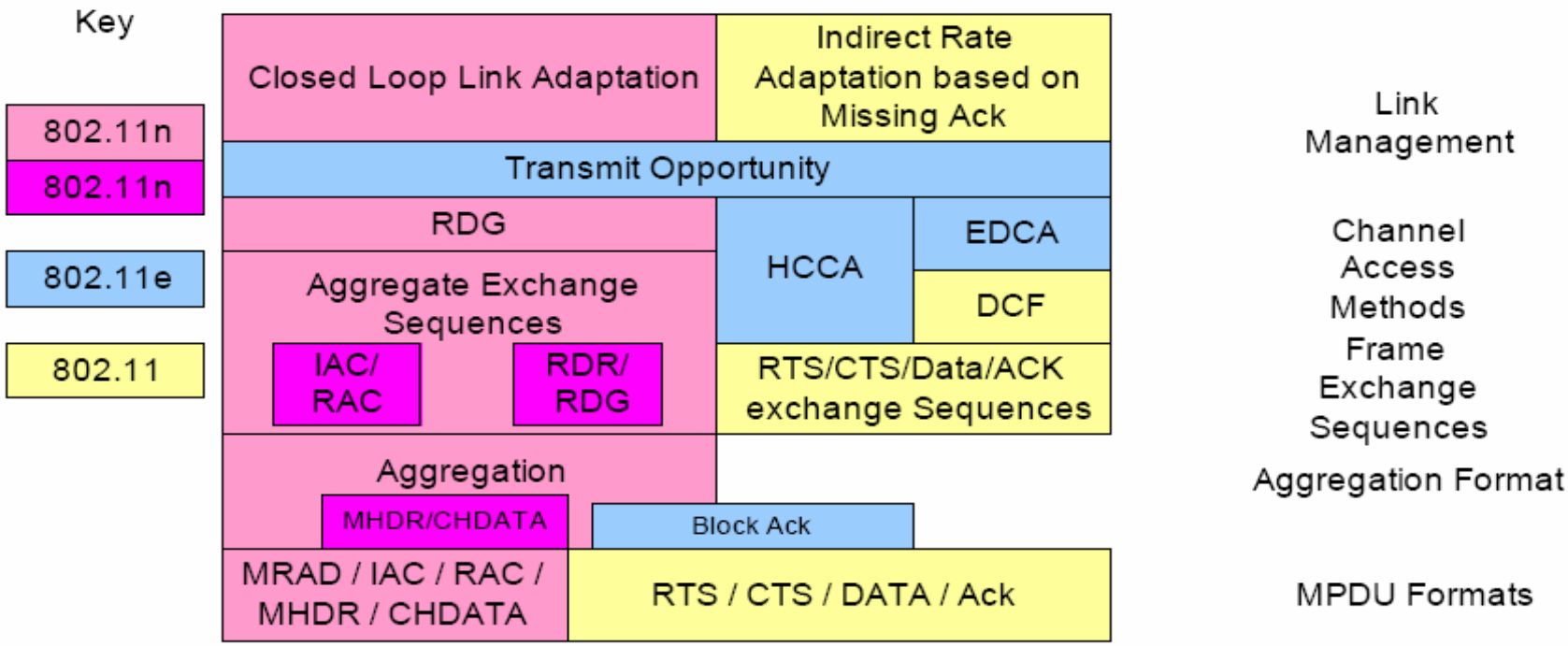
802.11n New MAC Features

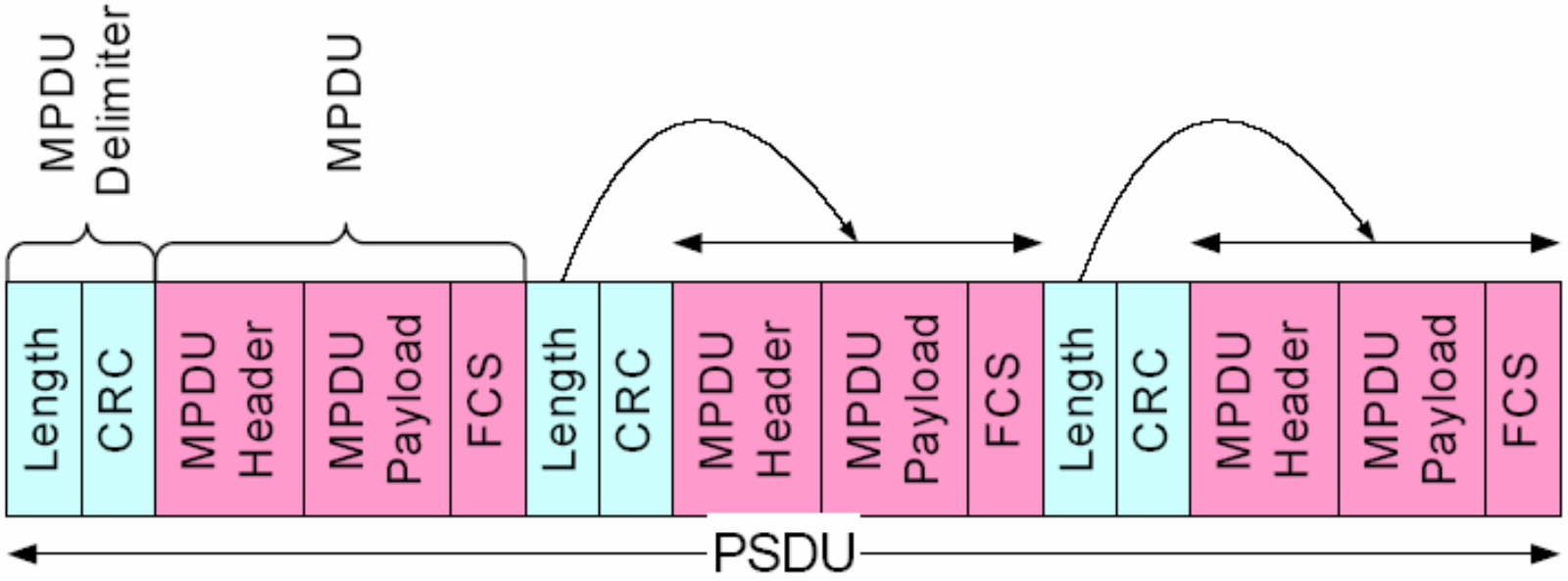
- Aggregation Format
- Aggregation Exchanges
- Header Compression
- Protection Mechanisms

