US008069202B1

(12) **United States Patent**
Cona et al.

(10) **Patent No.: US 8,069,202 B1**
(45) **Date of Patent: *Nov. 29, 2011**

(54) **CREATING A PROJECTION OF A SITUATIONAL NETWORK**

(75) Inventors: **Thomas Cona**, Athens, GA (US); **Patrick T. Igoe**, Philadelphia, PA (US); **Leonid Kravets**, Philadelphia, PA (US); **Edward A. Ehrlacher**, Philadelphia, PA (US)

(73) Assignee: **Resource Consortium Limited** (VG)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 700 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **11/924,711**

(22) Filed: **Oct. 26, 2007**
(Under 37 CFR 1.47)

Related U.S. Application Data

(60) Provisional application No. 60/887,843, filed on Feb. 2, 2007.

(51) **Int. Cl.**
G06F 15/16 (2006.01)

(52) **U.S. Cl.** **709/200**; 345/419; 340/8.1; 340/988

(58) **Field of Classification Search** 709/203, 709/206, 223; 370/338; 455/456; 705/2; 700/9; 701/202, 210; 707/102
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,835,907	A	11/1998	Newman	
6,091,956	A	7/2000	Hollenberg	
6,112,074	A	8/2000	Pinder	
6,424,840	B1	7/2002	Fitch	
6,563,910	B2	5/2003	Menard et al.	
6,600,928	B1	7/2003	Ahya et al.	
6,785,681	B2	8/2004	Keskar et al.	
6,788,766	B2	9/2004	Logan	
7,058,385	B2	6/2006	Lauper	
7,091,829	B2	8/2006	Lee	
7,177,398	B2	2/2007	Meer et al.	
7,181,346	B1	2/2007	Kleist et al.	
7,233,974	B2	6/2007	Kawahara et al.	
7,239,871	B2	7/2007	Shamp et al.	
7,266,558	B2 *	9/2007	Gray	455/456.1
7,283,045	B1 *	10/2007	Manz	340/506
7,523,191	B1	4/2009	Thomas et al.	
7,672,281	B1 *	3/2010	Humphries et al.	370/338
7,711,475	B1 *	5/2010	Cona et al.	701/202
2001/0009857	A1	7/2001	Vanttinen	
2002/0107029	A1 *	8/2002	Caughran et al.	455/456

(Continued)

OTHER PUBLICATIONS

Sydell, Laura, "What are you doing? Twitter Offers a Megaphone", May 21, 2007, http://www.npr.org/templates/story, 1 pg.

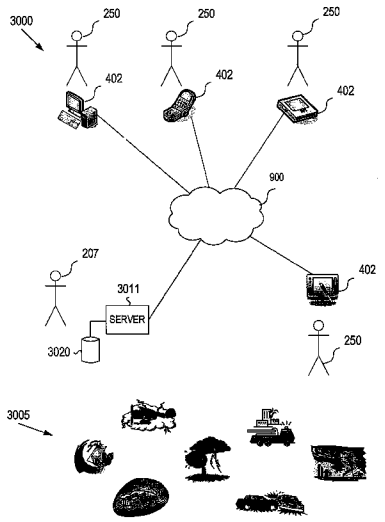
(Continued)

Primary Examiner — Dustin Nguyen
(74) *Attorney, Agent, or Firm* — Carlineo, Spicer & Kee, LLC

(57) **ABSTRACT**

A method of creating a projection of a situational network includes creating, by an event node server, an event node in a multi-dimensional personal information network, where the event node corresponds to a situation. A projection of nodes of the situational network is formed using geographic locations of a plurality of devices corresponding to nodes in the multi-dimensional personal information network. An invitation is transmitted to establish a link with the event node server to the devices corresponding to each node in the projection. A response is received from at least one of the devices accepting the invitation to establish a link with the event node server. A link with each device accepting the invitation is established.

18 Claims, 45 Drawing Sheets



U.S. PATENT DOCUMENTS

2002/0161838	A1	10/2002	Pickover et al.	
2002/0181684	A1	12/2002	Logan	
2003/0148774	A1	8/2003	Naghian et al.	
2003/0197615	A1	10/2003	Loche et al.	
2004/0039807	A1	2/2004	Boveda De Miguel et al.	
2005/0033511	A1 *	2/2005	Pechatnikov et al.	701/210
2005/0096840	A1 *	5/2005	Simske	701/202
2005/0132016	A1	6/2005	Boone	
2005/0135428	A1	6/2005	Hellgren	
2006/0211404	A1	9/2006	Cromp et al.	
2007/0021981	A1 *	1/2007	Cox	705/2
2007/0161382	A1	7/2007	Melinger et al.	
2007/0192116	A1	8/2007	Lovitt	
2007/0209054	A1	9/2007	Cassanova	
2007/0255785	A1	11/2007	Hayashi et al.	
2008/0046511	A1	2/2008	Skrenta	
2008/0086219	A1 *	4/2008	Evans et al.	700/9
2008/0139218	A1	6/2008	Duan	
2009/0015467	A1	1/2009	Kwon et al.	
2009/0024726	A1	1/2009	Jeon et al.	
2009/0030927	A1 *	1/2009	Cases et al.	707/102
2009/0213001	A1	8/2009	Appelman et al.	
2009/0254944	A1	10/2009	Watson et al.	

OTHER PUBLICATIONS

Web Pages, Send Word Now; http://www.sendwordnow.com, Jul. 19, 2007, 11 pgs.

Schneiderman, Ben, Preece, Jennifer; "911.gov", Feb. 16, 2007, Science Magazine, vol. 315, p. 944, www.sciencemag.org, 1 pg.

"Notify!/Severe Weather Alerts" Web Pages; www.weather.com, Jul. 12, 2007, 5 pgs.

Biever, Celeste; "My Space-style websites, perfect for disaster survival", NewScientistTech.com, Feb. 15, 2007, 2 pgs.

Jackson, Joab, "Disaster Prediction Social Networking Boosted by Geo-Data Feeds", http://news.nationalgeographic.com; Oct. 19, 2006, 5 pgs.

Kim, Ryan, "Hey Baby, want a date?", www.sfgate.com, Jul. 23, 2005, 3 pgs.

"Social Networking, What you need to know", INConnect Spring, 2007, www.ena.com, 8 pgs.

Hales, David, et al, "Friends for Free: Self Organizing Artificial Social Networks for Trust and Cooperation", University of Bologna, Italy, Aug. 2005, 20 pgs.

Dane County Department of Emergency Management Warning System, Oct. 23, 2006, www.countyofDane.com, 10 pgs.

Share your world with ((Echo))MyPlace and CarbonCloud, Jul. 15, 2007, www.thecarbonproject.com, 4 pgs.

Harrison, Jeff, "Location Based Social Networking for Crisis Management", 2006, www.thecarbonproject.com, 24 pgs.

Press Release, "WeatherBug and SendWordNow Launch Smart Notification, Weather Service to Deliver Nation's First Location Based, 2-way Mobile Weather Alerts and Notifications Based on Live WeatherBug Network Data", Jun. 12, 2006, www.aws.com, 6 pgs.

Phillips, Brenda D. Ph.D, et al, "Social Science Research Needs: A Focus on Vulnerable Populations, Forecasting and Warnings", Feb. 2006, Hurricane Forecast Socio-economic Workshop, Pomona, CA, 11 pgs.

* cited by examiner

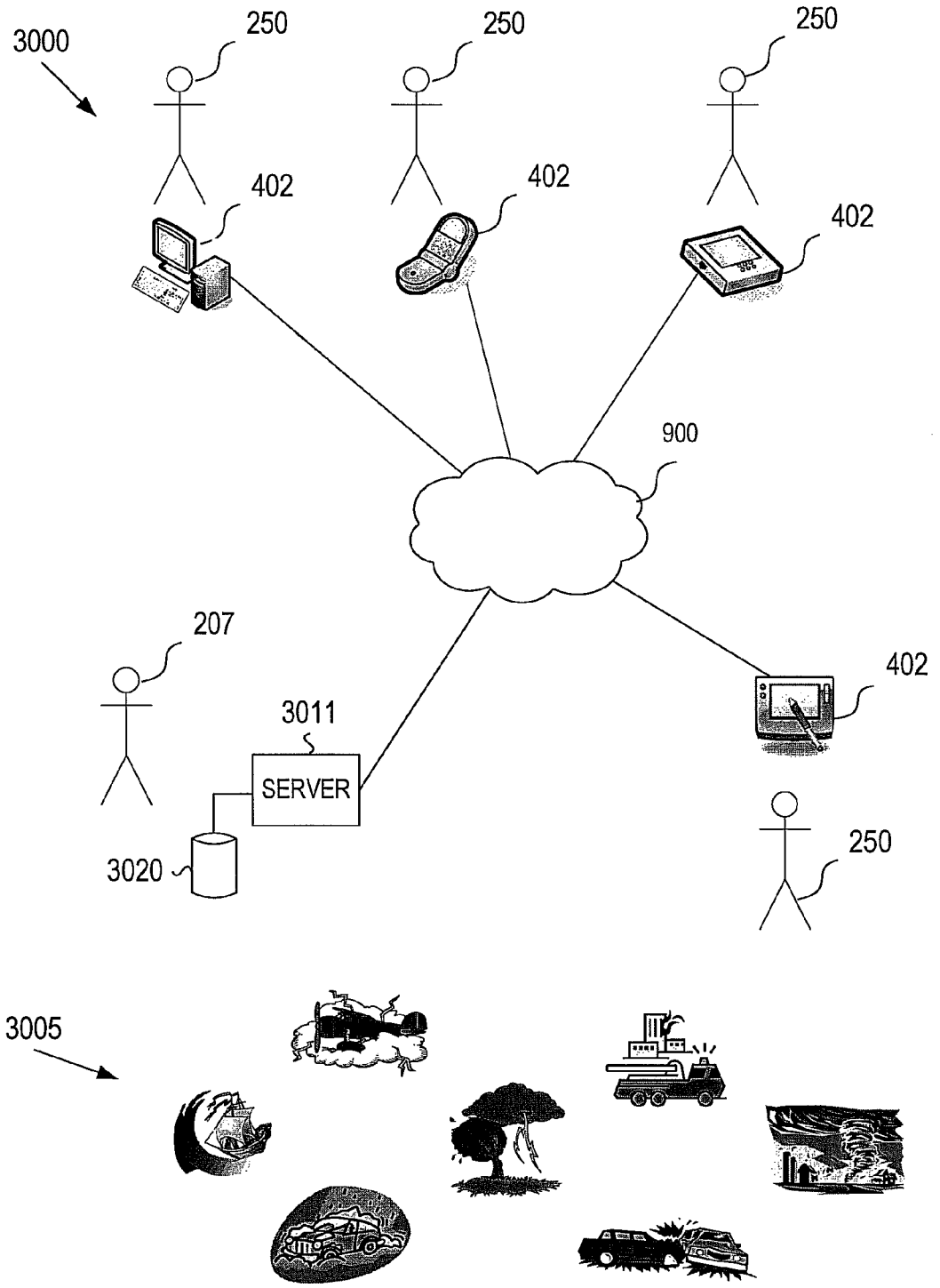

3000
250
250
250
402
402
402
900
207
402
3011
SERVER
3020
250
3005

Fig. 1

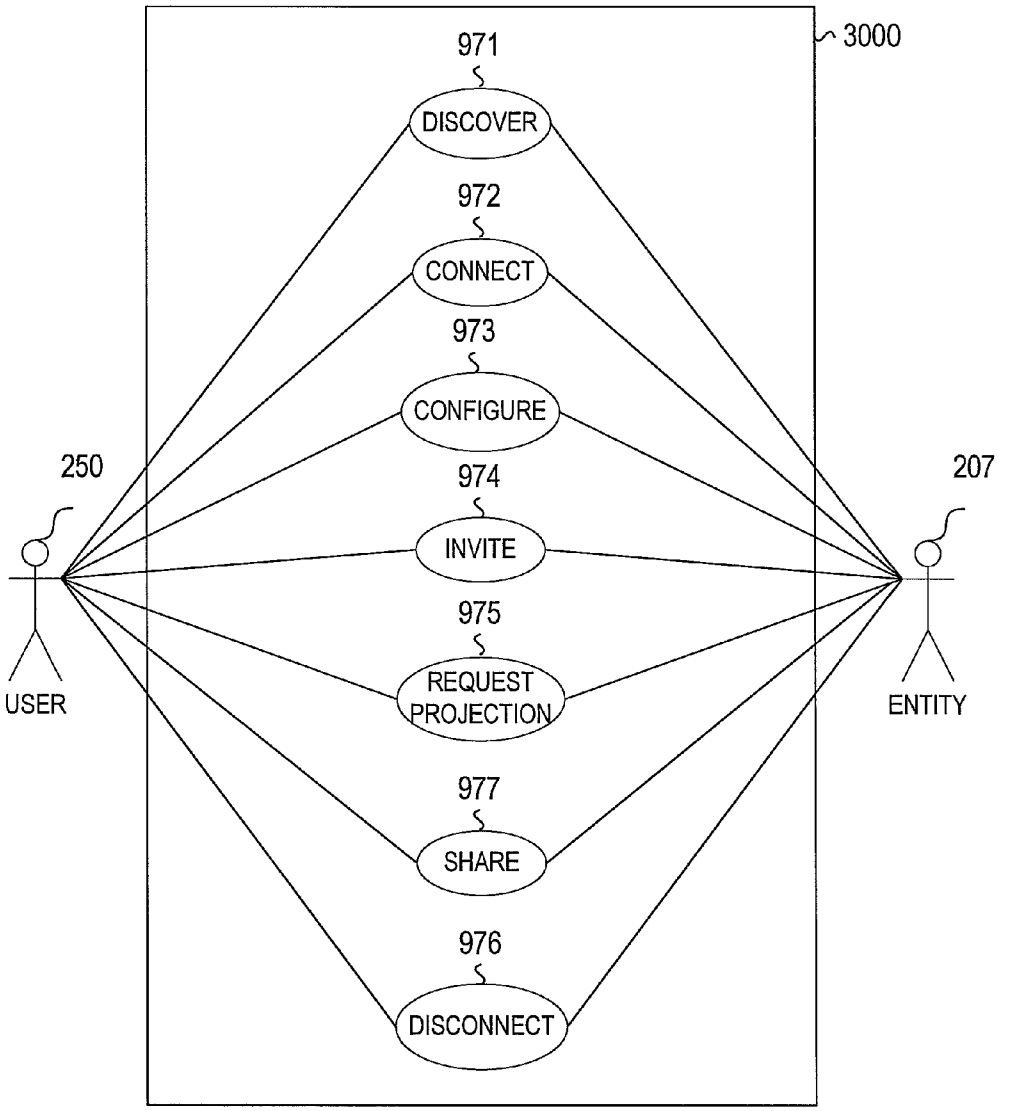

3000
971
DISCOVER
972
CONNECT
973
CONFIGURE
974
INVITE
975
REQUEST PROJECTION
977
SHARE
976
DISCONNECT
250
USER
207
ENTITY

Fig. 2

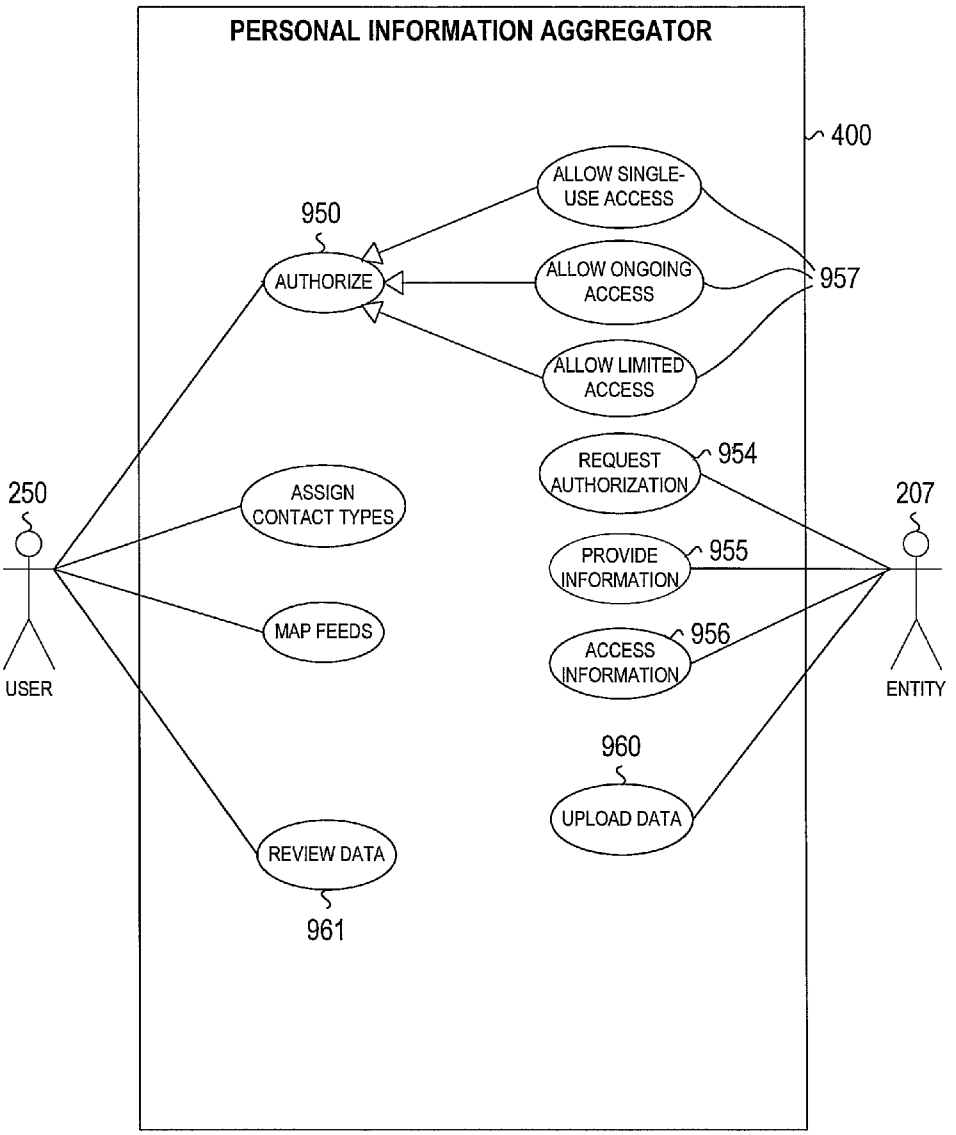

PERSONAL INFORMATION AGGREGATOR
400
ALLOW SINGLE-USE ACCESS
950
AUTHORIZE
ALLOW ONGOING ACCESS
957
ALLOW LIMITED ACCESS
REQUEST AUTHORIZATION
954
250
ASSIGN CONTACT TYPES
207
PROVIDE INFORMATION
955
MAP FEEDS
ACCESS INFORMATION
956
USER
ENTITY
960
UPLOAD DATA
REVIEW DATA
961

Fig. 3

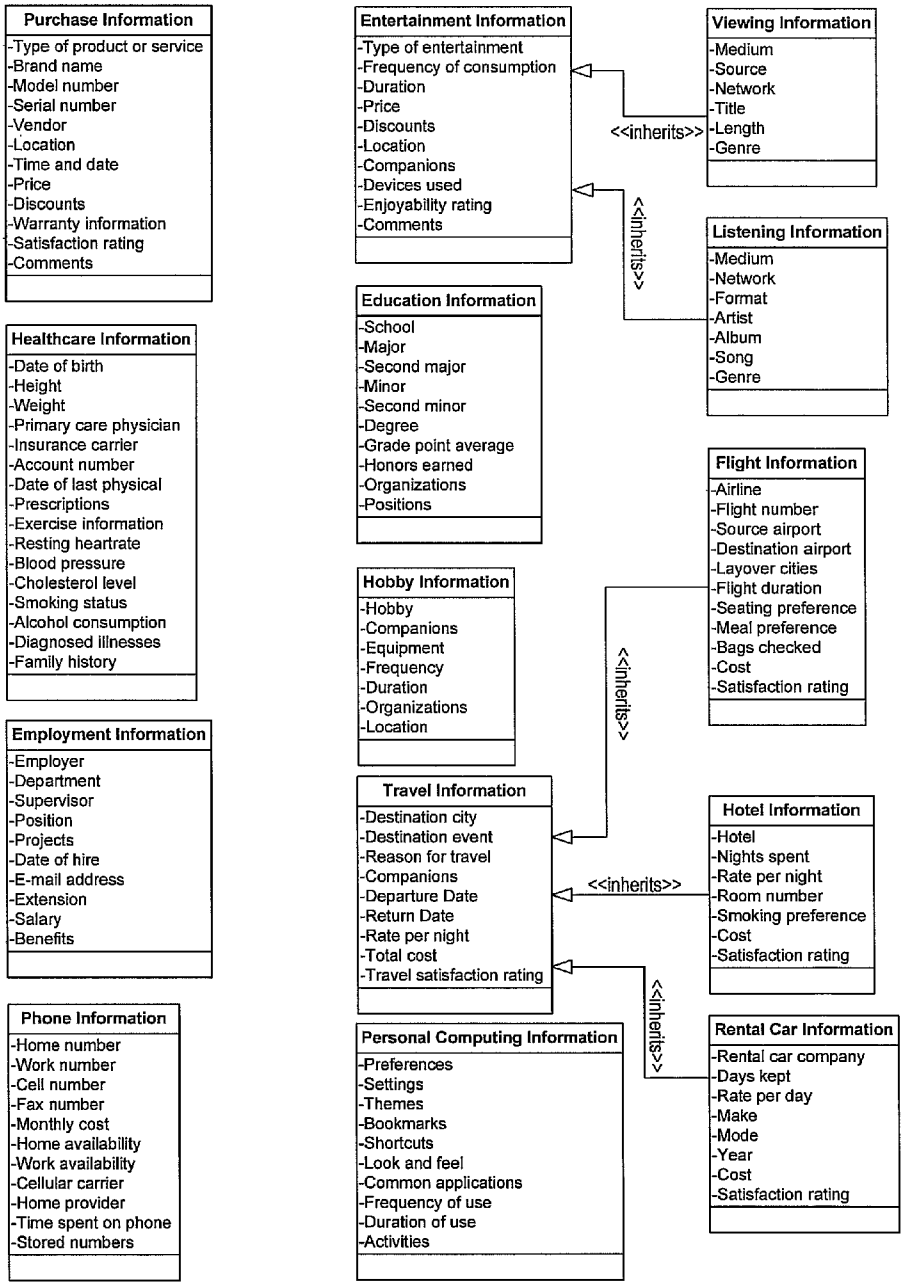

Purchase Information
-Type of product or service
-Brand name
-Model number
-Serial number
-Vendor
-Location
-Time and date
-Price
-Discounts
-Warranty information
-Satisfaction rating
-Comments
Healthcare Information
-Date of birth
-Height
-Weight
-Primary care physician
-Insurance carrier
-Account number
-Date of last physical
-Prescriptions
-Exercise information
-Resting heartrate
-Blood pressure
-Cholesterol level
-Smoking status
-Alcohol consumption
-Diagnosed illnesses
-Family history
Employment Information
-Employer
-Department
-Supervisor
-Position
-Projects
-Date of hire
-E-mail address
-Extension
-Salary
-Benefits
Phone Information
-Home number
-Work number
-Cell number
-Fax number
-Monthly cost
-Home availability
-Work availability
-Cellular carrier
-Home provider
-Time spent on phone
-Stored numbers
Entertainment Information
-Type of entertainment
-Frequency of consumption
-Duration
-Price
-Discounts
-Location
-Companions
-Devices used
-Enjoyability rating
-Comments
Viewing Information
-Medium
-Source
-Network
-Title
-Length
-Genre
<<inherits>>
<<inherits>>
Listening Information
-Medium
-Network
-Format
-Artist
-Album
-Song
-Genre
Education Information
-School
-Major
-Second major
-Minor
-Second minor
-Degree
-Grade point average
-Honors earned
-Organizations
-Positions
Flight Information
-Airline
-Flight number
-Source airport
-Destination airport
-Layover cities
-Flight duration
-Seating preference
-Meal preference
-Bags checked
-Cost
-Satisfaction rating
Hobby Information
-Hobby
-Companions
-Equipment
-Frequency
-Duration
-Organizations
-Location
<<inherits>>
Travel Information
-Destination city
-Destination event
-Reason for travel
-Companions
-Departure Date
-Return Date
-Rate per night
-Total cost
-Travel satisfaction rating
<<inherits>>
Hotel Information
-Hotel
-Nights spent
-Rate per night
-Room number
-Smoking preference
-Cost
-Satisfaction rating
<<inherits>>
Personal Computing Information
-Preferences
-Settings
-Themes
-Bookmarks
-Shortcuts
-Look and feel
-Common applications
-Frequency of use
-Duration of use
-Activities
Rental Car Information
-Rental car company
-Days kept
-Rate per day
-Make
-Mode
-Year
-Cost
-Satisfaction rating

