possible  
 21 adaptation to efficiently utilize the spectrum
- 22 d) Procedures supporting load balancing shall be supported and provisioned among the BSs for  
 23 increased system utilization and accommodating more users
- 24 e) BS supporting mobility, shall provide protocol primitives for collecting and forwarding neighbor BS  
 25 information advertisements.
- 26 f) BSeS should be capable of providing default transport connections for MSeS that need to use it for  
 27 emergency services.
- 28 g) 802.16g entities (BS/MS) shall provide relevant reports (e.g. measurements) on resource informa-  
 29 tion for use by entities on the network.

### 30 14.2.8 Element Management Requirements

- 31 a) Statistics for the FS/MSeS should be collected by the BS using primitives defined and available to a  
 32 higher layer Network Management Protocols.
- 33 b) Statistics for the BS (e.g. usage of resources) should be collected by the BS and available to a higher  
 34 layer Network Management Protocols
- 35 c) MS should collect statistics on the radio link that may be queried by the BS.
- 36 d) MSeS and BSeS should also collect statistics on neighboring BSeS for the purposes of HO.

### 37 14.2.9 Specification Requirements

38 There are several usage scenarios based on 802.16's specifications, such as Fixed Access, Nomadicity, Port-  
 39 ability with Simple Mobility Support, Full Mobility Support. If a procedure, message, IE or IRP does not  
 40 apply to all usage scenarios, the scenarios it applies to will be clearly specified.

### 14.3 Information Model Aspects

For the purpose of Management Interface development an Interface Methodology known as Integration Reference Point (IRP) was developed to promote the wider adoption of standardized Management interfaces in telecommunication networks. The IRP methodology employs Protocol & Technology Neutral modeling methods as well as protocol specific solution sets to help achieve its goals. The Integration Reference Point is a methodology to aid a modular approach to the development of standards interfaces.

There are three cornerstones to the IRP approach:

#### 1. Top-down, process-driven modeling approach

The process begins with a requirements phase, the aim at this step is to provide conceptual and use case definitions for a specific interface aspect as well as defining subsequent requirements for this IRP.

#### 2. Technology-independent modeling

The second phase of the process is the development of a protocol independent model of the interface. This protocol independent model is specified in the IRP Information Service.

#### 3. Standards-based technology-dependent modeling

The third phase of the process is to create one or more interface technology and protocol dependent models from the Information Service model. This is specified in the IRP Solution Set(s).

#### 14.3.1 Information Service Models

Information Service Models refer to both Interface IRPs and NRM IRPs.

This section is providing the IEEE 802.16 protocol neutral (IS) resource model (NRM/MIB) definitions.

##### 14.3.1.1 Information entities imported and local labels

**Table 450—Information entities imported and local labels**

Label reference	Local label
information object class, ManagedElement	ManagedElement
information object class, ManagedFunction	ManagedFunction
information object class, SubNetwork	SubNetwork
information object class, Top	Top

14.3.1.2 Class diagram

14.3.1.2.1 Attributes and relationships

Figure 1. establishes the naming and containment for the protocol neutral network management models of the 802.16 standard. The inheritance diagram show in Figure 2. is based on 802.16e and 802.16-2004. This diagram establishes the context of the IOC and shows ME's as inventory items and MF's as the functions that perform functions in the 802.16 network.

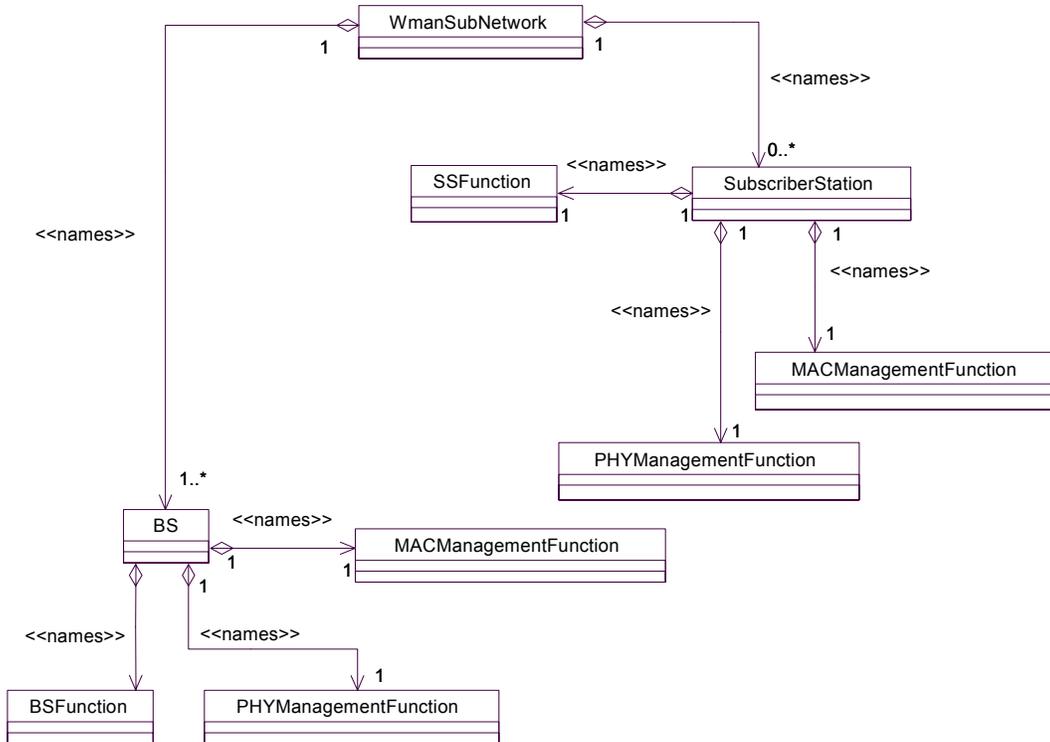


Figure 300—Containment and Naming Diagram

14.3.1.2.2 Inheritance

This clause depicts the inheritance relationships that exist between information object classes.

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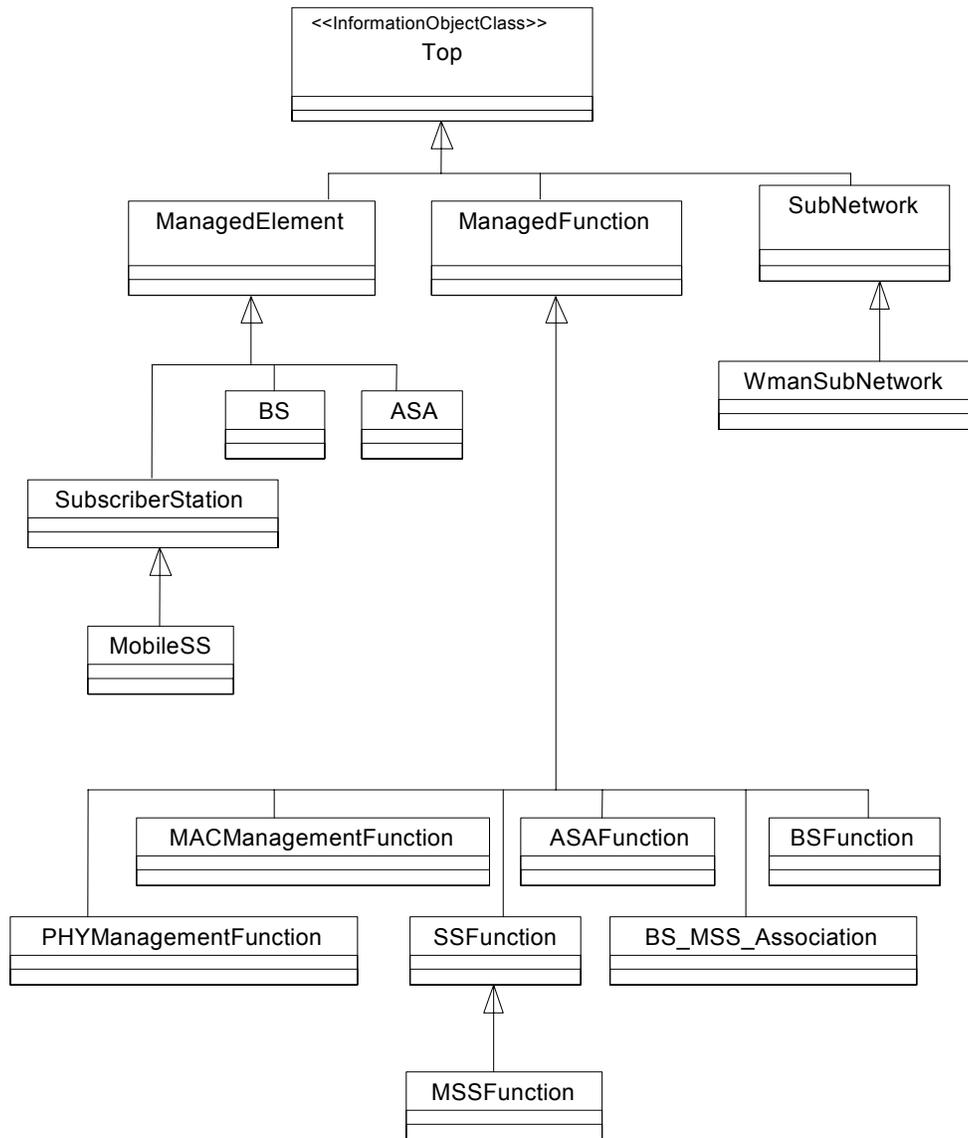


Figure 301—Inheritance Diagram

14.3.1.3 Information object classes definition

14.3.1.3.1 IOC BsFunction

14.3.1.3.1.1 Definition

This IOC represents a WMAN base station. For more information, see [zz]. It is derived from Managed-Function.

<Section Note: This table is just a template for reference.>

#### 14.3.1.3.1.2 Attributes

**Table 451—Attributes**

Attribute name	Defined in	Visibility	Support Qualifier	Read Qualifier	Write Qualifier
BsFunctionId	--	+	M	M	--
objectClass	Top	+inherited	M <sup>inherited</sup>	M <sup>inherited</sup>	.. <sup>inherited</sup>
objectInstance	Top	+inherited	M <sup>inherited</sup>	M <sup>inherited</sup>	.. <sup>inherited</sup>
userLabel	ManagedFunction	+inherited	M <sup>inherited</sup>	M <sup>inherited</sup>	M <sup>inherited</sup>
aaa	--	+	O	M	--
bbb	--	+	O	M	--
yyy	--	+	O	M	--
zzz	--	+	O	M	--

#### 14.3.1.3.2 IOC WmanSsFunction

##### 14.3.1.3.2.1 Definition

This IOC represents a WMAN subscriber station. For more information, see [tbd]. It is derived from ManagedFunction.

##### 14.3.1.3.2.2 Attributes

##### 14.3.1.3.3 IOC xxx

##### 14.3.1.3.4 IOC yyy

#### 14.3.1.4 Information relationships definition

#### 14.3.1.5 Notifications

#### 14.3.1.6 Information attributes definition

Table 452—Attributes

Attribute name	Defined in	Visibility	Support Qualifier	Read Qualifier	Write Qualifier
SsFunctionId	--	+	M	M	--
objectClass	Top	+inherited	M <sup>inherited</sup>	M <sup>inherited</sup>	--inherited
objectInstance	Top	+inherited	M <sup>inherited</sup>	M <sup>inherited</sup>	--inherited
userLabel	ManagedFunction	+inherited	M <sup>inherited</sup>	M <sup>inherited</sup>	M <sup>inherited</sup>
ccc	--	+	O	M	--
ddd	--	+	O	M	--
www	--	+	O	M	--
xxx	--	+	O	M	--

#### 14.3.1.6.1 Definition and legal values

Table 453—Definition and legal values

Attribute name	Definition	Legal Values
BsFunctionId	It contains 'name+value' that is the RDN, when naming an instance, of this object class containing this attribute. This RDN uniquely identifies the object instance within the scope of its containing (parent) object instance.	--
SsFunctionId		--
ZzzId		--
aaa	tbd	tbd
bbb	tbd	tbd
ccc	tbd	tbd
ddd	tbd	tbd
objectClass	As defined in [zz]: An attribute which captures the name of the class from which the object instance is an occurrence of.	--

## 14.4 Architectural Aspects

This specification includes primitives that are exposed to upper layers in a consistent manner for use by control and management plane protocols in a network agnostic manner. The network that manages and controls an 802.16 air interface device is therefore abstracted as a Network Control and Management System (NCMS).

### 14.4.1 Network Reference Model

The Figure 3 describes a network reference model along with the interfaces that are within the scope of this specification. Multiple SS or MS maybe attached to a BS. The SS communicate to the BS over the U interface using a Primary Management Connection or a Secondary Management Connection. MS typically only utilize the Primary Management Connection over the U interface for management and related control functions.

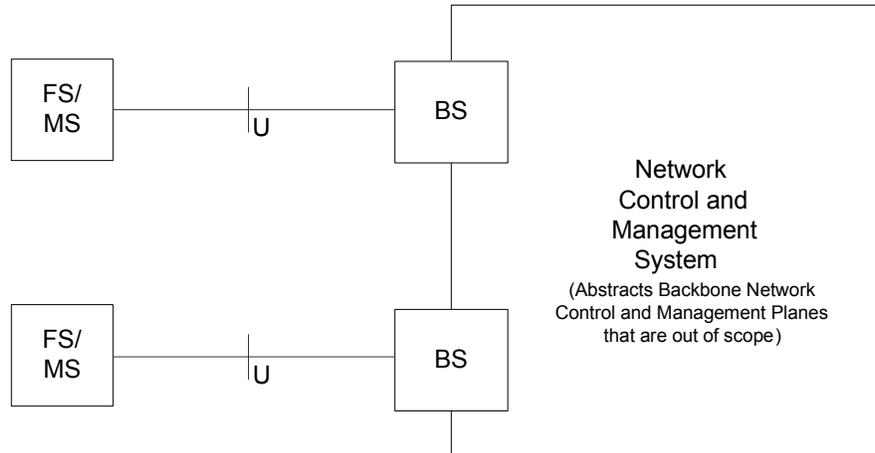
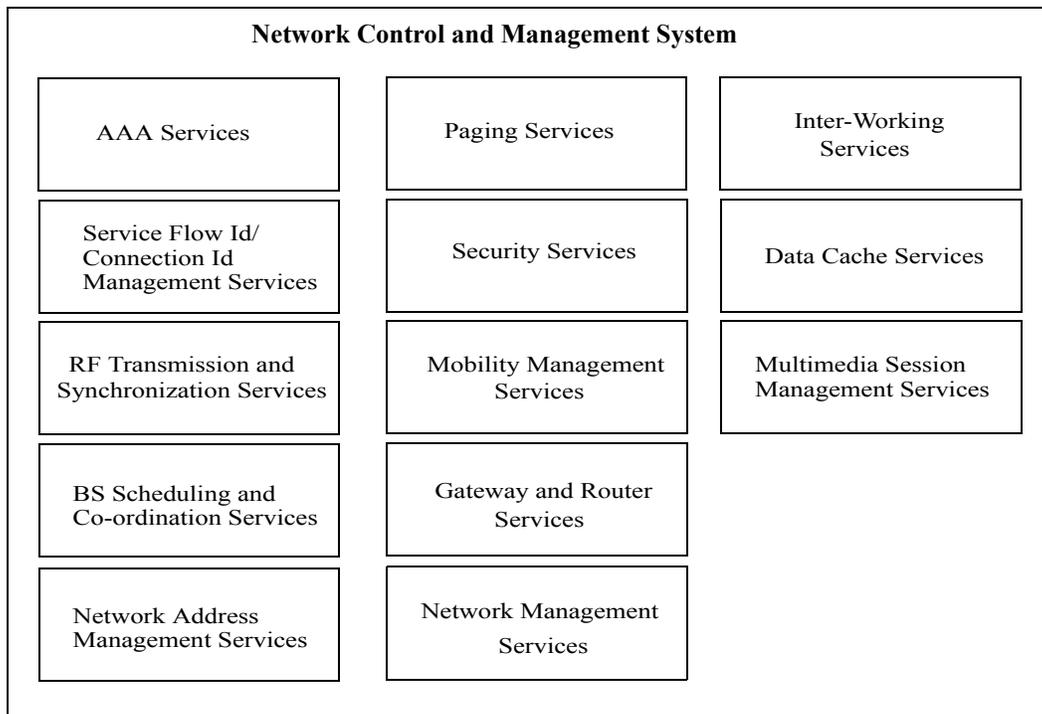


Figure 302—802.16g Network Reference Model

#### 14.4.1.1 Network Control and Management System (NCMS)

This abstraction is detailed in Figure 4 to show the different functional entities that make up such a Network Control and Management System. These entities may be centrally located or distributed across the network. The exact functionality of these entities and their services is outside the scope of this specification but shown here for illustration purposes and to better enable the description of the management and control procedures.



30 **Figure 303—Illustration of the Network Control and Management System (Informational)**

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NCMS protocols are not defined in this specification, however information elements (IEs) and protocol primitives for these IEs are exposed using Service Access Points (SAP). This includes CS, MAC and PHY layer context information used by NCMS protocols to manage and control the air interface. Every BS is assumed to be part of an NCMS and therefore as shown in Figure 3.

#### 14.4.1.1.1 SS/MS and BS Interface

This U interface may be implemented using either a primary management connection or a secondary management connection.

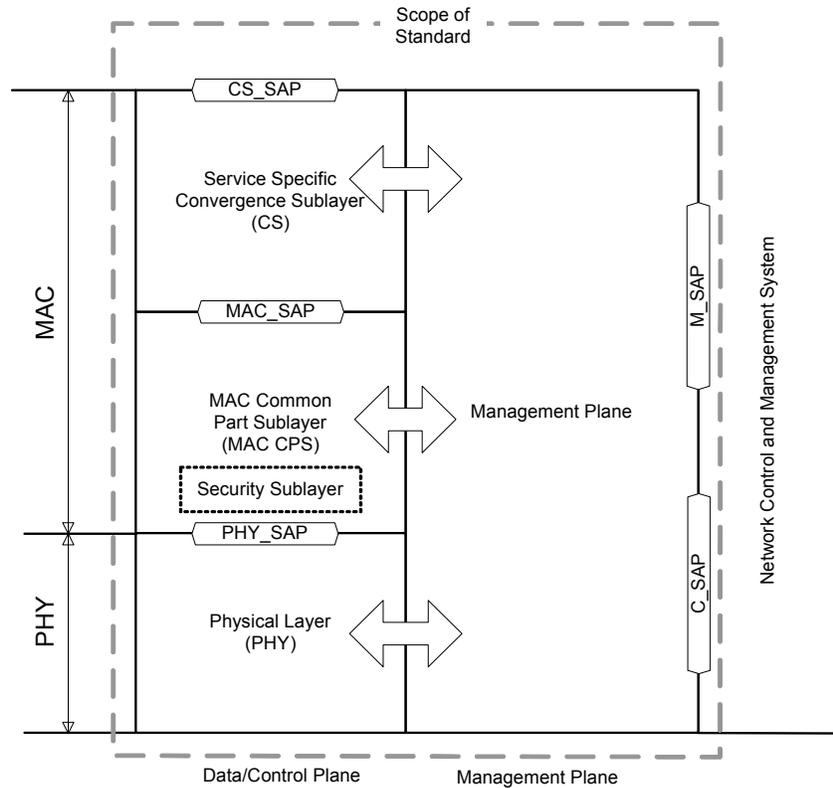
#### 14.4.1.1.2 BS and NCMS Interface

This interface is a set of Service Access Points (SAP) and is represented and in the Figure 5 below. It is decomposed in to two parts: the Management SAP used for Management primitives alone and the Control SAP is used for Control plane primitives that to support handovers, security context management, radio resource management, and low power operations (such as Idle mode and paging functions). The primary goal of such an interface is to ensure protocol separation.

These primitives do not define end to end protocol flows, but rather commands and indications for access to the Management and Control entities for the CS/MAC/PHY layers. Protocol procedures are defined using one or more of these primitives for performing distinct protocol functions on the air interface (eg. Paging, Handover etc.)

Management and Control entities are logical and may have SAPs between their protocol layers, however for simplicity they are not defined.

[Replace the figure 1 in section 1.4 with the one below]



**Figure 304—802.16g Protocol Architecture Model**

#### 14.4.1.1.2.1 Management SAP (M\_SAP)

The Management SAP may include, but is not limited to primitives related to:

- System configuration
- Monitoring Statistics
- Notifications/Triggers

#### 14.4.1.1.2.2 Control SAP (C\_SAP)

The Control SAP may include, but is not limited to primitives related to:

- Handovers (e.g. notification of HO request from MS, etc.)
- Idle mode mobility management (e.g. Mobile entering idle mode)
- Subscriber and session management (e.g. Mobile requesting session setup)
- Radio resource management, etc.
- AAA server signaling (Eg. EAP payloads).

