802.16m Inter-BS Communications

IEEE 802.16 Presentation Submission Template (Rev. 9)

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Venue:

Base Contribution:

IEEE C802.16m-08/597, 802.16m Inter-BS Communications

Purpose:

Supporting Contribution for SDD Comment.

Notice:

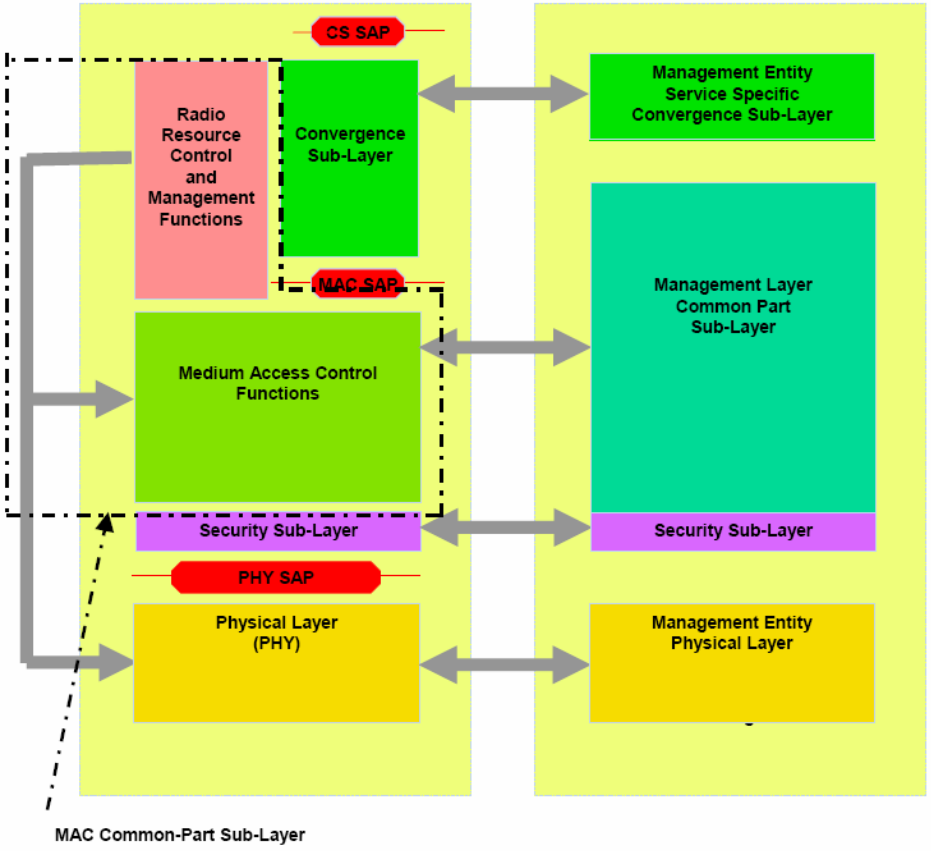
Release:

