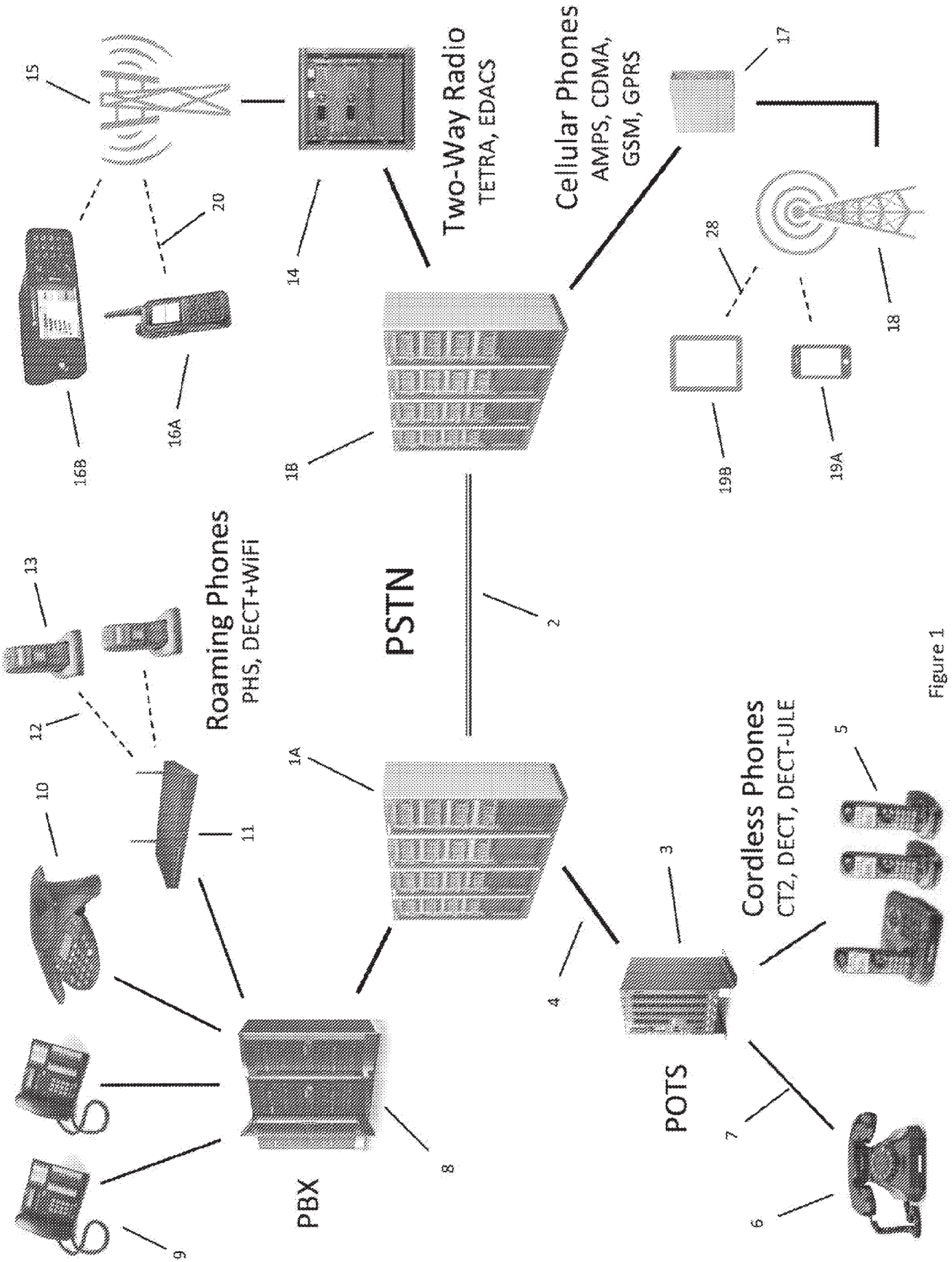

PSTN
2
1A
1B
PBX
8
9
10
11
12
13
Roaming Phones
PHS, DECT+WiFi
POTS
3
4
5
6
7
Cordless Phones
CT2, DECT, DECT-ULE
Two-Way Radio
TETRA, EDACS
14
15
16A
16B
20
Cellular Phones
AMPS, CDMA,
GSM, GPRS
17
18
19A
19B
28

Figure 1

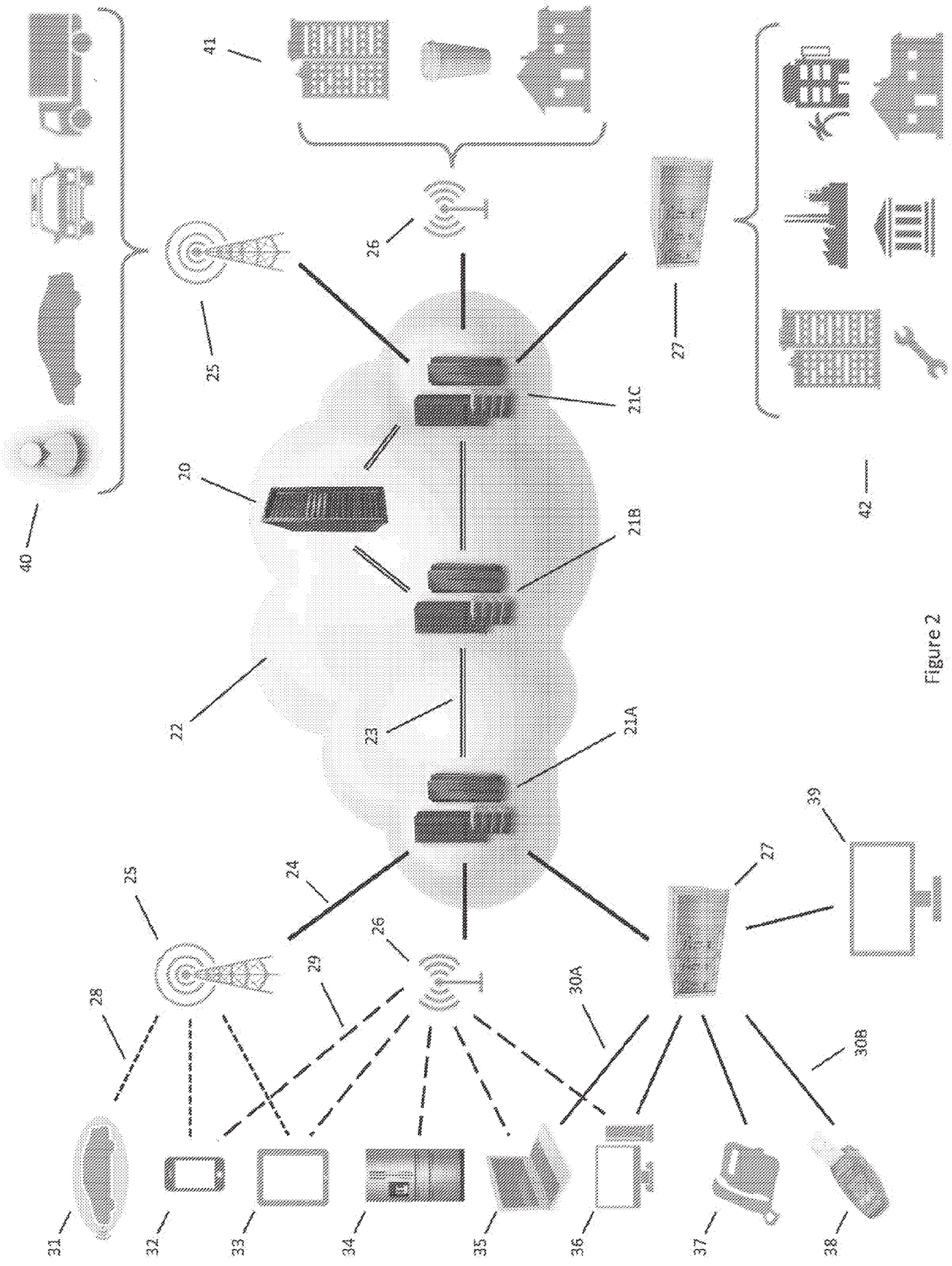

40
41
25
26
27
42
20
21C
21B
21A
22
23
24
25
26
27
28
29
30A
30B
39
31
32
33
34
35
36
37
38

Figure 2

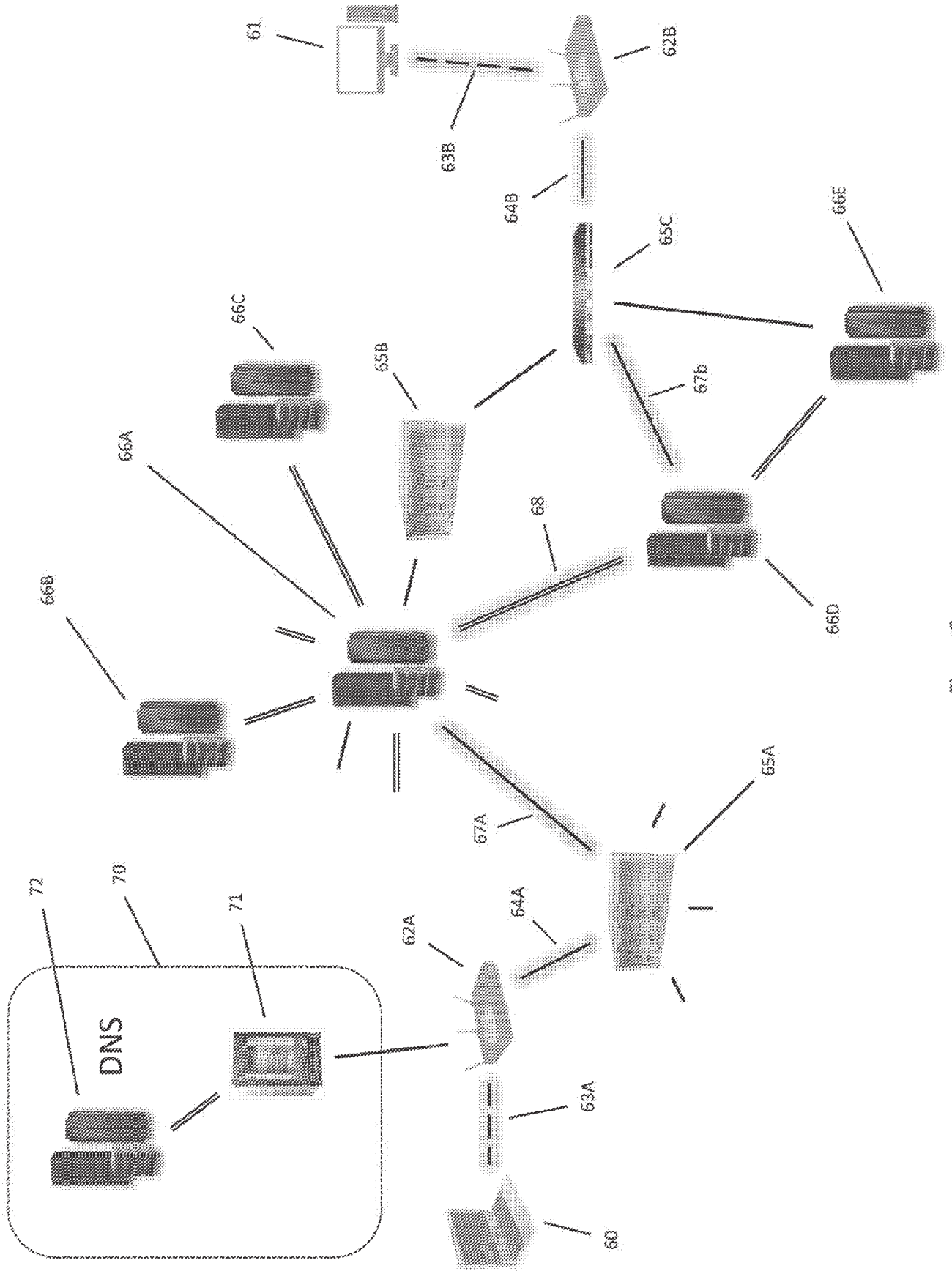
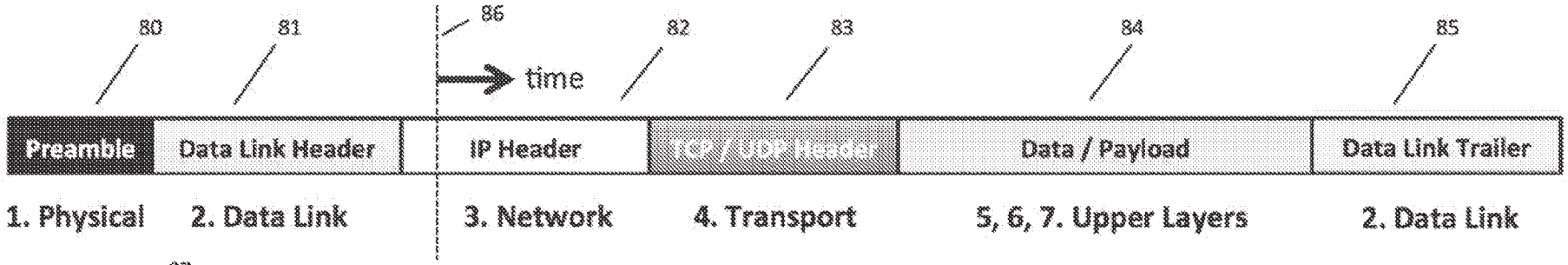

61
62B
63B
64B
65C
66E
66C
65B
67b
66A
68
66B
66D
65A
67A
72
70
71
64A
62A
DNS
63A
60

Figure 3



87

OSI Layer	Data Type	Current Examples
7. Application	Data (Upper Layers, App Layers, Payload)	Telnet, files (FTP, SFTP, FTAM, ZIP), email (SMTP, IMAP, POP3), web (DNS, HTTP, Safari, Firefox, Chrome, etc.), coms (SIP, IRC, NNTP, OTT), network mgmt (SNMP, DHCP, BGP, LDAP, CMIP), drivers (printer, scanner, camera), backup (NFS, online, custom)
6. Presentation		text (ASCII, EBCDIC, ZIP), graphics (PNG, JPG, GIF, BMP), sound & video (MP4, WMV, MOV, AVI, MIDI), documents (PDF, DOC, PPT, HTML, XML, MIME), streaming (RTP, RTSP, RTMP), encryption (TLS/SSL, SSH)
5. Session		SOCKS, RPC, authentication, full/half duplex, simplex
4. Transport	Segments, datagram	UDP, TCP, DCCP, VPN (GRE, PPTP, SSTM, SSH...), LCM
3. Network	Packet, datagram	IP, ICMP, IGMP
2. Data Link	Bit, frame, VLAN (802.1Q)	802.11, 802.3, ATM, PPP, HSUPA, LTE, DOCSIS, LLC
1. Physical (PHY)	Electrical, optical & RF signals (incl. bit streams)	WiFi, Ethernet, Serial, Parallel, Fiber, T1, 4G, Cable, Cu wire, RF Broadcast (FM, TV, DAB, DMB), Bluetooth, Bits

Figure 4

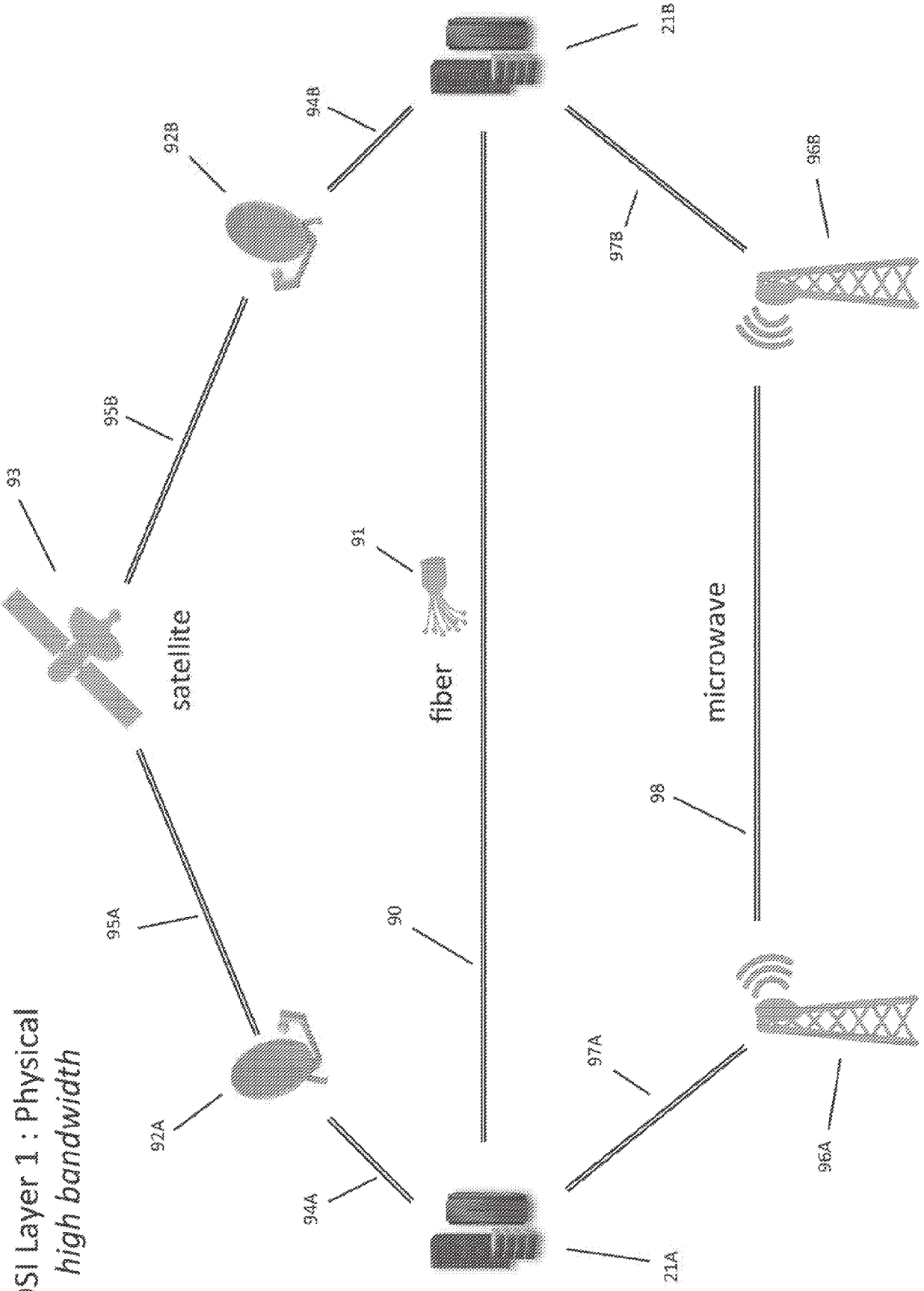
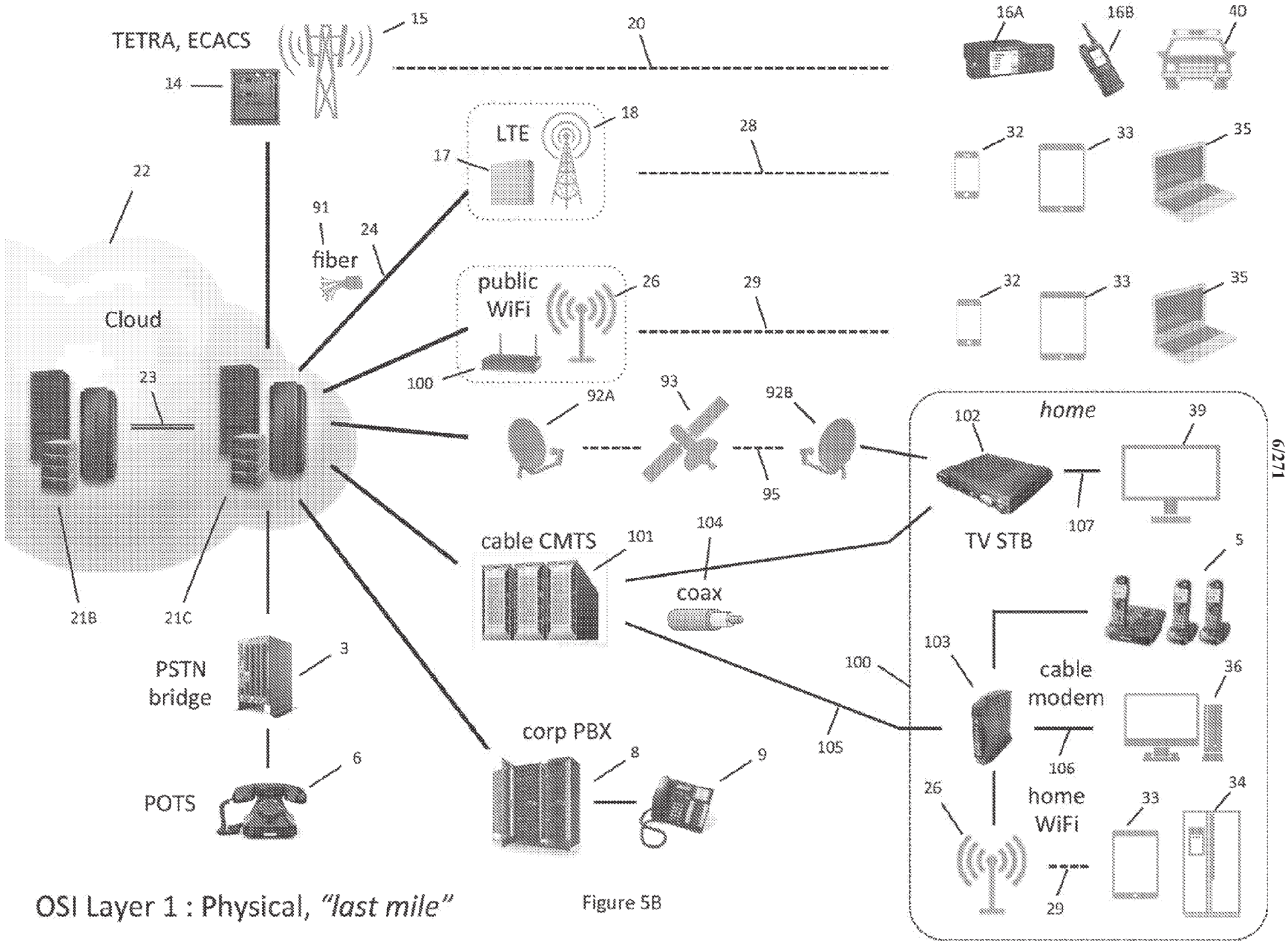

OSI Layer 1 : Physical
high bandwidth
satellite
fiber
microwave
21A
21B
90
91
92A
92B
93
94A
94B
95A
95B
96A
96B
97A
97B
98

Figure 5A



OSI Layer 1 : Physical, *"last mile"*

Figure 5B

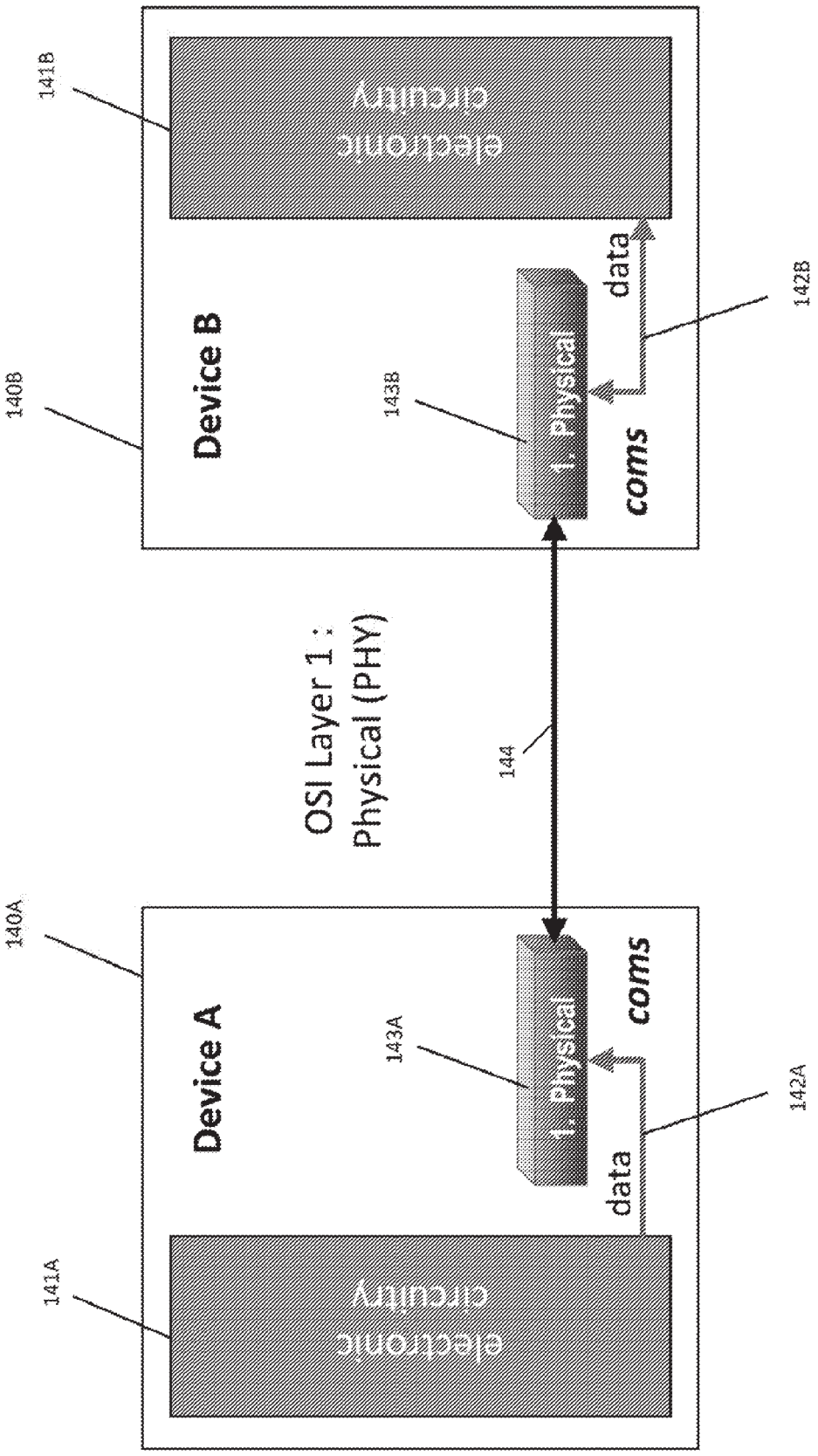

141B
electronic circuitry
Device B
140B
143B
1. Physical
coms
data
142B
OSI Layer 1 :
Physical (PHY)
144
140A
Device A
143A
1. Physical
coms
data
142A
141A
electronic circuitry

Figure 6A

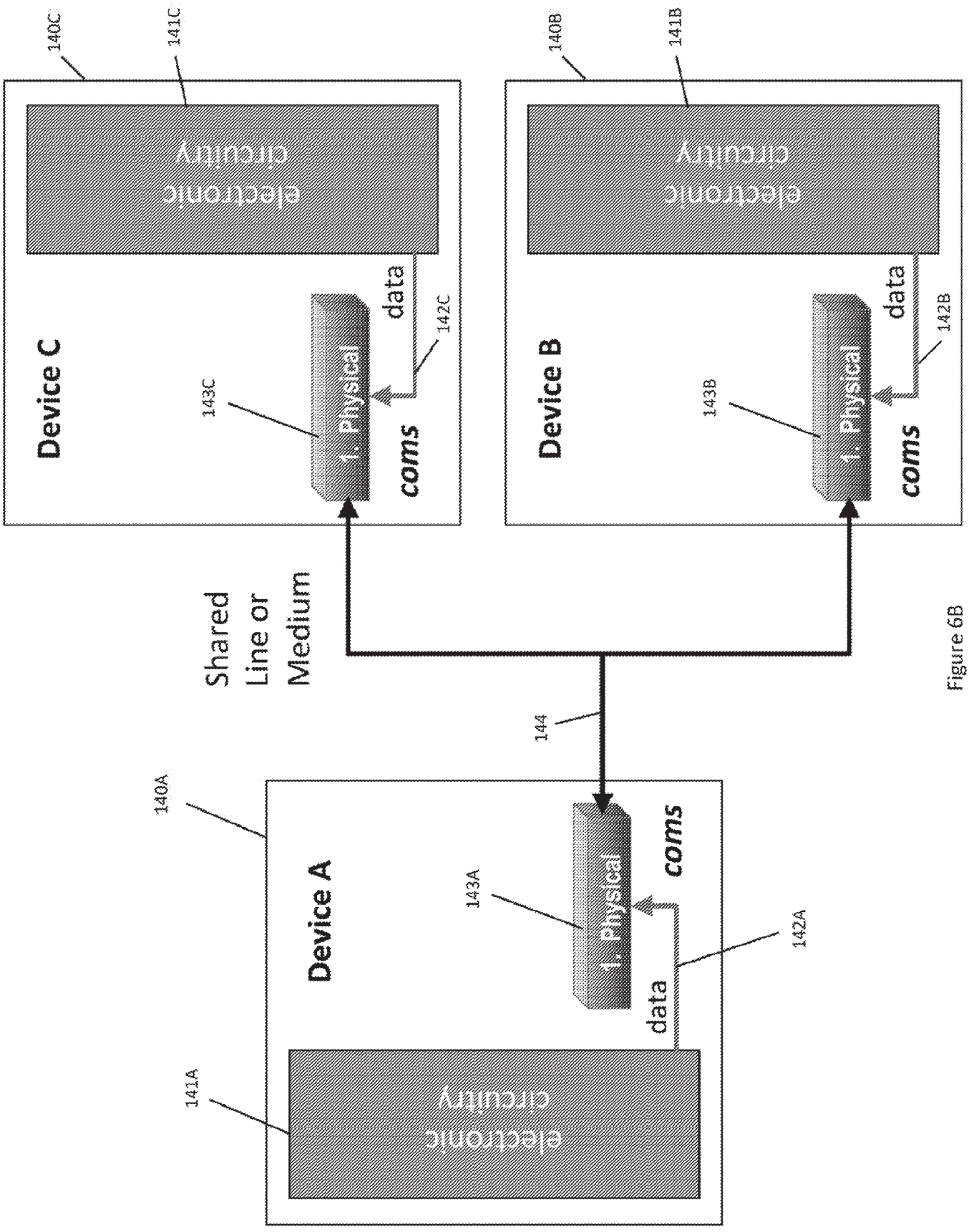

140C
141C
electronic circuitry
Device C
data
142C
143C
1. Physical
coms
140B
141B
electronic circuitry
Device B
data
142B
143B
1. Physical
coms
Shared Line or Medium
144
140A
Device A
143A
1. Physical
coms
142A
data
141A
electronic circuitry

Figure 6B

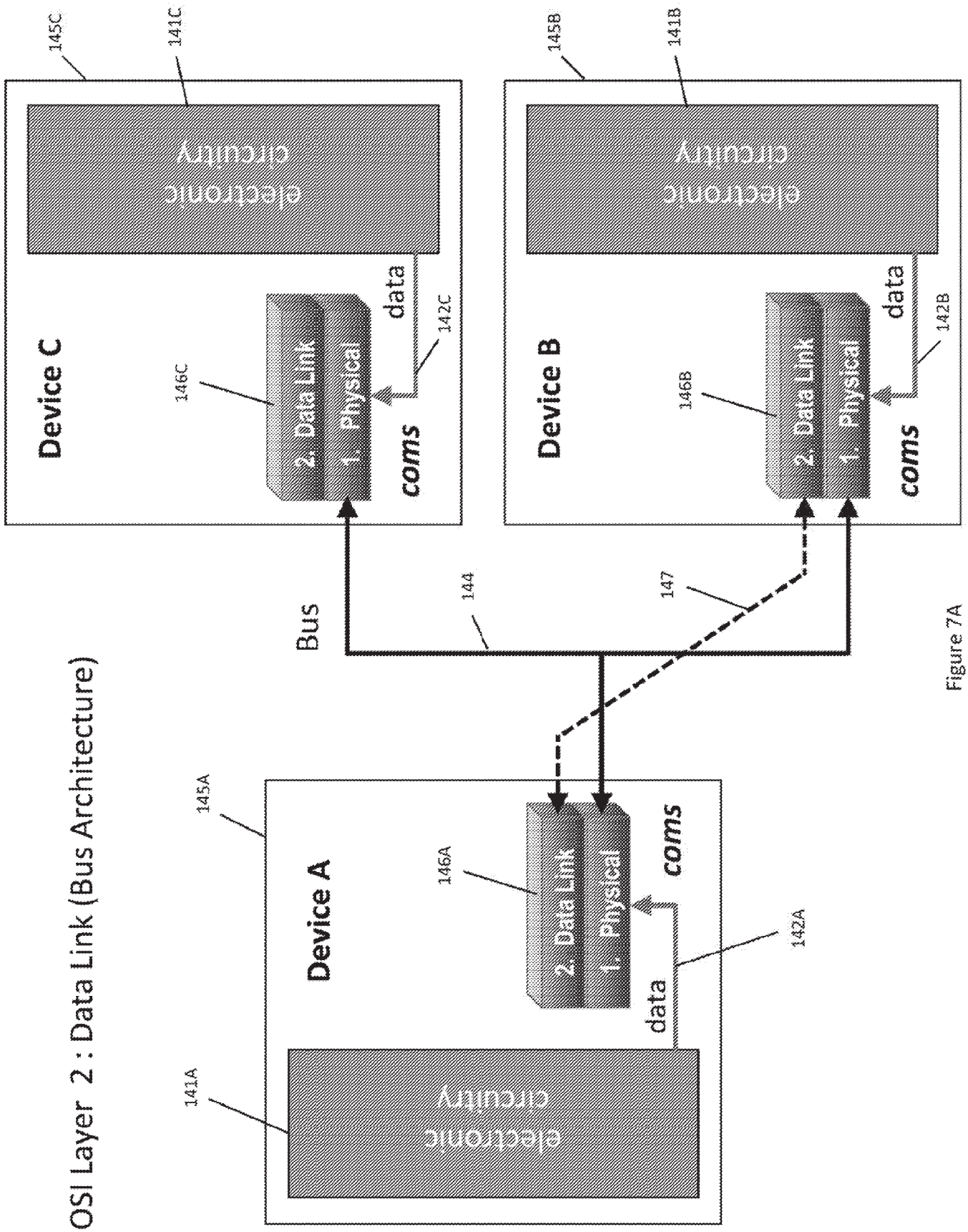

OSI Layer 2 : Data Link (Bus Architecture)
Device A
Device B
Device C
electronic circuitry
2. Data Link
1. Physical
coms
data
Bus
141A
141B
141C
142A
142B
142C
144
145A
145B
145C
146A
146B
146C
147

Figure 7A

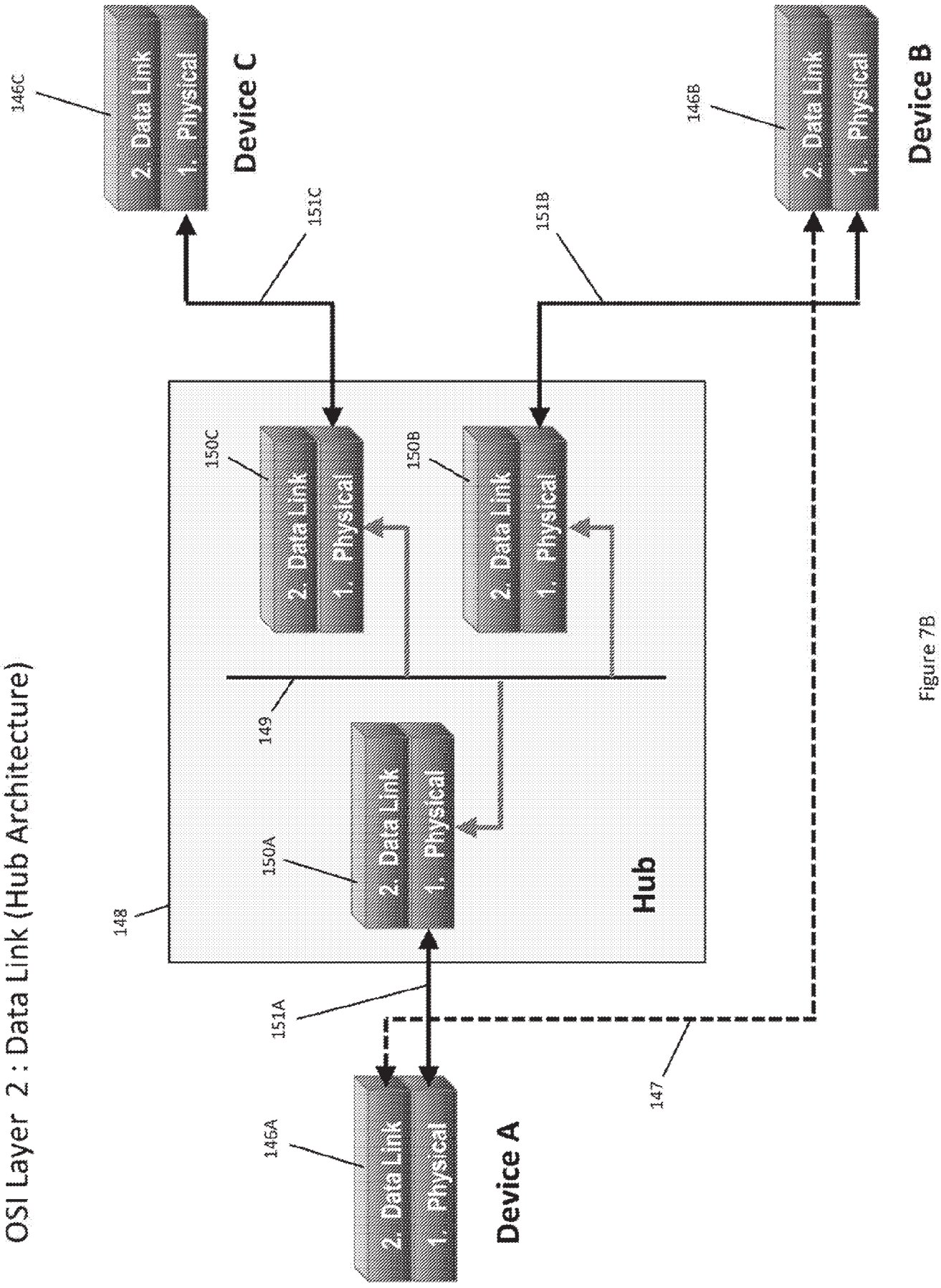

OSI Layer 2 : Data Link (Hub Architecture)
2. Data Link
1. Physical
Device C
Device B
Device A
Hub
146C
146B
146A
148
149
150A
150B
150C
151A
151B
151C
147

Figure 7B

OSI Layer 2 : Data Link (Daisy Chain Architecture)

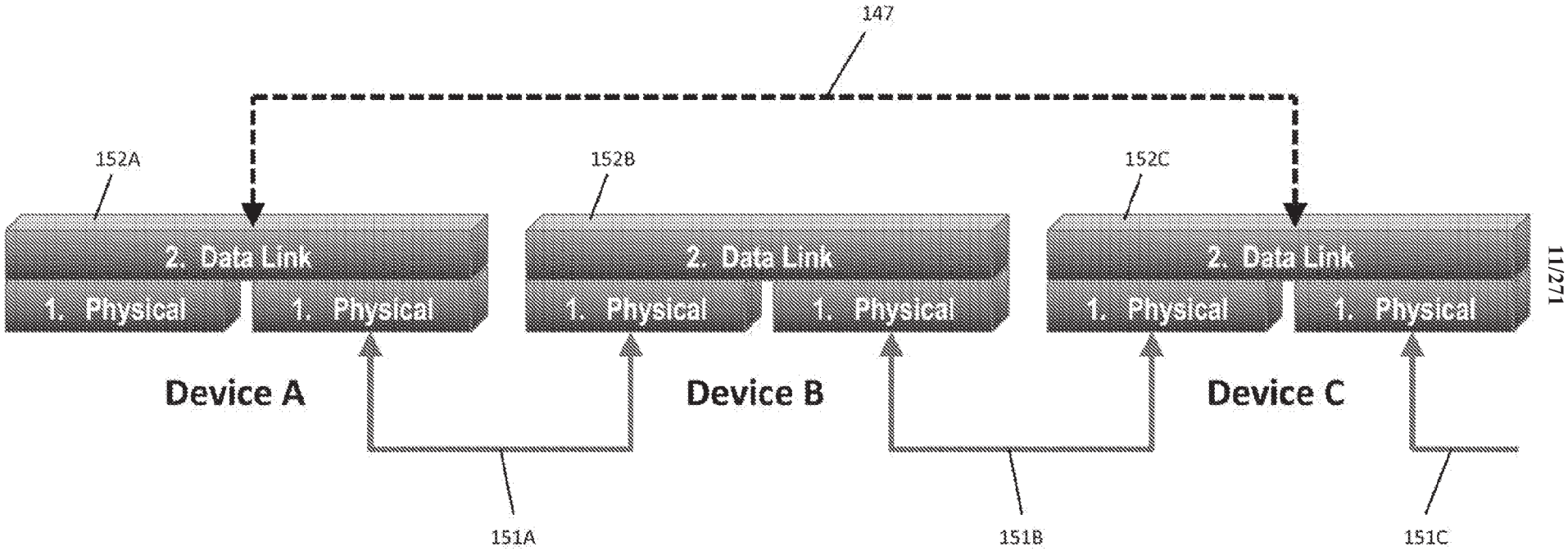


Figure 7C

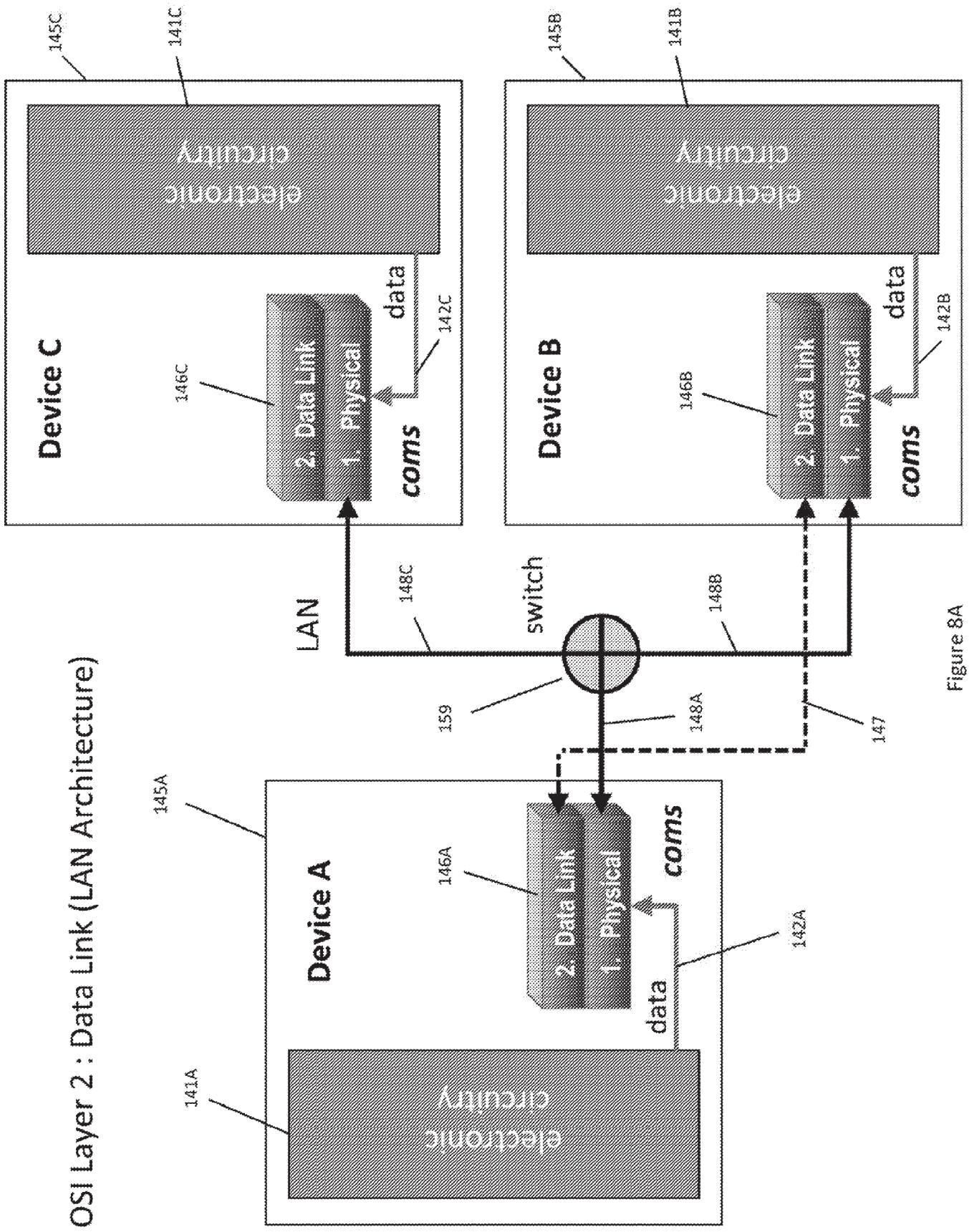

OSI Layer 2 : Data Link (LAN Architecture)
Device A
Device B
Device C
electronic circuitry
2. Data Link
1. Physical
coms
data
LAN
switch
145A
145B
145C
141A
141B
141C
142A
142B
142C
146A
146B
146C
147
148A
148B
148C
159

Figure 8A

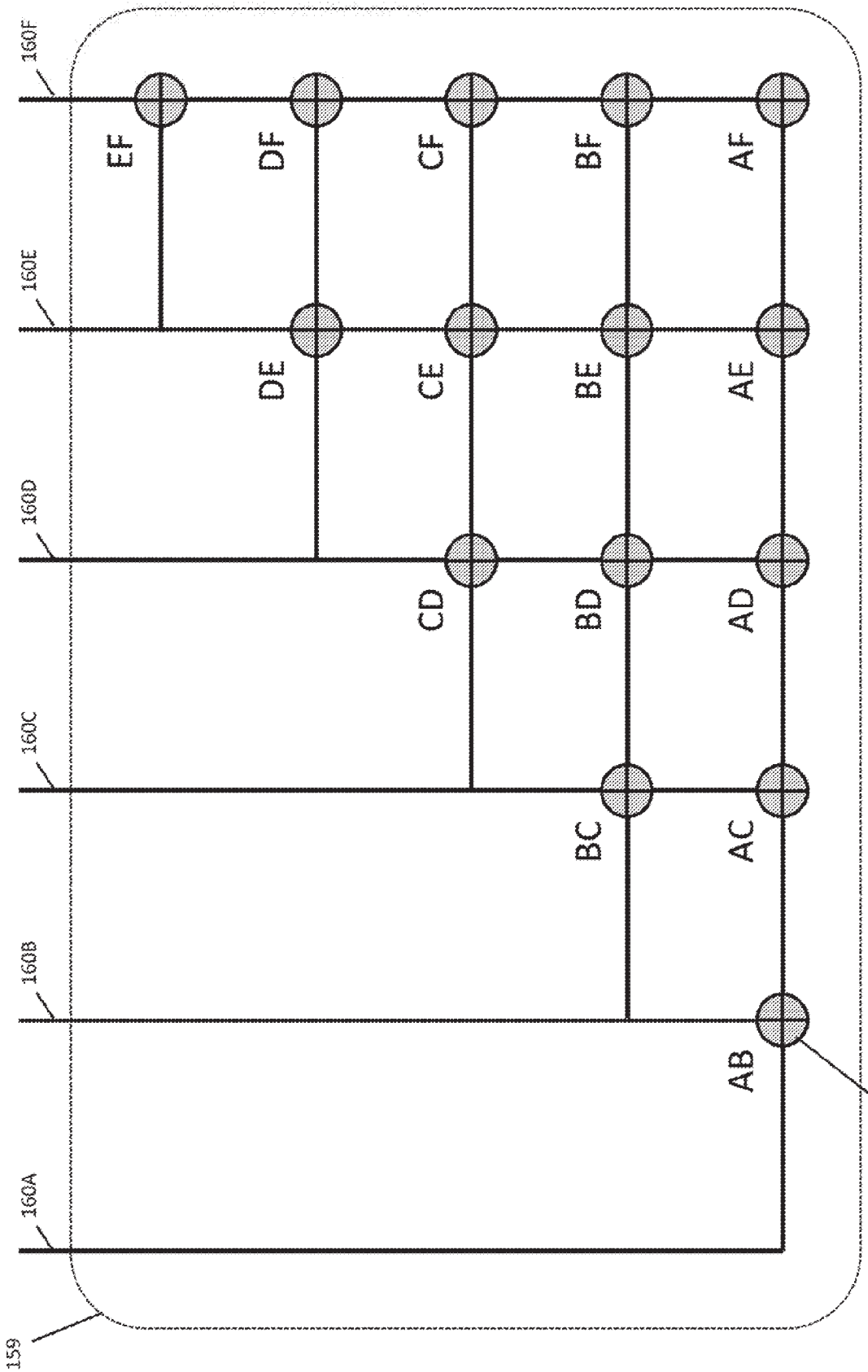

159
A
160A
B
160B
C
160C
D
160D
E
160E
F
160F
EF
DF
CF
BF
AF
DE
CE
BE
AE
CD
BD
AD
BC
AC
AB
161

Figure 8B

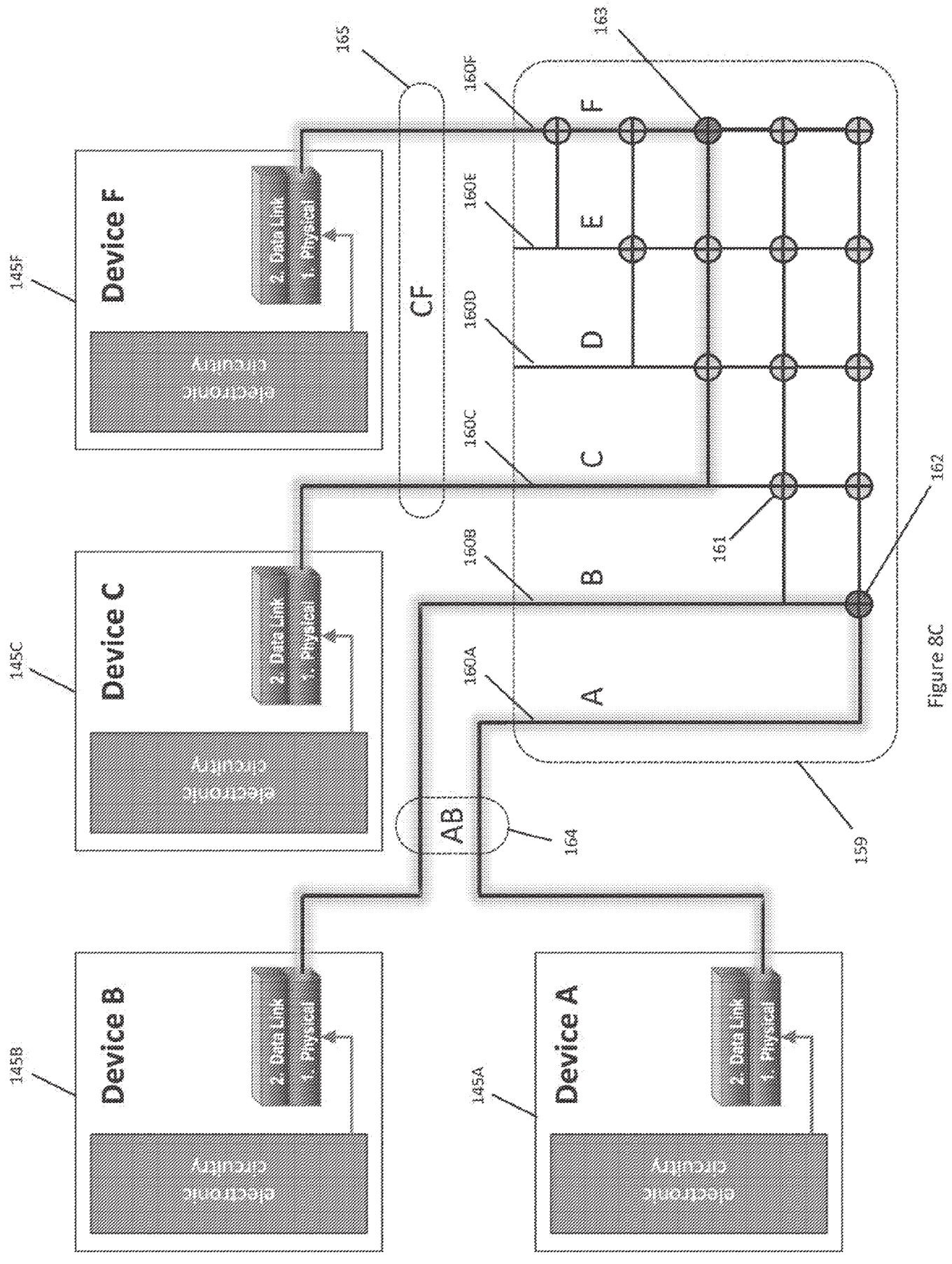
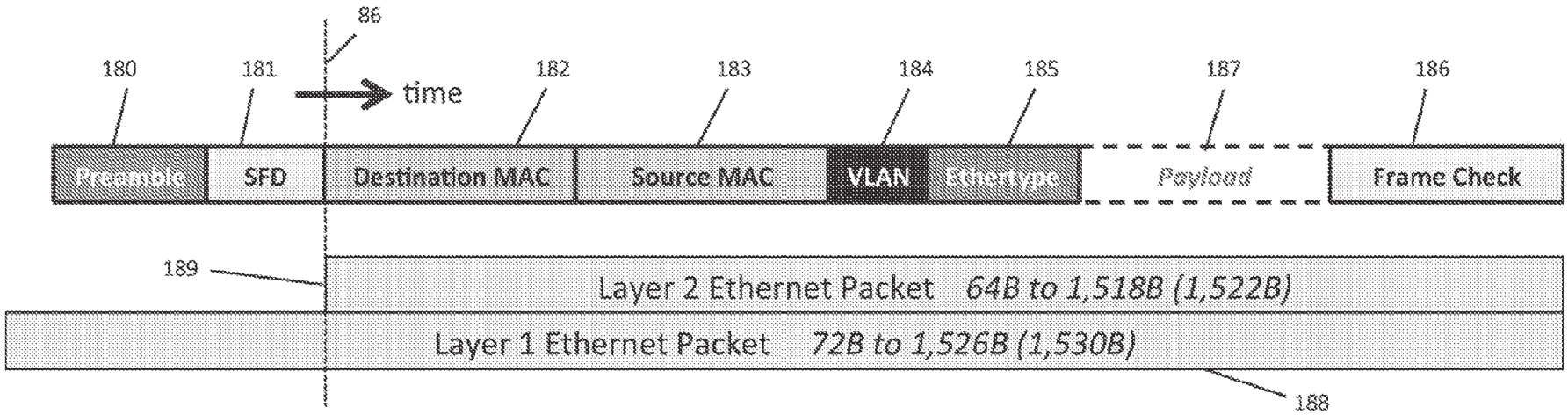

Device A
Device B
Device C
Device F
electronic circuitry
2. Data Link
1. Physical
145A
145B
145C
145F
A
B
C
D
E
F
160A
160B
160C
160D
160E
160F
161
162
163
164
165
159
AB
CF

Figure 8C



OSI Layers 1 & 2 : Data Link for Ethernet Packets (IEEE 802.3) 190

Layer	Packet Field	Size	Function
1	**Preamble**	7B	Data frame header
1	**SFD**	1B	Synchronize hardware devices (start frame delimiter)
2	**Destination MAC**	6B	Media Access Control (MAC) destination address on LAN
2	**Source MAC**	6B	Media Access Control (MAC) source address on LAN
2	**VLAN**	(4B)	802.1Q tag (optional)
2	**Ethertype**	2B	Type of data link (Ethernet II) or length (IEEE 802.3)
2–7	**Payload**	42B – 1500B	Content of packet (including network, IP, app info & data)
2	**Frame Check**	4B	Checksum of entire packet (32-bit CRC data link trailer)

Figure 9

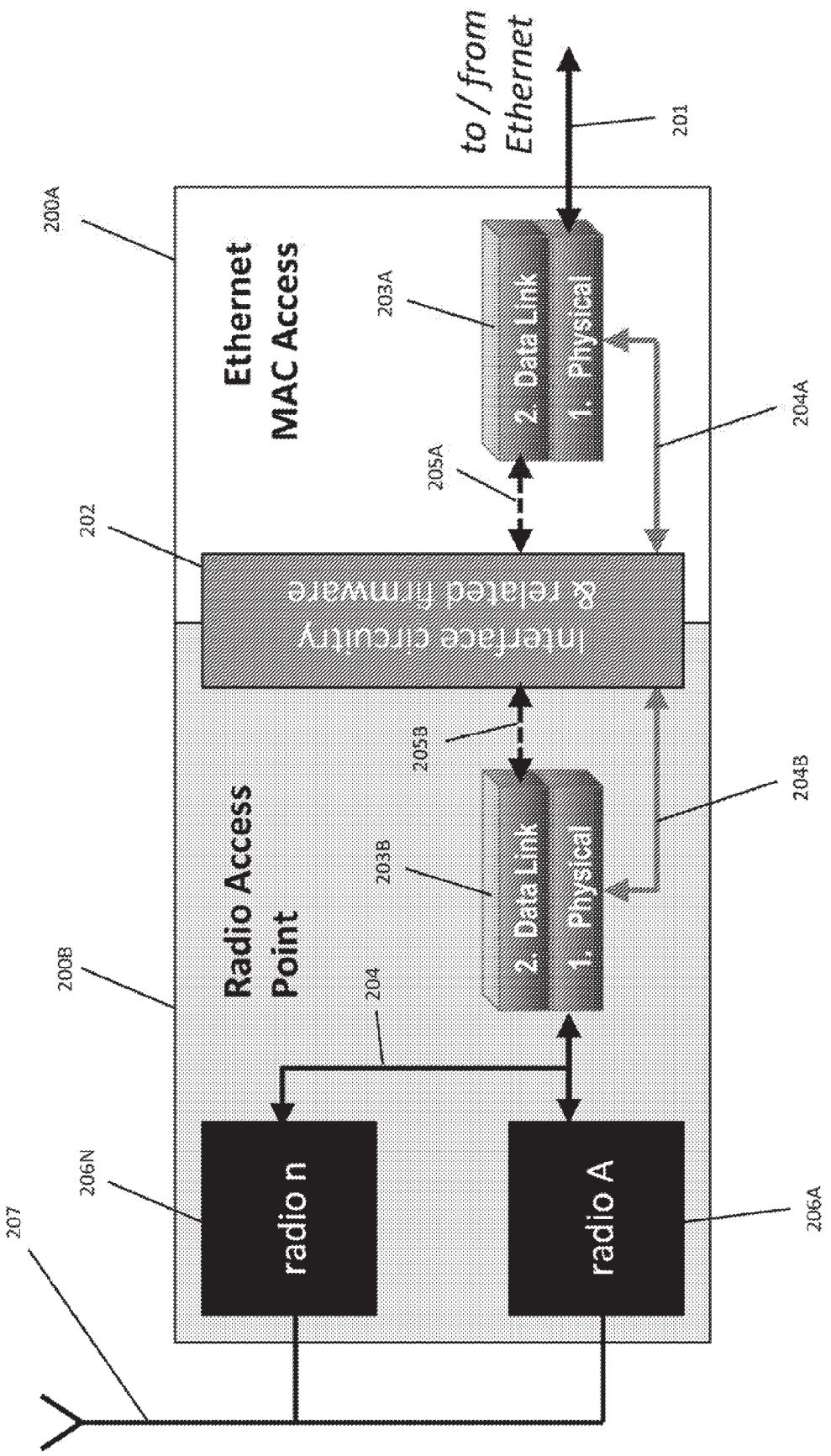
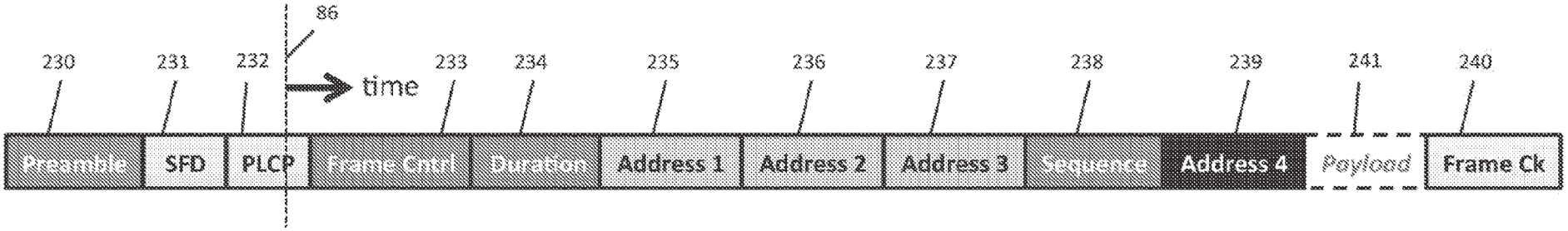

to / from Ethernet
201
200A
Ethernet MAC Access
203A
2. Data Link
1. Physical
204A
205A
202
interface circuitry & related firmware
205B
204B
203B
2. Data Link
1. Physical
200B
Radio Access Point
204
206N
radio n
radio A
206A
207

Figure 10



242

OSI Layers 1 & 2 : Data Link for WLAN Packets (WiFi, IEEE 802.11, etc.)

Layer	Packet Field	Size	Function
1	Preamble	10B	Data frame header
1	SFD	2B	Synchronize hardware devices (start frame delimiter)
1-2	PLCP	2B	Physical layer convergence procedure (length, rate, header error ck)
2	Frame Control	2B	Version Type (Management, Control, Data, Reserved)
2	Duration & ID	2B	NAV duration (except in power save mode, then Station ID)
2	Address 1	6B	BSS receiving station address (depends on To DS / From DS setting)
2	Address 2	6B	BSS transmitting station address (depends on To DS / From DS)
2	Address 3	6B	Conditional address (depends on To DS / From DS setting)
2	Sequence Cntrl	2B	Sequence & fragment number defining the packet frame
2	Address 4	6B	Source station address in WDS (wireless distribution system) mode
2–7	Payload	0 – 2312B	Content of packet (including network, IP, app info & data)
2	Frame Check	4B	Checksum of entire packet (32-bit CRC data link trailer)

Figure 11

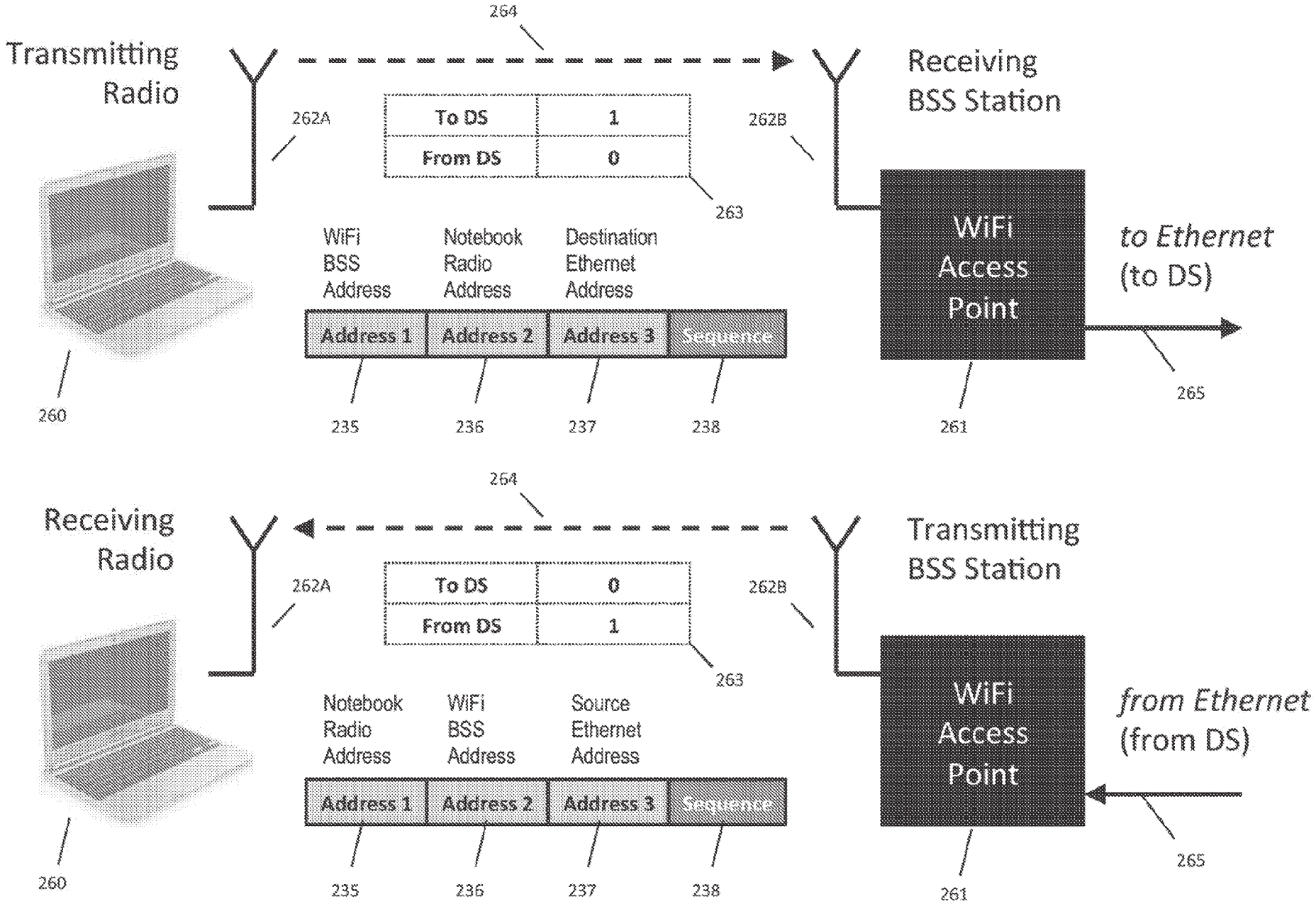

Transmitting Radio
264
Receiving BSS Station
262A
262B
To DS 1
From DS 0
263
WiFi Access Point
to Ethernet (to DS)
WiFi BSS Address
Notebook Radio Address
Destination Ethernet Address
Address 1
Address 2
Address 3
Sequence
260
235
236
237
238
261
265
Receiving Radio
264
Transmitting BSS Station
262A
262B
To DS 0
From DS 1
263
WiFi Access Point
from Ethernet (from DS)
Notebook Radio Address
WiFi BSS Address
Source Ethernet Address
Address 1
Address 2
Address 3
Sequence
260
235
236
237
238
261
265

Figure 12A

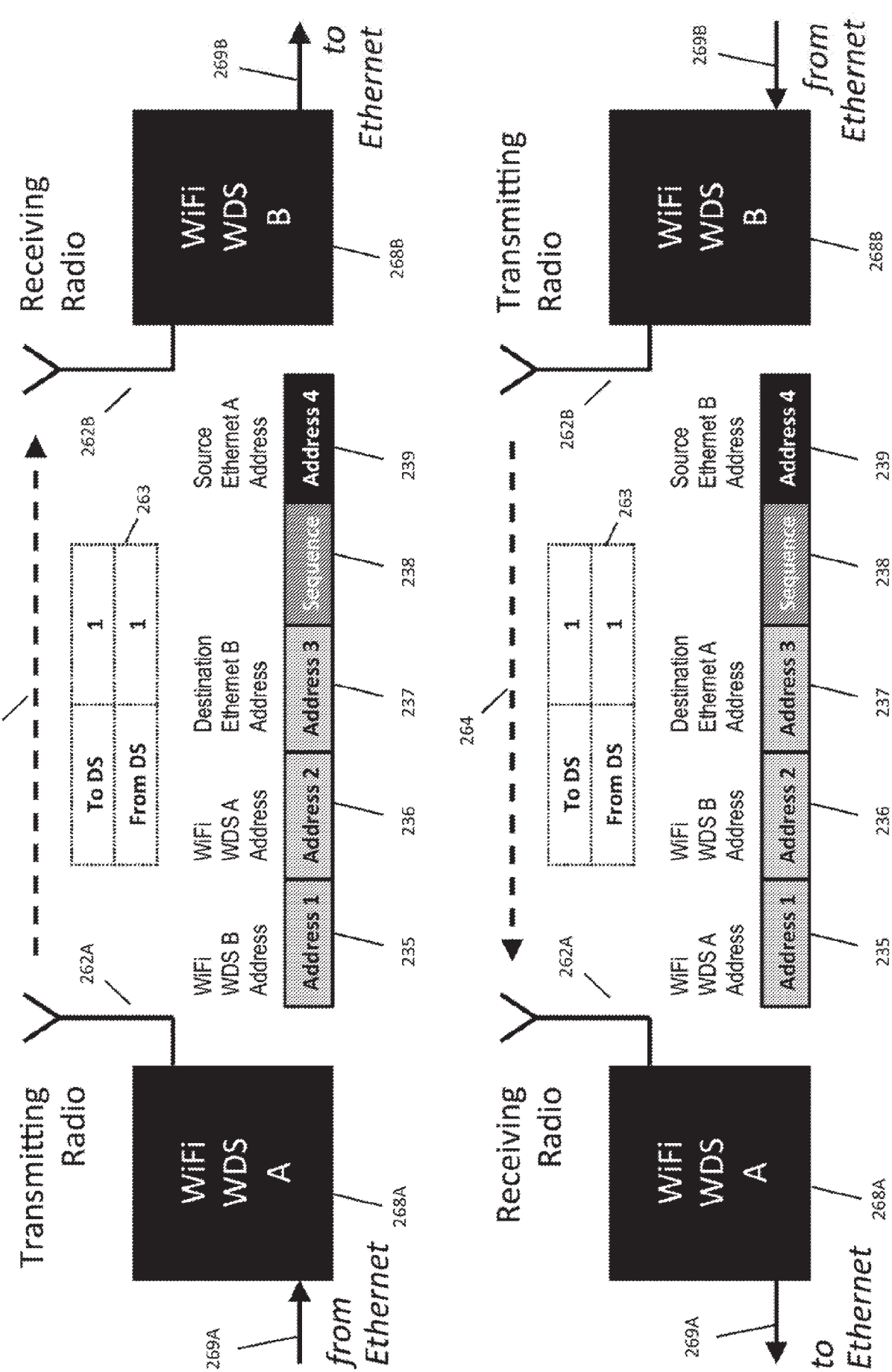

Transmitting Radio
WiFi WDS A
268A
from Ethernet
269A
262A
264
To DS
From DS
1
1
263
WiFi WDS B Address
WiFi WDS A Address
Destination Ethernet B Address
Source Ethernet A Address
Address 1
Address 2
Address 3
Address 4
235
236
237
238
239
262B
Receiving Radio
WiFi WDS B
268B
to Ethernet
269B
Receiving Radio
WiFi WDS A
268A
to Ethernet
269A
262A
264
To DS
From DS
1
1
263
WiFi WDS A Address
WiFi WDS B Address
Destination Ethernet A Address
Source Ethernet B Address
Address 1
Address 2
Address 3
Address 4
235
236
237
238
239
262B
Transmitting Radio
WiFi WDS B
268B
from Ethernet
269B

Figure 12B

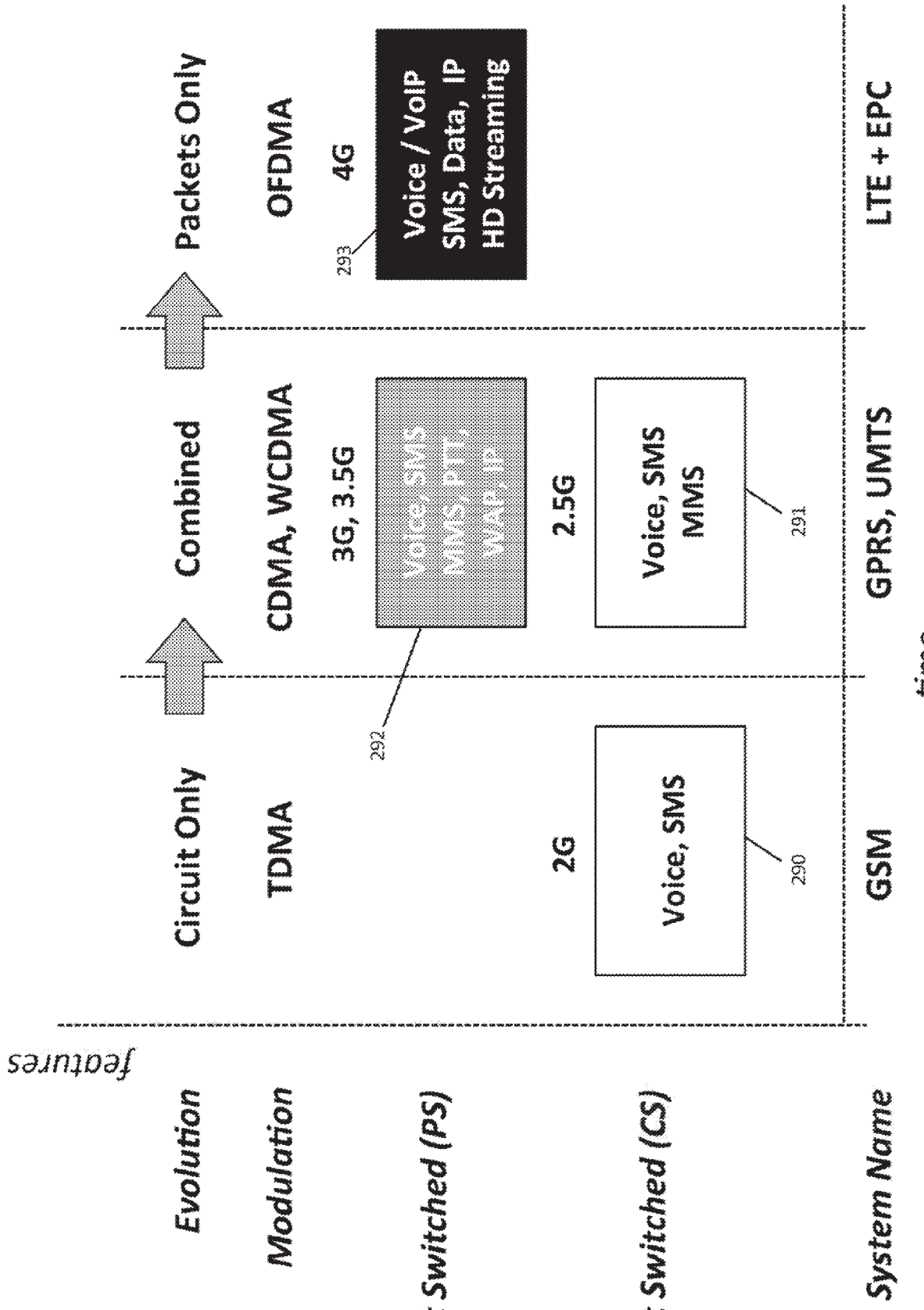

features
Evolution
Modulation
Packet Switched (PS)
Circuit Switched (CS)
System Name
Circuit Only
Combined
Packets Only
TDMA
CDMA, WCDMA
OFDMA
2G
3G, 3.5G
2.5G
4G
GSM
GPRS, UMTS
LTE + EPC
Voice, SMS
Voice, SMS MMS, PTT, WAP, IP
Voice, SMS MMS
Voice / VoIP SMS, Data, IP HD Streaming
290
291
292
293
time...

Figure 13

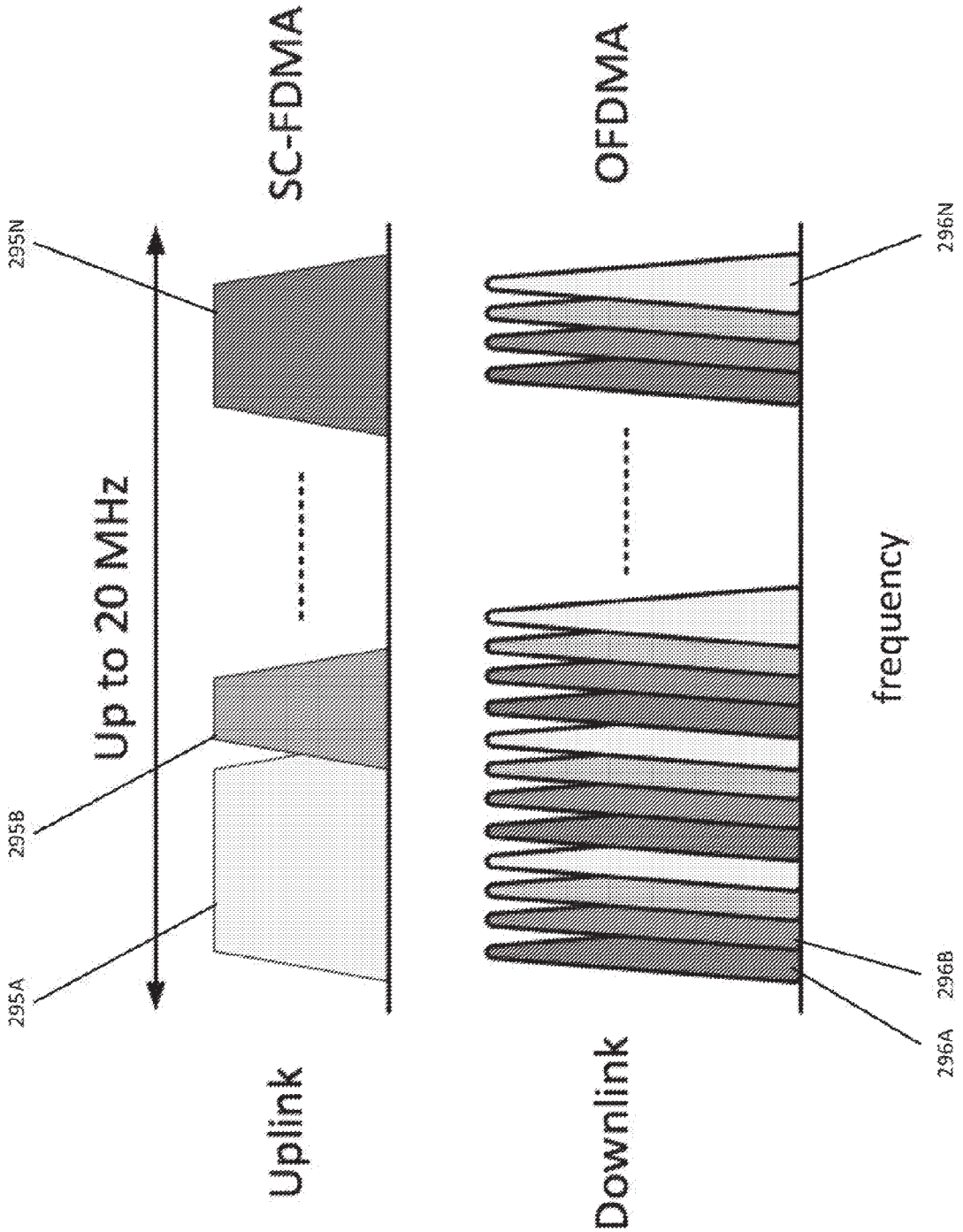

SC-FDMA
OFDMA
295N
Up to 20 MHz
295B
295A
Uplink
Downlink
frequency
296N
296B
296A

Figure 14A

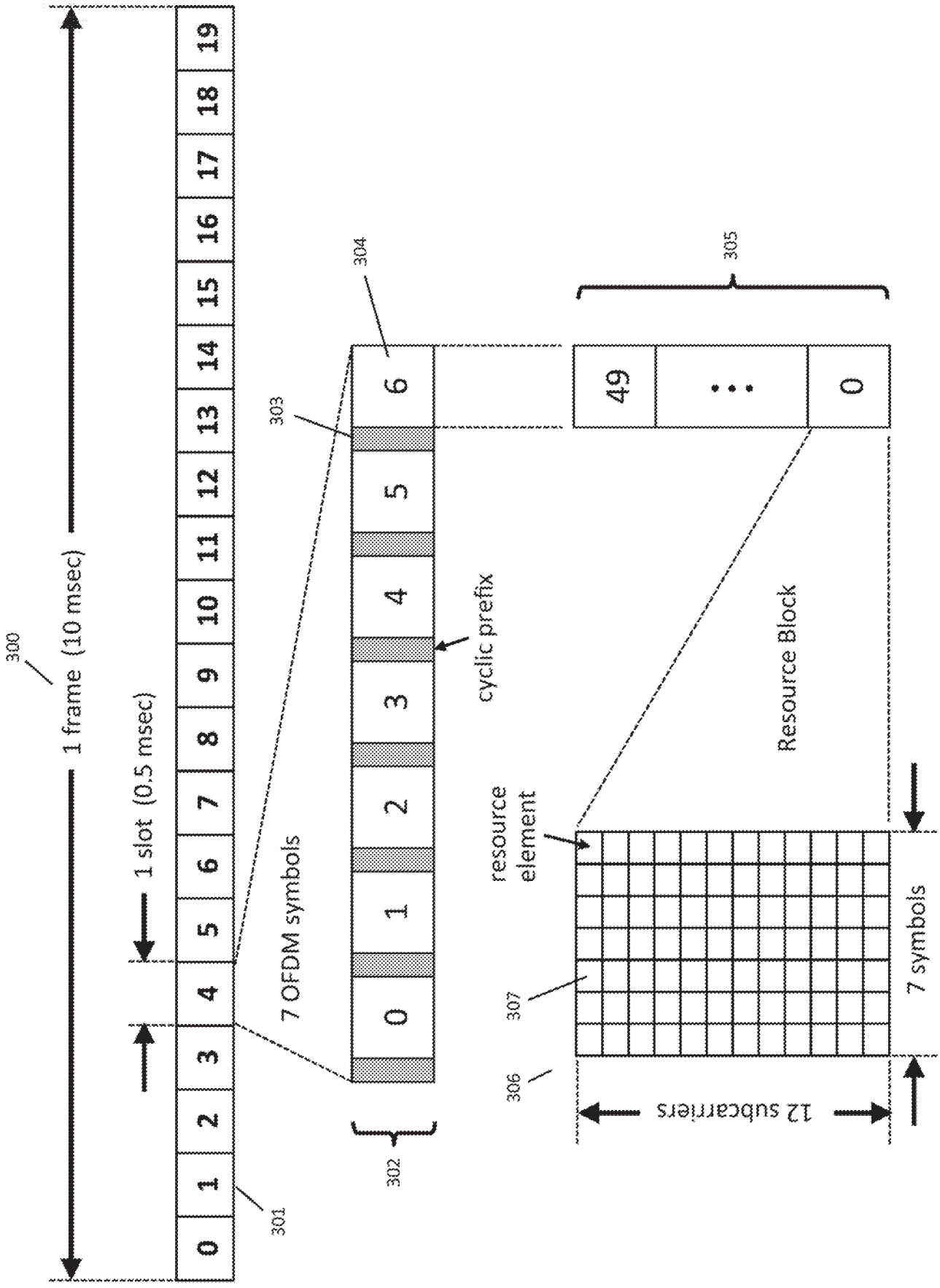

300
1 frame (10 msec)
1 slot (0.5 msec)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
301
303
304
7 OFDM symbols
0 1 2 3 4 5 6
cyclic prefix
302
305
49 ... 0
resource element
Resource Block
307
306
12 subcarriers
7 symbols

Figure 14B

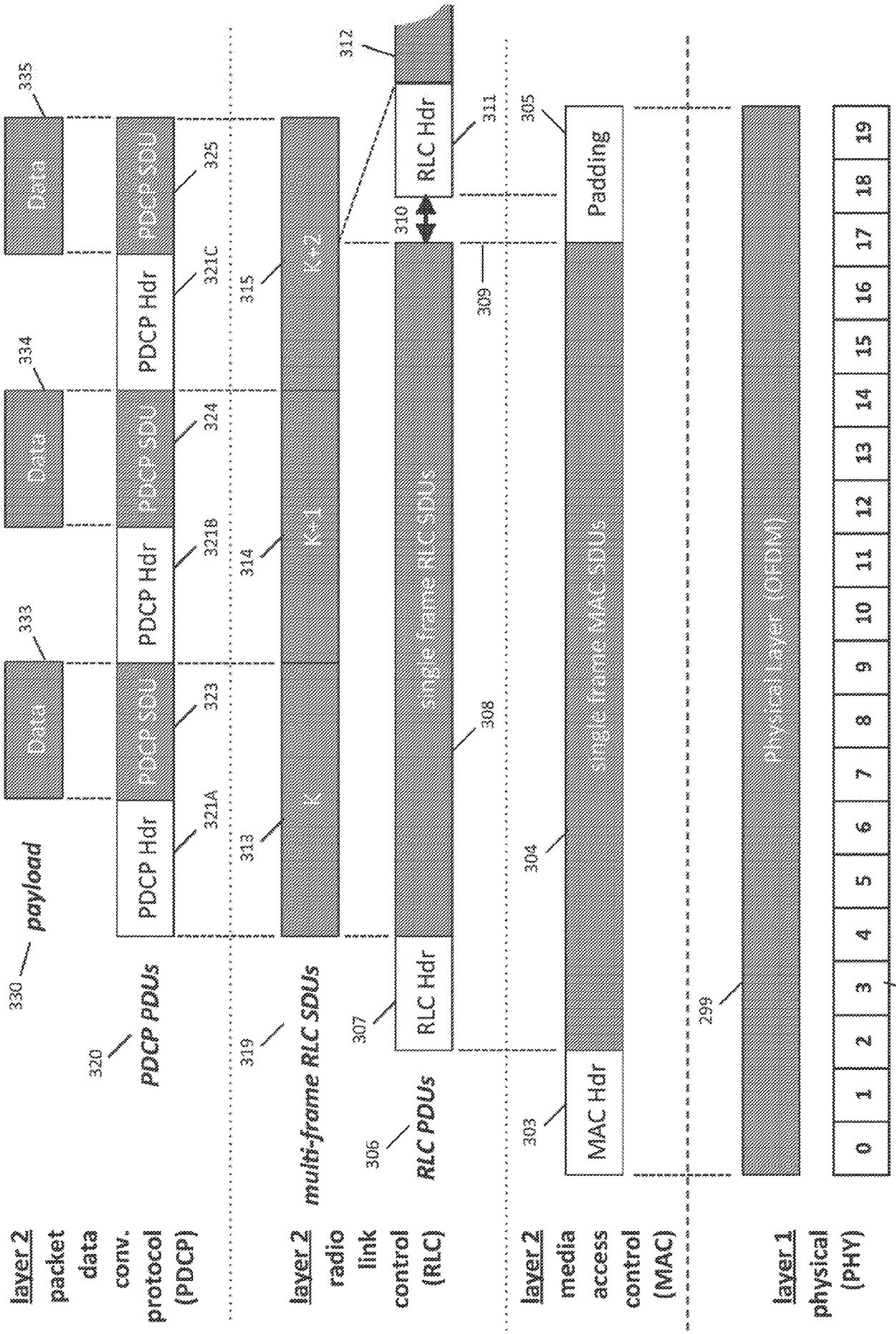

layer 2
packet
data
conv.
protocol
(PDCP)
layer 2
radio
link
control
(RLC)
layer 2
media
access
control
(MAC)
layer 1
physical
(PHY)
payload
PDCP PDUs
multi-frame RLC SDUs
RLC PDUs
Data
PDCP Hdr
PDCP SDU
K
K+1
K+2
single frame RLC SDUs
RLC Hdr
MAC Hdr
single frame MAC SDUs
Padding
Physical Layer (OFDM)
330
320
319
307
306
303
304
299
308
309
310
311
312
313
314
315
321A
321B
321C
323
324
325
333
334
335
305
301
300
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19

Figure 15

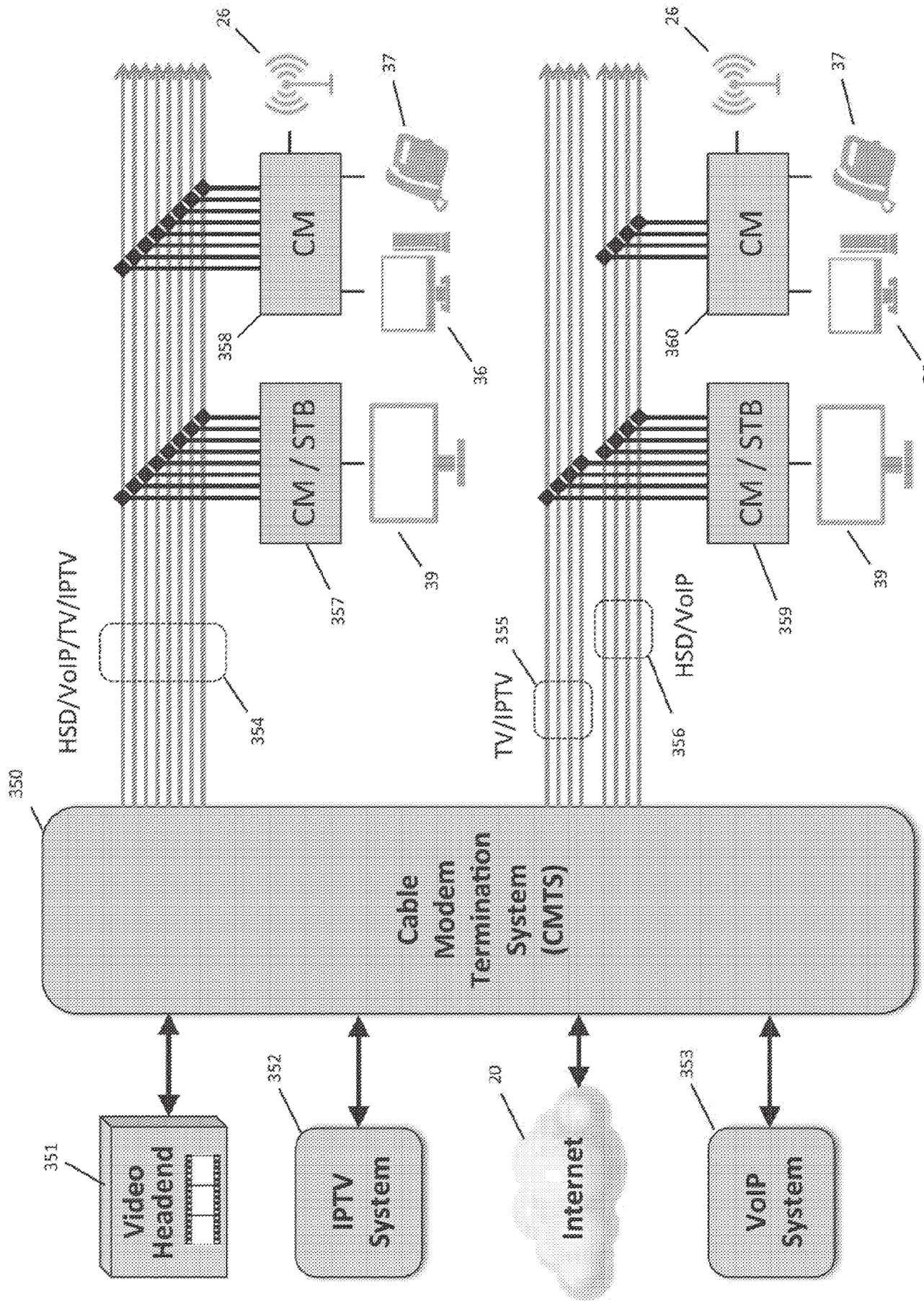

Video Headend
IPTV System
Internet
VoIP System
Cable Modem Termination System (CMTS)
HSD/VoIP/TV/IPTV
TV/IPTV
HSD/VoIP
CM
CM / STB
350
351
352
20
353
354
355
356
357
358
359
360
36
37
39
26

Figure 16

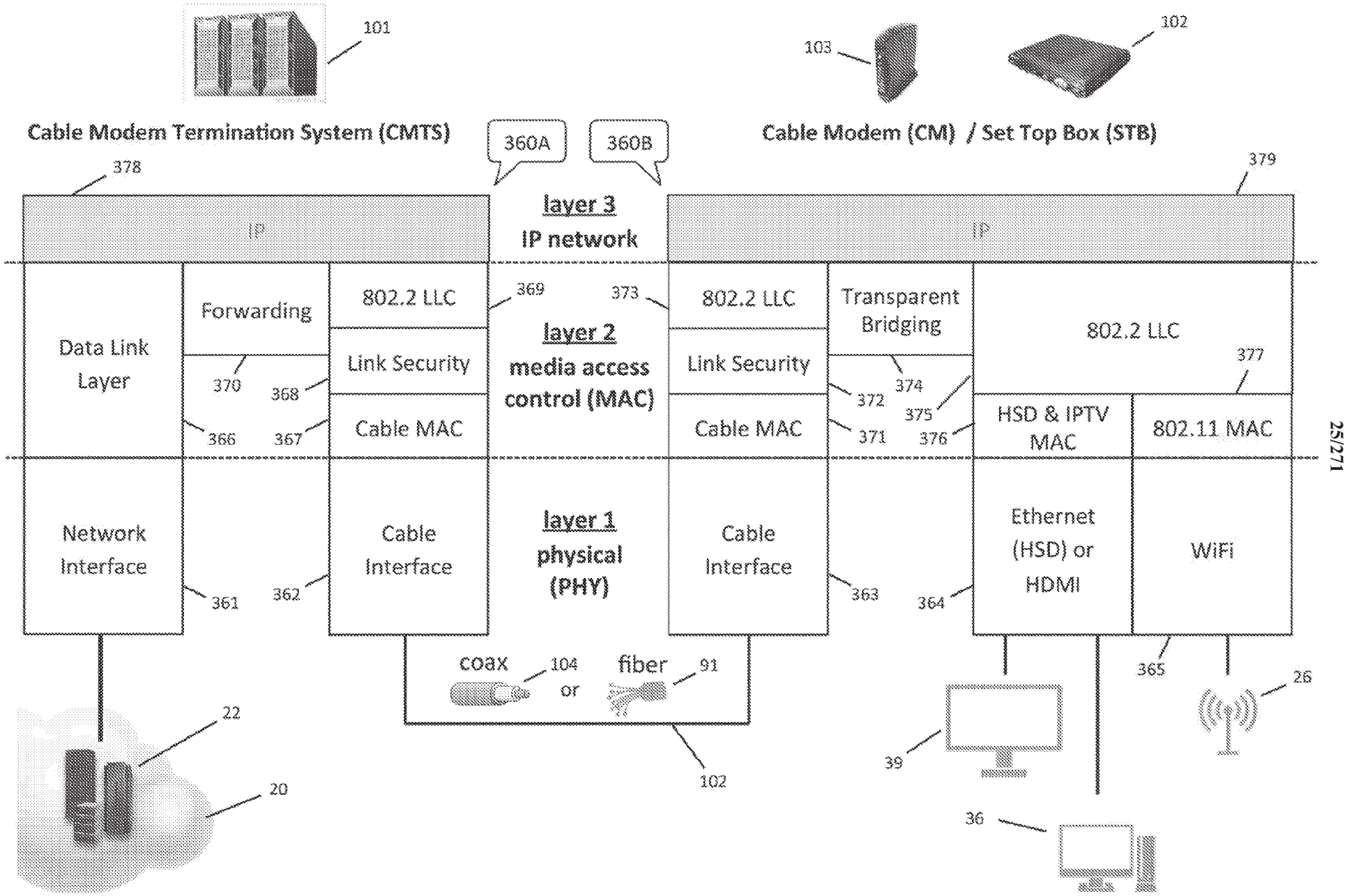

101
103
102
Cable Modem Termination System (CMTS)
360A
360B
Cable Modem (CM) / Set Top Box (STB)
378
379
IP
layer 3
IP network
IP
Data Link Layer
Forwarding
802.2 LLC
369
373
802.2 LLC
Transparent Bridging
802.2 LLC
377
Link Security
layer 2
media access control (MAC)
Link Security
374
372
375
HSD & IPTV MAC
802.11 MAC
370
368
366
367
Cable MAC
371
376
Cable MAC
Network Interface
361
Cable Interface
362
layer 1
physical (PHY)
Cable Interface
363
364
Ethernet (HSD) or HDMI
WiFi
365
coax
104
or
fiber
91
102
22
20
39
26
36

