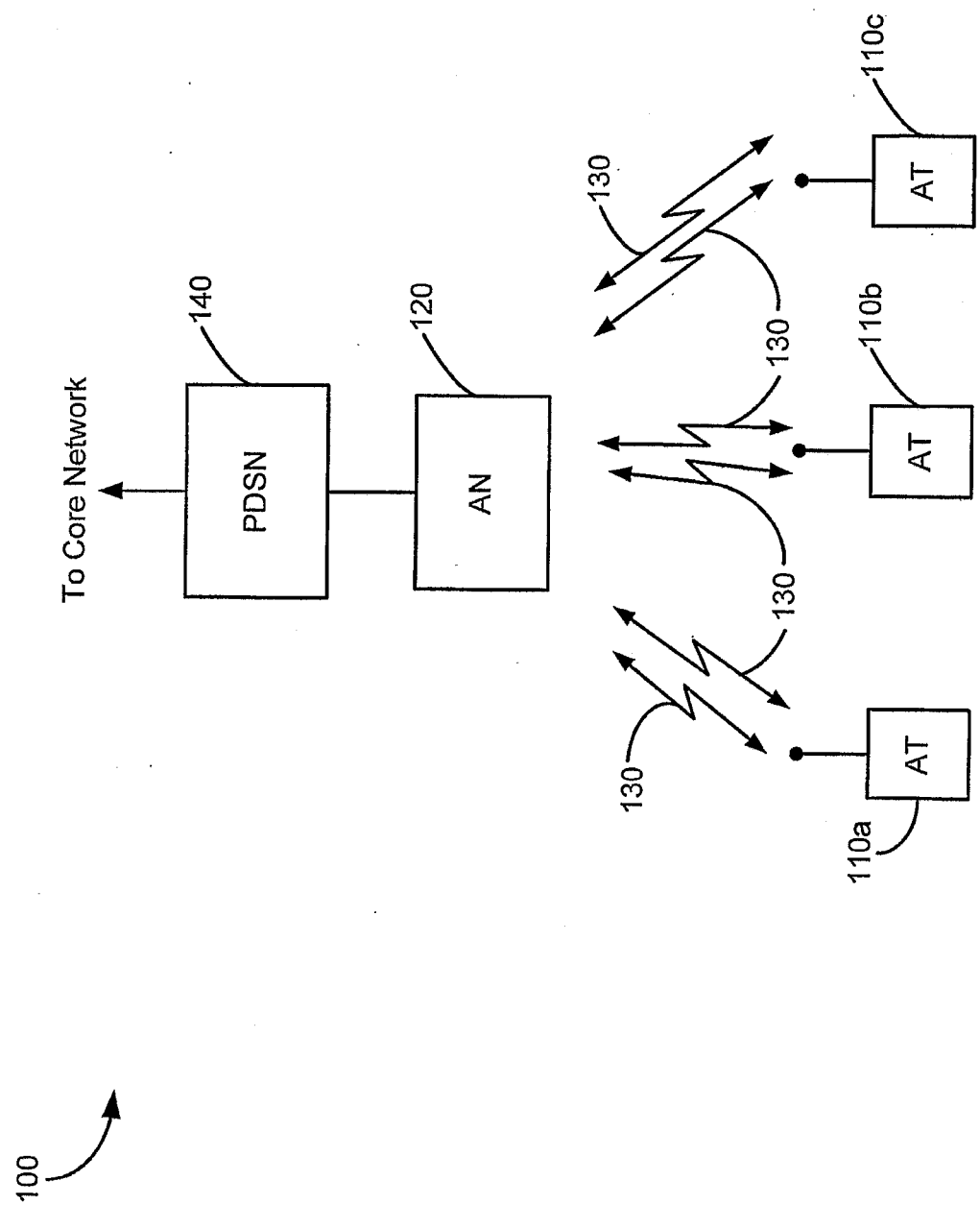
100
To Core Network
PDSN
140
AN
120
130
130
130
130
AT
110a
AT
110b
AT
110c