Fig. 4

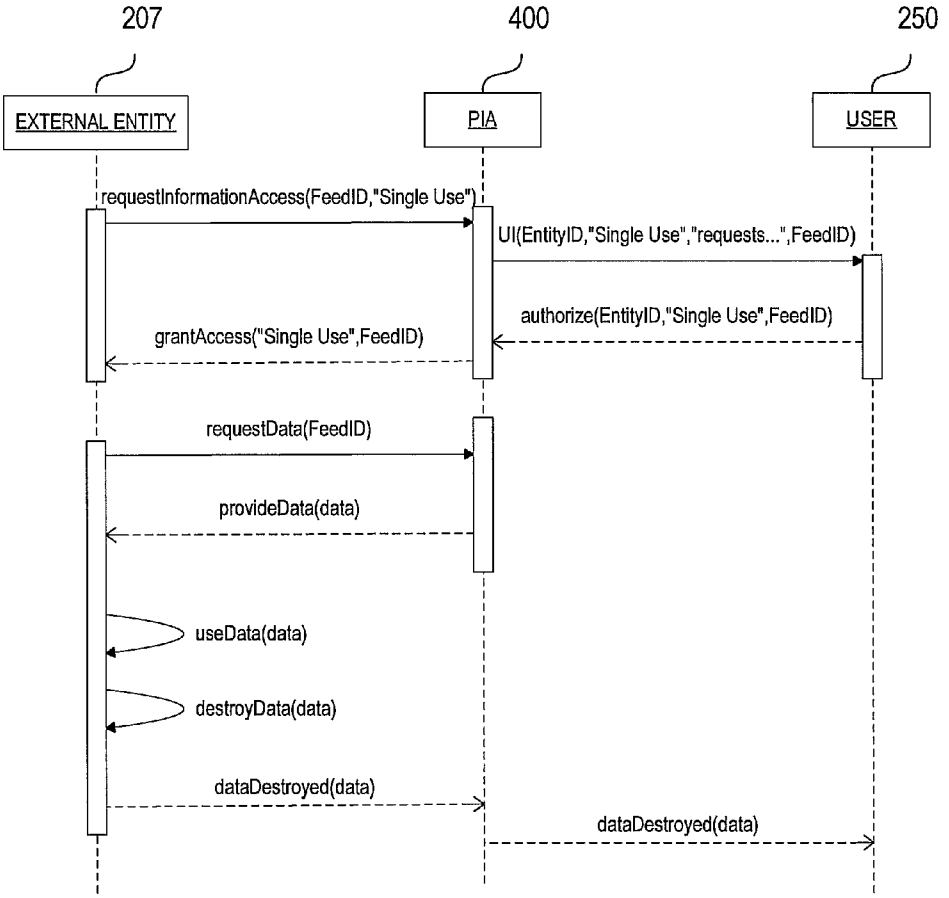

207
400
250
EXTERNAL ENTITY
PIA
USER
requestInformationAccess(FeedID,"Single Use")
UI(EntityID,"Single Use","requests...",FeedID)
authorize(EntityID,"Single Use",FeedID)
grantAccess("Single Use",FeedID)
requestData(FeedID)
provideData(data)
useData(data)
destroyData(data)
dataDestroyed(data)
dataDestroyed(data)

Fig. 5

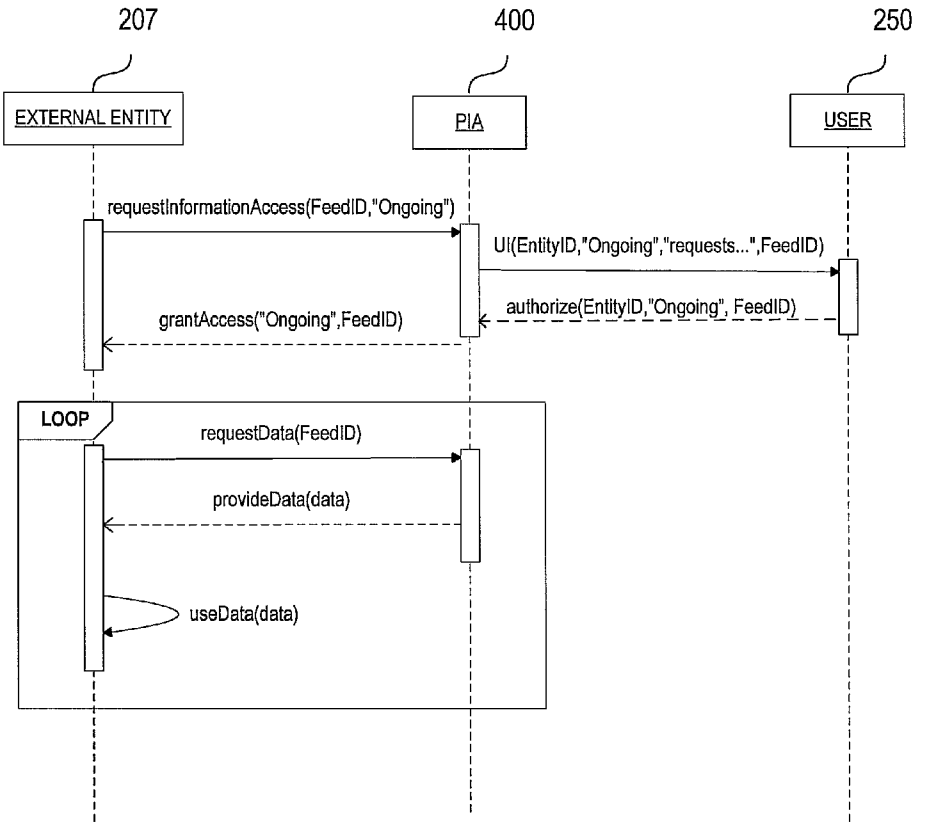

207
400
250
EXTERNAL ENTITY
PIA
USER
requestInformationAccess(FeedID,"Ongoing")
UI(EntityID,"Ongoing","requests...",FeedID)
authorize(EntityID,"Ongoing", FeedID)
grantAccess("Ongoing",FeedID)
LOOP
requestData(FeedID)
provideData(data)
useData(data)

Fig. 6

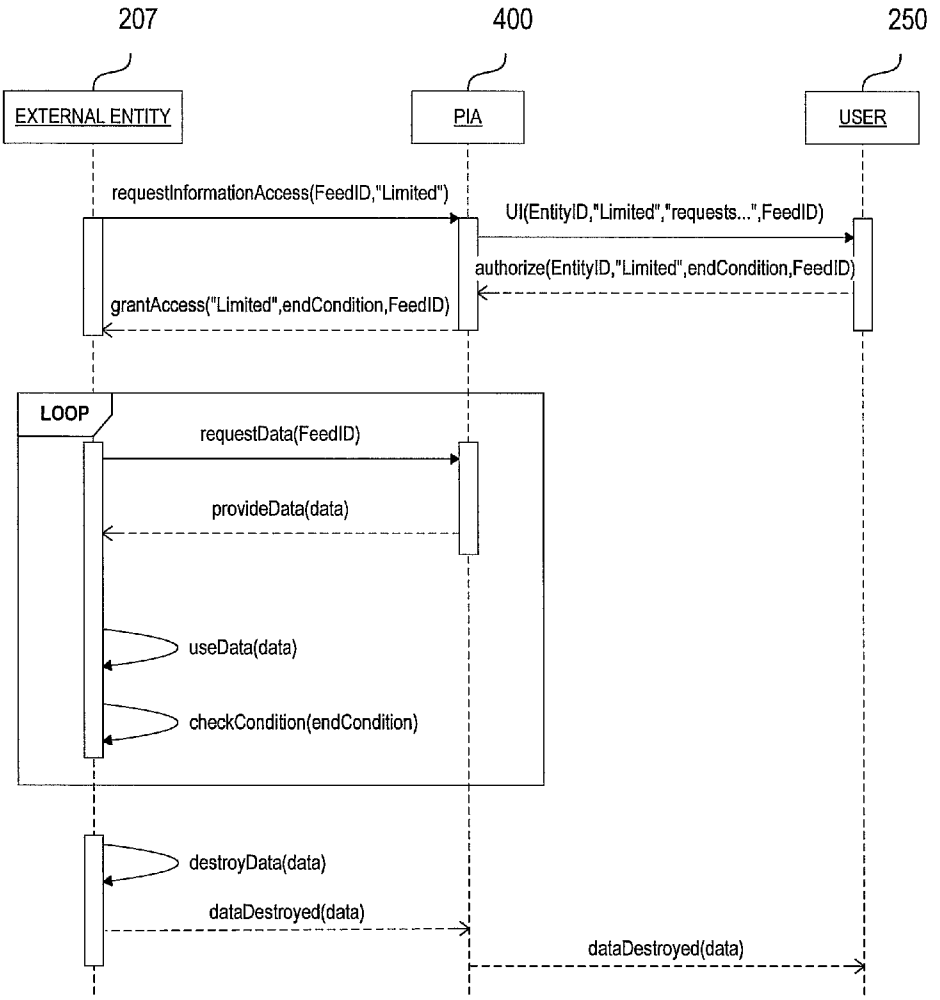

207
400
250
EXTERNAL ENTITY
PIA
USER
requestInformationAccess(FeedID,"Limited")
UI(EntityID,"Limited","requests...",FeedID)
authorize(EntityID,"Limited",endCondition,FeedID)
grantAccess("Limited",endCondition,FeedID)
LOOP
requestData(FeedID)
provideData(data)
useData(data)
checkCondition(endCondition)
destroyData(data)
dataDestroyed(data)
dataDestroyed(data)

Fig. 7

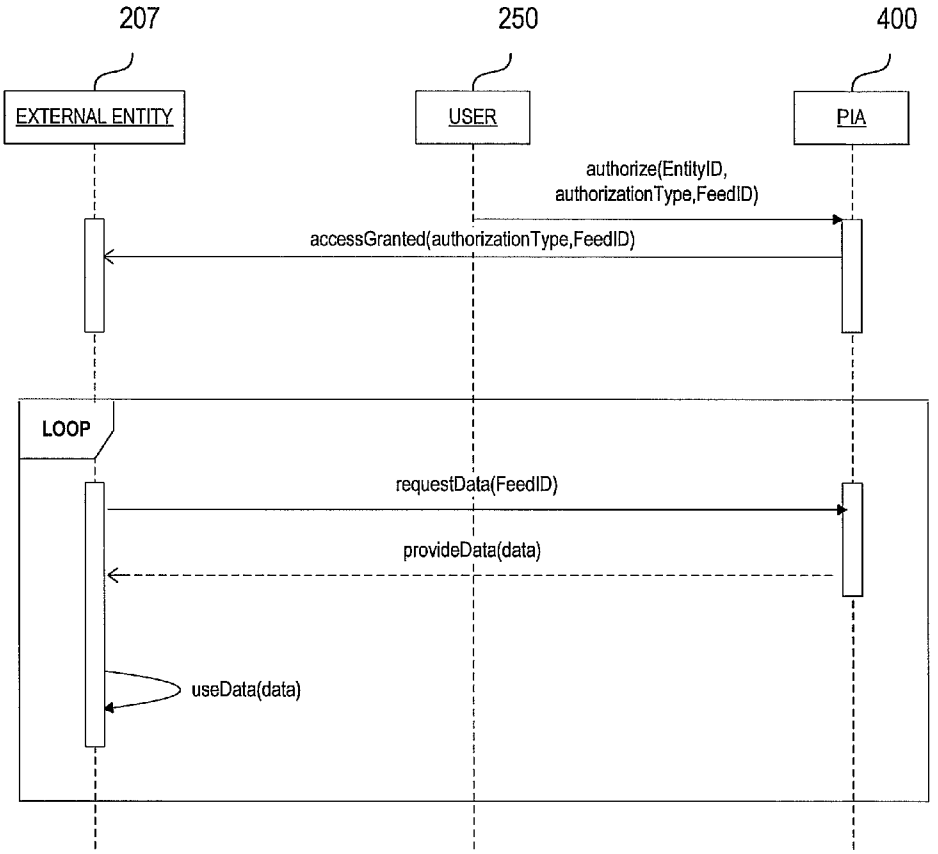

207
250
400
EXTERNAL ENTITY
USER
PIA
authorize(EntityID, authorizationType,FeedID)
accessGranted(authorizationType,FeedID)
LOOP
requestData(FeedID)
provideData(data)
useData(data)

Fig. 8

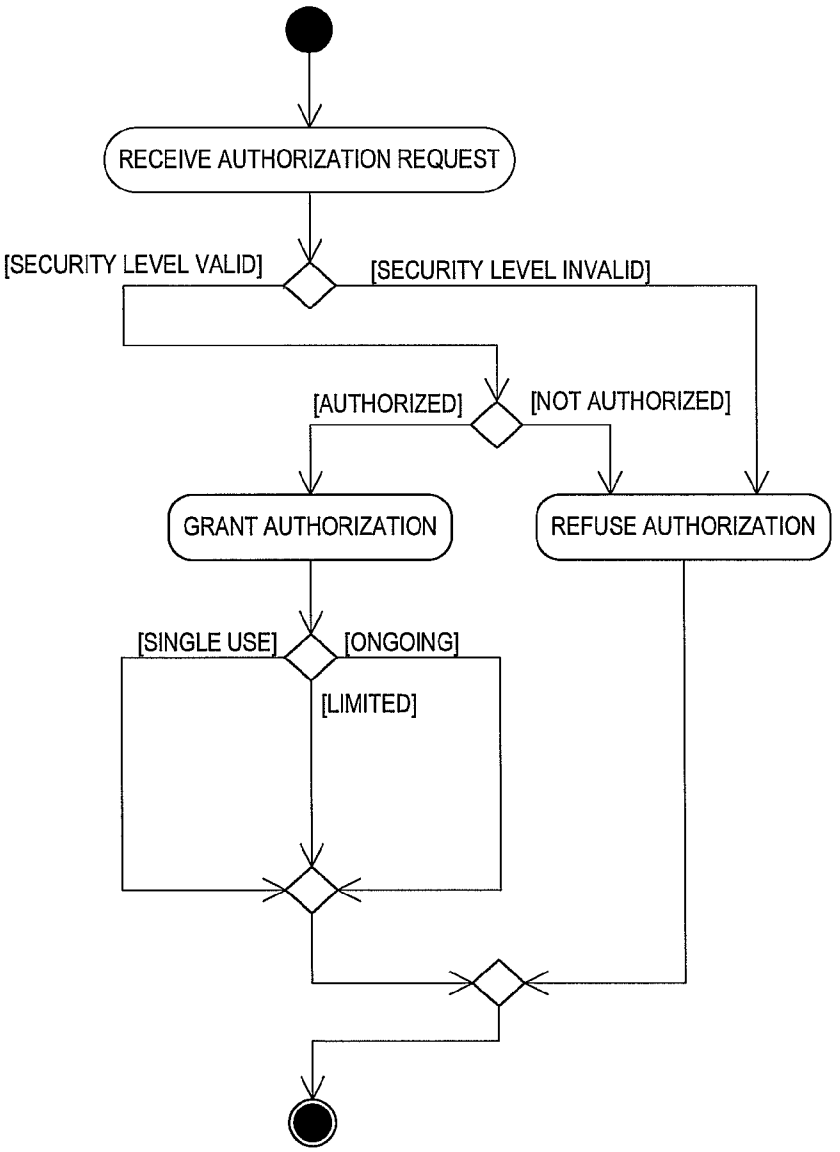

RECEIVE AUTHORIZATION REQUEST
[SECURITY LEVEL VALID]
[SECURITY LEVEL INVALID]
[AUTHORIZED]
[NOT AUTHORIZED]
GRANT AUTHORIZATION
REFUSE AUTHORIZATION
[SINGLE USE]
[ONGOING]
[LIMITED]

Fig. 9

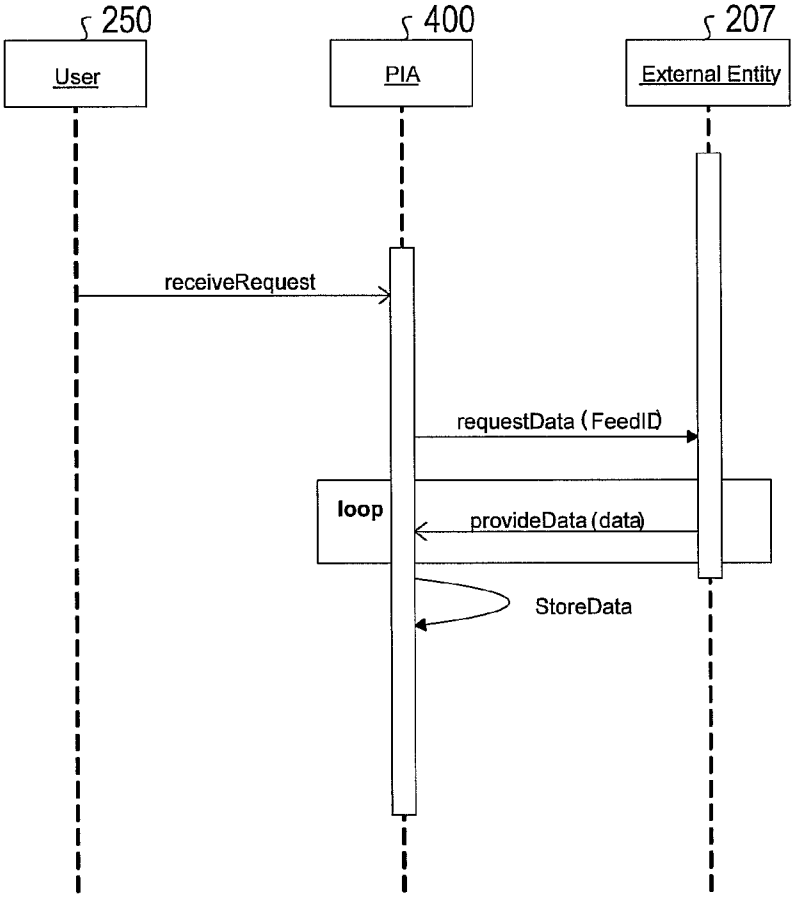

250
User
400
PIA
207
External Entity
receiveRequest
requestData (FeedID)
loop
provideData (data)
StoreData

Fig. 10

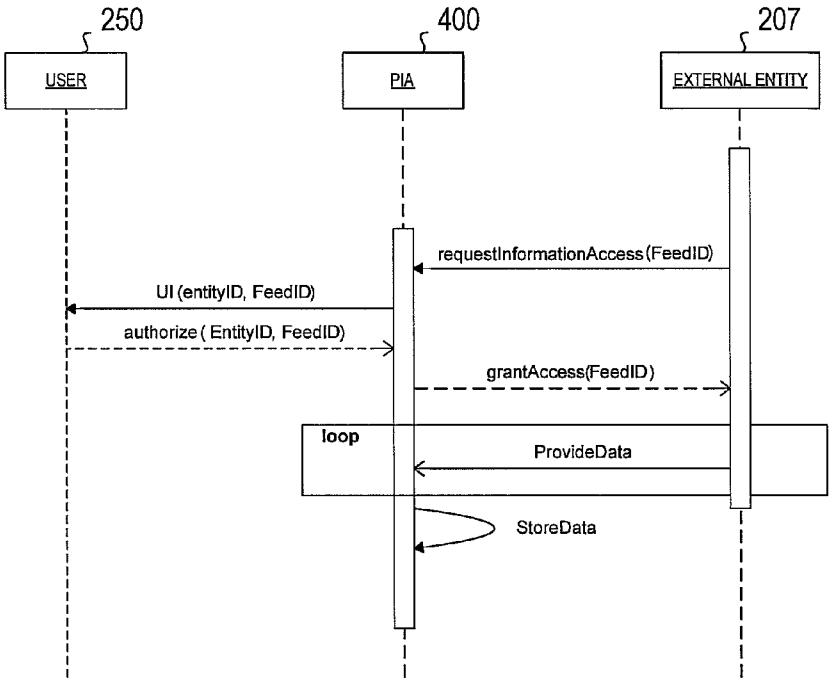

250
400
207
USER
PIA
EXTERNAL ENTITY
requestInformationAccess(FeedID)
UI (entityID, FeedID)
authorize (EntityID, FeedID)
grantAccess(FeedID)
loop
ProvideData
StoreData

Fig. 11

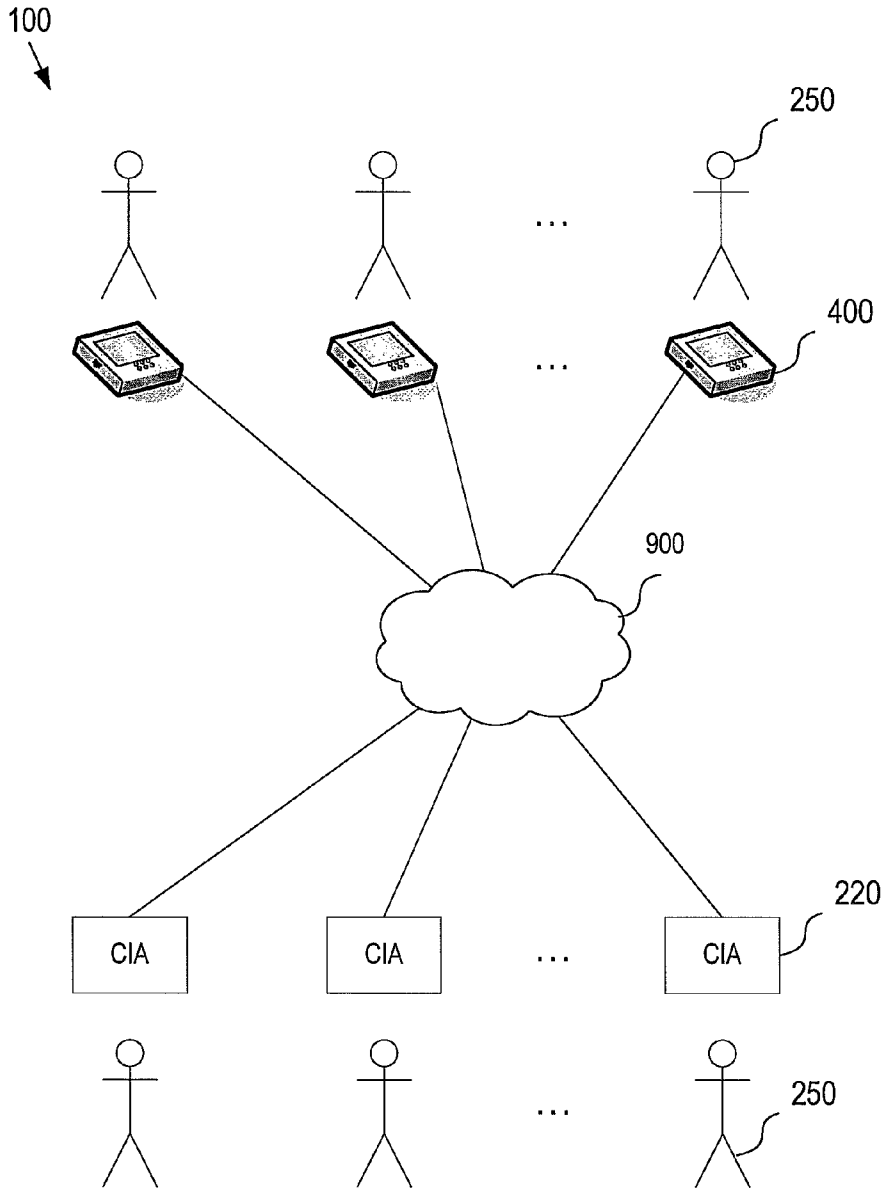


Fig. 12

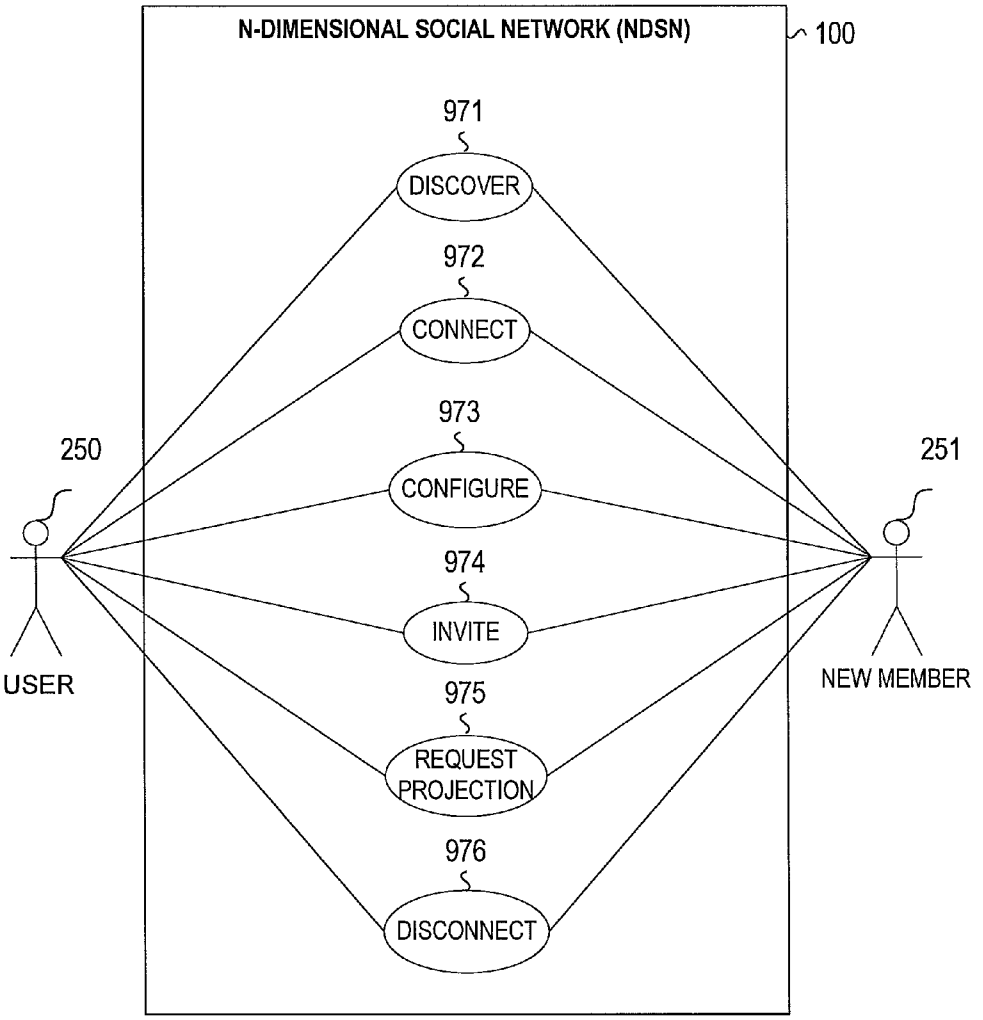

N-DIMENSIONAL SOCIAL NETWORK (NDSN)
100
971
DISCOVER
972
CONNECT
973
CONFIGURE
974
INVITE
975
REQUEST PROJECTION
976
DISCONNECT
250
USER
251
NEW MEMBER