MAC Architecture



Aggregation Framing

- Robust Structure
- Aggregation Framing is a purely-MAC function (PHY has no knowledge of MPDU boundaries)

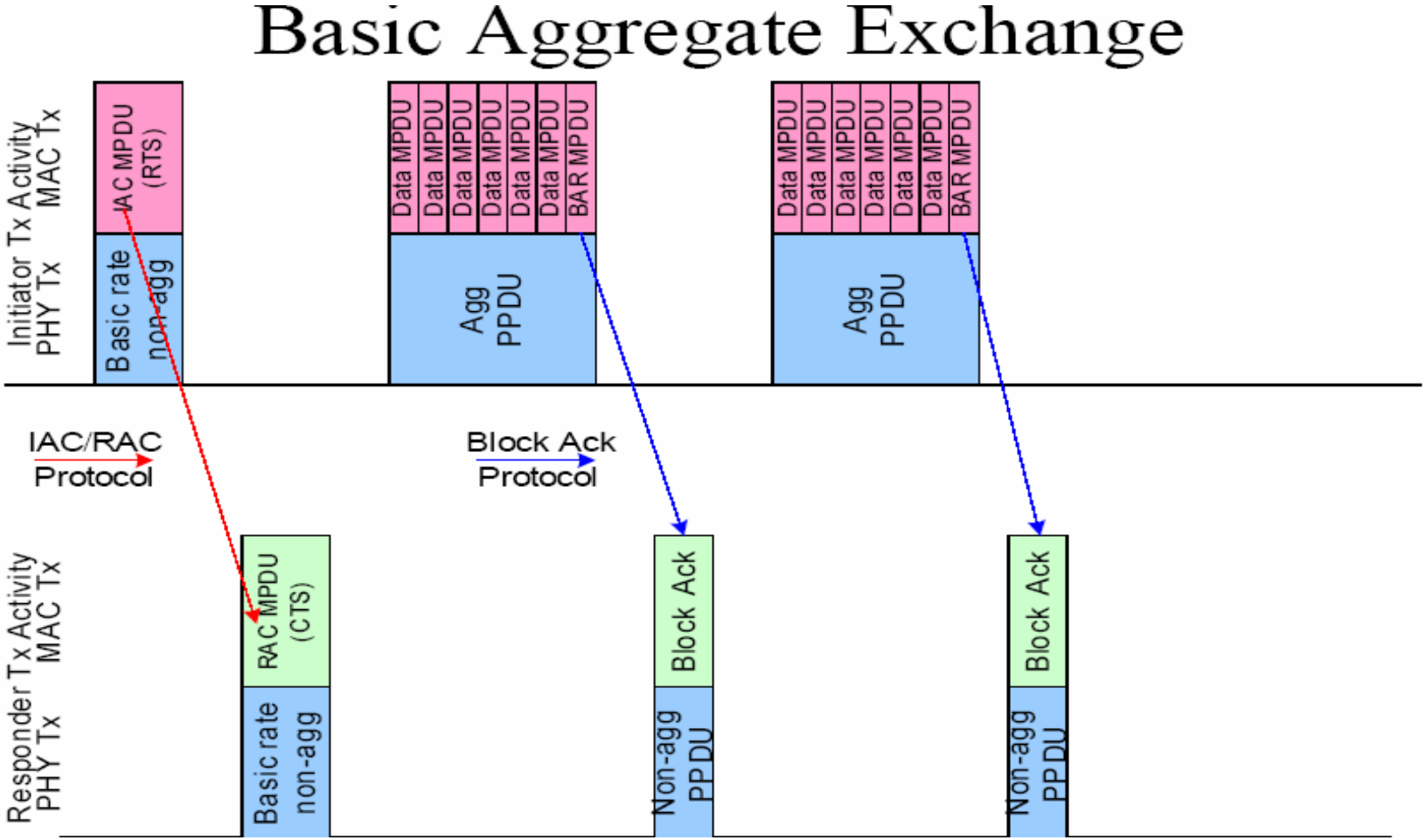


Aggregate Exchange Sequences

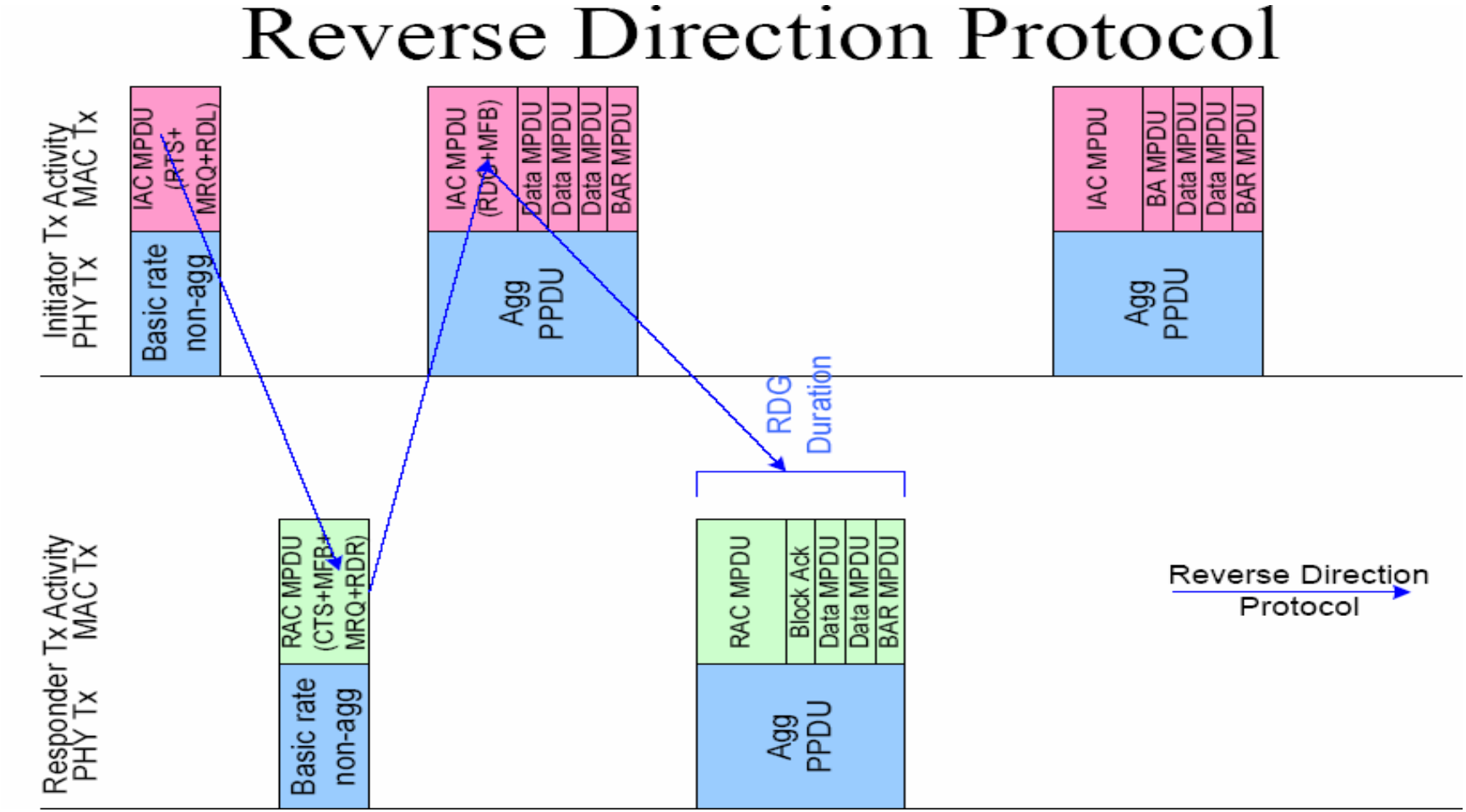
- MPDU or frame exchange sequences now extended to aggregate exchange sequences in which groups of frames are exchanged "at a time"
  - Allows effective use of Aggregate Feature
  - Allows control, data and acknowledgement to be sent in the same PPDU
- An initiator sends a PPDU and a responder may transmit a response PPDU
  - Either PPDU can be an aggregate

("Initiator" / "responder" are new terms relating to roles in aggregate exchange protocol)

