

Block Ack mechanism & Qos Control Field

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MAC Frame Format

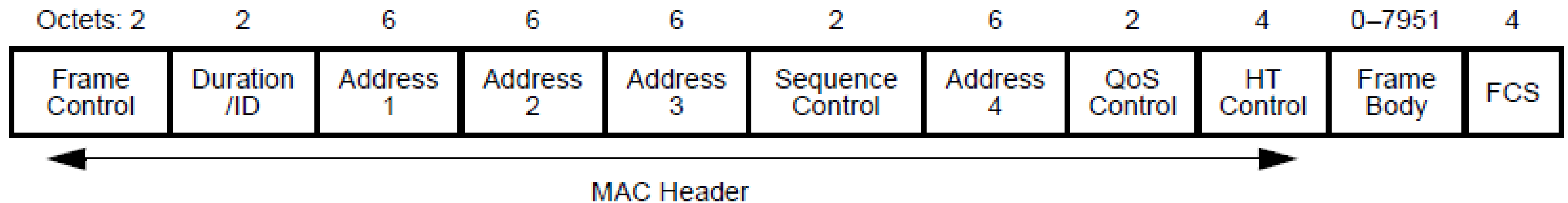


Figure 8-1—MAC frame format

TABLE 3.4 QoS Control field

QoS Station	Bits 0-3	Bit 4	Bits 5-6	Bit 7	Bits 8-15
AP	TID/Access Class	EOSP	ACK Policy	Reserved	TXOP Limit
AP	TID/Access Class	EOSP	ACK Policy	Reserved	AP PS Buffer State
Client STA	TID/Access Class	0	ACK Policy	Reserved	TXOP Duration Requested
Client STA	TID/Access Class	1	ACK Policy	Reserved	Queue Size

Transmitting station	Receiving station	Data frame subtype used
Non-QoS station	Non-QoS station	Non-QoS frame
Non-QoS station	QoS station	Non-QoS frame
QoS station	QoS station	QoS frame
QoS station	Non-QoS station	Non-QoS frame
All	Broadcast	Non-QoS frame, unless the transmitting station knows that all stations in the BSS are QoS capable, in which case a QoS frame would be used
All	Multicast	Non-QoS frame, unless the transmitting station knows that all stations in the BSS that are members of the multicast group are QoS capable, in which case a QoS frame would be used

- Initially defined in 802.11e standard as an optional scheme to improve the MAC efficiency.
- In 802.11n enhances the Block Ack mechanism made it mandatory to support all 802.11n capable devices(HT devices)
- Instead of transmitting individual ACK for every data frame, multiple data frames can be acknowledged together using BA frame.
- The BA mechanism improves the channel efficiency by aggregating several ACKs into one frame.