Fig. 13

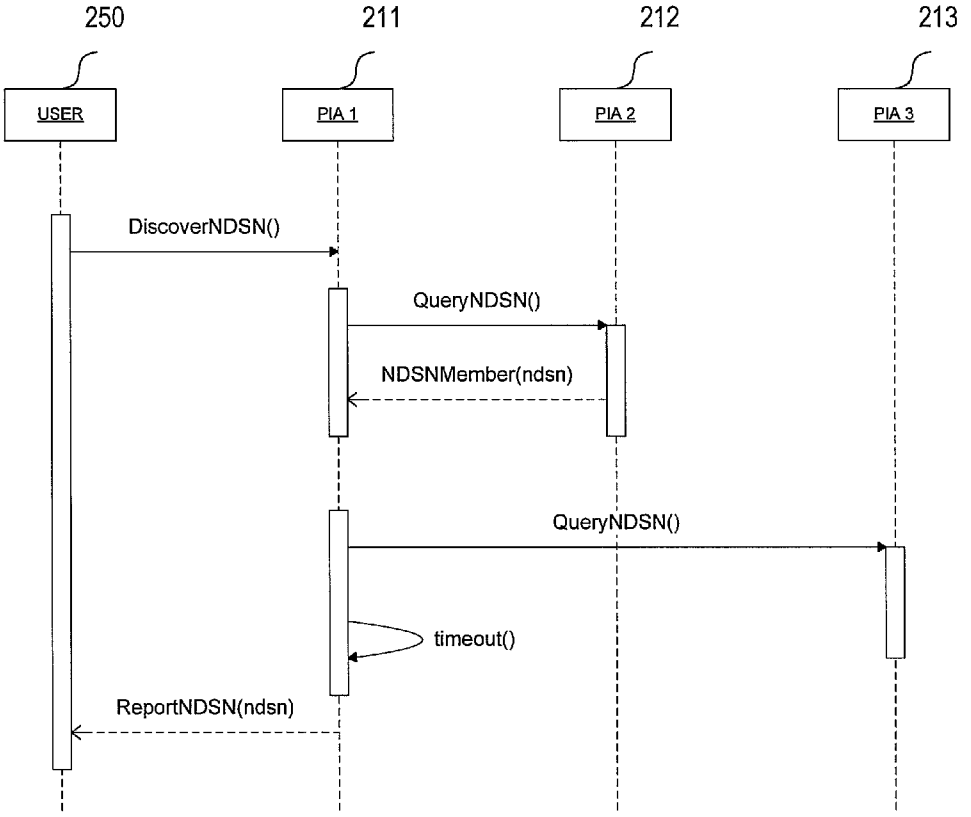

250
211
212
213
USER
PIA 1
PIA 2
PIA 3
DiscoverNDSN()
QueryNDSN()
NDSNMember(ndsn)
QueryNDSN()
timeout()
ReportNDSN(ndsn)

Fig. 14

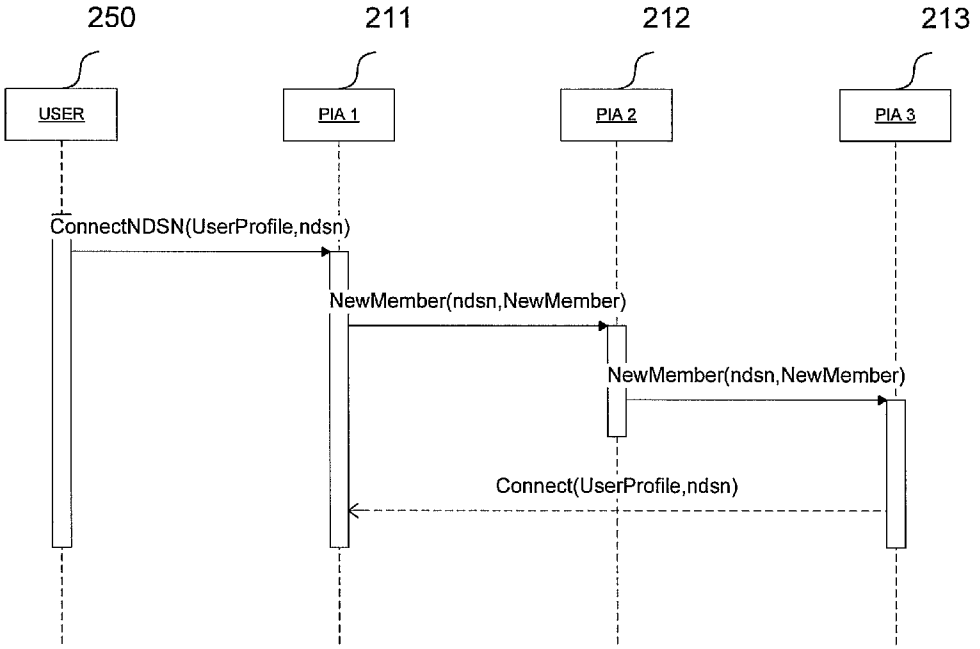

250
211
212
213
USER
PIA 1
PIA 2
PIA 3
ConnectNDSN(UserProfile,ndsn)
NewMember(ndsn,NewMember)
NewMember(ndsn,NewMember)
Connect(UserProfile,ndsn)

Fig. 15

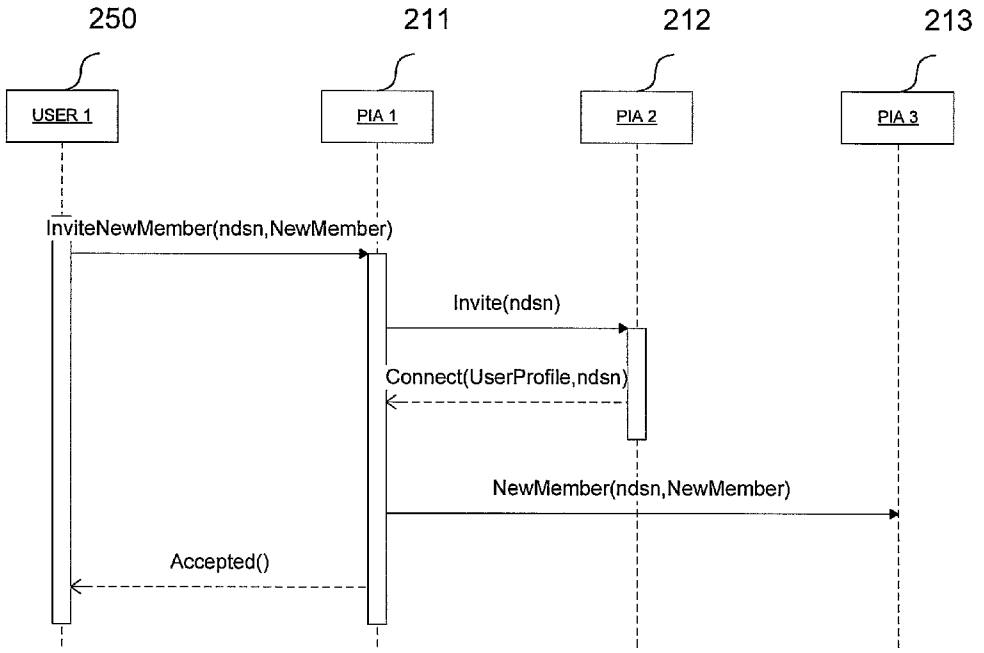

250
211
212
213
USER 1
PIA 1
PIA 2
PIA 3
InviteNewMember(ndsn,NewMember)
Invite(ndsn)
Connect(UserProfile,ndsn)
NewMember(ndsn,NewMember)
Accepted()

Fig. 16

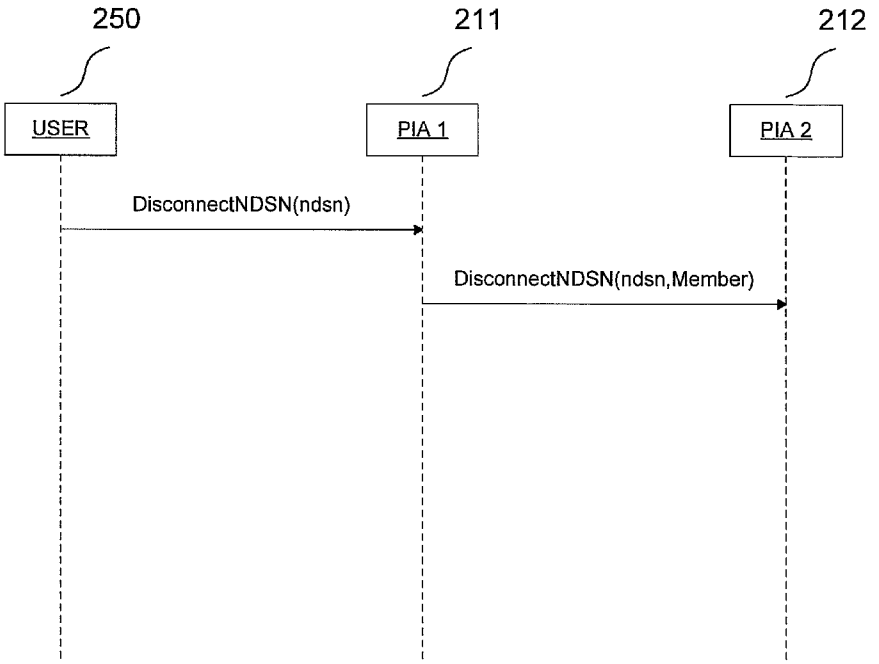

250
211
212
USER
PIA 1
PIA 2
DisconnectNDSN(ndsn)
DisconnectNDSN(ndsn,Member)

Fig. 17

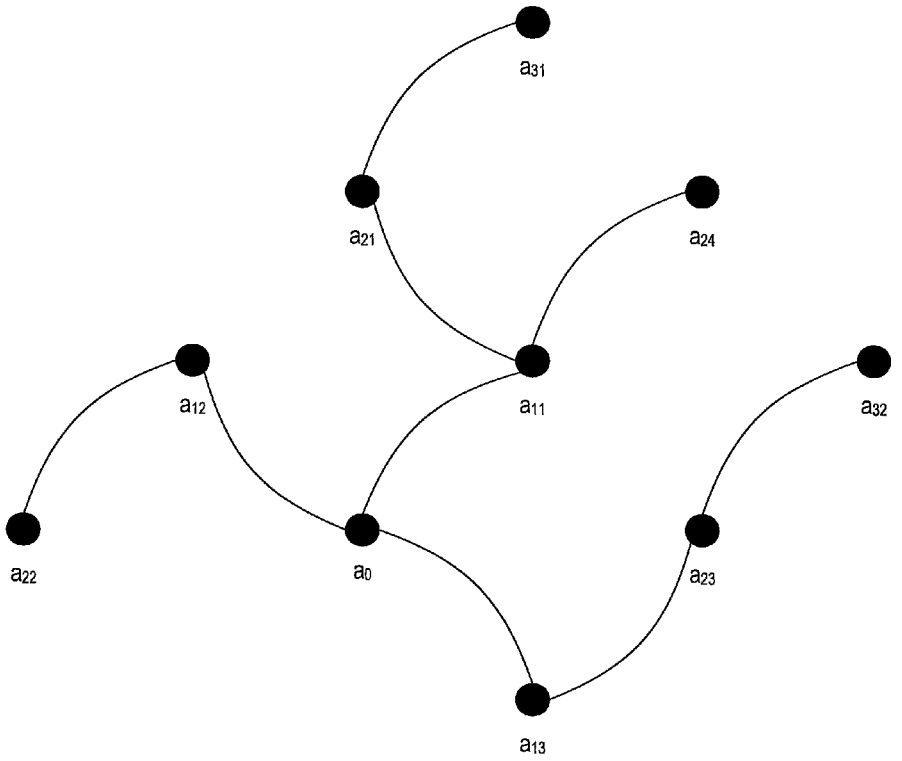


Fig. 18

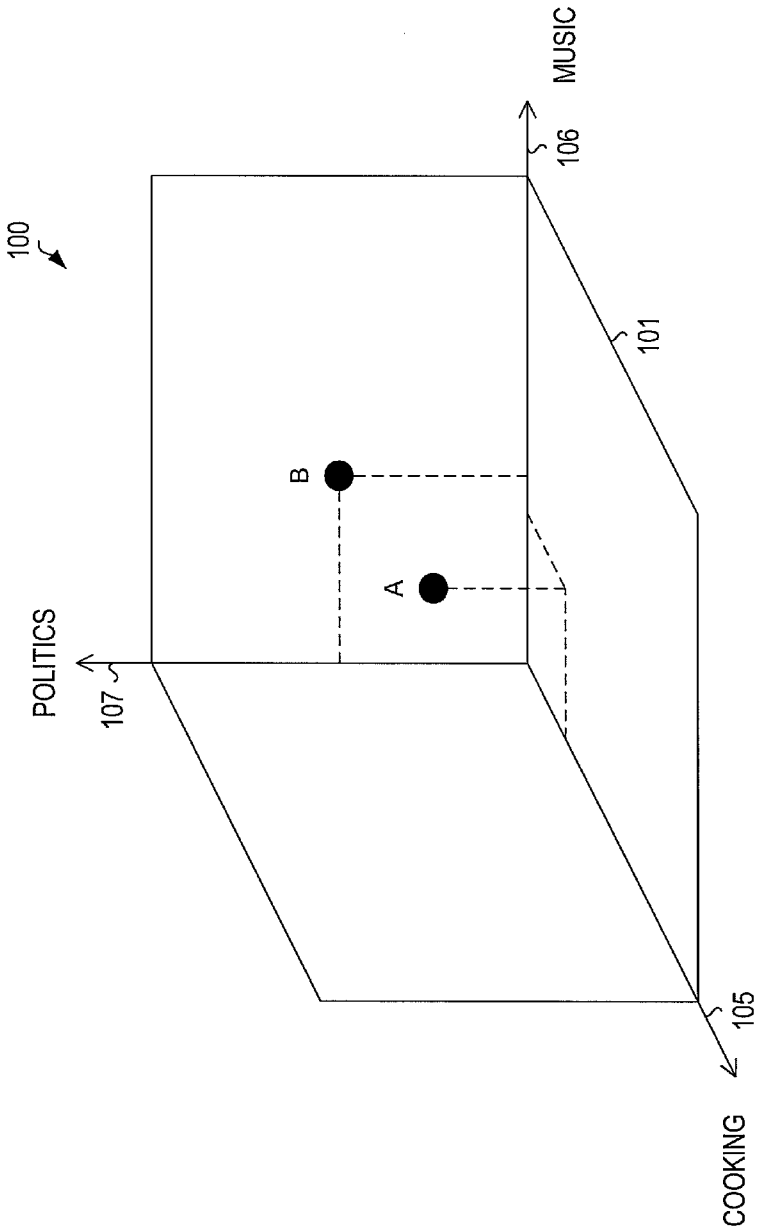


Fig. 19

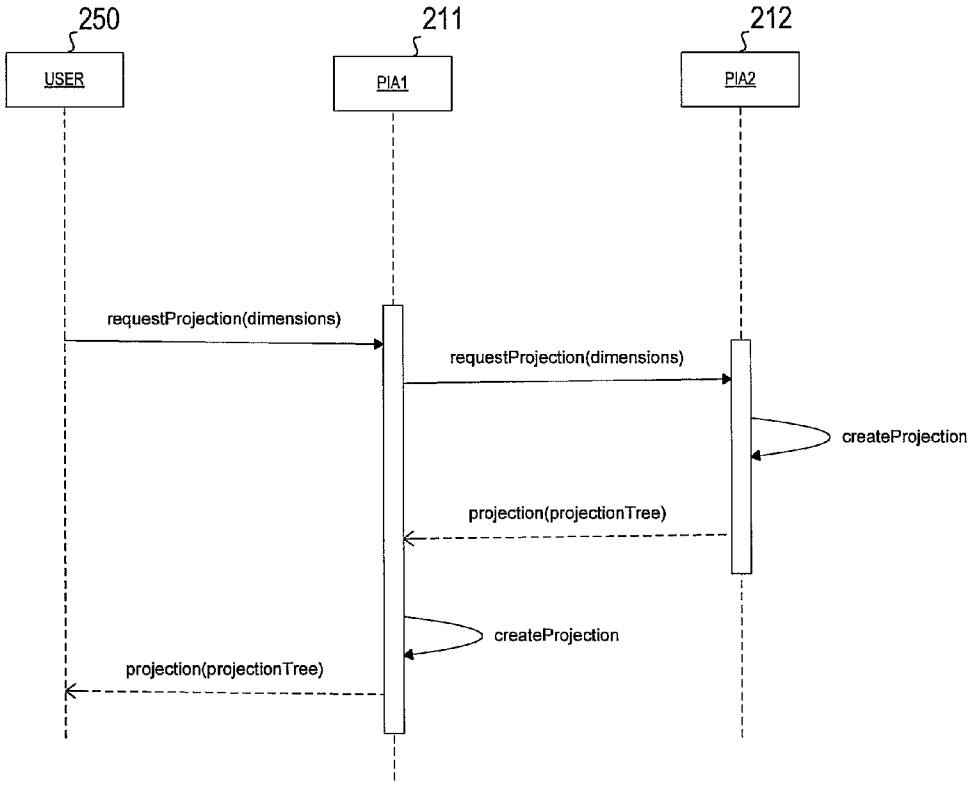

250
211
212
USER
PIA1
PIA2
requestProjection(dimensions)
requestProjection(dimensions)
createProjection
projection(projectionTree)
createProjection
projection(projectionTree)

Fig. 20

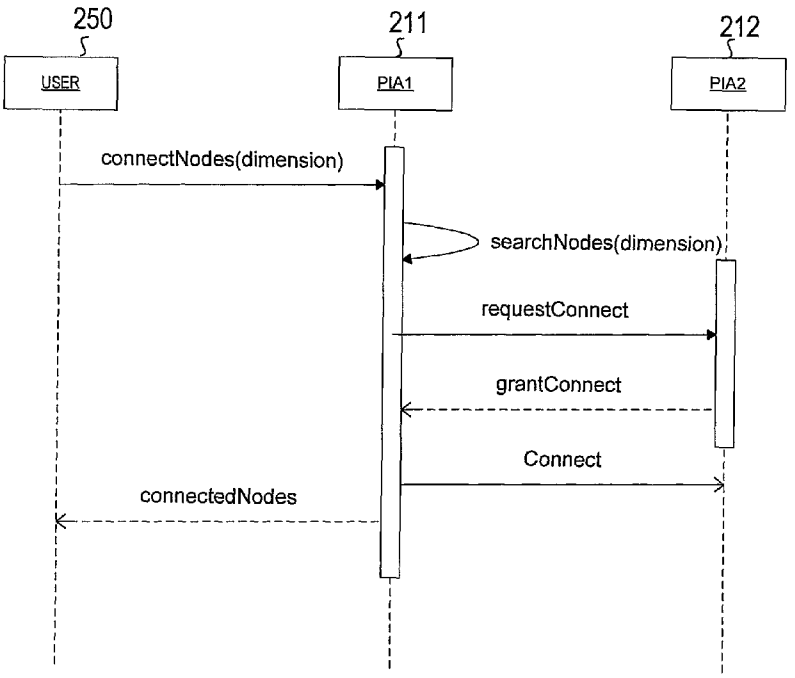

250
211
212
USER
PIA1
PIA2
connectNodes(dimension)
searchNodes(dimension)
requestConnect
grantConnect
Connect
connectedNodes

Fig. 21

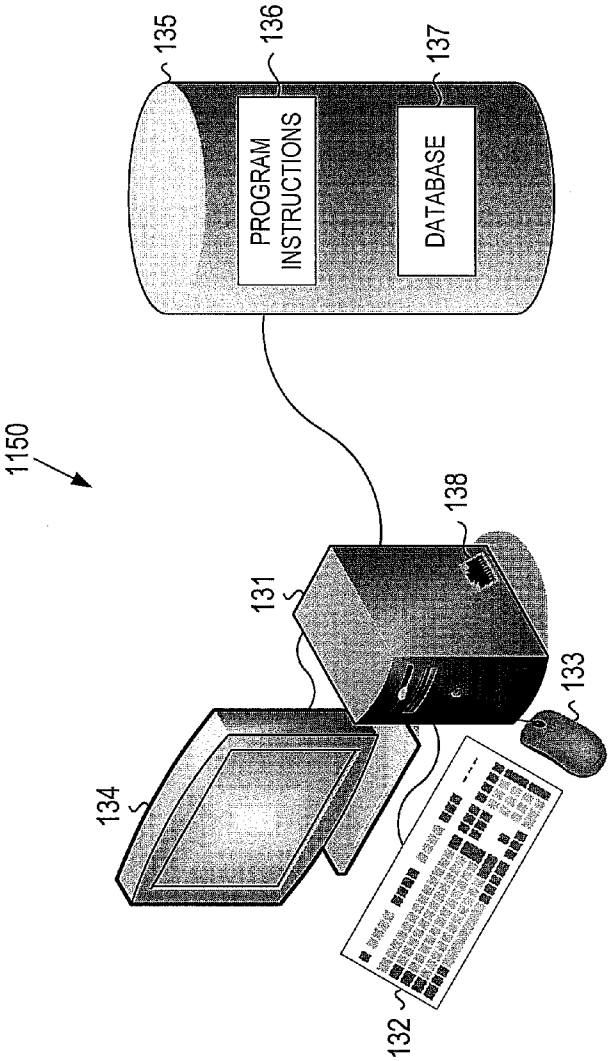

1150
135
PROGRAM INSTRUCTIONS
136
DATABASE
137
138
131
133
134
132

Fig. 22

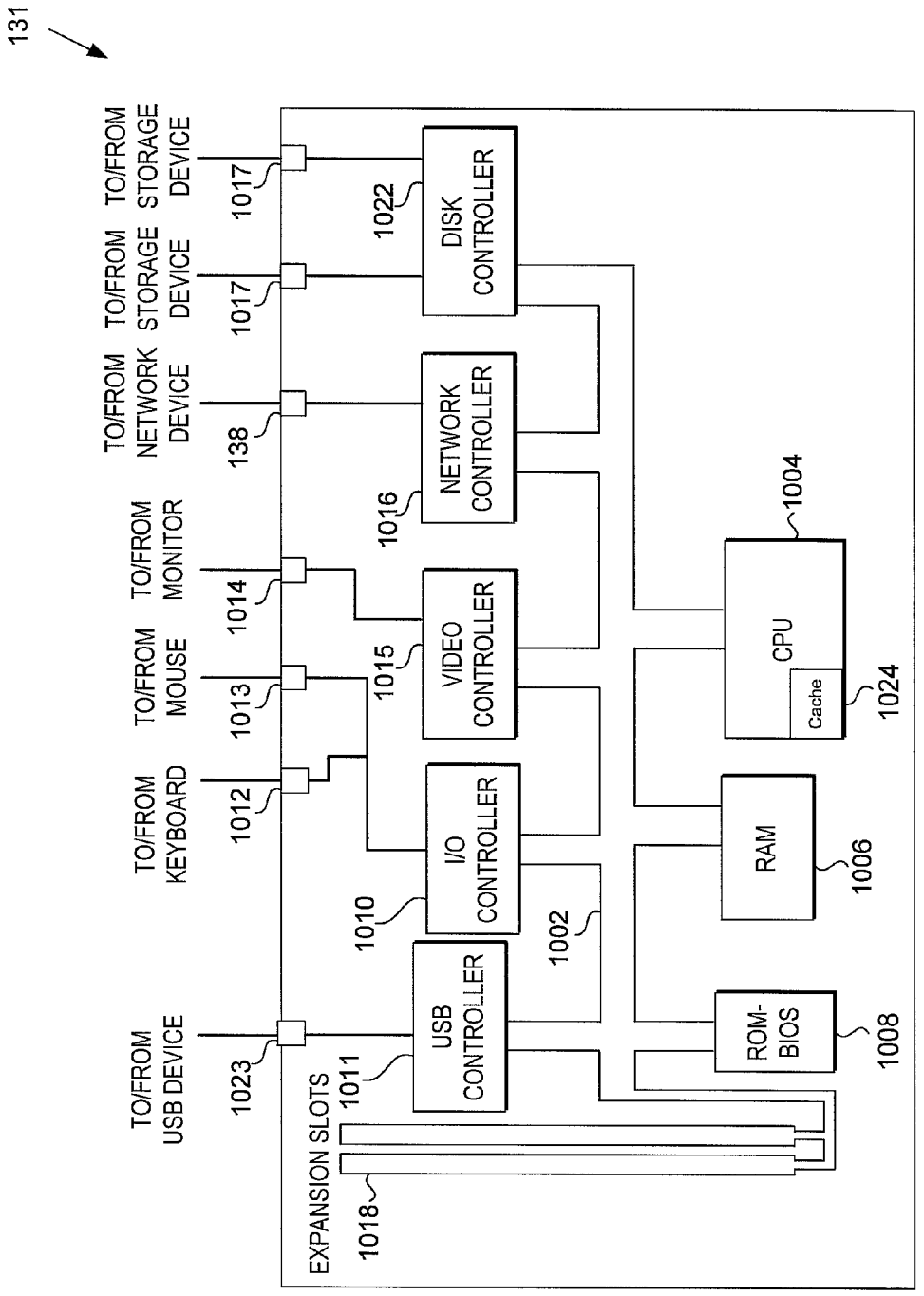

131
TO/FROM STORAGE DEVICE
TO/FROM STORAGE DEVICE
TO/FROM NETWORK DEVICE
TO/FROM MONITOR
TO/FROM MOUSE
TO/FROM KEYBOARD
TO/FROM USB DEVICE
1017
1017
138
1014
1013
1012
1023
1022
DISK CONTROLLER
1016
NETWORK CONTROLLER
1015
VIDEO CONTROLLER
1010
I/O CONTROLLER
1011
USB CONTROLLER
1002
EXPANSION SLOTS
1018
1004
CPU
Cache
1024
RAM
1006
ROM-BIOS
1008

