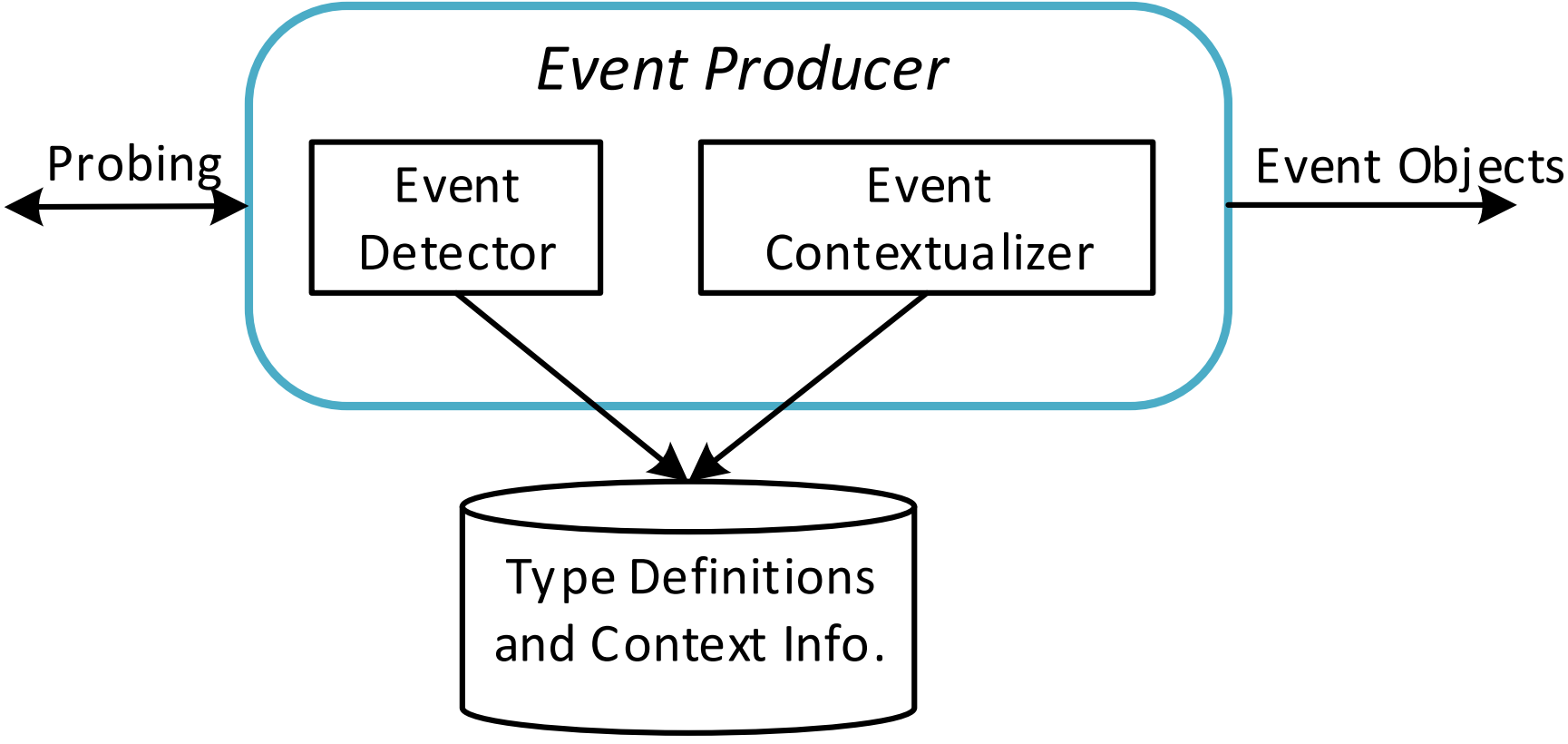
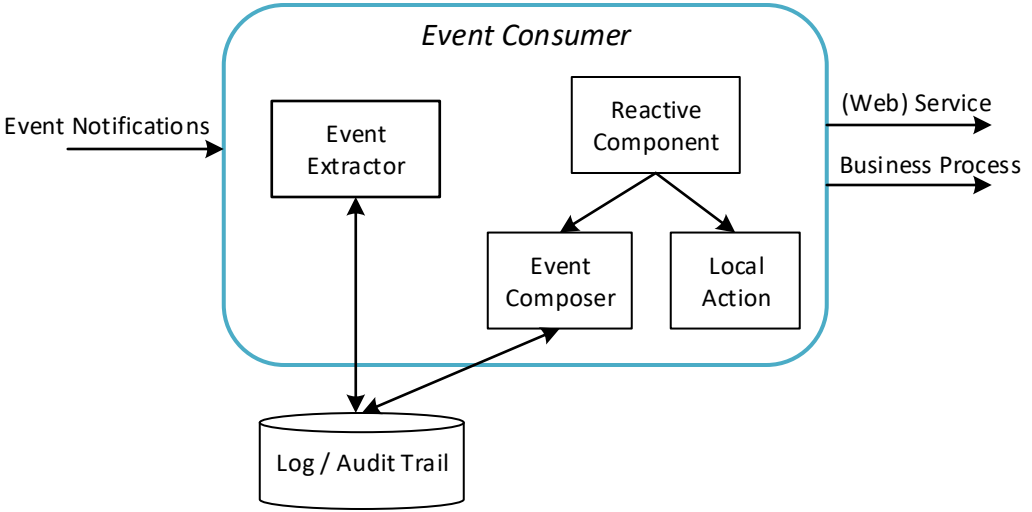
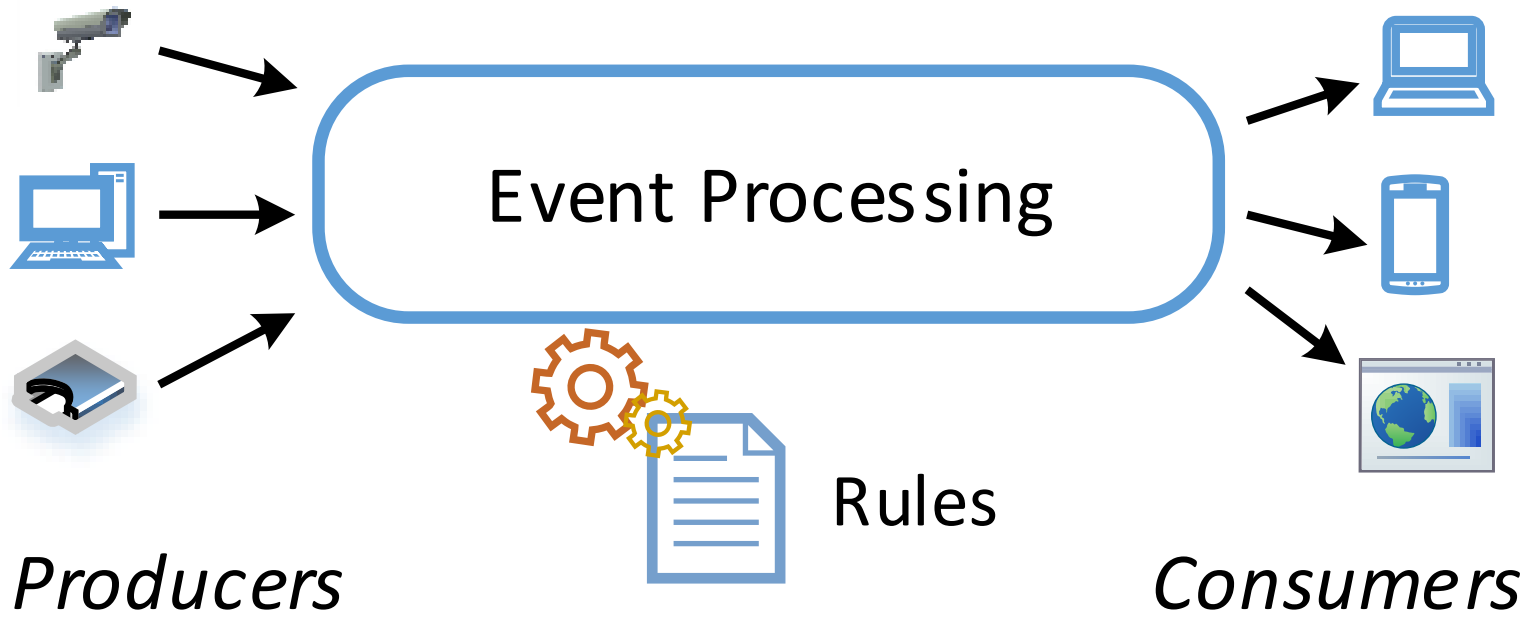
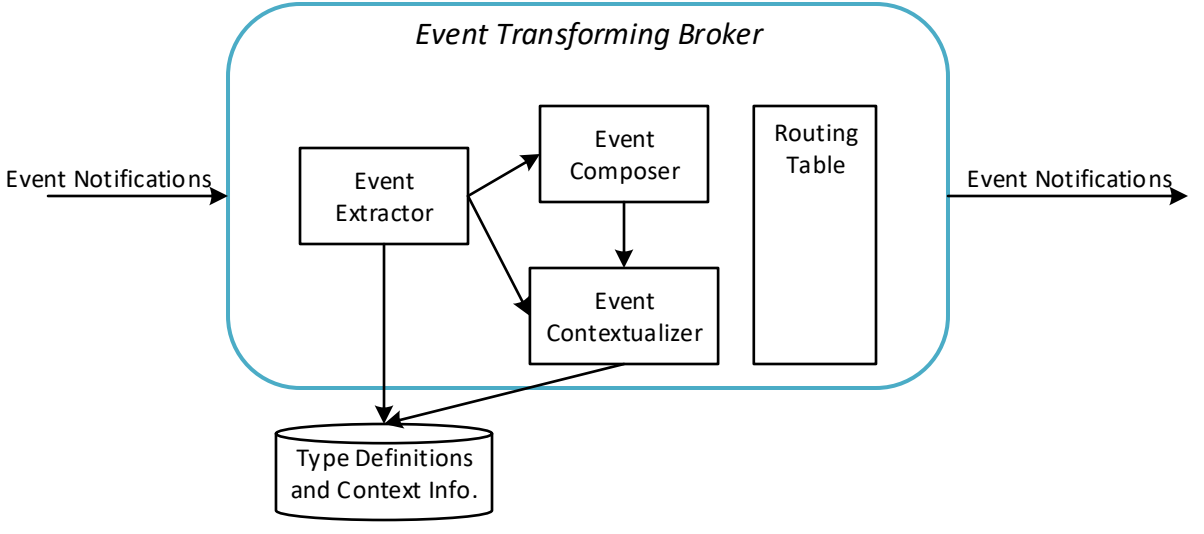
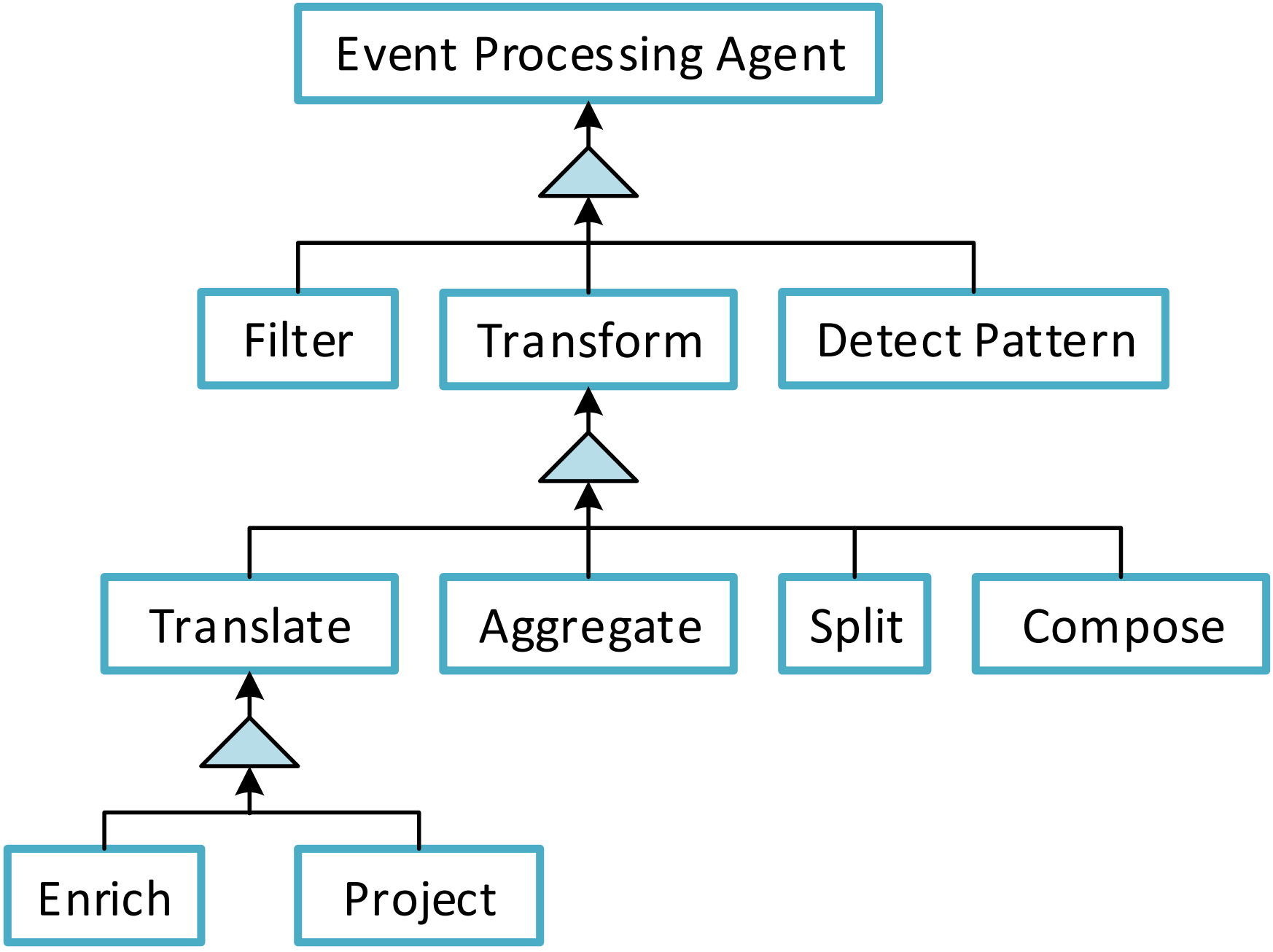
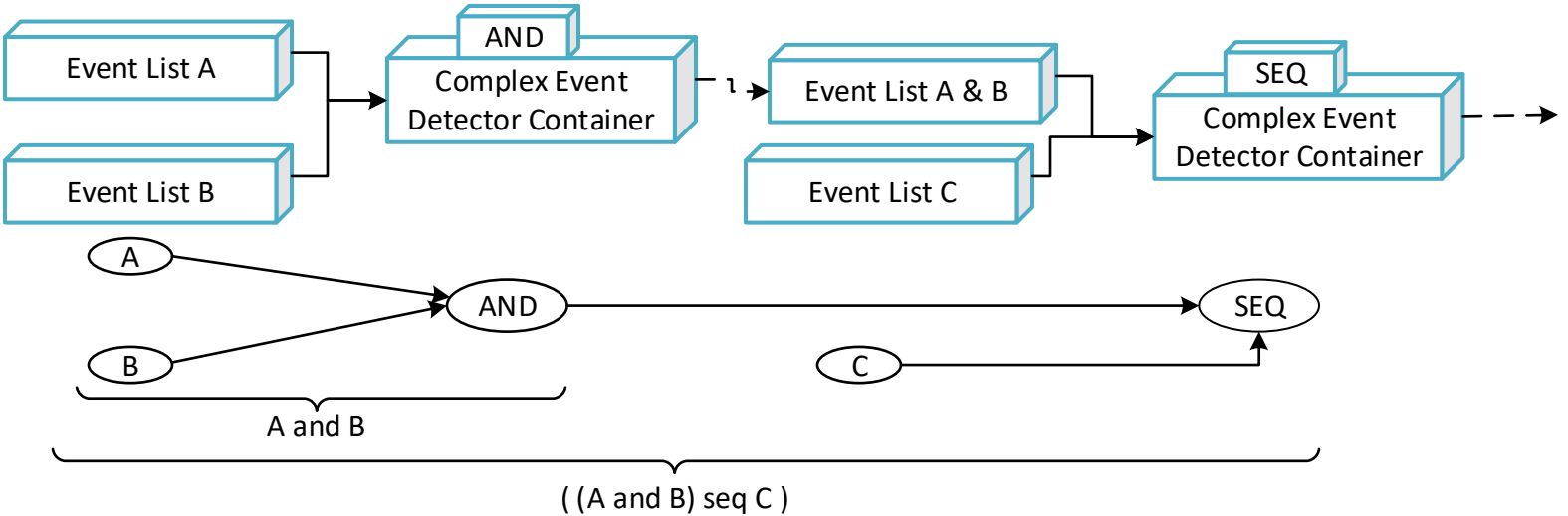

Event Producer
Probing
Event Detector
Event Contextualizer
Event Objects
Type Definitions and Context Info.