Basic Aggregate Exchange



Reverse Direction Protocol



Initiator Aggregate Control

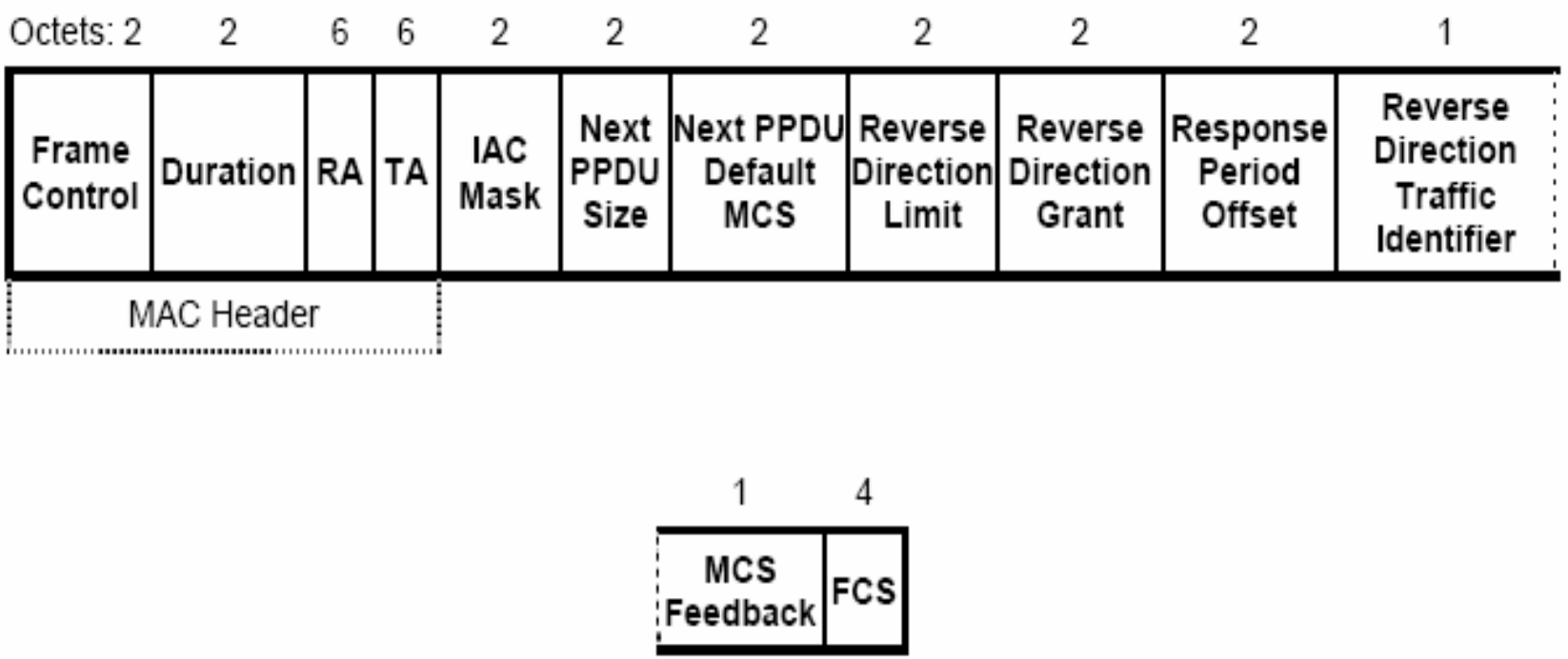