Block Ack Types

- Immediate Block Ack
- Delayed Block Ack

Different Phases of Block Ack

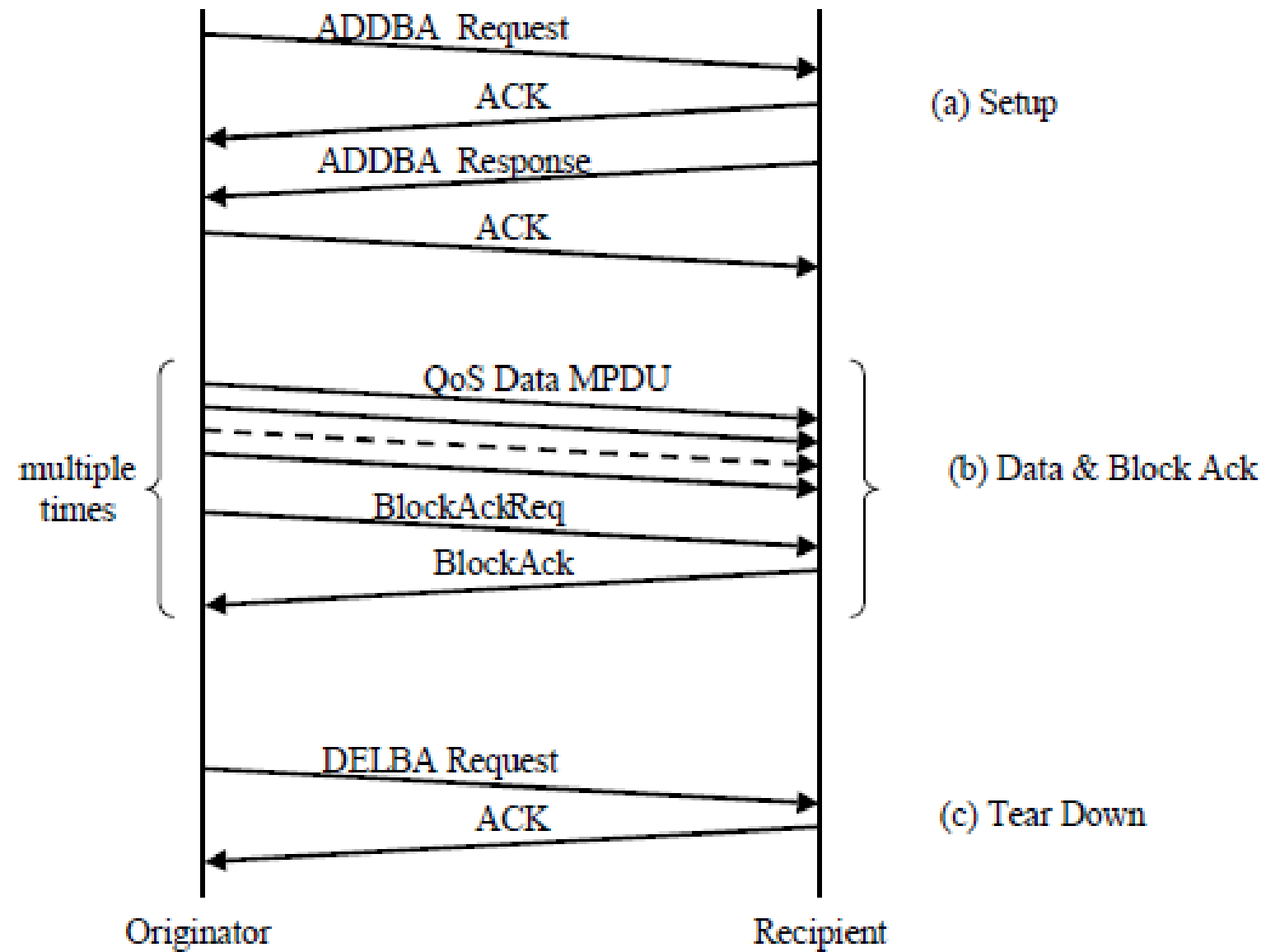


Figure 9-25—Message sequence chart for Block Ack mechanism:
(a) setup, (b) data and acknowledgment transfer and (c) tear down

