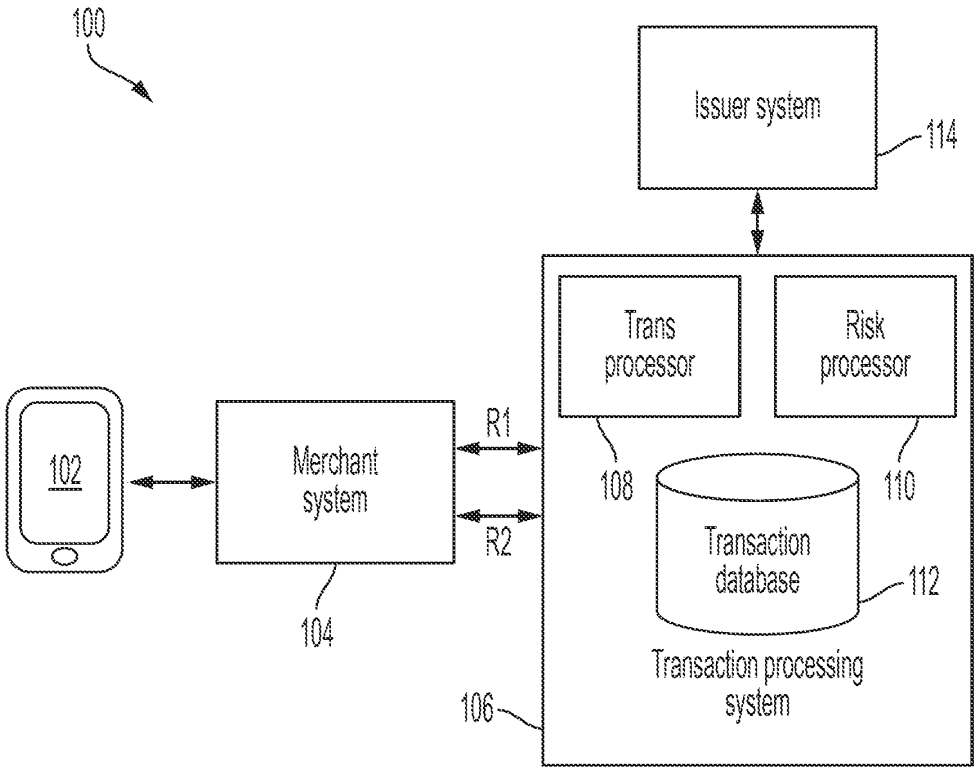

100
Issuer system
114
Trans processor
Risk processor
102
Merchant system
R1
R2
108
110
Transaction database
112
104
Transaction processing system
106

