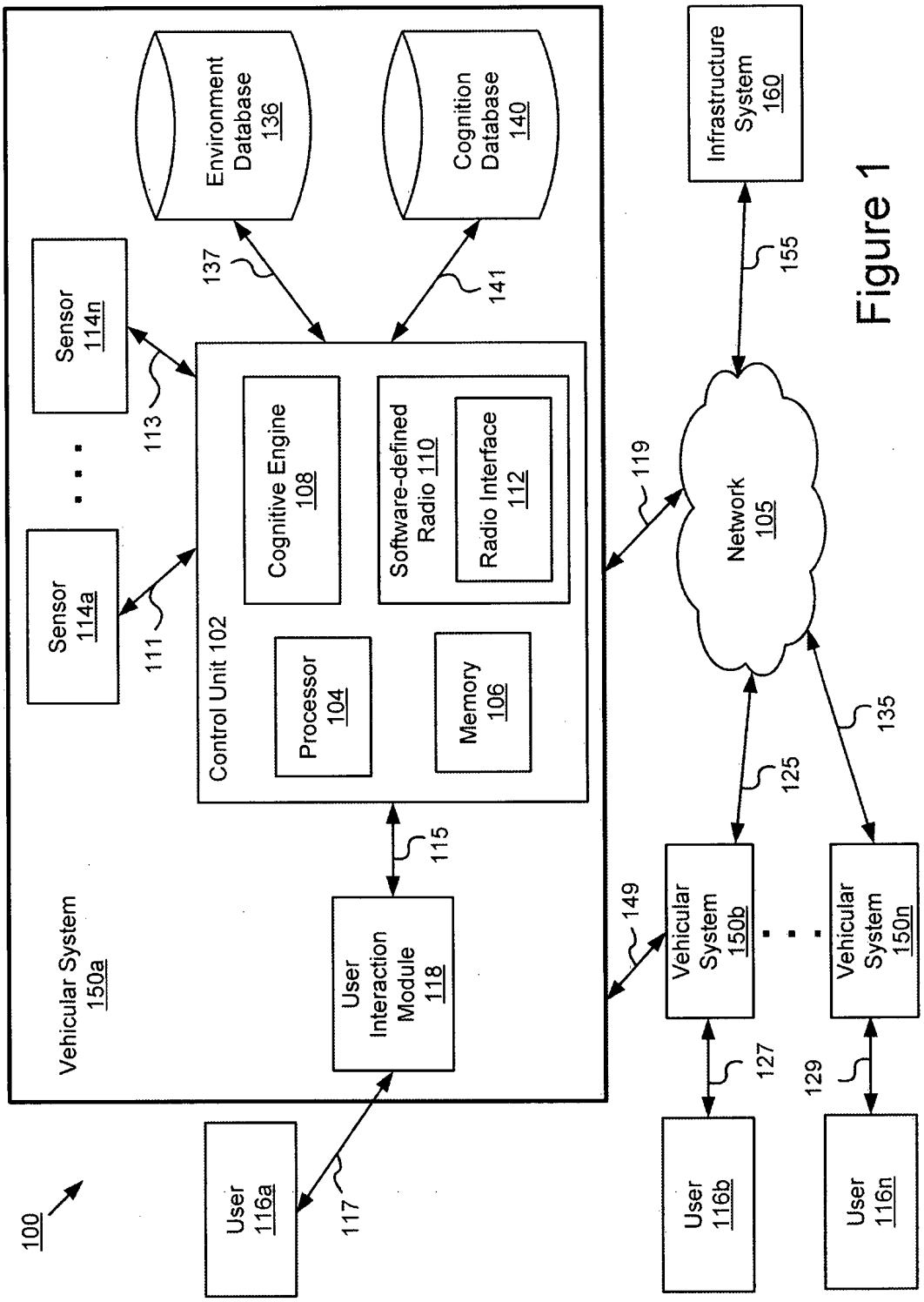
100
Vehicular System 150a
Control Unit 102
Processor 104
Memory 106
Cognitive Engine 108
Software-defined Radio 110
Radio Interface 112
Sensor 114n
Sensor 114a
User Interaction Module 118
Environment Database 136
Cognition Database 140
Infrastructure System 160
Network 105
Vehicular System 150b
Vehicular System 150n
User 116a
User 116b
User 116n
111
113
115
117
119
125
127
129
135
137
141
149
155