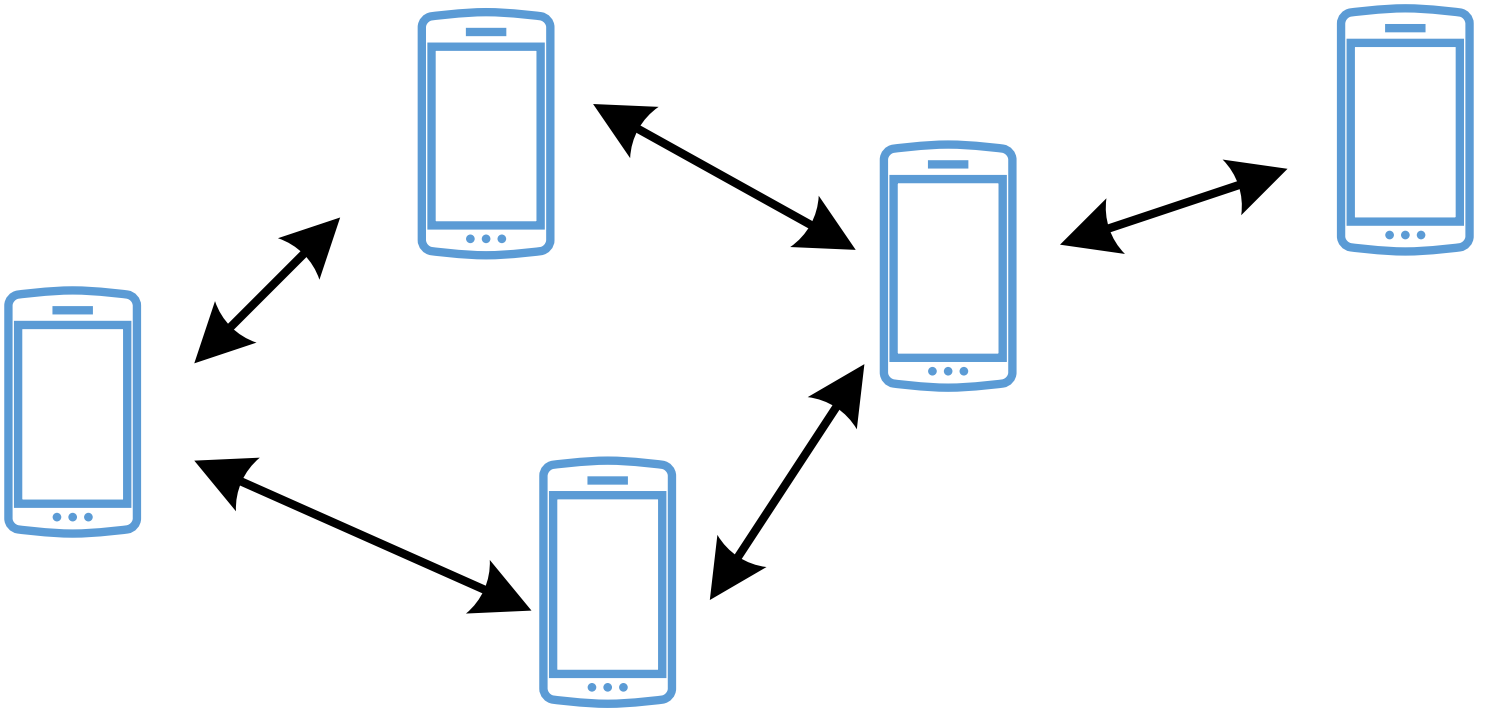

Event Consumer
Event Notifications
Event Extractor
Reactive Component
(Web) Service
Business Process
Event Composer
Local Action
Log / Audit Trail

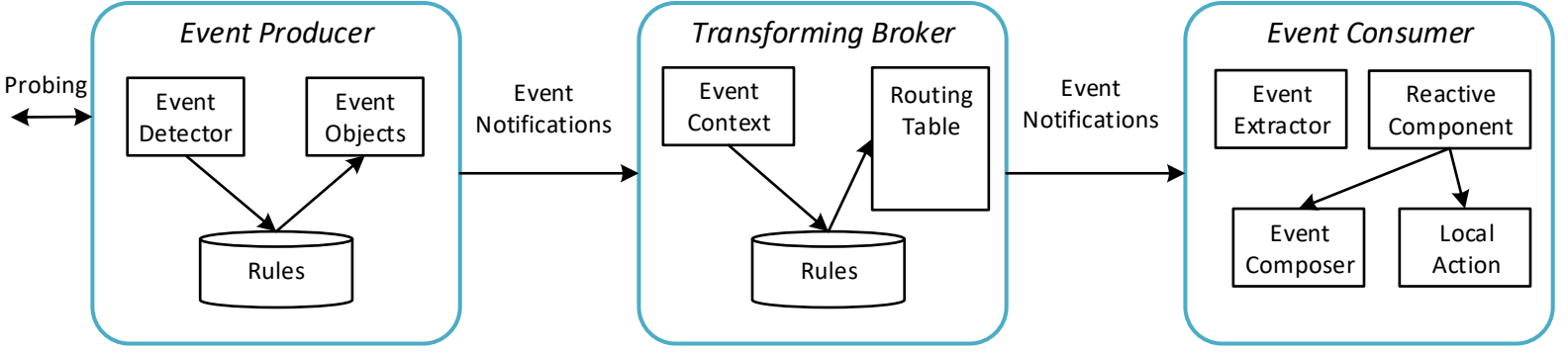

Event Processing
Rules
Producers
Consumers

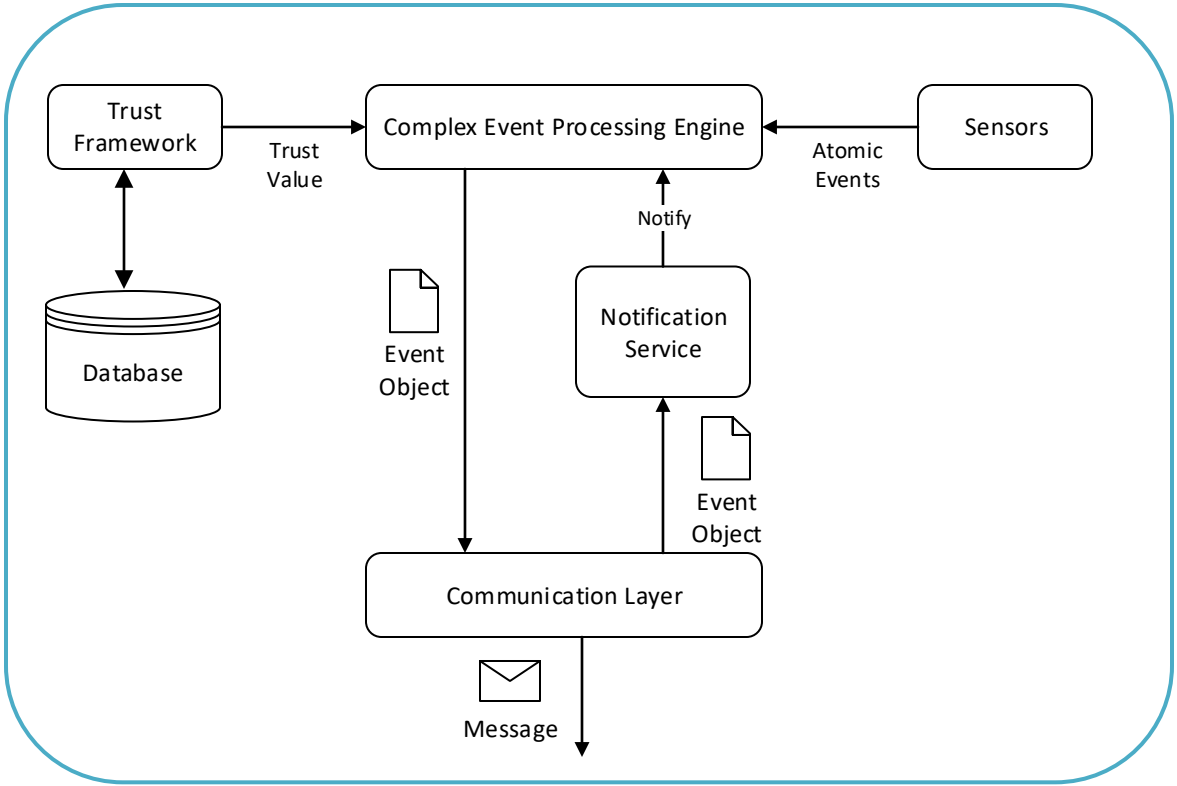

Event Transforming Broker
Event Notifications
Event Extractor
Event Composer
Event Contextualizer
Routing Table
Event Notifications
Type Definitions and Context Info.

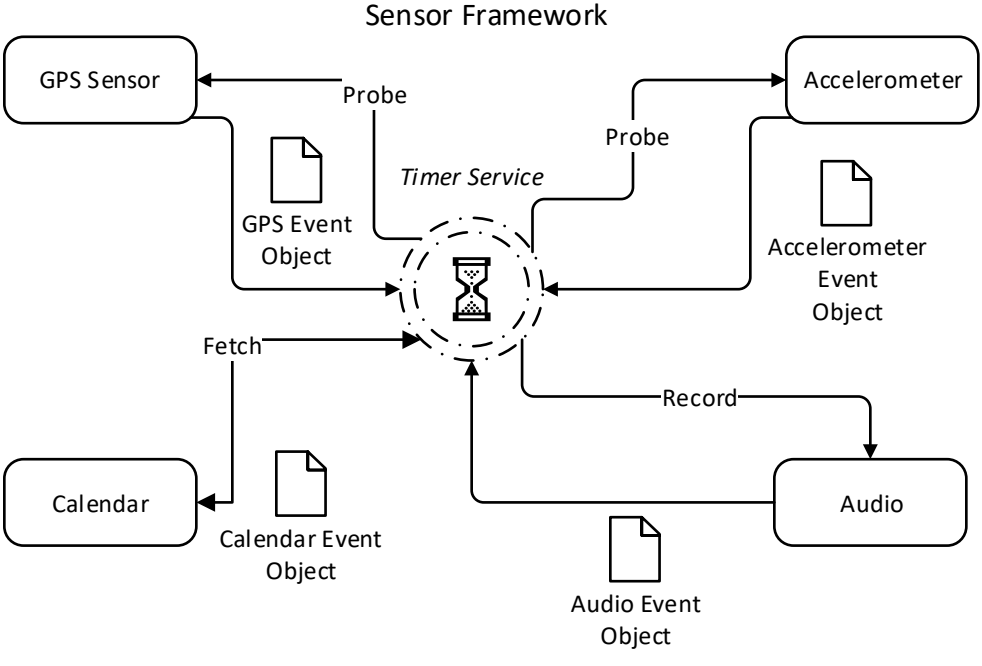

Event Processing Agent
Filter
Transform
Detect Pattern
Translate
Aggregate
Split
Compose
Enrich
Project

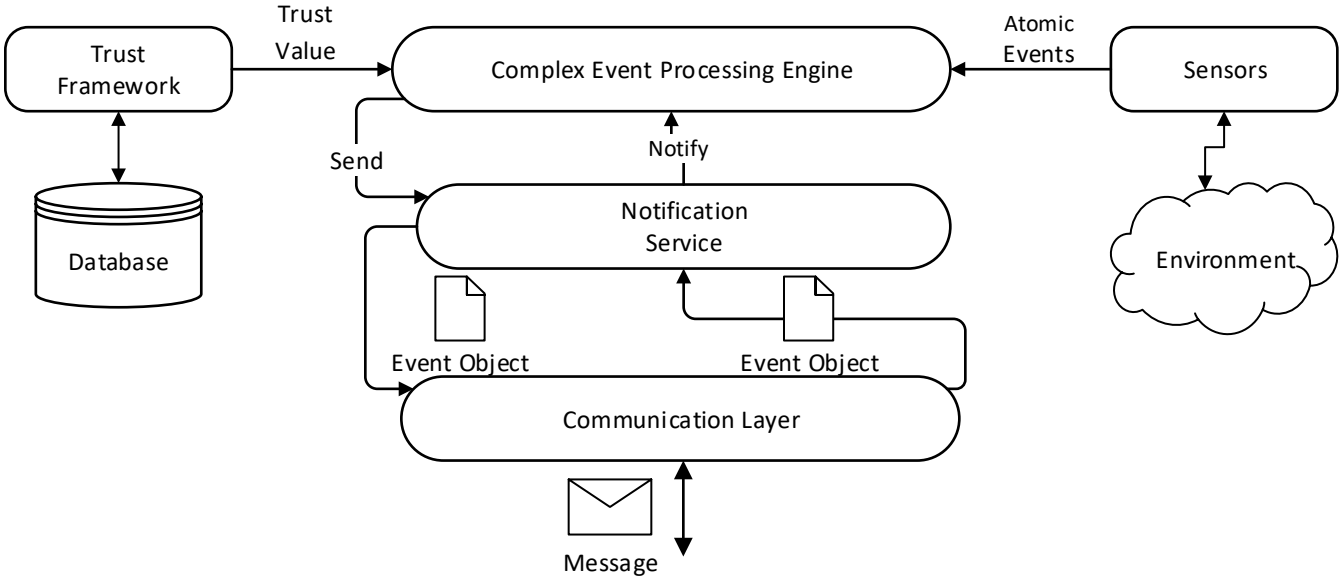

Event List A
Event List B
AND
Complex Event Detector Container
Event List A & B
Event List C
SEQ
Complex Event Detector Container
A
B
AND
SEQ
C
A and B
((A and B) seq C)