FIG. 1

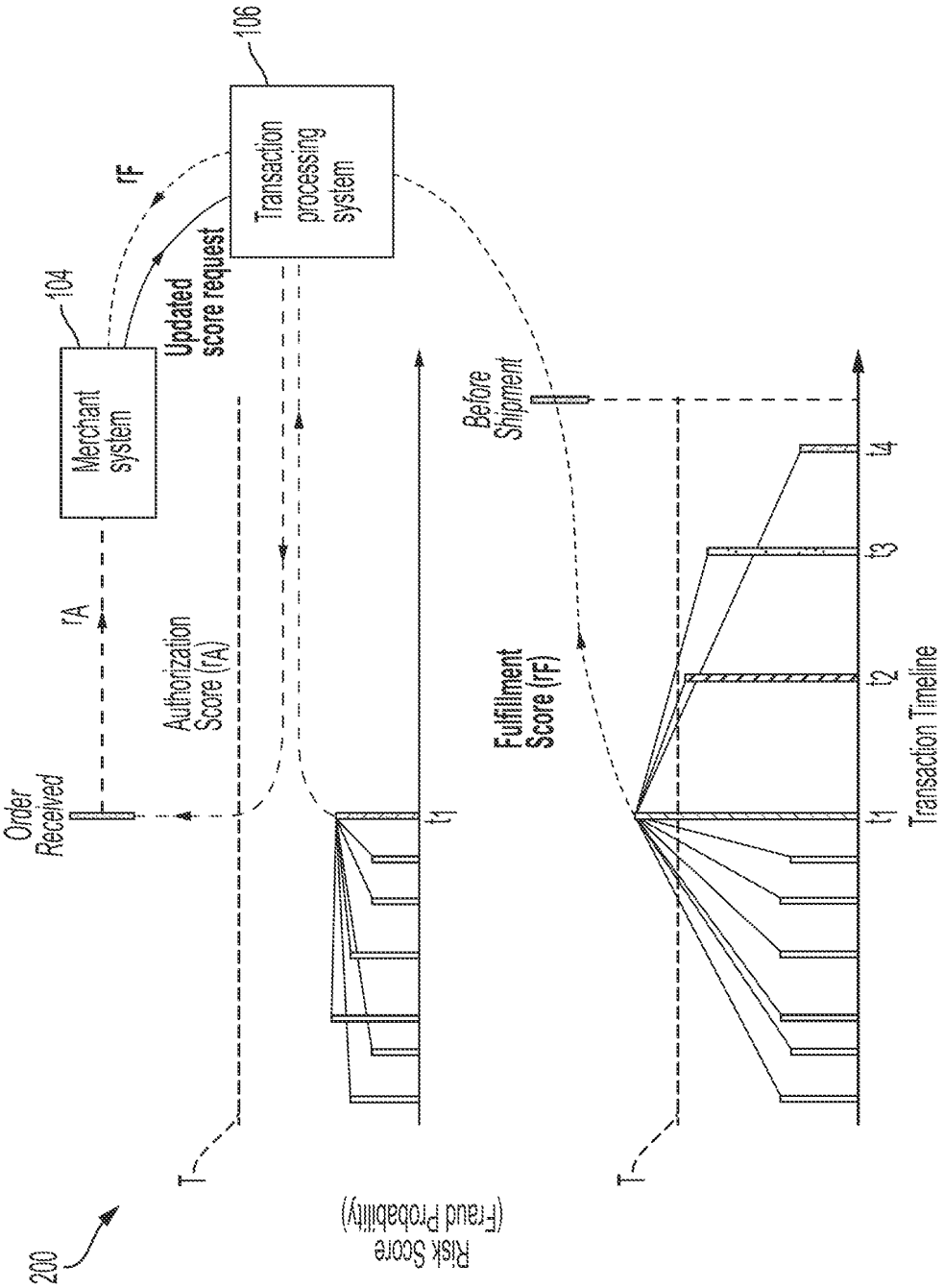

200
106
Transaction processing system
104
Merchant system
rF
Updated score request
rA
Authorization Score (rA)
Order Received
t1
Risk Score (Fraud Probability)
T
Before Shipment
Fulfillment Score (rF)
t1
t2
t3
t4
Transaction Timeline
T