Figure 1

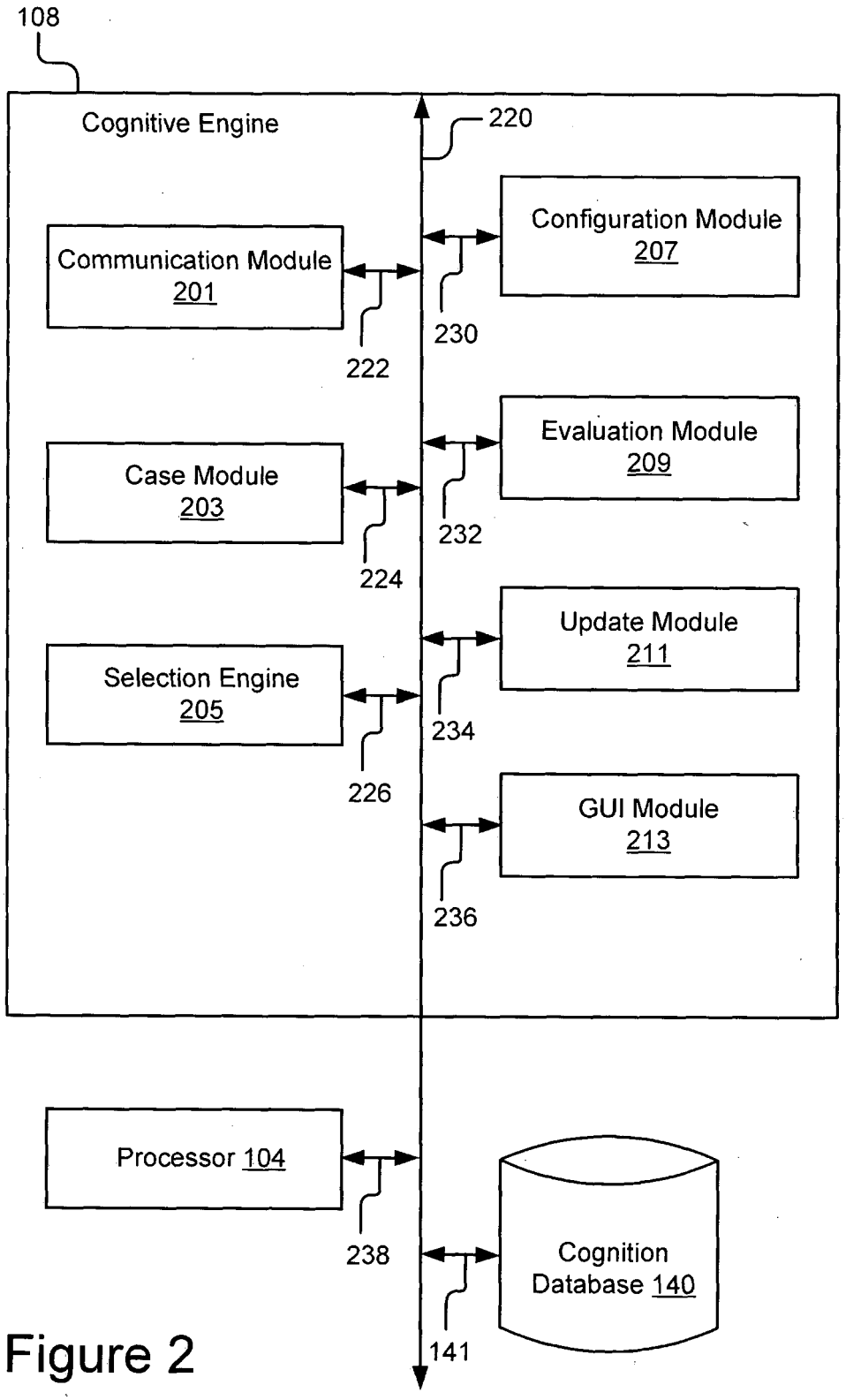
108
Cognitive Engine
220
Communication Module
201
222
Configuration Module
207
230
Case Module
203
224
Evaluation Module
209
232
Selection Engine
205
226
Update Module
211
234
GUI Module
213
236
Processor 104
238
Cognition
Database 140
141

Figure 2

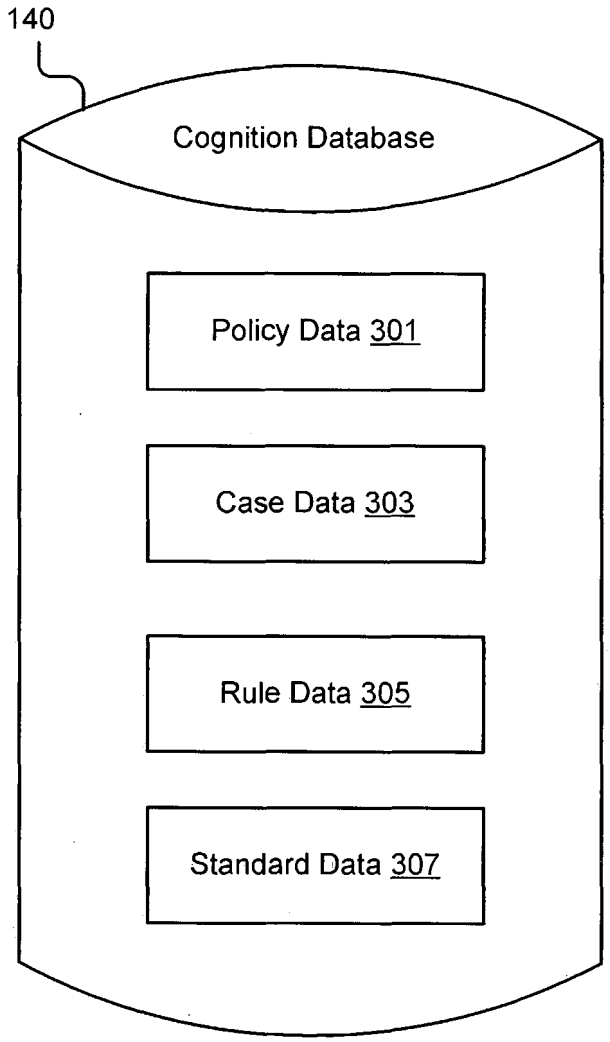
140
Cognition Database
Policy Data 301
Case Data 303
Rule Data 305
Standard Data 307