Immediate Block Ack

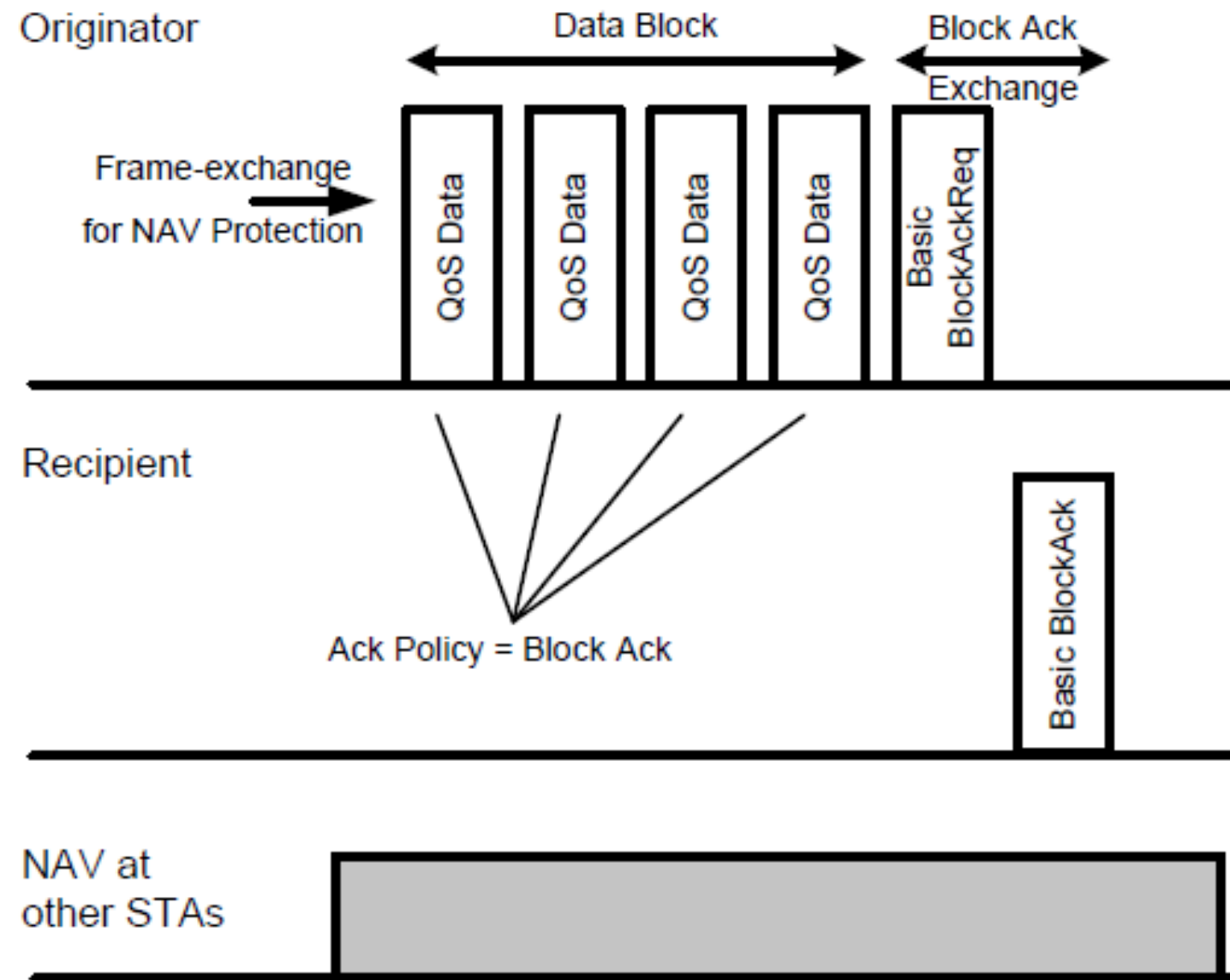


Figure 9-26—A typical Block Ack sequence when immediate policy is used

Delayed Block Ack

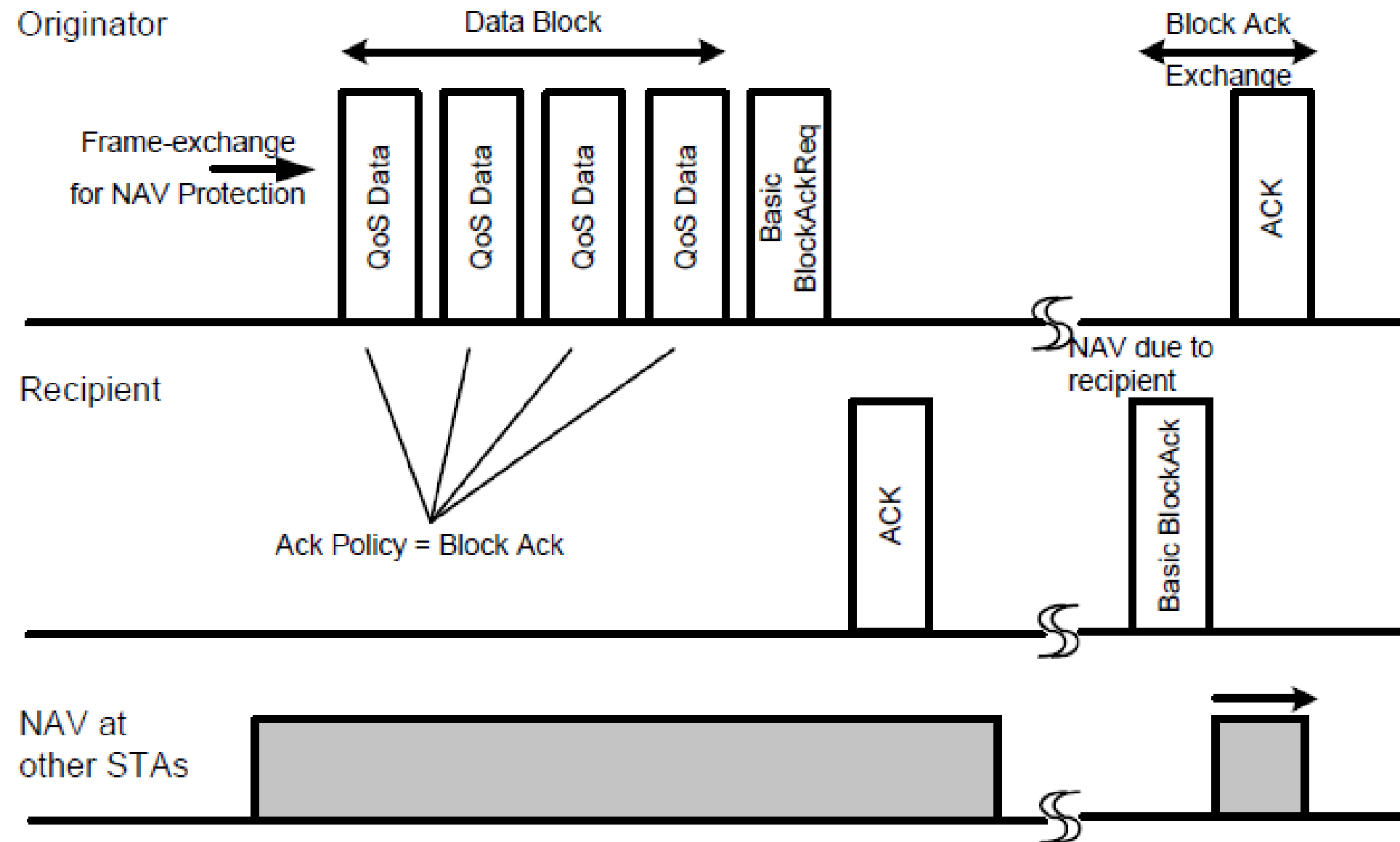


Figure 9-27—A typical BlockAck sequence when delayed policy is used

Block Ack Parameter Set

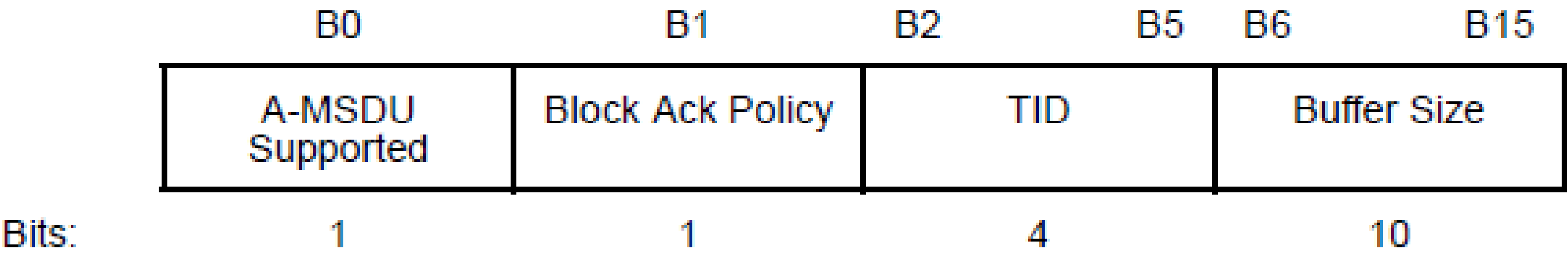


Figure 8-48—Block Ack Parameter Set fixed field

Addba Request

```

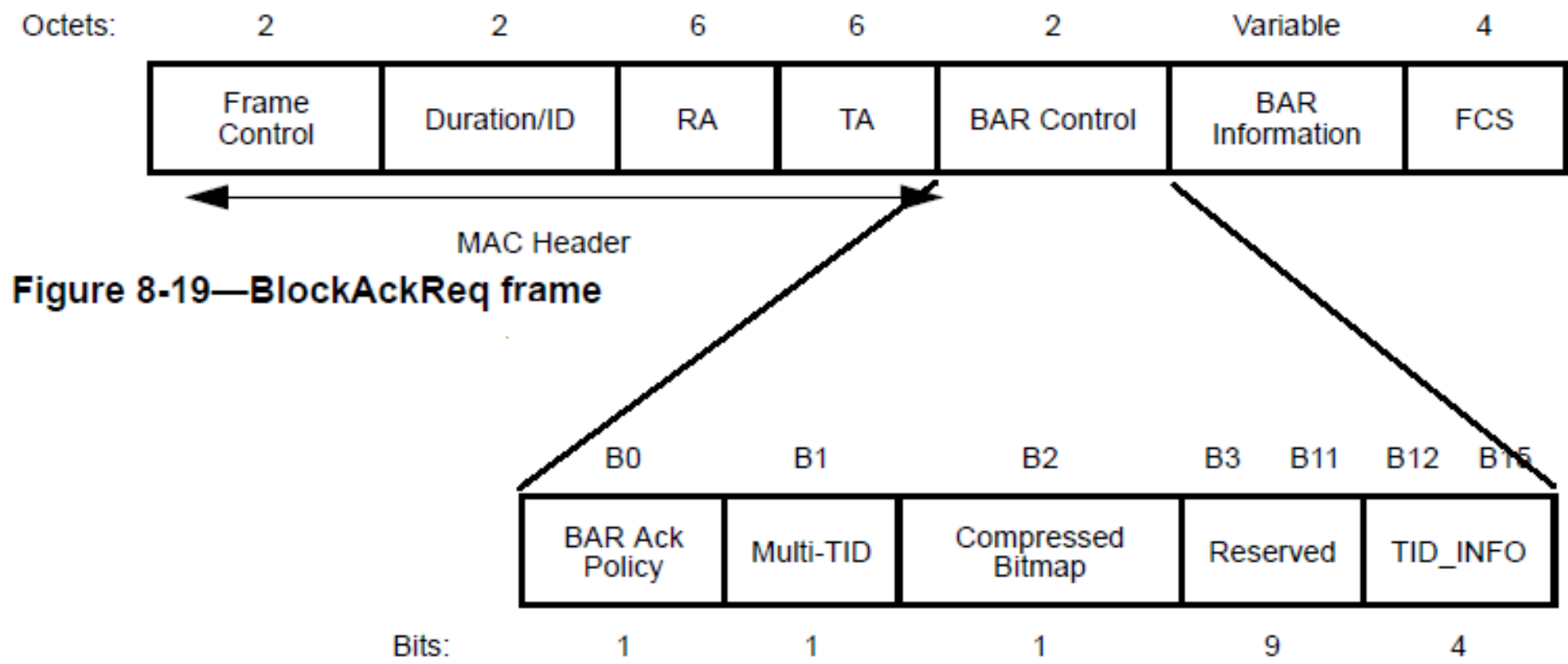
+ Frame 284: 37 bytes on wire (296 bits), 37 bytes captured (296 bits)
+ 802.11 radio information
- IEEE 802.11 Action, Flags: .....C
  Type/Subtype: Action (0x000d)
+ Frame Control Field: 0xd000
  .000 0000 0010 1100 = Duration: 44 microseconds
  Receiver address: Cisco_99:1a:ae (b8:38:61:99:1a:ae)
  Destination address: Cisco_99:1a:ae (b8:38:61:99:1a:ae)
  Transmitter address: Apple_ea:5b:66 (04:f7:e4:ea:5b:66)
  Source address: Apple_ea:5b:66 (04:f7:e4:ea:5b:66)
  BSS Id: Cisco_99:1a:ae (b8:38:61:99:1a:ae)
  Fragment number: 0
  Sequence number: 1811
+ Frame check sequence: 0x1b0d51d1 [correct]
- IEEE 802.11 wireless LAN management frame
  - Fixed parameters
    Category code: Block Ack (3)
    Action code: Add Block Ack Request (0x00)
    Dialog token: 0xd7
  - Block Ack Parameters: 0x1002, Block Ack Policy
    .... 0 = A-MSDUs: Not Permitted
    .... 1 = Block Ack Policy: Immediate Block Ack
    .... 00 00.. = Traffic Identifier: 0x0000
    0001 0000 00.. .... = Number of Buffers (1 Buffer = 2304 Bytes): 64
    Block Ack Timeout: 0x0000
  - Block Ack Starting Sequence Control (SSC): 0x0600
    .... 0000 = Fragment: 0
    0000 0110 0000 .... = Starting Sequence Number: 96

