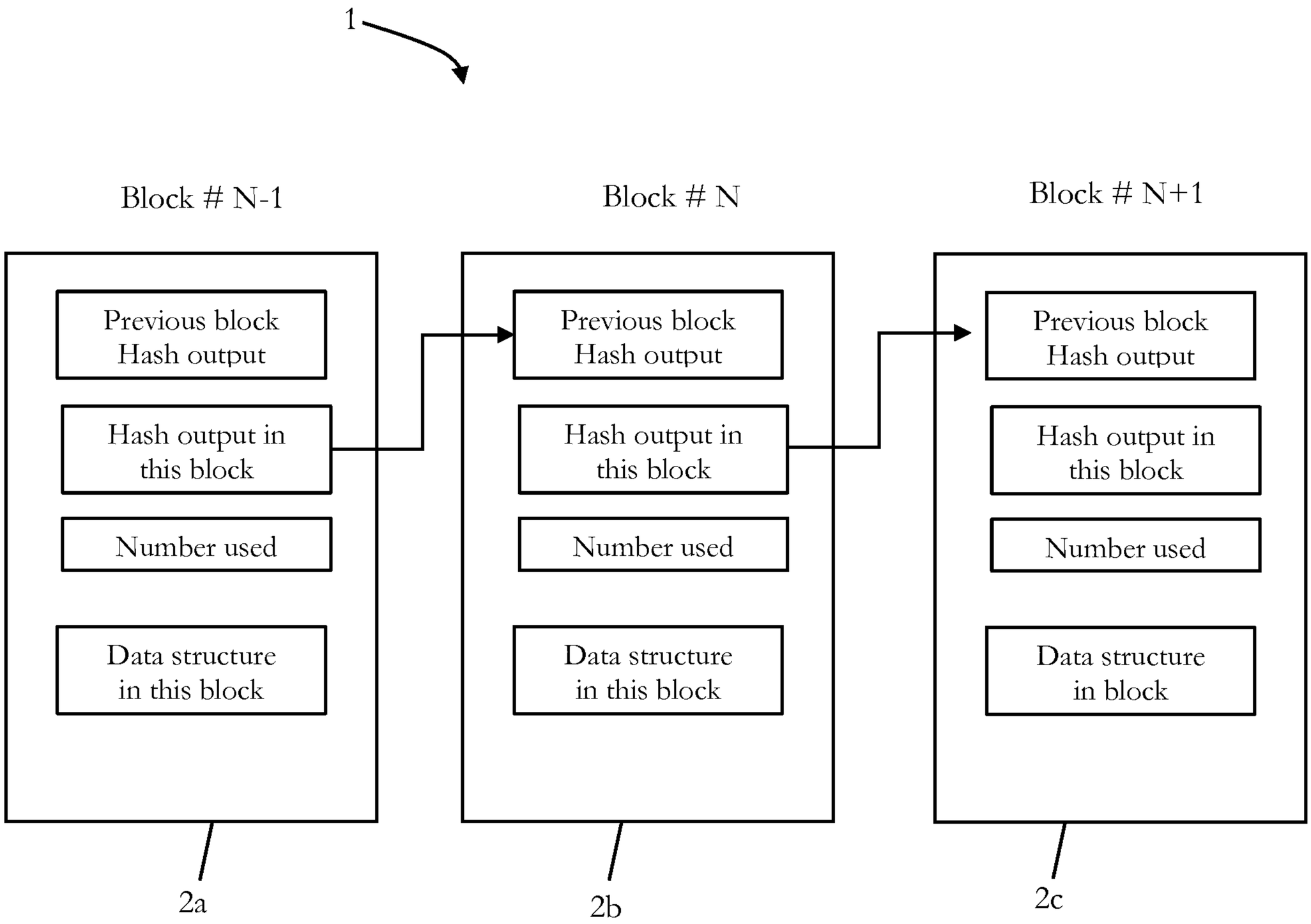

1
Block # N-1
Block # N
Block # N+1
Previous block Hash output
Hash output in this block
Number used
Data structure in this block
Previous block Hash output
Hash output in this block
Number used
Data structure in this block
Previous block Hash output
Hash output in this block
Number used
Data structure in block
2a
2b
2c

Fig. 1

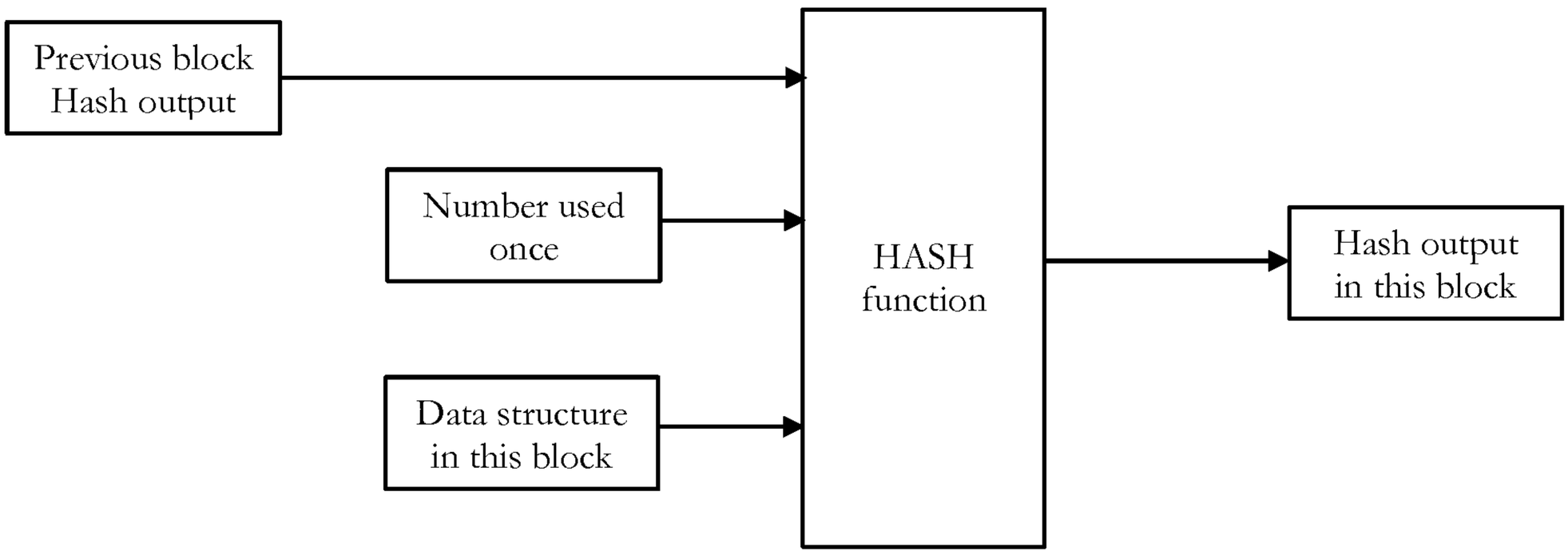

Previous block Hash output
Number used once
Data structure in this block
HASH function
Hash output in this block

Fig. 2

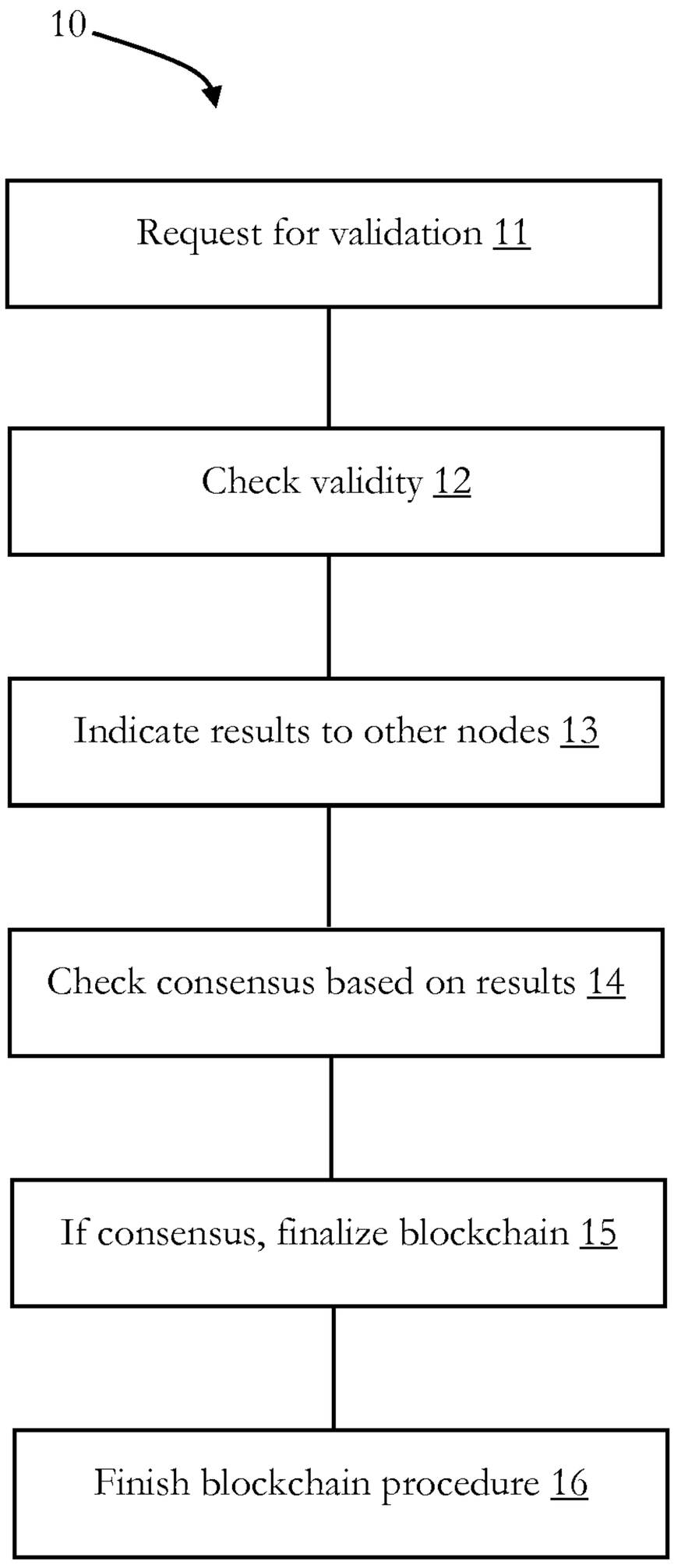

10
Request for validation 11
Check validity 12
Indicate results to other nodes 13
Check consensus based on results 14
If consensus, finalize blockchain 15
Finish blockchain procedure 16

