Recommendation on PMP Mode Compatible TDD Frame Structure

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None.

Purpose:

This is a response to IEEE 802.16mmr-05/021(call for contributions: IEEE 802.16's Study Group on Mobile Multi-hop Relay) to present a compatible TDD frame structure.

Recommendation on PMP Mode Compatible TDD Frame Structure

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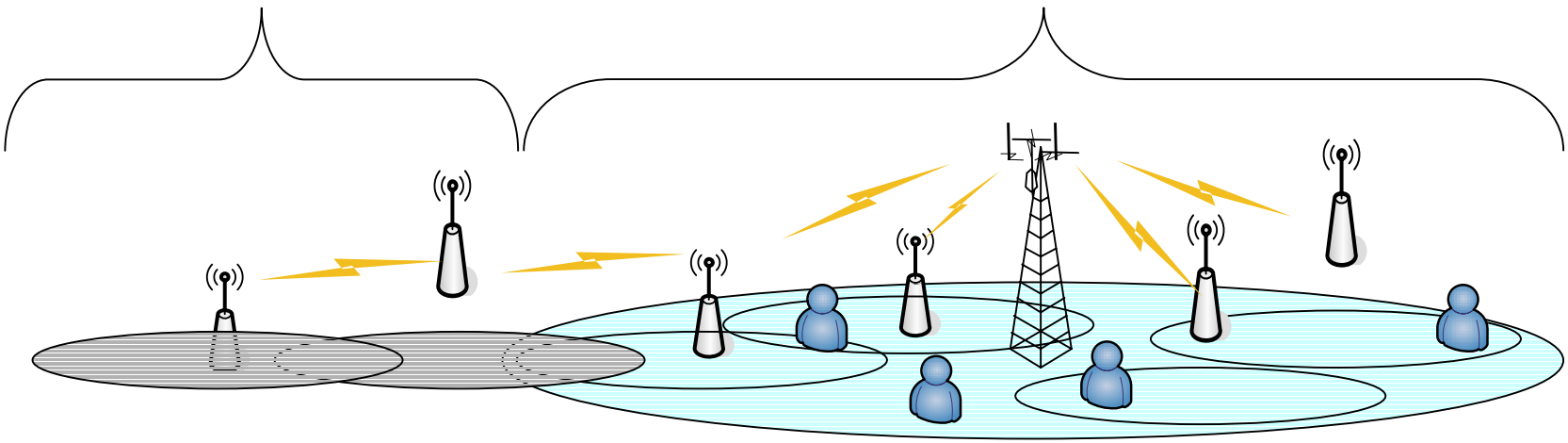
Response to 2nd Call For Contributions

- **Assess feasibility of Multi-hop Relay for fixed / mobile terminal including PHY/MAC modifications;**
  - TDD frame structure for relay application
  - New added MAC header info for RSs
- **Study the impact on MAC protocols to be newly added for the relay networking including handover cases**
  - Access for network entry
  - Switch between BS and RSs

Scenario and Assumptions

Coverage Extension (2) **Throughput Enhancement (1)**



	Coverage Extension	Throughput Enhancement
Broadcast information	BS → MS BS → RS → MS	BS → MS
Preamble for DL Sync	Provided by BS and RS	Provided by BS
Initial Ranging	MS → BS MS → RS → BS	MS → BS

