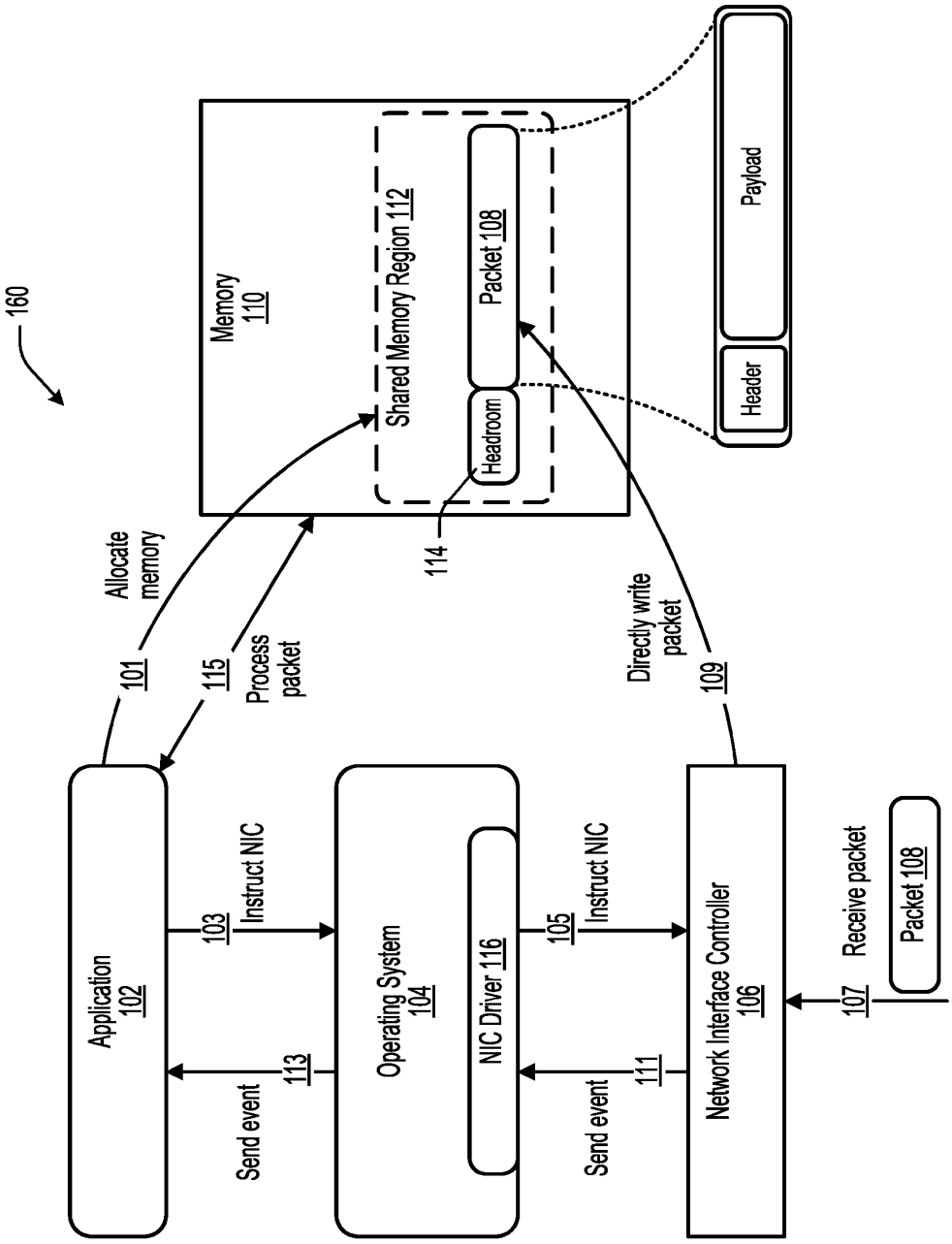

160
Memory
110
Shared Memory Region 112
Packet 108
Headroom
Payload
Header
114
Allocate memory
101
115
Process packet
Directly write packet
109
Application
102
103
Instruct NIC
Operating System
104
NIC Driver 116
105
Instruct NIC
Network Interface Controller
106
107
Receive packet
Packet 108
Send event
113
Send event
111