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4 **14.4.2 Management Interfaces**  
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8 **14.4.3 Information Service Models**  
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13 **14.5 Management Functions**  
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18 **14.5.1 Fault Management**  
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21 **14.5.1.1 Events/Logs**  
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23 **14.5.1.1.1 Persistence Requirements**  
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25 **14.5.1.2 Notification/Triggers**  
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28 <Section Note: Notification for events and trigger functions associated with some events are described>  
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30 **14.5.2 Configuration Management**  
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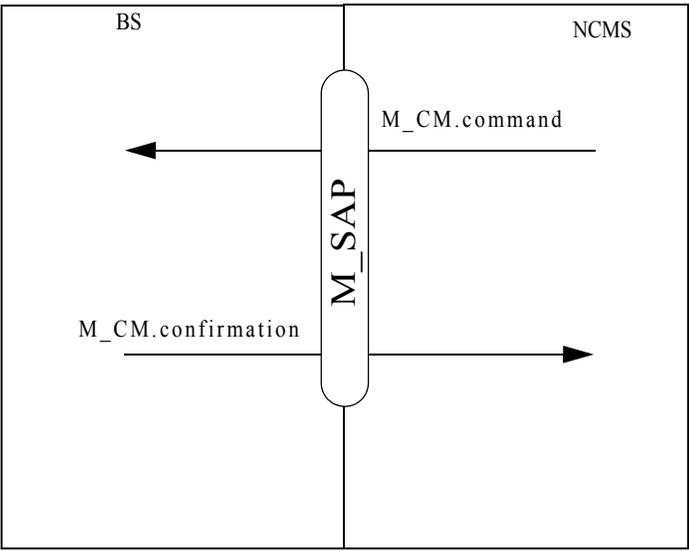
32 Configuration management is a principal and essential management function. It can be divided into: Capa-  
33 bility Management, Basic RF Management, Basic MAC Management, Time Management, Version Manage-  
34 ment and so on.  
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37 **14.5.2.1 Generic procedure and primitives**  
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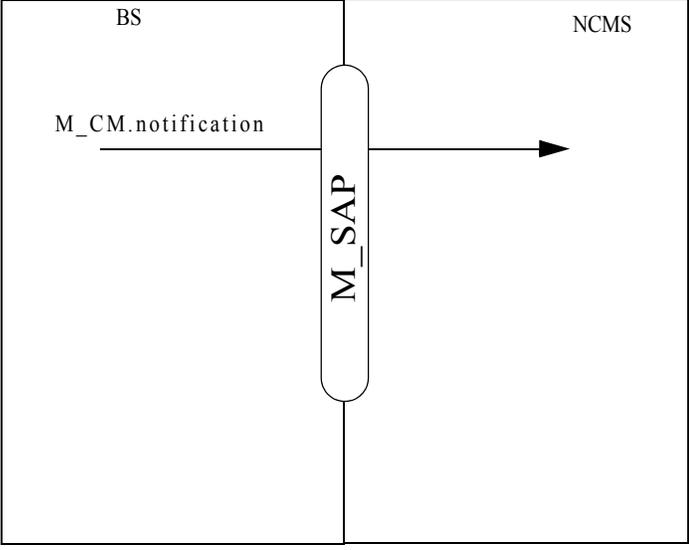
40 **14.5.2.1.1 Generic Procedure**  
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42 The Generic Procedures of configuration management are as follows:  
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**Figure 305—Procedure of configuration management initiated by NCMS**



**Figure 306—Procedure of configuration management initiated by BS**

When NCMS needs to carry out configuration management, it can initiate the procedure with M\_CM.command primitive with the specific action type and action information. When BS receives the primitive, it shall act according to the information contained in M\_CM.command and response with M\_CM.confirmation. The BS also may generate the M\_CM.notification primitive to report the status of the configuration information to NCMS.

### 14.5.2.1.2 Generic Service Primitives

#### 14.5.2.1.2.1 M\_CM.command

##### 14.5.2.1.2.1.1 Function

This primitive is originated by the NCMS to request the BS to execute the radio parameters configuration, capability configuration, RF resource configuration, Time configuration, or version configuration etc.

##### 14.5.2.1.2.1.2 Semantics of this primitive

The parameters of this primitive are as follows:

###### **M\_CM.command**

```
(
  Object ID,
  Action Type,
  Attribute List
)
```

###### **Object ID**

Object identifier.

###### **Action Type**

SET, GET, REMOVE, CANCEL, etc.

###### **Attribute List**

Contains the list of attributes on which the action shall be performed.

##### 14.5.2.1.2.1.3 When Generated

This primitive is originated by the NCMS when it needs to inform the BS to perform the specified configuration action.

##### 14.5.2.1.2.1.4 Effect of receipt

When the BS receives this primitive, it shall perform the specific functions as defined in the following table and reply to the NCMS with a M\_CM.confirmation with current status.

**Table 454—Action Type and Action**

Action Type	Action
SET	Set configuration information based on attribute list
GET	Report configuration information to NCMS based on attribute list
REMOVE	Remove configuration parameters according to the attribute list.
CANCEL	Cancel the action indicated by the last M_CM.command

#### 14.5.2.1.2.2 M\_CM.confirmation

##### 14.5.2.1.2.2.1 Function

This primitive is originated by the BS in response to M\_CM.command from the NCMS.

##### 14.5.2.1.2.2.2 Semantics of this primitive

The parameters of this primitive are as follows:

###### **M\_CM.confirmation**

```
(  
Object ID,  
Action Type,  
Attribute List  
)
```

###### **Object ID**

This is the Object identifier.

###### **Action Type**

This shall be set as the Action Type in M\_CM.command.

###### **Attribute List**

It contains the list of attributes which are the action results.

##### 14.5.2.1.2.2.3 When Generated

This primitive is originated by the BS in response to the M\_CM.command.

##### 14.5.2.1.2.2.4 Effect of receipt

When the NCMS receives this primitive, it shall check the parameters in the attribute list, update the related information, and take any further action necessitated by the result.

#### 14.5.2.1.2.3 M\_CM.notification

##### 14.5.2.1.2.3.1 Function

This primitive is originated by the BS to report its specific configuration information to NCMS.

##### 14.5.2.1.2.3.2 Semantics of this primitive

The parameters of this primitive are as follows:

###### **M\_CM.notification**

```
(  
Object ID,  
Attribute List  
)
```

###### **Object ID**

Object identifier.

###### **Attribute List**

It contains the specific configuration information which BS is reporting to NCMS.

#### 14.5.2.1.2.3.3 When generated

The BS needs to notify the NCMS of its specific configuration information.

#### 14.5.2.1.2.3.4 Effect of Receipt

When the NCMS receives this primitive, it shall check the attribute list in the primitive, update the related information, and take any further action necessitated by the result.

### 14.5.2.2 Capability Management

<Section Note: Subscriber Basic Capabilities negotiation recommendations>

#### 14.5.2.3 Basic RF Configuration

<Section Note: Procedures for setting and retrieving system information about frequency assignments for sectors, channel bandwidths, FFT sizes, Tx Power, etc. are described>

#### 14.5.2.4 Basic MAC Configuration

<Section Note: Procedures for setting and retrieving MAC parameters like SDU size limits, PDU size limits, list of Service classes supported, scan list, packing, fragmentation, ARQ block sizes etc. are described>

#### 14.5.2.5 BS Time Configuration

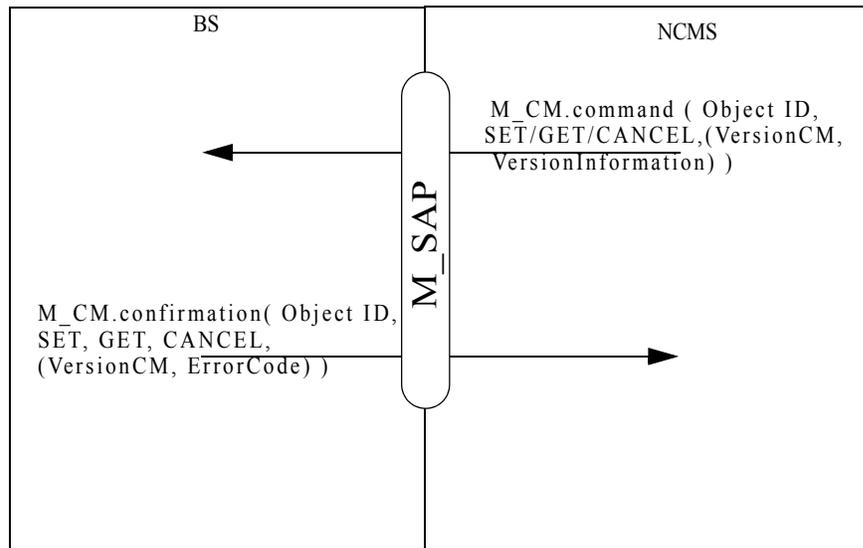
<Section Note: Procedures for setting and retrieving BS time information are described.>

#### 14.5.2.6 Version Configuration

Version configuration management is an essential and critical management function. It can be divided into; version information update, version verification, and version upload/download sub-procedures.

Figure 305b shows an example of using the generic primitives to describe the version configuration procedure.

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**Figure 307—Procedure of version configuration initiated by NCMS**

Figure 307 describes the version configuration procedure initiated by the NCMS with M\_CM.command. This procedure could be used to either obtain or set the version information at the BS. It can also be used to cancel the action of version update. After BS receives the primitive, it shall respond with M\_CM.confirmation to inform NCMS the result of version configuration action.

### 14.5.3 Accounting Management

Accounting event can be detected for an MS Network Entry. Since each MS can have multiple connections at the same time, accounting event for each connection should be detected. Accounting for an MS Network Entry is initiated when the MS registers at the network and terminated when the MS deregisters from the network. Similarly, accounting for a connection is initiated at the dynamic service addition (DSA) instant of the connection and terminated at the dynamic service deletion (DSD) instant of the connection.

#### 14.5.3.1 Accounting Procedure

Accounting primitives consist of Accounting request and Accounting response, as shown in Figure 308 and Figure 309. Figure 308 represents accounting primitives initiated by a BS when it receives REG-REQ/RSP, DREG-REQ/RSP, DREG-CMD, DSA-REQ/RSP, DSC-REQ/RSP or DSD-REQ/RSP. Figure 309 represents accounting primitives initiated by an NCMS.

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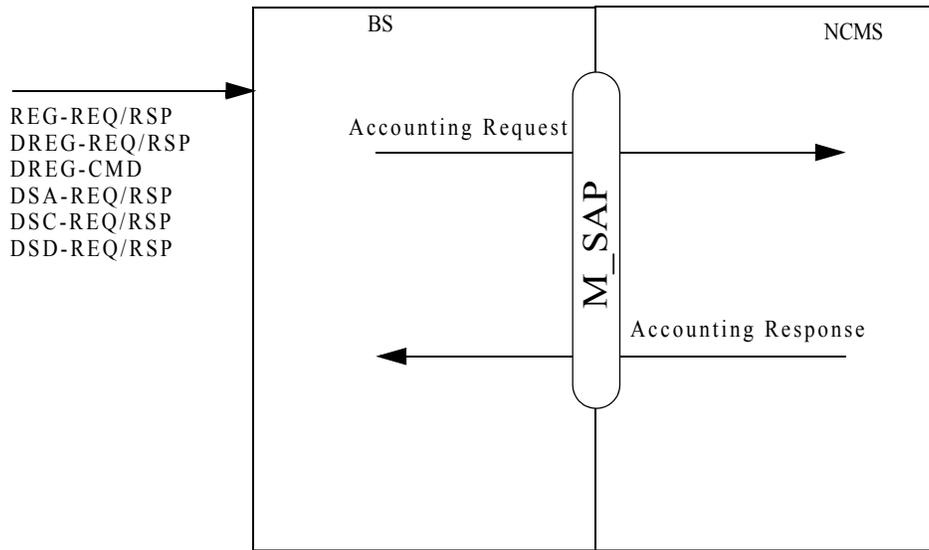


Figure 308—Accounting Primitive Initiated by a BS

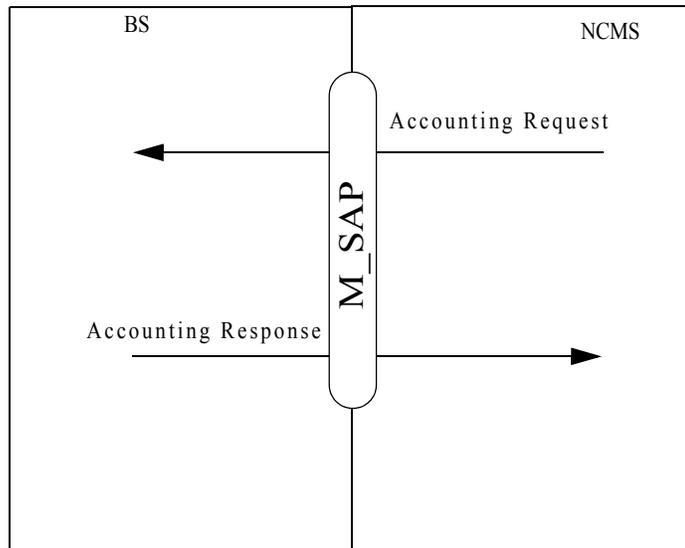


Figure 309—Accounting Primitive Initiated by an NCMS

### 14.5.3.2 Service Primitives for Accounting Management

#### 14.5.3.2.1 Accounting request

##### 14.5.3.2.1.1 Function

This primitive is issued by a BS to inform an NCMS of accounting event for MS Network Entry after Registration request/response (REG-REQ/RSP) or Deregistration command (DREG-CMD) of an MS. Also, it is issued by a BS to inform an NCMS of accounting event for connection after DSA, DSC or DSD procedure. On the other hand, this primitive can be issued by an NCMS depending on the policy of service provider.

##### 14.5.3.2.1.2 Semantics of the service primitive

The parameters of the primitives are as follows:

#### **Accounting request**

```
(
  MS MAC Address
  Service Flow Identifier
  Accounting Record Type
  Accounting Record Number
  Accounting Input Octets
  Accounting Output Octets
  Accounting Input Packets
  Accounting Output Packets
  Service Flow Information
)
```

#### **MS MAC Address**

48-bit MAC address which will identify MS

#### **Service Flow identifier**

32-bit service flow identifier which will identify service flows of an MS

#### **Accounting Record Type**

The type of accounting record being sent and EVENT\_RECORD, START\_RECORD, INTERIM\_RECORD, and STOP\_RECORD are currently defined. An Event Record is used to indicate that a one-time event has occurred (meaning that the start and end of the event are simultaneous). A Start Record is used to initiate an accounting session and contains accounting information that is relevant to the initiation of the session. An Interim Record contains cumulative accounting information for an existing accounting session. A Stop Record is sent to terminate an accounting session and contains cumulative accounting information relevant to the existing session.

#### **Accounting Record Number**

Identifies accounting record within one session

#### **Accounting Input Octets**

The number of octets received from the MS during the session (This parameter is only included in the Accounting Request Primitive from BS to NCMS).

#### **Accounting Output Octets**

The number of octets sent to the MS during the session (This parameter is only included in the Accounting Request Primitive from BS to NCMS).

#### **Accounting Input Packets**

The number of packets received from the MS during the session (This parameter is only included in the Accounting Request Primitive from BS to NCMS).

#### **Accounting Output Packets**

1           The number of packets sent to the MS during the session (This parameter is only included in  
2           the Accounting Request Primitive from BS to NCMS).  
3

#### 4           **Service Flow Information**

5           Required QoS information of a service flow include traffic characteristics and a scheduling  
6           type such as service class name, QoS parameter set type, maximum sustained traffic rate, max-  
7           imum traffic burst, minimum reserved traffic rate, minimum tolerable traffic rate, service flow  
8           scheduling type, tolerate jitter, and maximum latency This parameter is only included in the  
9           Accounting Request Primitive from BS to NCMS).  
10

#### 11           **14.5.3.2.1.3 When generated**

12  
13  
14  
15           This primitive is generated at a BS when an MS enters a network or terminates to access a network, or when  
16           an MS starts or stops dynamic services. Also, this primitive can be generated at an NCMS to request  
17           accounting event from a BS.  
18  
19

#### 20           **14.5.3.2.1.4 Effect of receipt**

21  
22           If this primitive is generated by a BS, accounting event is sent to an NCMS. On the other hand, if this prim-  
23           itive is generated by an NCMS, the BS transfers gathered accounting event to the NCMS using Accounting  
24           response primitive.  
25  
26  
27

#### 28           **14.5.3.2.2 Accounting response**

##### 29           **14.5.3.2.2.1 Function**

30  
31           This primitive is issued by either an NCMS or a BS to respond to Accounting request.  
32  
33

##### 34           **14.5.3.2.2.2 Semantics of the service primitive**

35           The parameters of the primitives are as follows:  
36  
37

#### 38           **Accounting response**

39           (  
40           MS MAC Address  
41           Service Flow Identifier  
42           Result Code  
43           Accounting Record Type  
44           Accounting Record Number  
45           Accounting Input Octets  
46           Accounting Output Octets  
47           Accounting Input Packets  
48           Accounting Output Packets  
49           Service Flow Information  
50           )  
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#### 59           **MS MAC Address**

60           48-bit MAC address which will identify MS

#### 61           **Service Flow identifier**

62           32-bit service flow identifier which will identify service flows of an MS

#### 63           **Result Code**

64  
65

The result of Accounting request

#### **Accounting Record Type**

The type of accounting record being sent and EVENT\_RECORD, START\_RECORD, INTERIM\_RECORD, and STOP\_RECORD are currently defined. An Event Record is used to indicate that a one-time event has occurred (meaning that the start and end of the event are simultaneous). A Start Record is used to initiate an accounting session and contains accounting information that is relevant to the initiation of the session. An Interim Record contains cumulative accounting information for an existing accounting session. A Stop Record is sent to terminate an accounting session and contains cumulative accounting information relevant to the existing session.

#### **Accounting Record Number**

Identifies accounting record within one session

#### **Accounting Input Octets**

The number of octets received from the MS during the session (This parameter is only included in the Accounting Response Primitive from BS to NCMS).

#### **Accounting Output Octets**

The number of octets sent to the MS during the session (This parameter is only included in the Accounting Response Primitive from BS to NCMS).

#### **Accounting Input Packets**

The number of packets received from the MS during the session (This parameter is only included in the Accounting Response Primitive from BS to NCMS).

#### **Accounting Output Packets**

The number of packets sent to the MS during the session (This parameter is only included in the Accounting Response Primitive from BS to NCMS).

#### **Service Flow Information**

Required QoS information of a service flow include traffic characteristics and a scheduling type such as service class name, QoS parameter set type, maximum sustained traffic rate, maximum traffic burst, minimum reserved traffic rate, minimum tolerable traffic rate, service flow scheduling type, tolerate jitter and maximum latency (This parameter is only included in the Accounting Response Primitive from BS to NCMS).

#### **14.5.3.2.2.3 When generated**

This primitive is generated at either an NCMS or a BS to respond to Accounting request.

#### **14.5.3.2.2.4 Effect of receipt**

If an NCMS or a BS receives the Accounting response, it completes accounting procedure.

### **14.5.4 Performance Management**

#### **14.5.4.1 Performance Monitoring Procedure**

The performance monitoring primitives are a set of primitives for supporting the performance monitoring procedure between BS and NCMS.

Figure 310 shows the example of performance monitoring procedure

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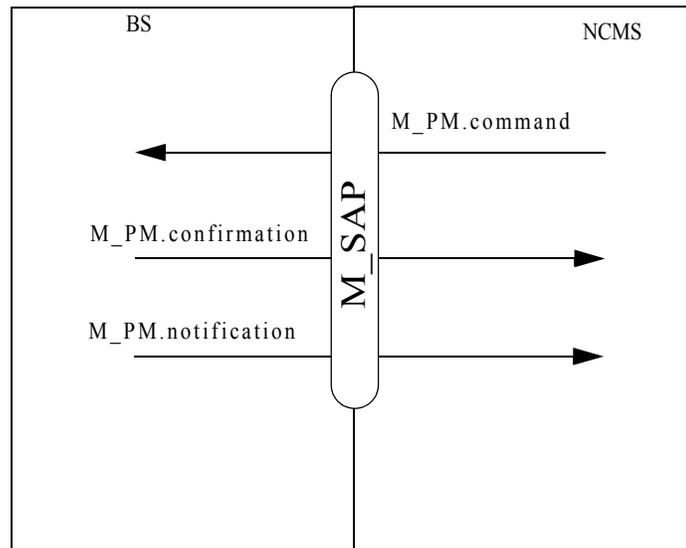


Figure 310—Example of primitive flow of Performance monitoring

#### 14.5.4.1.1 M\_PM.command

##### 14.5.4.1.1.1 Function

This primitive is used by NCMS to inform the BS of the performance monitoring configuration information, which includes the Object identifier, Action type, PM Configuration Attribute List.

##### 14.5.4.1.1.2 Semantics of the service primitives

The parameters of the primitive are as follows:

#### **M\_PM.command**

```

(
  Object ID
  Action Type
  PM_Configuration Attribute_List_ID
  PM Configuration Attribute List
  (
    Performance Item Name
    Performance Monitor Parameters
    Performance Report Parameters
  )
)
  
```

#### **Object ID**

This is the object identifier. It may be, for example, the BS\_ID, MS\_ID or SF\_ID etc. according to the performance monitor requirement.

**Action Type**

The Action Type defines the specific action performed by the BS. The possible Action Types are CREATE, REMOVE, SUSPEND, RESUME, GET and SET.

**PM\_Configuration Attribute\_List\_ID**

This uniquely identifies the PM\_Attribute List

**PM Configuration Attribute List**

(

**Performance Item Name**

The performance monitoring item name

**Performance Monitor Parameters**

It defines the information of monitor action type (periodic or event triggered), monitoring granularity (e.g. 5ms, 10ms, etc), etc. When Action Type is set to GET, REMOVE, SUSPEND or RESUME, this field is ignored.

**Performance Report Parameters**

It defines the information of report type ( periodic or event triggered) , reporting granularity (e.g. 1 hour, 1 day, etc.). When Action Type is set to GET, REMOVE, SUSPEND or RESUME, this field is ignored.

)

**14.5.4.1.1.3 When generated**

This primitive is used by the NCMS when it needs to start or stop monitoring the performance of the system on per BS, SS/MS or specific call based performance data. This primitive also can be used by NCMS to retrieve performance measurement from the BS immediately.

**14.5.4.1.1.4 Effect of receipt**

The BS will configure the performance monitoring items according to the received primitive. The BS action is defined based on Action Type in the primitive according to the following table:

**Table 455—Action and Action Type**

Action Type	Action
GET	The BS reports all performance measurements to NCMS according to PM Configuration Attribute List immediately.
SET	The BS configures the performance monitoring items according to PM Configuration Attribute List
CREATE	The BS creates a new PM Configuration Attribute List
REMOVE	The BS removes a PM Configuration Attribute List
SUSPEND	The BS suspends a provisioned PM_Configuration Attribute List
RESUME	The BS resumes the provisioned PM_Configuration Attribute List

#### 14.5.4.1.2 M\_PM.confirmation

##### 14.5.4.1.2.1 Function

This primitive is used by BS to response to the NCMS of M\_PM.command primitive, which confirms the proposed performance monitoring information by NCMS.

