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Source(s)	David A Castelow, Airspan Communications, Cambridge House, Oxford Road, Uxbridge, UK Voice: +44 1895 467281 Fax: +44 1895 467202 mailto:dcastelow@airspan.com
Re:	Supporting document for Letter Ballot #14
Abstract	A number of editorial changes to the draft of .16e
Purpose	The document is intended for consideration within comments resolution process.
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Editorial Changes to .16e document.

David Castelow,
Airspan Communications Ltd

The following is a set of proposed editorial changes to the .16e standard to improve readability.

1.4.1.1.3

The following picture displays the BS protocol stack

1.4.1.1.4 MSS Service Context

In the mobile environment, certain Service Flows are provisioned for each MSS. QoS parameters are provisioned by the operator for each flow and identified by certain Service Class names. Sets of Service Classes should be provisioned through upper layers (e.g. network management) at each BS and each MSS.

For each SU certain authorized Quality of Service parameter sets (AuthorizedQoSParamSet) shall be provisioned identified by the corresponding Service Class Name. In the initial Network Entry, Ranging and Hand-over processes, the MSS shall request from the Target BS ~~certain~~ specific QoS levels per Active Service Flow, differentiated by Service Class and represented by the AuthorizedQoSParamSet value. The BS shall respond with the name of the Service Class that is available for the Service Flow. This Service Class will become the AdmittedQoSParamSet in the case of successful Network Entry/HO.

A Network Service is defined as a service provided through the MSS by the network to a single persistent IP address with particular connectivity and air-interface MAC parameters (including QoS properties). Connectivity properties are defined by the service provided through the permanent IP address. The permanent IP address defines the MSS home-network. QoS properties are those of the Service Flow associated with the N~~n~~etwork S~~s~~ervice, as specified in 6.4.13.

An MSS Service Context is defined as a set of network services authorized for a given MSS. It is specified by an MSS Service Context Descriptor composed of the following elements:

Table 1d – MSS Service Context Descriptot

Context Element	Meaning
MSS 48-bit MAC address unique identifier	48-bit universal MAC address, as specified in 6.4.1. During HO it is used to refer to specific connectivity (addressing) and properties of MAC connections (including QoS properties)
Number ~~N~~ of Network Service IEs (N)	Number of Network Service Information Elements (NSIEs). Each NSIE corresponds to a single data connection
N x NSIE	The structure of an NSIE is specified below
Number ~~M~~ of Security Association (M)	The n~~N~~umber ~~M~~ of Security Associations established for the MSS.
M x SAIE	TBD

Table 1e – Network Service Information Element(SIE) Contents

Field	Meaning
Service Flow ID	As specified in 6.4.13.2. Service Flow ID has global meaning; it does not change in the process of hand-over.
MAC Connection Parameters	Connection parameters as specified in section 6.3.1.1
Service Class Name	Specifies the AuthorizedQoSParamSet, which is defined globally (while the AdmittedQosParamSet is defined each time in the process of hand-over).

1.4.1.2 MAC layer HO procedures

This section contains the procedures performed on the air-interface during HO ~~on the air-interface~~.

1.4.1.2.1 Network topology acquisition

1.4.1.2.1.1 Network topology advertisement

A BS may broadcast information about the network topology using the MOB-NBR-ADV MAC message..
An MSS may decode this message to find out information about the parameters of neighbor BS. Each MSS will thus be able to synchronize quickly with a neighbor BS.

1.4.1.2.1.2 MSS Scanning of neighbor BS

A BS may allocate time intervals to MSS's for the purpose of seeking and monitoring neighbor BS suitability as targets for HO. Such a time interval will be referred to as a **scanning interval**.
An MSS may request an allocation of a scanning interval using the MOB_SCN-REQ MAC message. The MSS indicates in this message the duration of time it requires for the scan, based on its PHY capabilities.
Upon reception of this message, the BS shall respond with the MOB_SCN-RSP MAC message. The MOB_SCNRSP MAC message shall either grant the requesting MSS a scanning interval that is at least as long as that requested by that MSS, or deny the request. A value of zero means that the request for an allocation of scanning interval is denied.
An MSS, upon detection of a MOB_SCN-RSP MAC message, shall use the allocated interval to seek for neighbor BS. When neighbor BS are identified, the MSS shall attempt to synchronize with their downlink transmissions, and estimate the quality of the PHY connection.
The BS may buffer incoming data addressed to the MSS during the scanning period, and transmit the data after the scanning period.