Figure 1 – IAC MPDU

Royal Automobile Club

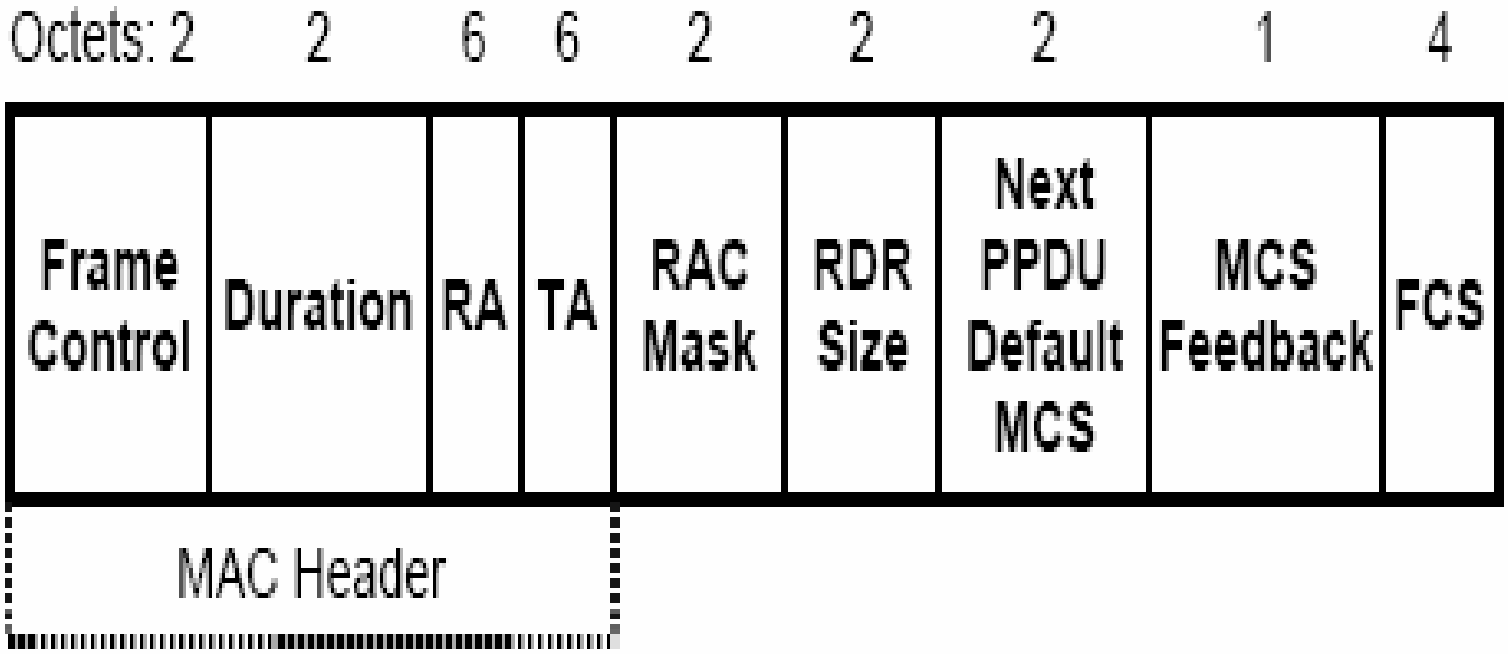


Figure 2 – RAC MPDU

Multiple Receiver Aggregate Descriptor