##### 14.5.4.1.2.2 Semantics of the service primitives

The parameters of the primitive are as follows:

#### **M\_PM.confirmation**

```
(
  Object ID
  Action Type
  PM_Configuration Attribute_List_ID
  PM Configuration Attribute List
  (
    Performance Item Name
    Status
    Performance Item Report Information
  )
)
```

#### **Object ID**

This is the object identifier. It may be, for example, the BS ID, MS ID or SF ID etc. according to the performance monitor requirement.

#### **PM\_Configuration Attribute\_List\_ID**

This uniquely identifies the PM\_Attribute List

#### **PM Configuration Attribute List**

```
(
  Performance Item Name
```

It is the name of performance monitoring item.

#### **Status**

This indicates the result of configuration performance item, it can be SUCCESS or FAILURE

#### **Performance Item Report Information**

The performance item report information. It could be the monitoring item value or other correspondent information. This information is only valid if the Action Type is set to GET.

```
)
```

##### 14.5.4.1.2.3 When generated

This primitive is generated by the BS to confirm start or stop performance monitor when it receives the M\_PM.iCommand.

##### 14.5.4.1.2.4 Effect of receipt

The NCMS checks the status in the primitive and continues next step accordingly.

#### 14.5.4.1.3 M\_PM.notification

##### 14.5.4.1.3.1 Function

This primitive is used by BS to report the performance monitoring items information.

#### 14.5.4.1.3.2 Semantics of the service primitives

The parameters of the primitive are as follows:

##### **M\_PM.notification**

```
(
  Object ID
  PM_Configuration Attribute_List_ID
  PM Reporting Item List
  (
    Performance Item Name
    Performance Item Report Information
  )
)
```

##### **Object ID**

It is the object identifier and can be, for example, the MS ID, SF ID etc. according to the performance monitor requirement;

##### **PM\_Configuration Attribute\_List\_ID**

This uniquely identifies the PM\_Attribute List

##### **PM Reporting Item List**

```
(
  Performance Item Name
  It is the name of the performance reporting item.
  Performance Item Report Information
  The performance item report information. It could be the monitoring item value or other correspondent information
)
```

#### 14.5.4.1.3.3 When generated

This primitive is generated by the BS to report the required performance metrics based on the report mode in the former performance monitoring.

#### 14.5.4.1.3.4 Effect of receipt

The NCMS will take corresponding actions after receiving this report.

### 14.5.5 Security Management

#### 14.5.5.1 EAP-based authentication procedure

When an MS try to initiate an EAP-based authentication or re-authentication procedure with a BS, it sends a PKMv2 EAP Start message. The BS informs of an NAS (Network Access Server) entity in NCMS as an EAP\_start.request primitive. If the MS receives EAP-Request/Identity messages, then it sends the EAP-Response/Identity message with MN's identifier to the NAS entity. After the EAP-Response/Identity message, the EAP methods are negotiated between the MS and the AAA server and the EAP messages are exchanged several times. The EAP messages encapsulated are exchanged between the MS and the NAS entity. If the EAP authentication procedure is finished successfully and also yields an MSK (Master Session Key), the BS which does not know EAP protocols receives the MSK and a key lifetime from the EAP client entity as an EAP\_Key\_Notification.indication primitive. It is already shared between the AAA server and

the MS through the EAP exchanges. The MSK is used for derivation for a PMK (Pair wise Master Key) and optional EIK (EAP Integrity Key).

Figure 311 shows EAP-based authentication procedure between a BS and an NAS entity in NCMS as follows

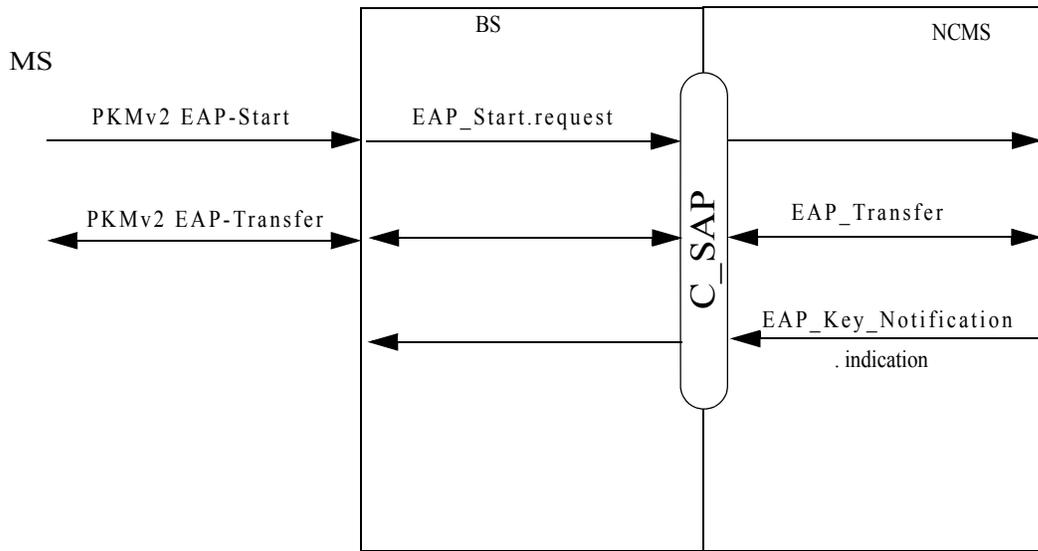


Figure 311—EAP based Authentication Procedure

#### 14.5.5.1.1 Service Primitives

##### 14.5.5.1.1.1 EAP\_Start.request

###### 14.5.5.1.1.1.1 Function

This primitive inform an AAA Client entity in NCMS that an MS is going to start EAP-based authentication.

###### 14.5.5.1.1.1.2 Semantics of the Service Primitives

The parameters of the primitives are as follows:

###### EAP\_Start.request

```
(
  MS ID
)
```

###### MS ID

48-bit unique identifier used for user identification between BS and NCMS

### 14.5.5.1.1.1.3 When generated

This primitive is issued by a BS when a MS wants to initiate EAP-based authentication procedure.

### 14.5.5.1.1.1.4 Effect of receipt

EAP payloads are forwarded for the authentication between BS and NCMS entity.

### 14.5.5.1.1.2 EAP\_Transfer

#### 14.5.5.1.1.2.1 Function

After the EAP\_start primitive, EAP payloads are exchanged between an MS and an NAS entity. The EAP payloads are encapsulated in the EAP Transfer because it is not interpreted in the MAC.

#### 14.5.5.1.1.2.2 Semantics of the Service Primitives

The parameters of the primitives are as follows:

##### **EAP\_Transfer**

```
(
  MS ID
  EAP Payload
)
```

##### **MS ID**

48-bit unique identifier used for user identification between BS and NCMS

##### **EAP Payload**

Contains the EAP authentication data

### 14.5.5.1.1.3 EAP\_Key\_Notification.indication

#### 14.5.5.1.1.3.1 Function

A MS derives the key from the EAP payloads and the NCMS entity informs the BS of it when the EAP exchanges are successfully completed and yield the MSK.

#### 14.5.5.1.1.3.2 Semantics of the Service Primitives

The parameters of the primitives are as follows:

##### **EAP\_Key\_Notification.indication**

```
(
  MS ID
  MSK
  MSK Lifetime
)
```

##### **MS ID**

48-bit unique identifier used for user identification between BS and NCMS

##### **MSK**

1 MSK is the product of EAP exchanges. It is used for the derivation of PMK (Pair wise Master  
2 Key) and EIK.

3 **MSK Lifetime**

4 It may be transferred from the EAP method or may be set by a vendor.  
5  
6  
7  
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9  
10 **14.5.5.1.1.3.3 When generated**

11 This primitive is issued by a NCMS (a NAS entity) when the EAP exchange are successfully completed and  
12 yield the MSK.  
13

14  
15 **14.5.5.1.1.3.4 Effect of receipt**

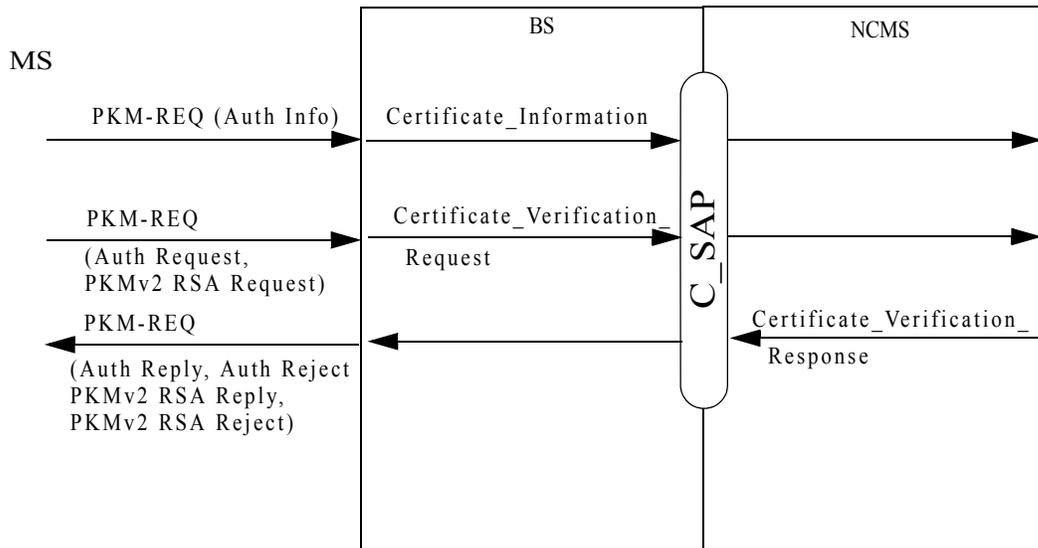
16 The BS could derive a PMK and optional EIK from the MSK.  
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22 **14.5.5.2 RSA-based authentication procedure**

23 When an MS tries to initiate an RSA-based authentication or re-authentication procedure with a BS, it sends  
24 PKM-REQ messages with Auth Info, Auth Request or PKMv2 RSA-Request message type. When a MS  
25 sends a PKM-REQ message with Auth Info message type which includes a CA (Certificate Authority)'s cer-  
26 tificate to the BS, the BS informs of an NCMS entity as a Certificate\_Infomation primitive. The NCSM  
27 entity verifies the CA's certificate if it has no information about the CA and keeps the certificate.  
28  
29

30 When an MS sends a PKM-REQ message with Auth Request or PKMv2 RSA-Request message type to  
31 authenticate the MS, the BS informs of an NCMS entity as a Certificate\_Verification\_Request primitive. An  
32 NCMS entity verifies the MS's certificate through asking to a CA and an OCSP (Online Certificate Status  
33 Protocol) server. The NCMS returns the result of verification to the BS whether the MS is authenticated or  
34 not as a Certificate\_Verification\_Response primitive. The BS sends the result of authentication and security  
35 information to the MS including security key information.  
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40 Figure 312 shows a RSA-based authentication procedure between a BS and an NCMS entity as follows:  
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Figure 312—RSA-based authentication procedure

#### 14.5.5.2.1 Service Primitives

##### 14.5.5.2.1.1 Certificate\_Information

###### 14.5.5.2.1.1.1 Function

This primitive informs of an NCMS entity that a CA's certificate which issues an MS's certificate.

###### 14.5.5.2.1.1.2 Semantics of the Service Primitives

The parameters of the primitives are as follows:

###### Certificate\_Information

```
(
  MS ID
  Certificate
)
```

###### MS ID

48-bit unique identifier used for user identification between a BS and an NCMS

###### Certificate

CA's certificate which issues an MS's certificate

###### 14.5.5.2.1.1.3 When generated

This primitive is issued by a BS (when the BS does not have CA's information that generates the certificate) when an MS informs the BS of CA's certificate.

#### 14.5.5.2.1.1.4 Effect of receipt

The NCMS has information for a CA's certificate and is able to verify an MS's certificate whether the MS's certificate is forged or not.

#### 14.5.5.2.1.2 Certificate\_Verification\_Request

##### 14.5.5.2.1.2.1 Function

This primitive is used by a BS to inform an MS's certificate to authenticate the MS of an NCMS entity.

##### 14.5.5.2.1.2.2 Semantics of the Service Primitives

The parameters of the primitives are as follows:

##### **Certificate\_Verification\_Request**

```
(
  MS ID
  Certificate
)
```

##### **MS ID**

48-bit unique identifier used for user identification between a BS and an NCMS

##### **Certificate**

MS's certificate which is issued by a trust CA

##### 14.5.5.2.1.2.3 When generated

This primitive is issued by a BS (when the BS does not have CA information that generates the certificate) when an MS requests the BS for authentication to access the network.

##### 14.5.5.2.1.2.4 Effect of receipt

The NCMS verifies an MS's certificate whether the MS's certificate is forged or not, and is revoked or good.

#### 14.5.5.2.1.3 Certificate\_Verification\_Response

##### 14.5.5.2.1.3.1 Function

This primitive informs a BS a result of MS's authentication by an NCMS entity.

##### 14.5.5.2.1.3.2 Semantics of the Service Primitives

The parameters of the primitives are as follows:

##### **Certificate\_Verification\_Response**

```
(
  MS ID
  Result
)
```

##### **MS ID**

48-bit unique identifier used for user identification between a BS and an NCMS

**Result**

Result of authentication such as valid, forged or revoked

**14.5.5.2.1.3.3 When generated**

This primitive informs the authentication result of a BS by a NCMS.

**14.5.5.2.1.3.4 Effect of receipt**

The BS transmits the PKM-RSP message to the MS. If the result is success, a pre-PAK is included in it.

**14.5.5.3 Authentication, Authorization and Accounting (AAA) Guidelines**

<Section Note: Recommendations for utilizing EAP, RADIUS protocols>

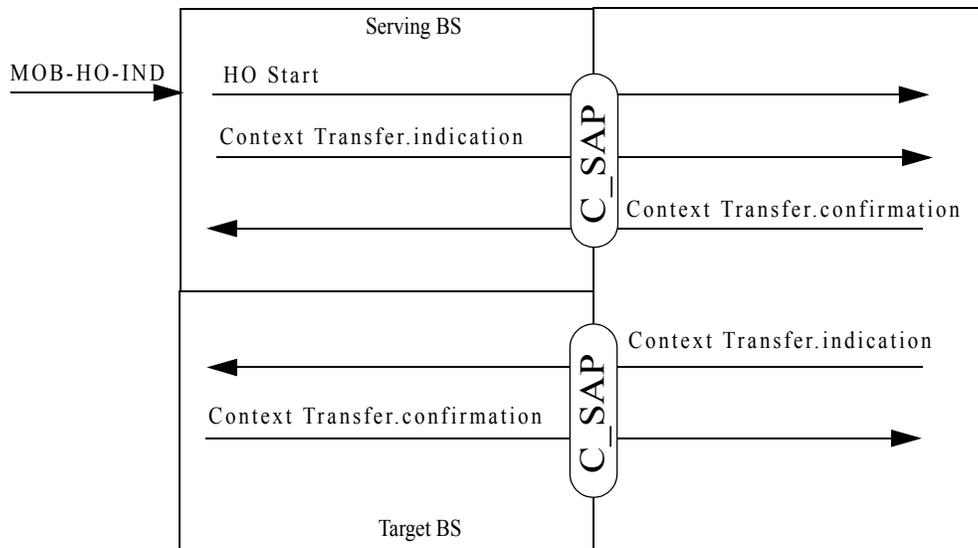
**14.5.5.4 Security Context and Key Management**

<Section Note: Recommendations for establishment and management of Security Associations, Key establishment and caching policies.>

**14.5.5.5 Security for Handoffs (EAP only)**

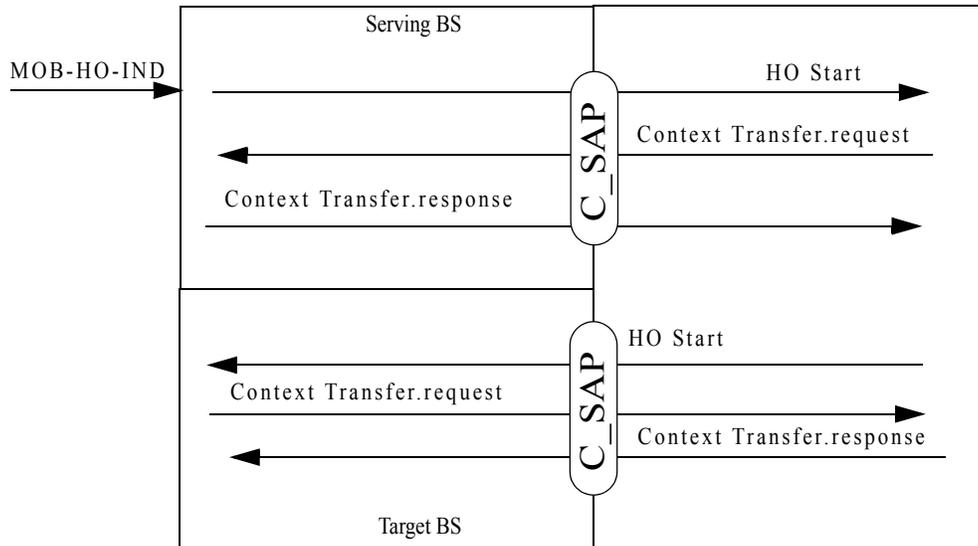
In the handover procedure, if an MS tries to process the network re-entry to a target BS, but the target BS has not an MS information, then the target BS may request the MS information to a serving BS and the serving BS may give a response of it.

Figure 313 shows the context transfer primitives initiated by a serving BS between a BS and an NCMS entity.



**Figure 313—Context transfer primitives initiated by a serving BS**

1 If an MS tries to process the network re-entry to a target BS, but the target BS has not an MS information,  
 2 then the target BS may request the MS information to a serving BS and the serving BS may give a response  
 3 of it. Figure 314 shows the context transfer procedure initiated by a target BS between a BS and an NCMS  
 4 entity as follows.  
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Figure 314—Context transfer primitives initiated by a target BS

#### 14.5.5.5.1 Service Primitives

##### 14.5.5.5.1.1 Context Transfer.indication

###### 14.5.5.5.1.1.1 Function

This primitives is issued by the serving BS or the NCMS entity in order to give the target BS the security context information of the MS. It is transmitted only to the real target after the handover procedure. The MS information what they have could be included.

###### 14.5.5.5.1.1.2 Semantics of the Service Primitives

The parameters of the primitives are as follows:

###### Context Transfer.indication

```
(
  Serving BS ID,
  Target BS ID,
  MS ID,
  Security Information
)
```

**MS ID**

1 48-bit unique identifier used for user identification between BS and NCMS

2 **Serving BS ID**

3 Base station unique identifier of the serving BS (same as in the DL-MAP)

4 **Target BS ID**

5 Base station unique identifier of the target BS (same as in the DL-MAP)

6 **Security Information**

7 The information negotiated during PKM procedure. It presents when the information could be  
8 provided. AK and AK sequence number transmitted by NCMS, TEK, TEK key lifetime, TEK  
9 sequence number, CBC Initialize Vector (the reuse of IV is TBD because of the security issue),  
10 SAID, GKEK, GKEK lifetime, GKEKKID, SAID, SA-type, SA service type and Crypto-  
11 graphic-Suite  
12  
13

14  
15 **14.5.5.5.1.3 When generated**

16  
17 This primitive is issued by a BS or the NCMS when the handover procedure is successfully processed. The  
18 actual trigger point may be different according to the security sharing policy. One example is a serving BS  
19 issues this primitive after it generates HO start primitive.  
20  
21

22 **14.5.5.5.1.4 Effect of receipt**

23 The entity receiving this primitive shall response with Context Transfer.confirmation primitive. In addition,  
24 if the serving BS issues this primitive for the MS security information, the NCMS entity shall forwards the  
25 MS information to the target BS or another NCMS entity using Context Transfer.indication primitive.  
26  
27  
28

29  
30 **14.5.5.5.1.2 Context Transfer.confirmation**

31 **14.5.5.5.1.2.1 Function**

32 This primitive is issued by the target BS or the NCMS in order to response the Context Transfer.indication.  
33  
34  
35

36 **14.5.5.5.1.2.2 Semantics of the Service Primitives**

37 The parameters of the primitives are as follows:  
38  
39  
40

41 **Context Transfer.confirmation**

42 (  
43 Serving BS ID,  
44 Target BS ID,  
45 MS ID,  
46 Result Code  
47 )  
48  
49  
50  
51

52 **MS ID**

53 48-bit unique identifier used for user identification between BS and NCMS.

54 **Serving BS ID**

55 Base station unique identifier of the serving BS (same as in the DL-MAP).

56 **Target BS ID**

57 Base station unique identifier of the target BS (same as in the DL-MAP).

58 **ResultCode**

59 The result of context transfer procedure.  
60  
61  
62  
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### 14.5.5.5.1.2.3 When generated

This primitive is issued by the target BS or the NCMS when the Context Transfer.indication is successfully processed.

### 14.5.5.5.1.2.4 Effect of receipt

This primitive informs the result of context transfer for the handover

## 14.5.5.5.1.3 Context Transfer.request

### 14.5.5.5.1.3.1 Function

After the successful handover procedure, the Target BS can re-establish the session information of MS in old BS.

### 14.5.5.5.1.3.2 Semantics of the Service Primitives

The parameters of the primitives are as follows:

#### Context Transfer.request

```
(
    Serving BS ID,
    Target BS ID,
    MS ID
)
```

#### MS ID

48-bit unique identifier used for user identification between BS and NCMS

#### Serving BS ID

Base station unique identifier of the serving BS (same as in the DL-MAP)

#### Target BS ID

Base station unique identifier of the target BS (same as in the DL-MAP)

### 14.5.5.5.1.3.3 When generated

This primitive is issued by the target BS or the NCMS entity to request the MS's security context information.