FIG. 1

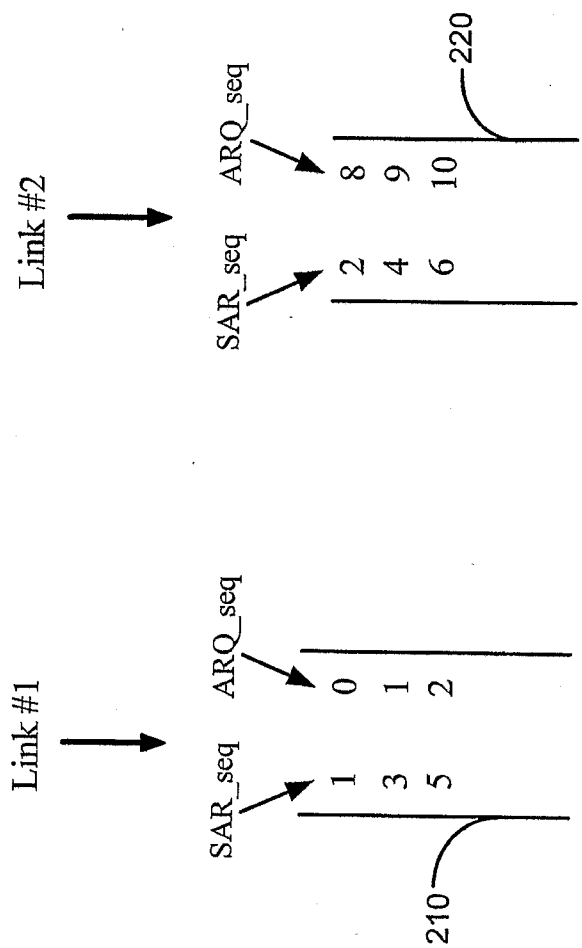

FIG. 2

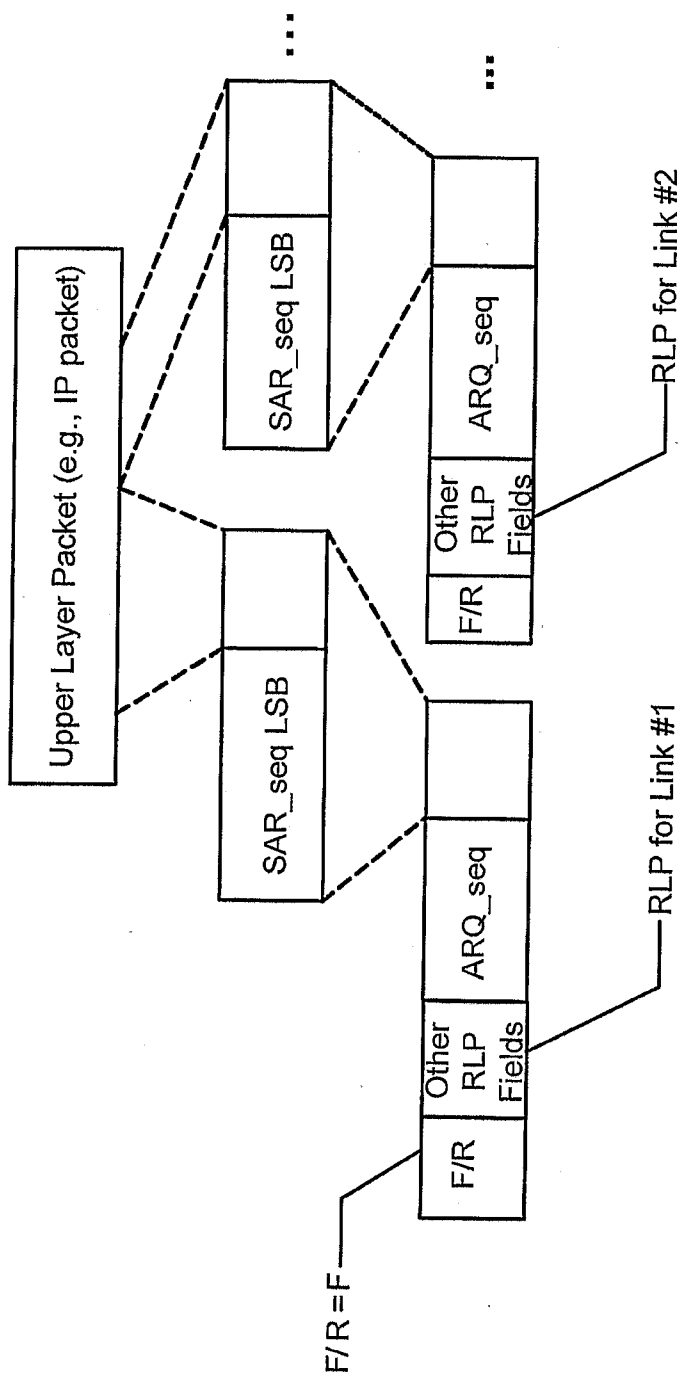
Upper Layer Packet (e.g., IP packet)
SAR_seq LSB
SAR_seq LSB
F/R
Other RLP Fields
ARQ_seq
F/R
Other RLP Fields
ARQ_seq
RLP for Link #2
RLP for Link #1
F/R = F

FIG. 3

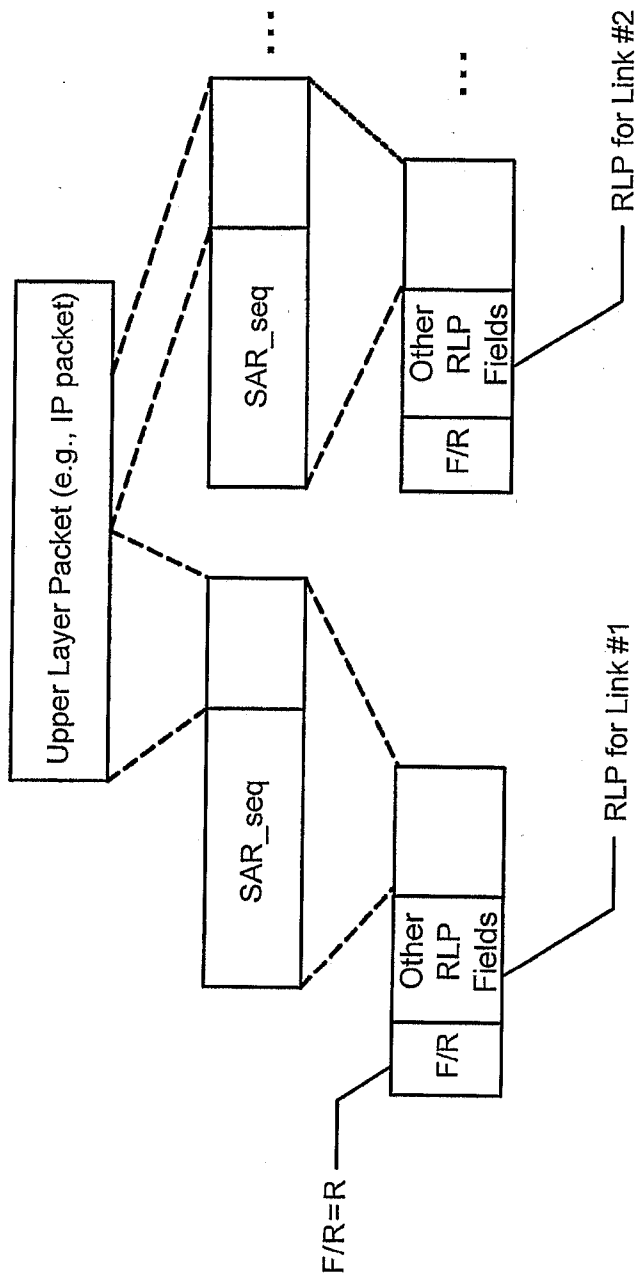
Upper Layer Packet (e.g., IP packet)
SAR_seq
SAR_seq
F/R
Other RLP Fields
F/R
Other RLP Fields
RLP for Link #2
RLP for Link #1
F/R=R