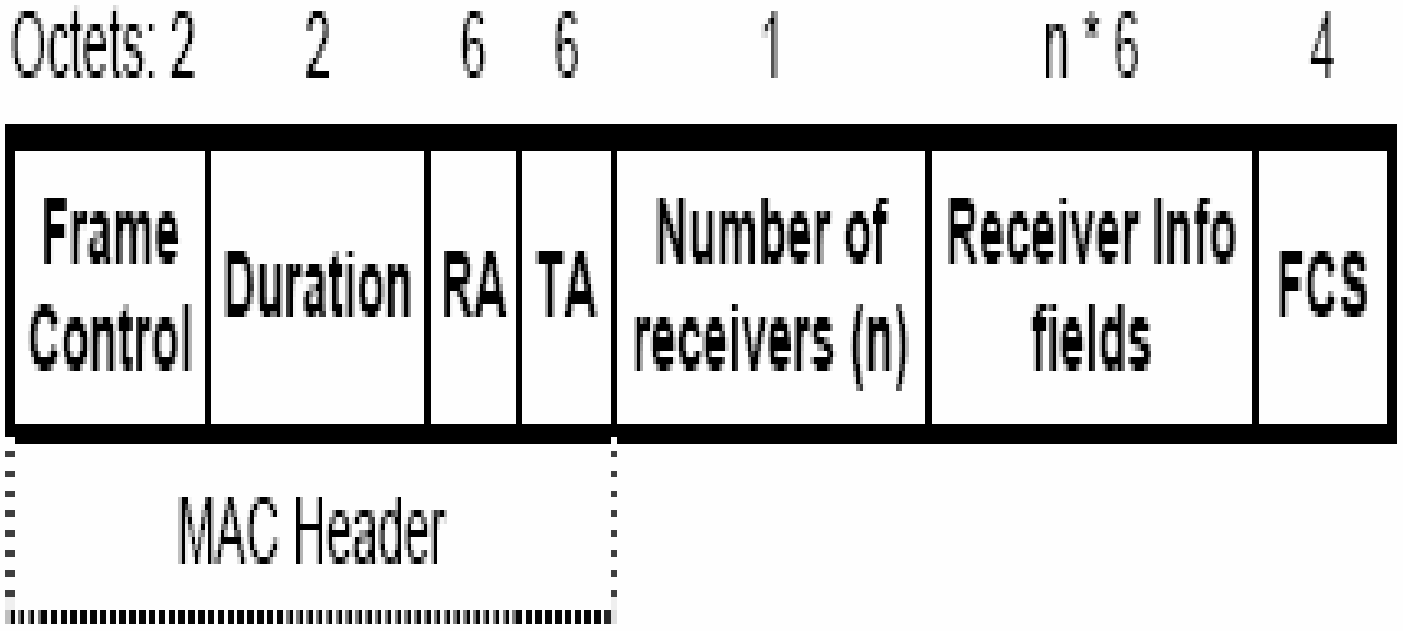


Figure 3 – MRAD MPDU

MAC Header MPDU

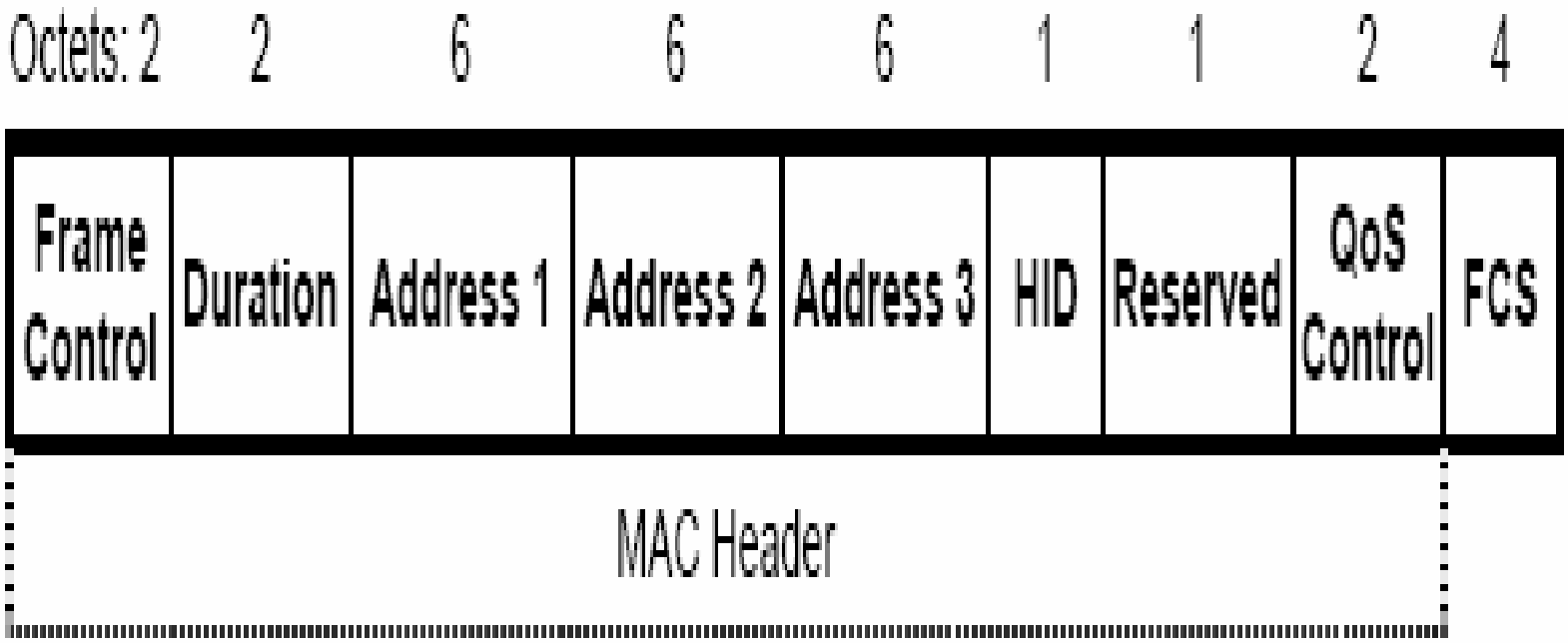