Figure 17

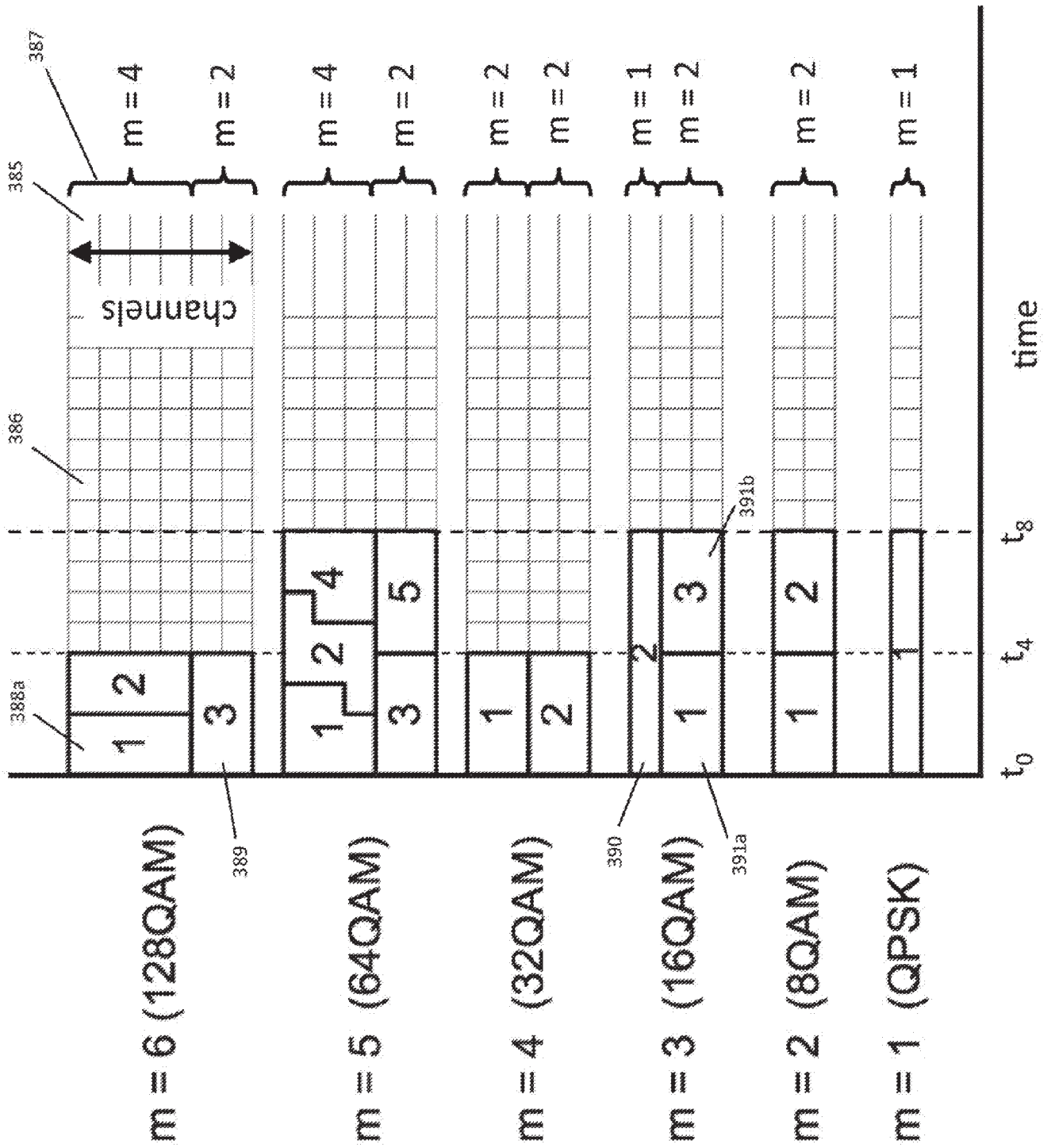

m = 6 (128QAM)
m = 5 (64QAM)
m = 4 (32QAM)
m = 3 (16QAM)
m = 2 (8QAM)
m = 1 (QPSK)
channels
time
t_0
t_4
t_8
385
386
387
388a
389
390
391a
391b
m = 4
m = 2
m = 1

Figure 18

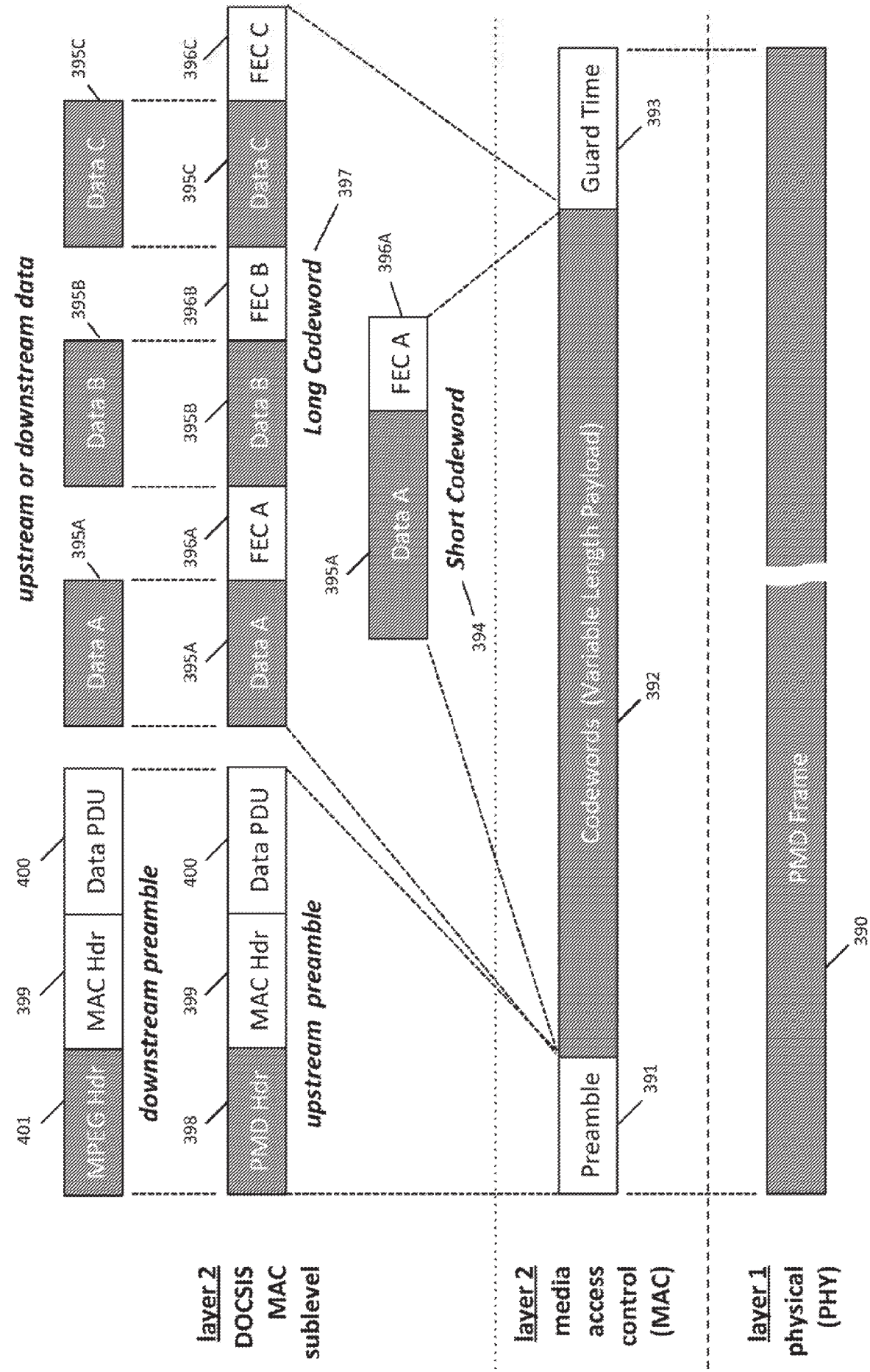

layer 2
DOCSIS
MAC
sublevel
layer 2
media
access
control
(MAC)
layer 1
physical
(PHY)
upstream or downstream data
downstream preamble
upstream preamble
Long Codeword
Short Codeword
MPEG Hdr
MAC Hdr
Data PDU
RMD Hdr
Data A
Data B
Data C
FEC A
FEC B
FEC C
Preamble
Codewords (Variable Length Payload)
Guard Time
RMD Frame
401
398
399
400
395A
395B
395C
396A
396B
396C
397
394
391
392
393
390

Figure 19

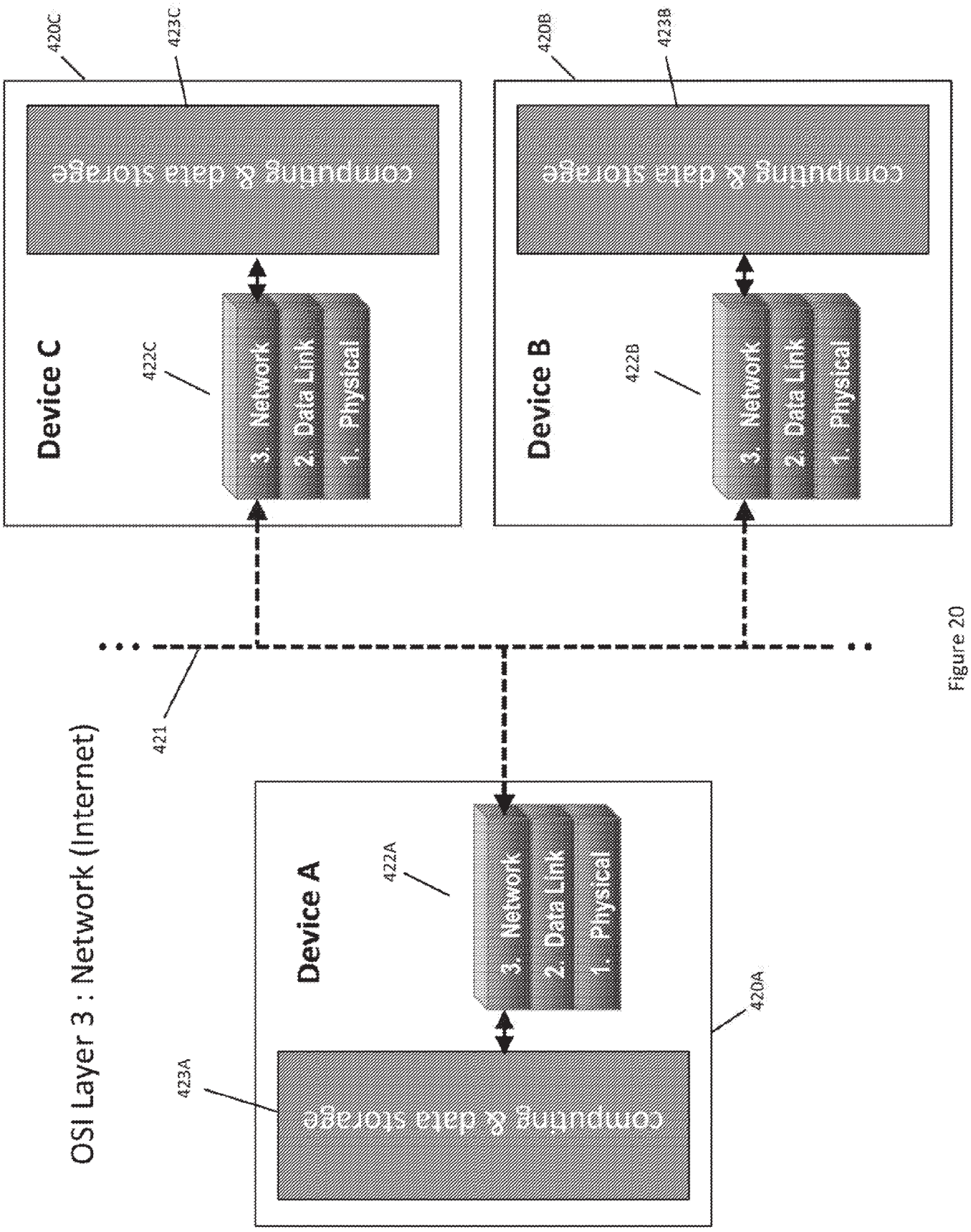

OSI Layer 3 : Network (Internet)
421
Device A
422A
3. Network
2. Data Link
1. Physical
423A
compute & data storage
420A
Device B
422B
3. Network
2. Data Link
1. Physical
423B
compute & data storage
420B
Device C
422C
3. Network
2. Data Link
1. Physical
423C
compute & data storage
420C

Figure 20

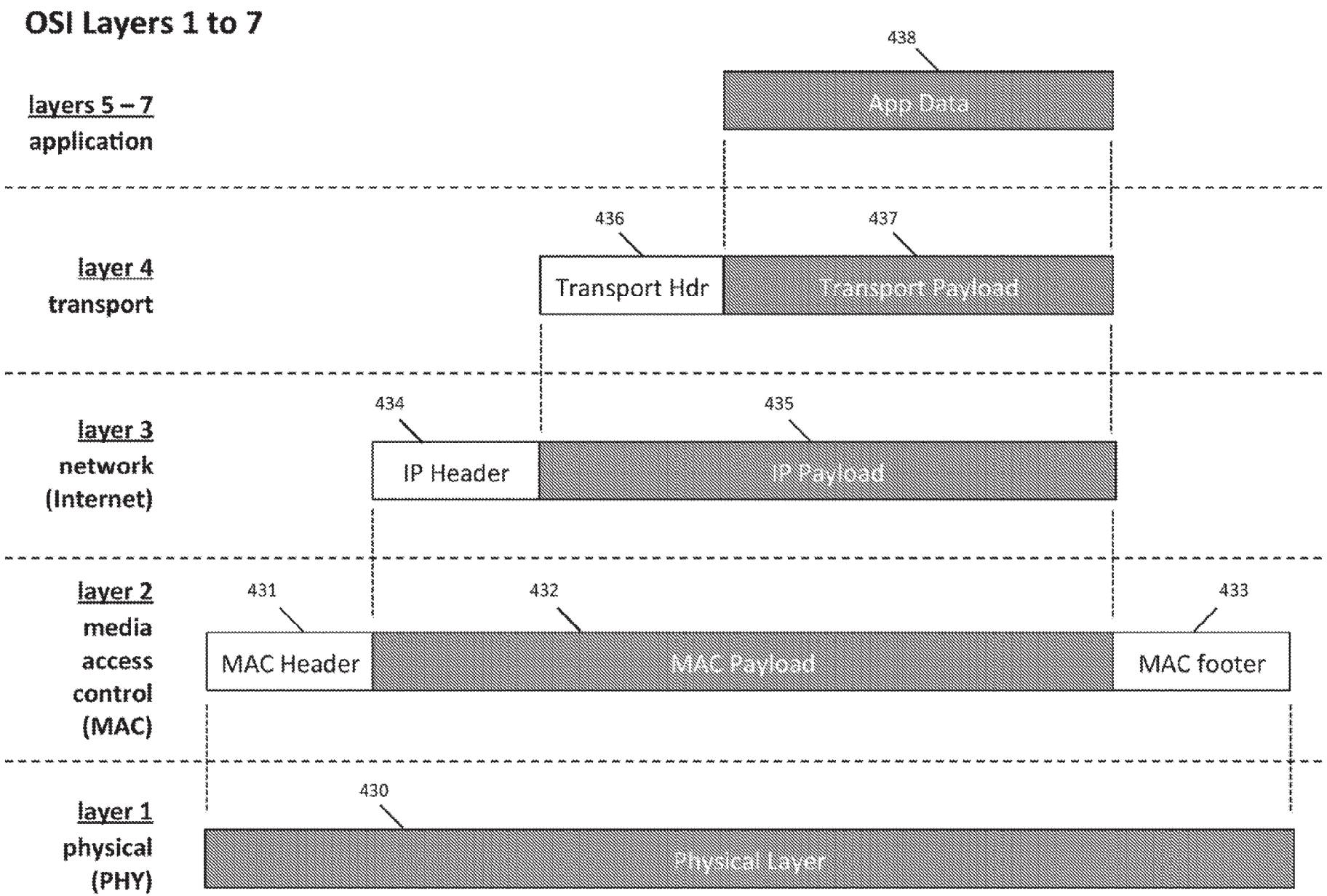

OSI Layers 1 to 7
layers 5 – 7
application
layer 4
transport
layer 3
network
(Internet)
layer 2
media
access
control
(MAC)
layer 1
physical
(PHY)
438
App Data
436
437
Transport Hdr
Transport Payload
434
435
IP Header
IP Payload
431
432
433
MAC Header
MAC Payload
MAC footer
430
Physical Layer

Figure 21

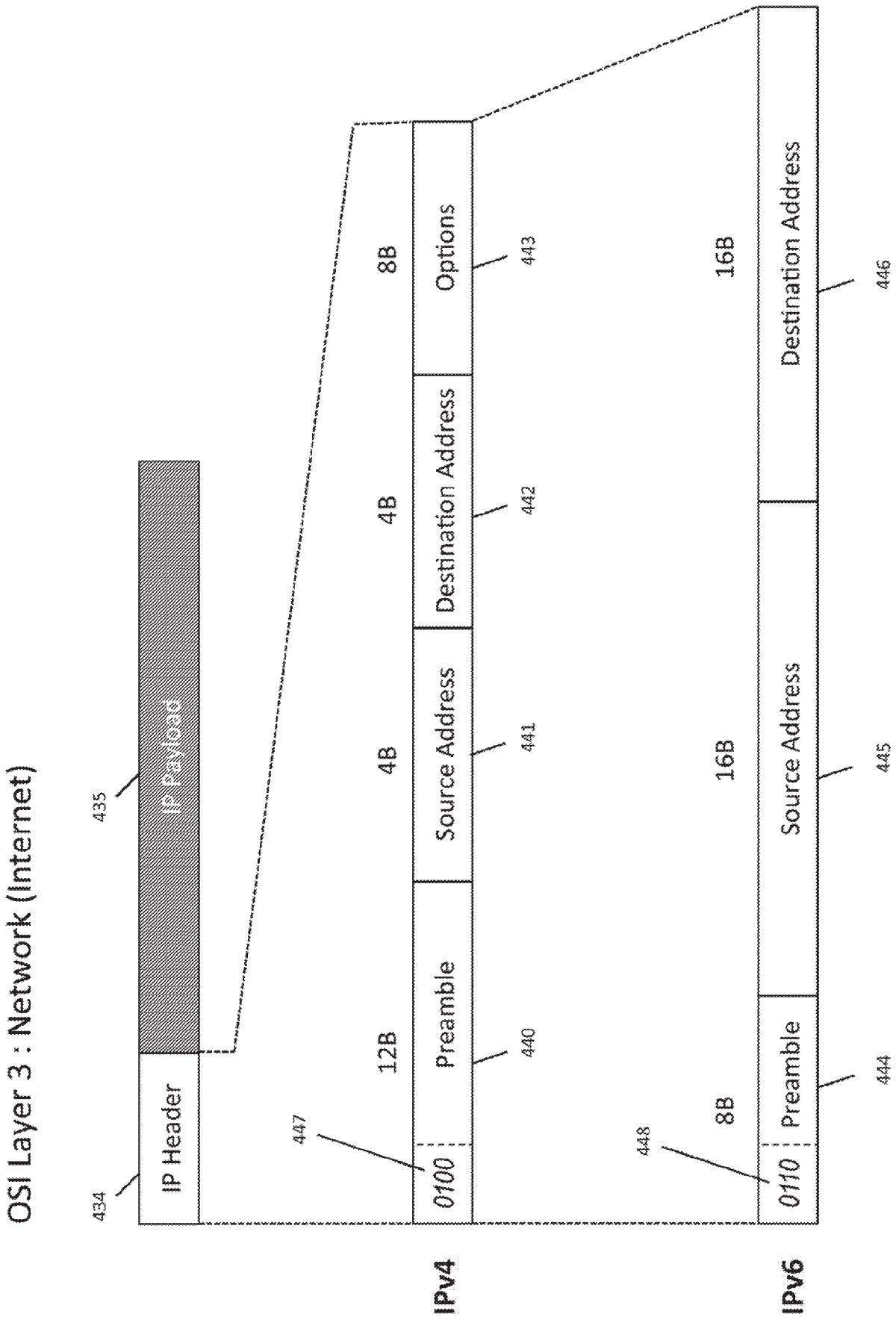
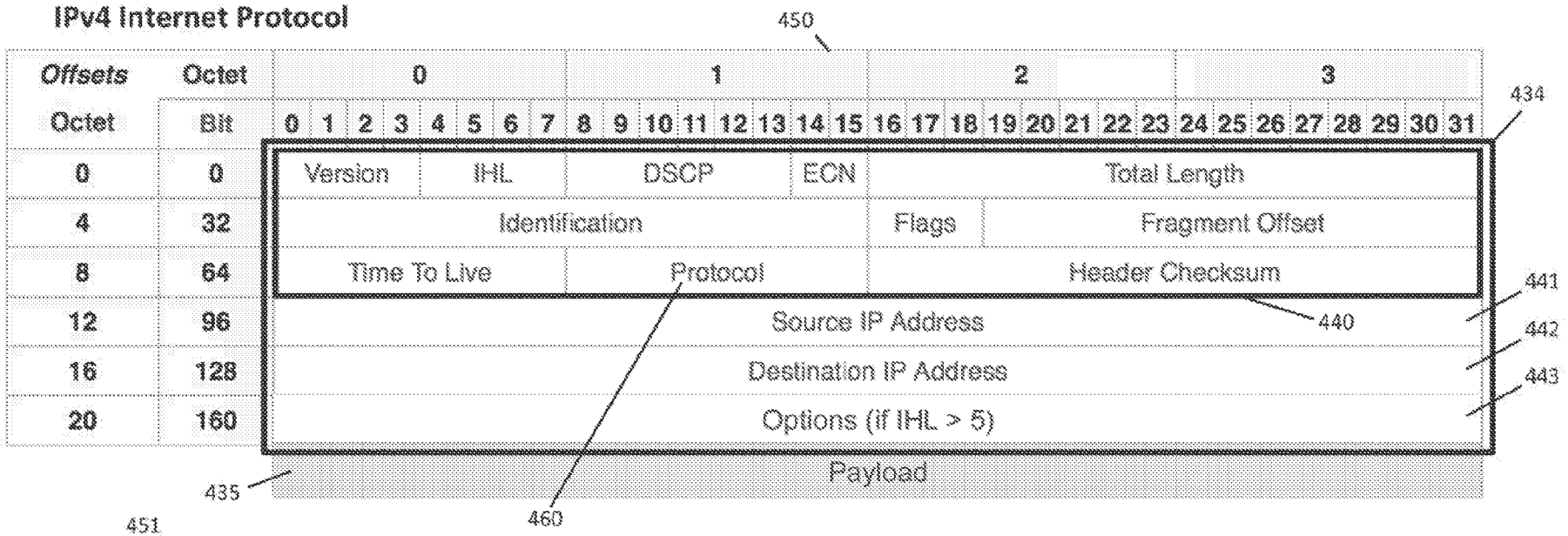

OSI Layer 3 : Network (Internet)
IP Header
IP Payload
434
435
IPv4
IPv6
0100
0110
Preamble
Source Address
Destination Address
Options
Preamble
Source Address
Destination Address
12B
4B
4B
8B
8B
16B
16B
440
441
442
443
444
445
446
447
448

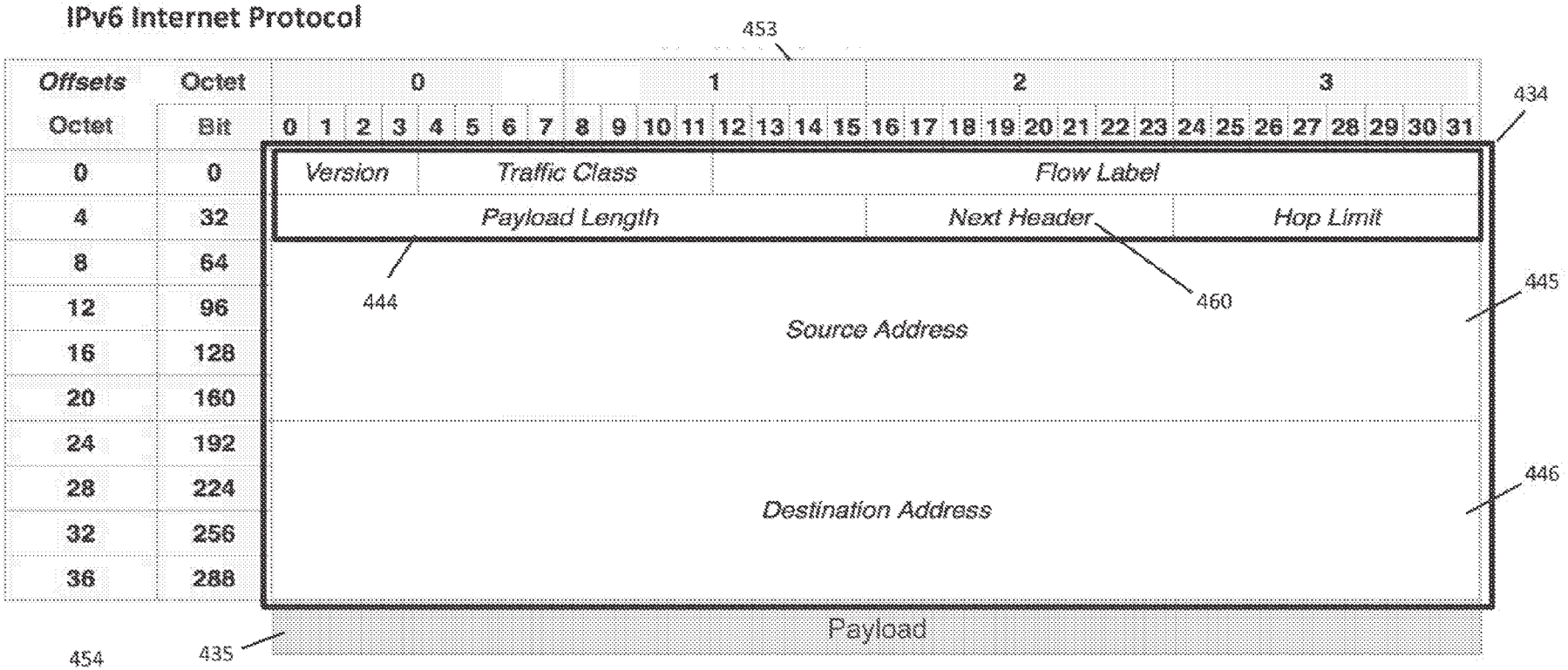
Figure 22



451

Layer	IPv4 Packet Field		Size		Function	
3	Version	IHL	4b	4b	Binary 0100 sets IP to version 4	# of 32b words in header 20 to 60B
3	DSCP	ECN	6b	2b	Differentiated services for QoS	Explicit network congestion notice
3	Total Length		2B		Length of IP packet incl. header and data, 20B to 65,535B	
3	Identification		2B		Uniquely identifies a group of fragments of a single IP datagram	
3	Flags	Frag Offset	3b	13b	Flags to manage fragmentation	Fragment offset from packet start
3	TTL	Protocol	1B	1B	Time-to-live to prevent immortals	Describes type of IP payload
3	Header Checksum		2B		16-bit checksum used for header error-checking, drops error packets	
3	Source Address		4B		IPv4 address of the sender of the packet, NAT may change IP address	
3	Destination Address		4B		IPv4 address of the receiver of the packet, NAT may change IP address	
3	Options (if IHL > 5)		4B		Infrequently used field, subject to security risks, active for IHL = 6 to 15	

Figure 23



454

Layer	IPv6 Packet Field		Size		Function	
3	Version	Traffic Class	4b	8b	Binary 0110 sets IP to version 6	6b differentiated services & 2b ECN
3	Flow Label		20b		Maintains path to avoid reordering in real-time applications	
3	Payload Length		2B		Payload size in octets, including any extension headers	
3	Next Header		1B		Specifies the type of next header, same as IPv4 protocol field	
3	Hop Limit		1B		Replaces IPv4 time to live field, decrements by 1 for each node passed	
3	Source Address		16B		The IPv6 address of the sending node	
3	Destination Address		16B		The IPv6 address of the destination node(s)	

Figure 24

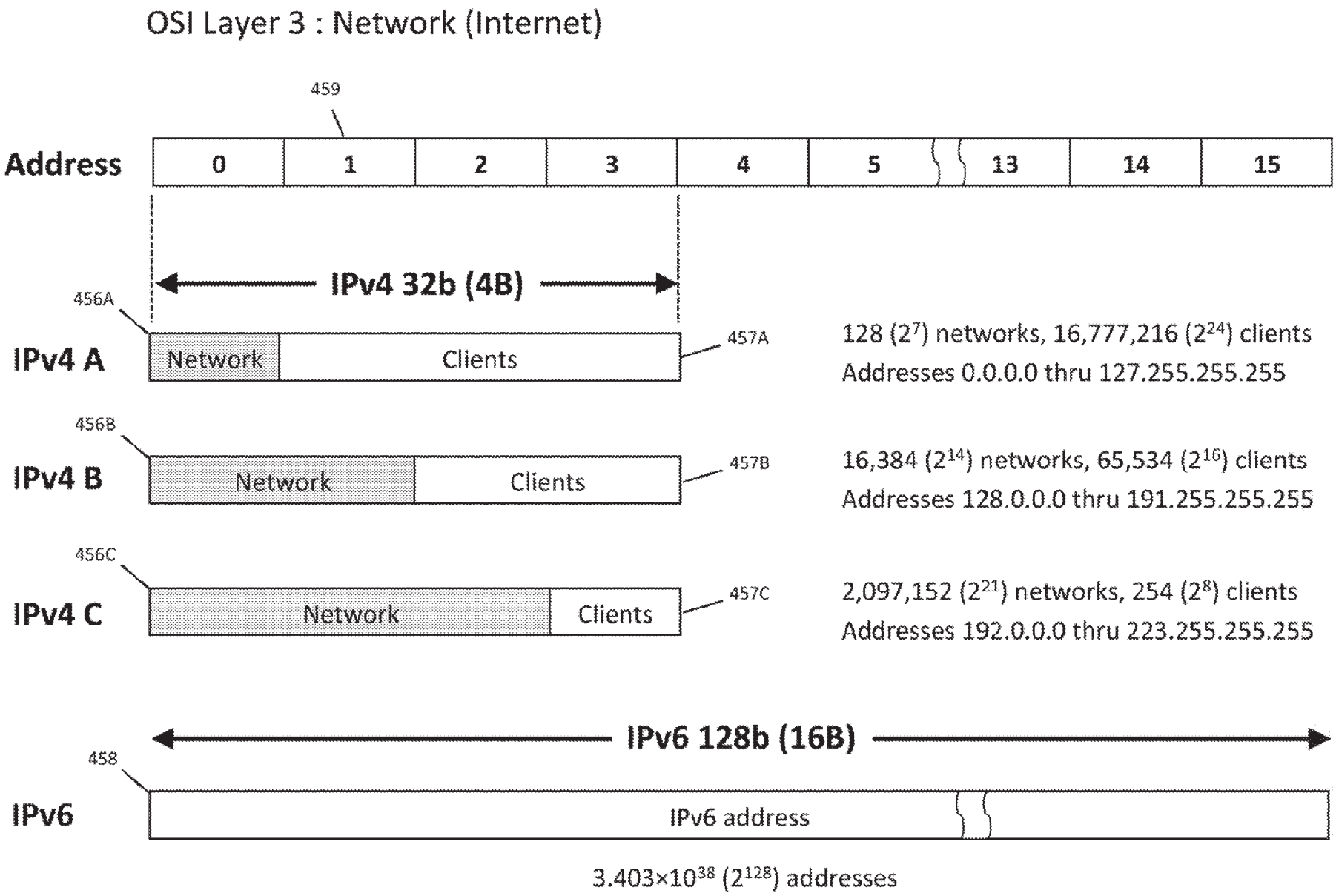

OSI Layer 3 : Network (Internet)
459
Address
0
1
2
3
4
5
13
14
15
IPv4 32b (4B)
456A
IPv4 A
Network
Clients
457A
128 (2^7) networks, 16,777,216 (2^24) clients
Addresses 0.0.0.0 thru 127.255.255.255
456B
IPv4 B
Network
Clients
457B
16,384 (2^14) networks, 65,534 (2^16) clients
Addresses 128.0.0.0 thru 191.255.255.255
456C
IPv4 C
Network
Clients
457C
2,097,152 (2^21) networks, 254 (2^8) clients
Addresses 192.0.0.0 thru 223.255.255.255
IPv6 128b (16B)
458
IPv6
IPv6 address
3.403×10^38 (2^128) addresses

Figure 25

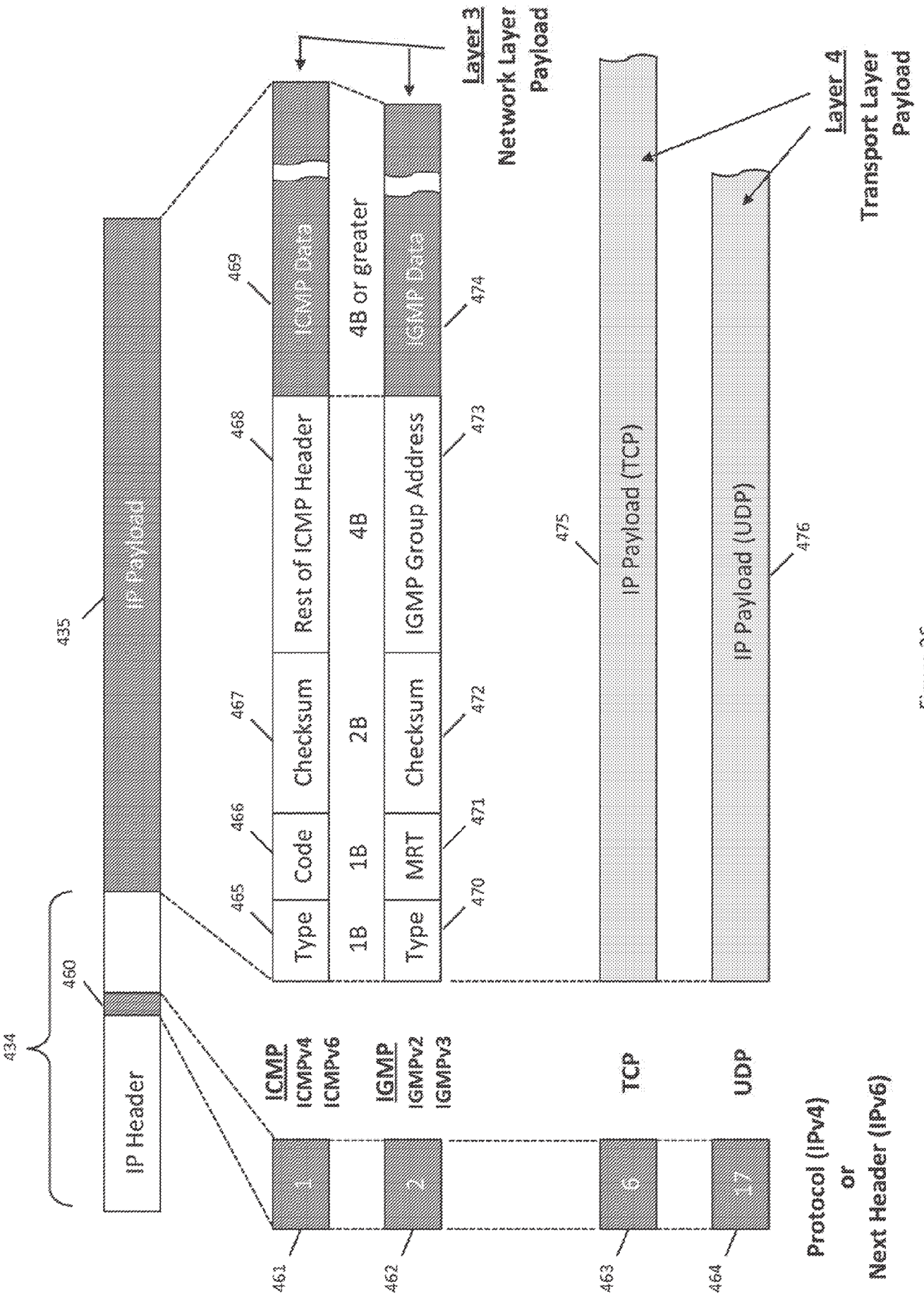

434
460
IP Header
435
IP Payload
ICMP
ICMPv4
ICMPv6
IGMP
IGMPv2
IGMPv3
TCP
UDP
461
462
463
464
1
2
6
17
Protocol (IPv4)
or
Next Header (IPv6)
Layer 3
Network Layer
Payload
Layer 4
Transport Layer
Payload
Type
Code
Checksum
Rest of ICMP Header
ICMP Data
1B
1B
2B
4B
4B or greater
465
466
467
468
469
Type
MRT
Checksum
IGMP Group Address
IGMP Data
1B
1B
2B
4B
4B or greater
470
471
472
473
474
IP Payload (TCP)
IP Payload (UDP)
475
476

Figure 26

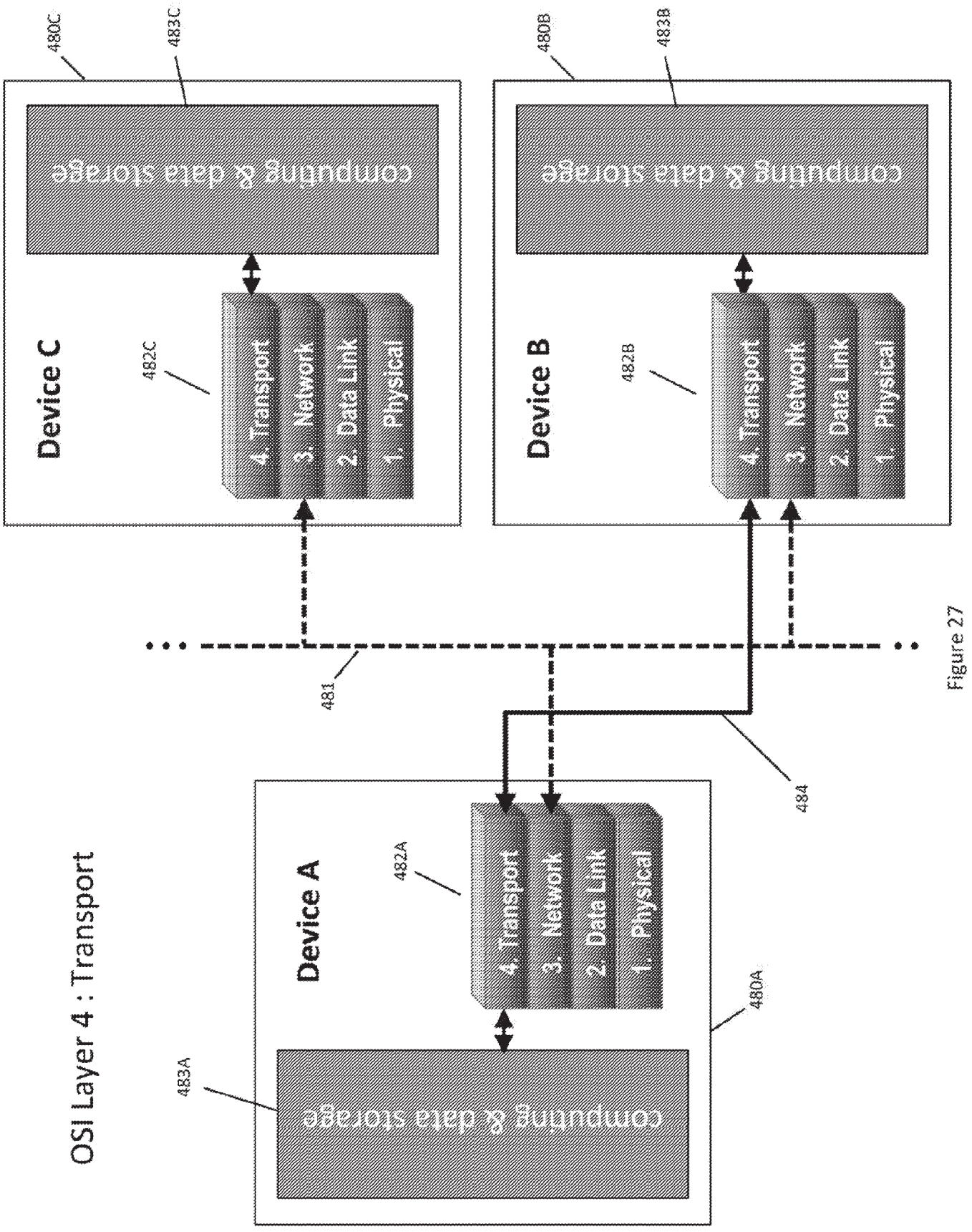

OSI Layer 4 : Transport
Device A
Device B
Device C
4. Transport
3. Network
2. Data Link
1. Physical
compute & data storage
480A
480B
480C
481
482A
482B
482C
483A
483B
483C
484

Figure 27

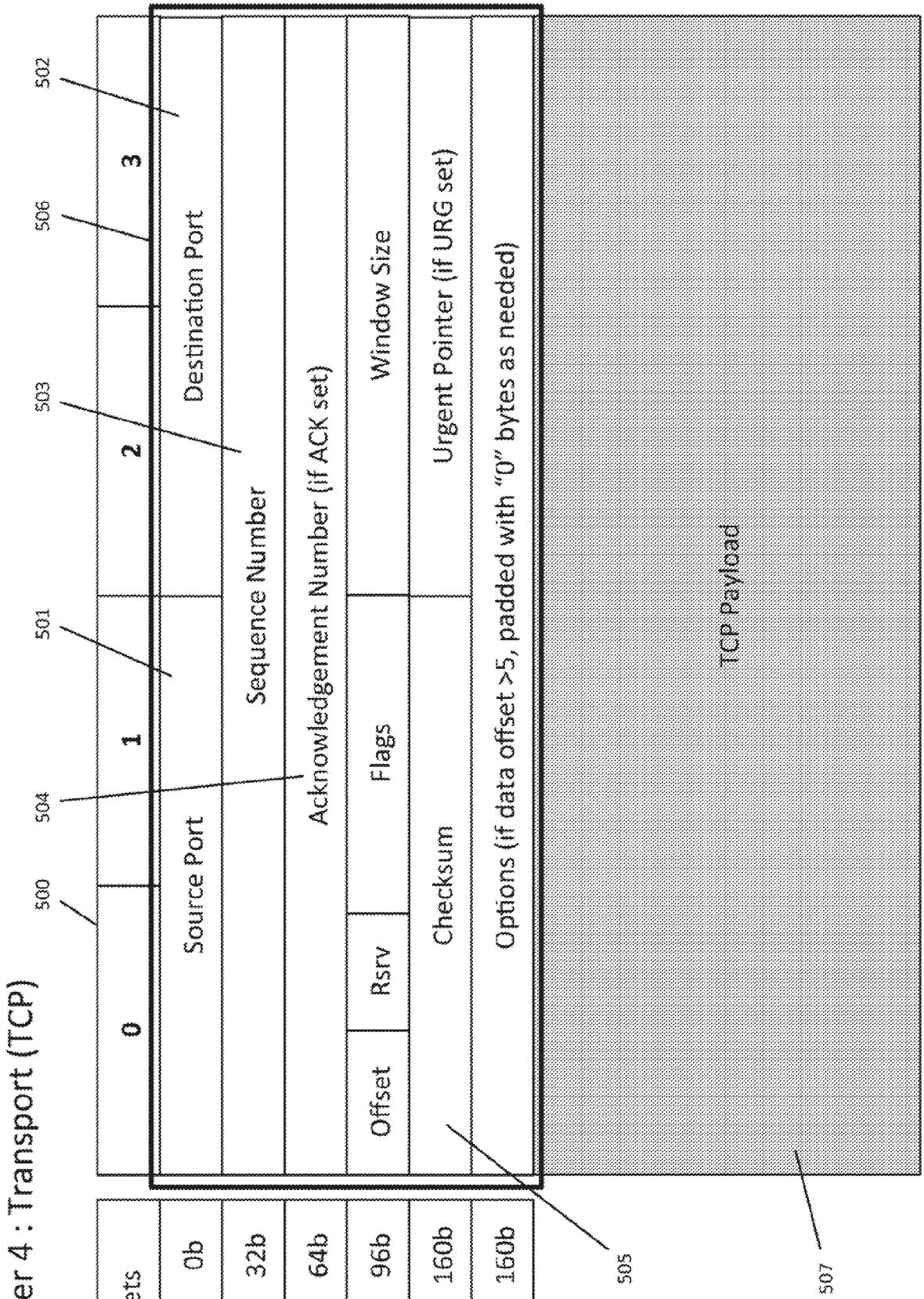

OSI Layer 4 : Transport (TCP)
Offsets
0B
4B
8B
12B
16B
20B
0b
32b
64b
96b
160b
160b
0
1
2
3
Source Port
Destination Port
Sequence Number
Acknowledgement Number (if ACK set)
Offset
Rsrv
Flags
Window Size
Checksum
Urgent Pointer (if URG set)
Options (if data offset >5, padded with "0" bytes as needed)
TCP Payload
500
501
502
503
504
505
506
507

Figure 28A

508

Layer	TCP Field	Size	TCP Function
4	**Source Port**	2B	Senders port, port for which reply should be sent
4	**Destination Port**	2B	Receiver's port (required), well known port # if server
4	**Sequence Number**	4B	Packet counter (SEQ #) incrementing each ACK reply by one
4	**Acknowledgement #**	4B	Acknowledges receipt of each packet in a sequence by sequence #
4	**Offset**	4b	Size of TCP header (offset from TCP header to data start), 20B to 60B
4	**Reserved**	3b	Reserved for future, default to 000 binary
4	**Flags**	9b	Control bits for congestion, urgency, acknowledgement, sync & reset
4	**Window Size**	2B	Size of the receive window
4	**Checksum**	2B	Error checking comprising 16b checksum of header and payload data
4	**Urgent Pointer**	2B	Offset from SEQ # indicating last urgent data byte (if URG is set to 1)
4	**Options**	1B to 40B	Option- Kind (1B required), Length (1B option), Data (var), as per Offset
4–7	**TCP Payload**	variable	TCP payload data

Figure 28B

OSI Layer 4 : Transport (TCP)

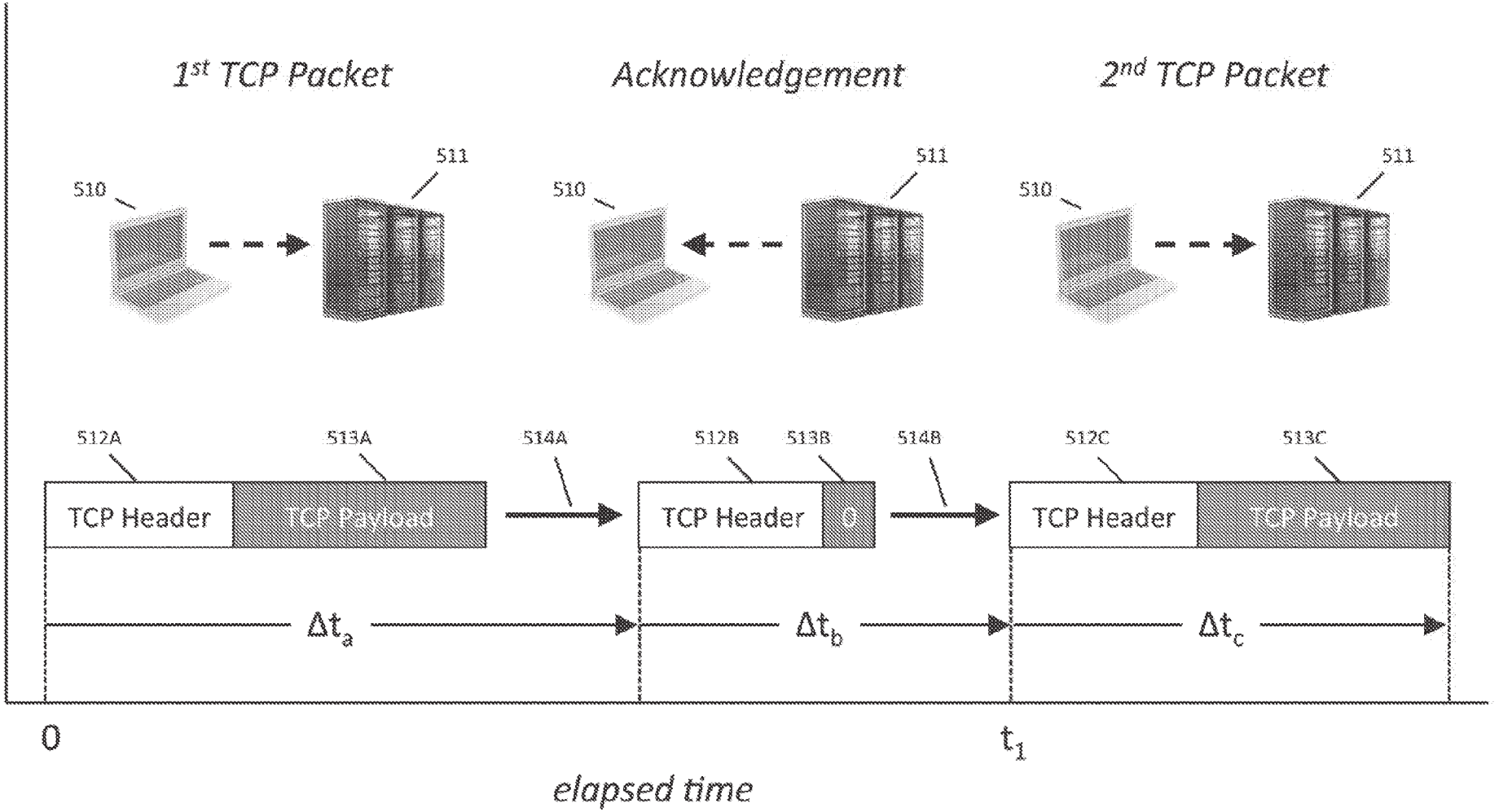
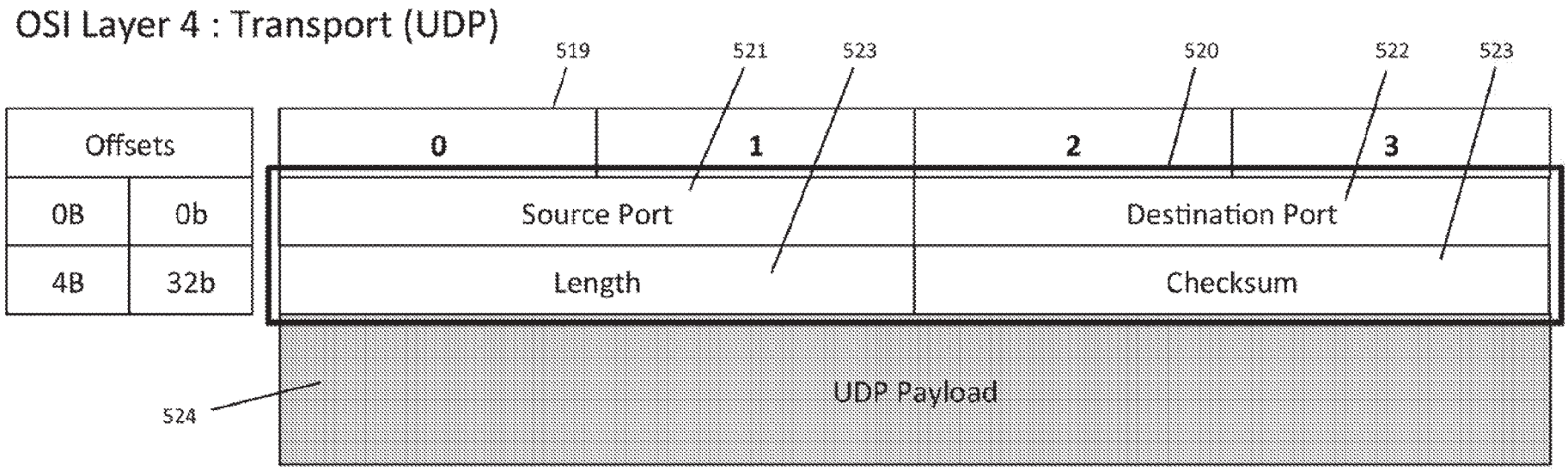


Figure 29



525

Layer	UDP Field	Size	Function
4	**Source Port**	2B	Senders port, port for which reply should be sent
4	**Destination Port**	2B	Receiver's port (required), well known port # if server
4	**Length**	2B	Total length of UDP header and payload, 8B to 65,535B
4	**Checksum**	2B	Error checking, required in IPv6, uses pseudo-header in IPv4 and IPv6
4–7	**UDP Payload**	variable	UDP payload data, 0B to 65,507B in IPv4

Figure 30

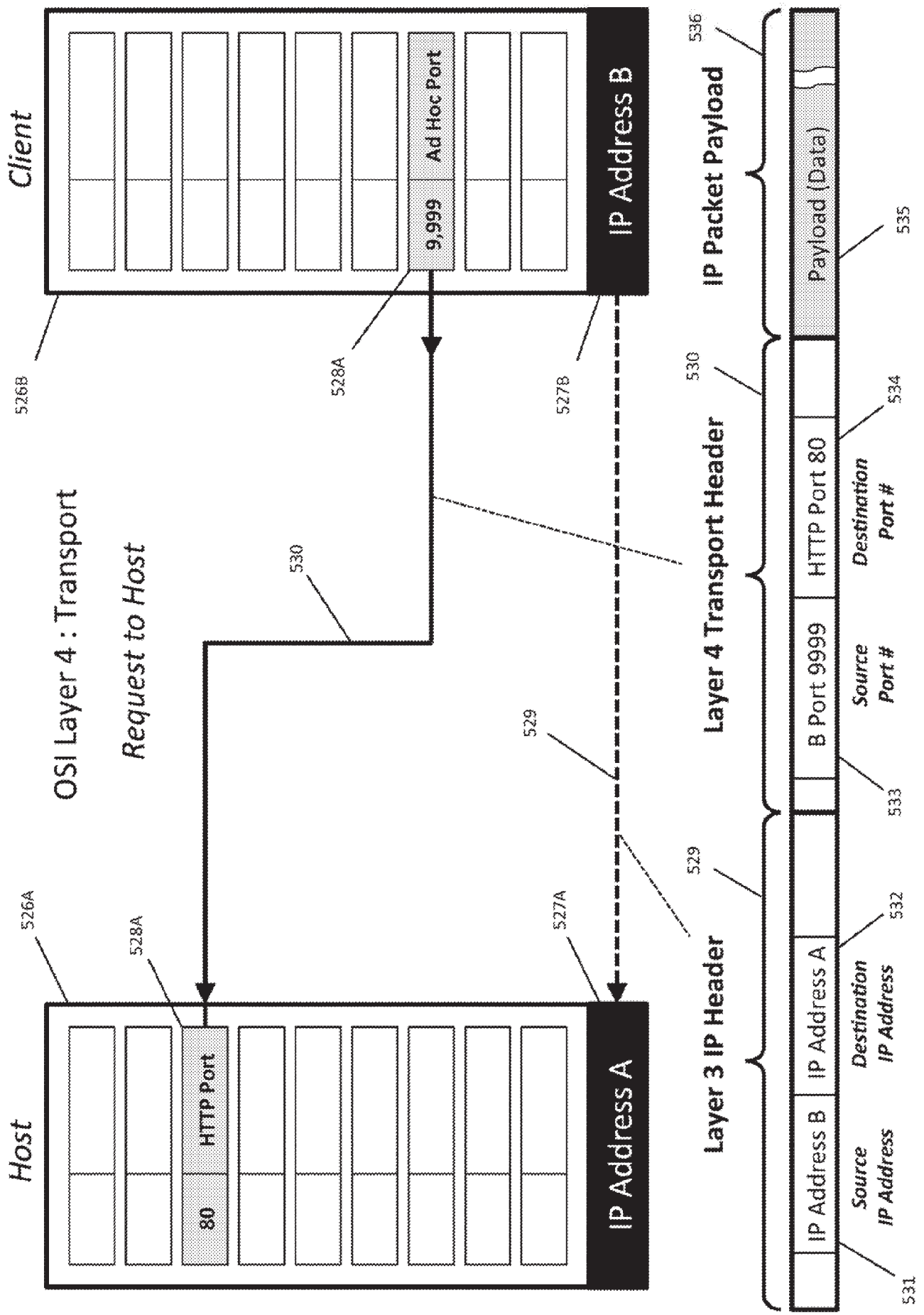

Client
IP Address B
9,999
Ad Hoc Port
526B
528A
527B
OSI Layer 4 : Transport
Request to Host
530
529
Host
526A
528A
527A
IP Address A
80
HTTP Port
Layer 3 IP Header
Layer 4 Transport Header
IP Packet Payload
536
530
529
534
535
533
532
531
IP Address B
IP Address A
B Port 9999
HTTP Port 80
Payload (Data)
Source IP Address
Destination IP Address
Source Port #
Destination Port #

Figure 31A

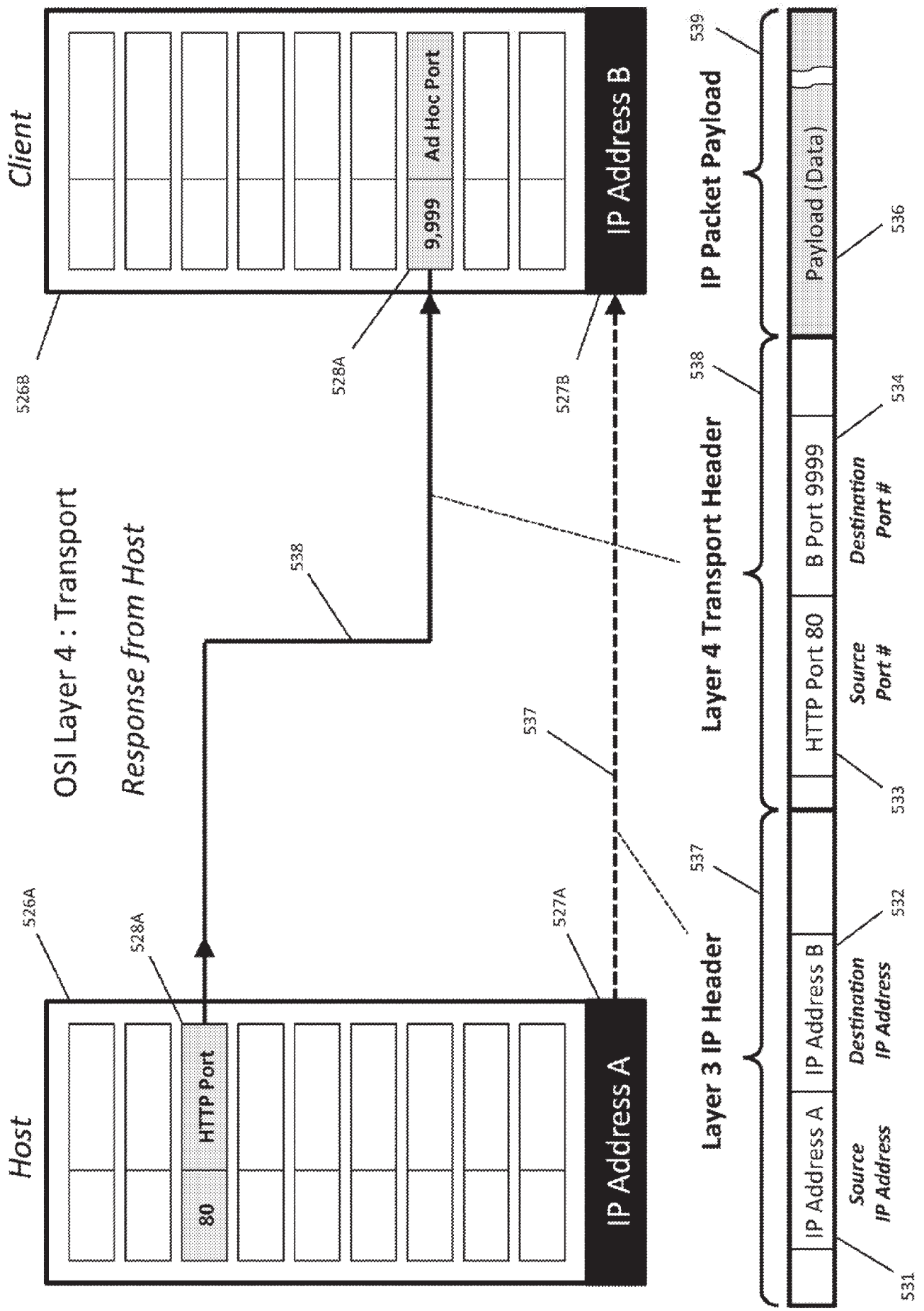

Host
Client
OSI Layer 4 : Transport
Response from Host
80
HTTP Port
9,999
Ad Hoc Port
IP Address A
IP Address B
526A
526B
528A
527A
527B
538
537
Layer 3 IP Header
Layer 4 Transport Header
IP Packet Payload
IP Address A
IP Address B
HTTP Port 80
B Port 9999
Payload (Data)
Source IP Address
Destination IP Address
Source Port #
Destination Port #
531
532
533
534
536
539

Figure 31B

540

Port #	UDP	TCP	Port Description	Registered
7	UDP	TCP	Echo/Ping (generally superseded by ICMP)	Official
20	UDP	TCP	FTP Data Transfer	Official
21	–	TCP	FTP Control (command)	Official
22	UDP	TCP	Secure shell (SSH) for secure login (SCP), SFTP, port forwarding	Official
23	UDP	TCP	Telnet	Official
25	–	TCP	Simple Mail Transfer (SMTP)	Official
26	UDP	TCP	Encrypted SMTP	Official
53	UDP	TCP	Domain Name Server (DNS)	Official
80	–	TCP	Hypertext Transfer Protocol (HTTP)	Official
110	–	TCP	Post Office Protocol (POP3)	Official
143	–	TCP	Internet Mail Access Protocol (IMAP)	Official
220	UDP	TCP	Internet Mail Access Protocol (IMAP v3)	Official
443	–	TCP	Hypertext Transfer Protocol over TLS/SSL (HTTPS)	Official
465	–	TCP	Simple Mail Transfer Protocol over TLS/SSL (SMTPS)	Official
989	UDP	TCP	FTPS Protocol (data): FTP over TLS/SSL	Official
990	UDP	TCP	FTPS Protocol (control): FTP over TLS/SSL	Official
992	UDP	TCP	TELNET protocol over TLS/SSL	Official
993	–	TCP	Internet Message Access Protocol over TLS/SSL (IMAPS)	Official
995	–	TCP	Post Office Protocol 3 over TLS/SSL (POP3S)	Official

Figure 31C

541

Port Number	UDP	TCP	Port Description	Registered
0 to 1,023	UDP	TCP	System Ports	Generally
1,024 to 49,151	UDP	TCP	Registered Ports, Open (Dynamic) Ports	Mixed
49,152 to 65,535	UDP	TCP	Open (Dynamic), Private and Ephemeral Ports	No

Figure 31D

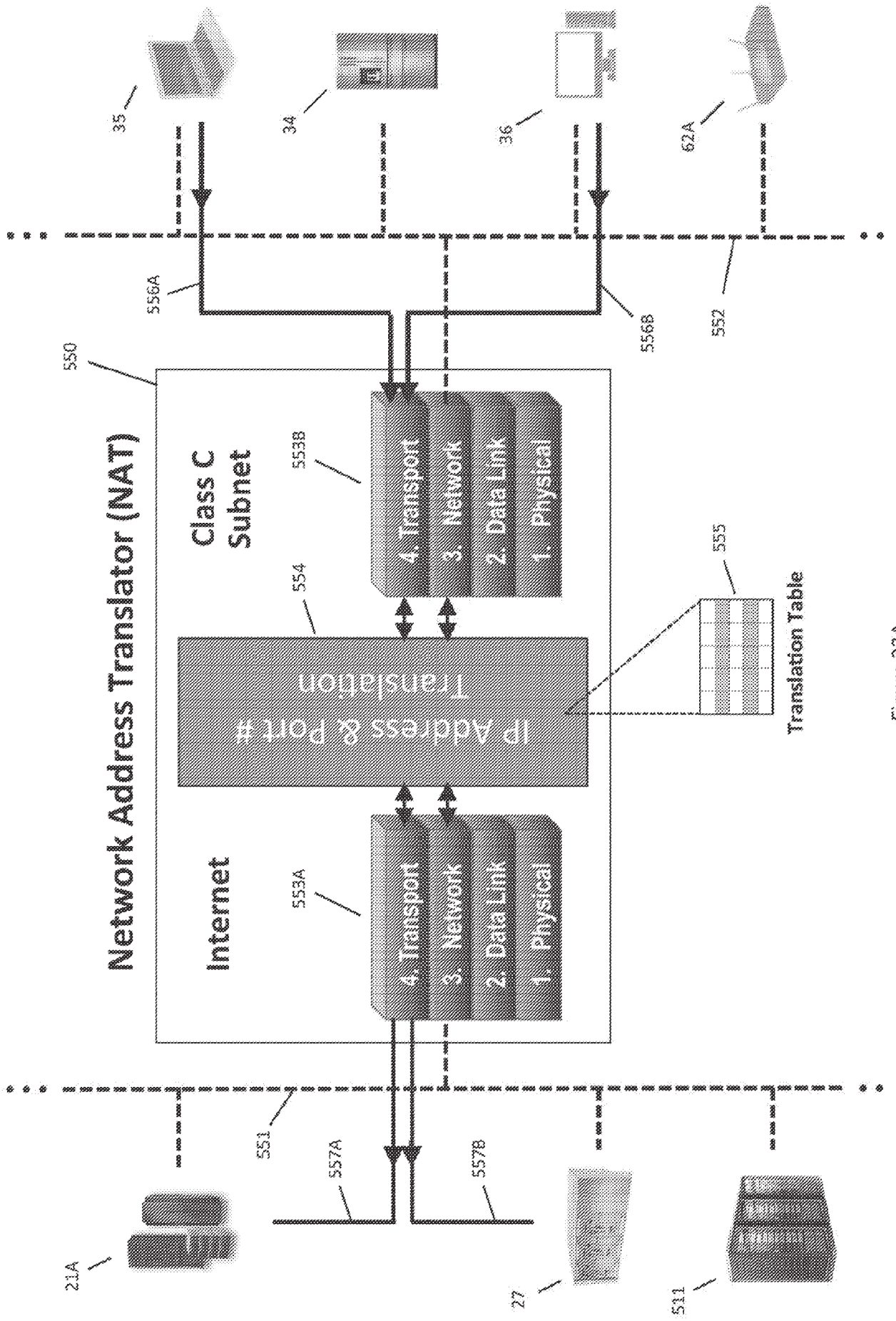

35
34
36
62A
556A
556B
552
550
Network Address Translator (NAT)
Class C Subnet
553B
4. Transport
3. Network
2. Data Link
1. Physical
554
IP Address & Port # Translation
555
Translation Table
Internet
553A
4. Transport
3. Network
2. Data Link
1. Physical
551
557A
557B
21A
27
511

Figure 32A

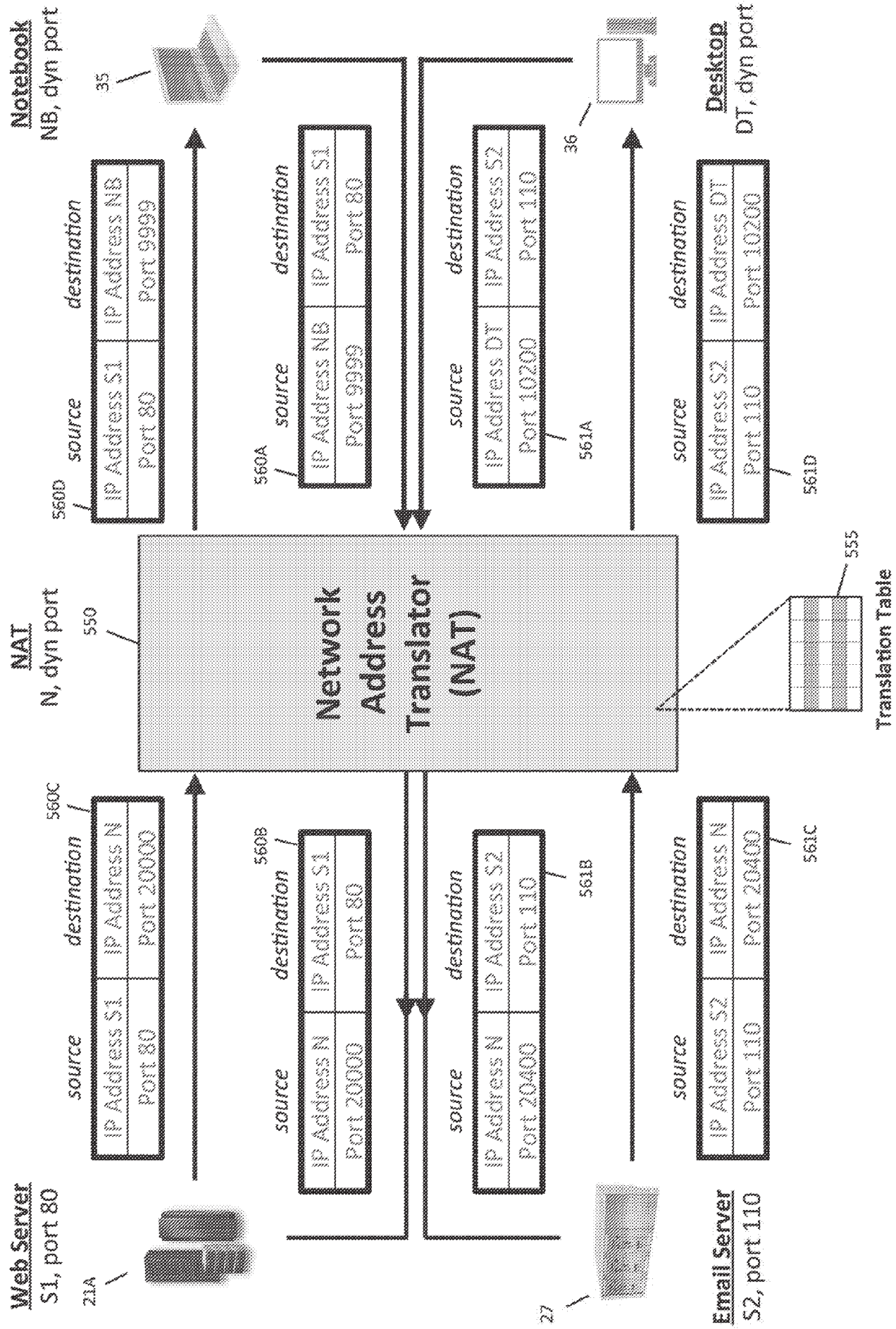

Notebook
NB, dyn port
35
Desktop
DT, dyn port
36
NAT
N, dyn port
550
Network Address Translator (NAT)
555
Translation Table
Web Server
S1, port 80
21A
Email Server
S2, port 110
27
source
destination
IP Address S1
Port 80
IP Address NB
Port 9999
560D
IP Address NB
Port 9999
IP Address S1
Port 80
560A
IP Address DT
Port 10200
IP Address S2
Port 110
561A
IP Address S2
Port 110
IP Address DT
Port 10200
561D
IP Address S1
Port 80
IP Address N
Port 20000
560C
IP Address N
Port 20000
IP Address S1
Port 80
560B
IP Address N
Port 20400
IP Address S2
Port 110
561B
IP Address S2
Port 110
IP Address N
Port 20400
561C

Figure 32B

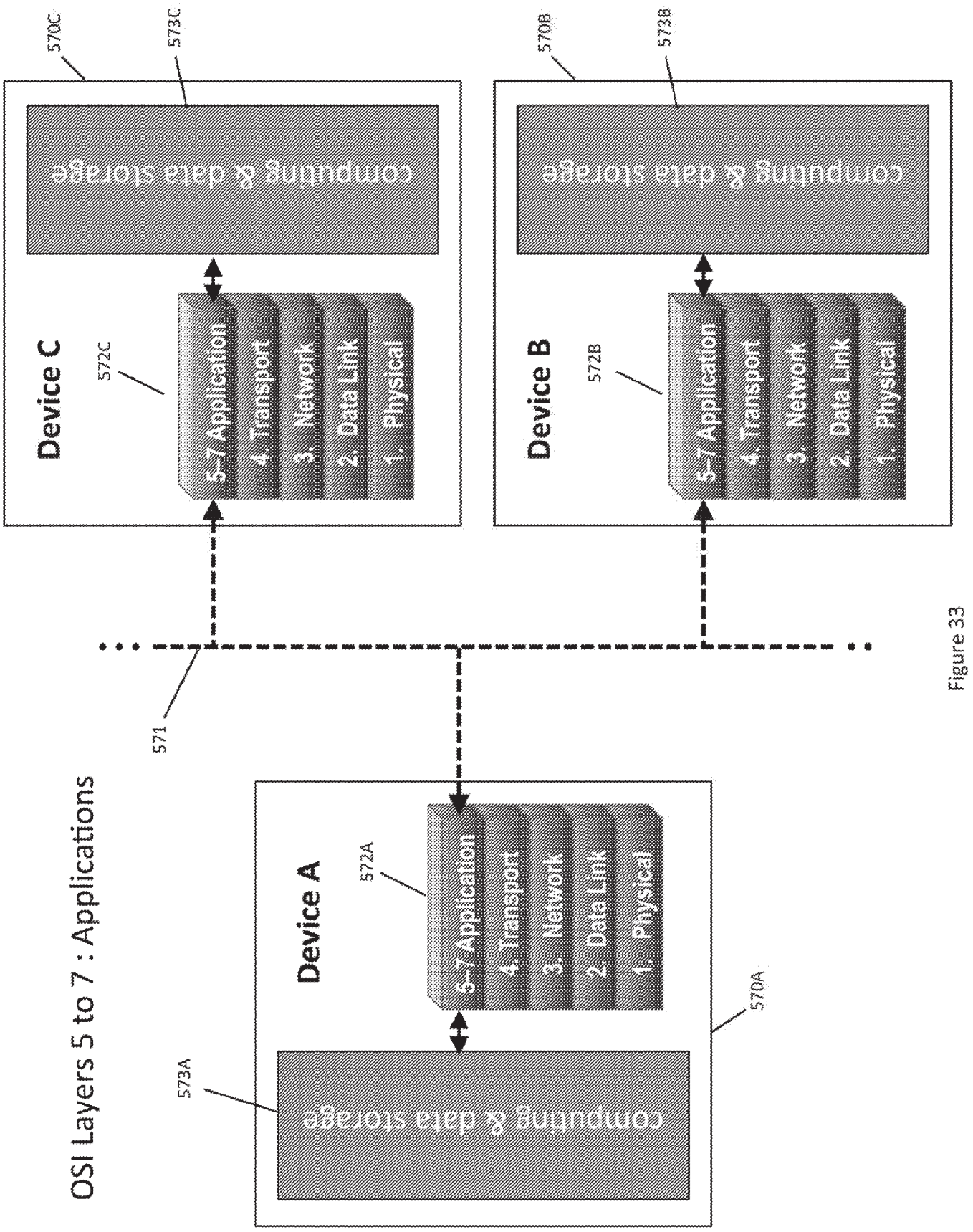

OSI Layers 5 to 7 : Applications
Device A
Device B
Device C
5-7 Application
4. Transport
3. Network
2. Data Link
1. Physical
compute & data storage
570A
570B
570C
571
572A
572B
572C
573A
573B
573C

Figure 33

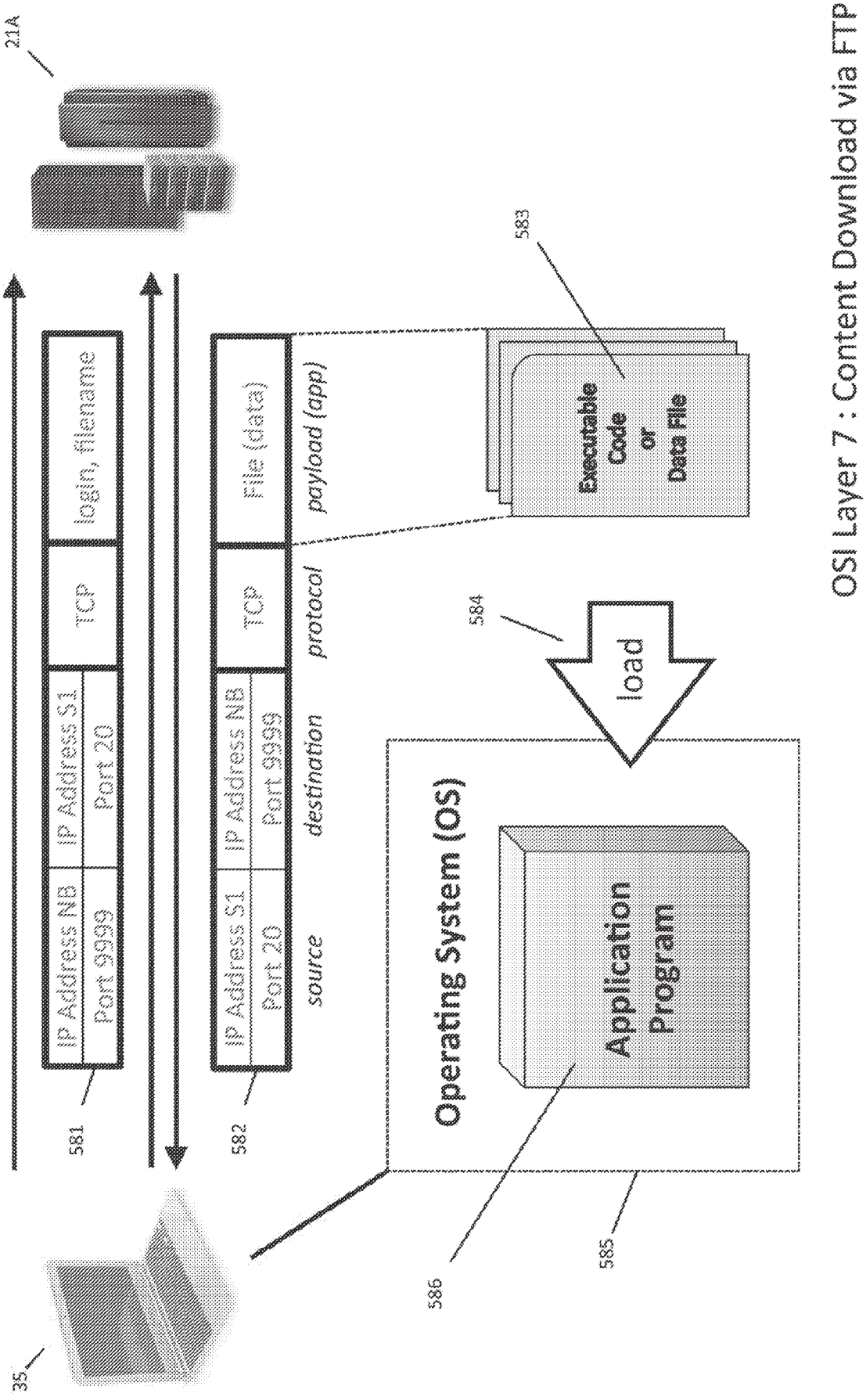

OSI Layer 7 : Content Download via FTP
Notebook
NB, dyn port
35
File Server
S1, port 20
21A
source
destination
protocol
payload (app)
IP Address NB
Port 9999
IP Address S1
Port 21
TCP
FTP command
580
IP Address NB
Port 9999
IP Address S1
Port 20
TCP
login, filename
581
IP Address S1
Port 20
IP Address NB
Port 9999
TCP
File (data)
582
583
Executable Code or Data File
584
load
Operating System (OS)
Application Program
585
586

Figure 34

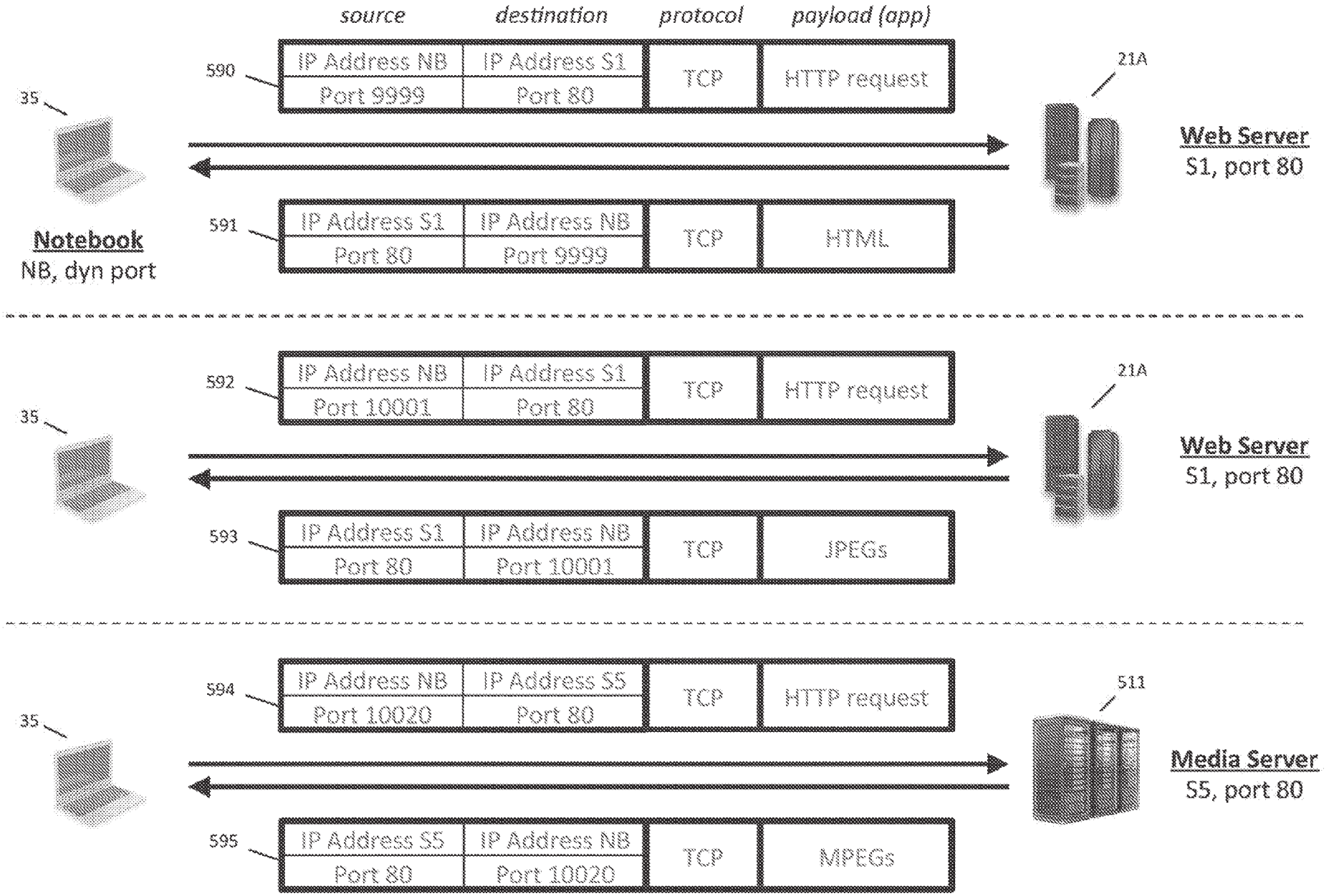


Figure 35A

OSI Layer 7 : web page download via HTTP

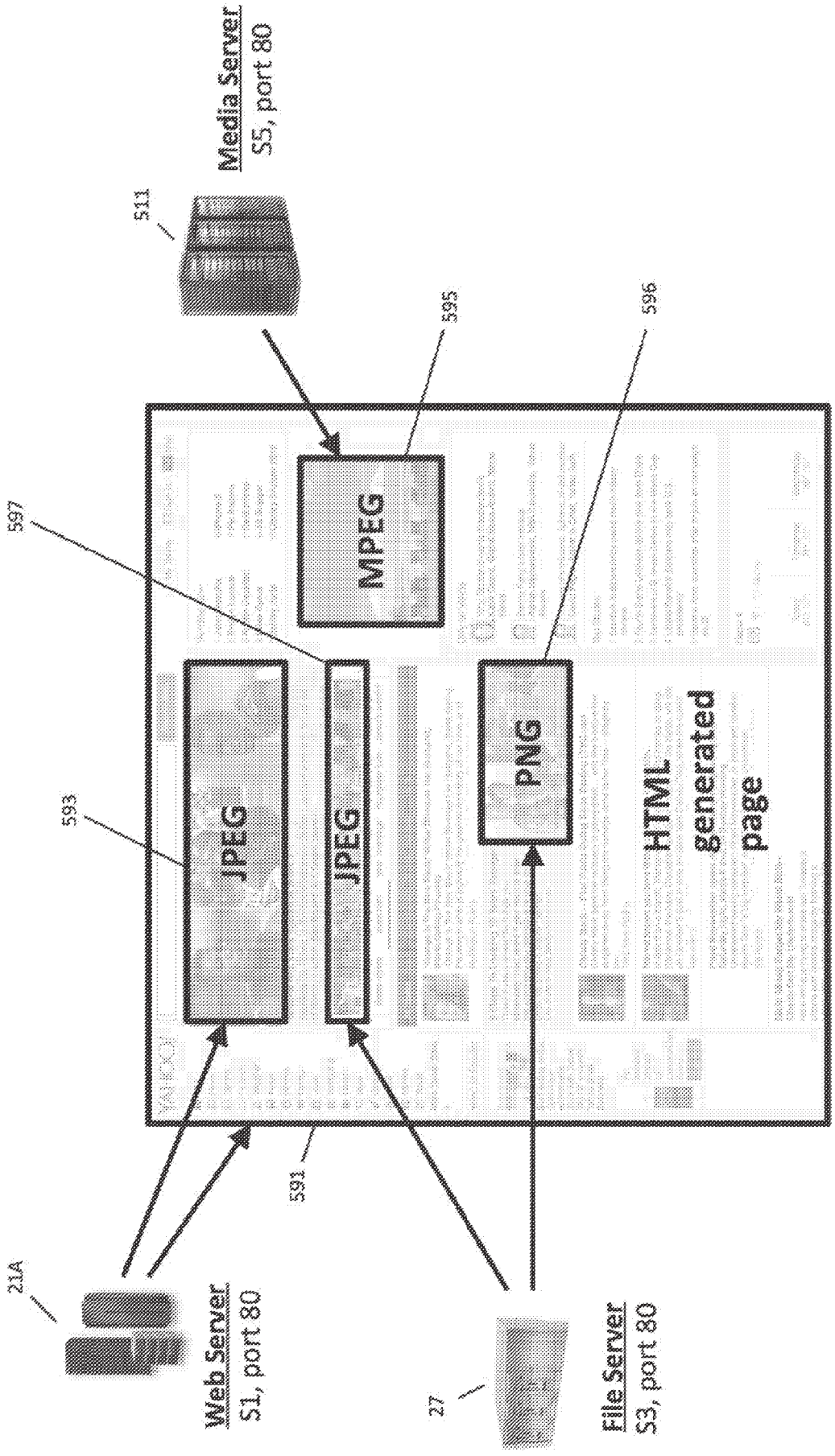

Media Server
S5, port 80
511
595
596
597
MPEG
JPEG
JPEG
PNG
HTML
generated
page
593
591
21A
Web Server
S1, port 80
27
File Server
S3, port 80

Figure 35B

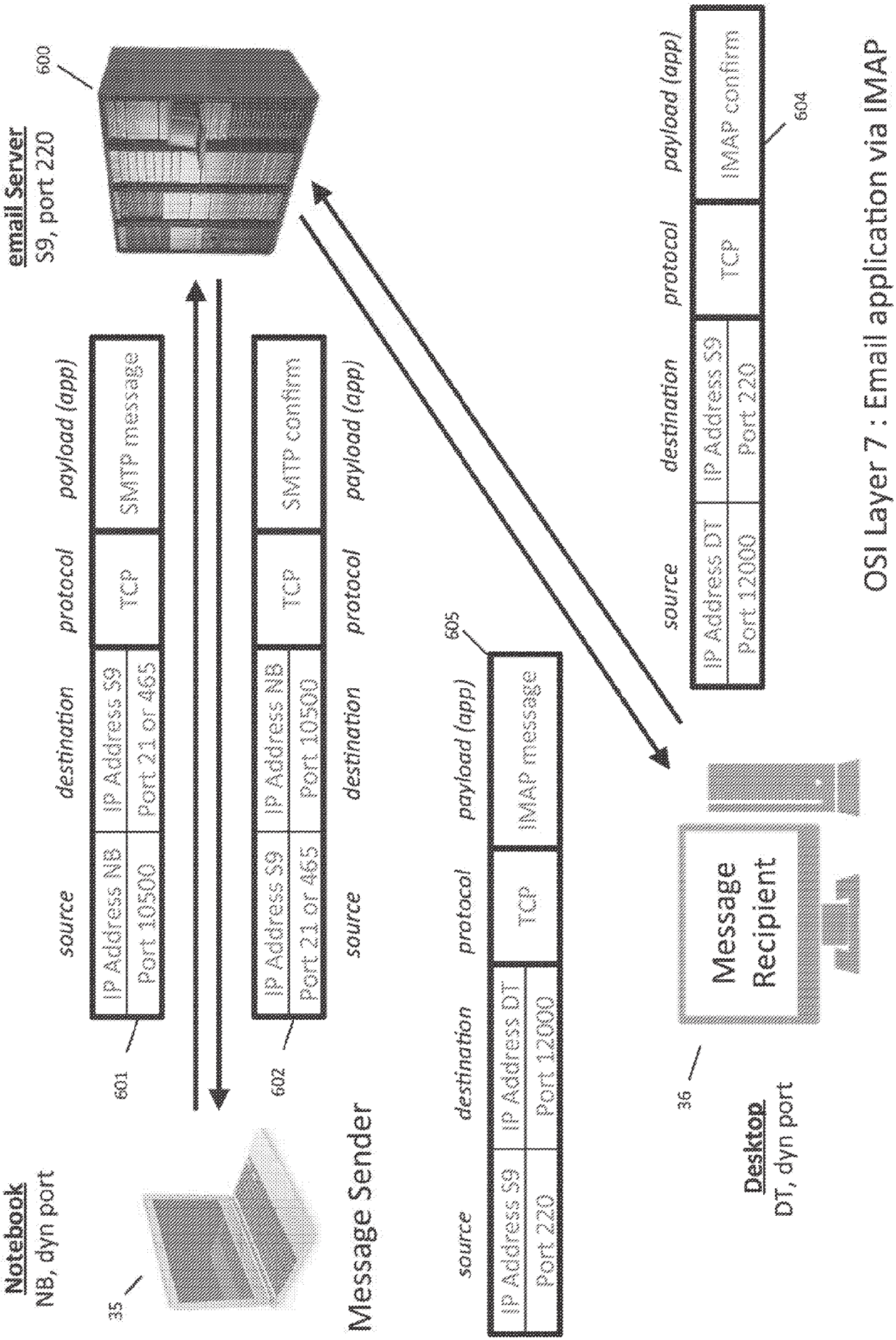

email Server
S9, port 220
600
Notebook
NB, dyn port
35
Message Sender
source
destination
protocol
payload (app)
IP Address NB
Port 10500
IP Address S9
Port 21 or 465
TCP
SMTP message
601
IP Address S9
Port 21 or 465
IP Address NB
Port 10500
TCP
SMTP confirm
602
605
IP Address S9
Port 220
IP Address DT
Port 12000
TCP
IMAP message
source
destination
protocol
payload (app)
IP Address DT
Port 12000
IP Address S9
Port 220
TCP
IMAP confirm
604
OSI Layer 7 : Email application via IMAP
36
Desktop
DT, dyn port
Message Recipient

Figure 36

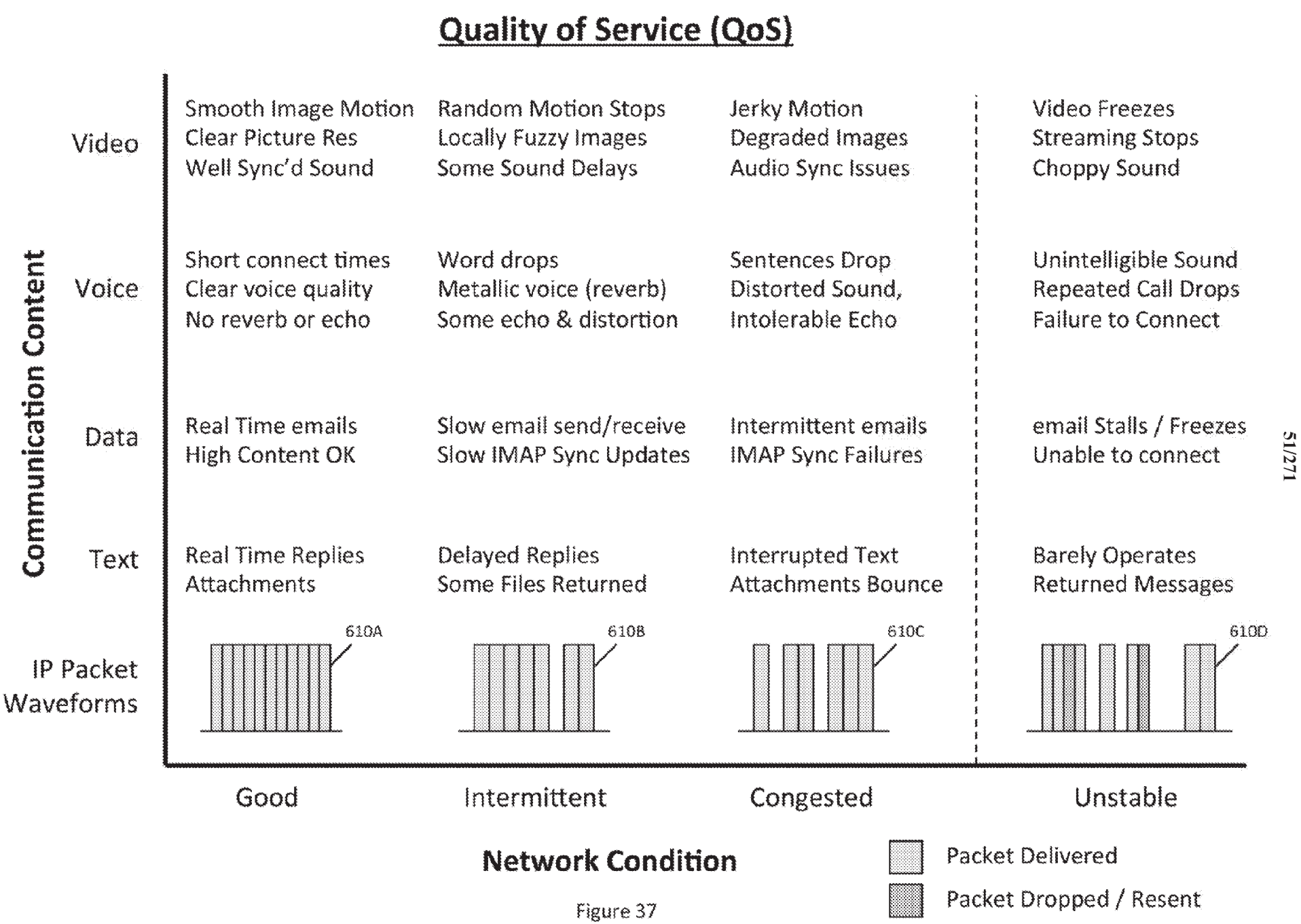

Quality of Service (QoS)
Communication Content
Video
Voice
Data
Text
IP Packet Waveforms
Smooth Image Motion
Clear Picture Res
Well Sync'd Sound
Random Motion Stops
Locally Fuzzy Images
Some Sound Delays
Jerky Motion
Degraded Images
Audio Sync Issues
Video Freezes
Streaming Stops
Choppy Sound
Short connect times
Clear voice quality
No reverb or echo
Word drops
Metallic voice (reverb)
Some echo & distortion
Sentences Drop
Distorted Sound,
Intolerable Echo
Unintelligible Sound
Repeated Call Drops
Failure to Connect
Real Time emails
High Content OK
Slow email send/receive
Slow IMAP Sync Updates
Intermittent emails
IMAP Sync Failures
email Stalls / Freezes
Unable to connect
Real Time Replies
Attachments
Delayed Replies
Some Files Returned
Interrupted Text
Attachments Bounce
Barely Operates
Returned Messages
610A
610B
610C
610D
Good
Intermittent
Congested
Unstable
Network Condition
Packet Delivered
Packet Dropped / Resent
51/271

