Definition of terminology used in Mobile Multihop Relay

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Terms and Definitions for Mobile Multihop Relay

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Previously Harmonized Terminology
Comment by C802.16j-06/027r4 and Agreement by C802.16j-06/019r2

access link

active MMR-BS

cooperative relay

fixed relay station

inband relay

inter-MMR-BS handover

intra-MMR-BS handover

k-hop

MMR base station

MMR diversity set

mobile multihop relay

relay link

Previously Harmonized Terminology (1)

Comment by C802.16j-06/027r4 and revision by C802.16j-06/019r2

C802.16j-06/027r4 suggests this new definition:

cell: The radio coverage area for a particular access station (e.g. BS, MMR-BS, or RS) using one-hop radio links.

Informative notes: A cell is the total direct-access area supported by a given station. This includes coverage areas of all sectored antennas but excludes coverage areas of relay stations managed by the station. Depending on the type of station, there are MMR-BS cells, RS cells, and BS cells.

We accept this new definition (including informative note) and update slightly

cell: The radio coverage area from which an MS can access the network via a particular station (e.g. BS, MMR-BS, or RS) using one-hop radio links.

MMR-BS cell

RS cell

RS cell

MS

MMR-BS

RS
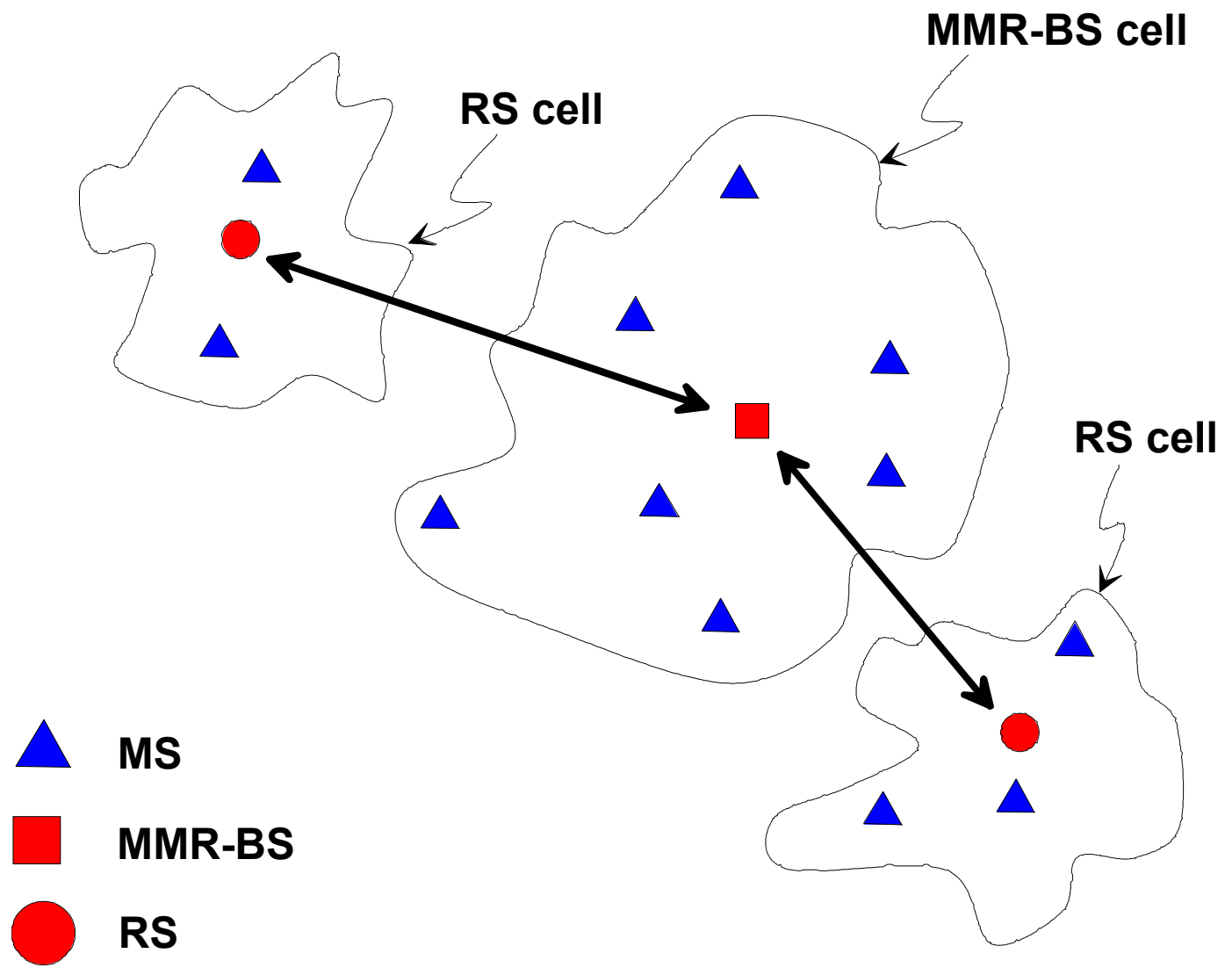
Previously Harmonized Terminology (2)