```

Addba Response

```
+ Frame 286: 37 bytes on wire (296 bits), 37 bytes captured (296 bits)
+ 802.11 radio information
- IEEE 802.11 Action, Flags: .....C
  Type/Subtype: Action (0x000d)
+ Frame Control Field: 0xd000
  .000 0000 0010 1100 = Duration: 44 microseconds
  Receiver address: Apple_ea:5b:66 (04:f7:e4:ea:5b:66)
  Destination address: Apple_ea:5b:66 (04:f7:e4:ea:5b:66)
  Transmitter address: Cisco_99:1a:ae (b8:38:61:99:1a:ae)
  Source address: Cisco_99:1a:ae (b8:38:61:99:1a:ae)
  BSS Id: Cisco_99:1a:ae (b8:38:61:99:1a:ae)
  Fragment number: 0
  Sequence number: 1859
+ Frame check sequence: 0x8b73faef [correct]
- IEEE 802.11 wireless LAN management frame
  - Fixed parameters
    Category code: Block Ack (3)
    Action code: Add Block Ack Response (0x01)
    Dialog token: 0xd7
    Status code: Successful (0x0000)
  - Block Ack Parameters: 0x1002, Block Ack Policy
    .... ..0 = A-MSDUs: Not Permitted
    .... ..1. = Block Ack Policy: Immediate Block Ack
    .... ..00 00.. = Traffic Identifier: 0x0000
    0001 0000 00.. .... = Number of Buffers (1 Buffer = 2304 Bytes): 64
    Block Ack Timeout: 0x0000
```