FIG. 2

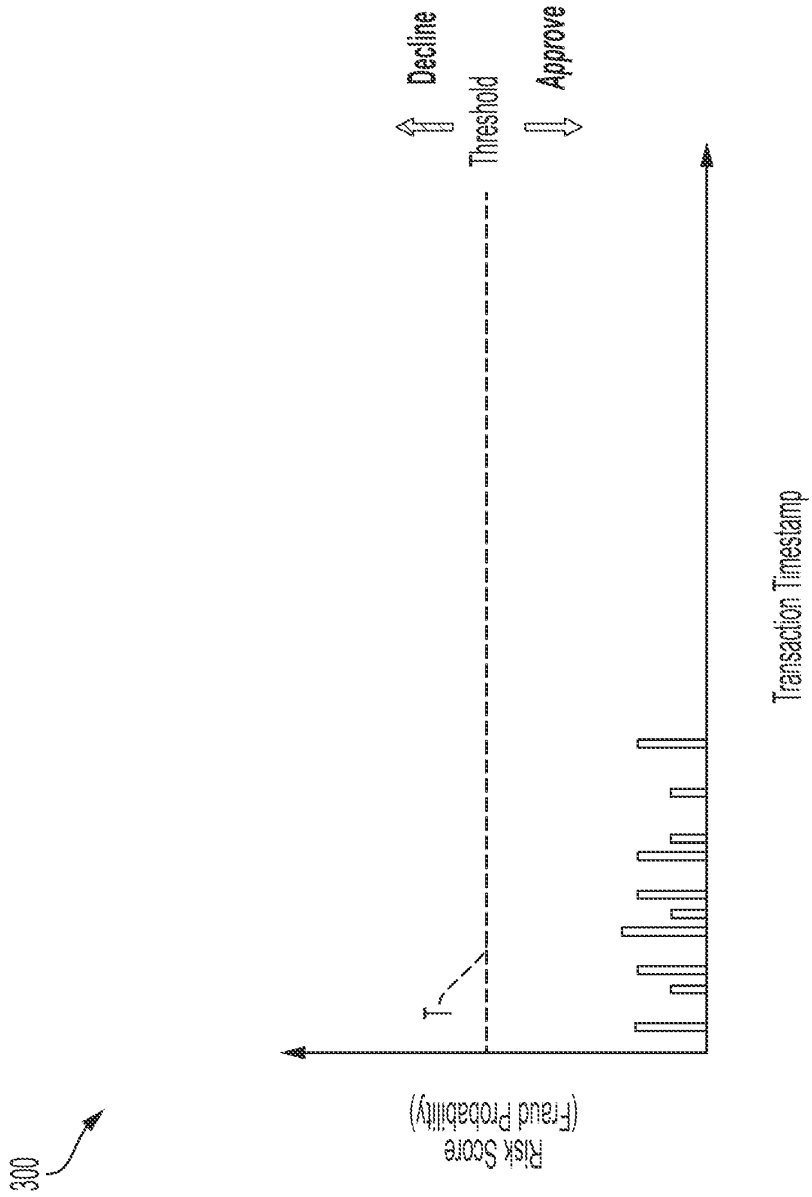

300
Risk Score
(Fraud Probability)
Decline
Threshold
Approve
T
Transaction Timestamp

FIG. 3

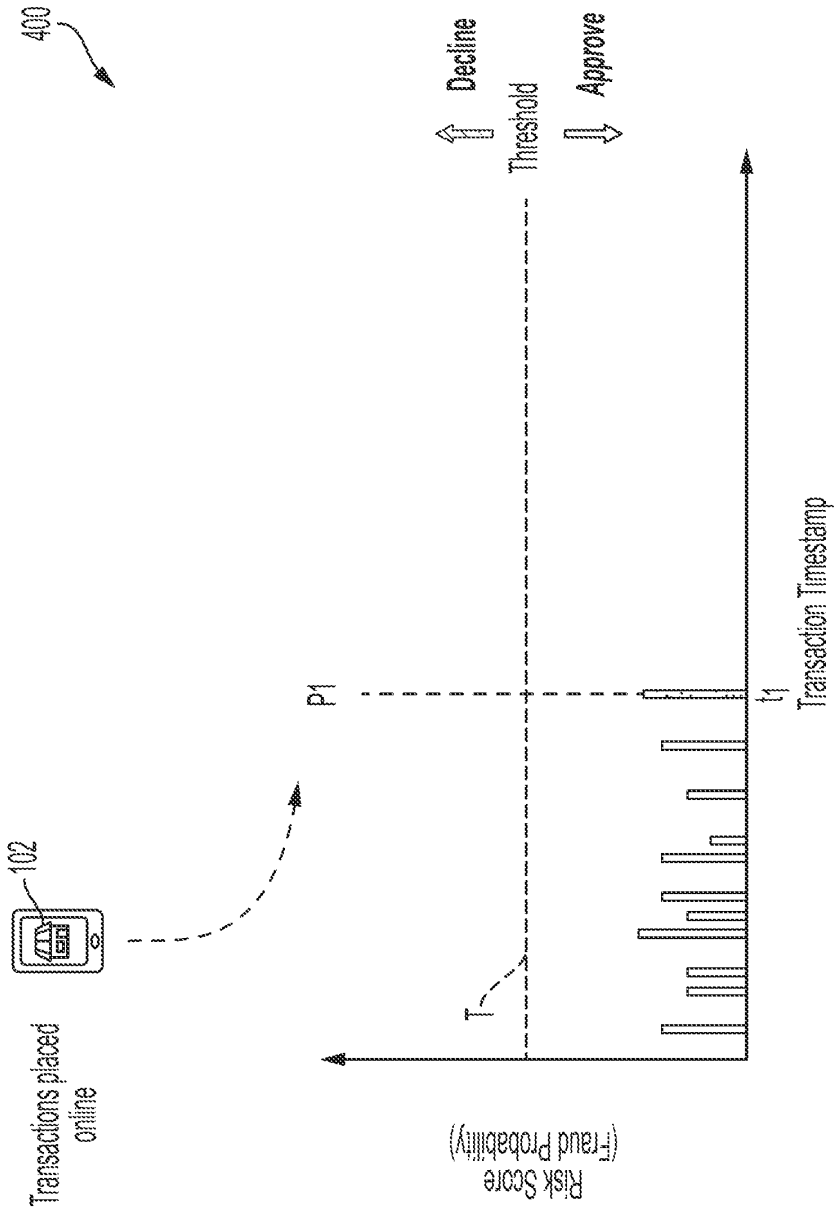

400
Decline
Threshold
Approve
P1
t1
Transaction Timestamp
102
Transactions placed online
T
Risk Score
(Fraud Probability)