1.4.1.2.1.3 Association Procedure

Association is an optional initial ranging parameter negotiation and MSS table notation maintenance procedure occurring during Initial Ranging of a BS. The Association relationship function is to ~~memorialize~~ record that an MSS has performed
successful Scanning and Ranging of a BS for the purpose of expediting a potential future hand-over of the MSS to the then Target BS. The MSS may store successful Ranging information for an Associated BS for the purpose of setting I~~i~~nitial Ranging values in a future Ranging event, possibly associated with a hand-over, to the Associated BS.
Upon completion of a successful MSS initial-ranging of a BS, as specified in IEEE Standard P802.16-REVd/ D3-2004 section 6.4.9.5, ~~Initial~~ initial ranging and automatic adjustments with the extensions specified in 11.1.3 RNG-REQ message encodings, Table 289a—RNG-REQ message encodings, and 11.1.4 RNG-RSP message encodings, Table 290a—RNG-RSP message encodings, if the RNG-RSP message contains a Service Level Prediction parameter set to 2, the MSS may mark the BS as Associated in its MSS local Association table of identities, recording elements of the RNG-RSP to the MSS local Association table, and setting an appropriate aging timer (See Table 264a—Parameters and Constants, ASC-AGING-TIMER). The a~~A~~ssociation state in the MSS local Association table shall be aged-out after a period specified by the ASC-AGING-TIMER timeout and the Association
entry removed.
While an Association is current (aging timer has not expired), MSS may use recorded Associated Ranging values to set Initial Ranging values in a new initial Ranging event to the same Associated BS. An MSS may have several Associated BS in its local Association table concurrently and shall use the respective stored Associated Ranging values only with the related Associated BS.

1.4.1.2.2 HO process

The section defines the HO process in which an MSS migrates from the air-interface provided by one BS to the air-interface provided by another BS. The HO process consists of the stages listed below (not necessarily in the order listed):
— HO initiation, the decision to start the process is taken
— Termination of service with the Serving BS, where all connections belonging to the MSS are terminated, and the context associated with them (i.e. information in queues, ARQ state-machine, counters, timers, etc.) ~~is~~ are discarded or forwarded to the Target BS.
— Network re-entry in Target BS, where the MSS re-enters the network using a fast network entry procedure. After network re-entry, service flows belonging to the MSS are re-associated with newly established connections. QoS parameters of service flows (AdmittedQoSParamSet) may be different from the

AuthorizedQoSParamSet, based on the availability of resources in the Target BS.
The Serving BS may terminate the service with the MSS upon receiving hand-over indication from the MSS, or it may maintain the service with the MSS until receiving network entry indication from the Target BS.
The HO process, and its similarity to the initial network entry process, is depicted in Figure 0f.

1.4.1.2.2.1 Cell Selection

Cell selection is a terminology used to refer to situations where an MSS leaves a BS before getting to the normal-operation state. ~~Such~~ This procedure does not involve termination of existing connections, nor does it

1.4.1.2.2.2 HO initiation

Either an MSS or a BS may initiate a HO by transmitting the MOB_MSSHO-REQ or MOB_BSHO-REQ MAC messages. It is anticipated that in most situations the MSS will be the initiator of the HO, but sometimes a BS may be the initiator of a HO to facilitate load sharing among BS or because of the uplink connection quality.

1.4.1.2.2.3 HO cancellation/rejection

After the MSS or BS have initiated an HO using MOB_MSSHO/BSHO-REQ, the MSS may cancel or reject HO at any time through transmission of the MOB_HO-IND. The rejection shall be made through transmission of a MOB_HO-IND with the HO reject option (HO_IND_type = 10). ~~If the HO_IND_type field has the value of 10 (HO reject option),~~In this case the BS may reconfigure the Target BS list and retransmit the MOB_BSHO-RSP
message including a new Target BS list. The cancellation shall be made through transmission of a MOB_HOIND with the HO cancel option (HO_IND_type = 01).

1.4.1.2.2.4 Termination with the Serving BS

After the [MSS/BS]MOB_HO-REQ/MOB_HO-RSP handshake is completed, the MSS may begin the actual HO. At some stage during the HO process the MSS terminates service with the Serving BS. This is done by sending a MOB_HO-IND MAC message with the Serving BS release option (HO_IND_type=00).
~~If the HO_IND_type field has the value of 00 (Serving BS release option),~~In this case the BS may either close all connections
and discard MAC state machines and MAC PDUs associated with the MSS or it may retain the connections, MAC state machine and PDU associated with the MSS to be forwarded to the Target BS for service continuation, or to be discarded upon reception of ~~hand-over~~an HO indication from the Target BS.