BlockAck Request Frame

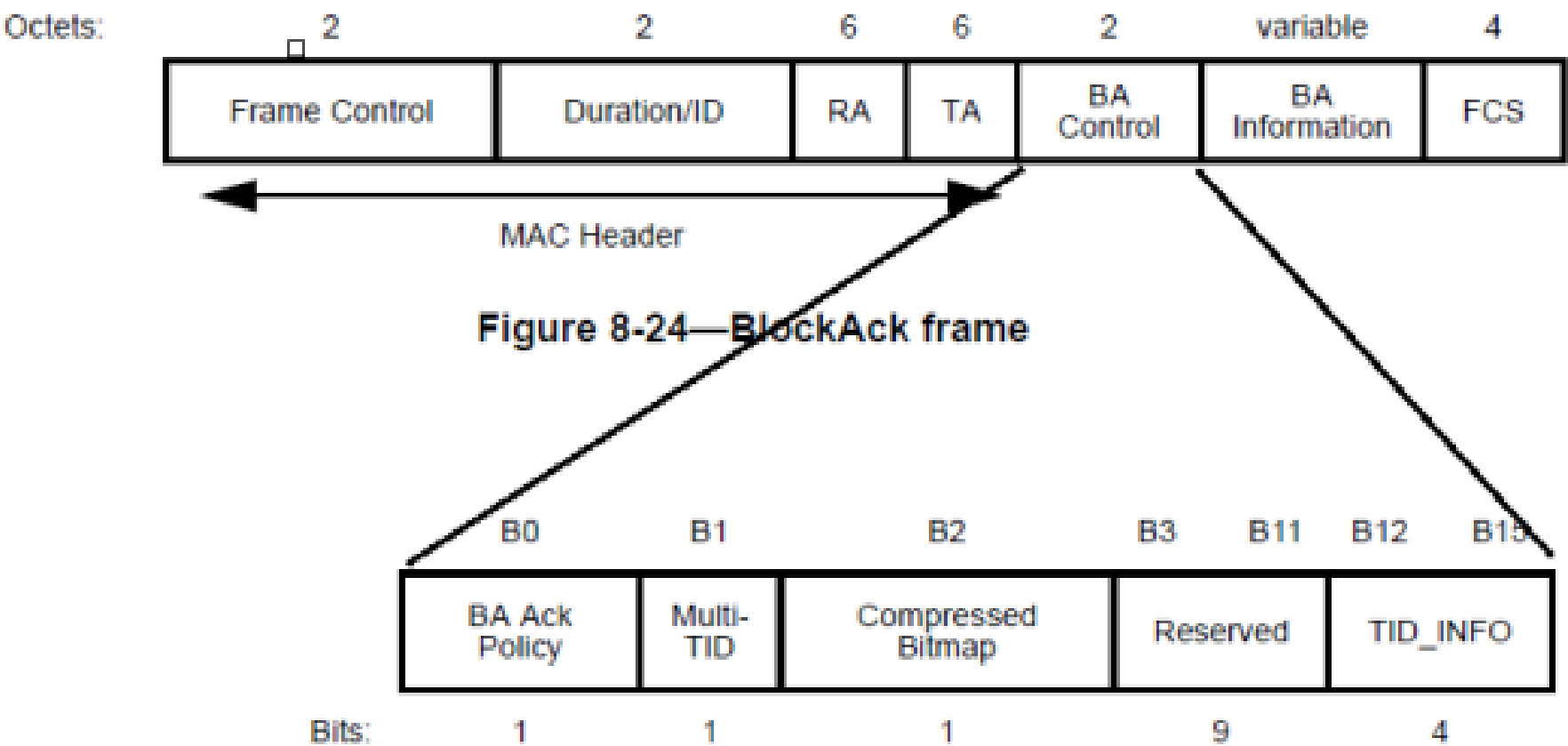


Multi-TID subfield value	Compressed Bitmap subfield value	BlockAckReq frame variant
0	0	Basic BlockAckReq
0	1	Compressed BlockAckReq
1	0	Reserved
1	1	Multi-TID BlockAckReq

BlockAck Request Frame

```
⊞ Frame 290: 24 bytes on wire (192 bits), 24 bytes captured (192 bits)
⊞ 802.11 radio information
⊞ IEEE 802.11 802.11 Block Ack Req, Flags: .....C
  Type/Subtype: 802.11 Block Ack Req (0x0018)
    ⊞ Frame Control Field: 0x8400
      .... ..00 = Version: 0
      .... 01.. = Type: Control frame (1)
      1000 .... = Subtype: 8
    ⊞ Flags: 0x00
      .000 0000 0010 1100 = Duration: 44 microseconds
      Receiver address: Cisco_99:1a:ae (b8:38:61:99:1a:ae)
      Transmitter address: Apple_ea:5b:66 (04:f7:e4:ea:5b:66)
      .... .10. = Block Ack Request Type: Compressed Block Ack Request (0x02)
    ⊞ Block Ack Request (BAR) Control: 0x0004
      .... .... .... ....0 = BAR Ack Policy: Sender Does Not Require Immediate Acknowledgement
      .... .... .... ..0. = Multi-TID: False
      .... .... .... .1.. = Compressed Bitmap: True
      .... 0000 0000 0... = Reserved: 0x0000
      0000 .... .... .... = TID for which a BlockAck frame is requested: 0x0000
    ⊞ Block Ack Starting Sequence Control (SSC): 0x0610
      .... .... .... 0000 = Fragment: 0
      0000 0110 0001 .... = Starting Sequence Number: 97
    ⊞ Frame check sequence: 0x766e5e64 [correct]
```

BlockAck Frame Format

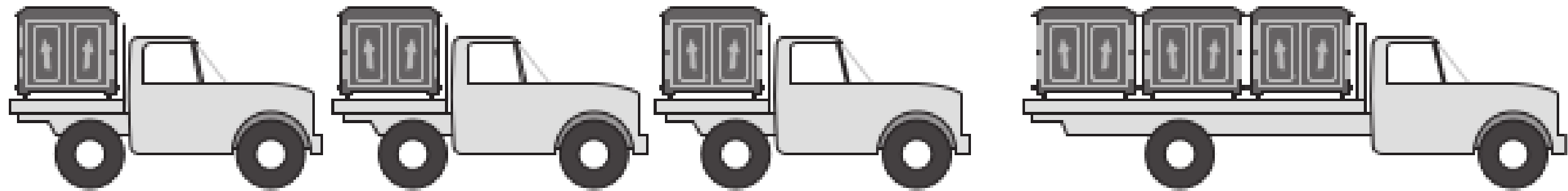


Multi-TID subfield value	Compressed Bitmap subfield value	BlockAck frame variant
0	0	Basic BlockAck
0	1	Compressed BlockAck
1	0	Reserved
1	1	Multi-TID BlockAck