Fig. 3

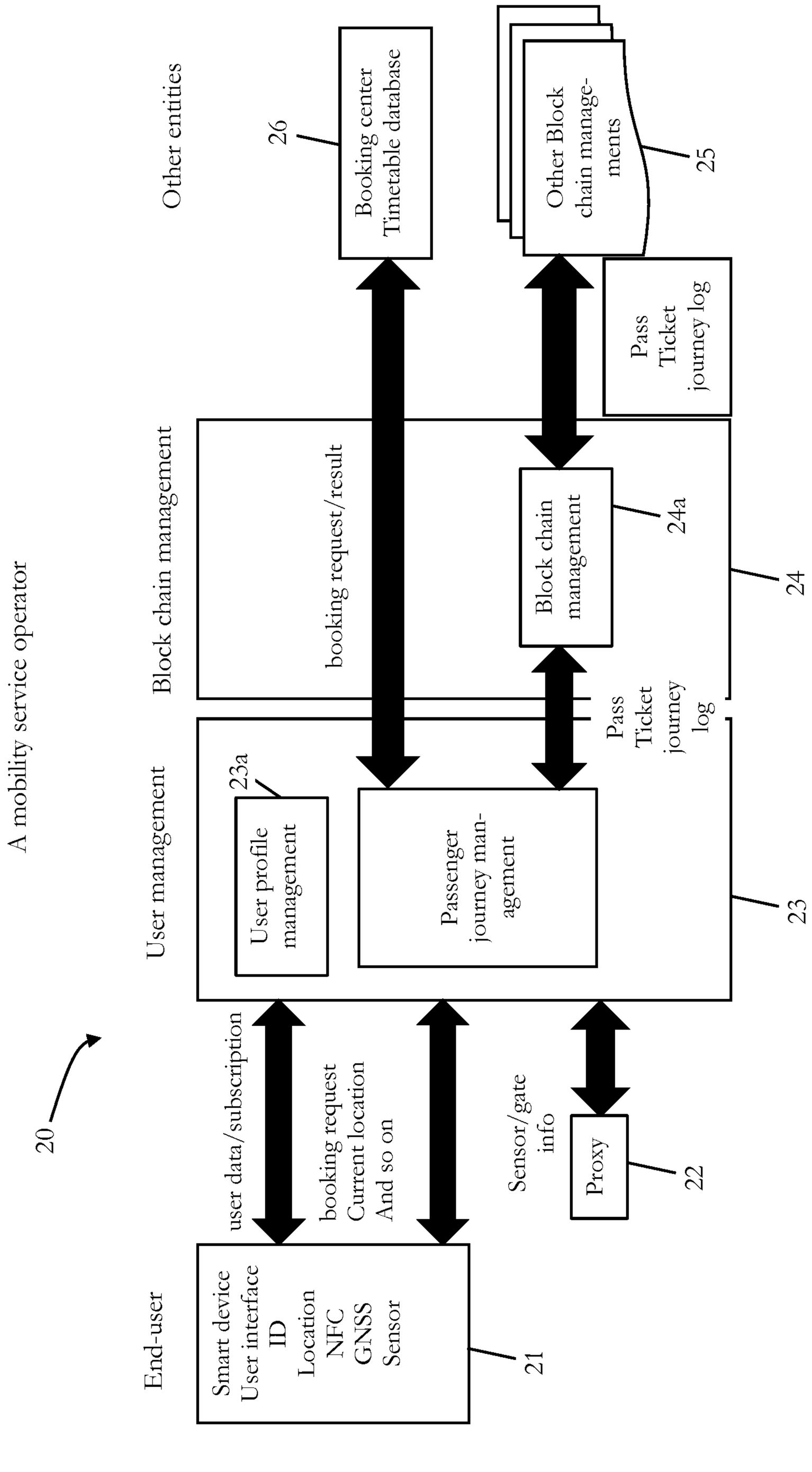

Other entities
26
Booking center
Timetable database
Other Block
chain manage-
ments
25
A mobility service operator
Block chain management
Block chain
management
24a
Pass
Ticket
journey log
24
booking request/result
User management
23a
User profile
management
Passenger
journey man-
agement
Pass
Ticket
journey
log
23
20
user data/subscription
booking request
Current location
And so on
Sensor/gate
info
Proxy
22
End-user
Smart device
User interface
ID
Location
NFC
GNSS
Sensor
21

Fig. 4

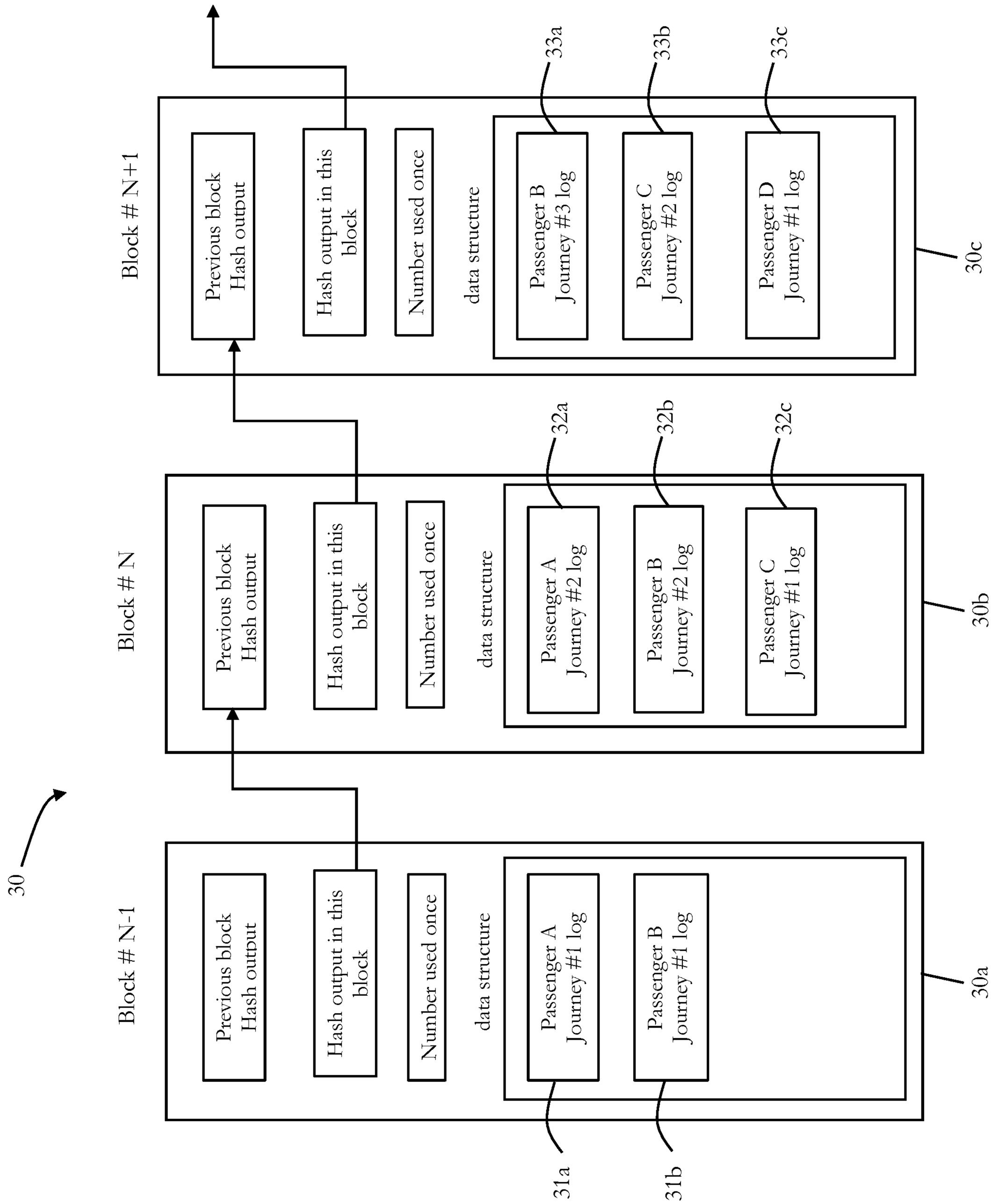

30
Block # N-1
Previous block Hash output
Hash output in this block
Number used once
data structure
Passenger A Journey #1 log
Passenger B Journey #1 log
30a
31a
31b
Block # N
Previous block Hash output
Hash output in this block
Number used once
data structure
Passenger A Journey #2 log
Passenger B Journey #2 log
Passenger C Journey #1 log
30b
32a
32b
32c
Block # N+1
Previous block Hash output
Hash output in this block
Number used once
data structure
Passenger B Journey #3 log
Passenger C Journey #2 log
Passenger D Journey #1 log
30c
33a
33b
33c