Target with two hop

Application Scenarios

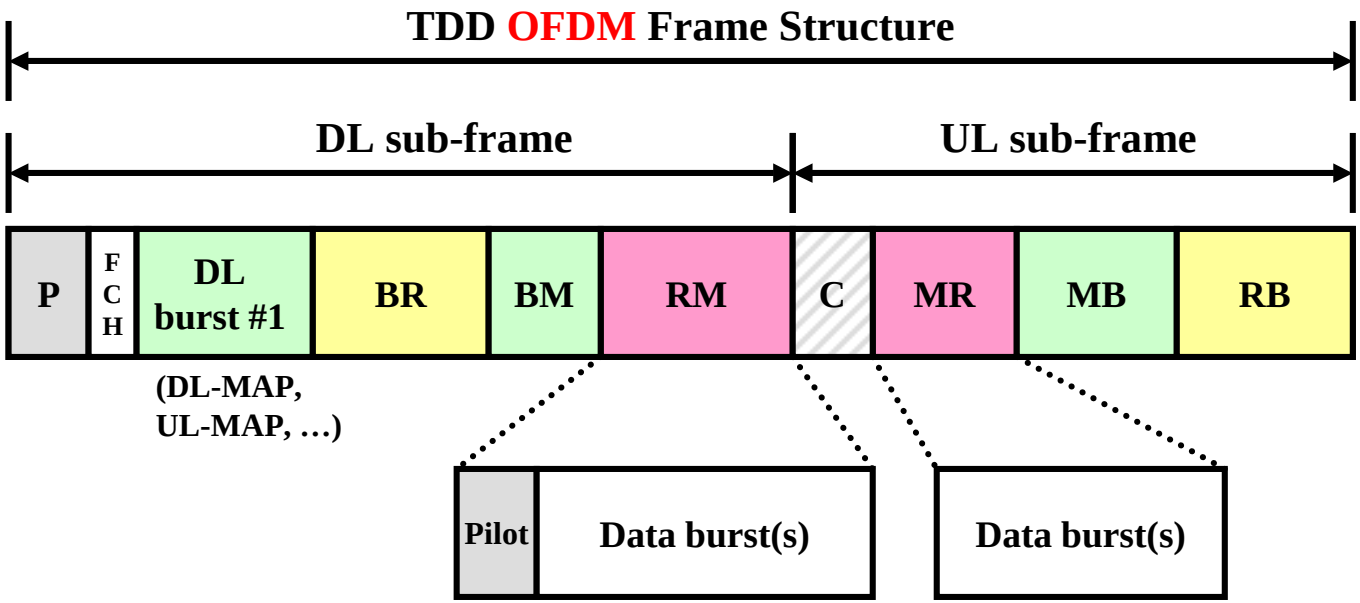
- **Throughput Enhancement → Proposed a two-hop frame structure**
  - It shall be compatible to the TDD mode with no relaying
  - BS/RS and RS/MS use the same frequency, i.e.,homogeneous relaying.
  - From BS viewpoint, an RS behaves the same as an SS. The transmission/reception burst is controlled by the BS.
  - From MSs viewpoint, an RS just performs decode-and-forward for relayed MSs but it is transparent to the relayed MSs.

- **Coverage Extension → For future study**

Supported Functions

- **Frame structure**
  - Modified frame structure to support RSs to forward the transmission over the air and increase link throughput from viewpoint of MSs.
- **Network entry**
  - Support transparent RS while a MS process network entry procedure in MMR application.
- **Synchronization**
  - The MSs and RSs can synchronize with BS in the proposed relay frame structure.
- **RS switch**
  - Support smooth switch for BS→RS, RS→RS, and RS→BS.