Fig. 23

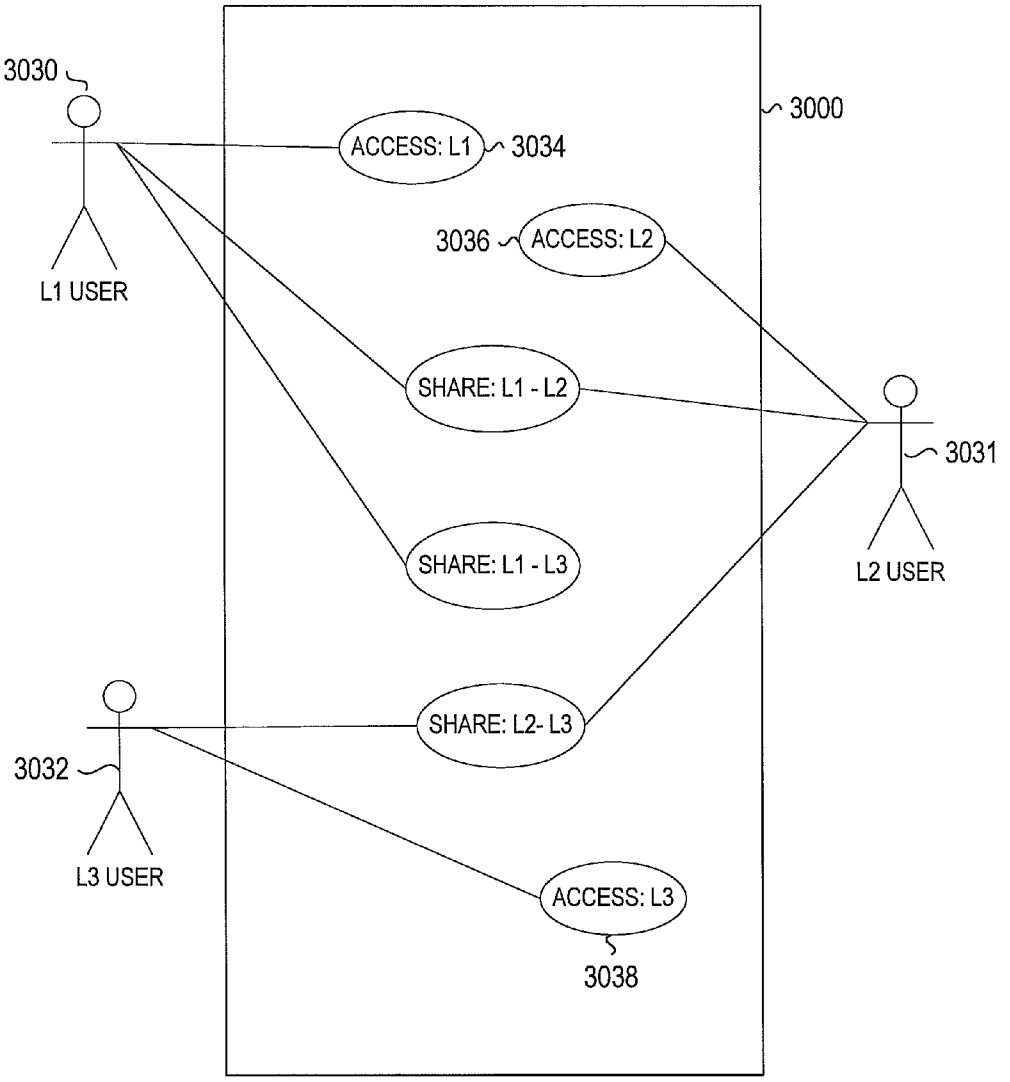

3030
L1 USER
3000
ACCESS: L1
3034
3036
ACCESS: L2
SHARE: L1 - L2
3031
L2 USER
SHARE: L1 - L3
SHARE: L2- L3
3032
L3 USER
ACCESS: L3
3038

Fig. 24

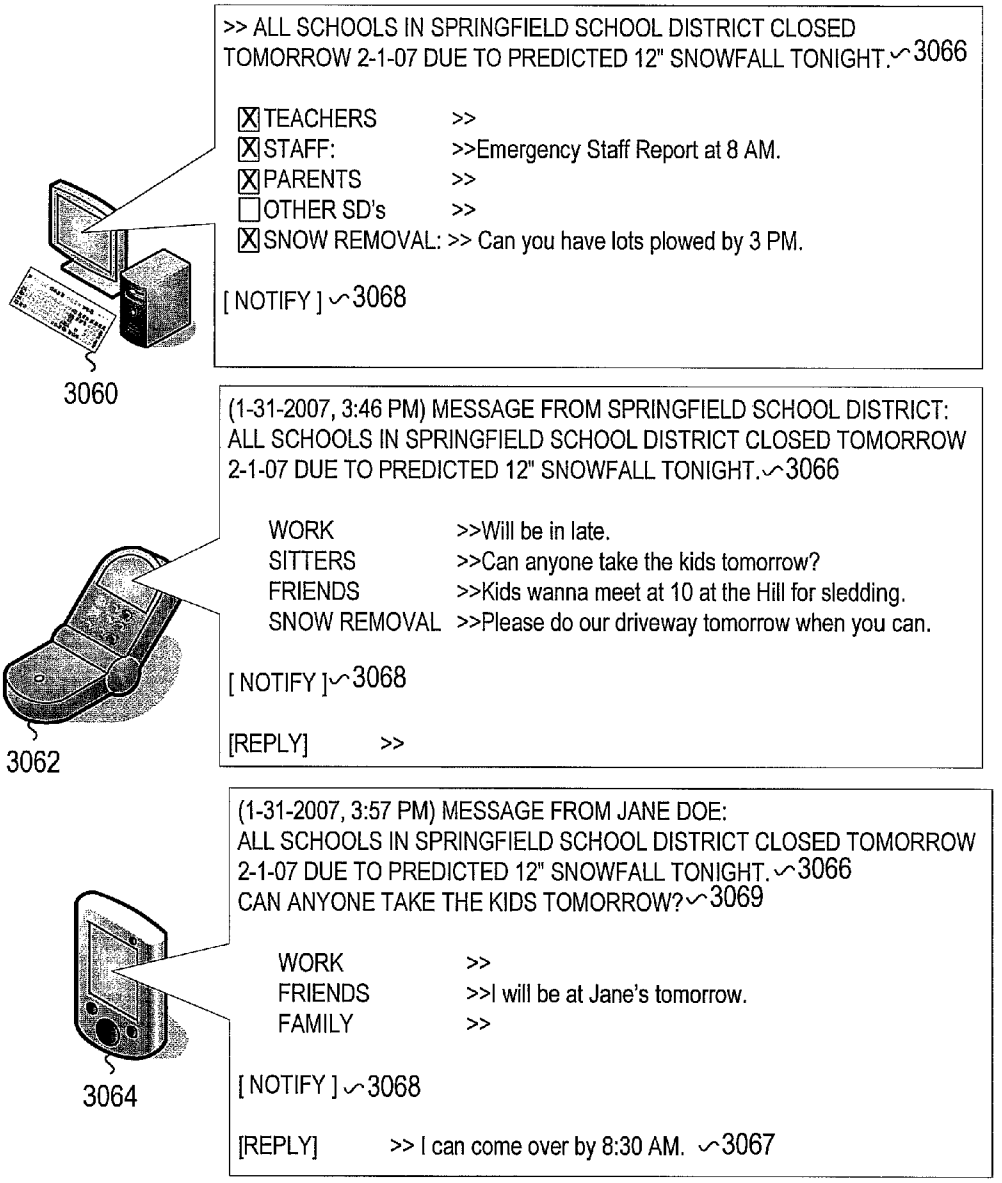

>> ALL SCHOOLS IN SPRINGFIELD SCHOOL DISTRICT CLOSED TOMORROW 2-1-07 DUE TO PREDICTED 12" SNOWFALL TONIGHT. 3066
[X] TEACHERS >>
[X] STAFF: >>Emergency Staff Report at 8 AM.
[X] PARENTS >>
[ ] OTHER SD's >>
[X] SNOW REMOVAL: >> Can you have lots plowed by 3 PM.
[NOTIFY] 3068
3060
(1-31-2007, 3:46 PM) MESSAGE FROM SPRINGFIELD SCHOOL DISTRICT:
ALL SCHOOLS IN SPRINGFIELD SCHOOL DISTRICT CLOSED TOMORROW 2-1-07 DUE TO PREDICTED 12" SNOWFALL TONIGHT. 3066
WORK >>Will be in late.
SITTERS >>Can anyone take the kids tomorrow?
FRIENDS >>Kids wanna meet at 10 at the Hill for sledding.
SNOW REMOVAL >>Please do our driveway tomorrow when you can.
[NOTIFY] 3068
[REPLY] >>
3062
(1-31-2007, 3:57 PM) MESSAGE FROM JANE DOE:
ALL SCHOOLS IN SPRINGFIELD SCHOOL DISTRICT CLOSED TOMORROW 2-1-07 DUE TO PREDICTED 12" SNOWFALL TONIGHT. 3066
CAN ANYONE TAKE THE KIDS TOMORROW? 3069
WORK >>
FRIENDS >>I will be at Jane's tomorrow.
FAMILY >>
[NOTIFY] 3068
[REPLY] >> I can come over by 8:30 AM. 3067
3064

Fig. 25

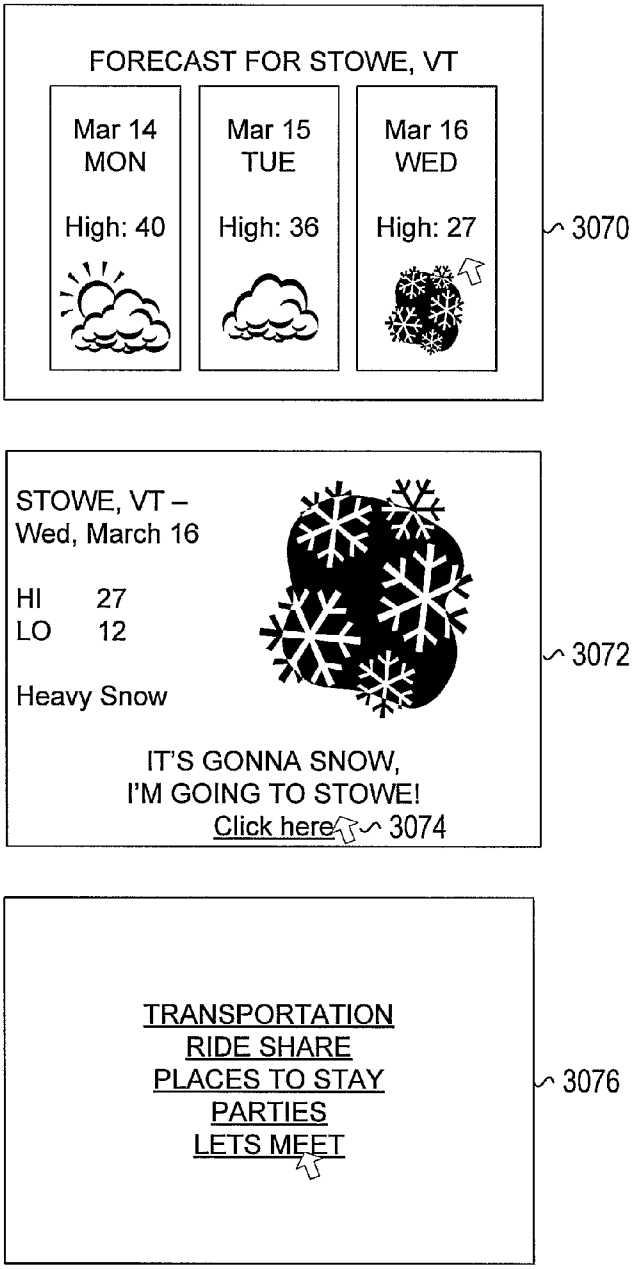

FORECAST FOR STOWE, VT
Mar 14
MON
High: 40
Mar 15
TUE
High: 36
Mar 16
WED
High: 27
3070
STOWE, VT –
Wed, March 16
HI 27
LO 12
Heavy Snow
IT'S GONNA SNOW,
I'M GOING TO STOWE!
Click here
3074
3072
TRANSPORTATION
RIDE SHARE
PLACES TO STAY
PARTIES
LETS MEET
3076

Fig. 26

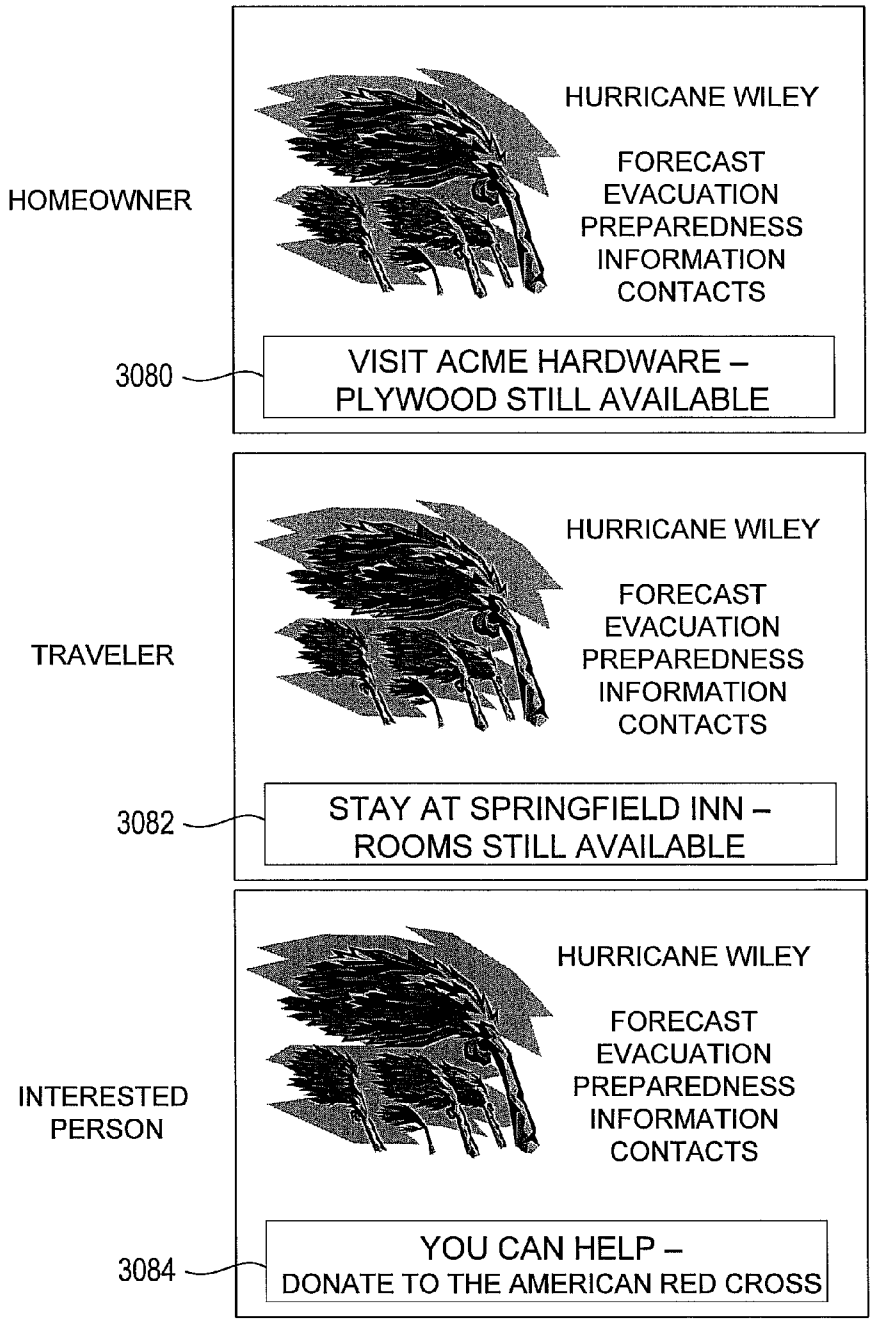

HOMEOWNER
HURRICANE WILEY
FORECAST
EVACUATION
PREPAREDNESS
INFORMATION
CONTACTS
3080
VISIT ACME HARDWARE –
PLYWOOD STILL AVAILABLE
TRAVELER
HURRICANE WILEY
FORECAST
EVACUATION
PREPAREDNESS
INFORMATION
CONTACTS
3082
STAY AT SPRINGFIELD INN –
ROOMS STILL AVAILABLE
INTERESTED PERSON
HURRICANE WILEY
FORECAST
EVACUATION
PREPAREDNESS
INFORMATION
CONTACTS
3084
YOU CAN HELP –
DONATE TO THE AMERICAN RED CROSS

Fig. 27

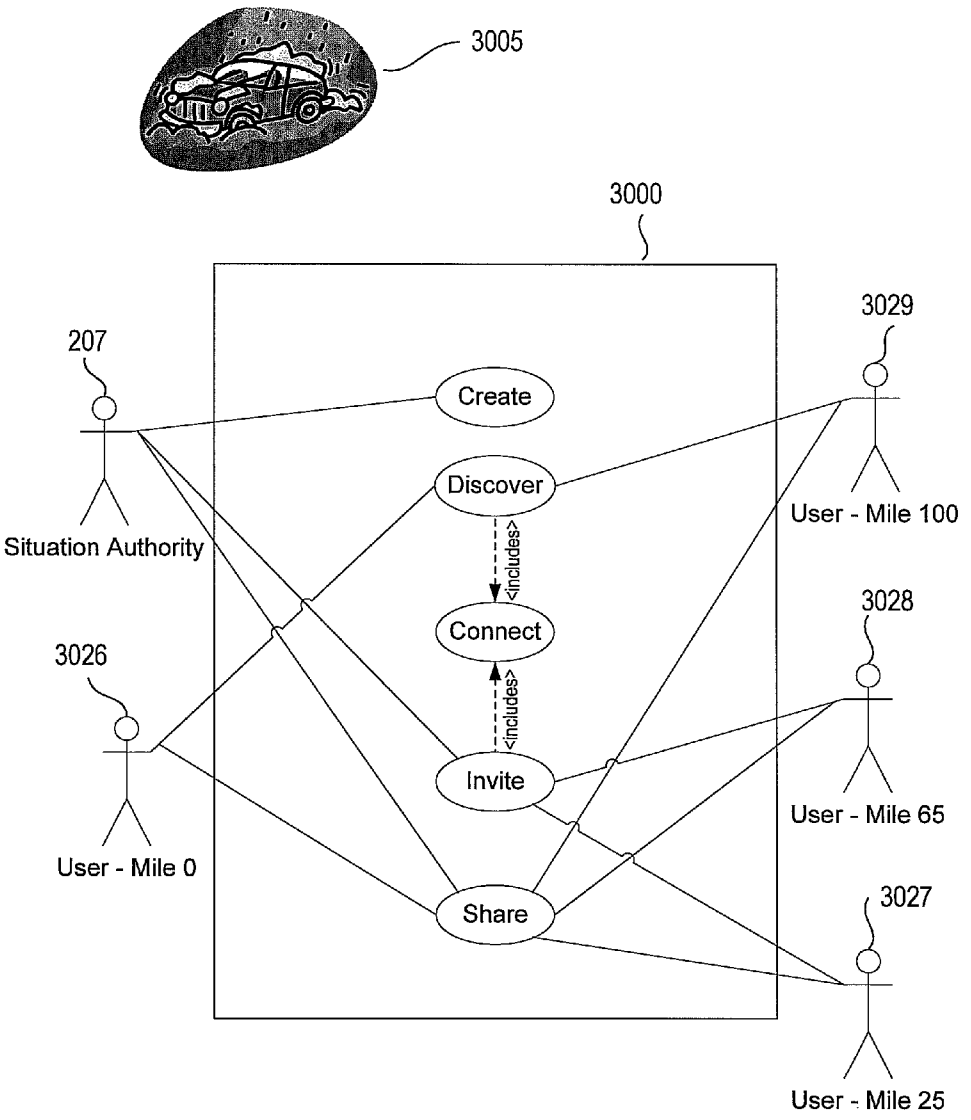

3005
3000
207
Situation Authority
Create
Discover
<includes>
Connect
<includes>
Invite
Share
3029
User - Mile 100
3028
User - Mile 65
3027
User - Mile 25
3026
User - Mile 0

Fig. 28

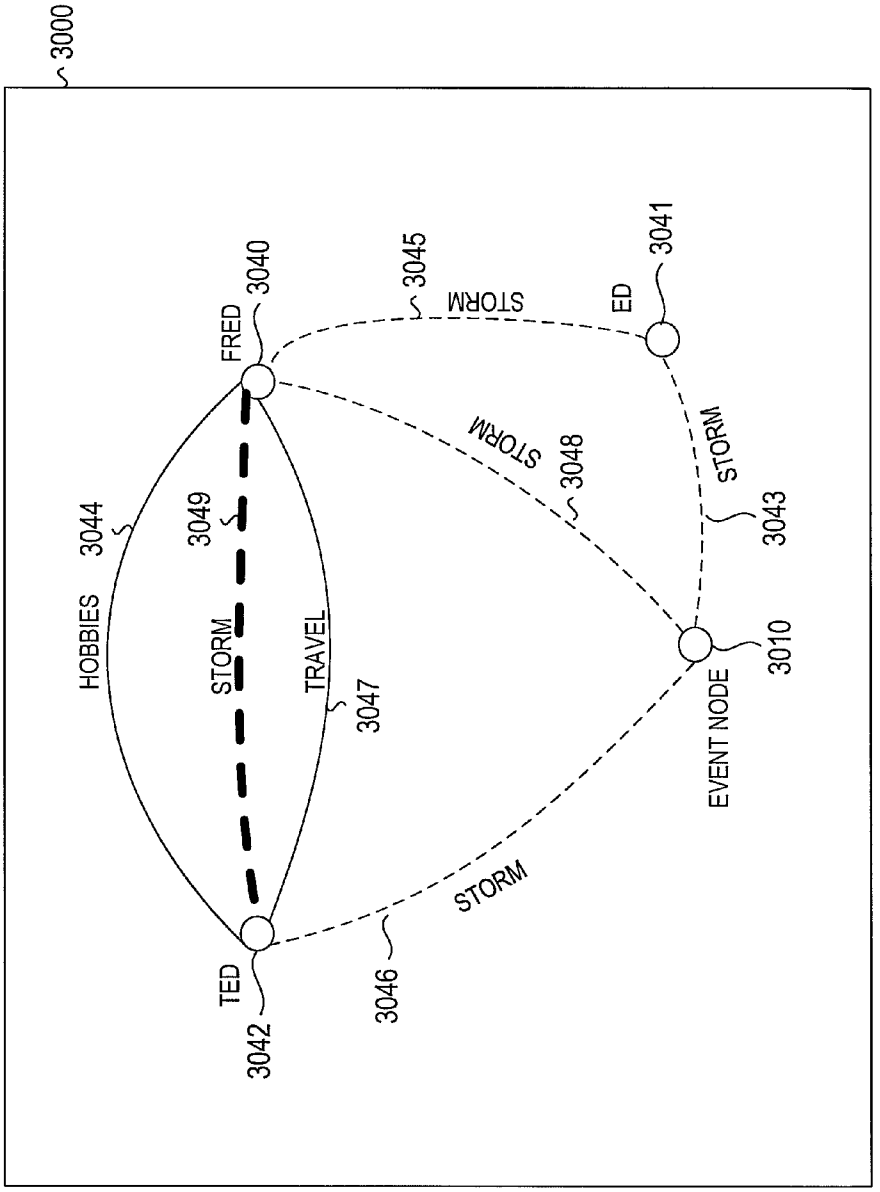

3000
HOBBIES
3044
STORM
3049
TRAVEL
3047
FRED
3040
TED
3042
STORM
3045
STORM
3048
STORM
3046
ED
3041
STORM
3043
EVENT NODE
3010