Figure 6 – MHDR MPDU

Compressed Header Data MPDU

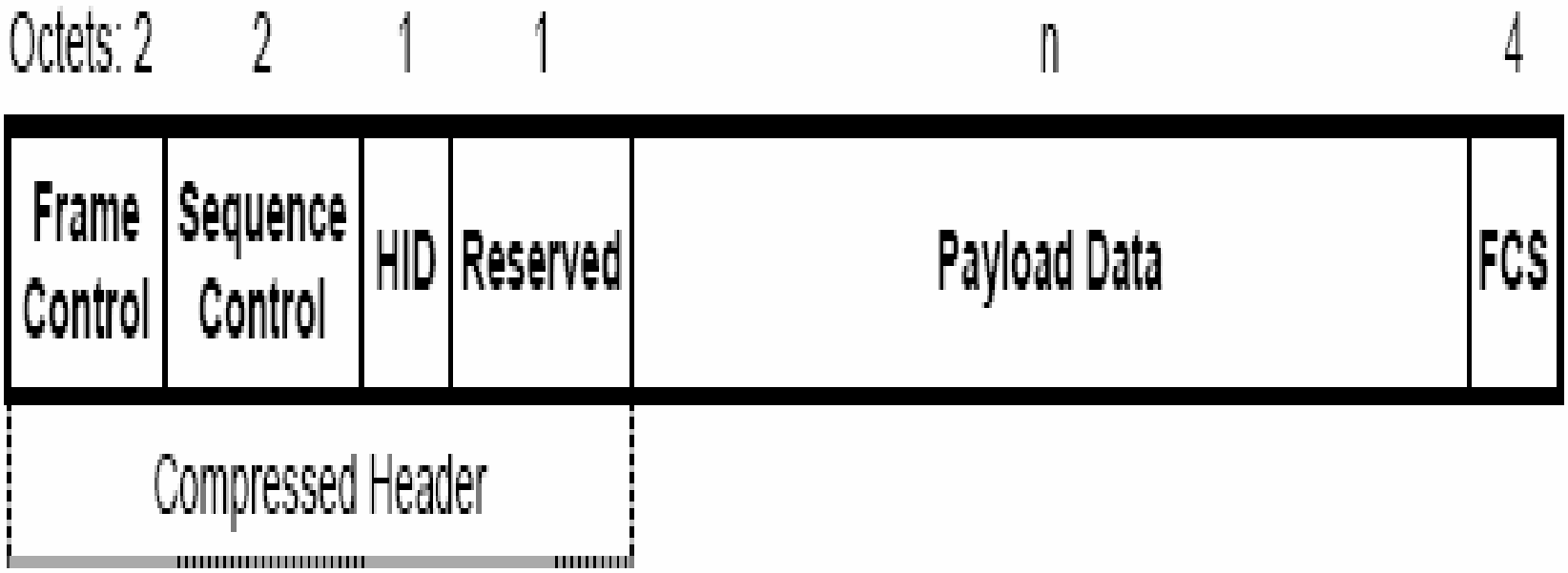
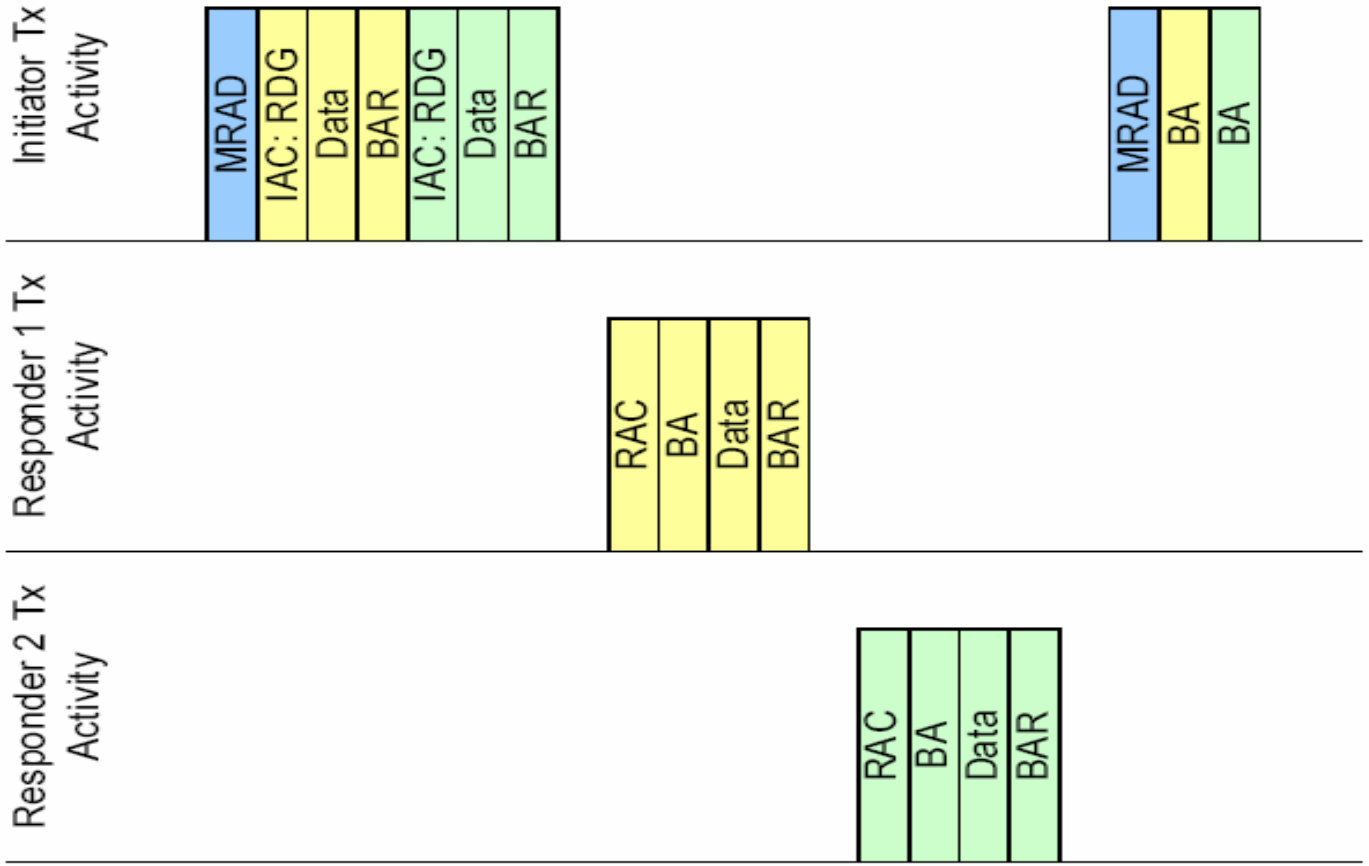