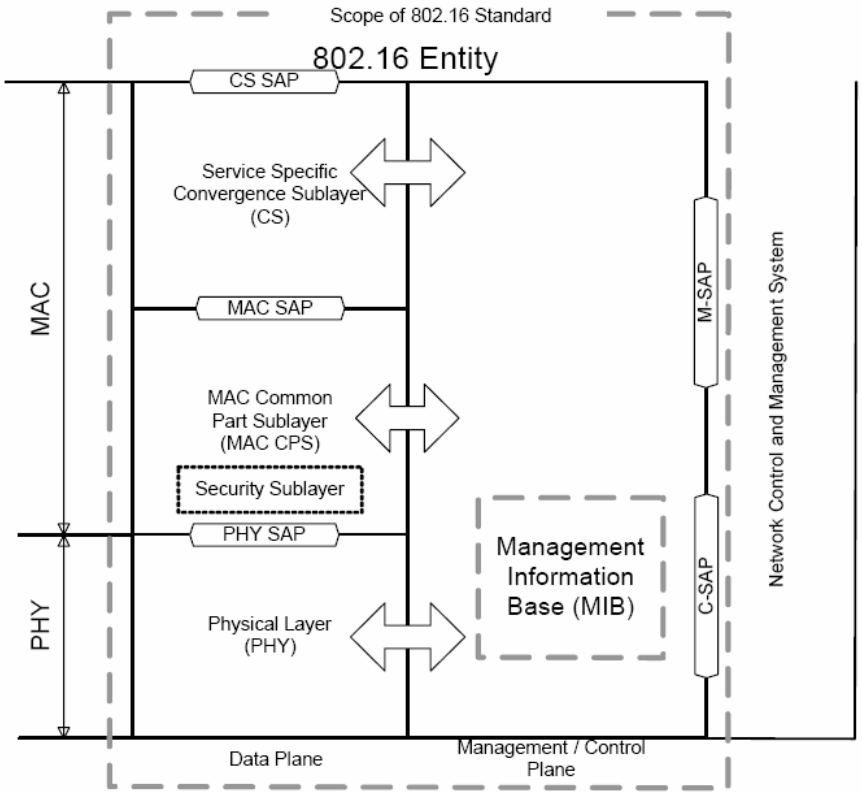
Patent Policy:

Overview

- What is the current SDD version of the 802.16m protocol stack.
- What features require inter-BS communication.
- What inter-BS communication interfaces have already been standardized
- What new procedures / interfaces / SAPs may be needed

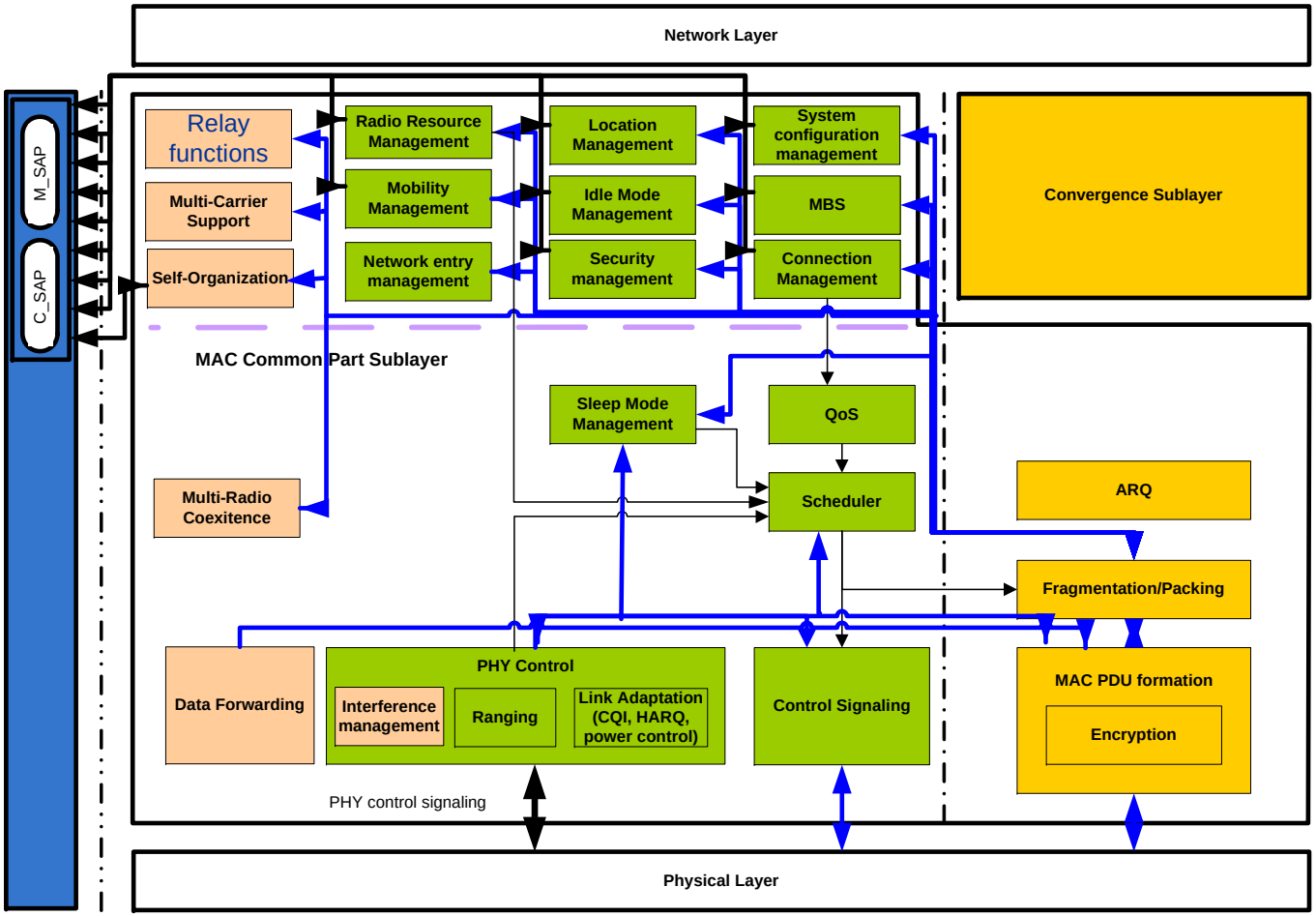
SDD reference model of the protocol stack (most recent version)