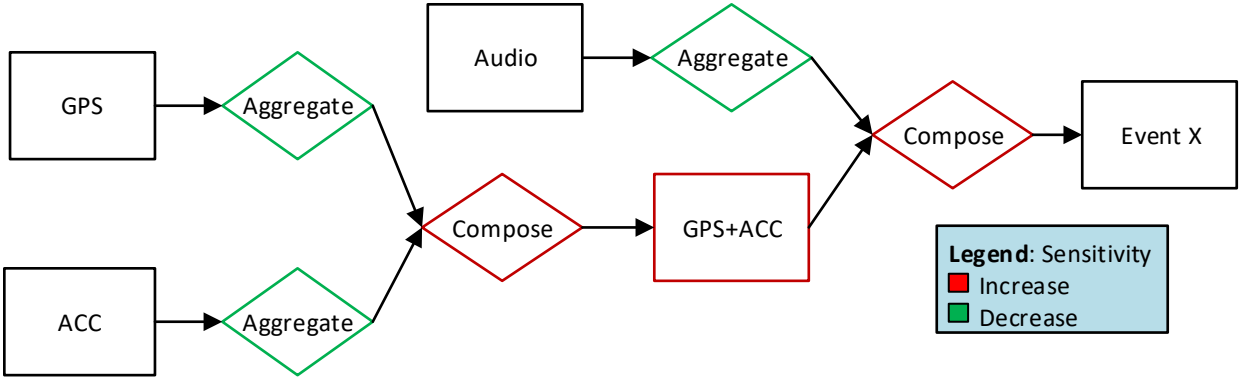


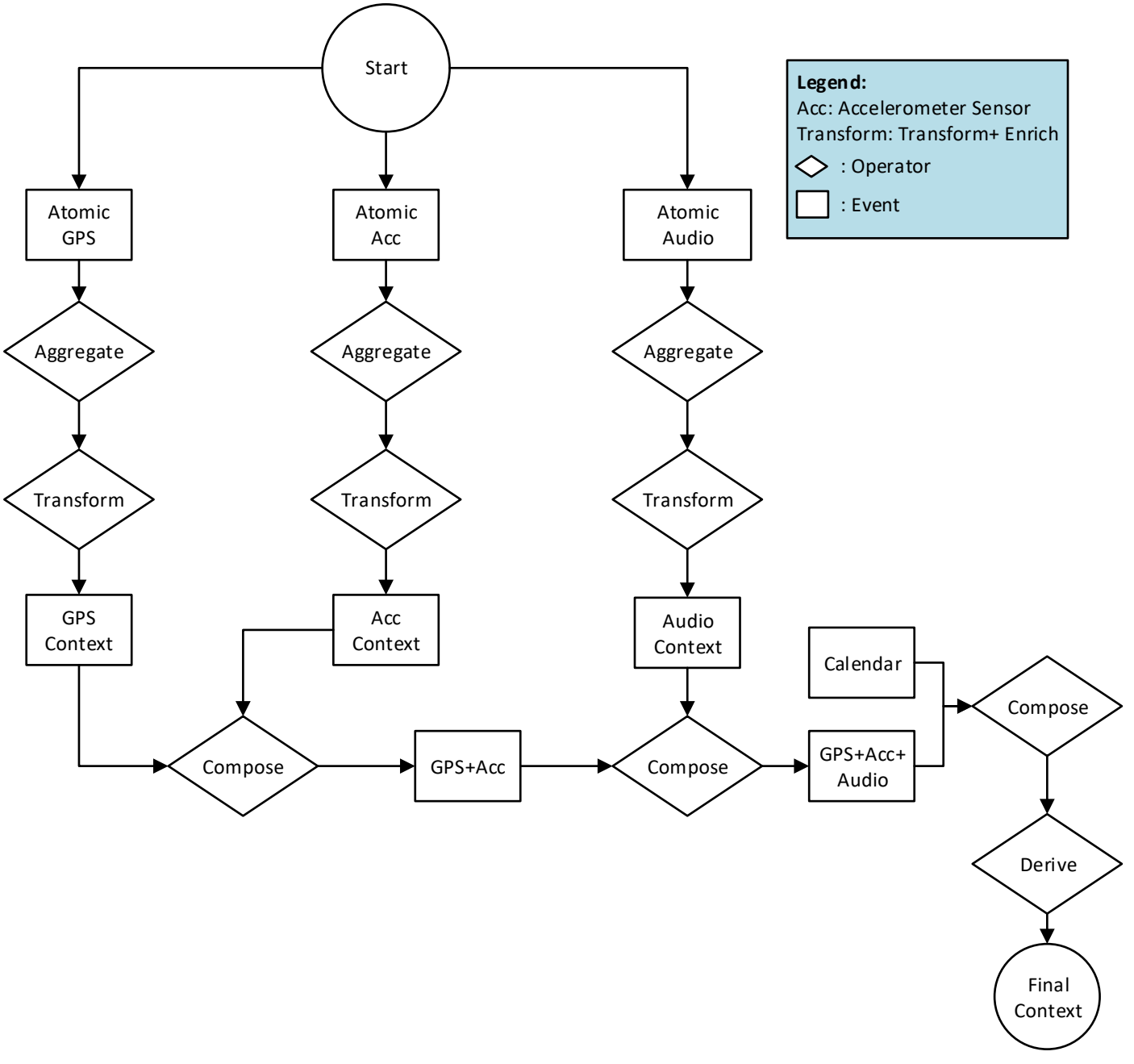

Probing
Event Producer
Event Detector
Event Objects
Rules
Event Notifications
Transforming Broker
Event Context
Routing Table
Rules
Event Notifications
Event Consumer
Event Extractor
Reactive Component
Event Composer
Local Action

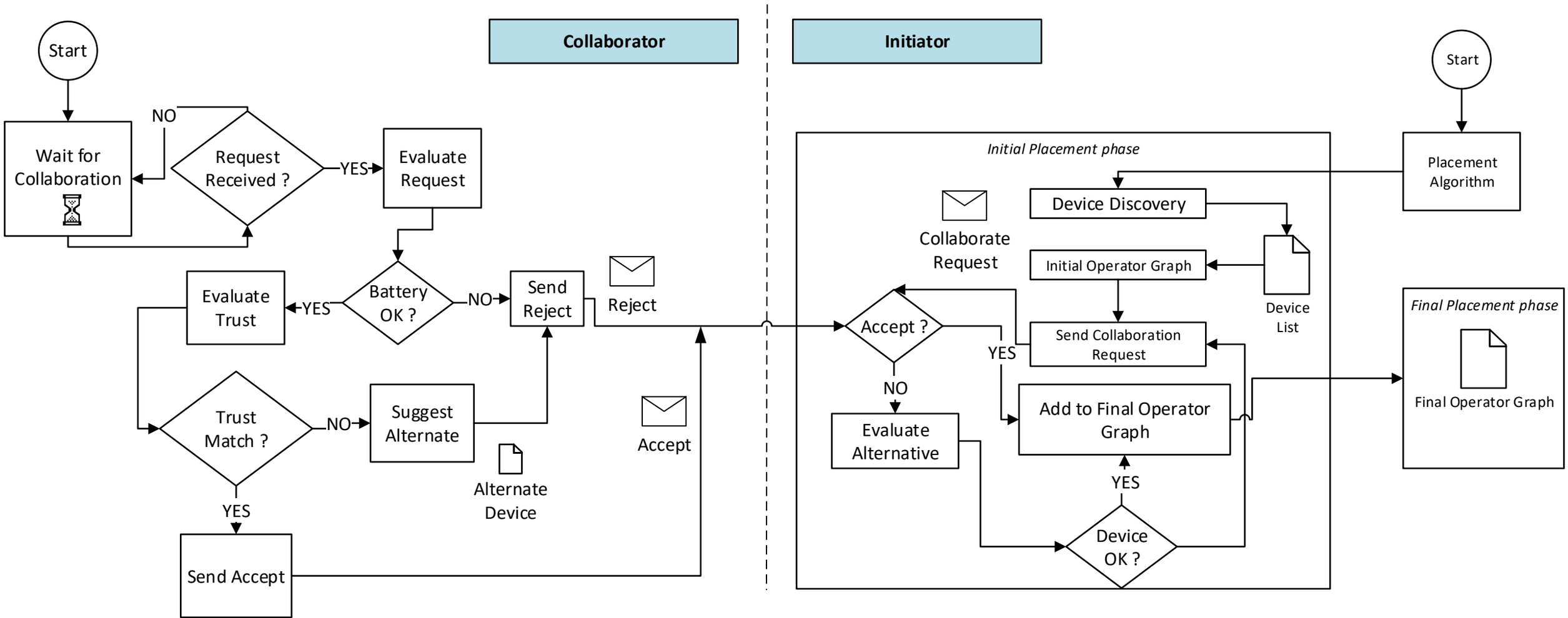

Trust Framework
Trust Value
Complex Event Processing Engine
Sensors
Atomic Events
Notify
Database
Event Object
Notification Service
Event Object
Communication Layer
Message

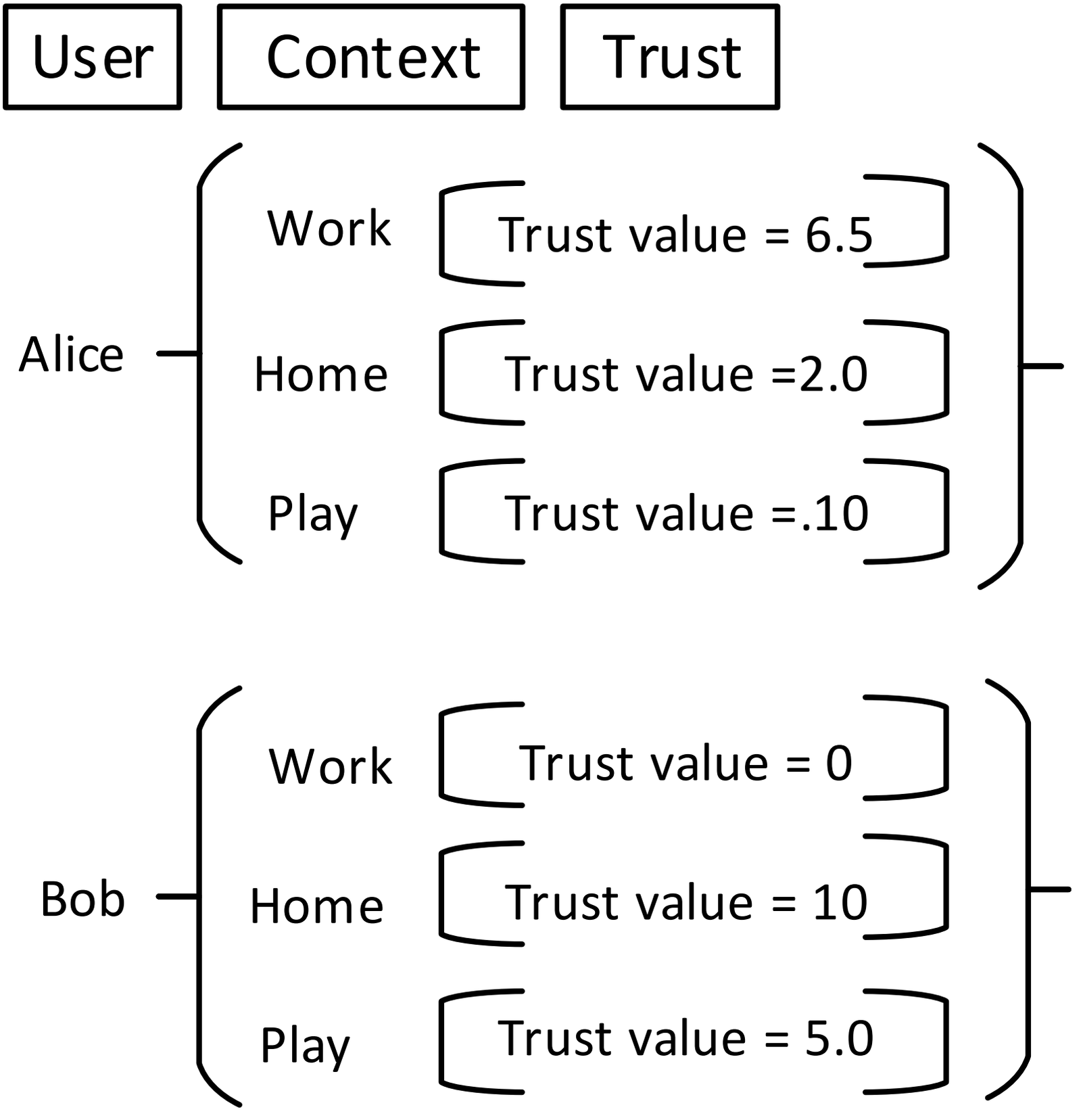

Sensor Framework
GPS Sensor
Probe
Accelerometer
Probe
Timer Service
GPS Event Object
Accelerometer Event Object
Fetch
Record
Calendar
Audio
Calendar Event Object
Audio Event Object

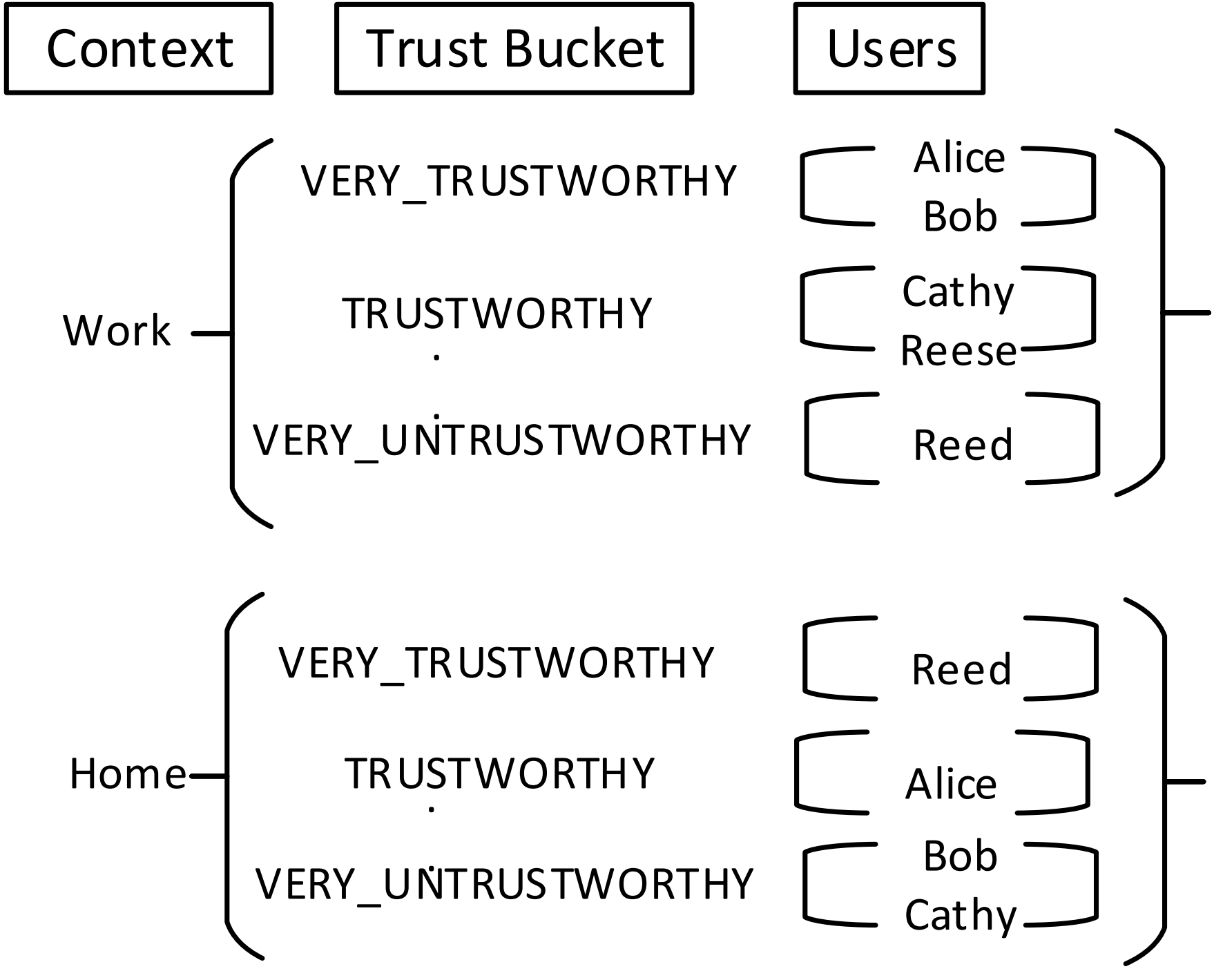

Trust Framework
Trust Value
Complex Event Processing Engine
Atomic Events
Sensors
Database
Send
Notify
Notification Service
Environment
Event Object
Event Object
Communication Layer
Message