FIG. 4

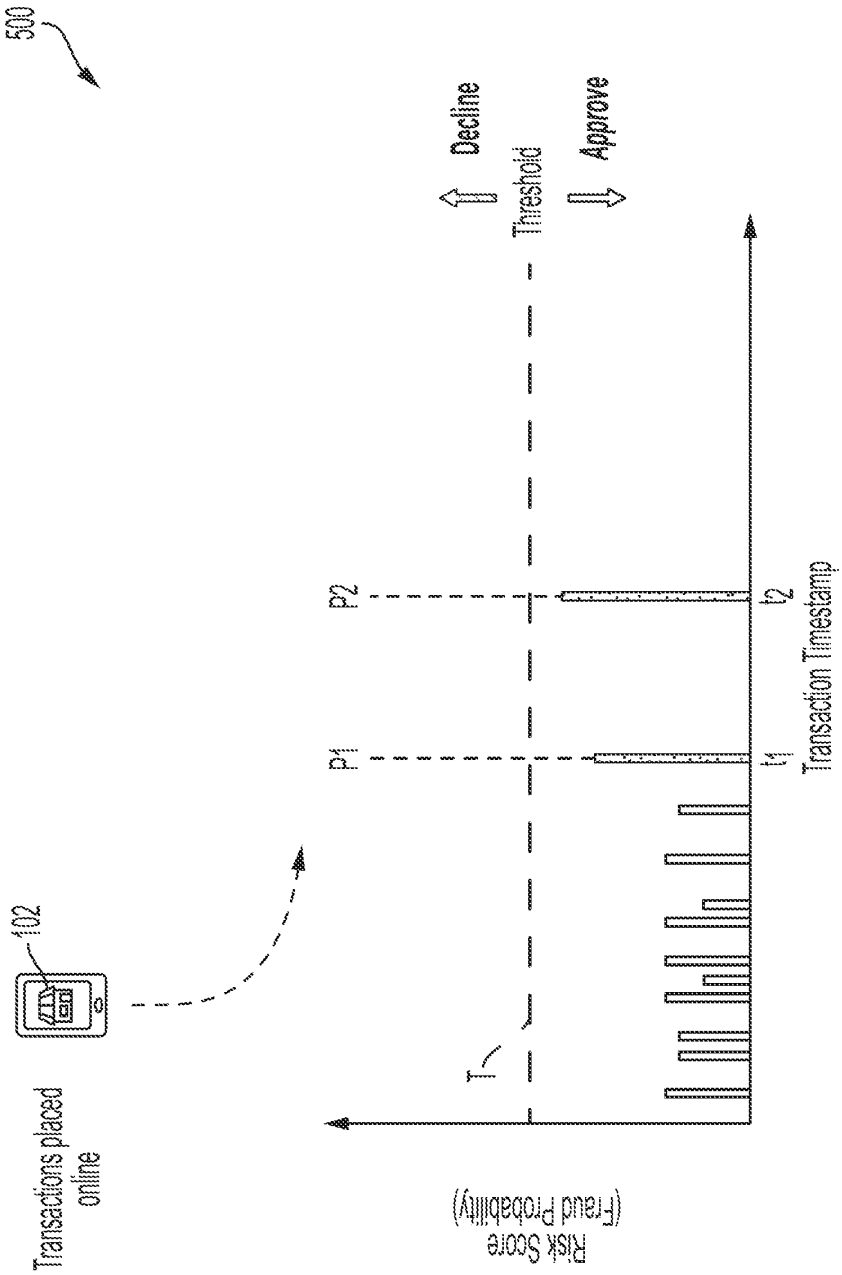

500
Decline
Threshold
Approve
P2
P1
t2
t1
Transaction Timestamp
T
Risk Score
(Fraud Probability)
102
Transactions placed online