FIG. 1

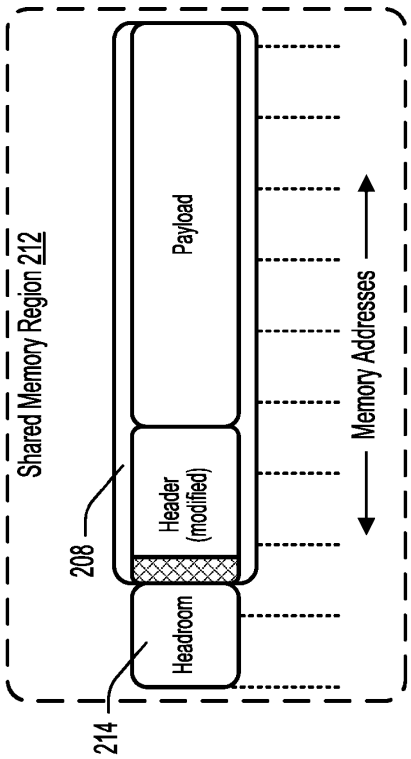


FIG. 2B

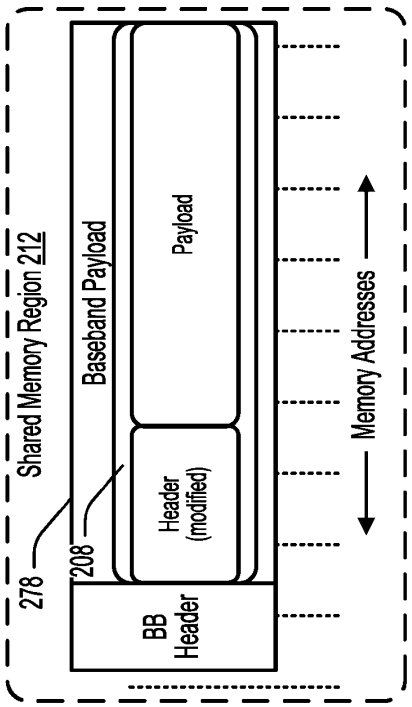


FIG. 2D

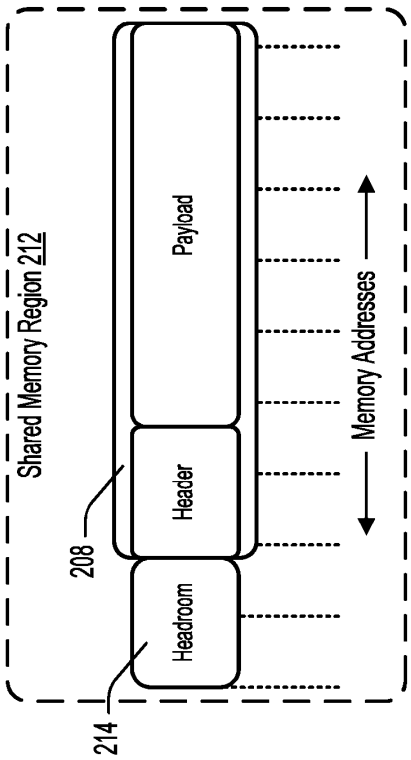


FIG. 2A

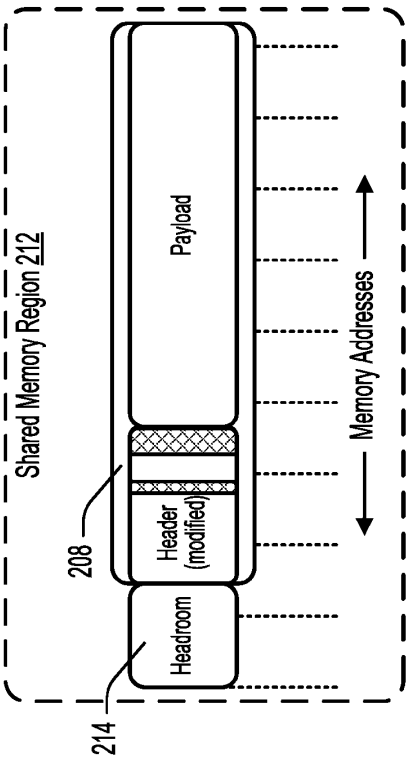
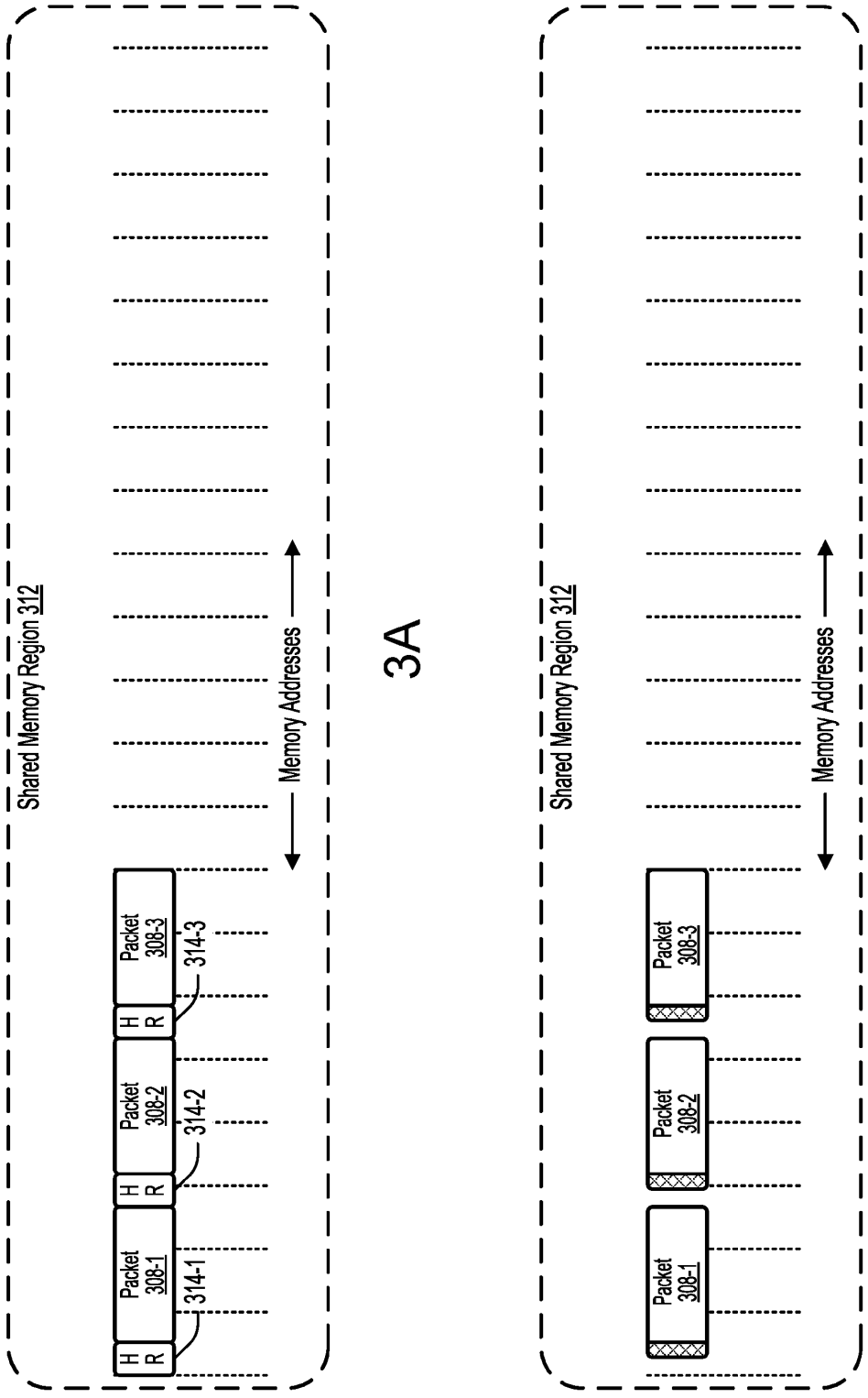