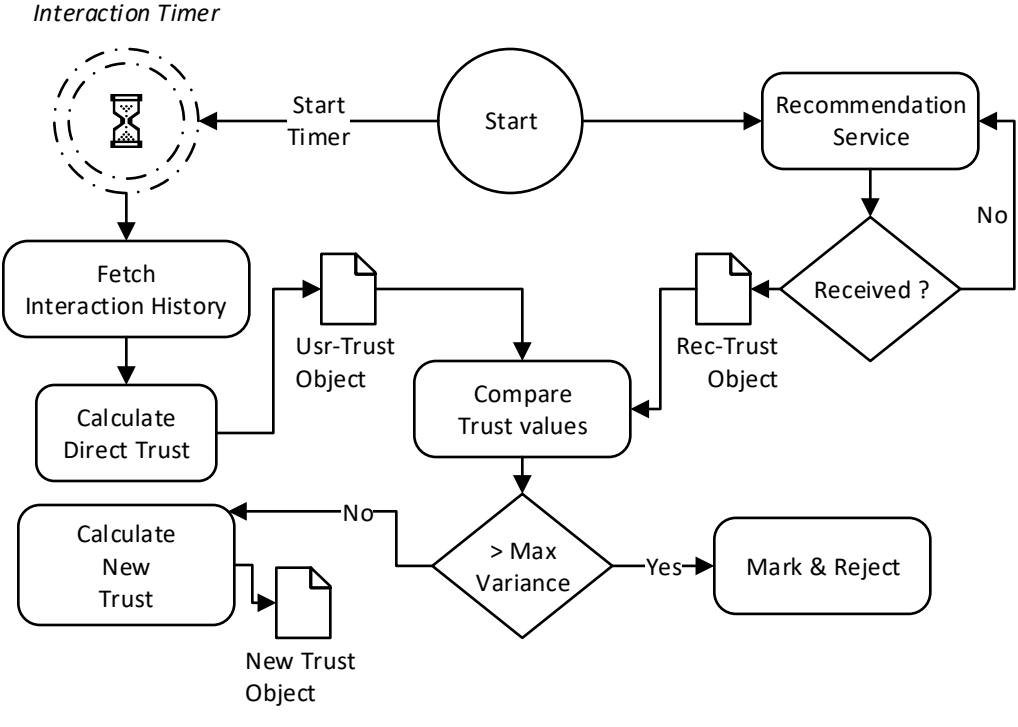

GPS
Aggregate
ACC
Aggregate
Compose
Audio
Aggregate
GPS+ACC
Compose
Event X
Legend: Sensitivity
Increase
Decrease

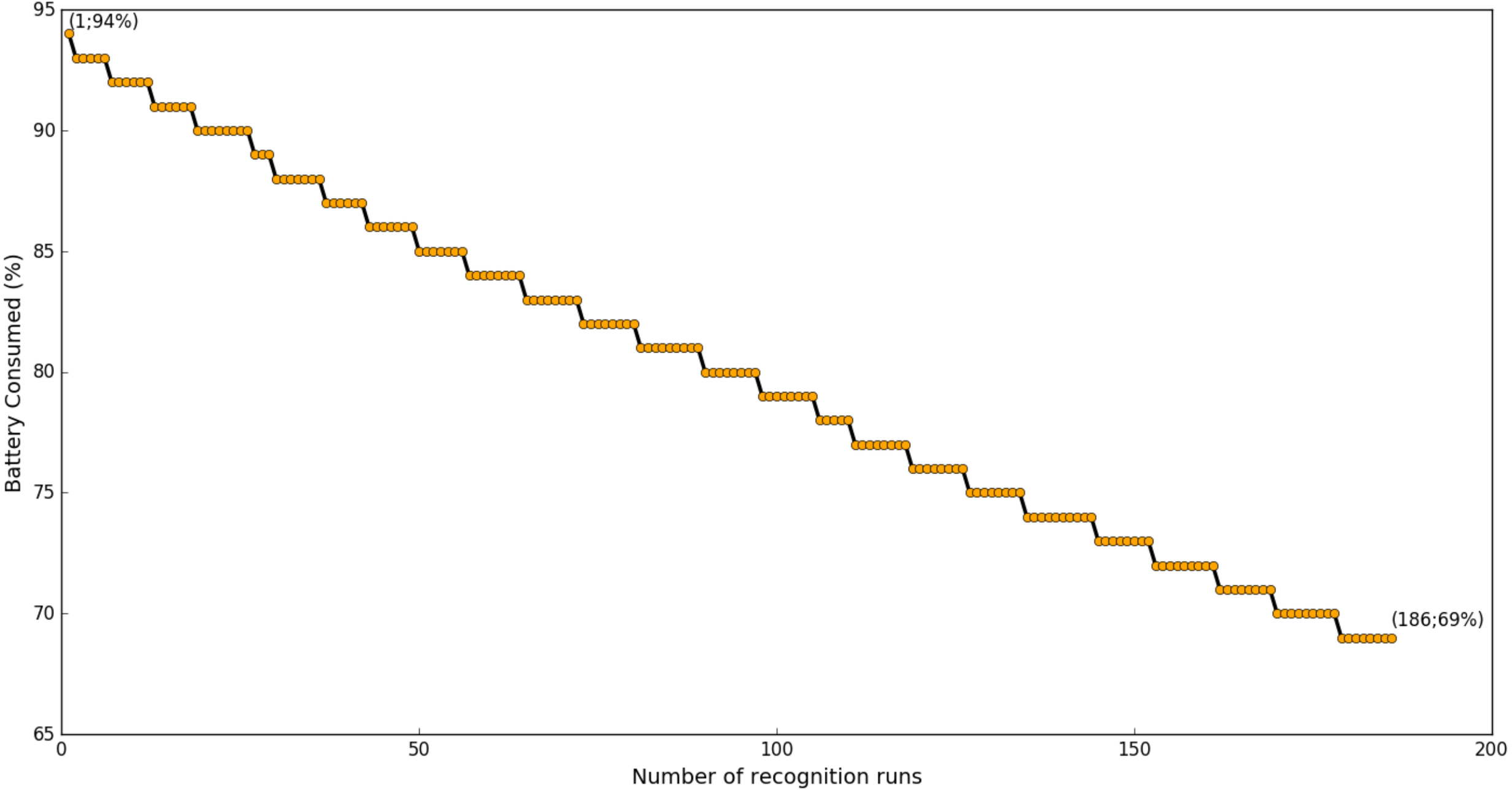

Start
Legend:
Acc: Accelerometer Sensor
Transform: Transform+ Enrich
: Operator
: Event
Atomic GPS
Atomic Acc
Atomic Audio
Aggregate
Aggregate
Aggregate
Transform
Transform
Transform
GPS Context
Acc Context
Audio Context
Calendar
Compose
Compose
GPS+Acc
Compose
GPS+Acc+ Audio
Derive
Final Context


Collaborator
Initiator
Start
Wait for Collaboration
Request Received ?
NO
YES
Evaluate Request
Battery OK ?
YES
NO
Evaluate Trust
Send Reject
Reject
Trust Match ?
NO
Suggest Alternate
Alternate Device
YES
Send Accept
Accept
Start
Placement Algorithm
Initial Placement phase
Collaborate Request
Device Discovery
Initial Operator Graph
Device List
Accept ?
YES
Send Collaboration Request
NO
Evaluate Alternative
Add to Final Operator Graph
YES
Device OK ?
Final Placement phase
Final Operator Graph

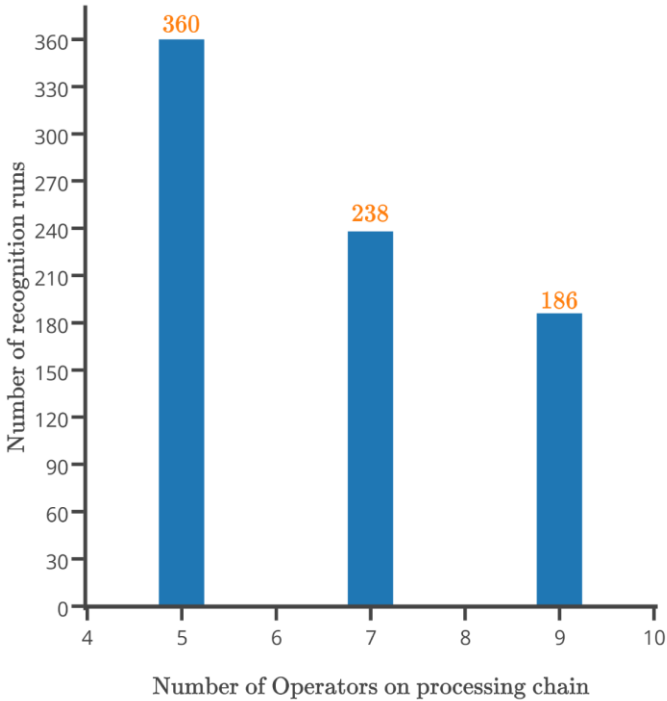

User
Context
Trust
Alice
Work
Trust value = 6.5
Home
Trust value =2.0
Play
Trust value =.10
Bob
Work
Trust value = 0
Home
Trust value = 10
Play
Trust value = 5.0

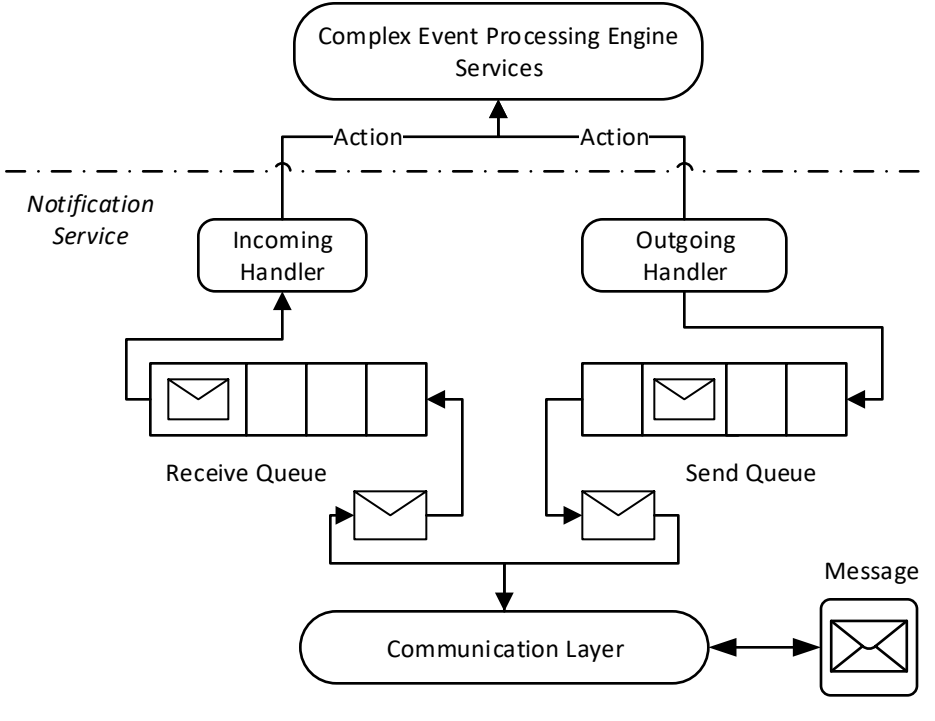

Context
Trust Bucket
Users
Work
VERY_TRUSTWORTHY
TRUSTWORTHY
VERY_UNTRUSTWORTHY
Alice
Bob
Cathy
Reese
Reed
Home
VERY_TRUSTWORTHY
TRUSTWORTHY
VERY_UNTRUSTWORTHY
Reed
Alice
Bob
Cathy

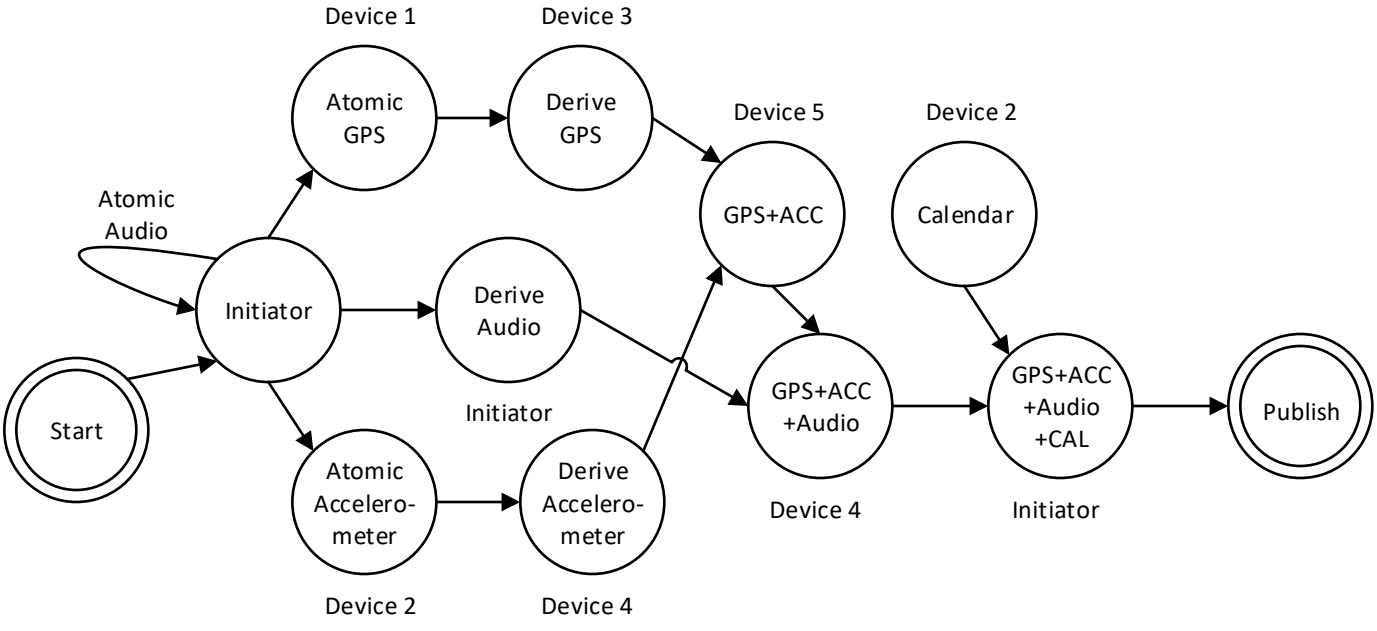

Interaction Timer
Start Timer
Start
Recommendation Service
No
Received ?
Fetch Interaction History
Usr-Trust Object
Rec-Trust Object
Calculate Direct Trust
Compare Trust values
Calculate New Trust
No
> Max Variance
Yes
Mark & Reject
New Trust Object