Figure 3

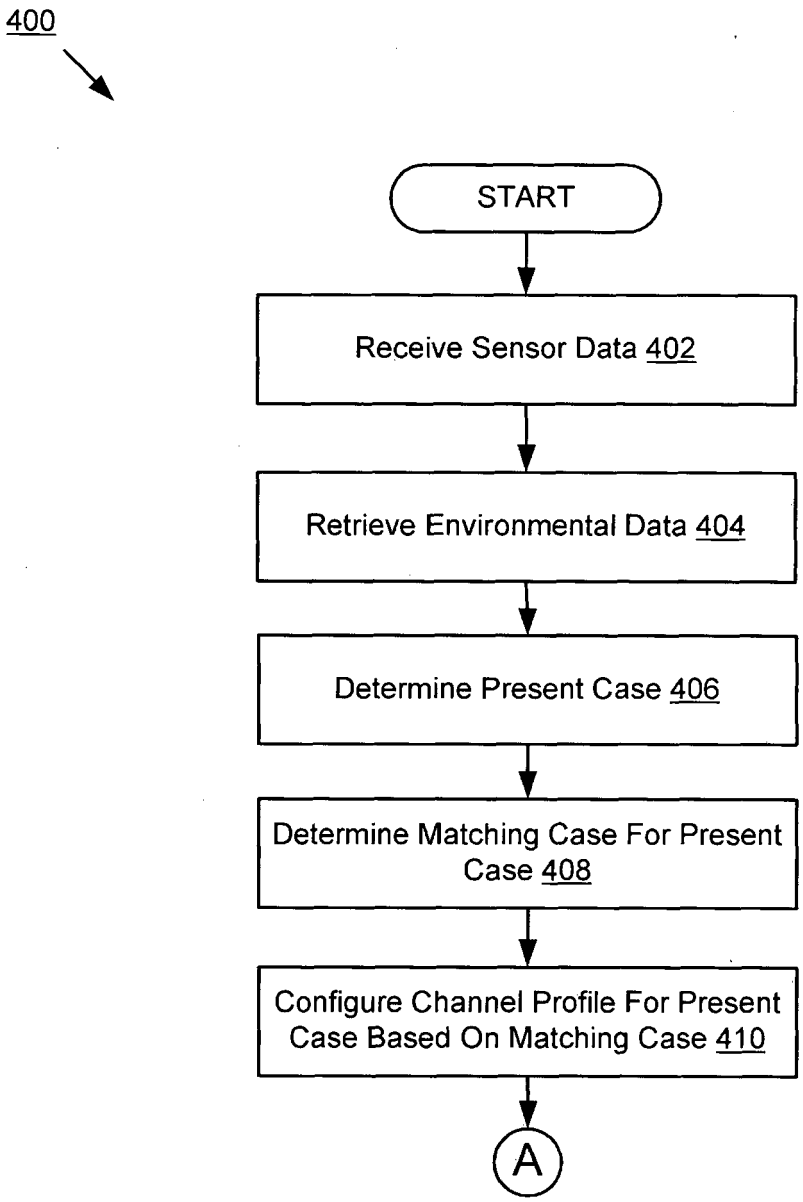
400
START
Receive Sensor Data 402
Retrieve Environmental Data 404
Determine Present Case 406
Determine Matching Case For Present Case 408
Configure Channel Profile For Present Case Based On Matching Case 410
A