Fig. 29

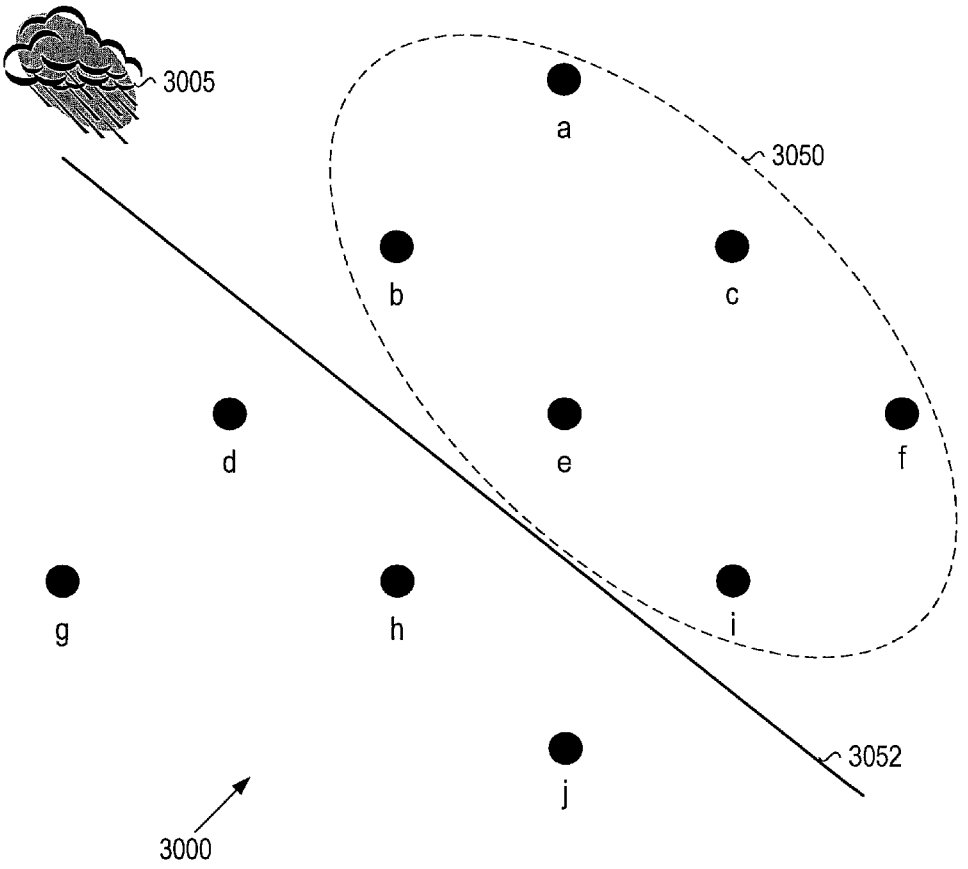


Fig. 30

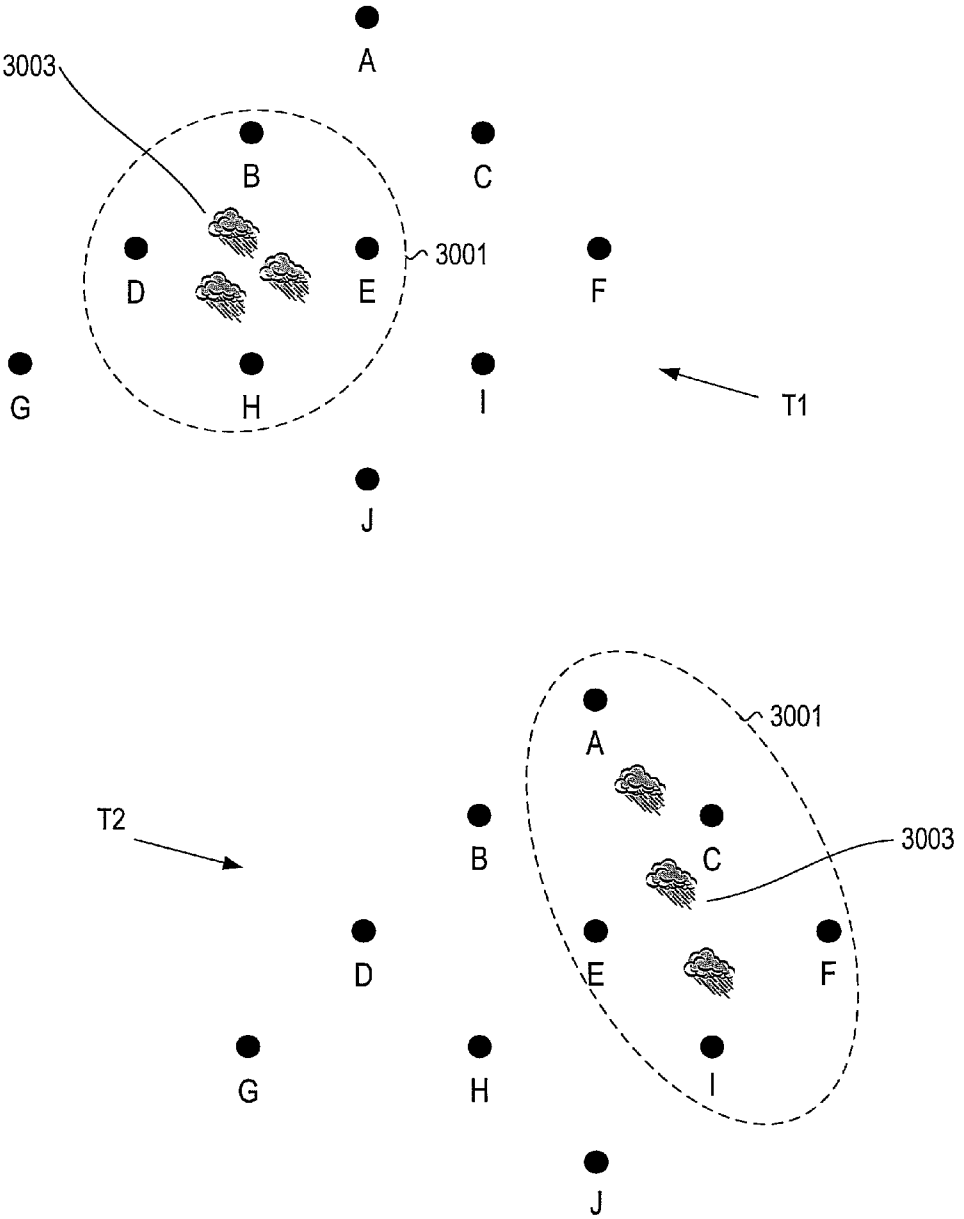


Fig. 31

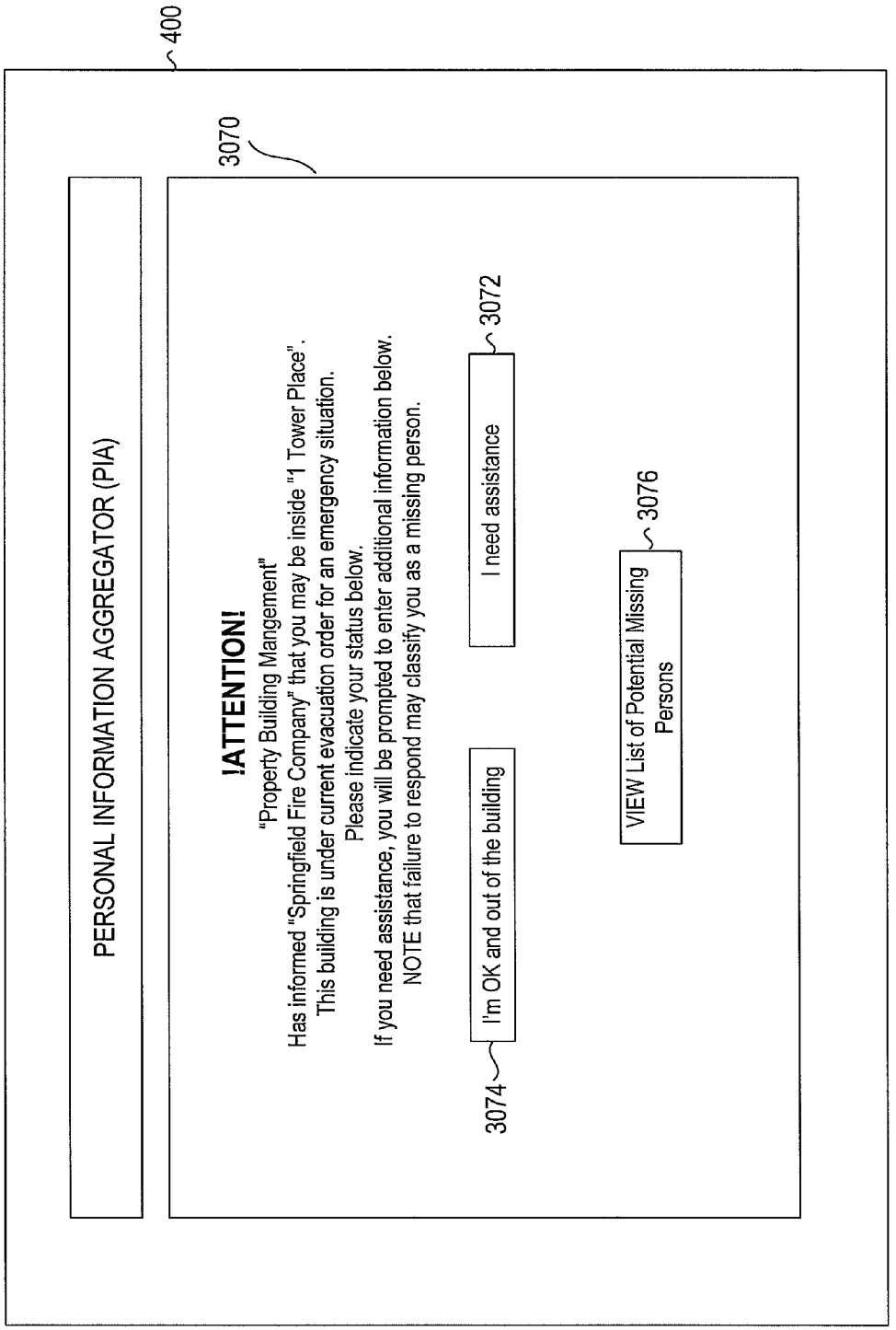

400
PERSONAL INFORMATION AGGREGATOR (PIA)
3070
!ATTENTION!
"Property Building Mangement"
Has informed "Springfield Fire Company" that you may be inside "1 Tower Place".
This building is under current evacuation order for an emergency situation.
Please indicate your status below.
If you need assistance, you will be prompted to enter additional information below.
NOTE that failure to respond may classify you as a missing person.
3072
I need assistance
3074
I'm OK and out of the building
3076
VIEW List of Potential Missing Persons

Fig. 32

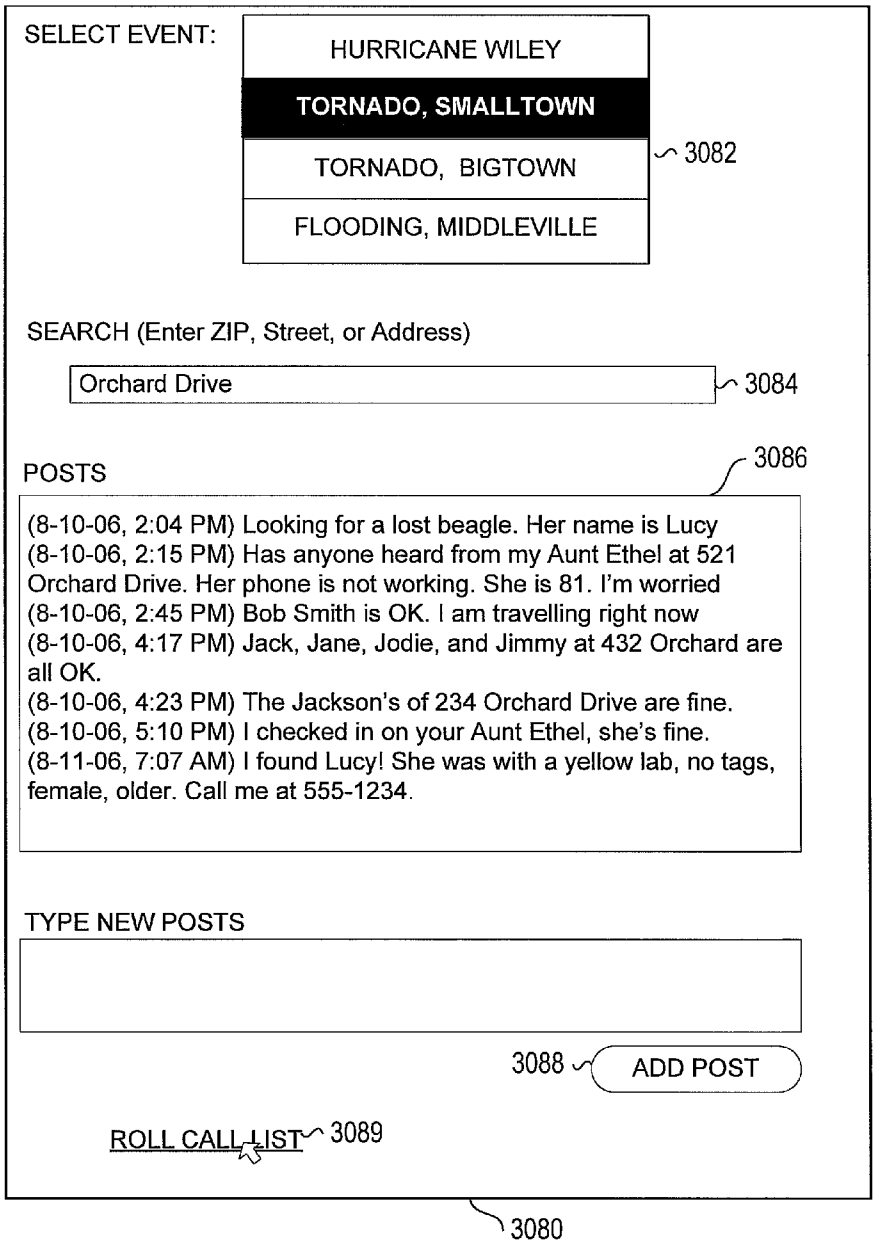

SELECT EVENT:
HURRICANE WILEY
TORNADO, SMALLTOWN
TORNADO, BIGTOWN
FLOODING, MIDDLEVILLE
3082
SEARCH (Enter ZIP, Street, or Address)
Orchard Drive
3084
POSTS
3086
(8-10-06, 2:04 PM) Looking for a lost beagle. Her name is Lucy
(8-10-06, 2:15 PM) Has anyone heard from my Aunt Ethel at 521 Orchard Drive. Her phone is not working. She is 81. I'm worried
(8-10-06, 2:45 PM) Bob Smith is OK. I am travelling right now
(8-10-06, 4:17 PM) Jack, Jane, Jodie, and Jimmy at 432 Orchard are all OK.
(8-10-06, 4:23 PM) The Jackson's of 234 Orchard Drive are fine.
(8-10-06, 5:10 PM) I checked in on your Aunt Ethel, she's fine.
(8-11-06, 7:07 AM) I found Lucy! She was with a yellow lab, no tags, female, older. Call me at 555-1234.
TYPE NEW POSTS
3088
ADD POST
ROLL CALL LIST
3089
3080

Fig. 33

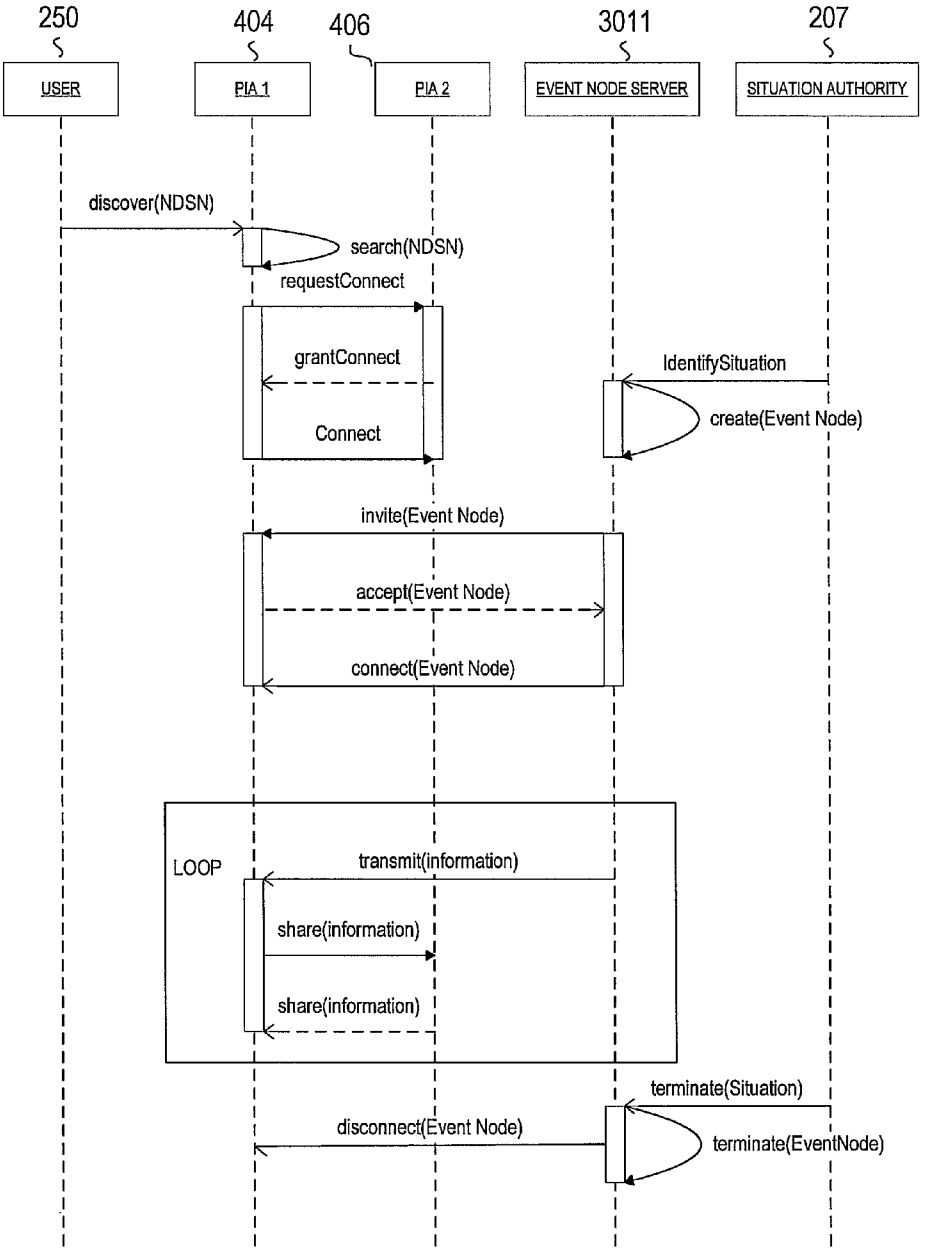

250
404
406
3011
207
USER
PIA 1
PIA 2
EVENT NODE SERVER
SITUATION AUTHORITY
discover(NDSN)
search(NDSN)
requestConnect
grantConnect
Connect
IdentifySituation
create(Event Node)
invite(Event Node)
accept(Event Node)
connect(Event Node)
LOOP
transmit(information)
share(information)
share(information)
terminate(Situation)
disconnect(Event Node)
terminate(EventNode)

Fig. 34

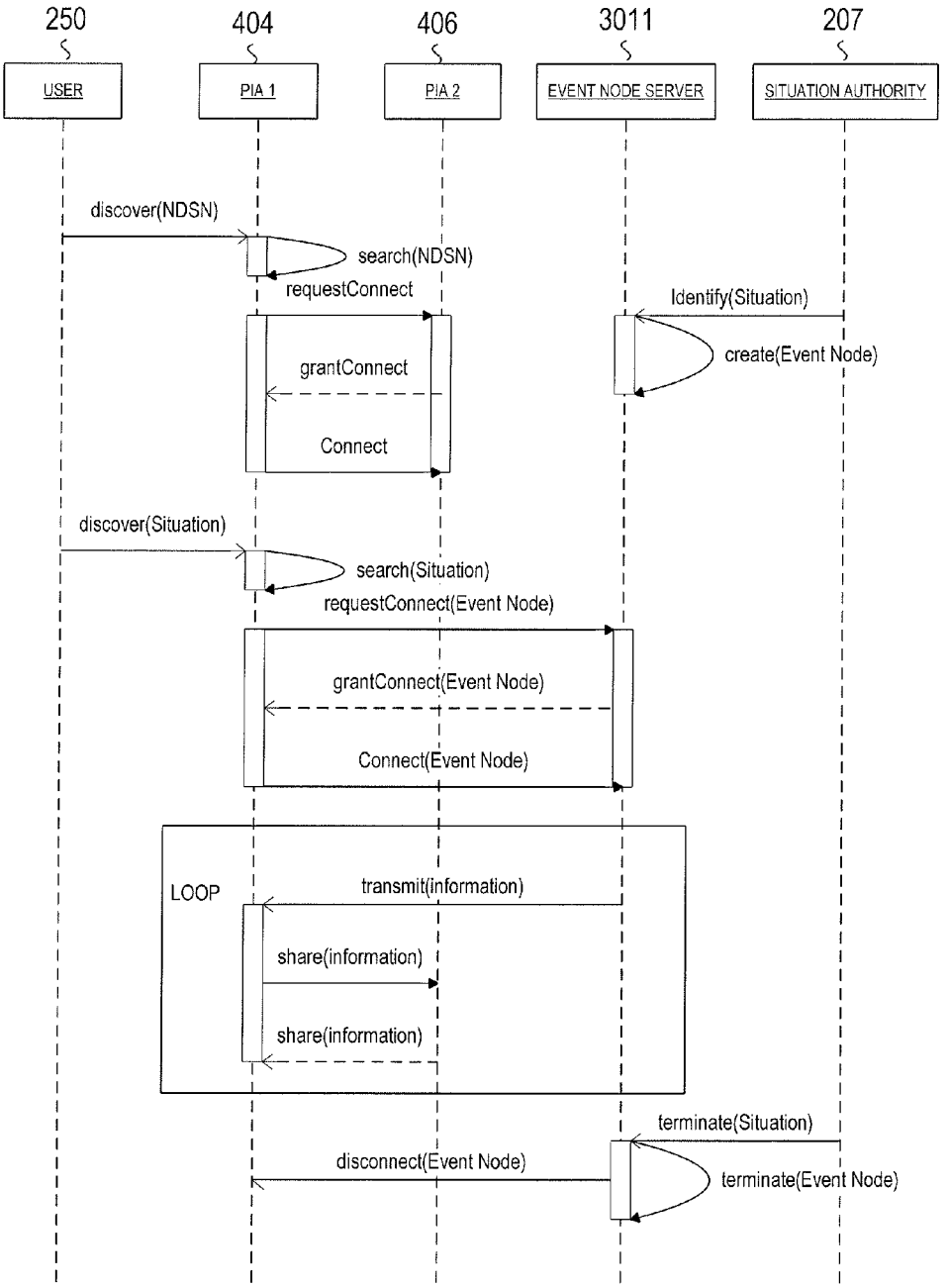

250
404
406
3011
207
USER
PIA 1
PIA 2
EVENT NODE SERVER
SITUATION AUTHORITY
discover(NDSN)
search(NDSN)
requestConnect
Identify(Situation)
create(Event Node)
grantConnect
Connect
discover(Situation)
search(Situation)
requestConnect(Event Node)
grantConnect(Event Node)
Connect(Event Node)
LOOP
transmit(information)
share(information)
share(information)
terminate(Situation)
disconnect(Event Node)
terminate(Event Node)

Fig. 35

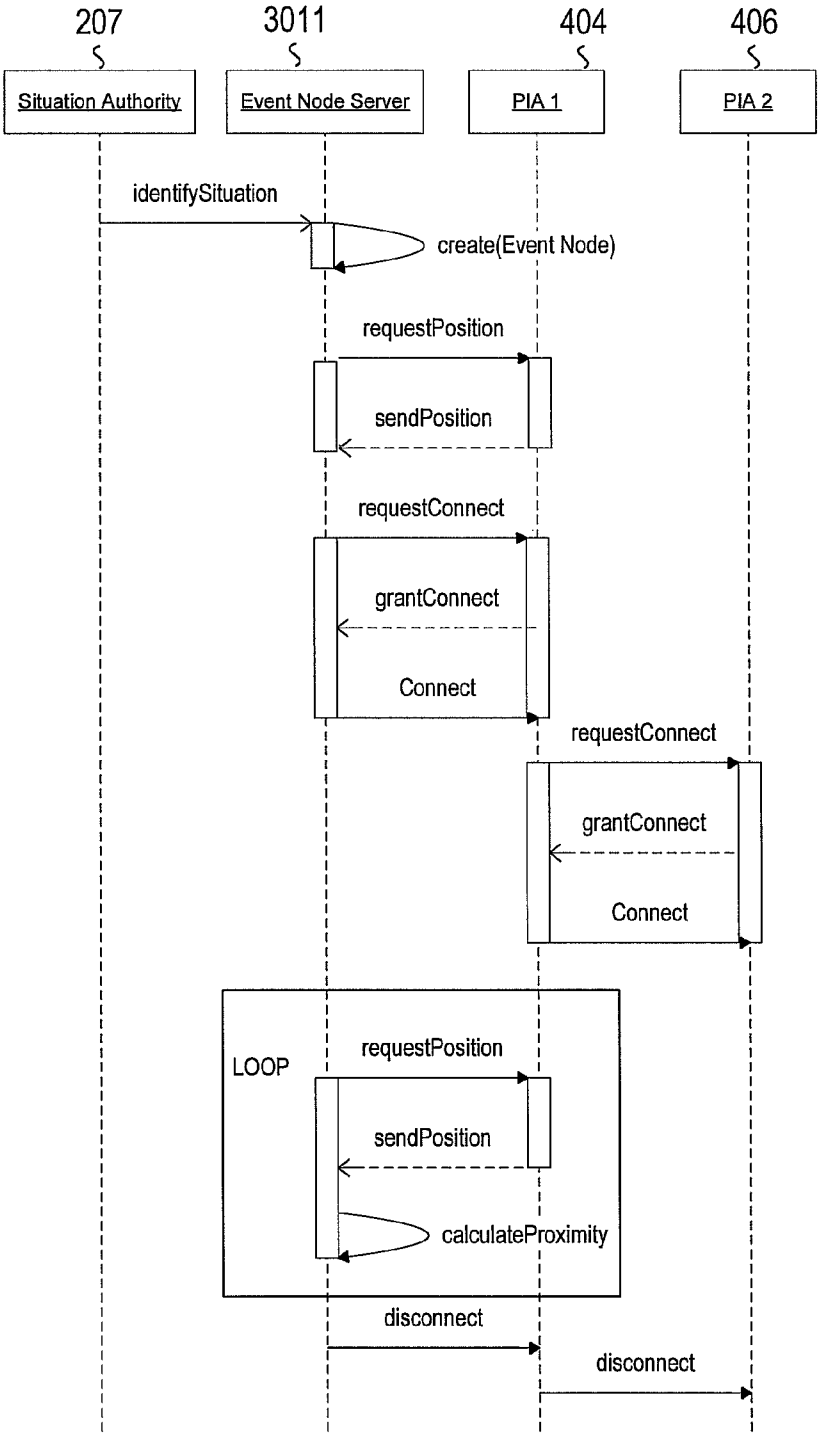

207
3011
404
406
Situation Authority
Event Node Server
PIA 1
PIA 2
identifySituation
create(Event Node)
requestPosition
sendPosition
requestConnect
grantConnect
Connect
requestConnect
grantConnect
Connect
LOOP
requestPosition
sendPosition
calculateProximity
disconnect
disconnect