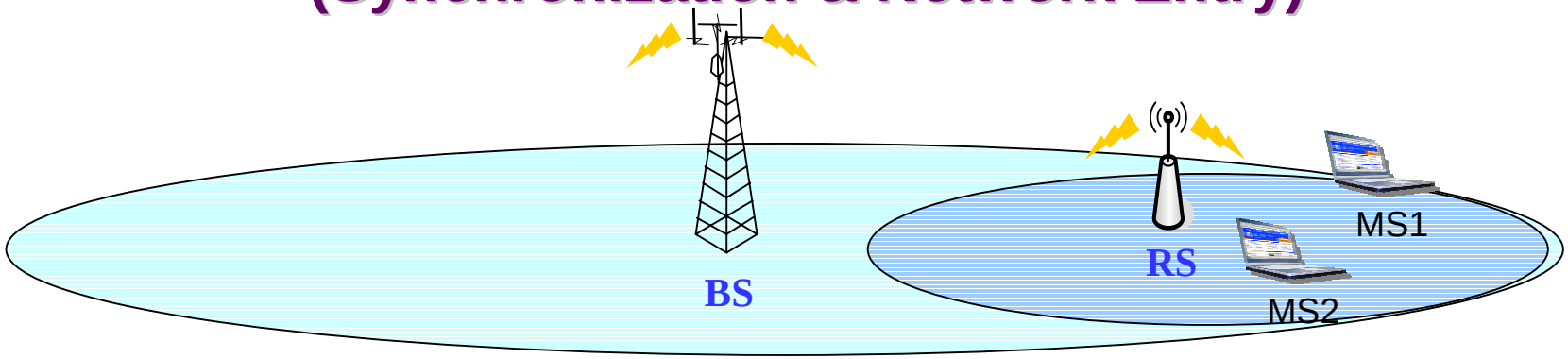
Frame Structure for Two-hop

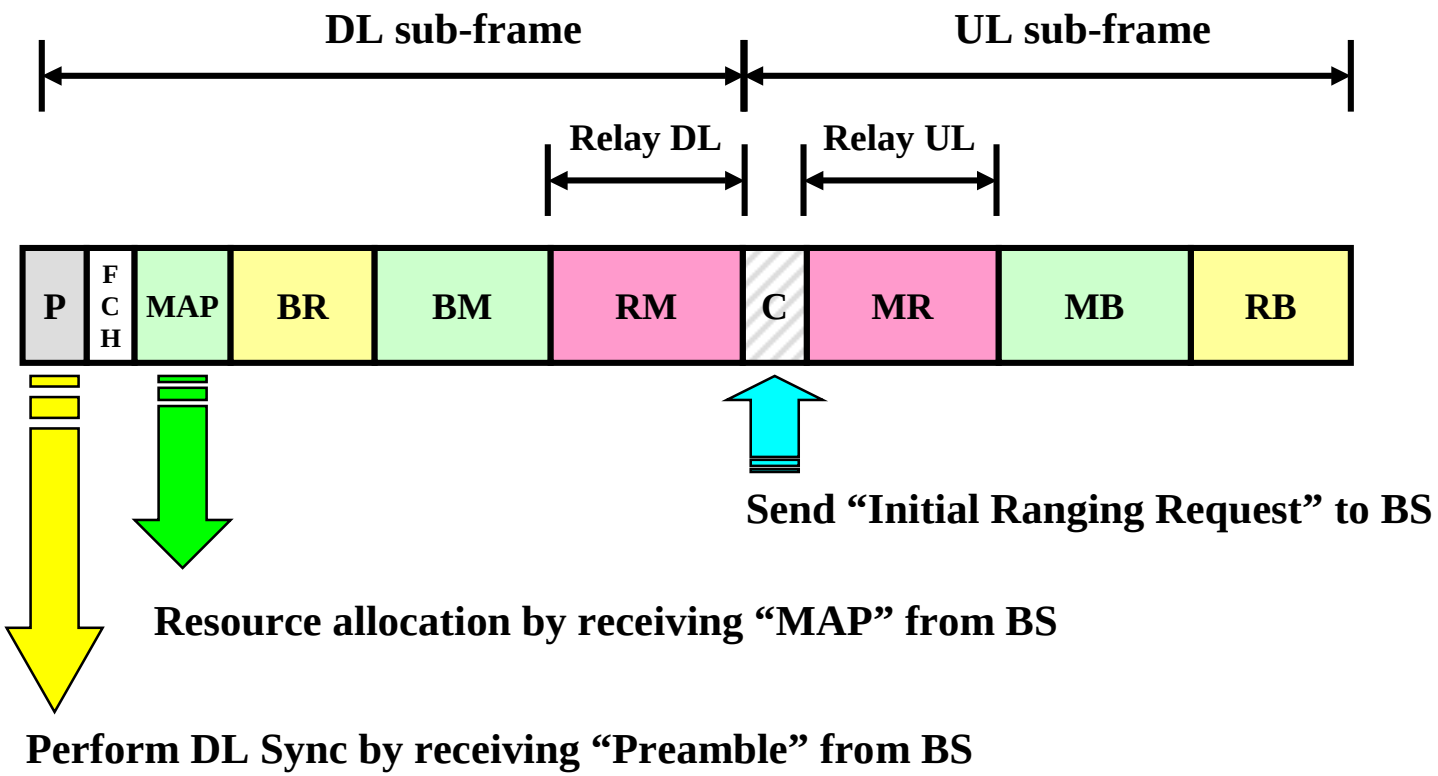


C	contention area
FCH	frame control header
P	preamble
BM	base station to mobile station
BR	base station to relay station
MB	mobile station to base station
MR	mobile station to relay station
RB	relay station to base station
RM	relay station to mobile station