FIG. 4

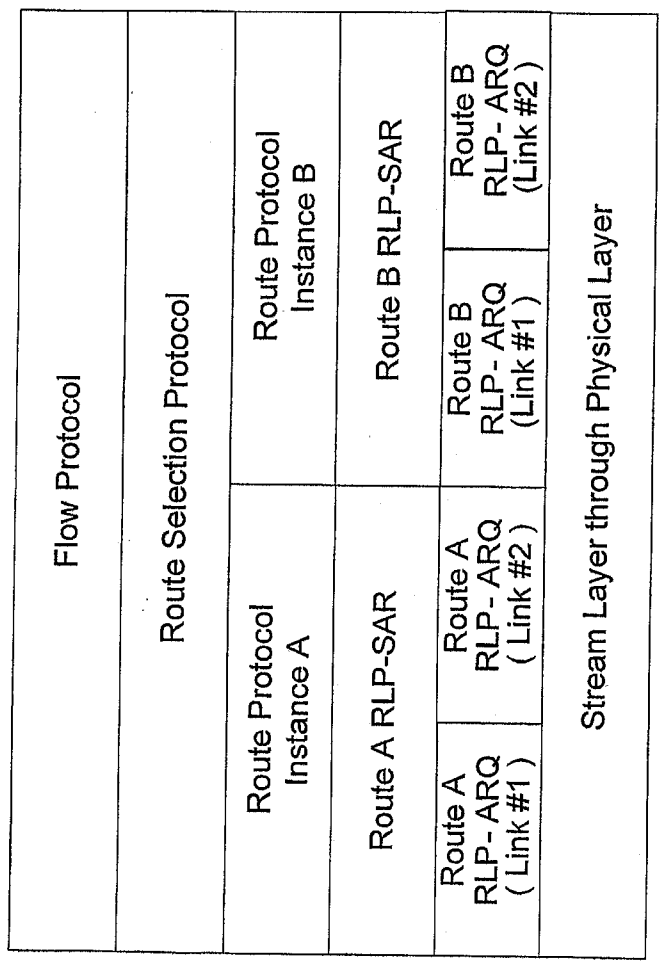
Flow Protocol
Route Selection Protocol
Route Protocol Instance A
Route Protocol Instance B
Route A RLP-SAR
Route B RLP-SAR
Route A RLP- ARQ (Link #1)
Route A RLP- ARQ (Link #2)
Route B RLP- ARQ (Link #1)
Route B RLP- ARQ (Link #2)
Stream Layer through Physical Layer

FIG. 5

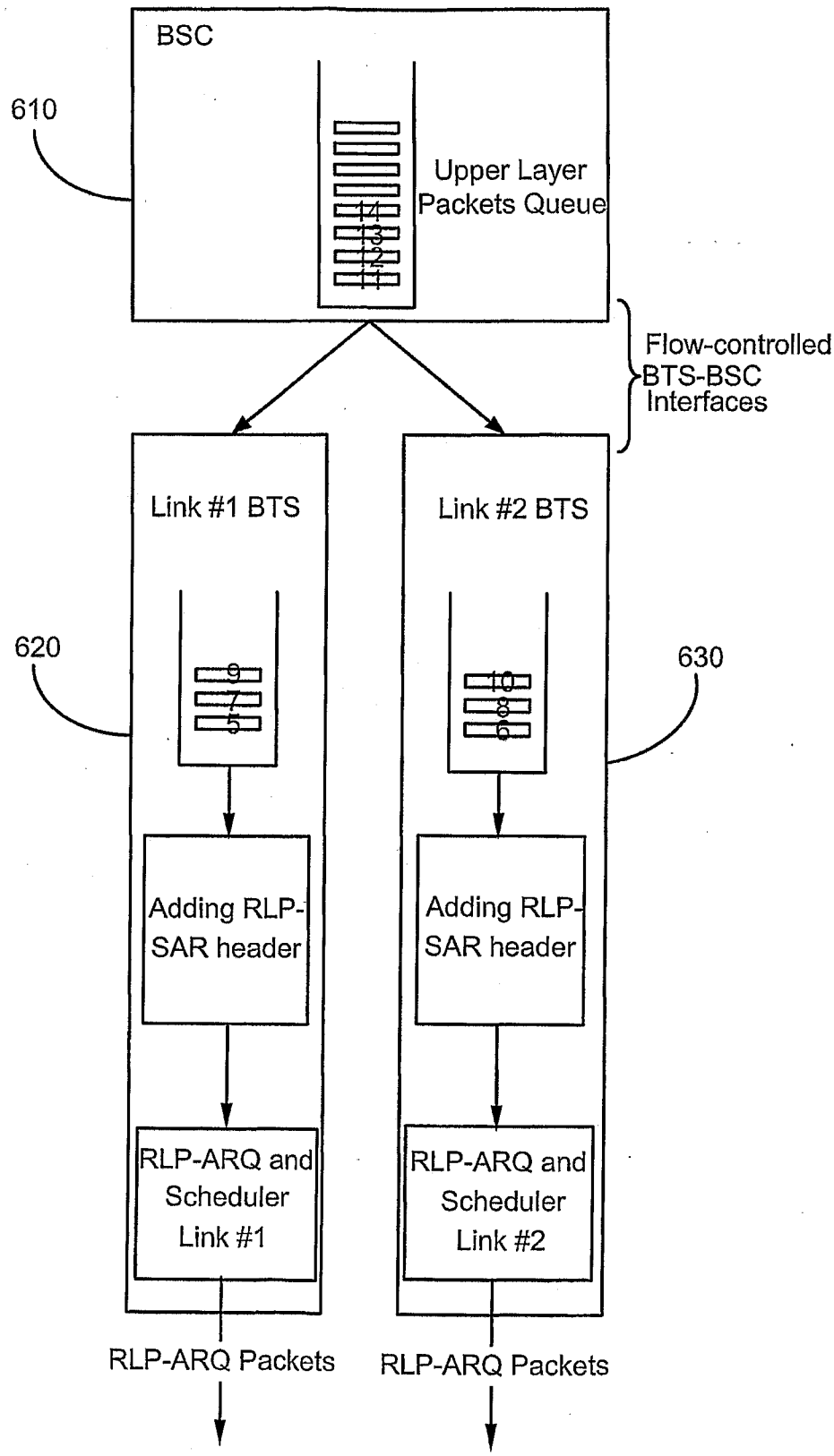
BSC
610
Upper Layer Packets Queue
14
13
12
11
Flow-controlled BTS-BSC Interfaces
Link #1 BTS
Link #2 BTS
620
630
9
7
5
10
8
6
Adding RLP-SAR header
Adding RLP-SAR header
RLP-ARQ and Scheduler Link #1
RLP-ARQ and Scheduler Link #2
RLP-ARQ Packets
RLP-ARQ Packets