Figure 37

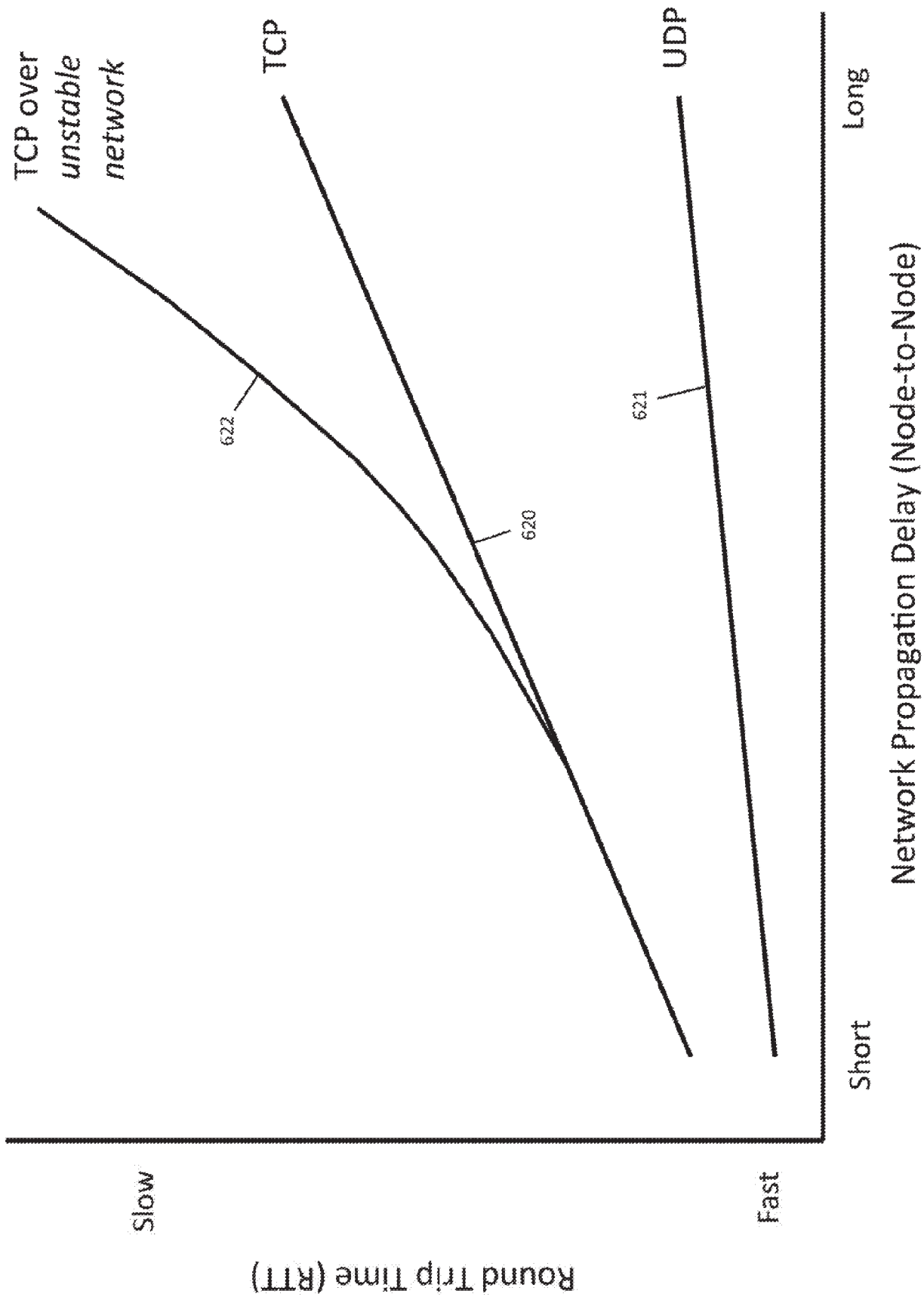

Round Trip Time (RTT)
Slow
Fast
Short
Long
Network Propagation Delay (Node-to-Node)
TCP over unstable network
TCP
UDP
622
620
621

Figure 38

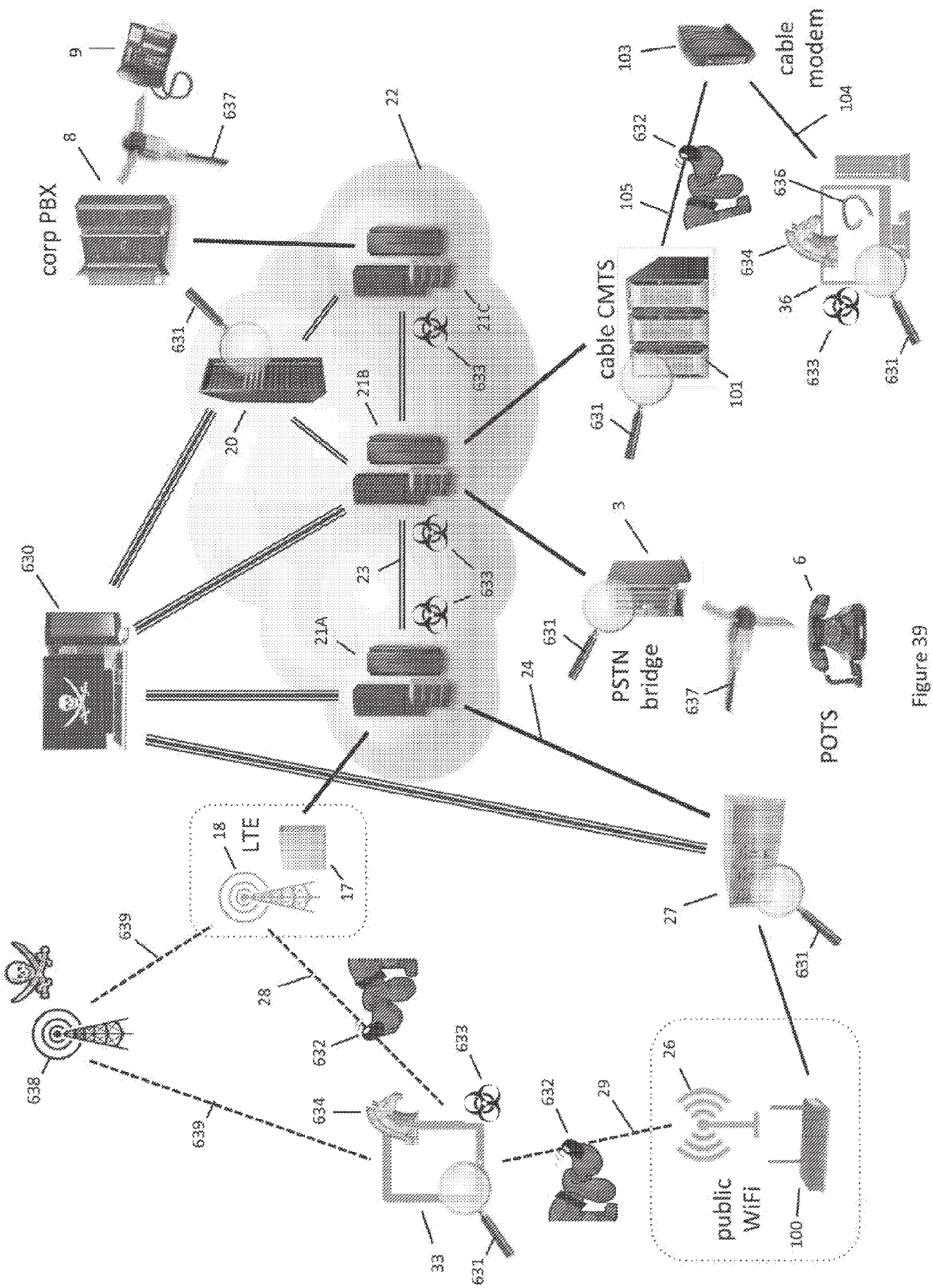

corp PBX
cable CMTS
cable modem
PSTN bridge
POTS
LTE
public WiFi
22
21A
21B
21C
23
24
20
630
631
632
633
634
636
637
638
639
100
101
103
104
105

Figure 39

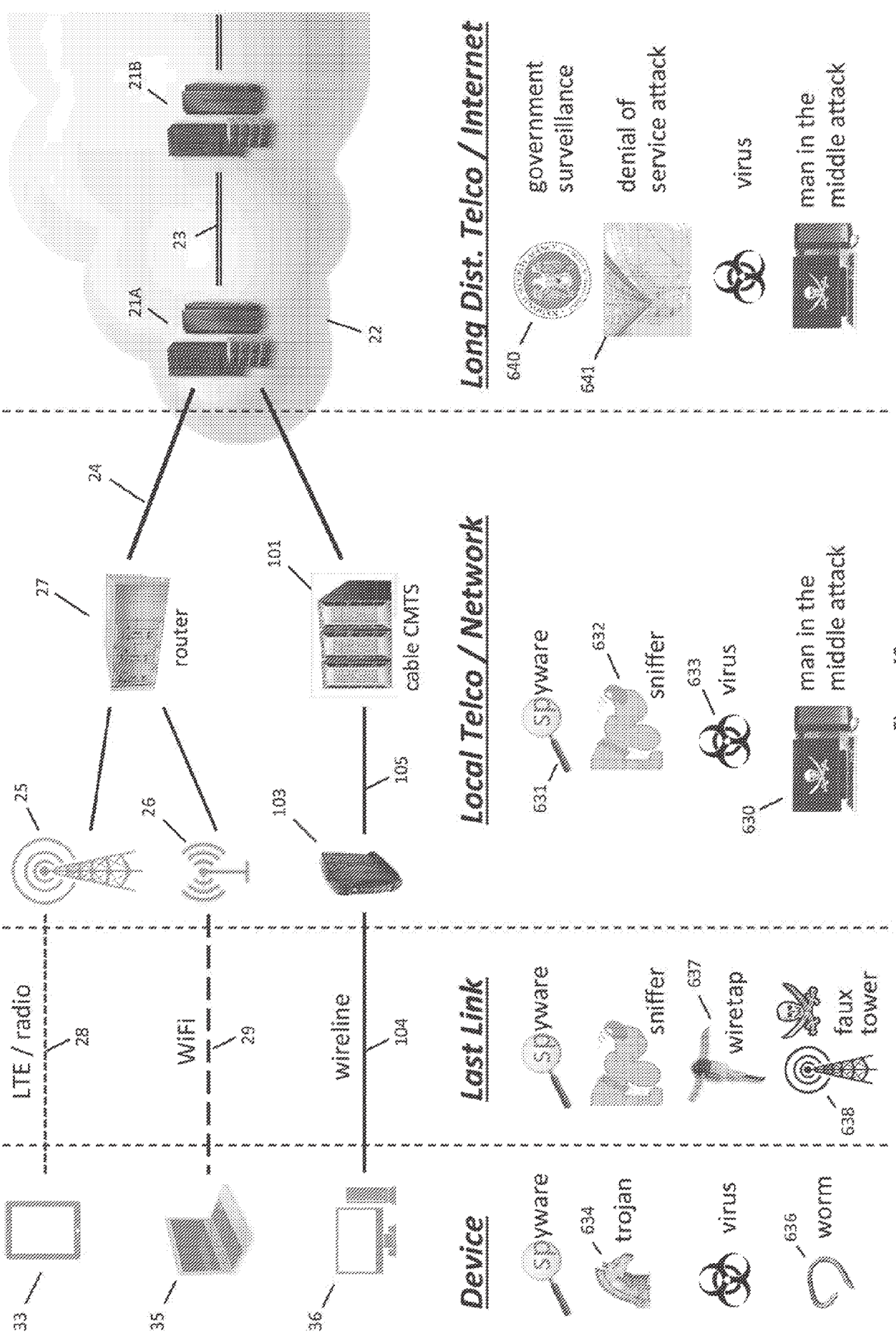

last mile
cloud
LTE / radio
WiFi
wireline
28
29
104
25
26
103
105
27
router
24
101
cable CMTS
21A
21B
23
22
Device
Last Link
Local Telco / Network
Long Dist. Telco / Internet
33
35
36
spyware
trojan
virus
worm
sniffer
wiretap
faux tower
638
637
634
636
631
632
633
630
640
641
man in the middle attack
virus
denial of service attack
government surveillance

Figure 40

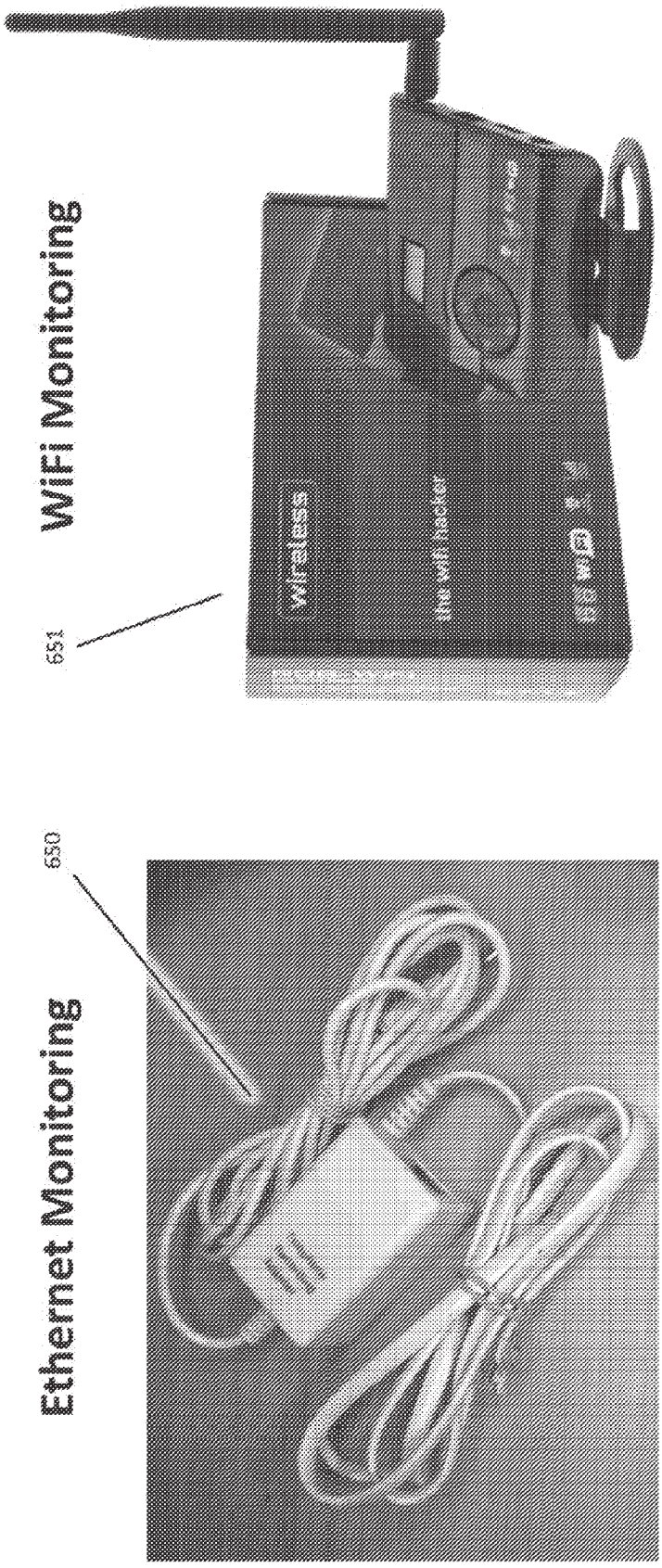
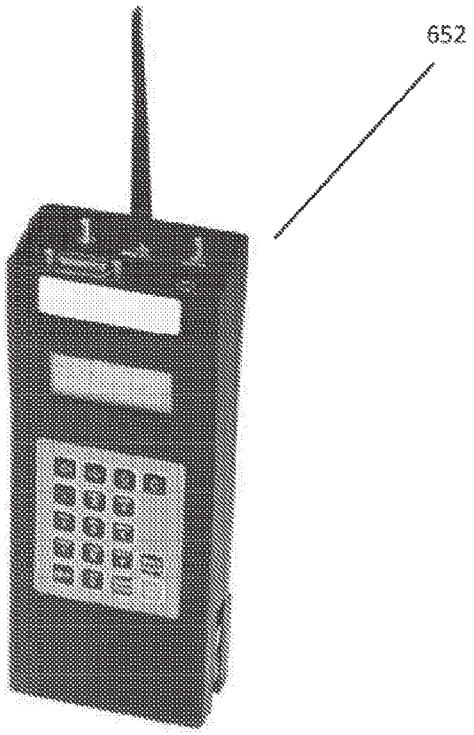

WiFi Monitoring
651
wireless
the wifi hacker
Ethernet Monitoring
650

Figure 41A

Cell Phone Monitoring



Cell Phone Monitoring

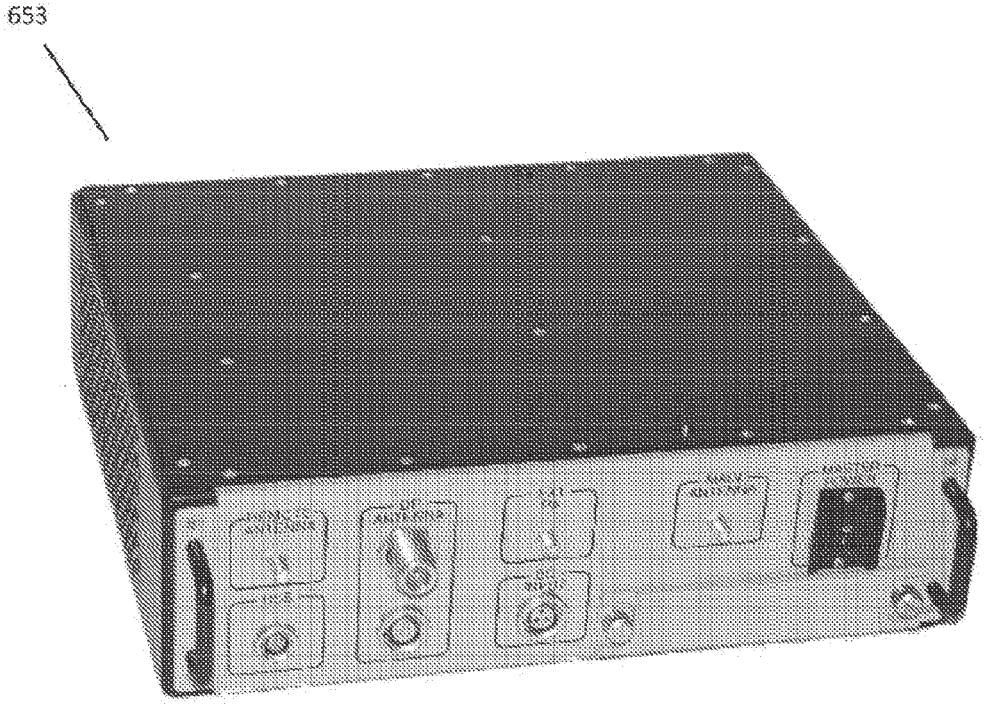


Figure 41B

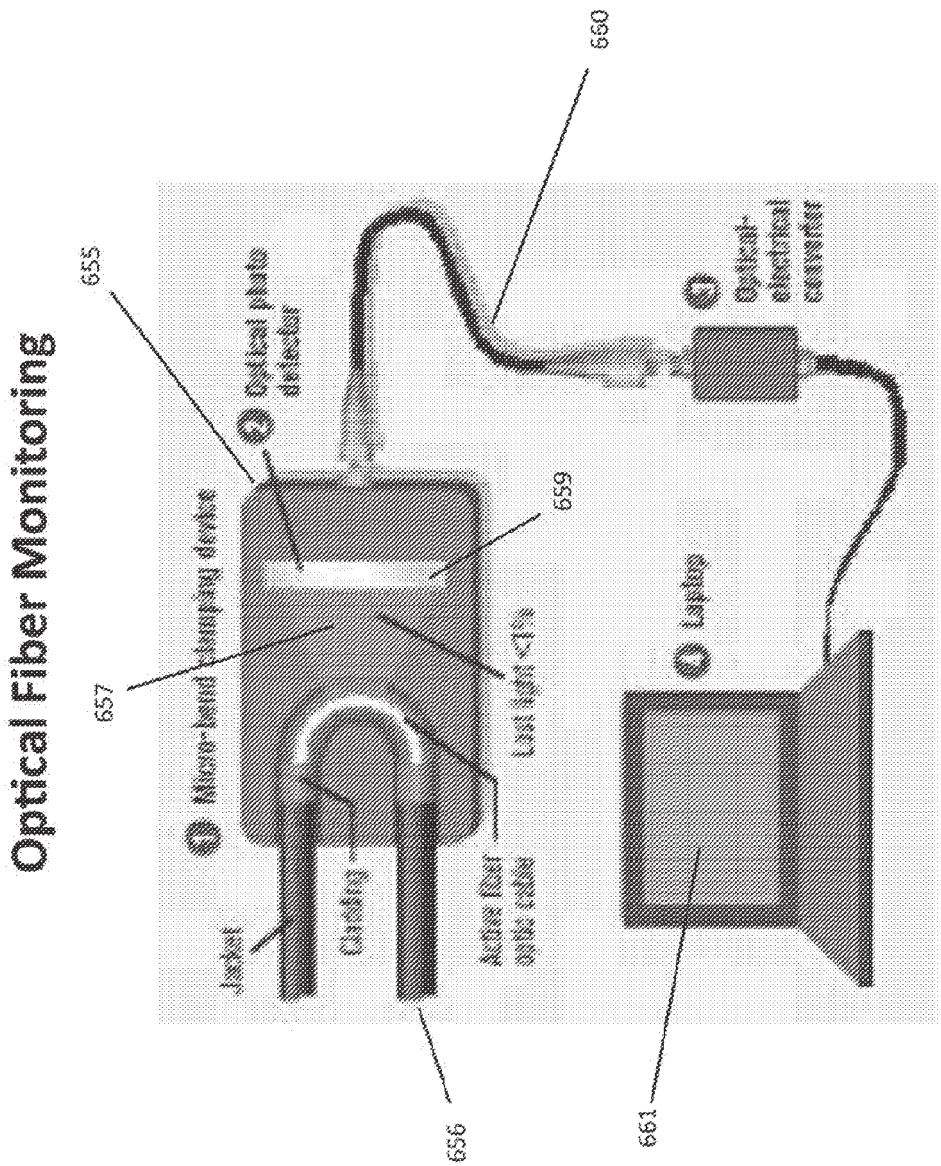

Optical Fiber Monitoring
655
660
657
659
656
661
Optical photo detector
Optical-electrical converter
Laptop
Jacket
Cladding
Lost light <1%

Figure 41C

Commercial Spyware Top 10 Comparison

FEATURES										
OS Support	Android, iPhone, iPad, BlackBerry, Symbian Nokia, Windows Mobile	Android, iPhone, BlackBerry, Symbian	iPhone, Android, BlackBerry, Windows Mobile, Symbian	Android, iPhone, BlackBerry	Android	Android, iPhone, BlackBerry, Symbian	iPhone, Android, BlackBerry, Windows Mobile, Symbian	iPhone, BlackBerry, Android, Symbian S60, Nokia, Windows Mobile	iPhone, iPad, BlackBerry, Android, Symbian, Windows Mobile	iPhone, Android, BlackBerry, Nokia phone, Windows Mobile
SPY on Calls	✓	✓	View Call History	✓	Voice Call Log	✓	✓	✓	✓	✓
SPY on SMS and MMS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SPY on Emails	✓	Email Logging	✓	✓	✓	✓	✓	✓	✓	✗
Track GPS Location	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Monitor Internet Use	Browsing History, Website Bookmarks, Blocking Websites	Browsing Website History	URL Tracking	View Visited Websites	View Visited Websites	View Visited Websites, Bookmarks	Browsing History	✗	✓	✗
Access Address Book	✓	✗	✓	✓	✗	✓	✓	✓	✓	✗
Access Calendar	✓	Monitor Appointments	✓	✓	✗	✓	✗	✗	✗	✗
Instant Messages	Skype, WhatsApp, iMessage	Skype, WhatsApp, BlackBerry Chat Logging	WhatsApp, iMessage,BlackBerry Message Chats	Skype, Gtalk, BBM, WhatsApp, iMessage, Facebook, Viber	✗	Skype, Gtalk, BBM, WhatsApp, iMessage, Facebook, Viber, WeChat, Yahoo	✓	✗	BBM, Facebook Chat	✗
Bugging	✓	✗	✗	✓	✗	✓	✗	✗	✗	✗
Control Apps	✓	✗	✓	✓	✗	✗	✓	✗	✗	✗
View Photos/Videos	✓	✓	✓	✓	✗	✗	✓	✓	✓	✗
Remote Control	✓	✗	✗	✓	Block Websites	✓	✓	✗	✓	✓

Figure 42

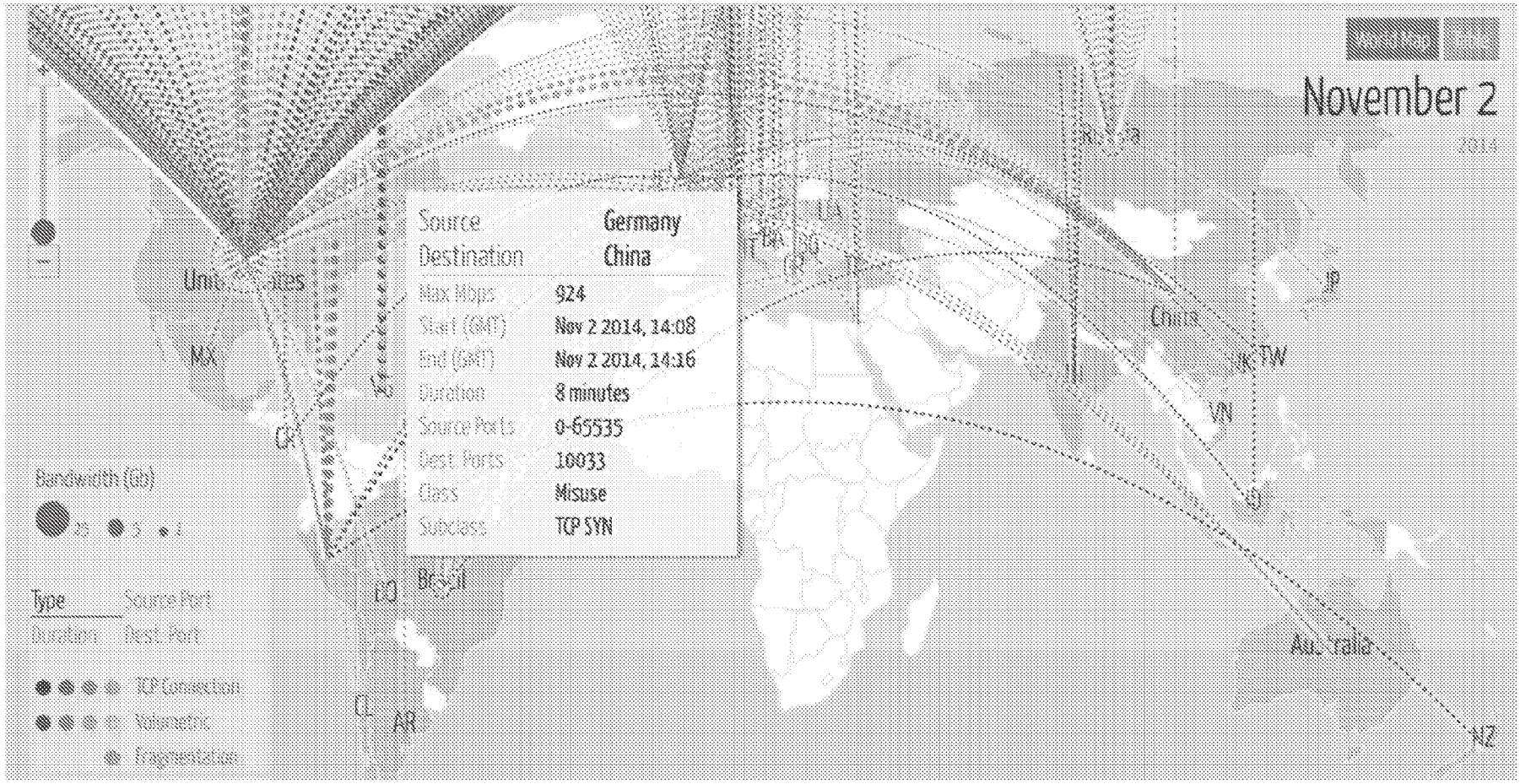

Digital Attack Map
Top daily DDoS attacks worldwide
Map
Gallery
Understanding DDoS
FAQ
About
November 2
2014
Source
Germany
Destination
China
Max Mbps
924
Start (GMT)
Nov 2 2014, 14:08
End (GMT)
Nov 2 2014, 14:16
Duration
8 minutes
Source Ports
0-65535
Dest. Ports
10033
Class
Misuse
Subclass
TCP SYN
Bandwidth (Gb)
Type
Source Port
Duration
Dest. Port
TCP Connection
Volumetric
Fragmentation
Brasil
Chi
JP
TW
VN
Au. ralia
NZ
AR
CL
MX

Figure 43

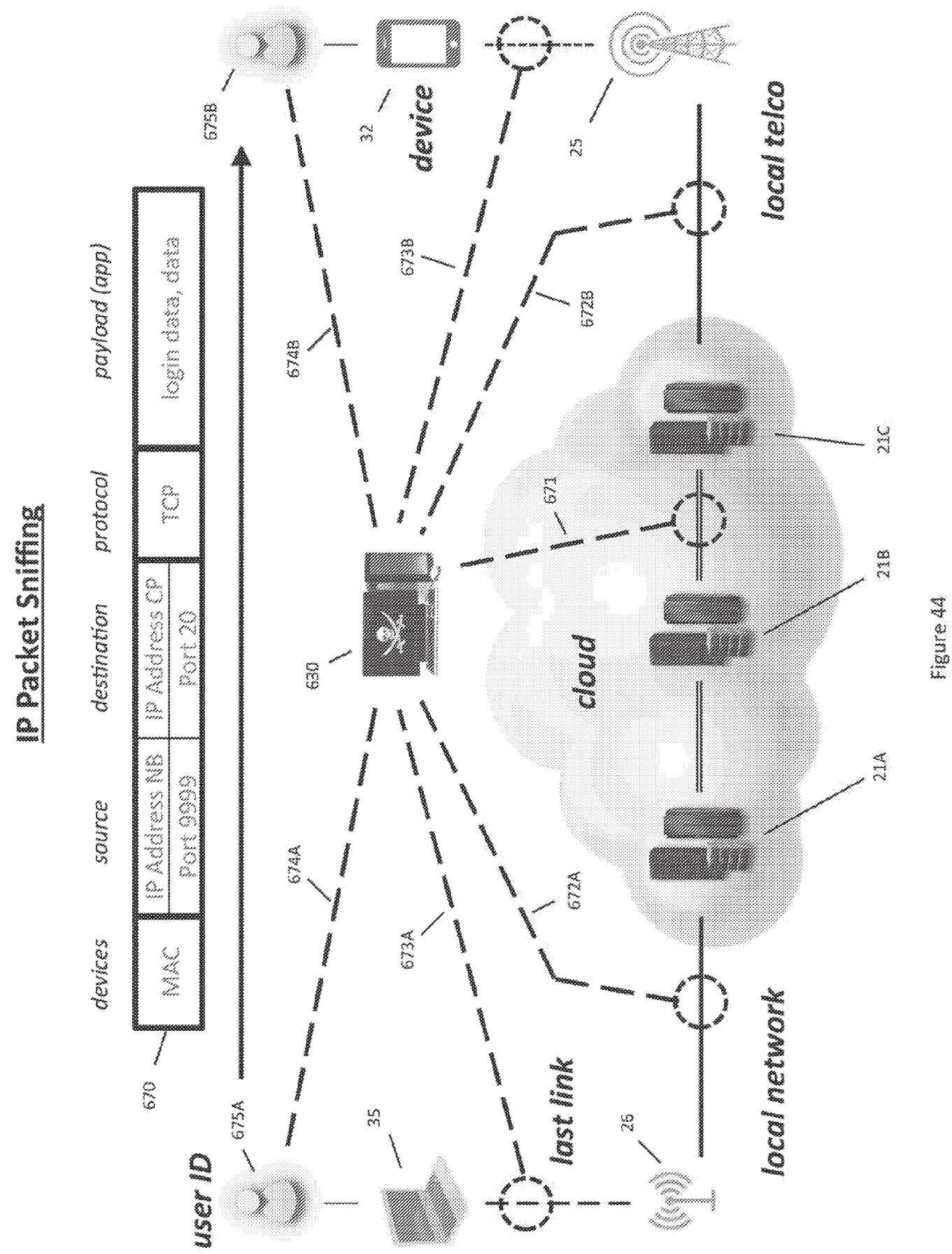
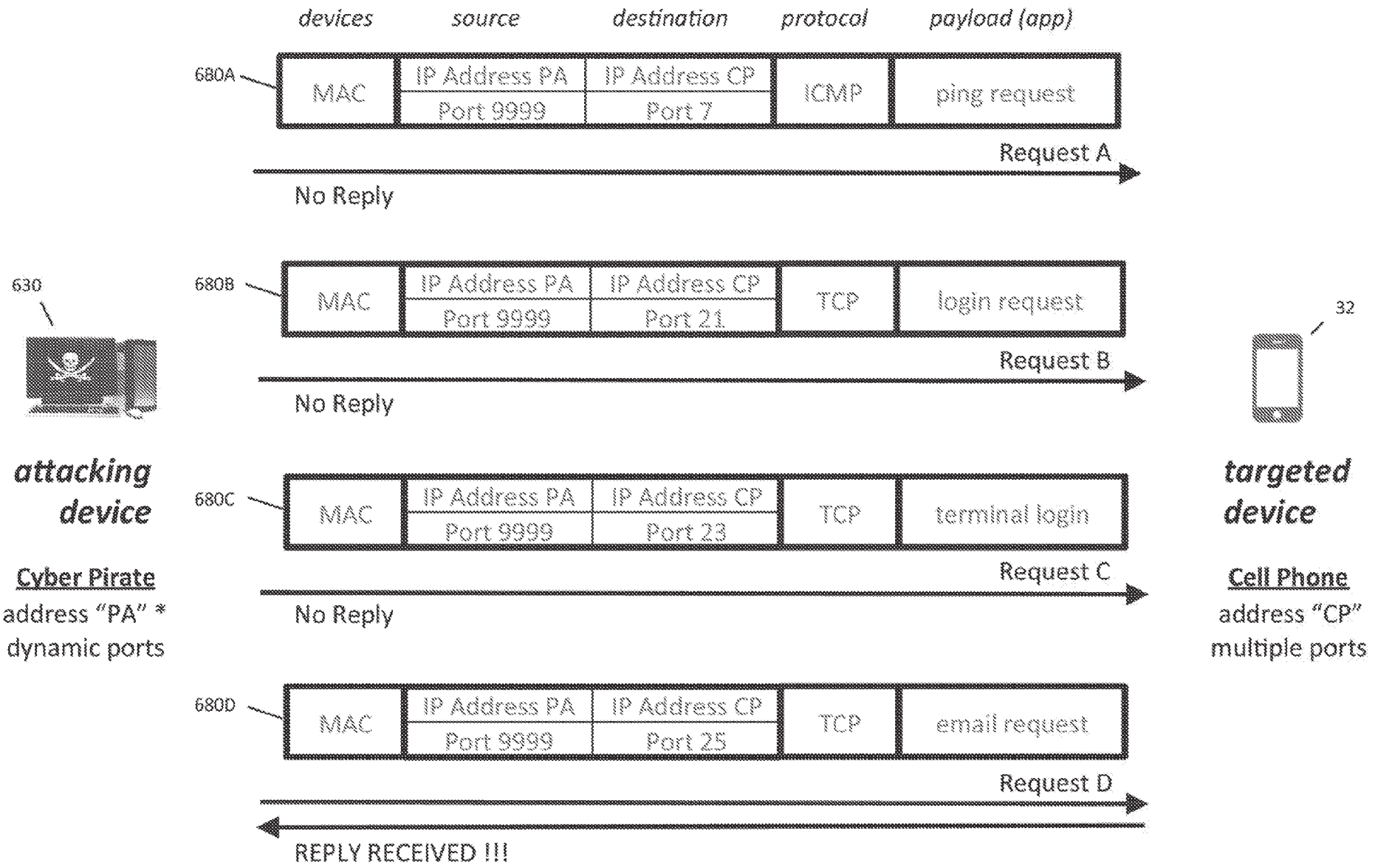

IP Packet Sniffing
devices
source
destination
protocol
payload (app)
MAC
IP Address NB
Port 9999
IP Address CP
Port 20
TCP
login data, data
670
675A
675B
674A
674B
673A
673B
672A
672B
671
630
35
32
25
26
user ID
last link
cloud
device
local telco
local network
21A
21B
21C

Figure 44

Port Interrogation Based Discovery



* pseudo-address PA disguises real device ID

Figure 45

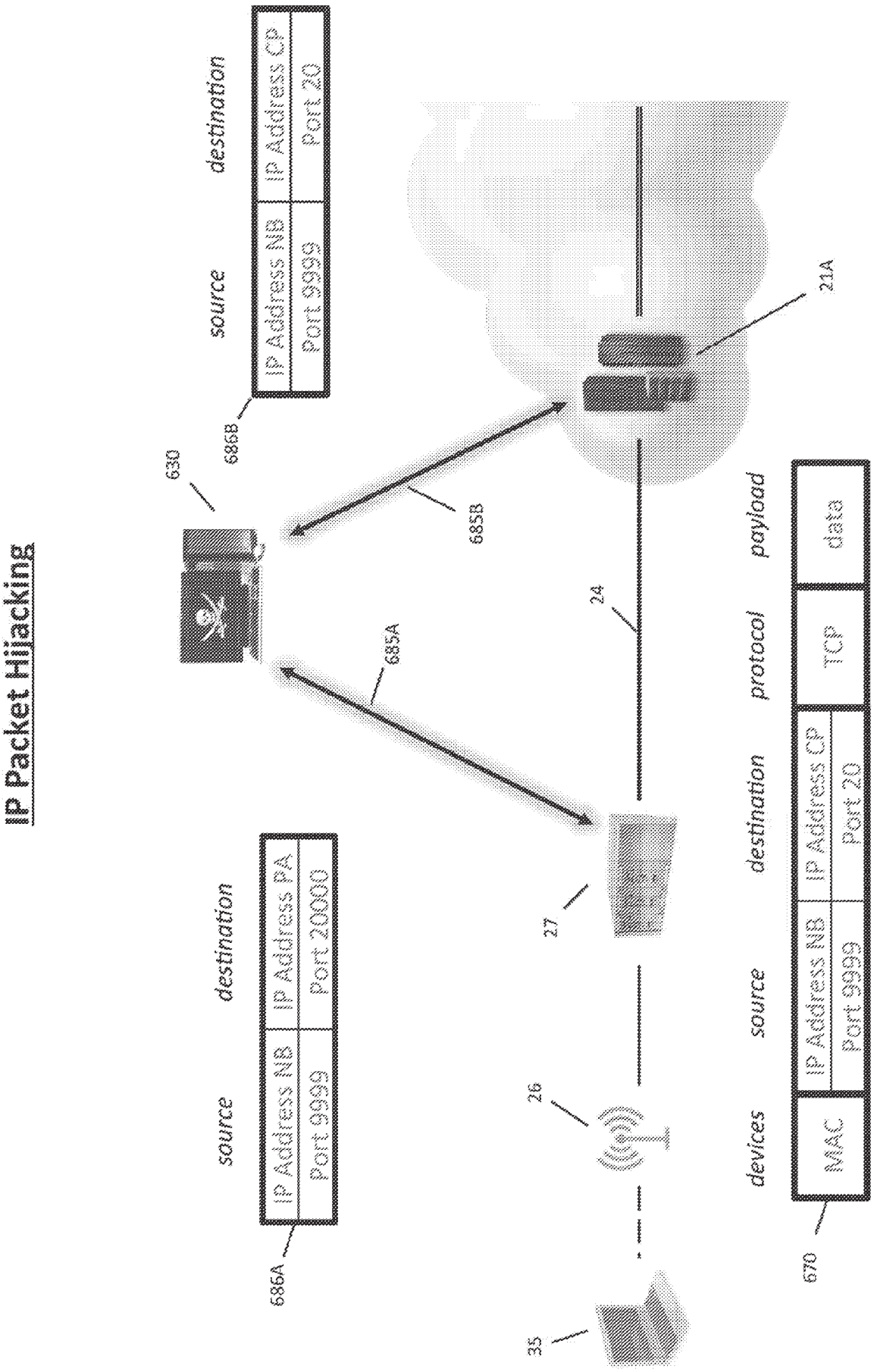

IP Packet Hijacking
source
destination
IP Address NB
IP Address PA
Port 9999
Port 20000
686A
630
685A
685B
686B
IP Address NB
IP Address CP
Port 9999
Port 20
24
21A
26
27
35
devices
source
destination
protocol
payload
MAC
IP Address NB
IP Address CP
Port 9999
Port 20
TCP
data
670

Figure 46

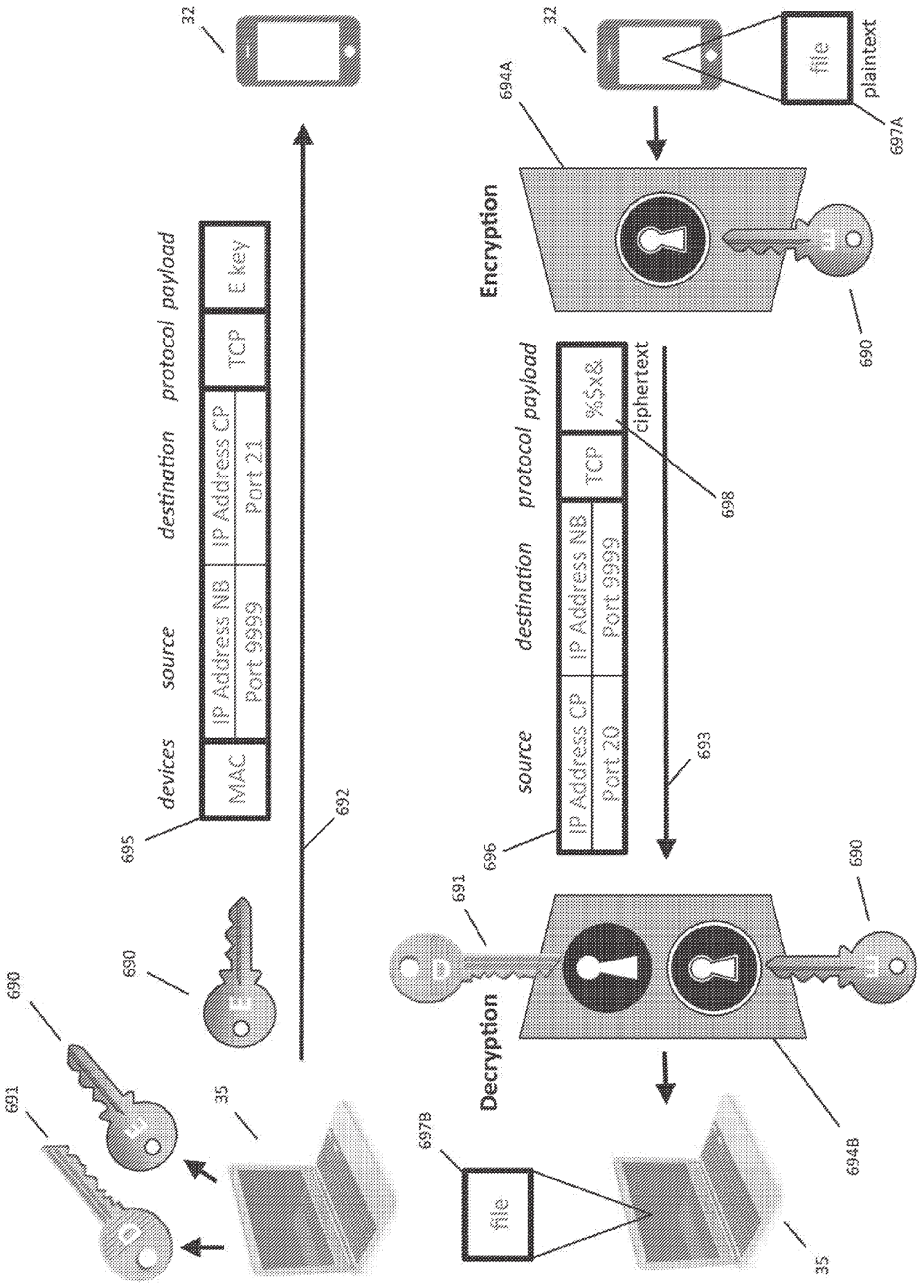

32
695
devices
source
destination
protocol
payload
MAC
IP Address NB
Port 9999
IP Address CP
Port 21
TCP
E key
692
690
691
35
Encryption
694A
file
plaintext
697A
690
696
IP Address CP
Port 20
IP Address NB
Port 9999
TCP
%$x&
ciphertext
698
693
Decryption
691
690
694B
697B
file
35

Figure 47

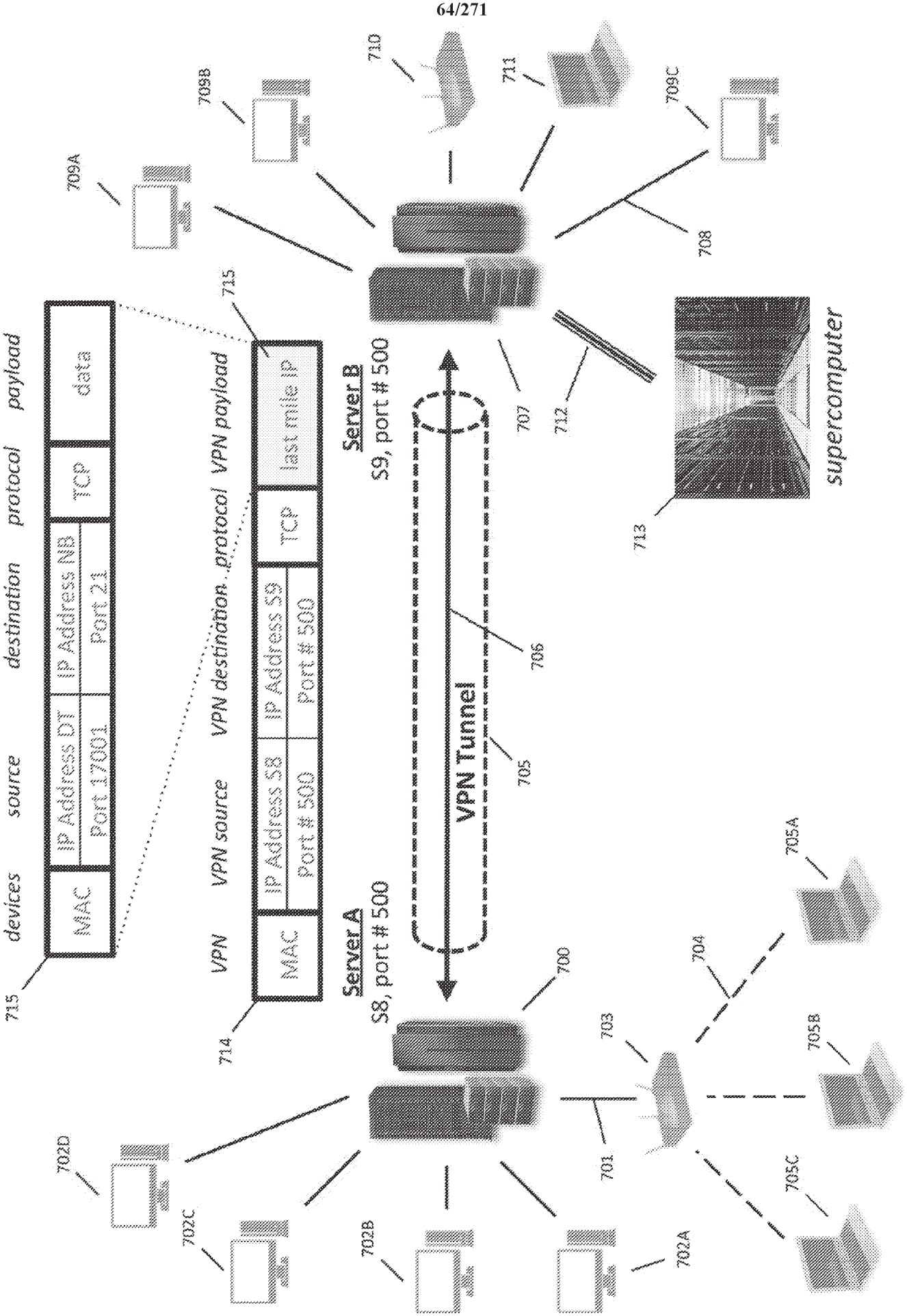

devices
source
destination
protocol
payload
MAC
IP Address DT
Port 17001
IP Address NB
Port 21
TCP
data
715
VPN
VPN source
VPN destination
protocol
VPN payload
MAC
IP Address S8
Port # 500
IP Address S9
Port # 500
TCP
last mile IP
714
Server A
S8, port # 500
Server B
S9, port # 500
VPN Tunnel
705
706
700
701
703
704
705A
705B
705C
707
708
709A
709B
709C
710
711
712
713
supercomputer
702A
702B
702C
702D

Figure 48A

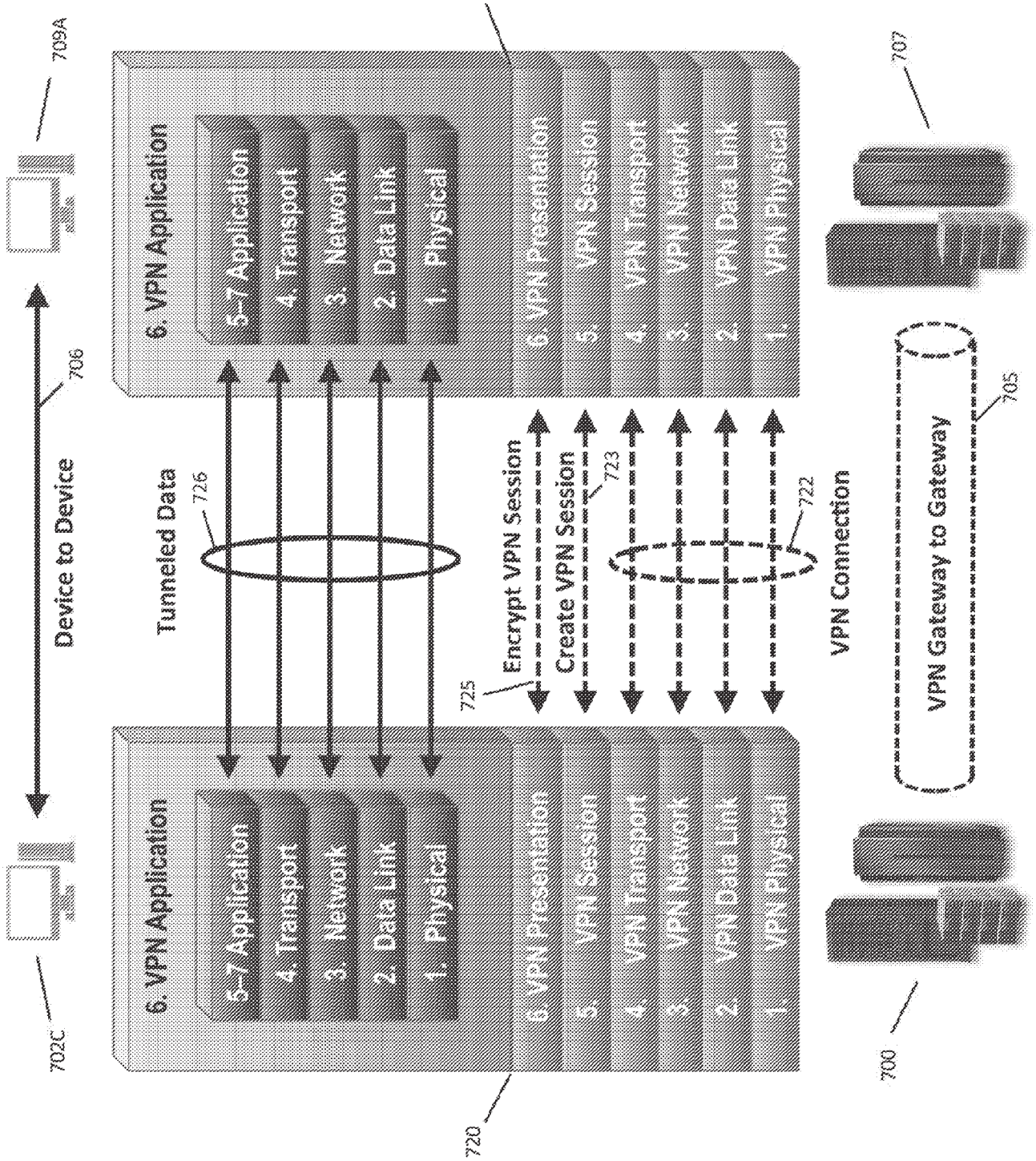

709A
721
707
6. VPN Application
5–7 Application
4. Transport
3. Network
2. Data Link
1. Physical
6. VPN Presentation
5. VPN Session
4. VPN Transport
3. VPN Network
2. VPN Data Link
1. VPN Physical
Device to Device
706
Tunneled Data
726
Encrypt VPN Session
Create VPN Session
723
725
722
VPN Connection
VPN Gateway to Gateway
705
702C
720
700

Figure 48B

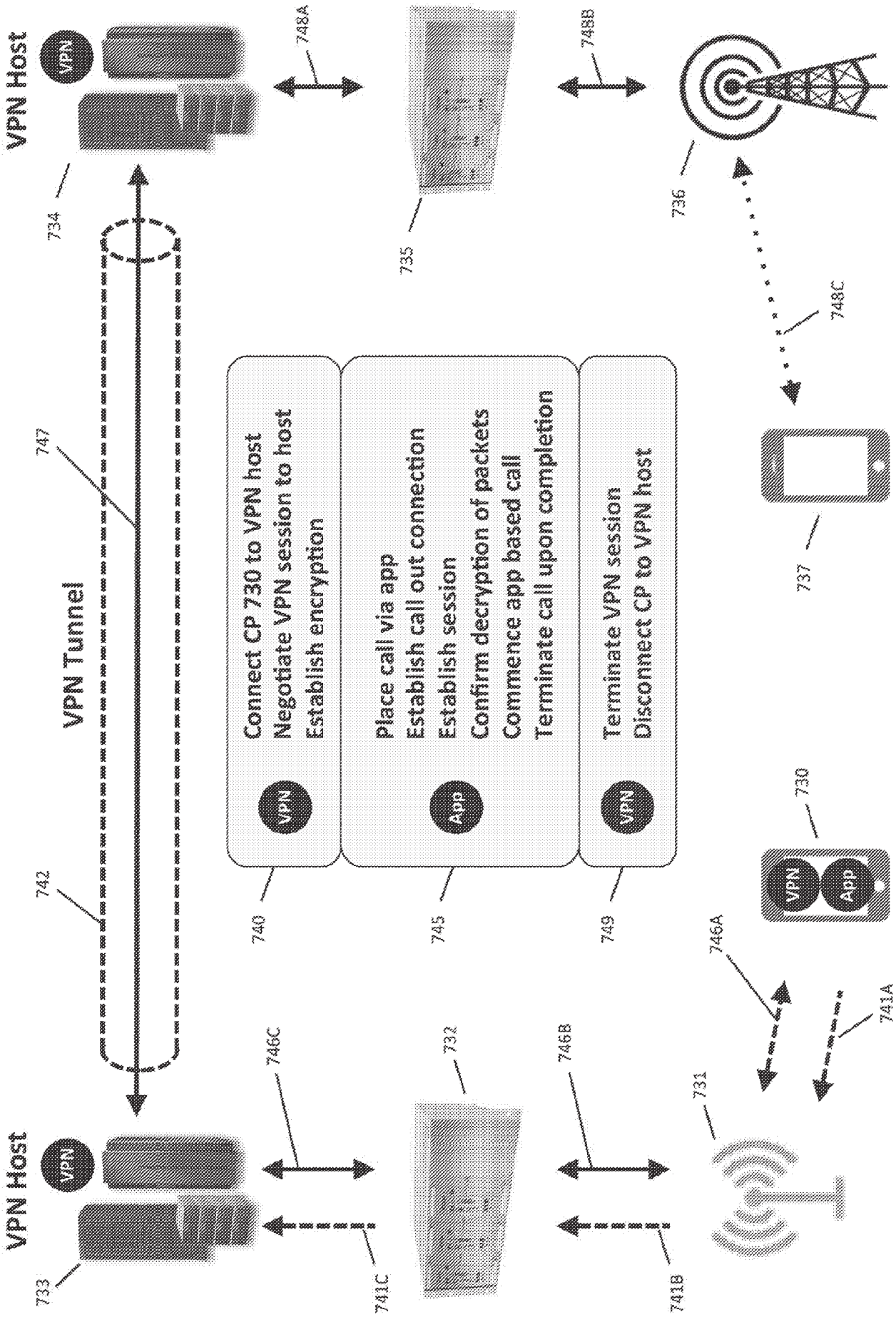

VPN Host
VPN
734
VPN Tunnel
747
742
748A
735
748B
736
748C
737
Connect CP 730 to VPN host
Negotiate VPN session to host
Establish encryption
740
Place call via app
Establish call out connection
Establish session
Confirm decryption of packets
Commence app based call
Terminate call upon completion
745
Terminate VPN session
Disconnect CP to VPN host
749
App
730
746A
741A
731
746B
741B
732
746C
741C
733
VPN Host
VPN

Figure 48C

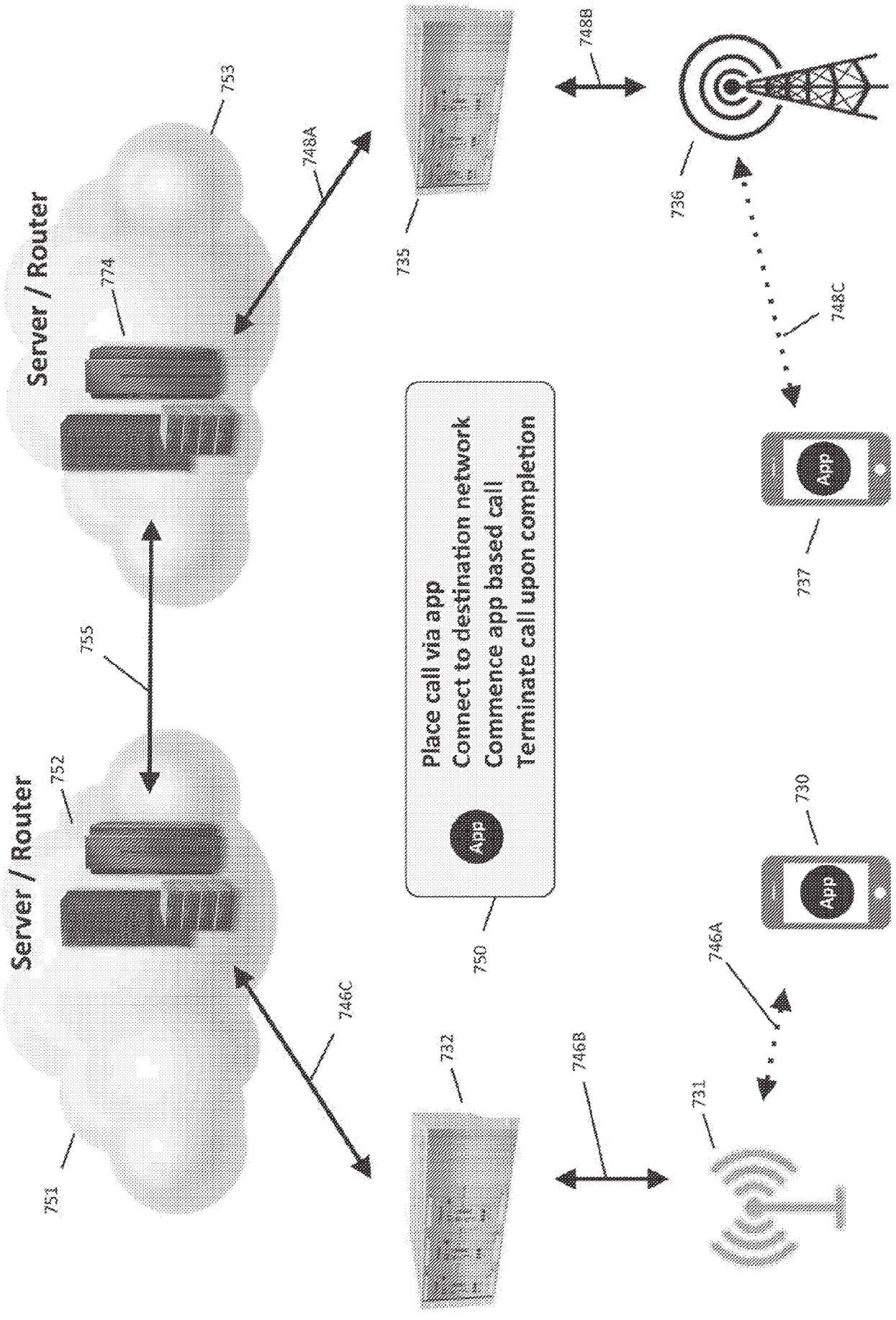

Server / Router
Server / Router
751
752
753
755
774
746C
748A
732
735
746B
748B
736
731
746A
748C
737
730
750
Place call via app
Connect to destination network
Commence app based call
Terminate call upon completion
App
App
App

Figure 49A

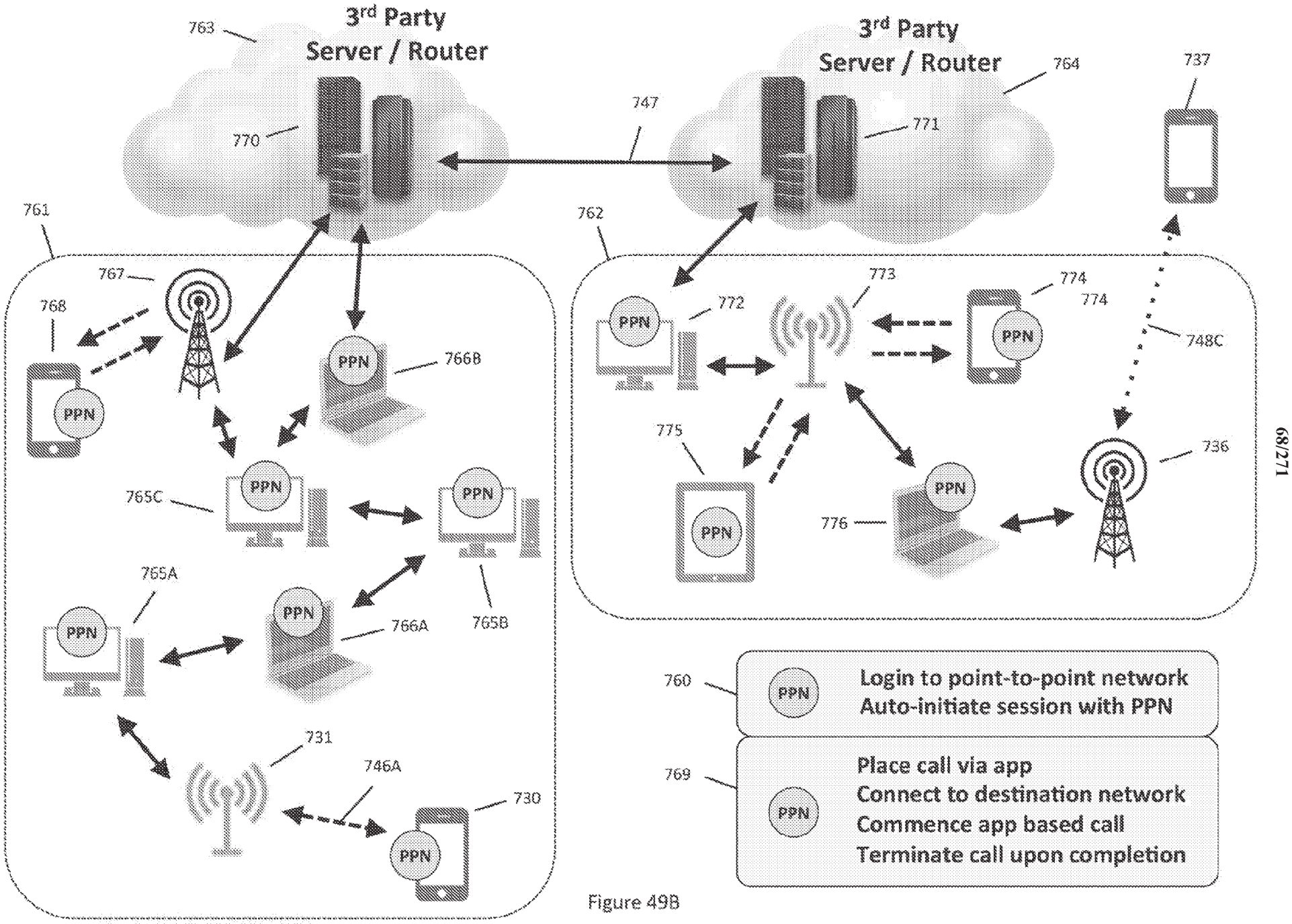

3rd Party
Server / Router
763
770
747
3rd Party
Server / Router
764
771
737
761
762
767
768
PPN
766B
765C
765A
766A
765B
731
746A
730
772
773
774
748C
775
776
736
Login to point-to-point network
Auto-initiate session with PPN
760
Place call via app
Connect to destination network
Commence app based call
Terminate call upon completion
769

Figure 49B

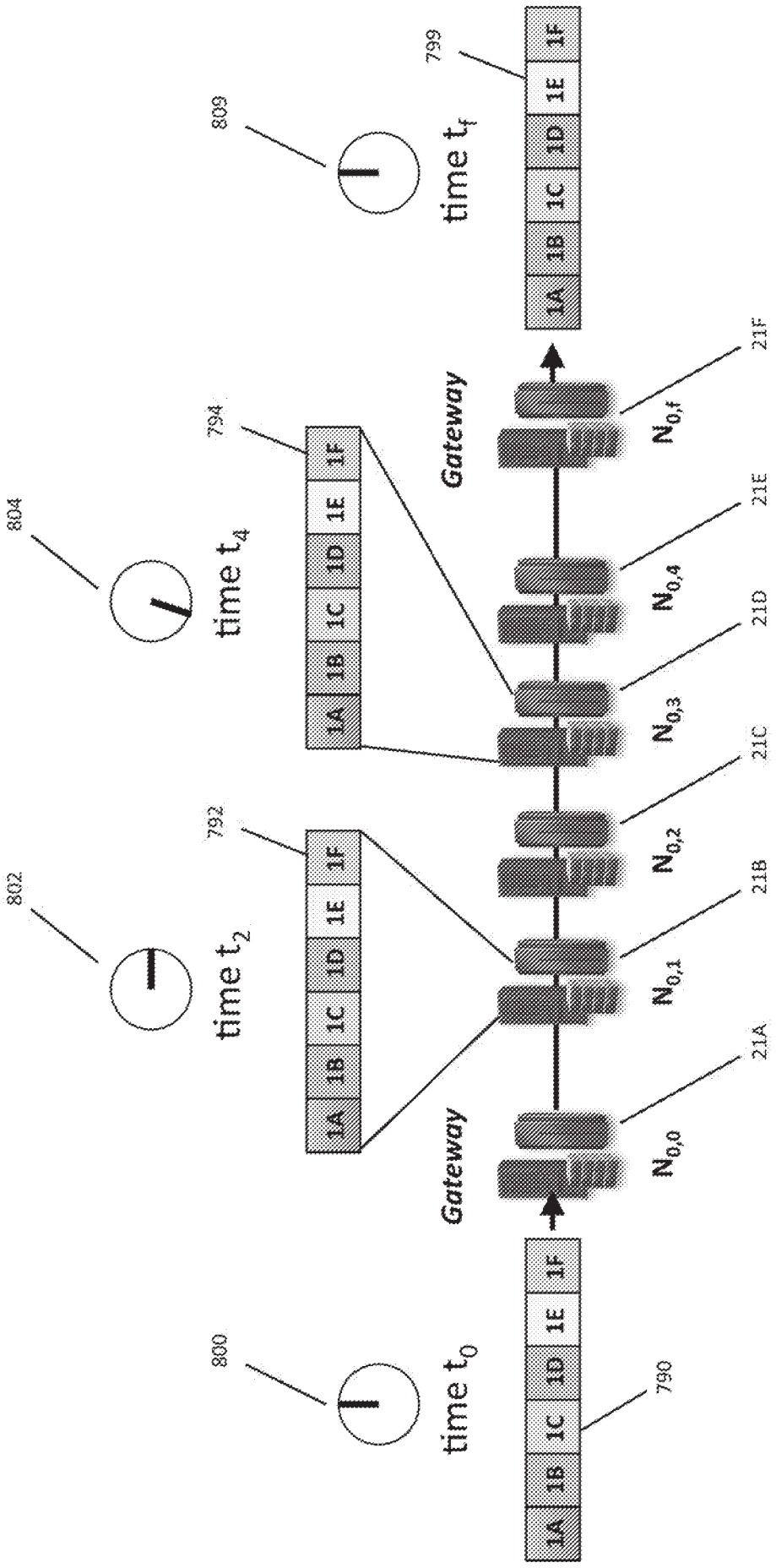

800
time t_0
790
1A 1B 1C 1D 1E 1F
Gateway
$N_{0,0}$
21A
$N_{0,1}$
21B
$N_{0,2}$
21C
$N_{0,3}$
21D
$N_{0,4}$
21E
$N_{0,f}$
21F
802
time t_2
792
1A 1B 1C 1D 1E 1F
804
time t_4
794
1A 1B 1C 1D 1E 1F
809
time t_f
799
1A 1B 1C 1D 1E 1F

Figure 50

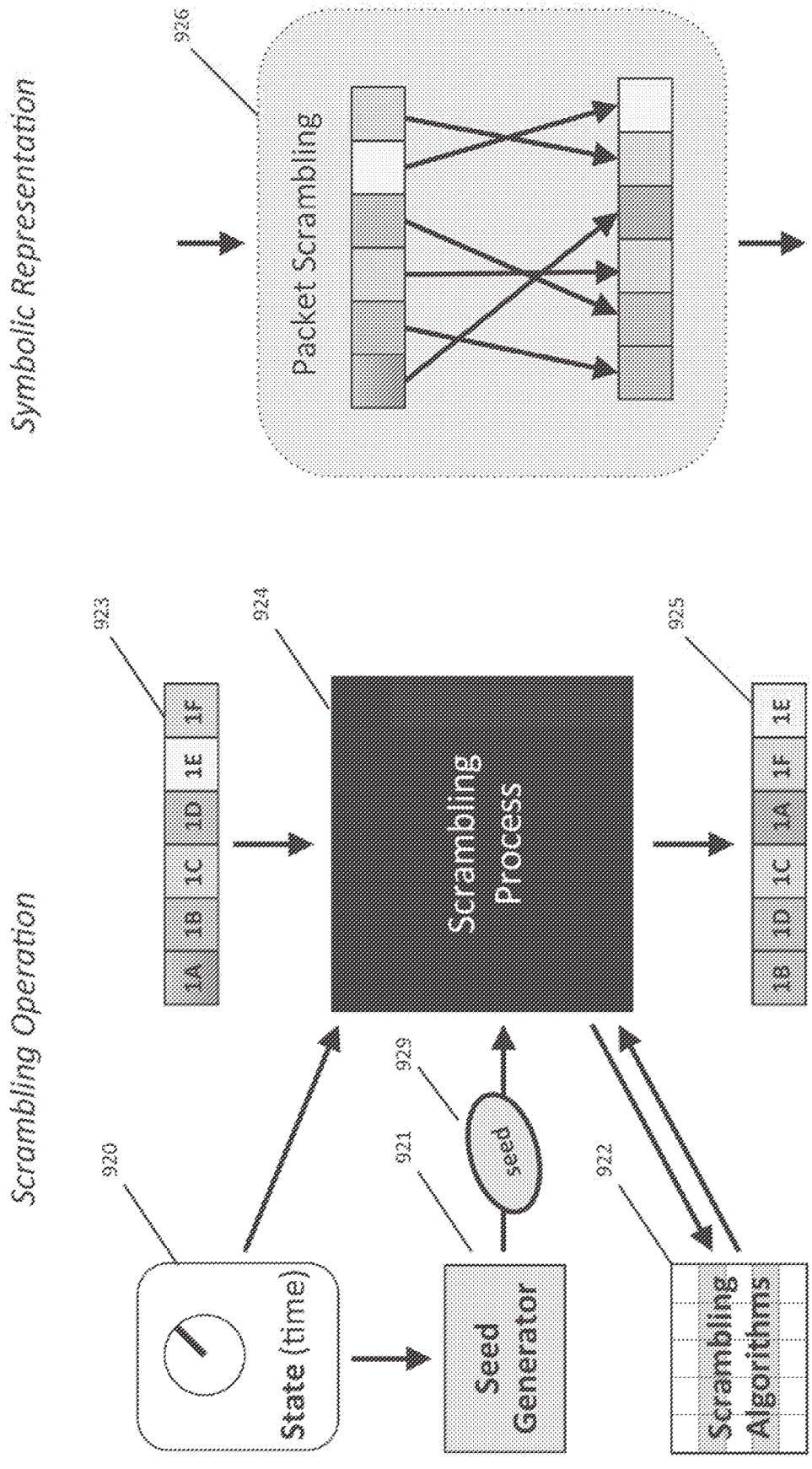

Symbolic Representation
926
Packet Scrambling
Scrambling Operation
923
924
925
1A 1B 1C 1D 1E 1F
Scrambling Process
1B 1D 1C 1A 1F 1E
920
921
929
922
State (time)
Seed Generator
seed
Scrambling Algorithms

Figure 51A

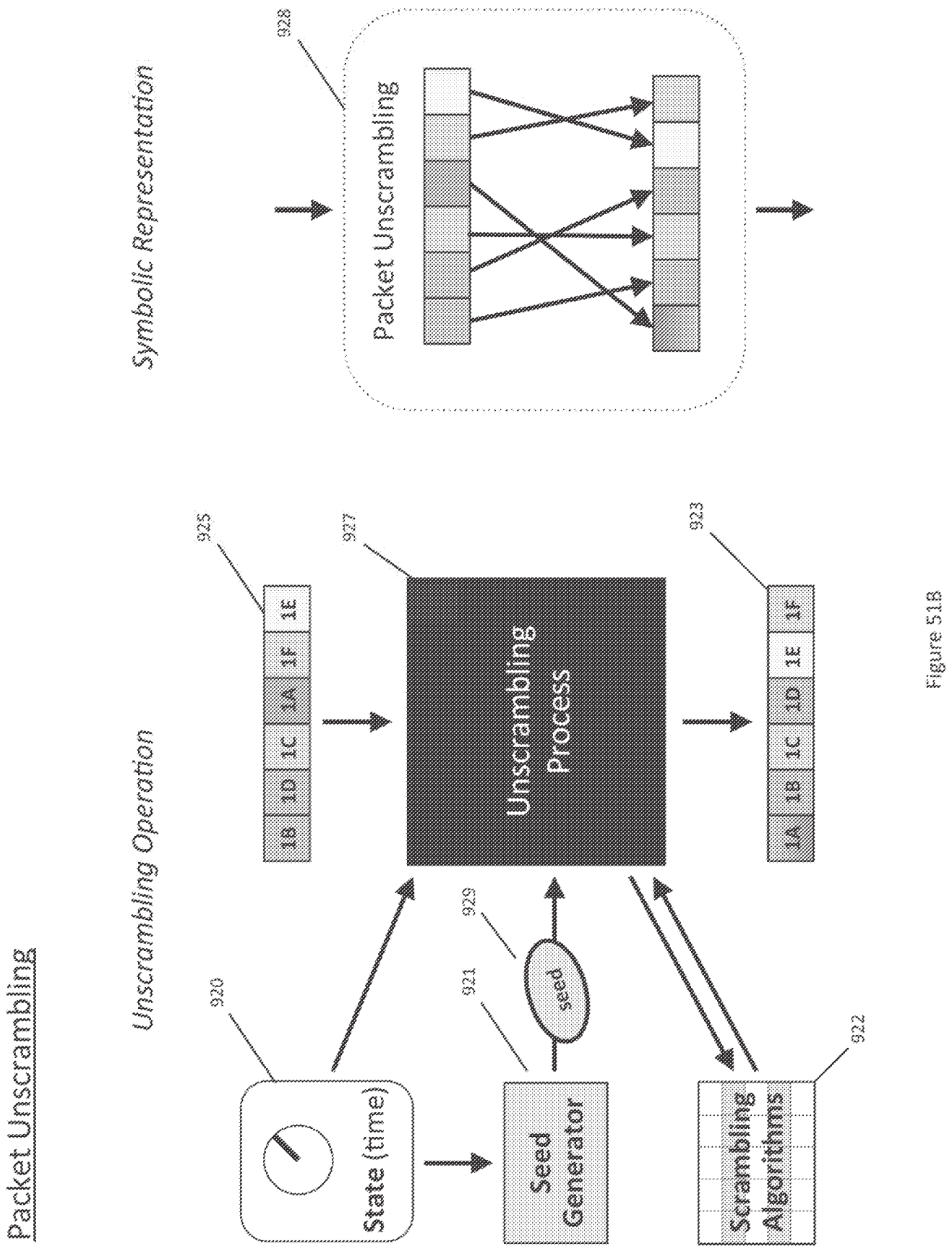

Packet Unscrambling
Unscrambling Operation
Symbolic Representation
920
State (time)
921
Seed Generator
929
seed
922
Scrambling Algorithms
925
1B 1D 1C 1A 1F 1E
927
Unscrambling Process
923
1A 1B 1C 1D 1E 1F
928
Packet Unscrambling

Figure 51B

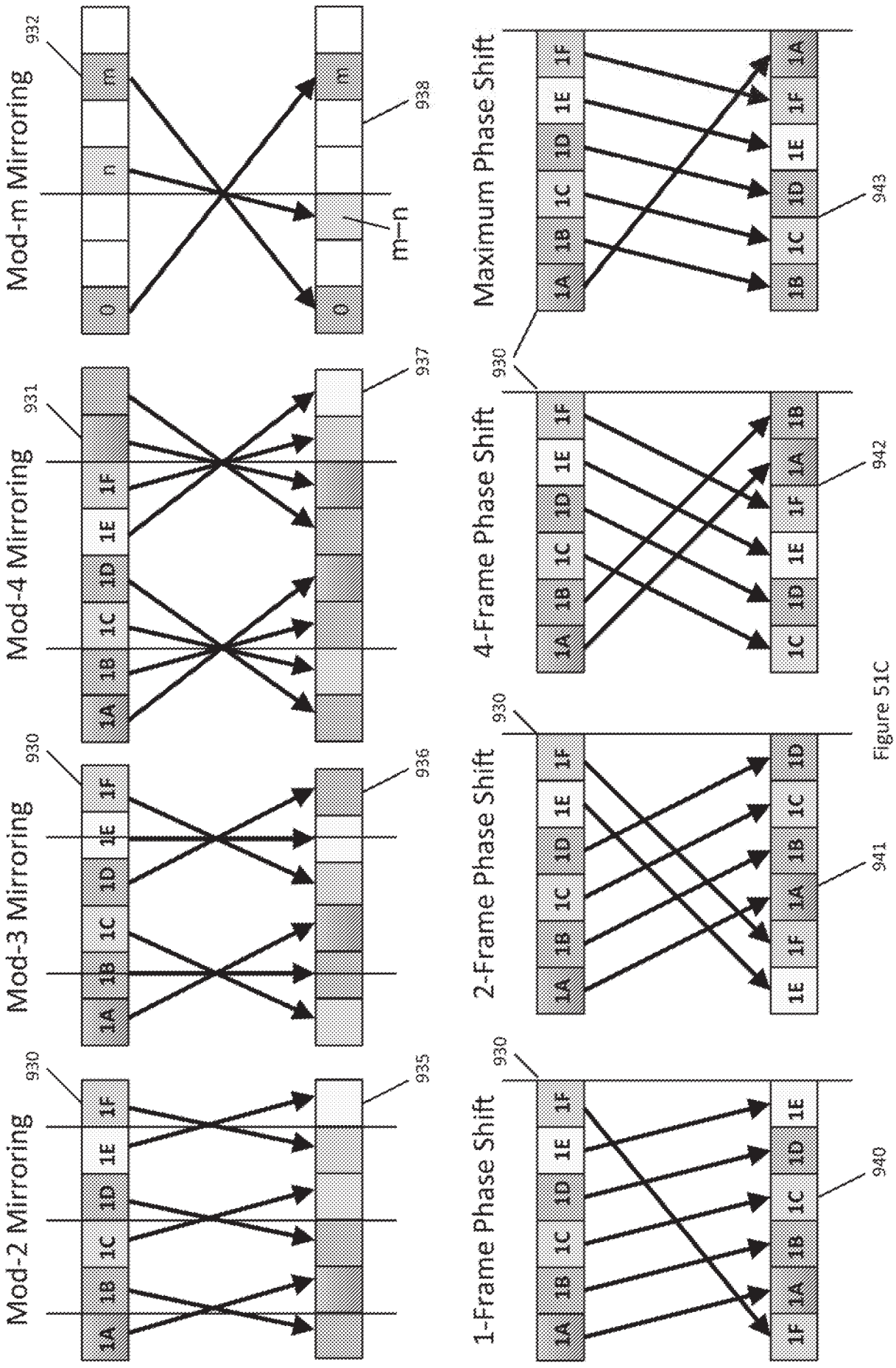

Mod-2 Mirroring
930
1A
1B
1C
1D
1E
1F
935
Mod-3 Mirroring
930
936
Mod-4 Mirroring
931
937
Mod-m Mirroring
932
0
n
m
m−n
938
1-Frame Phase Shift
940
2-Frame Phase Shift
941
4-Frame Phase Shift
942
Maximum Phase Shift
943

Figure 51C

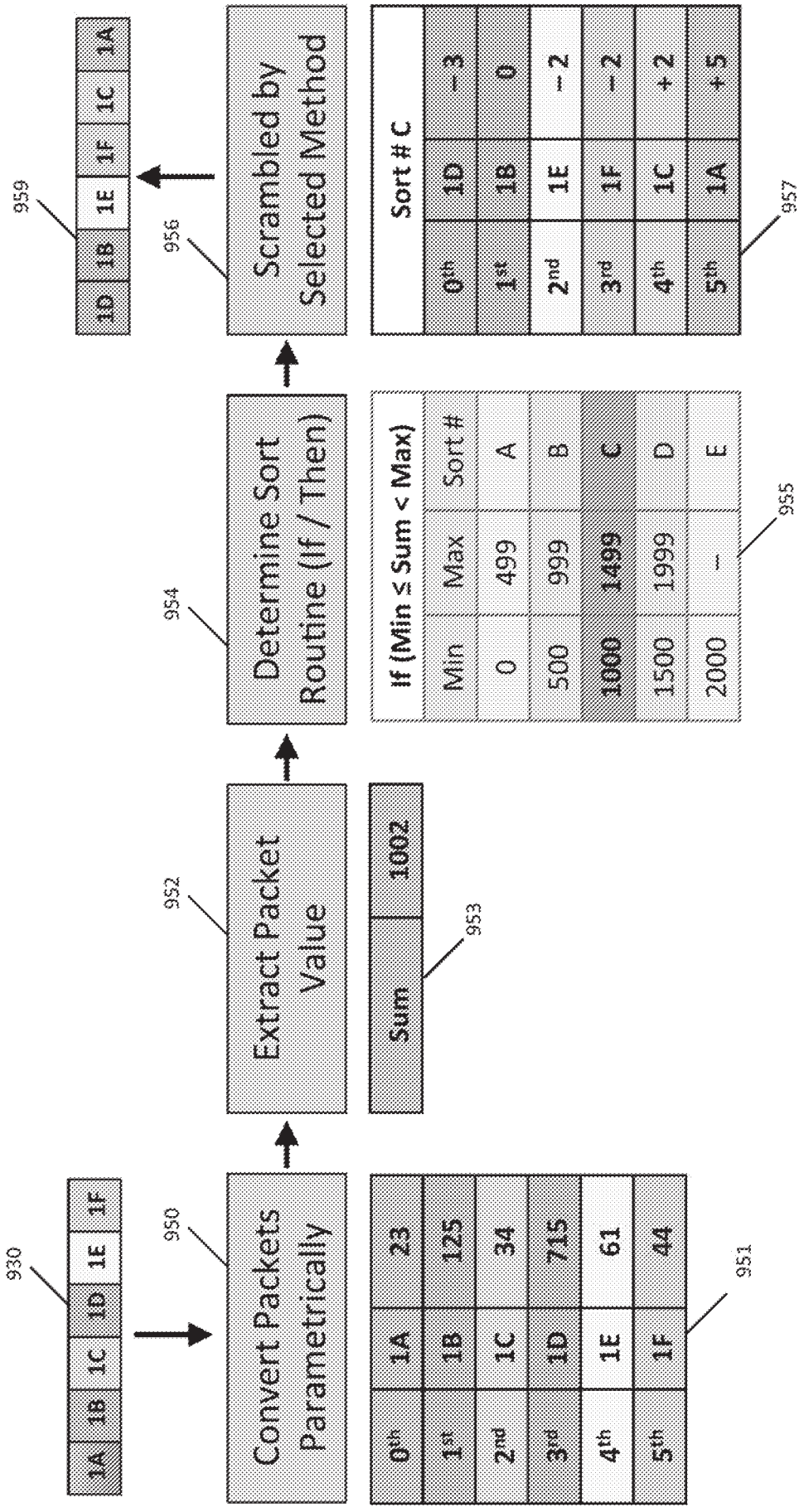

930
1A 1B 1C 1D 1E 1F
950
Convert Packets Parametrically
951
0th 1A 23
1st 1B 125
2nd 1C 34
3rd 1D 715
4th 1E 61
5th 1F 44
952
Extract Packet Value
953
Sum 1002
954
Determine Sort Routine (If / Then)
955
If (Min ≤ Sum < Max)
Min Max Sort #
0 499 A
500 999 B
1000 1499 C
1500 1999 D
2000 – E
956
Scrambled by Selected Method
957
Sort # C
0th 1D −3
1st 1B 0
2nd 1E −2
3rd 1F −2
4th 1C +2
5th 1A +5
959
1D 1B 1E 1F 1C 1A

Figure 51D

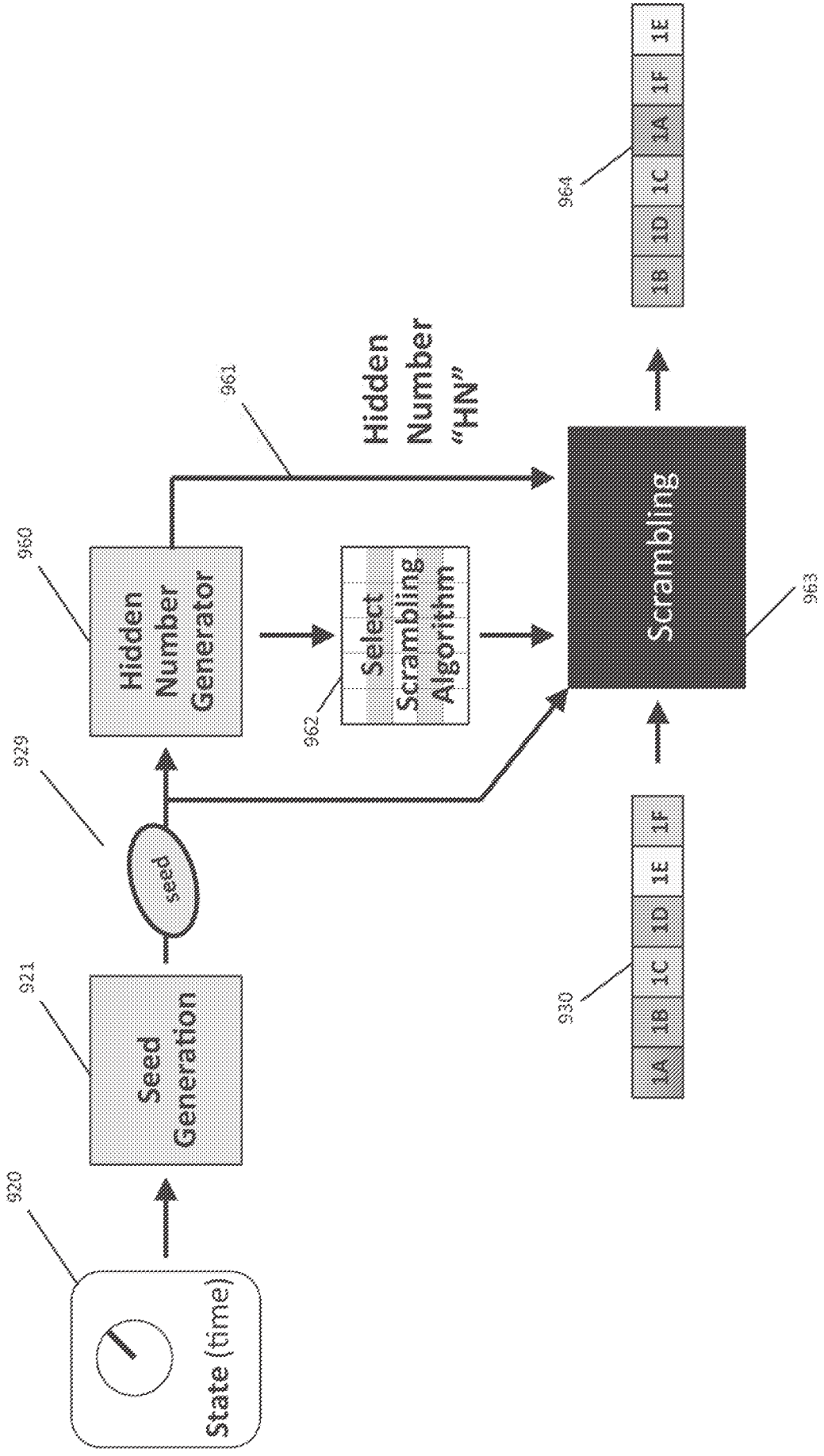

State (time)
920
Seed Generation
921
seed
929
Hidden Number Generator
960
961
Hidden Number "HN"
Select Scrambling Algorithm
962
Scrambling
963
964
1A 1B 1C 1D 1E 1F
930
1B 1D 1C 1A 1F 1E

Figure 51E

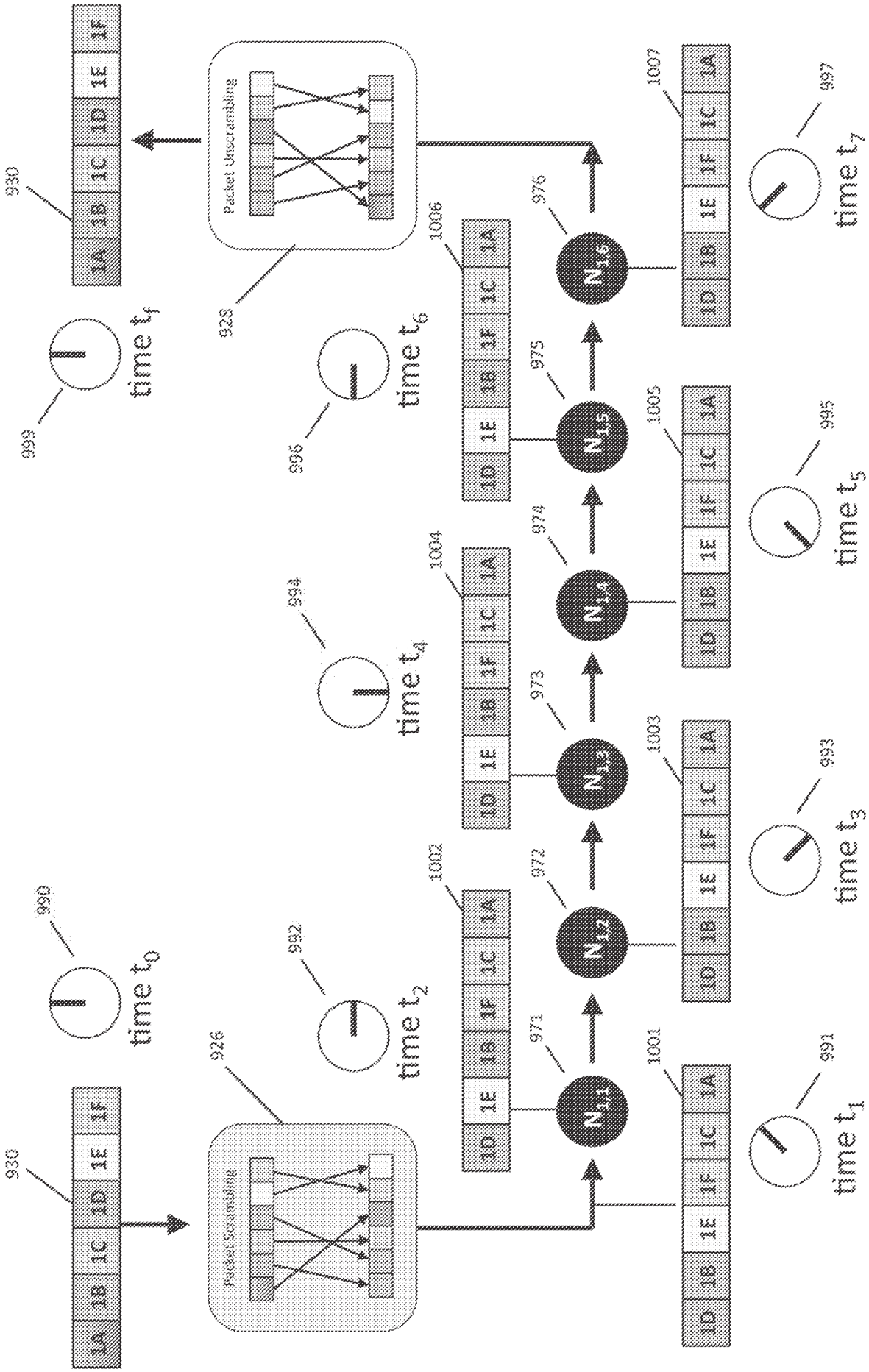

930
1A
1B
1C
1D
1E
1F
926
Packet Scrambling
928
Packet Unscrambling
930
time t_0
990
time t_1
991
time t_2
992
time t_3
993
time t_4
994
time t_5
995
time t_6
996
time t_7
997
971
$N_{1,1}$
972
$N_{1,2}$
973
$N_{1,3}$
974
$N_{1,4}$
975
$N_{1,5}$
976
$N_{1,6}$
999
1001
1002
1003
1004
1005
1006
1007

Figure 51F

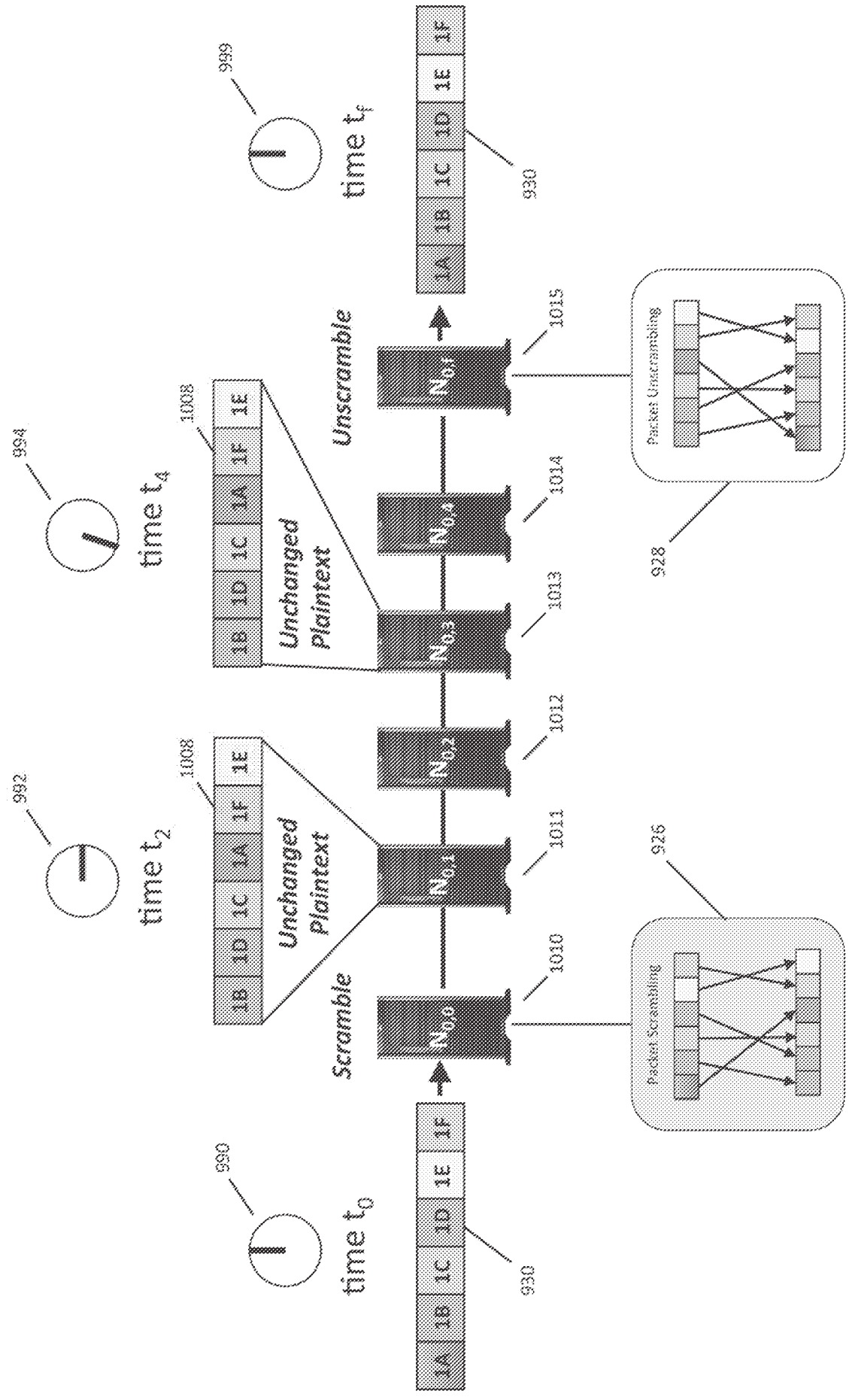

time t_0
time t_2
time t_4
time t_f
990
992
994
999
930
1008
Scramble
Unchanged Plaintext
Unscramble
1010
1011
1012
1013
1014
1015
926
928
Packet Scrambling
Packet Unscrambling