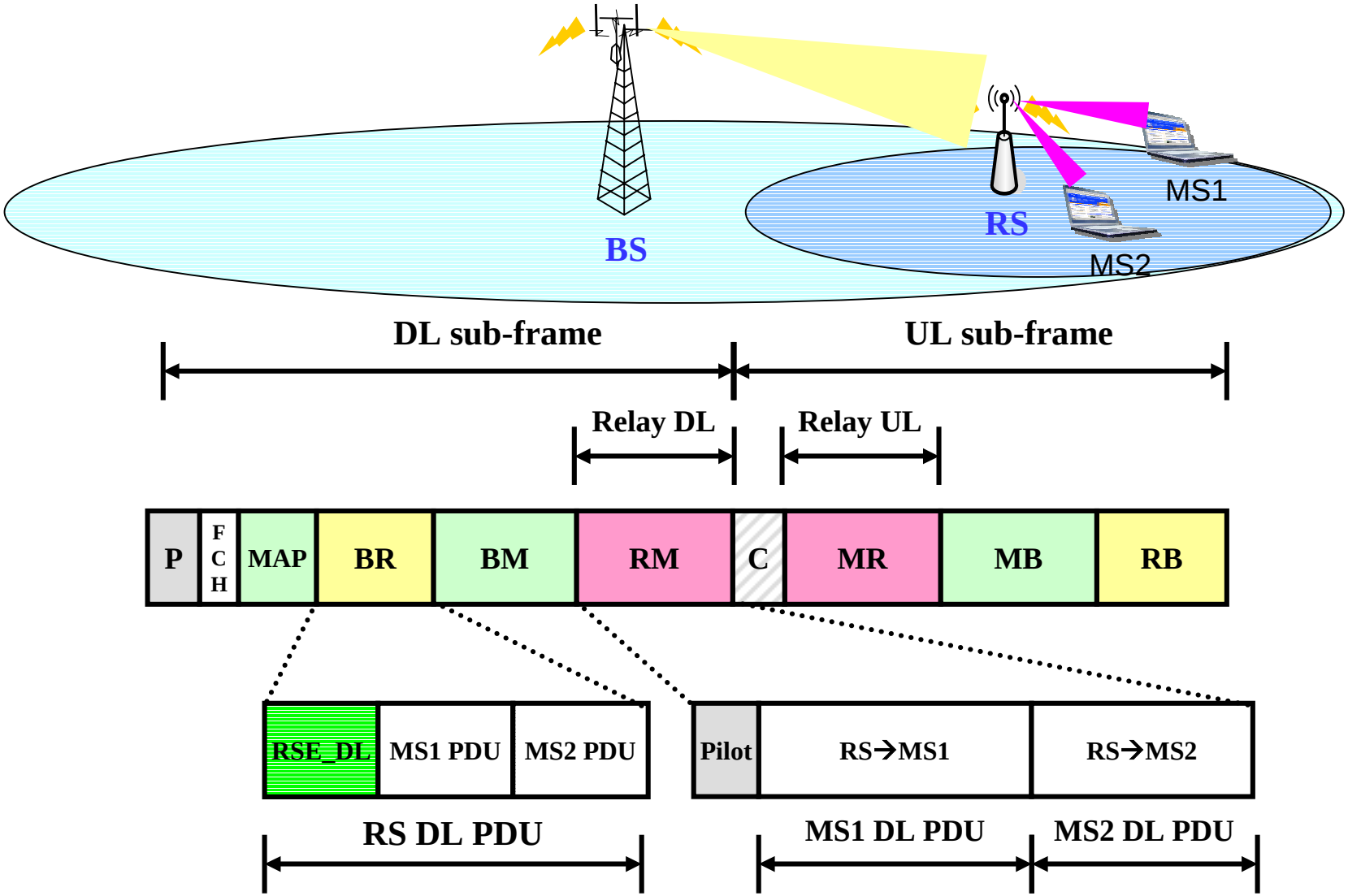
- **All MSs are located in the coverage of the BS so BS can directly assign resource allocation in MAP_IE and transmit control messages in by broadcast information.**
- **RS shall perform decode and forward the relay data within current or upcoming frame according to scheduling of BS.**

Example of Two Hop Relaying (Synchronization & Network Entry)