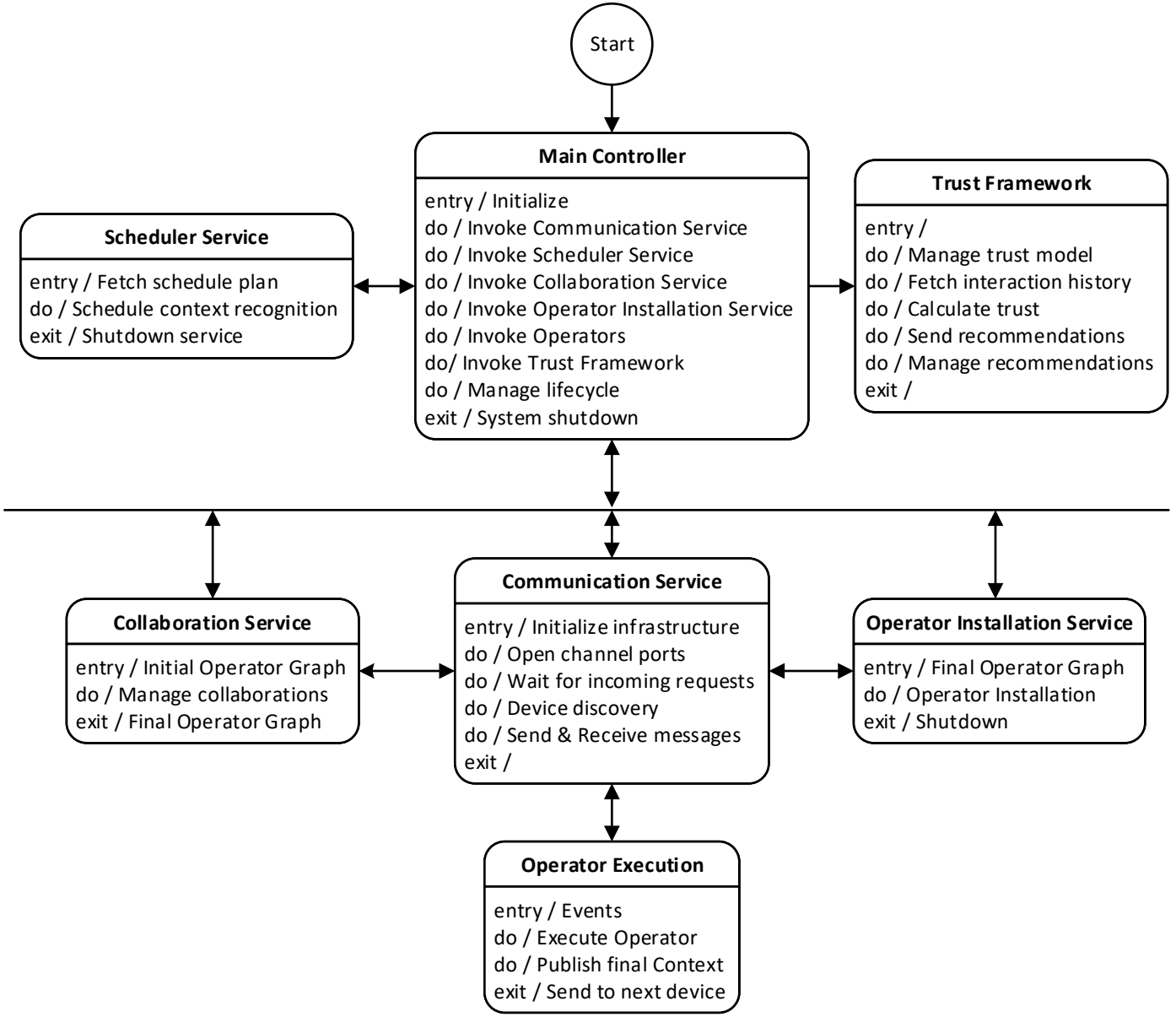

(1;94%)
(186;69%)
Battery Consumed (%)
Number of recognition runs
95
90
85
80
75
70
65
0
50
100
150
200

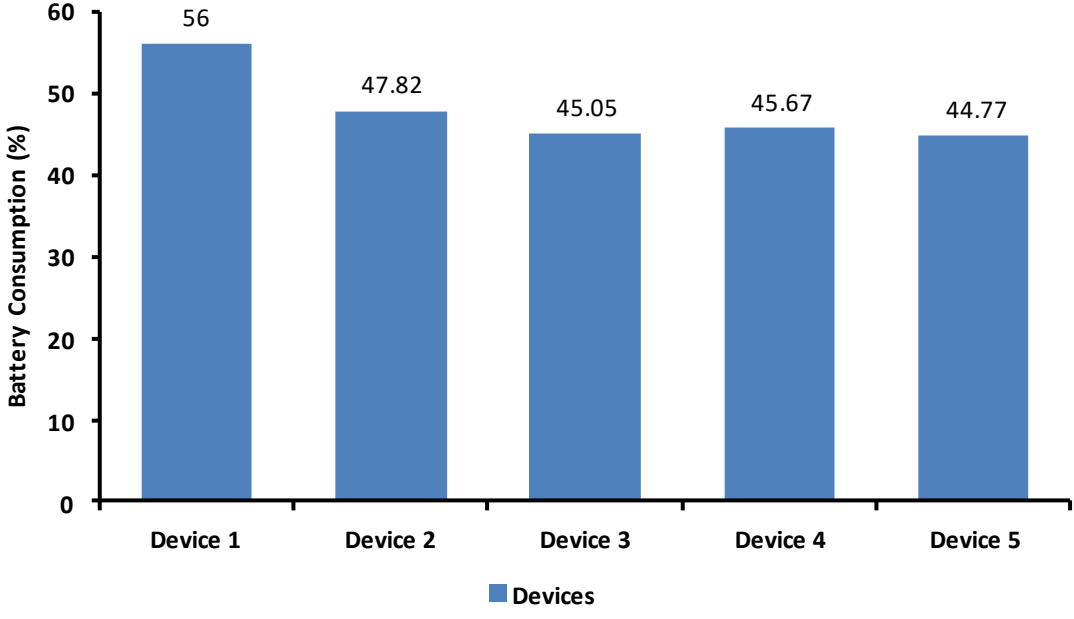
Number of Operators vs Number of runs per 25% battery usages

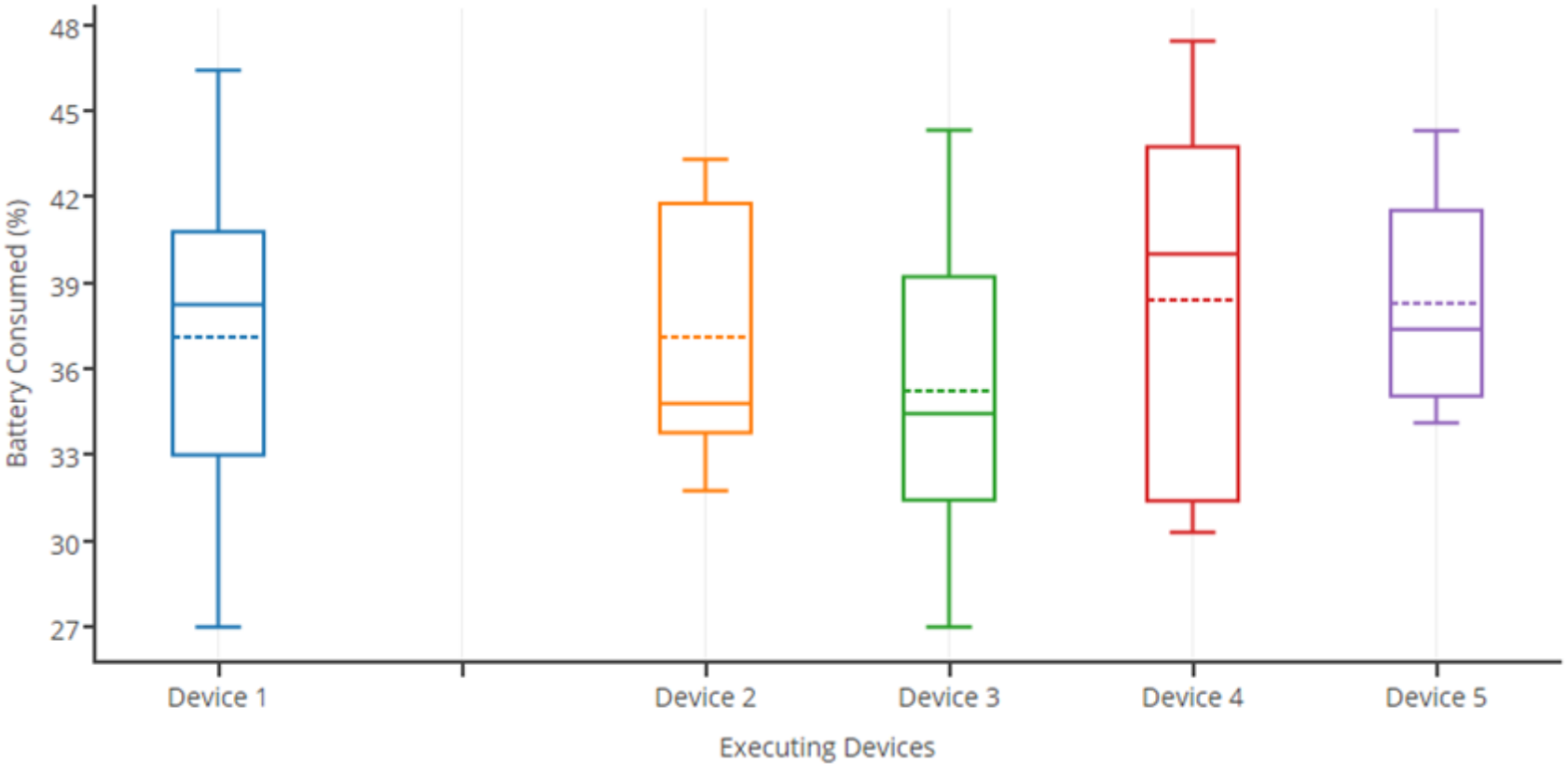


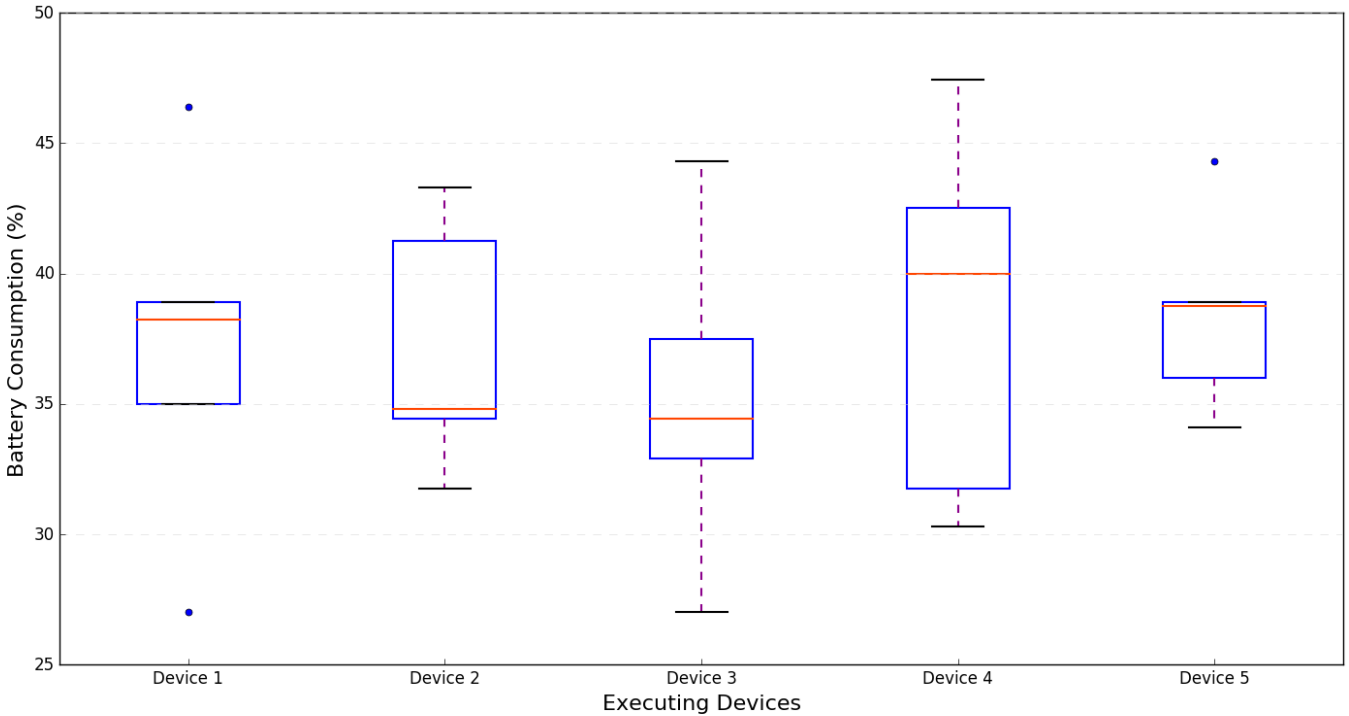

Complex Event Processing Engine Services
Action
Action
Notification Service
Incoming Handler
Outgoing Handler
Receive Queue
Send Queue
Message
Communication Layer

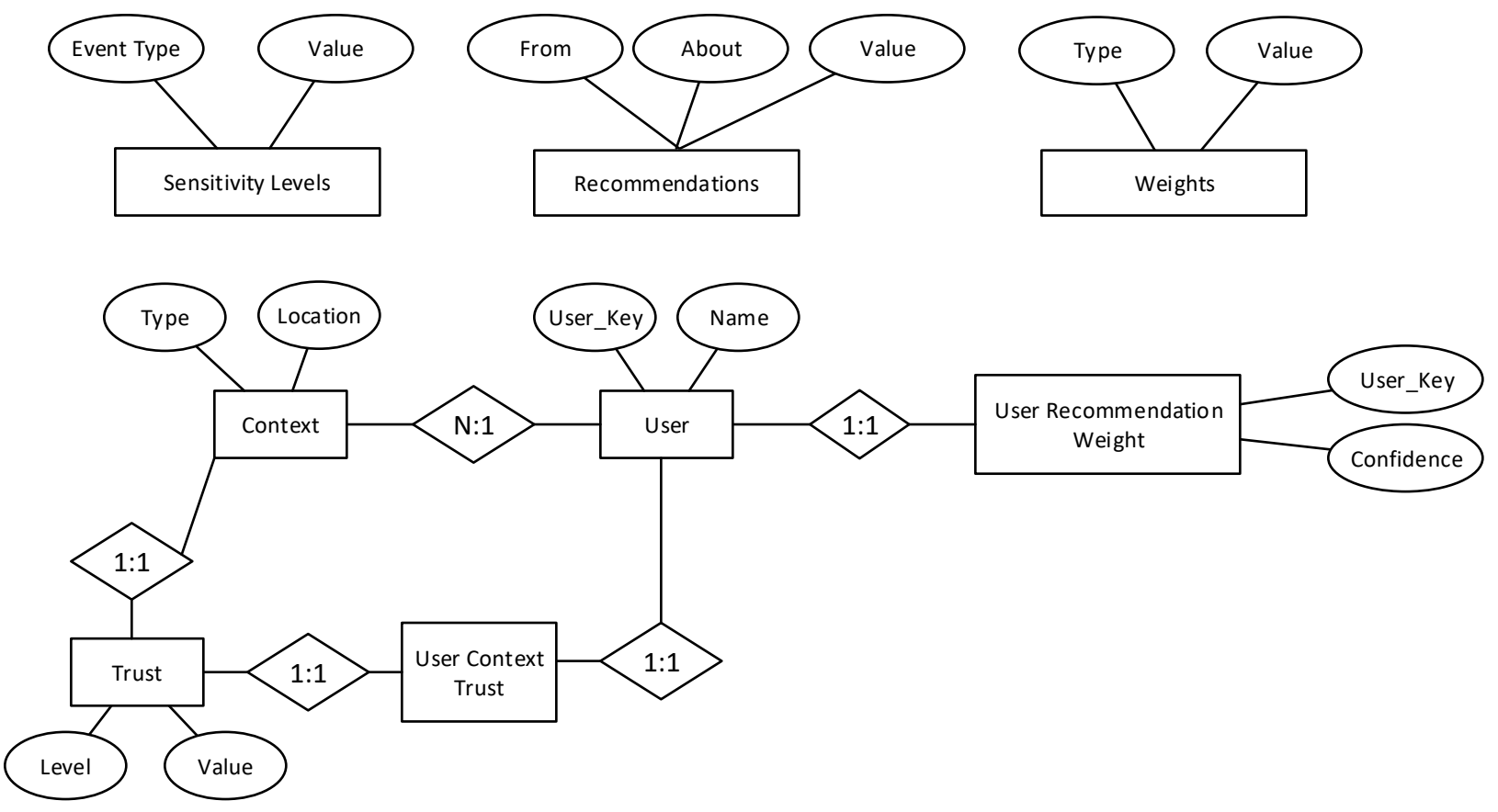

Device 1
Device 3
Atomic GPS
Derive GPS
Device 5
Device 2
Atomic Audio
GPS+ACC
Calendar
Initiator
Derive Audio
Initiator
GPS+ACC +Audio
GPS+ACC +Audio +CAL
Publish
Start
Atomic Accelero-meter
Derive Accelero-meter
Device 4
Initiator
Device 2
Device 4