### 14.5.5.5.1.3.4 Effect of receipt

The NCMS entity or the BS receiving this primitive provides the security context information using Context Transfer.response primitive.

## 14.5.5.5.1.4 Context Transfer.response

### 14.5.5.5.1.4.1 Function

This primitive is issued by the serving BS or the NCMS to response the Context Transfer.request.

### 14.5.5.5.1.4.2 Semantics of the Service Primitives

The parameters of the primitives are as follows:

**Context Transfer.response**

(  
 Serving BS ID,  
 Target BS ID,  
 MS ID,  
 Result Code  
 )

**MS ID**

48-bit unique identifier used for user identification between BS and NCMS

**Serving BS ID**

Base station unique identifier of the serving BS (same as in the DL-MAP)

**Target BS ID**

Base station unique identifier of the target BS (same as in the DL-MAP)

**ResultCode**

The result of context transfer procedure

**Security Information**

The information negotiated during PKM procedure. AK and AK sequence number transmitted by an NCMS, TEK, TEK key lifetime, TEK sequence number, CBC Initialize Vector (the reuse of IV is TBD because of the security issue), SAID, SA-type, SA service type and Cryptographic-Suite

**14.5.5.5.1.4.3 When generated**

This primitive is issued by the serving BS or the NCMS entity after receiving Context Transfer.request primitive.

**14.5.5.5.1.4.4 Effect of receipt**

This primitive informs the result of context transfer for the handover

**14.5.5.6 Protecting Management Messages**

<Section Note: Recommendations for protecting management messages.>

**14.5.6 Service Flow Management****14.5.6.1 BS Service Provisioning**

<Section Note: Provisioning of the services on the BS are described. Ex: Setting and retrieval of Operator IDs, BS IDs etc. and type of convergence layers supported and their configuration parameters are described.>

**14.5.6.2 SS/MS Provisioning**

<Section Note: Provisioning. Configuration and management for BS initiated connections and service flow creations for static and dynamic QoS>

### 14.5.6.3 SS/MS Connection Management

#### 14.5.6.3.1 IPv4 Connection Management

There are two kinds of IP allocation method in the secondary management connection, DHCP (Dynamic Host Control Protocol) and MIP (Mobile IP).

First, for the IP allocation using DHCP, the DHCP protocol is employed in SS/MS and NCMS (a DHCP relay agent and a server). DHCP payloads are transported between SS/MS and BS, but BS forward them encapsulated. SS/MS sends a DHCPDISCOVER message in order to initiate IP allocation procedure. A SS/MS receives a DHCPOFFER message which has the information of DHCP server. The SS/MS requests an IP address allocation by sending a DHCPREQUEST message. Then a newly allocated IP address is provided by the DHCP server in a DHCPACK message. A Gateway address, DNS (Domain Name Server) addresses, and an IP address lease time are also represented.

Second, for the IP allocation using MIP, the MIP protocol is employed in MS and NCMS or a mobility agent (a Foreign Agent and/or a Home Agent). MIP payloads encapsulated also are forwarded between MS and BS. MIP procedure is started when a MS receives an Agent Advertisement message with information of a mobility agent. After that, the SS sends a MIP Registration Request message which includes a Home Agent address, a user NAI (Network Access Identifier) and so on. Then, the MS receives a MIP Registration Response message with successful Result-Code. If the MS forwards the MIP Registration Request message with no IP address, an allocated IP address is represented in the MIP Registration Response.

#### 14.5.6.3.2 Service Primitives

##### 14.5.6.3.2.1 DHCP\_Transfer

###### 14.5.6.3.2.1.1 Function

DHCP payloads are exchanged between an SS/MS and a DHCP Client entity. The DHCP payloads are encapsulated in the DHCP Transfer primitive because it is not interpreted in the BS.

###### 14.5.6.3.2.1.2 Semantics of the Service Primitives

The parameters of the primitives are as follows:

###### **DHCP\_Transfer**

```
(
  MS/SS ID
  DHCP Payload
)
```

###### **MS/SS ID**

48-bit unique identifier used for user identification between BS and NCMS

###### **DHCP Payload**

Contains the DHCP payload

### 14.5.6.3.2.2 MIP\_Transfer

#### 14.5.6.3.2.2.1 Function

MIP payloads are exchanged between an MS and an entity with functionalities of mobility agent in NCMS. The MIP payloads are encapsulated in the MIP Transfer primitive because it is not interpreted in the BS.

#### 14.5.6.3.2.2.2 Semantics of the Service Primitives

The parameters of the primitives are as follows:

##### **MIP\_Transfer**

```
(
  MS ID
  MIP Payload
)
```

##### **MS ID**

48-bit unique identifier used for user identification between BS and NCMS

##### **MIP Payload**

Contains the MIP payload

### 14.5.6.3.2.3 IP\_Allocation\_Notification.indication

#### 14.5.6.3.2.3.1 Function

After MIP or DHCP exchanges are completed, the SS/MS gets a new allocated IP address. For the BS, NCMS sends a new allocated IP address for the SS/MS in IP\_Allocation.indication primitive.

#### 14.5.6.3.2.3.2 Semantics of the Service Primitives

The parameters of the primitives are as follows:

##### **IP\_Allocation\_Notification.indication**

```
{
  MS ID
  IP Address
}
```

##### **MS ID**

48-bit unique identifier used for user identification between BS and NCMS

##### **IP Address**

A new address allocated to the SS/MS using DHCP or MIP.

#### 14.5.6.3.2.3.3 When generated

This primitive is issued by a NCMS (a DHCP client or a Mobility Agent) when the IP allocation procedure are successfully completed.

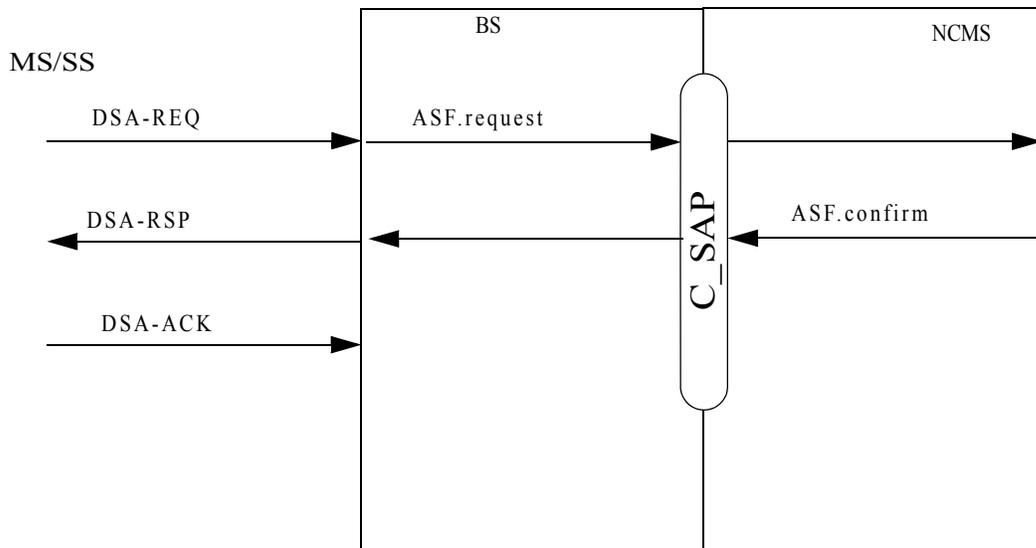
**14.5.6.3.2.3.4 Effect of receipt**

A newly allocated IP address is known to the BS.

**14.5.6.4 QoS Management**

The QoS Management Primitives are a set of primitives for supporting QoS management between BS and NCMS (access network). They are defined to support QoS service flows. A service flow ID is created and managed by the NCMS (or a network entity). A unique identifier of all SAPs is service flow ID because the service flow ID can only be identified in a network operator. The CID is only managed in MAC layer in a BS. MS ID in ASF request and CSF request is used to authorize the MS whether the QoS information is permitted.

Service flow application clients that interact with CS convergence layer should transform service flow information and CS parameter information to appropriate parameters of network protocol in network side and in reverse direction. How to convert specific QoS parameters between 802-16-Service-Flow and Network Flows is out of scope. Network side protocol modules such as RSVP, COPS (Common Open Policy Service) and SNMP (Simple Network Management Protocol) have better convert the specific QoS parameters between two sides. The service flow management primitives are designed as 2-way handshake style because resource reservation protocols in IETF and primitives at the 802.16 MAC SAP are designed as 2-way handshake style but service flow messages in IEEE 802.16-2004 is designed as 3-way handshake style to negotiate QoS requirements in a service flow.



**Figure 315—ASF request and ASF confirm primitives flow**

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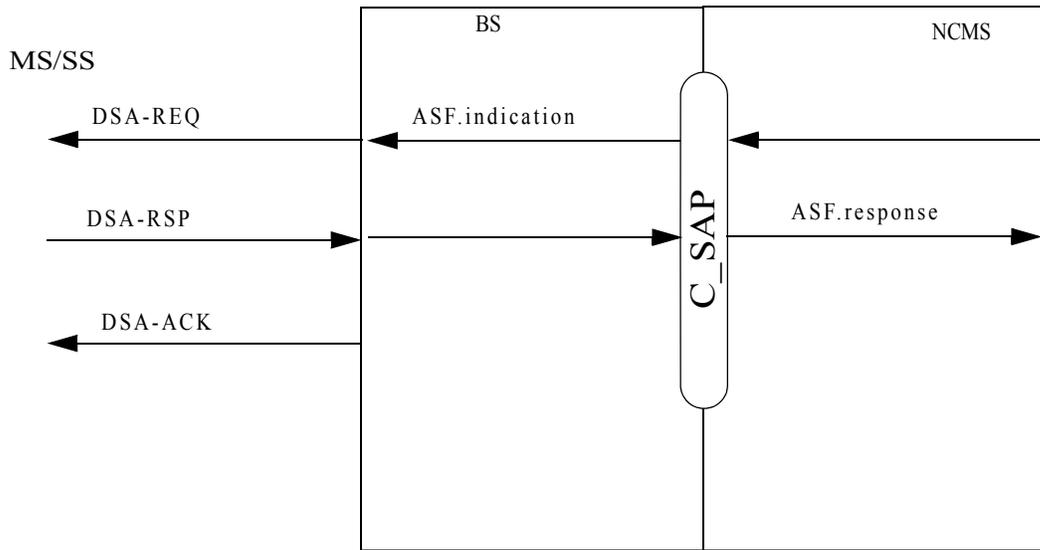


Figure 316—ASF indication and ASF response primitives flow

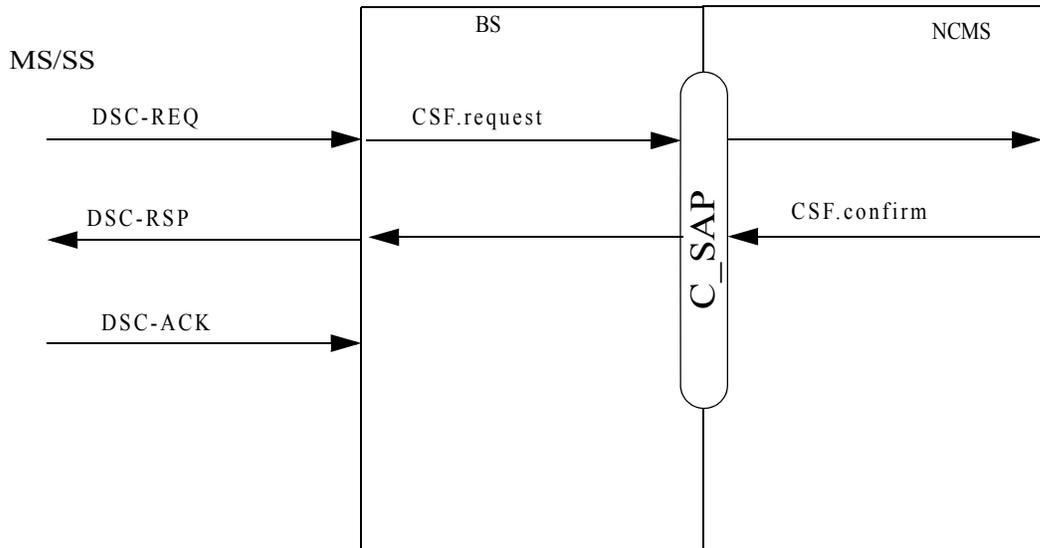


Figure 317—CSF request and CSF confirm primitives flow

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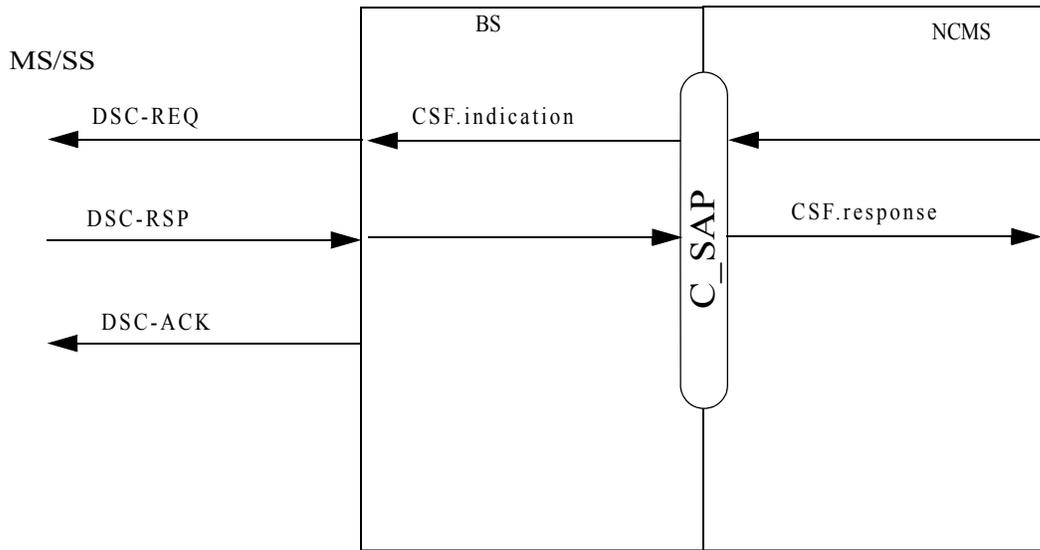


Figure 318—CSF indication and ASF response primitives flow

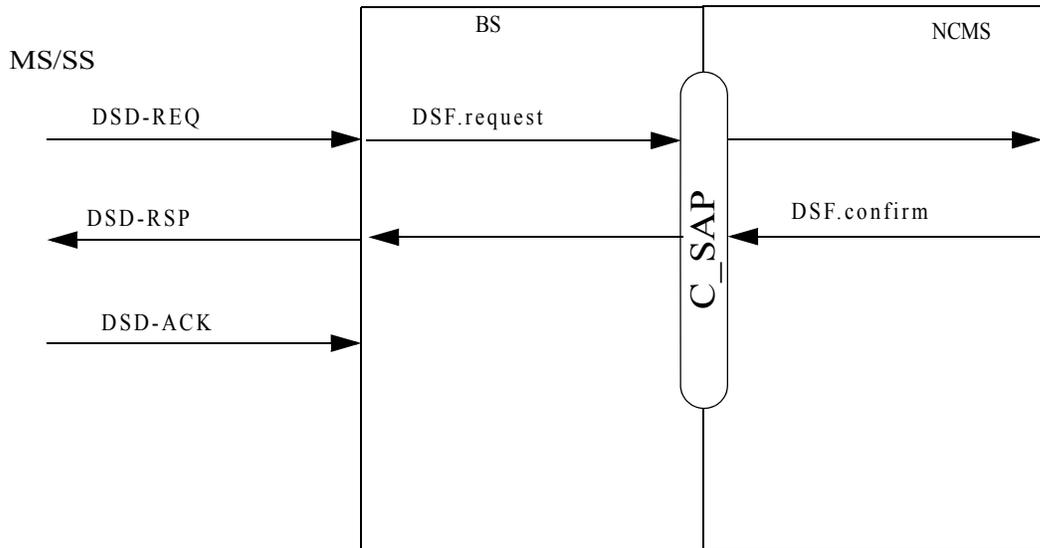
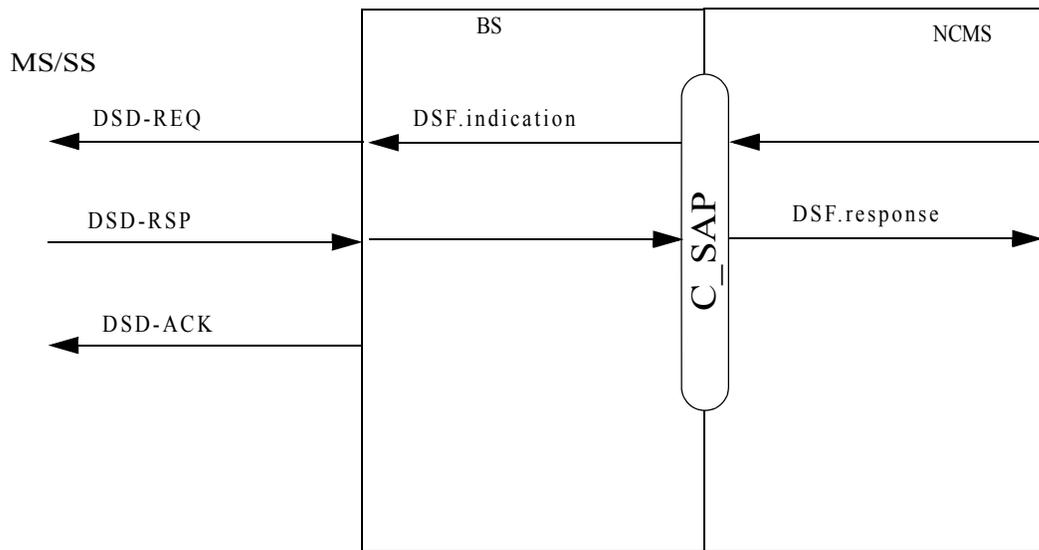


Figure 319—DSF request and DSF confirm primitives flow



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Figure 320—DSF indication and DSF response primitives flow

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#### 14.5.6.4.1 Add\_Service\_Flow.request (ASF.request)

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33

##### 14.5.6.4.1.1 Function

34  
35  
36  
37

This primitive is used by a BS to inform an QoS information from an MS of the QoS management entity in NCMS.

38  
39

##### 14.5.6.4.1.2 Semantics of the service primitive

40  
41

The parameters of the primitives are as follows:

42  
43

#### Add\_Service\_Flow.request

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49  
50  
51  
52

```

(
  Transaction ID
  MS ID
  Service flow descriptor
  Service flow information
  CS parameter information
)
  
```

53  
54

#### Transaction ID

55  
56

A unique sequential identifier of the transaction set by the BS

57

#### MS ID

58

48-bit unique identifier used by MS. MS ID is used for user authorization

59

#### Service flow descriptor

60  
61

Information regarding the attribute an uplink or downlink service flow

62

#### Service flow information

63  
64  
65

Required QoS information of a service flow include traffic characteristics and a scheduling type such as service class name, QoS parameter set type, maximum sustained traffic rate, max-

imum traffic burst, minimum reserved traffic rate, minimum tolerable traffic rate, service flow scheduling type, tolerate jitter and maximum latency

**CS parameter information**  
Required IP filter rules of a service flow such as packet classification rule and IPv6 flow label

#### 14.5.6.4.1.3 When generated

This primitive is generated when a BS receives a DSA-REQ message.

#### 14.5.6.4.1.4 Effect of receipt

The QoS management entity in NCMS shall respond to this primitive by sending Add\_Service\_Flow.confirm. The management entity for service flows checks the validity of the request from the point of view of its own resources. If the request is accepted, the QoS management entity in NCMS creates unique service flow ID for the request.

#### 14.5.6.4.2 Add\_Service\_Flow.confirm (ASF.confirm)

##### 14.5.6.4.2.1 Function

This primitive is used by the QoS management entity in NCMS to response the ASF.request from a BS. Service flow information in ASF response has approved QoS information if the ASF.request is accepted.

##### 14.5.6.4.2.2 Semantics of the service primitive

The parameters of the primitives are as follows:

#### **Add\_Service\_Flow.confirm**

```
(
  Transaction ID
  MS ID
  Service flow ID
  Service flow descriptor
  Service flow information
  CS parameter information
  Service flow error parameter information
)
```

#### **Transaction ID**

A unique sequential identifier of the transaction set by the BS

#### **MS ID**

48-bit unique identifier used by MS. MS ID is used for user identification

#### **Service flow ID**

Unique identifier to identify a service flow

#### **Service flow descriptor**

Information regarding the attribute an uplink or downlink service flow

#### **Service flow information**

Approved complete QoS information of a service flow such as service class name, QoS parameter set type, maximum sustained traffic rate, maximum traffic burst, minimum reserved traffic rate, minimum tolerable traffic rate, service flow scheduling type, tolerate jitter and maximum latency

#### **CS parameter information**

Approved IP filter rules of a service flow such as packet classification rule and IPv6 flow label

## Service flow error parameter information

Failed reason and every specific failed QoS parameter if a ASF request is rejected

### 14.5.6.4.2.3 When generated

This primitive is generated when the QoS management entity in NCMS responds to Add\_Service\_Flow.request primitive.

### 14.5.6.4.2.4 Effect of receipt

This primitive informs the result of the service flow creation of a BS. A BS receiving the primitive shall transmit DSA-RSP message following the information provided by this message.

### 14.5.6.4.3 Add\_Service\_Flow.indication (ASF.indication)

#### 14.5.6.4.3.1 Function

This primitive is used by the QoS management entity in NCMS to inform QoS information. Service flow information and service flow ID are included in ASF.indication of a BS.