Figure 52

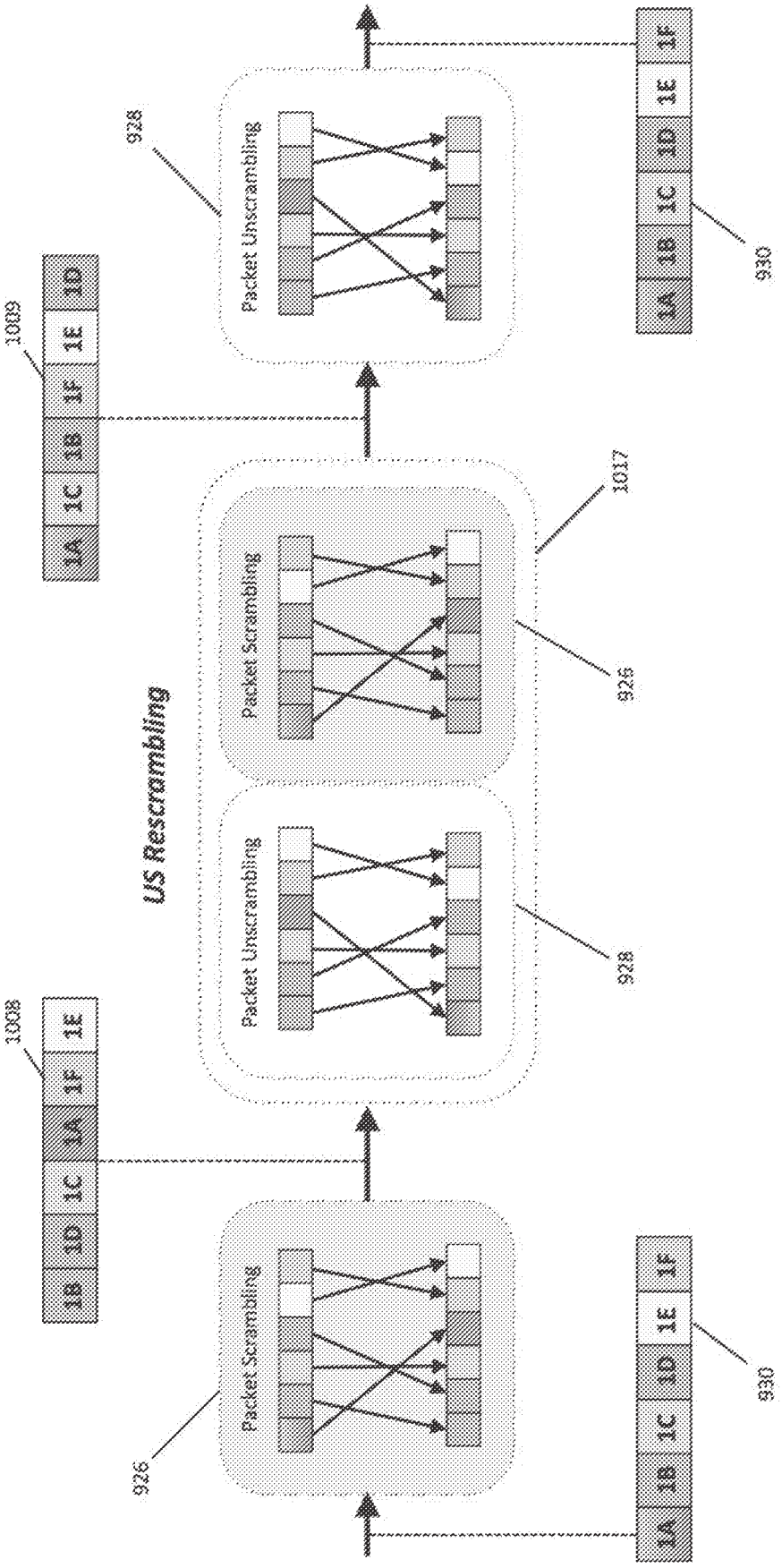

US Rescrambling
Packet Scrambling
Packet Unscrambling
926
928
930
1017
1018
1019
1A 1B 1C 1D 1E 1F

Figure 53

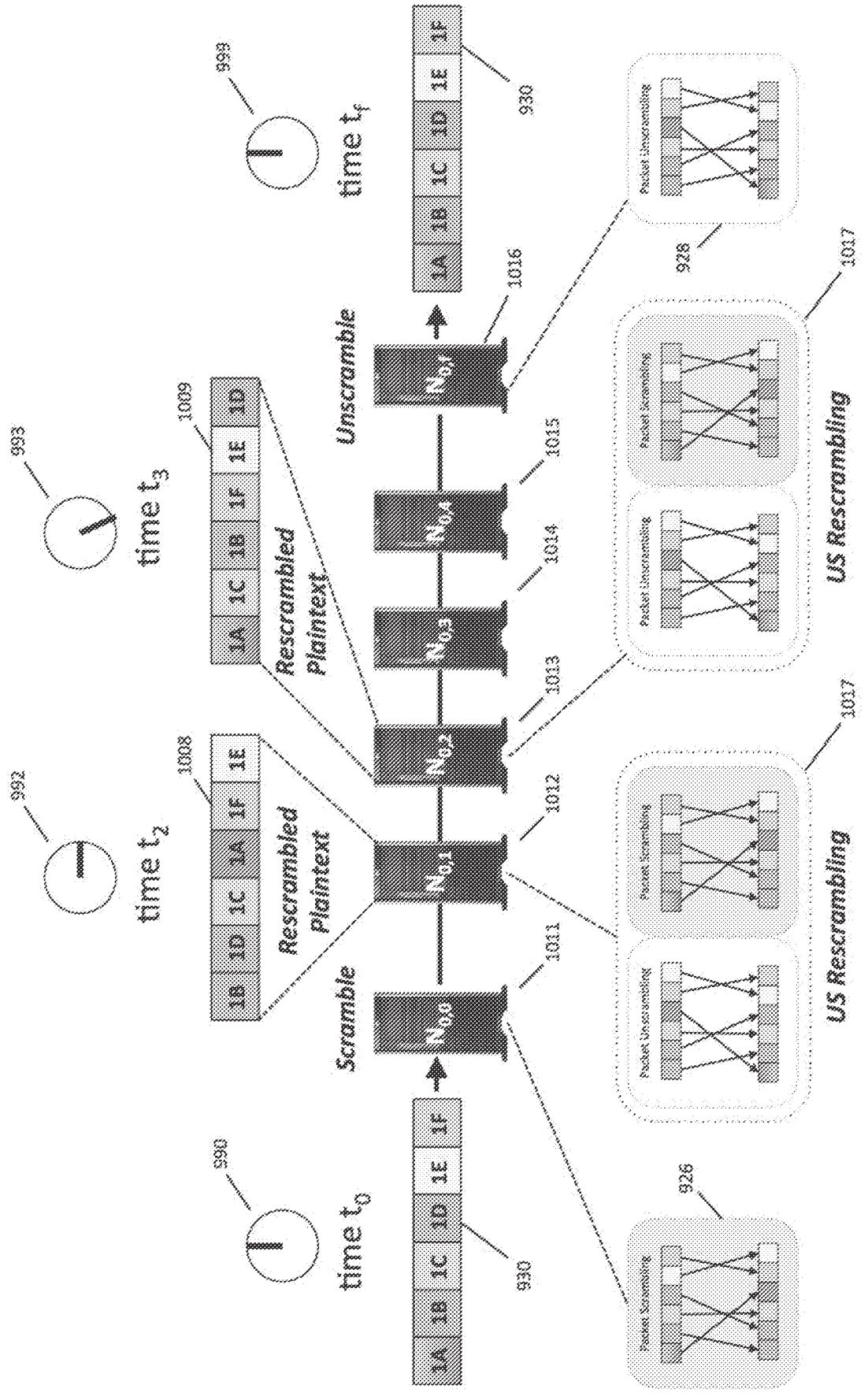

time t_0
time t_2
time t_3
time t_f
990
992
993
993
1A 1B 1C 1D 1E 1F
930
1B 1D 1C 1A 1F 1E
1008
1A 1C 1B 1F 1E 1D
1009
Scramble
Rescrambled Plaintext
Rescrambled Plaintext
Unscramble
$N_{0,0}$
$N_{0,1}$
$N_{0,2}$
$N_{0,3}$
$N_{0,4}$
$N_{0,f}$
1011
1012
1013
1014
1015
1016
1A 1B 1C 1D 1E 1F
930
US Rescrambling
US Rescrambling
1017
1017
926
928
Packet Scrambling
Packet Unscrambling

Figure 54

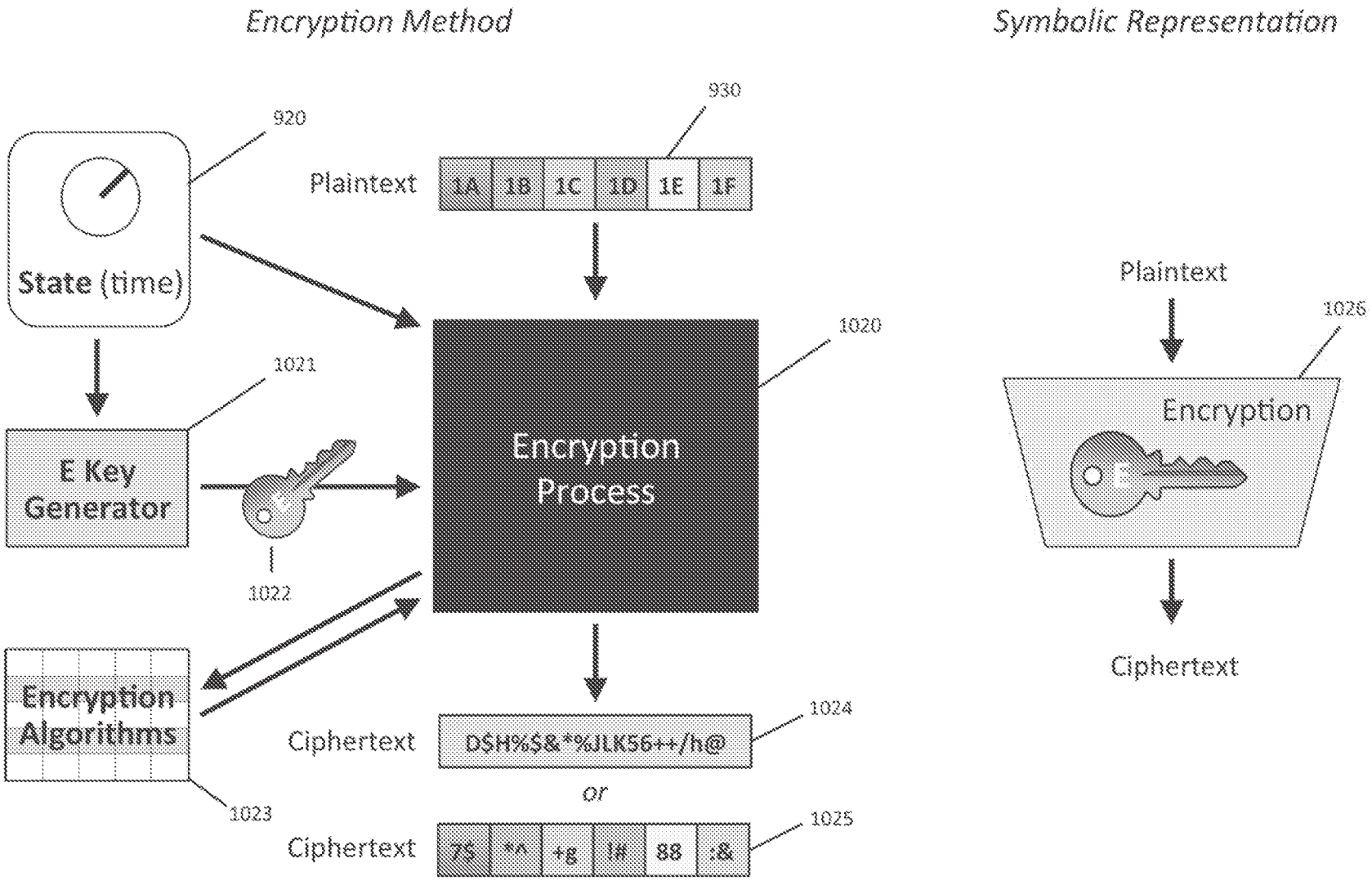

Encryption Method
Symbolic Representation
930
920
Plaintext
1A
1B
1C
1D
1E
1F
State (time)
1020
1021
E Key Generator
Encryption Process
1022
Encryption Algorithms
1023
Ciphertext
D$H%$&*%JLK56++/h@
1024
or
Ciphertext
7$
*^
+g
!#
88
:&
1025
Plaintext
1026
Encryption
Ciphertext

Figure 55A

Packet Decryption

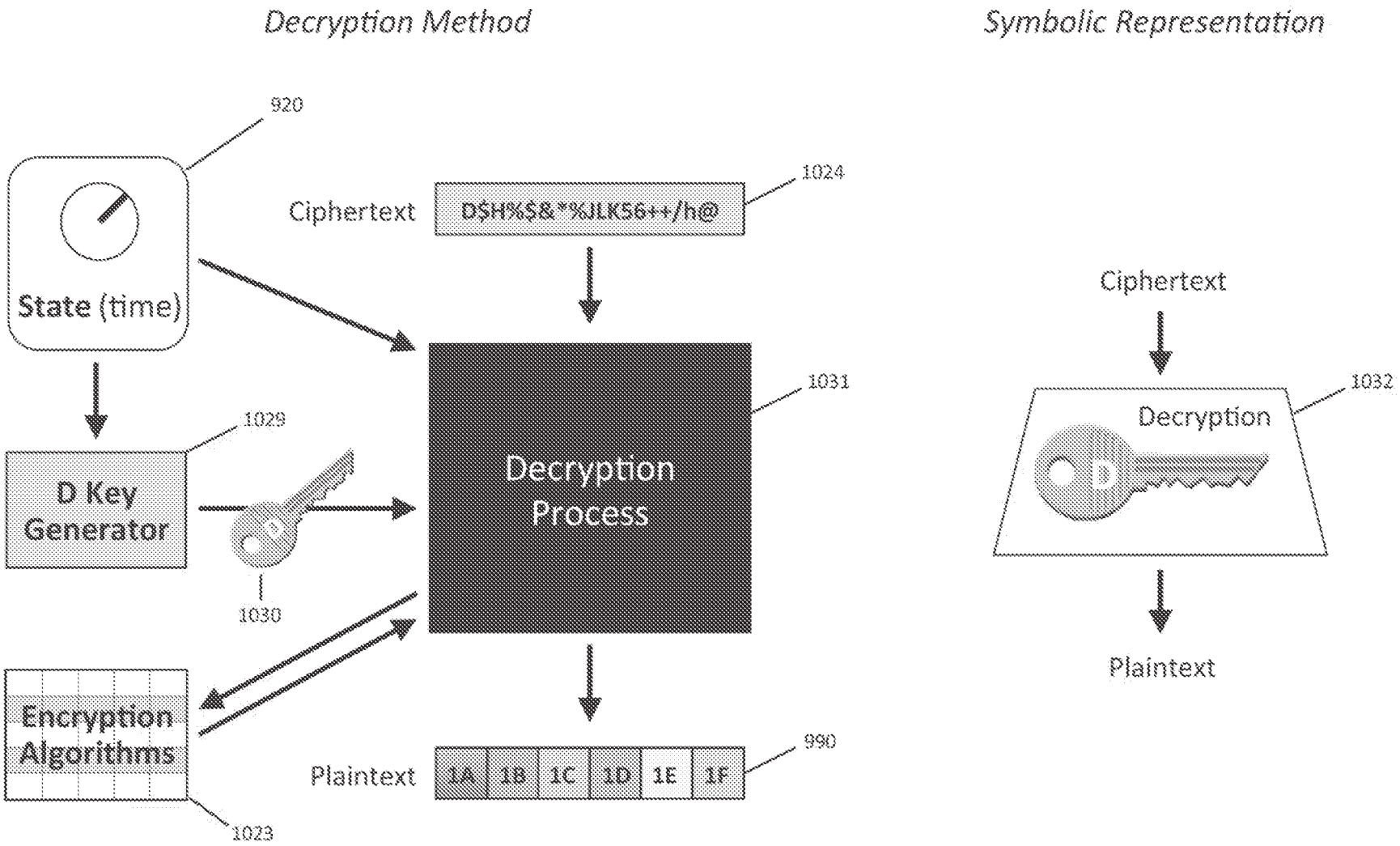


Figure 55B

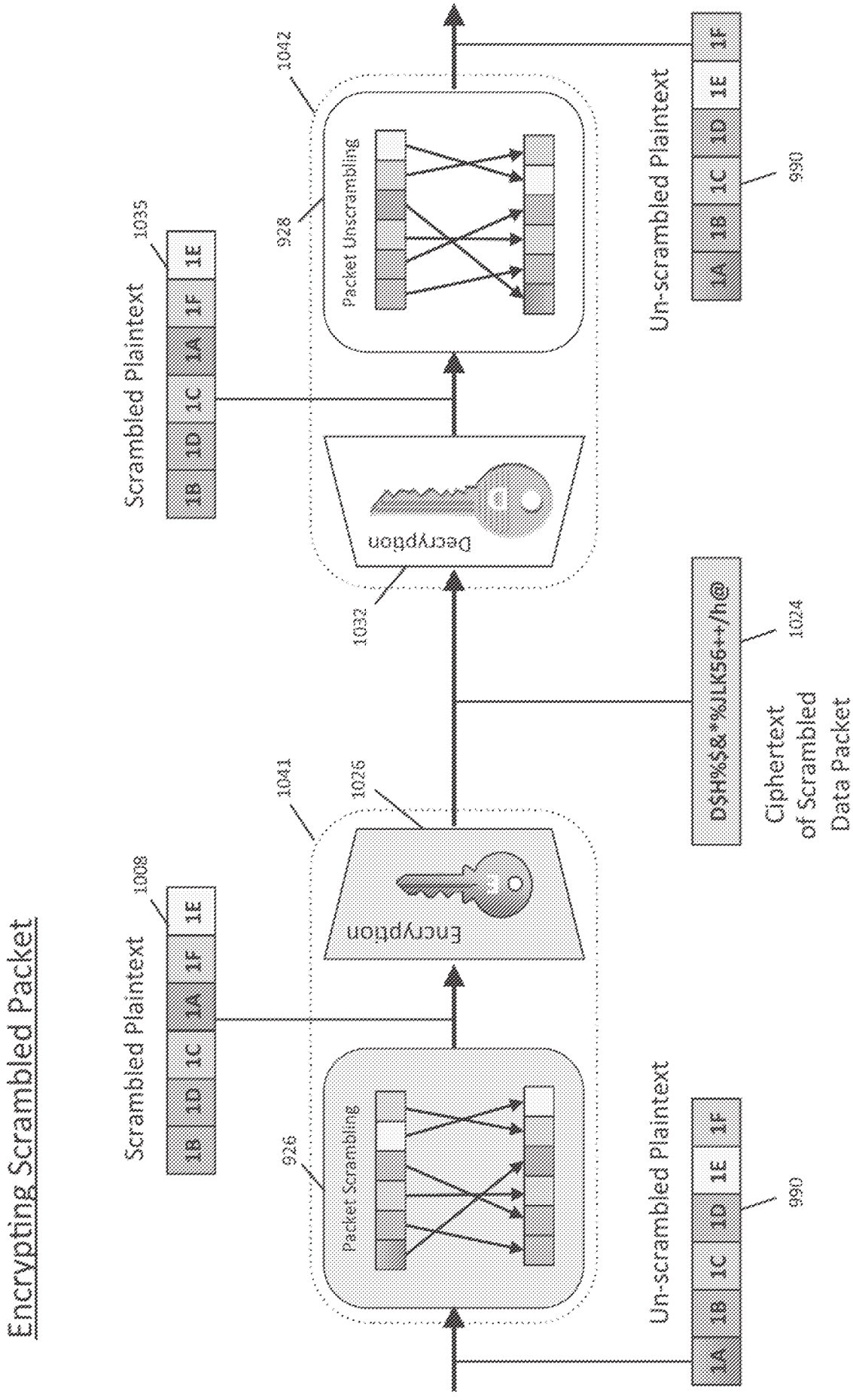

Encrypting Scrambled Packet
Scrambled Plaintext
1008
1B 1D 1C 1A 1F 1E
926
Packet Scrambling
1041
1026
Encryption
Un-scrambled Plaintext
1A 1B 1C 1D 1E 1F
990
DSH%$&**%JLK56++/h@
1024
Ciphertext of Scrambled Data Packet
1032
Decryption
928
Packet Unscrambling
1042
Scrambled Plaintext
1035
1B 1D 1C 1A 1F 1E
Un-scrambled Plaintext
1A 1B 1C 1D 1E 1F
990

Figure 56

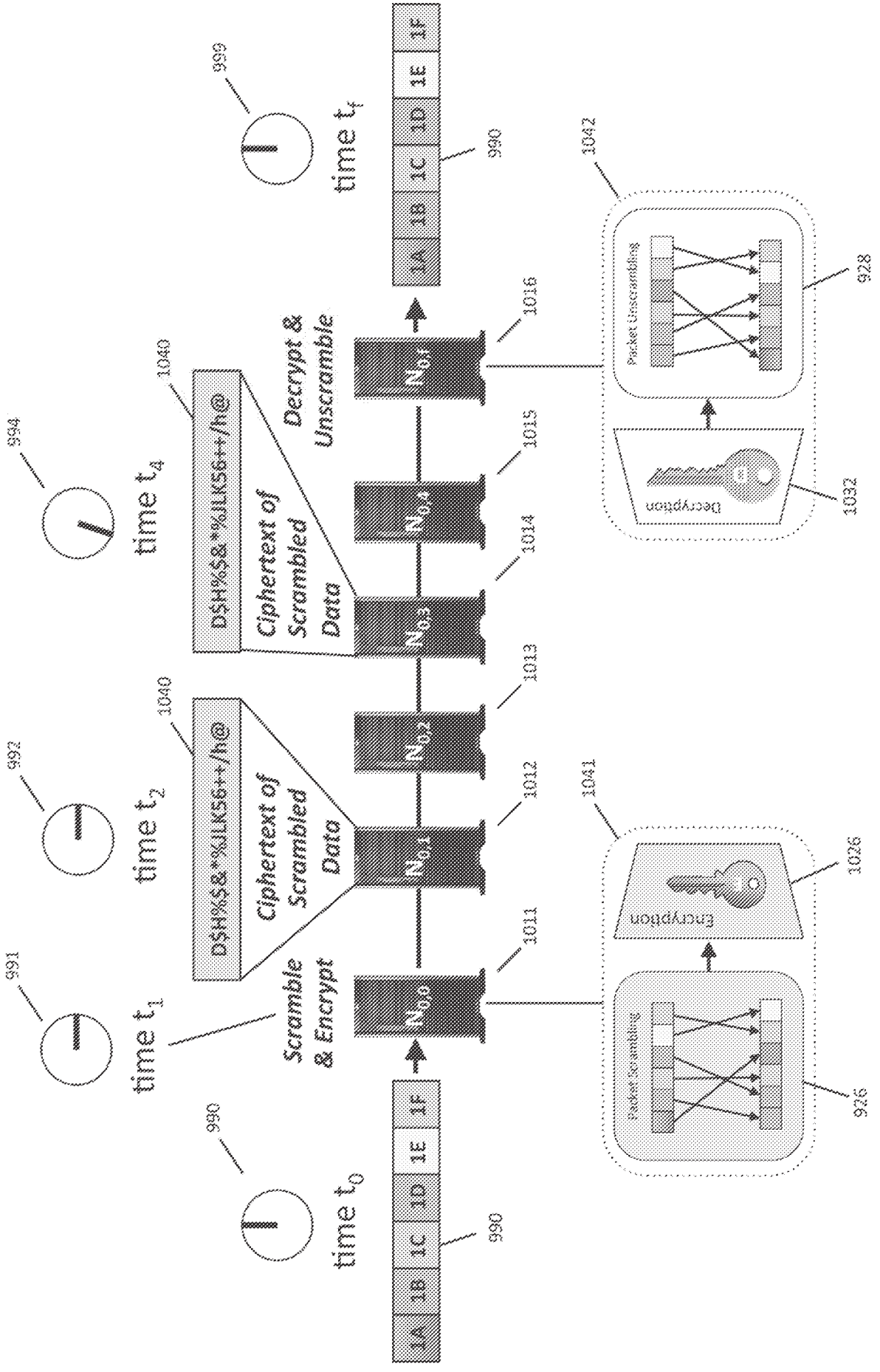

time t_0
time t_1
time t_2
time t_4
time t_f
Scramble & Encrypt
Decrypt & Unscramble
Ciphertext of Scrambled Data
D$H%$&*%JLK56++/h@
Packet Scrambling
Packet Unscrambling
Encryption
Decryption
1A 1B 1C 1D 1E 1F
990
991
992
994
999
1011
1012
1013
1014
1015
1016
1026
1032
1040
1041
1042
926
928

Figure 57

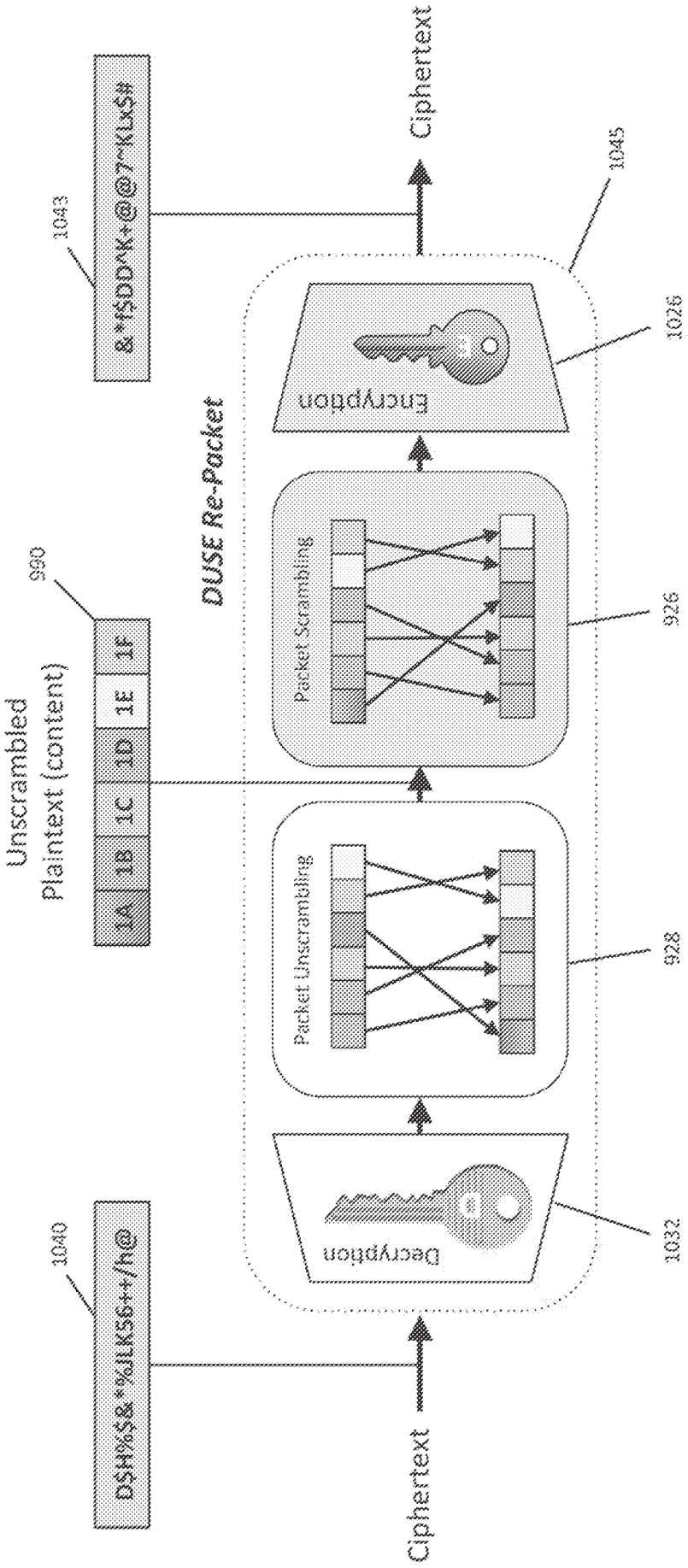

Ciphertext
1040
D$H%$&*%JLK56++/h@
Unscrambled
Plaintext (content)
990
1A
1B
1C
1D
1E
1F
DUSE Re-Packet
Decryption
1032
Packet Unscrambling
928
Packet Scrambling
926
Encryption
1026
1045
1043
&*fSDD^K+@@7~KLxS#
Ciphertext

Figure 58

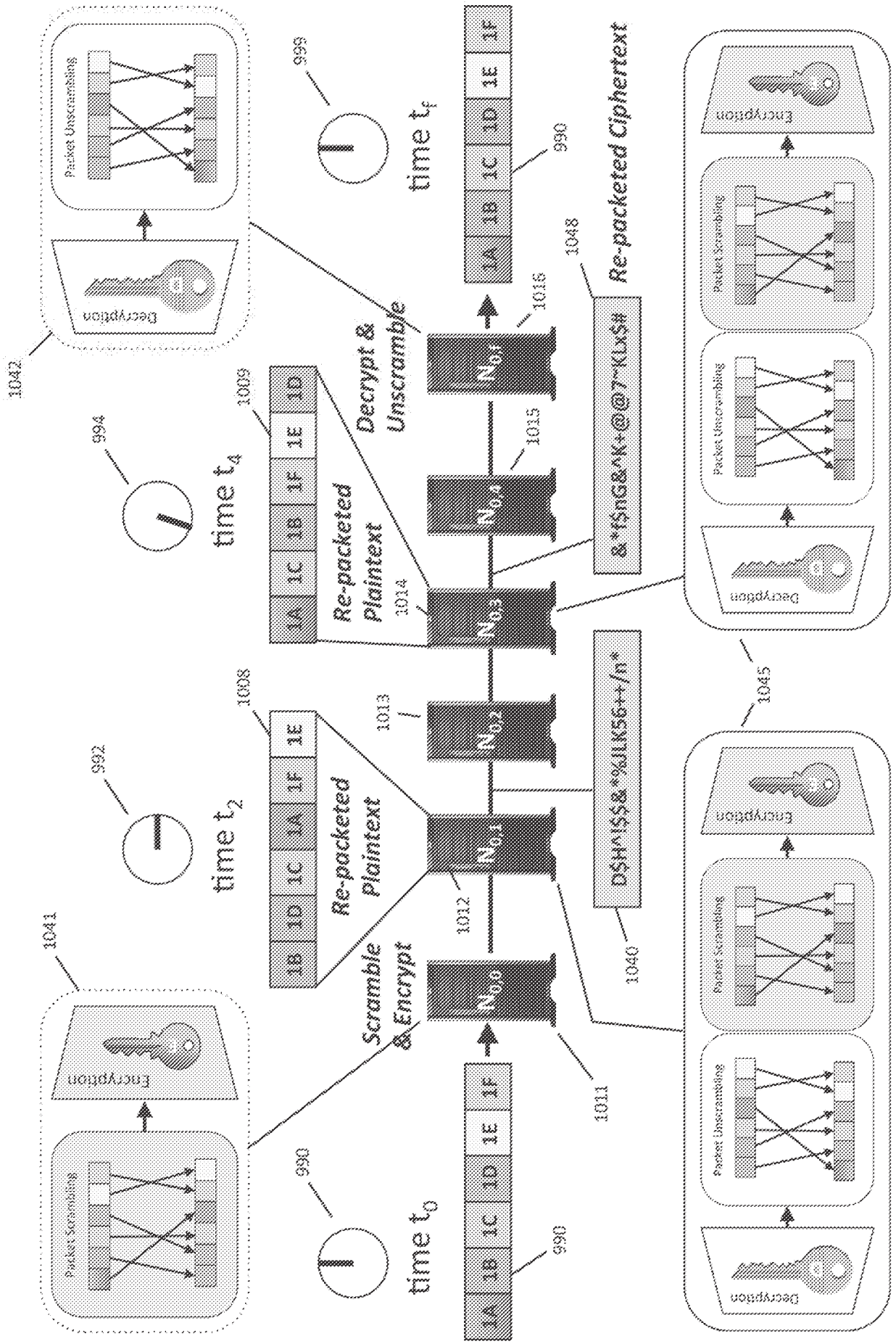

time t_0
time t_2
time t_4
time t_f
990
992
994
999
1A 1B 1C 1D 1E 1F
1B 1D 1C 1A 1F 1E
1A 1C 1B 1F 1E 1D
1A 1B 1C 1D 1E 1F
Scramble & Encrypt
Re-packeted Plaintext
Decrypt & Unscramble
Re-packeted Plaintext
Re-packeted Ciphertext
D$H^I$$&*%JLK56++/n*
&*fSnG&^K+@@7~KLx$#
$N_{0,0}$
$N_{0,1}$
$N_{0,2}$
$N_{0,3}$
$N_{0,4}$
$N_{0,f}$
1011
1012
1013
1014
1015
1016
1040
1041
1042
1045
1048
Encryption
Packet Scrambling
Packet Unscrambling
Decryption
DUSE Re-Packet
DUSE Re-Packet

Figure 59

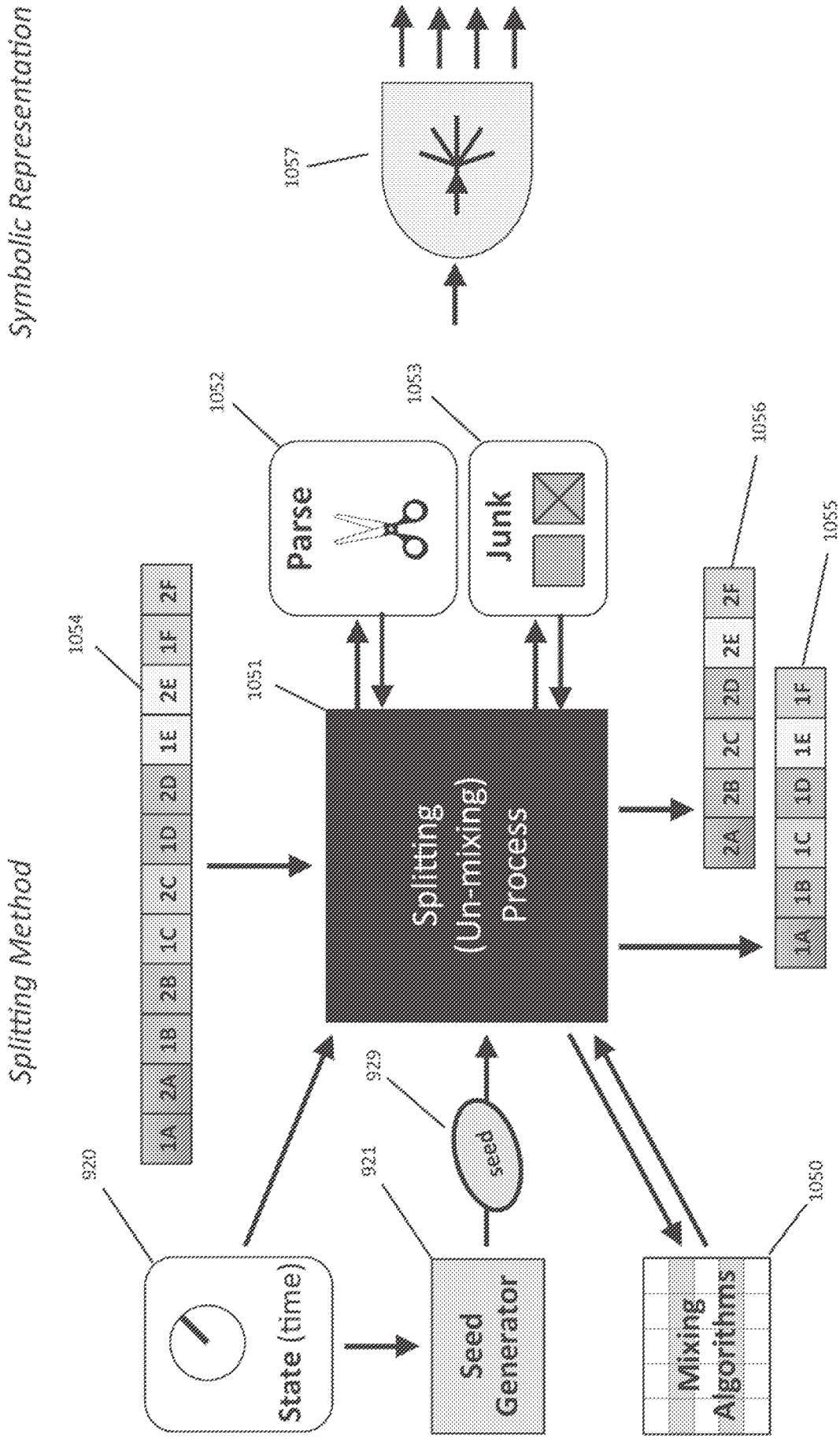

Symbolic Representation
Splitting Method
1057
1052
1053
Parse
Junk
1054
1A 2A 1B 2B 1C 2C 1D 2D 1E 2E 1F 2F
1051
Splitting (Un-mixing) Process
1056
2A 2B 2C 2D 2E 2F
1055
1A 1B 1C 1D 1E 1F
920
State (time)
921
Seed Generator
929
seed
1050
Mixing Algorithms

Figure 60A

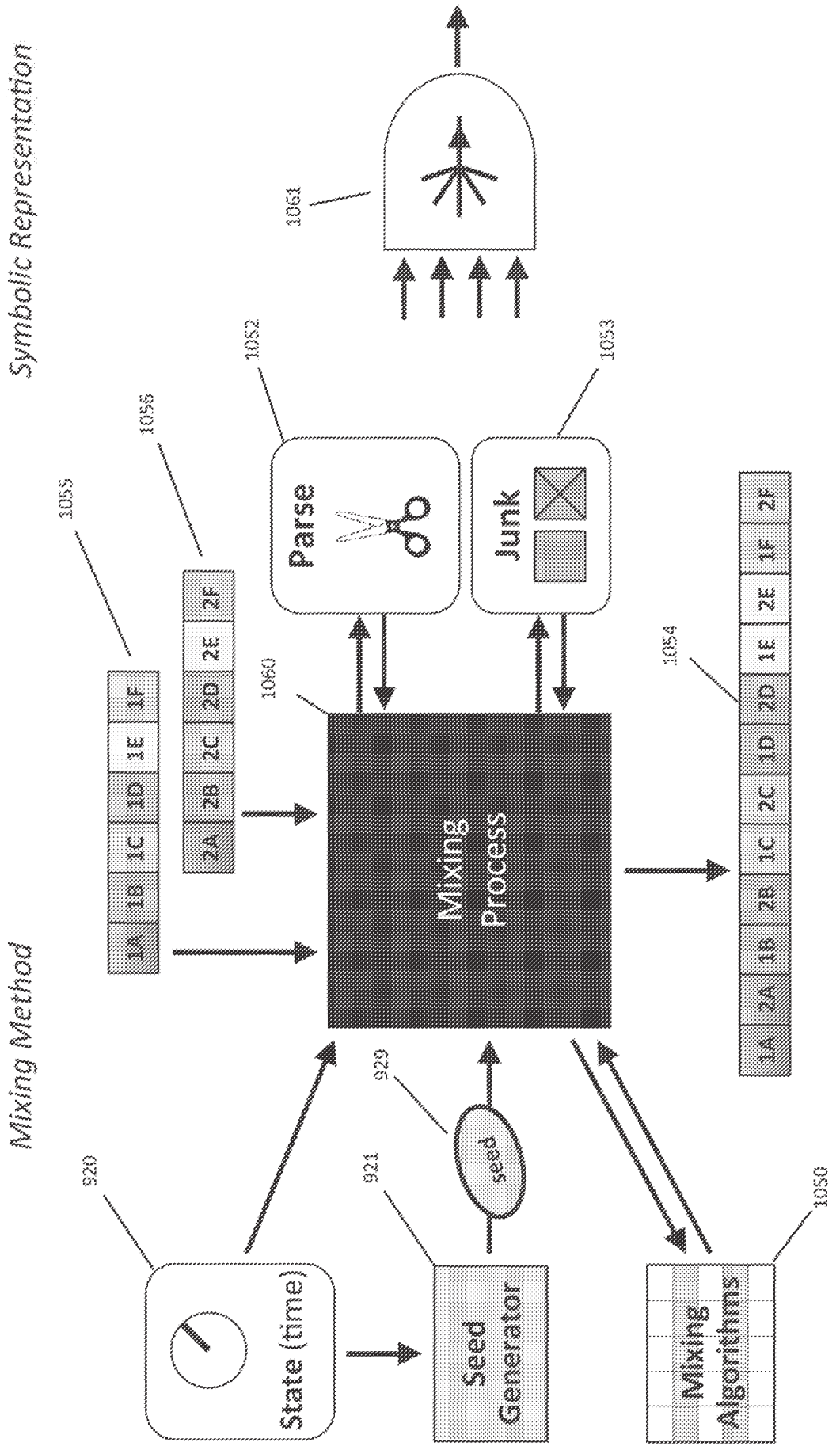

Symbolic Representation
Mixing Method
1061
1052
1053
1056
1055
Parse
Junk
1060
Mixing Process
1054
1A 1B 1C 1D 1E 1F
2A 2B 2C 2D 2E 2F
1A 2A 1B 2B 1C 2C 1D 2D 1E 2E 1F 2F
920
921
929
seed
State (time)
Seed Generator
Mixing Algorithms
1050

Figure 60B

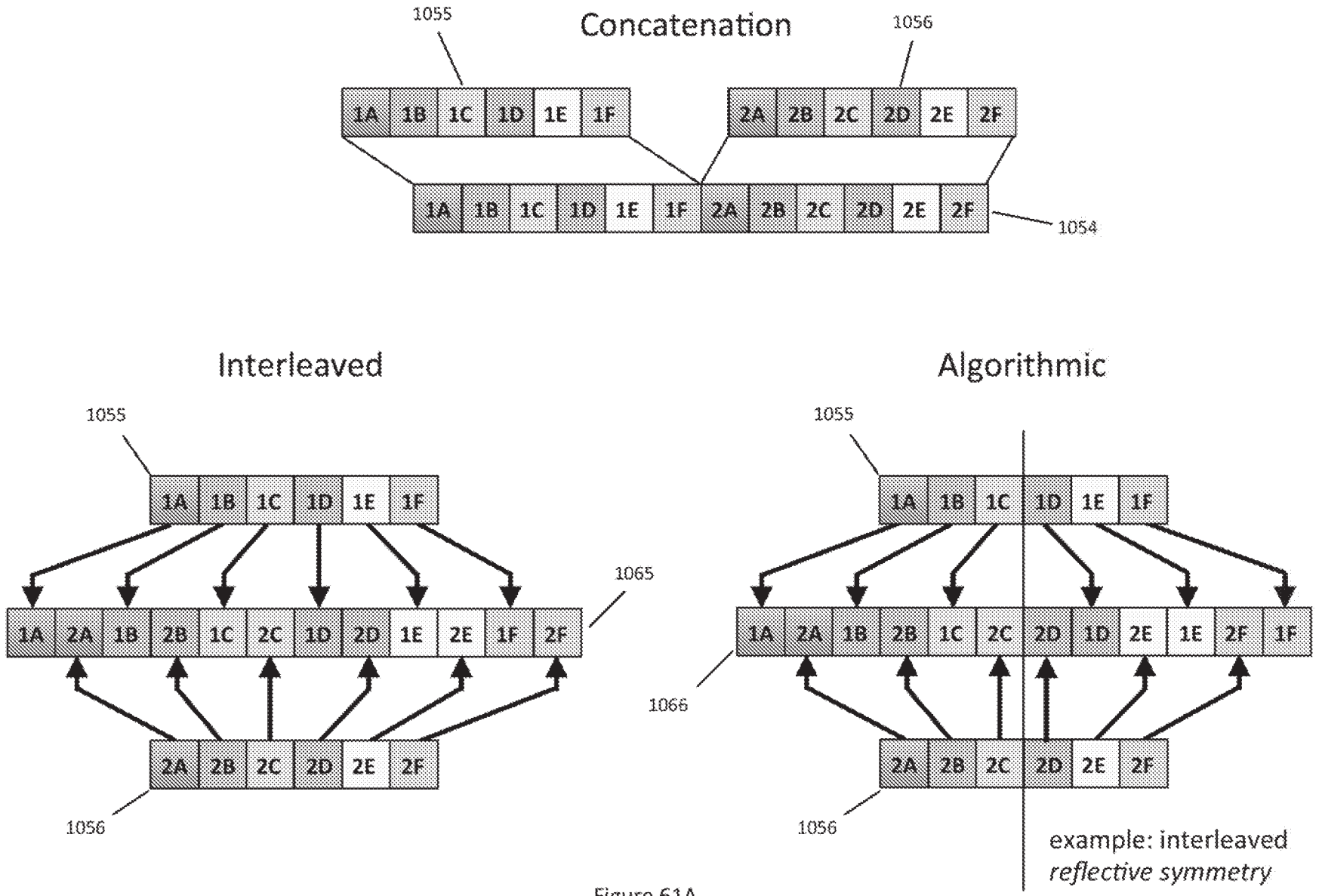

Concatenation
1055
1056
1A 1B 1C 1D 1E 1F
2A 2B 2C 2D 2E 2F
1A 1B 1C 1D 1E 1F 2A 2B 2C 2D 2E 2F
1054
Interleaved
1055
1A 1B 1C 1D 1E 1F
1065
1A 2A 1B 2B 1C 2C 1D 2D 1E 2E 1F 2F
2A 2B 2C 2D 2E 2F
1056
Algorithmic
1055
1A 1B 1C 1D 1E 1F
1066
1A 2A 1B 2B 1C 2C 2D 1D 2E 1E 2F 1F
2A 2B 2C 2D 2E 2F
1056
example: interleaved
reflective symmetry

Figure 61A

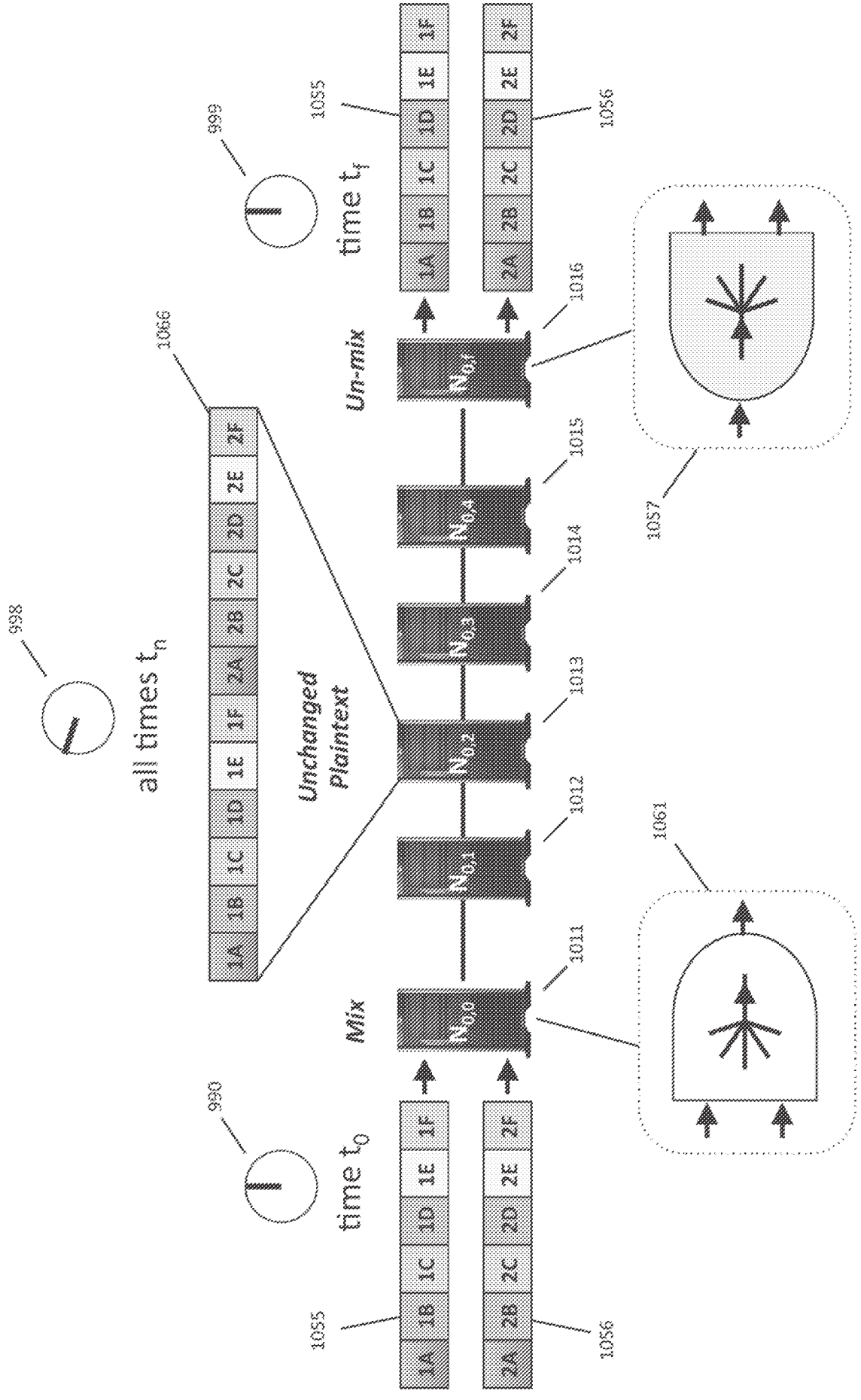

998
all times t_n
1066
1A 1B 1C 1D 1E 1F 2A 2B 2C 2D 2E 2F
Unchanged Plaintext
990
time t_0
Mix
1055
1A 1B 1C 1D 1E 1F
2A 2B 2C 2D 2E 2F
1056
1011
1012
1013
1014
1015
1016
999
time t_f
Un-mix
1061
1057

Figure 61B

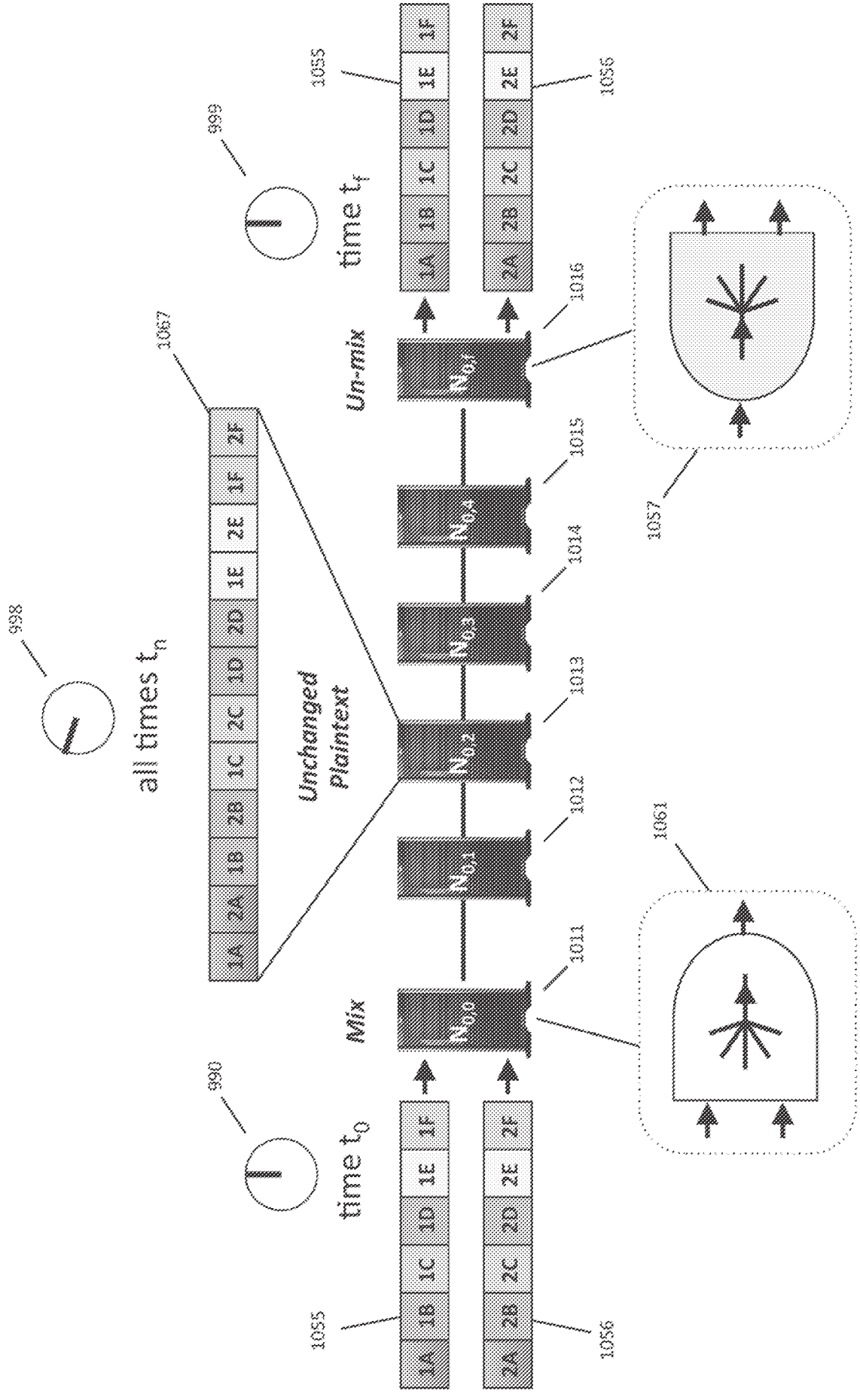

998
all times t_n
1067
1A 2A 1B 2B 1C 2C 1D 2D 1E 2E 1F 2F
Unchanged Plaintext
990
time t_0
Mix
1055
1A 1B 1C 1D 1E 1F
2A 2B 2C 2D 2E 2F
1056
1011
1012
1013
1014
1015
1016
N_{01} N_{02} N_{03} N_{04} N_{05}
Un-mix
999
time t_f
1055
1A 1B 1C 1D 1E 1F
2A 2B 2C 2D 2E 2F
1056
1061
1057

Figure 61C

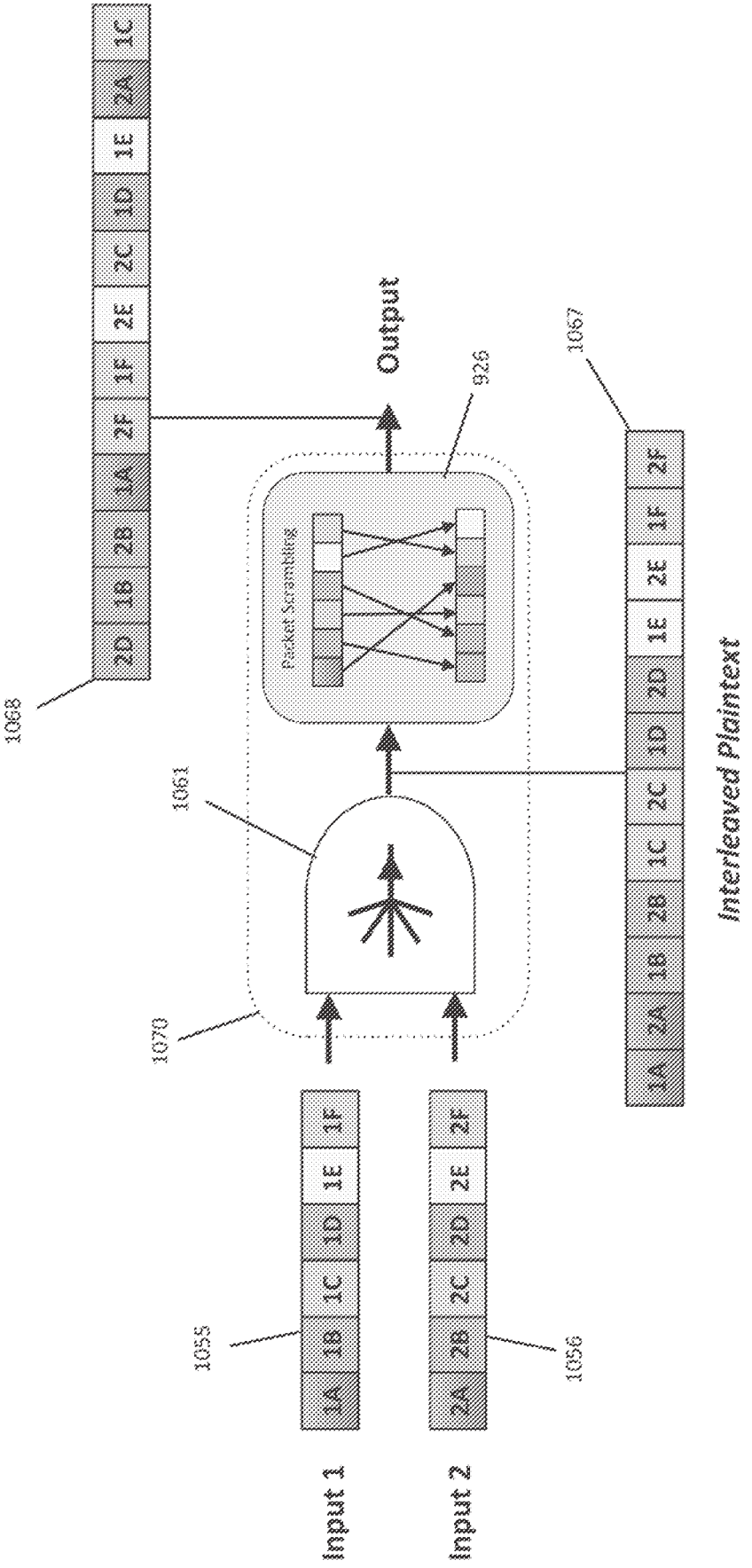

Input 1
Input 2
1A 1B 1C 1D 1E 1F
2A 2B 2C 2D 2E 2F
1055
1056
1061
1070
Packet Scrambling
926
Output
1067
1A 2A 1B 2B 1C 2C 1D 2D 1E 2E 1F 2F
Interleaved Plaintext
1068
2D 1B 2B 1A 2F 1F 2E 2C 1D 1E 2A 1C

Figure 62A

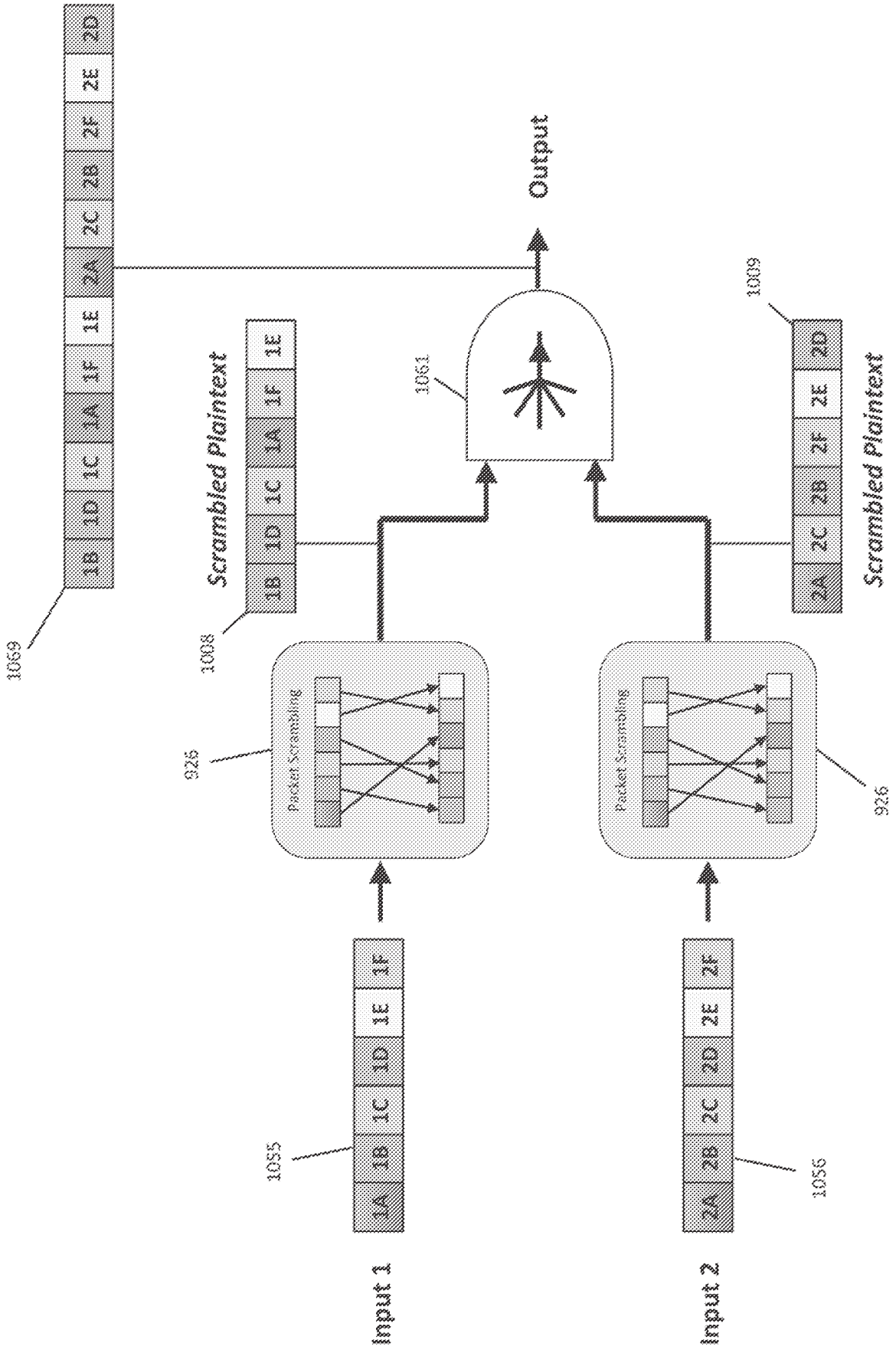

Input 1
Input 2
1A 1B 1C 1D 1E 1F
2A 2B 2C 2D 2E 2F
1055
1056
Packet Scrambling
925
926
Scrambled Plaintext
1008
1009
1061
Output
1059

Figure 62B

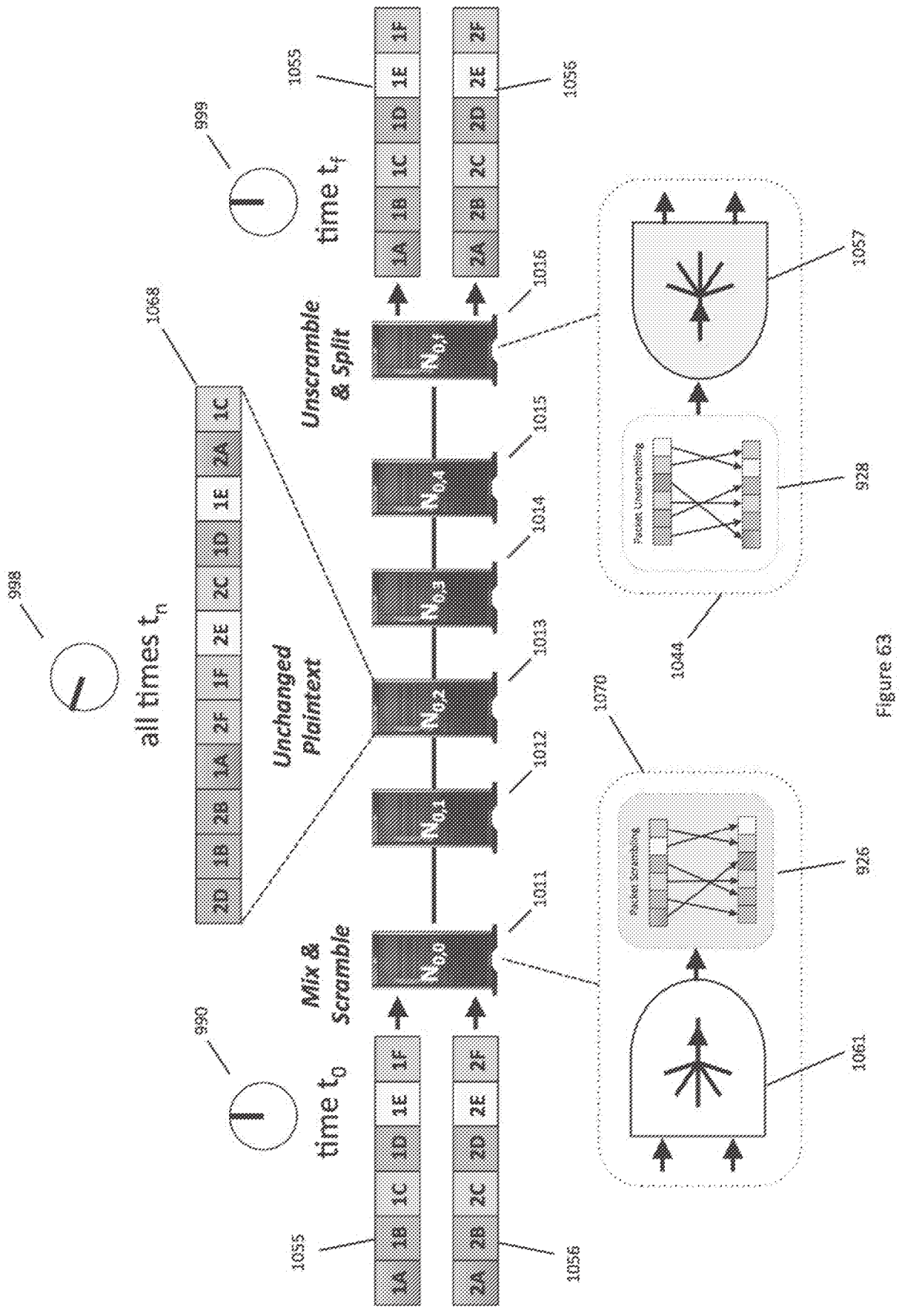

998
all times t_n
2D 1B 2B 1A 2F 1F 2E 2C 1D 1E 2A 1C
1068
Unchanged Plaintext
990
time t_0
Mix & Scramble
1A 1B 1C 1D 1E 1F
2A 2B 2C 2D 2E 2F
1055
1056
N_{00}
N_{01}
N_{02}
N_{03}
N_{04}
N_{0j}
1011
1012
1013
1014
1015
1016
Unscramble & Split
999
time t_f
1055
1056
1A 1B 1C 1D 1E 1F
2A 2B 2C 2D 2E 2F
1070
Packet Scrambling
926
1061
1044
Packet Unscrambling
928
1057

Figure 63

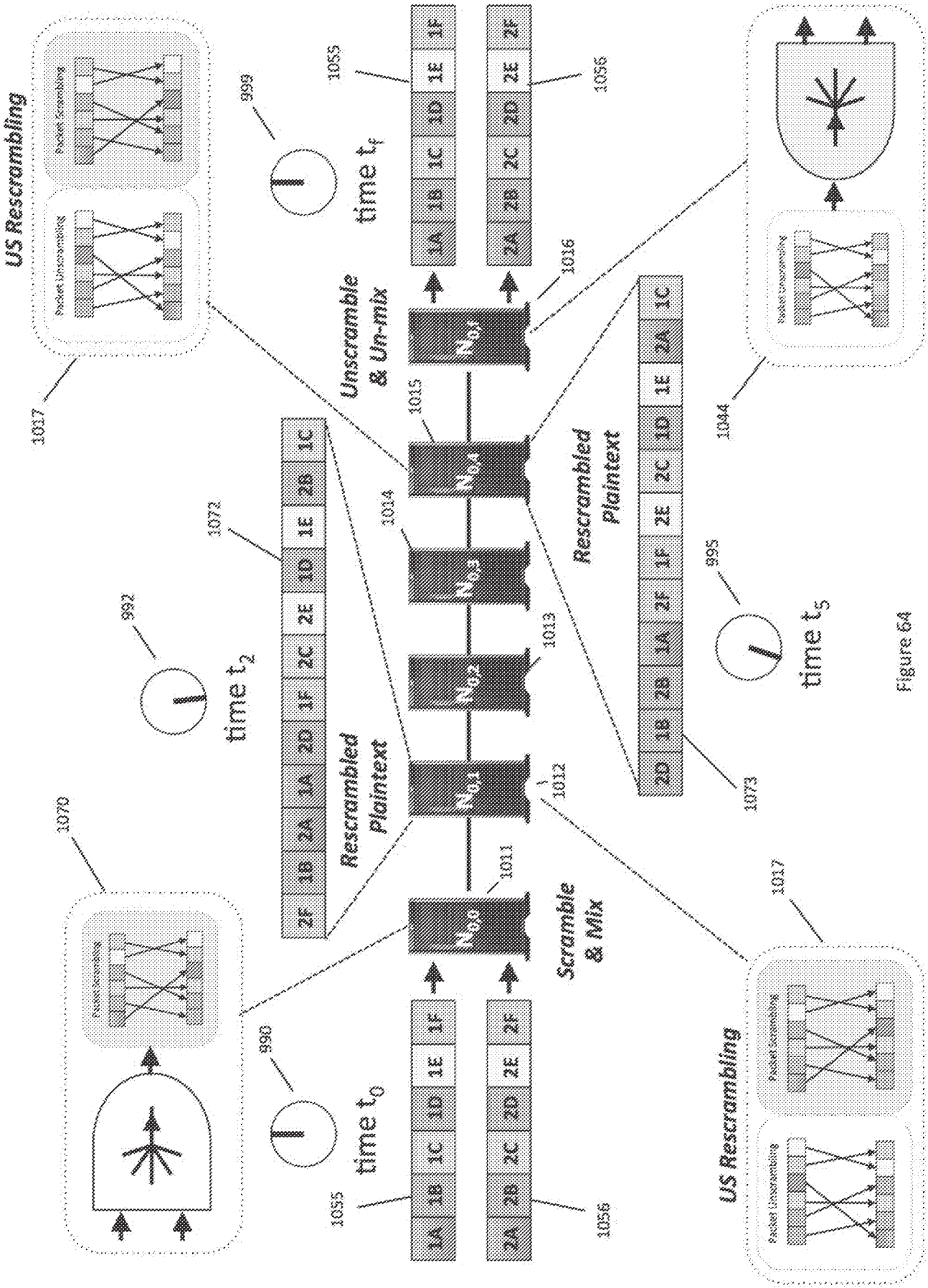

US Rescrambling
Packet Unscrambling
Packet Scrambling
1017
1070
990
time t_0
1055
1A 1B 1C 1D 1E 1F
2A 2B 2C 2D 2E 2F
1056
992
time t_2
1072
2F 1B 2A 1A 2D 1F 2C 2E 1D 1E 2B 1C
Rescrambled Plaintext
1011
1012
1013
1014
1015
1016
Scramble & Mix
Unscramble & Un-mix
999
time t_f
1055
1A 1B 1C 1D 1E 1F
2A 2B 2C 2D 2E 2F
1056
Rescrambled Plaintext
1073
2D 1B 2B 1A 2F 1F 2E 2C 1D 1E 2A 1C
995
time t_5
1044
US Rescrambling
1017

Figure 64

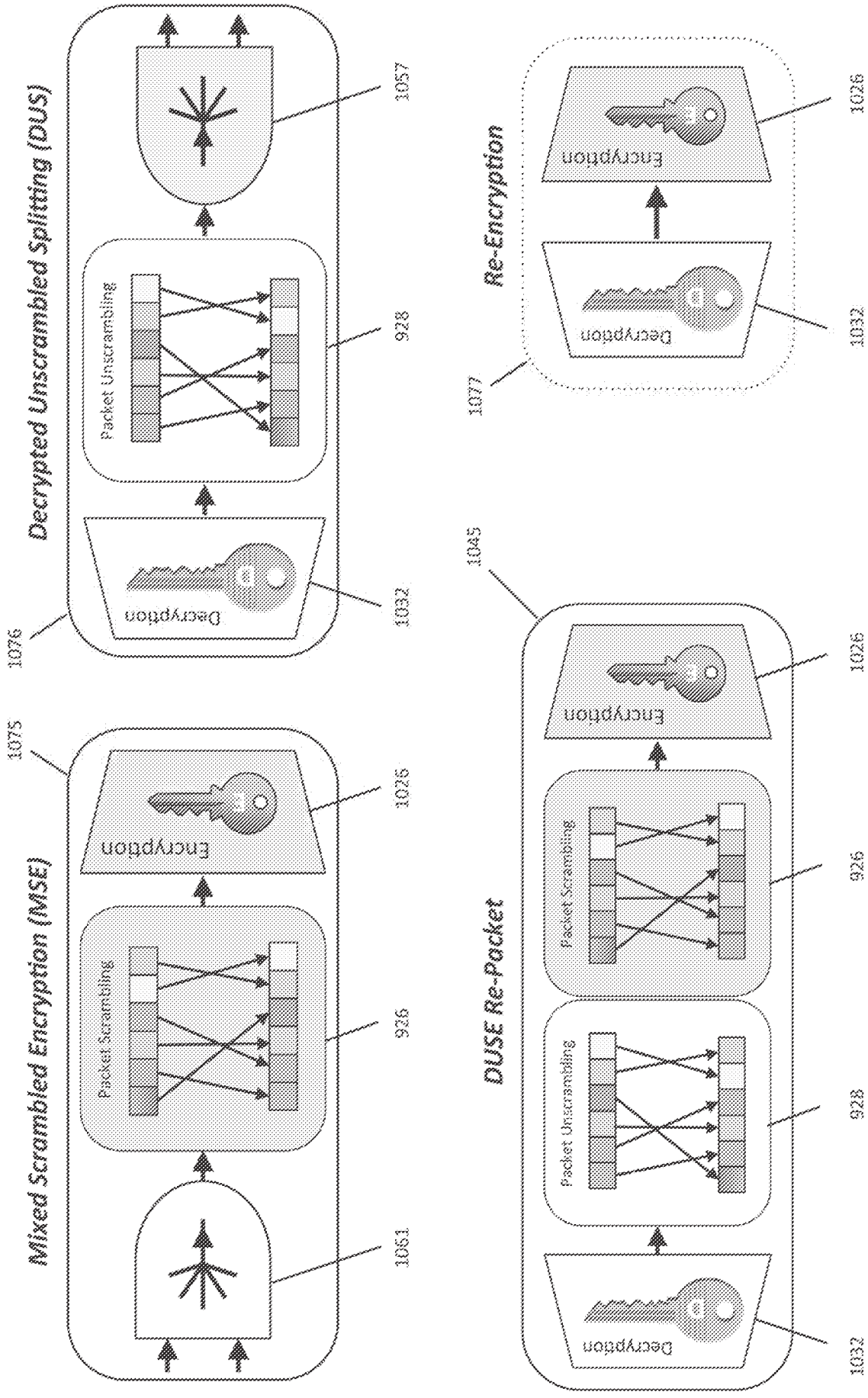

Mixed Scrambled Encryption (MSE)
Encryption
Packet Scrambling
1075
1026
926
1051
Decrypted Unscrambled Splitting (DUS)
Decryption
Packet Unscrambling
1076
1032
928
1057
DUSE Re-Packet
1045
Encryption
Packet Scrambling
Packet Unscrambling
Decryption
1026
926
928
1032
Re-Encryption
1077
Encryption
Decryption
1026
1032

Figure 65

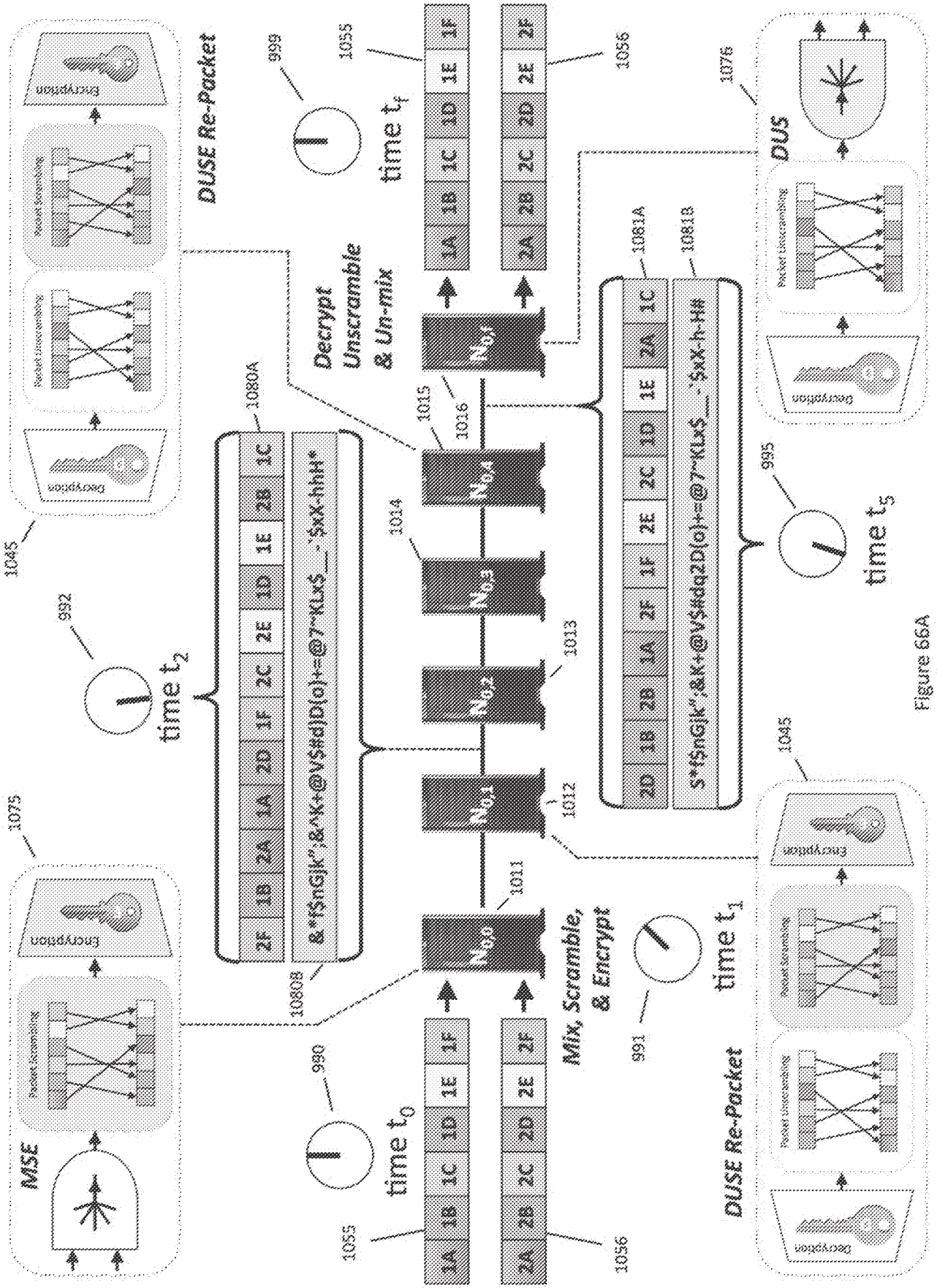

MSE
DUSE Re-Packet
DUS
Encryption
Packet Scrambling
Packet Unscrambling
Decryption
Decrypt
Unscramble
& Un-mix
Mix, Scramble,
& Encrypt
time t_0
time t_1
time t_2
time t_f
time t_5
1A 1B 1C 1D 1E 1F
2A 2B 2C 2D 2E 2F
&*f$nGjk";&^K+@V$#d]D[o]+=@7~KLx$__`$xX-hnH*
s*f$nGjk";&K+@V$#dq2D[o]+=@7~KLx$__`$xX-h-H#
No.0
No.1
No.2
No.3
No.4
No.1
990
991
992
995
999
1011
1012
1013
1014
1015
1016
1036
1045
1055
1056
1075
1076
10808
1080A
1081A
1081B

Figure 66A

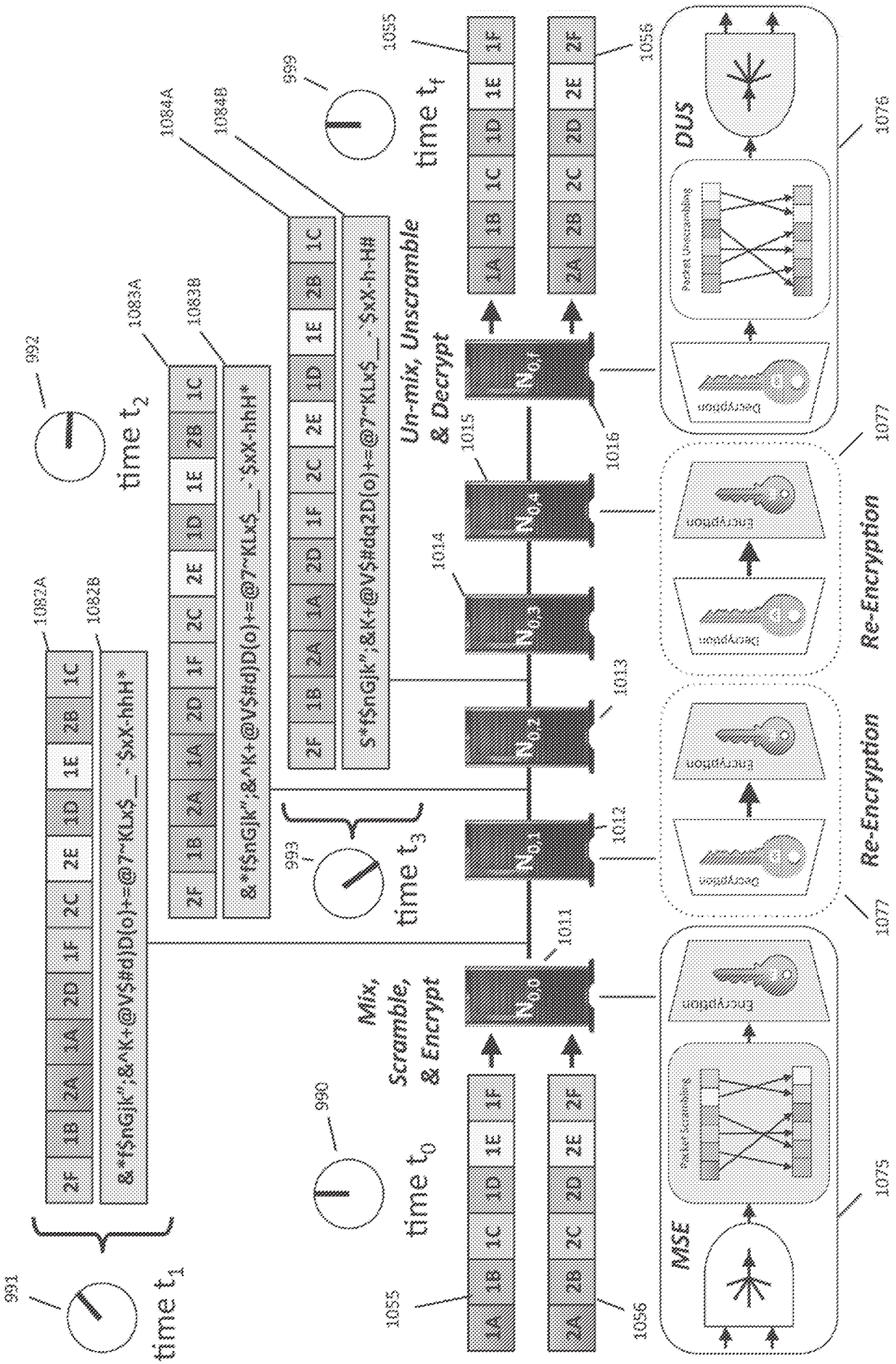

991
time t_1
2F 1B 2A 1A 2D 1F 2C 2E 1D 1E 2B 1C
1082A
1082B
&*t$nGjk";&^K+@V$#dJD(o)+=@7~KLx$__`$xX-hhH*
992
time t_2
1083A
1083B
2F 1B 2A 1A 2D 1F 2C 2E 1D 1E 2B 1C
&*t$nGjk";&^K+@V$#dJD(o)+=@7~KLx$__`$xX-hhH*
1084A
1084B
999
time t_4
1055
2F 1B 2A 1A 2D 1F 2C 2E 1D 1E 2B 1C
s*t$nGjk";&K+@V$#dq2D(o)+=@7~KLx$__`$xX-h-H#
990
time t_0
Mix, Scramble, & Encrypt
993
time t_3
Un-mix, Unscramble & Decrypt
1014
1015
1016
1055
1A 1B 1C 1D 1E 1F
2A 2B 2C 2D 2E 2F
N_{00} N_{01} N_{02} N_{03} N_{04} N_{07}
1011
1012
1013
1056
MSE
Packet Scrambling
Encryption
Re-Encryption
Re-Encryption
Decryption
Packet Unscrambling
DUS
1075
1077
1077
1076

Figure 66B

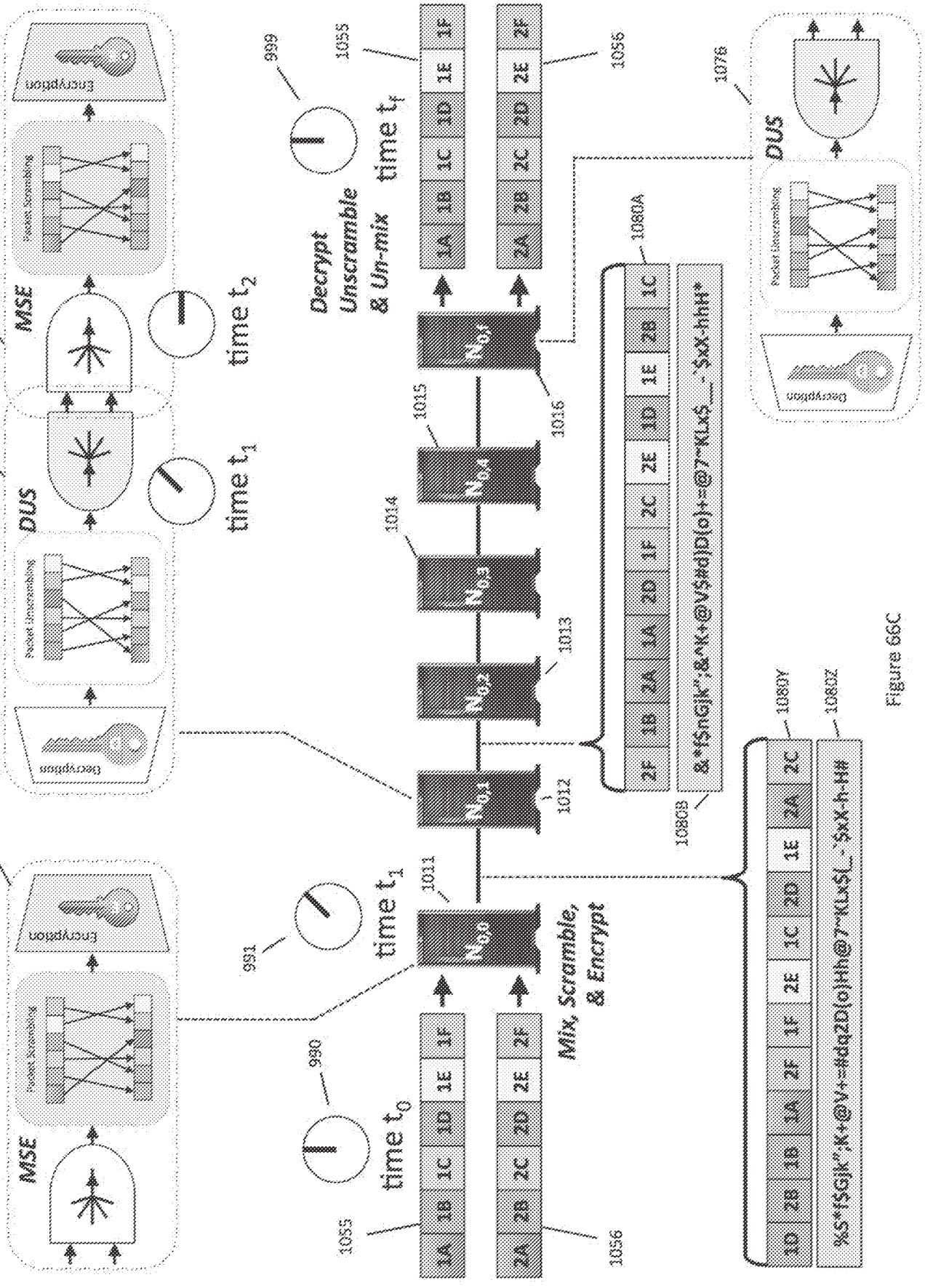

Incoming State 991
Outgoing State 992
MSE
DUS
Encryption
Packet Scrambling
Packet Unscrambling
time t_0
time t_1
time t_2
time t_f
Mix, Scramble, & Encrypt
Decrypt Unscramble & Un-mix
1055
1056
1075
1076
1080A
1080B
1080Y
1080Z
1011
1012
1013
1014
1015
1016
999
991
980
&*fSnGjk";&^K+@V$#d)D(o)+=@7~KLx$__`$xX-hHH*
%S*fSGjk";K+@V+=#dq2D(o)Hh@7~KLxSL_`$xX-h-H#

Figure 66C

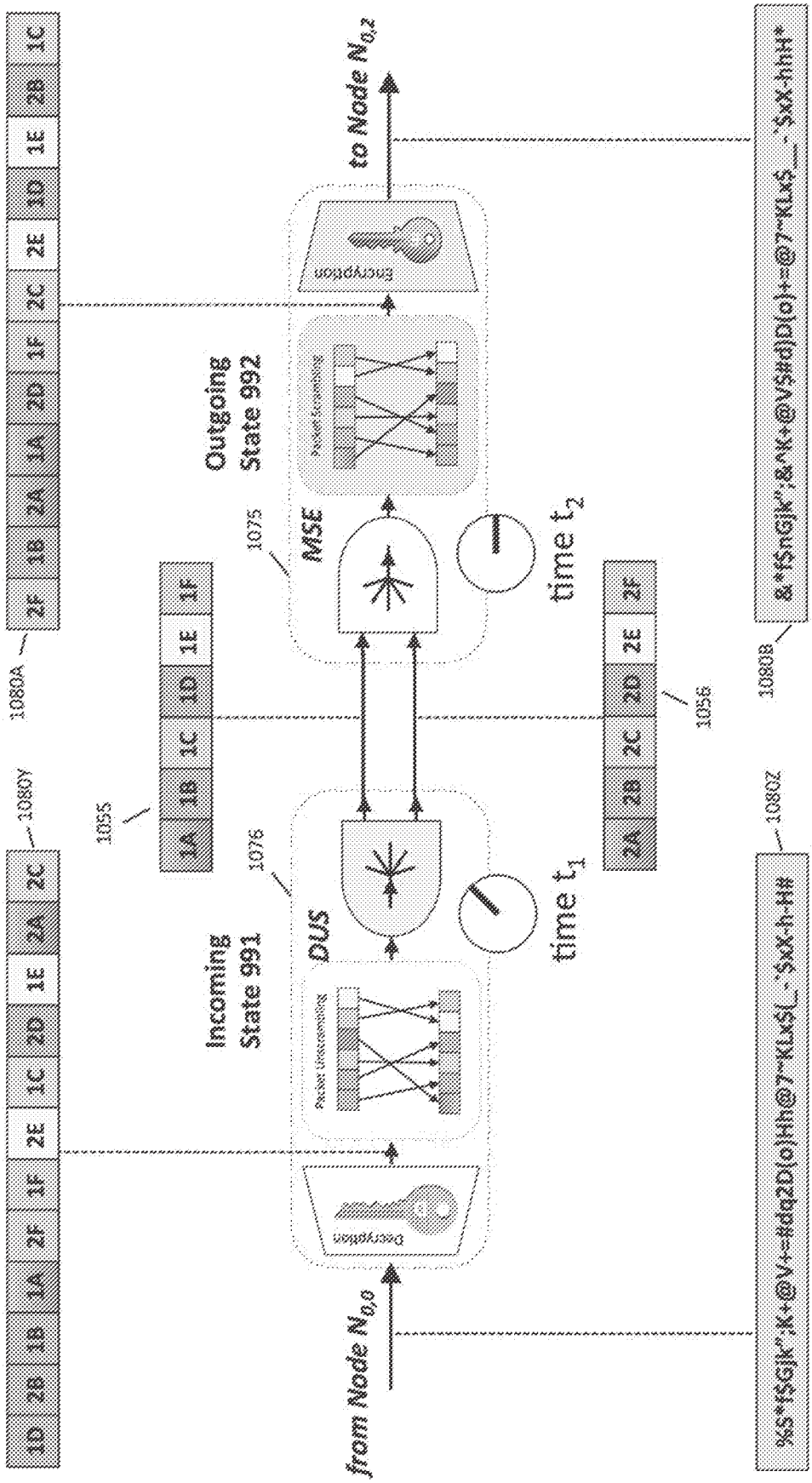

1D 2B 1B 1A 2F 1F 2E 1C 2D 1E 2A 2C
1080Y
1D 2B 1B 1A 2F 1F 2E 1C 2D 1E 2A 2C 2F 1B 2A 1A 2D 1F 2C 2E 1D 1E 2B 1C
1080A
from Node $N_{0,0}$
Incoming State 991
1055
1A 1B 1C 1D 1E 1F
1076
DUS
Decryption
Packet Unscrambling
%S*fSGjk";K+@V+=#dq2D(o)Hn@7~KLx$L_`$xX-h-H#
1080Z
time t_1
time t_2
1075
MSE
Outgoing State 992
Encryption
Packet Scrambling
to Node $N_{0,2}$
2A 2B 2C 2D 2E 2F
1056
1080B
&*fSnGjk";&^K+@V$#d)D(o)+=@7~KLx$__`$xX-hhH*

Figure 66D

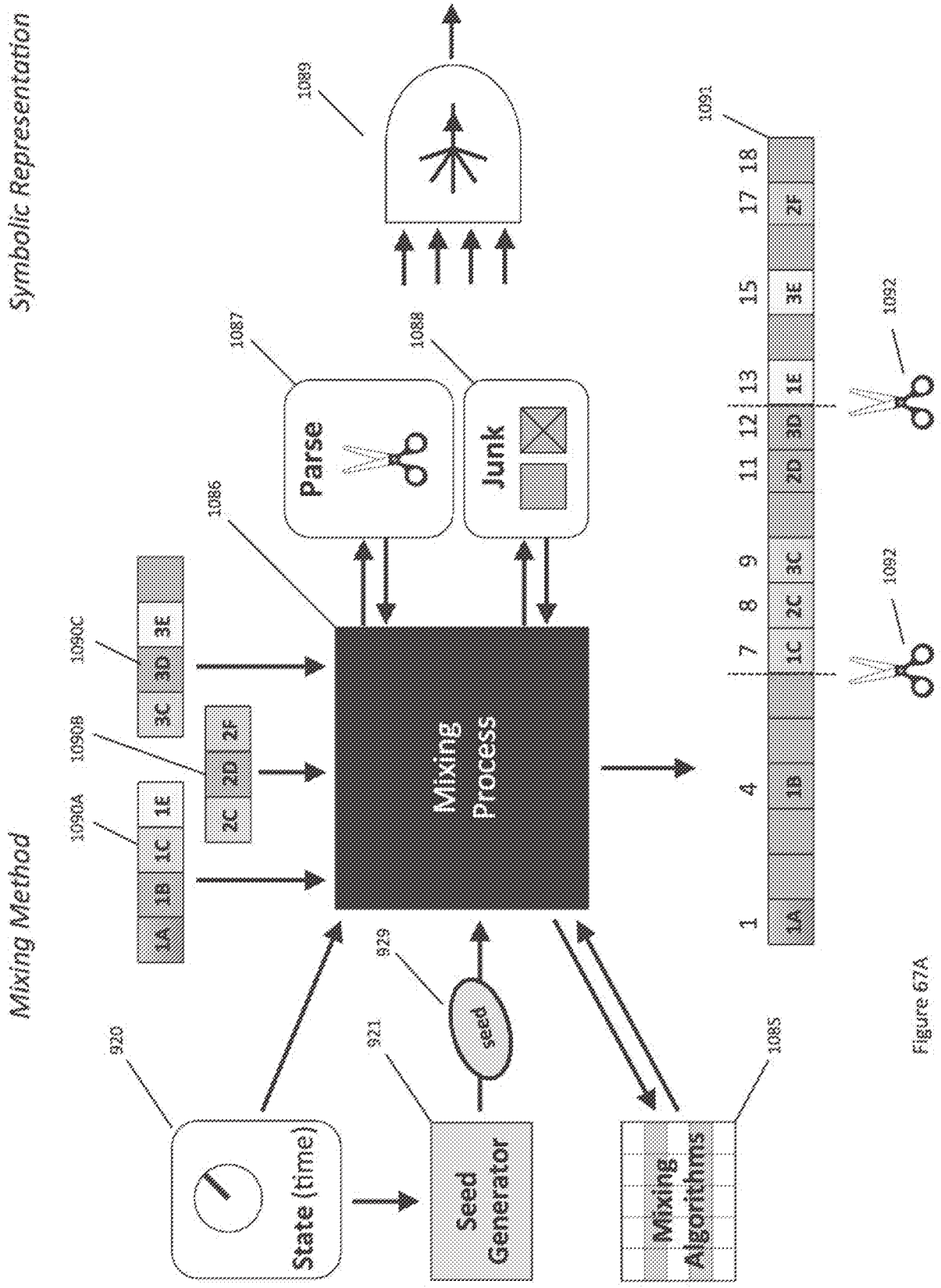

Symbolic Representation
Mixing Method
State (time)
Seed Generator
seed
Mixing Algorithms
Mixing Process
Parse
Junk
1A
1B
1C
1E
2C
2D
2F
3C
3D
3E
1
4
7
8
9
11
12
13
15
17
18
920
921
929
1085
1086
1087
1088
1089
1090A
1090B
1090C
1091
1092
1092