FIG. 2C


Shared Memory Region 312
Memory Addresses
Packet 308-3
H R
Packet 308-2
H R
Packet 308-1
H R
314-3
314-2
314-1
Shared Memory Region 312
Memory Addresses
Packet 308-3
Packet 308-2
Packet 308-1

3A

FIG. 3B

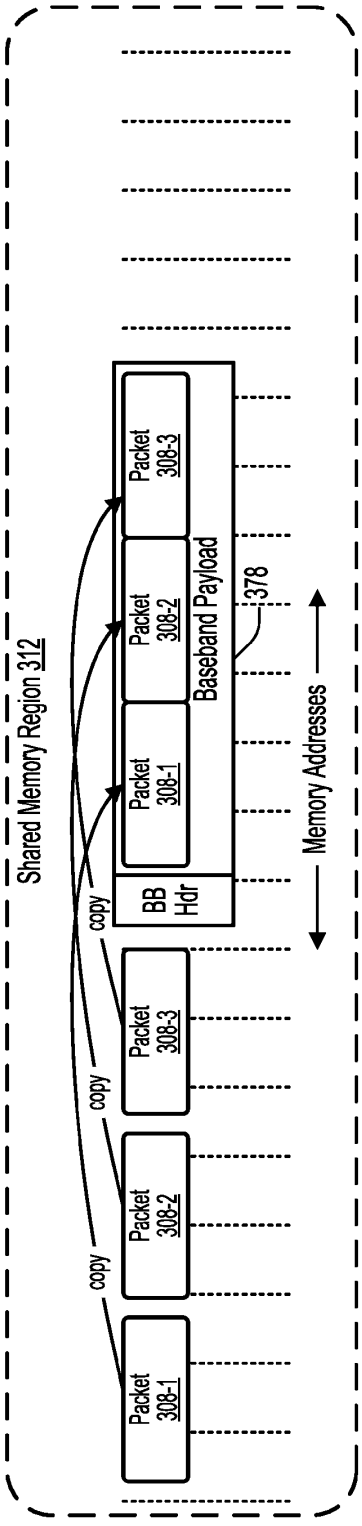

Shared Memory Region 312
Packet 308-1
Packet 308-2
Packet 308-3
BB Hdr
Baseband Payload
378
Memory Addresses
copy
copy
copy

FIG. 3C

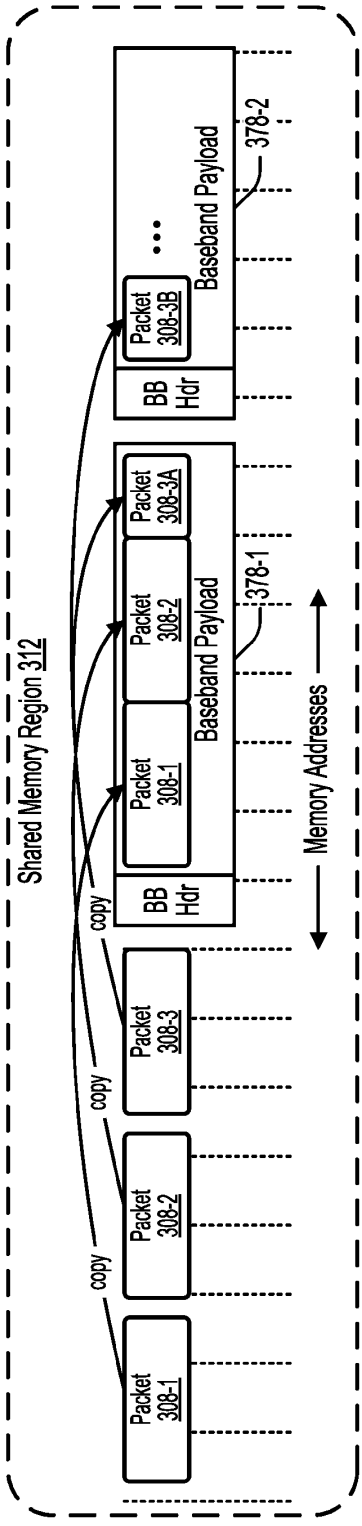

Shared Memory Region 312
Packet 308-1
Packet 308-2
Packet 308-3
Packet 308-3A
Packet 308-3B
BB Hdr
Baseband Payload
378-1
378-2
Memory Addresses
copy
copy
copy