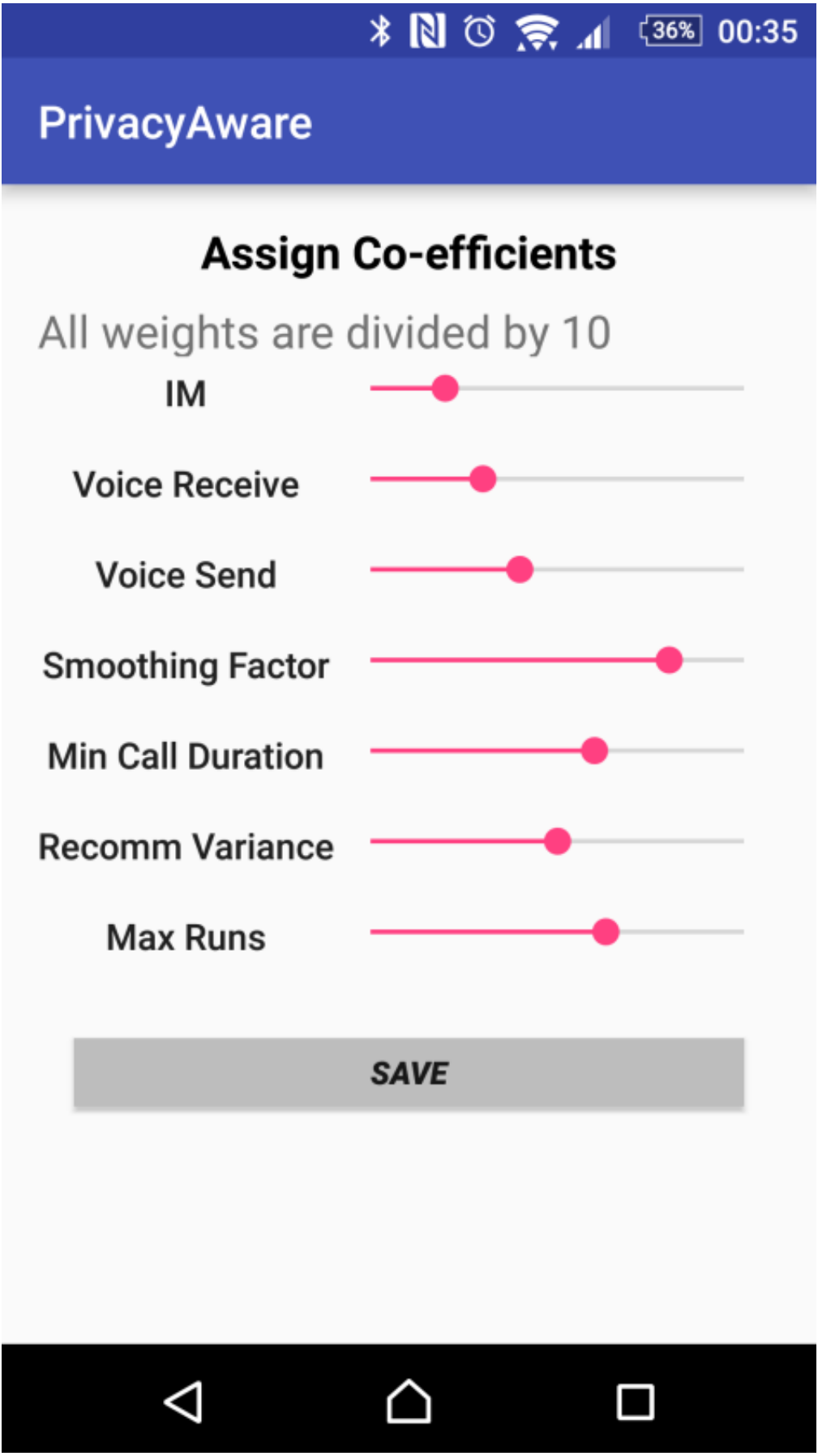

Start
Main Controller
entry / Initialize
do / Invoke Communication Service
do / Invoke Scheduler Service
do / Invoke Collaboration Service
do / Invoke Operator Installation Service
do / Invoke Operators
do/ Invoke Trust Framework
do / Manage lifecycle
exit / System shutdown
Scheduler Service
entry / Fetch schedule plan
do / Schedule context recognition
exit / Shutdown service
Trust Framework
entry /
do / Manage trust model
do / Fetch interaction history
do / Calculate trust
do / Send recommendations
do / Manage recommendations
exit /
Collaboration Service
entry / Initial Operator Graph
do / Manage collaborations
exit / Final Operator Graph
Communication Service
entry / Initialize infrastructure
do / Open channel ports
do / Wait for incoming requests
do / Device discovery
do / Send & Receive messages
exit /
Operator Installation Service
entry / Final Operator Graph
do / Operator Installation
exit / Shutdown
Operator Execution
entry / Events
do / Execute Operator
do / Publish final Context
exit / Send to next device


60
50
40
30
20
10
0
Battery Consumption (%)
56
47.82
45.05
45.67
44.77
Device 1
Device 2
Device 3
Device 4
Device 5
Devices

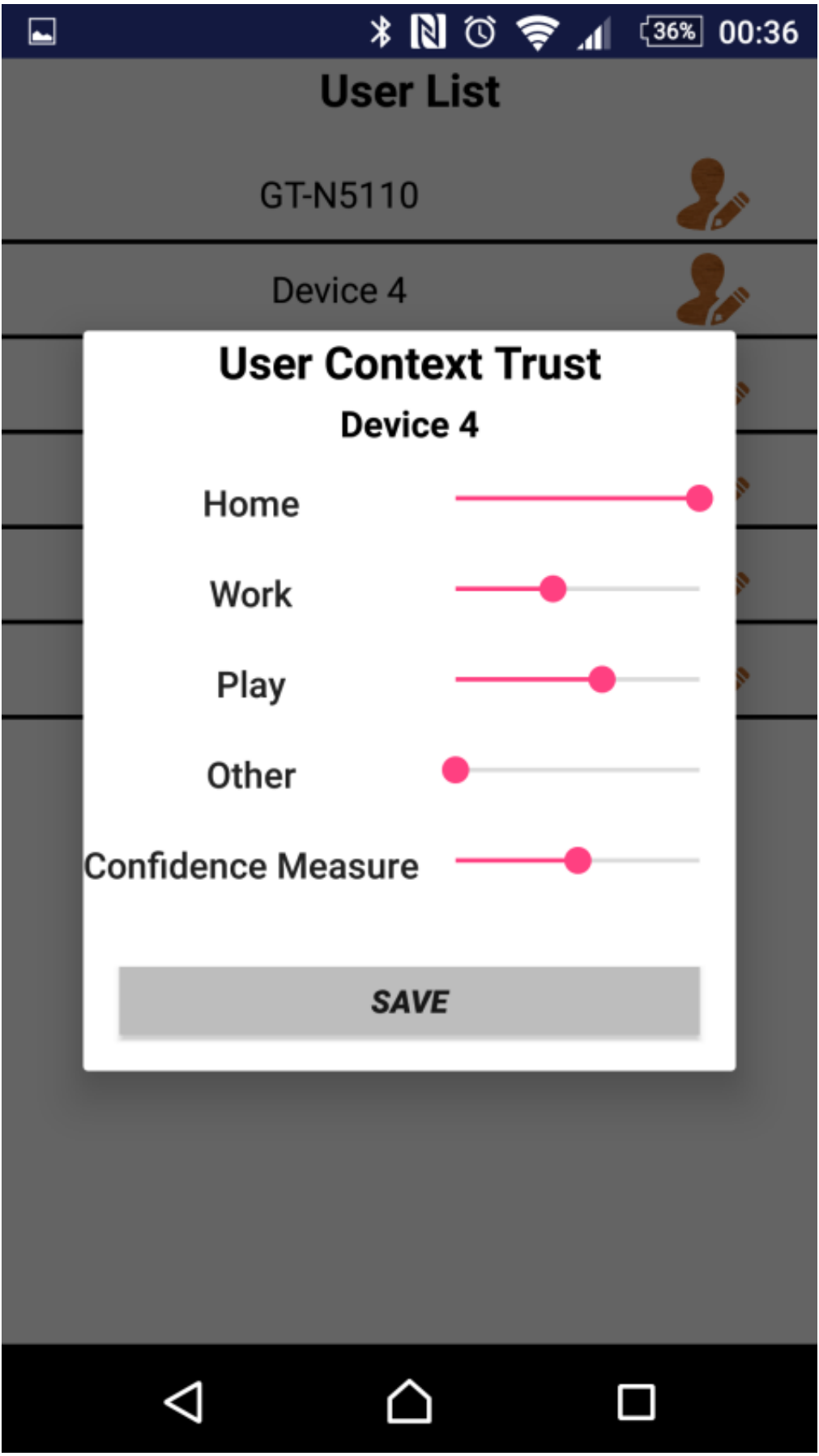

48
45
42
39
36
33
30
27
Battery Consumed (%)
Device 1
Device 2
Device 3
Device 4
Device 5
Executing Devices

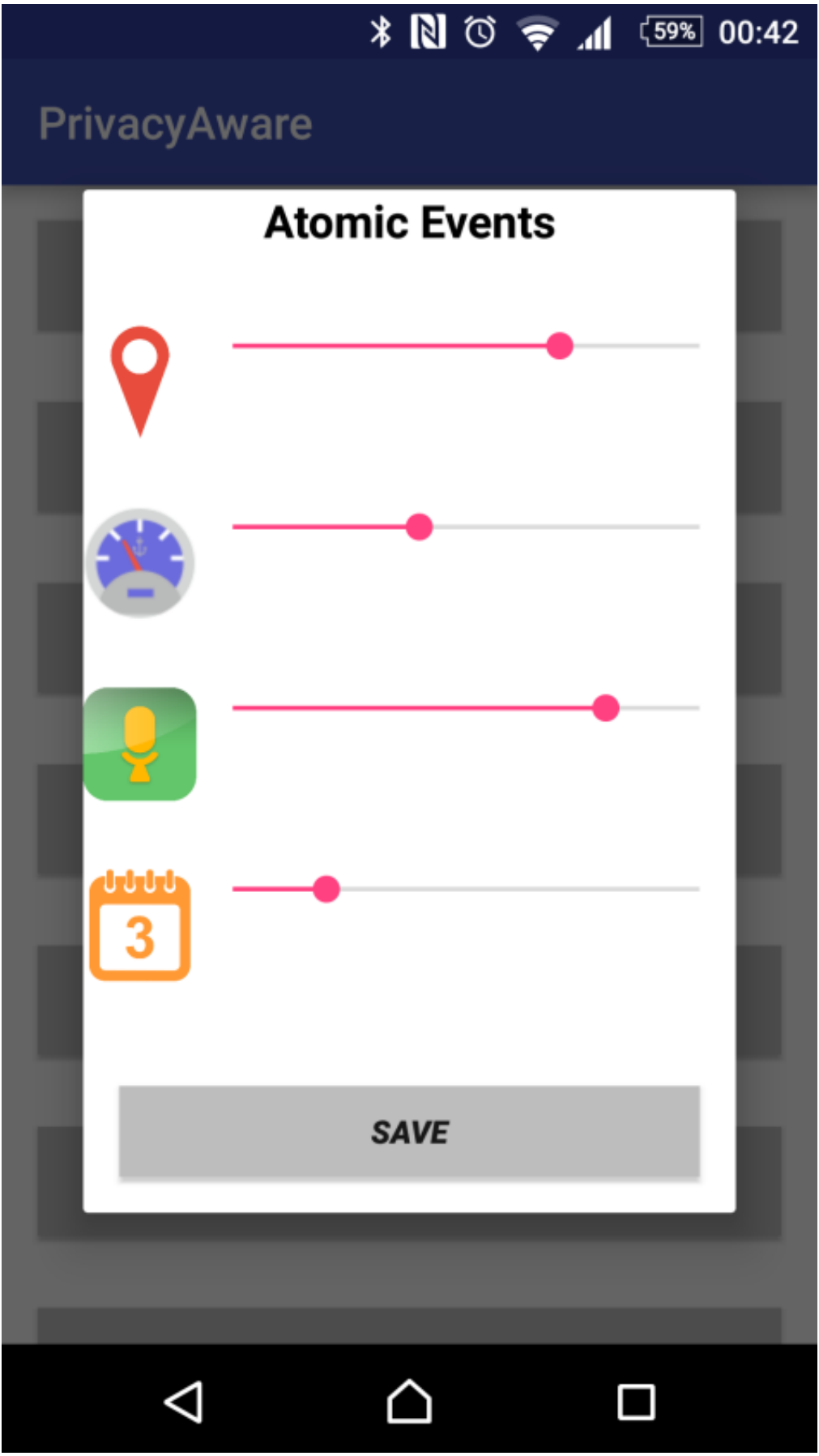

50
45
40
35
30
25
Battery Consumption (%)
Device 1
Device 2
Device 3
Device 4
Device 5
Executing Devices

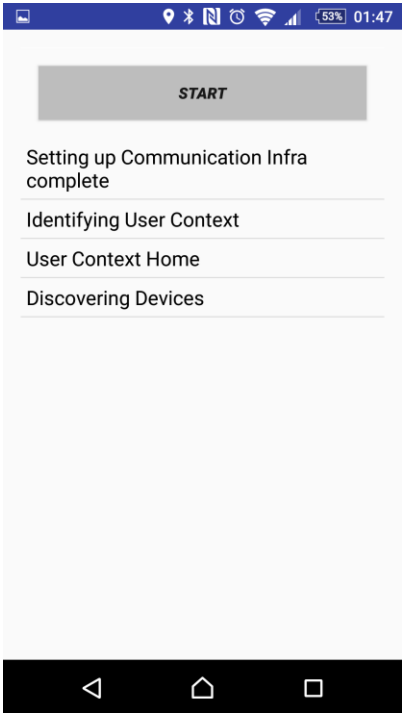

Event Type
Value
Sensitivity Levels
From
About
Value
Recommendations
Type
Value
Weights
Type
Location
Context
N:1
User_Key
Name
User
1:1
User Recommendation Weight
User_Key
Confidence
1:1
Trust
1:1
User Context Trust
1:1
Level
Value

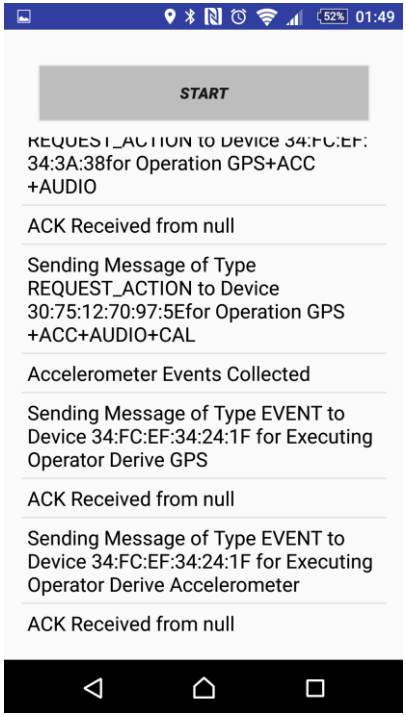

36% 00:35
PrivacyAware
Assign Co-efficients
All weights are divided by 10
IM
Voice Receive
Voice Send
Smoothing Factor
Min Call Duration
Recomm Variance
Max Runs
SAVE