Fig. 5

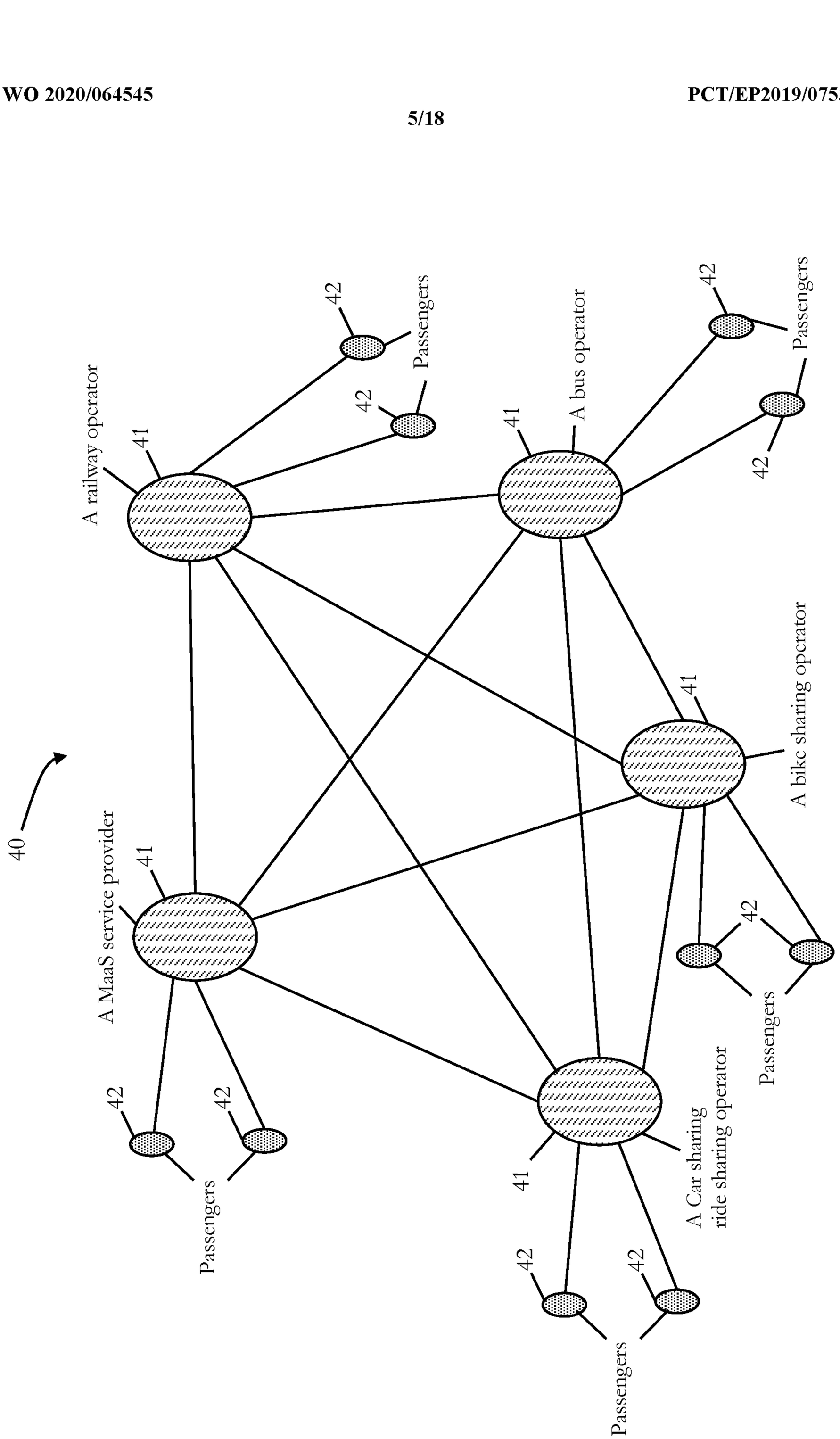

40
A railway operator
41
42
Passengers
42
A bus operator
41
42
42
Passengers
A bike sharing operator
41
42
Passengers
A MaaS service provider
41
42
42
Passengers
A Car sharing
ride sharing operator
41
42
42
Passengers

Fig. 6

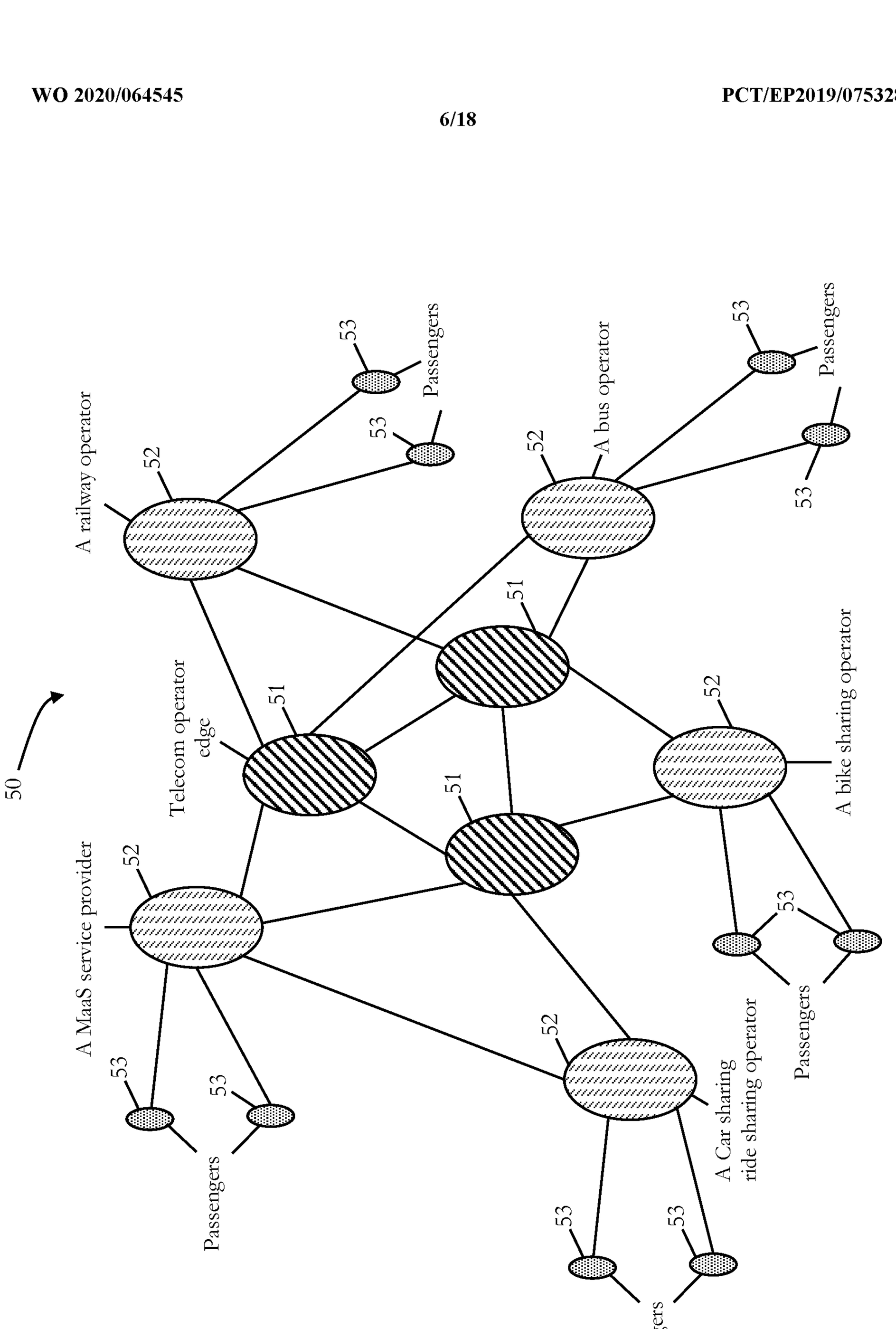

50
A railway operator
52
53
Passengers
53
Telecom operator
edge
51
A bus operator
52
53
Passengers
53
51
A MaaS service provider
52
53
53
Passengers
51
A bike sharing operator
52
53
53
Passengers
A Car sharing
ride sharing operator
52
53
53
Passengers

Fig. 7

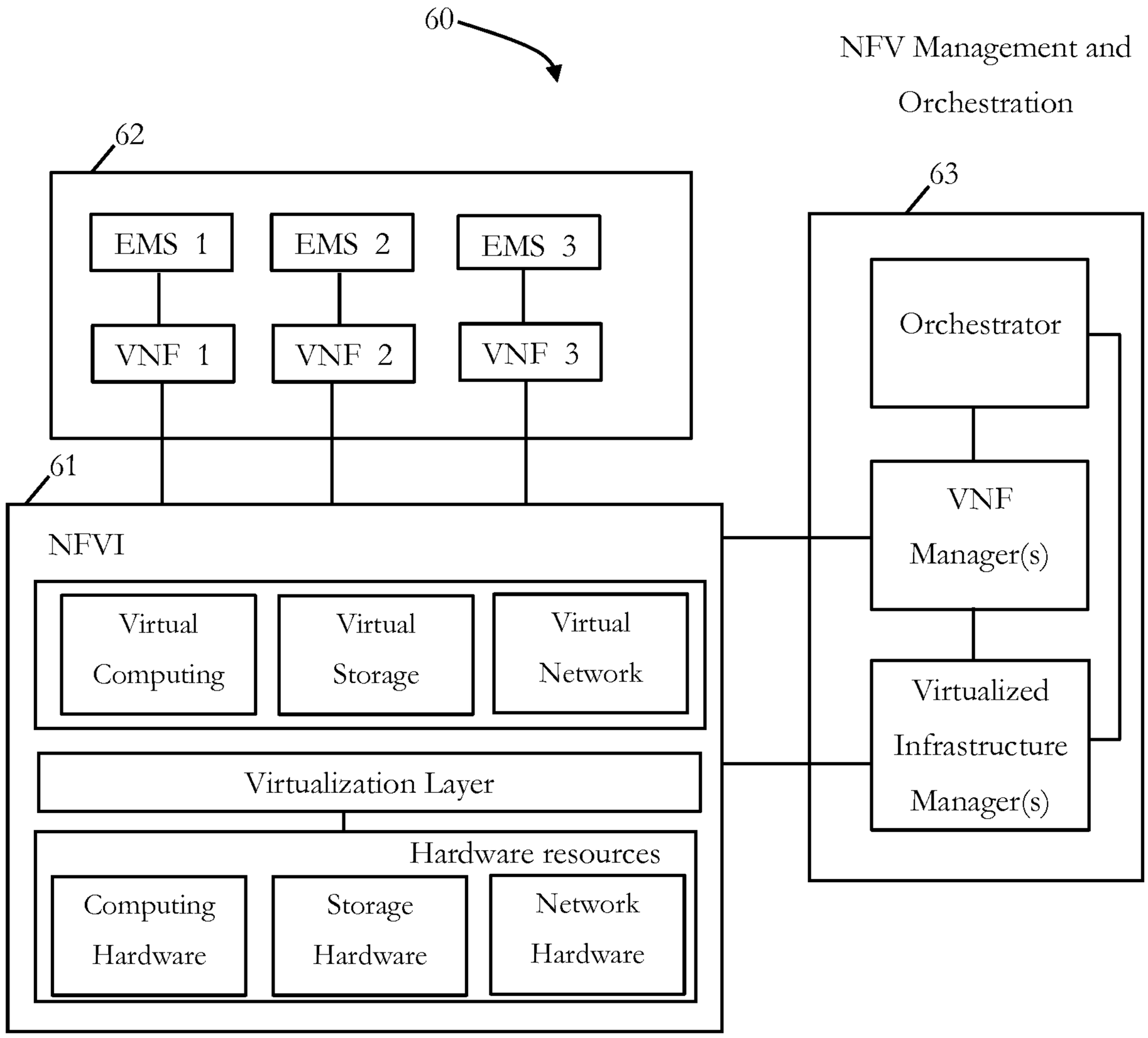

60
62
EMS 1
EMS 2
EMS 3
VNF 1
VNF 2
VNF 3
61
NFVI
Virtual Computing
Virtual Storage
Virtual Network
Virtualization Layer
Hardware resources
Computing Hardware
Storage Hardware
Network Hardware
NFV Management and Orchestration
63
Orchestrator
VNF Manager(s)
Virtualized Infrastructure Manager(s)