Figure 4A

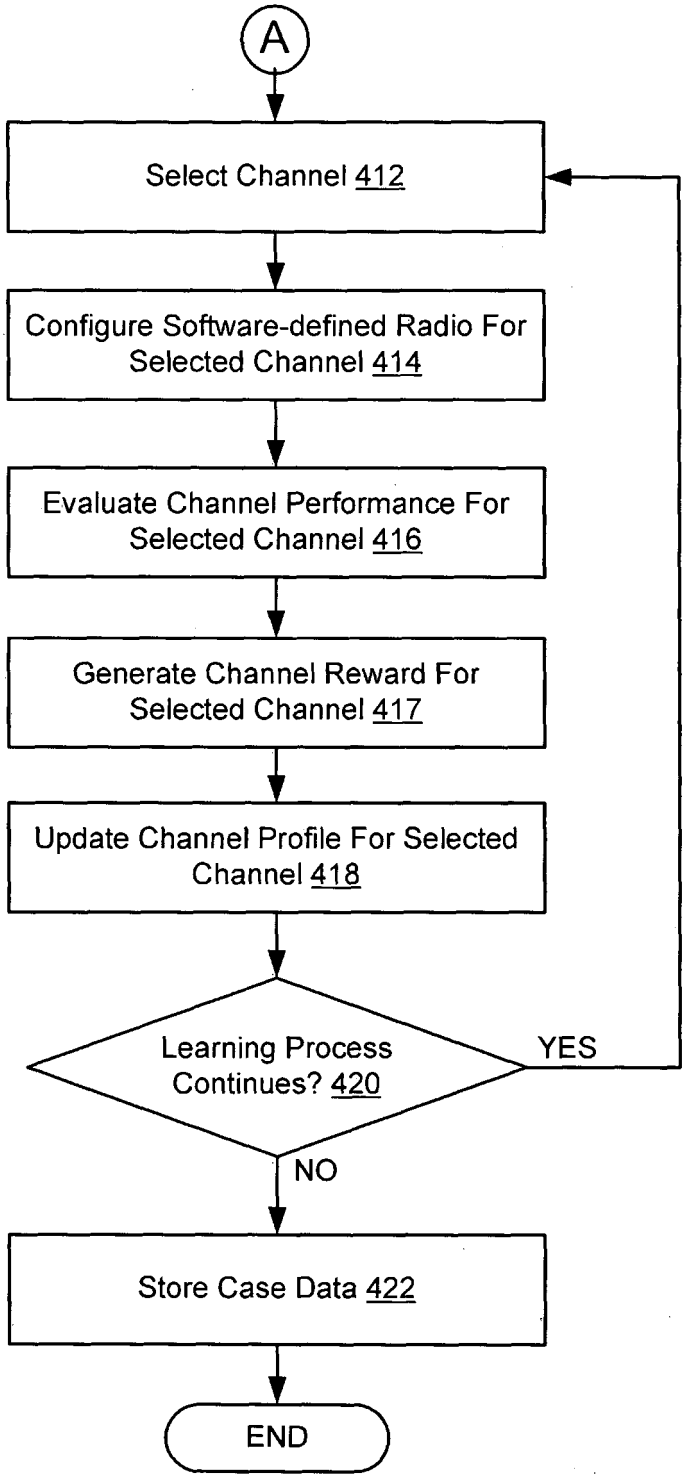
A
Select Channel 412
Configure Software-defined Radio For Selected Channel 414
Evaluate Channel Performance For Selected Channel 416
Generate Channel Reward For Selected Channel 417
Update Channel Profile For Selected Channel 418
Learning Process Continues? 420
YES
NO
Store Case Data 422
END