FIG. 3D

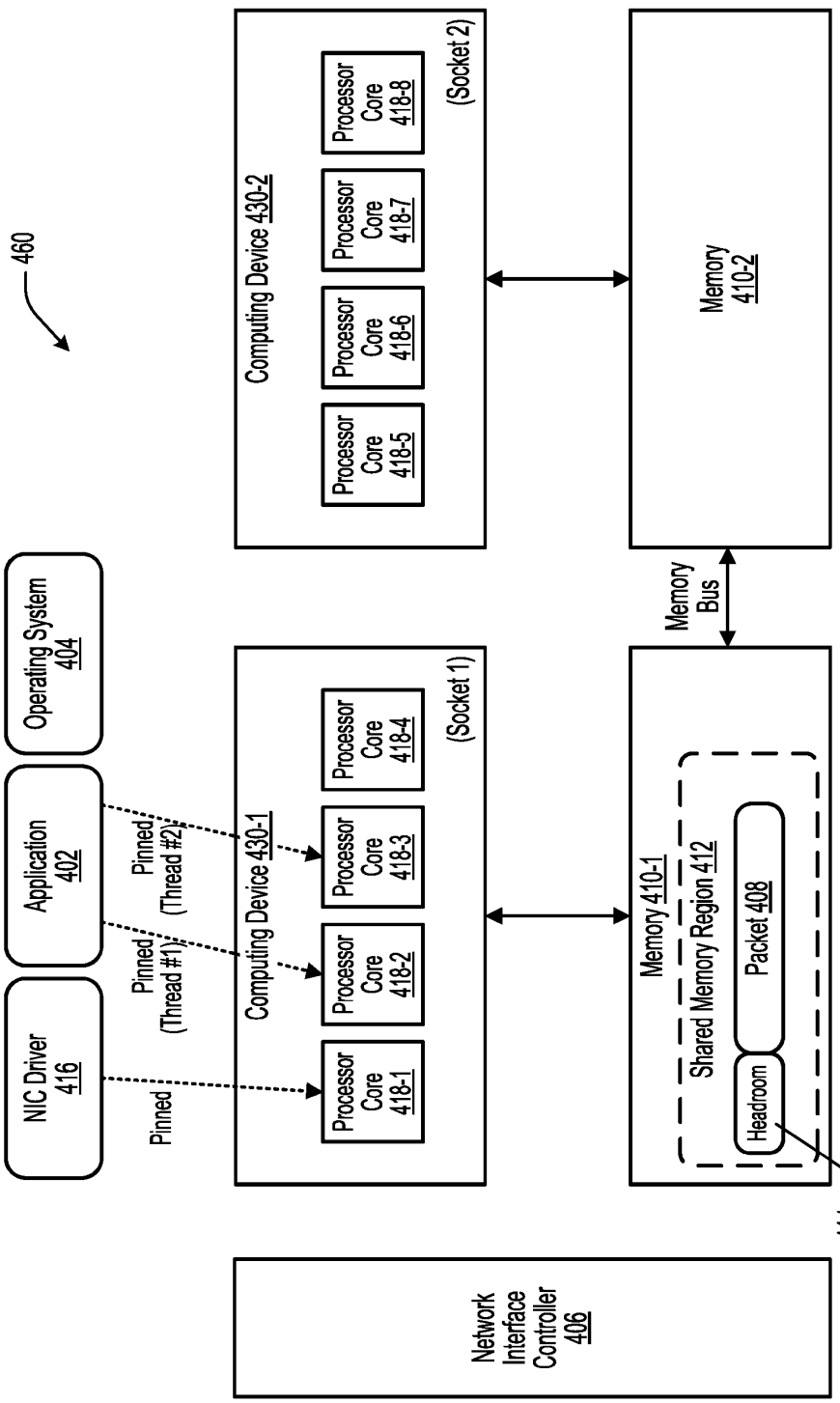

460
Operating System 404
Application 402
NIC Driver 416
Pinned
Pinned (Thread #1)
Pinned (Thread #2)
Computing Device 430-1
(Socket 1)
Processor Core 418-1
Processor Core 418-2
Processor Core 418-3
Processor Core 418-4
Computing Device 430-2
(Socket 2)
Processor Core 418-5
Processor Core 418-6
Processor Core 418-7
Processor Core 418-8
Memory Bus
Memory 410-2
Memory 410-1
Shared Memory Region 412
Headroom
Packet 408
414
Network Interface Controller 406