Figure 7 – CHDATA MPDU

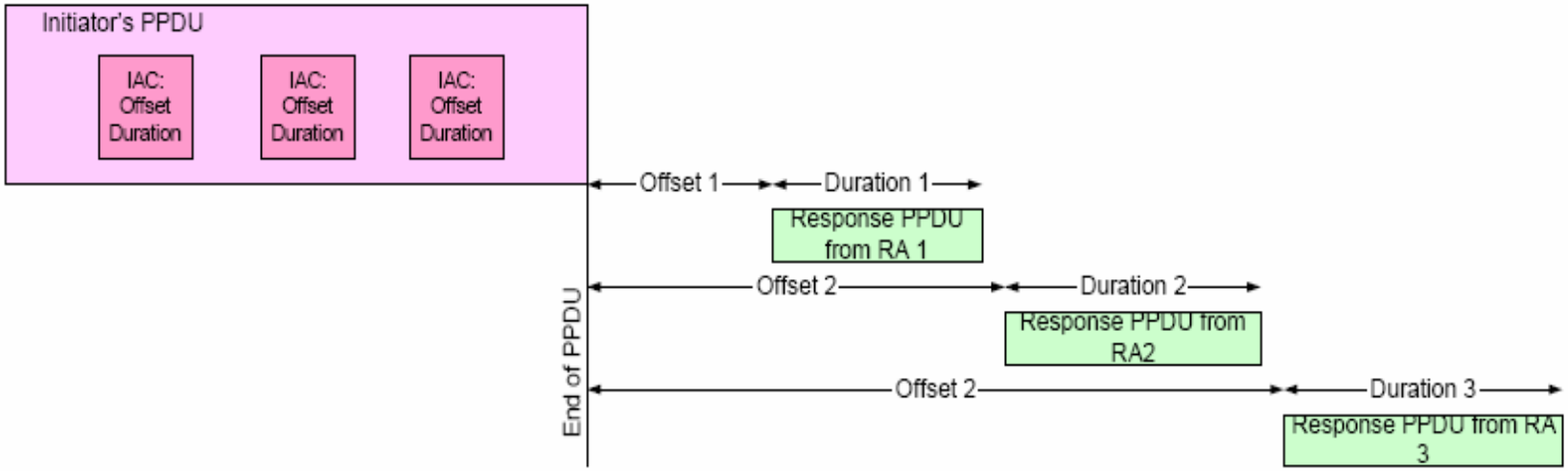
Multiple Receiver Aggregation

- Aggregates can contain MPDUs addressed for multiple receiver addresses (MRA)
- MRA may be followed by multiple responses from the multiple receivers
- MRA is effective in improving throughput in applications where frames are buffered to many receiver addresses

Periodic Multi-Receiver Aggregation



Multiple Responses



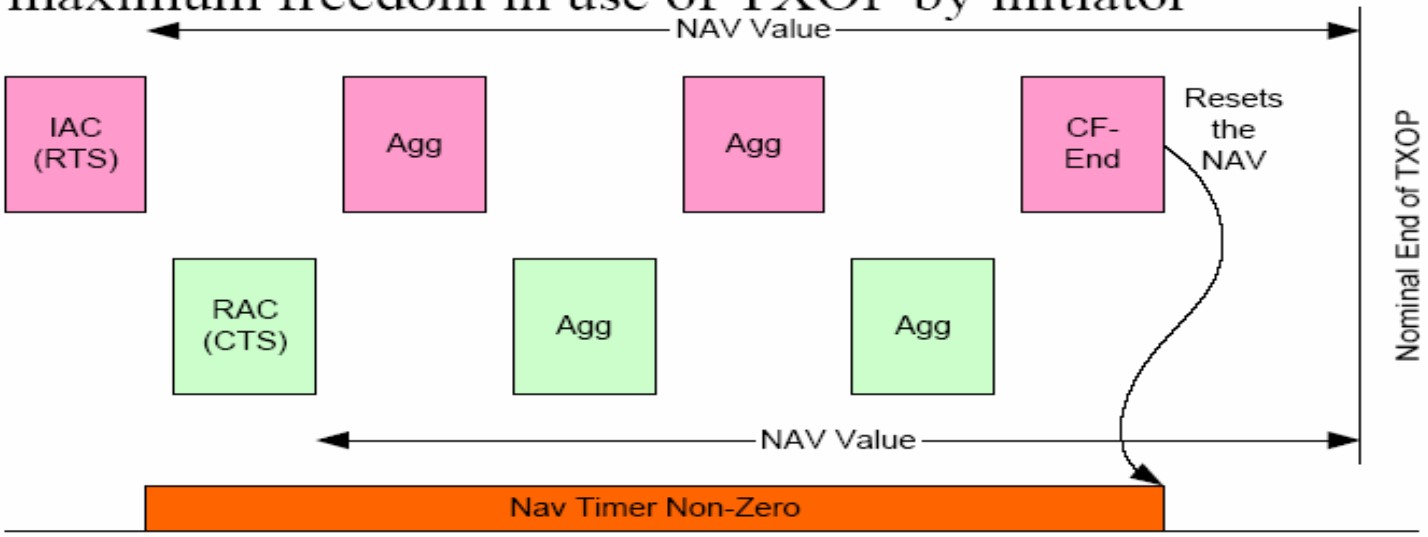
- MRA contains multiple IAC for
  - One per response
  - At most one per receiver
- IAC specifies response offset and duration