#### 14.5.6.4.3.2 Semantics of the service primitive

The parameters of the primitives are as follows:

#### Add\_Service\_Flow.indication

```
(
  Transaction ID
  MS ID,
  Service flow descriptor
  Service flow ID
  Service flow information
  CS parameter information
)
```

#### Transaction ID

A unique sequential identifier of the transaction set by the BS

#### MS ID

48-bit unique identifier used by MS.

#### Service flow descriptor

Information regarding the attribute an uplink or downlink service flow

#### Service flow ID

Unique identifier to identify a service flow.

#### Service flow information

Approved complete QoS information of a service flow such as service class name, QoS parameter set type, maximum sustained traffic rate, maximum traffic burst, minimum reserved traffic rate, minimum tolerable traffic rate, service flow scheduling type, tolerate jitter and maximum latency.

#### CS parameter information

Approved IP filter rules of a service flow such as packet classification rule and IPv6 flow label

### 14.5.6.4.3.3 When generated

This primitive is generated when the QoS management entity in NCMS informs QoS information of a BS.

#### 14.5.6.4.3.4 Effect of receipt

A BS receiving the primitive shall transmit DSA-REQ message following the information provided by this message.

#### 14.5.6.4.4 Add\_Service\_Flow.response (ASF.response)

##### 14.5.6.4.4.1 Function

This primitive is used by a BS to respond the ASF.indication to the QoS management entity in NCMS.

##### 14.5.6.4.4.2 Semantics of the service primitive

The parameters of the primitives are as follows:

#### Add\_Service\_Flow.response

```
(
  Transaction ID
  Service flow ID
  Service flow descriptor
  Service flow information
  CS parameter information
  Service flow error parameter information
)
```

#### Transaction ID

A unique sequential identifier of the transaction set by the BS

#### Service flow ID

Unique identifier to identify a service flow

#### Service flow descriptor

Information regarding the attribute an uplink or downlink service flow

#### Service flow information

Approved complete QoS information of a service flow such as service class name, QoS parameter set type, maximum sustained traffic rate, maximum traffic burst, minimum reserved traffic rate, minimum tolerable traffic rate, service flow scheduling type, tolerate jitter and maximum latency

#### CS parameter information

Approved IP filter rules of a service flow such as packet classification rule and IPv6 flow label

#### Service flow error parameter information

Failed reason and every specific failed QoS parameter if a ASF request is rejected

##### 14.5.6.4.4.3 When generated

This primitive is generated when a BS receives a DSA-RSP message.

##### 14.5.6.4.4.4 Effect of receipt

This primitive informs the result of the service flow creation of the QoS management entity in NCMS.

#### 14.5.6.4.5 Change\_Service\_Flow.request (CSF.request)

##### 14.5.6.4.5.1 Function

This primitive is used by a BS to inform an QoS information from an MS of the QoS management entity in NCMS.

##### 14.5.6.4.5.2 Semantics of the service primitive

The parameters of the primitives are as follows:

#### **Change\_Service\_Flow.request**

```
(
  Transaction ID
  MS ID
  Service flow ID
  Service flow information
  CS parameter information
)
```

#### **Transaction ID**

A unique sequential identifier of the transaction set by the BS

#### **MS ID**

48-bit unique identifier used by MS. MS ID is used for user authorization

#### **Service flow ID**

Unique identifier to identify a service flow

#### **Service flow information**

Required QoS information of a service flow include traffic characteristics and a scheduling type such as service class name, QoS parameter set type, maximum sustained traffic rate, maximum traffic burst, minimum reserved traffic rate, minimum tolerable traffic rate, tolerate jitter and maximum latency

#### **CS parameter information**

Required IP filter rules of a service flow such as packet classification rule and IPv6 flow label

##### 14.5.6.4.5.3 When generated

This primitive is generated when a BS receives a DSC-REQ message.

##### 14.5.6.4.5.4 Effect of receipt

The QoS management entity in NCMS shall respond to this primitive by sending Change\_Service\_Flow.confirm. The management entity for service flows checks the validity of the request from the point of view of its own resources.

#### 14.5.6.4.6 Change\_Service\_Flow.confirm (CSF.confirm)

##### 14.5.6.4.6.1 Function

This primitive is used by the QoS management entity in NCMS to response the CSF.request from a MS. Service flow information in CSF response have approved QoS information if the CSF request is accepted.

#### 14.5.6.4.6.2 Semantics of the service primitive

The parameters of the primitives are as follows:

##### **Change\_Service\_Flow.confirm**

```
(
  Transaction ID
  Service flow ID
  Service flow information
  CS parameter information
  Service flow error parameter information
)
```

##### **Transaction ID**

A unique sequential identifier of the transaction set by the BS

##### **Service flow ID**

Unique identifier to identify a service flow

##### **Service flow information**

Approved complete QoS information of a service flow such as service class name, QoS parameter set type, maximum sustained traffic rate, maximum traffic burst, minimum reserved traffic rate, minimum tolerable traffic rate, tolerate jitter and maximum latency

##### **CS parameter information**

Approved IP filter rules of a service flow such as packet classification rule and IPv6 flow label

##### **Service flow error parameter information**

Failed reason and every specific failed QoS parameter if the request is rejected

#### 14.5.6.4.6.3 When generated

This primitive is generated when the QoS management entity in NCMS responds to Change\_Service\_Flow.request primitive.

#### 14.5.6.4.6.4 Effect of receipt

This primitive informs the result of the service flow modification of a BS. A BS receiving the primitive shall transmit DSC-RSP message following the information provided by this message.

#### 14.5.6.4.7 Change\_Service\_Flow.indication (ASF.indication)

##### 14.5.6.4.7.1 Function

This primitive is used by the QoS management entity in NCMS to inform QoS information. Service flow information is included in CSF.indication of a BS.

##### 14.5.6.4.7.2 Semantics of the service primitive

The parameters of the primitives are as follows:

##### **Change\_Service\_Flow.indication**

```
(
  Transaction ID
  MS ID,
  Service flow ID
  Service flow information
  CS parameter information
)
```

1 )

**Transaction ID**

A unique sequential identifier of the transaction set by the BS

**MS ID**

48-bit unique identifier used by MS.

**Service flow ID**

Unique identifier to identify a service flow

**Service flow information**

Approved complete QoS information of a service flow such as service class name, QoS parameter set type, maximum sustained traffic rate, maximum traffic burst, minimum reserved traffic rate, minimum tolerable traffic rate, tolerate jitter and maximum latency

**CS parameter information**

Approved IP filter rules of a service flow such as packet classification rule and IPv6 flow label

**14.5.6.4.7.3 When generated**

This primitive is generated when the QoS management entity in NCMS informs QoS information of a BS.

**14.5.6.4.7.4 Effect of receipt**

A BS receiving the primitive shall transmit DSC-REQ message following the information provided by this message.

**14.5.6.4.8 Change\_Service\_Flow.response (CSF.response)****14.5.6.4.8.1 Function**

This primitive is used by a BS to respond the CSF.indication to the QoS management entity in NCMS.

**14.5.6.4.8.2 Semantics of the service primitive**

The parameters of the primitives are as follows:

**Change\_Service\_Flow.response**

1 (

Transaction ID

Service flow ID

Service flow information

CS parameter information

Service flow error parameter information

2 )

**Transaction ID**

A unique sequential identifier of the transaction set by the BS

**Service flow ID**

Unique identifier to identify a service flow

**Service flow information**

Approved complete QoS information of a service flow such as service class name, QoS parameter set type, maximum sustained traffic rate, maximum traffic burst, minimum reserved traffic rate, minimum tolerable traffic rate, tolerate jitter and maximum latency

**CS parameter information**

Approved IP filter rules of a service flow such as packet classification rule and IPv6 flow label

## Service flow error parameter information

Failed reason and every specific failed QoS parameter if a CSF request is rejected

### 14.5.6.4.8.3 When generated

This primitive is generated when a BS receives a DSC-RSP message.

### 14.5.6.4.8.4 Effect of receipt

This primitive informs the result of the service flow creation of the QoS management entity in NCMS.

### 14.5.6.4.9 Delete\_Service\_Flow.request (DSF.request)

#### 14.5.6.4.9.1 Function

This primitive is used by a BS to inform QoS information from an MS of the QoS management entity in NCMS.

#### 14.5.6.4.9.2 Semantics of the service primitive

The parameters of the primitives are as follows:

#### Delete\_Service\_Flow.request

```
(
  Transaction ID
  Service flow ID
)
```

#### Transaction ID

A unique sequential identifier of the transaction set by the BS

#### Service flow ID

Unique identifier to identify a service flow

### 14.5.6.4.9.3 When generated

This primitive is generated when a BS receives a DSD-REQ message.

### 14.5.6.4.9.4 Effect of receipt

The QoS management entity in NCMS shall respond to this primitive by sending Delete\_Service\_Flow.confirm. The management entity for service flows delete assigned resources for service flow ID.

### 14.5.6.4.10 Delete\_Service\_Flow.confirm (DSF.confirm)

#### 14.5.6.4.10.1 Function

This primitive is used by the QoS management entity in NCMS to response the DSF.request from a MS.

#### 14.5.6.4.10.2 Semantics of the service primitive

The parameters of the primitives are as follows:

**Delete\_Service\_Flow.confirm**

```
(
  Transaction ID
  Service flow ID
  Service flow error parameter information
)
```

**Transaction ID**

A unique sequential identifier of the transaction set by the BS

**Service flow ID**

Unique identifier to identify a service flow

**Service flow error parameter information**

Failed reason and every specific failed QoS parameter if a DSF request is rejected

**14.5.6.4.10.3 When generated**

This primitive is generated when the QoS management entity in NCMS responds to Delete\_Service\_Flow.request primitive.

**14.5.6.4.10.4 Effect of receipt**

This primitive informs the result of the service flow deletion to a BS. A BS receiving the primitive shall transmit DSD-RSP message following the information provided by this message.

**14.5.6.4.11 Delete\_Service\_Flow.indication (DSF.indication)****14.5.6.4.11.1 Function**

This primitive is used by the QoS management entity in NCMS to inform QoS information. Service flow ID is included in DSF.indication of a BS.

**14.5.6.4.11.2 Semantics of the service primitive**

The parameters of the primitives are as follows:

**Delete\_Service\_Flow.indication**

```
(
  Transaction ID
  Service flow ID
)
```

**Transaction ID**

A unique sequential identifier of the transaction set by the BS

**Service flow ID**

Unique identifier to identify a service flow

**14.5.6.4.11.3 When generated**

This primitive is generated when the QoS management entity in NCMS informs QoS information of a BS.

#### 14.5.6.4.11.4 Effect of receipt

A BS receiving the primitive shall transmit DSD-REQ message following the information provided by this message.

#### 14.5.6.4.12 Delete\_Service\_Flow.response (DSF.response)

##### 14.5.6.4.12.1 Function

This primitive is used by a BS to respond the DSF.indication to the QoS management entity in NCMS.

##### 14.5.6.4.12.2 Semantics of the service primitive

The parameters of the primitives are as follows:

##### **Delete\_Service\_Flow.response**

```
(
  Transaction ID
  Service flow ID
  Service flow error parameter information
)
```

##### **Transaction ID**

A unique sequential identifier of the transaction set by the BS

##### **Service flow ID**

Unique identifier to identify a service flow

##### **Service flow error parameter information**

Failed reason and every specific failed QoS parameter if a DSF request is rejected

##### 14.5.6.4.12.3 When generated

This primitive is generated when a BS receives a DSD-RSP message.

##### 14.5.6.4.12.4 Effect of receipt

This primitive informs the result of the service flow deletion of the QoS management entity in NCMS. The QoS management entity in NCMS deletes assigned resources for service flow ID.

#### 14.5.6.5 Managing Connection Resources

<Section Note: Managing constraints on the CID and SFID related resources. Recommendations on when CIDs could be recycled etc.>

#### 14.5.6.6 Managing Multicast Broadcast Services

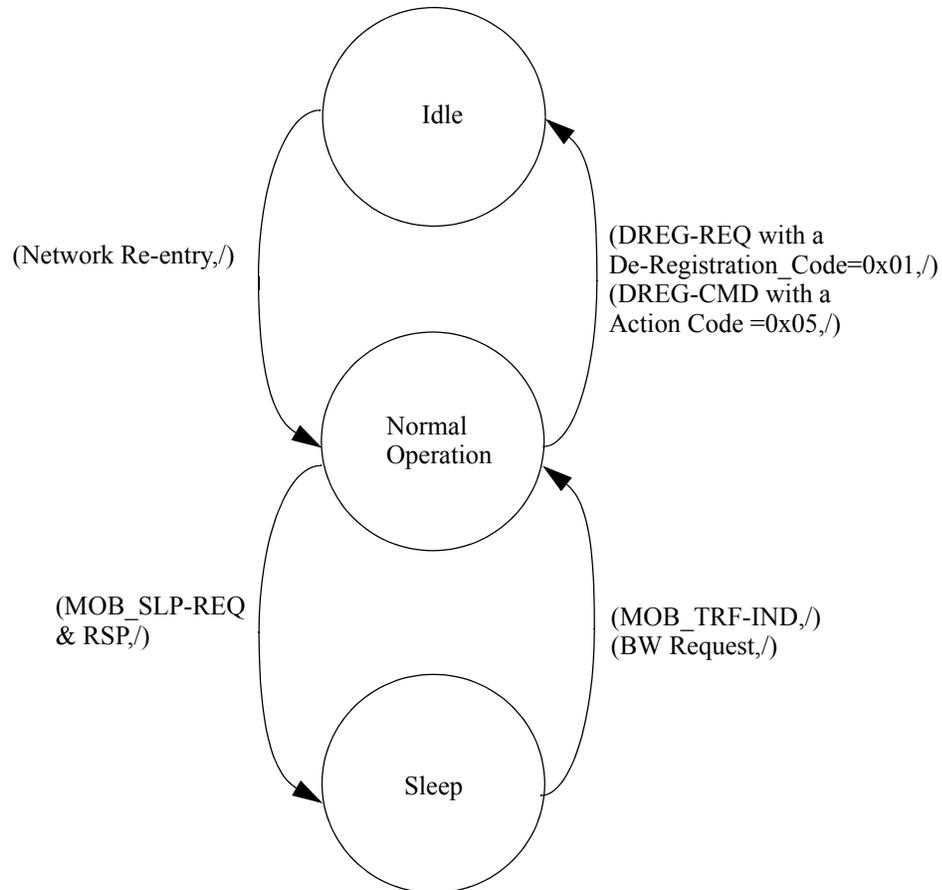
<Section Note: >

#### 14.5.7 Subscriber Mode Management

The following informative subsection describes subscriber mode management.

### 14.5.7.1 Managing Device States

In Normal Operation, an MS transmits and receives packets to/from a BS. Currently, two subscriber modes are defined, i.e., Sleep and Idle Modes. Sleep Mode is intended to minimize an MS power usage and decrease usage of serving BS air interface resources by pre-negotiated periods of absence from the serving BS air interface. Idle Mode allows an MS to become periodically available for DL broadcast traffic without registration at a specific BS as the MS traverses an air link environment populated by multiple BSs, and thus, allows the MS to conserve power and operational resources.



**Figure 321—Subscriber Mode transition diagram at MS and BS**

Sleep Mode operation is defined between an MS and a BS only, and an NCMS does not need to manage Sleep Mode of subscriber. Thus, both an MS and a BS manage all Normal Operation, Sleep Mode, and Idle Mode of subscriber. On the other hand, an NCMS manages Normal Operation and Idle Mode. In this contribution, Subscriber Mode transitions at an MS, a BS, and an NCMS are modeled and described, as shown in Figure 321 and Figure 322.

Figure 321 shows Subscriber Mode transition diagram at both an MS and a BS. Subscriber Mode at both an MS and a BS changes from Normal Operation to Idle Mode when the MS issues an MS De-registration Request (DREG-REQ) message with De-Registration\_Request\_Code=0x01 or the BS issues an De-register Command (DREG-CMD) message with Action Code = 0x05. Then, the MS stays at Idle Mode and updates its location when the paging group changes. The Subscriber Mode returns back to Normal Operation from Idle Mode after completing Network re-entry. Transition from Normal Operation to Sleep Mode is per-

1 formed after an MS successfully exchanges Sleep Request (MOB\_SLP-REQ) and Sleep Response  
 2 (MOB\_SLP-RSP) messages with a BS. If there is any DL traffic toward an MS from a BS, MOB\_TRF-IND  
 3 is broadcast to the MS from the BS and Subscriber Mode of the MS and the BS changes from Sleep Mode to  
 4 Normal Operation. If there is any UL traffic from an MS, Bandwidth Request (BW Request) is sent to the  
 5 serving BS from the MS and Subscriber Mode of the MS and the BS changes from Sleep Mode to Normal  
 6 Operation, too.  
 7  
 8

9  
 10 Figure 322 shows Subscriber Mode transition diagram at an NCMS with service primitives related with the  
 11 Subscriber Mode Idle transition. Subscriber Mode transition from Normal Operation to Idle Mode is performed  
 12 by exchanging Idle\_mode\_initiation.request and Idle\_mode\_initiation.response between a BS and an NCMS  
 13 after successful DREG-REQ message with De-Registration\_Request\_Code=0x01 or DREG-CMD message  
 14 with Action Code = 0x05 between an MS and a BS, where Idle\_mode\_initiation.request and  
 15 Idle\_mode\_initiation.response are defined in 14.5.11.1 and 14.5.11.2, respectively. Subscriber Mode transition  
 16 from Idle Mode to Normal Operation is initiated after exchanging Paging\_announce, Idle\_ReEntry.indi-  
 17 cation, and Idle\_ReEntry.confirmation between a BS and an NCMS, where Paging\_announce,  
 18 Idle\_ReEntry.indication, and Idle\_ReEntry.confirmation are defined in 14.5.11.3, 14.5.11.4, and 14.5.11.5,  
 19 respectively.  
 20  
 21  
 22  
 23  
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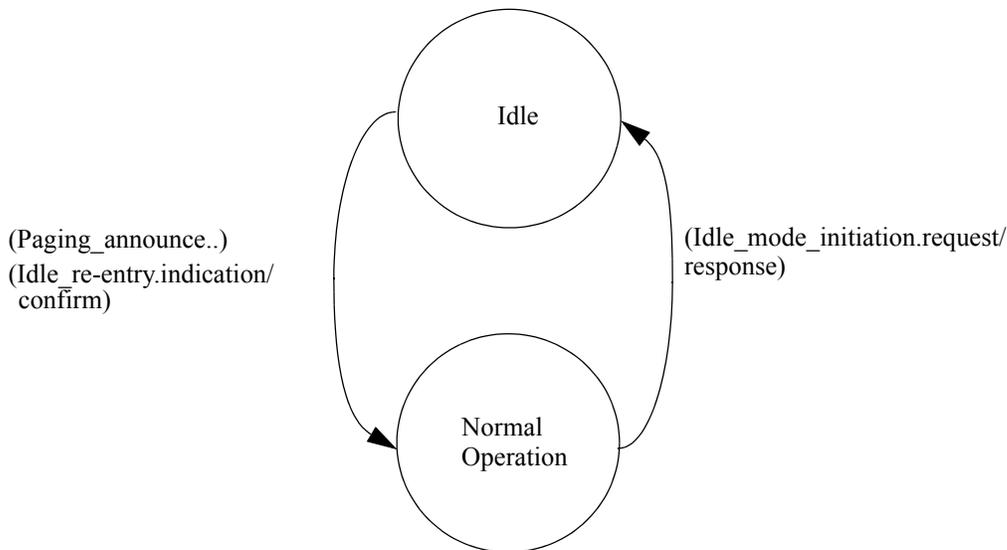


Figure 322—Subscriber Mode transition diagram at NCMS

## 14.5.8 Roaming Management

## 14.5.9 Mobility and Handover Management

### 14.5.9.1 Mobility Parameters

<Section Note: Requirements for different kinds of handoff (Hard-Handoff, FBSS, SHO). Thresholds etc.>

### 14.5.9.1.1 Handover Context for Connections

Handover context for connections is the set of information which is shared between the serving BS and the target BS for re-establishment of the transport connections during HO. HO context is consisted of the following information.

#### General MS Information

It is the information required to identify the MS. IP address and MAC address of the MS can be included in this information.

#### MS Capability Information

It is the information about MS capabilities which need to be negotiated with the serving BS at the initial network entry.

#### Security Information

It is the information negotiated during PKM procedure. If the MS and the target BS can derive the AK for them without the help of the serving BS, AK key may be excluded from this information.

#### Service Flow Information

It is the information negotiated during DSx-related procedure.

#### MAC state Information

It is the information used to maintain MAC state machine and to manage MAC PDU transmission.

For the re-establishment of connections at target BS during HO, serving BS shall provide target BS with the HO context through the mobility management entity in NCMS using HO primitives. If the target BS can not re-use some information in the HO context for restoring the former MAC state or re-establishing connections, the mobility management entity in NCMS may exclude the information from the shared HO context.

### 14.5.9.1.2 Neighbor BS List Management

#### 14.5.9.1.2.1 Primitives for managing Neighbor BS List

##### 14.5.9.1.2.1.1 NBR\_BS\_Update.request

###### 14.5.9.1.2.1.1.1 Function

This primitive is issued by a mobility management entity in NCMS to inform BS of neighbor BS list and channel information for those neighbor BSs.