FIG. 4

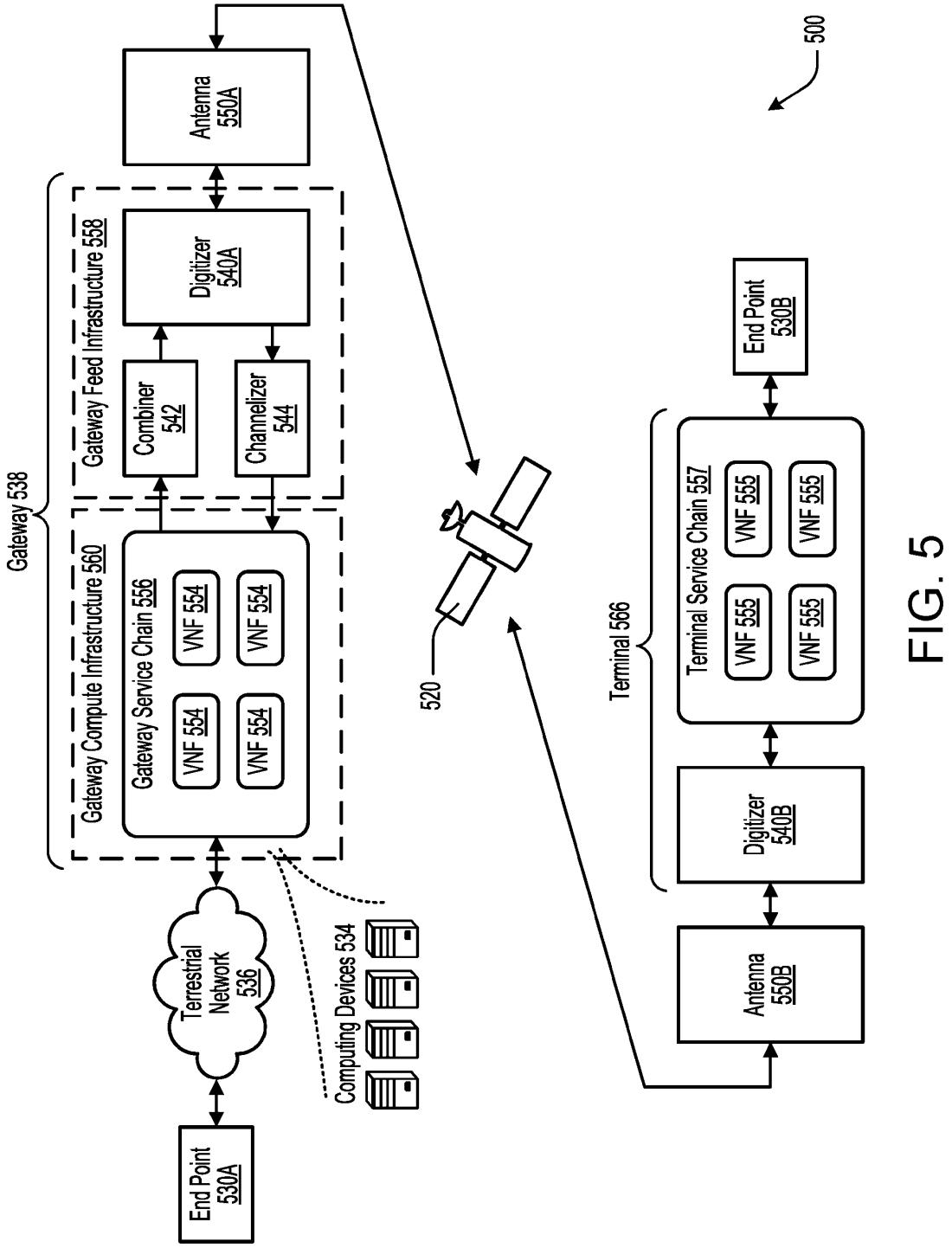

500
Gateway 538
Gateway Compute Infrastructure 560
Gateway Feed Infrastructure 558
Gateway Service Chain 556
VNF 554
VNF 554
VNF 554
VNF 554
Combiner 542
Channelizer 544
Digitizer 540A
Antenna 550A
Terrestrial Network 536
End Point 530A
Computing Devices 534
520
Terminal 566
Terminal Service Chain 557
VNF 555
VNF 555
VNF 555
VNF 555
Digitizer 540B
Antenna 550B
End Point 530B