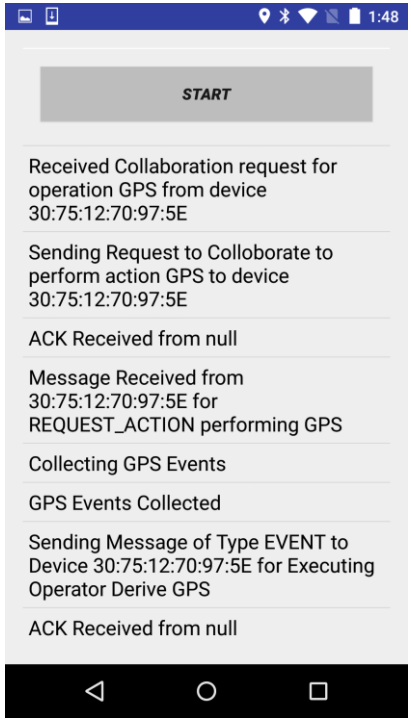
36% 00:35
PrivacyAware
Defined Contexts
Home
Location: Georgenstraße 2, 64297
Darmstadt, Germany
Type: Home
Work
Location: Rundeturmstraße 10, 64283
Darmstadt, Germany
Type: Work
ADD

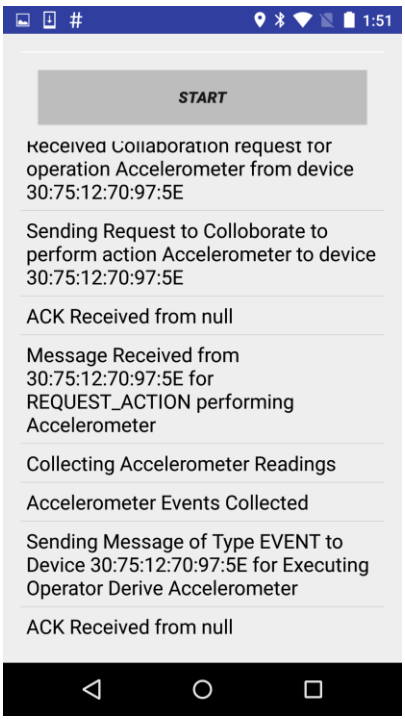

36% 00:36
User List
GT-N5110
Device 4
User Context Trust
Device 4
Home
Work
Play
Other
Confidence Measure
SAVE

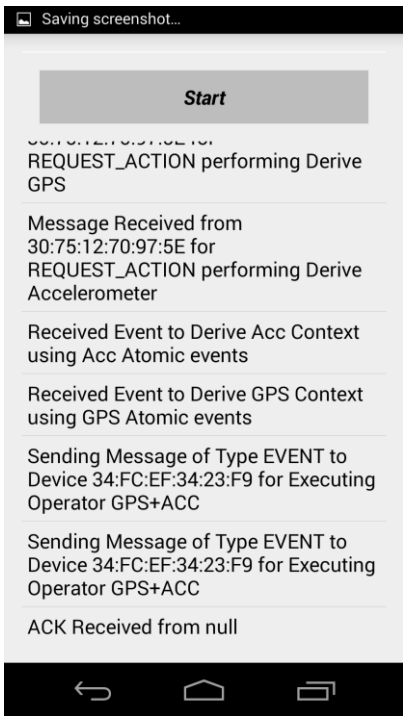

59%
00:42
PrivacyAware
Atomic Events
3
SAVE

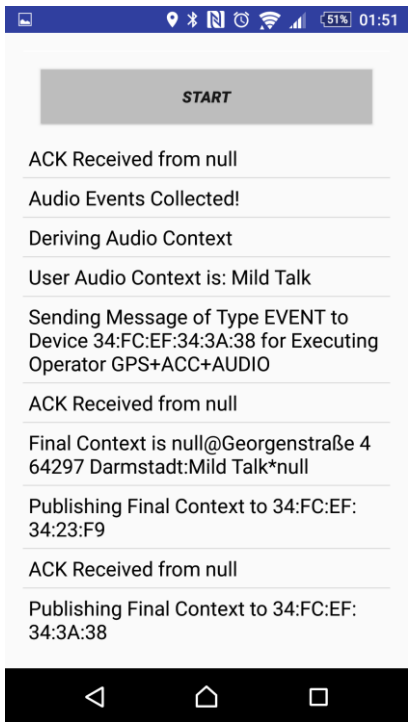

01:47
START
Setting up Communication Infra complete
Identifying User Context
User Context Home
Discovering Devices

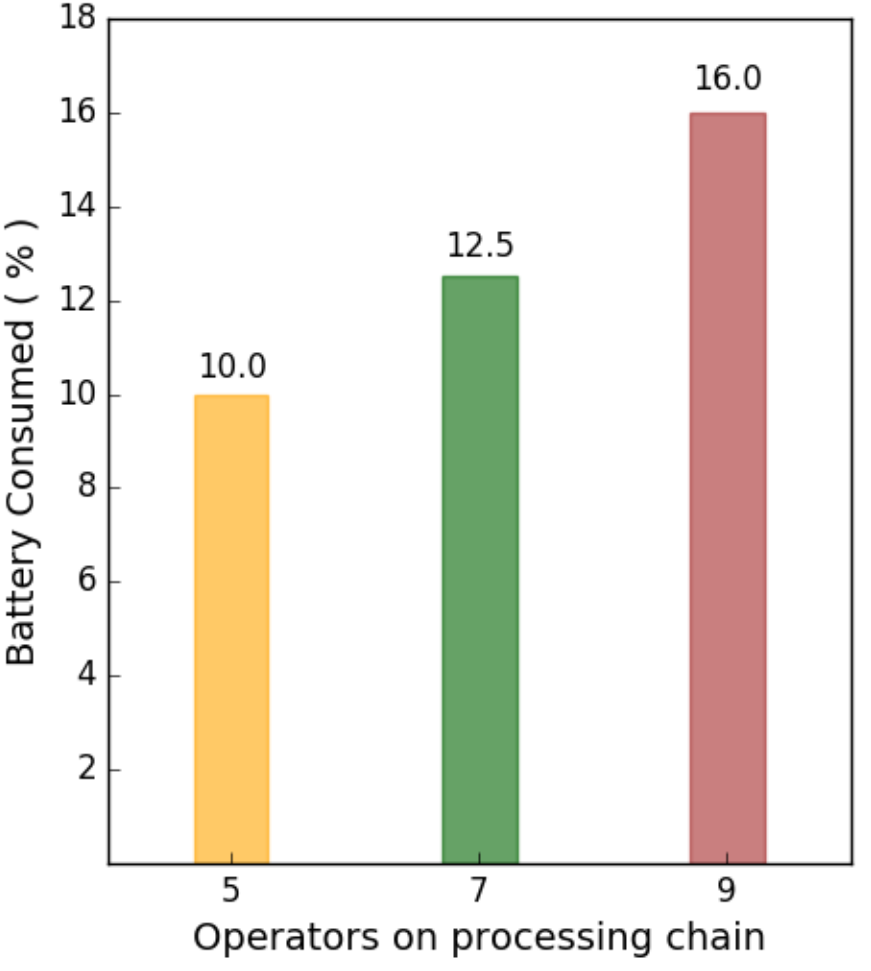

01:49
START
REQUEST_ACTION to Device 34:FC:EF:34:3A:38for Operation GPS+ACC+AUDIO
ACK Received from null
Sending Message of Type REQUEST_ACTION to Device 30:75:12:70:97:5Efor Operation GPS+ACC+AUDIO+CAL
Accelerometer Events Collected
Sending Message of Type EVENT to Device 34:FC:EF:34:24:1F for Executing Operator Derive GPS
ACK Received from null
Sending Message of Type EVENT to Device 34:FC:EF:34:24:1F for Executing Operator Derive Accelerometer
ACK Received from null

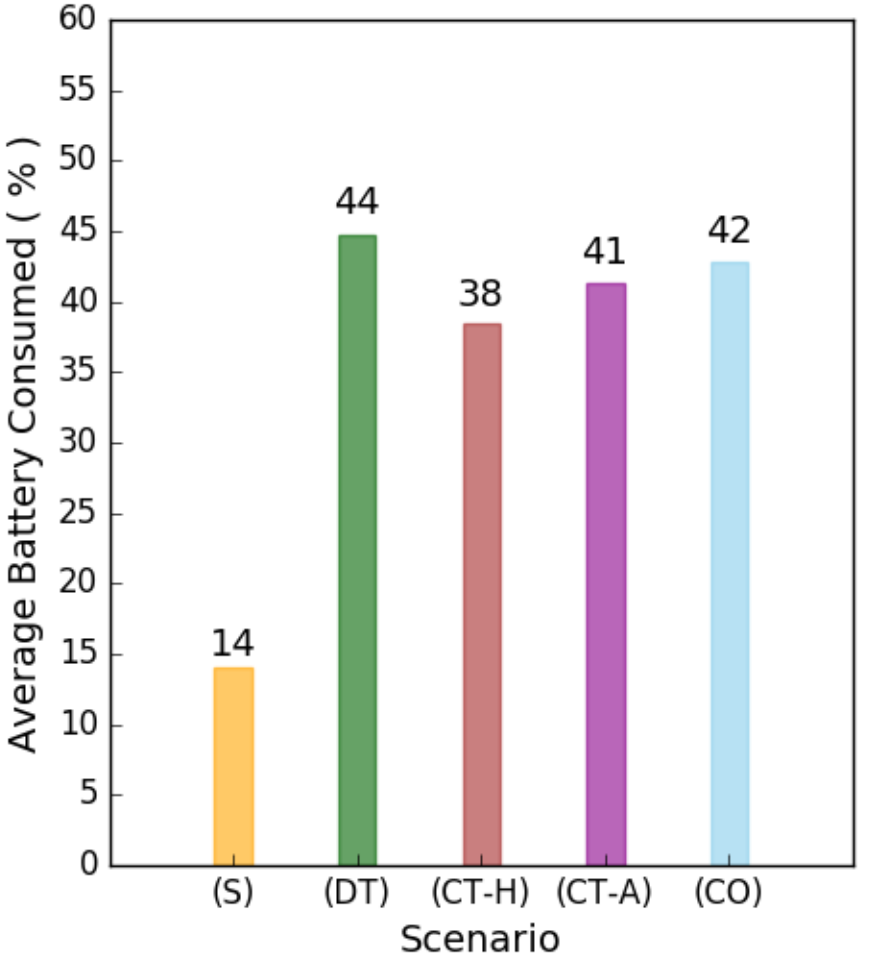

1:48
START
Received Collaboration request for operation GPS from device 30:75:12:70:97:5E
Sending Request to Colloborate to perform action GPS to device 30:75:12:70:97:5E
ACK Received from null
Message Received from 30:75:12:70:97:5E for REQUEST_ACTION performing GPS
Collecting GPS Events
GPS Events Collected
Sending Message of Type EVENT to Device 30:75:12:70:97:5E for Executing Operator Derive GPS
ACK Received from null

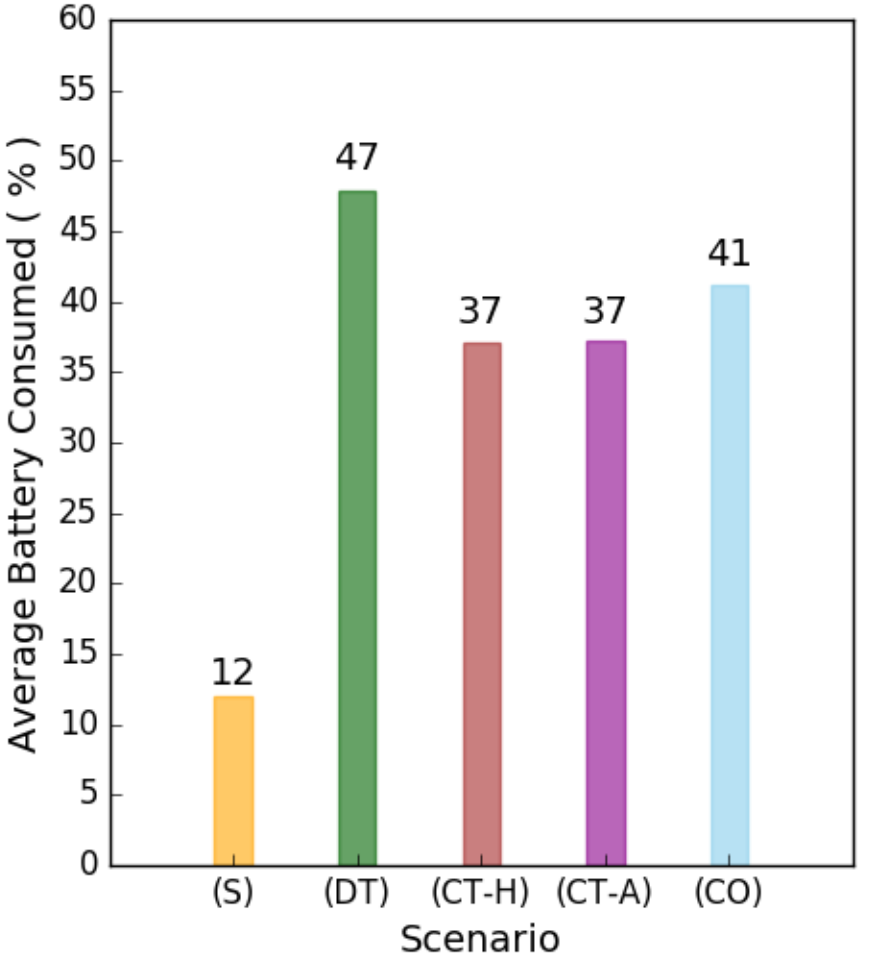

1:51
START
Received Collaboration request for operation Accelerometer from device 30:75:12:70:97:5E
Sending Request to Colloborate to perform action Accelerometer to device 30:75:12:70:97:5E
ACK Received from null
Message Received from 30:75:12:70:97:5E for REQUEST_ACTION performing Accelerometer
Collecting Accelerometer Readings
Accelerometer Events Collected
Sending Message of Type EVENT to Device 30:75:12:70:97:5E for Executing Operator Derive Accelerometer
ACK Received from null

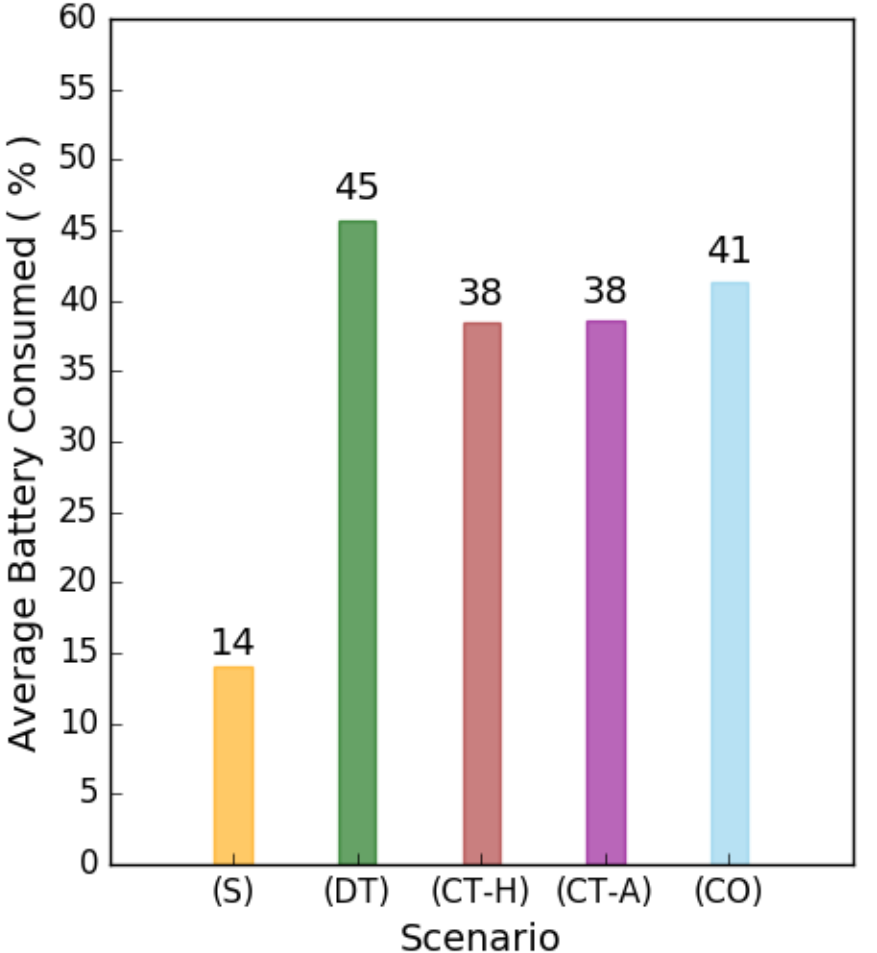

Saving screenshot...
Start
REQUEST_ACTION performing Derive GPS
Message Received from 30:75:12:70:97:5E for REQUEST_ACTION performing Derive Accelerometer
Received Event to Derive Acc Context using Acc Atomic events
Received Event to Derive GPS Context using GPS Atomic events
Sending Message of Type EVENT to Device 34:FC:EF:34:23:F9 for Executing Operator GPS+ACC
Sending Message of Type EVENT to Device 34:FC:EF:34:23:F9 for Executing Operator GPS+ACC
ACK Received from null