Figure 4B

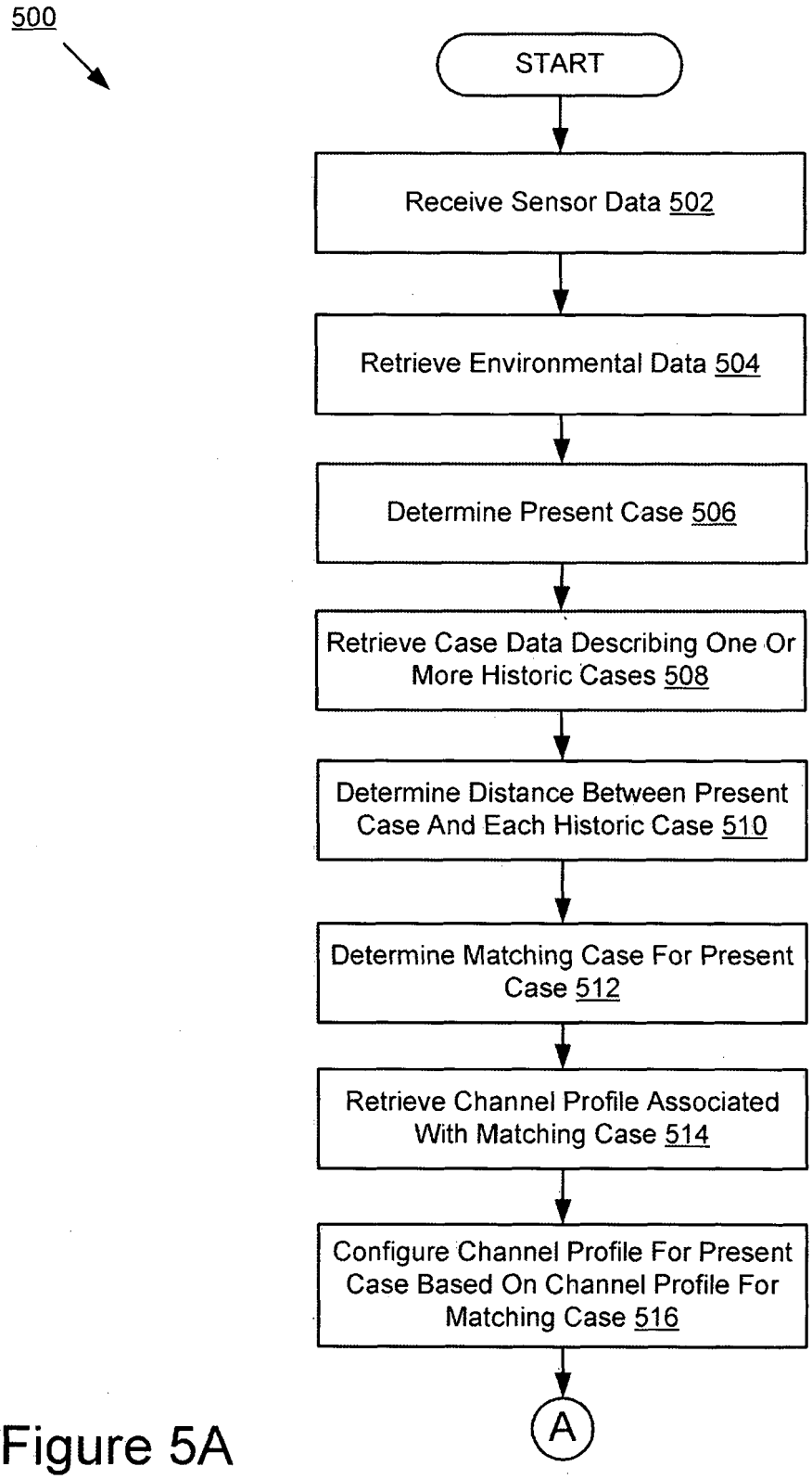
500
START
Receive Sensor Data 502
Retrieve Environmental Data 504
Determine Present Case 506
Retrieve Case Data Describing One Or More Historic Cases 508
Determine Distance Between Present Case And Each Historic Case 510
Determine Matching Case For Present Case 512
Retrieve Channel Profile Associated With Matching Case 514
Configure Channel Profile For Present Case Based On Channel Profile For Matching Case 516
A

Figure 5A

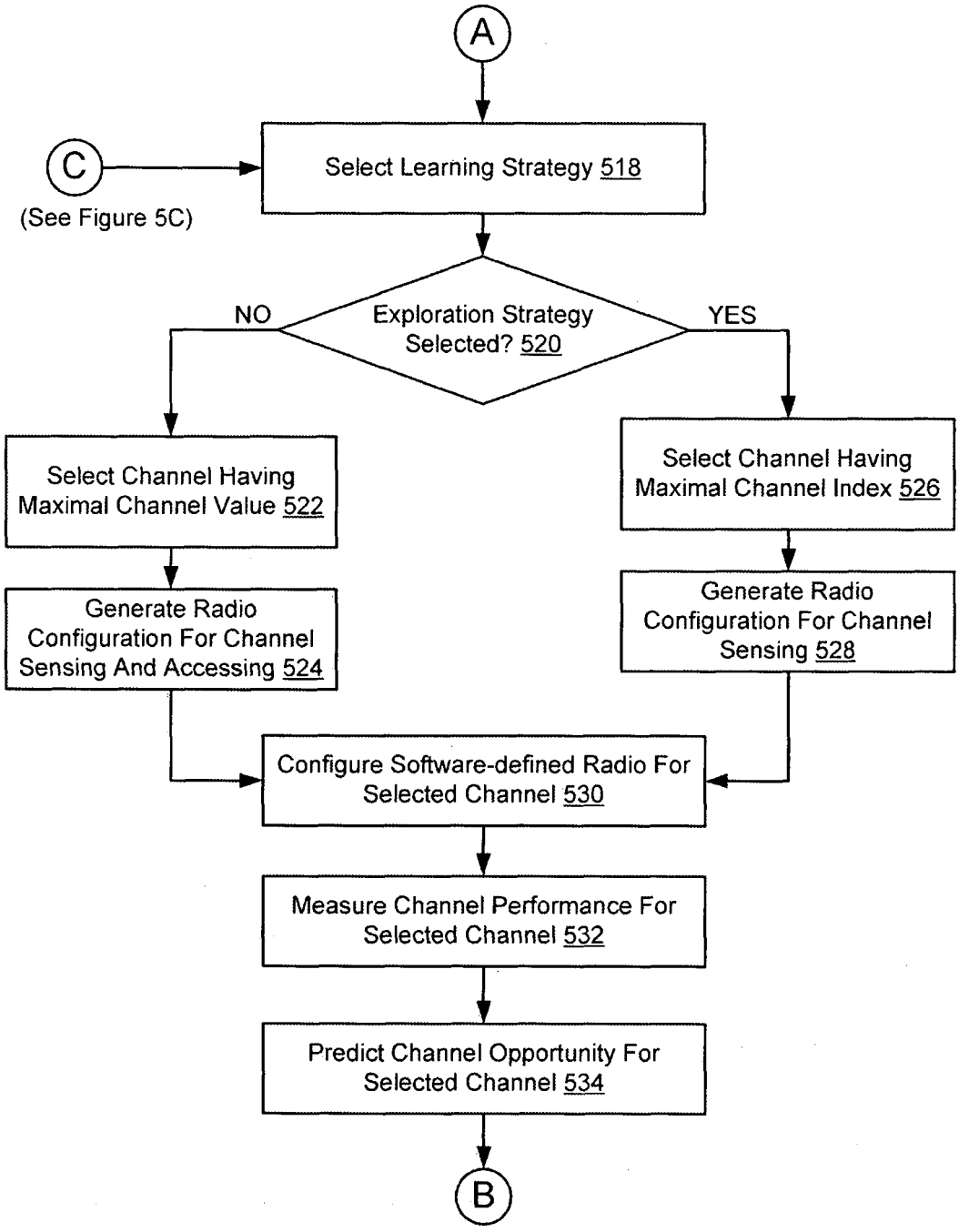
A
C
(See Figure 5C)
Select Learning Strategy 518
Exploration Strategy Selected? 520
NO
YES
Select Channel Having Maximal Channel Value 522
Generate Radio Configuration For Channel Sensing And Accessing 524
Select Channel Having Maximal Channel Index 526
Generate Radio Configuration For Channel Sensing 528
Configure Software-defined Radio For Selected Channel 530
Measure Channel Performance For Selected Channel 532
Predict Channel Opportunity For Selected Channel 534
B