Fig. 8

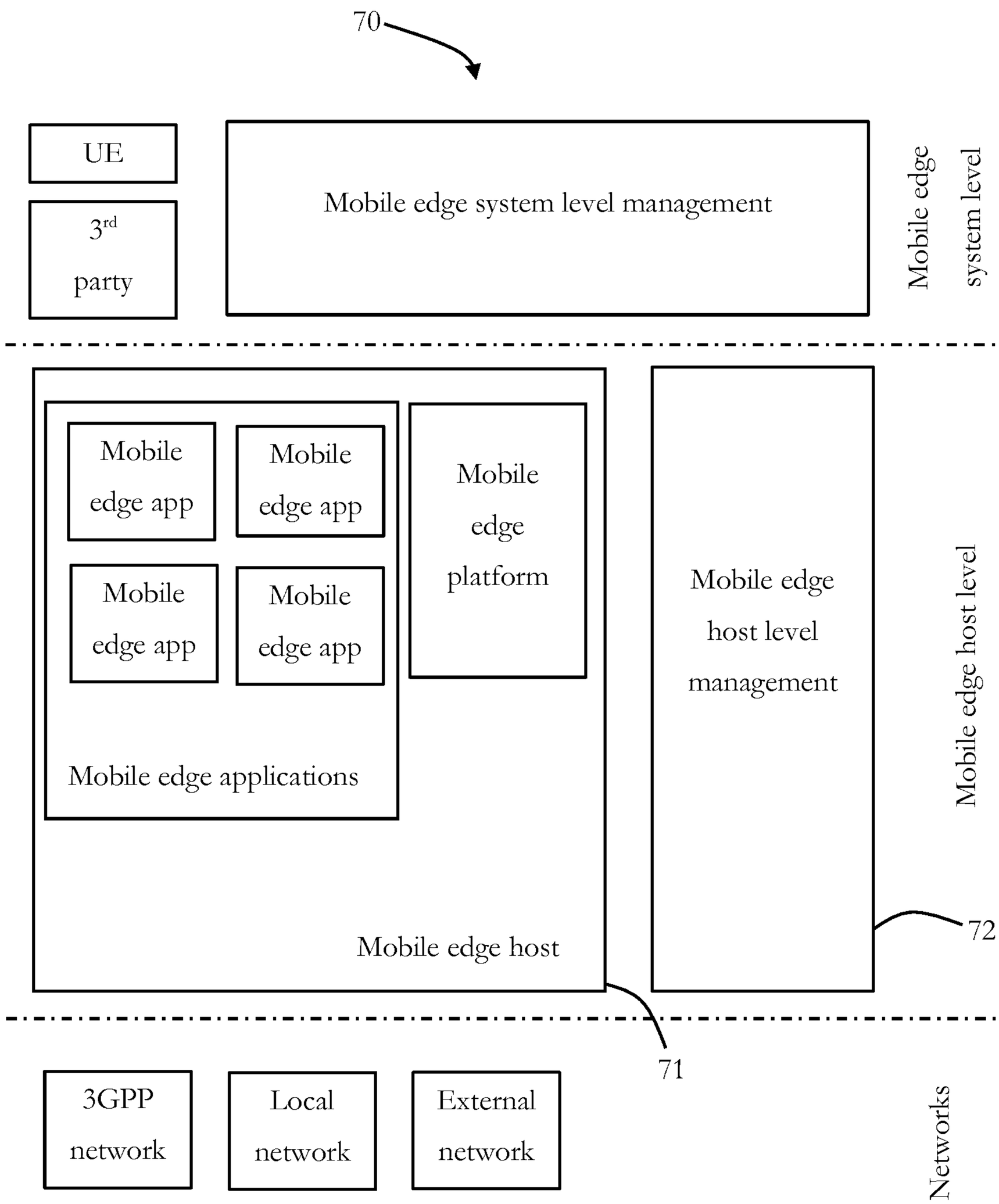

70
UE
3rd party
Mobile edge system level management
Mobile edge system level
Mobile edge app
Mobile edge app
Mobile edge app
Mobile edge app
Mobile edge platform
Mobile edge applications
Mobile edge host
Mobile edge host level management
Mobile edge host level
72
71
3GPP network
Local network
External network
Networks

Fig. 9

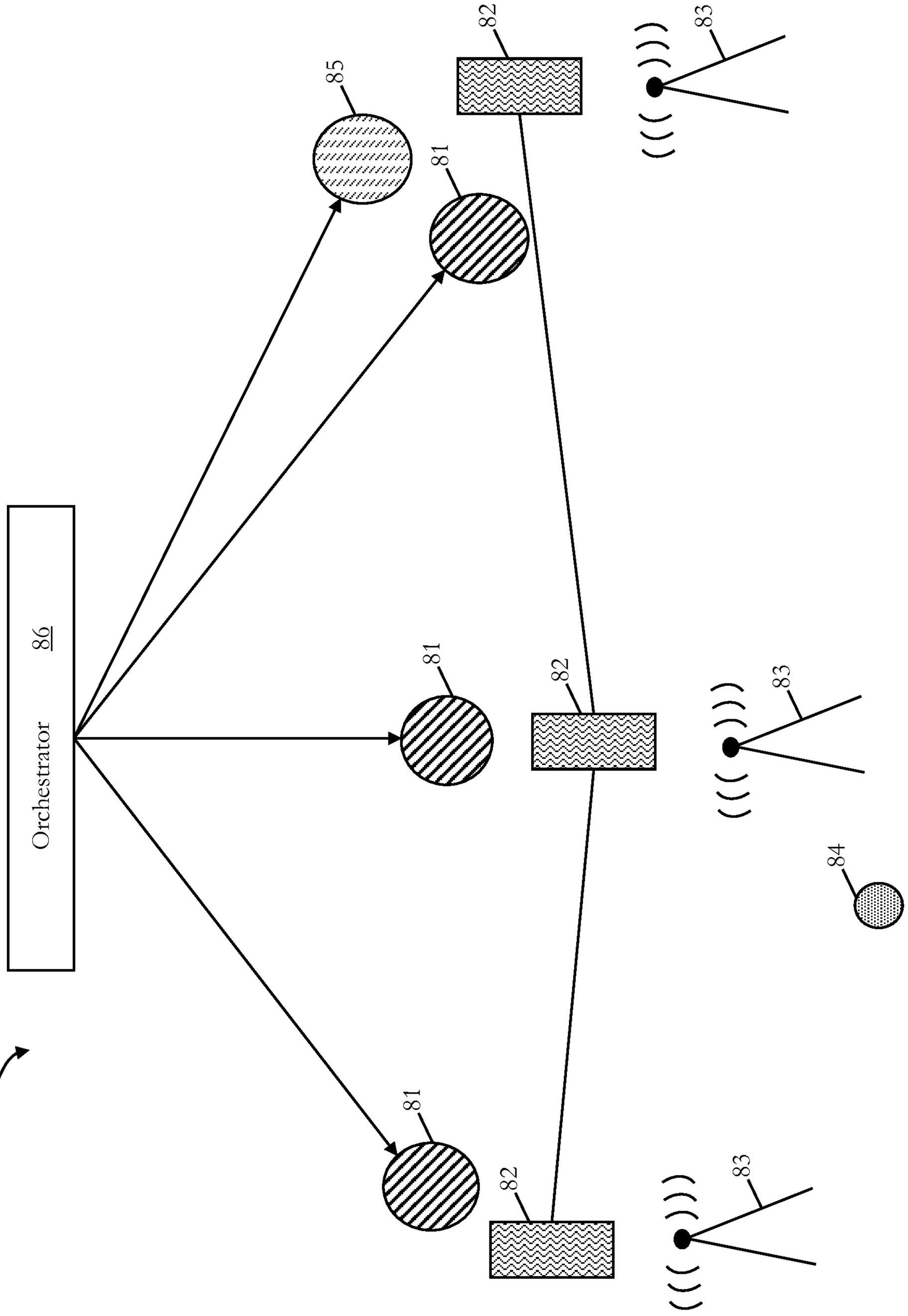


Fig. 10

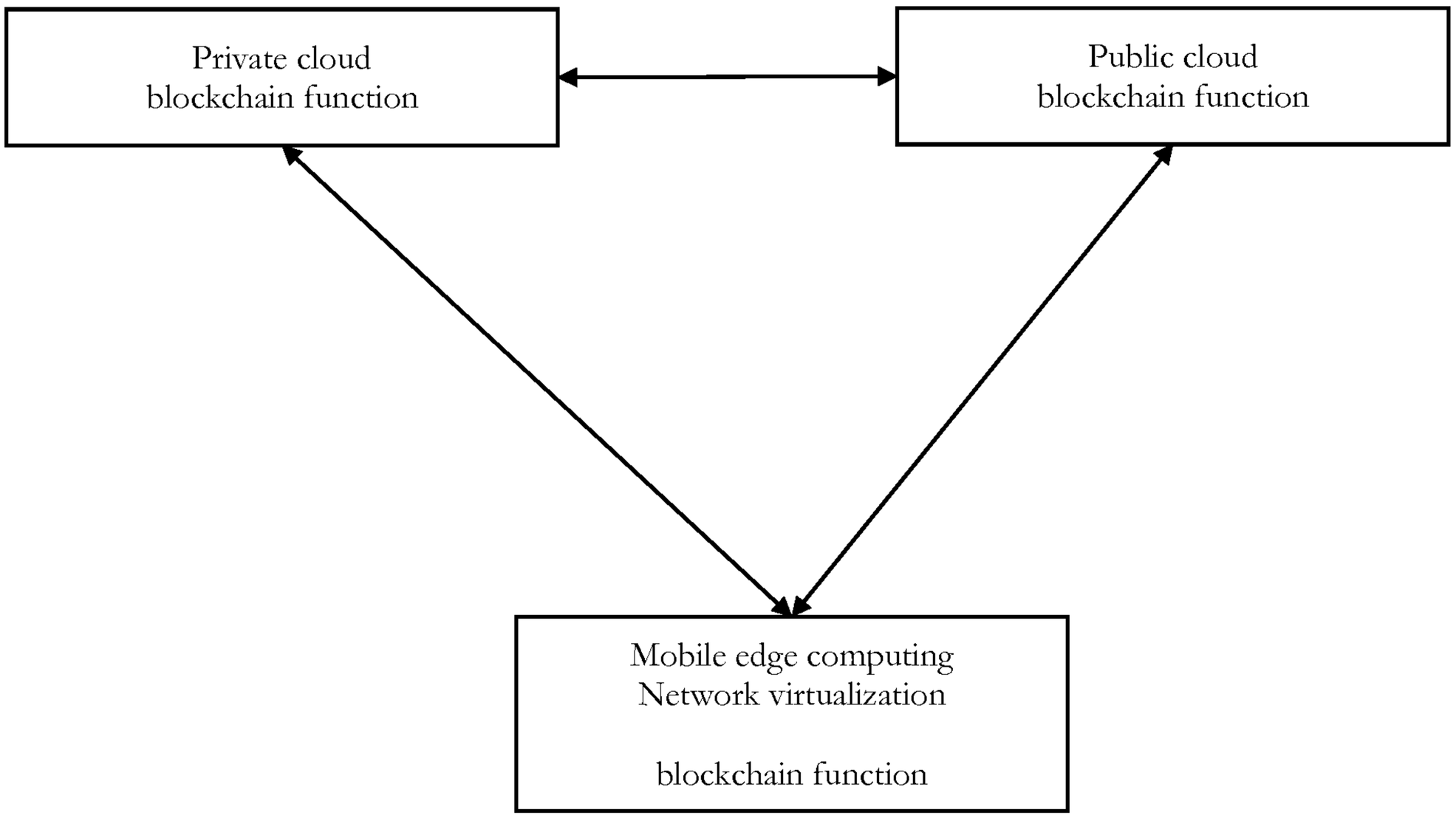

Private cloud
blockchain function
Public cloud
blockchain function
Mobile edge computing
Network virtualization
blockchain function