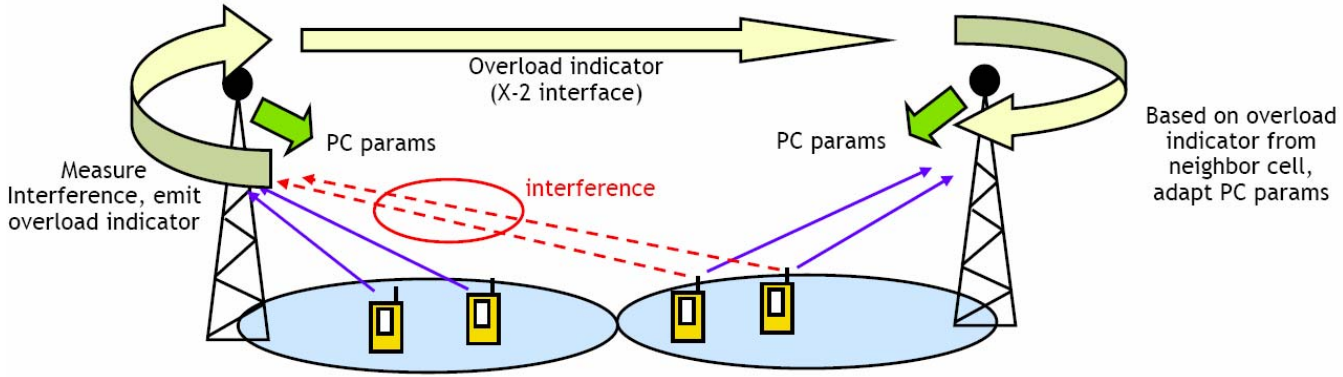
The SDD explicitly states “no SAP is required between RRC and MAC”.

SDD C-plane (most recent version)



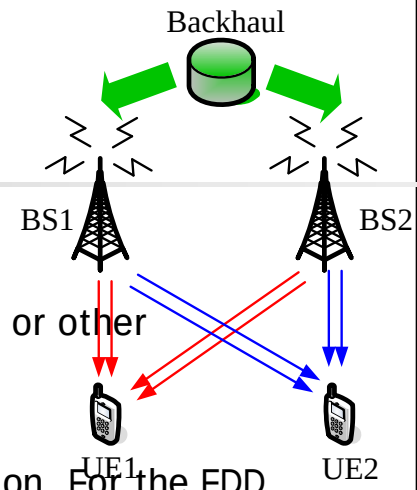
Everything connects with everything else.