FIG. 5

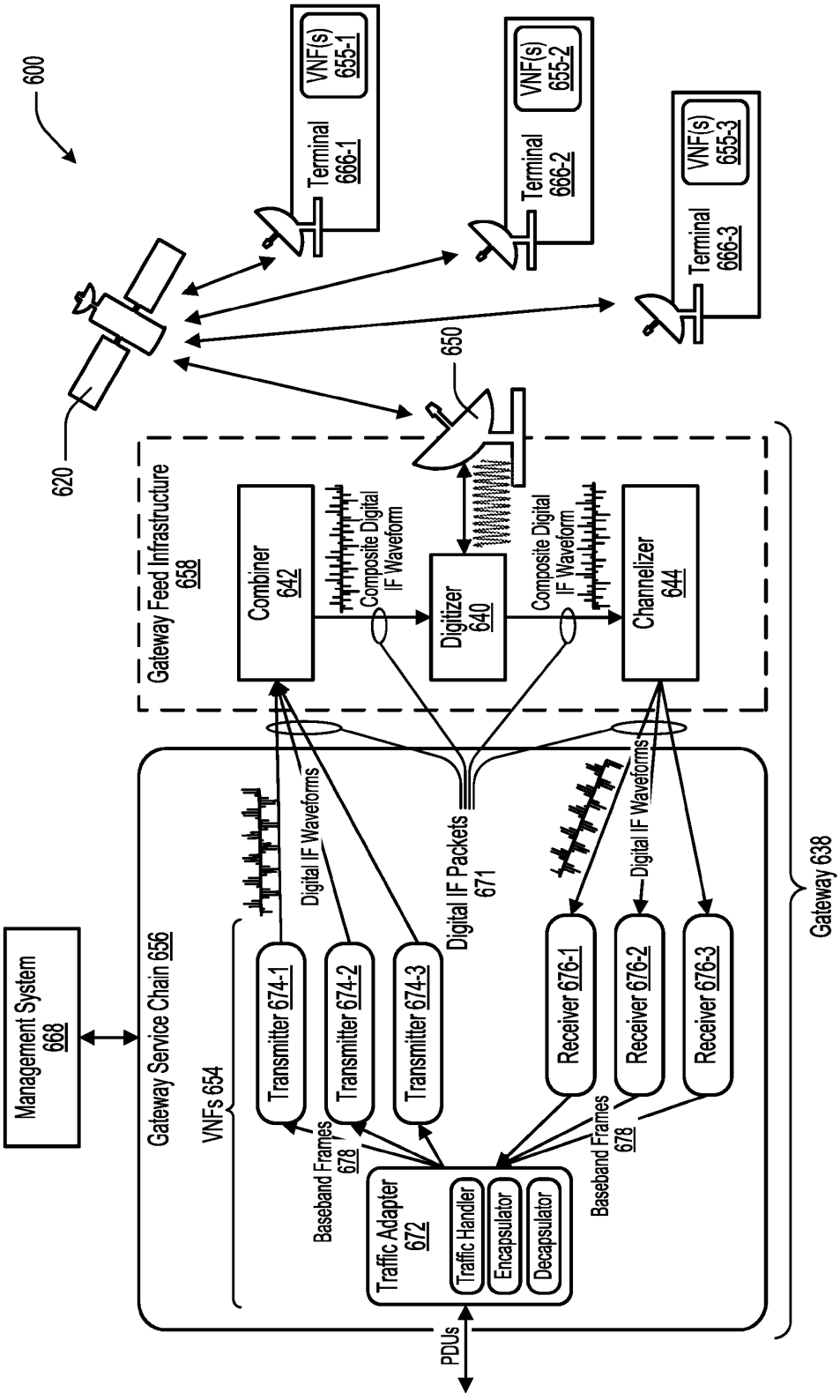

600
Terminal 666-1
VNF(s) 655-1
Terminal 666-2
VNF(s) 655-2
Terminal 666-3
VNF(s) 655-3
620
650
Gateway Feed Infrastructure 658
Combiner 642
Composite Digital IF Waveform
Digitizer 640
Composite Digital IF Waveform
Channelizer 644
Digital IF Packets 671
Digital IF Waveforms
Digital IF Waveforms
Management System 668
Gateway Service Chain 656
VNFs 654
Transmitter 674-1
Transmitter 674-2
Transmitter 674-3
Receiver 676-1
Receiver 676-2
Receiver 676-3
Baseband Frames 678
Baseband Frames 678
Traffic Adapter 672
Traffic Handler
Encapsulator
Decapsulator
PDUs
Gateway 638