Figure 67A

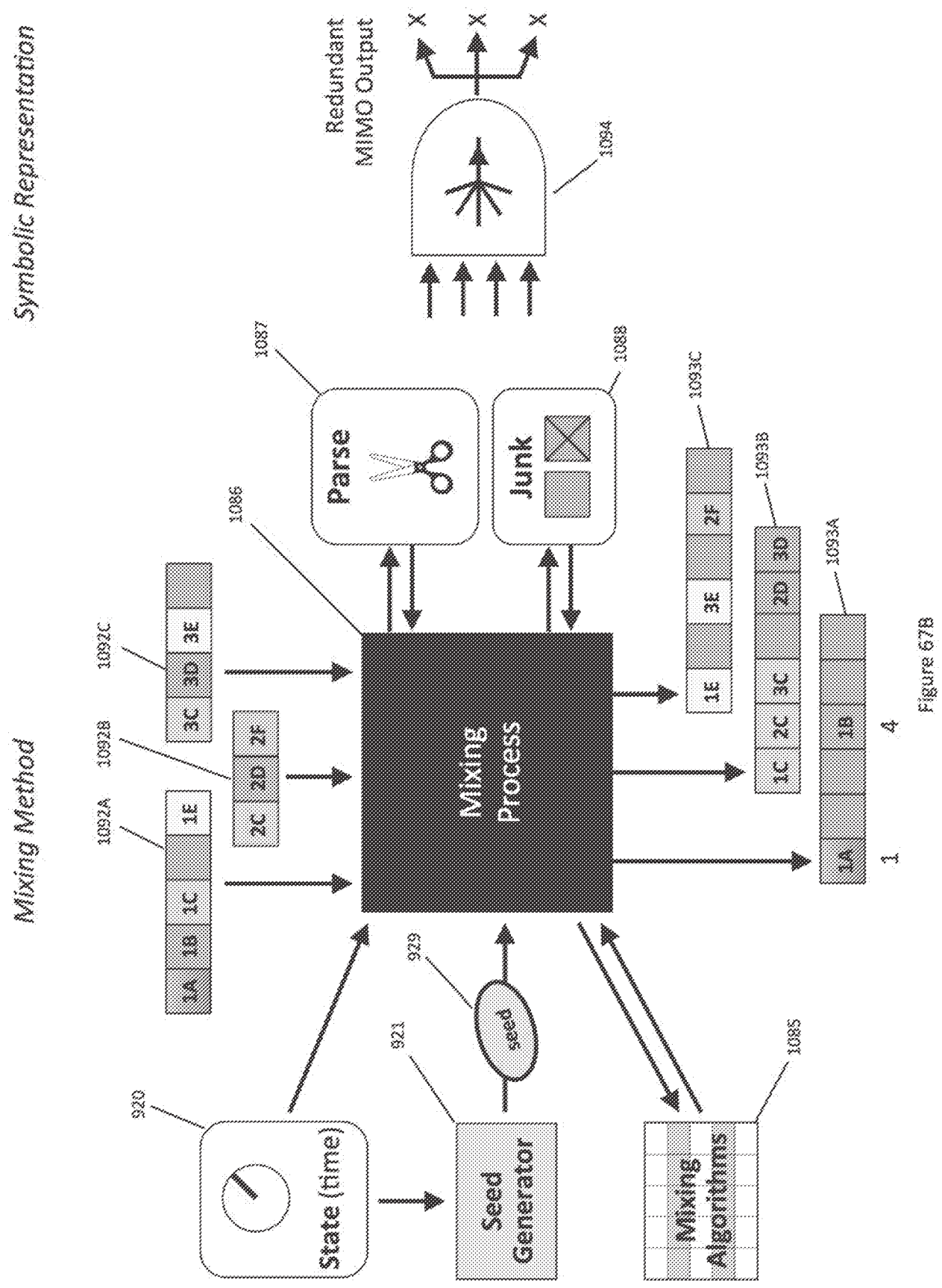

Symbolic Representation
Mixing Method
Redundant MIMO Output
X
X
X
1094
1087
Parse
1088
Junk
1086
Mixing Process
1092A
1A
1B
1C
1E
1092B
2C
2D
2F
1092C
3C
3D
3E
1093C
1E
3E
2F
1093B
1C
2C
3C
2D
3D
1093A
1A
1B
1
4
920
State (time)
921
Seed Generator
929
seed
1085
Mixing Algorithms

Figure 67B

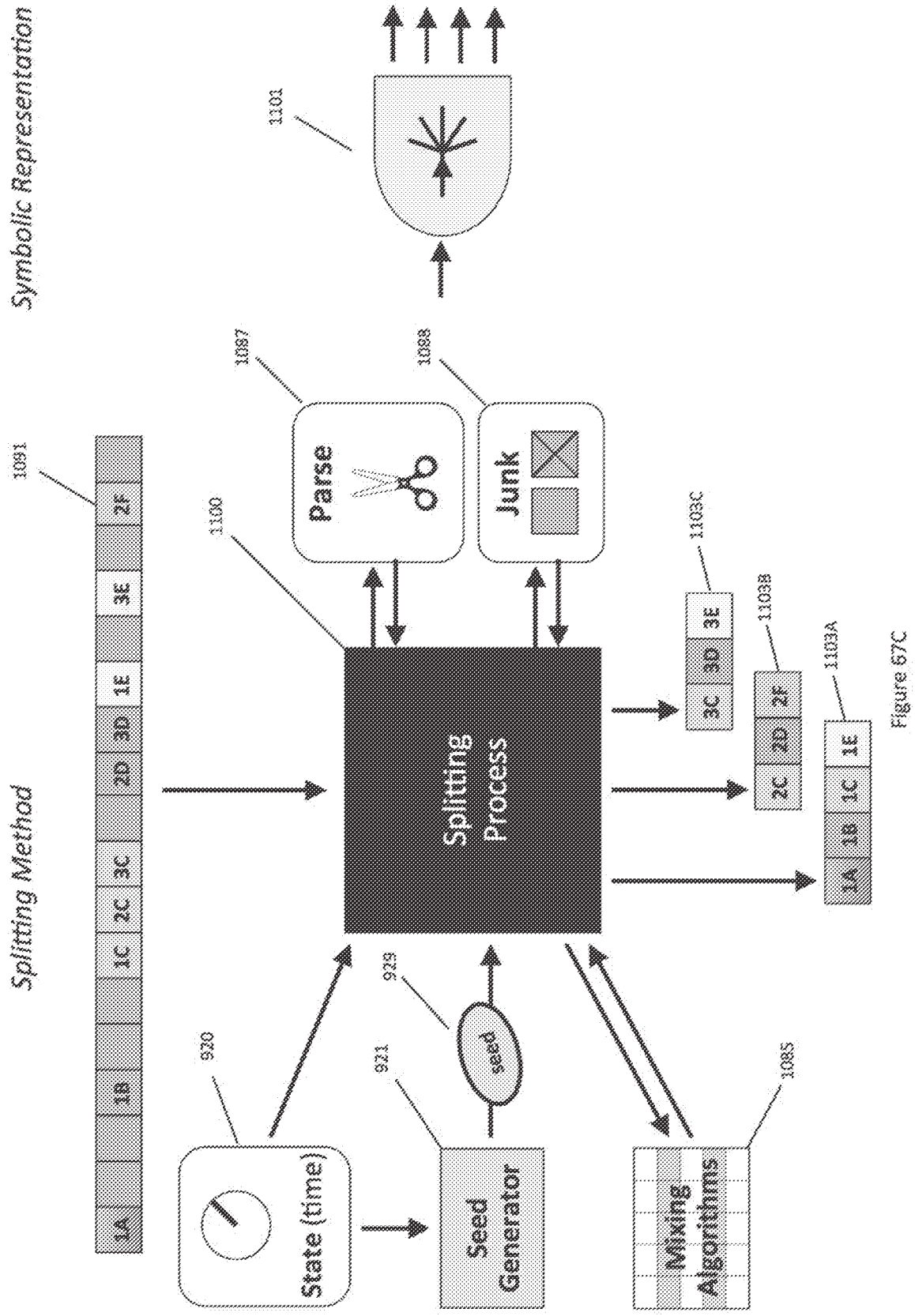

Symbolic Representation
Splitting Method
1101
1087
1088
1091
1100
Parse
Junk
1103C
1103B
1103A
1A
1B
1C
2C
3C
2D
3D
1E
3E
2F
Splitting Process
920
921
929
seed
1085
State (time)
Seed Generator
Mixing Algorithms

Figure 67C

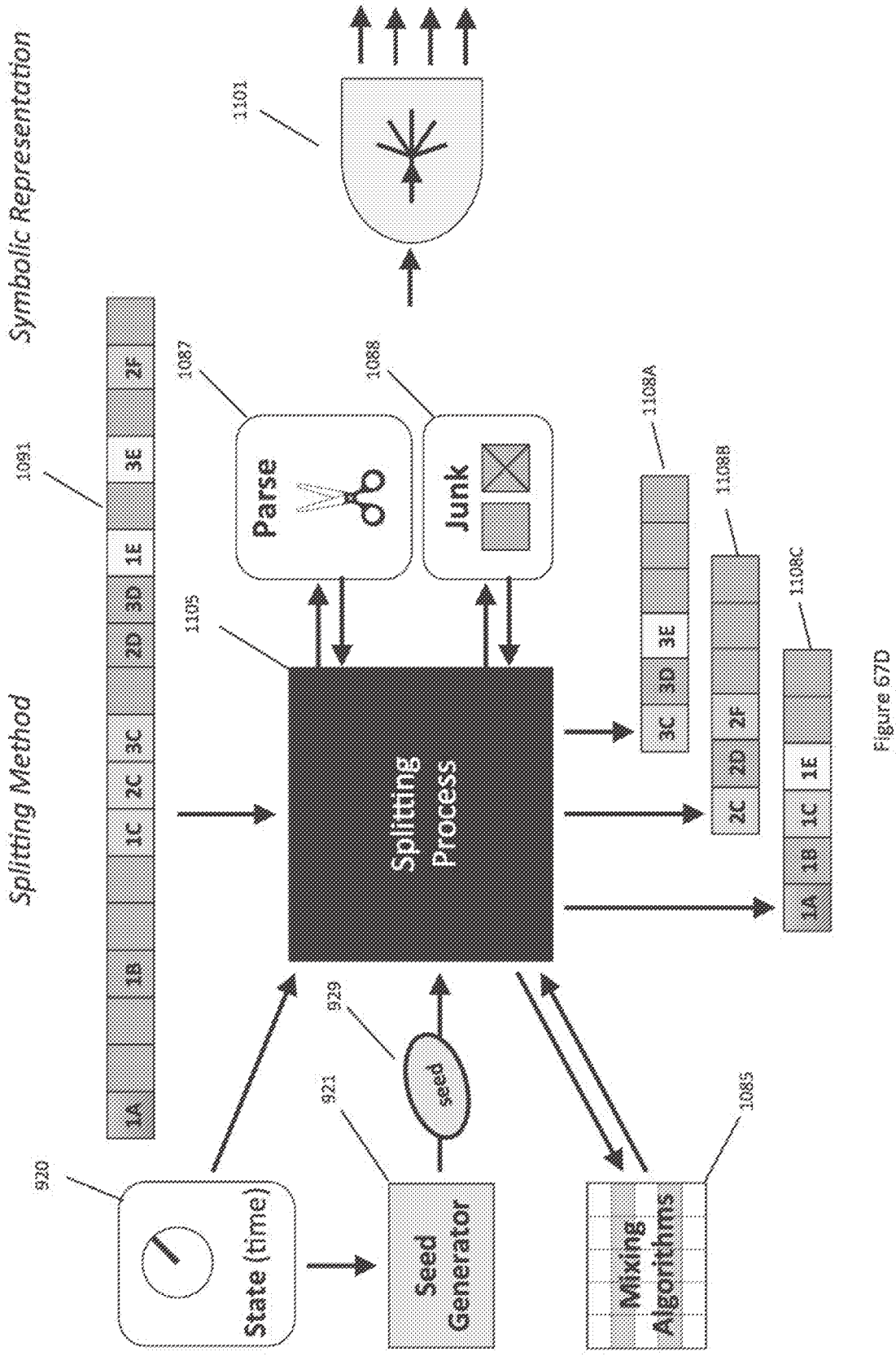

Symbolic Representation
Splitting Method
1101
1091
1087
1088
1105
1108A
1108B
1108C
Parse
Junk
Splitting Process
1A
1B
1C
2C
3C
2D
3D
1E
3E
2F
920
921
929
1085
State (time)
Seed Generator
seed
Mixing Algorithms

Figure 67D

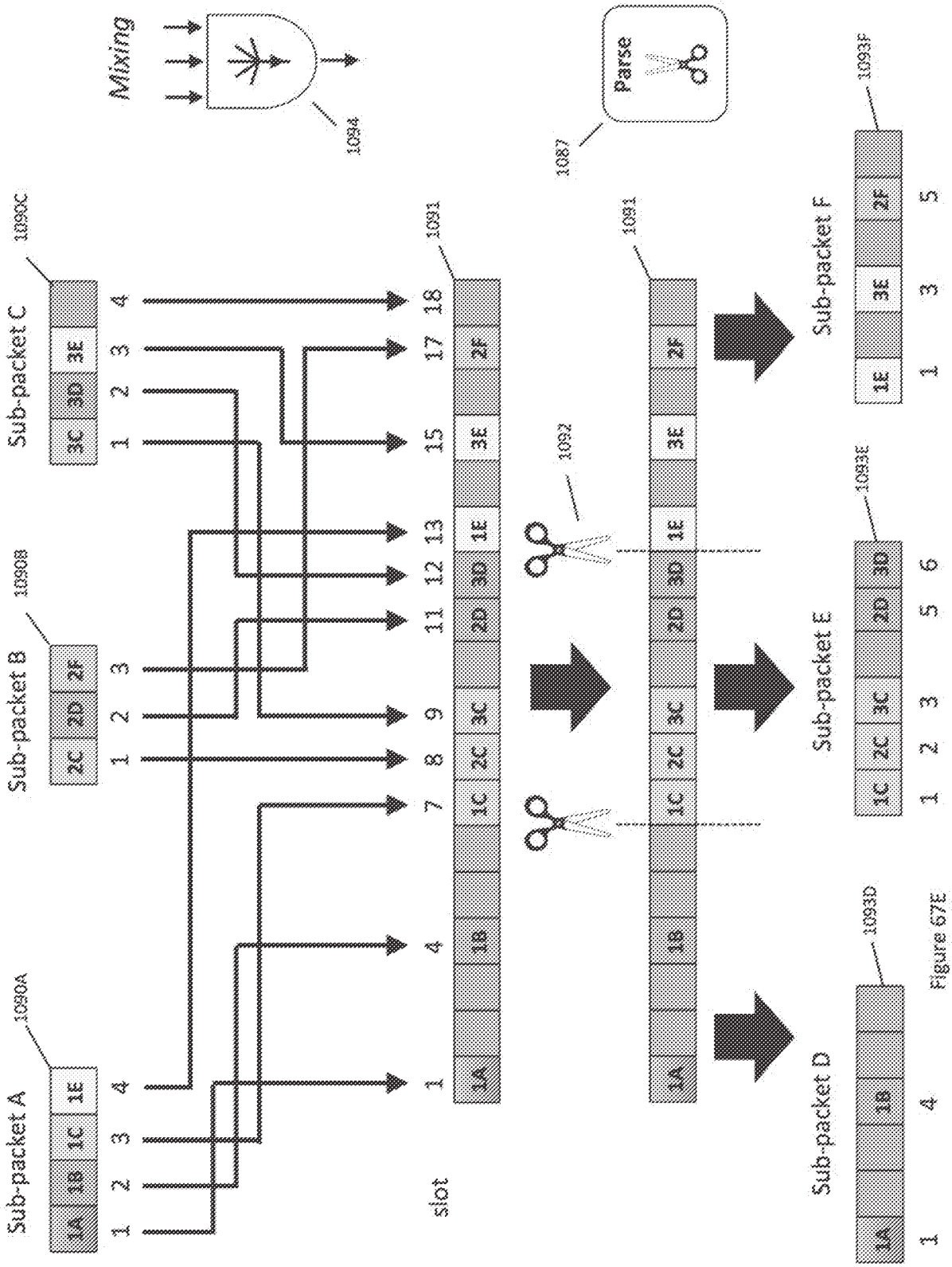

Sub-packet A
1090A
1A
1B
1C
1E
Sub-packet B
1090B
2C
2D
2F
Sub-packet C
1090C
3C
3D
3E
Mixing
1094
slot
1091
1087
Parse
1092
1093D
1093E
1093F
Sub-packet D
Sub-packet E
Sub-packet F

Figure 67E

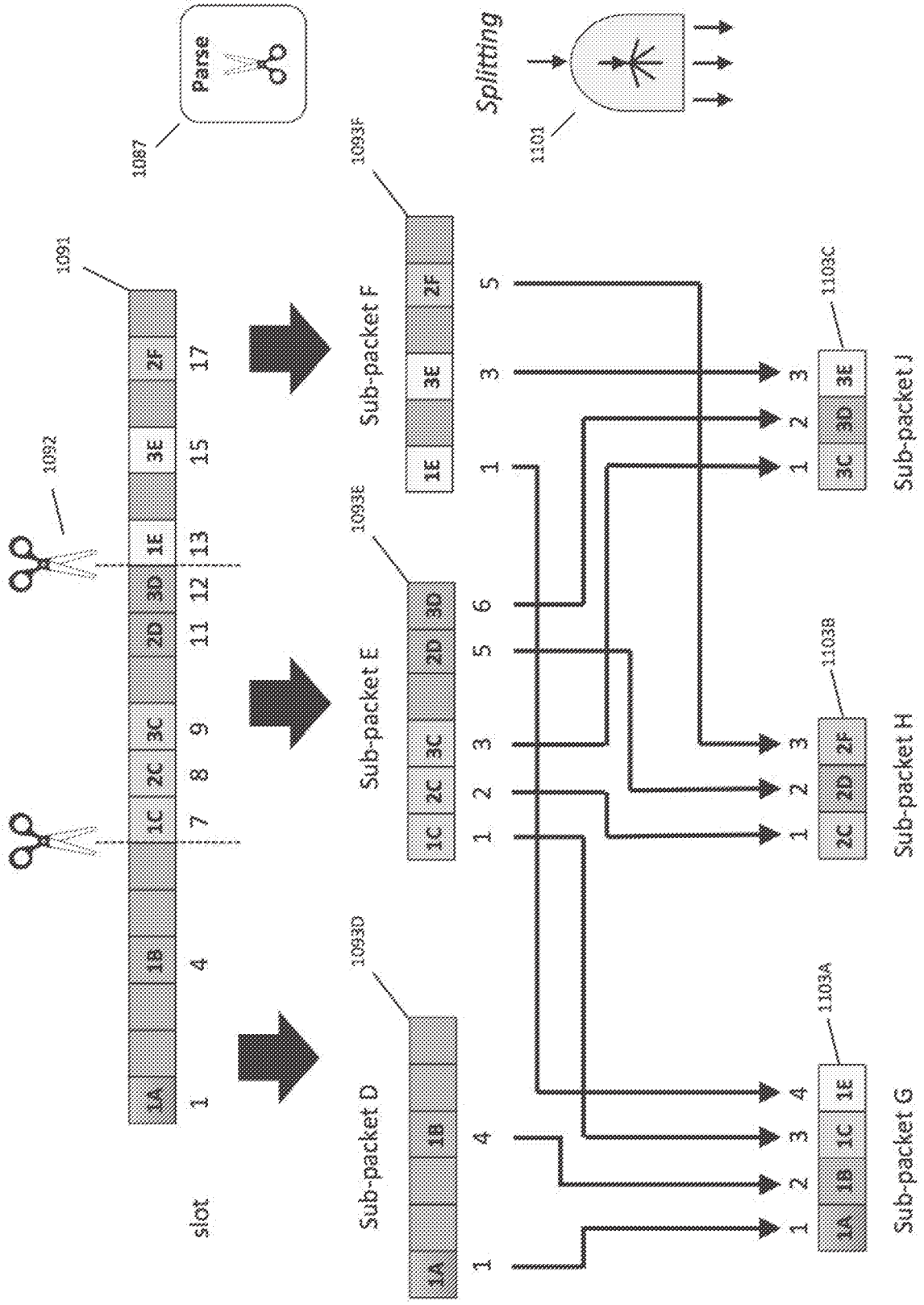

Parse
1087
1091
1092
Splitting
1101
slot
1A
1B
1C
2C
3C
2D
3D
1E
3E
2F
Sub-packet D
Sub-packet E
Sub-packet F
Sub-packet G
Sub-packet H
Sub-packet J
1093D
1093E
1093F
1103A
1103B
1103C

Figure 67F

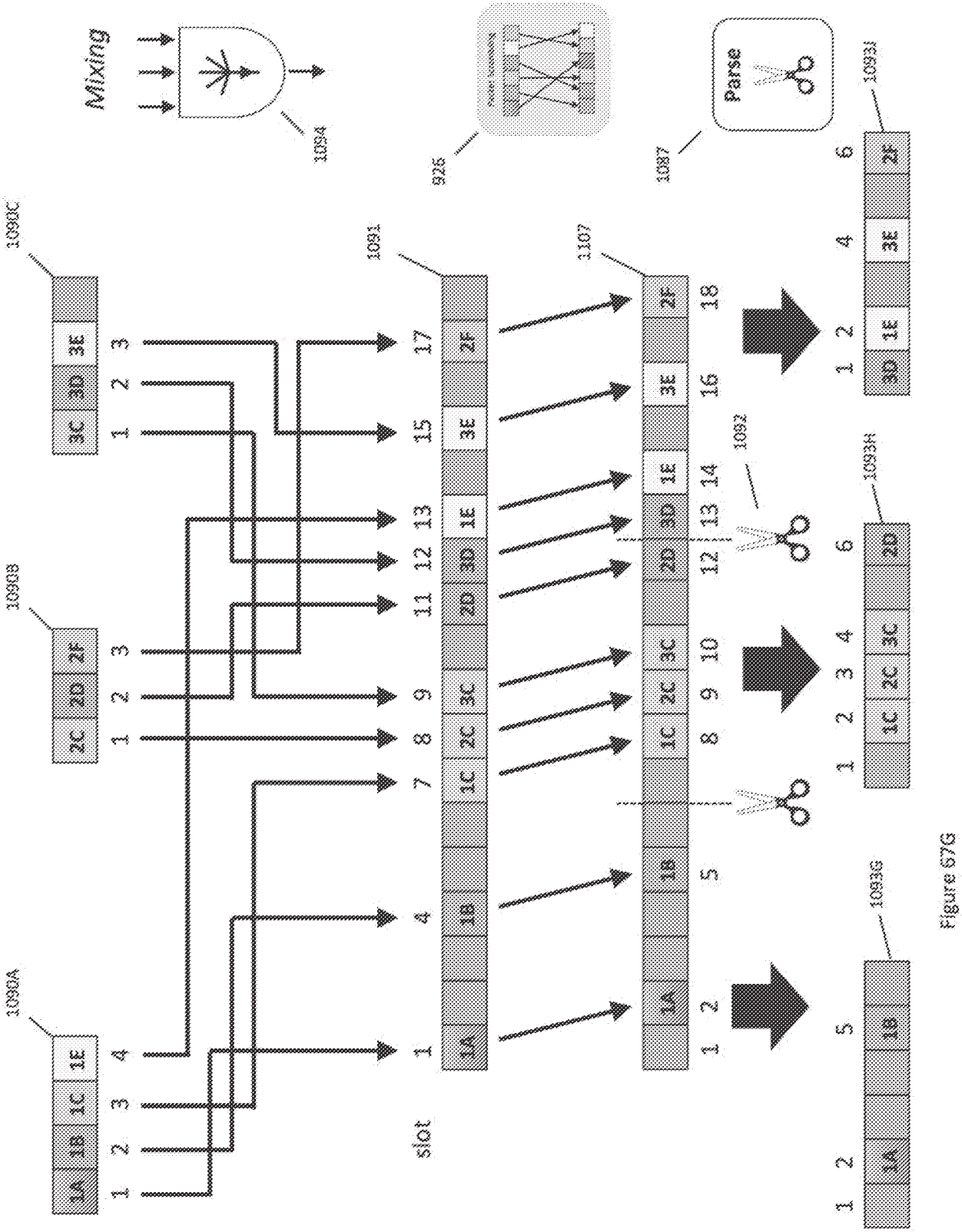

Mixing
1094
926
1087
Parse
1090A
1090B
1090C
1091
1107
1092
1093G
1093H
1093J
slot
1A
1B
1C
1E
2C
2D
2F
3C
3D
3E

Figure 67G

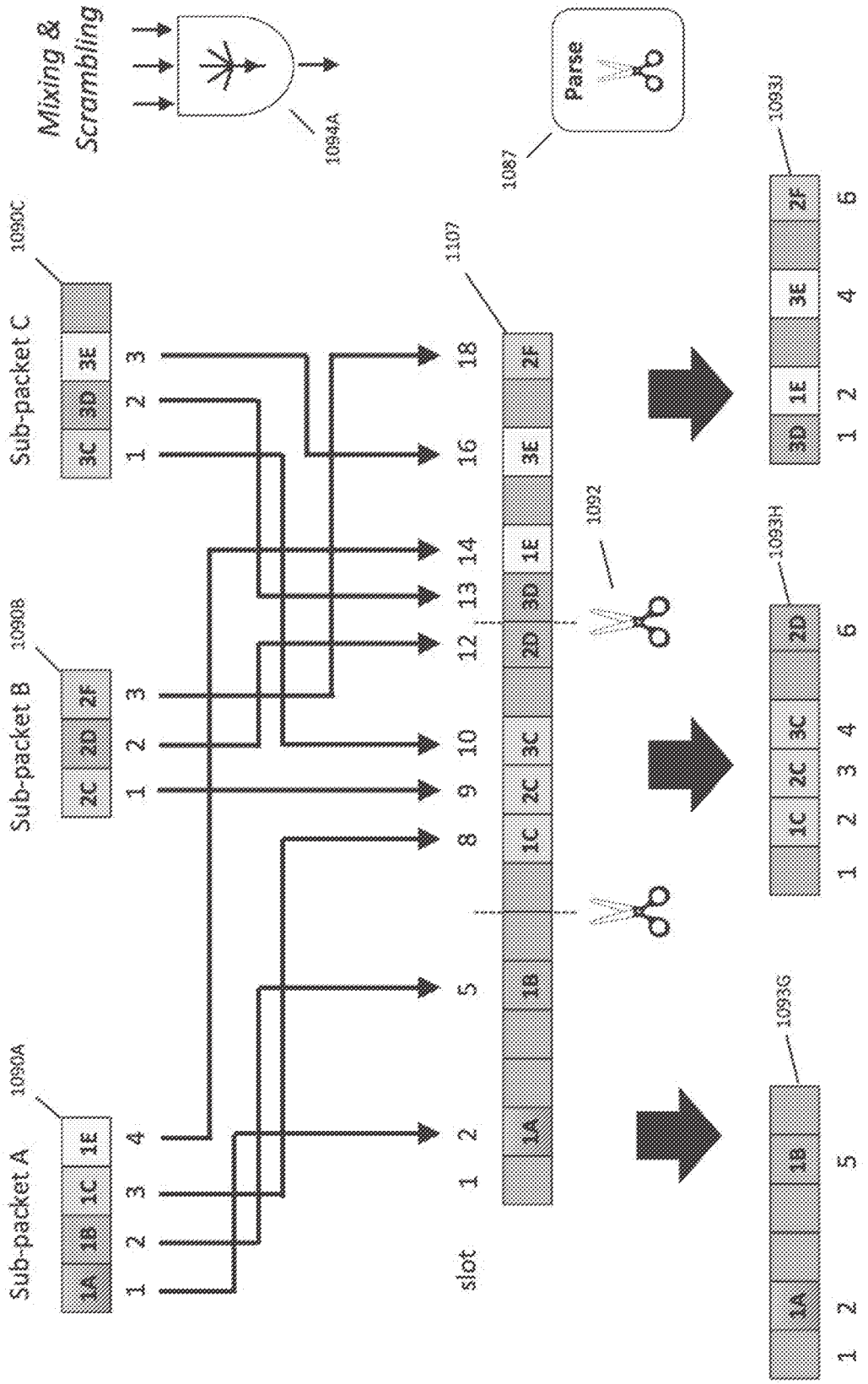

Sub-packet A
1090A
1A
1B
1C
1E
Sub-packet B
1090B
2C
2D
2F
Sub-packet C
1090C
3C
3D
3E
Mixing & Scrambling
1094A
1087
Parse
1092
1097
slot
1093G
1093H
1093J

Figure 67H

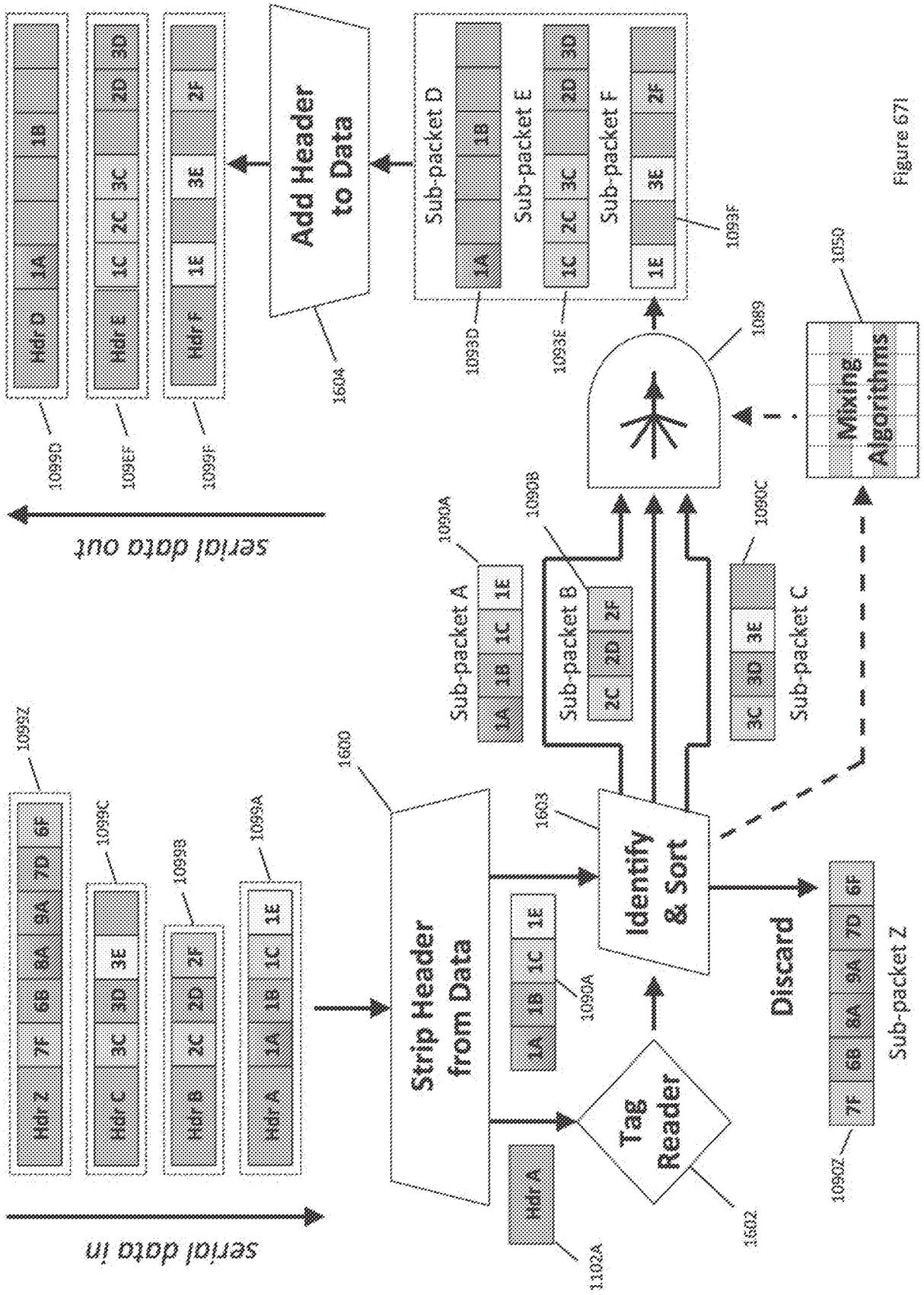

serial data in
Hdr Z
7F
6B
8A
9A
7D
6F
1099Z
Hdr C
3C
3D
3E
1099C
Hdr B
2C
2D
2F
1099B
Hdr A
1A
1B
1C
1E
1099A
1600
Strip Header from Data
1603
Identify & Sort
Tag Reader
1602
Hdr A
1102A
1A
1B
1C
1E
1090A
Discard
Sub-packet Z
1090Z
Sub-packet A
1090A
Sub-packet B
1090B
2C
2D
2F
Sub-packet C
1090C
3C
3D
3E
1089
1050
Mixing Algorithms
Sub-packet D
1093D
Sub-packet E
1093E
Sub-packet F
1093F
1604
Add Header to Data
Hdr D
1099D
Hdr E
1099E
Hdr F
1099F
serial data out

Figure 671

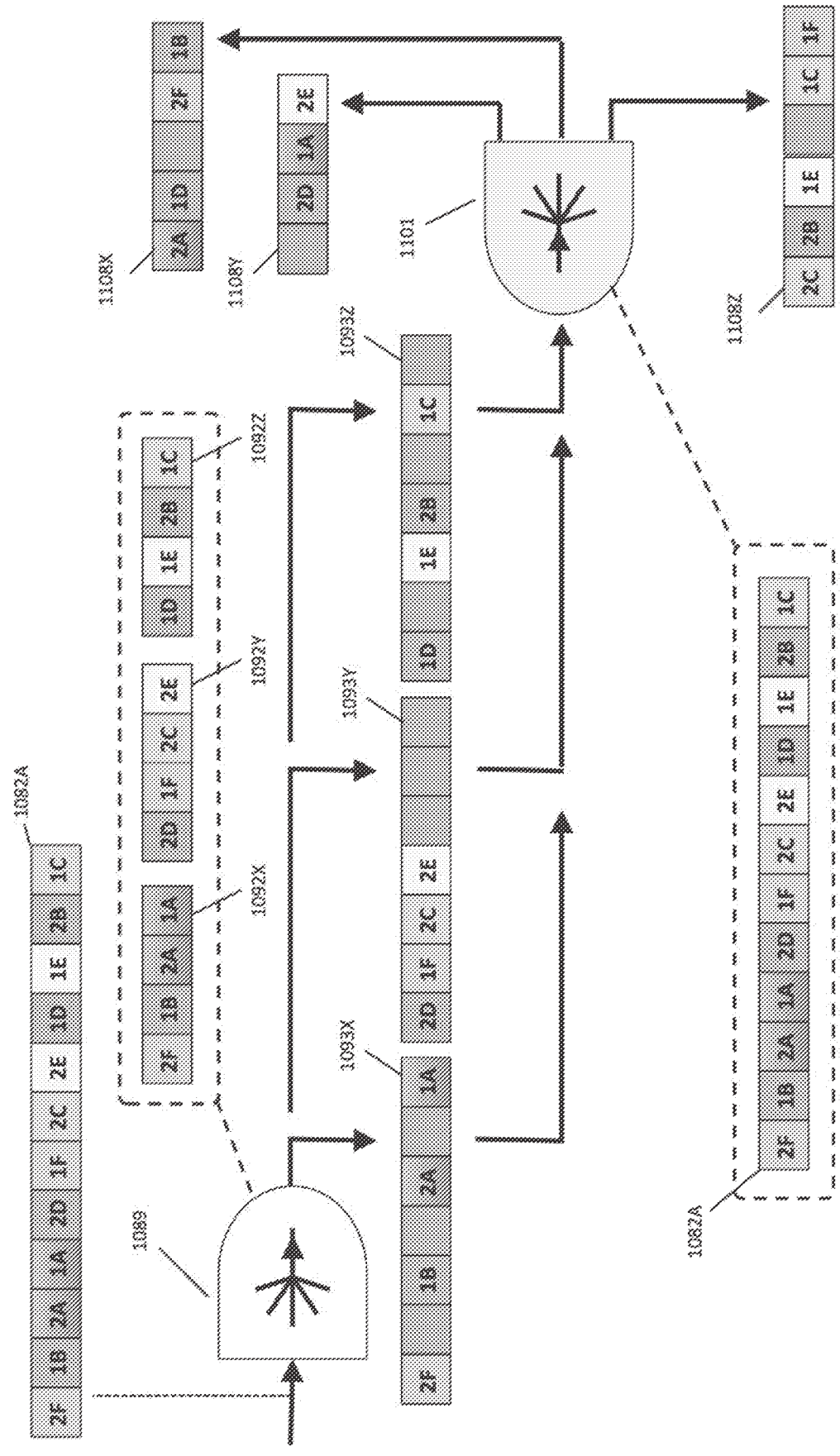

1092A
2F 1B 2A 1A 2D 1F 2C 2E 1D 1E 2B 1C
1089
1092X
2F 1B 2A 1A
1092Y
2D 1F 2C 2E
1092Z
1D 1E 2B 1C
1093X
1B 2A 1A
1093Y
2D 1F 2C 2E
1093Z
1D 1E 2B 1C
1101
1108X
2A 1D 2F 1B
1108Y
2D 1A 2E
1108Z
2C 2B 1E 1C 1F
1092A
2F 1B 2A 1A 2D 1F 2C 2E 1D 1E 2B 1C

Figure 67J

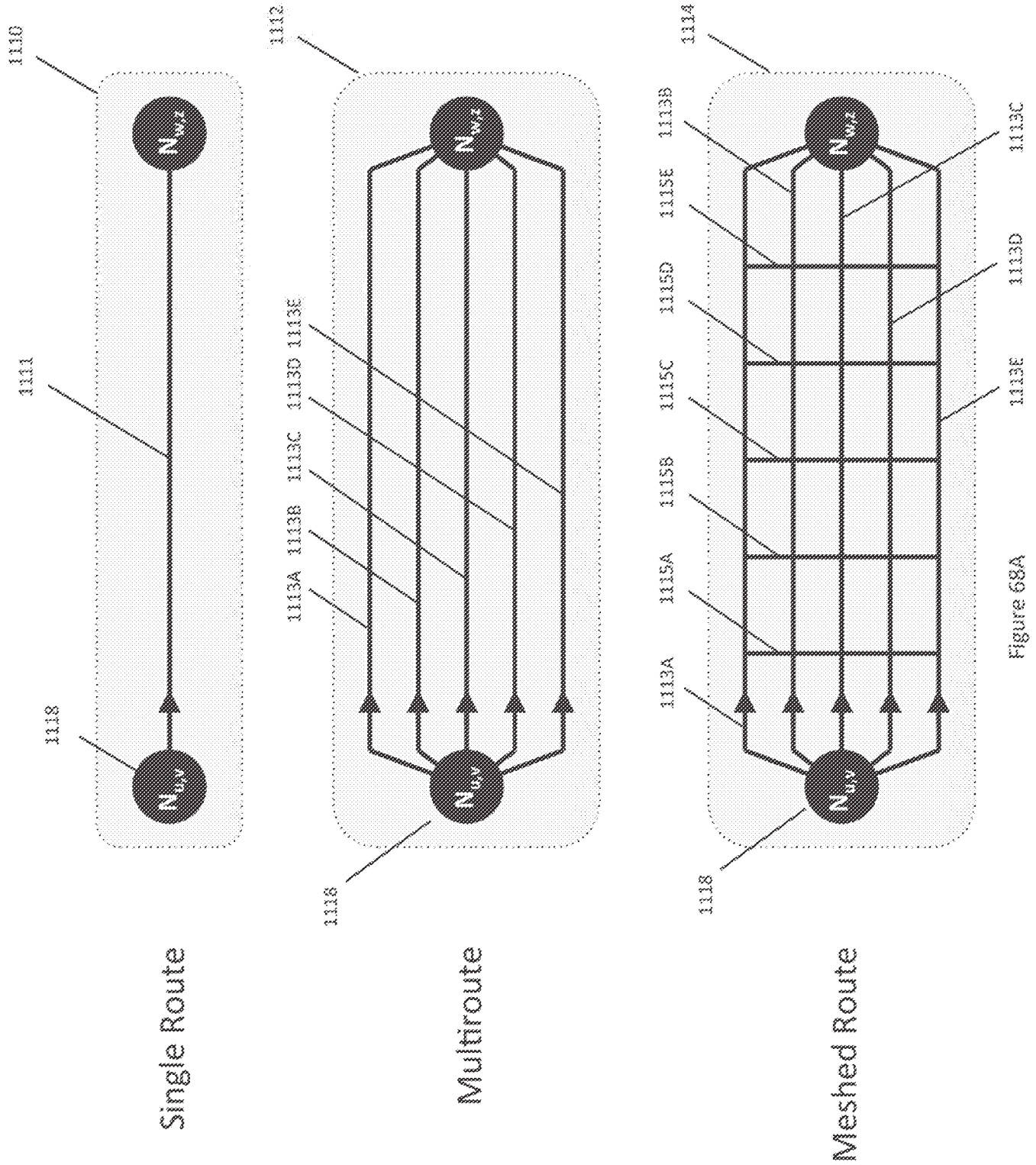

1110
1111
1118
$N_{u,v}$
$N_{w,z}$
Single Route
1112
1113A
1113B
1113C
1113D
1113E
1116
Multiroute
1114
1115A
1115B
1115C
1115D
1115E
Meshed Route

Figure 68A

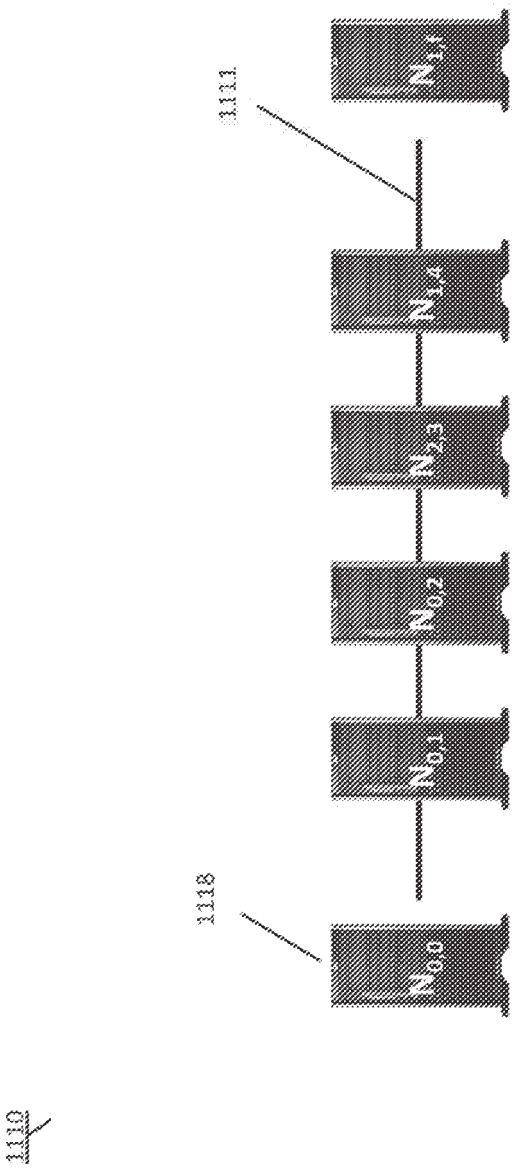


Figure 68B

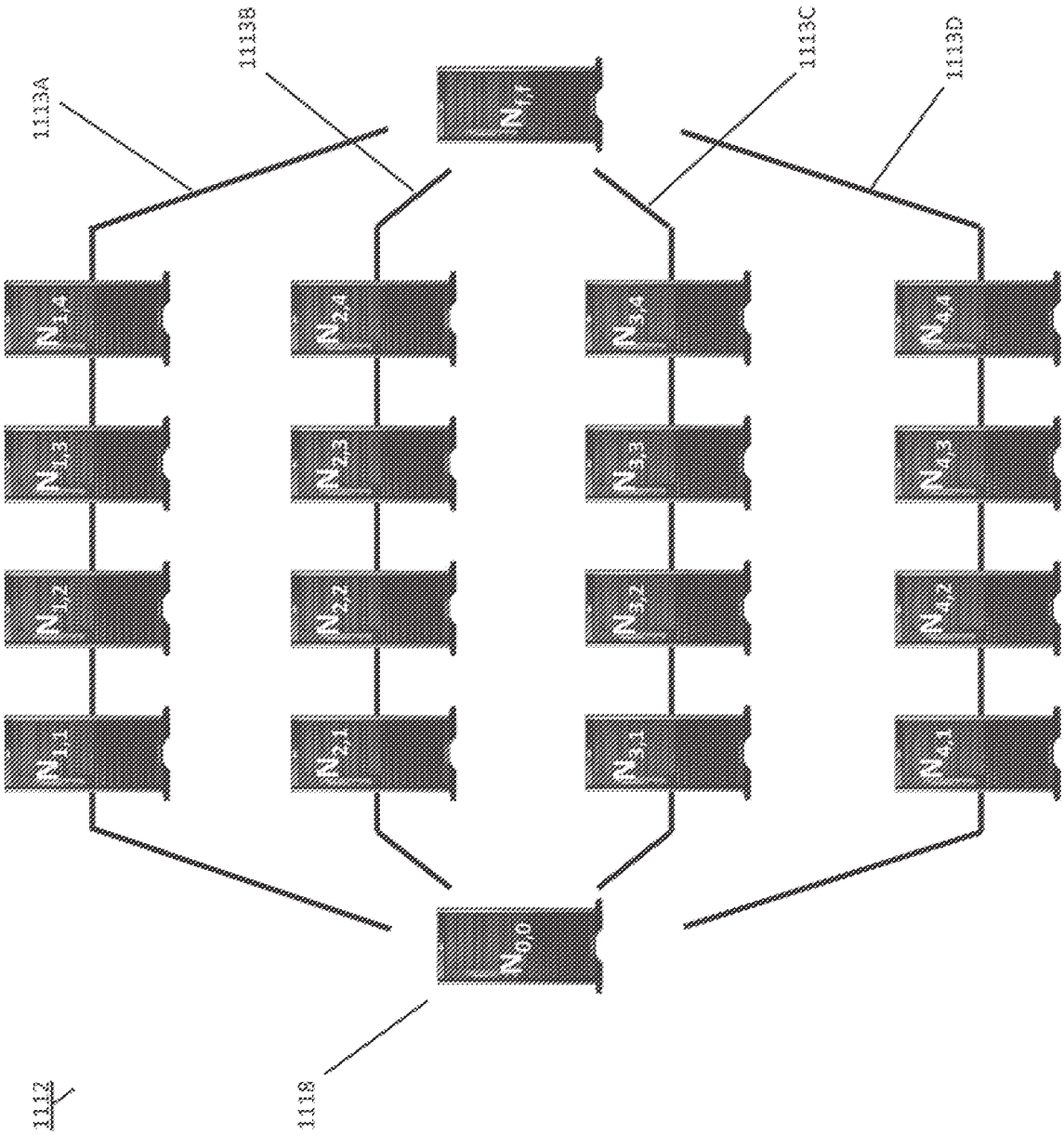

1112
1118
1113A
1113B
1113C
1113D
$N_{0,0}$
$N_{1,1}$
$N_{1,2}$
$N_{1,3}$
$N_{1,4}$
$N_{2,1}$
$N_{2,2}$
$N_{2,3}$
$N_{2,4}$
$N_{3,1}$
$N_{3,2}$
$N_{3,3}$
$N_{3,4}$
$N_{4,1}$
$N_{4,2}$
$N_{4,3}$
$N_{4,4}$

Figure 68C

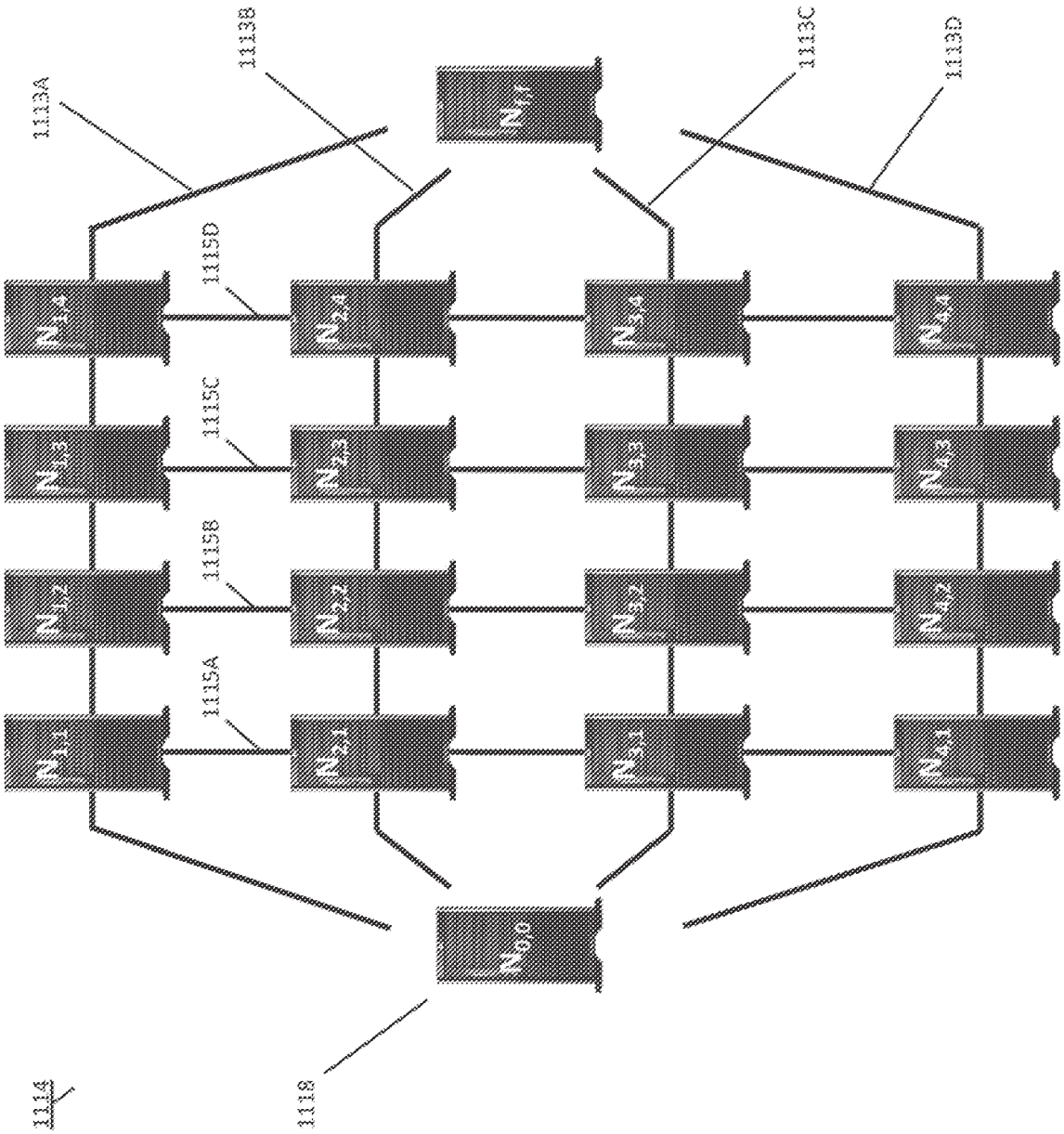

1114
1118
1113A
1113B
1113C
1113D
1115A
1115B
1115C
1115D
$N_{0,0}$
$N_{1,1}$
$N_{1,2}$
$N_{1,3}$
$N_{1,4}$
$N_{2,1}$
$N_{2,2}$
$N_{2,3}$
$N_{2,4}$
$N_{3,1}$
$N_{3,2}$
$N_{3,3}$
$N_{3,4}$
$N_{4,1}$
$N_{4,2}$
$N_{4,3}$
$N_{4,4}$

Figure 68D

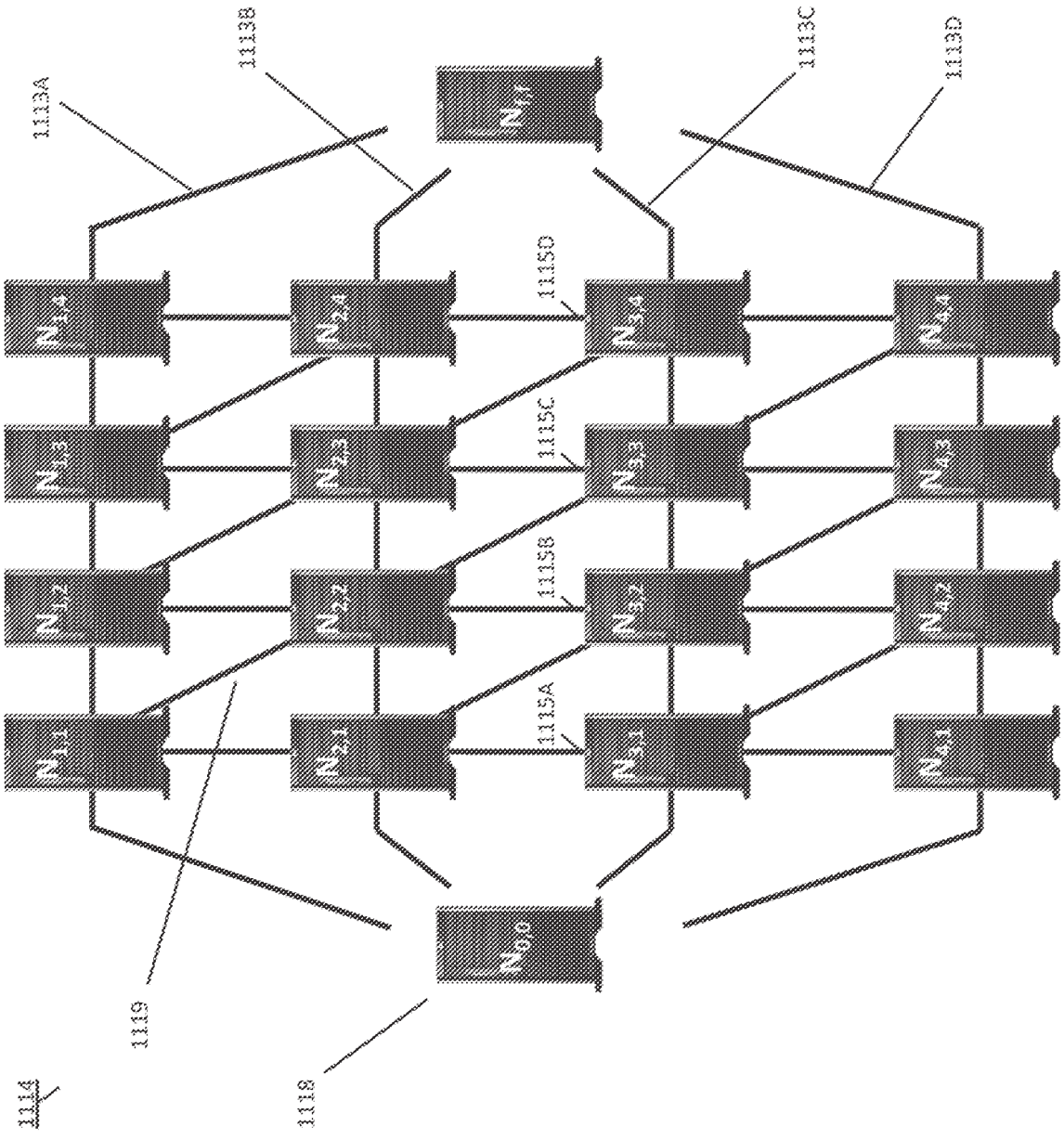

1114
1119
1118
1113A
1113B
1113C
1113D
1115A
1115B
1115C
1115D
N0,0
N1,1
N1,2
N1,3
N1,4
N2,1
N2,2
N2,3
N2,4
N3,1
N3,2
N3,3
N3,4
N4,1
N4,2
N4,3
N4,4
N7,1

Figure 68E

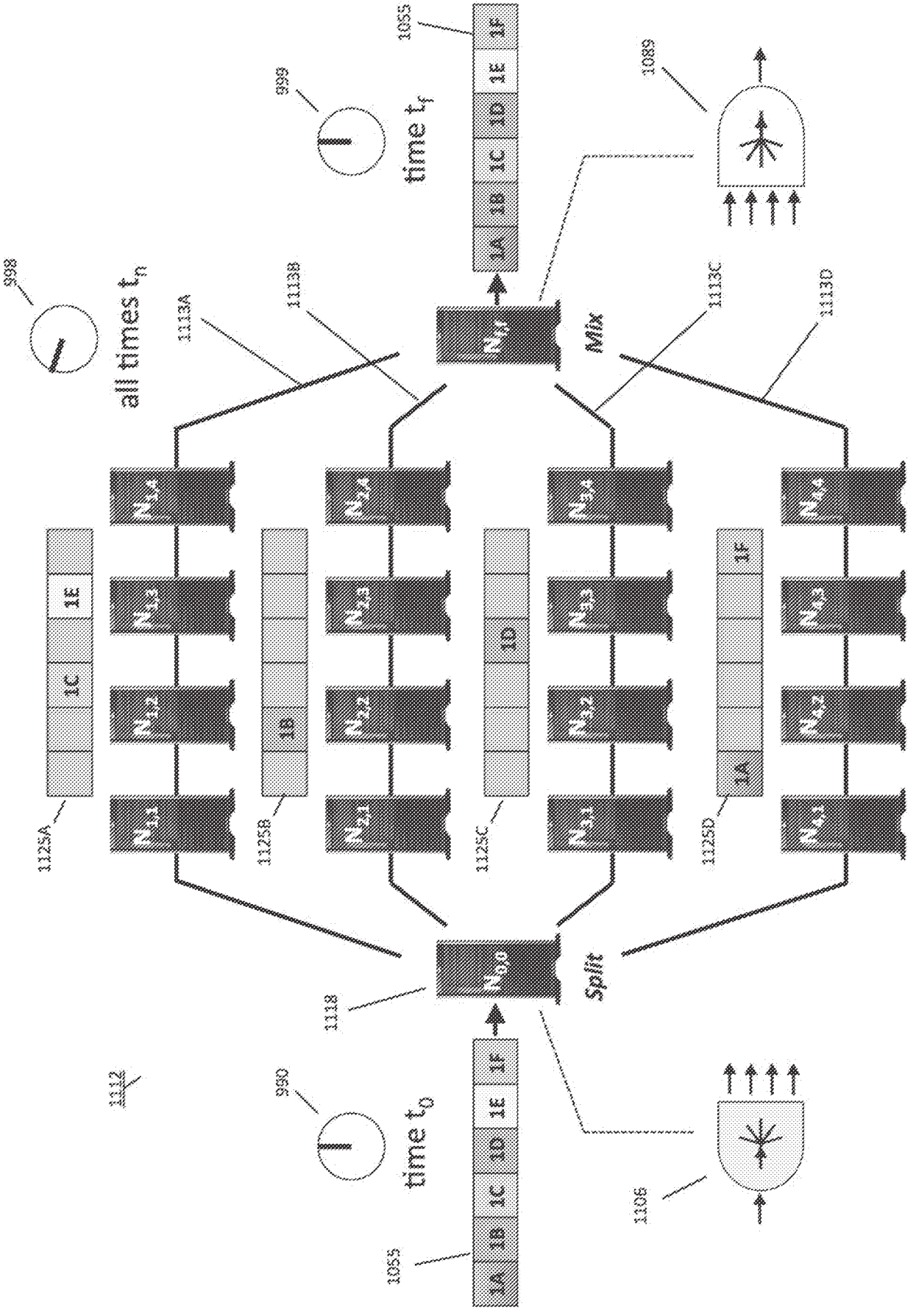

1112
998
all times t_n
999
time t_f
990
time t_0
1055
1A
1B
1C
1D
1E
1F
1089
1106
1118
Split
Mix
1113A
1113B
1113C
1113D
1125A
1125B
1125C
1125D

Figure 69

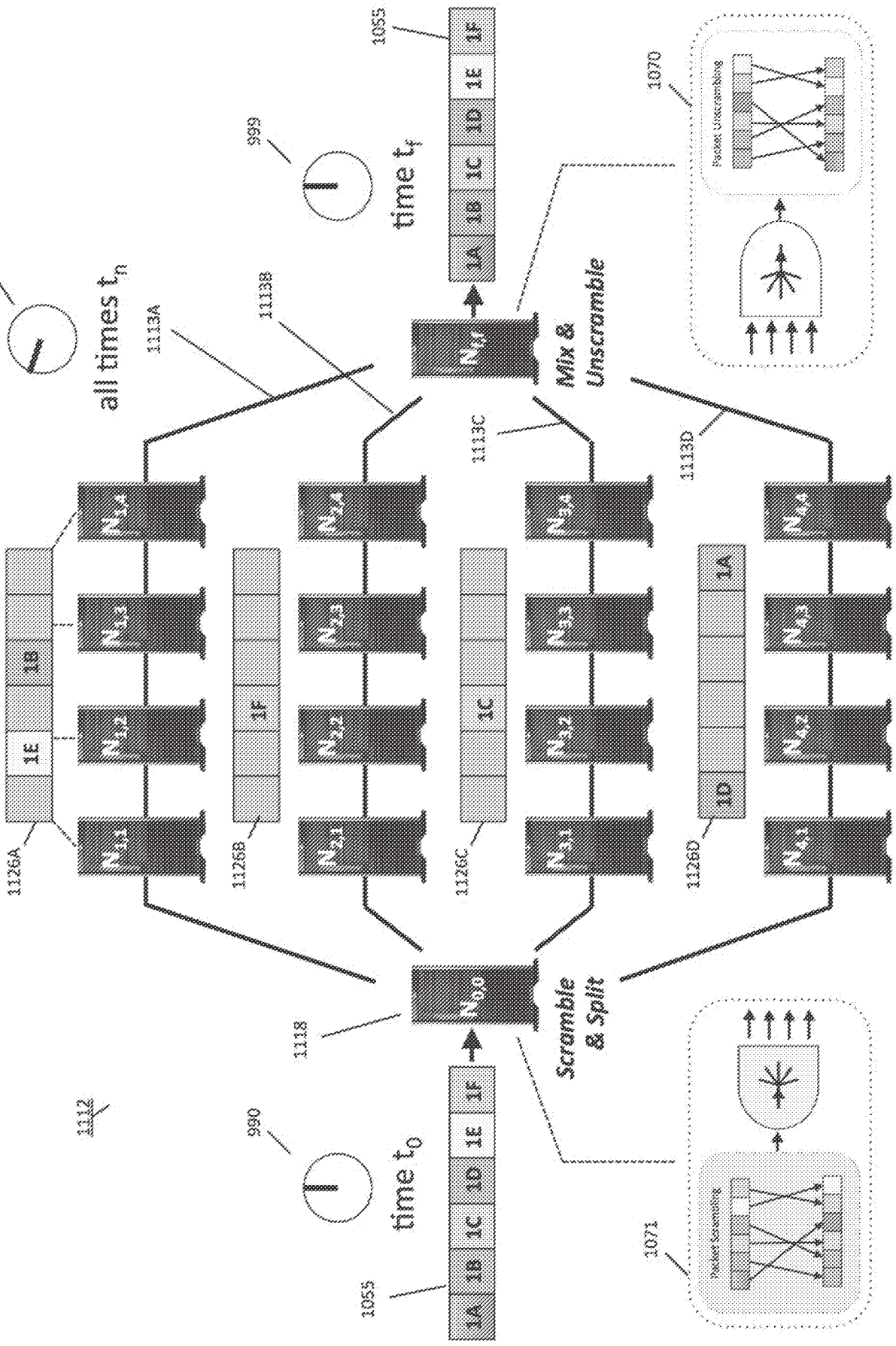

1112
998
all times t_n
999
time t_f
990
time t_0
1055
1A
1B
1C
1D
1E
1F
1118
Scramble & Split
1113A
1113B
1113C
1113D
Mix & Unscramble
1126A
1126B
1126C
1126D
1070
1071
Packet Unscrambling
Packet Scrambling

Figure 70

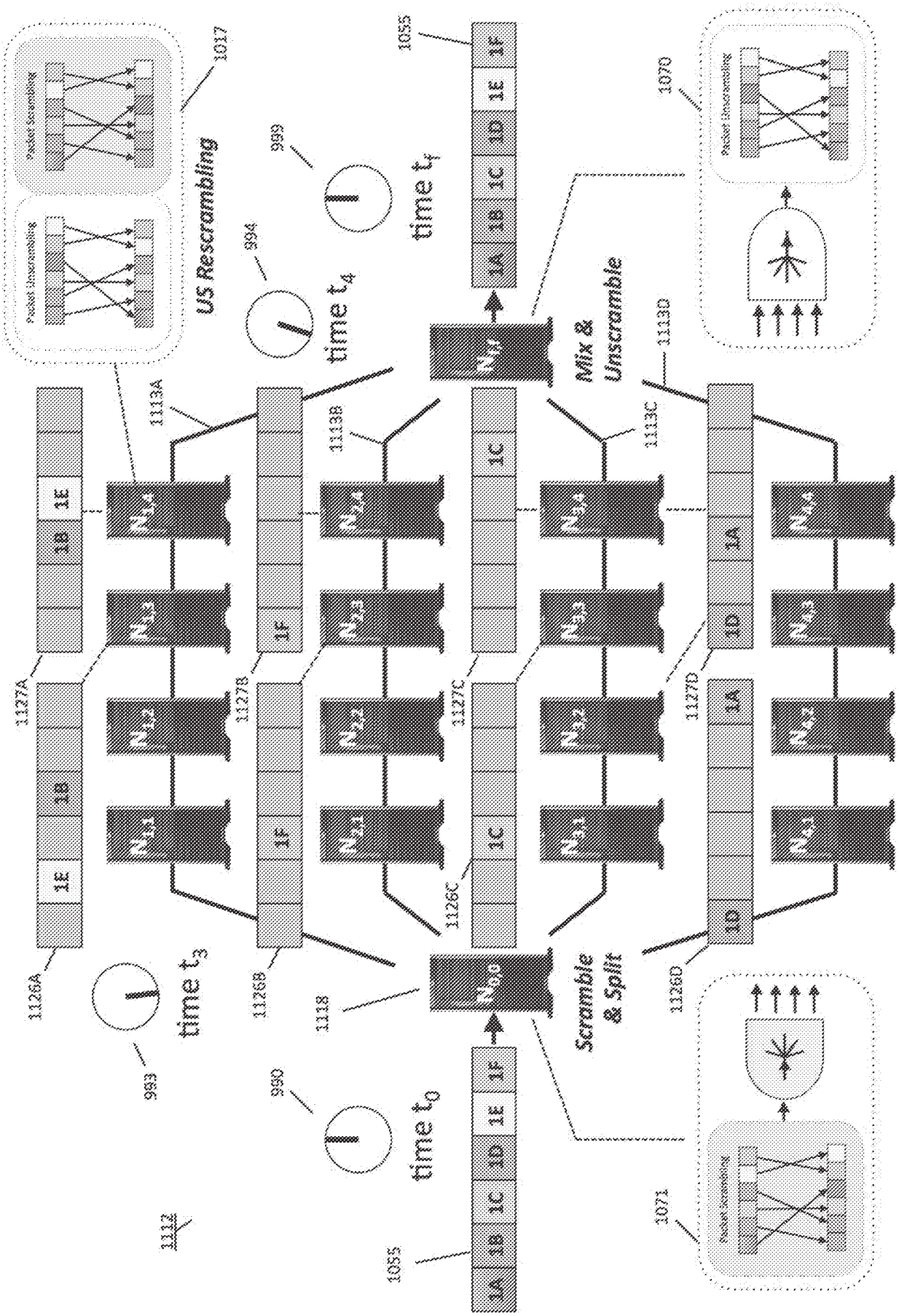

1112
1055
1A
1B
1C
1D
1E
1F
1126A
1126B
1126C
1126D
1127A
1127B
1127C
1127D
1118
1113A
1113B
1113C
1113D
1017
1070
1071
990
994
999
983
time t_0
time t_3
time t_4
time t_f
Scramble & Split
Mix & Unscramble
US Rescrambling
Packet Descrambling
Packet Scrambling

Figure 71A

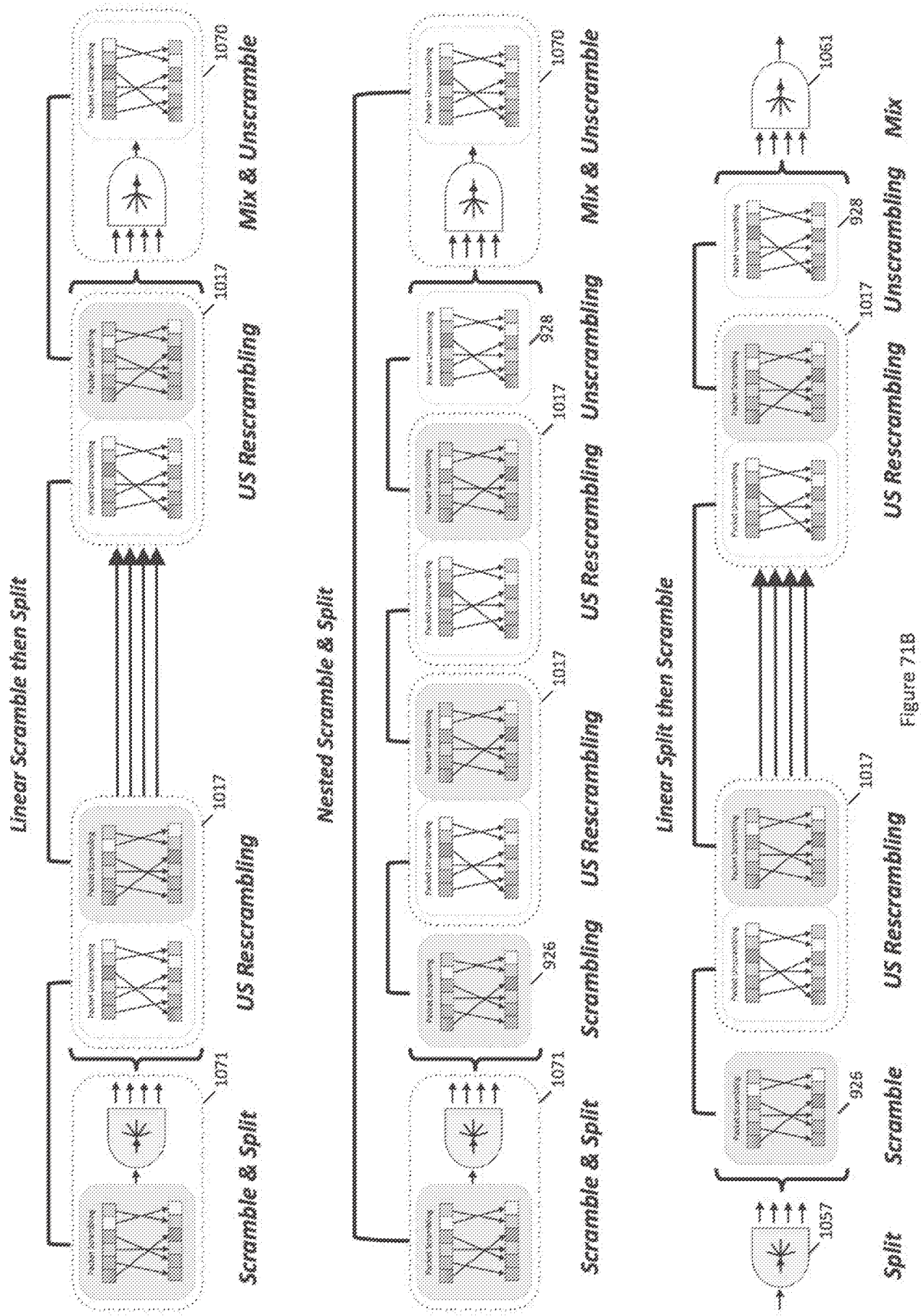
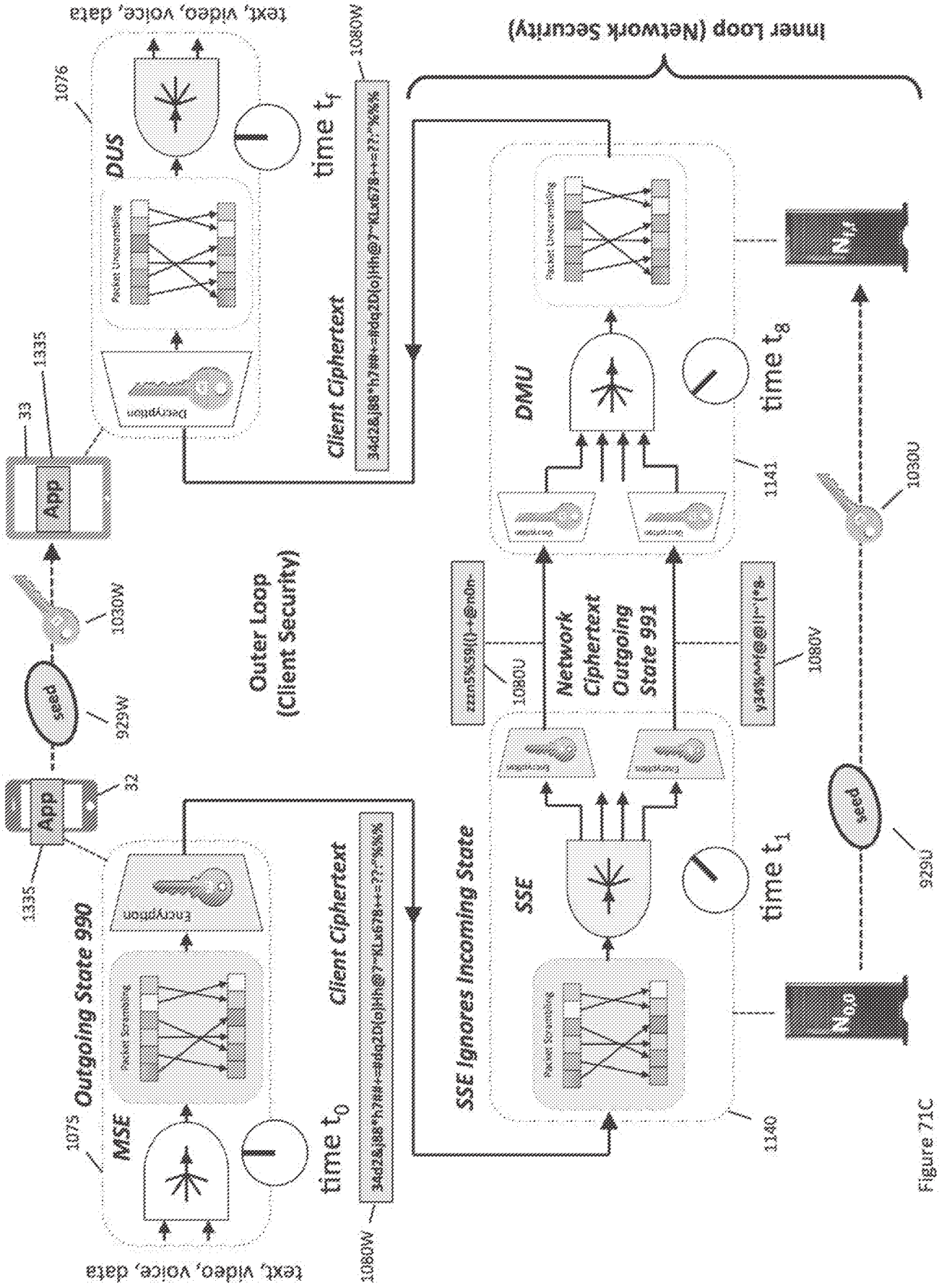

Linear Scramble then Split
Scramble & Split
US Rescrambling
Mix & Unscramble
1071
1017
1070
Nested Scramble & Split
Scrambling
Unscrambling
926
928
Linear Split then Scramble
Split
Scramble
Mix
1057
1061

Figure 71B


text, video, voice, data
1076
DUS
Packet Unscrambling
Decryption
time t_f
1080W
Client Ciphertext
34d28j88*h7##+=#dq2DIoIHh@7*KLs678++=??*%%
Inner Loop (Network Security)
33
1335
App
1030W
seed
929W
32
1335
App
Outer Loop
(Client Security)
1075
Outgoing State 990
MSE
Packet Scrambling
Encryption
text, video, voice, data
time t_0
1080W
Client Ciphertext
34d28j88*h7##+=#dq2DIoIHh@7*KLs678++=??*%%
SSE Ignores Incoming State
SSE
Encryption
Packet Scrambling
time t_1
1140
zzn9$$$8(}-+@n0n-
1080U
Network Ciphertext Outgoing State 991
y3#%^^e@!r'(*s-
1080V
DMU
Encryption
Packet Unscrambling
time t_8
1141
N_{01}
N_{02}
1030U
seed
929U
Figure 71C

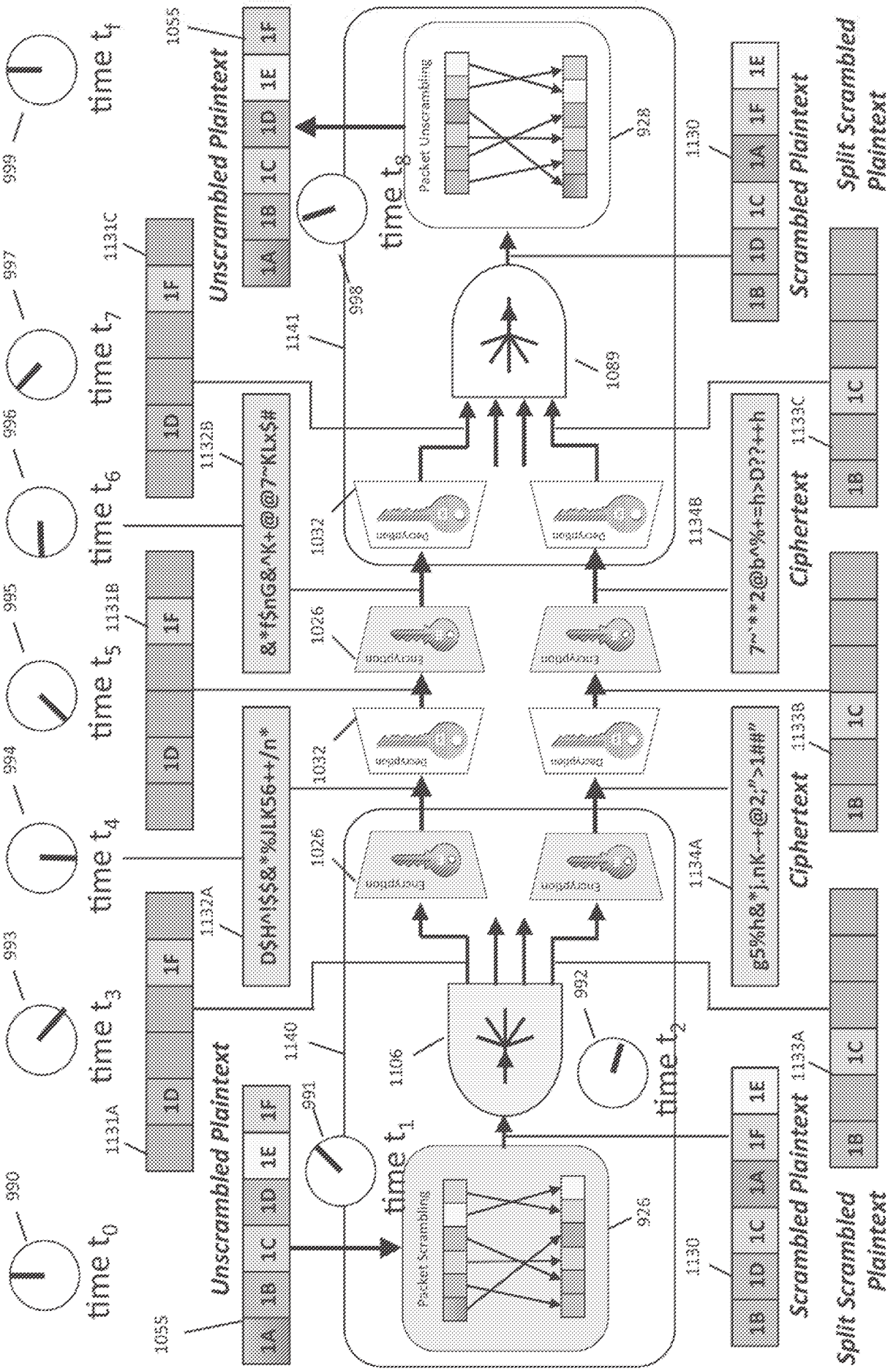

time t_0
time t_1
time t_2
time t_3
time t_4
time t_5
time t_6
time t_7
time t_8
Unscrambled Plaintext
Scrambled Plaintext
Split Scrambled Plaintext
Ciphertext
Packet Scrambling
Packet Unscrambling
Encryption
Decryption
1055
1130
1131A
1131B
1131C
1132A
1132B
1133A
1133B
1133C
1134A
1134B
1140
1141
1106
1089
1026
1032
926
928
990
991
992
993
994
995
996
997
998
999

Figure 72

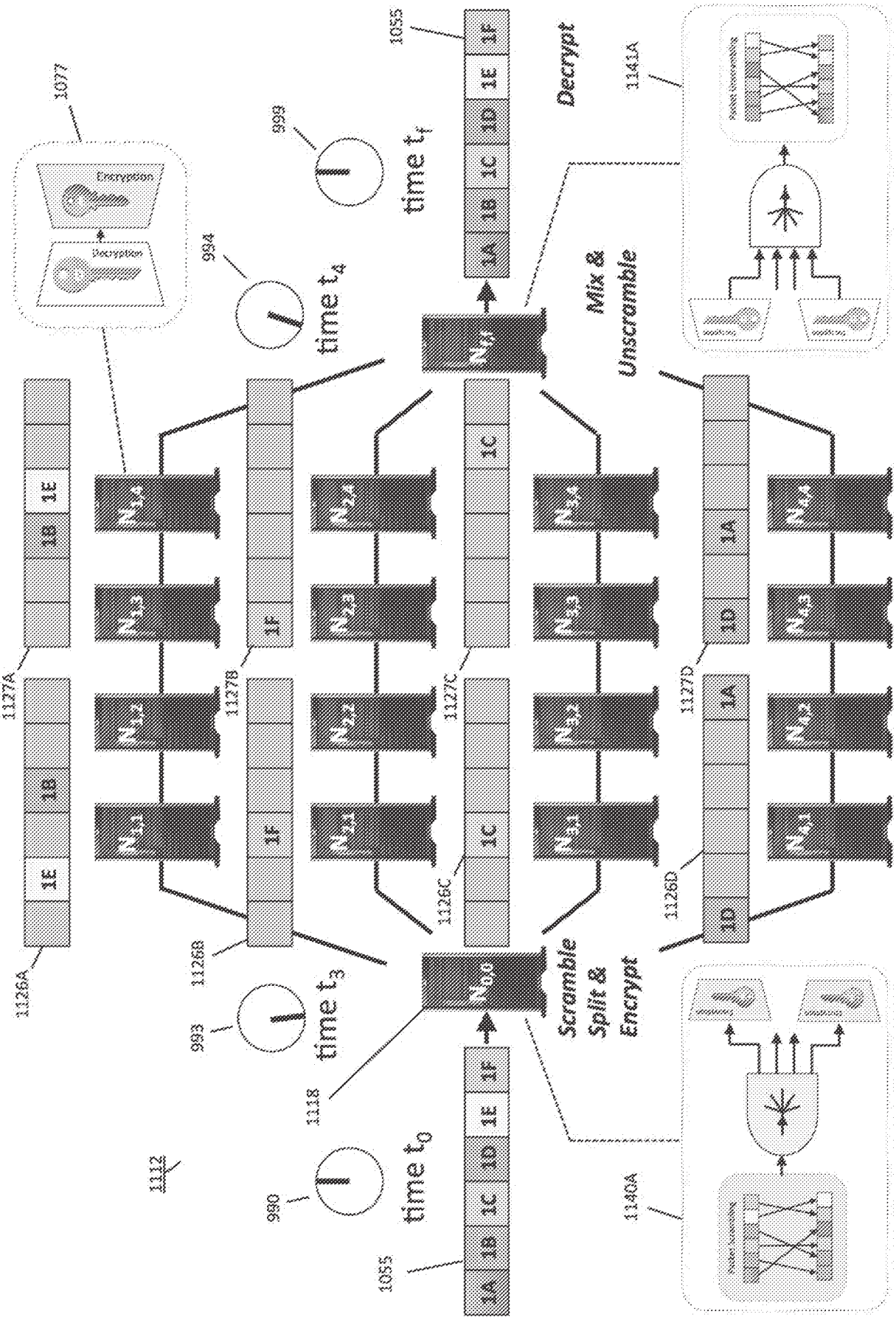

1112
1077
Encryption
Decryption
1126A
1127A
1126B
1127B
1126C
1127C
1126D
1127D
1118
1055
1055
1140A
1141A
980
993
994
999
time t_0
time t_3
time t_4
time t_f
Scramble
Split &
Encrypt
Mix &
Unscramble
Decrypt

Figure 73

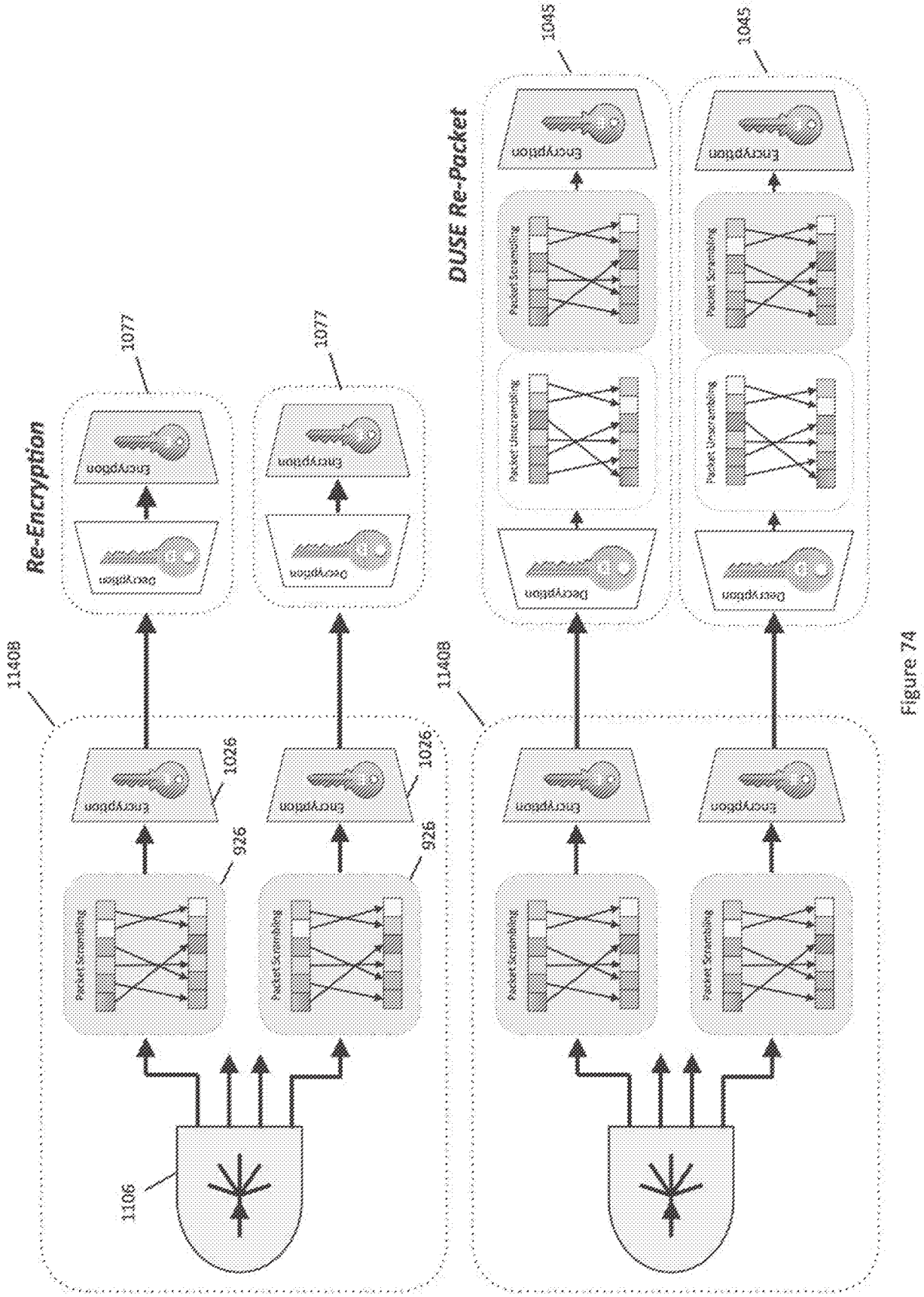

Re-Encryption
DUSE Re-Packet
1106
1408
926
1026
1077
1045
Packet Scrambling
Packet Unscrambling
Encryption
Decryption

Figure 74

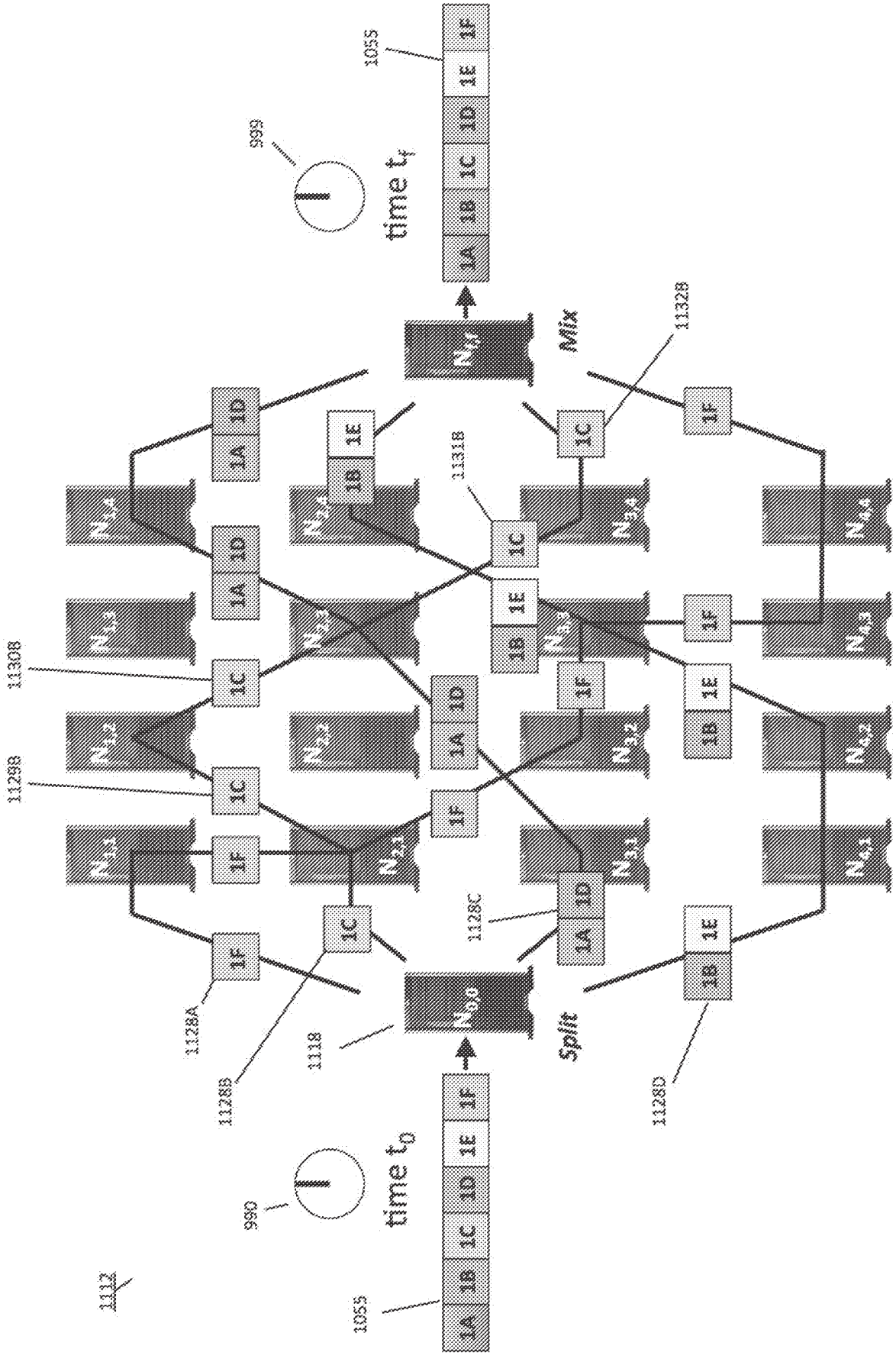

1112
1055
1A
1B
1C
1D
1E
1F
time t_0
990
1118
1128A
1128B
1128C
1128D
Split
Mix
time t_f
999
1055
1130B
1131B
1132B

Figure 75

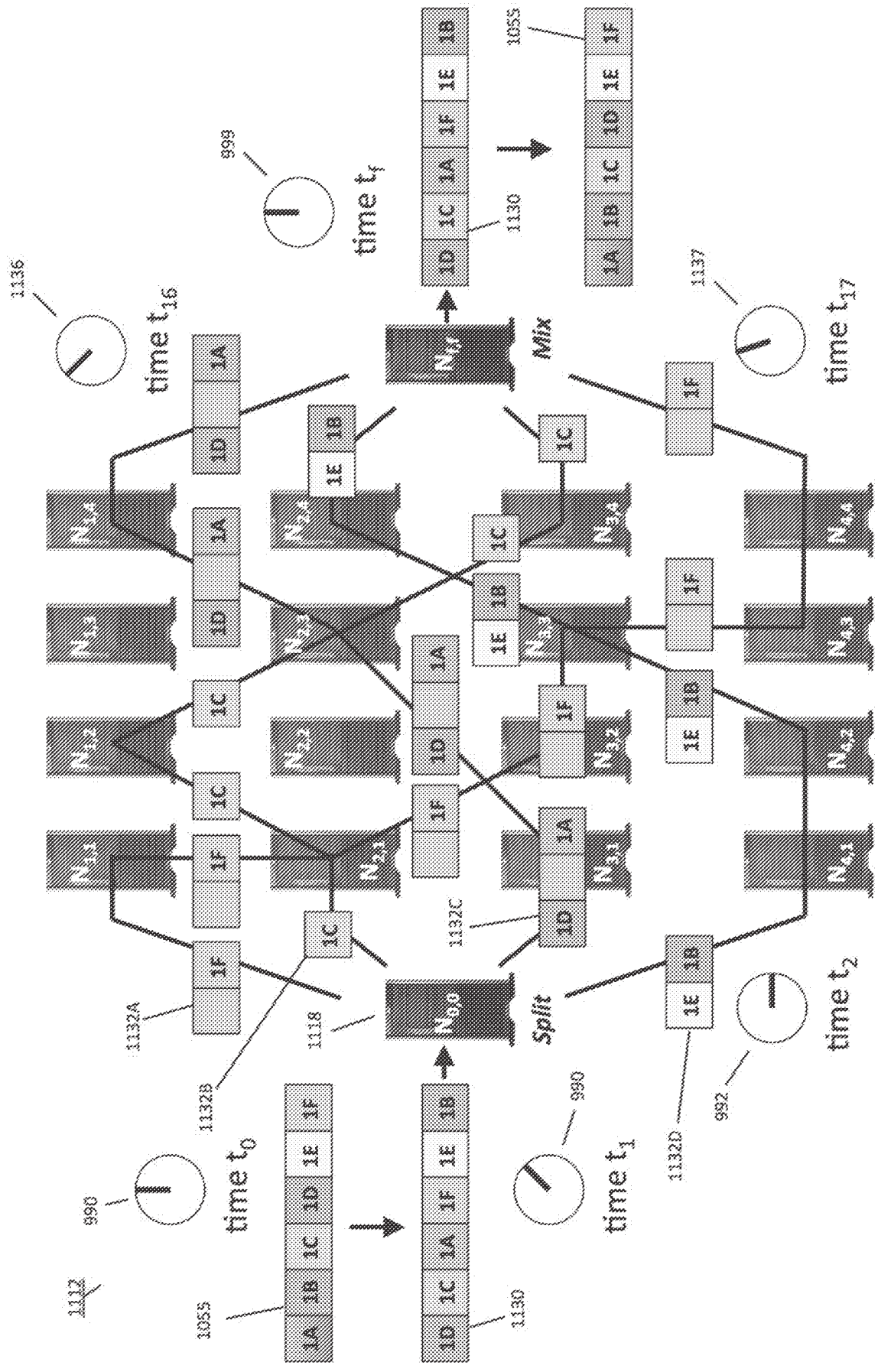

1112
990
time t_0
1055
1130
1132A
1132B
1118
1132C
Split
time t_1
1132D
992
time t_2
time t_{16}
1136
time t_f
999
Mix
1137
time t_{17}