Comment by C802.16j-06/027r4 and revision by C802.16j-06/019r2

C802.16j-06/027r4 suggests the following updated definition. We accept this new definition; however, we request the underlined sentence be removed since this point is already made by the definition.

MMR-cell: The radio coverage area of an MMR-BS cell and all of its subordinate RS cells.

Informative Notes: All communications resources within an MMR-cell are managed by the MMR-BS either through centralized or decentralized control. The MMR-cell contains all MSs connected to the MMR-BS using one-hop links and all MSs connected to any of the RSs managed by the MMR-BS. Resource management and control of MSs within an MMR-cell may be via direct radio links (i.e. not relayed) or via relayed messages. <u>An MMR-cell is the radio coverage area of a virtual base station.</u>

MMR cell

MS

MMR-BS

RS
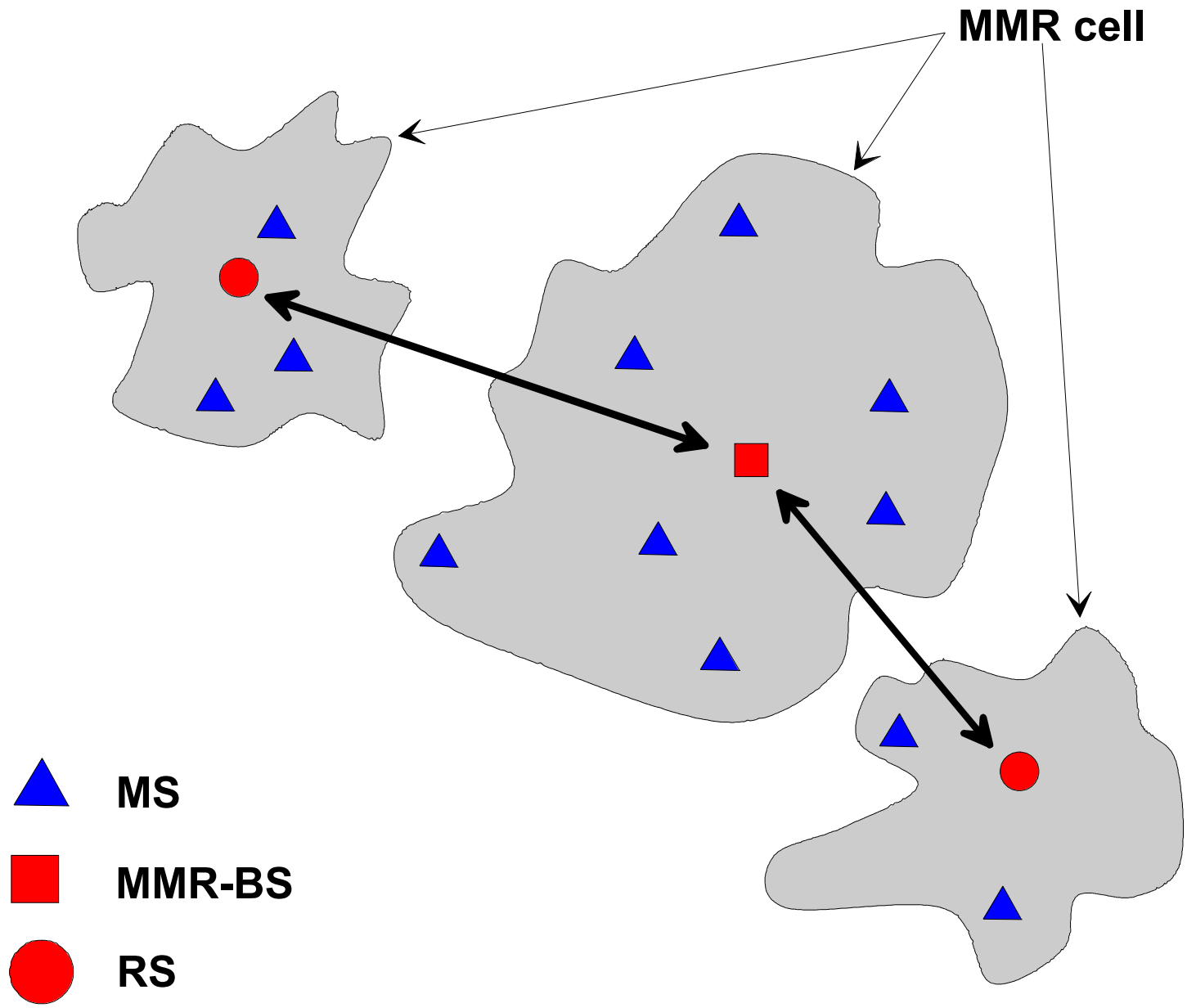
Terminology Suggested by *C802.16j-06/027r4*
Agreement by C802.16j-06/019r2

access station: The station at the point of direct access into the network for a given MS. *An access station can be a BS, RS, or MMR-BS.*

relay downlink (R-DL): Downlink between the MMR-BS and RS nodes or between RS nodes for downstream relay.

relay uplink (R-UL): Uplink between the MMR-BS and RS nodes or between RS nodes for upstream relay.

virtual base station (VBS): VBS consists of a serving MMR-BS and a subset of RSs along the selected relay path between MMR-BS and the designated access RS. VBS provides relay functions including data forwarding, mobility management, connectivity, security and QOS, with central coordination from BS.

The following were slightly revised for consistency:

downstream traffic: Data flowing from the MMR-BS to the destination MS

MMR-frame: An MMR frame is an IEEE Std 802.16e-2005 frame that has been modified to support multihop relay.

upstream traffic: Data flowing from the MS to the destination MMR-BS

Terminology Suggested by *C802.16j-06/019r2*
Comment by C802.16j-06/027r4

C802.16j-06/027r4 requests the following be deleted:

active RS: An RS that is informed of some/all of the MS's capabilities, security parameters, service flows, and MAC context information. For macro diversity handover the MS transmits/receives data to/from all active RSs in the MMR diversity set.

anchor RS: In the context of macro diversity handover (MDHO), cooperative relay, and fast station switching (FASS), the anchor RS transmits ranging, synchronization, and other control information to the MS. In FASS, the anchor RS is the RS that is designated to transmit/receive data to/from the MS in a given frame.