Protection Mechanisms

- LongNAV
  - An entire sequence is protected by NAV set using MPDU duration field or during contention-free period
  - CF-end packet at end of EDCA TXOP sequence may be used to return unused time by resetting NAV
- Pairwise Spoofing
  - Protection of pairs of PPDUs sent between an initiator and a single responder
  - Uses Legacy PLCP header duration spoofing
- Single-ended Spoofing
  - Protection of aggregate and any responses using legacy PLCP spoofing at the initiator only
  - Can be used to protect multiple responses

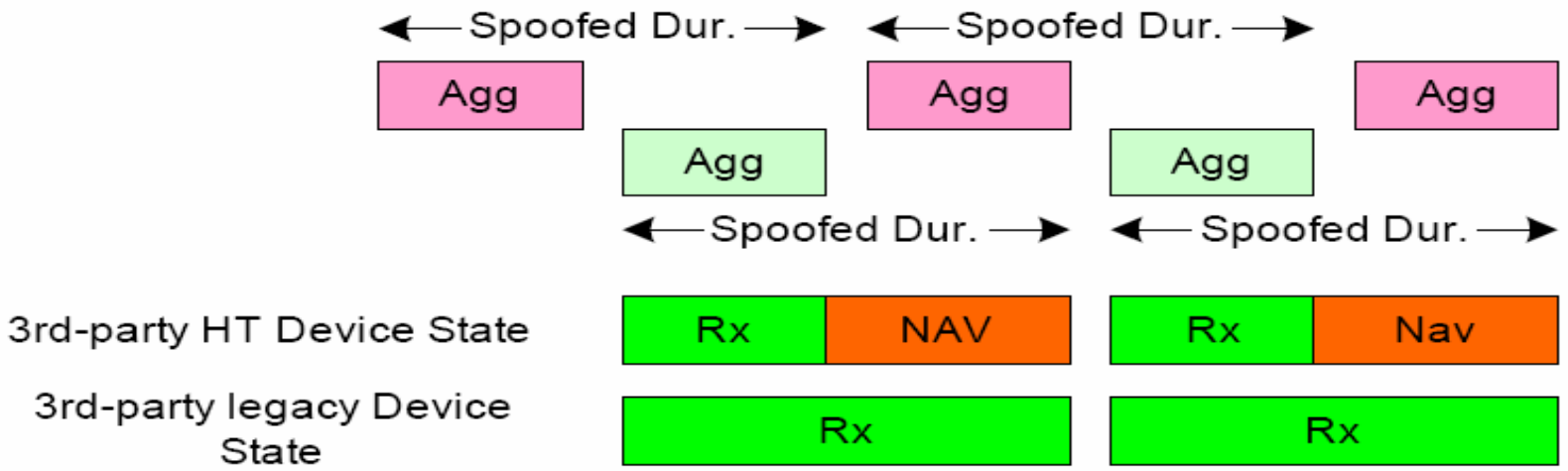
LongNAV protection

- Provides protection of a sequence of multiple PPDUs
- Provides a solution for .11b
- Comes "for free" with polled TXOP
- Gives maximum freedom in use of TXOP by initiator



Pairwise Spoofing Protection

- Protects pairs of PPDUs (current and following)
- Very low overhead, suitable for short exchanges
- Places Legacy devices into receiving mode for spoofed duration
- Spoofing is interpreted by HT devices as a NAV setting



Operating Mode Selection

- BSS operating mode controls the use of protection mechanisms and 40/20 width switching by HT STA
  - Supports mixed BSS of legacy + HT devices
- HT AP-managed modes
  - If only the control channel is overlapped, managed mixed mode provides a low overhead alternative to mixed mode
  - If both channels are overlapped, 20 MHz base mode allows an HT AP to dynamically switch channel width for 40 MHz-capable HT STA

Channel Selection

- Support 40/20 MHz and 20 MHz operating modes of whole BSS
- In 40/20 MHz mode, all legacy PPDUs are 20 MHz, all HT PPDUs exchanged between HT STA are either 40 MHz or 20 MHz depending on operating mode and STA capability
- Channel selection constraints

– Partial overlap between HT systems is not allowed

– Legacy STAs are only allowed in the control sub-channel except in 20 MHz-base managed mixed mode

- An HT AP responds to changes in environment to maintain channel selection constraints