Figure 76

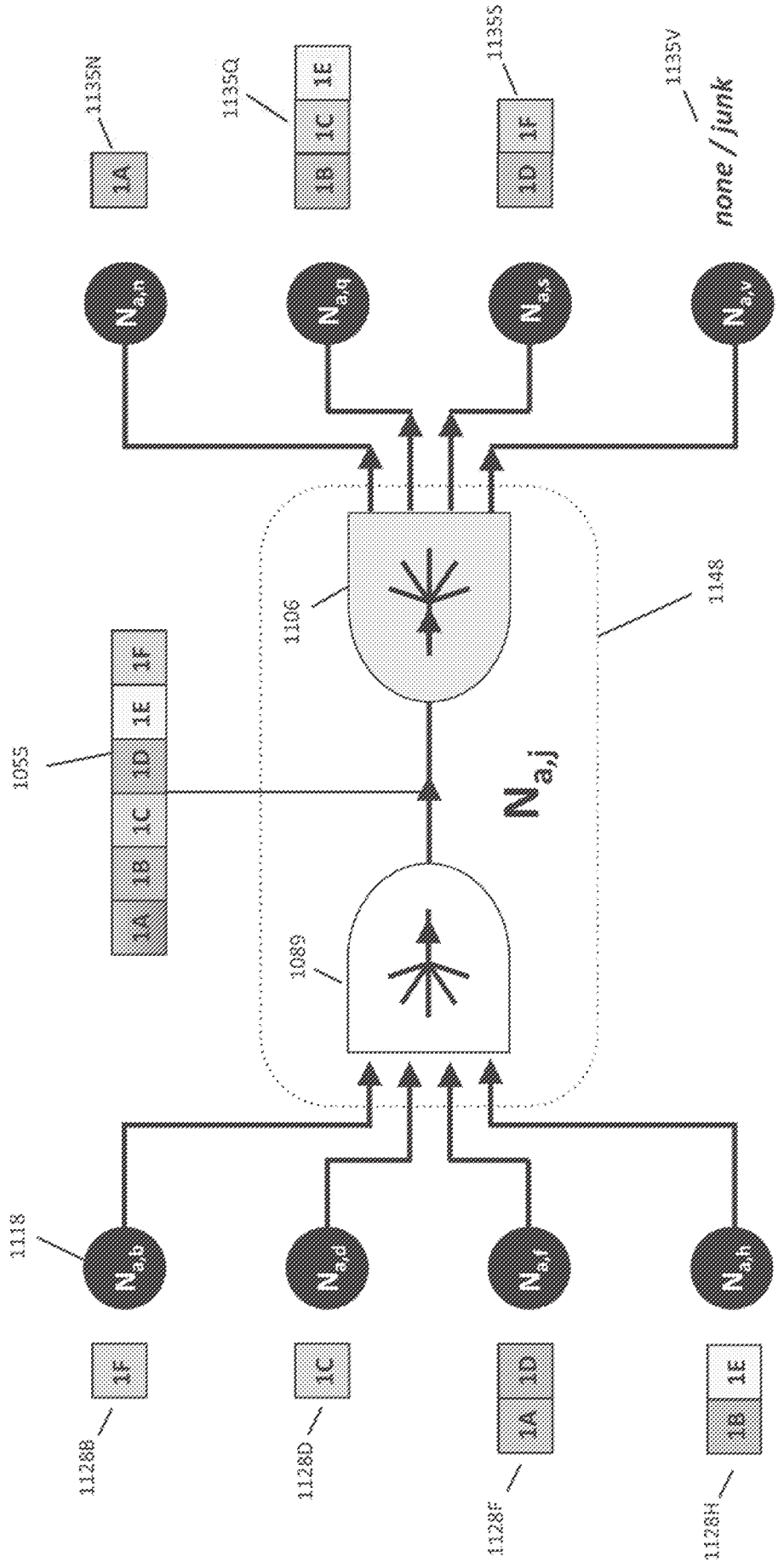

1135N
1A
1135Q
1B
1C
1E
11355
1D
1F
1135V
none / junk
$N_{a,n}$
$N_{a,o}$
$N_{a,s}$
$N_{a,v}$
1106
1148
1055
1A
1B
1C
1D
1E
1F
$N_{a,j}$
1089
1118
$N_{a,b}$
$N_{a,d}$
$N_{a,f}$
$N_{a,h}$
1F
1C
1A
1D
1B
1E
11288
1128D
1128F
1128H

Figure 77A

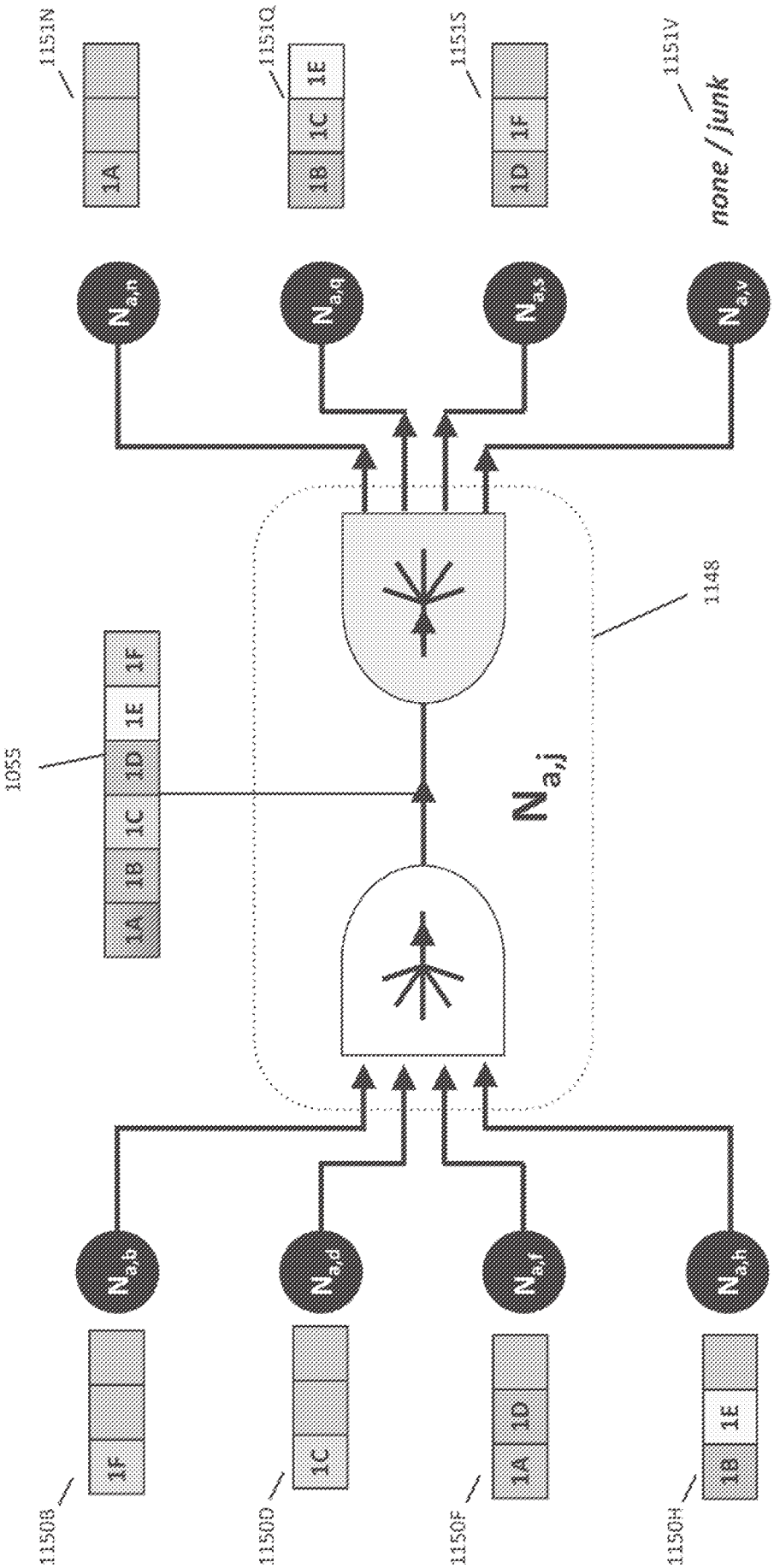

1151N
1151Q
1151S
1151V
none / junk
1A
1B
1C
1D
1E
1F
1055
1148
$N_{a,i}$
1150B
1150D
1150F
1150H

Figure 77B

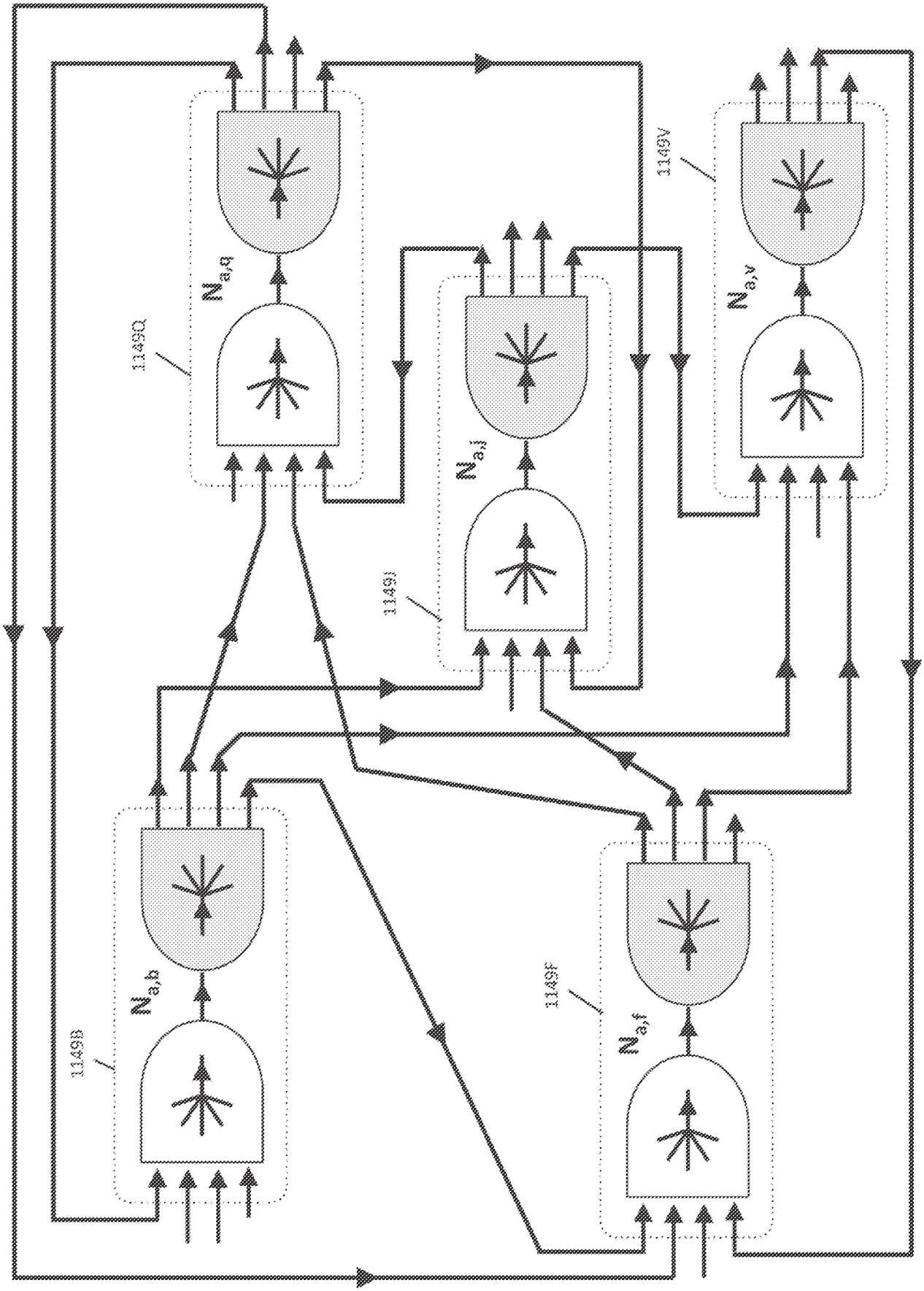


Figure 77C

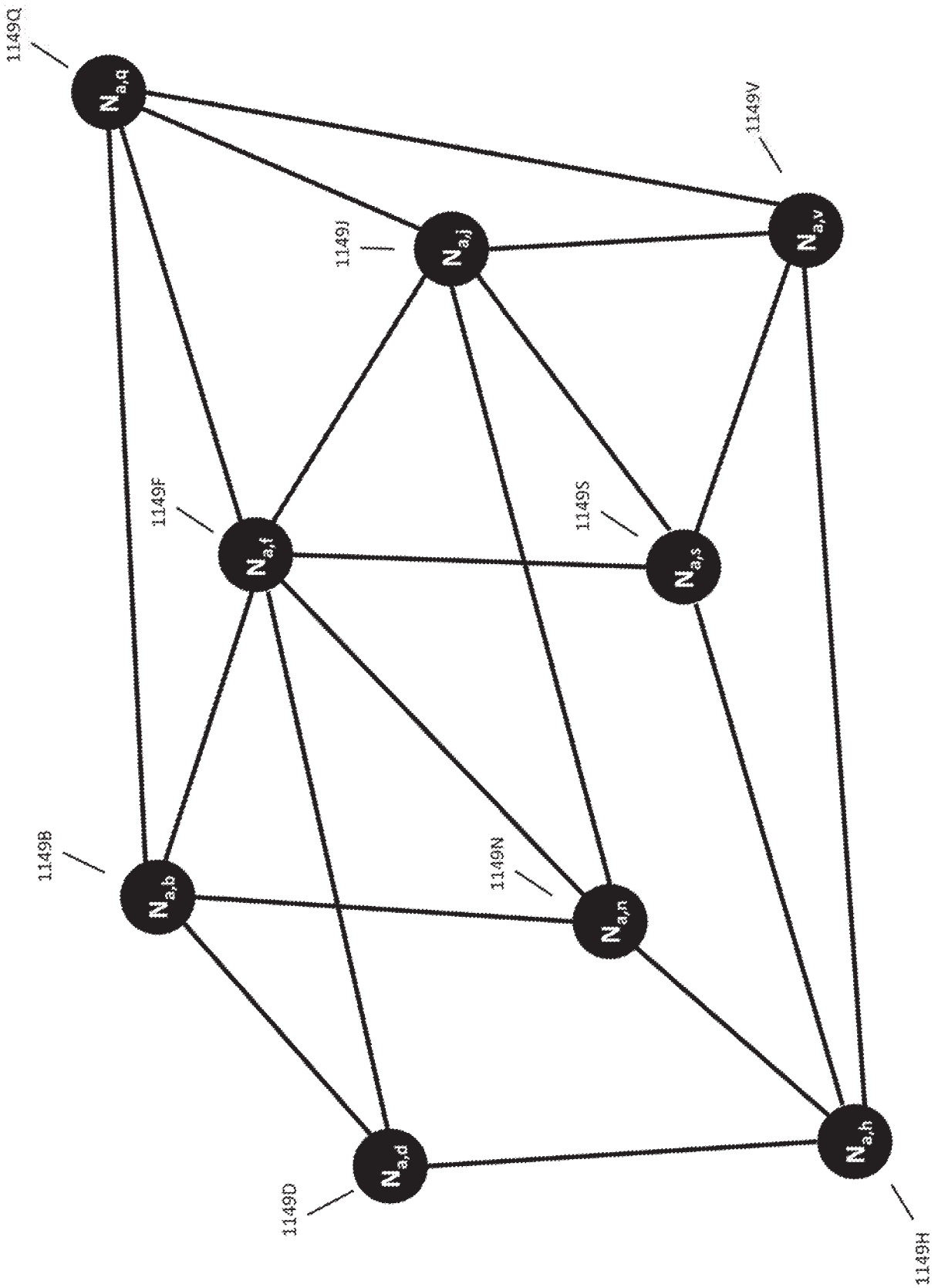

1149Q
$N_{a,q}$
1149V
$N_{a,v}$
1149J
$N_{a,j}$
1149F
$N_{a,f}$
1149S
$N_{a,s}$
1149B
$N_{a,b}$
1149N
$N_{a,n}$
1149D
$N_{a,d}$
1149H
$N_{a,h}$

Figure 77D

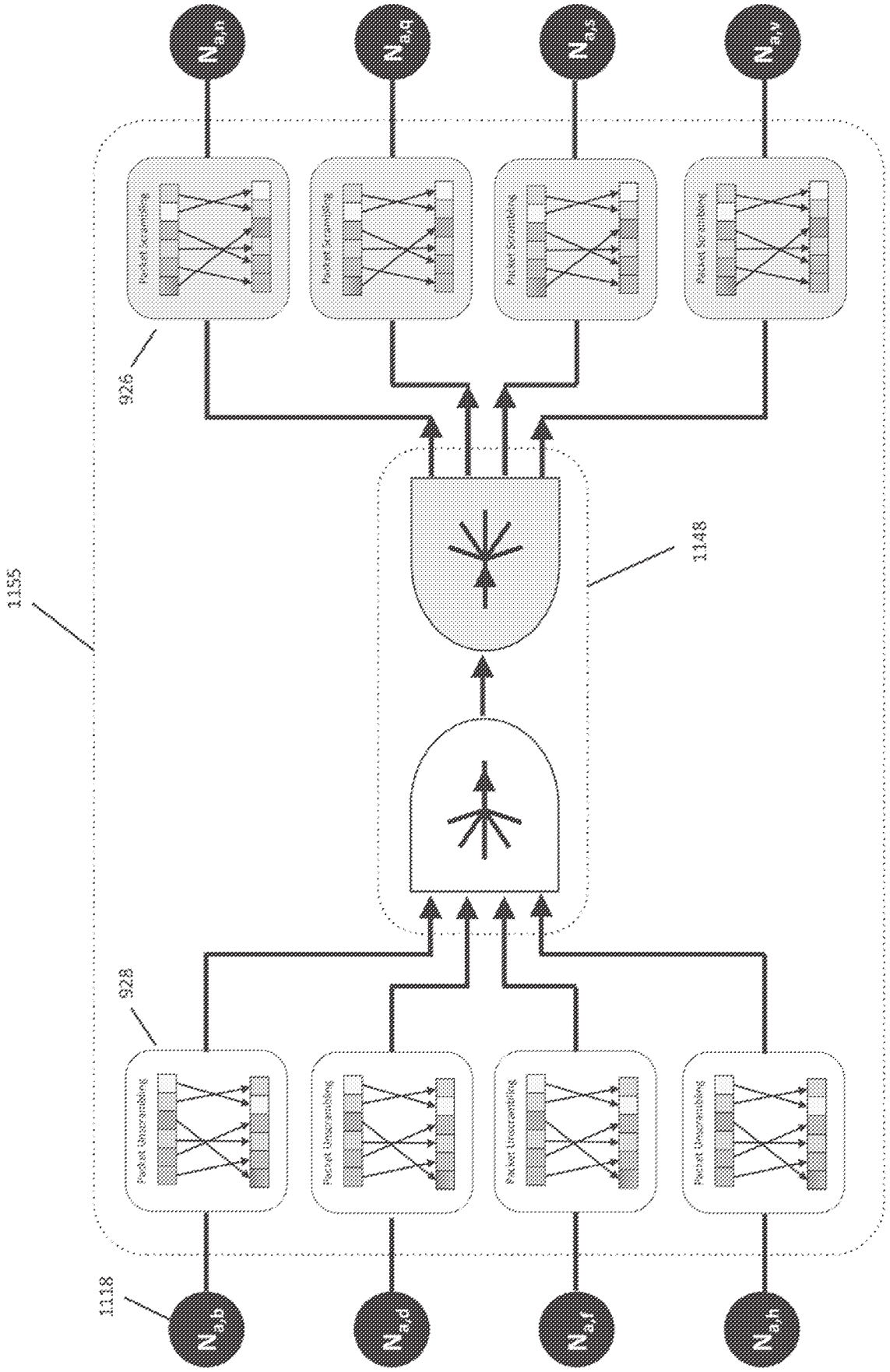

1155
926
928
1148
1118
Packet Scrambling
Packet Unscrambling

Figure 78A

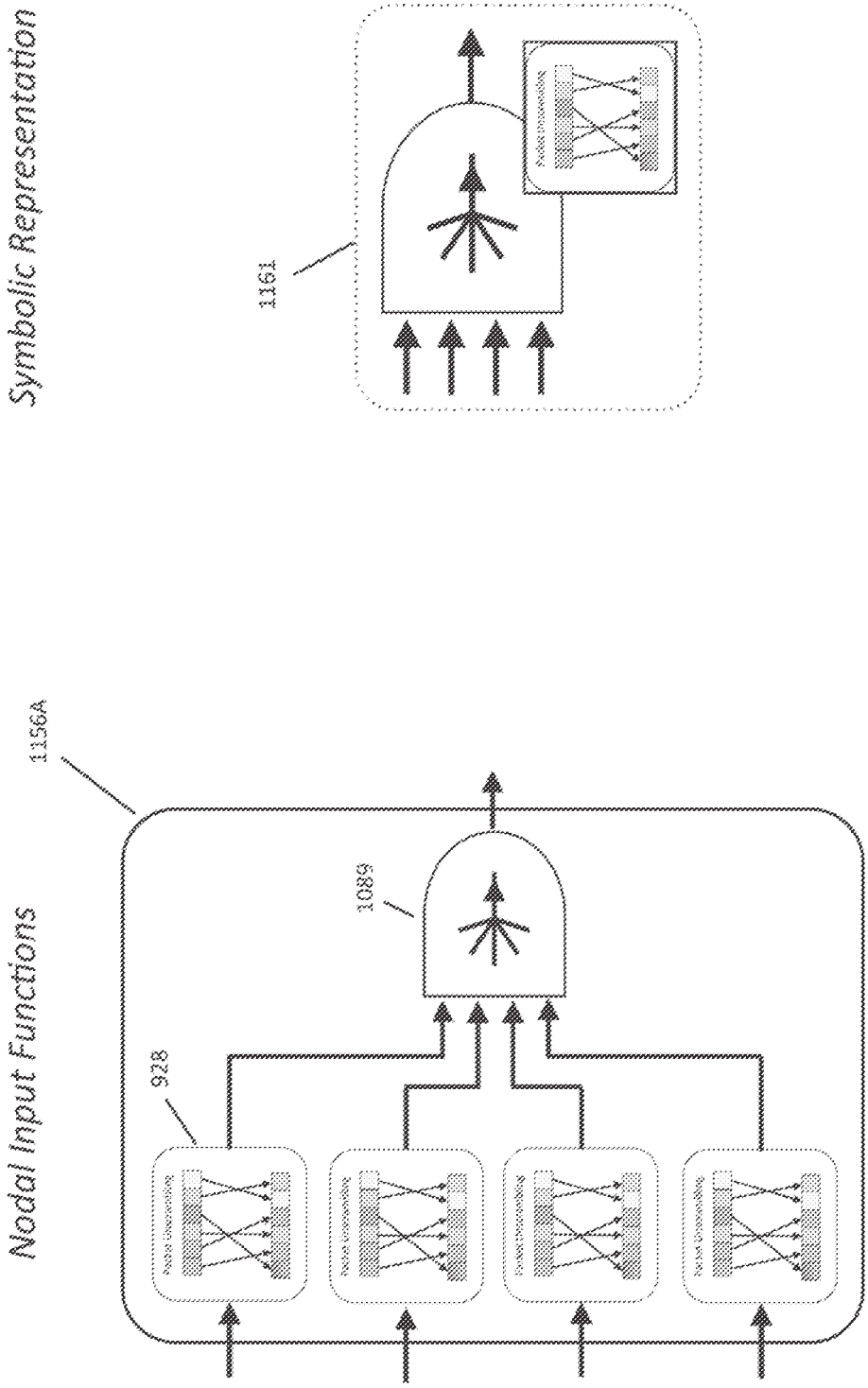

Symbolic Representation
1161
Nodal Input Functions
1156A
1089
928

Figure 78B

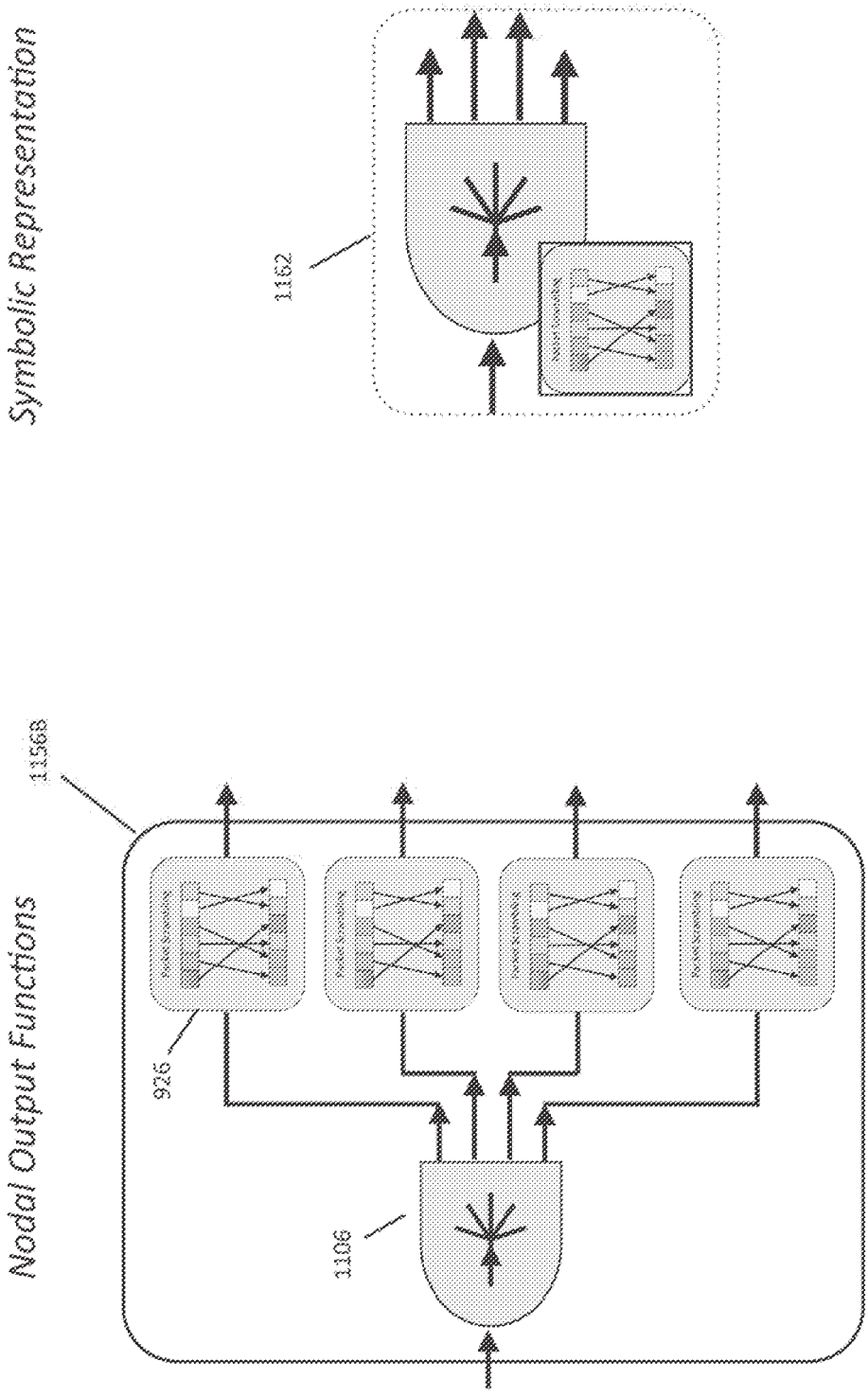

Symbolic Representation
1162
Nodal Output Functions
11568
926
1106

Figure 78C

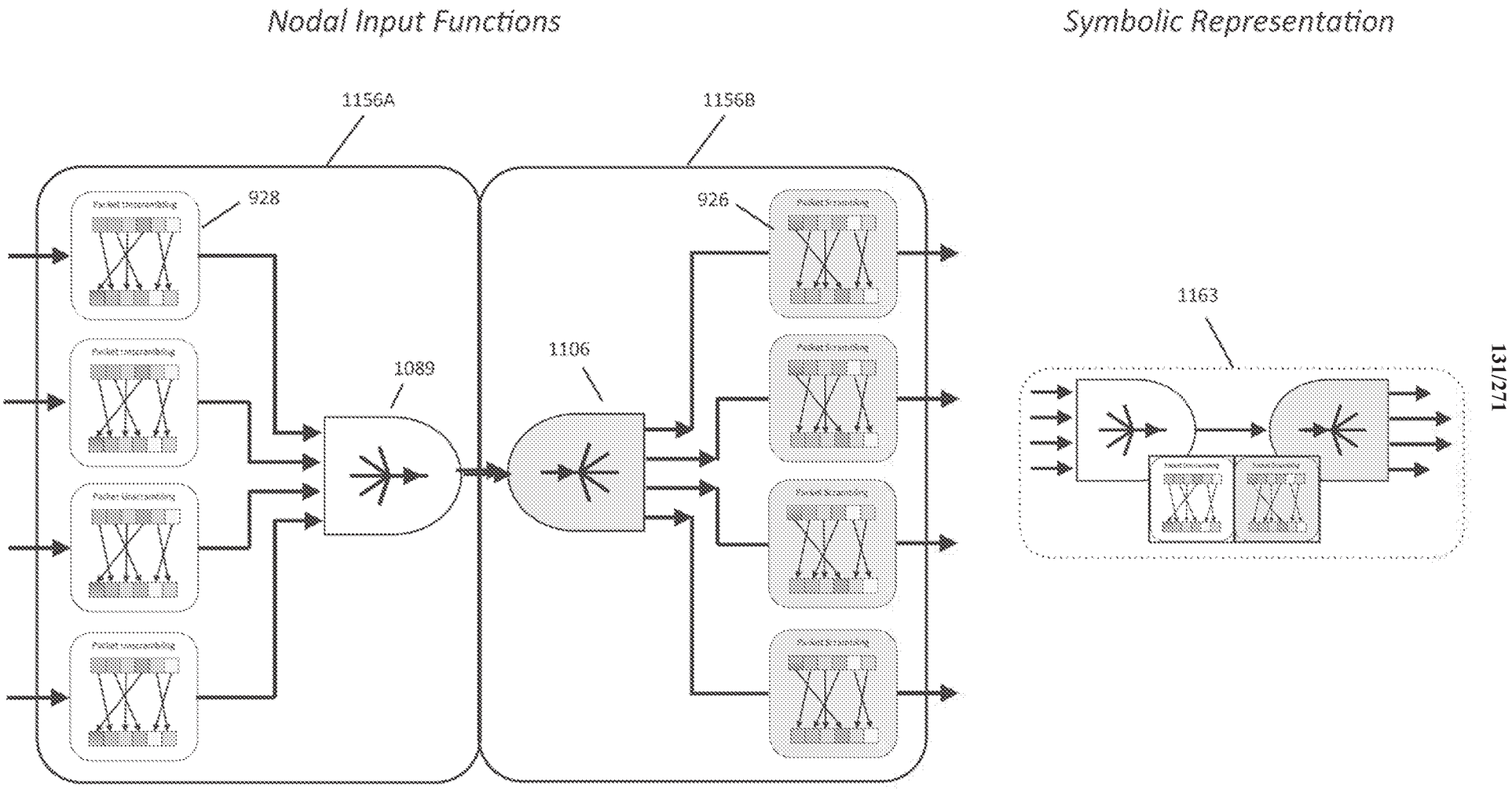

Nodal Input Functions
Symbolic Representation
1156A
1156B
928
926
1089
1106
1163

Figure 78D

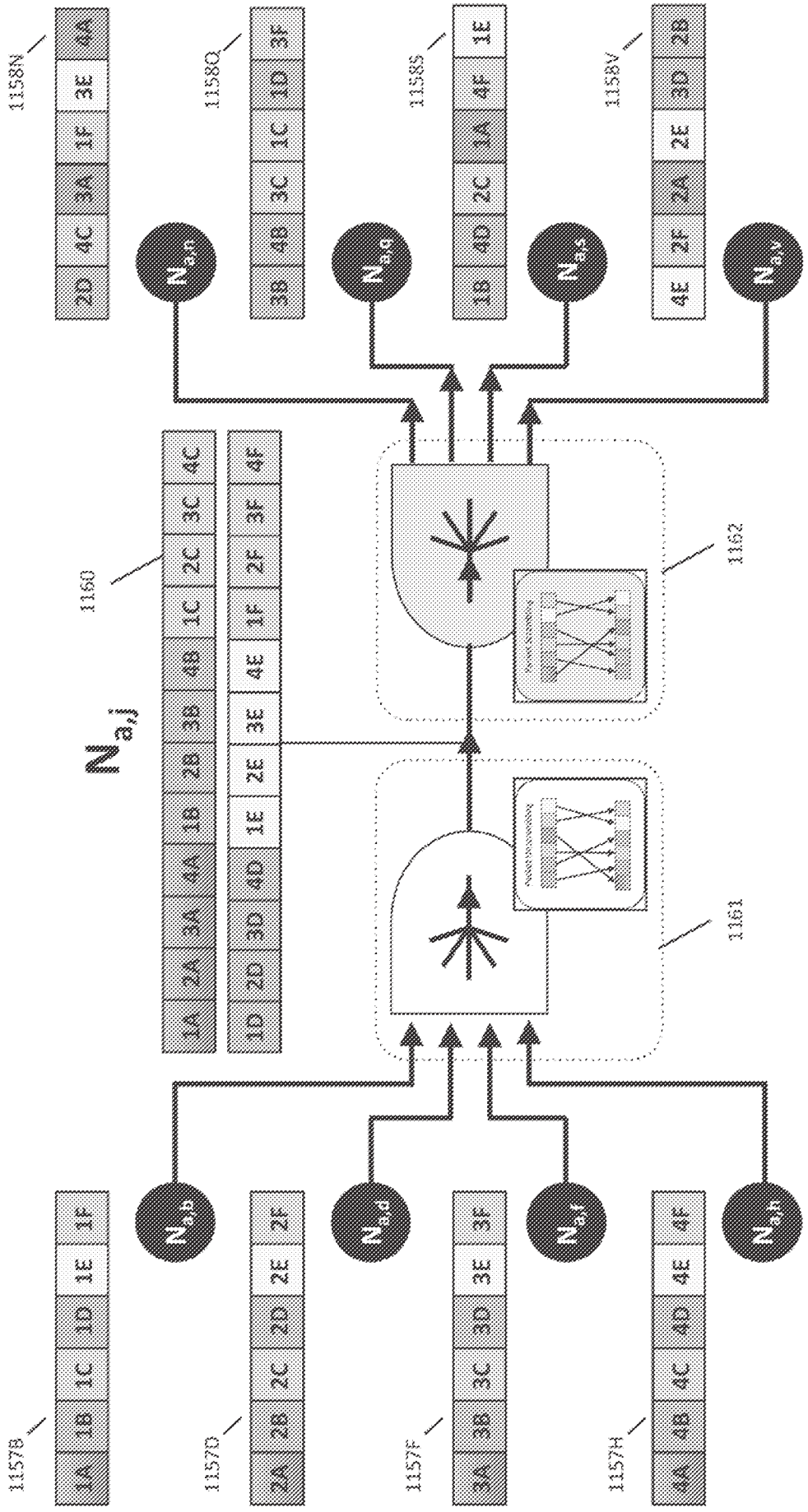

1158N
1158Q
1158S
1158V
1160
$N_{a,j}$
1162
1161
1157B
1157D
1157F
1157H

Figure 79A

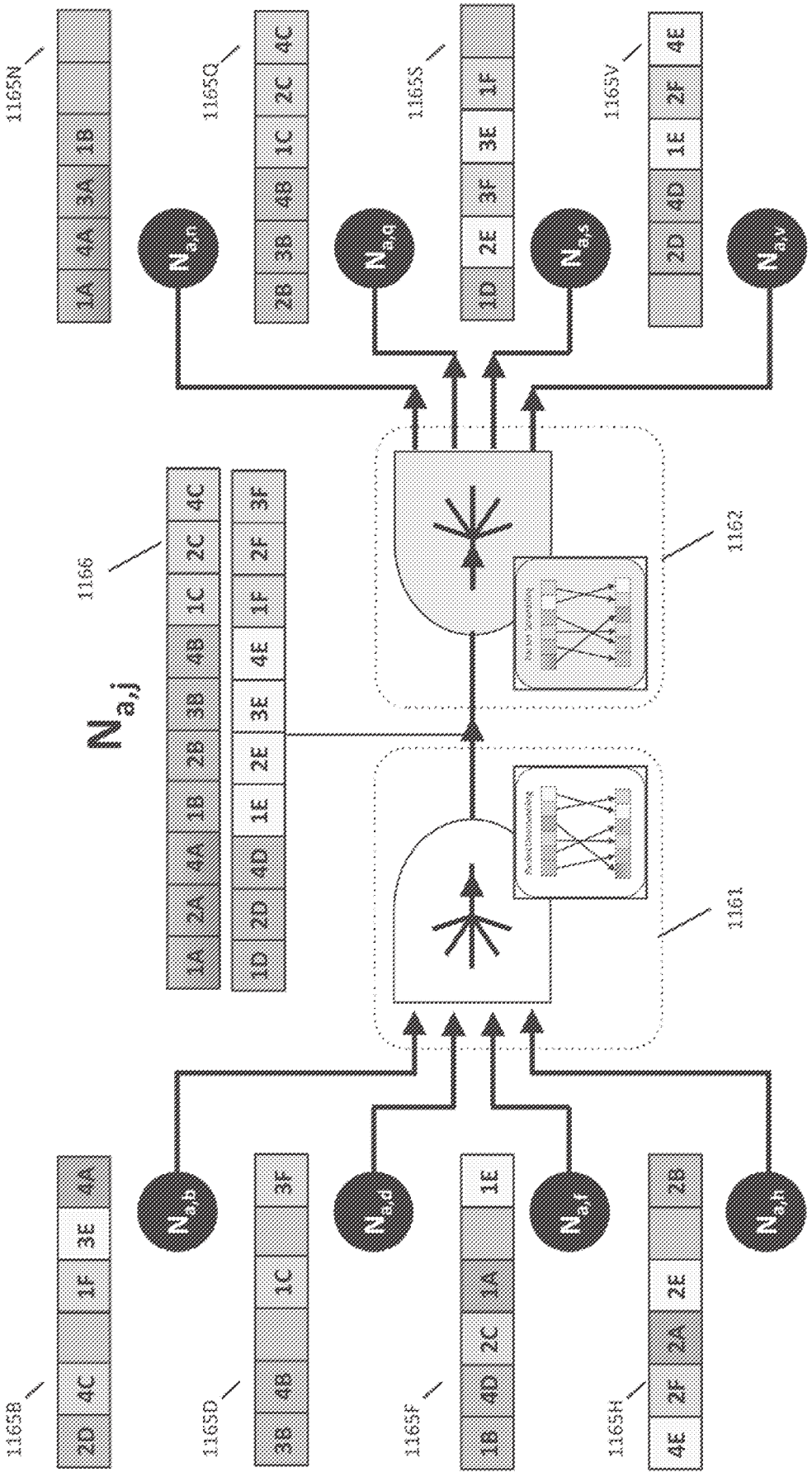

1165N
1A 4A 3A 1B
1165Q
2B 3B 4B 1C 2C 4C
1165S
1D 2E 3F 3E 1F
1165V
2D 4D 1E 2F 4E
$N_{a,n}$
$N_{a,q}$
$N_{a,s}$
$N_{a,v}$
1166
$N_{a,j}$
1A 2A 4A 1B 2B 3B 4B 1C 2C 4C
1D 2D 4D 1E 2E 3E 4E 1F 2F 3F
1162
1161
$N_{a,b}$
$N_{a,d}$
$N_{a,f}$
$N_{a,h}$
1165B
2D 4C 1F 3E 4A
1165D
3B 4B 1C 3F
1165F
1B 4D 2C 1A 1E
1165H
4E 2F 2A 2E 2B

Figure 79B

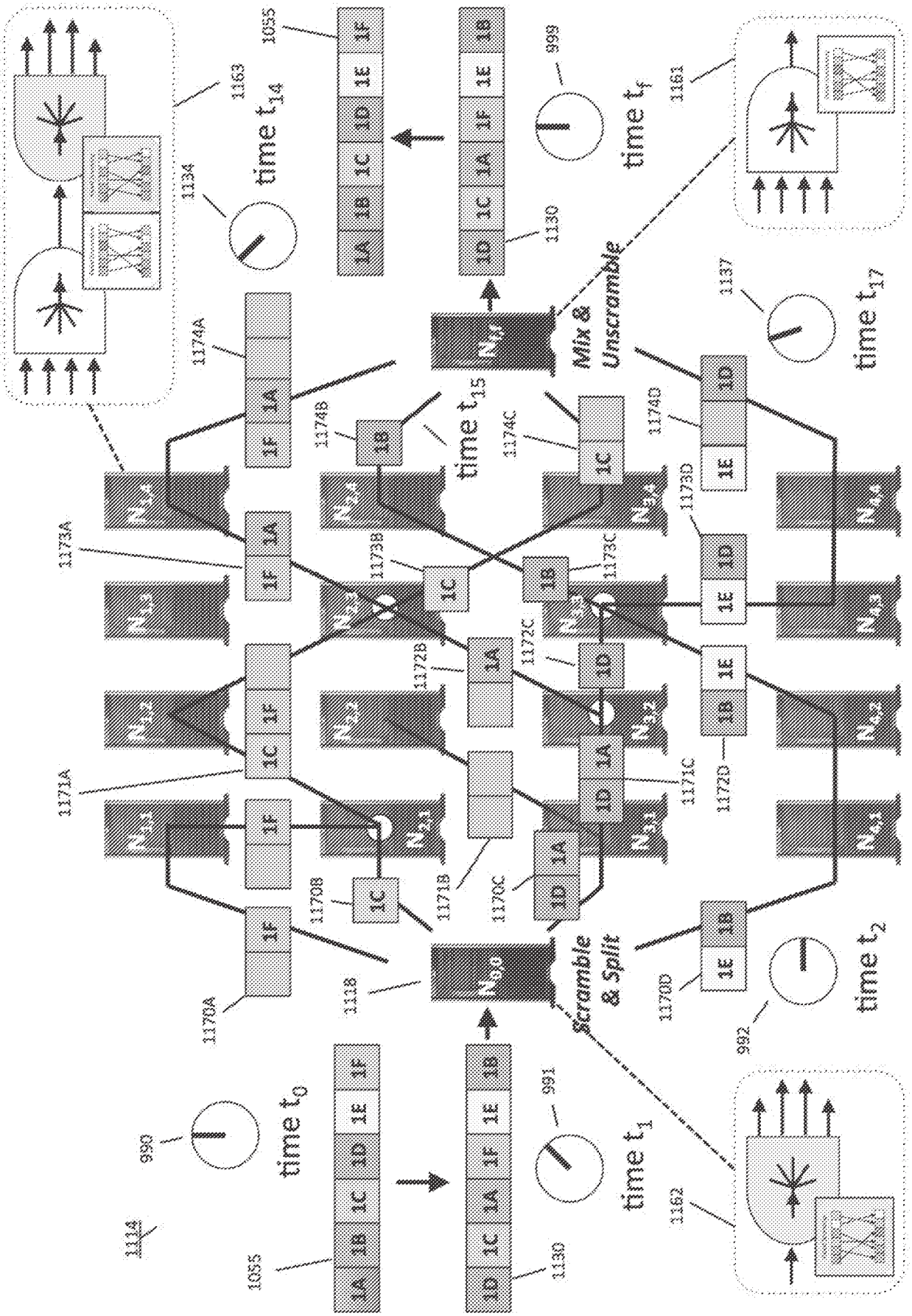

time t_0
time t_1
time t_2
time t_{14}
time t_{15}
time t_{17}
time t_f
Scramble & Split
Mix & Unscramble
1114
1118
1130
1134
1137
1161
1162
1163
1170A
1170C
1170D
1171A
1171B
1171C
1172B
1172C
1172D
1173A
1173B
1173C
1173D
1174A
1174B
1174C
1174D
1708
990
991
992
993
1055
1A
1B
1C
1D
1E
1F

Figure 8D

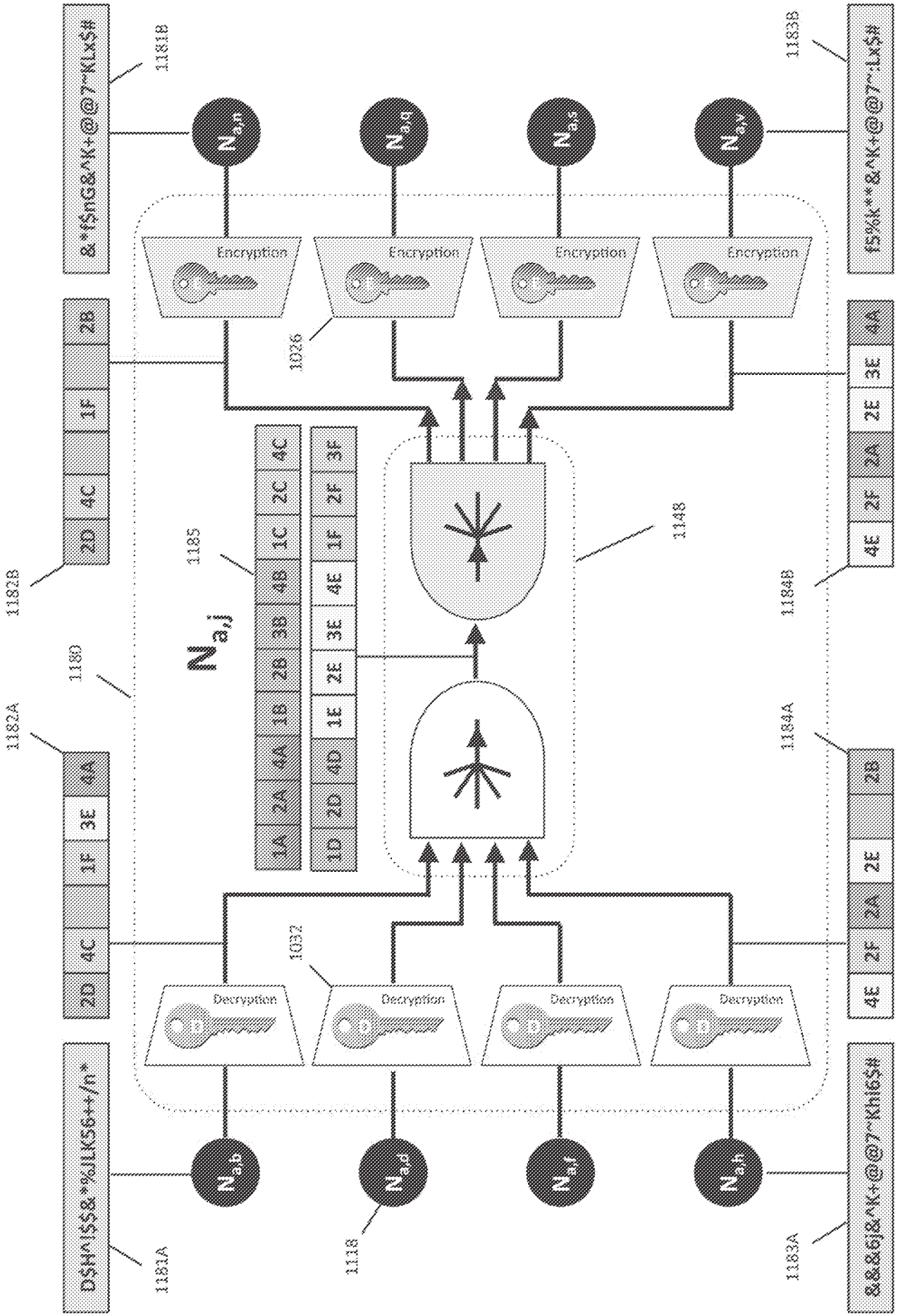

D$H^I$$&*%JLKS6++/n*
1181A
&*f$nG&^K+@@7~KLx$#
1181B
8&&6j&^K+@@7~Kh!6$#
1183A
f5%k**&^K+@@7~Lx$#
1183B
1182A
1182B
1184A
1184B
1185
1148
1118
1026
1032
Encryption
Decryption
Na,n
Na,q
Na,s
Na,v
Na,b
Na,d
Na,f
Na,h
Na,j

Figure 81A

Symbolic Representation
1090
Nodal Input Functions
1089
1032
Decryption
Decryption
Decryption
Decryption

Figure 81B

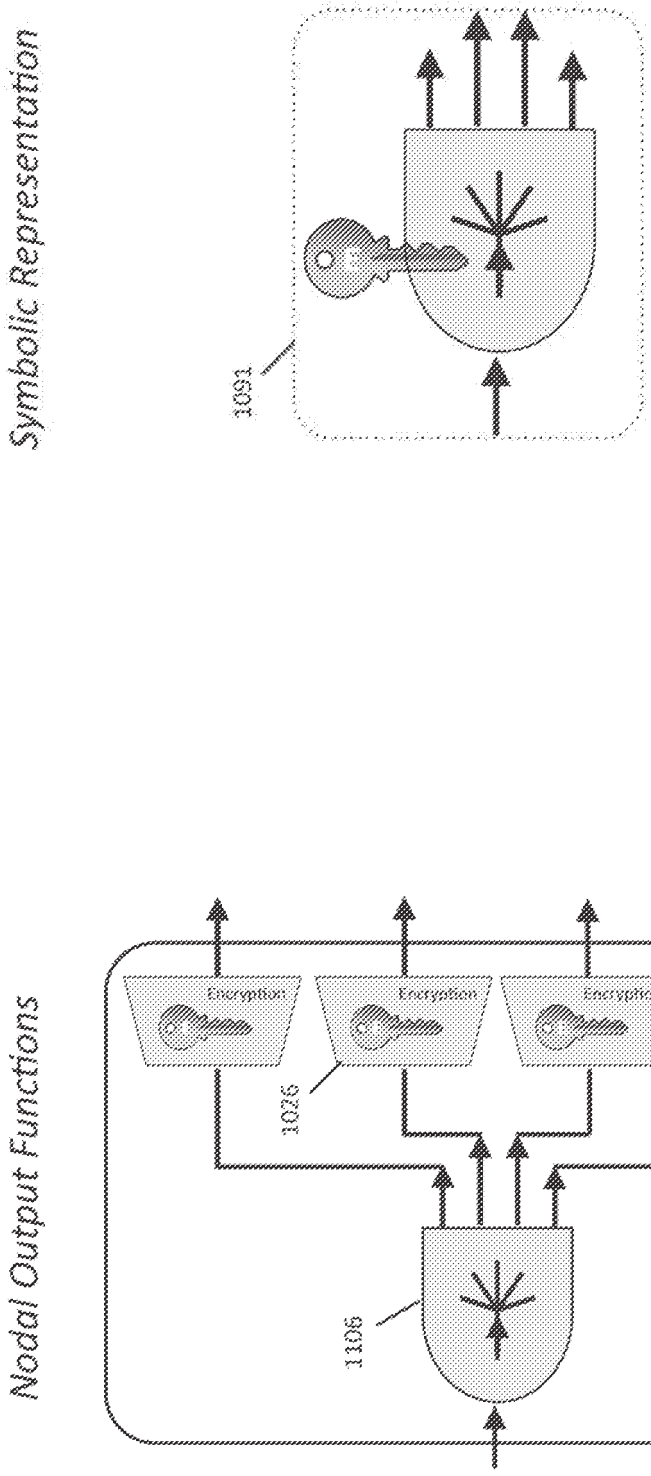

Symbolic Representation
1091
Nodal Output Functions
Encryption
Encryption
Encryption
Encryption
1026
1106

Figure 81C

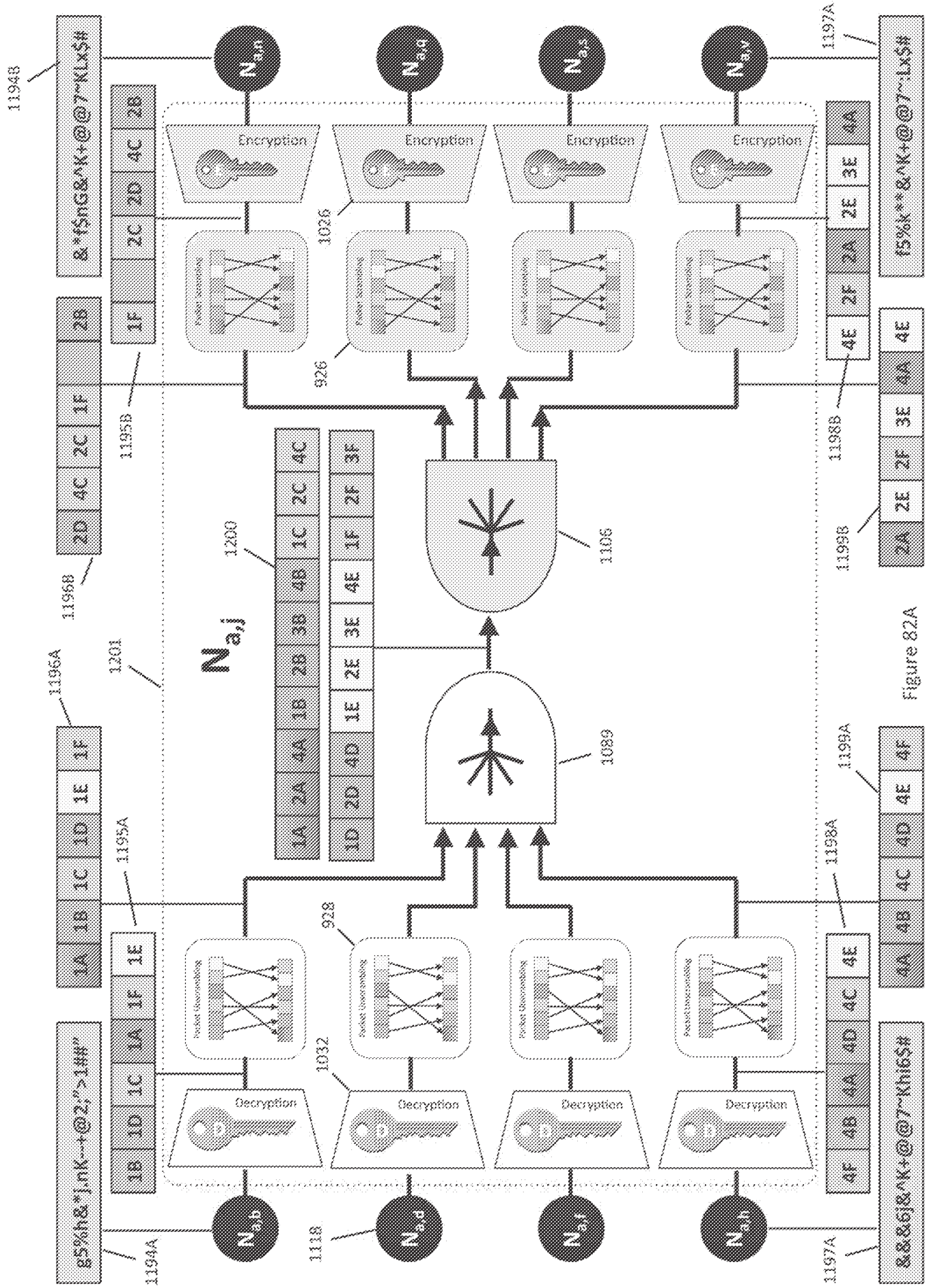

11948
&*f5mG&^K+@@7~KLx$#
1196B
2D 4C 2C 1F 2B
1195B
1F 2C 2D 4C 2B
1026
926
1200
$N_{a,j}$
1201
1196A
1A 1B 1C 1D 1E 1F
1195A
1B 1D 1C 1A 1F 1E
928
1032
g5%h&*j,mK--+@2,">1##"
1194A
1118
1106
1089
1198B
2A 2E 2F 3E 4A 4E
4E 2F 2A 2E 3E 4A
1197A
f5%k**&^K+@@7~Lx$#
1199B
1198A
4A 4B 4C 4D 4E 4F
4F 4B 4A 4D 4C 4E
1199A
1197A
&&&6j&^K+@@7~Khi6S#
Encryption
Decryption
Packet Scrambling
Packet Unscrambling

Figure 82A

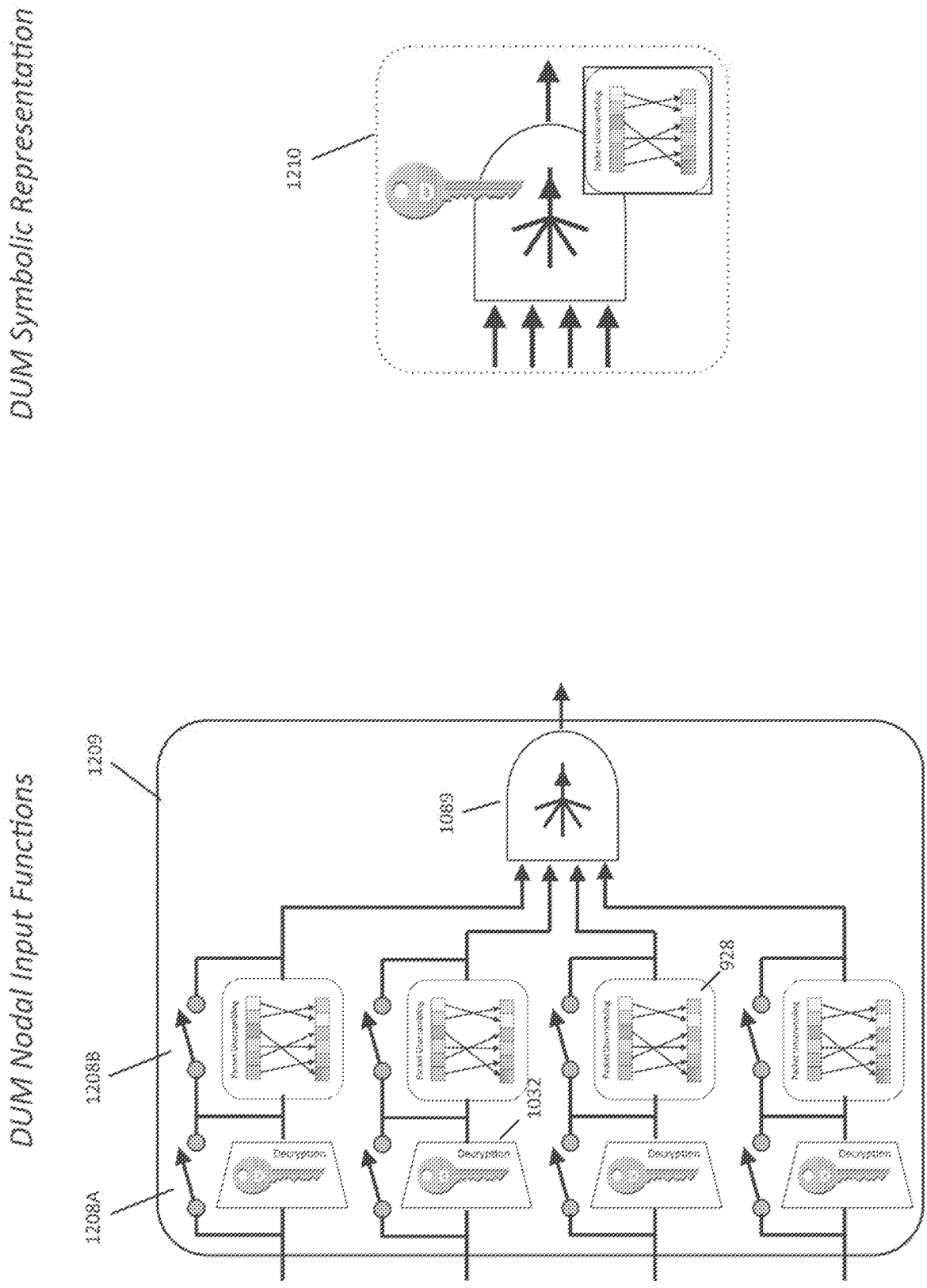
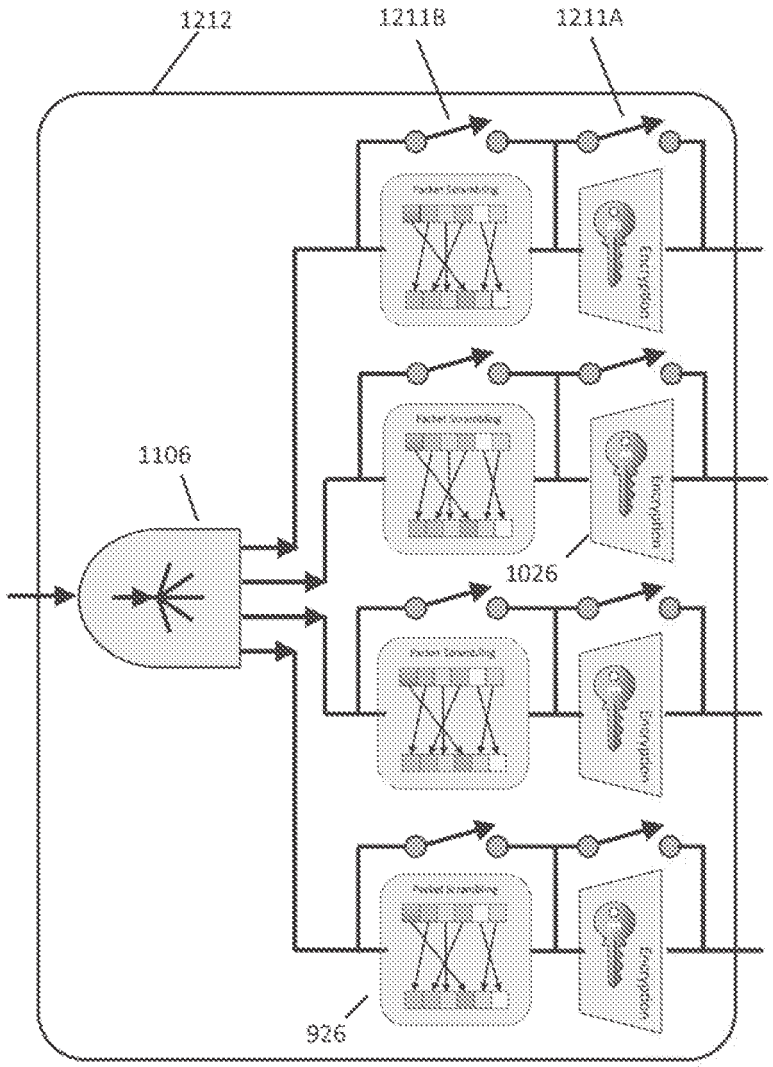

DUM Symbolic Representation
1210
DUM Nodal Input Functions
1209
1208B
1208A
1089
1032
928
Decryption
Decryption
Decryption
Decryption

Figure 82B

SSE Nodal Output Functions



Symbolic Representation

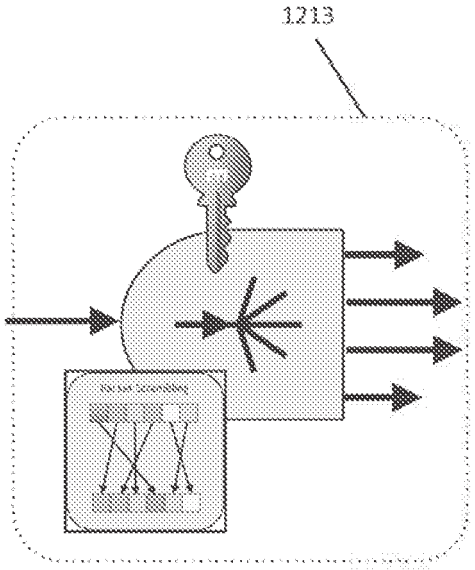


Figure 82C

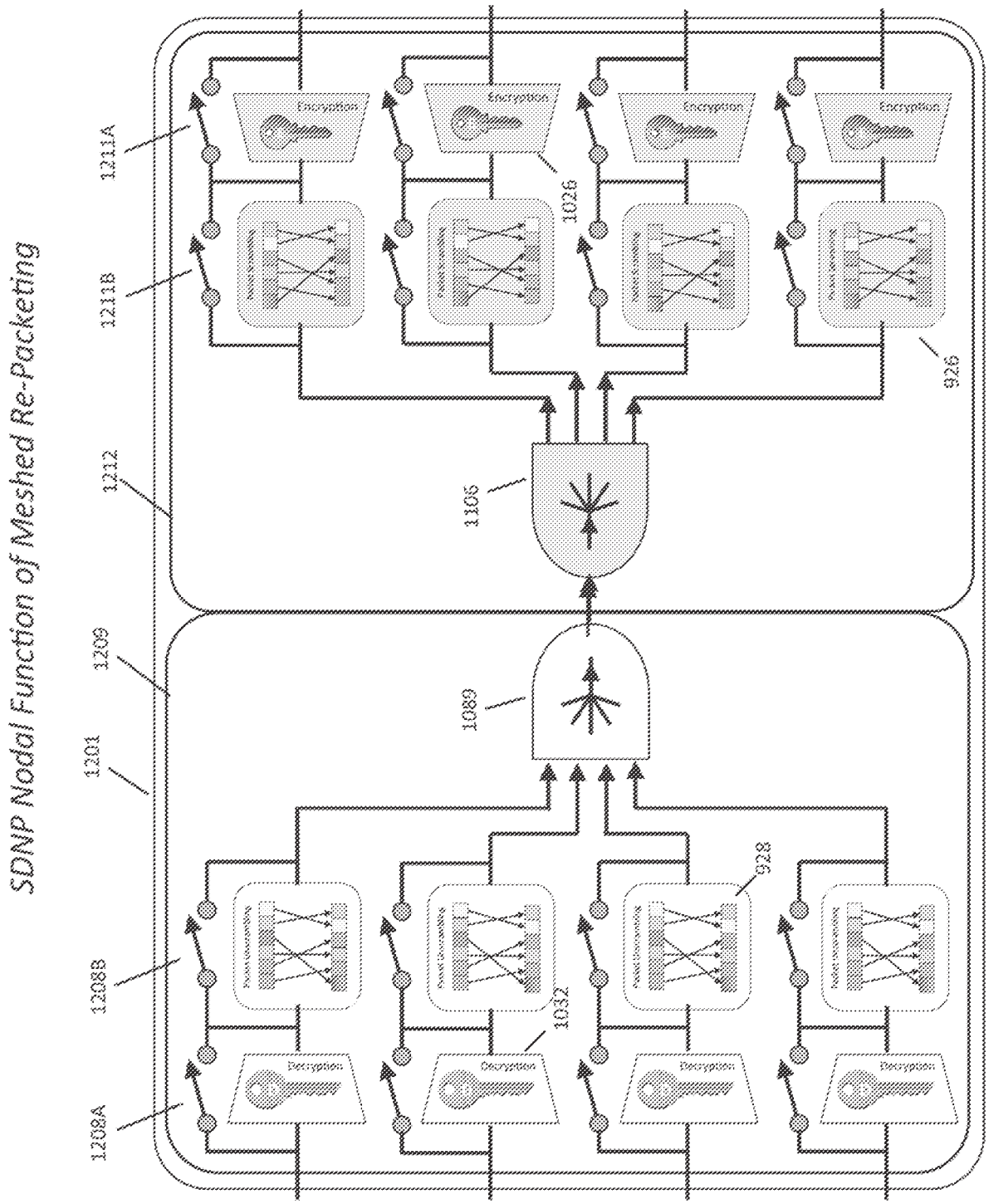

SDNP Nodal Function of Meshed Re-Packeting
1201
1209
1212
1211A
1211B
1208A
1208B
1089
1105
1026
926
928
1032
Encryption
Decryption

Figure 83A

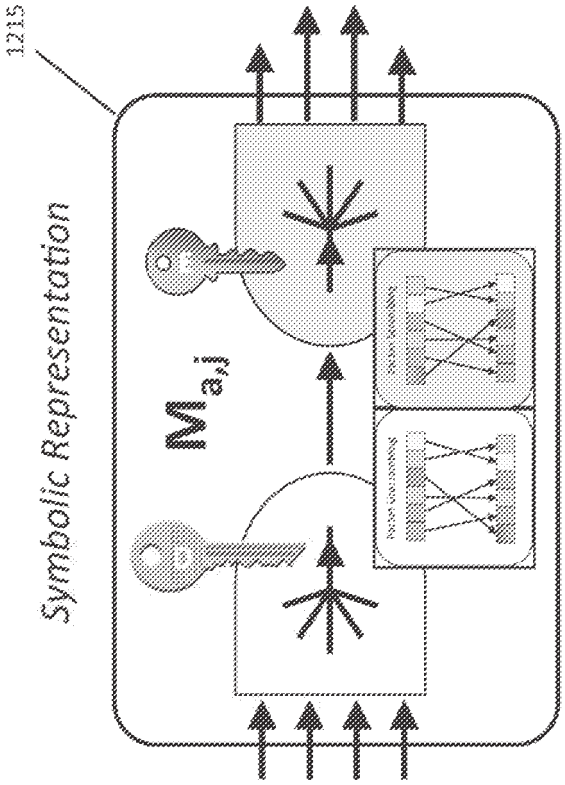


Figure 83B

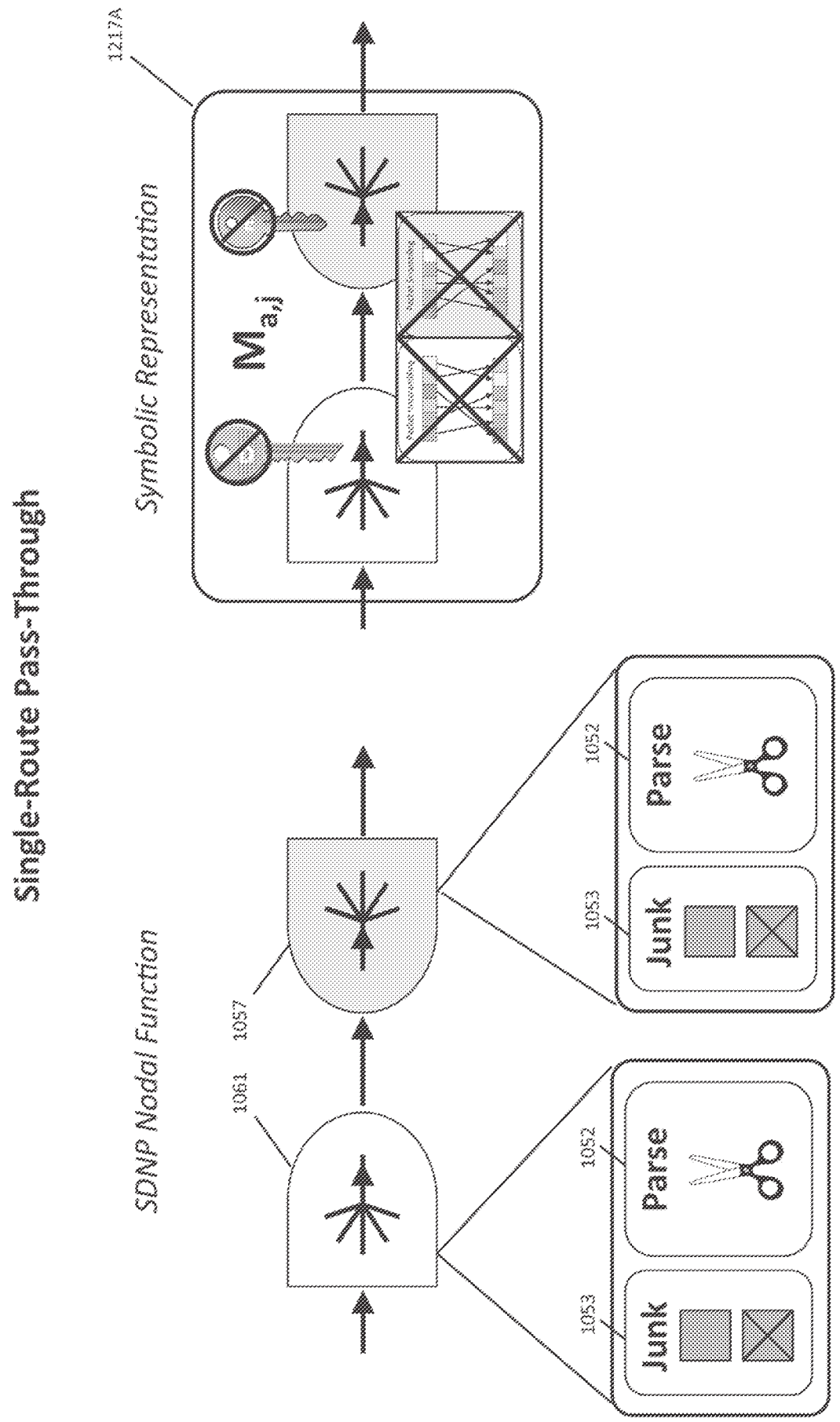

Single-Route Pass-Through
SDNP Nodal Function
Symbolic Representation
1217A
$M_{a,j}$
1061
1057
1052
Parse
1053
Junk
1052
Parse
1053
Junk

Figure 83C

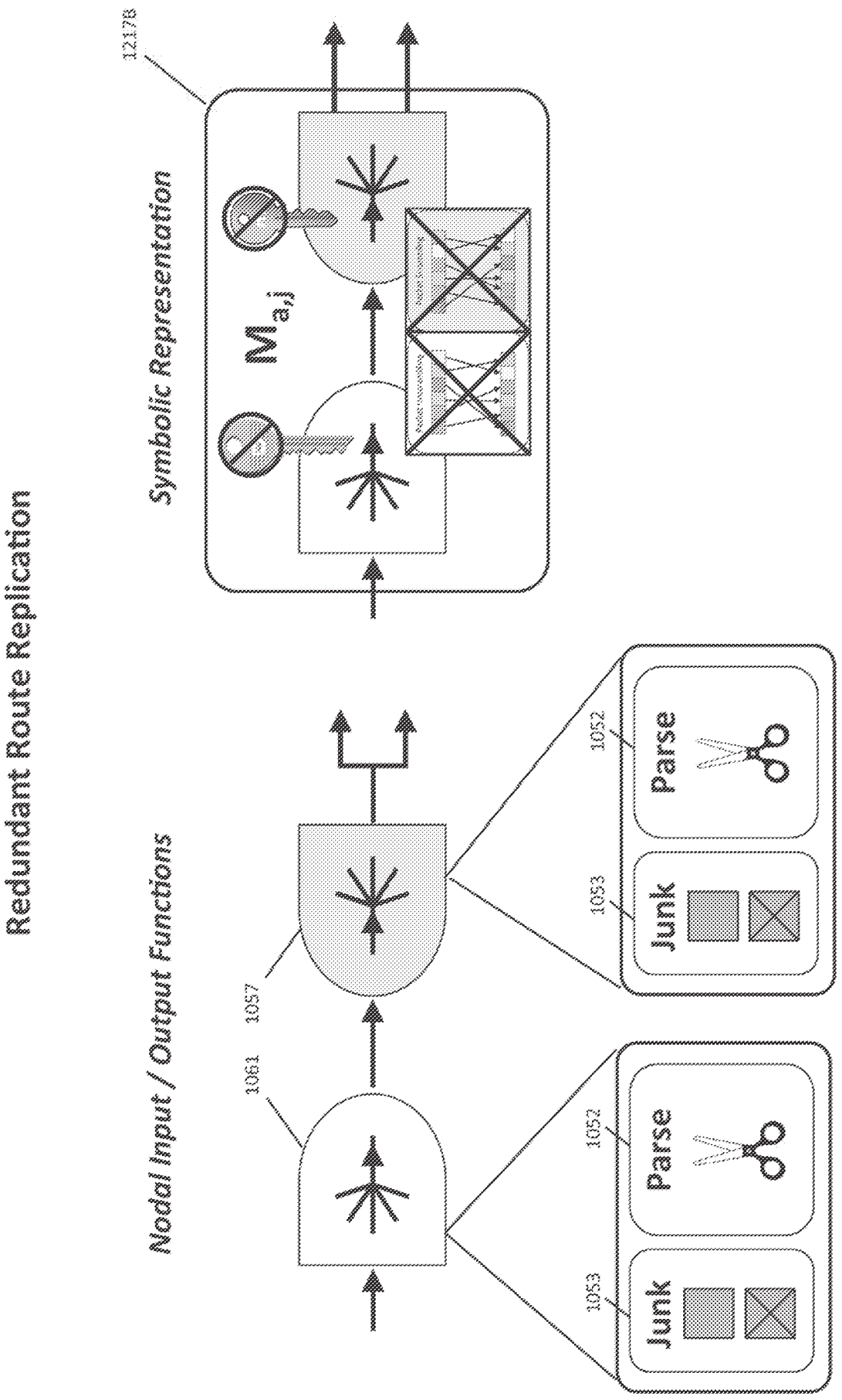

Redundant Route Replication
Nodal Input / Output Functions
Symbolic Representation
12178
$M_{a,j}$
1061
1057
1052
1053
Parse
Junk
1052
1053
Parse
Junk

Figure 83D

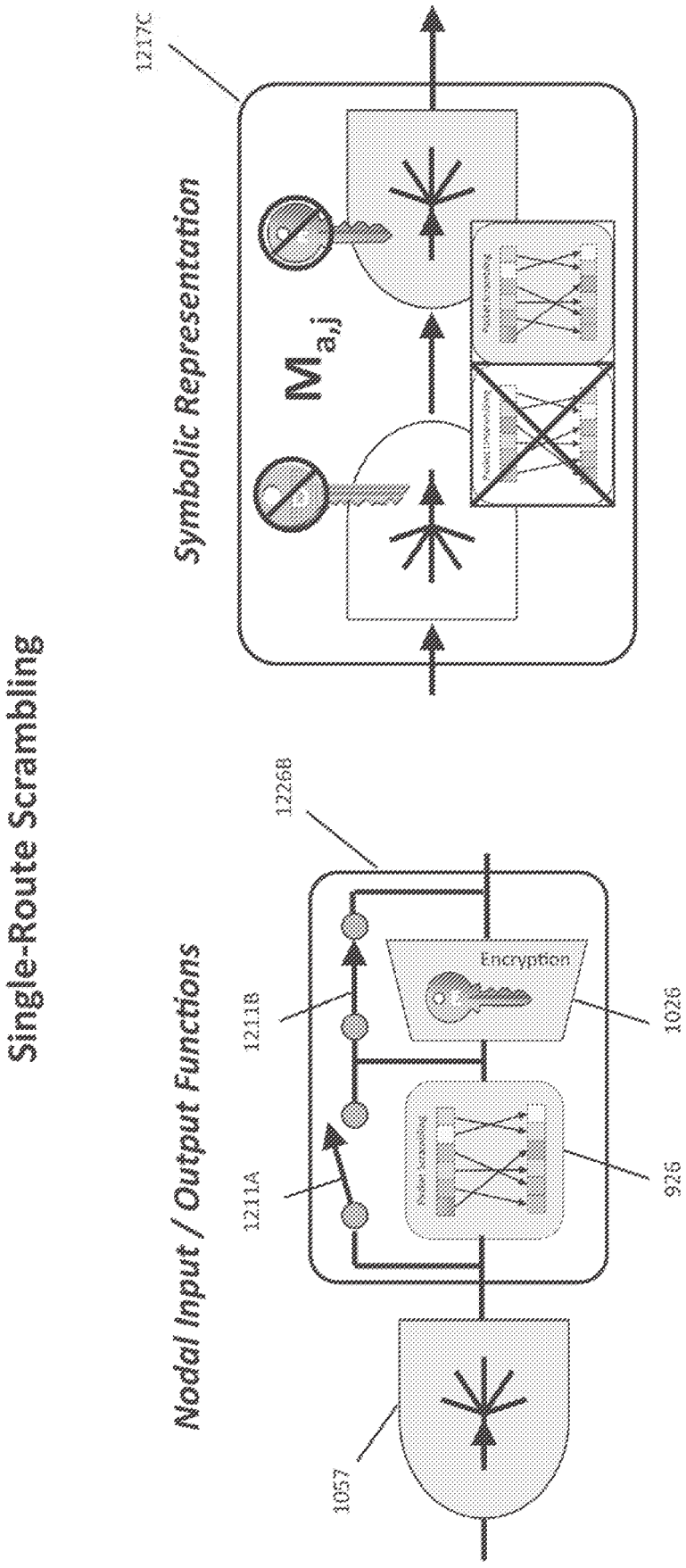

Single-Route Scrambling
Nodal Input / Output Functions
Symbolic Representation
1217C
$M_{a,j}$
12268
12118
1211A
1026
925
1057
Encryption

Figure 83E

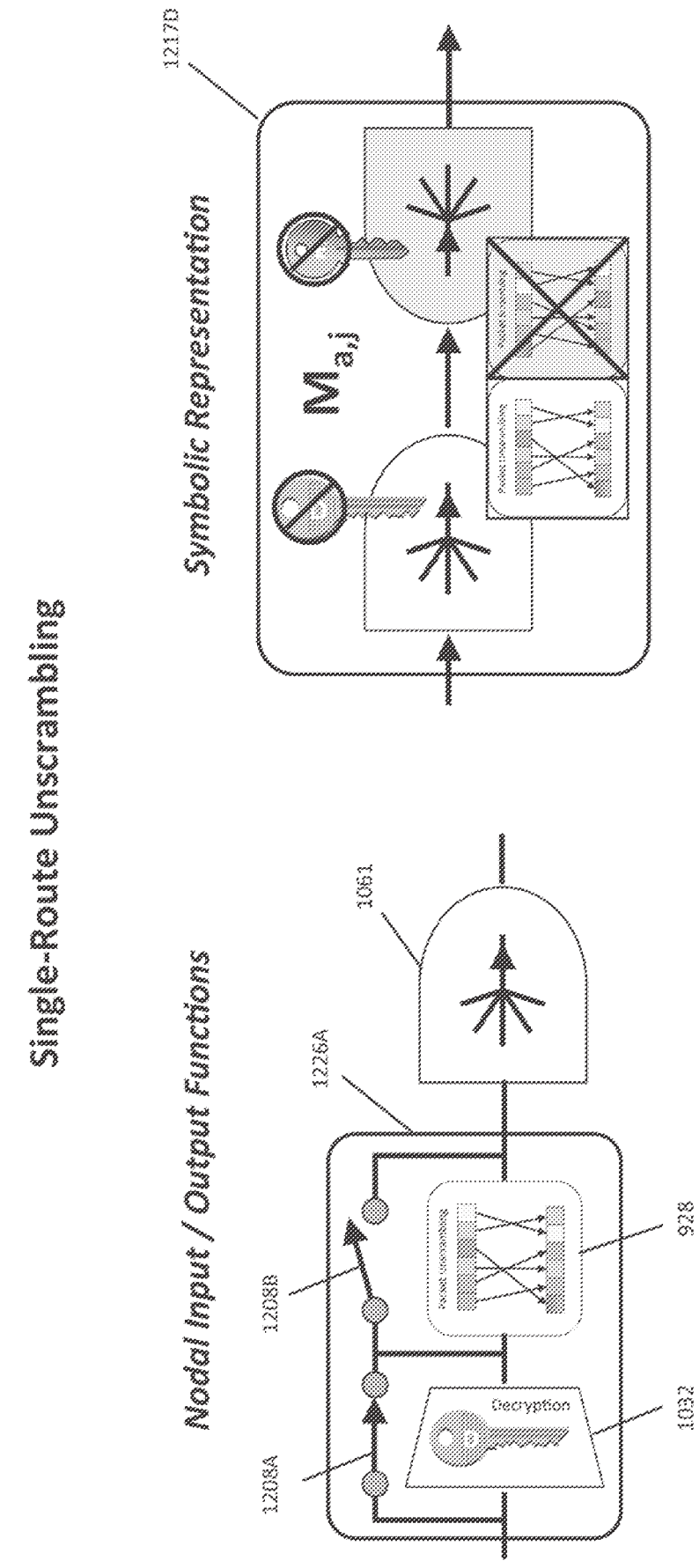

Single-Route Unscrambling
Nodal Input / Output Functions
Symbolic Representation
1217B
1226A
1061
1208B
1208A
928
1032
Decryption
$M_{a,j}$

Figure 83F

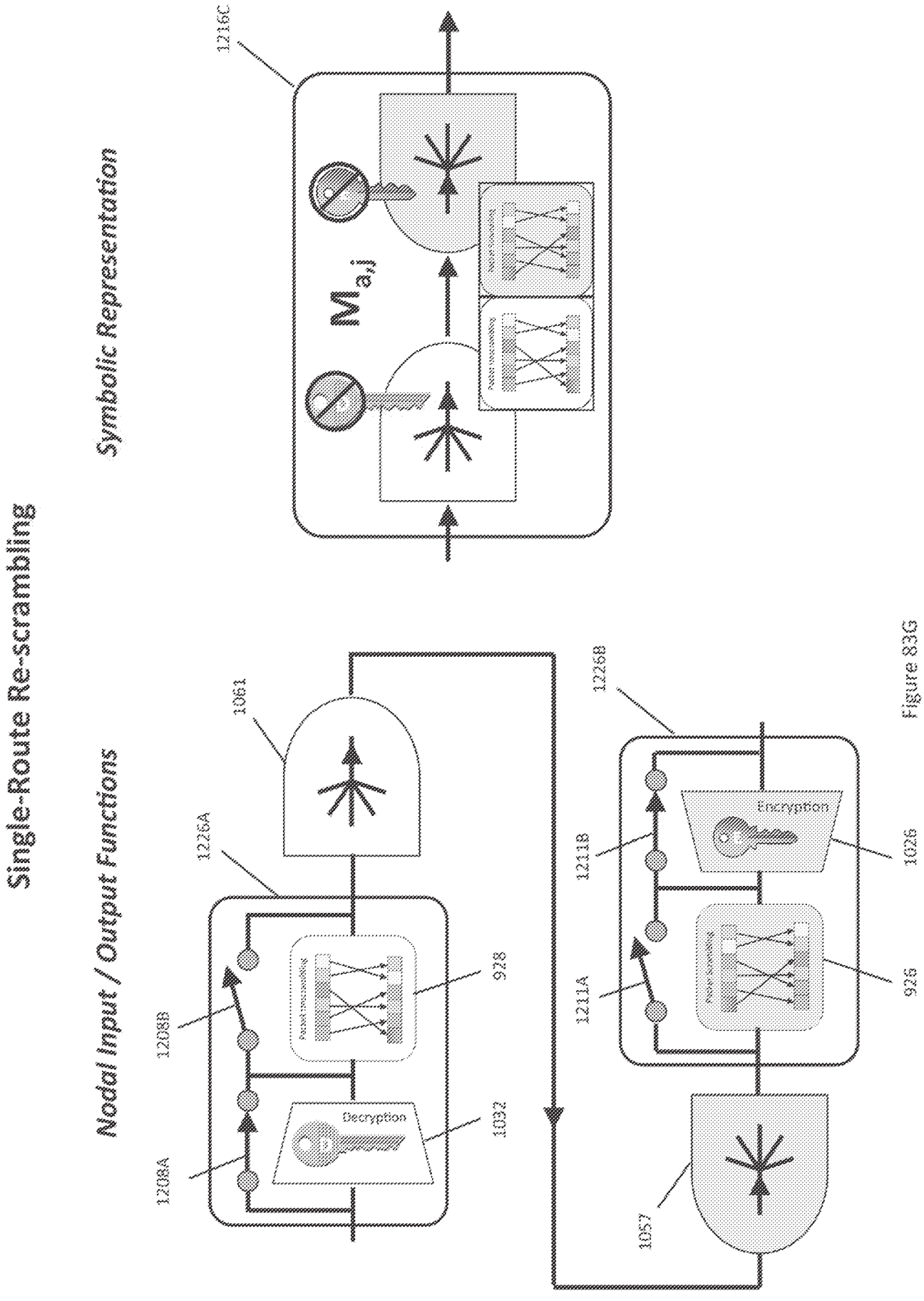

Single-Route Re-scrambling
Nodal Input / Output Functions
Symbolic Representation
1216C
$M_{a,j}$
1061
1226A
1208B
1208A
928
1032
Decryption
1226B
1211B
1211A
926
1026
Encryption
1057

Figure 83G

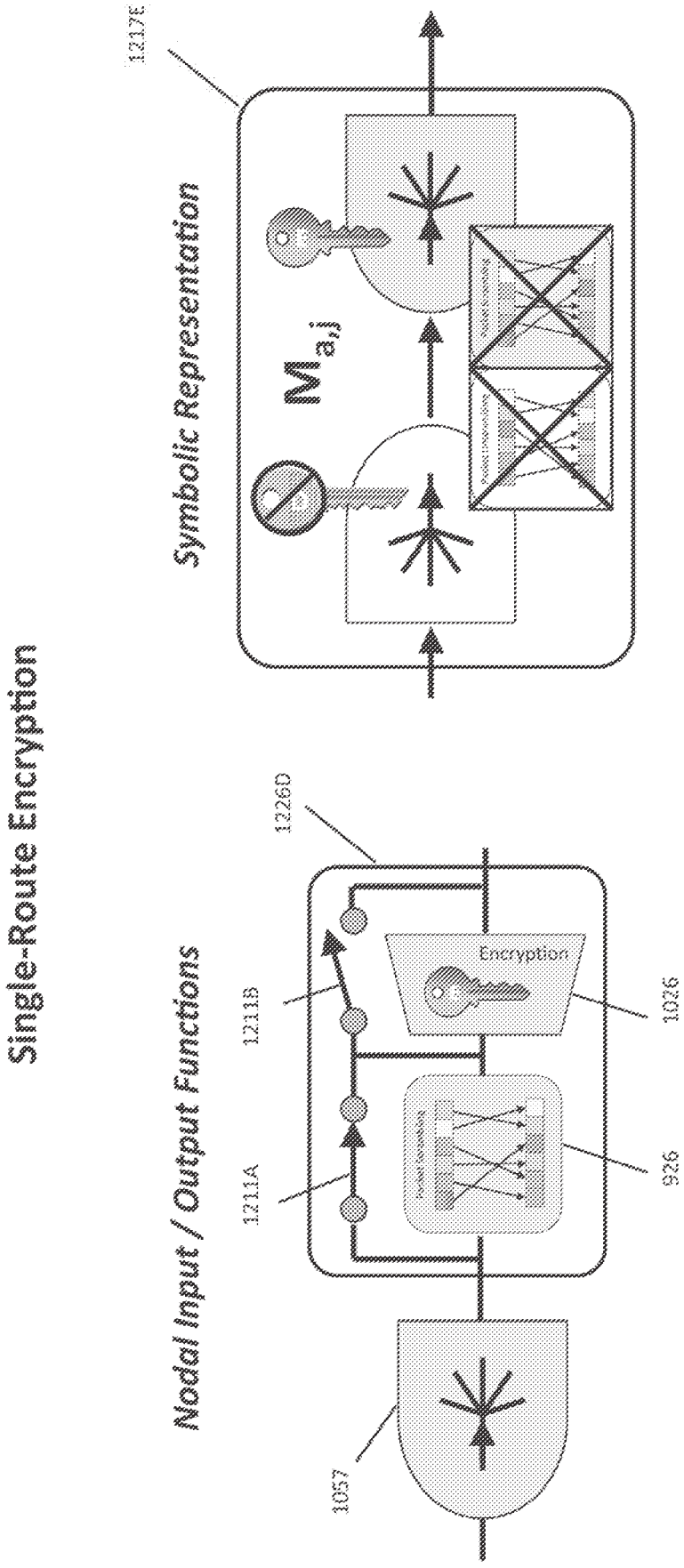

Single-Route Encryption
Nodal Input / Output Functions
Symbolic Representation
1211A
1211B
1226D
1026
926
1057
1317E
$M_{a,j}$
Encryption

Figure 83H

Single-Route Decryption

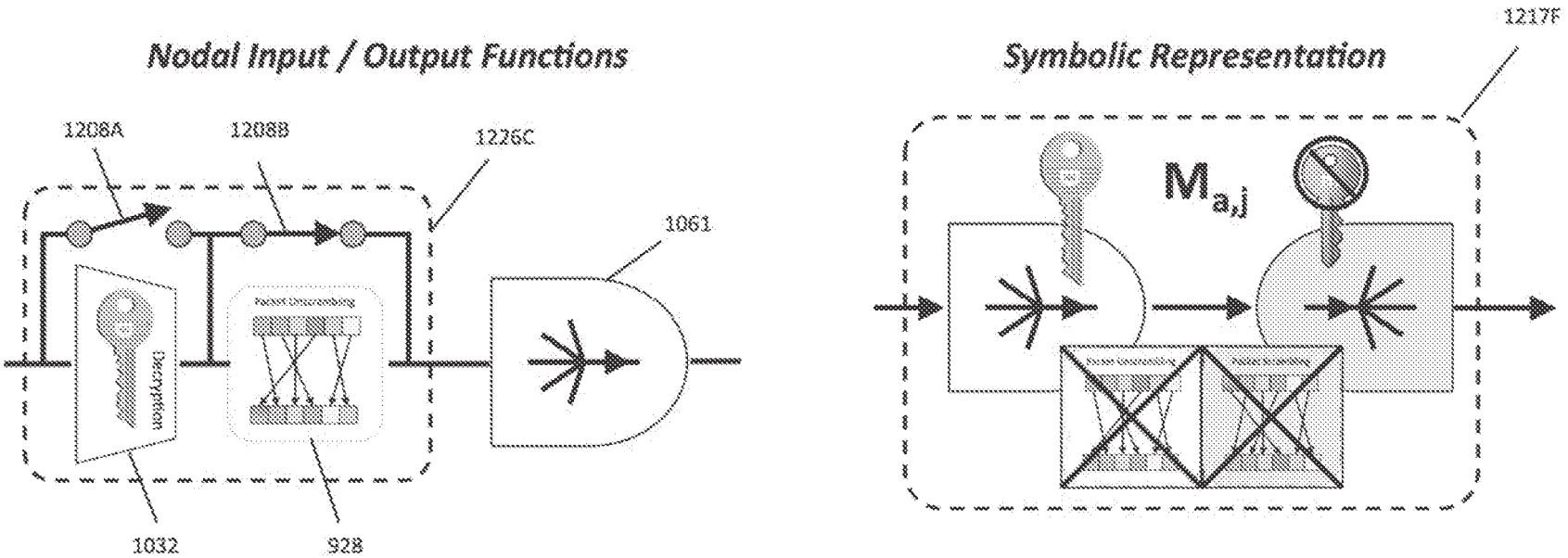


Figure 83I

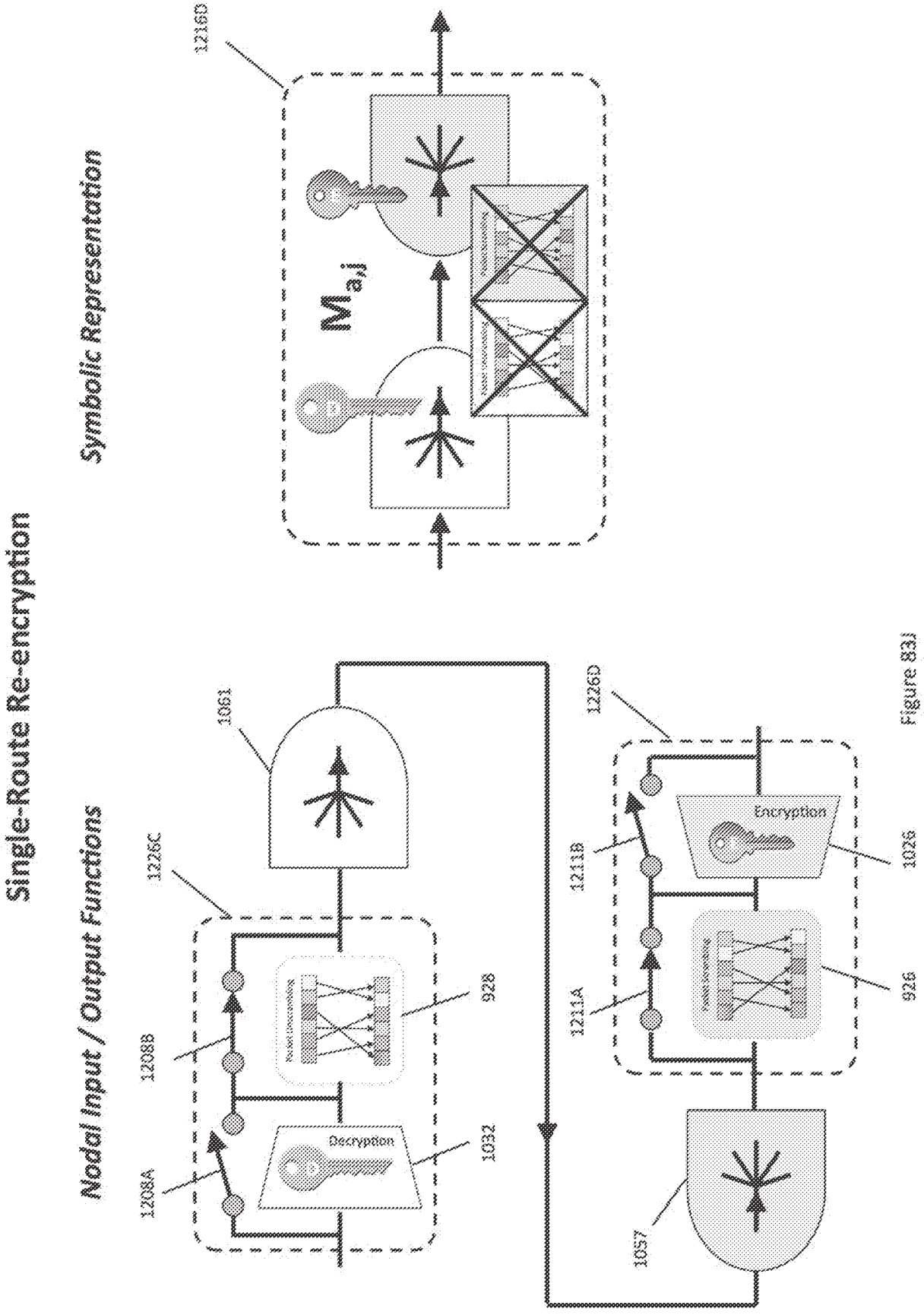

Single-Route Re-encryption
Nodal Input / Output Functions
Symbolic Representation
1216D
$M_{a,j}$
1061
1226C
1208B
1208A
928
1032
Decryption
1226D
1211B
1211A
1026
926
Encryption
1057