FIG. 6

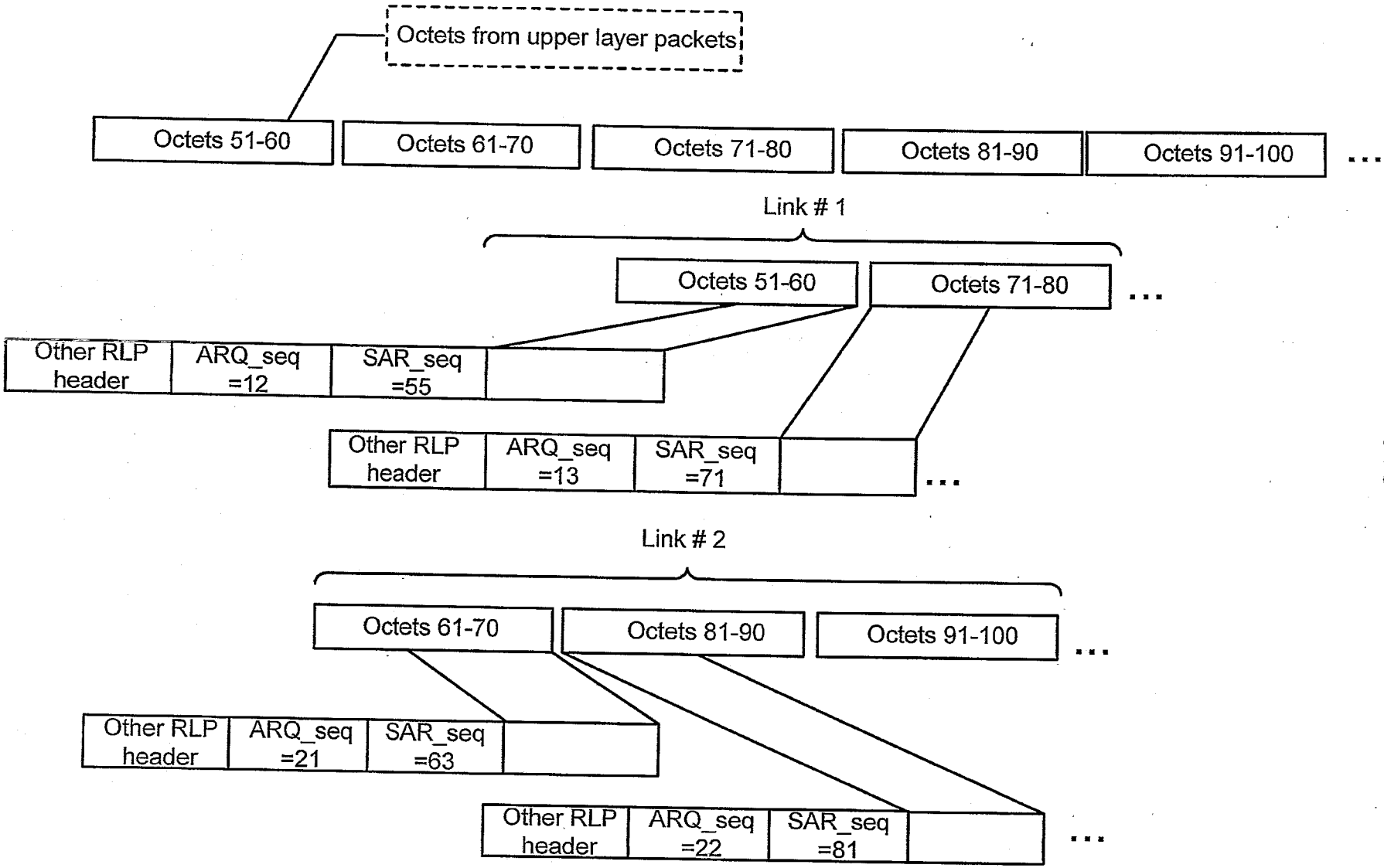
Octets from upper layer packets
Octets 51-60
Octets 61-70
Octets 71-80
Octets 81-90
Octets 91-100
...
Link # 1
Octets 51-60
Octets 71-80
...
Other RLP header
ARQ_seq =12
SAR_seq =55
Other RLP header
ARQ_seq =13
SAR_seq =71
...
Link # 2
Octets 61-70
Octets 81-90
Octets 91-100
...
Other RLP header
ARQ_seq =21
SAR_seq =63
Other RLP header
ARQ_seq =22
SAR_seq =81
...

FIG. 7

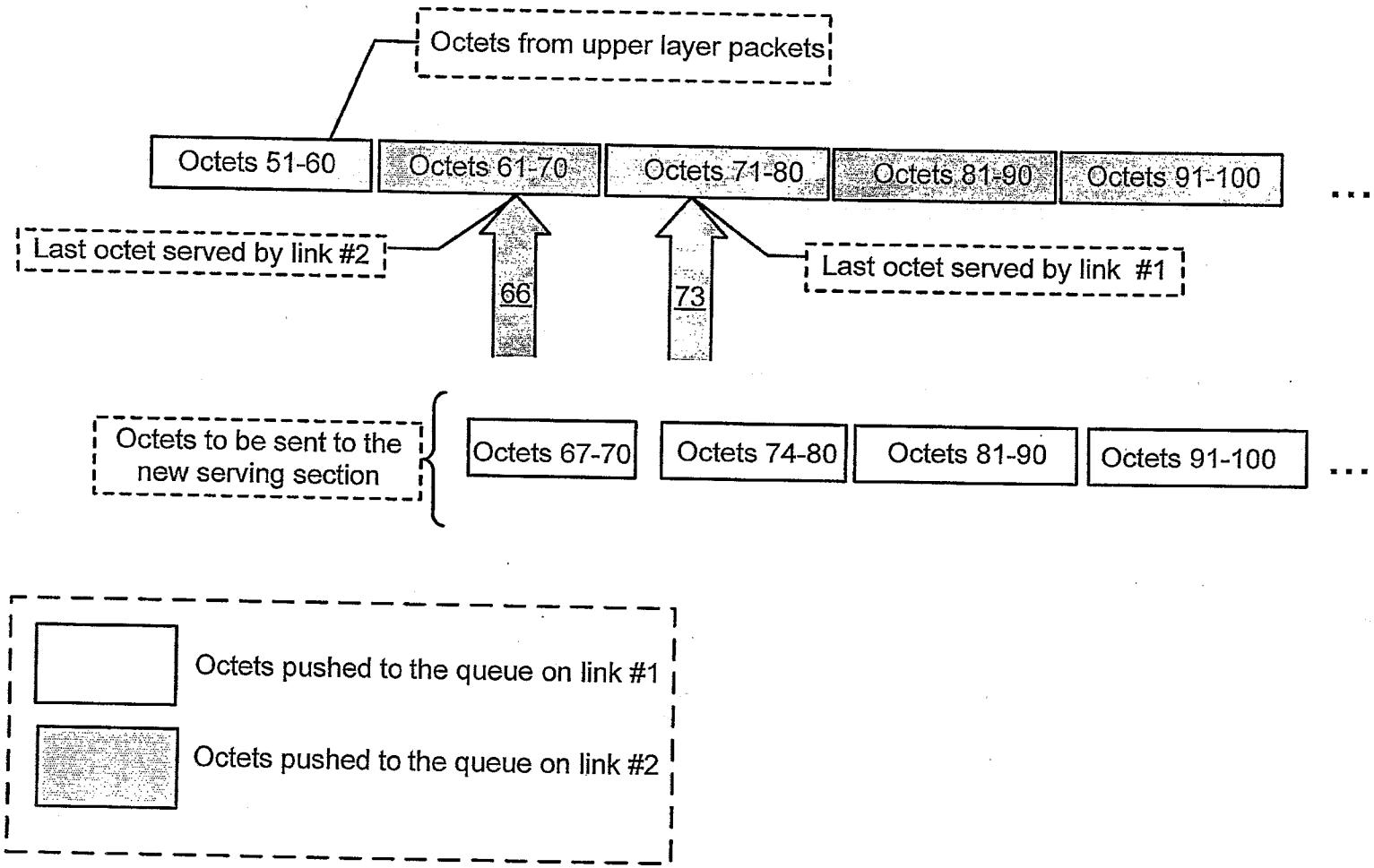
Octets from upper layer packets
Octets 51-60
Octets 61-70
Octets 71-80
Octets 81-90
Octets 91-100
...
Last octet served by link #2
66
73
Last octet served by link #1
Octets to be sent to the new serving section
Octets 67-70
Octets 74-80
Octets 81-90
Octets 91-100
...
Octets pushed to the queue on link #1
Octets pushed to the queue on link #2