Figure 5B

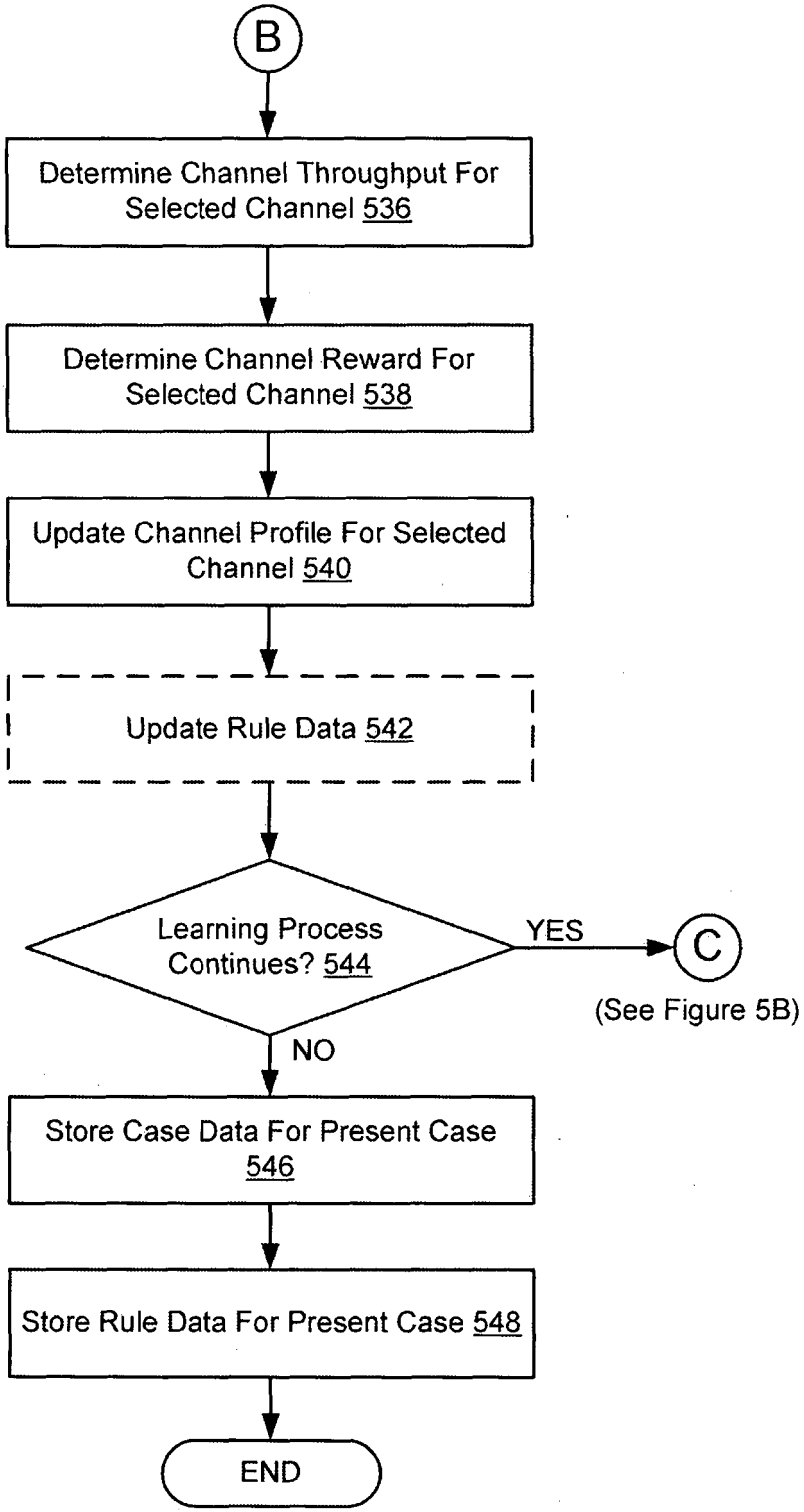
B
Determine Channel Throughput For Selected Channel 536
Determine Channel Reward For Selected Channel 538
Update Channel Profile For Selected Channel 540
Update Rule Data 542
Learning Process Continues? 544
YES
C
(See Figure 5B)
NO
Store Case Data For Present Case 546
Store Rule Data For Present Case 548
END