###### 14.5.9.1.2.1.1.2 Semantics of the service primitive

The parameters of the primitive are as follow:

#### NBR\_BS\_Update.request

```
(
  Number of neighbor BSs,
  List of neighbor BS information
)
```

#### Number of neighbor BSs

The number of the current active neighbor BSs

#### List of neighbor BS information

This parameter includes channel information for neighbor BSs. BS ID and UCD/DCD parameters per each neighbor BS may be included in this parameter

1  
2  
3  
4 **14.5.9.1.2.1.1.3 When generated**

5  
6 This primitive is generated when the mobility management entity in NCMS recognizes that initialization of  
7 BS is completed or there are some changes in neighbor BS list or in channel information of one of neighbor  
8 BSs.  
9

10  
11 **14.5.9.1.2.1.1.4 Effect of receipt**

12  
13 A BS receiving NBR\_BS\_Update.request shall update internal information about neighbor BSs and adopt  
14 the information into subsequent MOB\_NBR-ADV messages. The BS also shall response to this primitive by  
15 sending NBR\_BS\_update.response.  
16

17  
18  
19  
20 **14.5.9.1.2.1.2 NBR\_BS\_Update.response**

21  
22 **14.5.9.1.2.1.2.1 Function**

23  
24  
25 This primitive is issued by BS to response to NBR\_BS\_Update.request.  
26

27  
28 **14.5.9.1.2.1.2.2 Semantics of the service primitive**

29  
30 The parameters of the primitive are as follow:

31  
32 **NBR\_BS\_Update.response**  
33 (  
34 Result  
35 )  
36  
37

38  
39  
40 **14.5.9.1.2.1.2.3 When generated**

41  
42 This primitive is generated when BS receives NBR\_BS\_Update.request.  
43

44  
45 **14.5.9.1.2.1.2.4 Effect of receipt**

46  
47 The mobility management entity in NCMS shall inform the neighbor BS of the updating result.  
48

49  
50 **14.5.9.1.2.1.3 NBR\_BS\_Update.indication**

51  
52 **14.5.9.1.2.1.3.1 Function**

53  
54 This primitive is issued by BS to inform the mobility management entity in NCMS of changes in UCD and  
55 DCD.  
56  
57

58  
59  
60 **14.5.9.1.2.1.3.2 Semantics of the service primitive**

61  
62 The parameters of the primitive are as follow:

63  
64 **NBR\_BS\_Update.indication**  
65

```

1      (
2          DCD configuration change count,
3          UCD configuration change count,
4          DCD parameters,
5          UCD parameters
6      )
7
8
9

```

#### 14.5.9.1.2.1.3.3 When generated

This primitive is generated when one or more parameters in DCD and UCD are changed to inform mobility management entity of such changes.

#### 14.5.9.1.2.1.3.4 Effect of receipt

If mobility management entity in NCMS receives this primitive, it shall inform neighbor BSs of those changes.

#### 14.5.9.1.2.1.4 NBR\_BS\_Update.confirmation

##### 14.5.9.1.2.1.4.1 Function

This primitive is issued by mobility management entity in NCMS to respond to NBR\_BS\_Update.indication.

##### 14.5.9.1.2.1.4.2 Semantics of the service primitive

The parameters of the primitive are as follow:

```

34      NBR_BS_Update.confirmation
35      (
36          Result
37      )
38
39

```

##### 14.5.9.1.2.1.4.3 When generated

This primitive is generated when mobility management entity receives NBR\_BS\_Update.indication.

##### 14.5.9.1.2.1.4.4 Effect of receipt

If the value of result field in NBR\_BS\_Update.confirmation is not success, then BS shall retransmit NBR\_BS\_Update.indication within pre-defined number of times.

### 14.5.9.1.3 Connection Management during handover

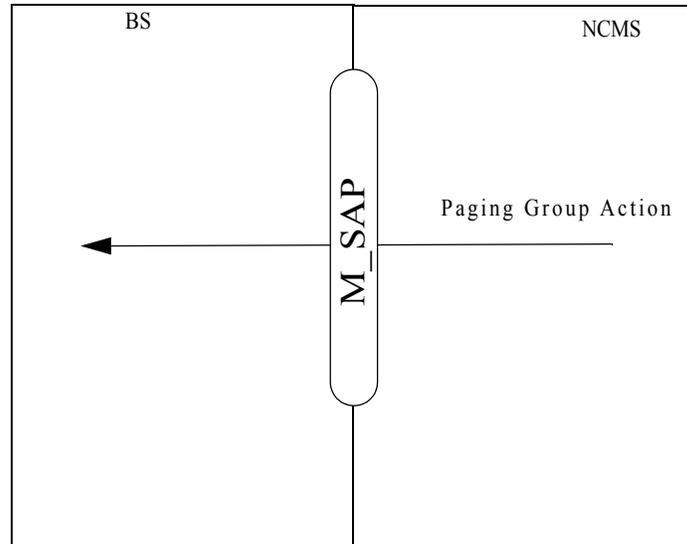
## 14.5.9.2 Paging Management

### 14.5.9.2.1 Paging Group Management

#### 14.5.9.2.1.1 Paging Group Management Procedure

The location information of an idle MS is managed by the unit of Paging Group in Paging Service of an NCMS, and paging messages are sent to all the BSs within the called MS's Paging Group. The NCMS

1 should divide the whole service area into multiple Paging Groups and notify this Paging Group information  
 2 to all the BSs within the service area, where a BS may be a member of one or more Paging Groups. In this  
 3 contribution, we propose service primitive for Paging Group Action which is exchanged through Manage-  
 4 ment Service Access Point (M-SAP) of Management Plane specified in IEEE 802.16g baseline document.  
 5 Paging Group Action is performed by Paging Service of an NCMS, as shown in Fig. 2  
 6



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36  
37 **Figure 323—ASF indication and ASF response primitives flow**

#### 38 39 40 41 42 43 44 **14.5.9.2.1.2 Service Primitive for Paging Group Management**

##### 45 46 47 **14.5.9.2.1.2.1 Paging Group Action**

###### 48 49 **14.5.9.2.1.2.1.1 Function**

50  
51 This primitive is issued by an NCMS to inform a BS of Paging Group ID(s) of the BS.

###### 52 53 **14.5.9.2.1.2.1.2 Semantics of the service primitive**

54  
55 The parameter of the primitive is as follows:

###### 56 57 **Paging Group Action**

58  
59 (  
60     Paging Controller ID  
61     Number of Paging Group IDs  
62     Paging Group ID List  
63  
64  
65

1 )

**Paging Controller ID**

2  
3 The Paging Controller ID is a logical network identifier for the serving BS or other network  
4 entity retaining MS service and operational information and/or administering paging activity  
5 for the MS while in Idle Mode.  
6

**Number of Paging Group IDs**

7  
8 The number of Paging Group IDs in this primitive.  
9

**Paging Group ID List**

10 List of Paging Group IDs of a BS (eg, Paging Group ID1, Paging Group ID2, . . . , Paging  
11 Group IDn)  
12  
13

**14.5.9.2.1.2.1.3 When generated**

14  
15 This primitive is generated when an NCMS initializes or updates paging group configuration information  
16 and notifies the information to a BS.  
17  
18

**14.5.9.2.1.2.1.4 Effect of receipt**

19  
20 When the BS receives this primitive, it updates its Paging Group ID information according to the delivered  
21 Paging Group ID List, and broadcasts the updated Paging Group ID information in MOB\_NBR-ADV,  
22 DREG-CMD, MOB\_PAG-ADV, DCD, RNG-RSP messages.  
23  
24  
25  
26  
27  
28

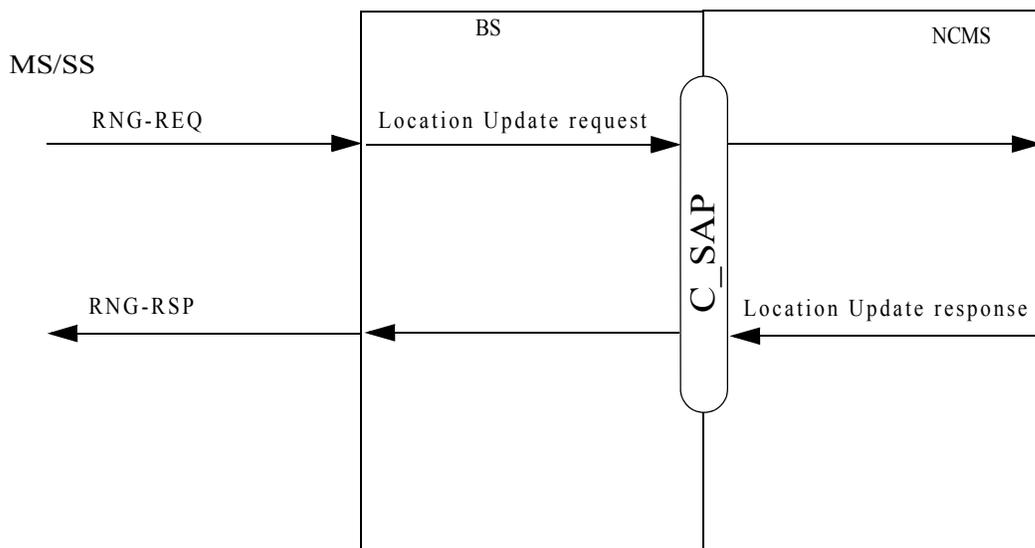
**14.5.9.2.2 Paging Procedure****14.5.9.3 Location Management****14.5.9.3.1 Location Update Procedure**

29  
30 Location management of an MS is performed by mobility management service of an NCMS. An MS in idle  
31 mode performs Location Update in order to inform an NCMS of its current location information, i.e., paging  
32 group, and this information is used to page cells within paging group of the called MS when there is pending  
33 DL traffic toward the MS.  
34  
35  
36

37 Location Update is performed if any of Location Update conditions is met and there are currently four Loca-  
38 tion Update conditions defined: Zone Update, Timer Update, Power Down Update, and MAC Hash Skip  
39 Threshold Update. In Zone Update, the MS shall perform Location Update process when the MS detects a  
40 change in paging group by comparing the paging group identifier, PG\_ID, stored in the MS with that of  
41 transmitted by the preferred BS in the DCD message or MOB\_PAG-ADV broadcasting message. In Timer  
42 Update, MS shall periodically perform Location Update process prior to the expiration of the idle mode  
43 timer. In Power Down Update, the MS shall attempt to complete a Location Update once as part of its  
44 orderly power down procedure. In MAC Hash Skip Threshold update, the MS shall perform Location  
45 Update process when the MS MAC hash skip counter exceeds MAC hash skip threshold.  
46  
47  
48  
49  
50  
51  
52  
53  
54

55 All the above Location Updates are realized by Ranging request/response (RNG-REQ/RSP) message  
56 between an MS and a BS, and Location Update request and Location Update response service primitives are  
57 defined between a BS and an NCMS to perform Location Update.  
58

59  
60 Figure 324 shows service primitives for Location Update between a BS and an NCMS.  
61  
62  
63  
64  
65



25  
26  
27  
28  
29

Figure 324— Location Update Primitives

30  
31

### 14.5.9.3.2 Service Primitives for Location Update

32  
33

#### 14.5.9.3.2.1 Location Update request

34  
35

##### 14.5.9.3.2.1.1 Function

36  
37  
38  
39  
40

This primitive is issued by a BS to inform a management entity of Mobility Management Services in an NCMS that an MS requests to initiate Location Update.

41  
42

##### 14.5.9.3.2.1.2 Semantics of the service primitive

43  
44

The parameters of the primitives are as follows:

45  
46

##### Location Update request

47  
48  
49  
50  
51  
52  
53  
54  
55  
56

```
(
  MS MAC Address
  BS ID
  Paging Controller ID
  Paging Group ID
  MAC Hash Skip Threshold
  Power Down Indicator
)
```

57  
58

##### MS MAC Address

59  
60

48-bit MAC address which will identify MS

61

##### BS ID

62

Identifier of serving BS

63

##### Paging Controller ID

64  
65

The Paging Controller ID is a logical network identifier for the serving BS or other network

entity retaining MS service and operational information and/or administering paging activity for the MS while in Idle Mode.

**Paging Group ID**

One or more logical affiliation groupings of BS

**MAC Hash Skip Threshold**

Maximum number of successive MOB\_PAG-ADV messages that may be sent from a BS without individual notification for an MS, including MAC address hash of an MS for which Action Code is 00, 'No Action Required'.

**Power Down Indicator**

Indicates the MS is currently attempting to perform Location Update due to power down.

**14.5.9.3.2.1.3 When generated**

This primitive is generated when the BS receives RNG-REQ message with Paging Controller ID and Ranging Purpose Indication with bit #1 set to 1, MAC Hash Skip Threshold, or Power Down Indicator.

**14.5.9.3.2.1.4 Effect of receipt**

This primitive shall be generated on BS side and a management entity of Mobility Management Services shall respond to this primitive by sending Location Update response.

**14.5.9.3.2.2 Location Update response**

**14.5.9.3.2.2.1 Function**

This primitive is issued by the NCMS to respond to Location Update request from the BS

**14.5.9.3.2.2.2 Semantics of the service primitive**

The parameters of the primitives are as follows:

**Location Update response**

(  
 MS MAC Address  
 Location Update Result  
 Paging Information  
 Paging Controller ID  
 MAC Hash Skip Threshold  
 Power Down Response  
 )

**MS MAC Address**

48-bit MAC address which will identify MS

**Location Update Result**

Response to Location Update Request:

0b00=Failure of Idle Mode Location Update. The MS shall perform Network Re-entry from Idle Mode

0b01=Success of Idle Mode Location Update

0b10, 0b11: Reserved

**Paging Information**

New Paging Information assigned to MS. Paging Information shall only be included if Location Update Response=0x01 and if Paging Information has changed. The Paging Information TLV defines the Paging Group ID, PAGING\_CYCLE and PAGING OFFSET parameters to be

1 used by the MS in IDLE mode. PAGING\_CYCLE is the cycle in which the paging message is  
2 transmitted within the paging group. PAGING\_OFFSET determines the frame within the cycle  
3 in which the paging message is transmitted and it must be smaller than PAGING\_CYCLE  
4 value. Paging Group ID specifies the paging group the MS is assigned to.

#### 6 **Paging Controller ID**

7 Paging Controller ID is a logical network identifier for the serving BS or other network entity  
8 retaining MS service and operational information and/or administering paging activity for the  
9 MS while in Idle Mode. Paging Controller ID shall only be included if Location Update  
10 Response=0x01 and if Paging Controller ID has changed.

#### 12 **MAC Hash Skip Threshold**

13 Maximum number of successive MOB\_PAG-ADV messages that may be sent from a BS with-  
14 out individual notification for an MS, including MAC address hash of an MS for which Action  
15 Code for the MS is 00,'No Action Required'. If BS does not include this TLV item in the RNG-  
16 RSP message, any BS may omit MAC Address Hash of the MS with Action Code 00,'No  
17 Action Required' from any MOB\_PAG-ADV message.

#### 19 **Power Down Response**

20 Indicates the MS's Power Down Location Update result.  
21 0x00= Failure of Power Down Information Update.  
22 0x01= Success of Power Down Information Update.

#### 25 **14.5.9.3.2.2.3 When generated**

26  
27 This primitive is generated at an NCMS in order to request a BS to issue a RNG-RSP message.

#### 30 **14.5.9.3.2.2.4 Effect of receipt**

31  
32 A BS receiving Location Update response shall transmit RNG-RSP message with the appropriate param-  
33 eters settings.  
34

#### 38 **14.5.9.4 MS Handover Management**

39  
40 <Section Note: How an MS handles its handover functions>

#### 43 **14.5.9.5 Inter BS Handover Management**

44  
45 <Section Note: How a BS handles its handover functions with neighboring BSes>

#### 48 **14.5.9.6 Macro Diversity Management**

49  
50 <Section Note: How a BS along with the NCMS entities handles macro diversity>

#### 52 **14.5.9.7 Handover Control Protocol Procedures**

##### 55 **14.5.9.7.1 HO Control Primitives**

56  
57 The HO Control Primitives are a set of primitives for supporting HO procedure between BS and NCMS.  
58 They are defined for access to the Mobility Control entity to support handovers.

##### 61 **14.5.9.7.1.1 HO request**

62  
63 This primitive is used by a serving BS to inform the mobility control entity in NCMS of an incoming HO  
64 request from an MS. The following parameters are included in this primitive.  
65

**Serving BS ID**

Base station unique identifier (Same number as that broadcasted on the DL-MAP message).

**MS ID**

48-bit unique identifier used by MS.

**HO Type**

Indication of HO types; HO or SHO/FBSS.

**Mode**

Various modes in Anchor BS update or Active Set Update.

**Candidate target BS list**

This is the list of BSes which are recommended for a target BS or an active BS by the MS. Additional HO quality information such as Service Level Prediction also can be included in this list.

**Service flow Information**

Information of all the service flows that have been established between the MS and the serving BS.

**CS parameter information**

Approved IP filter rules of a service flow such as packet classification rule and IPv6 flow label.

**14.5.9.7.1.2 HO indication**

This primitive is used by the mobility control entity in NCMS to inform target BSes of the pending HO. It delivers the following parameters.

**Serving BS ID**

Base station unique identifier (Same number as that broadcasted on the DL-MAP message)

**MS ID**

48-bit unique identifier used by MS

**HO Type**

Indication of HO types; HO or SHO/FBSS

**Mode**

Various modes in Anchor BS update or Active Set Update

**Service flow Information**

Information of all the service flows that have been established between the MS and the serving BS

**HO Quality Information**

Information related with quality of HO procedure; Service Level Prediction, HO Optimization Flag, Arrival Time Difference, etc.

**CS parameter information**

Approved IP filter rules of a service flow such as packet classification rule and IPv6 flow label

**14.5.9.7.1.3 HO response**

The Mobility Control entity in NCMS responds to the serving BS with the list of recommended target BSes. This primitive is always sent in reply to the HO request primitive.

The following parameters are included in this primitive.

**MS ID**

48-bit unique identifier used by MS

**HO Type**

Indication of HO types; HO or SHO/FBSS

**Mode**

Various modes in Anchor BS update or Active Set Update

**Recommended target BS list**

1 The list must be a subset of the candidate target BS list from the corresponding HO request.  
 2 The recommended target BS list is to be delivered to the MS in the MOB\_BSHO-RSP. The  
 3 BSeS in the list may be the candidate target BSeS for HO or an Anchor BS or Active BSeS for  
 4 SHO/FBSS according to the value of HO type and Mode. MS Access Information, Newly Allo-  
 5 cation Information, and HO Quality Information can be included in this list  
 6

#### 7 8 **14.5.9.7.1.4 HO confirmation** 9

10 This primitive is used by the target BS to responds to the HO indication primitive from the serving BS or the  
 11 mobility control entity in NCMS. It delivers the following parameters.  
 12

##### 13 14 **Target BS ID**

15 Base station unique identifier of the target BS

##### 16 17 **MS ID**

18 48-bit unique identifier used by MS

##### 19 20 **Result Flag**

##### 21 22 **HO Type**

23 Indication of HO types; HO or SHO/FBSS

##### 24 25 **Mode**

26 Various modes in Anchor BS update or Active Set Update

##### 27 28 **MS Access Information**

29 Information needed by MS to access the target BS; HO ID, CQI CH Information, HO Authori-  
 30 zation Policy Information

##### 31 32 **Newly Allocated Information**

33 Newly allocated information for the MS or each service flow; SAID, CID

##### 34 35 **HO Quality Information**

36 Information related with quality of HO procedure; HO Optimization Flag, Service Level Pre-  
 37 diction  
 38

#### 39 40 **14.5.9.7.1.5 HO start** 41

42 In case of HO, this primitive is used to indicate the starting of the actual HO. In case of SHO/FBSS, it can be  
 43 used to update Anchor BS or to add a new Active BS to the current Active set. Both of the serving BS and  
 44 the mobility control entity in NCMS can use this primitive to inform the target BS or the mobility control  
 45 entity in NCMS of the starting of the actual HO. The following parameters are included in this primitive.  
 46

##### 47 48 **MS ID**

49 48-bit unique identifier used by MS

##### 50 51 **HO Type**

52 Indication of HO types; HO or SHO/FBSS

##### 53 54 **Mode**

55 Various modes in Anchor BS update or Active Set Update

##### 56 57 **Target BS ID**

58 Base station unique identifier to which the MS attempts the actual HO  
 59

#### 60 61 **14.5.9.7.1.6 HO cancel** 62

63 In case of HO, this primitive indicates the cancellation of the pending HO. In case of SHO/FBSS, it can be  
 64 used to cancel anchor BS update or Active set update, or to remove a target BS from the current active set.  
 65 Both of the serving BS and the mobility control entity in NCMS can use this primitive. This primitive con-  
 66 veys the following parameters.

##### 67 68 **MS ID**

69 48-bit unique identifier used by MS

**HO Type**

Indication of HO type; HO and SHO/FBSS

**Mode**

It is valid for SHO/FBSS and cancels Anchor BS update or Active set update.  
In addition, it may indicate removal of the target BS from the current active set.

**14.5.9.7.1.7 HO Directive**

This primitive is generated by the Mobility Control entity in NCMS to induce the handover of a particular MS. Transmission of MOB\_BSHO-REQ message is triggered by this primitive.

**MS ID**

48-bit unique identifier used by MS

**HO Type**

Indication of HO types; HO or SHO/FBSS

**Mode**

Various modes in Anchor BS update or Active Set Update

**Recommended target BS list**

This is the list of recommended target BSes by the mobility control entity. The BSes in the list may be the candidate target BSes for HO or an Anchor BS or Active BSes for SHO/FBSS according to the value of HO type and Mode. MS Access Information, Newly Allocation Information, and HO Quality Information can be included in this list

**14.5.9.7.1.8 Scanning.request****14.5.9.7.1.8.1 Function**

This primitive is issued by the mobility management entity in NCMS to request radio signal information of MSs.

**14.5.9.7.1.8.2 Semantics of the service primitive**

The parameters of the primitive are as follow:

**Scanning.request**

(  
Number of MS,  
List of MS ID  
)

**Number of MS**

Number of MSs

**List of MS ID**

The list of MS ID

**14.5.9.7.1.8.3 When generated**

This primitive is generated when the mobility management entity in NCMS decides that BS-initiated HO should be occurred because the BS is about to be overloaded.

#### 14.5.9.7.1.8.4 Effect of receipt

The BS shall response to the scanning.request primitive using scanning.response primitive.