FIG. 8

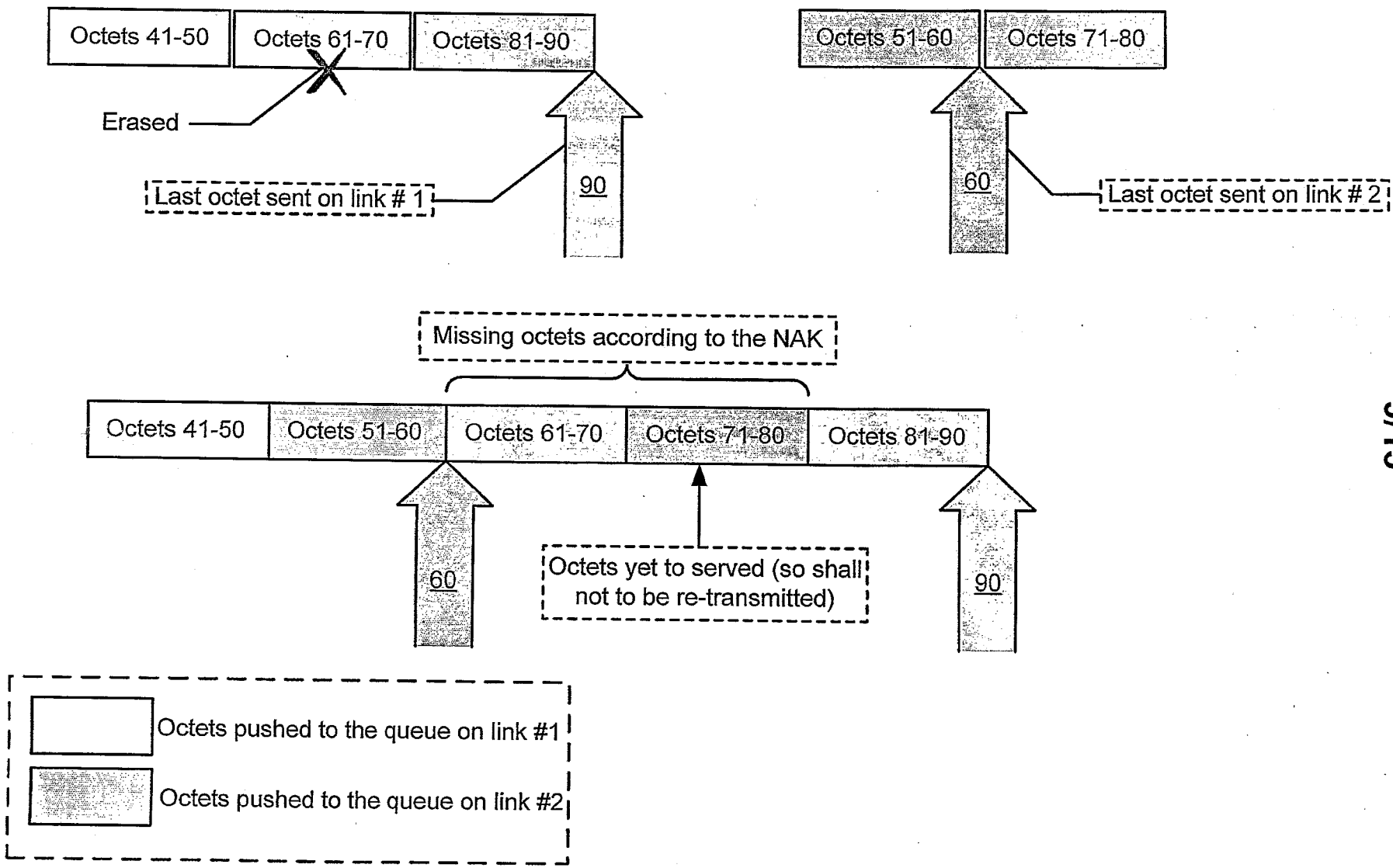
Octets 41-50
Octets 61-70
Octets 81-90
Erased
Last octet sent on link # 1
90
Octets 51-60
Octets 71-80
60
Last octet sent on link # 2
Missing octets according to the NAK
Octets 41-50
Octets 51-60
Octets 61-70
Octets 71-80
Octets 81-90
60
Octets yet to served (so shall not to be re-transmitted)
90
Octets pushed to the queue on link #1
Octets pushed to the queue on link #2

FIG. 9

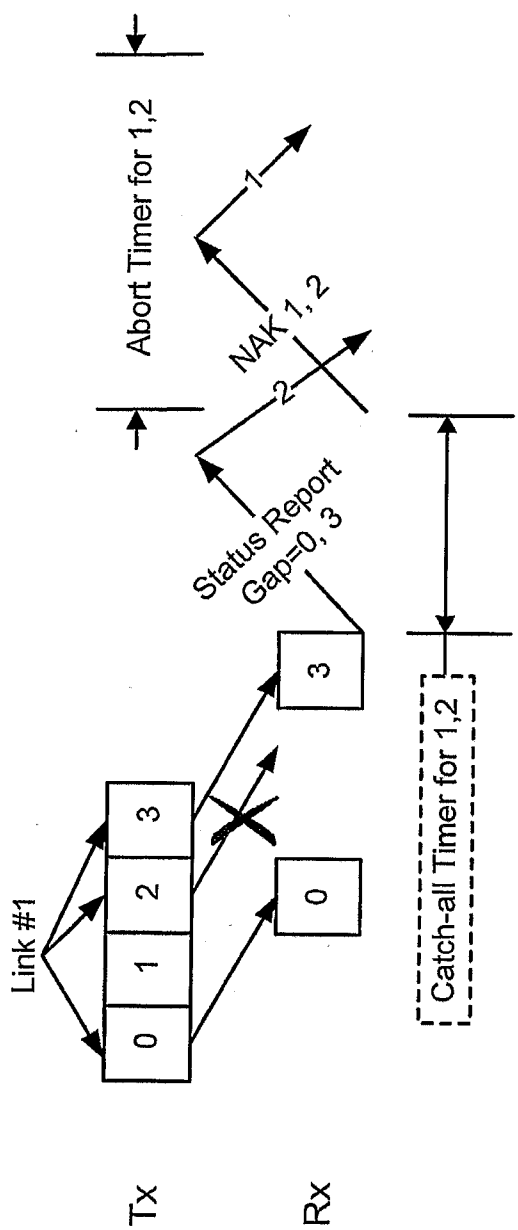
Tx
Rx
Link #1
0
1
2
3
0
3
Status Report
Gap=0, 3
Abort Timer for 1,2
NAK 1, 2
1
2
Catch-all Timer for 1,2