FIG. 6

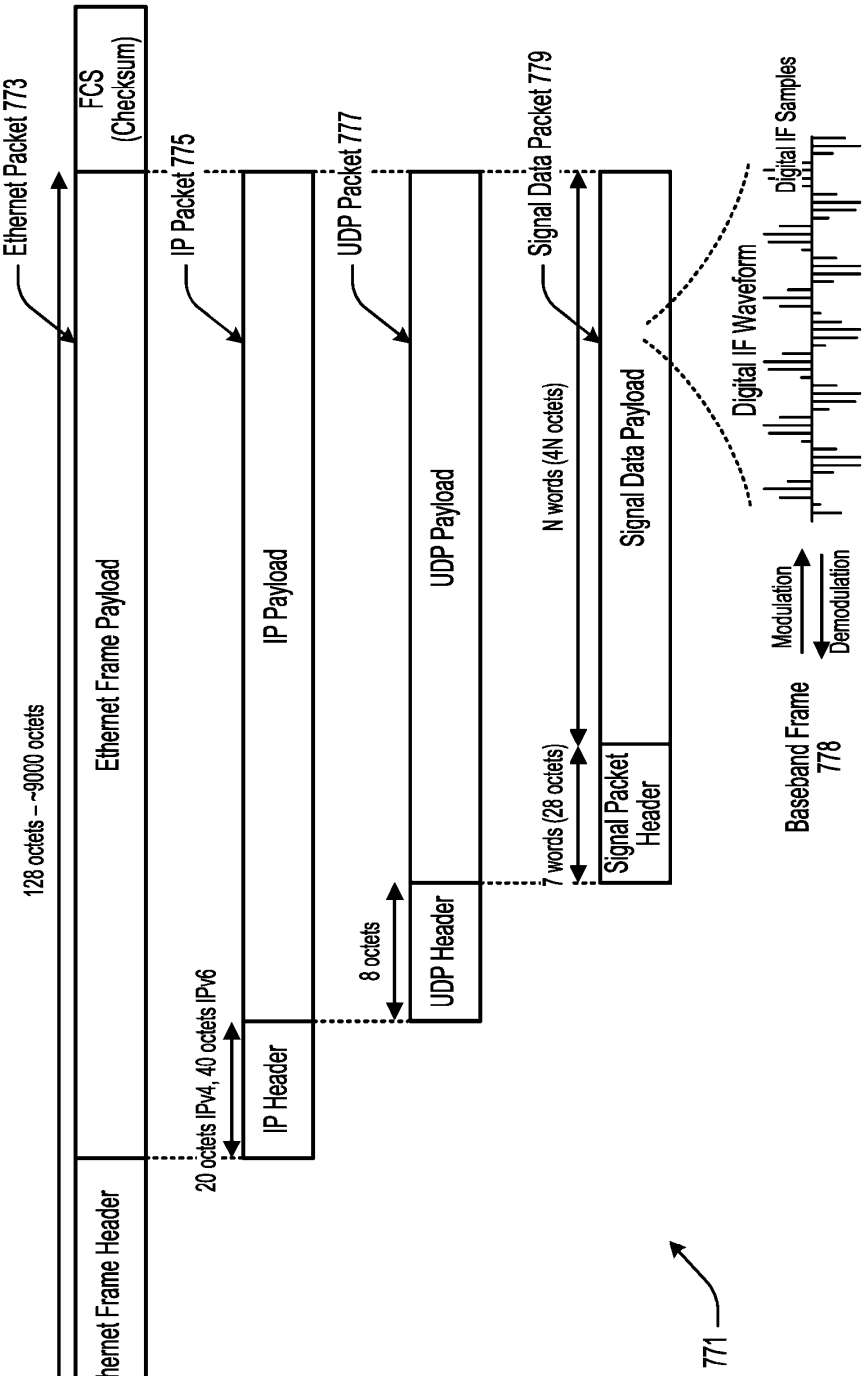

Ethernet Packet 773
FCS (Checksum)
IP Packet 775
UDP Packet 777
Signal Data Packet 779
128 octets – ~9000 octets
Ethernet Frame Payload
IP Payload
UDP Payload
N words (4N octets)
Signal Data Payload
Digital IF Samples
Digital IF Waveform
Modulation
Demodulation
Baseband Frame 778
Ethernet Frame Header
20 octets IPv4, 40 octets IPv6
IP Header
8 octets
UDP Header
7 words (28 octets)
Signal Packet Header
771