C802.16j-06/027r4 requests deleting the underlined sentence:

anchor MMR-BS: In the context of macro diversity handover (MDHO), cooperative relay, and fast access station switching (FASS), the anchor MMR-BS transmits registration, ranging, synchronization, and other control information to the MS. <u>In FASS, the anchor MMR-BS is the MMR-BS that is designated to transmit/receive data to/from the MS in a given frame.</u>

MDHO
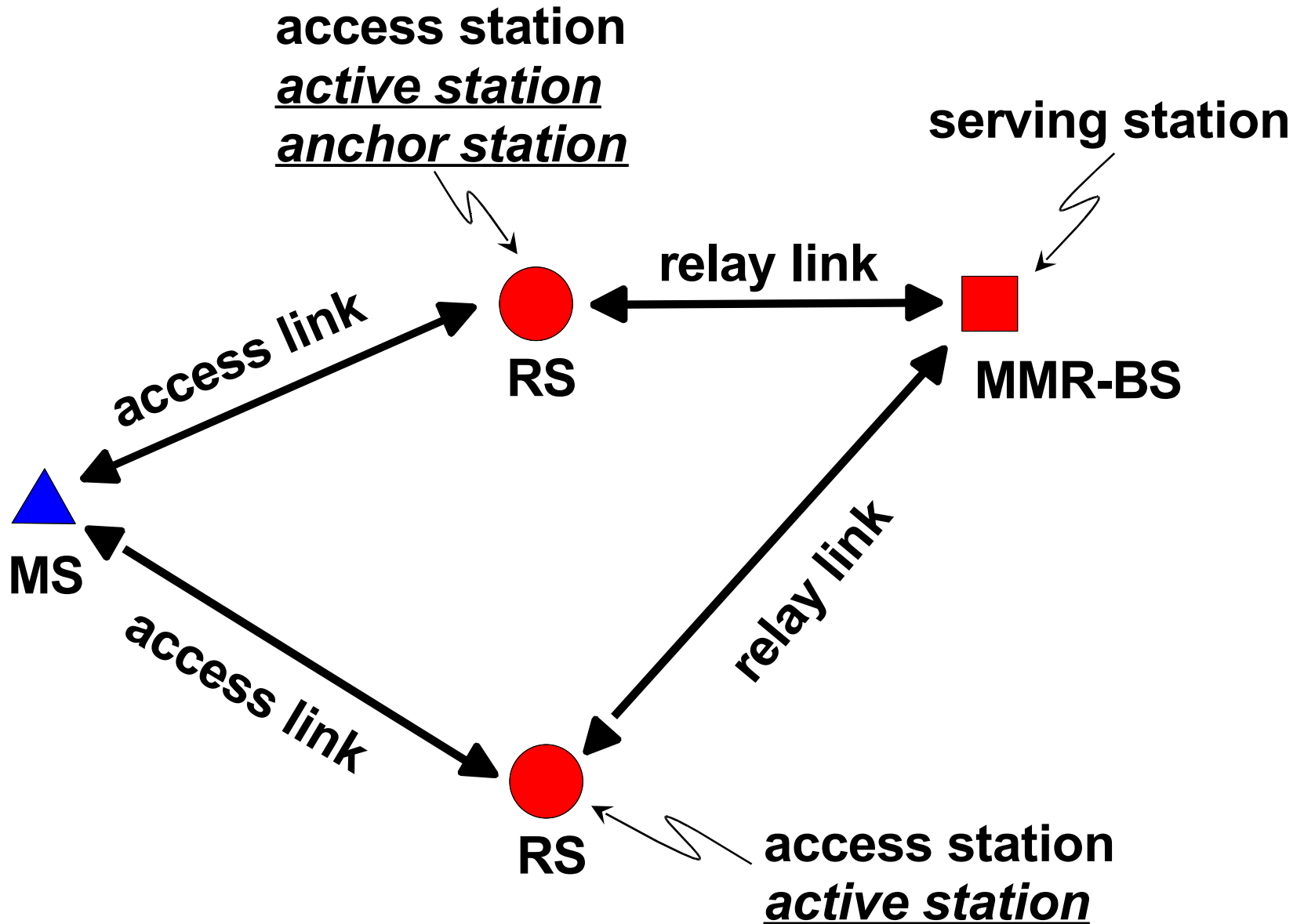
- Description from 802.16e, section 6.3.22.3.1, p. 251:

"For an MS and a BS that support MDHO, the MS and the BS shall maintain a list of BSs that are involved in MDHO with the MS. The list is called the Diversity Set. Among the BSs in the Diversity Set, an Anchor BS is defined... When operating in MDHO, the MS communicates with all BSs in the Diversity Set for UL and DL unicast messages and traffic… MDHO begins with a decision for an MS to transmit/receive unicast messages and traffic from multiple BSs at the same time interval. For DL MDHO, two or more BSs provide synchronized transmission of MS downlink data such that diversity combining can be performed by the MS. For UL MDHO, the transmission from an MS is received by multiple BSs such that selection diversity of the information received by multiple BSs can be performed…

There are several conditions that are required to enable MDHO and/or FBSS between MS and a group of BSs:
— The BSs involved in MDHO are synchronized based on a common time source.
— The frames sent by the BSs involving in MDHO at a given frame time arrive at the MS within the prefix interval.
— BSs involved in MDHO have synchronized frame structure.
— BSs involving in MDHO have the same frequency assignment.
— BSs involving in MDHO shall use the same set of CIDs for the connections that are established with the MS.
— The same MAC/PHY PDUs shall be sent by all the BSs involving in MDHO to the MS.
— BSs involved in MDHO are also required to share or transfer MAC context."

- This implies that the diversity set (i.e. active stations) is composed of stations that are:
  - within one-hop communication of the MS
  - synchronized to the same time source
  - residing on the same frequency
  - informed of the MS's MAC context.

This can be any combination of MMR-BSs, RSs, and/or BSs – it just depends on frequency planning, frame structure (e.g. if MMR-BSs and RSs aren't allowed to transmit to an MS in the same part of the frame, they can't be part of the same diversity set), and station locations.
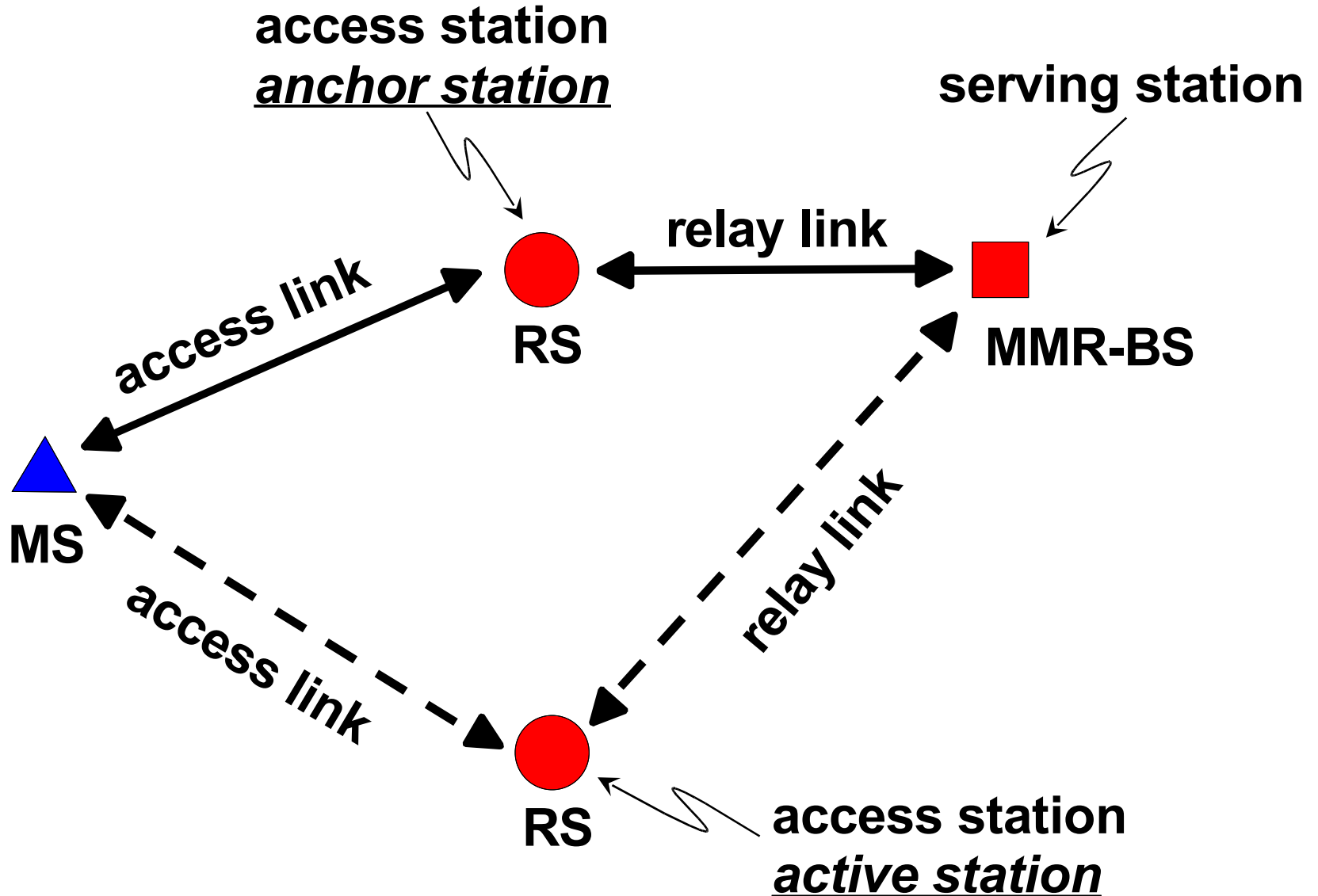
Macro Diversity Handover