1.4.1.2.3 Drops during HO

A drop is defined as the situation where an MSS has stopped communication with its Serving BS (either in the downlink, or in the uplink) before the normal HO sequence outlined in Cell Selection and Termination with the Serving BS has been completed.
An MSS can detect a drop by its failure to demodulate the downlink, or by exceeding the RNG-REQ retries limit allowed for the periodic ranging mechanism. A BS can detect a drop by exceeding the RNG-REQ retries limit allowed for the periodic ranging mechanism.
When the MSS has detected a drop, it shall attempt network re-entry with its preferred Target BS as outlined in section ~~Re-entry with the Target BS~~1.4.1.2.4. When the BS has detected a drop, it shall react as if a MOB_HOIND MAC message has been received with HO_IND_type=00.

1.4.1.2.4 Re-entry with the Target BS

At re-entry, the MSS performs the steps as shown in Figure 0f.

1.4.1.2.4.1 Synchronize with downlink and obtain parameters

For MSS that have used their scanning interval to synchronize with a Target BS and have decoded the MOB_NBR-ADV message in the Serving BS, this stage should be immediate. In other situations this procedure defaults to the one specified for initial network entry.

1.4.1.2.4.2 Obtain uplink parameters

For MSS's that have decoded the MOB_NBR-ADV message, this stage should be immediate. In other situations this procedure defaults to the one specified for initial network entry.

1.4.1.2.4.3 Ranging and uplink parameters adjustment

An MSS may perform an initial network entry as specified in 6.4.9. During this stage the MSS is assigned a new basic and primary management CID in the Target BS. If the MSS has used scanning interval(s) to do preliminary ranging with a Target BS, and if the Target BS received a HO-pre-notification message that contains the MAC address of the MSS, (see Section Annex C, Backbone network HO procedures) the BS may choose, instead of waiting for an initial ranging request in Initial Ranging Interval, to allocate a non-contention ranging opportunity for the MSS.

As opposed to regular network entry, where initial ranging is performed on contention basis, here the ranging opportunity may be allocated individually based on an MSS's 48-bit MAC address assuming this identifier was forwarded to the Target BS via the backbone network. Allocation of non-contention ranging opportunity is done using the Fast_UL_ranging_IE() (see Fast ranging (Paging) Information Element) in the UL-MAP.

1.4.1.2.4.4 MSS re-authorization

During this stage the MSS performs the re-authorization part of the PKM protocol used at initial network entry (see IEEE Standard P802.16-REVd/D3-2004, section 7.2). The BS authenticates the user and as the security context has not changed (it is transferred from the old BS via backbone, see Section Annex C, Backbone network HO procedures) the security sub-layer can continue in normal operation.

1.4.1.2.4.5 Re-register and re-establish provisioned connections

This stage is equivalent to several stages performed during initial network entry. In this stage the MSS reregisters with the BS, and receives on the registration response a conversion table that maps the connections it had with its pervious Serving BS to a new set of connections on the current Serving BS. In doing so, the MSS skips the **establish-IP-connectivity** stage, where it is assigned an IP address for management purposes. This stage is not really skipped during HO, instead it is postponed until the normal-operation stage is reached. The **transfer-operational-parameters** and the **time-of-day establishment** stage are skipped as none of the information contained in the configuration file, nor the time-of-day is expected to change. The MSS attempts the re-registration by sending the normal REG-REQ MAC message. At this stage the MSS has already provided its 48-bit MAC address identifier, and the BS can recognize that the MSS is performing a HO. The BS REG-RSP shall include TLV values for re-establishing the active provisioned Service Flows.

1.4.1.2.4.6 Commence Normal Operation

At this stage, normal operation commences. The MSS shall re-establish its IP connectivity as specified at initial network entry. Figure ~~<TBD>~~ 0f shows how a complete HO process might look like in the time domain.

6.3.3.1.1.3 When generated

Generated to trigger creation of a new connection or connections servicing a newly arrived MSS; specifies classifier(s) to forward
data to the connections and QoS parameters for the connection.