Figure 83J

Single-Route Scrambled Encryption

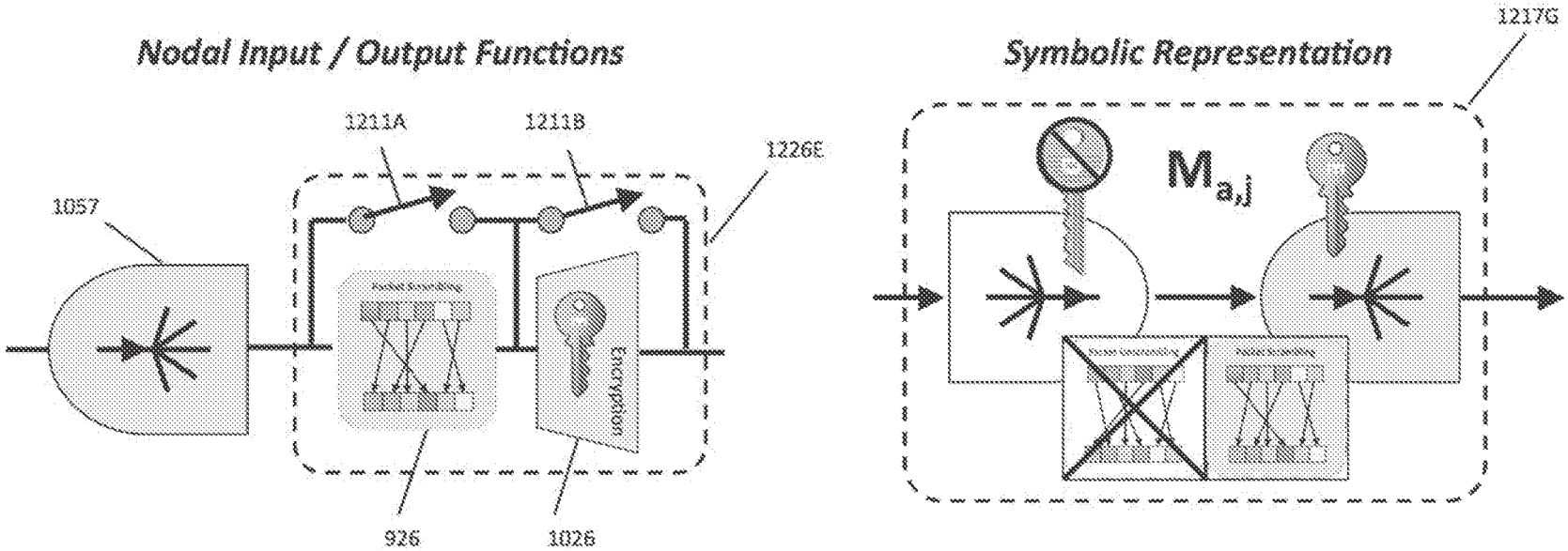


Figure 83K

Single-Route Unscrambled Decryption

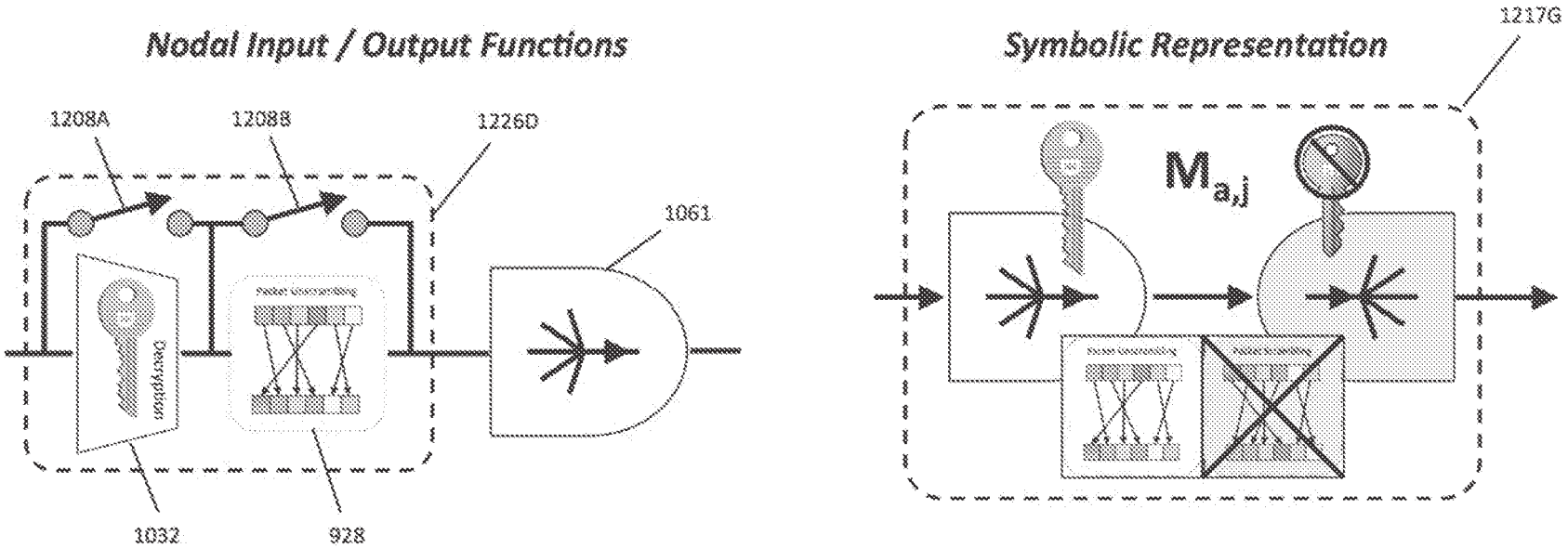


Figure 83L

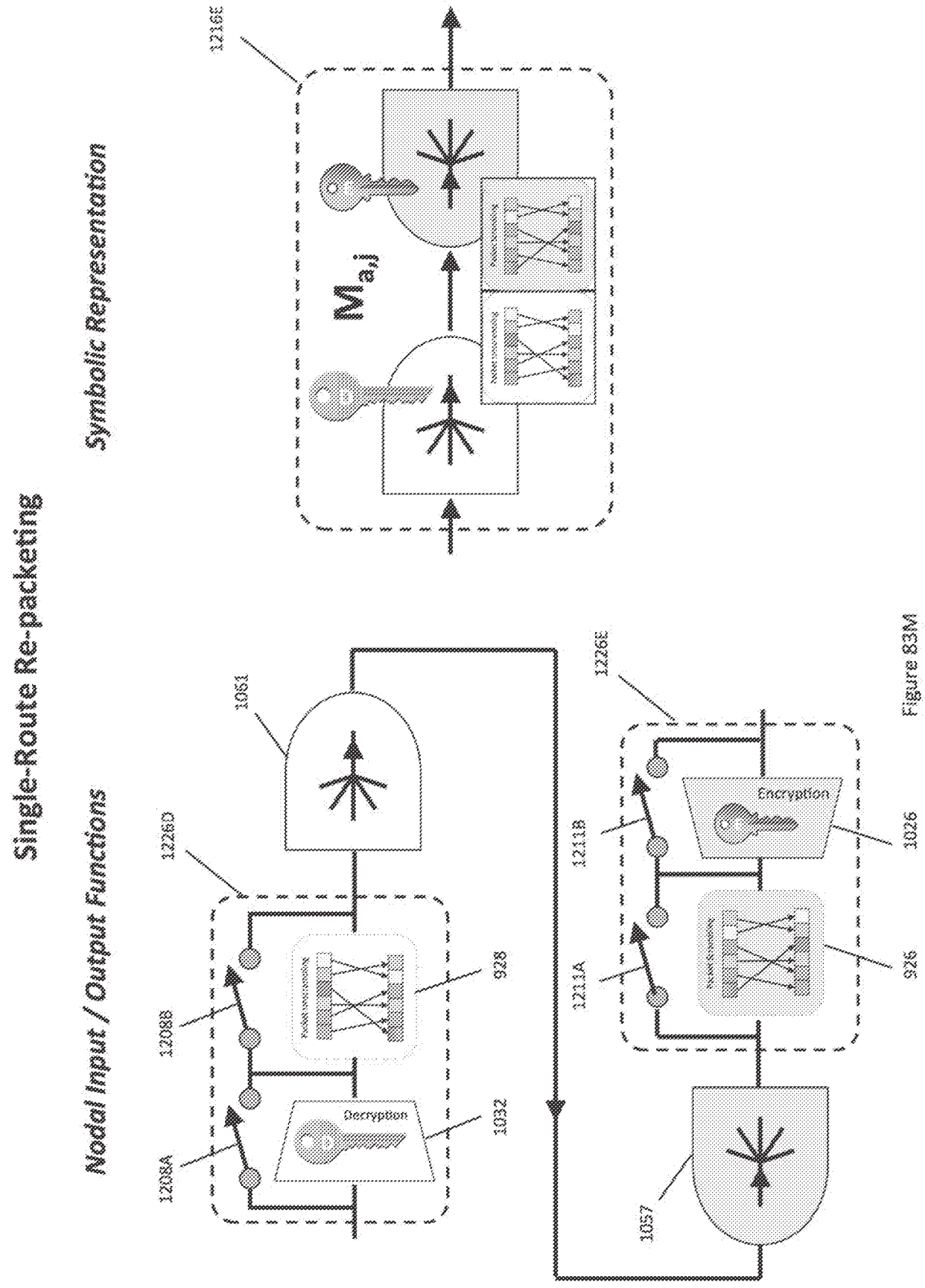

Single-Route Re-packeting
Nodal Input / Output Functions
Symbolic Representation
1216E
$M_{a,j}$
1051
1226D
1208B
1208A
928
1032
Decryption
1226E
1211B
1211A
1026
926
Encryption
1057

Figure 83M

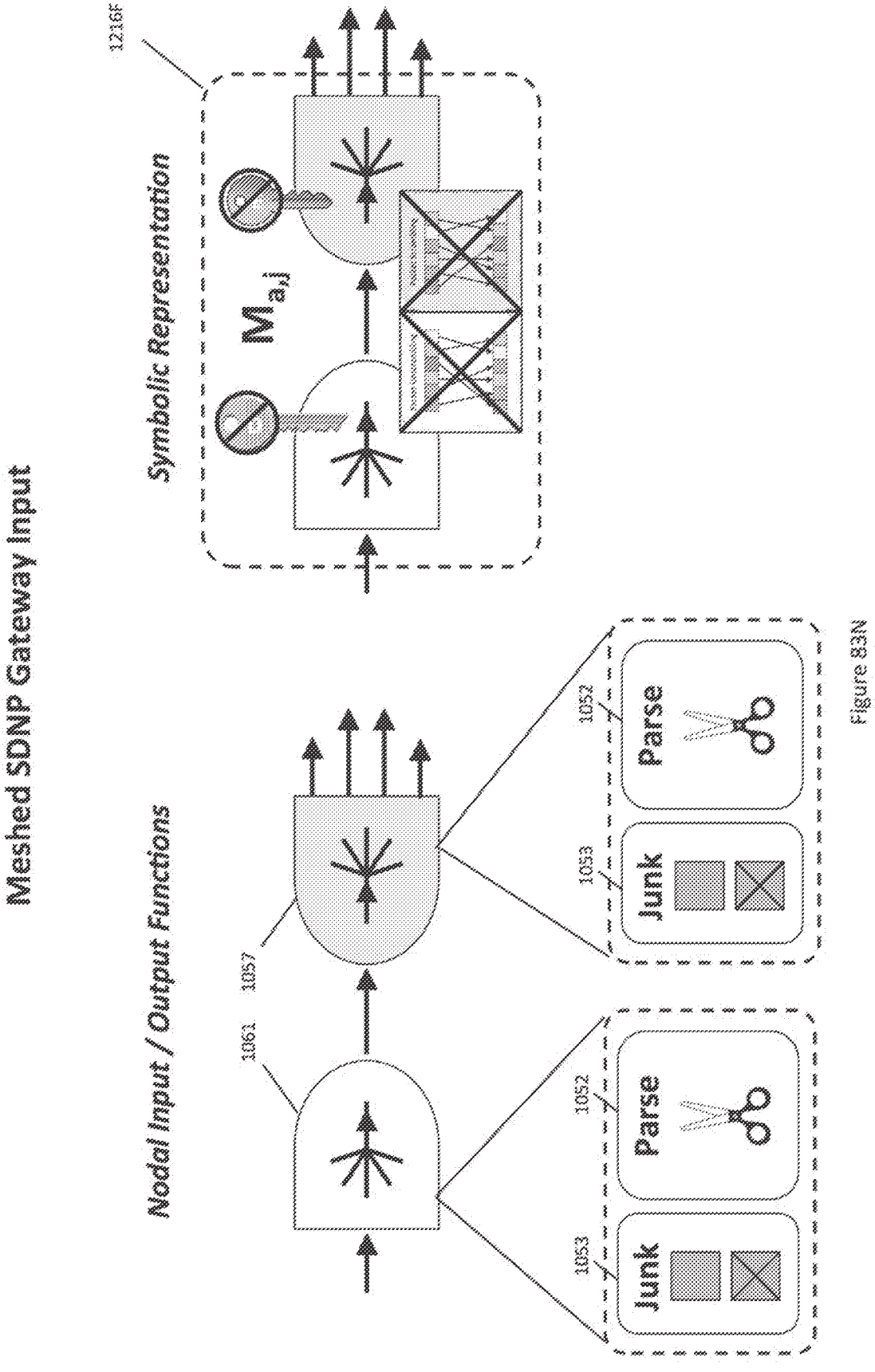

Meshed SDNP Gateway Input
Nodal Input / Output Functions
1061
1057
1053
Junk
1052
Parse
1053
Junk
1052
Parse
Symbolic Representation
1216F
$M_{a,j}$

Figure 83N

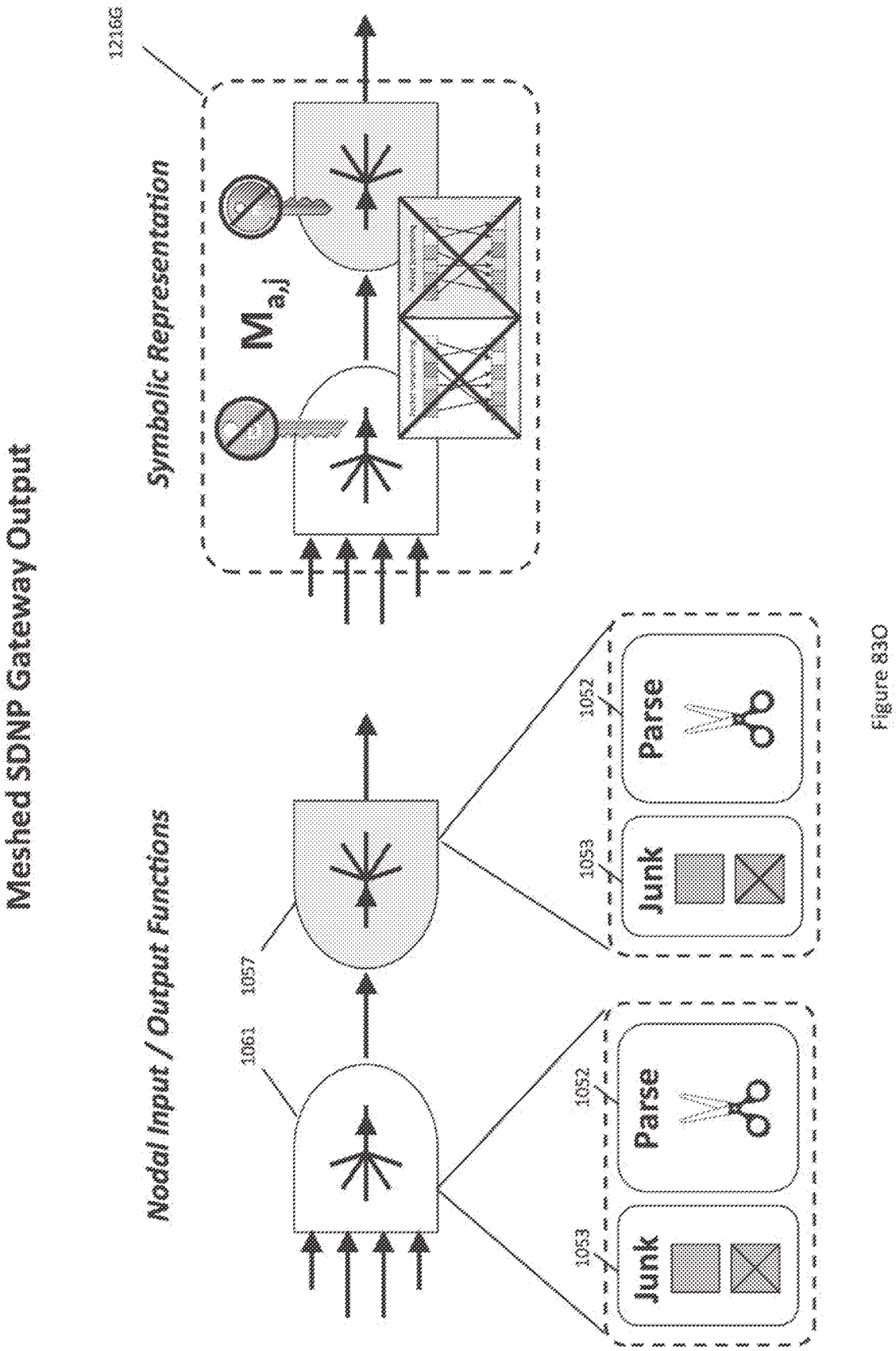

Meshed SDNP Gateway Output
Nodal Input / Output Functions
1061
1057
1052
1053
Parse
Junk
1052
1053
Parse
Junk
Symbolic Representation
12166
$M_{a,i}$

Figure 83O

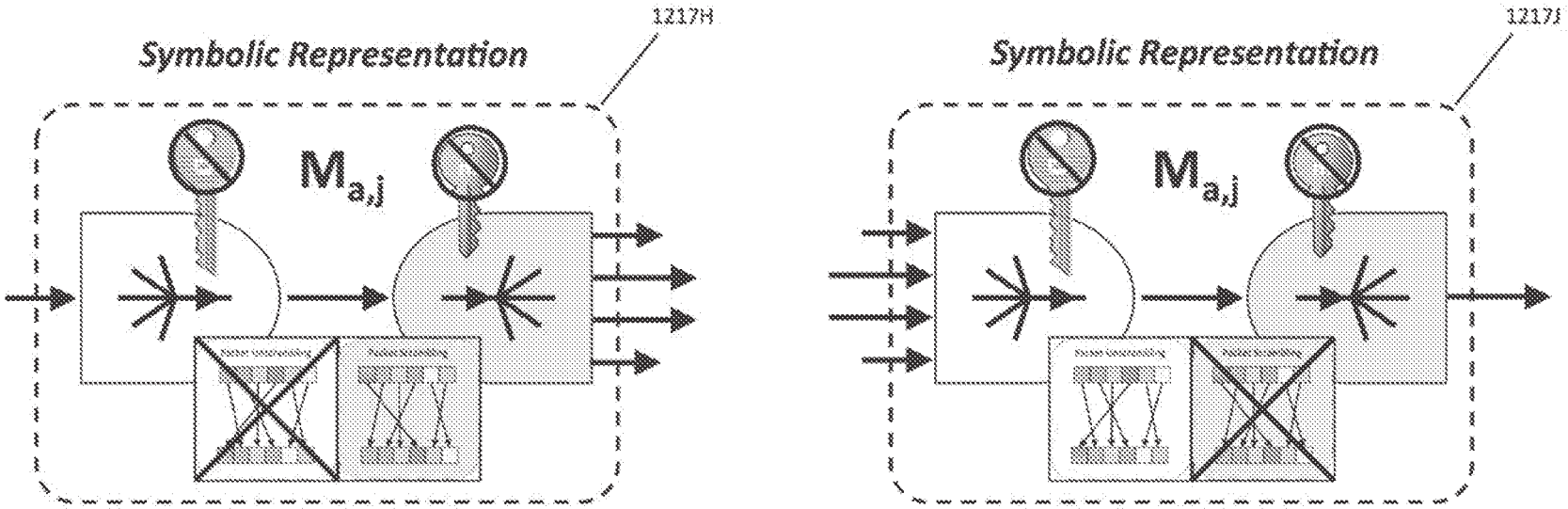

Scrambled SDNP Gateway Input
Unscrambled SDNP Gateway Output
Symbolic Representation
Symbolic Representation
$M_{a,j}$
$M_{a,j}$

Figure 83P

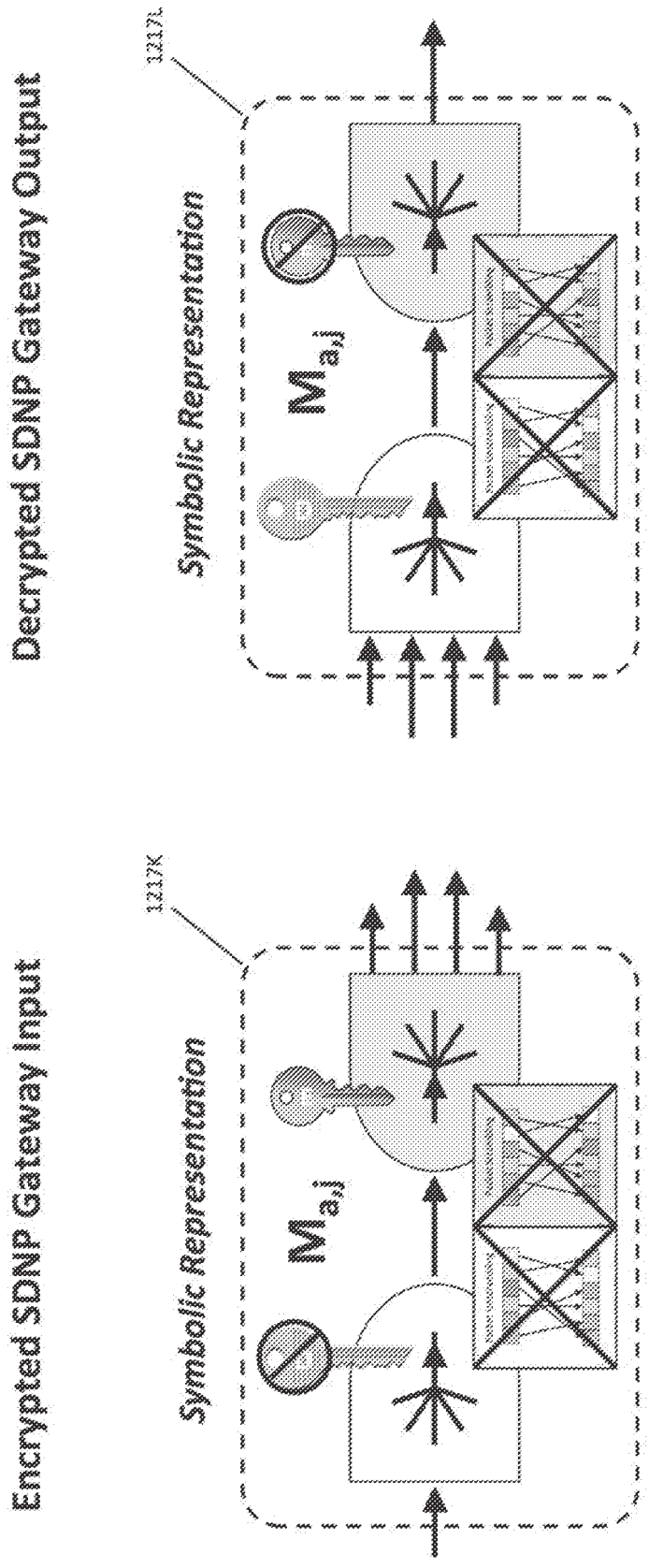

Encrypted SDNP Gateway Input
Symbolic Representation
$M_{a,j}$
1217K
Decrypted SDNP Gateway Output
Symbolic Representation
$M_{a,j}$
1217L

Figure 83Q

Scrambled Encrypted SDNP Gateway Input

Unscrambled Decrypted SDNP Gateway Output

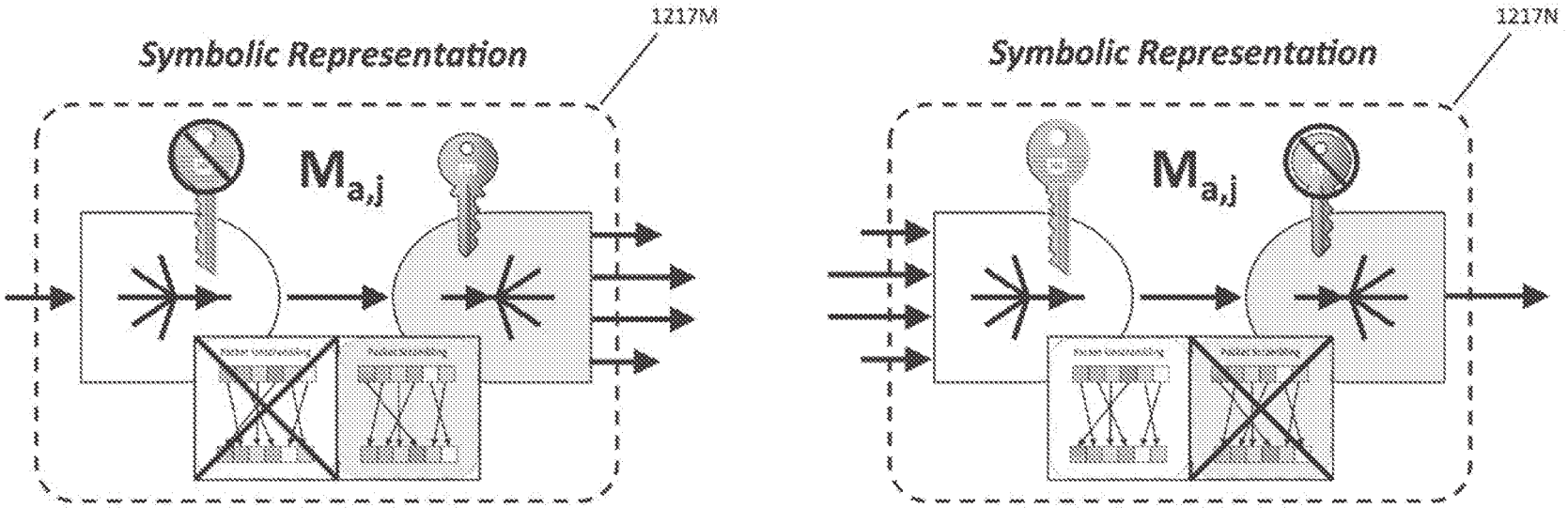


Figure 83R

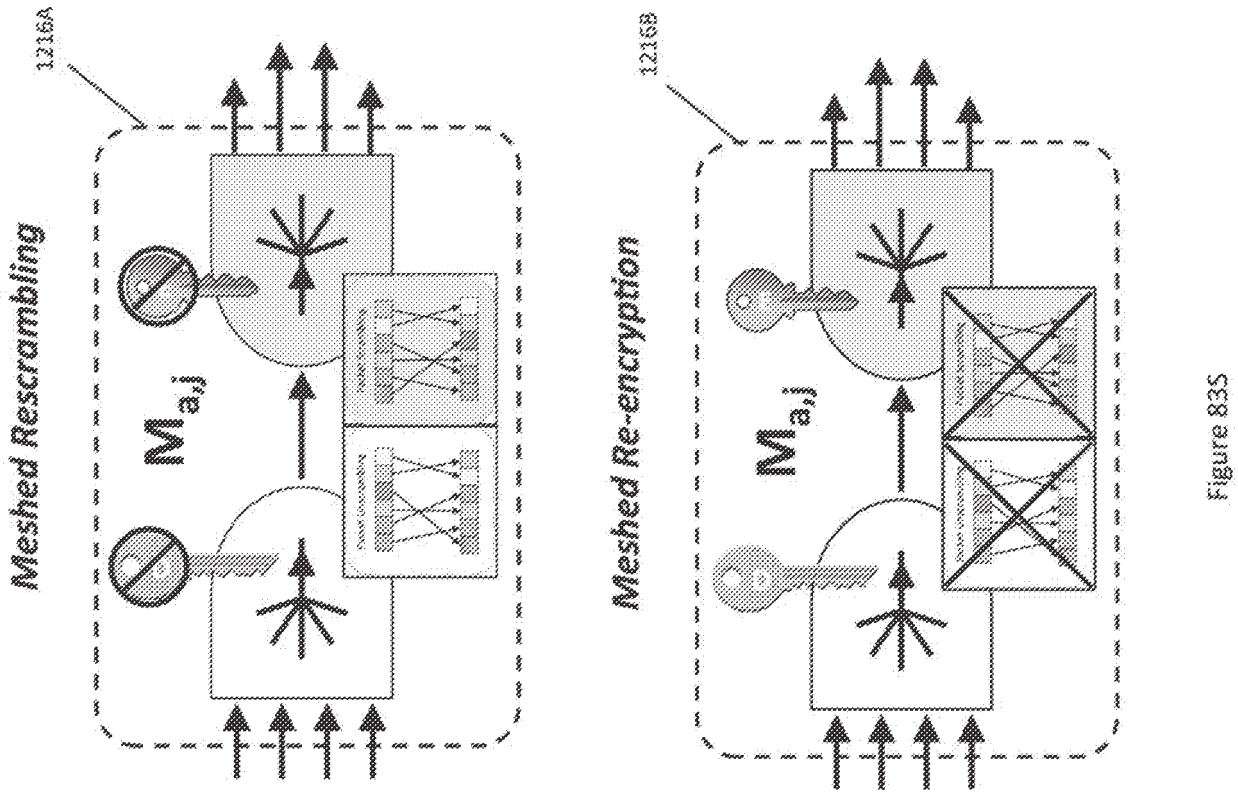

1216A
Meshed Rescrambling
$M_{a,j}$
1216B
Meshed Re-encryption
$M_{a,j}$

Figure 83S

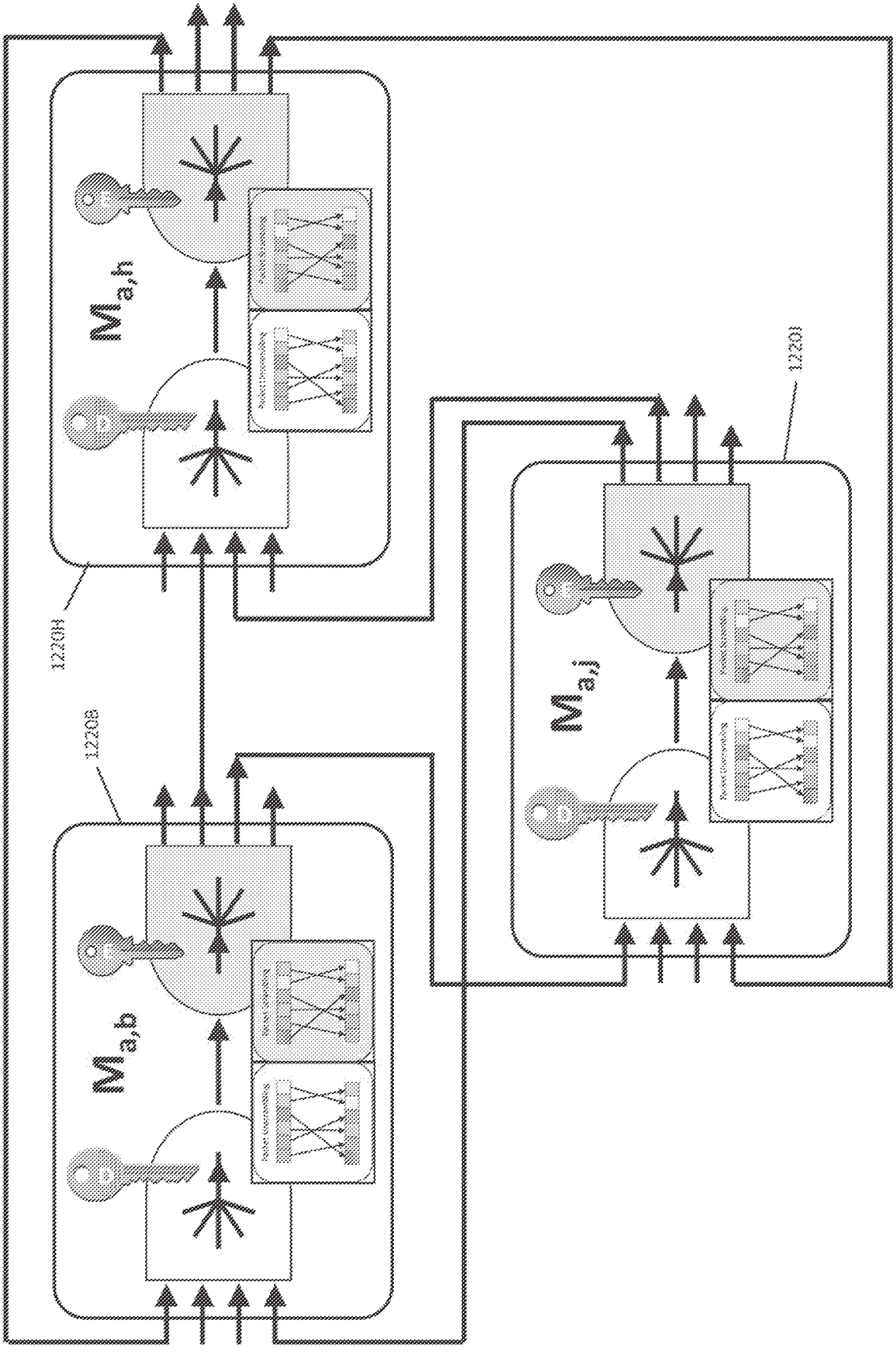


Figure 84A

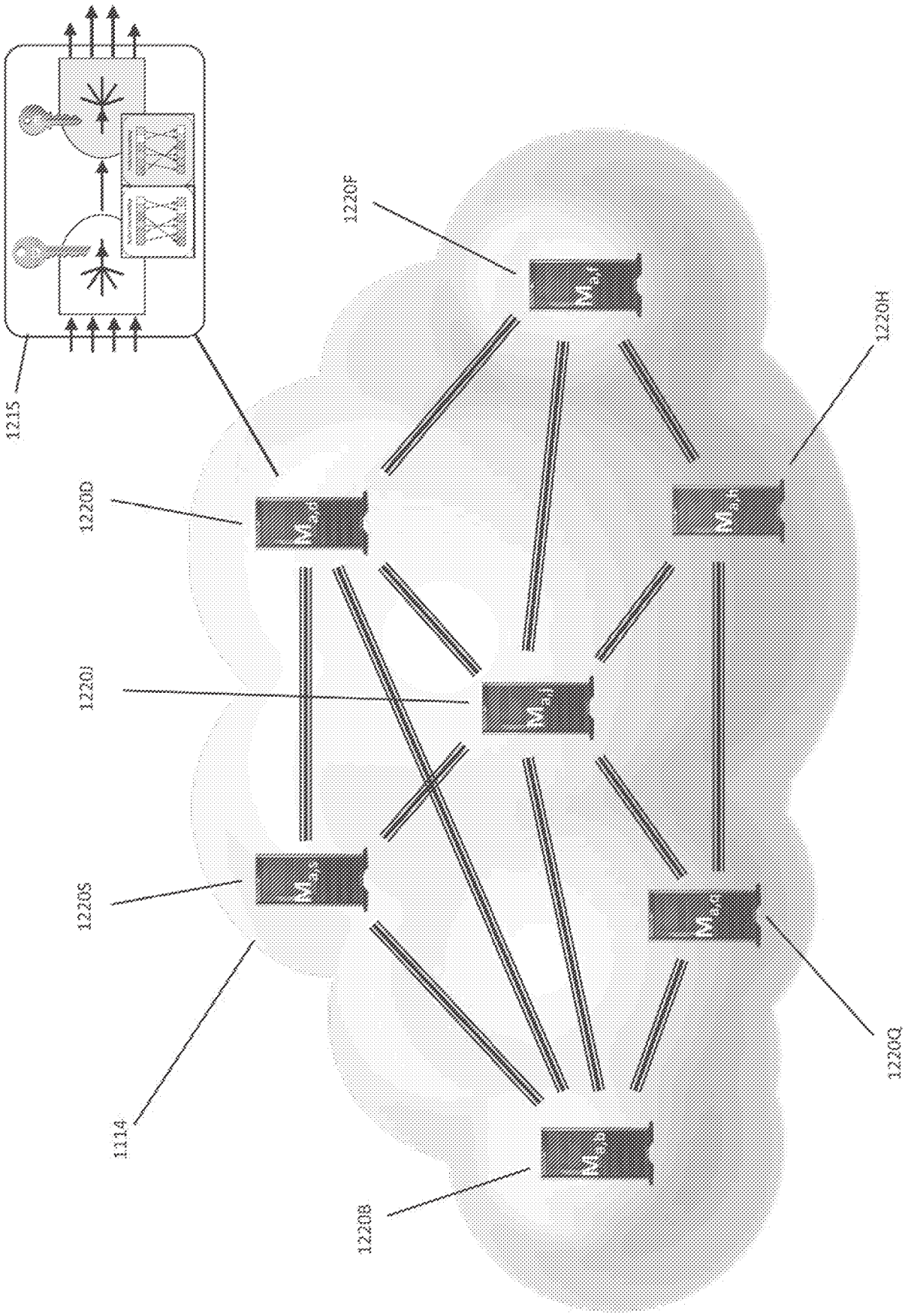


Figure 84B

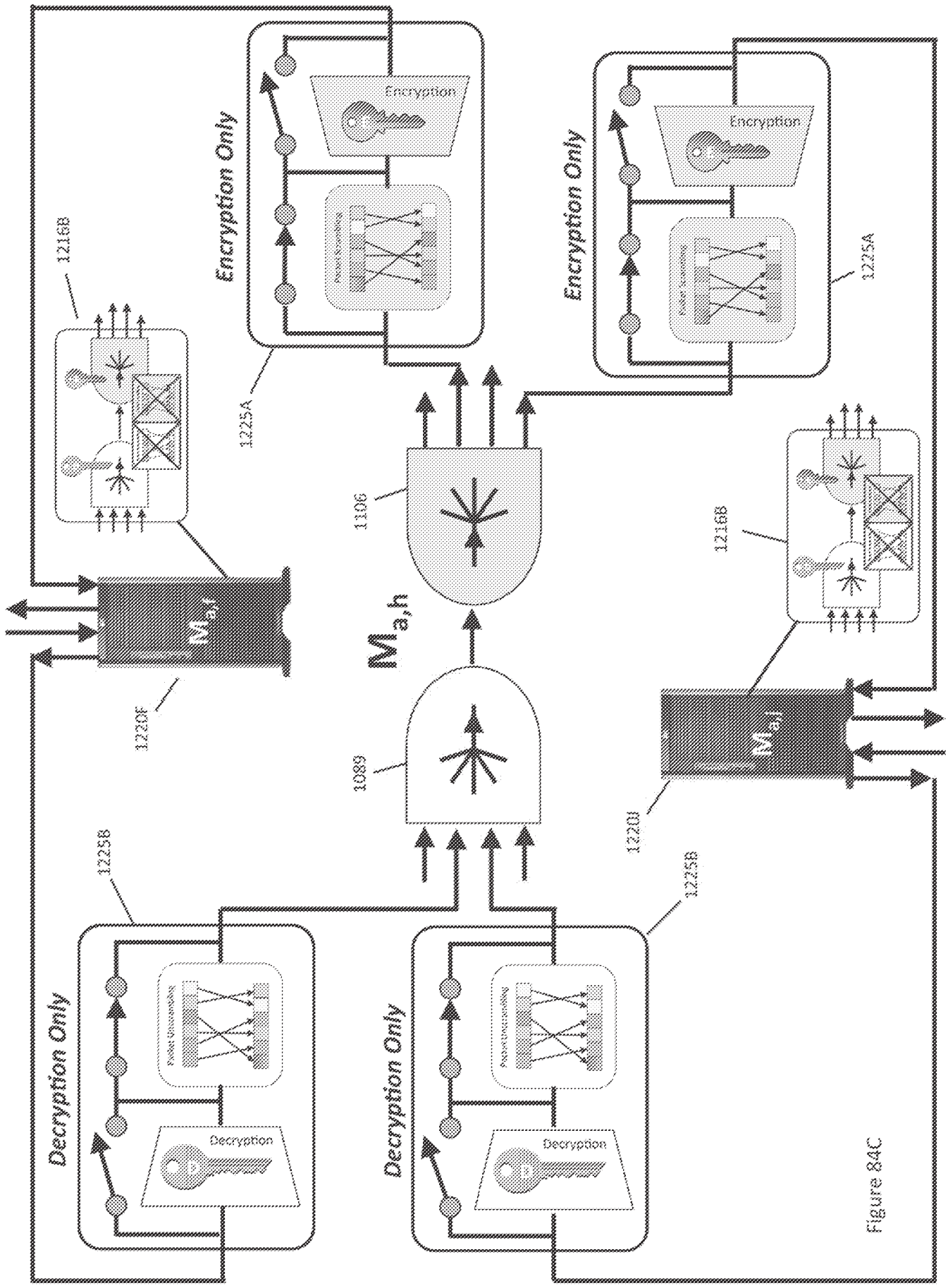

Encryption Only
Encryption
Encryption Only
Encryption
1216B
1225A
1225A
1106
1216B
$M_{a,h}$
$M_{a,l}$
1089
1220F
1220J
1225B
1225B
Decryption Only
Decryption
Decryption Only
Decryption

Figure 84C

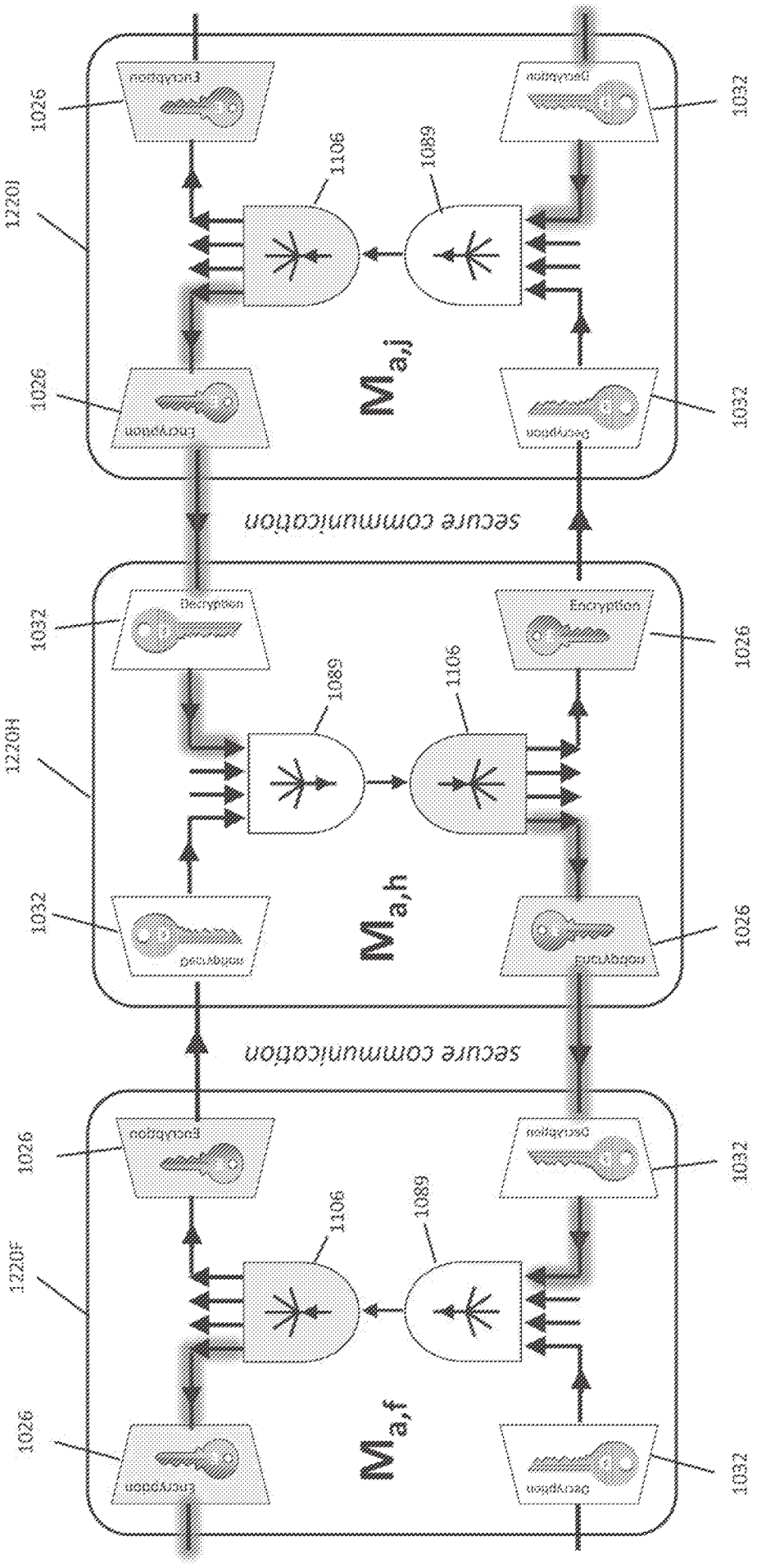

1220J
1220H
1220F
1026
1032
1106
1089
Encryption
Decryption
$M_{a,j}$
$M_{a,h}$
$M_{a,f}$
secure communication

Figure 84D

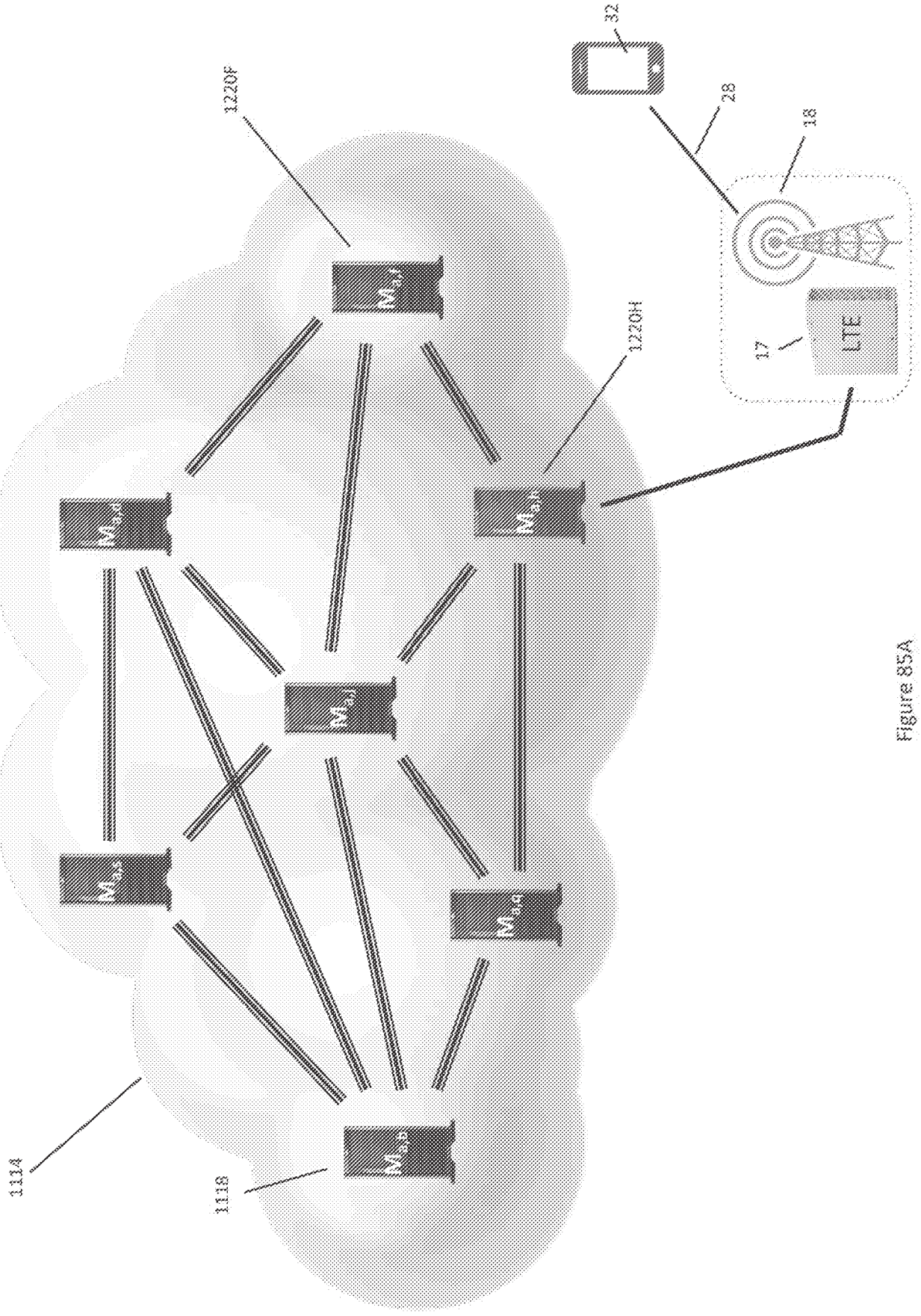


Figure 85A

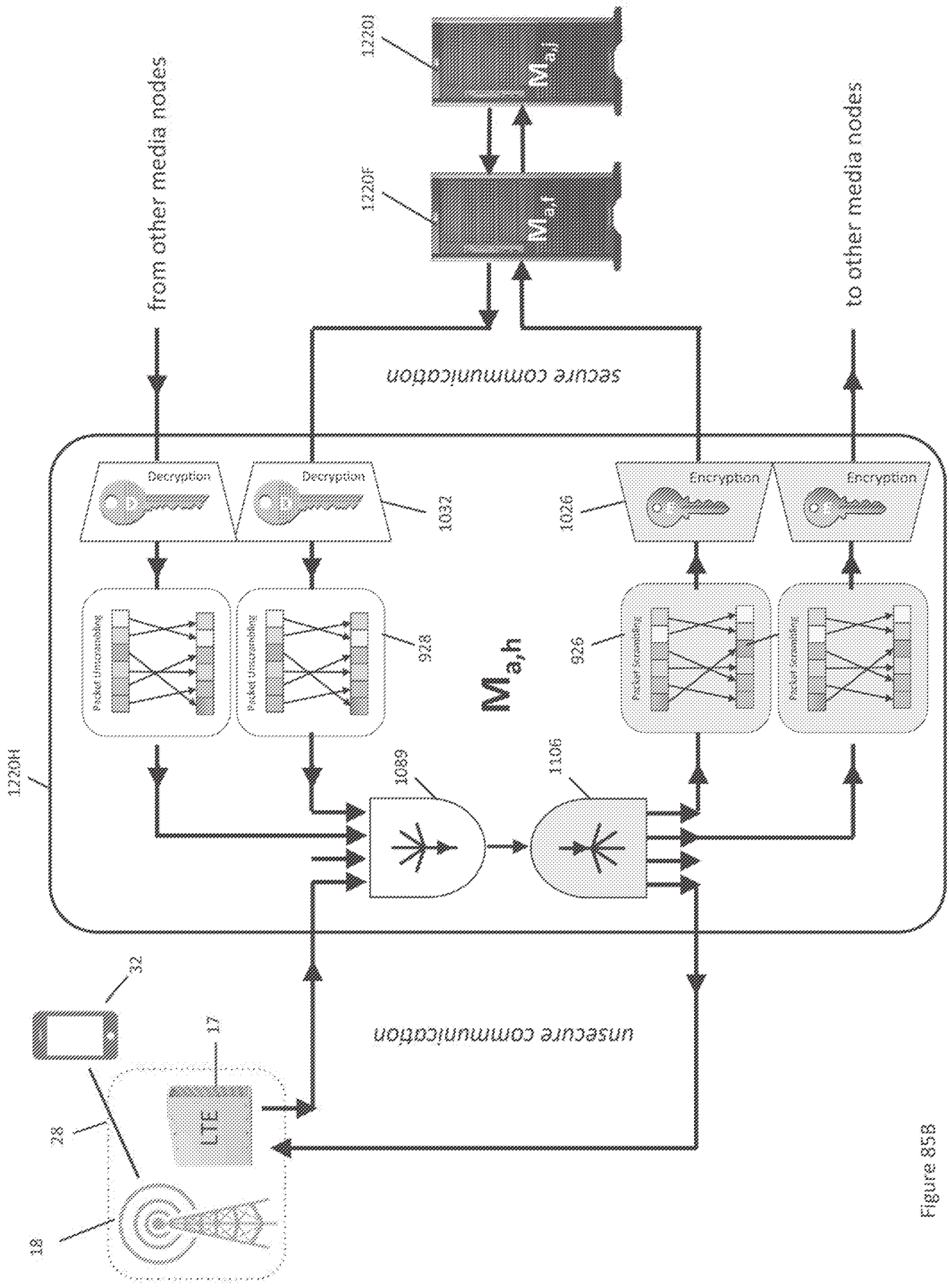

1220J
$M_{a,J}$
1220F
$M_{a,f}$
from other media nodes
to other media nodes
secure communication
Decryption
Decryption
1032
Encryption
Encryption
1026
Packet Unscrambling
Packet Unscrambling
928
$M_{a,h}$
926
Packet Scrambling
Packet Scrambling
1220H
1089
1106
32
17
LTE
28
18
unsecure communication

Figure 85B

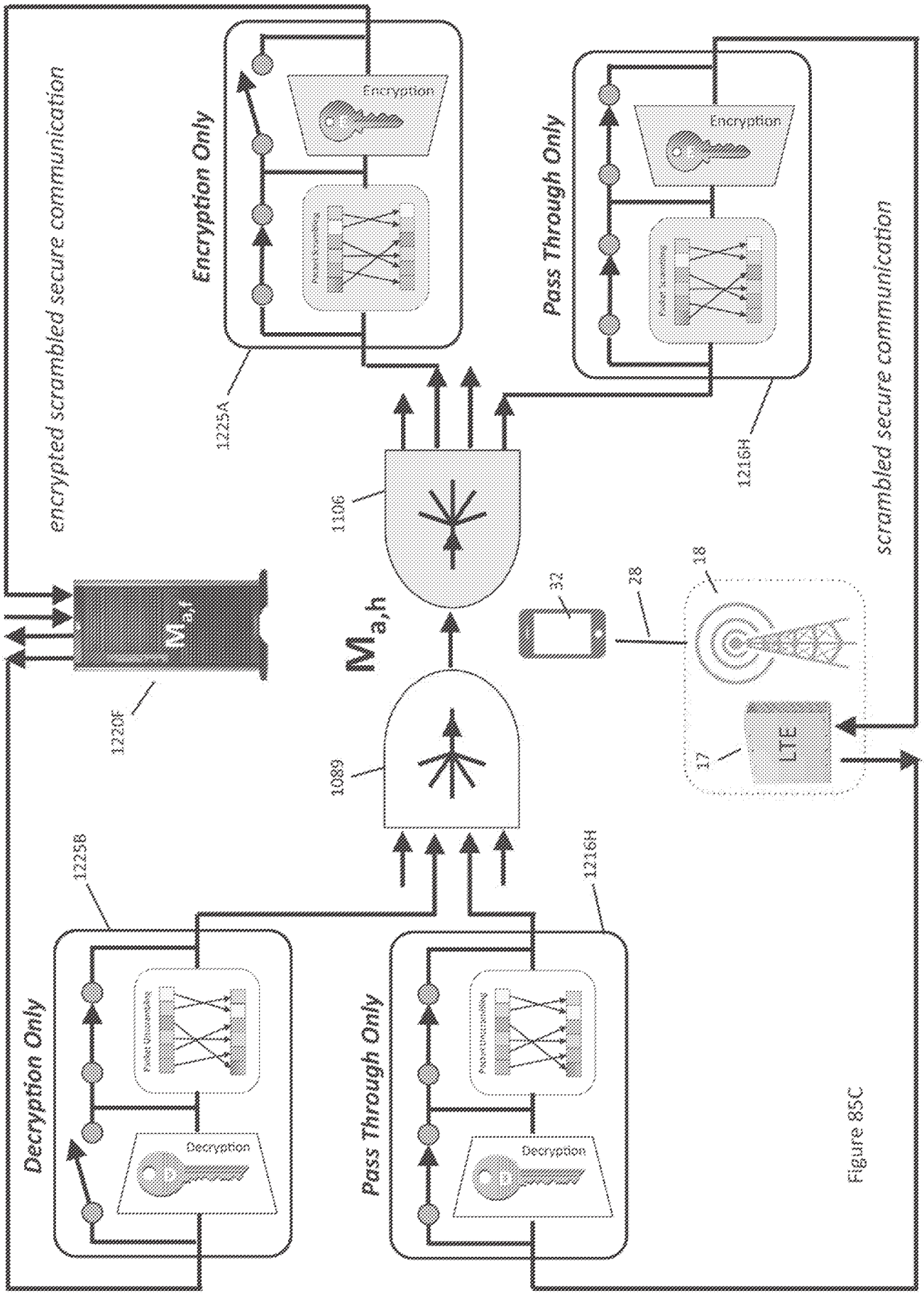

encrypted scrambled secure communication
Encryption Only
Encryption
Packet Scrambling
1225A
Pass Through Only
Encryption
Packet Scrambling
1216H
1106
$M_{a,h}$
$M_{a,l}$
1220F
1089
32
28
18
17
LTE
scrambled secure communication
Decryption Only
1225B
Packet Descrambling
Decryption
Pass Through Only
1216H
Packet Descrambling
Decryption

Figure 85C

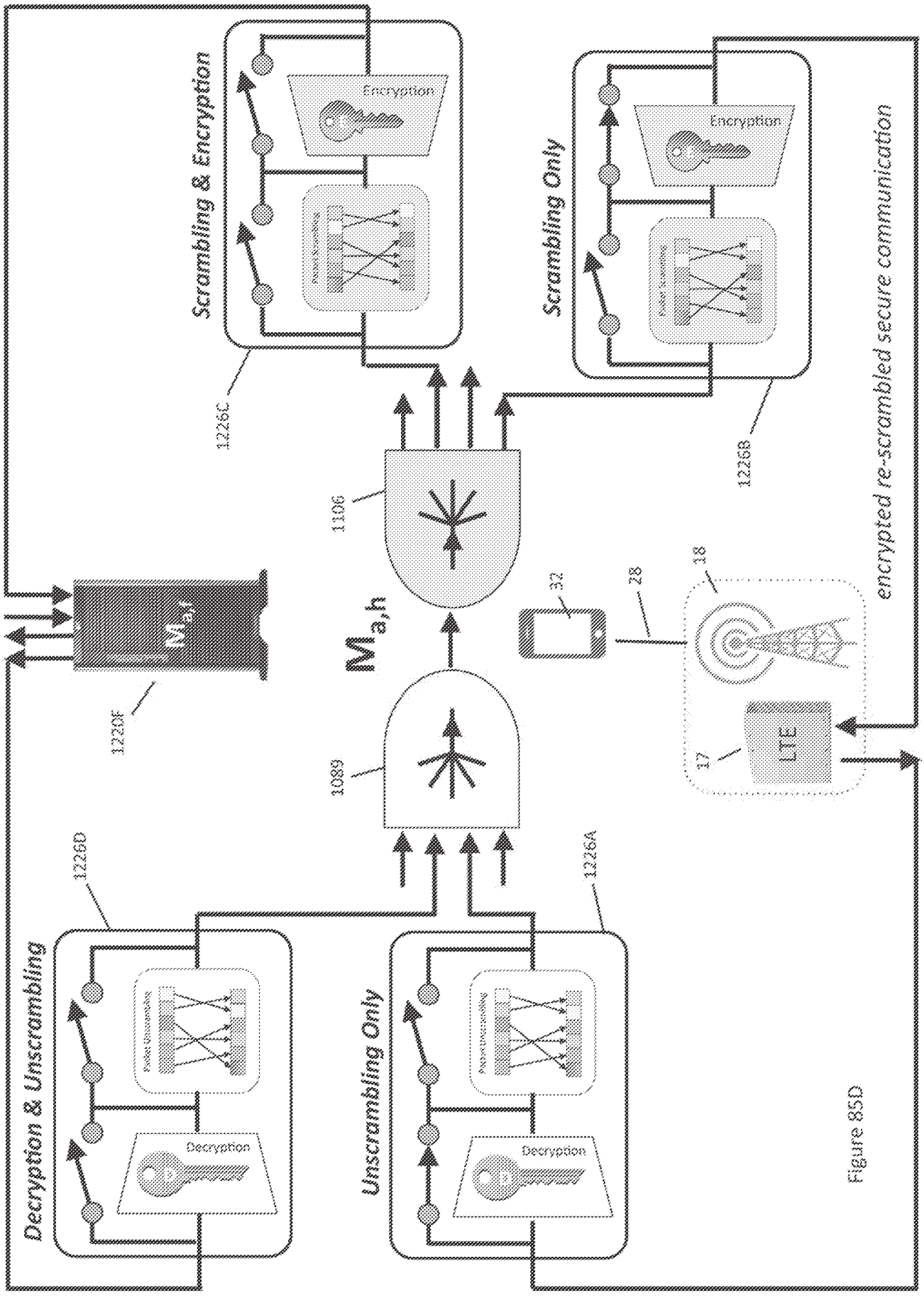

Scrambling & Encryption
Encryption
Packet Scrambling
1226C
Scrambling Only
Encryption
Packet Scrambling
1226B
1106
$M_{a,h}$
$M_{a,l}$
1220F
1089
32
28
18
17
LTE
encrypted re-scrambled secure communication
Decryption & Unscrambling
1226D
Packet Descrambling
Decryption
Unscrambling Only
1226A
Packet Descrambling
Decryption

Figure 85D

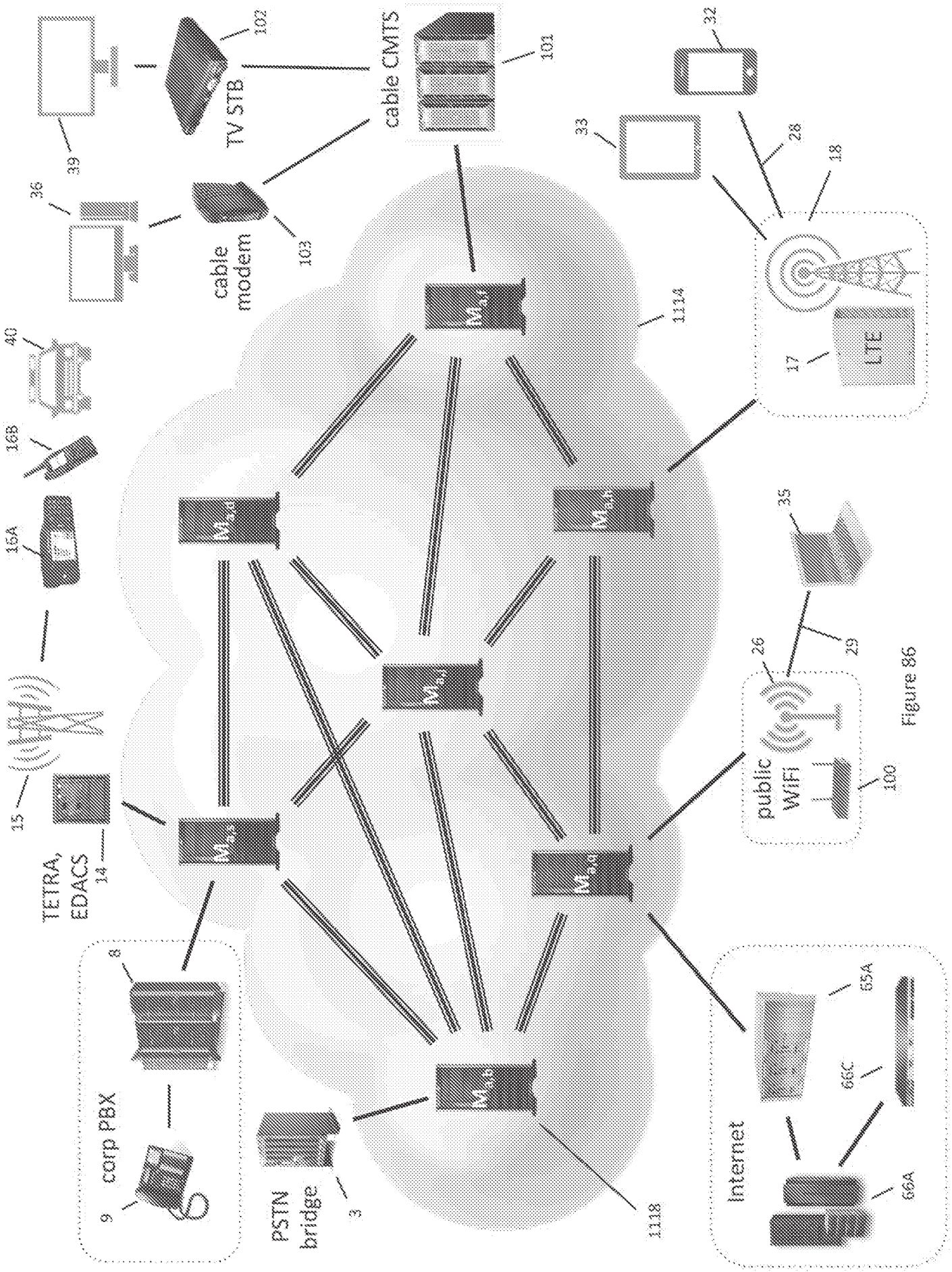

cable CMTS
101
TV STB
102
cable modem
103
TETRA, EDACS
14
15
16A
16B
40
36
39
33
32
28
18
17
LTE
1114
35
29
26
public WiFi
100
corp PBX
8
9
PSTN bridge
3
1118
Internet
65A
66C
66A

Figure 86

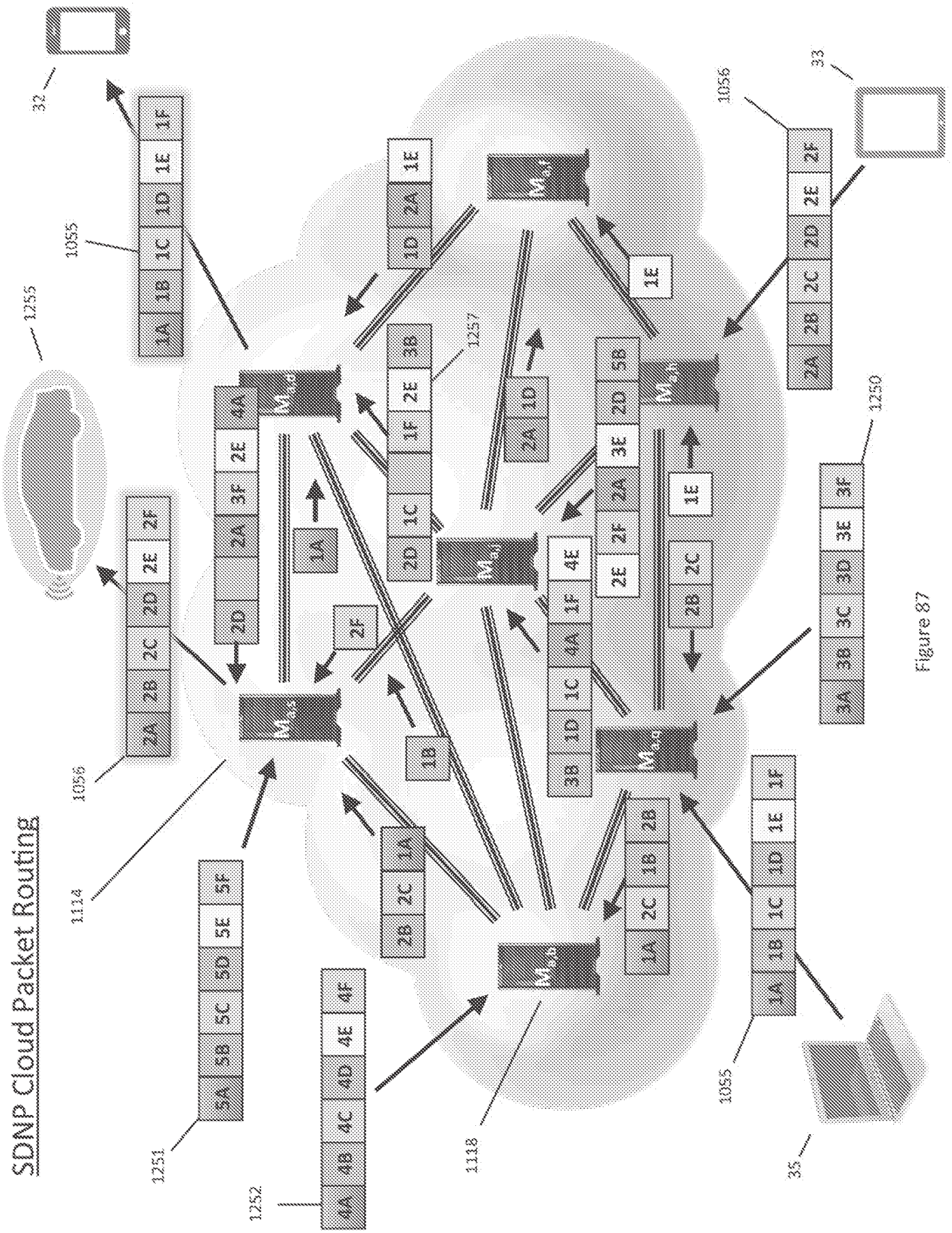

SDNP Cloud Packet Routing
32
33
35
1055
1056
1114
1118
1250
1251
1252
1255
1257
1A 1B 1C 1D 1E 1F
2A 2B 2C 2D 2E 2F
3A 3B 3C 3D 3E 3F
4A 4B 4C 4D 4E 4F
5A 5B 5C 5D 5E 5F

Figure 87

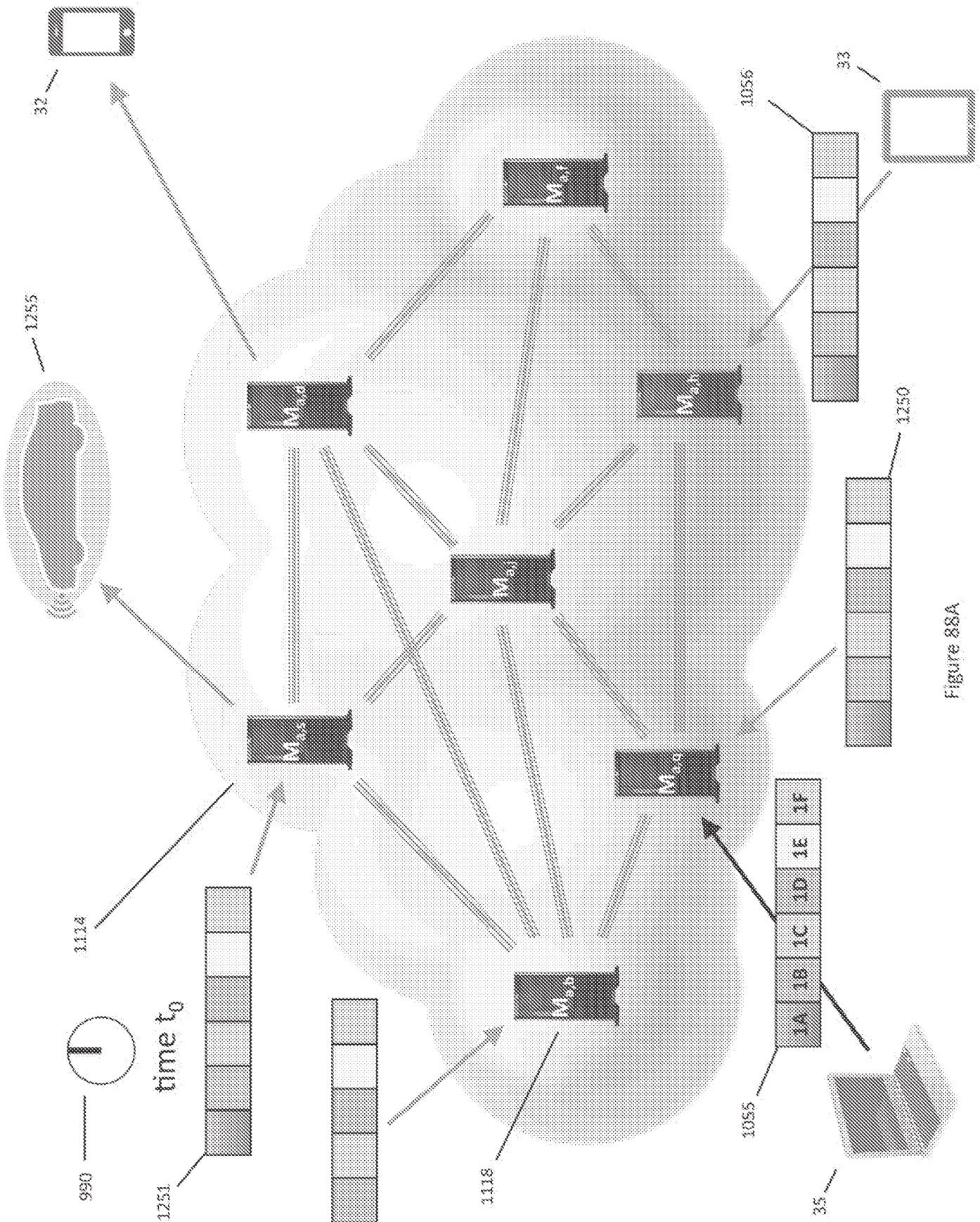

32
1255
1114
990
time t_0
1251
1252
1118
1055
1A
1B
1C
1D
1E
1F
35
1056
33
1250

Figure 88A

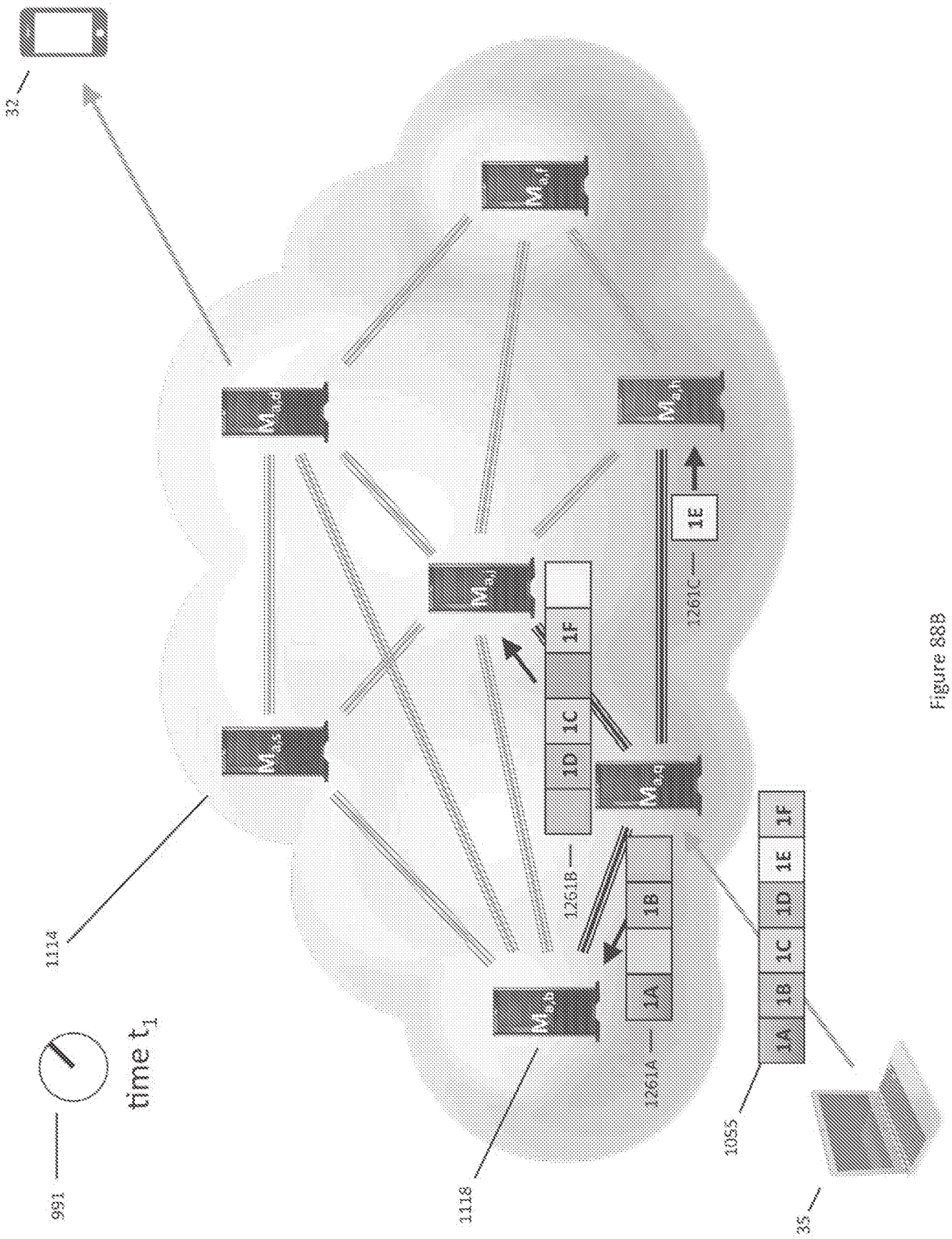

32
1114
991
time t_1
1118
1261A
1261B
1261C
1055
35
1A
1B
1C
1D
1E
1F

Figure 88B

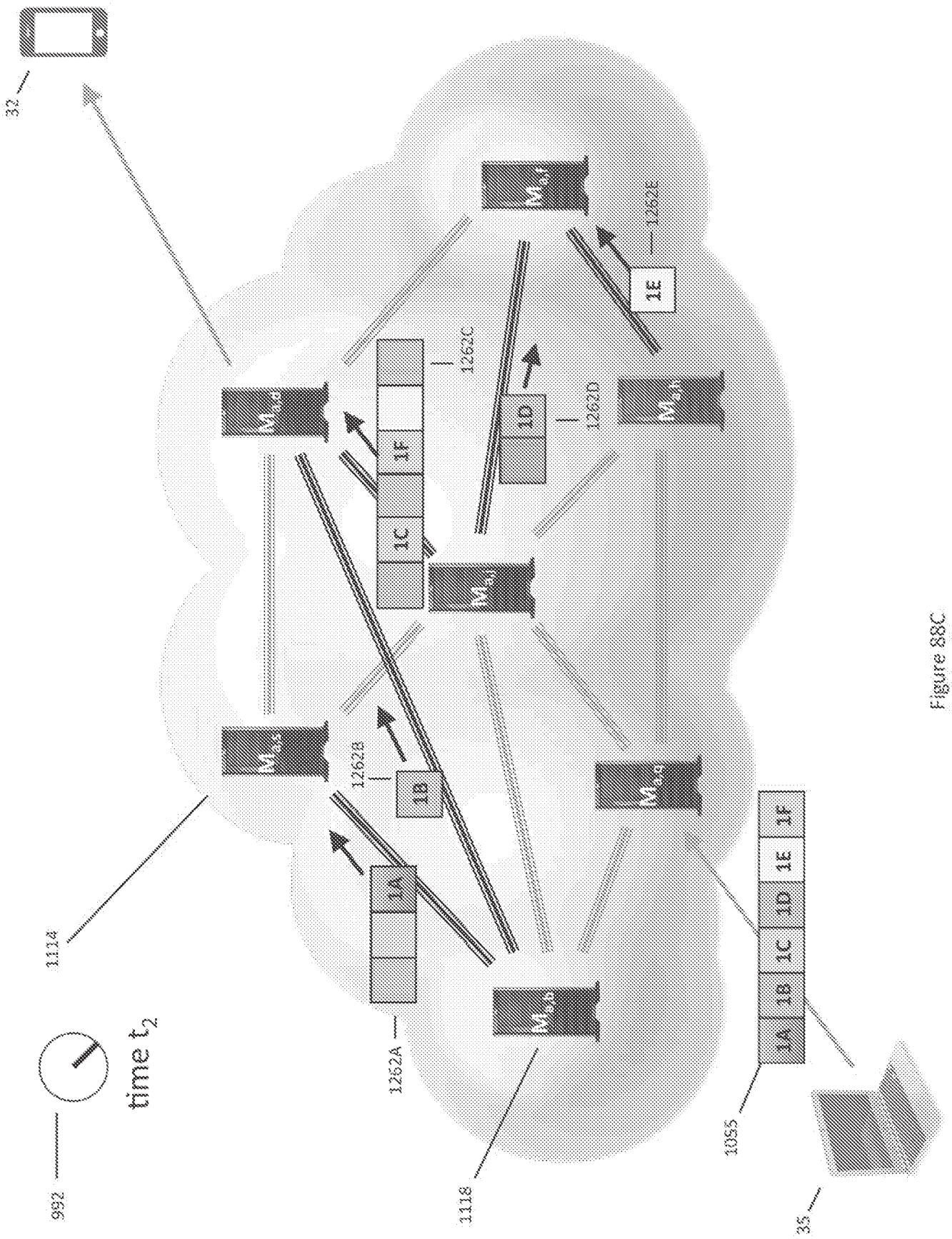

32
1114
992
time t_2
1262A
1262B
1262C
1262D
1262E
1A
1B
1C
1D
1E
1F
1118
1055
35

Figure 88C

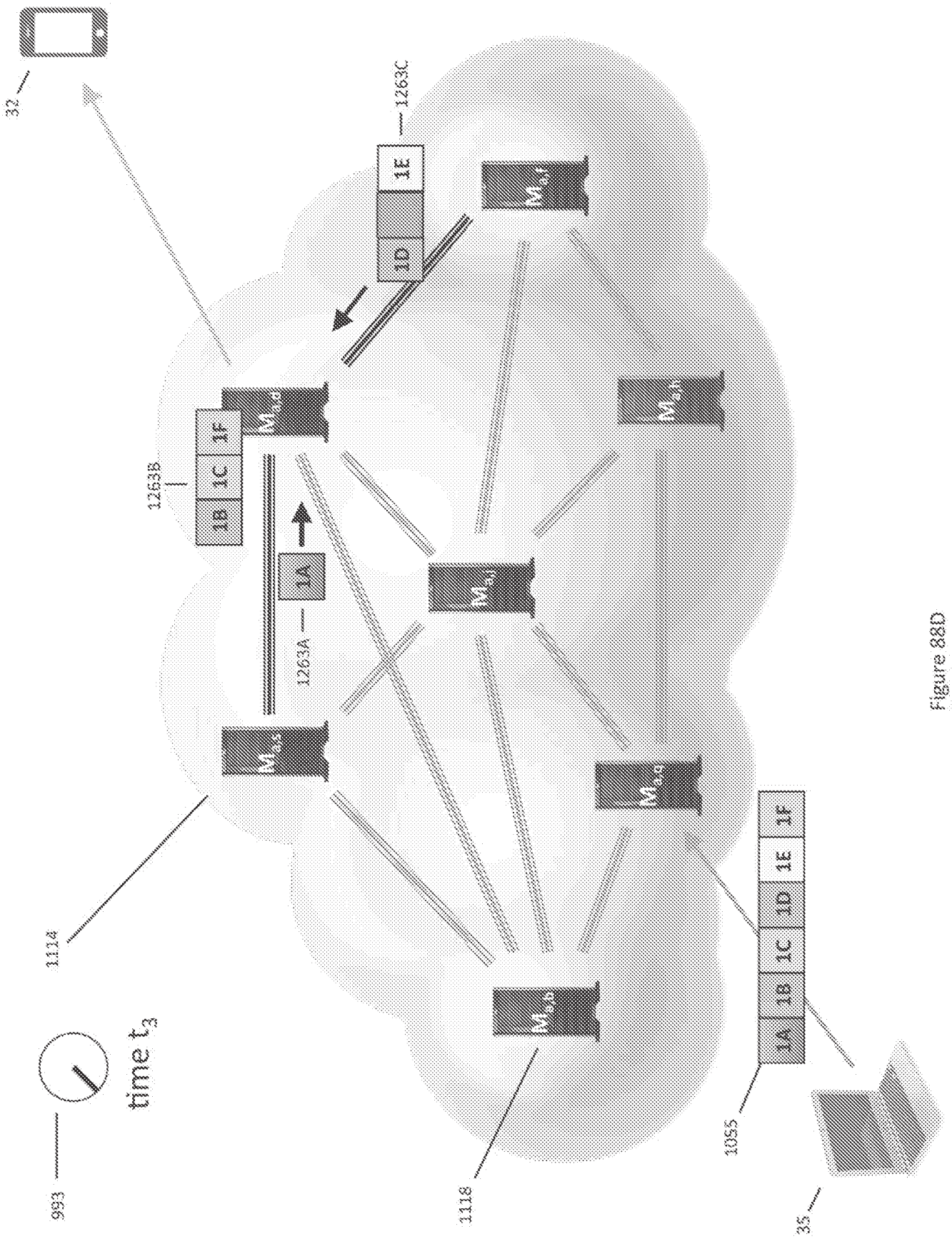

32
1263C
1E
1D
1F
1C
1B
1263B
1A
1263A
1114
time t_3
993
1118
1055
35

Figure 88D

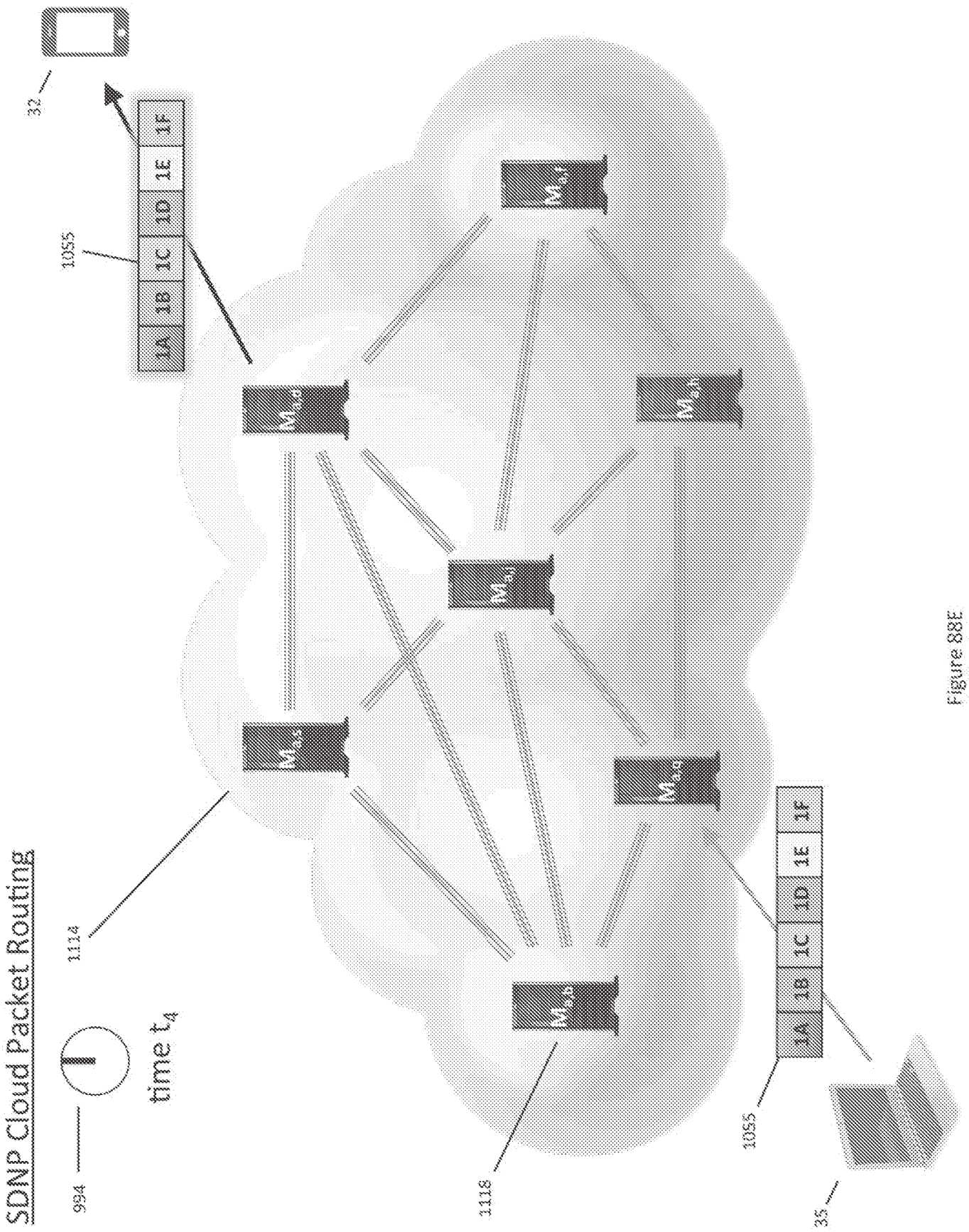

SDNP Cloud Packet Routing
994
time t_4
1114
1118
1055
1A
1B
1C
1D
1E
1F
32
35

Figure 88E

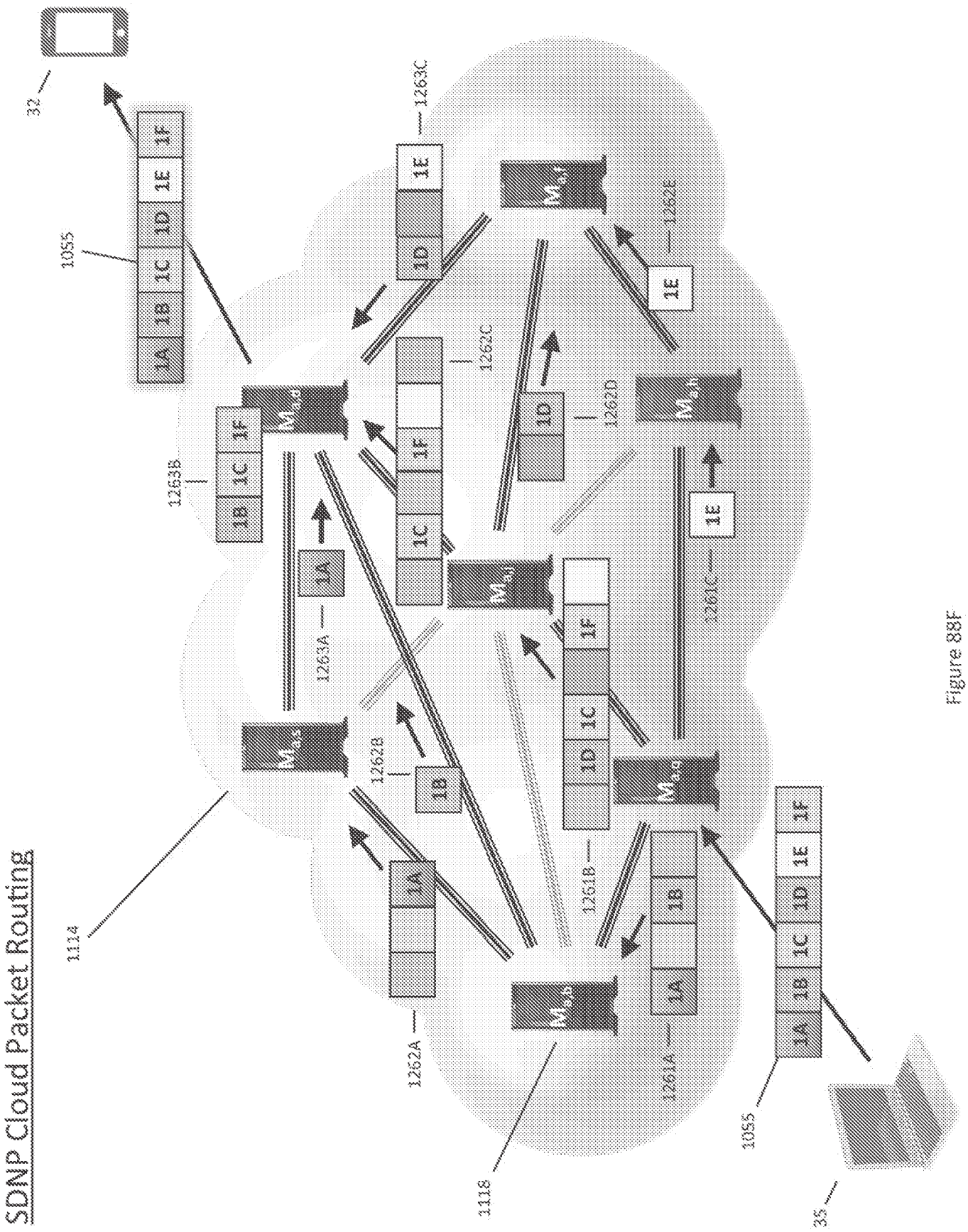

SDNP Cloud Packet Routing
32
1055
1A
1B
1C
1D
1E
1F
1114
1263B
1263A
1263C
1262C
1262D
1262E
1262B
1262A
1261B
1261C
1261A
1118
35