Figure 5C

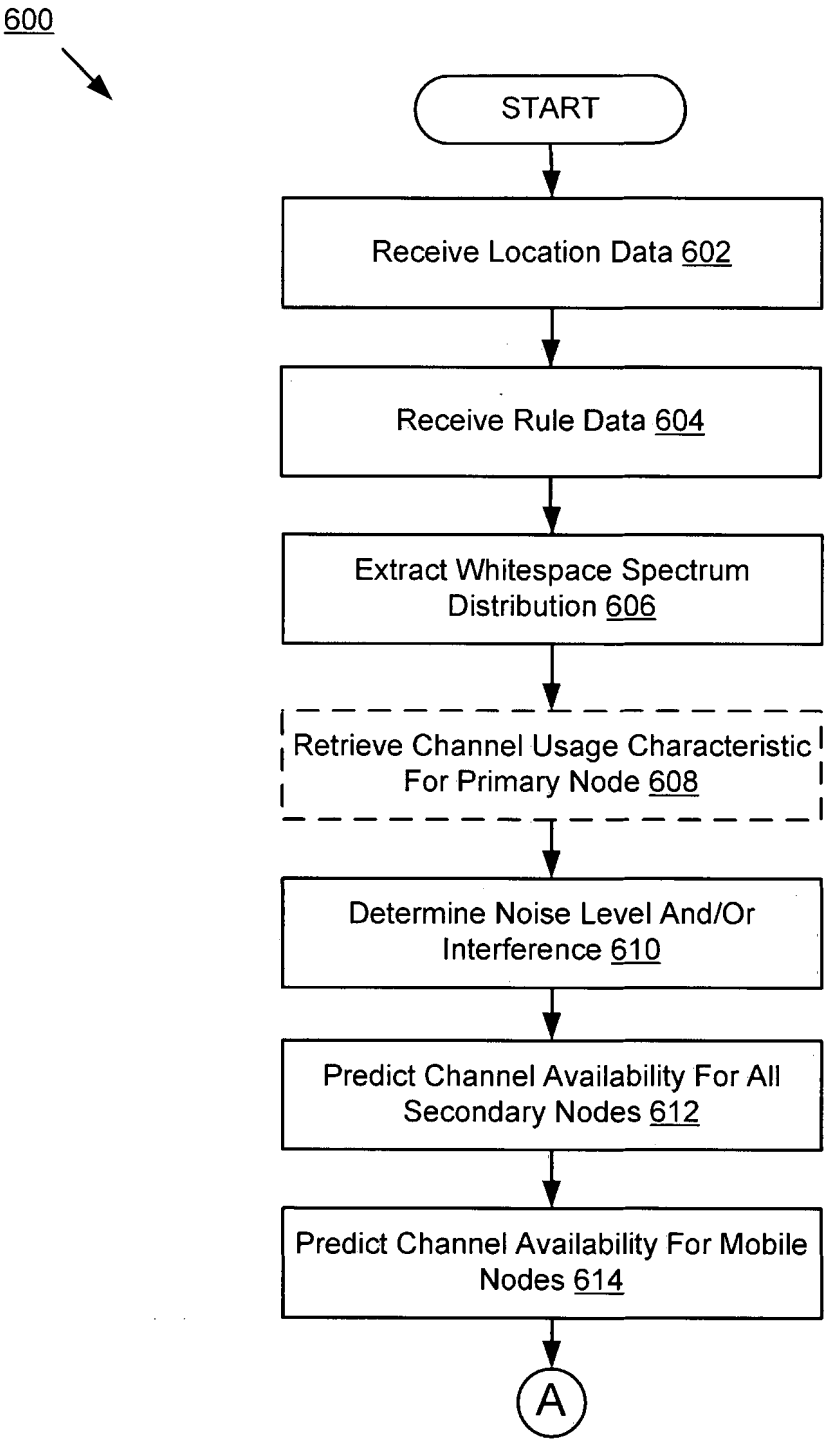
600
START
Receive Location Data 602
Receive Rule Data 604
Extract Whitespace Spectrum Distribution 606
Retrieve Channel Usage Characteristic For Primary Node 608
Determine Noise Level And/Or Interference 610
Predict Channel Availability For All Secondary Nodes 612
Predict Channel Availability For Mobile Nodes 614
A