FIG. 5

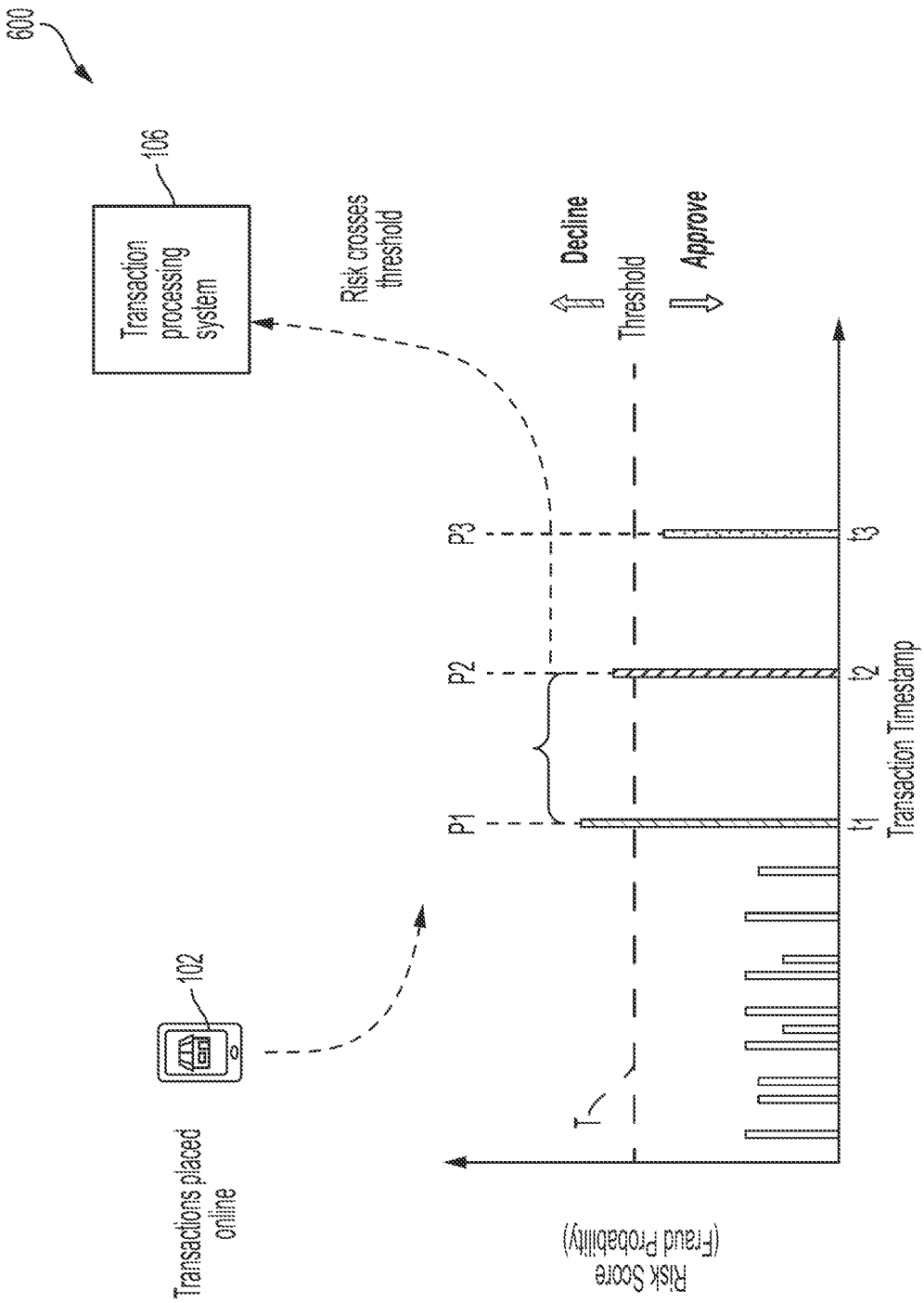

600
106
Transaction processing system
Risk crosses threshold
Decline
Threshold
Approve
P3
P2
P1
t3
t2
t1
Transaction Timestamp
102
Transactions placed online
T
Risk Score (Fraud Probability)