Fig. 11

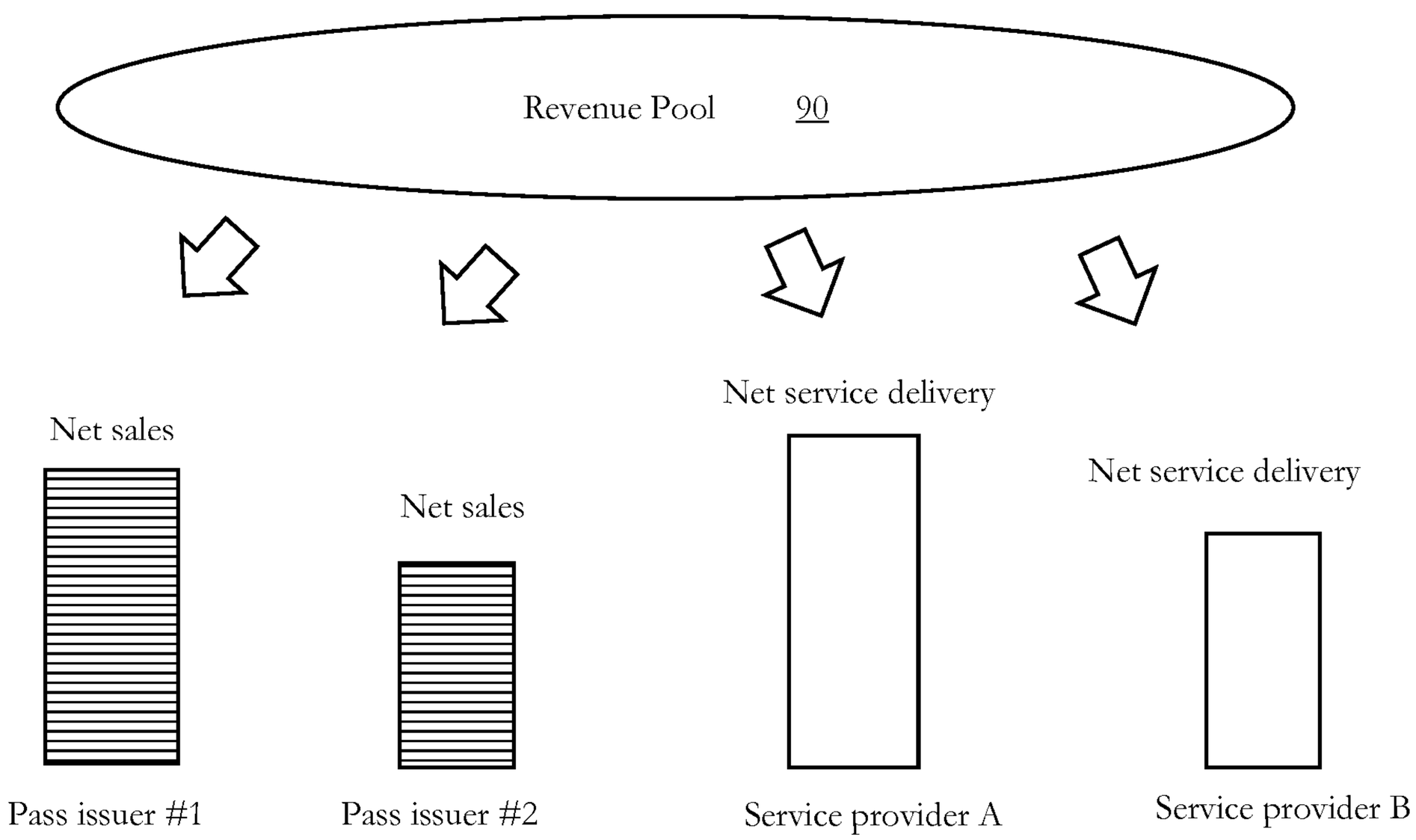

Revenue Pool 90
Net sales
Net sales
Net service delivery
Net service delivery
Pass issuer #1
Pass issuer #2
Service provider A
Service provider B

Fig. 12

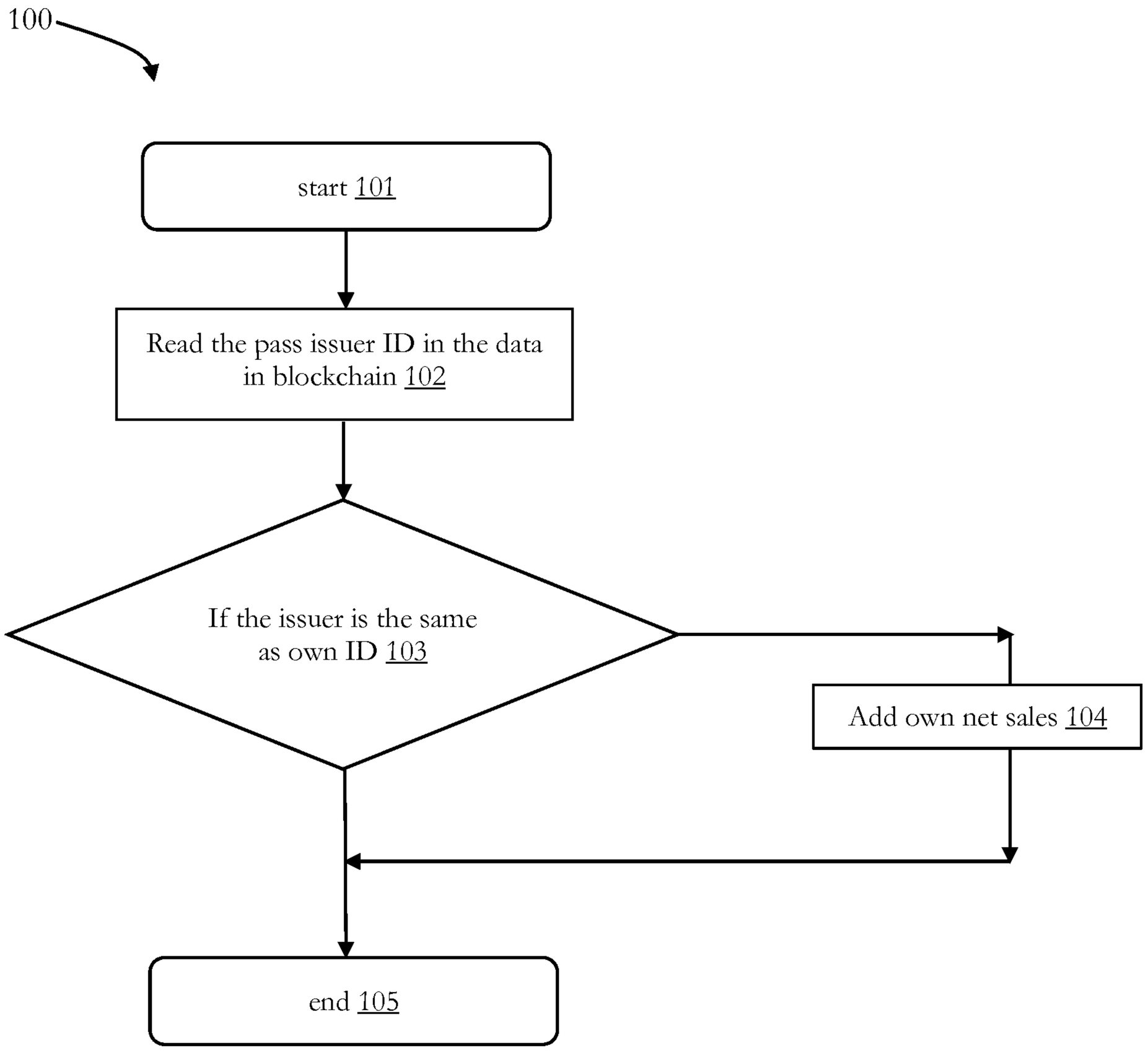

100
start 101
Read the pass issuer ID in the data in blockchain 102
If the issuer is the same as own ID 103
Add own net sales 104
end 105