Fig. 36

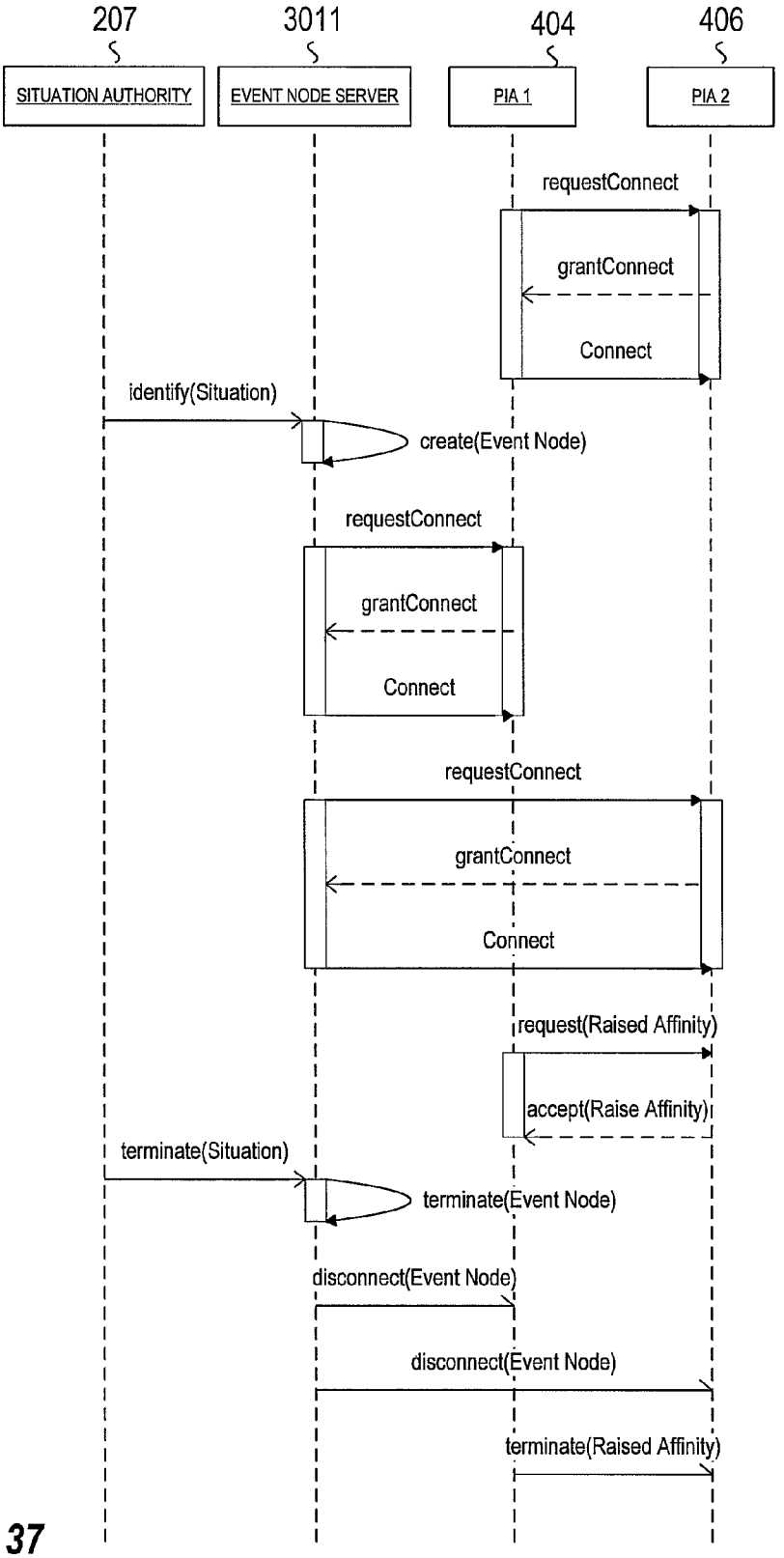

207
3011
404
406
SITUATION AUTHORITY
EVENT NODE SERVER
PIA 1
PIA 2
requestConnect
grantConnect
Connect
identify(Situation)
create(Event Node)
requestConnect
grantConnect
Connect
requestConnect
grantConnect
Connect
request(Raised Affinity)
accept(Raise Affinity)
terminate(Situation)
terminate(Event Node)
disconnect(Event Node)
disconnect(Event Node)
terminate(Raised Affinity)

Fig. 37

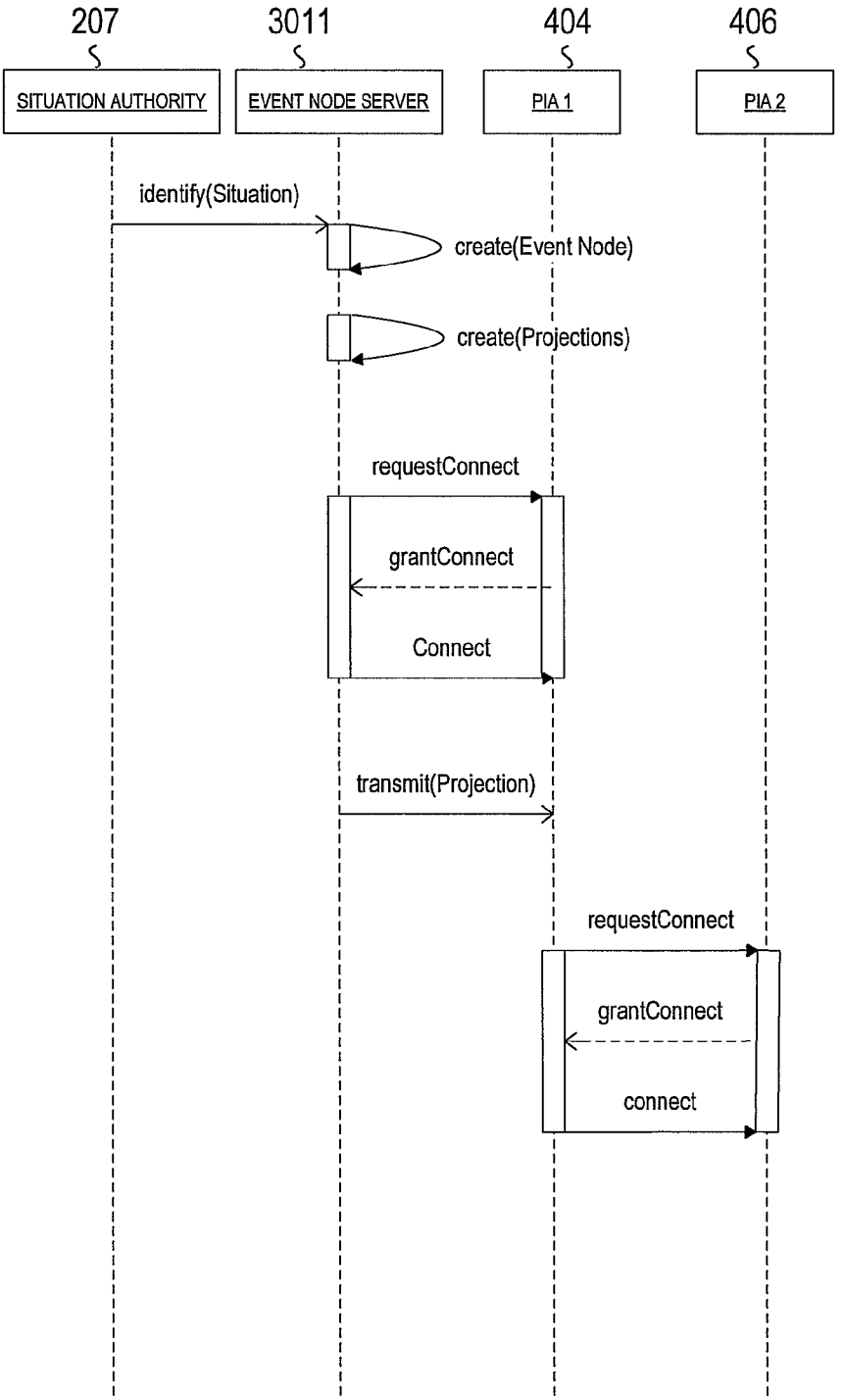

207
3011
404
406
SITUATION AUTHORITY
EVENT NODE SERVER
PIA 1
PIA 2
identify(Situation)
create(Event Node)
create(Projections)
requestConnect
grantConnect
Connect
transmit(Projection)
requestConnect
grantConnect
connect

Fig. 38

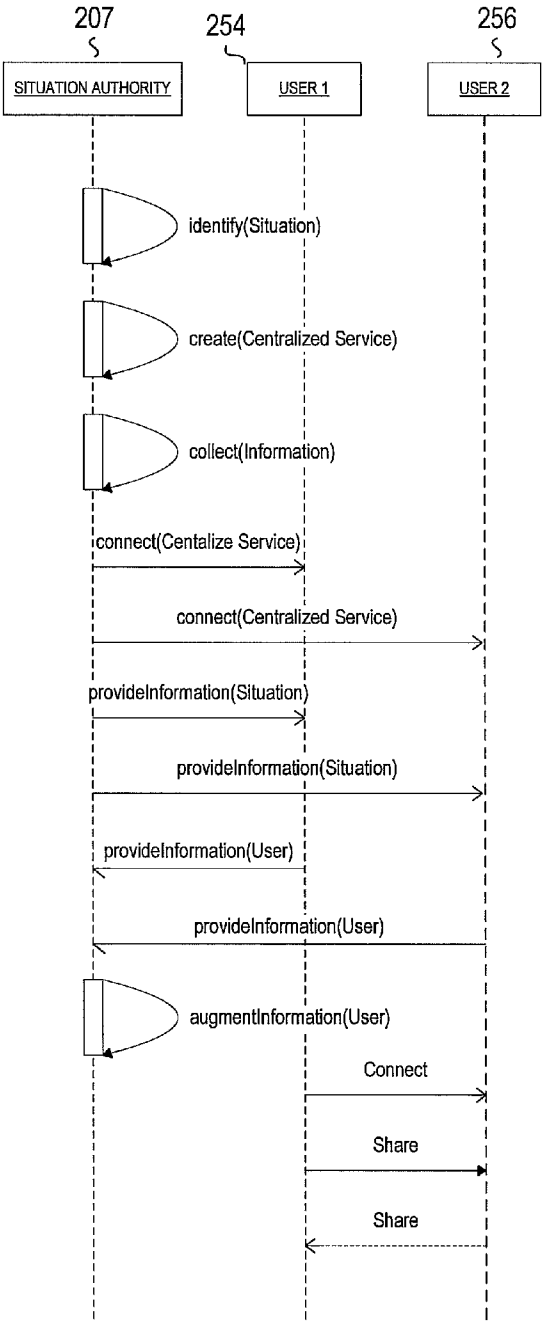

207
254
256
SITUATION AUTHORITY
USER 1
USER 2
identify(Situation)
create(Centralized Service)
collect(Information)
connect(Centalize Service)
connect(Centralized Service)
provideInformation(Situation)
provideInformation(Situation)
provideInformation(User)
provideInformation(User)
augmentInformation(User)
Connect
Share
Share

Fig. 39

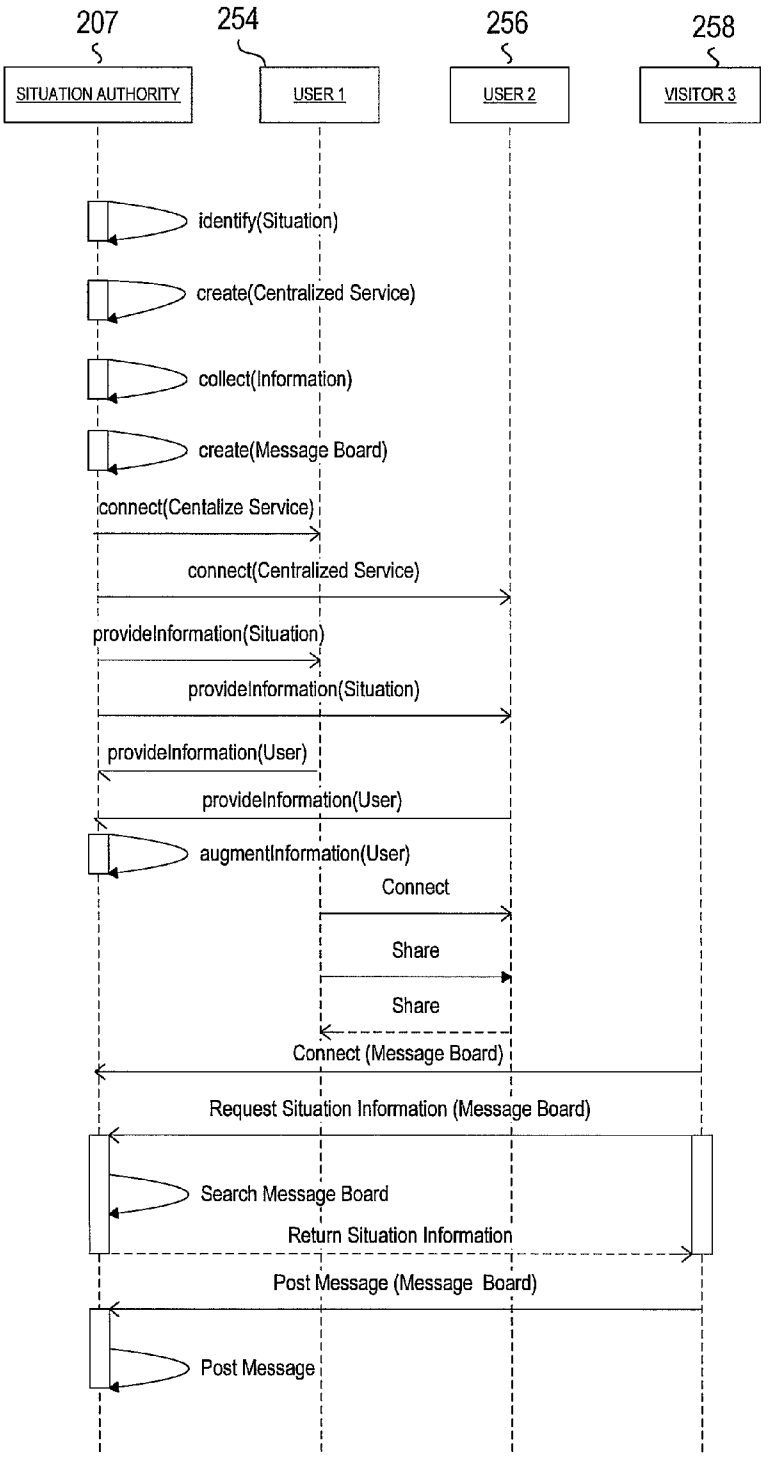

207
254
256
258
SITUATION AUTHORITY
USER 1
USER 2
VISITOR 3
identify(Situation)
create(Centralized Service)
collect(Information)
create(Message Board)
connect(Centalize Service)
connect(Centralized Service)
provideInformation(Situation)
provideInformation(Situation)
provideInformation(User)
provideInformation(User)
augmentInformation(User)
Connect
Share
Share
Connect (Message Board)
Request Situation Information (Message Board)
Search Message Board
Return Situation Information
Post Message (Message Board)
Post Message

Fig. 40

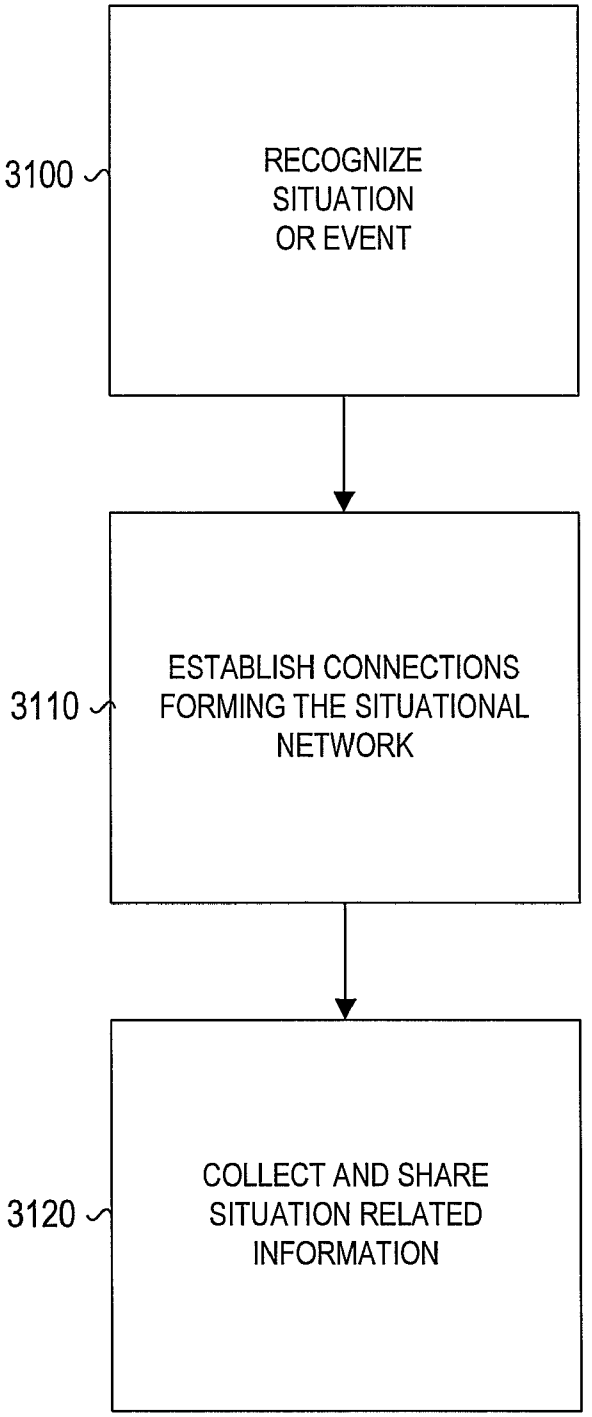

3100
RECOGNIZE SITUATION OR EVENT
3110
ESTABLISH CONNECTIONS FORMING THE SITUATIONAL NETWORK
3120
COLLECT AND SHARE SITUATION RELATED INFORMATION

Fig. 41

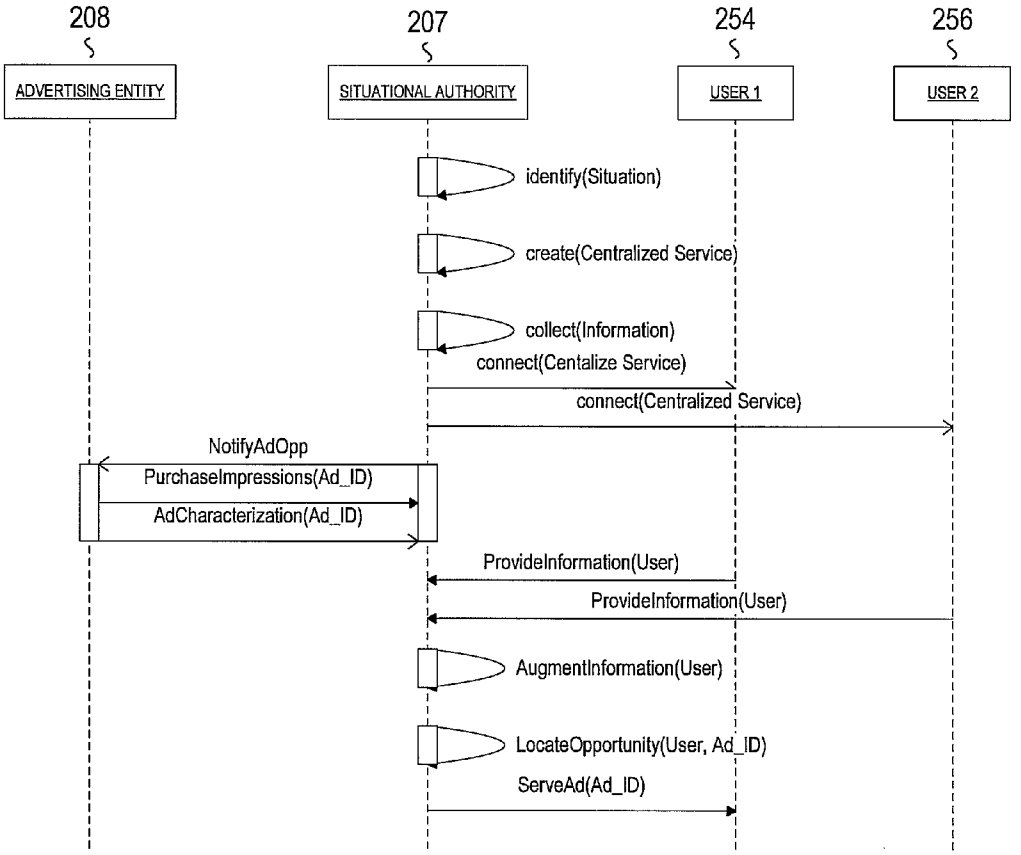

208
207
254
256
ADVERTISING ENTITY
SITUATIONAL AUTHORITY
USER 1
USER 2
identify(Situation)
create(Centralized Service)
collect(Information)
connect(Centalize Service)
connect(Centralized Service)
NotifyAdOpp
PurchaseImpressions(Ad_ID)
AdCharacterization(Ad_ID)
ProvideInformation(User)
ProvideInformation(User)
AugmentInformation(User)
LocateOpportunity(User, Ad_ID)
ServeAd(Ad_ID)