FIG. 10

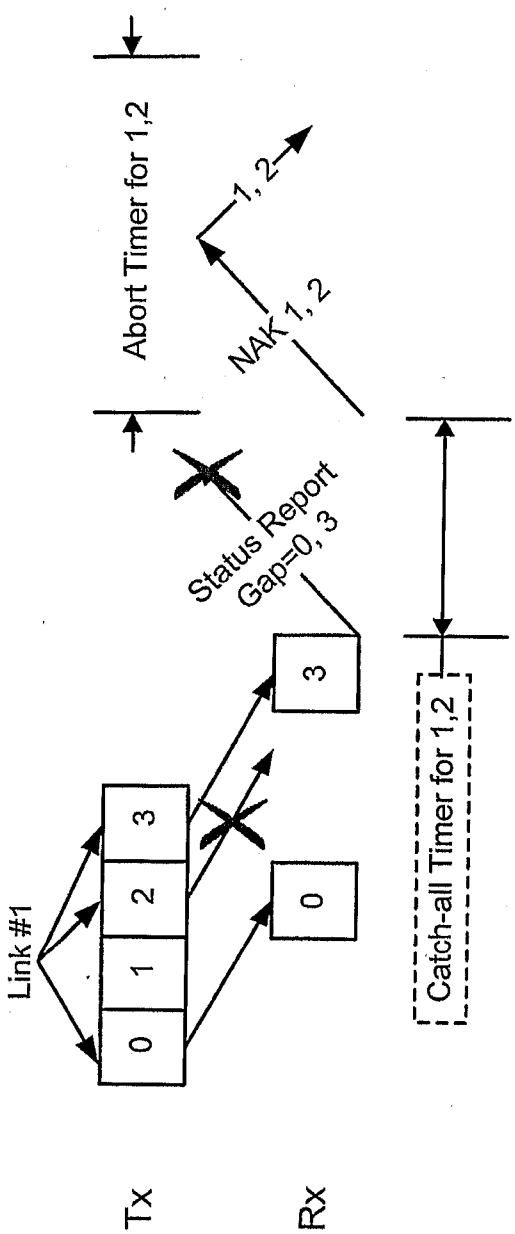
Tx
Rx
Link #1
0
1
2
3
0
3
Status Report
Gap=0, 3
NAK 1, 2
1, 2
Abort Timer for 1,2
Catch-all Timer for 1,2

FIG. 11

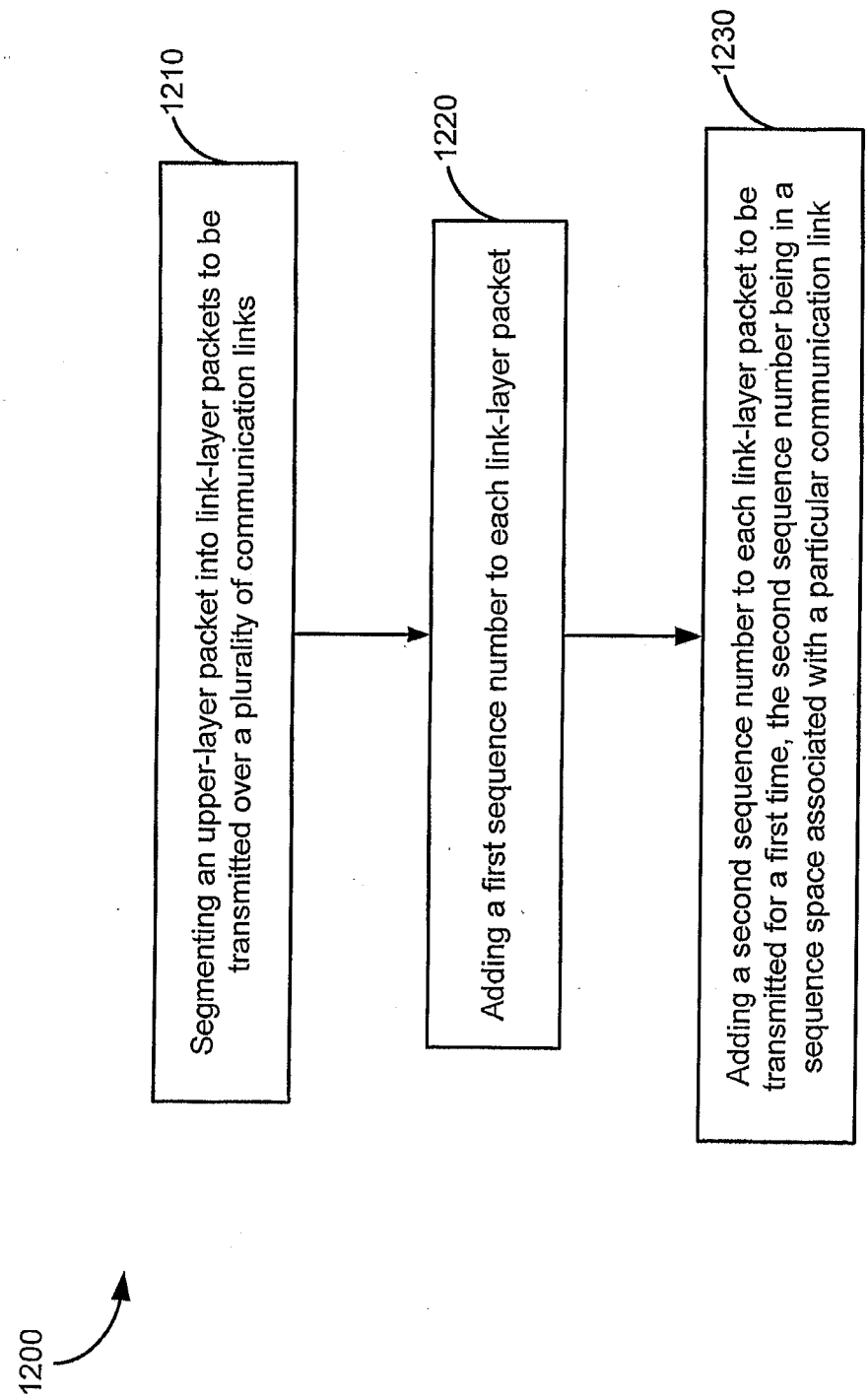
1200
1210
Segmenting an upper-layer packet into link-layer packets to be transmitted over a plurality of communication links
1220
Adding a first sequence number to each link-layer packet
1230
Adding a second sequence number to each link-layer packet to be transmitted for a first time, the second sequence number being in a sequence space associated with a particular communication link