#### 14.5.9.7.1.9 Scanning.response

##### 14.5.9.7.1.9.1 Function

This primitive is issued by the BS to respond to scanning.request

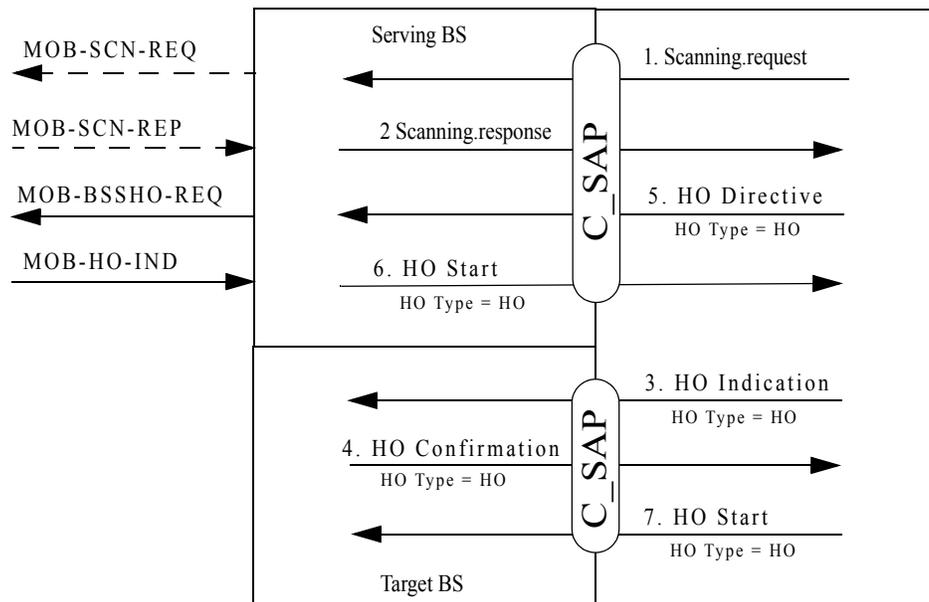


Figure 325—Example Primitive Flow of HO initiated by BS

##### 14.5.9.7.1.9.2 Semantics of the service primitive

The parameters of the primitive are as follows:

###### Scanning.confirmation

```
(
  Number of MS,
  List of MS ID,
  List of Signal information
)
```

###### Number of MS

Number of MSs

###### List of MS ID

The list of MS ID

**List of Signal Information**  
TBD.

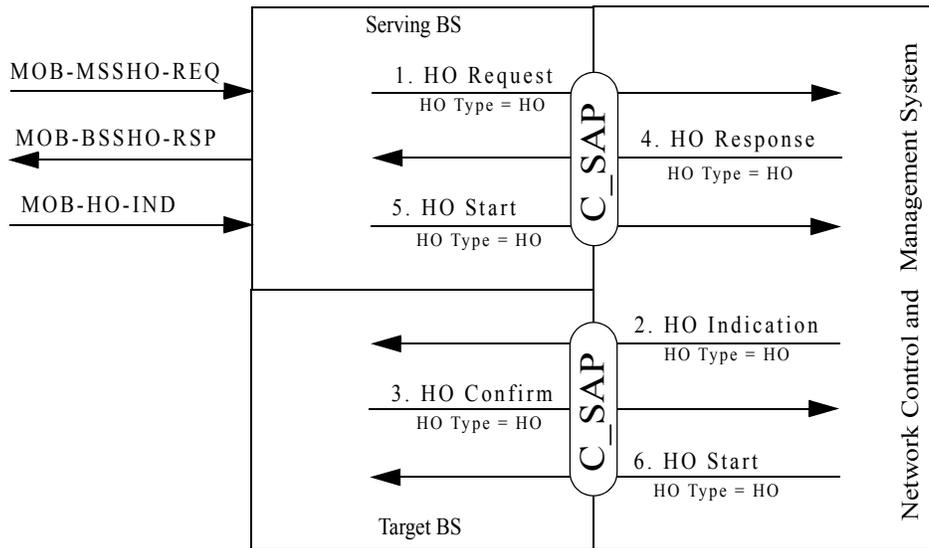
**14.5.9.7.1.9.3 When generated**

This primitive is generated when the receives scanning.request

**14.5.9.7.1.9.4 Effect of receipt**

The mobility management entity in NCMS may decide the specific MS and its potential target BS for BS-initiated HO based on the reported signal quality in the scanning.response primitive.

**14.5.9.7.2 Hard Handoff Procedures**



**Figure 326—Example Primitive Flow of HO Initiated by MS**

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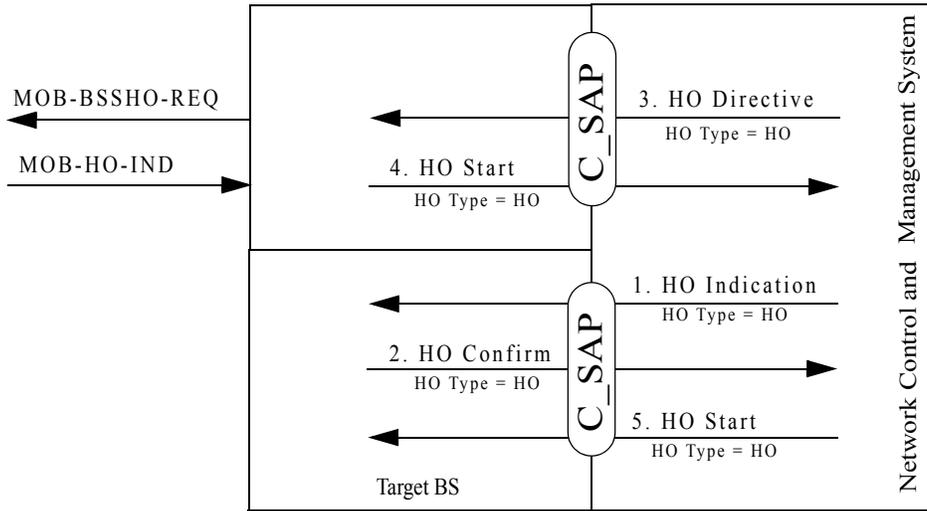


Figure 327—Example Primitive Flow of HO Initiated by BS

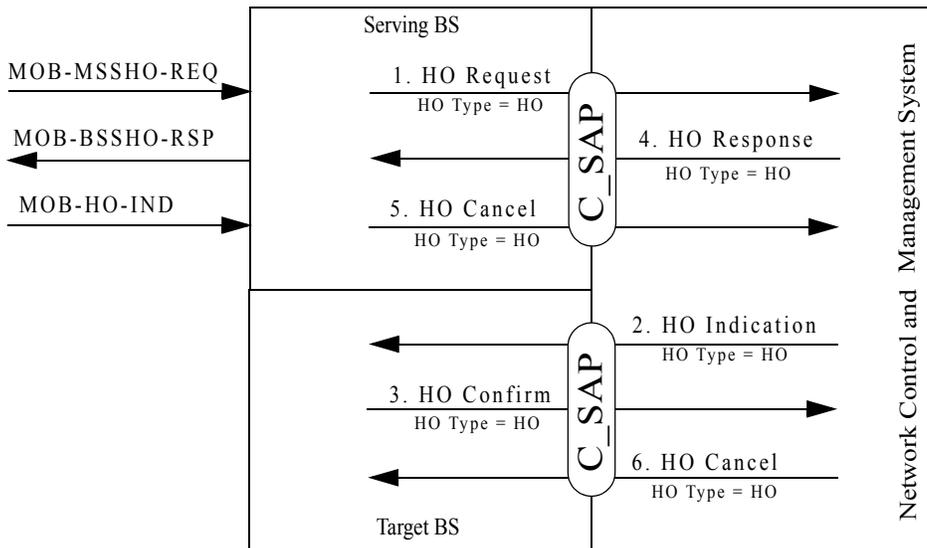


Figure 328—Example Primitive Flow of HO Cancel

14.5.9.7.3 Fast Base Station Switching Procedures

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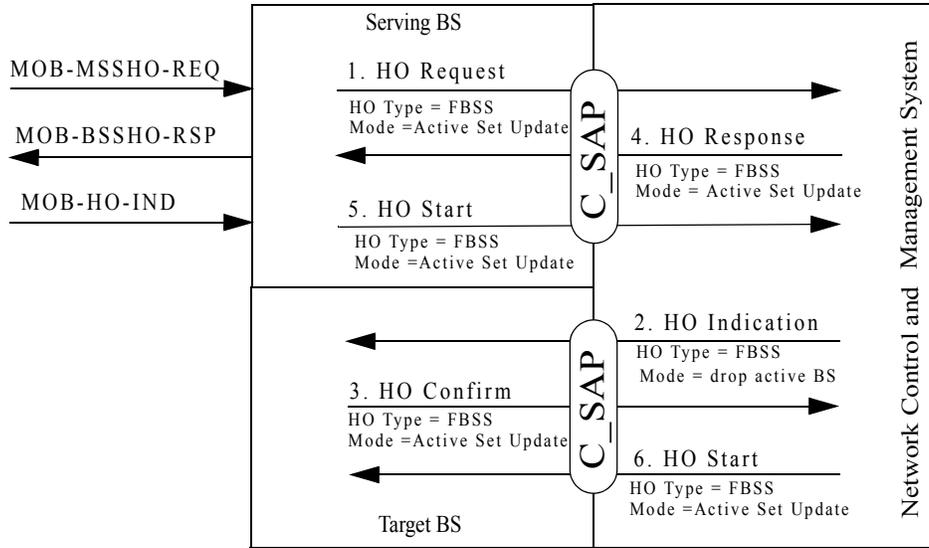


Figure 329—Example Primitive Flow of Active Set Update (Add)

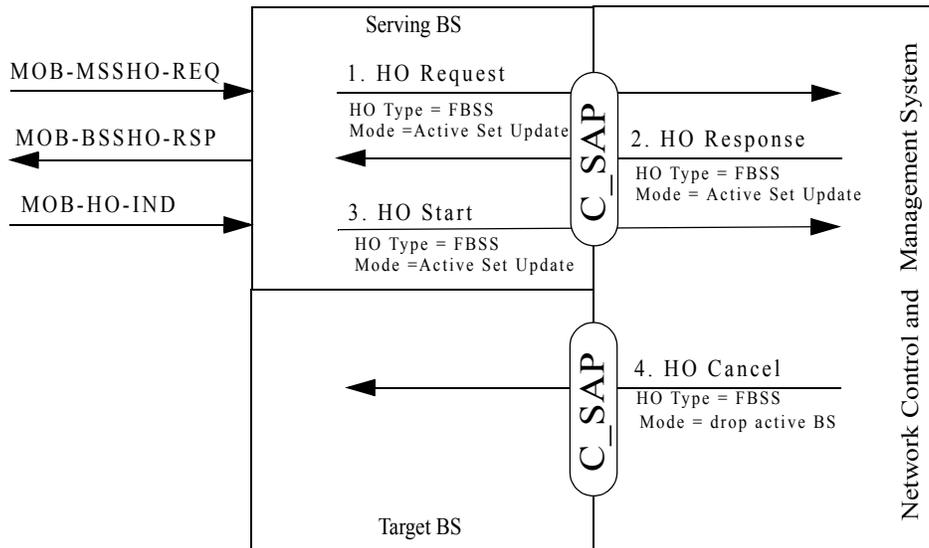


Figure 330—Example Primitive Flow of Active Set Update (Drop)

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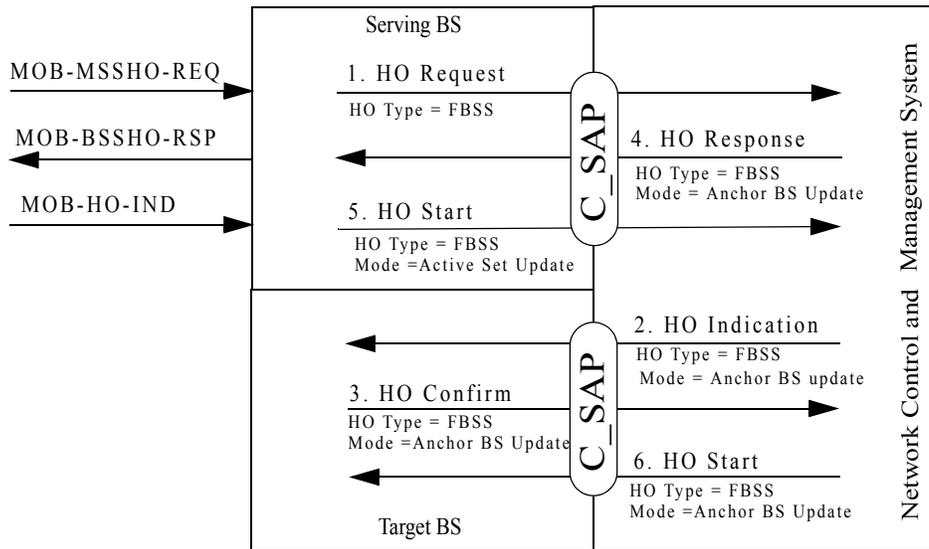


Figure 331—Example Primitive Flow of Anchor BS Update (Using MAC messages)

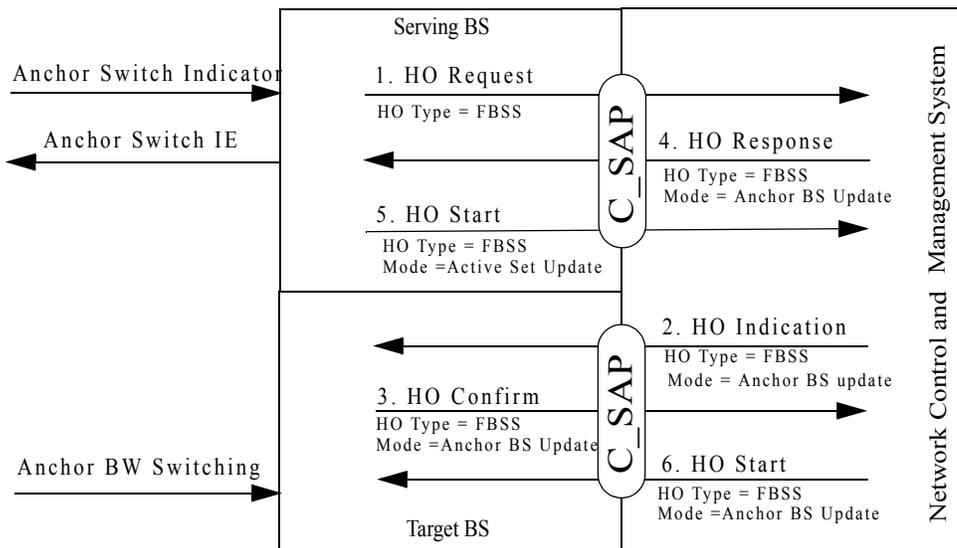


Figure 332—Example Primitive Flow of Anchor BS Update (Using selection feedback mechanism)

#### 14.5.9.7.4 Soft Handoff Procedures

SHO procedures are the same as FBSS procedures except that the primitives may have different parameter values.

#### 14.5.10 Backbone Messages

#### 14.5.11 Interface SAP for Upper Layer Protocols

##### 14.5.11.1 Idle\_Mode\_Initiation.request

###### 14.5.11.1.1 Function

This primitive is issued by BS to inform a management entity of Paging Services in NCMS that an MS requests to initiate Idle Mode.

###### 14.5.11.1.2 Semantics of the service primitive

The parameters of the primitives are as follows:

##### **Idle\_Mode\_Initiation.request**

```
(
  MS MAC Address
  Paging_Cycle_Request
  Idle Mode Retain Information
  MAC Hash Skip Threshold
  Service Flow parameters
  Service and operational information
)
```

##### **MS MAC Address**

48-bit MAC Address which will identify MS during Idle Mode

##### **Paging\_Cycle\_Request**

Paging Cycle requested by MS

##### **Idle Mode Retain Information**

MS request for Paging Controller retention of network re-entry related MAC management message and MS service and operational information to expedite future Network Re-entry from Idle Mode. (see 6.3.2.3.42.)

##### **MAC Hash Skip Threshold**

Maximum number of successive MOB\_PAG-ADV messages that may be sent from a BS individual notification for an MS, including MS MAC Address Hash of an MS for which Action Code is 0b00, 'No Action Required'.

##### **Service Flow parameters**

Parameters for Service Flow which exists without actually being activated to carry traffic at MS Idle Mode Initialization, e.g. Paging Preference.

##### **Service and operational information**

MS service and operational information associated with MAC state machines, CS classifier information, etc.

### 14.5.11.1.3 When generated

This primitive is generated when a BS receives a DREG-REQ message with Deregisration\_Request\_Code=0x01, “request for MS De-Registration from serving BS and initiation of MS Idle Mode.

### 14.5.11.1.4 Effect of receipt

This primitive shall be generated on BS side and a management entity of Paging Services shall respond to this primitive by sending Idle\_Mode\_Initiation.response.

## 14.5.11.2 Idle\_Mode\_Initiation.response

### 14.5.11.2.1 Function

This primitive is issued by a management entity in Paging Services in NCMS to respond to Idle\_Mode\_Initiation.Request.

### 14.5.11.2.2 Semantics of the Service Primitive

The parameters of the primitives are as follows:

#### Idle\_Mode\_Initiation.response

```
(
Action code
MS MAC Address
Paging Information
Paging Controller ID
Idle Mode Retain Information
MAC Hash Skip Threshold
REQ-duration
)
```

#### Action code

Indicates the value of Action code to be included in DREQ-CMD message. (see Table 55.)

#### MS MAC Address

48-bit MAC Address which will identify MS during Idle Mode

#### Paging Information

Paging Group ID, Paging Cycle, and Paging Offset parameters followed by MS in Idle Mode.

#### Paging Controller ID

A logical network identifier for the serving BS or other network entity retaining MS service and operational information and/or administrating paging activity for the MS while in Idle Mode. Paging Controller ID shall be set to BS ID when a BS is acting as Paging Controller.

#### Idle Mode Retain Information

MS request for Paging Controller retention of network re-entry related MAC management message and MS service and operational information to expedite future Network Re-entry from Idle Mode. (see 6.3.2.3.42.)

#### MAC Hash Skip Threshold

Maximum number of successive MOB\_PAG-ADV messages that may be sent from a BS individual notification for an MS, including MS MAC Address Hash of an MS for which Action Code is 0b00, ‘No Action Required’.

#### REQ-duration

Waiting value for the DREG-REQ message re-transmission (measured in frames).

### 14.5.11.2.3 When generated

This primitive is generated to request a BS to issue a DREG-CMD message.

### 14.5.11.2.4 Effect of receipt

A BS receiving Idle\_Mode\_Initiation.response shall transmit DREG-CMD message with setting each field in accordance with the information elements in this primitive.

## 14.5.11.3 Paging\_Announce

### 14.5.11.3.1 Function

This primitive is issued by a management entity of Paging Services in NCMS to request a BS to page an MS which is supposed to be in Idle Mode by transmitting MOB\_PAG-ADV message including the MS MAC Address Hash and relevant Action Code.

### 14.5.11.3.2 Semantics of the service primitive

The parameters of the primitives are as follows:

#### **Paging\_Announce**

```
(
  MS MAC Address
  Paging Information
  Action Code
)
```

#### **MS MAC Address**

48-bit MAC Address which will identify MS during Idle Mode

#### **Paging Information**

Paging Group ID, Paging Cycle, and Paging Offset parameters followed by MS in Idle Mode.

#### **Action Code**

Action required for MS in Idle Mode (e.g. Network Re-entry, ranging for location update, and so on)

### 14.5.11.3.3 When generated

This primitive is generated by a management entity of Paging Services to request a BS to transmit BS Broadcast Paging message.

### 14.5.11.3.4 Effect of receipt

A BS receiving Paging\_Announce shall transmit MOB\_PAG-ADV message following the information provided by this primitive.

## 14.5.11.4 Idle\_ReEntry.indication

### 14.5.11.4.1 Function

This primitive is issued by a BS to inform a management entity of Paging Services that the specified MS is attempting to re-enter network in response to paging.

#### 14.5.11.4.2 Semantics of the service primitive

The parameters of the primitives are as follows:

##### **Idle\_ReEntry.indication**

```
(
  MS MAC Address
  Paging Information
  Paging Controller ID
  BS ID
)
```

##### **MS MAC Address**

48-bit MAC Address which will identify MS during Idle Mode

##### **Paging Information**

Paging Group ID, Paging Cycle, and Paging Offset parameters followed used by MS in Idle Mode.

##### **Paging Controller ID**

A logical network identifier for the serving BS or other network entity retaining MS service and operational information and/or administrating paging activity for the MS while in Idle Mode. Paging Controller ID shall be set to BS ID when a BS is acting as Paging Controller.

##### **BS ID**

A network identifier of the BS at which the MS is attempting to re-enter network

#### 14.5.11.4.3 When generated

This primitive is generated by a BS when it receives a RNG-REQ message including Ranging Purpose Indication with setting bit #0 to 1 in combination with Paging Controller ID.

#### 14.5.11.4.4 Effect of receipt

Idle\_ReEntry.indication notifies a management entity of Paging Services that the specified MS is attempting to re-enter network through the specified BS in order to receive DL traffic. The management entity also checks MS service and operational information for the MS, and transmits Idle\_ReEntry.confirmation in response to this primitive.

#### 14.5.11.5 Idle\_ReEntry.confirmation

##### 14.5.11.5.1 Function

This primitive is issued by a management entity of Paging Services to confirm the MS Network Re-entry from Idle Mode and provides the BS at which the MS is attempting to re-enter network with service and operational information.

#### 14.5.11.5.2 Semantics of the service primitive

The parameters of the primitives are as follows:

##### **Idle\_ReEntry.confirmation**

```
(
  MS MAC Address
  Service and operational information
)
```

**MS MAC Address**

48-bit MAC Address which will identify MS during Idle Mode

**Service and operational information**

MS service and operational information associated with MAC state machines, CS classifier information, etc.

**14.5.11.5.3 When generated**

This primitive is generated by BS when a RNG-REQ message including Ranging Purpose Indication with setting bit #0 to 1 in combination with Paging Controller ID.