UL Interference Control (aka. Tx PSD Control)



- Method shown refers to BS-centralized Tx PSD control as done in LTE.
- An MS-distributed (and faster) Tx PSD control method that does not require X2 communication but requires a hybrid OFDMA/CDMA UL air interface where the CDMA is used for signaling.
- Nevertheless irrespectively of centralized or distributed architectural decisions, there is a need to transfer side information for Tx PSD control as well as for Fractional Frequency Reuse algorithms (see contribution C80216m-08_598).

Multi-BS MIMO



Each BS acquires the channel information of all MSs that it serves.

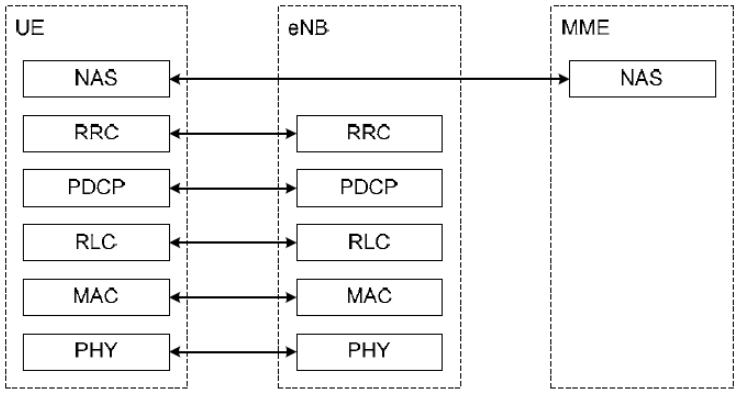
- For the uplink, base stations estimate the channel directly from the MS pilots or other reference signals. This applies to both TDD and FDD.
- For the TDD downlink, uplink estimates could be used for downlink transmission. For the FDD downlink, channel information is acquired through explicit feedback from the MSs.

BSs channel information needed for coordination.

- Each BS needs to share the complete channel information, e.g. short-term channel matrices, between itself and MSs that it may serve through multi-BS MIMO.
  - Things are easier in the DL. In one version of the DL algorithm, each BS sends the fedback precoder vector to one (centralized) or all BSs of the MIMO cluster (patent pending).
  - Things are much tougher in the UL for Network MIMO. MMSE-type processing should be done at a centralized location (i.e. one of the BS of the cluster) and soft information signals should be relayed there.

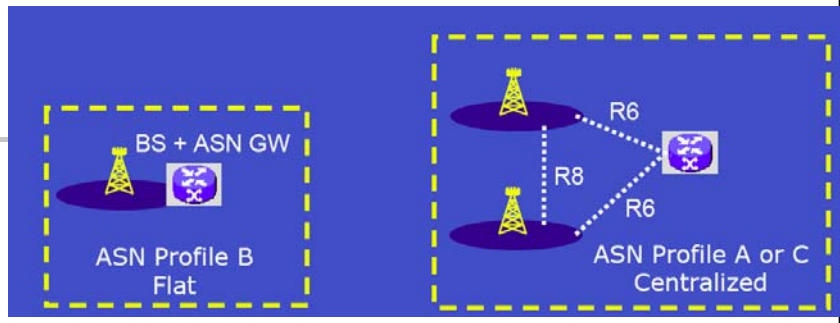
Scheduling (shared control channel) information needs to be decided at one BS/JB and propagated to the others.