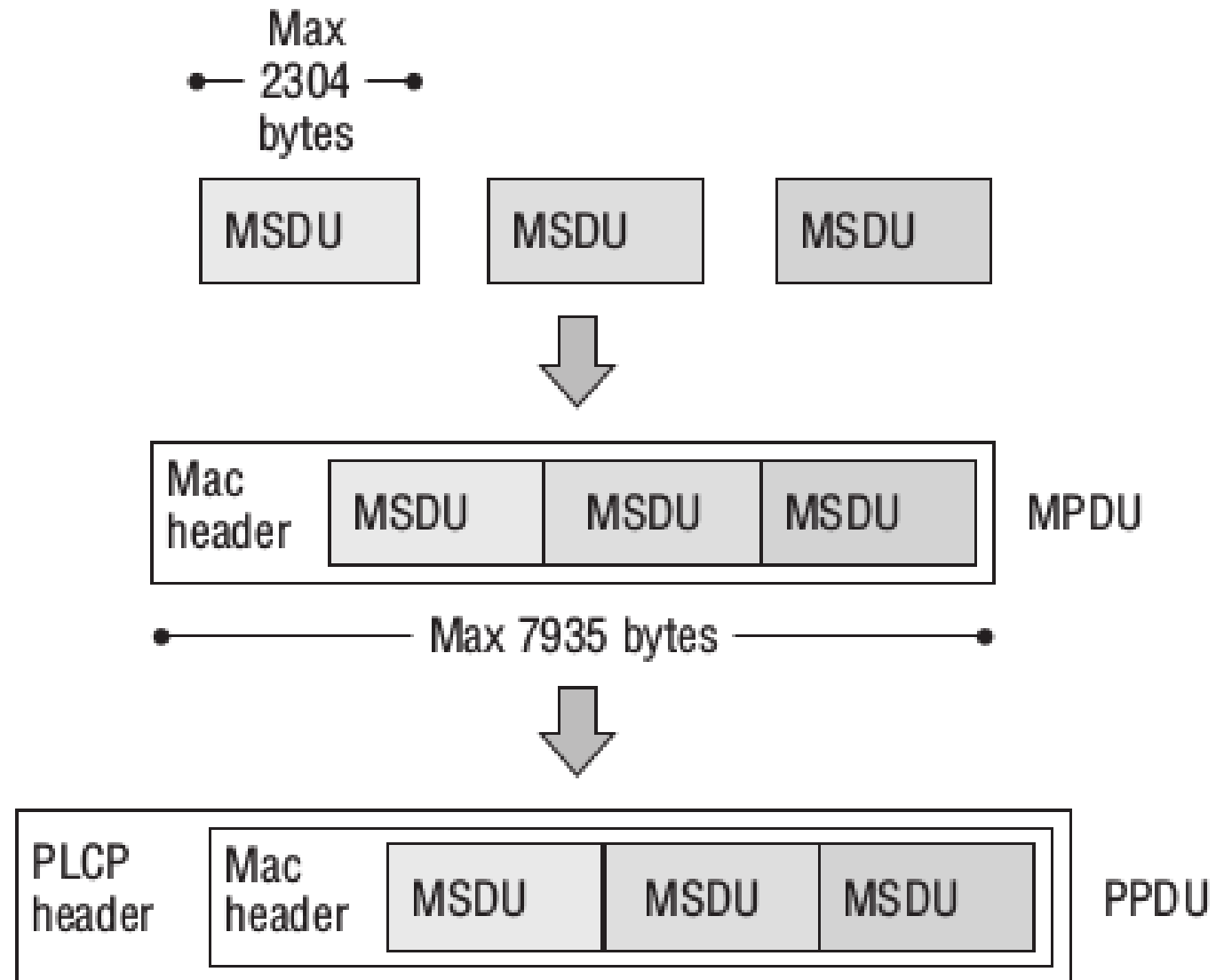

```

+ Frame 291: 32 bytes on wire (256 bits), 32 bytes captured (256 bits)
+ 802.11 radio information
+ IEEE 802.11 802.11 Block Ack, Flags: .....C
  Type/Subtype: 802.11 Block Ack (0x0019)
  Frame Control Field: 0x9400
    .... ..00 = Version: 0
    .... 01.. = Type: Control frame (1)
    1001 .... = Subtype: 9
  Flags: 0x00
    .000 0000 0000 0000 = Duration: 0 microseconds
    Receiver address: Apple_ea:5b:66 (04:f7:e4:ea:5b:66)
    Transmitter address: Cisco_99:1a:ae (b8:38:61:99:1a:ae)
    .... .10. = Block Ack Type: Compressed Block (0x02)
  Block Ack Request Control: 0x0004
    .... ..0 = BAR Ack Policy: Sender Does Not Require Immediate Acknowledgment
    .... ..0. = Multi-TID: False
    .... ..1.. = Compressed Bitmap: True
    .... 0000 0000 0... = Reserved: 0x0000
    0000 .... .. = TID for which a Basic BlockAck frame is requested: 0x0000
  Block Ack Starting Sequence Control (SSC): 0x0610
    .... ..0000 = Fragment: 0
    0000 0110 0001 .... = Starting Sequence Number: 97
  Block Ack Bitmap: 0000000000000000
    Missing frame: 97
    Missing frame: 98
    Missing frame: 99
    Missing frame: 100
  