FIG. 6

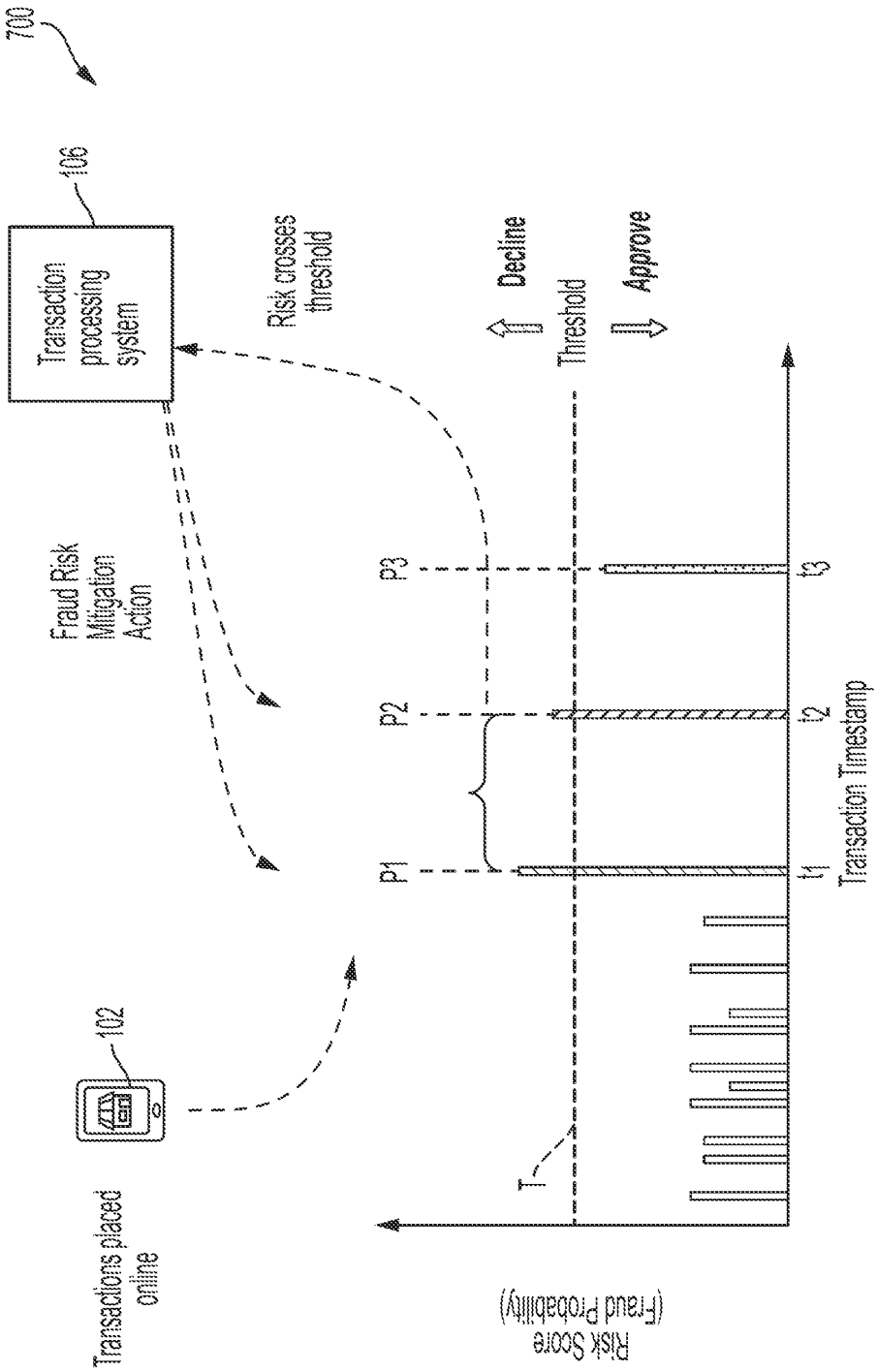
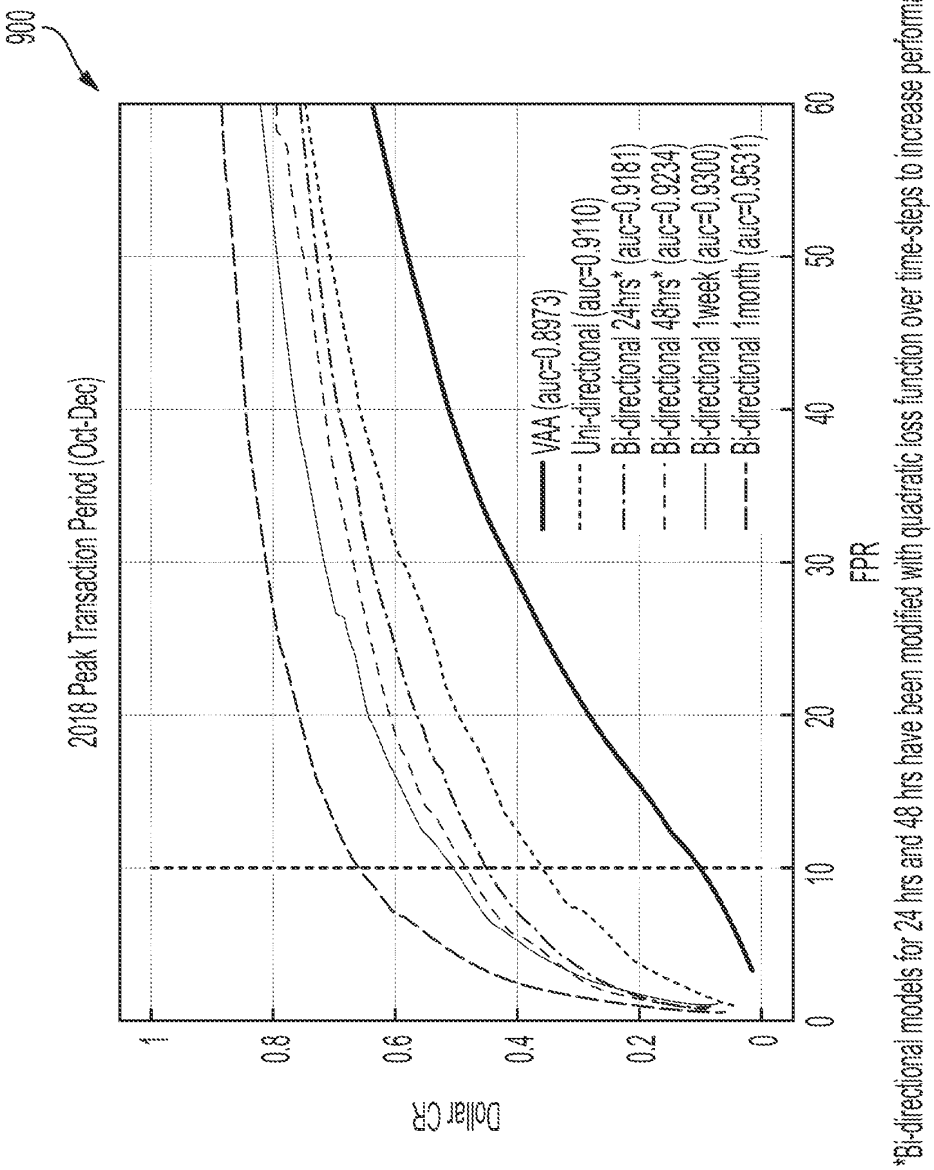

700
106
Transaction processing system
Risk crosses threshold
Decline
Threshold
Approve
Fraud Risk Mitigation Action
P3
P2
P1
t3
t2
t1
Transaction Timestamp
102
Transactions placed online
T
Risk Score (Fraud Probability)

FIG. 7

800

	FPR	Production (VAA)	Uni-directional (v1)	Bi-directional (v2)
Merchant 1	10-20	0.04	0.215 (5.4x)	0.422 (10.5x)
Merchant 2	10-20	0.334	0.653 (2.0x)	0.675 (2.0x)
Merchant 3	10-20	NA	0.105	0.179
Merchant 4	10-20	NA	0.228	0.556
Merchant 5	10-20	NA	0.267	0.362
Merchant 6	10-20	0.216	0.759 (3.5x)	0.844 (3.9x)
Merchant 7	10-20	0.216	0.433 (2.0x)	0.844 (3.9x)
Merchant 8	10-20	0.41	0.677 (1.7x)	0.872 (2.1x)