FBSS

- Description from 802.16e, section 6.3.22.3.2, p. 252:

"For MS and BS that support FBSS, the MS and the BS shall maintain a list of BSs that are involved in FBSS with the MS. The list is called the Diversity Set. Among the BSs in the Diversity Set, an Anchor BS is defined. Regular operation when MS is registered at a single BS is a particular case of FBSS with Diversity Set consisting of single BS, which in this case shall be the Anchor BS. When operating in FBSS, the MS only communicates with the Anchor BS for UL and DL messages including management and traffic connections. Transition from one Anchor BS to another ("switching") is performed without invocation of HO procedure described in 6.3.22.2. Anchor update procedure is defined in 6.3.22.3.4.

There are several conditions that are required to enable FBSS handover between MS and a group of BSs. These conditions are listed below:

- BSs involved in FBSS are synchronized based on a common time source
- The frames sent by the BSs from Diversity Set arrive at the MS within the prefix interval
- BSs involved in FBSS have synchronized frames
- BSs involved in FBSS operate at same frequency channel
- BSs involved in FBSS are also required to share or transfer MAC context" (i.e. the MS's service flows, connection mappings, keys, etc.)

- This has the same implications as discussed for MDHO

Fast Access Station Switching

access station
anchor station

serving station

relay link

RS

MMR-BS

access link

MS

access link

relay link

RS

access station
active station

Response and Suggested Terms by *C802.16j-06/027r4*

We agree to delete these specific terms if their general counterparts include RSs as possible station types. Based on the definition of MDHO and FASS, RSs will serve as both active and anchor stations.

active station: A station that is informed of some/all of the MS's capabilities, security parameters, service flows, and MAC context information. For macro diversity handover the MS transmits/receives data to/from all active stations in the MMR diversity set. An active station can be a BS, MMR-BS, or RS.

anchor station: In the context of macro diversity handover (MDHO), cooperative relay, and fast access station switching (FASS), the anchor station transmits ranging, synchronization, and other control information to the MS. In FASS, the anchor station is the one designated to transmit/receive data to/from the MS in a given frame. An anchor station can be a BS, MMR-BS, or RS.