Figure 6A

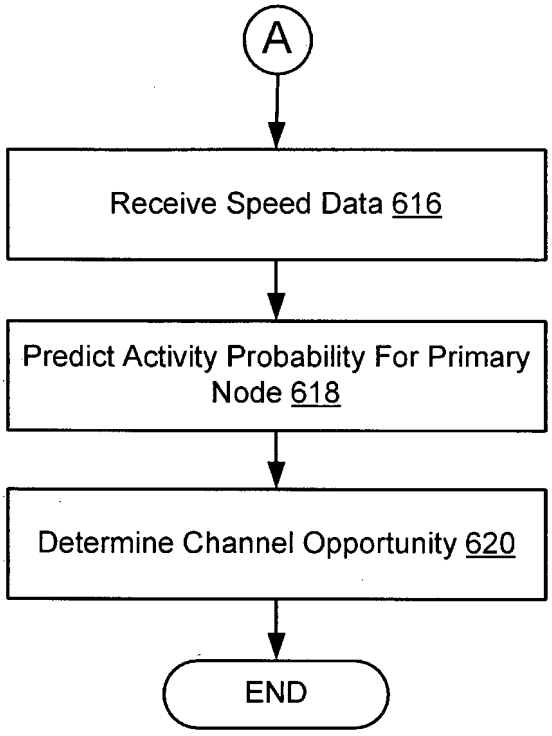
A
Receive Speed Data 616
Predict Activity Probability For Primary Node 618
Determine Channel Opportunity 620
END

Figure 6B

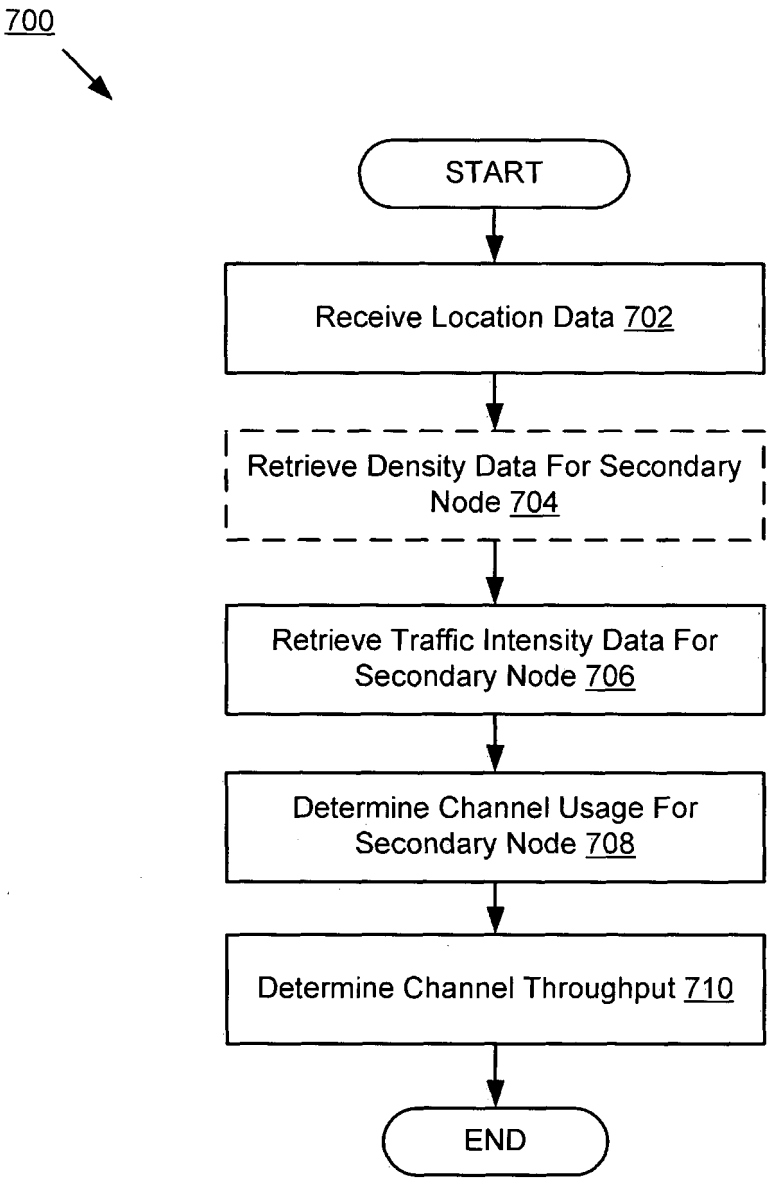
700
START
Receive Location Data 702
Retrieve Density Data For Secondary Node 704
Retrieve Traffic Intensity Data For Secondary Node 706
Determine Channel Usage For Secondary Node 708
Determine Channel Throughput 710
END

Figure 7