Figure 88F

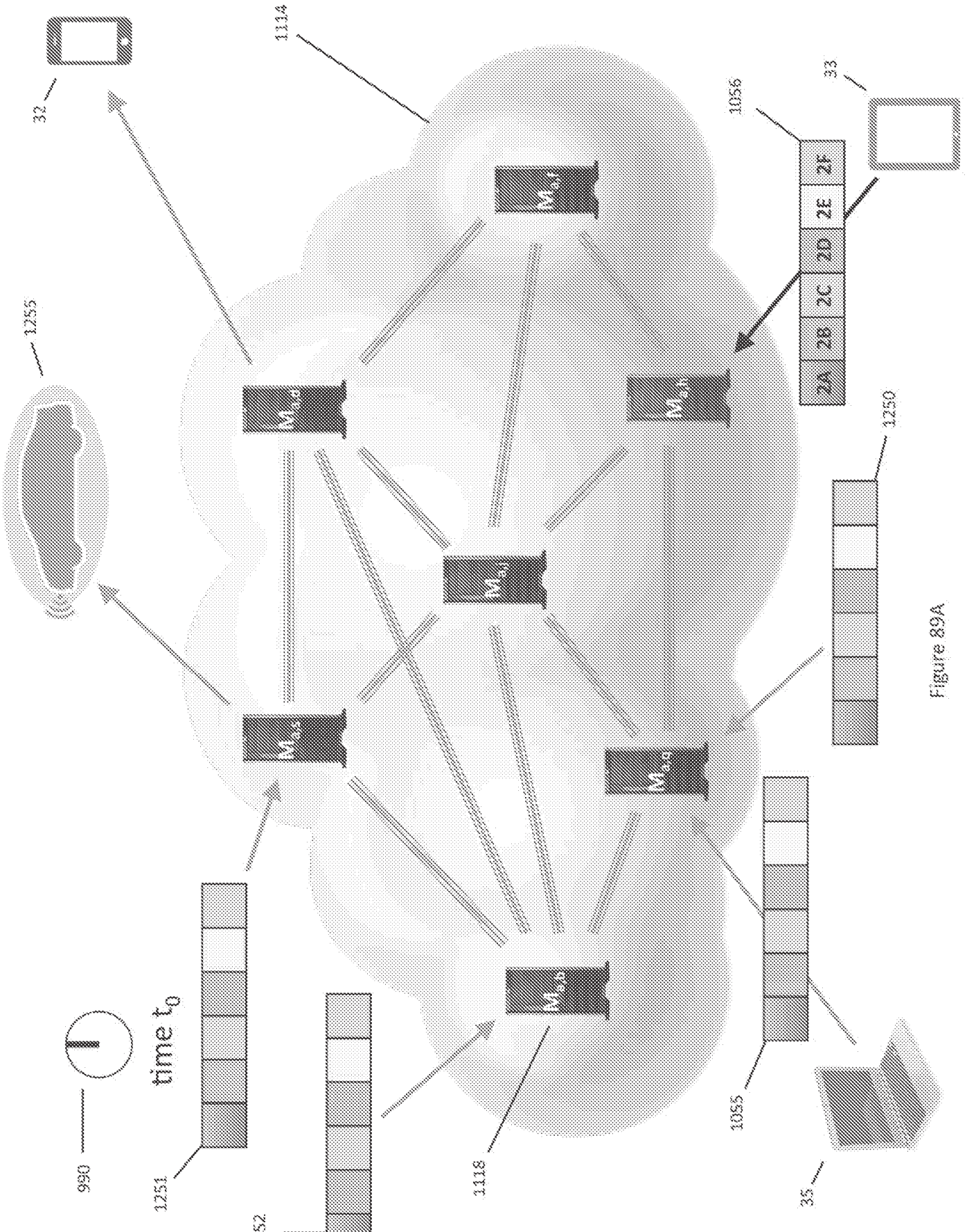

990
time t_0
1251
1252
1118
1055
35
1250
1056
2A
2B
2C
2D
2E
2F
33
32
1114
1255

Figure 89A

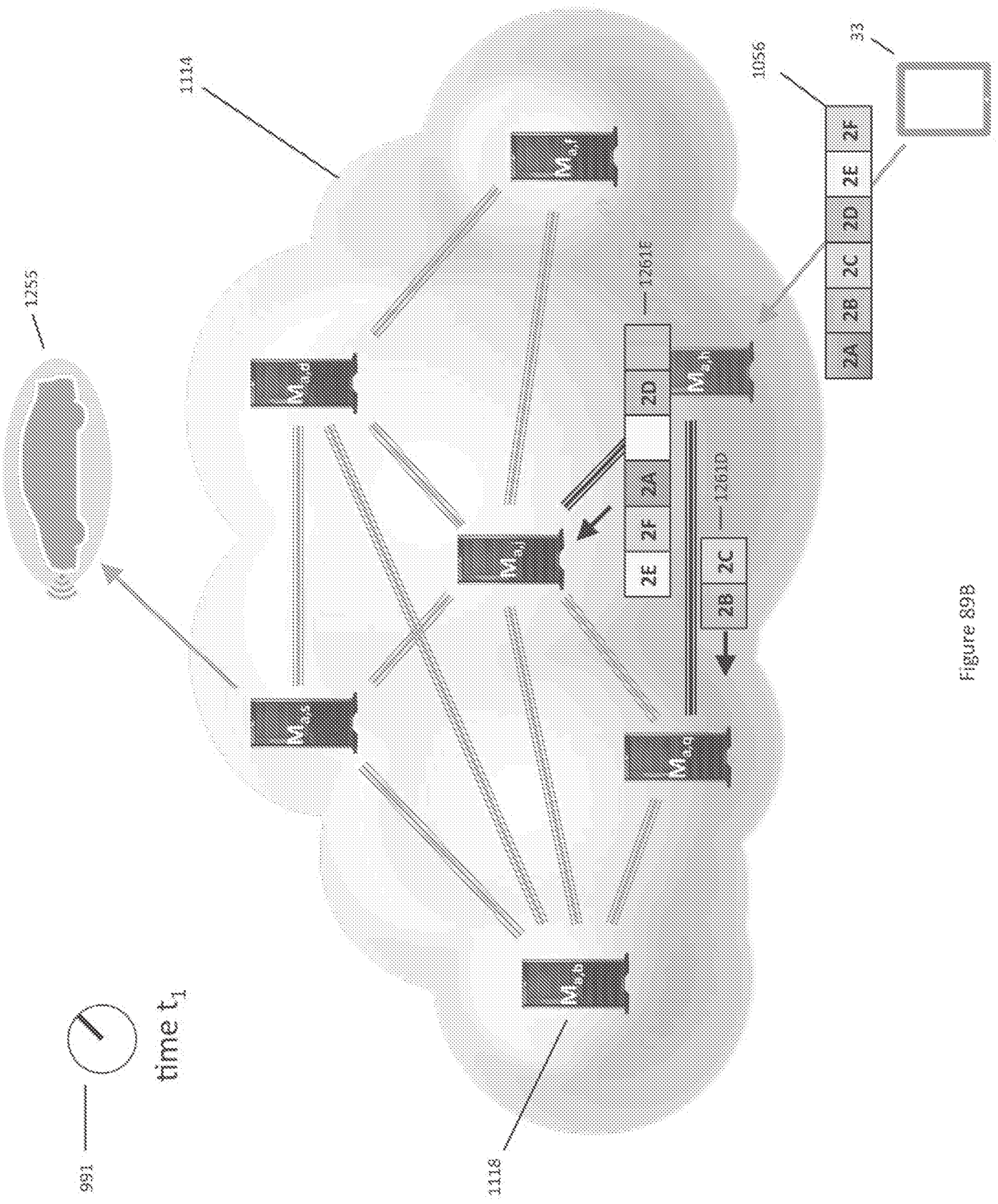


Figure 89B

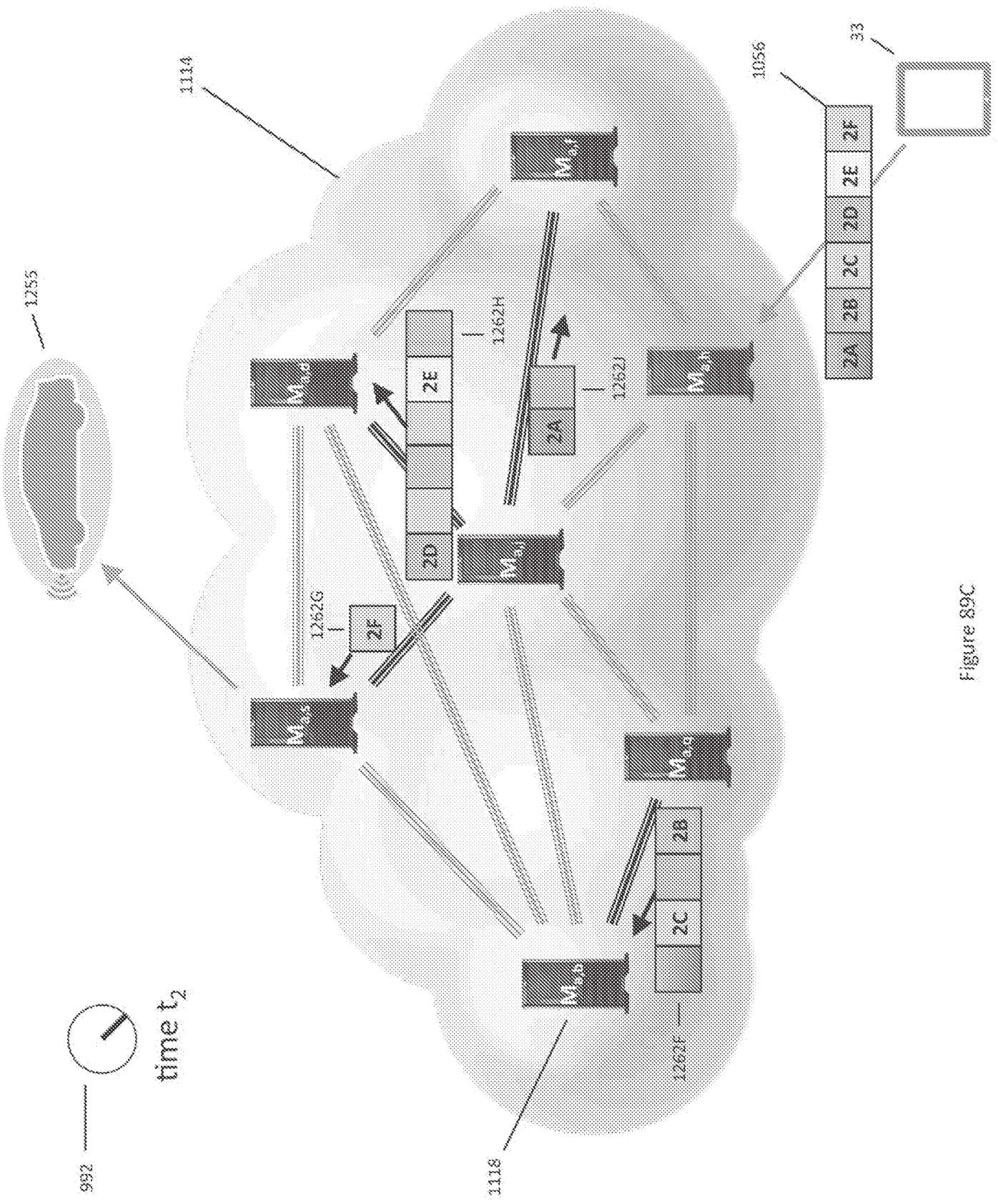

992
time t_2
1255
1114
1118
1056
33
1262G
1262H
1262J
1262F
2A
2B
2C
2D
2E
2F

Figure 89C

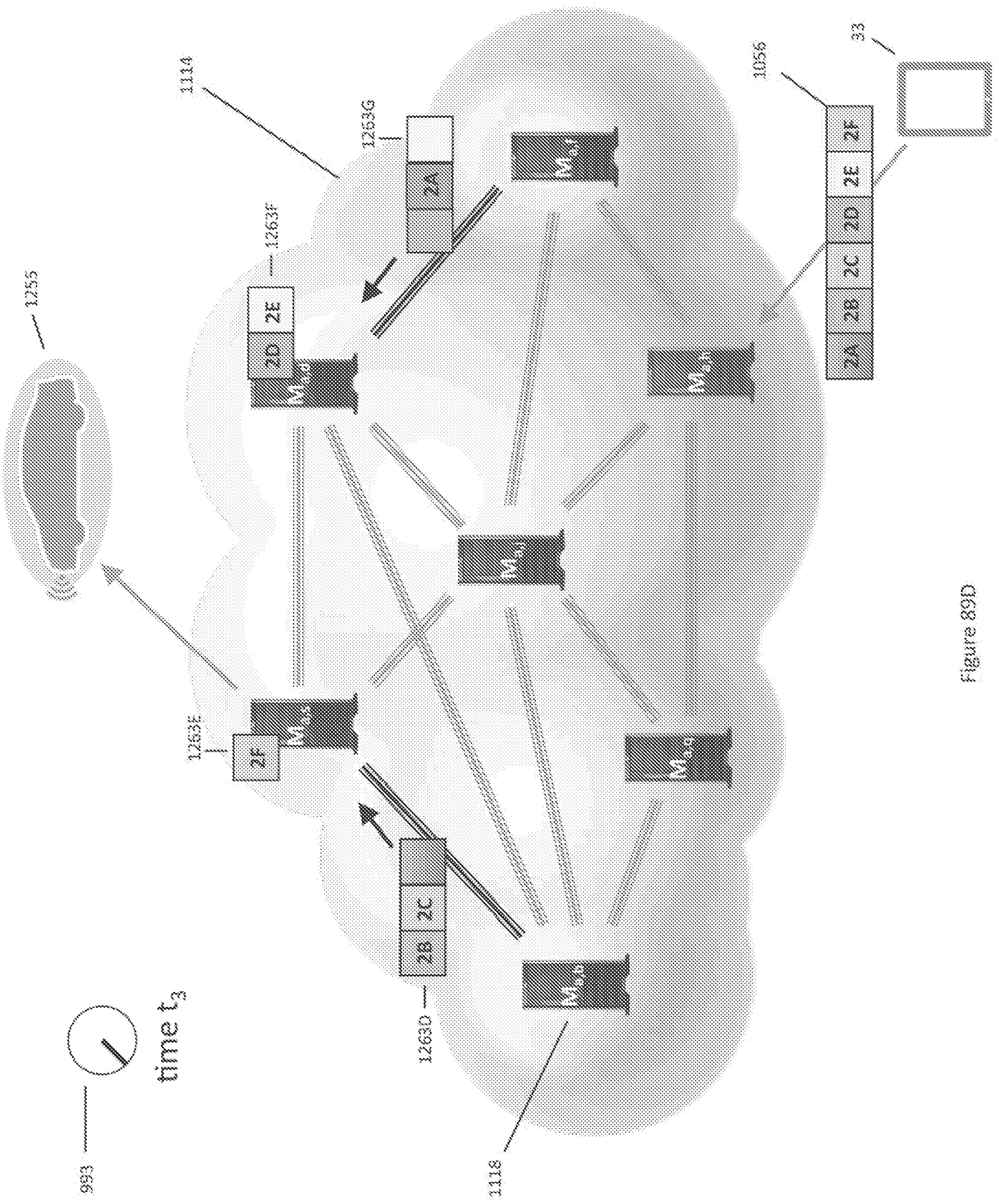

993
time t_3
1255
1114
1263E
1263F
1263G
1263D
1056
33
1118
2A
2B
2C
2D
2E
2F

Figure 89D

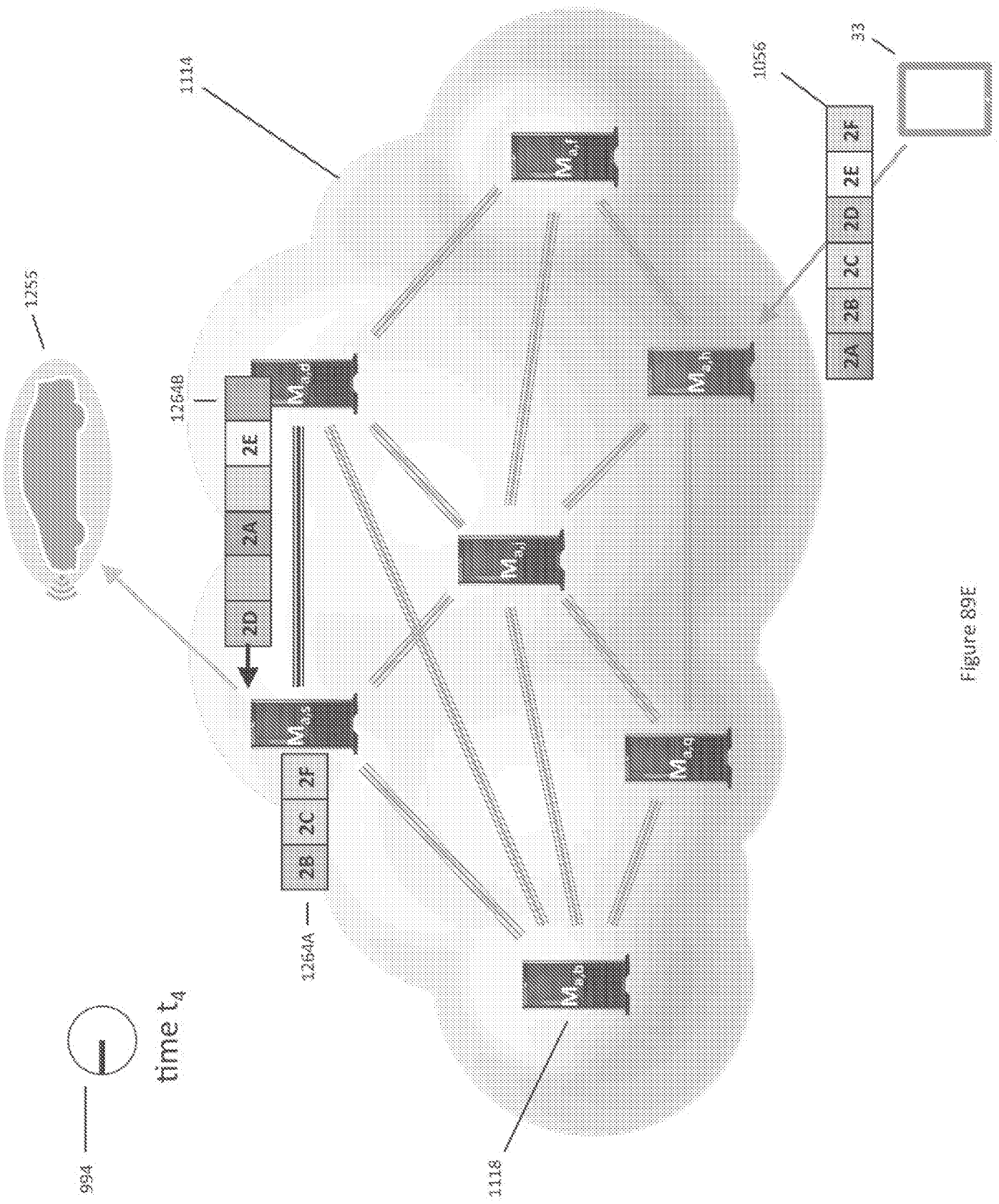

994
time t_4
1255
1114
12648
2D
2A
2E
2B
2C
2F
1264A
1118
1056
2A
2B
2C
2D
2E
2F
33

Figure 89E

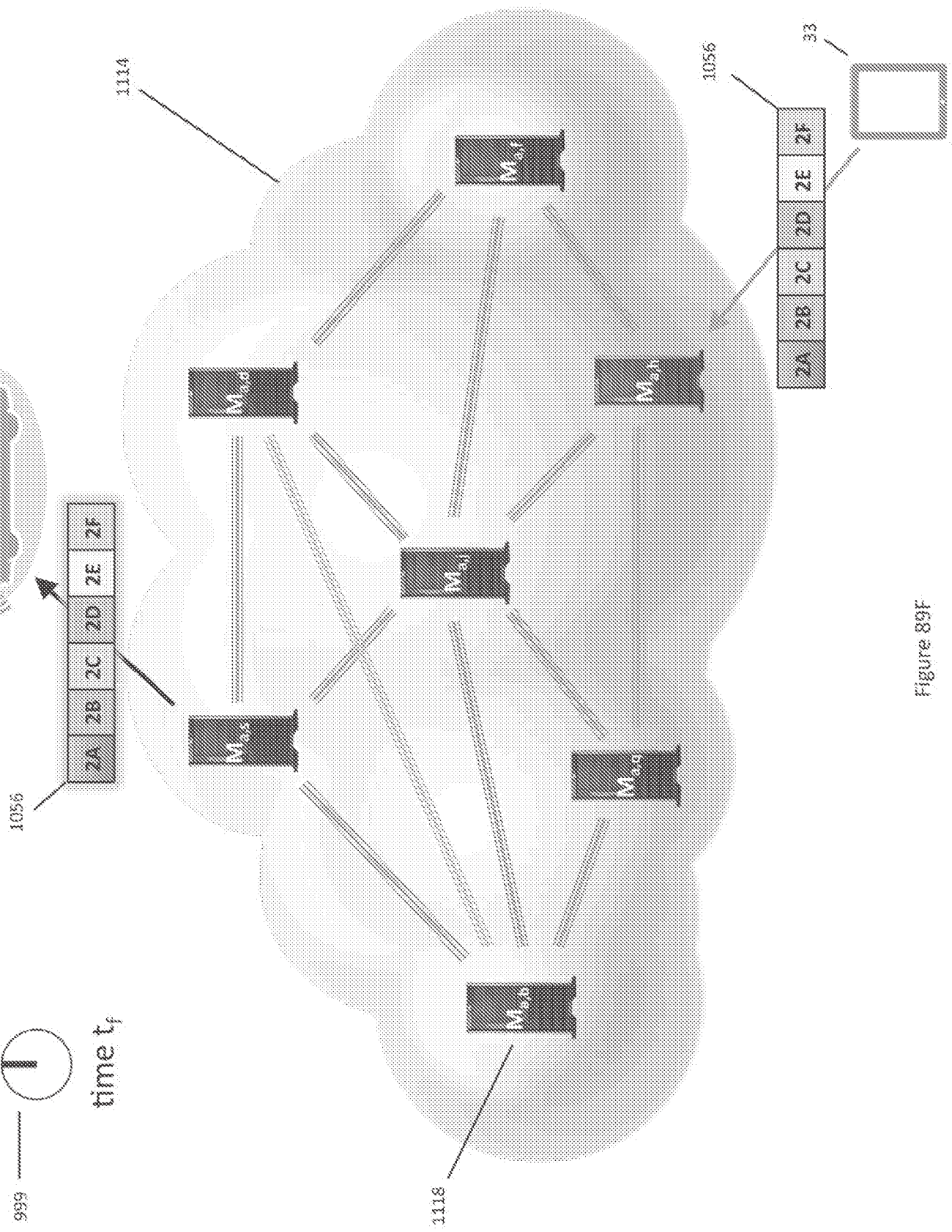


Figure 89F

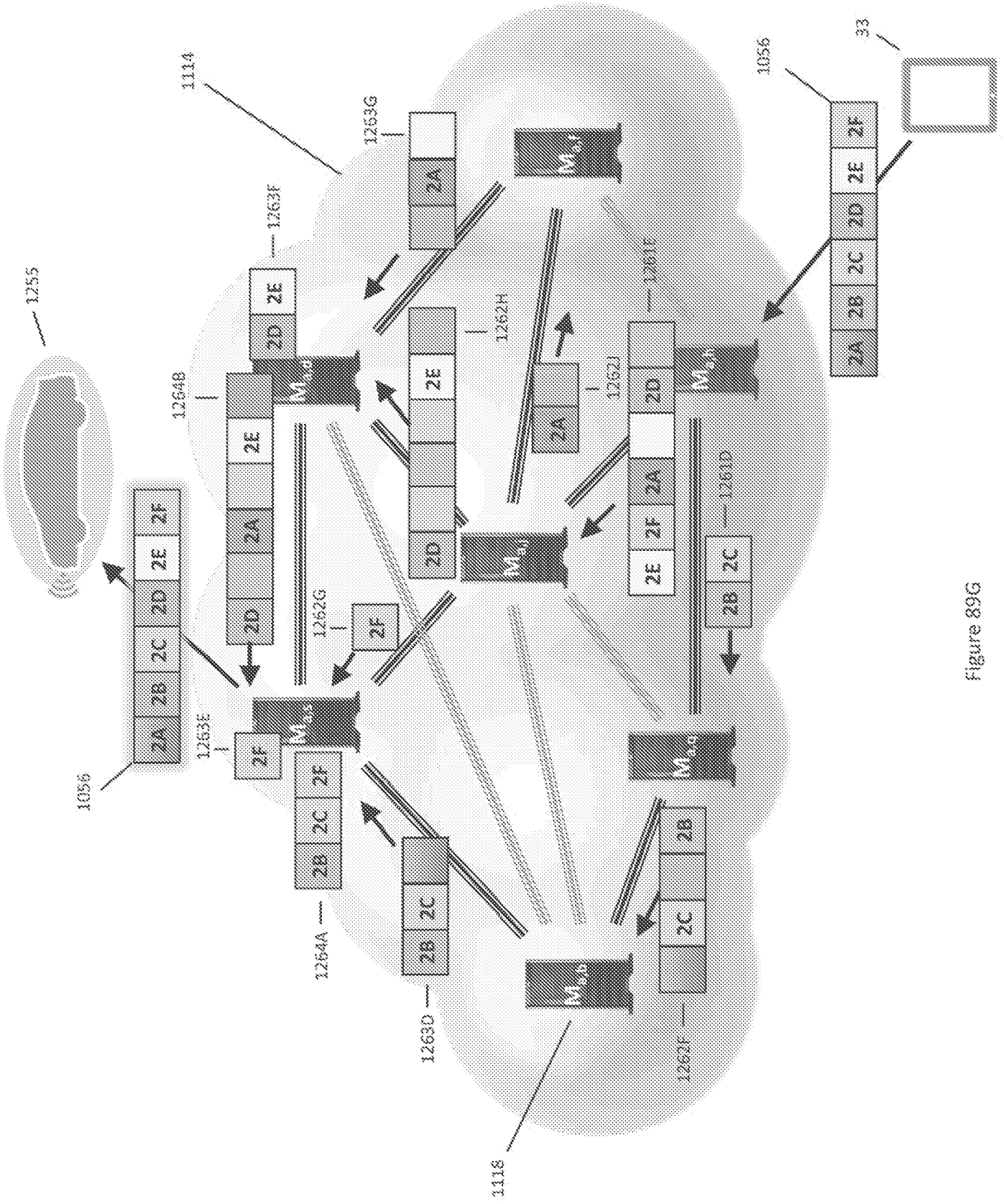

1255
1114
1056
1263G
1263F
1263E
1264A
1263D
1263F
1261F
1261D
1262H
1262J
1262G
12648
1118
33
2A
2B
2C
2D
2E
2F

Figure 89G

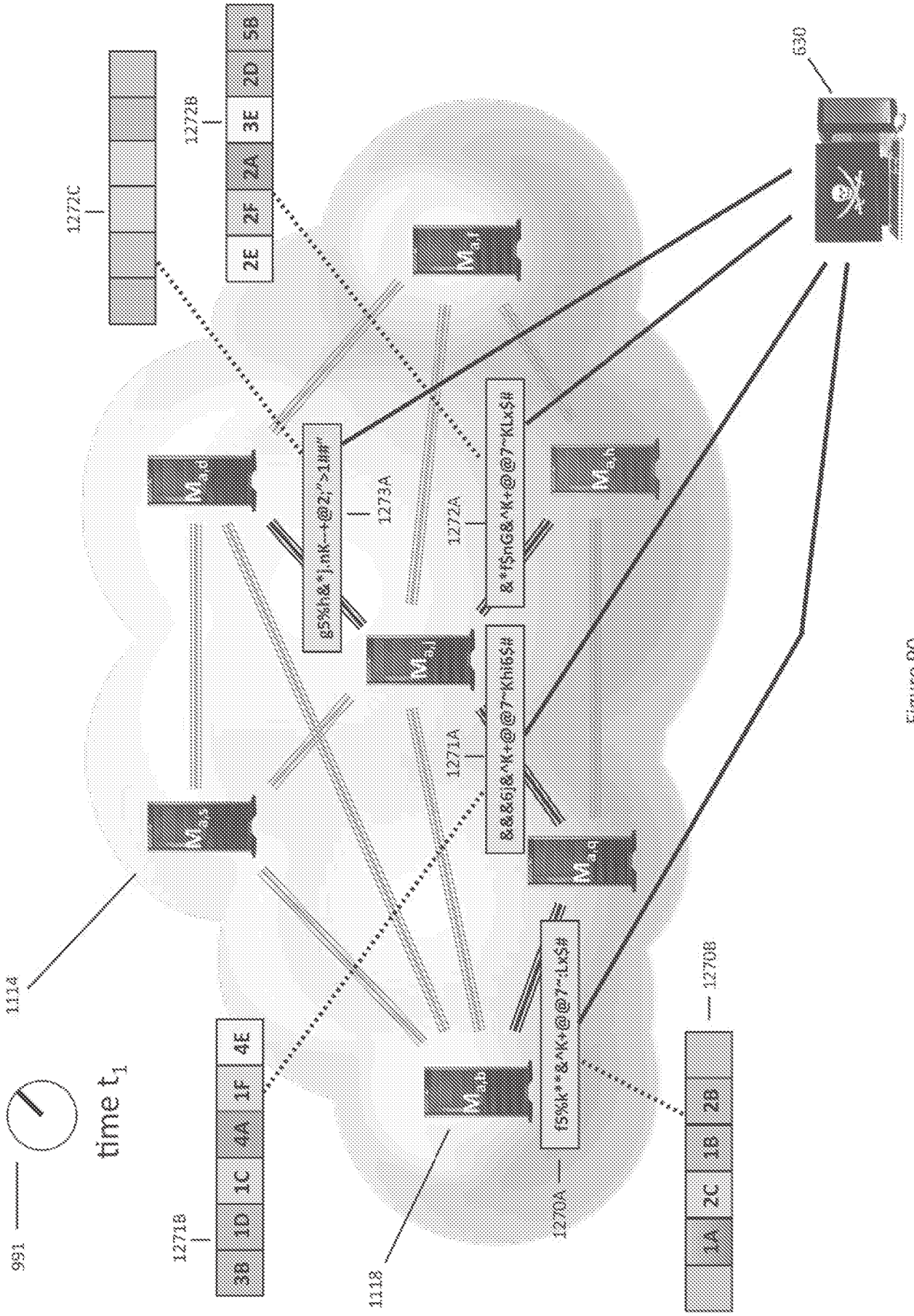

991
time t_1
1114
1118
1271A
1272A
1273A
1270A
1270B
1272B
1272C
630
3B 1D 1C 4A 1F 4E
1A 2C 1B 2B
2E 2F 2A 3E 2D 5B
&&&6j&^K+@@7~Khi6$#
&*!$nG&^K+@@7~KLx$#
g5%h&*jnK--+@2,'>1#"
f5%k**&^K+@@7~Lx$#

Figure 90

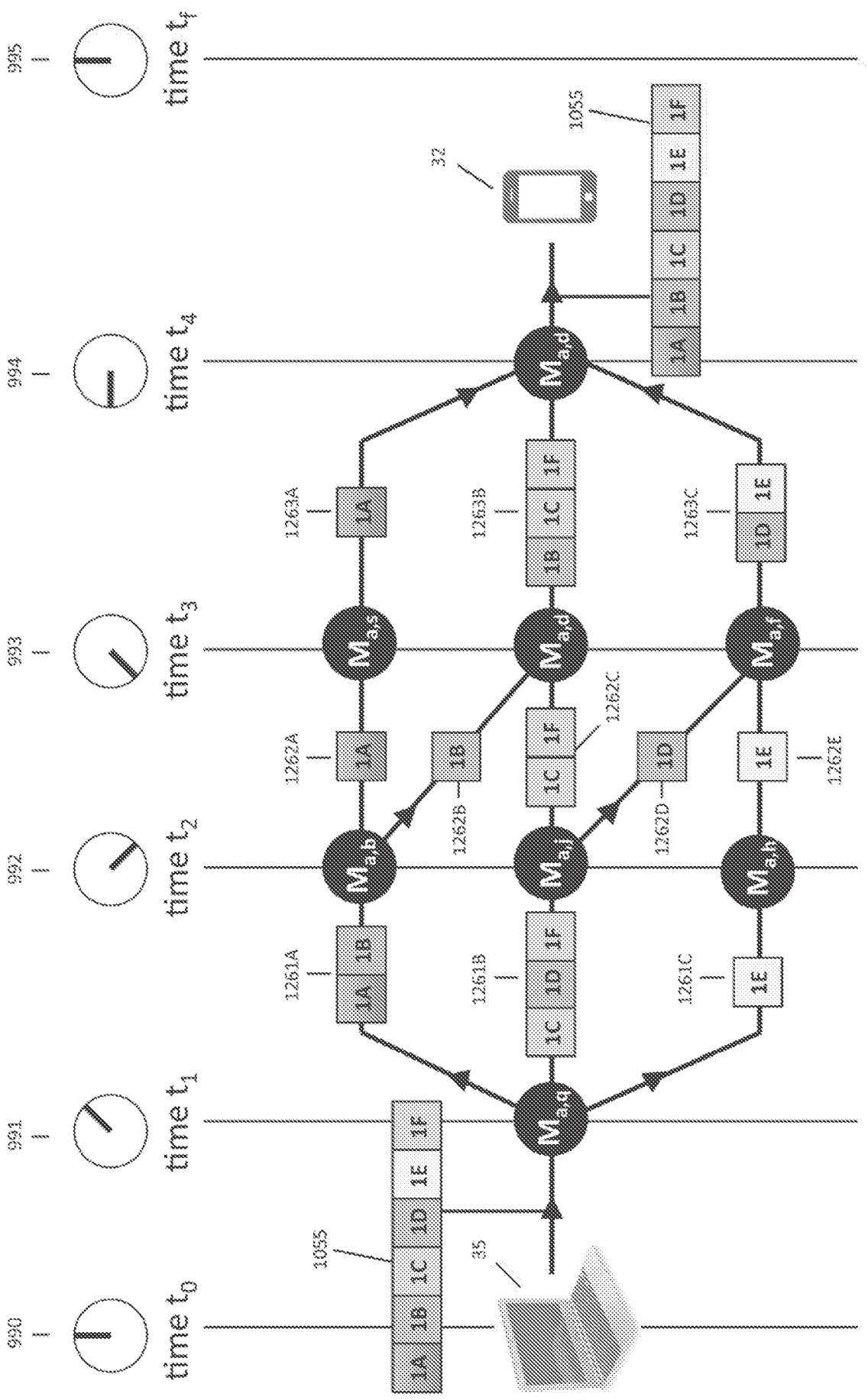

990
time t_0
991
time t_1
992
time t_2
993
time t_3
994
time t_4
995
time t_f
1055
1A
1B
1C
1D
1E
1F
35
32
1261A
1261B
1261C
1262A
1262B
1262C
1262D
1262E
1263A
1263B
1263C
$M_{a,0}$
$M_{a,1}$
$M_{a,2}$
$M_{a,3}$
$M_{a,4}$

Figure 91A

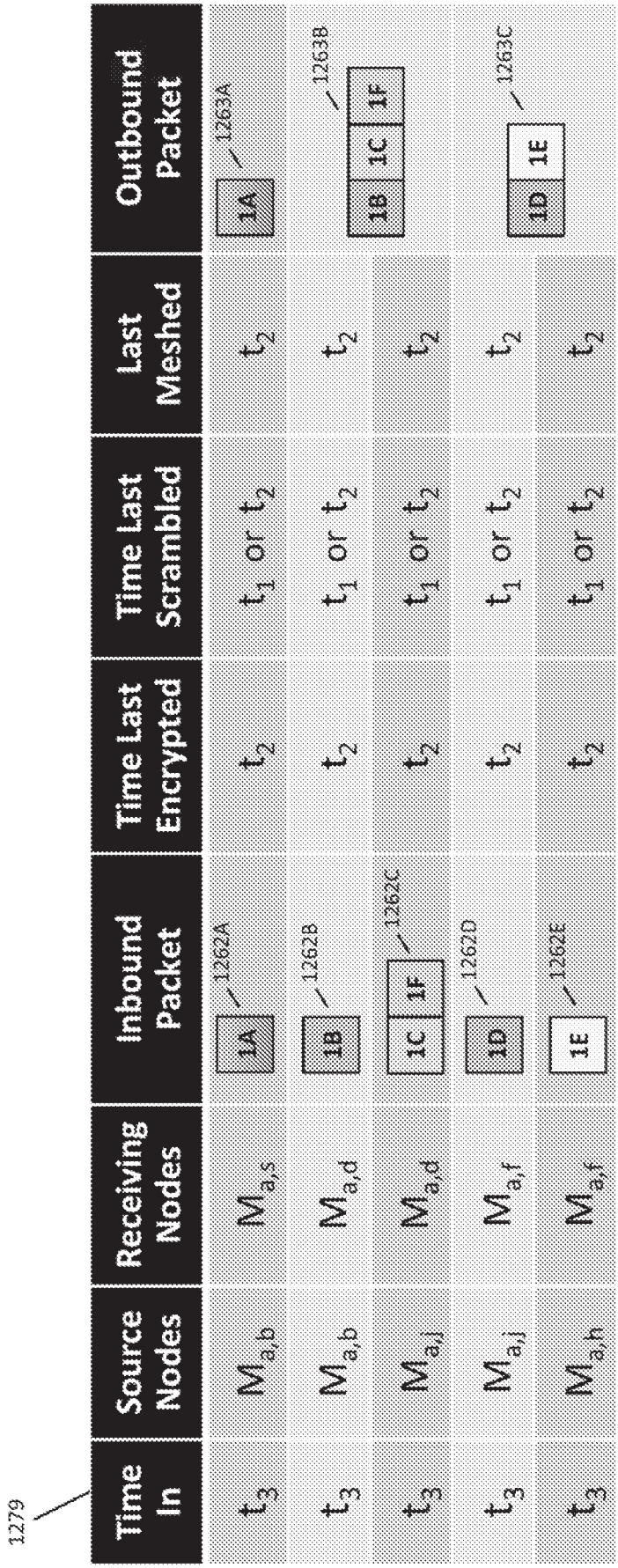

1279
Time In
Source Nodes
Receiving Nodes
Inbound Packet
Time Last Encrypted
Time Last Scrambled
Last Meshed
Outbound Packet
t_3
$M_{a,b}$
$M_{a,s}$
1A
1262A
t_2
t_1 or t_2
t_2
1A
1263A
t_3
$M_{a,b}$
$M_{a,d}$
1B
1262B
t_2
t_1 or t_2
t_2
1B 1C 1F
1263B
t_3
$M_{a,j}$
$M_{a,d}$
1C 1F
1262C
t_2
t_1 or t_2
t_2
t_3
$M_{a,j}$
$M_{a,f}$
1D
1262D
t_2
t_1 or t_2
t_2
1D 1E
1263C
t_3
$M_{a,h}$
$M_{a,f}$
1E
1262E
t_2
t_1 or t_2
t_2

Figure 91B

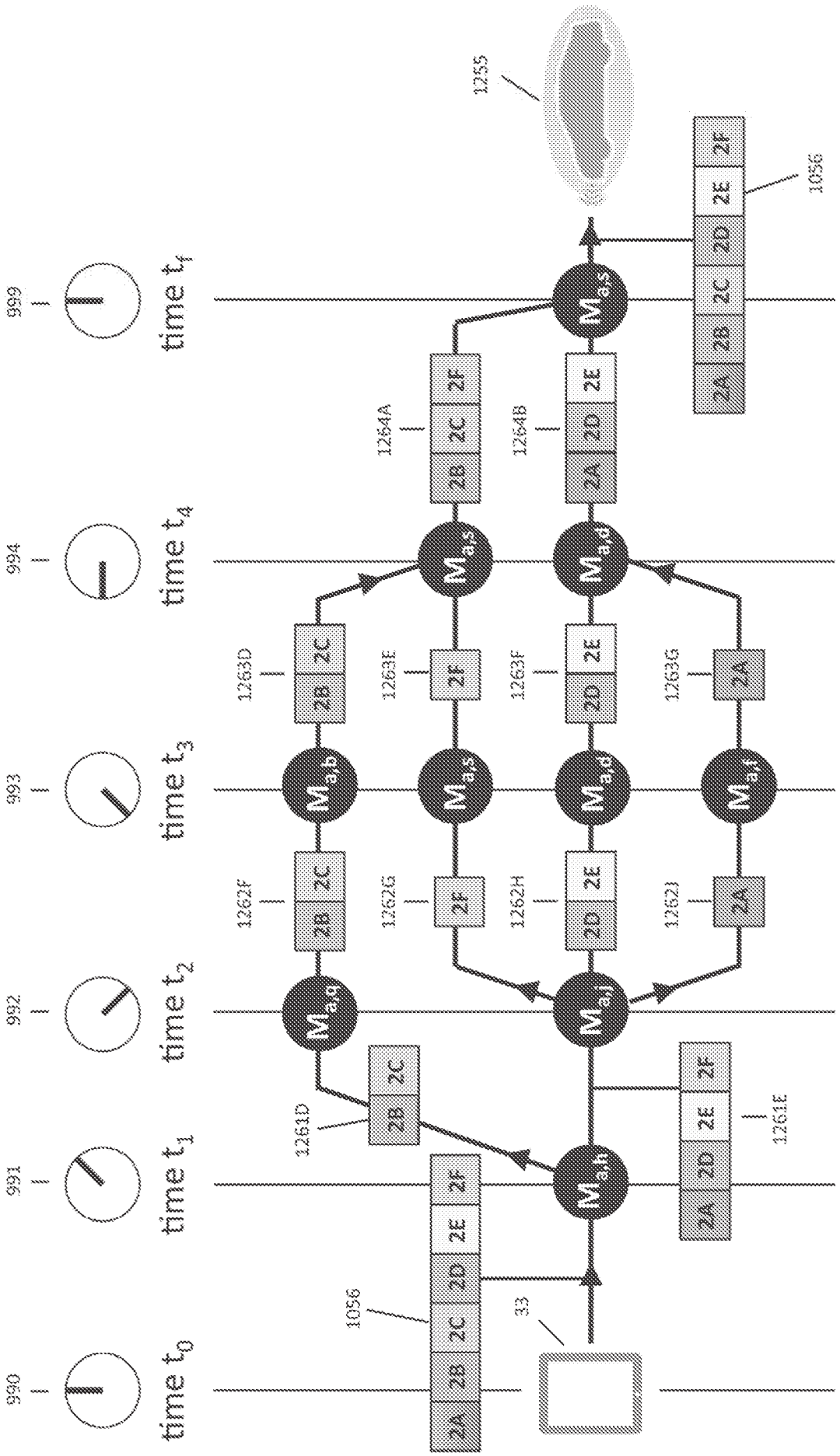

time t_0
time t_1
time t_2
time t_3
time t_4
time t_f
990
991
992
993
994
999
1056
33
1255
1261D
1261E
1262F
1262G
1262H
1262J
1263D
1263E
1263F
1263G
1264A
1264B
2A
2B
2C
2D
2E
2F
$M_{a,h}$
$M_{a,j}$
$M_{a,p}$
$M_{a,s}$

Figure 91C

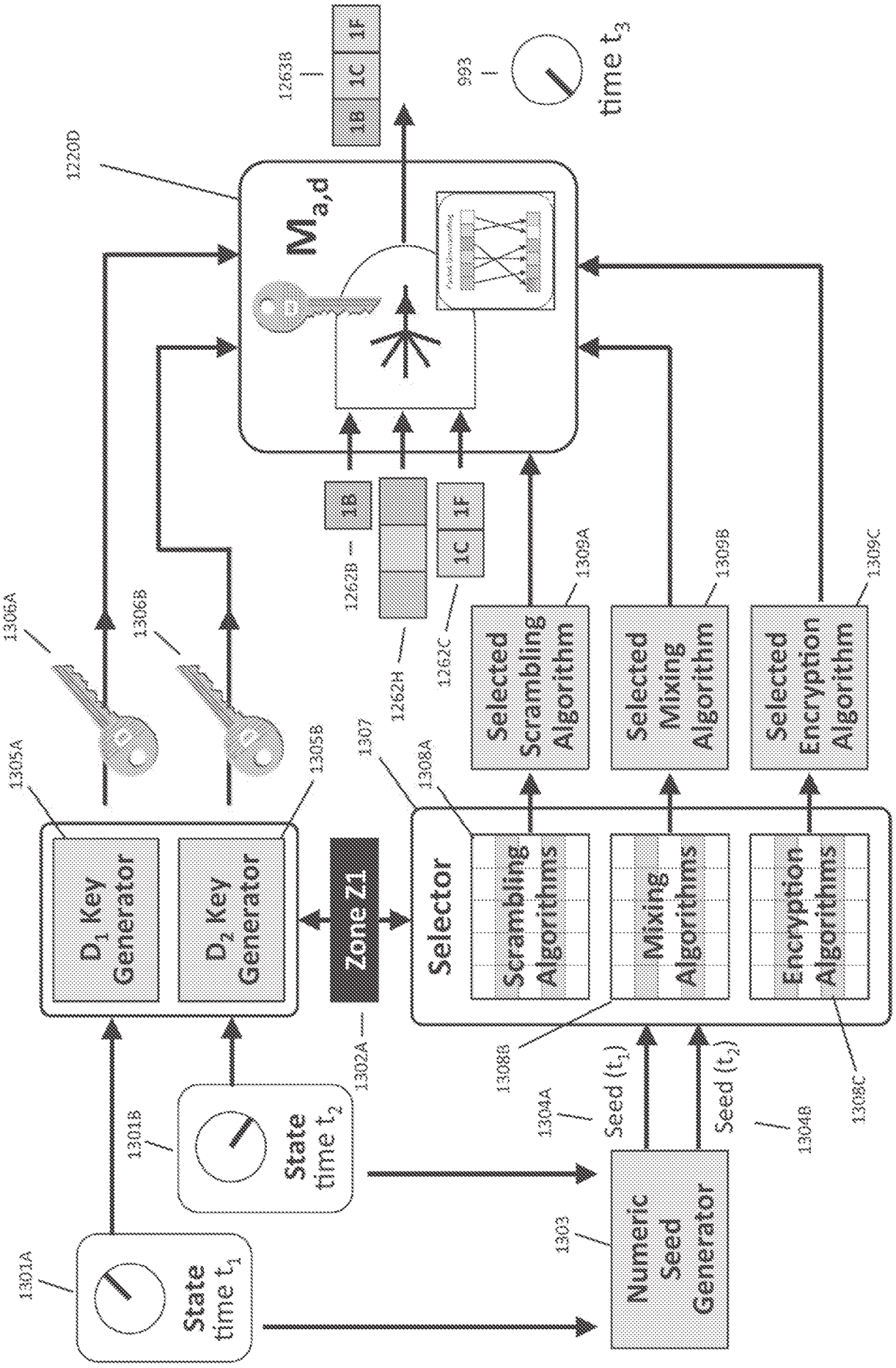

1220D
$M_{a,d}$
1263B
1B
1C
1F
993
time t_3
1306A
1306B
1262B
1262H
1262C
1309A
1309B
1309C
Selected Scrambling Algorithm
Selected Mixing Algorithm
Selected Encryption Algorithm
1305A
1305B
1307
1308A
D_1 Key Generator
D_2 Key Generator
Zone Z1
Selector
Scrambling Algorithms
Mixing Algorithms
Encryption Algorithms
1302A
1308B
1308C
1304A
1304B
Seed (t_1)
Seed (t_2)
1301A
1301B
State time t_1
State time t_2
1303
Numeric Seed Generator

Figure 92A

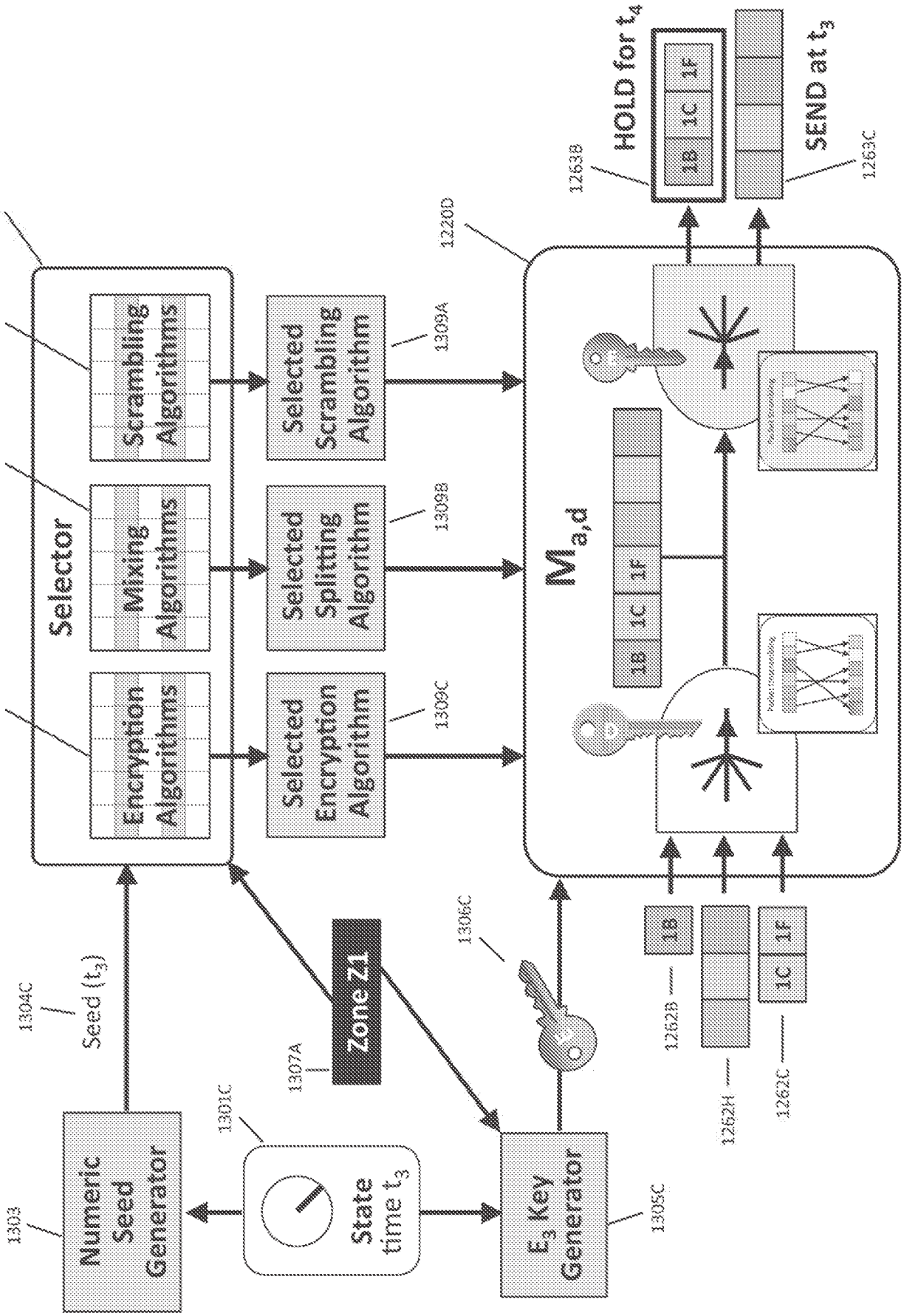

1307
Selector
1308A
Scrambling Algorithms
1308B
Mixing Algorithms
1308C
Encryption Algorithms
Selected Scrambling Algorithm
1309A
Selected Splitting Algorithm
1309B
Selected Encryption Algorithm
1309C
1220D
$M_{a,d}$
1B
1C
1F
12638
HOLD for t_4
1263C
SEND at t_3
1262B
1262H
1262C
1306C
1307A
Zone Z1
1304C
Seed (t_3)
1301C
State time t_3
1303
Numeric Seed Generator
1305C
E_3 Key Generator

Figure 92B

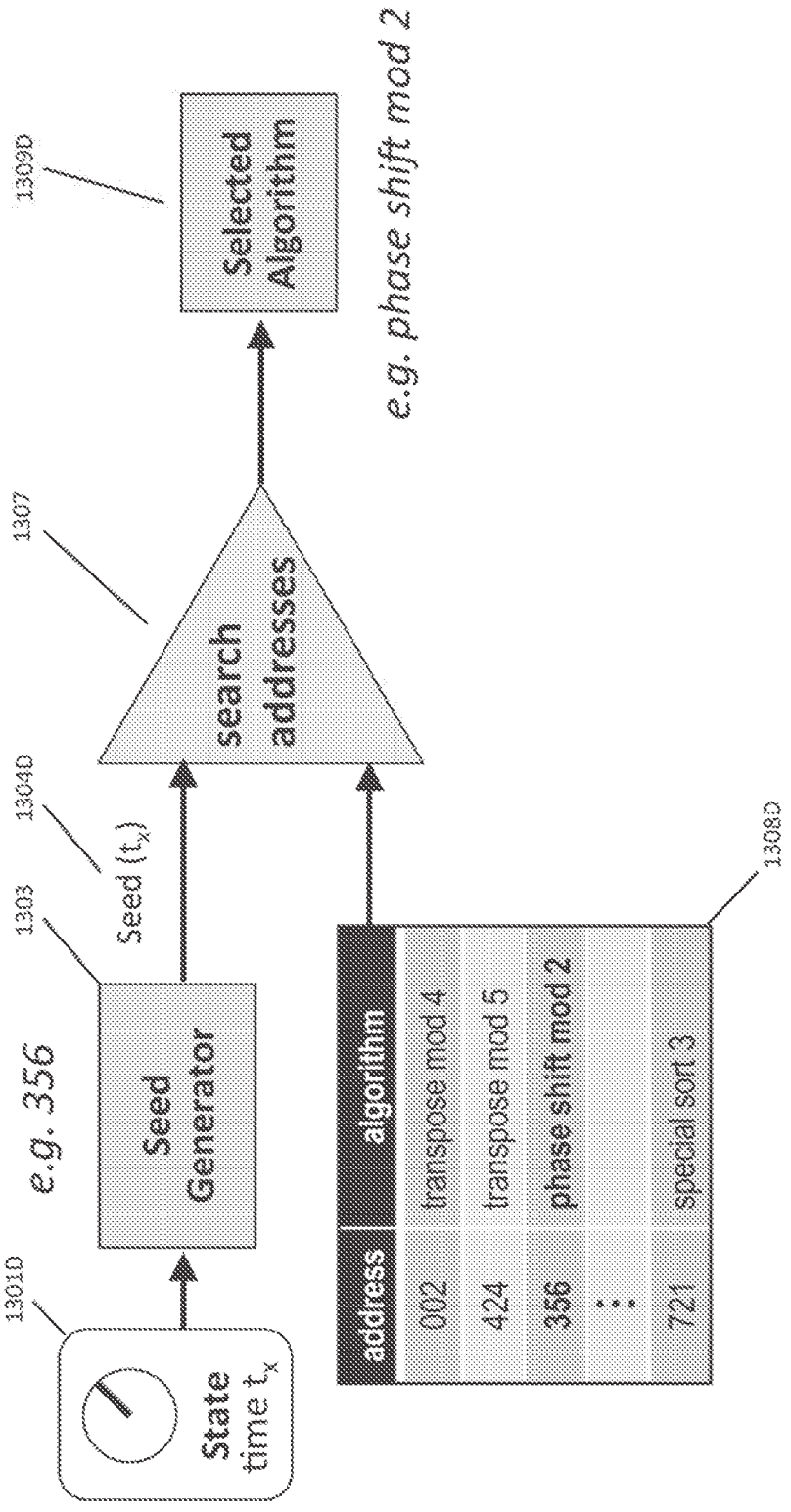

1309D
Selected Algorithm
1307
search addresses
e.g. phase shift mod 2
1304D
Seed (t_x)
1303
e.g. 356
Seed Generator
1301D
State time t_x
1308D
address
algorithm
002
transpose mod 4
424
transpose mod 5
356
phase shift mod 2
721
special sort 3

Figure 93

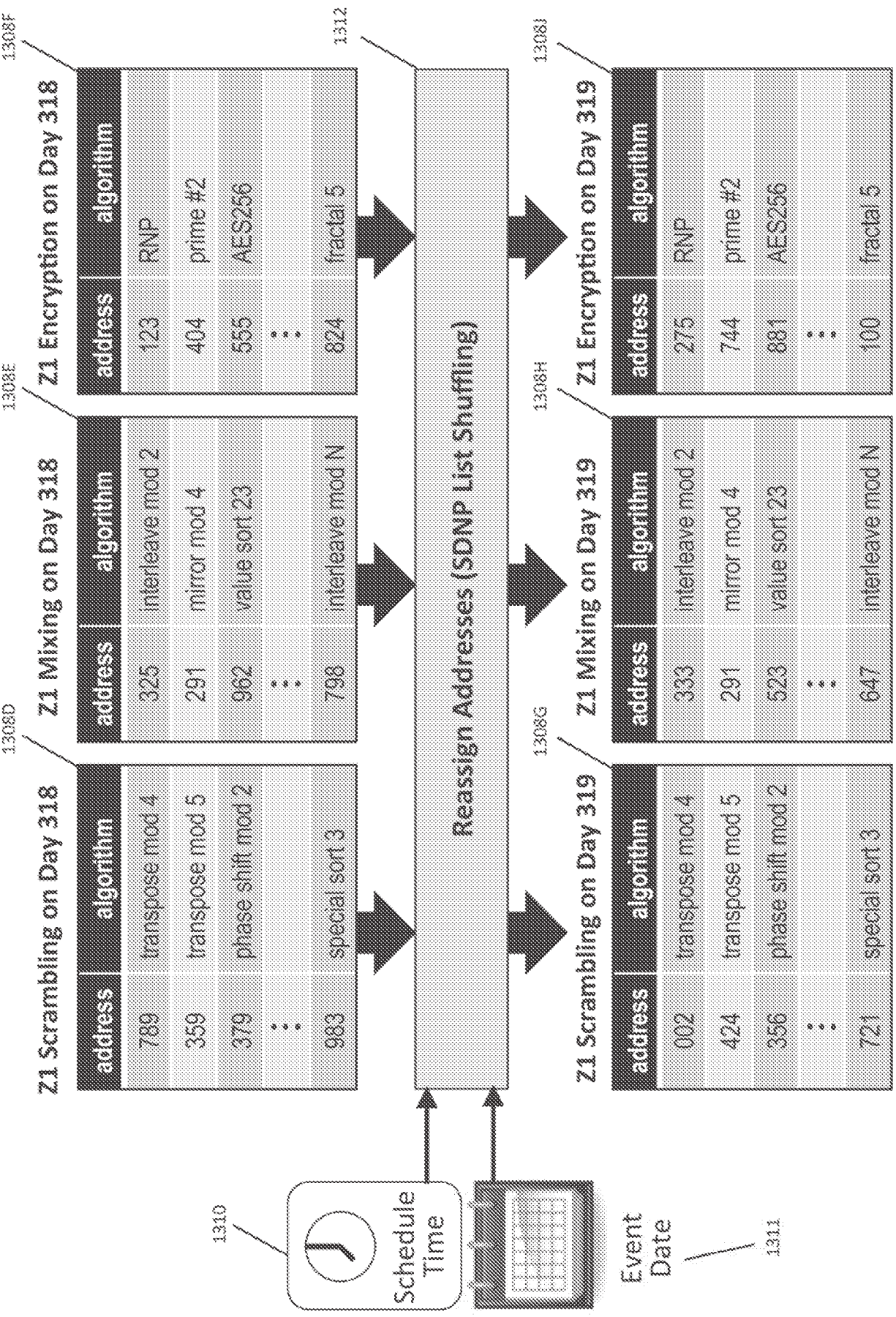

1308D
Z1 Scrambling on Day 318
address
algorithm
789
transpose mod 4
359
transpose mod 5
379
phase shift mod 2
983
special sort 3
1308E
Z1 Mixing on Day 318
address
algorithm
325
interleave mod 2
291
mirror mod 4
962
value sort 23
798
interleave mod N
1308F
Z1 Encryption on Day 318
address
algorithm
123
RNP
404
prime #2
555
AES256
824
fractal 5
1312
Reassign Addresses (SDNP List Shuffling)
1308G
Z1 Scrambling on Day 319
address
algorithm
002
transpose mod 4
424
transpose mod 5
356
phase shift mod 2
721
special sort 3
1308H
Z1 Mixing on Day 319
address
algorithm
333
interleave mod 2
291
mirror mod 4
523
value sort 23
647
interleave mod N
1308I
Z1 Encryption on Day 319
address
algorithm
275
RNP
744
prime #2
881
AES256
100
fractal 5
1310
Schedule Time
1311
Event Date

Figure 94

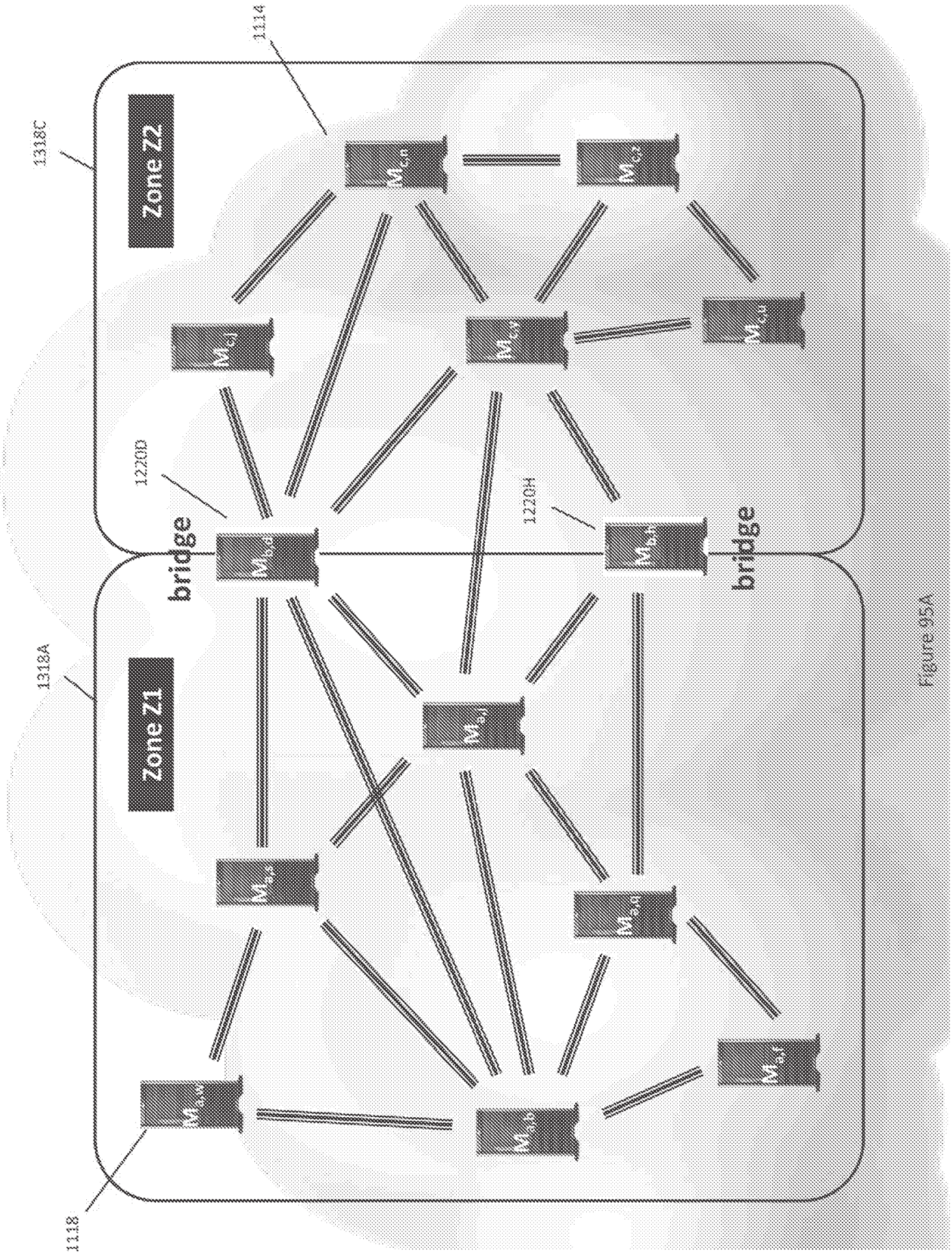

1318C
1114
Zone Z2
1220B
bridge
1220H
bridge
1318A
Zone Z1
1118

Figure 95A

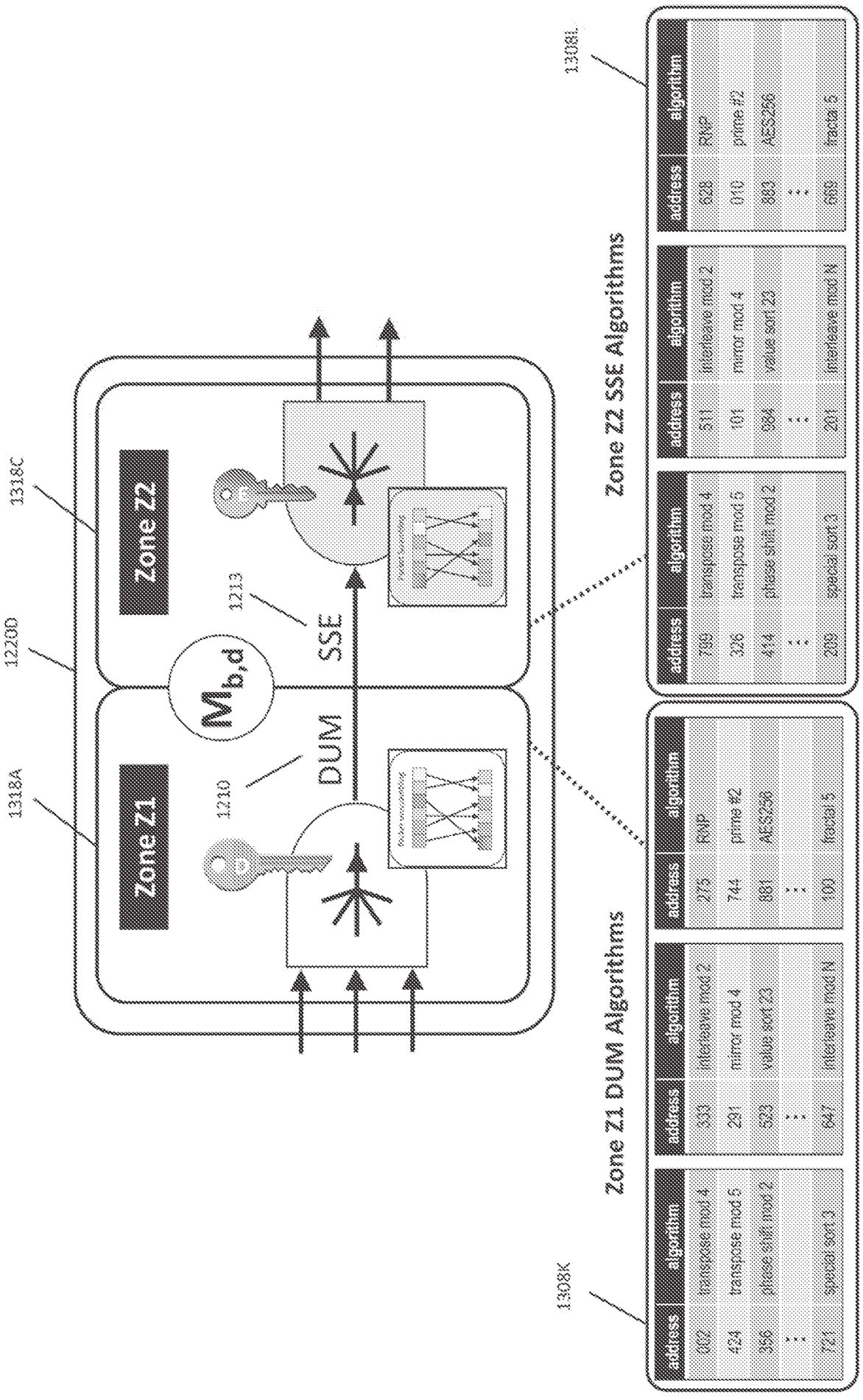

1318A
1318C
1220D
1210
1213
Zone Z1
Zone Z2
DUM
SSE
$M_{b,d}$
1308K
Zone Z1 DUM Algorithms
address
algorithm
002
transpose mod 4
434
transpose mod 5
356
phase shift mod 2
772
special sort 3
331
interleave mod 2
291
mirror mod 4
523
value sort 23
647
interleave mod N
275
RNP
744
prime #2
881
AES256
100
fractal 5
1308L
Zone Z2 SSE Algorithms
799
transpose mod 4
326
transpose mod 5
414
phase shift mod 2
239
special sort 3
511
interleave mod 2
101
mirror mod 4
984
value sort 23
201
interleave mod N
628
RNP
010
prime #2
883
AES256
668
fractal 5

Figure 95B

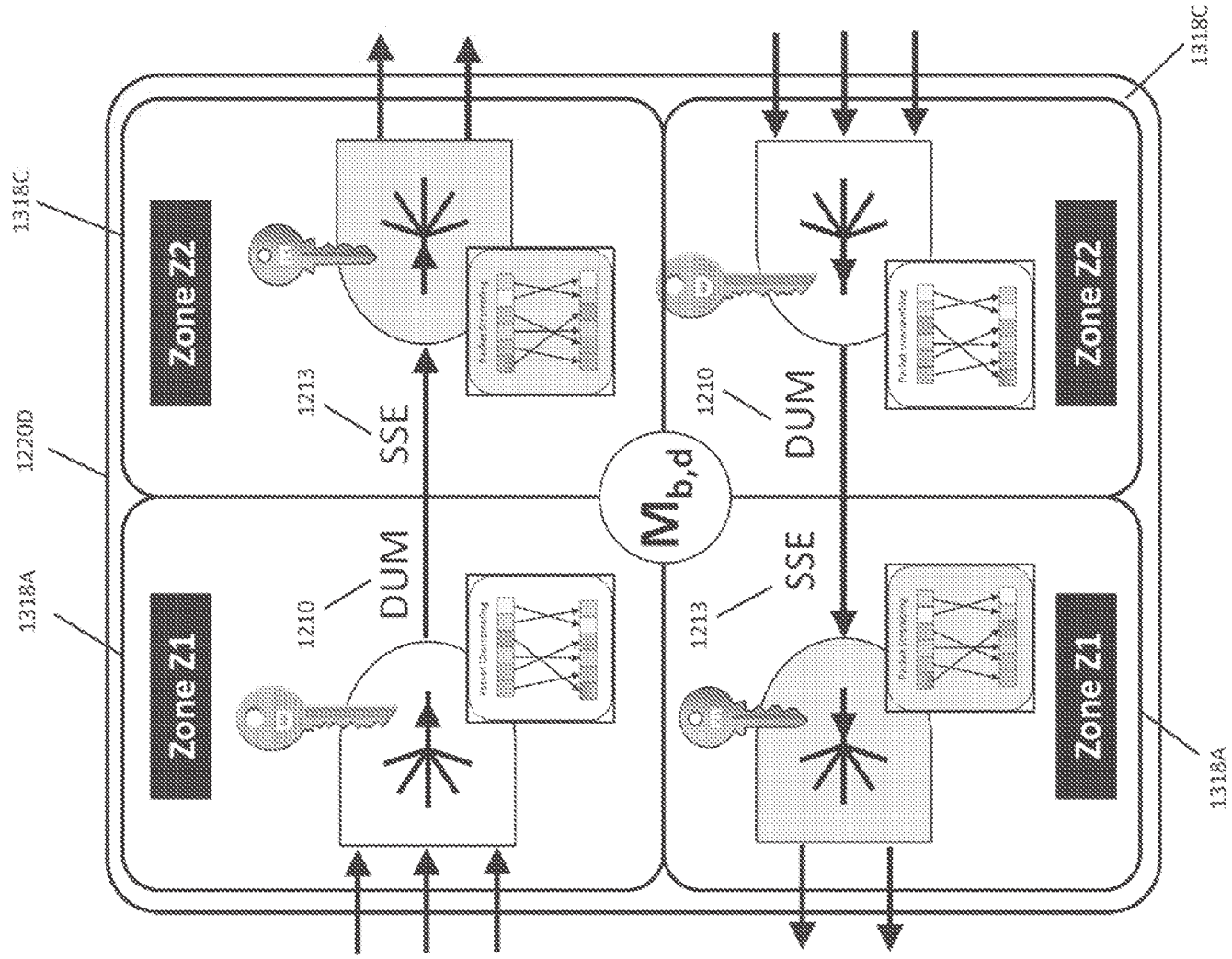

1318C
1220D
1318A
Zone Z2
Zone Z1
1213
SSE
1210
DUM
$M_{b,d}$
1210
DUM
1213
SSE
Zone Z2
Zone Z1
1318C
1318A

Figure 95C

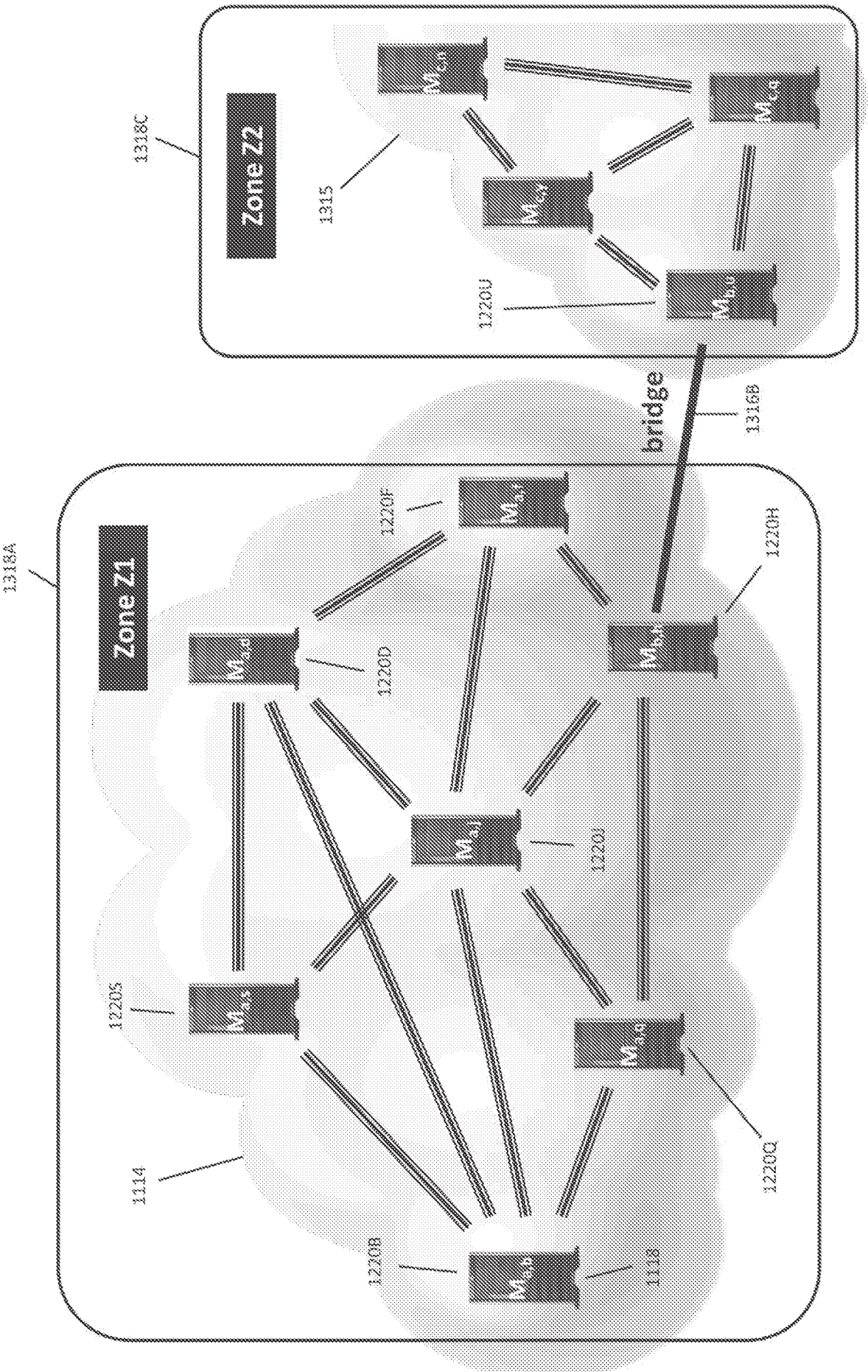

1318A
Zone Z1
1220F
1220H
1220D
1220S
1220I
1114
1220Q
1220B
1118
bridge
1316B
1318C
Zone Z2
1315
1220J

Figure 95D

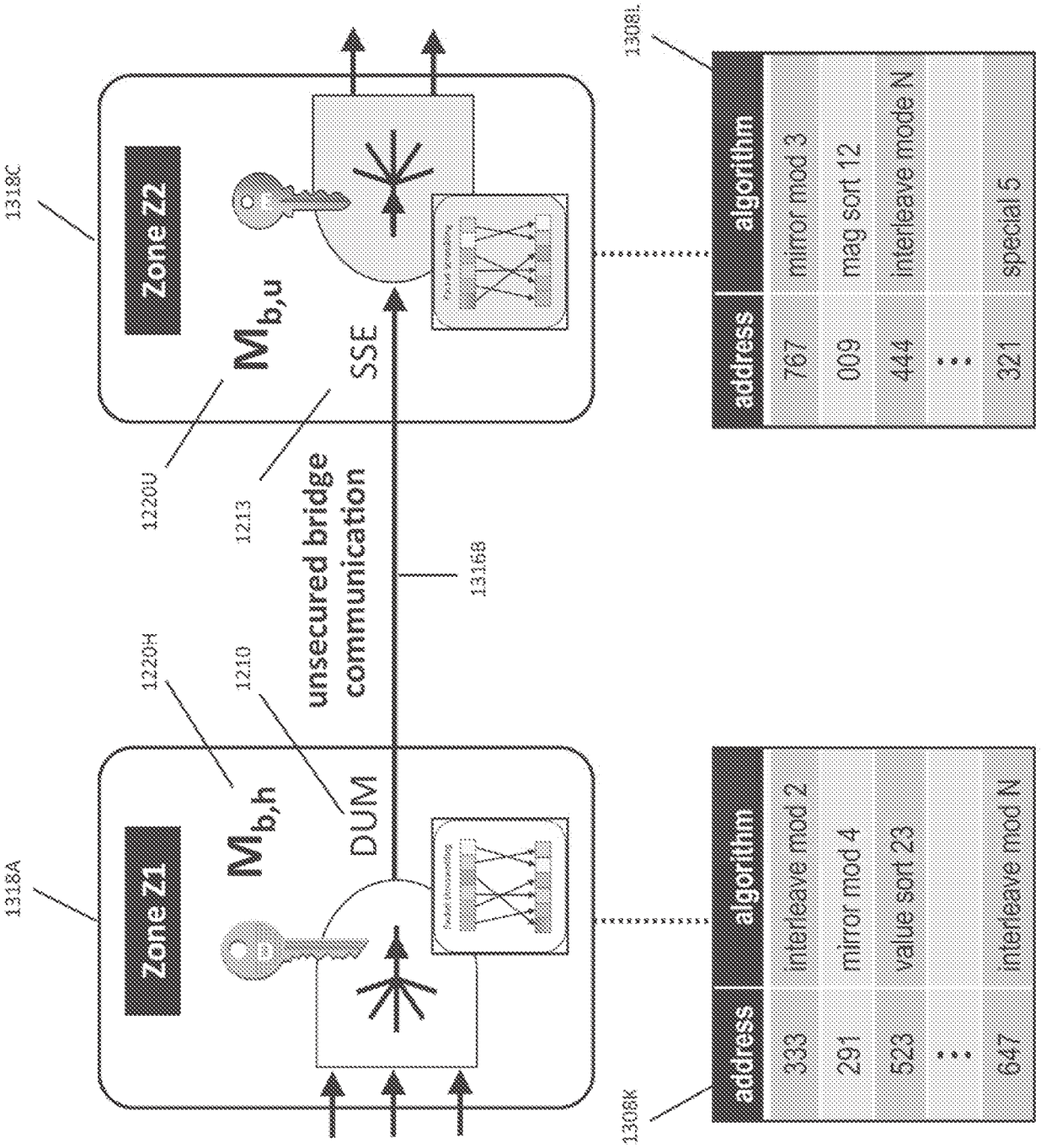

1318A
Zone Z1
$M_{b,h}$
1220H
1210
DUM
unsecured bridge communication
1316B
1220U
1213
SSE
$M_{b,u}$
Zone Z2
1318C
1308L
address
algorithm
767
mirror mod 3
009
mag sort 12
444
interleave mode N
321
special 5
1308K
address
algorithm
333
interleave mod 2
291
mirror mod 4
523
value sort 23
647
interleave mod N

Figure 95E

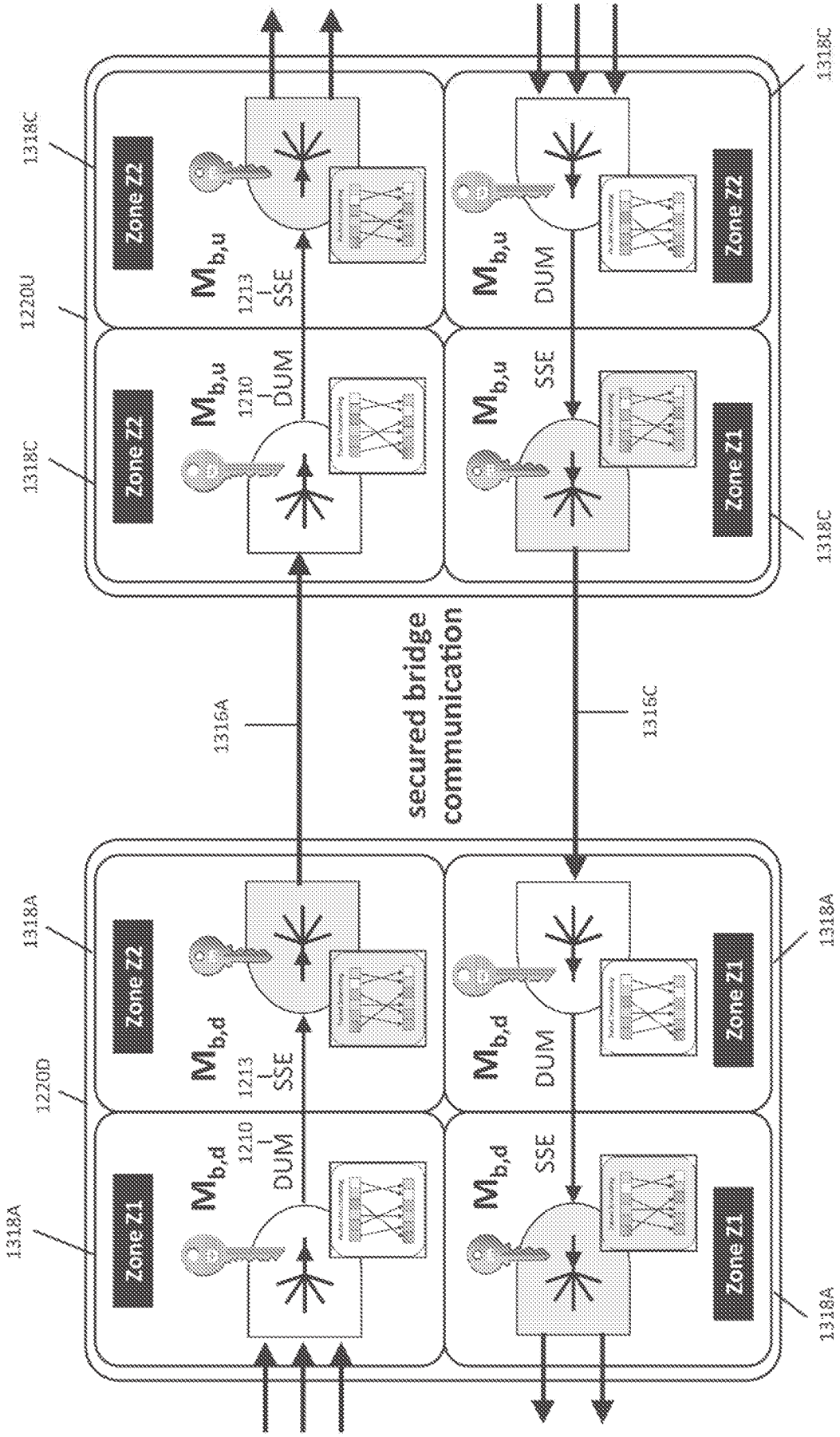

1318A
1220D
1318A
1318C
1220U
1318C
Zone Z1
Zone Z2
$M_{b,d}$
$M_{b,u}$
1210
1213
DUM
SSE
1316A
1316C
secured bridge communication

Figure 95F

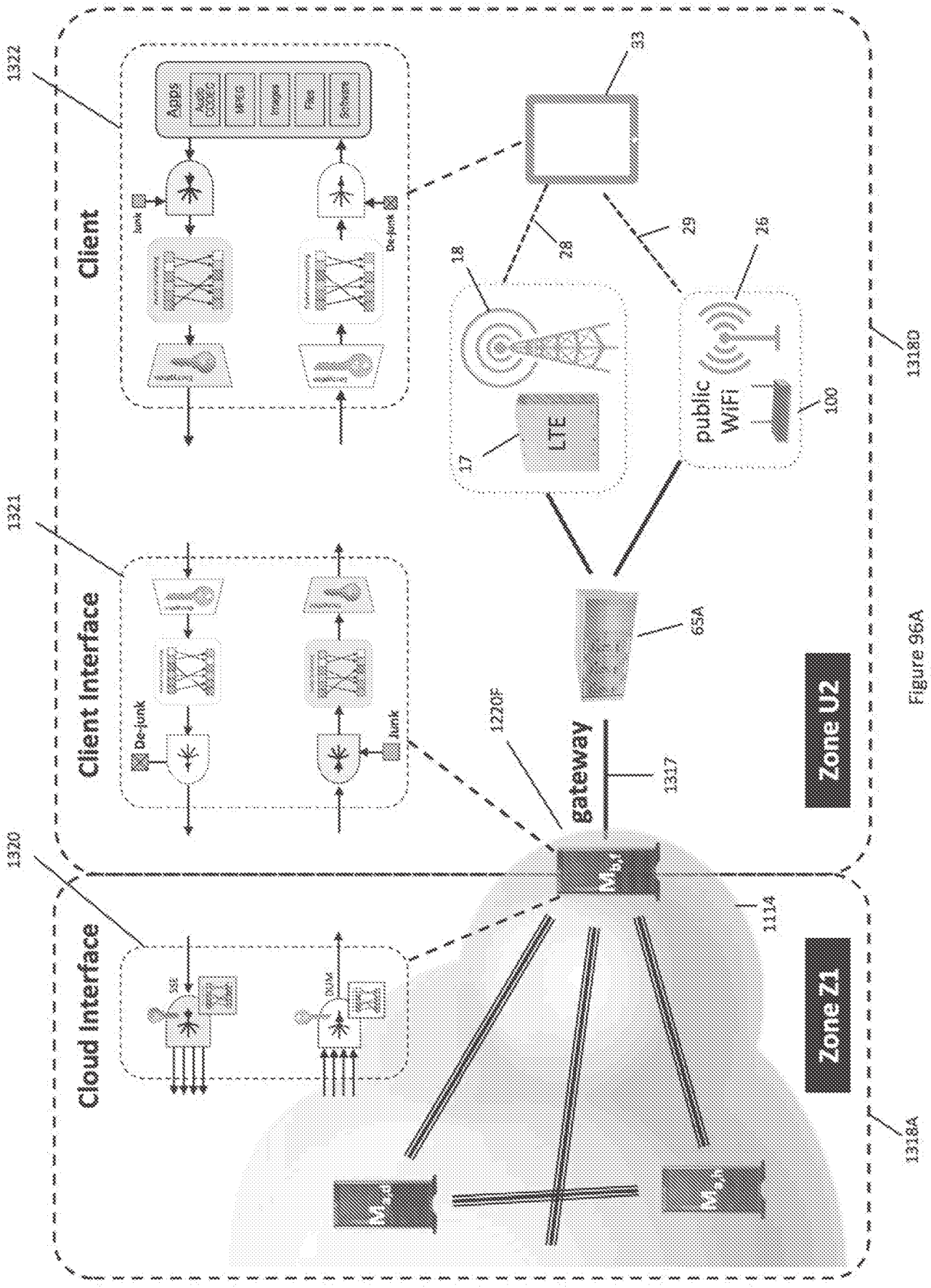

1322
Client
Apps
App Store
Widgets
Engine
Files
Services
Junk
De-junk
33
28
29
26
18
17
LTE
public WiFi
100
1318D
1321
Client Interface
De-junk
Junk
65A
1220F
gateway
1317
Zone U2
1320
Cloud Interface
SIM
SIM
1114
Zone Z1
1318A

Figure 96A

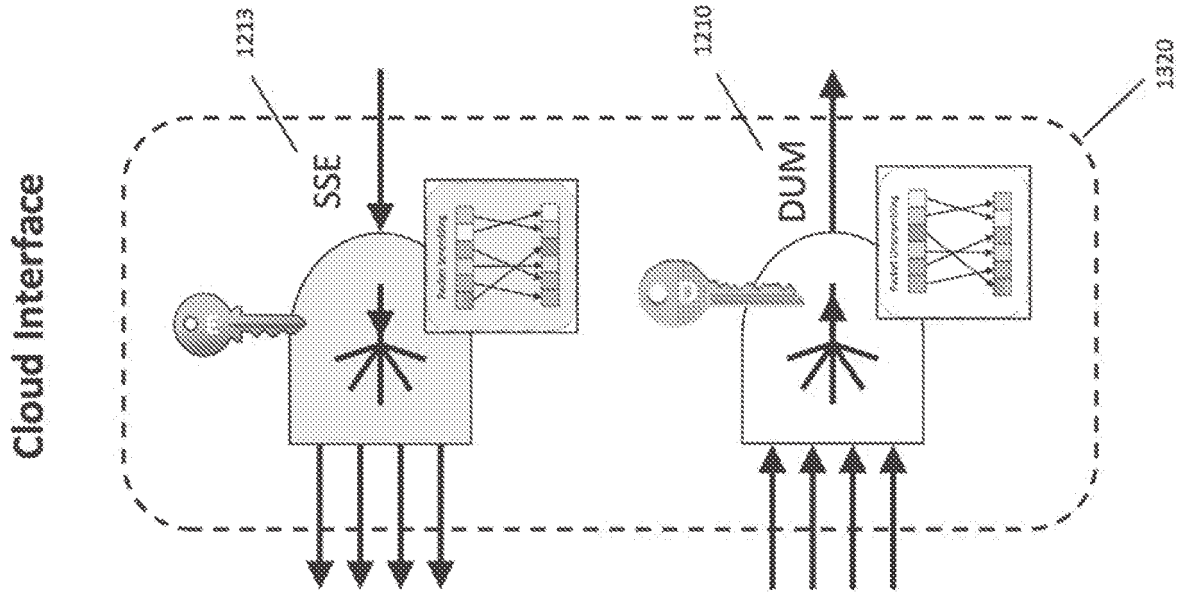


Figure 96B

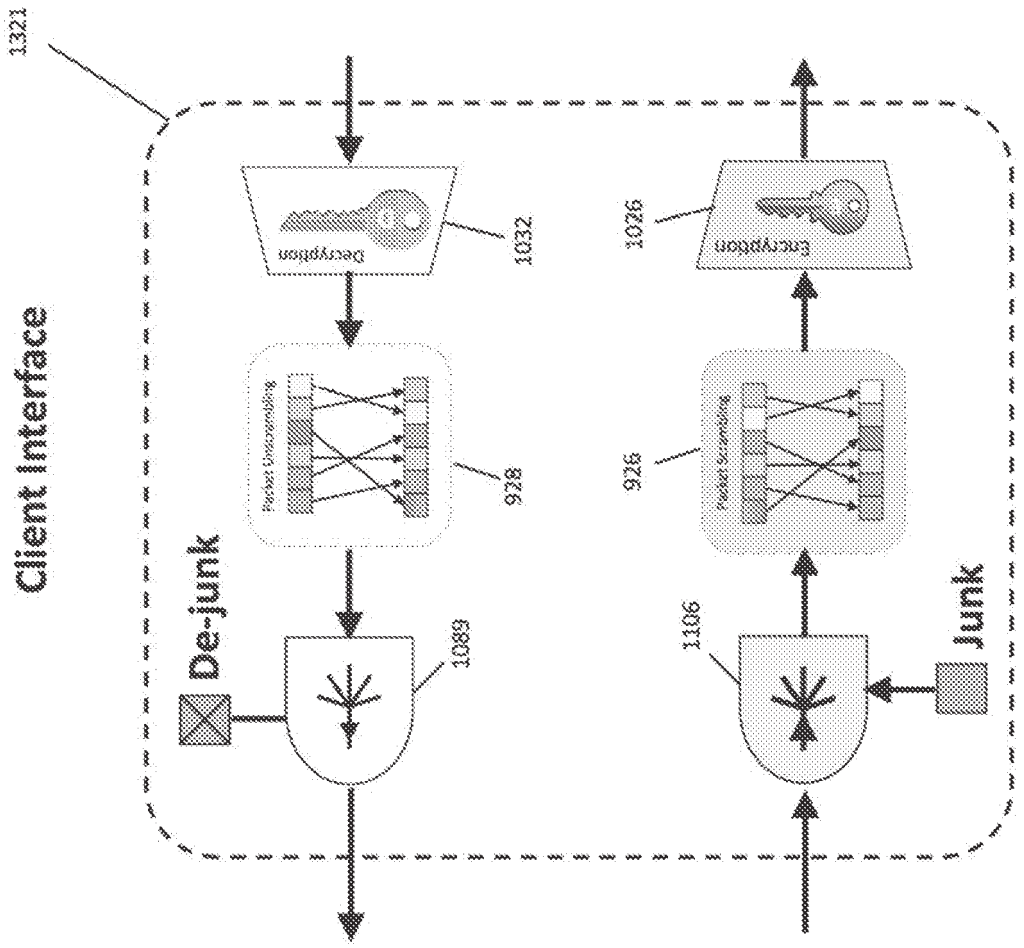

1321
Client Interface
De-junk
Decryption
1032
928
1089
926
Encryption
1026
1106
Junk

Figure 96C

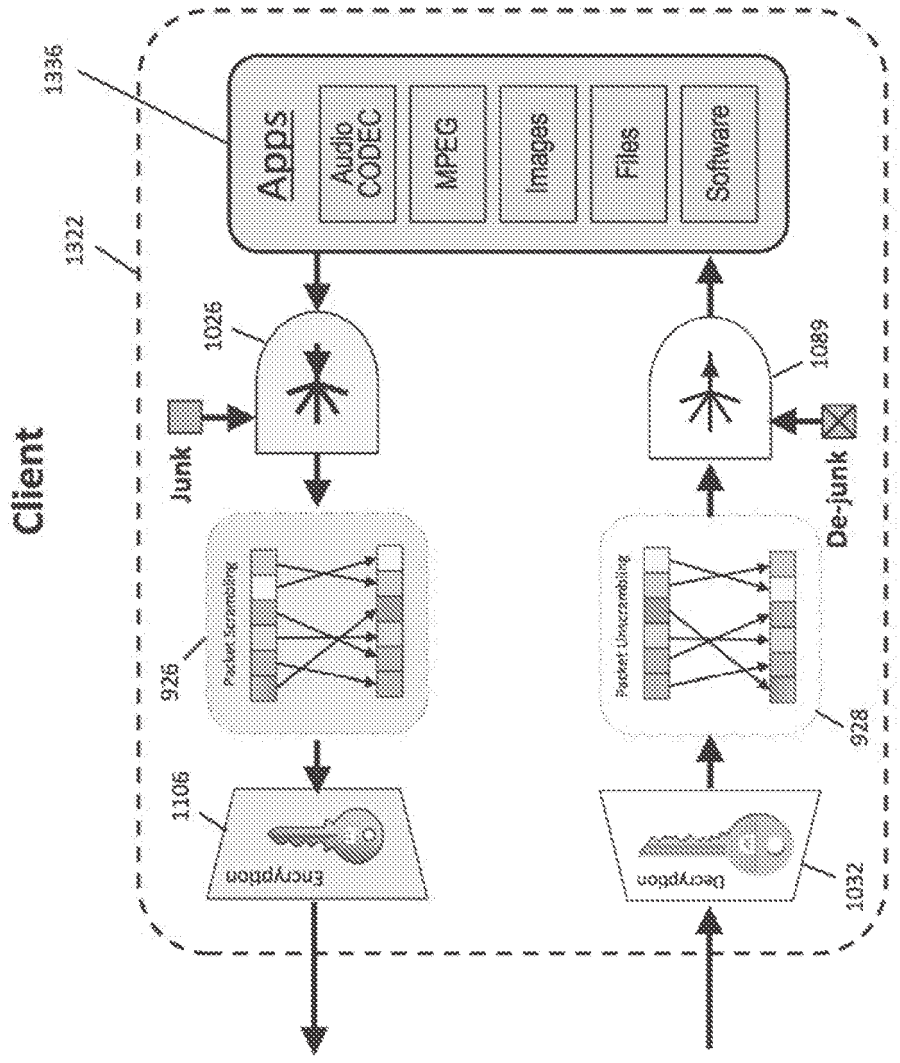

Client
1336
Apps
Audio CODEC
MPEG
Images
Files
Software
1322
1026
Junk
1089
De-junk
926
928
1106
1032
Encryption
Decryption

Figure 96D