Fig. 13

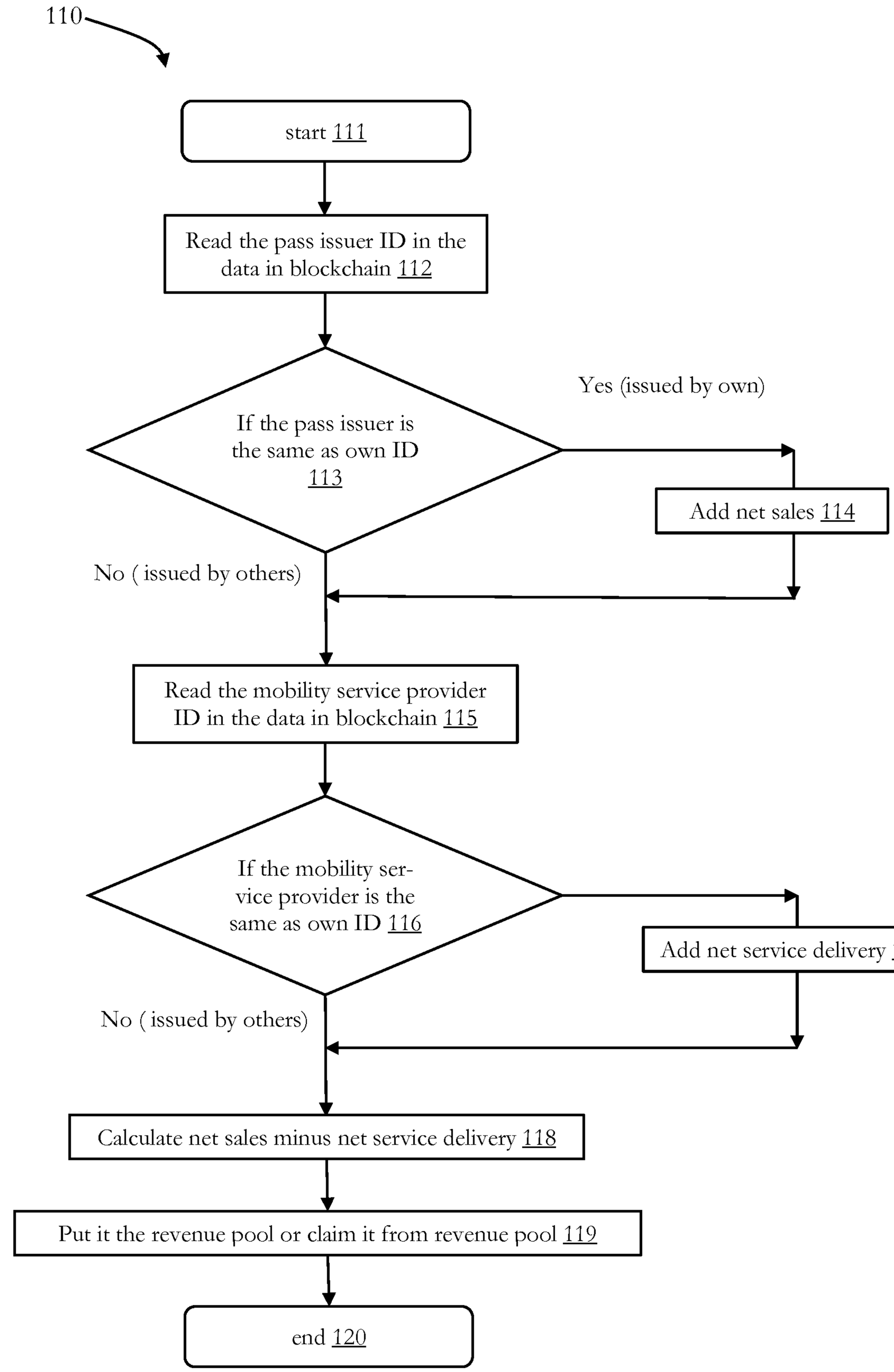

110
start 111
Read the pass issuer ID in the data in blockchain 112
If the pass issuer is the same as own ID 113
Yes (issued by own)
Add net sales 114
No (issued by others)
Read the mobility service provider ID in the data in blockchain 115
If the mobility service provider is the same as own ID 116
Add net service delivery 117
No (issued by others)
Calculate net sales minus net service delivery 118
Put it the revenue pool or claim it from revenue pool 119
end 120

Fig. 14

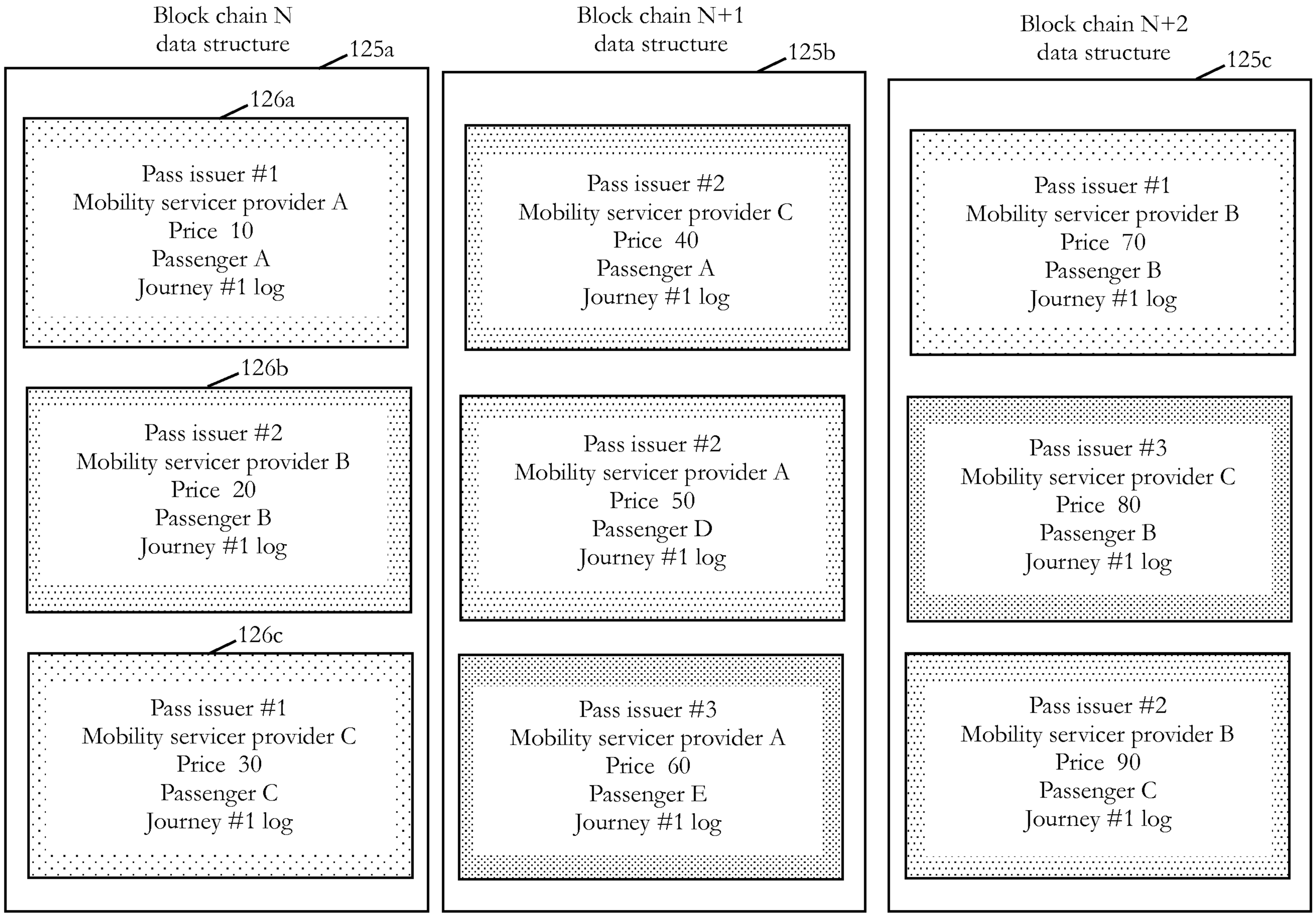

Block chain N
data structure
125a
126a
Pass issuer #1
Mobility servicer provider A
Price 10
Passenger A
Journey #1 log
126b
Pass issuer #2
Mobility servicer provider B
Price 20
Passenger B
Journey #1 log
126c
Pass issuer #1
Mobility servicer provider C
Price 30
Passenger C
Journey #1 log
Block chain N+1
data structure
125b
Pass issuer #2
Mobility servicer provider C
Price 40
Passenger A
Journey #1 log
Pass issuer #2
Mobility servicer provider A
Price 50
Passenger D
Journey #1 log
Pass issuer #3
Mobility servicer provider A
Price 60
Passenger E
Journey #1 log
Block chain N+2
data structure
125c
Pass issuer #1
Mobility servicer provider B
Price 70
Passenger B
Journey #1 log
Pass issuer #3
Mobility servicer provider C
Price 80
Passenger B
Journey #1 log
Pass issuer #2
Mobility servicer provider B
Price 90
Passenger C
Journey #1 log

Fig. 15

		block N			block N+1			block N+2			Total
Pass issuers	#1	10		30				70			110
	#2		20		40	50				90	200
	#3						60		80		140
mobility service providers	A	10				50	60				120
	B		20					70		90	180
	C			30	40				80		150