We suggest the use of general terms that indicate the applicable station types:

candidate station: A potential point of direct access into the network for a given MS during the next handover. A candidate can be an RS, BS, or MMR-BS.

neighbor station: A station that is within one-hop communication range of the station of interest. A neighbor can be an MS, RS, BS, or MMR-BS.

serving station: For any MS, the serving station is the station with which the MS has most recently completed registration at initial entry or during a handover. A serving station can be a BS or MMR-BS. Informative note: The term serving BS is defined in IEEE Std 802.16e-2005 section 3.5.2. The serving station is not necessarily the access station although this is possible.

target station: A station which is the primary candidate for MS network access following a handover. The target station can be an RS, BS, or MMR-BS.

Informative note: Target BS was defined in IEEE Std 802.16e-2005 section 3.5.3.

Terminology Suggested by *C802.16j-06/019r2* (1)

access traffic: Traffic traveling over an access link

fast access station switching (FASS): Method by which an MS can change its access station from frame to frame depending on the station selection mechanism. The access station can be an RS, BS, or MMR-BS. The MS is transmitting/receiving data to/from one of the active stations (the anchor station) during any given frame.

Informative notes: Fast BS switching (FBSS) was defined in IEEE Std 802.16e-2005 section 3.77 and the terminology is modified here to allow switching between any type of access station (RS, BS, or MMR-BS). Switching can occur between the same type or different types of access stations.

intermediate RS: Any *k*-hop RS along an *m*-hop relay path where $k<m$.

Informative notes: The endpoints of a relay path are the MMR-BS and the RS that has direct access to the MS. An *m*-hop relay path consists of *m* hops between these endpoints.

mobile relay station (MRS): A relay station that is intended to function while in motion.

Informative notes: MRS mobility is constrained by the same limits as an MS in IEEE Std 802.16e-2005. An MRS may be installed in a bus or train for use by IEEE Std 802.16e-2005 subscribers.

neighborhood: A set of stations consisting of a reference station and all of its neighbor stations.

Informative notes: The term "neighborhood" is always used with reference to a particular station (i.e. each station has a neighborhood consisting of all stations within one-hop communications range).

nomadic relay station (NRS): A relay station that is intended to function from a location that is fixed during periods of time comparable to that of a user session.

Informative notes: An NRS is not permanently installed. An NRS may rely solely on battery power in some instances.

Terminology Suggested by *C802.16j-06/019r2* (2)