FIG. 12

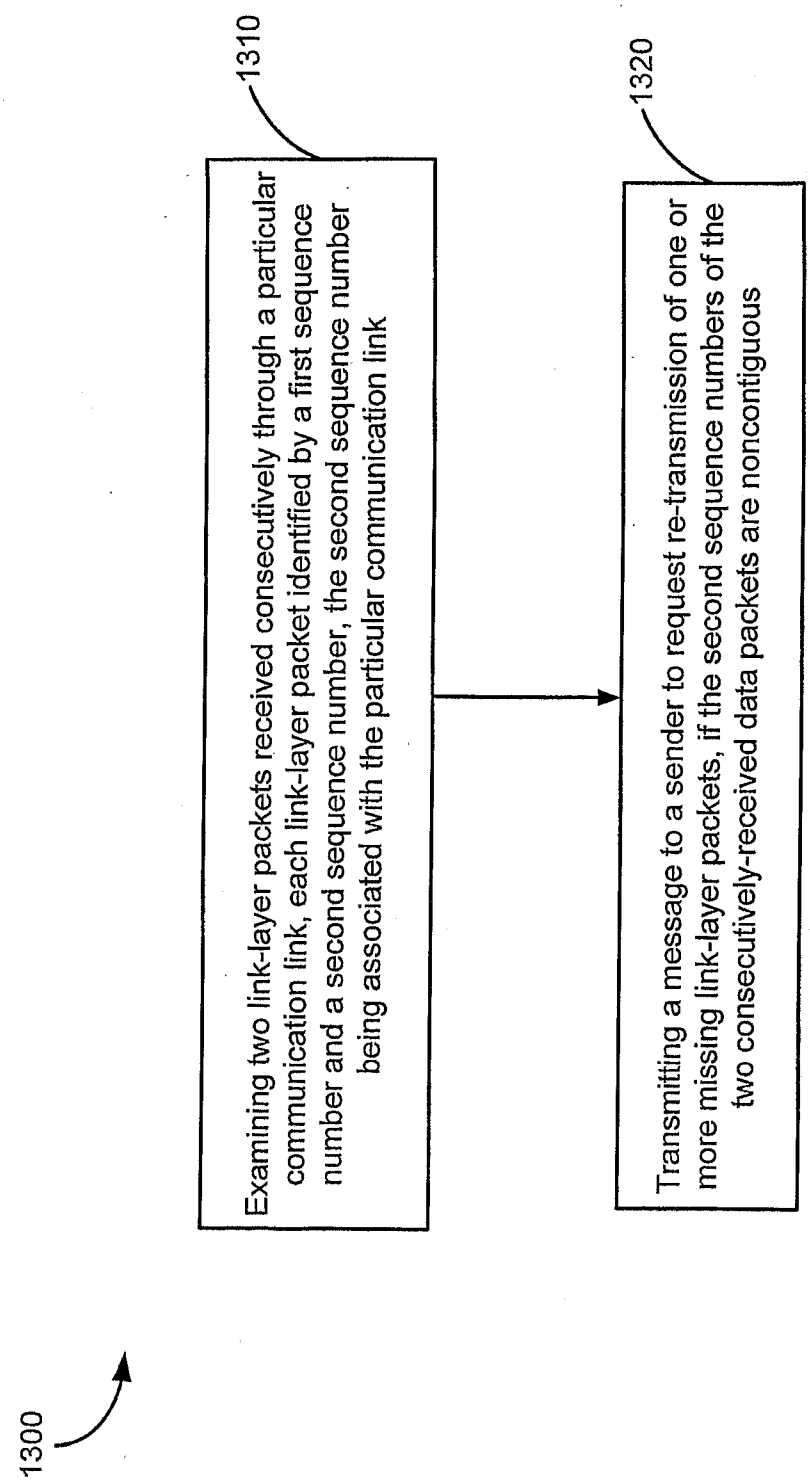
1300
1310
Examining two link-layer packets received consecutively through a particular communication link, each link-layer packet identified by a first sequence number and a second sequence number, the second sequence number being associated with the particular communication link
1320
Transmitting a message to a sender to request re-transmission of one or more missing link-layer packets, if the second sequence numbers of the two consecutively-received data packets are noncontiguous