6.3.3.1.6 CS to MA: CS_MSS_DEPARTURE.indication

Page 19:

e) Initial ranging CID if MSS is an MS registered on one downlink channel and is currently in the process of pre-registration on another channel.
f) In all other cases, the Basic CID is used as soon as one is assigned in the RNG-RSP message.
The following parameters may be included in the RNG-REQ message:

Serving BS ID

For MSS during hand-over or network re-entry, the BS ID of the BS to which the MSS is currently connected (has completed complete registration cycle and is in Normal Operation).
The s~~S~~erving BS ID shall not be included if the interval timer is timed-out (Serving BS ID AGINGTIMER, see Table 264a-Parameters and Constants). Inclusion of the Serving BS ID in the RNGREQ message signals to the Target BS that the MSS is currently connected to the network through the Serving BS and is in the process of either ~~a~~ hand-over or network re-entry.

6.4.2.3.6 Ranging Response (RNG-RSP) message

[Add the following to section 6.4.2.3.6:]

When a BS sends a RNG-RSP message in response to a RNG-REQ message containing Serving BS ID, the BS may include the following TLV parameter in the RNG-RSP message:

Service Level Prediction _ This value indicates the level of service the MSS can expect from this BS. The following encodings apply:
0 = No service possible for this MSS.
1 = Some service is available for one or ~~several~~ more Service Flows authorized for the MSS.
2 = For each authorized Service Flow, a MAC connection can be established with QoS specified by the AuthorizedQoSParamSet.
3 = No service level prediction available.
Service Level ~~prediction~~ Prediction may be accompanied by a number of Service Flow Encodings as specified in 11.4.9 with the following parameters only:
— Service Class Name

When provided, Service Class Name shall be included only as an unmodified, ~~Globally~~ globally defined Service Class Name. Alternatively, QoS Parameter Set items as provided in 11.4.9. In the event that the Service Class Name, when ~~to be~~ included in a RNG-RSP, is unique to the BS, or has been temporarily modified from its Globally defined AuthorizedQoSParamSet, the RNG-RSP message shall include a combination of an (unmodified)~~,~~ Global Service Class Name and QoS Param Set items as provided in 11.4.9 such that they, in combination, define the AdmittedQoSParamSet represented.
— Service Flow Identifier
Service class name may refer either to AuthorizedQoSParamSet (then Service Level Prediction should be encoded as '2') or to a subset of it (then Service Level Prediction should be encoded as '1').

6.4.2.3.8 Registration Response (REG-RSP) message

[Append to section 6.4.2.3.8 Registration Response (REG-RSP) message:]

For mobile networks, a Target BS may include CID_update TLVs in the REG-RSP for an MSS recognized by the Target BS as performing HO or network re-entry by the presence of a Serving BS ID in the RNG-REQ.

CID_update - The CID_update is a compound TLV value that provides a shorthand method for renewing active connections used by the MSS in its previous Serving BS. The TLVs specify the CID in the Target BS that shall replace the active CID used in the previous Serving BS. Multiple iterations of these TLVs may occur in the REG-RSP suitable to re-creating and re-assigning all active Service Flows for the MSS from its previous Serving BS including Basic, Primary and Secondary CIDs. If any of the Service Flow parameters change, then those Service Flow parameters and CS parameter encoding TLVs that have changed will be added. Only active Service Flows are transferred in this manner.
These TLVs enable the Target BS to renew connections used in the previous Serving BS, but with different QoS settings.

6.4.2.3.9 PKM Message codes

[Change table 26 in section 6.4.2.3.9:]

[Add the following to section 6.4.2.3.9:]

6.4.2.3.9.11 EAP Transfer Request message

When an SS has an EAP message received from an EAP method for transmission to the BS, it encapsulates it in an EAP Transfer Request message.
Code: 13

Page 23:

6.4.2.3.44 Traffic Indication message (MOB_TRF-IND)

This message is sent from BS to MSS on the broadcast CID. The message is intended for MSS's that are in sleep-mode, and is sent during those MSS's listening-intervals. The message indicates whether there has been traffic addressed to each MSS that is in sleep-mode. An MSS that is in sleep-mode during its listeninginterval shall decode this message to seek an indication addressed to itself.
When an MSS awakens, it will check the frame number to ensure that it did not lose frame synchronization with the BS, if it does not find its own SLPID in ~~the~~ any MOB_TRF-IND messages received during the listening interval, it will consider this as a negative
indication and shall return to sleep mode.