LTE C-plane and X2



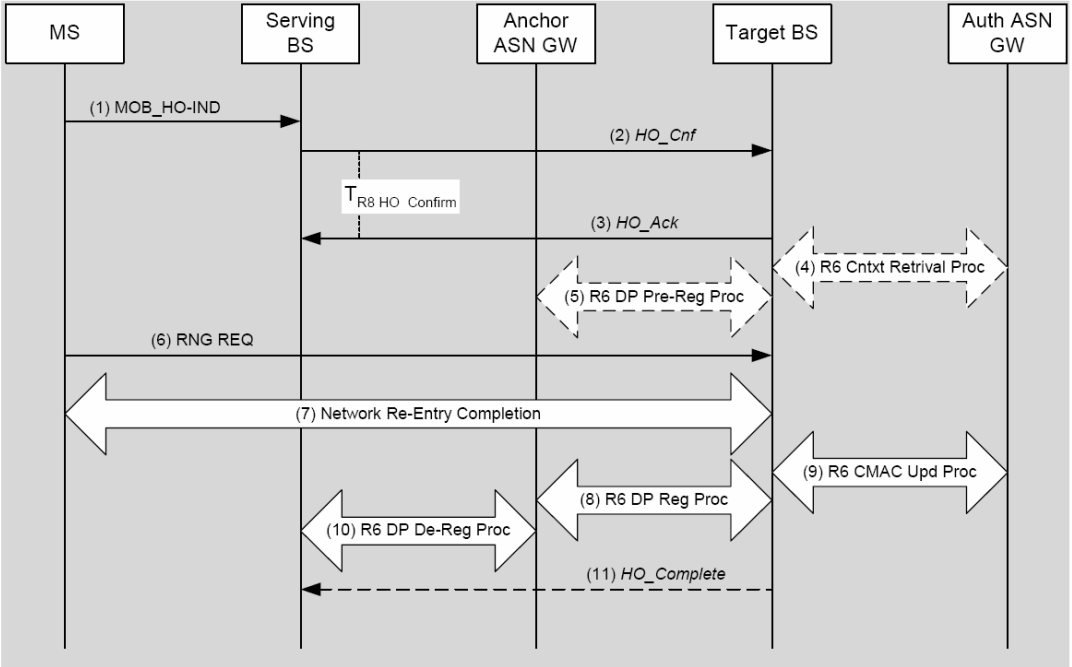
- The following components account for the overall X2-C interface delay:
  - Source eNB processing delay --------- <1 ms
  - X2-C transfer delay --------- 2 – 15 ms
  - MME routing delay --------- 1 ms
  - Target eNB processing delay --------- <1 ms
- The X2-C interface delay can be anywhere between 5 and 18 ms. The official number is “typically 10ms-20ms but longer delays may be experienced”.

ASN Profiles



ASN Profile	Descriptions	Pro	Con
Profile A	•Centralized architecture •Separate BS and ASN-GW entities •Split RRM: RRA at BS and RRC at ASN-GW	•Able to provide simplified pico-cell •Able to provide soft handover and FBSS •Fewer backhauls for RRM messages	•Interoperability between BS and ASN-GW from different vendors •Heavy workload at ASN-GW as compared to Profile C.
Profile B	•Distributed architecture •Combined BS and ASN-GW entities	•Simple architecture •Suitable for small scale deployment	•Difficult to customize IP and wireless functions for ASN-GW
Profile C	•Distributed architecture •Separate BS and ASN-GW entities •RRM at BS	•Able to provide simplified pico-cell •Able to get BS and ASN-GW from different vendors	•Extra backhauls for RRM messages

R8 Interface –example procedure



- For a simple one-way signaling procedure we may need ~ 30ms.
- The R8 interface is not mandatory i.e. most of the WiMAX products do not use it.
- There is no LTE RAN without an X2 interface.
- Latencies for both X2-C and the new R8m must come way down to be practical for some Multi-BS MIMO algorithms and certain deployment environments.

Rxx or new R8 (R8m) Interface

- The application part (AP) of Rxx should be lightweight.
  - It may be better to focus on 2-3 procedures (Multi-BS MIMO, UL Interference Control, Dynamic FFR) rather than inherit all the legacy applications of R8.
  - A lightweight Rxx should reduce latency and ease interoperability (compare X2 and Iub).
  - Alternatively, the time-critical procedures should be supported with some form of priorities over a modified R8 (R8m).
- The most critical to latency is the DL Multi-BS MIMO application.
  - The DL problem has a feedback architecture - control signals need to initially arrive at one BS/JB and then be fedback to multiple BS within the ASN
    - Contrast that to the UL problem that has feed-forward architecture.
- The most critical to overhead is the UL Multi-BS MIMO application that requires effectively splitting the PHY.