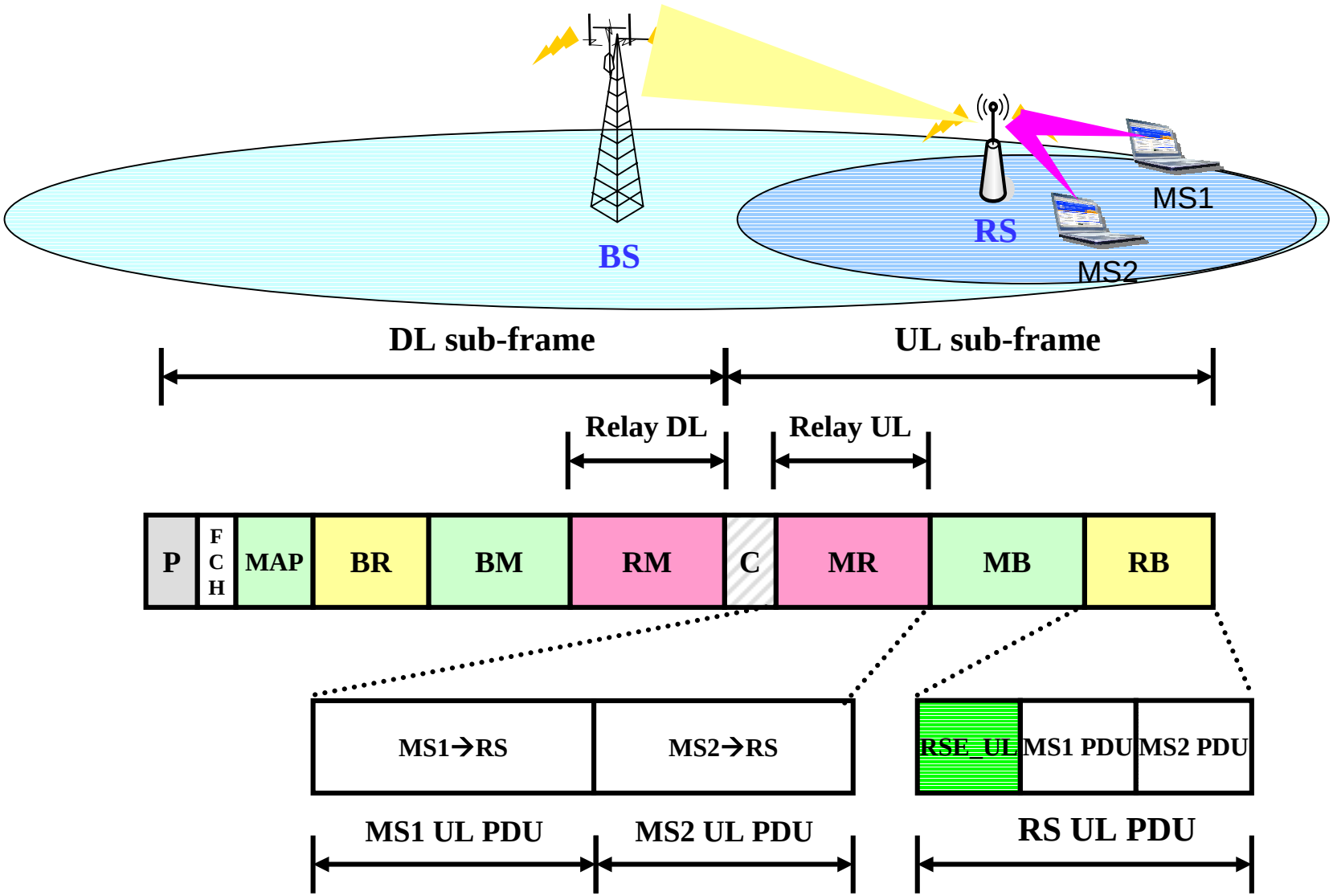


Example of Two Hop Relaying (DL Relay)



RSE_DL relay service element in downlink

Example of Two Hop Relaying (UL Relay)