Fig. 16

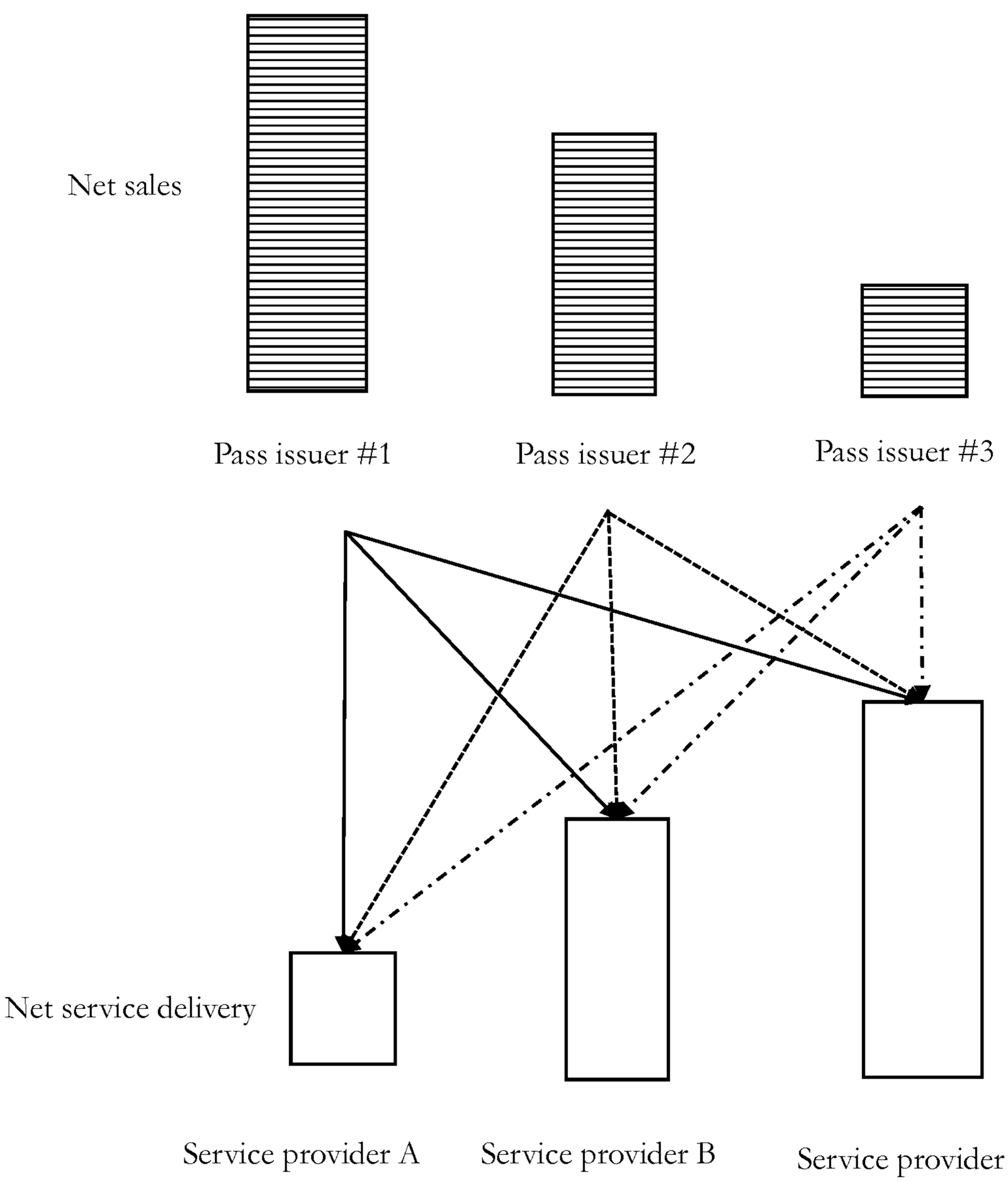


Fig. 17

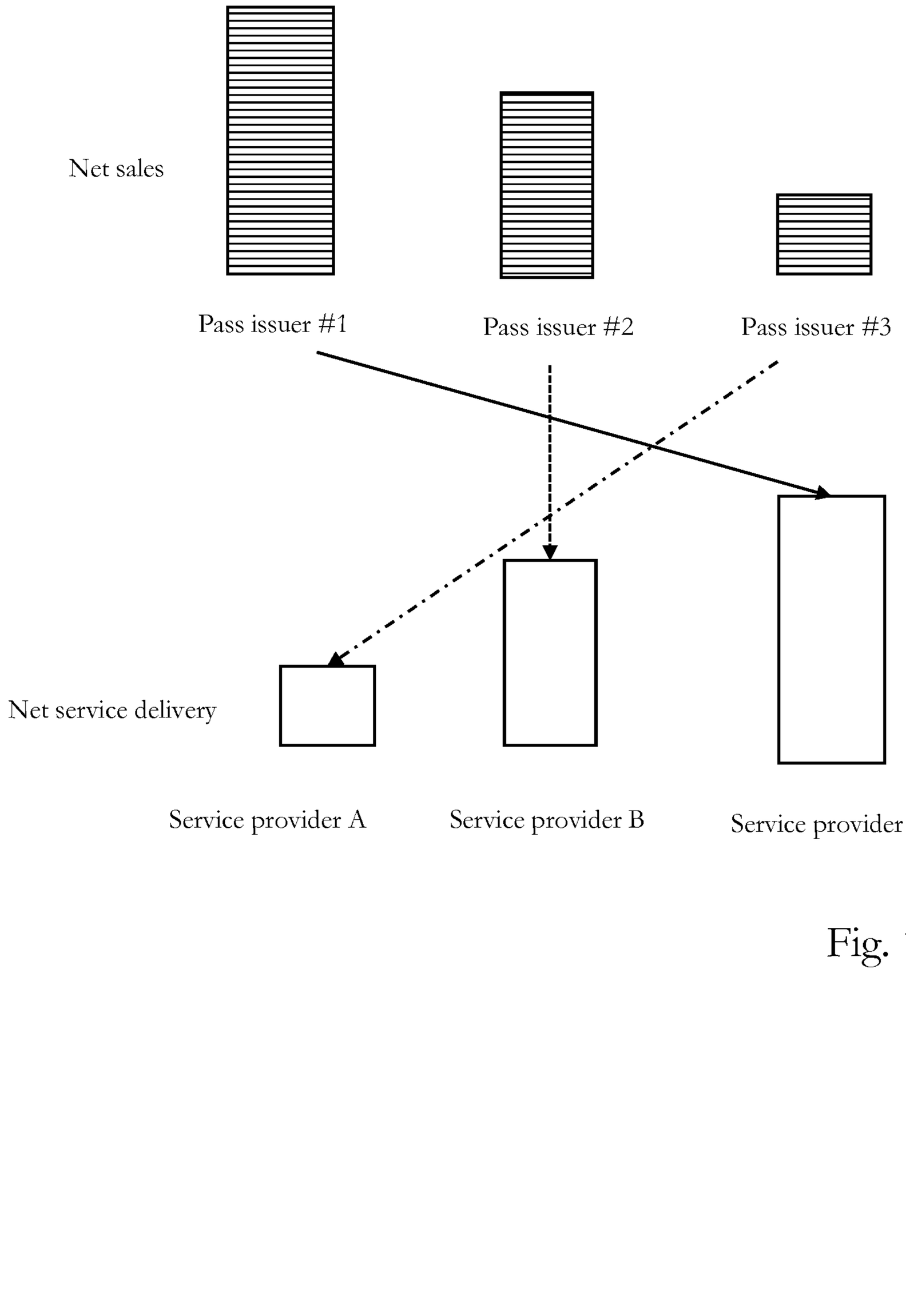

Net sales
Pass issuer #1
Pass issuer #2
Pass issuer #3
Net service delivery
Service provider A
Service provider B
Service provider C

Fig. 18

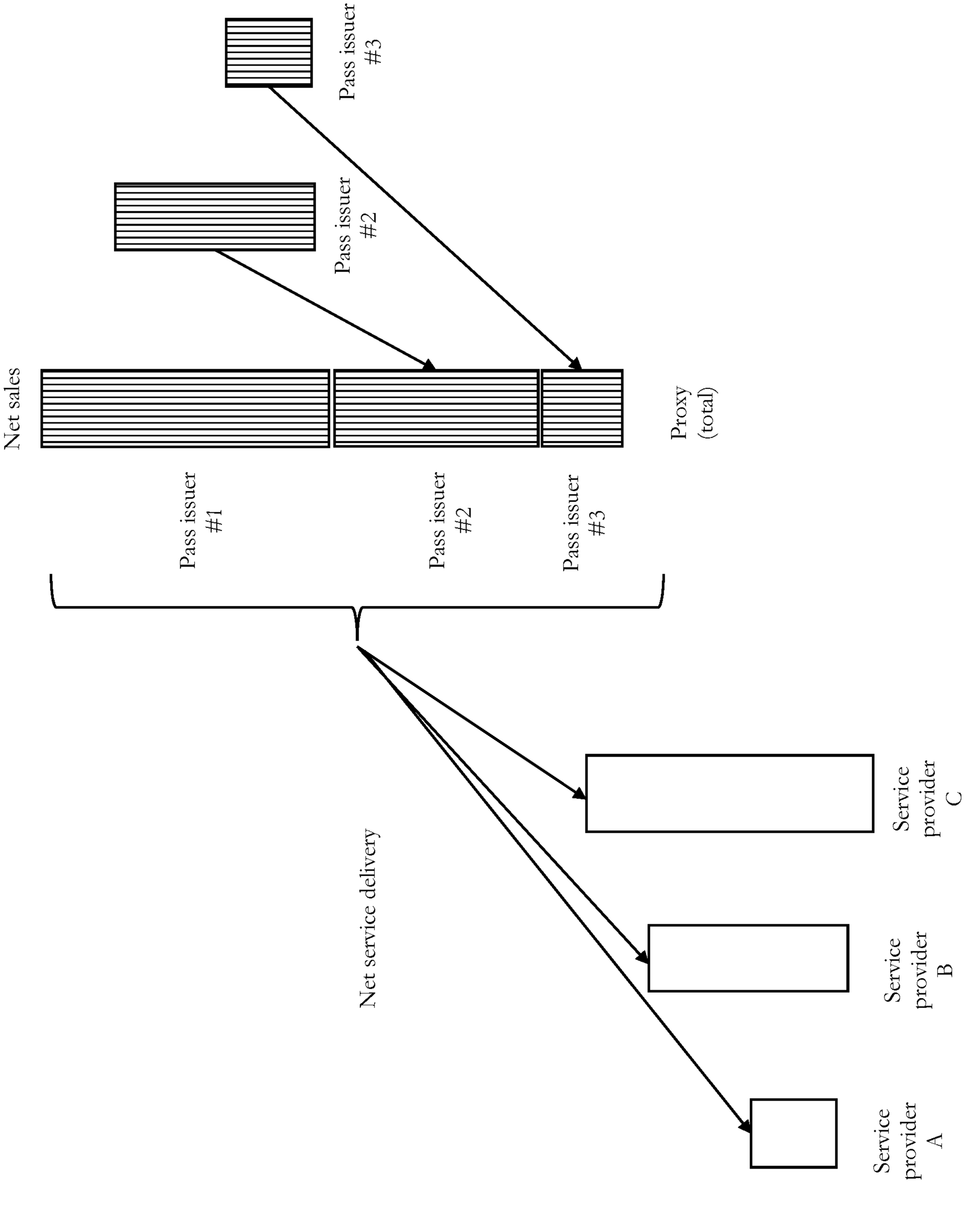

Net service delivery
Service provider A
Service provider B
Service provider C
Net sales
Pass issuer #1
Pass issuer #2
Pass issuer #3
Proxy (total)
Pass issuer #2
Pass issuer #3