FIG. 7

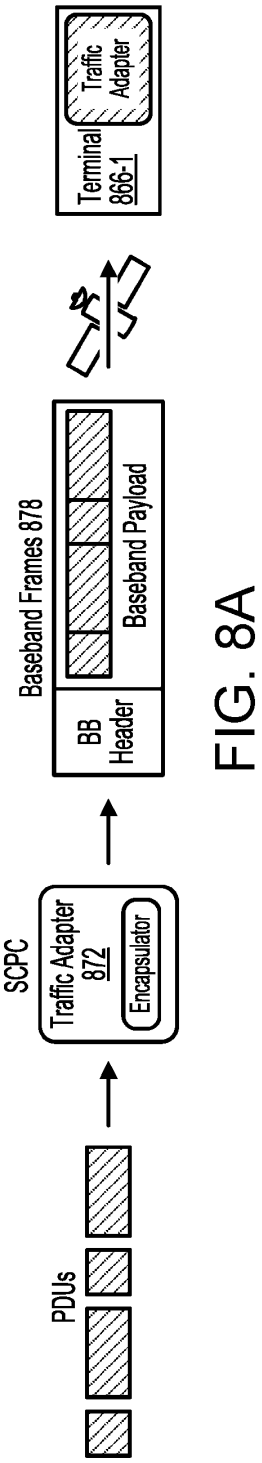


FIG. 8A

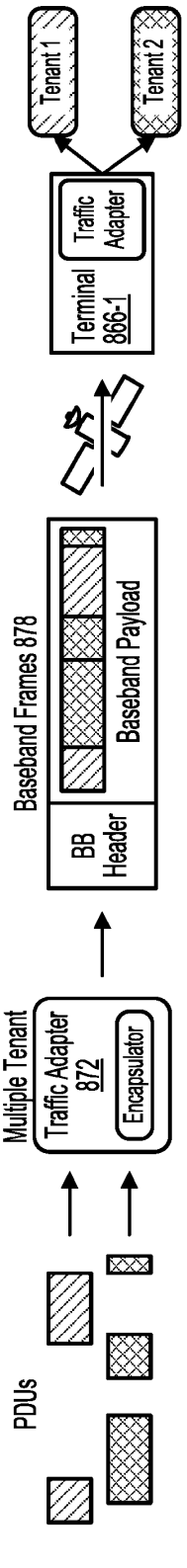


FIG. 8B

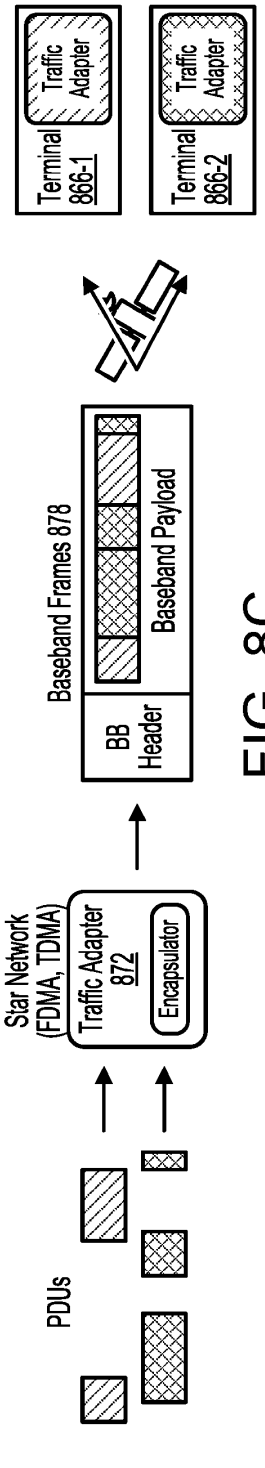
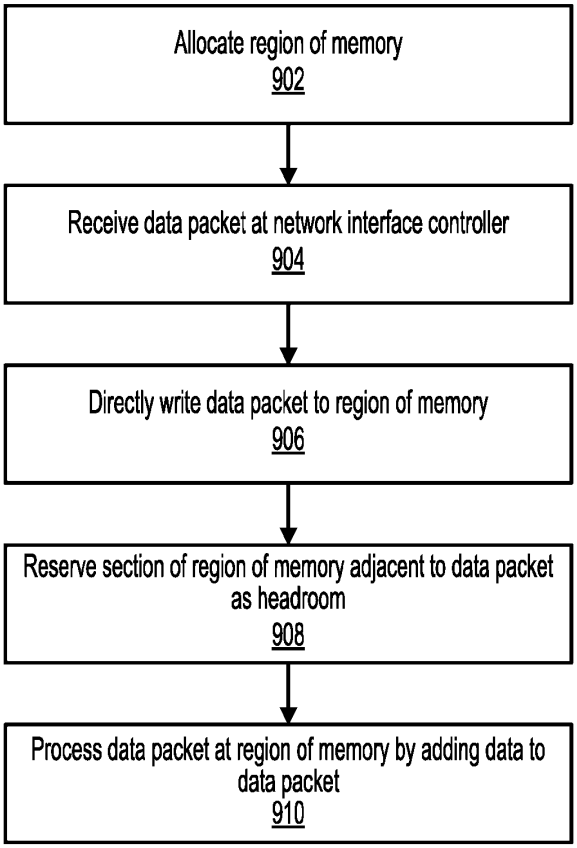


FIG. 8C


Allocate region of memory
902
Receive data packet at network interface controller
904
Directly write data packet to region of memory
906
Reserve section of region of memory adjacent to data packet as headroom
908
Process data packet at region of memory by adding data to data packet
910

900

FIG. 9

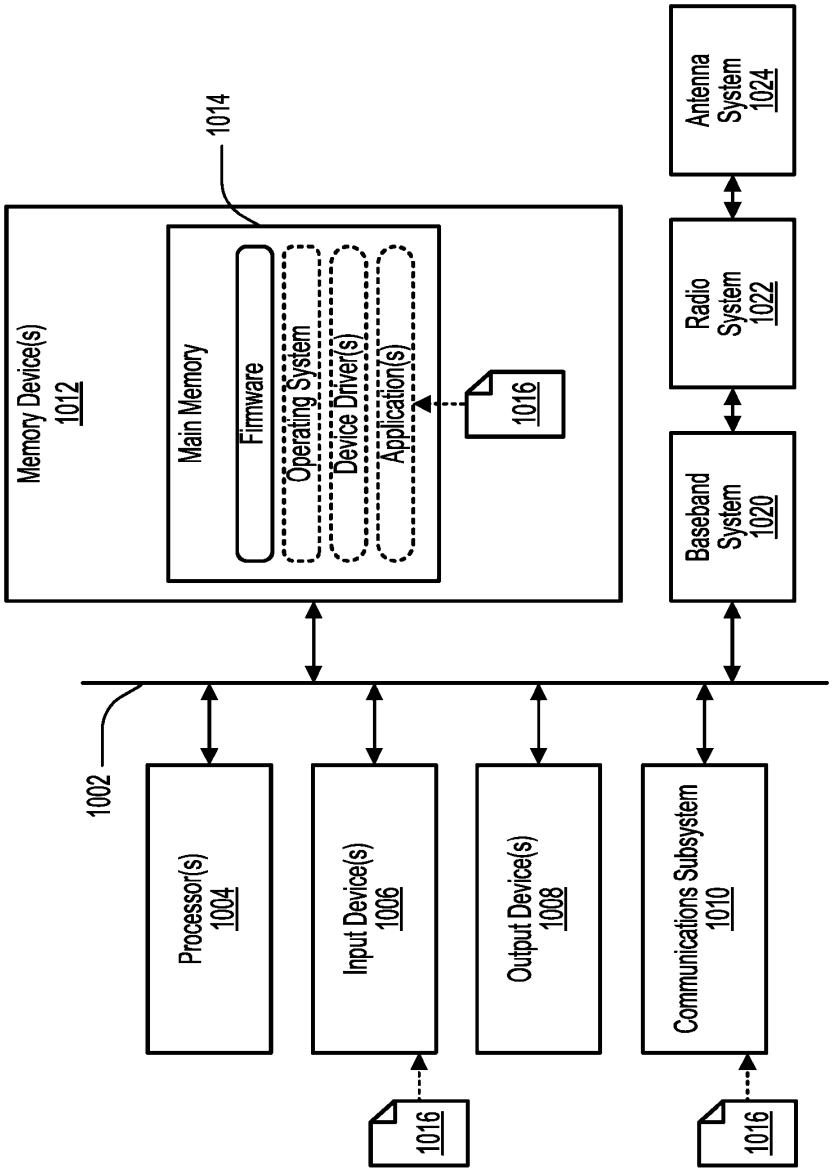

Memory Device(s)
1012
1014
Main Memory
Firmware
Operating System
Device Driver(s)
Application(s)
1016
Antenna System
1024
Radio System
1022
Baseband System
1020
1002
Processor(s)
1004
Input Device(s)
1006
Output Device(s)
1008
Communications Subsystem
1010
1016
1016
1000

FIG. 10