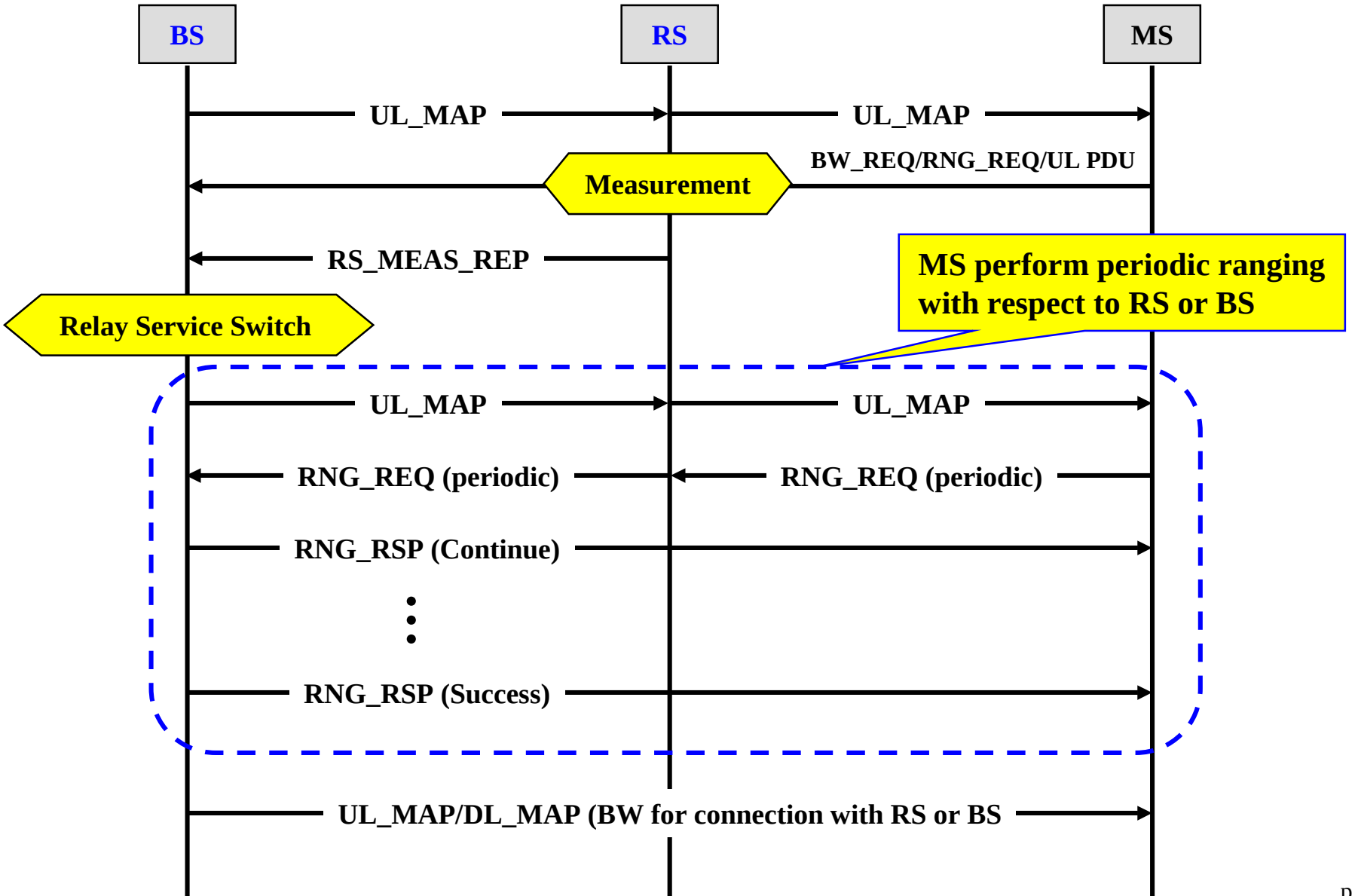


RSE_UL relay service element in uplink

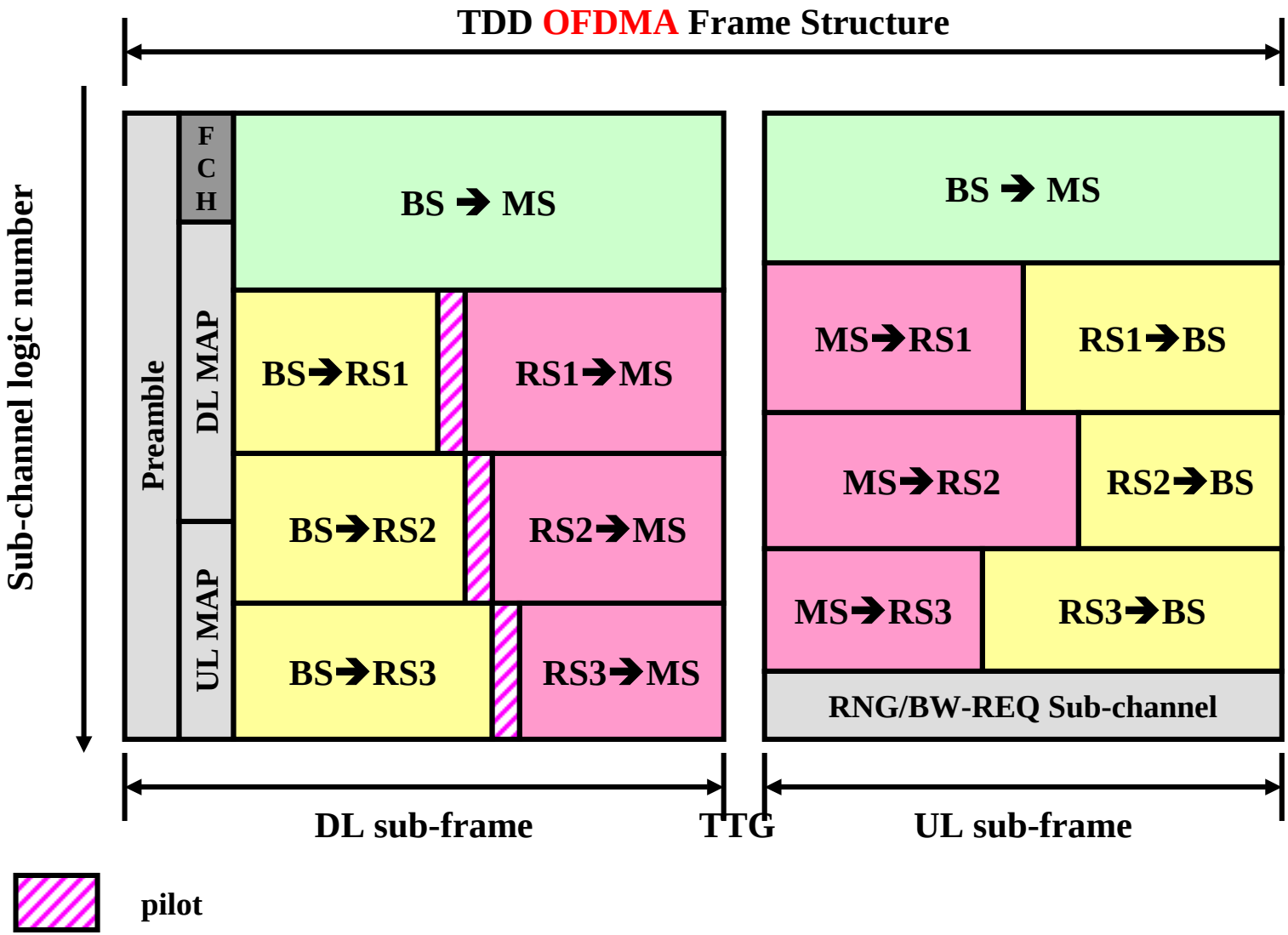
Relay Service Element (RSE)

- **RSE_DL (relay service element in downlink)**
  - Relay service CID for an RS
  - The relayed MS info including
    - **The downlink relaying service CIDs and their DL burst profiles of the MSs served by the RS.**
    - **The uplink relaying service CIDs and their UL burst profiles of the MSs served by the RS.**
- **RSE_UL (relay service element in uplink)**
  - Relay service CID for an RS
  - Uplink measurements for existing/candidate relayed MSs (RS_MEAS_REP).