FIG. 8



*Bi-directional models for 24 hrs and 48 hrs have been modified with quadratic loss function over time-steps to increase performance

FIG. 9

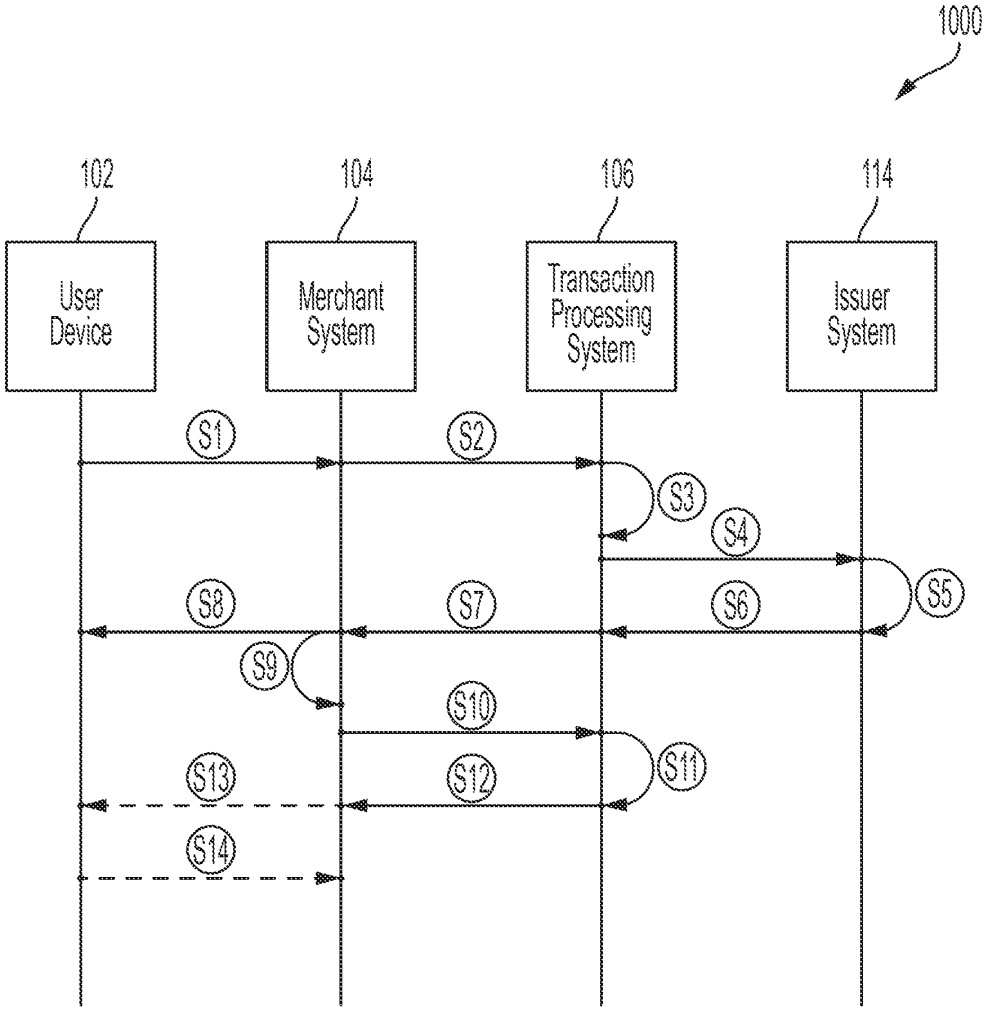

1000
102
104
106
114
User Device
Merchant System
Transaction Processing System
Issuer System
S1
S2
S3
S4
S5
S6
S7
S8
S9
S10
S11
S12
S13
S14