**14.5.11.5.4 Effect of receipt**

BS receiving Idle\_ReEntry.confirmation transmits RNG-RSP message including HO Process Optimization which is based on the service and operational information in this primitive.

**14.5.11.6 Idle\_ReEntry\_Complete****14.5.11.6.1 Function**

This primitive is issued by a BS to inform a management entity of Paging Services that an MS has re-entered network successfully.

**14.5.11.6.2 Semantics of the service primitive**

The parameters of the primitives are as follows:

**Idle\_ReEntry.confirmation**

```
(
MS MAC Address
Paging Controller ID
BS ID
)
```

**MS MAC Address**

48-bit MAC Address which will identify MS during Idle Mode

**Paging Controller ID**

A logical network identifier for the serving BS or other network entity retaining MS service and operational information and/or administrating paging activity for the MS while in Idle Mode. Paging Controller ID shall be set to BS ID when a BS is acting as Paging Controller.

**BS ID**

A network identifier of the BS at which the MS is attempting to re-enter network

**14.5.11.6.3 When generated**

This primitive is generated by a BS when Network Re-entry process specified in 6.3.22.10 has been completed.

**14.5.11.6.4 Effect of receipt**

The buffered DL traffic is delivered to the serving BS and finally to MS.

## 14.5.12 Radio Resource Management

### 14.5.12.1 Radio Measurements and Reporting

The RRM Primitives are a set of primitives for supporting RRM procedures between BS and NCMS.

#### 14.5.12.1.1 RRM Primitives

##### 14.5.12.1.1.1 RRM Spare Capacity Request Primitive

The Radio Resource Controller (RRC) may use this primitive to request a BS to provide spare capacity information to the RRC. Note that the RRC may be located in another BS, or in a central entity in the NCMS.

###### **RRM Type**

Indication of RRM type: Spare Capacity Request

###### **Sender NCMS Node ID**

NCMS Node or BS unique identifier

###### **Target NCMS Node ID**

NCMS Node or BS unique identifier

###### **Spare Capacity Report Type**

Type of requested report profile. 1 for spare capacity report type 1. (Types > 1 reserved for future types)

###### **Report Characteristics**

Indicates whether report should be sent periodically, or event driven. Following events are possible:

- Completion of Network Entry
- Deregistration of MS
- Adding / changing / deleting connections
- MOB\_MSHO-REQ received from MS
- MOB\_SCAN-REPORT received from MS
- Association performed by MS
- MOB\_HO-IND received by Serving BS
- Completion of network re-entry at Target BS after HO
- Report solicitation from RRC

##### 14.5.12.1.1.2 Spare capacity report primitive

The BS may use this primitive to provide spare capacity information to the RRC, as requested by the RRC within the Spare Capacity Request Primitive.

###### **RRM Type**

Indication of RRM type: Spare Capacity Report

###### **Sender NCMS Node ID**

NCMS Node or BS unique identifier

###### **Target NCMS Node ID**

NCMS Node or BS unique identifier

###### **Spare Capacity Report Type**

Type of report profile = 1

###### **Available Radio Resource**

Percentage of reported average available subchannels and symbols resources per frame, as defined in section 14.5.13.3

#### 14.5.12.1.1.3 PHY report request primitive

The Radio Resource Controller (RRC) may use this primitive to request a BS to provide a report of the link level quality for a specific MS.

##### **RRM Type**

Indication of RRM type: Physical Parameters Request

##### **Sender NCMS Node ID**

NCMS Node or BS unique identifier

##### **Target NCMS Node ID**

BS unique identifier

##### **MS ID**

48-bit unique identifier of the MS

#### 14.5.12.1.1.4 RRM PHY report primitive

The BS may use this primitive to provide a report of the link level quality for a specific MS to the Radio Resource Controller (RRC).

##### **RRM Type**

Indication of RRM type: Physical Parameters Report

##### **Sender NCMS Node ID**

BS unique identifier

##### **Target NCMS Node ID**

NCMS Node or BS unique identifier

##### **MS ID**

48-bit unique identifier used by MS

##### **Downlink Physical Service Level**

Channel rate available for the MS calculated as a multiple of 1/32 of nominal bandwidth in the correspondent direction assuming 1 bit/Hz. For example, if DL channel bandwidth is 10 MHz, value PSL=4 means  $4 \cdot \frac{1}{32} \cdot 10 \text{ Mbps} = 1.25 \text{ Mbps}$ . 1 PSL 96 (Number of sub channels in different OFDMA modes is multiple of 16 or 32; highest modulation (QAM64) provides 3 bits/Hz)

##### **Downlink RSSI mean**

As specified in 8.1.9 Channel quality measurements [802.16-2004].

##### **Downlink RSSI standard deviation**

As specified in 8.1.9 Channel quality measurements [802.16-2004].

##### **Downlink CINR mean**

As specified in 8.1.9 Channel quality measurements [802.16-2004].

##### **Downlink CINR standard deviation**

As specified in 8.1.9 Channel quality measurements [802.16-2004].

##### **Uplink Physical Service Level**

Channel rate available for the MS calculated as a multiple of 1/32 of nominal bandwidth in the correspondent direction assuming 1 bit/Hz. (see definition of Downlink Physical Service Level)

##### **Uplink RSSI mean**

As specified in 8.1.9 Channel quality measurements [802.16-2004].

##### **Uplink RSSI standard deviation**

As specified in 8.1.9 Channel quality measurements [802.16-2004].

##### **Uplink CINR mean**

As specified in 8.1.9 Channel quality measurements [802.16-2004].

##### **Uplink CINR standard deviation**

As specified in 8.1.9 Channel quality measurements [802.16-2004].

#### 14.5.12.1.1.5 RRM Neighbor-BS Radio Resource Status Update primitive

This primitive can be used by RRC to inform a Serving BS about the list of Neighbor BS's which are potential HO Target Base Stations for any MS's being served by the SBS, including an information about their radio resource status

##### **RRM Type**

Indication of RRM type: Neighbor-BS Radio Resource Status Update

##### **Sender NCMS Node ID**

NCMS Node or BS unique identifier

##### **Target NCMS Node ID**

BS unique identifier

##### **N NEIGHBORS**

Number of neighbor BS's

For (j=0; j<N NEIGHBORS; j++) {

##### **BS Identity**

Unique identifier of BS

##### **Available Radio Resource**

Percentage of reported average available subchannels and symbols resources per frame, as defined in section 14.5.13.3

##### **DCD Configuration Change Count**

This represents the Neighbor BS current Downlink Channel Descriptor (DCD) configuration change count

##### **UCD Configuration Change Count**

This represents the Neighbor BS current Uplink Channel Descriptor (UCD) configuration change count

}

#### 14.5.12.1.2 RRM Procedures

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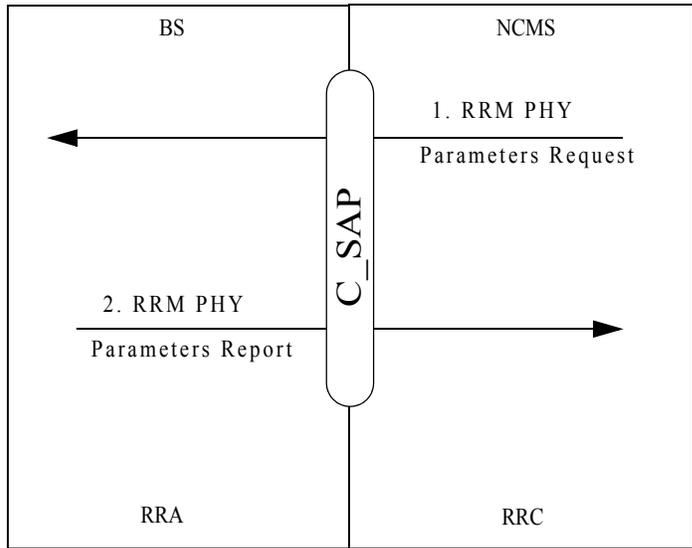


Figure 333—Example Primitive Flow of Physical Parameter Report

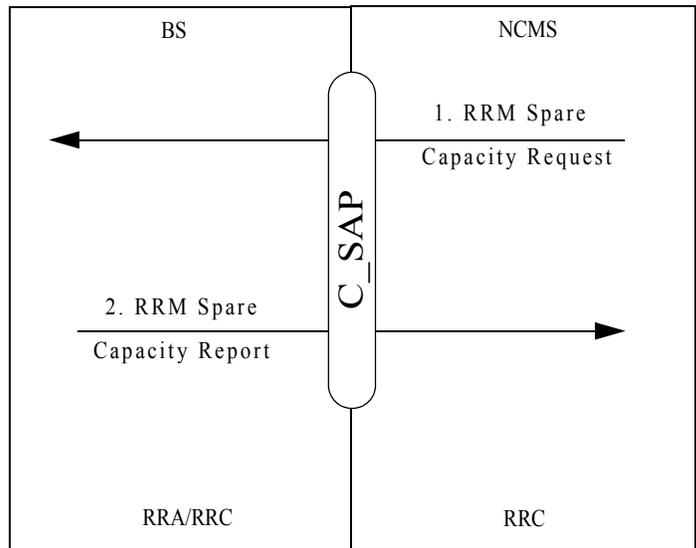
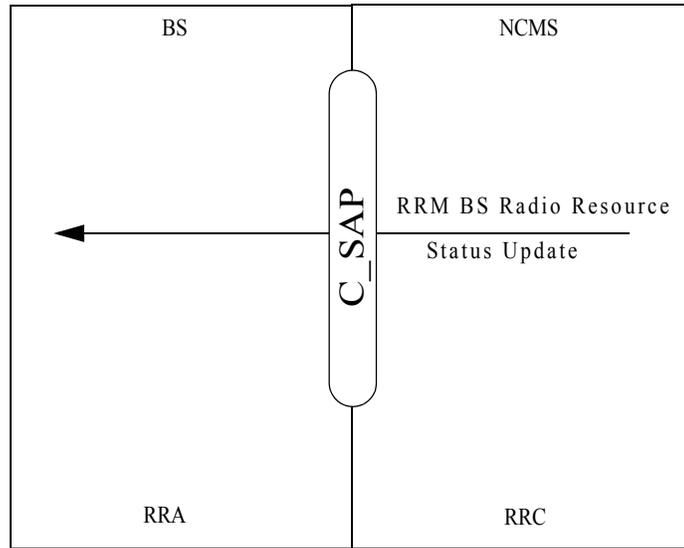


Figure 334—Example Primitive Flow of Spare capacity Report

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**Figure 335—Example Primitive Flow of Radio Resource Status Update**

**14.5.12.2 Power Control Management**

<Section Note: PHY Specific sections>

**14.5.13 MAC Management Enhancements**

**14.5.13.1 Service Identity Broadcast**

*[Add the following entries to Table 14 in IEEE Standard 802.16-2004]*

**Table 456—MAC Management Messages**

Type	Message name	Message description	Connection
201	SII-ADV	MAC management message	broadcast CID

**14.5.13.1.1 Service Identity Information (SII-ADV) message**

A BS may use the SII-ADV message to broadcast service identity information. The message may be broadcast periodically without solicitation or could be solicited by an (M)SS. This message is sent from the BS to all MSs on a broadcast CID.

**Table 457—Service Identity Information (SII-ADV) message format**

Syntax	Size	Notes
SII-ADV () {		
Management message type = 201	8 bits	
TLV Encoded Information	Variable	TLV specific
}		

**14.5.13.1.2 Service Information Identity (SII) TLV**

It is a compound TLV that contains 1 or more service identity, and it is used in a broadcast SII-ADV message.

**Table 458—Service Identity Information (SII) Compound TLV**

Type	Length	Value
1	Variable	Compound

**14.5.13.1.3 Service Identity TLV**

The service identity can be represented as a 24-bit identity or NAI. The following TLVs are defined for each representation of the identity.

**Table 459—Using 24-bit Identity**

Type	Length	Value
2	3 bytes	24-bit Identifier

**Table 460—Using NAI**

Type	Length	Value
3	32 bytes	realm

## 14.5.13.2 Management Signaling Method

### 14.5.13.2.1 Management Signalling Messages

The following messages may be used to query and set the information elements (IE) on the SS by the BS. These messages shall only be used to query or set IEs that are indicated in the table A1. The table A1 explicitly indicates the type of operation that can be performed on a particular IE.

*[Add the following entries as additions to the end of Table 14:]*

**Table 461—Management Signalling Messages**

Type	Message name	Message description	Connection
202	QRY_IE_REQ	Query IE request	primary management
203	QRY_IE_RSP	Query IE response	primary management
204	SET_IE_REQ	Set IE request	primary management
205	SET_IE_RSP	Set IE response	primary management

**Table 462—Information Elements for Query/Set Operations**

Information Element (IE) Name	Description	Type of Operation = One of (Query Only, Set Only, Query and Set)
tbd	tbd	

#### 14.5.13.2.1.1 Query IE Request message (QRY\_IE\_REQ)

BS uses the QRY\_IE\_REQ message to query information on the SS by describing by one or more IEs. The QRY\_IE\_REQ message is sent from the BS to the SS on the SS's primary management connection.

**Table 463—Query IE Request (QRY\_IE\_REQ) Message Format**

Syntax	Size	Notes
QRY_IE_REQ_Message_Format() {		
Management message type=202	8 bits	
Transaction id	8 bits	
Response timeout	8 bits	In units of 5 frames
TLV Encoded Information	variable	
}		

Parameters shall be as follows:

**Transaction id**

A unique sequential identifier of the transaction set by the initiator.

**Response timeout**

In units of 5 frames (by which the sender expects to receive a corresponding QRY\_IE\_RSP message)

The QRY\_IE\_REQ shall include the following parameters encoded as TLV Tuples:

**HMAC Tuple (see 11.12)**

The HMAC Tuple shall be the last attribute in the message.

The base station will serialize all the QRY\_IE-REQ messages sent to the SS, waiting until the SS has responded, or a timeout has occurred before querying the SS again, or with more information. The BS may replay a message to override previously sent messages before the timeout has occurred. In this case the SS will not respond to the previous request instead will process the newly received message.

**14.5.13.2.1.2 Query IE Response message (QRY\_IE\_RSP)**

The QRY\_IE\_RSP message is sent by the SS in response to QRY\_IE-REQ containing the results of the information elements sent in the corresponding QRY\_IE-REQ. The QRY\_IE\_RSP message is sent from the SS to the BS on the SS's primary management CID.

Parameters shall be as follows:

**Transaction id**

A unique sequential identifier of the transaction set by the initiator.

**RSP Status**

Error encoding of the response status. Allowed values are:

0 – success

1 – Error Response timeout too short

2 – Error TLV

The QRY\_IE\_RSP shall include the following parameters encoded as TLV Tuples:

**HMAC Tuple (see 11.12)**

**Table 464—Query IE Response(QRY\_IE\_RSP) message format**

Syntax	Size	Notes
QRY_IE_RSP_Message_Format() {		
Management message type = 203	8 bits	
Transaction id	8 bits	
RSP Status	8 bits	Allowed values are: 0 – success 1 – Error Response timeout too short 2 – Error TLV
TLV Encoded Information	variable	
}		

The HMAC Tuple shall be the last attribute in the message.

#### 14.5.13.2.1.3 Set IE Request message (SET\_IE\_REQ)

BS uses the SET\_IE\_REQ message to set information on the SS describing by one or more IEs. SS uses the SET\_IE\_REQ message to notify or alert the BS of an event or error condition. The SET\_IE\_REQ message is sent from the BS to the SS or from the SS to the BS on the SS's primary management CID.

Parameters shall be as follows:

##### **Transaction id**

A unique sequential identifier of the transaction set by the initiator.

##### **Response timeout**

Number of frames x 5 by which the sender expects to receive a corresponding SET\_IE\_RSP message with either a success or error RSP Status. If this value is set to 0, the sender does not require a response and the receiver will not issue one.

The SET\_IE\_REQ shall include the following parameters encoded as TLV Tuples:

##### **HMAC Tuple (see 11.12)**

The HMAC Tuple shall be the last attribute in the message.

#### 14.5.13.2.1.4 Set IE Response message (SET\_IE\_RSP)

The SET\_IE\_RSP message is sent by the SS in response to SET\_IE-REQ containing the results of the operation in the corresponding QRY\_IE-REQ.

The SET\_IE\_RSP message is sent from the SS to the BS on the SS's primary management CID.

**Table 465—Set IE Request (SET\_IE\_REQ) message format**

Syntax	Size	Notes
SET_IE_REQ_Message_Format() {		
Management message type = 204	8 bits	
Transaction id	8 bits	
Response timeout	8 bits	Number of frames x 5 by which the sender expects to receive a corresponding SET_IE_RSP message with either a success or error RSP Status. If this value is set to 0, the sender does not require a response and the receiver will not issue one.
TLV Encoded Information	variable	
}		

**Table 466—Set IE Response (SET\_IE\_RSP) message format**

Syntax	Size	Notes
SET_IE_RSP_Message_Format() {		
Management message type = 204	8 bits	
Transaction ID	16 bits	
RSP Status	8 bits	Allowed values are: 0 – success 1 – Error Response timeout too short 2 – TLV set Operation Error
TLV Encoded Information	variable	
}		

Parameters shall be as follows:

**Transaction id**

A unique sequential identifier of the transaction set by the initiator.

**RSP Status**

Error encoding of the response status. Allowed values are:

- 0 – success
- 1 – Error Response timeout too short
- 2 –TLV set operation Error

The SET\_IE\_RSP shall include the following parameters encoded as TLV Tuples:

#### **HMAC Tuple (see 11.12)**

The HMAC Tuple shall be the last attribute in the message.

The base station will serialize all the SET\_IE-REQ messages sent to the MS, waiting until the MS has responded, or a timeout has occurred before configuring the MS again, or with additional settings. In case a timeout has occurred

### **14.5.13.3 BS Radio Resource Advertising**

*[Apply the following modification to table 108f]*

**Table 108f—MOB\_NBR-ADV message format**

Syntax	Size (bits)	Note
Skip-optional-fields bitmap	8	Bit [0]: if set to 1, omit Operator ID field Bit [1]: if set to 1, omit NBR BS ID field Bit [2]: if set to 1, omit HO process optimization field Bit [3]: if set to 1, omit QoS related fields Bit [4]: if set to 1, omit 802.16g related fields Bit [4 <sub>5</sub> ]-[7]: reserved

*[Add the following entries in the table 108f, immediately above the row "DCD Configuration Change Count"]*

*[Add the following text after table 108f]*

**DL/UL Available Radio Resource:**

Table 108f—MOB\_NBR-ADV message format

Syntax	Size (bits)	Note
if (Skip-optional-fields-[4]=0) {		
Skip-802.16g-fields bitmap	8	Bit [0]: if set to 1, omit Radio Resource related fields Bit [1]-[7]: reserved
if (Skip-802.16g-fields-[0]=0) {		
DL Available Radio Resource	8	Percentage of available radio resource DL 0x00 : 0% 0x01 : 1%, ..., 0x64 : 100% 0x65 – 0xFE : reserved, 0xFF indicates no information available
UL Available Radio Resource	8	Percentage of available radio resource UL 0x00 : 0% 0x01 : 1%, ..., 0x64 : 100% 0x65 – 0xFE : reserved, 0xFF indicates no information available
}		
}		

Available Radio Resource indicator shall indicate the average percentage of available physical radio resources for DL/UL where averaging shall take place over a time interval which shall be defined by configuration. Available physical radio resources shall be defined as the set of subchannels and symbols within a radio frame, which are not used by any non-best-effort service flow class.

## Appendix 1

<Section Note: Discussion on Spanning Tree>

## Annex F: IRP Solution Sets for Management (Informative)

## Annex G: Network Topologies (Informative)

This annex provides two types of network topologies without precluding other typical topologies.

### G.1 Full distributed network

Figure 336 is a diagram of the typical full distributed network.

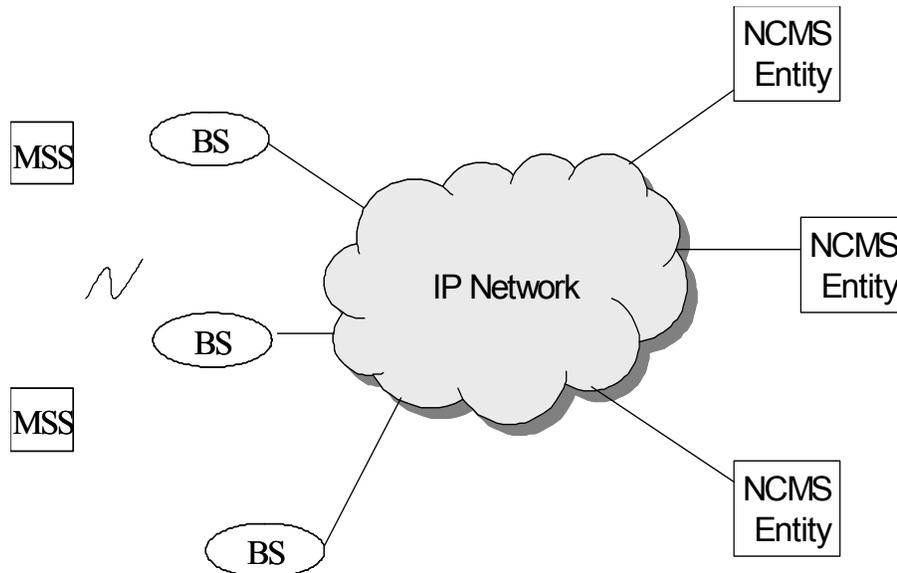


Figure 336—Distributed network

In a full distributed network, BS connects to IP network directly. NCMS is implemented as several network elements, each of the elements is also connects to IP network directly. Some NCMS functions, such as gateway and router service, are embedded in BS.

## G.2 Centralized network

802.16's network can also be deployed as cellular system does now. Figure 7 is a diagram of the typical centralized network, which is similar to 3G core network.

<Section Note: Figure 7 TBD>

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