Fig. 42

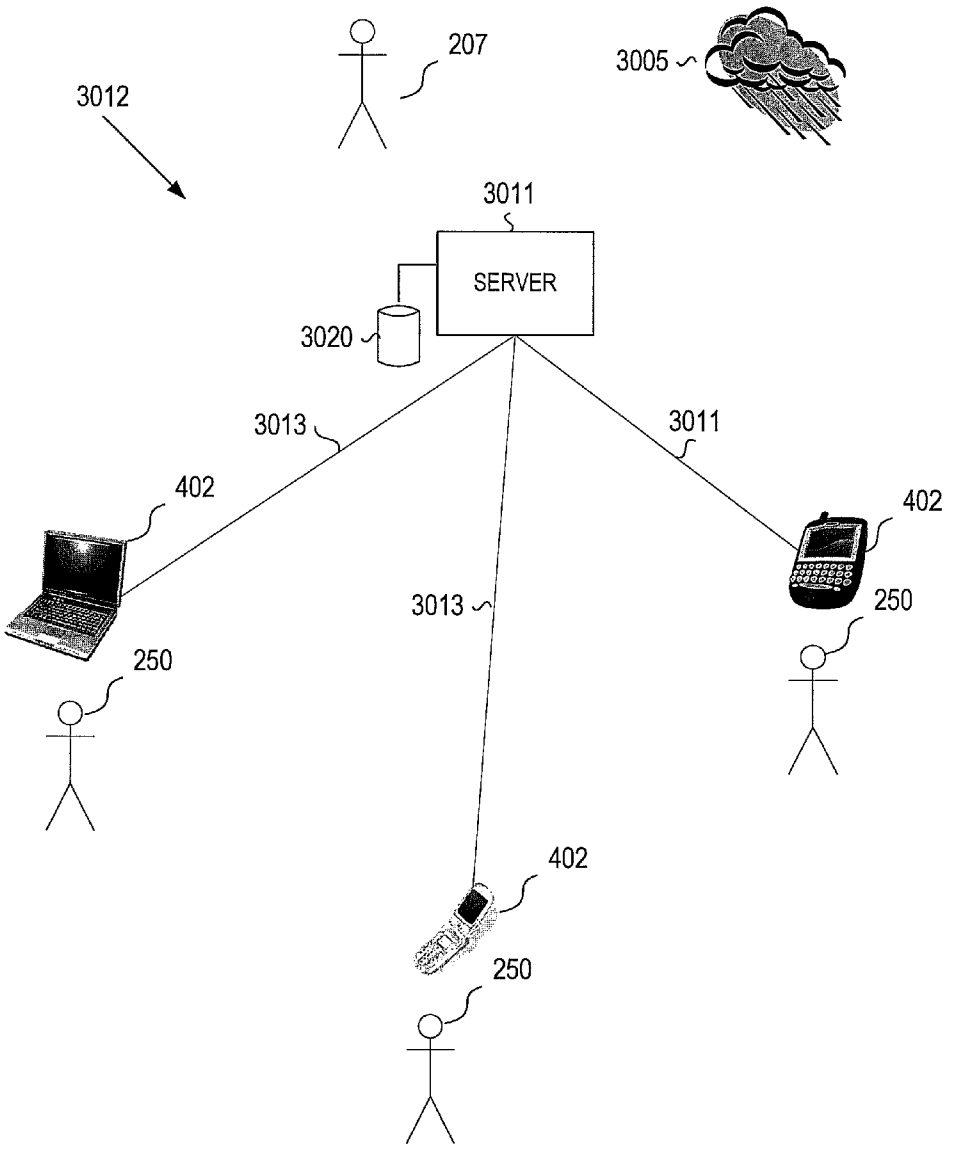

207
3005
3012
3011
SERVER
3020
3013
3011
402
402
3013
250
250
402
250

Fig. 43

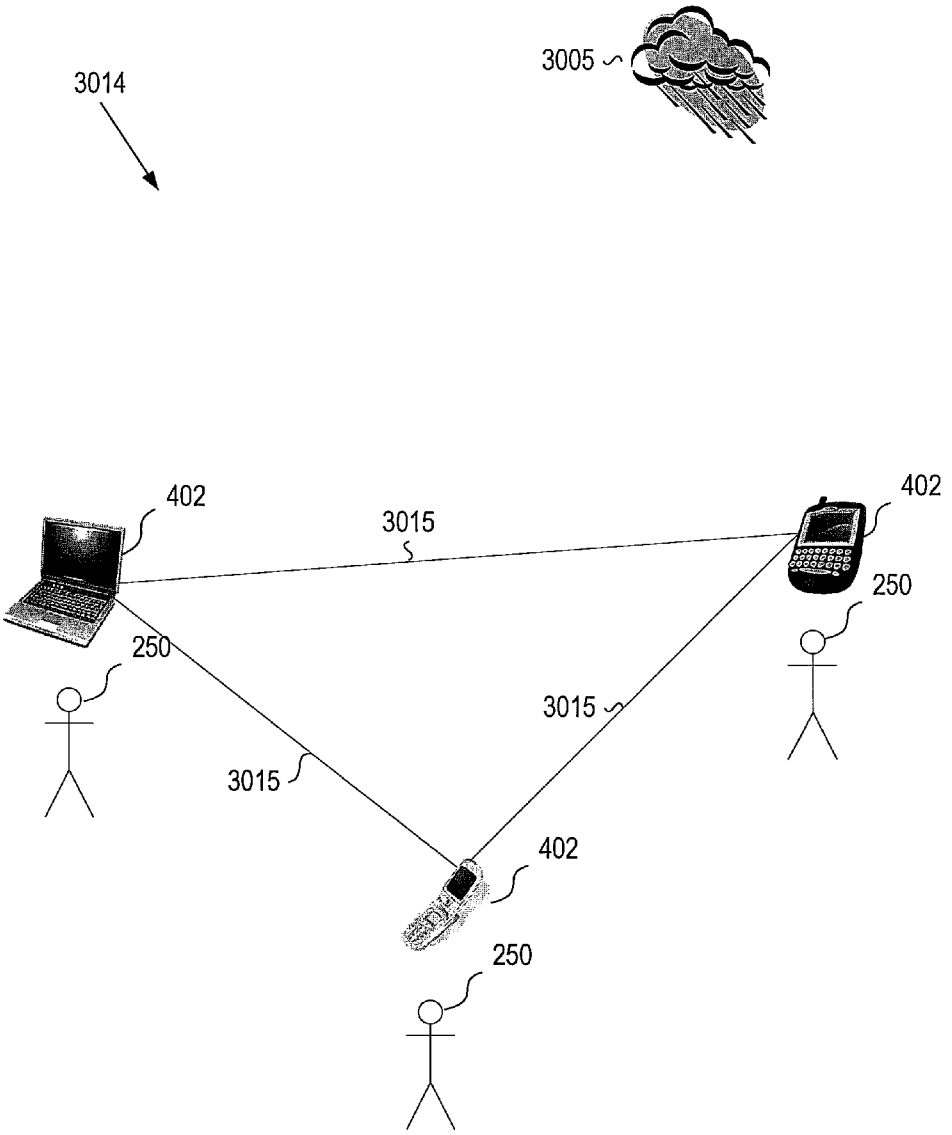


Fig. 44

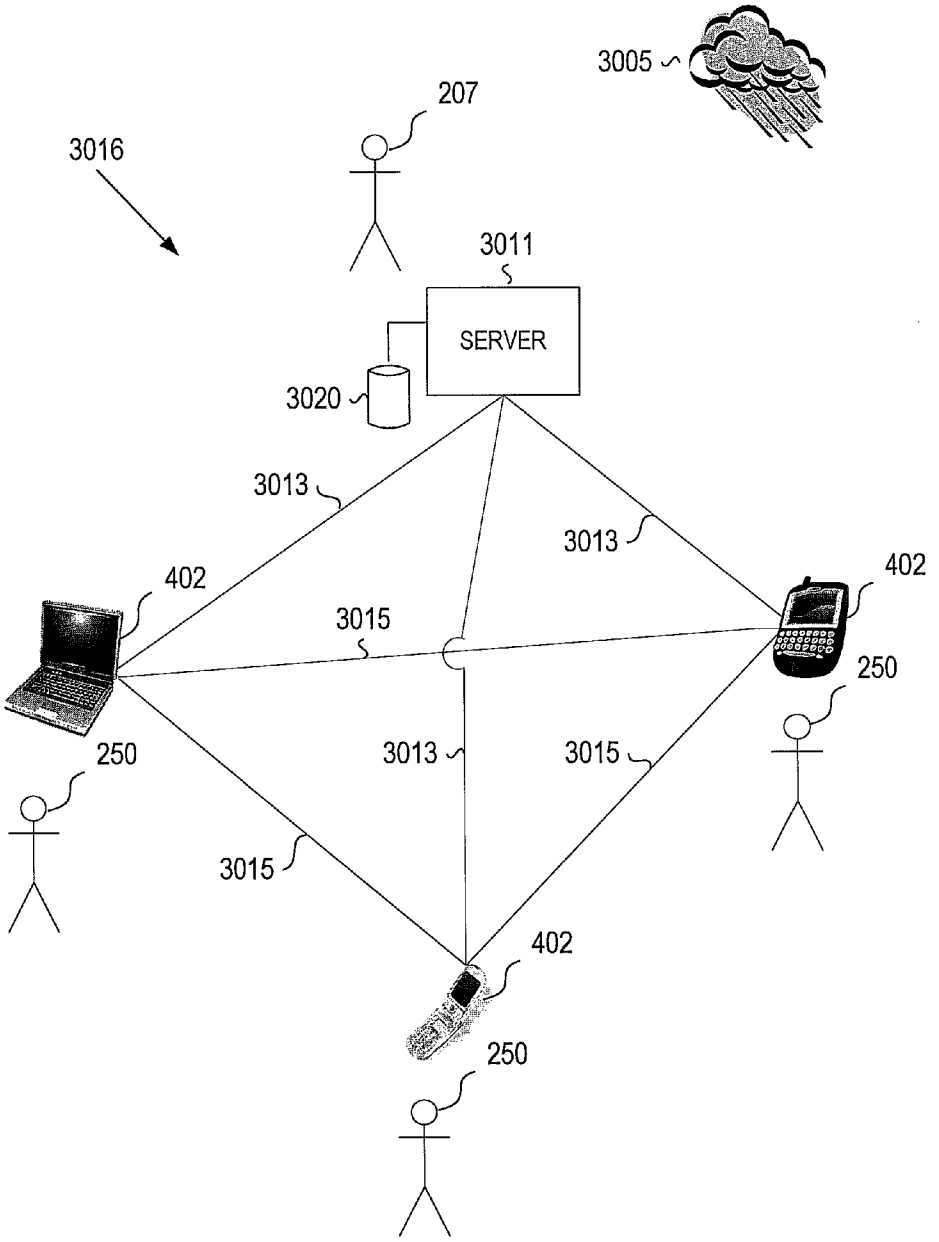

3005
207
3016
3011
SERVER
3020
3013
3013
402
402
3015
250
250
3013
3015
3015
402
250

Fig. 45

CREATING A PROJECTION OF A SITUATIONAL NETWORK

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Patent Application No. 60/887,843, filed Feb. 2, 2007, and entitled Situational Network, the entire disclosure of which is incorporated herein by reference.

This application is related to co-pending U.S. patent application Ser. No. 11/566,947, filed Dec. 5, 2006, entitled Aggregating Personal Information in a Personal Information Aggregator, the entire disclosure of which is incorporated herein by reference.

This application is also related to U.S. patent application Ser. No. 11/924,706, filed Oct. 26, 2007, now U.S. Pat. No. 7,812,717 and entitled Situational Network; U.S. patent application Ser. No. 11/924,721, filed Oct. 26, 2007, entitled Location Based Services in a Situational Network; U.S. patent application Ser. No. 11/924,727, filed Oct. 26, 2007, now U.S. Pat. No. 7,711,475 and entitled Use of a Situational Network for Navigation and Travel; U.S. patent application Ser. No. 11/924,731, filed Oct. 26, 2007, entitled Access of Information Using a Situational Network; U.S. patent application Ser. No. 11/924,741, filed Oct. 26, 2007, entitled Searchable Message Board; and U.S. patent application Ser. No. 11/924,748, filed Oct. 26, 2007, entitled Targeted Advertising in a Situational Network.

BRIEF DESCRIPTION OF THE DRAWINGS

The following detailed description will be better understood when read in conjunction with the appended drawings, in which there is shown one or more of the multiple embodiments of the present invention. It should be understood, however, that the various embodiments of the present invention are not limited to the precise arrangements and instrumentalities shown in the drawings.

In the Drawings:

FIG. **1** is a network diagram of an embodiment of a Situational Network (SitNet);

FIG. **2** is a use case diagram for the SitNet of FIG. **1**;

FIG. **3** is a use case diagram for a personal information aggregator (PIA) used in accordance with the SitNet of FIG. **1**;

FIG. **4** is a class diagram for the structure of the personal information stored in the PIA used in accordance with the SitNet of FIG. **1**;

FIG. **5** is a sequence diagram for the interactions associated with a PIA single-use authorization request to receive data from the PIA used in accordance with the SitNet of FIG. **1**;

FIG. **6** is a sequence diagram for the interactions associated with a PIA ongoing-use authorization request to receive data from the PIA used in accordance with the SitNet of FIG. **1**;

FIG. **7** is a sequence diagram for the interactions associated with a PIA limited-use authorization request to receive data from the PIA used in accordance with the SitNet of FIG. **1**;

FIG. **8** is a sequence diagram for the interactions associated with a user-initiated PIA authorization to provide data from the PIA used in accordance with the SitNet of FIG. **1**;

FIG. **9** is an activity diagram for the steps performed by the PIA used in accordance with the SitNet of FIG. **1**;

FIG. **10** is a sequence diagram for the interactions associated with user-initiated receiving of data by the PIA used in accordance with the SitNet of FIG. **1**;

FIG. **11** is a sequence diagram for the interactions associated with an authorization request to provide data to the PIA used in accordance with the SitNet of FIG. **1**;

FIG. **12** is a network diagram of an N-Dimensional Social Network (NDSN) used in accordance with the SitNet of FIG. **1**;

FIG. **13** is a use case diagram for the NDSN of FIG. **12**;

FIG. **14** is a sequence diagram for the interactions associated with a user discovering an NDSN used in accordance with the SitNet of FIG. **1**;

FIG. **15** is a sequence diagram for the interactions associated with a user connecting to other members of an NDSN used in accordance with the SitNet of FIG. **1**;

FIG. **16** is a sequence diagram for the interactions associated with a user inviting a new member to connect to the members of an NDSN used in accordance with the SitNet of FIG. **1**;

FIG. **17** is a sequence diagram for the interactions associated with a user disconnecting from other members of an NDSN used in accordance with the SitNet of FIG. **1**;

FIG. **18** is an example of nodes of the NDSN of FIG. **12**;

FIG. **19** is an example of a projected NDSN used in accordance with the SitNet of FIG. **1**;

FIG. **20** is a sequence diagram for the interactions associated with creating a projection of the NDSN used in accordance with the SitNet of FIG. **1**;

FIG. **21** is a sequence diagram for the interactions associated with a user connecting to other members of an NDSN used in accordance with the SitNet of FIG. **1**;

FIG. **22** is a block diagram of a computer system for realization of the SitNet of FIG. **1**;

FIG. **23** is a block diagram of a computer system through which the implementation of the SitNet of FIG. **1** may be realized;

FIG. **24** is a user case diagram of an emergency event situational network in accordance with the SitNet of FIG. **1**;

FIG. **25** is an example of a propagation of a notification using a PIA in accordance with the SitNet of FIG. **1**;

FIG. **26** is an example of a method of connecting to a weather-dependent social network in accordance with the SitNet of FIG. **1**;

FIG. **27** is an example of presenting targeted advertisements to different users in accordance with the SitNet of FIG. **1**;

FIG. **28** is a use case diagram in accordance with the SitNet of FIG. **1**;

FIG. **29** is an example of temporally limited links in accordance with the SitNet of FIG. **1**;

FIG. **30** is an example of a geographic projection of nodes in accordance with the SitNet of FIG. **1**;

FIG. **31** is an example of an event relative embodiment of a SitNet;

FIG. **32** is an example of presenting a roll call to a user in accordance with the SitNet of FIG. **1**;

FIG. **33** is an example of a searchable message board that can be used in accordance with the SitNet of FIG. **1**;

FIG. **34** is a sequence diagram in accordance with the SitNet of FIG. **1**;

FIG. **35** is a sequence diagram in accordance with the SitNet of FIG. **1**;

FIG. **36** is a sequence diagram in accordance with the SitNet of FIG. **1**;

FIG. **37** is a sequence diagram in accordance with the SitNet of FIG. **1**;

FIG. **38** is a sequence diagram in accordance with the SitNet of FIG. **1**;

FIG. **39** is a sequence diagram in accordance with the SitNet of FIG. **1**;

FIG. **40** is a sequence diagram in accordance with the SitNet of FIG. **1**;

FIG. **41** is a flow diagram in accordance with the SitNet of FIG. **1**;

FIG. **42** is a sequence diagram in accordance with the SitNet of FIG. **1**;

FIG. **43** is a network diagram of an alternative embodiment of a SitNet;

FIG. **44** is a network diagram of an alternative embodiment of a SitNet; and

FIG. **45** is a network diagram of an alternative embodiment of a SitNet.

DETAILED DESCRIPTION

Certain terminology is used herein for convenience only and is not to be taken as a limitation on the embodiments of the present invention. In the drawings, the same reference letters are employed for designating the same elements throughout the several figures.

The words "right", "left", "lower" and "upper" designate directions in the drawings to which reference is made. The words "inwardly" and "outwardly" refer to directions toward and away from, respectively, the geometric center of the situational network and designated parts thereof. The terminology includes the words above specifically mentioned, derivatives thereof and words of similar import.

Unified Modeling Language ("UML") can be used to model and/or describe methods and systems and provide the basis for better understanding their functionality and internal operation as well as describing interfaces with external components, systems and people using standardized notation. When used herein, UML diagrams including, but not limited to, use case diagrams, class diagrams and activity diagrams, are meant to serve as an aid in describing the embodiments of the present invention, but do not constrain implementation thereof to any particular hardware or software embodiments. Unless otherwise noted, the notation used with respect to the UML diagrams contained herein is consistent with the UML 2.0 specification or variants thereof and is understood by those skilled in the art.

Referring generally to FIG. **1**, a situational network **3000** is created when an occurrence or expected occurrence of an event or situation **3005** causes connections, also referred to as links, to be established between, within or among a set of participants **250**, **207**. The situational network allows the participants **250**, **207** to interact and exchange information over connections to or through a computer network **900** regarding the event or situation **3005**. Some or all of the participants included in the situational network (SitNet) **3000** may have no prior knowledge of or connection or contact with each other or other participants of the situational network through any other type of social network or personal interactions.

In the context of the situational network **3000**, the participants may include external entities **207**, also called situation authorities, central authorities or trusted providers, that generally are able to aggregate and provide comprehensive information related to the situation. Situation authorities **207** include, but are not limited to news organizations, such as news agencies (e.g., CNN), weather agencies (e.g., The Weather Channel), traffic agencies (e.g., Traffic.com), emergency relief organizations (e.g., The American Red Cross), and government agencies (e.g., local fire departments, state Departments of Transportation, Federal Emergency Management Agency (FEMA)). There is a corresponding situation authority server **3011**, also referred to as an event node server, for each situation authority **207**. The situation authority server **3011** may be connected to a database **3020** for storing information related to the situation **3005**, or data related to other participants in the SitNet **3000**.

Participants in the SitNet **3000** also include users **250**, which are alternately referred to as individuals or members. Users **250** are connected via the situational network **3000** using devices **402** such as cell phones, PDA's, personal computers, network servers, PVR's, in-vehicle and portable navigation systems, or other devices generally known to those skilled in the art that enable connection to, from and through the computer network **900**. There is at least one device **402** corresponding to each user **250**, although a user **250** may use more than one device **402** to access and share information within the situational network **3000**. The devices **402** may be connected into the situational network **3000** automatically, by requesting a connection, or by receiving an invitation to connect, each of which is described in greater detail below.

The connections, or links, established in forming and sustaining the situational network **3000** may be persistent or temporary. A persistent connection allows participants to exchange information without requiring the user to re-authenticate, re-authorize, or re-create the connection. Temporary connections require one or both sides of the link to re-authenticate or re-authorize the connection each time information is to be sent or received. Some temporary links may enable one-time use, such that a new connection, including authorization or authentication, is created each time information is passed between the participants.

Examples of events or situations **3005** that might initiate the formation of a situational network include weather phenomenon, such as hurricanes, tornadoes, severe thunderstorms, or winter storms; emergency situations, such as building fires, aircraft crashes, or toxic substance releases; natural disasters, such as earthquakes, tsunamis, or floods; weather related activities, such as skiing or surfing; navigation and/or travel incidents, such as road closures or construction, vehicle accidents, traffic congestion, roadway debris, or air turbulence; and public health crises, such as disease outbreak. Many of these event types are interrelated. For example, there a high correlation between vehicle accidents and freezing precipitation. Thus, it is possible to anticipate or pre-form a situational network based on an expected weather condition or forecast or anticipated road construction.

If the event or situation is not stationary or changes over time (e.g., in scope or location), such as a weather event with a time-dependent trajectory or size, the participants in the situational network may also change as the situation evolves over time. This embodiment is referred to as an event relative or dynamic SitNet. A change in the characteristics, either actual or forecast, associated with the situation are used to determine which users should be connected to or disconnected from the SitNet. Examples of characteristics for a weather phenomenon include location, size, shape, speed, precipitation rate, wind velocity, and trajectory. Some examples of characteristics that may be associated with navigation situations include location, altitude, visibility, length of traffic backup, and road surface conditions. In one embodiment, the users are connected or disconnected to the SitNet based on their movement relative to the situation.

Referring to FIG. **31**, an example of an event relative SitNet is shown for two different times T**1** and T**2**. At time T**1**, participants B, D, E, and H are connected to a situation authority in SitNet **3001** that has been established for a cluster of severe thunderstorms **3003**. At time T**2**, in response to the

changes in the location and shape of the thunderstorm cluster **3003**, participants A, C, F, and I have been added to the SitNet **3001**, and participants B, D, and H have been disconnected. Participant E is included in the SitNet **3001** at both time T**1** and T**2**.

Referring to FIG. **36**, the event relative embodiment of the SitNet has a dynamic set of user connections in which links between the participants in the situational network are added or removed as the situation or event changes its geographic location or as the user changes his position relative to the situation. User devices **404**, **406** are connected into the situational network when it is determined that users of the devices **404**, **406** are affected by the event or situation. Similarly, users are disconnected from the situational network as the event or situation moves away, the users move away from the situation, or the users are no longer determined to be affected by the event or situation. For example, due to the uncertain nature of hurricane trajectory prediction, the list of users connected to the SitNet may change for each updated forecast of the hurricane, with users determined to be out of the projected hurricane path being disconnected from the SitNet while other users included in the projected hurricane path are added. As the hurricane passes, some users may be disconnected from the network if their area was not adversely affected, while those affected by the storm may remain connected to the SitNet or even be disconnected from the event relative SitNet and invited to connect to a different SitNet for those affected by the Hurricane, possibly requiring emergency assistance or aid by a relief agency.

A SitNet may be formed when users involved in a situation or event are determined to be in relatively close geographic positions. If the SitNet is not pre-formed or anticipated by the event or situation, but its formation is a result of the occurrence of the event or situation causing the potential members of the SitNet to be within a relatively small geographic area, such embodiment of the SitNet may be referred to as a proximity based SitNet. A proximity based SitNet may be established without the involvement of a situation authority or the creation an event node, described in greater detail below. User devices, such as Personal Information Aggregators (PIAs), discussed in greater detail below, containing a GPS or other geographic positioning devices generally understood by those skilled in the art, can share location coordinates to determine if they are within a proximity limit that has either been preset within the device or predetermined by the user. In one embodiment, PIAs crawling a multi-dimensional personal information network (NDSN), discussed in greater detail below, can locate other PIAs with the same proximity if the PIAs are allowed to share their location coordinates. The users may have no previous interaction or knowledge of each other, but may be related thought their PIAs by a high order separation of nodes in the NDSN (i.e., their PIAs may have indirectly changed information as described below). For example, while traveling internationally, several people without any other prior personal connection or relationship are coincidentally delayed at the same airport. They are alerted to the proximity of the other users by their PIAs which have established that they share something in common, such as currently reside in the same town, state or county, or have attended the same school or university. A SitNet can be formed through connections established through the PIAs, possibly resulting in a personal meeting between the individuals.

A proximity based SitNet may be established in response to a request for goods or services (i.e. the need for goods or services is the situation) by an individual. A device associated with an individual broadcasts a message containing a request for goods and/or services. The message also includes positional coordinates. Other devices receiving the request within a close proximity to the requesting device may establish a connection with the requesting device to provide information about the rendering of the service or the availability of the goods. The devices may also be used to facilitate a personal meeting between the device users if the rendering of the service or procurement of goods requires such a meeting. The connections in the SitNet are maintained until the service has been completed by one user with a responding device, or until the goods have been obtained.

A variety of different architectures may be used to connect the devices of participants in the situational network. In one embodiment, a situational network may be formed using a centralized architecture. Referring to FIG. **43**, in a centralized architecture embodiment, user devices **402** in the SitNet **3012** corresponding to users **250** are connected using centralized connections **3013** to a situation authority server **3011** associated with a situation authority **207**. Information related to the situation **3005** is shared between the situation authority **207** and the users **250**. Information originating from a user **250** in the SitNet **3012** and related to the situation **3005** may be shared with other users **250** in the SitNet **3012** via the situation authority **207**. The situation authority **207** may distribute the information as received from the users **250** via the centralized connections **3013** between the situation authority server **3011** and the user devices **402** or perform a verification of the information before distributing the information to the users **250** of the SitNet **3012** through the centralized connections **3013**.

Referring to FIG. **44**, the situational network may also be formed using a decentralized architecture, such as a peer-to-peer network understood by one skilled in the art. In FIG. **44**, user devices **402** of SitNet **3014** corresponding to users **250** are connected to each other through peer-to-peer connections **3015**. The user device **402** may be connected at the same time to more than one other user device **402**. Information related to the situation **3005** is shared using the user devices **402** directly between users **250** using the peer-to-peer connections **3015**. Information can be distributed from a user **250** to all other users or a subset of the users in the SitNet **3014**.

In one embodiment, the situation authority acts as a participant in the peer-to-peer network. While the situation authority may act as an important source of information, it does not act as the central authority or host, as would be found in the centralized architecture described above.

Referring to FIG. **45**, both centralized and decentralized architectures may be utilized to form a combined architecture for the situational network. In FIG. **45**, the user devices **402** in the SitNet **3016** are connected to the situation authority server **3011** using centralized connections **3013**. The user devices **402** are also interconnected with each other using peer-to-peer connections **3015**. In the event that the situation authority server **3011** becomes disabled or connectivity between the situation authority **207** and the users **250** is lost, the peer to peer connections **3015** that have been established between the users **250** or corresponding user devices **402** can still allow vital situation information to be exchange between users **250**. In one embodiment, the situation authority **207** facilitates the formation of the peer-to-peer connections **3015** by providing users **250** with some type of indication of other users **250** also connected to the situational network **3016** through the situation authority server **3011**. One such indication may be a projection of nodes of the SitNet **3016**, described in greater detail below.

Regardless of the architecture used to form and sustain the situational network, the situational network is generally

formed according to the process outlined in FIG. **41**, which includes a recognition or identification of a situation **3100**, a connection of participants **3110**, and a sharing of information related to the situation **3120**. This is also demonstrated in FIG. **39**, where the situation is identified by situation authority **207**. Users **256**, **256** and situation authority **207** are all interconnected, and able to exchange information. Furthermore, those skilled in the art will recognize that any of the available architectures (e.g., centralized, peer-to-peer, or combination thereof) may be used to form and sustain the various embodiments of the situational network described above, including the event relative (dynamic) SitNet or the proximity based SitNet. Certain architectures may be more applicable to certain embodiments. For example, the peer-to-peer architecture may naturally be used to form a proximity based SitNet described previously due to the inherent nature of the proximity SitNet. Nonetheless, those skilled in the art will recognize that a centralized or combination architecture may also be used for the proximity based SitNet depending on the particular situation and/or connections available.

In one embodiment, the situational network may be established using the framework of an N-dimensional social network (NDSN), also referred to hereafter as a multi-dimensional personal information network, as described in detail below. In this embodiment, users are connected into the situational network through the NDSN using a PIA. In the context of the NDSN, a PIA associated with each user is or encompasses a node of the situational network. The situation or event itself may also be associated with a node on the SitNet, known as the event node for the SitNet. For example, an entity, such as a trusted provider of information (e.g., a news source such as CNN or weather.com), establishes an event node in an NDSN that propagates up-to-date information on the situation to PIAs of the NDSN connected to that event node. In one embodiment, the SitNet may have more than one event node.

Referring to FIG. **2**, user PIAs connected to an event node using the connect use case **972** in the SitNet **3000** may discover each other using the discover use case **971**, described below. Personal or situation relevant information is shared between the users using the share use case **977**. In addition, connections between PIAs, also called links, may be established where one or both of the PIAs are not linked directly to the event node, wherein a direct link to the event node is also referred to as a first order connection. In one embodiment, the SitNet can be formed in the absence of an event node, such as in a de-centralized (peer-to-peer) architecture as described above.

A Personal Information Aggregator (PIA) provides a user with the ability to store, organize and control personal information. The PIA obtains personal information that may be controlled by separate entities (e.g., credit reporting agencies, financial institutions and merchants), aggregates the information and organizes the information in manners that have been selected by the user. The user controls access to the personal information stored in the PIA by authorizing access by other entities to subsets of the personal information stored in the PIA. In many cases, the use of the authorized information is bound and restricted by legal contract, and therefore, the user has legal remedies available to enforce proper use of the information.

The user of a PIA can be any person, group or entity that wishes to manage and control his (or its) personal information. For example, a family can use a PIA to aggregate personal information that the family members have in common (place of residence, family vacations, etc.).

An entity that accesses the information stored in a PIA can be an individual person, a group, entity or equipment (e.g., digital video recorder) or software (e.g., web browser) that has been configured to access the PIA. The nature and composition of a group that accesses a PIA can encompass a broad range of organizations, e.g., a health clinic, an auto dealership, a coin collectors club, etc.

The personal information obtained by and/or stored in a PIA encompasses a broad array of types of information about a person's life, social interactions, health and healthcare, consumer behavior including consumer purchases, entertainment consumption and habits, fitness activity, travel, financial, employment, education, hobbies and personal computing and/or other aspects of a person's world that can be reduced in any way to data. The personal information stored in the PIA is obtained from a variety of sources, including input data feeds that are generated by providers of goods and services, healthcare providers, organizations, clubs, social contacts and other persons and entities. In addition, personal information stored in the PIA may be entered directly by the user.