FIG. 13

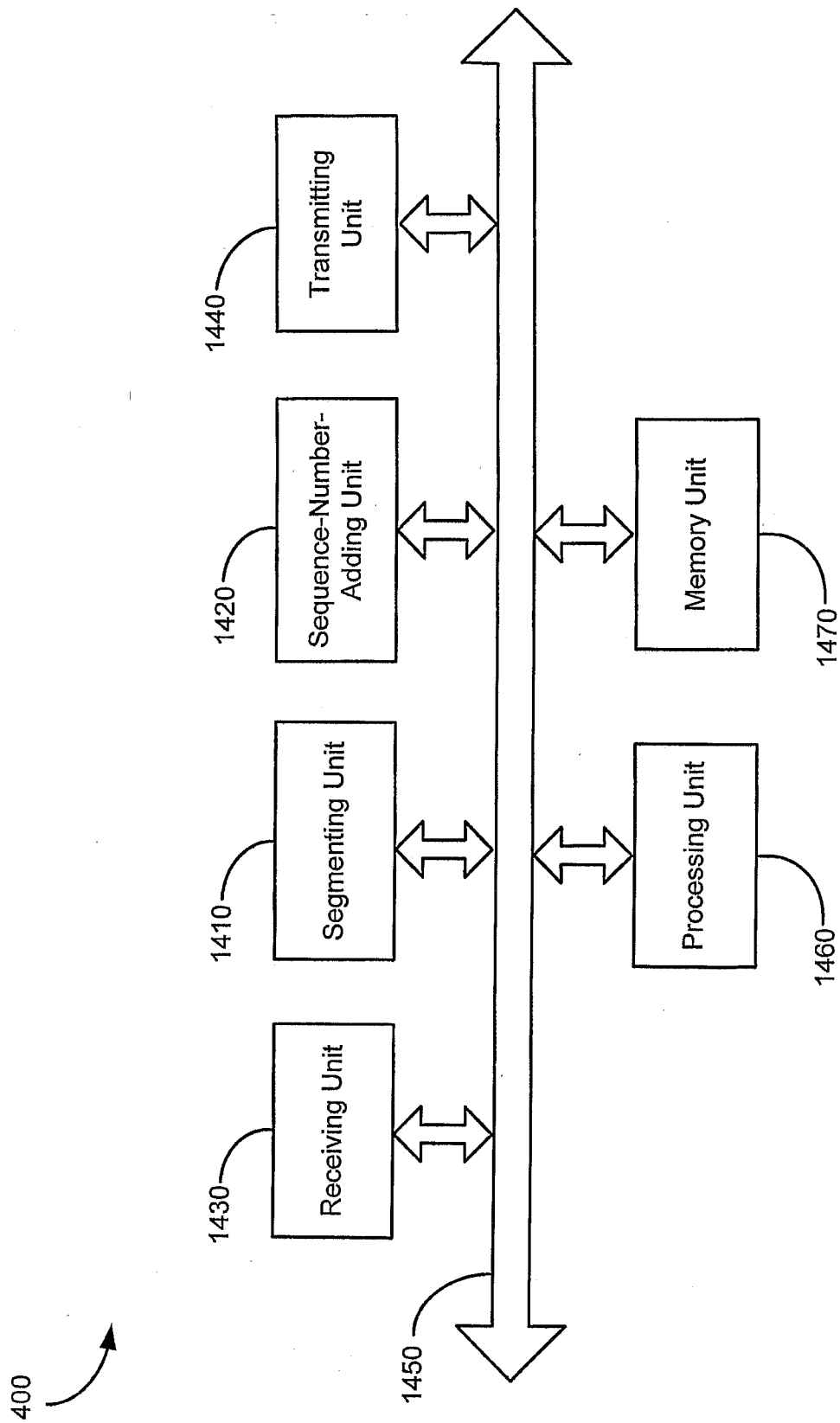
1400
1450
1430
Receiving Unit
1410
Segmenting Unit
1420
Sequence-Number-Adding Unit
1440
Transmitting Unit
1460
Processing Unit
1470
Memory Unit

FIG. 14

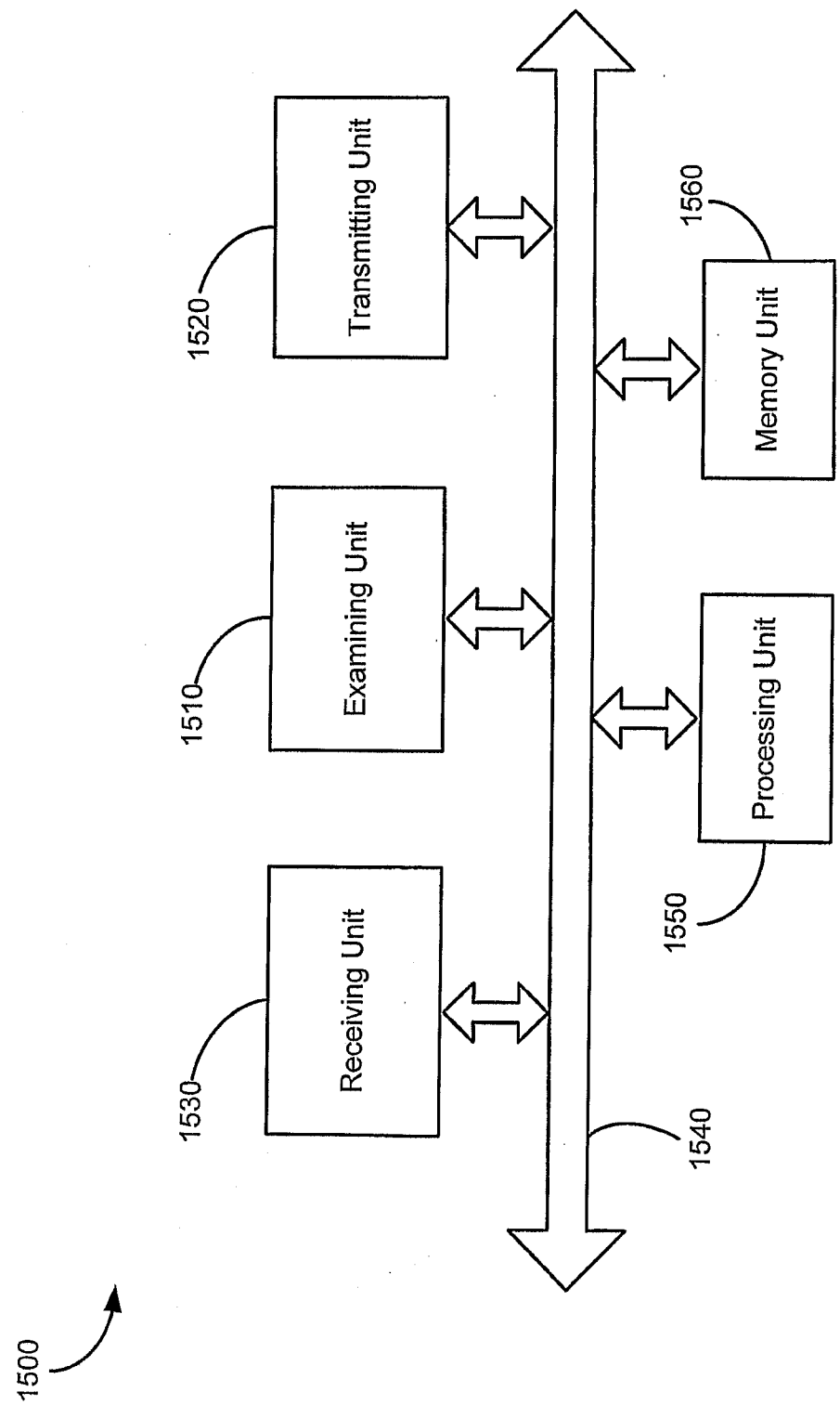
1500
1520
Transmitting Unit
1510
Examining Unit
1530
Receiving Unit
1540
1560
Memory Unit
1550
Processing Unit

FIG. 15