out-of-band relay: MMR using *different* RF channels on relay (i.e. MMR-BS-to-RS or RS-to-RS) and access links (i.e. MMR-BS-to-MS or RS-to-MS).
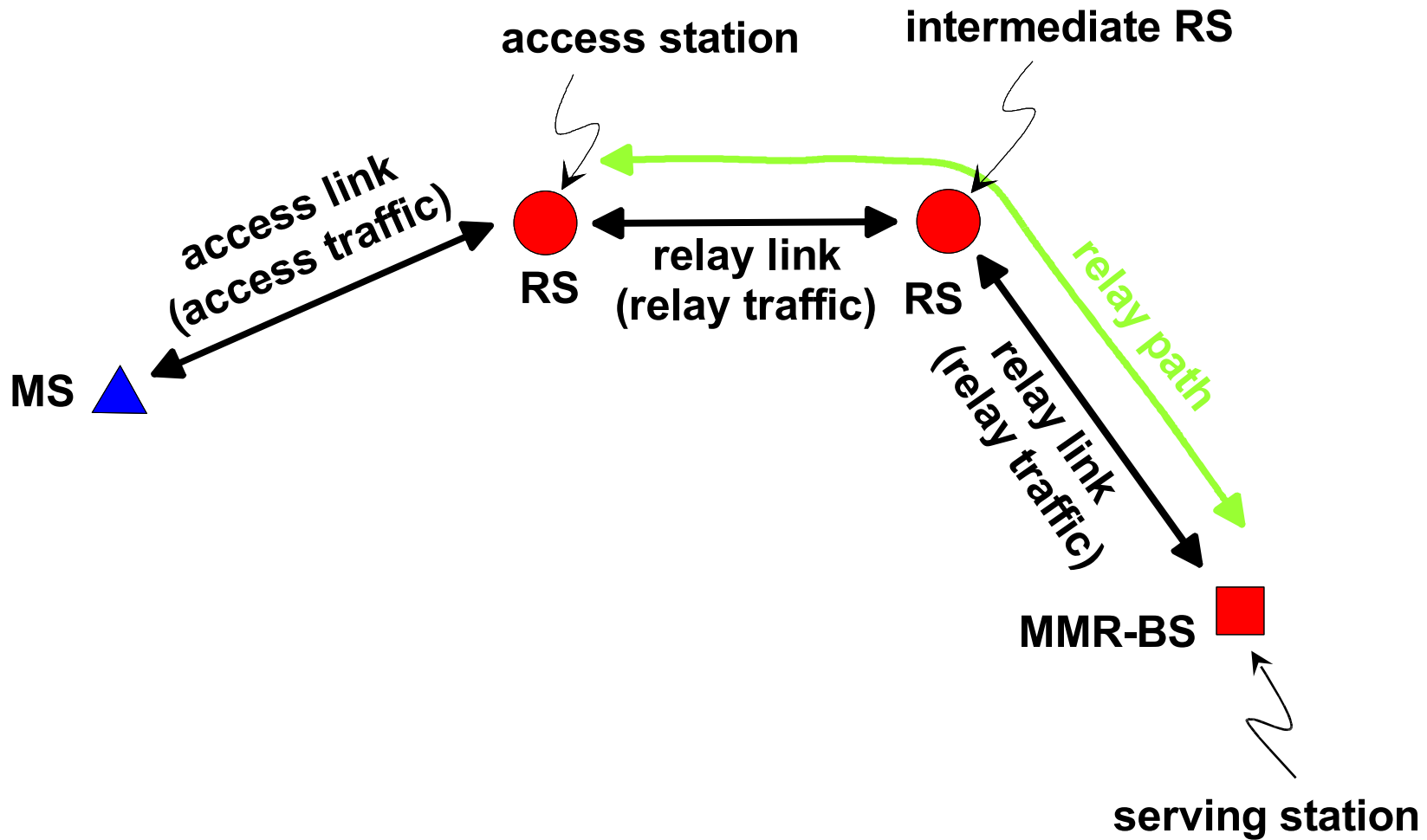
relay path: Concatenation of k consecutive relay links (k >= 1) between the MMR-BS and the designated access RS.

relay traffic: Traffic traveling over a relay link.

relay station (RS): A station that conforms to IEEE Std 802.16j and whose functions are 1) to relay user data and possibly control information between other stations, and 2) to execute processes that indirectly support mobile multihop relay.

Informative notes: All RSs are managed by an MMR-BS, but they may have some control of relay functions within their neighborhood.

RS cell mobility: Mobility of an entire RS cell where an RS and its subordinate RSs and MSs located within the RS cell move together as a group. Serving MMR-BS

access station

intermediate RS

access link
(access traffic)

relay link
(relay traffic)

RS

RS

relay path

relay link
(relay traffic)

MS

MMR-BS

serving station

Terminology Suggested by *C802.16j-06/027r4*

Postponed by C802.16j-06/019r2

The following terms are considered premature:

R-MAC: MAC sub-layer to support multi-hop relay.

R-MAP: The MAP dedicated to the R-zone resource allocation.

R-PHY: Physical sub-layer to support multi-hop relay.

R-Zone: The OFDMA resource dedicated to the links between MMR-BS and RS and between RSs communications.