Fig. 19

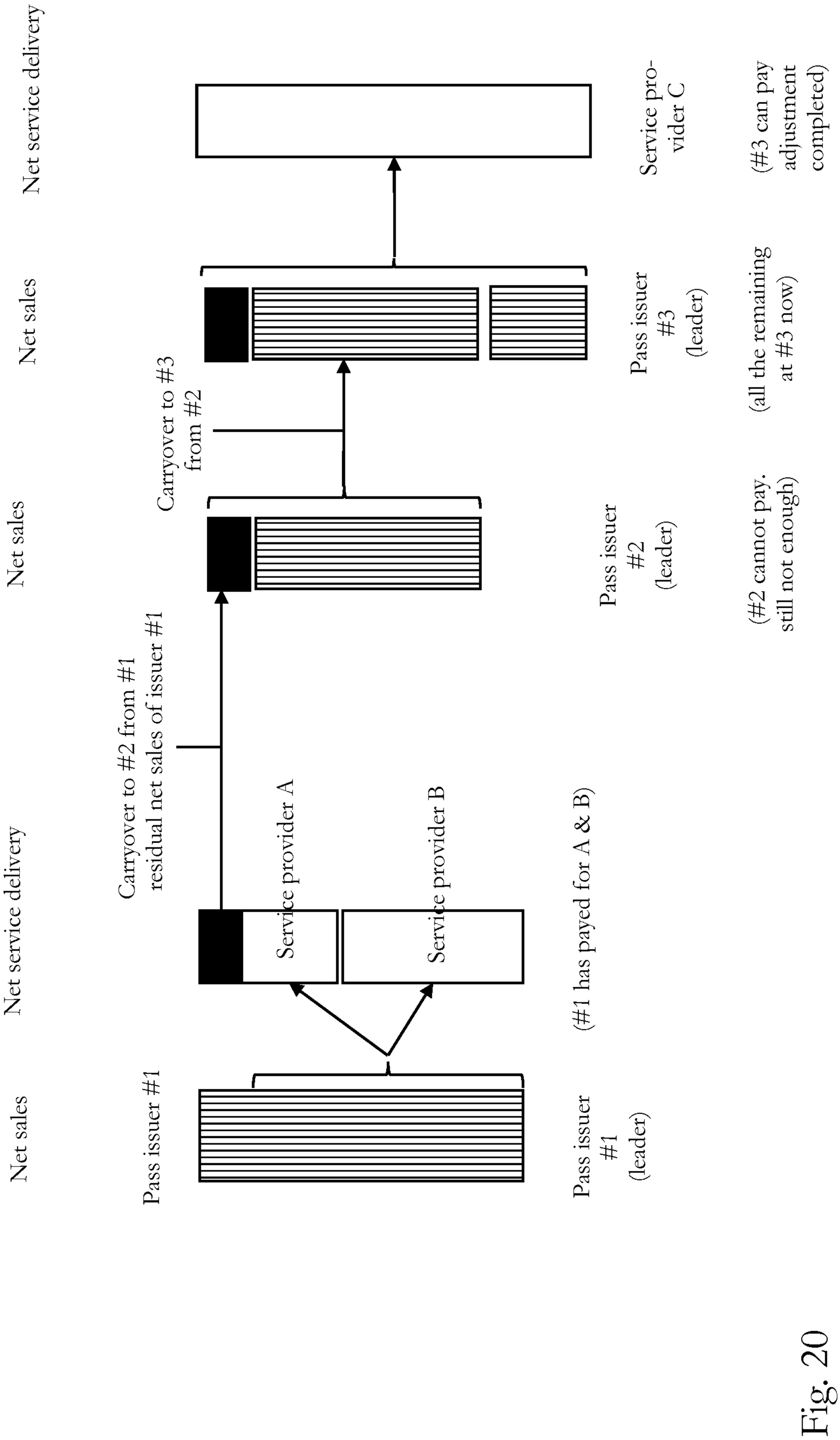

Net service delivery
Net sales
Service pro-vider C
(#3 can pay adjustment completed)
Carryover to #3 from #2
Pass issuer #3 (leader)
Net sales
Pass issuer #2 (leader)
(#2 cannot pay. still not enough)
(all the remaining at #3 now)
Carryover to #2 from #1 residual net sales of issuer #1
Net service delivery
Net sales
Service provider A
Service provider B
Pass issuer #1 (leader)
(#1 has payed for A & B)

Fig. 20

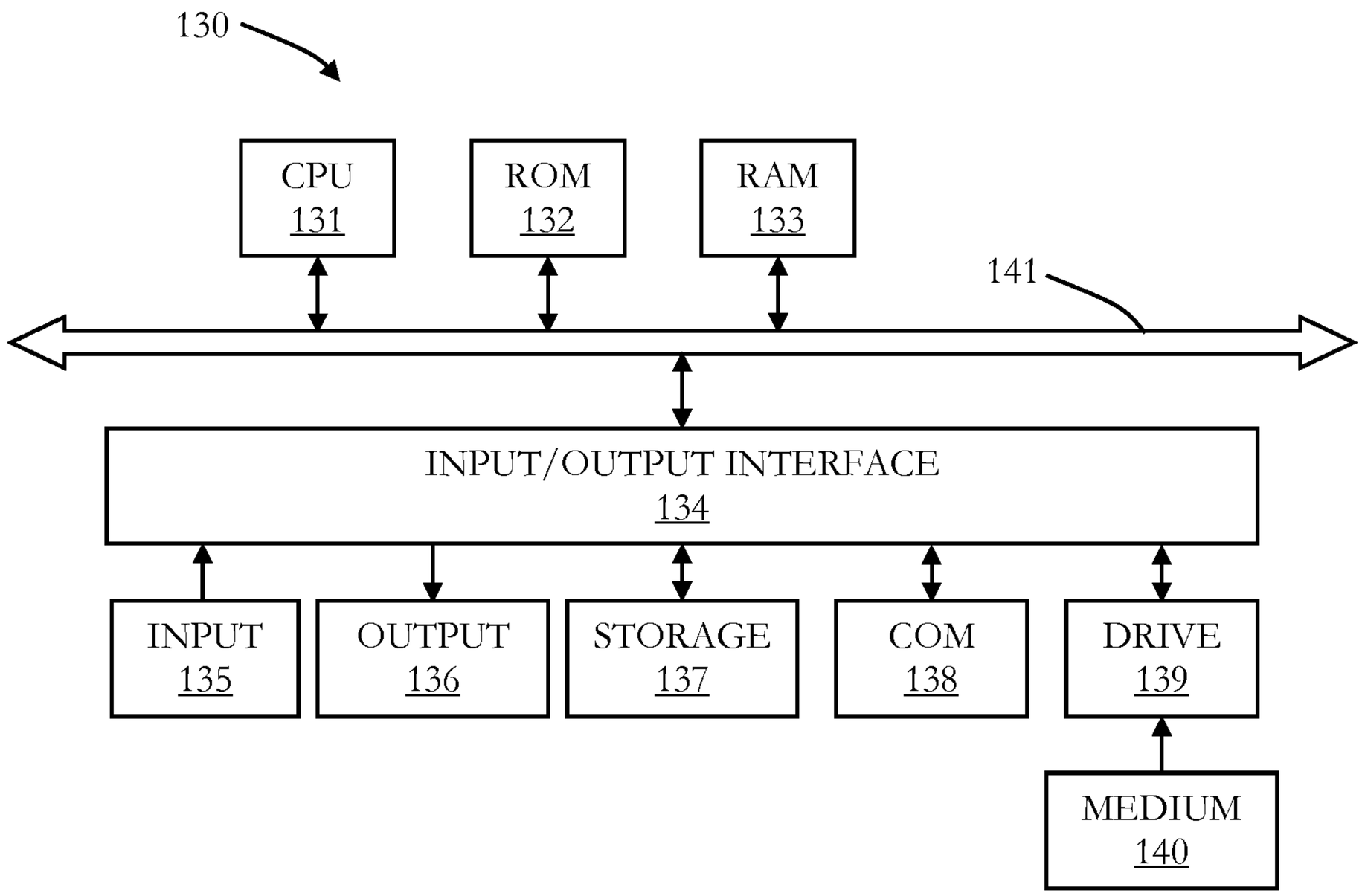

130
CPU
131
ROM
132
RAM
133
141
INPUT/OUTPUT INTERFACE
134
INPUT
135
OUTPUT
136
STORAGE
137
COM
138
DRIVE
139
MEDIUM
140

Fig. 21

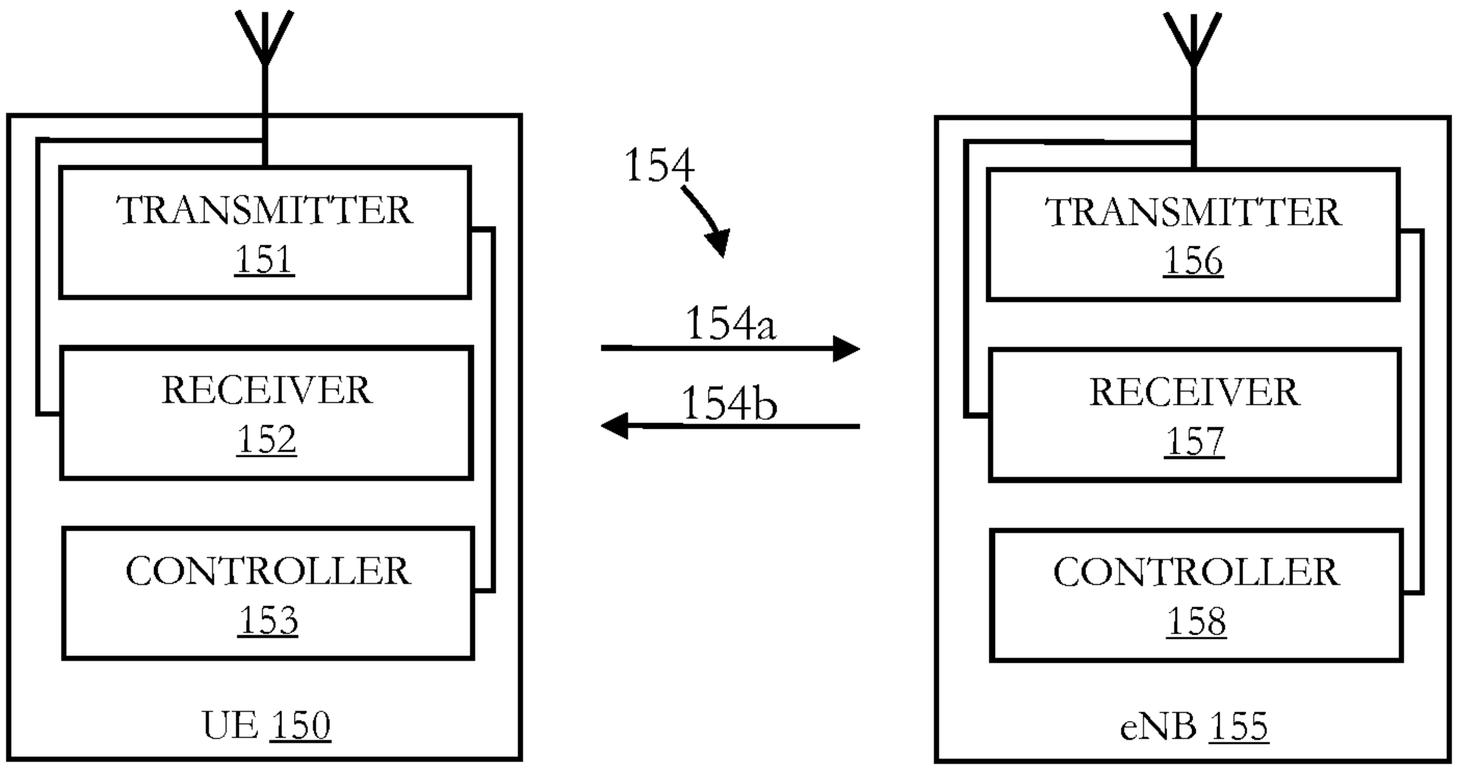

TRANSMITTER
151
RECEIVER
152
CONTROLLER
153
UE 150
154
154a
154b
TRANSMITTER
156
RECEIVER
157
CONTROLLER
158
eNB 155

Fig. 22