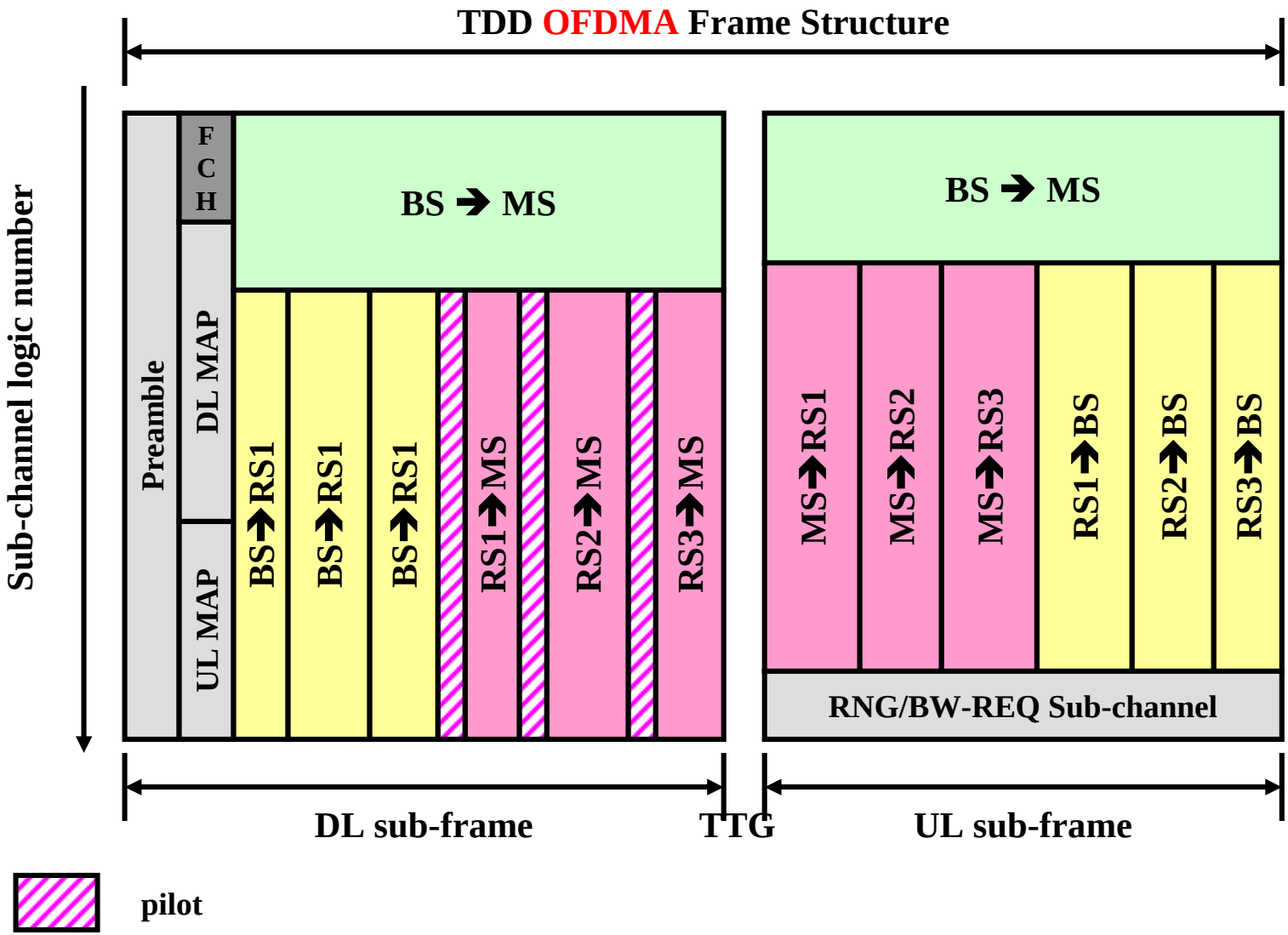
Access and Switch Access Relay Services



OFDMA Frame Structure for Two-hop (FDM)



OFDMA Frame Structure for Two-hop (TDM)



Summaries

- **Based on assumption of "all MSs located in BS coverage", we propose a PMP mode compatible two hop relay TDD frame structure.**
  - RS can perform decode-and-forward to enhance throughput of relayed MSs.
- **RS is fully transparent from viewpoint of MSs.**
  - DL synchronization and network entry process are the same as the relayless case.
  - RS support UL measurement for BS to determine RS selection.
    - **No effort is added on MS.**

References

- IEEE C80216mmr-05/005r2, Fang-Ching Ren, Chang-Lung Hsiao, Yu-Ching Hsu, and Wern-Ho Sheen, A Recommendation on PMP Mode Compatible Frame Structure
- IEEE: S802_16mmr-05/019, Naftali Chayat and Ran Yaniv, PHY aspects in MMR-enabled networks