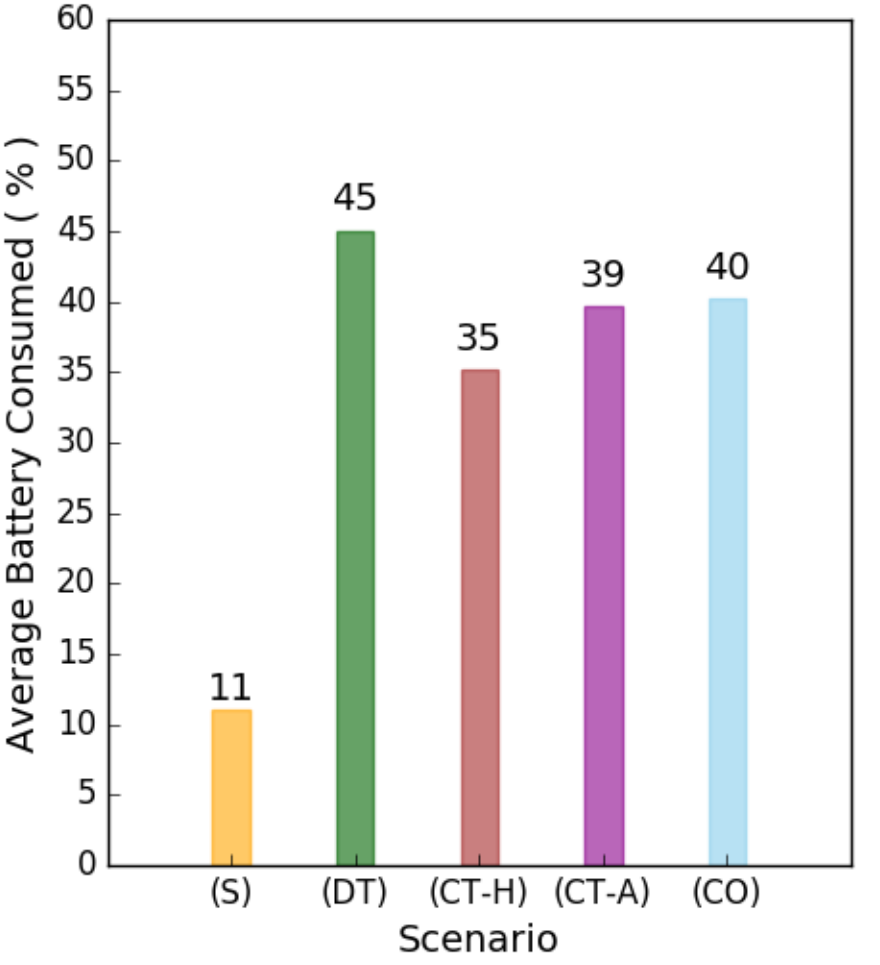

01:51
START
ACK Received from null
Audio Events Collected!
Deriving Audio Context
User Audio Context is: Mild Talk
Sending Message of Type EVENT to Device 34:FC:EF:34:3A:38 for Executing Operator GPS+ACC+AUDIO
ACK Received from null
Final Context is null@Georgenstraße 4 64297 Darmstadt:Mild Talk*null
Publishing Final Context to 34:FC:EF:34:23:F9
ACK Received from null
Publishing Final Context to 34:FC:EF:34:3A:38

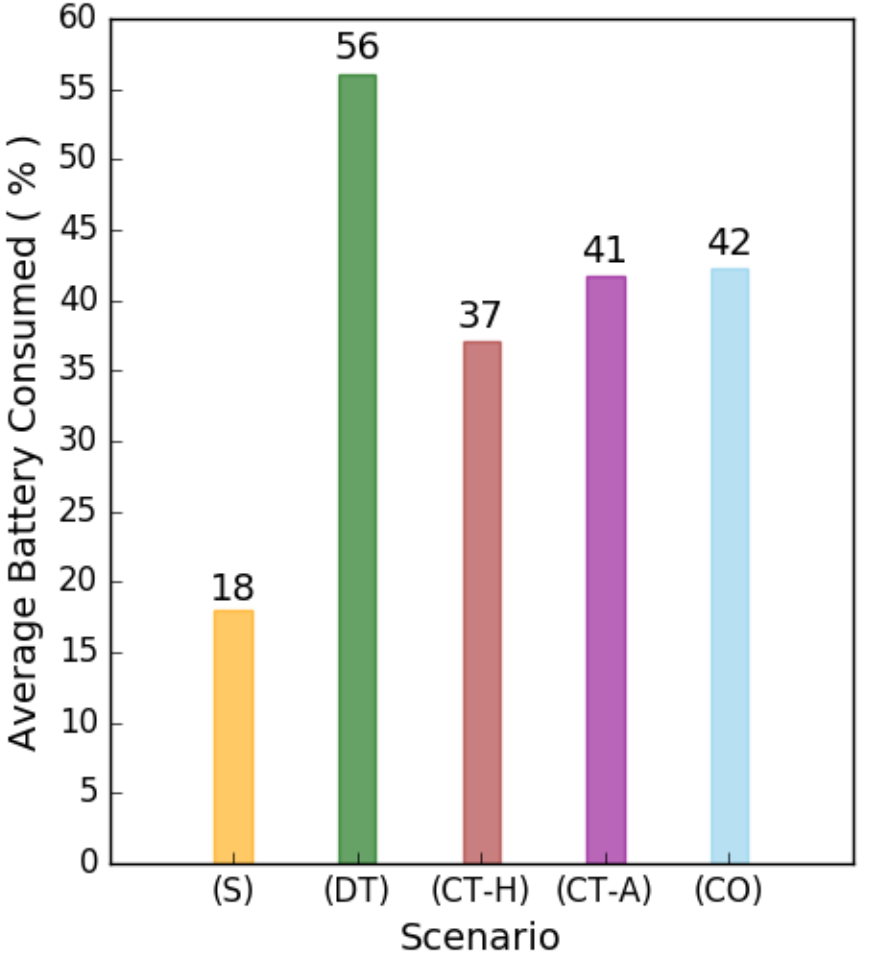

18
16
14
12
10
8
6
4
2
Battery Consumed (%)
10.0
12.5
16.0
5
7
9
Operators on processing chain

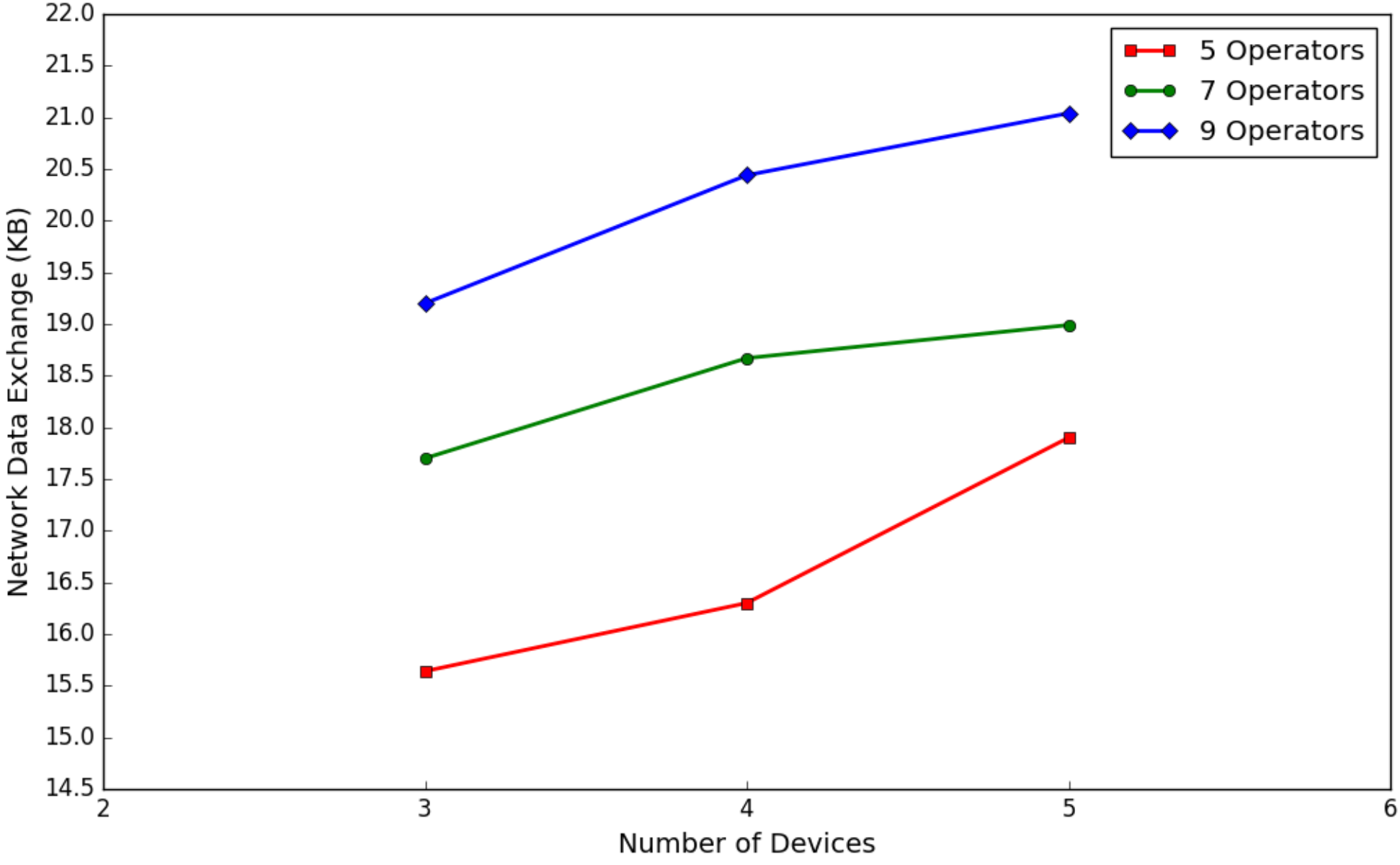

Average Battery Consumed (%)
60
55
50
45
40
35
30
25
20
15
10
5
0
14
44
38
41
42
(S)
(DT)
(CT-H)
(CT-A)
(CO)
Scenario

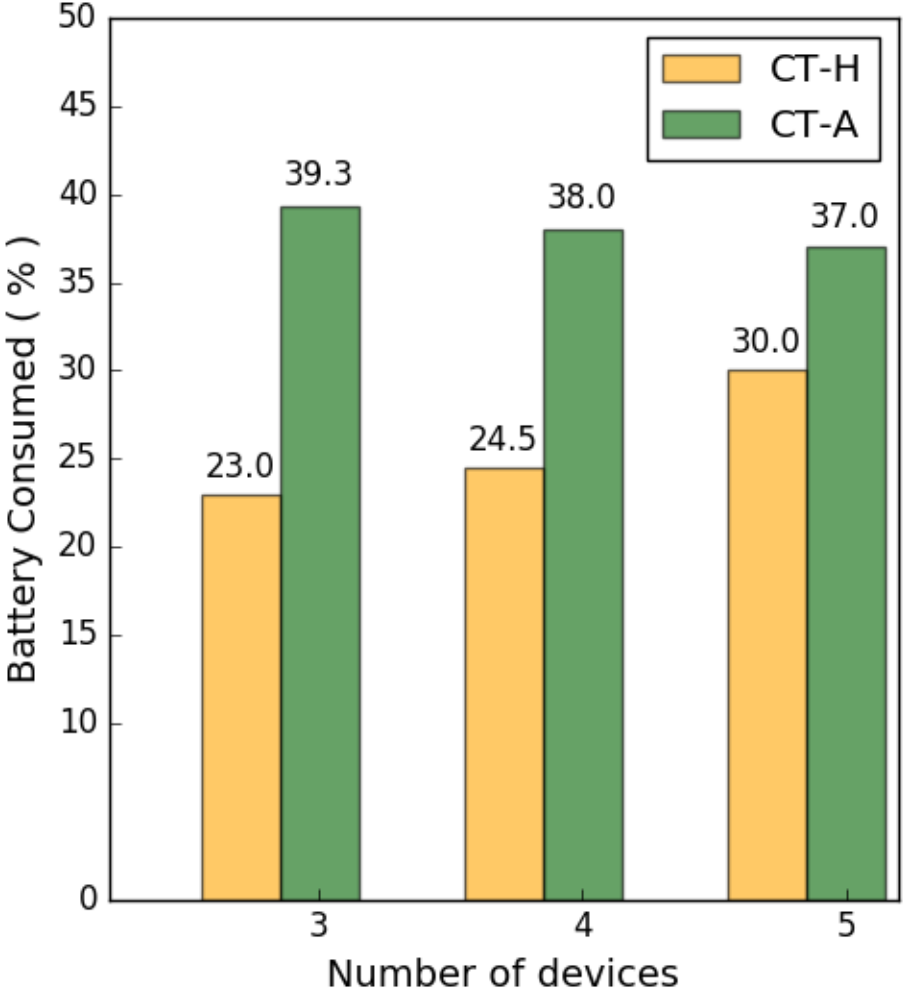

Average Battery Consumed (%)
60
55
50
45
40
35
30
25
20
15
10
5
0
12
47
37
37
41
(S)
(DT)
(CT-H)
(CT-A)
(CO)
Scenario


Average Battery Consumed (%)
60
55
50
45
40
35
30
25
20
15
10
5
0
14
45
38
38
41
(S)
(DT)
(CT-H)
(CT-A)
(CO)
Scenario


Average Battery Consumed (%)
60
55
50
45
40
35
30
25
20
15
10
5
0
11
45
35
39
40
(S)
(DT)
(CT-H)
(CT-A)
(CO)
Scenario


Average Battery Consumed (%)
60
55
50
45
40
35
30
25
20
15
10
5
0
18
56
37
41
42
(S)
(DT)
(CT-H)
(CT-A)
(CO)
Scenario


22.0
21.5
21.0
20.5
20.0
19.5
19.0
18.5
18.0
17.5
17.0
16.5
16.0
15.5
15.0
14.5
Network Data Exchange (KB)
2
3
4
5
6
Number of Devices
5 Operators
7 Operators
9 Operators


50
45
40
35
30
25
20
15
10
0
Battery Consumed (%)
CT-H
CT-A
39.3
38.0
37.0
30.0
24.5
23.0
3
4
5
Number of devices