```

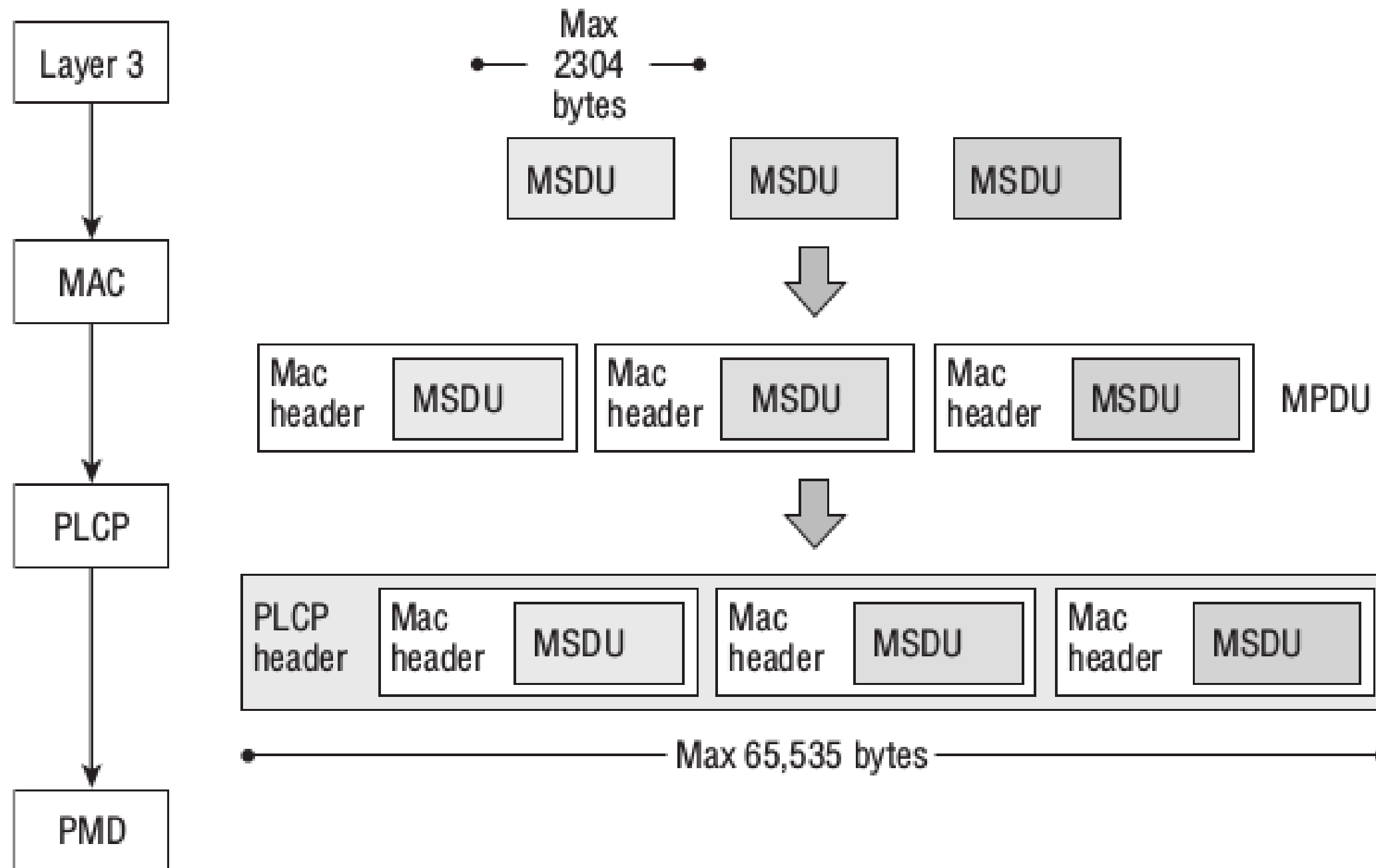
Aggregation



A-MSDU Aggregation





A-MPDU Aggregation



Thank You!



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