FIG. 10

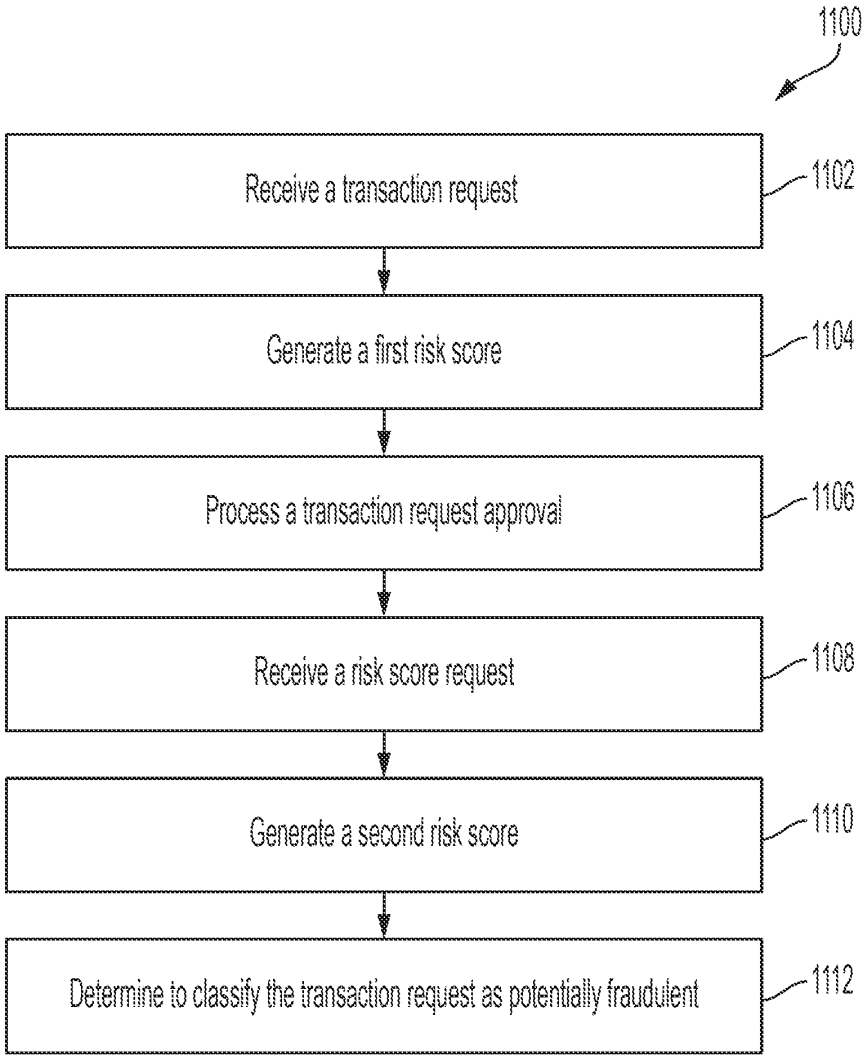

1100
Receive a transaction request
1102
Generate a first risk score
1104
Process a transaction request approval
1106
Receive a risk score request
1108
Generate a second risk score
1110
Determine to classify the transaction request as potentially fraudulent
1112

FIG. 11

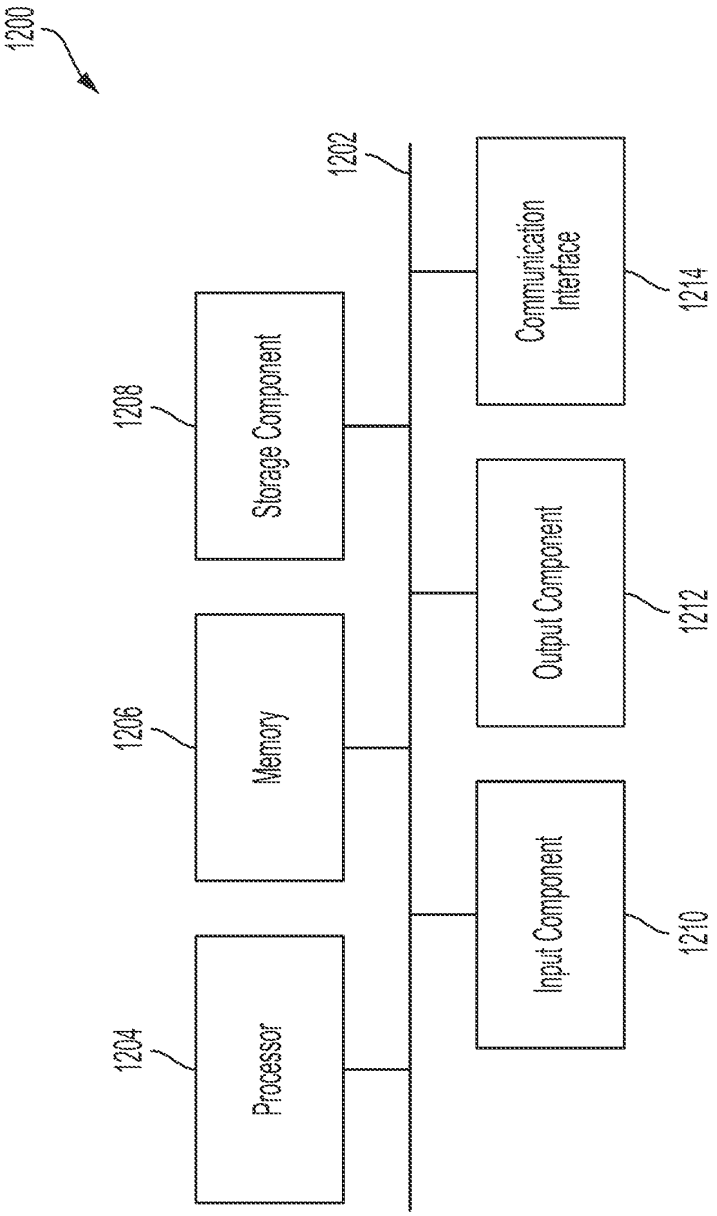

1200
1202
Communication Interface
1214
Storage Component
1208
Output Component
1212
Memory
1206
Input Component
1210
Processor
1204

FIG. 12