In some cases, there may be data regarding the user that is contained on the Internet, private networks, or in personal data storage. In one embodiment, the PIA "crawls" such networks or storage areas, searching for information to add to its store of personal information associated with the user.

A community information aggregator (CIA) performs functions that are similar to those of a PIA for a community of users (e.g., an association of architects or a chess club) A CIA provides a community with the ability to store, organize and control information associated with the community and personal information associated with members of the community. The CIA obtains, aggregates and organizes such information, and makes the information available to other authorized entities in a manner similar to that described herein with respect to PIAs.

A CIA may obtain data by searching other sources of information, e.g., web sites on the Internet. In one embodiment, a CIA gathers information about a user that is not published by that user's PIA by crawling public and/or private information sources. In one embodiment, a marketer's CIA uses a known piece of information about a user to search for and store additional information about the user. For example, a user's known e-mail address can be used to locate Internet postings of product reviews, blog postings and comments, listings in membership directories or other information associated with the user. This additional information could be used as input for recommendations targeted to the user.

A user controls the information coming in to the PIA by granting authorization to desired sources and denying authorization to unwanted sources. The source of the information may request authorization to provide information to the PIA. Alternatively, the user or the PIA may initiate the operation of receiving data from a source. The authorized information received by the PIA is organized and stored in the PIA. The PIA generates composite and derived output data feeds from the stored personal information. These data feeds may be accessed by providers of goods and services, healthcare providers, communities (e.g., organizations and clubs), social contacts, CIAs, other PIAs and other persons and entities if authorized by the user In some embodiments, the PIA can be configured to notify the user or automatically reject requests from entities known to be invalid, such as spammers.

Referring to FIG. **3**, an entity **207** requests authorization for access to a user's PIA **400** by using the Request Authorization use case **954**. The user **250** can authorize the request using one of the access type use cases **957** (e.g., Allow Single-

use Access, Allow Ongoing Access, Allow Limited Access) of the Authorize use case **950**. If authorized, the entity **207** may access the requested output data feed of personal information if the request was for access by using the Access Information use case **956**. Similarly, the entity **207** may provide information to the requested input data feed of the PIA if the request was to provide data by using the Provide information use case **955**. It should be noted that an entity **207** is not limited to authorization for a single feed, nor is an entity **207** limited to an exclusively input or output role. Rather, an entity **207** may have authorization to concurrently access one or more input data feeds and provide data to one or more input data feeds.

The personal information stored by the PIA may reside in data structures that are implemented as tables in a relational database management system (DBMS) and that can be accessed by the PIA's application program. FIG. **4** illustrates an example of data structures used to store the personal information in a PIA. In FIG. **4**, each data structure used to store information in the PIA is represented by a programming class in an object-oriented language (e.g., Java or C++), and the type of information stored in the PIA for each class of data is represented by the attributes of the class.

Those skilled in the art will recognize that there are many types of personal information that can be stored in the PIA **400**. Similarly, the design of the data structures used to store the information can vary greatly, depending on various factors such as the design requirements for the PIA (e.g., response time) and the selected platforms used to implement the PIA (e.g., DBMS, operating system, etc.).

An Upload Data use case **960** (see FIG. **3**) allows entities **207***a* to upload data to be stored in the PIA **400**; the Review Data **961** use case allows the user **250** to review the uploaded data.

In one embodiment, the user **250** controls access to both the input and output data feeds of the PIA. Specific authorization must be granted to allow an input data feed to be accepted by the PIA **400**. Similarly, specific authorization must be granted to allow access to an output data feed provided by the PIA. Authorization can be granted by various mechanisms. Those skilled in the art will recognize that an authorization request may be sent to the PIA using a wide variety of available hardware and technologies generally known in the art.

Authorization may be granted only for a "single use" of a data feed. For example, a user might grant authorization for an insurer to access a composite "Medical Record" output data feed for only a single use in order to process an insurance claim. Alternatively, the authorization might also be contingent upon the agreement that any data received from the output data feed is to be destroyed after the single use of the data.

The authorization request might also specify a "nature of use" for the requested data. For example, a healthcare provider might specify in an authorization request that the data will only be used by a specified doctor during a specified episode of care.

Authorization might be granted for only a portion of the requested data. This situation might be handled by creating one or more data feeds that contain only the authorized subset of the requested data.

FIG. **5** depicts the interactions associated with a PIA single-use authorization request in one embodiment of the invention. The External Entity **207** sends a requestInformationAccess message to the PIA **400**, with arguments indicating the requested data feed (FeedID) and the nature of the request ("Single Use"). Upon receiving the request from the External Entity **207**, the PIA **400** sends a UI message to the user **250**. The arguments of the UI request provide the ID of the entity (EntityID), the nature of the request, the ID of the requested data, and the text to be displayed to the user ("requests . . . "). The User **250** responds by sending an authorize message to the PIA **400**, passing back in the message's arguments the entity's ID, the nature of the authorization ("Single Use"), and the data feed (FeedID) for which authorization is granted. The PIA **400** notifies the External Entity **207** that the authorization has been granted by sending it a grantAccess message with arguments indicating the nature of the authorization and the data feed for which authorization is granted.

After receiving notification of the authorization, the External Entity **207** sends the PIA **400** a requestData message with an argument specifying the data feed that is being requested. If the feed ID matches that for which authorization has been granted, the PIA **400** responds by sending the requested data to the External Entity **207** in a provideData message. After receiving the requested data from the PIA **400**, the External Entity **207** uses the data (useData). Since the authorization was for a single use, the External Entity **207** destroys the data (destroyData) after its use. To notify the PIA **400** of the data's destruction, the External Entity **207** sends a dataDestroyed message, which the PIA **400** passes on to the User **250**. In one embodiment, the PIA **400** might utilize a timer to remind itself to check for notification that the data has been destroyed, and to send a message to the user **250** if not notified within a prescribed time period.

FIG. **6** depicts the interactions associated with an ongoing-use authorization request in one embodiment of the invention. The External Entity **207** sends a requestInformationAccess message to the PIA **400**, with arguments indicating requested data feed (FeedID) and the nature of the request ("Ongoing"). Upon receiving the request from the External Entity **207**, the PIA **400** sends a UI message to the user **250**. The arguments of the UI request provide the ID of the entity (EntityID), the nature of the request, the requested data feed, and the text to be displayed to the user ("requests . . . "). The User **250** responds by sending an authorize message to the PIA **400**, passing back in the message's arguments the entity's ID, the nature of the authorization ("Ongoing"), and the data feed for which authorization is granted. The PIA **400** notifies the External Entity **207** that the authorization has been granted by sending it a grantAccess message with arguments indicating the nature of the authorization and the data feed for which authorization is granted.

After receiving notification of the authorization, the External Entity **207** sends the PIA **400** a requestData message with an argument specifying the data feed that is being requested. If the feed ID matches that for which authorization has been granted, the PIA **400** responds by sending the requested data to the External Entity **207** in a provideData message. After receiving the requested data from the PIA **400**, the External Entity **207** uses the data (useData). Since the authorization is for ongoing access, this cycle of a requestData message followed by a provideData message continues indefinitely.

FIG. **7** depicts the interactions associated with a limited-use authorization request. In this example, authorization is granted for limited use of a data feed, and the authorization is revoked on a specific termination date or due to some other set of termination conditions. For example, the travel department at the user's employer might be granted authorization to access a composite Travel Preferences input data feed so long as the user is still employed by the employer. The PIA **400** keeps a persistent record of the authorization, so that authorization needs only to be granted once, rather than repeatedly, and revokes the authorization if the employment is terminated.

The External Entity **207** sends a requestInformationAccess message to the PIA **400**, with arguments indicating the requested data feed (FeedID) and the nature of the request ("Limited"). Upon receiving the request from the External Entity **207**, the PIA **400** sends a UI message to the user **250**. The arguments of the UI request provide the ID of the entity (EntityID), the nature of the request, the requested data feed, and the text to be displayed to the user ("requests . . . "). The User **250** responds by sending an authorize message to the PIA **400**, with arguments that specify the entity's ID, the nature of the authorization ("Limited"), the termination criteria (endCondition) and the data feed for which authorization is granted. The PIA **400** notifies the External Entity **207** that the authorization has been granted by sending it a grantAccess message with arguments indicating the nature of the authorization, the termination conditions and the data feed for which authorization is granted.

After receiving notification of the authorization, the External Entity **207** sends the PIA **400** a requestData message with an argument specifying the data feed that is being requested. If the feed ID matches that for which authorization has been granted, the PIA **400** responds by sending the requested data to the External Entity **207** in a provideData message.

After receiving the requested data from the PIA **400**, the External Entity **207** uses the data (useData) and then, since the authorization was for limited use, checks for the existence of the termination conditions (checkCondition). If the termination conditions are met, the External Entity **207** destroys all of the data (destroyData) which it has received under this authorization. To notify the PIA **400** of the data's destruction, the External Entity **207** sends a "dataDestroyed" message, which the PIA **400** passes on to the User **250**. In another embodiment, the PIA **400**, instead of the external entity, might check for the termination conditions, and notify the external entity **207** when the conditions are met.

In an alternate embodiment, the user **250**, instead of the external entity, might initiate the authorization. FIG. **8** depicts the interactions associated with a PIA authorization request for such a situation. Although an ongoing authorization request is shown in the example of FIG. **8**, it is understood that a user-initiated authorization request may also be for single or limited use. In FIG. **8**, the User **250** initiates the authorization by sending an authorize message to the PIA **400**, with arguments that specify the entity's ID (EntityID), the nature of the authorization (authorizationType), and the data feed (FeedID) for which authorization is granted. Upon receiving the authorization from the User **250**, the PIA **400** notifies the External Entity **207** of the authorization by sending an accessGranted message with an argument specifying the nature of the authorization and identifying the authorized data feed.

After receiving notification of the authorization, the External Entity **207** sends the PIA **400** a requestData message with an argument specifying the data feed that is being requested. If the feed ID matches that for which authorization has been granted, the PIA **400** responds by sending the requested data to the External Entity **207** in a provideData message. After receiving the requested data from the PIA **400**, the External Entity **207** uses the data (useData). Since the authorization is for ongoing access, this cycle of a requestData message followed by a provideData message continues indefinitely.

With regard to the receipt of input data feeds by the PIA **400**, the user **250**, in one embodiment, might request the PIA **400** to receive data from the external entity. FIG. **10** depicts the interactions associated with such a situation. The User **250** requests the PIA **400** to receive a data feed from the External Entity **207** by sending a receiveRequest message to the PIA **400**. The PIA **400** requests the data feed from the External Entity **207** by sending a requestData message to the External Entity **207**. The External Entity **207** provides the requested data feed to the PIA **400** by sending the provideData message to the PIA **400**. After receiving the requested data from the External Entity **207**, the PIA **400** stores the data.

It should be noted that in another embodiment, the External Entity **207** may be configured to provide data to the PIA **400** once the PIA has configured itself to accept the data feed from the External Entity **207**, and thus, the requestData message would be eliminated from the interaction.

In an alternate embodiment, the External Entity **207** requests authorization to provide data feeds to the PIA **400**. FIG. **11** depicts the interactions associated with such a situation. The External Entity **207** requests authorization to provide data to the PIA **400** by sending a requestInformationAccess message to the PIA **400**. The PIA **400** notifies the User **250** of the authorization request by sending a UI message to the User **250**. The User **250** approves the authorization request by sending an authorize message to the PIA **400**. The PIA **400** notifies the External Entity **207** of the approval by sending a grantAccess message to the External Entity **207**. The External Entity **207** provides the requested data feed to the PIA **400** by sending the provideData message to the PIA **400**. After receiving the requested data from the External Entity **207**, the PIA **400** stores the data.

In any interaction in which the PIA receives data from an external entity, an additional operation might be used to authenticate the source of the data, i.e., the external entity and the data feeds provided by that source. A person skilled in the art will recognize that there are various well-known technologies that might be used to provide this assurance; some examples are the use of public and private keys, digital signatures and hashcodes.

FIG. **9** is an activity diagram corresponding to an Authorize activity. In the depicted embodiment, the requesting entity has an associated security level. This security level is used as an additional condition for obtaining access to the PIA's data feeds. The PIA receives an authorization request and checks the requesting entity's security level. If the security level is allowable for the requested data feed based on the entity's security level and the nature of the authorization request (single-use, limited use or ongoing), then the PIA next determines if it will authorize the request based on factors independent of the entity's security level. In one example, the user may only allow a certain entity access during normal work day hours, and not during the evening or on weekends. In another example, an entity may only be allowed single-use access, and therefore the entity will be refused authorization if ongoing or limited use is requested.

A PIA, depending upon the particular embodiment, may present user interface displays to the user for managing the user's personal information. In one embodiment, the user interface (UI), which may be a GUI or a text-based interface, may be presented on a computer display screen. Alternatively, the user interface may be presented on the display of a PIA appliance, or on a smaller screen contained within a handheld device associated with the PIA.

The PIA **400** or CIA may be implemented on a variety of hardware and software platforms, e.g., a handheld device, a personal computer or a dedicated appliance. The latter is a device that provides a user with the functions of a PIA **400**. In this example, the PIA **400**, which is implemented as the appliance includes a display and a set of buttons which provide the user with a user interface. In addition, the PIA appliance in this example has a port which may be used for connecting the PIA appliance to a network (e.g., Internet) for transmitting and receiving input and output data feeds as well

as any configuration information or data used by the PIA **400**. Those skilled in the art will recognize that the PIA **400** and the CIA may be implemented on a variety of hardware and software platforms.

Similarly, the type of hardware that is used by the PIA to store personal information can vary considerably, depending in part on such factors as user preferences and available technologies. In one embodiment, the personal information is stored in a device that is under the physical possession and control of the user, e.g., a small handheld portable device. The device may be dedicated solely to providing the functions of a PIA; alternatively, the device may also have other functions. For example, a mobile phone may be configured to provide the additional functions of a PIA. In such an embodiment, a database management system (DBMS) such as Microsoft SQL Server CE™ might be used for storing and managing the personal information.

In other embodiments, the personal information is stored in other types of devices that are under the physical possession and control of the user, e.g., the user's personal computer or a dedicated PIA appliance. In these embodiments, a database package such as Microsoft Access™ or a DBMS such as Microsoft SQL Server™, mySQL or postgreSQL might be used for storing the personal information.

The computer network **900** may be implemented with a variety of hardware platforms. For example, the computer network **900** may be implemented using the IEEE 802.3 (Ethernet) or IEEE 802.11 (wireless) networking technologies, either separately or in combination. In addition, the computer network **900** may be implemented with a variety of communication tools. For example, the computer network **900** may be implemented using the well-known TCP/IP suite of protocols. The Internet and some corporate intranets are examples of computer networks that use the technologies and standards described above.

In yet another embodiment, the personal information is stored in a remote server that is operated by a separate PIA provider and provides "virtual" PIA functions to one or more users. The PIA provider operating the remote computer ensures that the user has exclusive control over his personal information by providing one or more mechanisms for validating the user's identity before allowing the user to exercise control over his personal information. In this embodiment, a DBMS such as IBM DB2™ or mySQL might be used for storing and managing the personal information

Those skilled in the art will recognize that there are a wide variety of choices other than the examples given above regarding the selection and arrangement of the equipment, technologies, platforms and systems used to store personal information in the PIA.

The technologies used by the PIA to send and receive its data feeds are varied and depend upon the specific embodiment. In one embodiment in which the PIA is implemented on a handheld device, the technologies include Bluetooth for local feeds and wireless short message service (SMS) for remote feeds. Bluetooth is used to establish a data connection between the PIA and a blood pressure monitor in a physician's office, and this data connection is used to send the blood pressure measurements taken by the monitor the PIA. SMS is used to send the latest healthcare information, which includes blood pressure measurements, to the PIA.

In an embodiment in which the PIA is implemented on a personal computer or a remote computer, Internet access through an Internet Service Provider (ISP) might be used for sending and receiving data. In this embodiment, the ISP might provide access to the Internet as a dial-up service, or through a higher-speed technology such as broadband or DSL. Since the Internet can expose the data being sent and received to unauthorized persons and systems, the data feeds, in this embodiment, might be encrypted, e.g., by using the HTTPS protocol, or by implementing a virtual private network (VPN) between the PIA and the sources and receivers of the data feeds.

An N-dimensional social network (NDSN), also called a multi-dimensional personal information network, captures and manages multi-dimensional relationships between persons and other entities that are users of the network. An NDSN may be used as a framework for establishing a Situational Network. A user (i.e., a member or participant) of the NDSN may be an individual (i.e., person), a group (e.g., healthcare clinic, law firm, supermarket chain, etc), or entity. The NDSN uses multiple dimensions of association to characterize the relationships between users or members. For example, while friendship is a dimension that might be used by the NDSN, the NDSN might also utilize other dimensions such as family, professional connection, consumer (e.g., consumer-to-merchant) relationship and healthcare-relation (e.g., providers, insurers, etc.) to characterize the relationship between two or more users. In addition, the NDSN might utilize dimensions that link participants by preferences and behaviors, e.g., a preference for a type of product or service.

The NDSN permits the user to discover and utilize the indirect relationships to other users that are connected to him through first-degree users. The multiple dimensions of the NDSN **100** and the ability to discover and use indirect relationships are described in more detail below. The NDSN also provides a decentralized architecture outside the control of a single entity.

The NDSN can also provide a "projected" view of a subset of the members of the NDSN to the user based on a subset of the NDSN's multiple dimensions. Such a "projected" view allows the user to use and manage smaller portions of the entire social network. The projected social network is described in more detail below.

In one embodiment, the NDSN comprises interconnected nodes, where individual users, members, entities, communities, or other aggregations of entities within the NDSN are associated with the nodes. Each node provides an associated entity with the ability to store and manage his profile and relationships with other users of the NDSN. Nodes may connect via different dimensions. Sets of nodes may exhibit high interconnectedness along some dimensions and little or no interconnection along other dimensions.

Each node is capable of communicating in a peer-to-peer fashion with other nodes in the NDSN, and thus is a user's point of connection to the NDSN, providing a user with access to information that can be obtained from other users of the NDSN with whom the user has a relationship. Conversely, a node provides a user with the ability to selectively share (by providing access to) his personal information with other users of the NDSN. A node may be, or may encompass, a user's PIA or CIA.

Referring to FIG. **12**, the NDSN **100** includes multiple users **250** and other entities associated therewith. Each of the users **250** or other entities of the NDSN **100** has an associated node which encompasses a PIA **400** or a CIA **220** or other device or software application (not shown). The PIAs **400** and CIAs **220** can be interconnected through the computer network **900**.

Those skilled in the art will recognize that a node of the NDSN **100** may be implemented using a wide variety of available hardware and technologies generally known in the art, such as software on a personal computer or a handheld PDA. In addition, those skilled in the art will recognize that

the nodes of the NDSN **100** may be interconnected and may communicate with each other using a wide variety of available hardware and technologies generally known in the art, such as TCP/IP over an Ethernet or a wireless network. In one embodiment, some users may have their nodes hosted in a common location, e.g., on a local or remote server.

A user's PIA **400** provides various functions that permit the user to connect to and interact with other members of the NDSN **100**. Referring to FIG. **13**, a user **250** employs the Discover use case **971** to discover the existence of other members of the NDSN **100**. The user **250** may or may not have prior knowledge of the existence of members of the NDSN **100**, and therefore, may not need to discover the existence of the members of the NDSN **100**. The user **250** employs the Connect use case **972** to connect to other members of the NDSN **100** and configures his user profile by utilizing the Configure **973** use case. Once connection to other members of the NDSN **100** is established for the user **250**, the user **250** can invite a new member **251** to connect to members of the NDSN **100** by utilizing the Invite use case **974**. The user **250** employs the Request Projection **975** use case to obtain a projection of the NDSN. If the user **250** decides to disconnect himself from the other members of the NDSN **100**, he employs the Disconnect use case **976**. The new member **251** can similarly employ the use cases (Discover **971**, Connect **972**, Configure **973**, Invite **974**, Request Projection **975** and Disconnect **976**) as described above.

The NDSN **100** captures multiple various dimensions of the relationship between two users. The dimensions that are captured are wide-ranging and can cover many aspects of a user's life. Each relationship between two users in the NDSN **100** may have an attribute of affinity, i.e., trust or alignment. This permits the NDSN to characterize a relationship between users along a continuous range, rather than treating the relationships in a binary (i.e., true or false) fashion. For example, rather than characterizing another user as simply a friend (or not), the NDSN user can characterize the level of trust that he has in another user with whom he is related by friendship; in other words the NDSN can capture the level of friendship between two users.

In other embodiments, the multiple relationships between two users may have a single affinity attribute, as opposed to one affinity attribute per relationship. The value of the affinity attribute may be derived from the user attributes (which may be contained in the user profile) of one or both of the related nodes. For example, if both related users each have a user attribute that identifies them as basketball fans, then the derived affinity attribute along a Sports dimension would have a value of 0.9. However, if only one of the users has a user attribute that identifies him as a basketball fan, then the derived affinity attribute might have a lower value of 0.6.

Those skilled in the art will recognize that there are numerous well-known software and hardware technologies that may be utilized to implement the attributes of the users of the NDSN **100** and the attributes of the associations between the users.

A node of the NDSN **100** is connected to another node by one or more degrees or separation. A connection from one node directly to another node is considered to be of first-degree separation; a connection that goes indirectly through one other node is of second-degree separation; a connection that goes indirectly through two other nodes is of third-degree separation, and so on. In the example of FIG. **18**, nodes a_{11}, a_{12} and a_{13} have first-degree separation from node a_0; nodes a_{21}, a_{22} and a_{23} have second-degree separation from a_0; and nodes a_{31} and a_{32} have third-degree separation from a_0.

Two nodes that are separated by two or more degrees of separation are indirectly connected. Either of such indirectly connected nodes may attempt to establish a direct connection with the other node, thus reducing the degree of separation to one.

A user might desire to work with a "projected" view, i.e., a subset of the nodes, of the NDSN **100**. Such a desire might be based, for example, on a need to increase processing speed and reduce resource requirements such as CPU speed and memory size. A user can obtain a "projected" view of the NDSN **100**, by employing the Request Projection use case **975** (see FIG. **13**). Referring to FIG. **19**, Node A and Node B are connected to the user **250**. The relationship between the user **250** and Node A has components in three dimensions: Music **106**, Politics **107** and Cooking **105**, while the relationship between the user **250** and Node B has components in the Music **106** and Politics **107** dimensions, but not the Cooking dimension **105**. In FIG. **19**, the projected view **101** of the NDSN **100** includes those nodes (i.e., Node A) of the NDSN **100** that reside along a selected projection of the Cooking dimension **105** (and not the Music or Politics dimensions **106**, **107**). Nodes that reside in the two-dimensional plane formed by the Music dimension **106** and the Politics dimension **107** (i.e., Node B) are thus not included in the projected view **101** of the NDSN **100**, since they do not include a Cooking component. A projection of the NDSN **100** may also be obtained along multiple dimensions.

The affinity attributes between nodes of the NDSN **100** may also be used to determine the set of nodes that form a projection of the NDSN **100**. For example, the set of nodes in a projection of the NDSN **100** might include those nodes that have a cooking dimension relationship with the user **250** and additionally have an affinity attribute along that dimension that exceeds a specified threshold.

FIG. **20** depicts an example of the interactions associated with creating a projection of the NDSN **100**. In FIG. **20**, the User **250** requests a projection by sending a requestProjection message to PIA**1** **211**. PIA**1** **211** then requests a second projection by sending a requestProjection message to PIA**2** **212**. PIA**2** **212** creates the second projection by sending itself a createProjection message, and provides the second projection by sending a projection message to PIA**1** **211** containing the argument projectionTree which holds the second projection. PIA**1** creates the projection requested by the user by sending itself a createProjection message. The projection created by PIA**1** **211** is based on the second projection received from PIA**2** **212**. In some embodiments, the projection created by PIA**1** **211** is further based on other projections requested and received from other PIAs (not shown).

In other embodiments, thresholds are employed to limit the extent of a requested projection. For example, a time limit may be imposed on the operation of creating a projection, i.e., the operation will terminate after a specified duration of time. As another example, a limit on the number of nodes contained in the projection may be used to place an upper bound on the size of the projection.

In some embodiments, a maximum measure of separation, which can be measured in various ways, may be used to limit the projection operation. In one embodiment, the User **250** specifies the maximum degree of separation, and the PIA**1** **211** requests a second projection from PIA**2** **212** with a maximum degree of separation that is one less than the degree specified by the User **250**.

A user node in the NDSN **100** may contain the user's profile, which may include information regarding the user's basic personal information (e.g., name, home address, work address, e-mail addresses and date of birth), demographics

(e.g., age, age group, gender, years of education, income, net worth, occupation, marital status, geographic region, religion, ethnicity, etc.), user attributes, interests, affiliations and other information that can be used in the NDSN to characterize the user. The user node, which in some embodiments is a PIA, may collect some of this information without requiring direct entry by the user. Such information is extracted by monitoring, processing and analyzing data that enters the PIA through its input data feeds. The user also may have the option of directly entering, reviewing and modifying his user profile; these actions can be performed on a variety of types of devices or equipment that may provide the user with data connections to the other nodes of the NDSN, including, e.g., a PIA, a CIA, a personal computer, or a handheld device (e.g., a cell phone or personal digital assistant (PDA)).

As described above, a user **250** may have no prior knowledge of the existence of the members of the NDSN **100**, and may choose to see if he can discover the existence of members of one or more NDSNs. Members of an NDSN may be discovered in various ways, including broadcasting a query, querying a CIA, querying neighboring nodes and querying other directories.

A node may be able to discover other nodes by broadcasting a message on the local network. Upon receipt of the broadcast message one or more of the other nodes may respond to the issuing node with, e.g., a list of available public feeds (if the node is a PIA), or other information.

A CIA may maintain a list of PIAs that can be accessed by another PIA such that direct connections to the member PIAs may be established. This would allow a member to easily find other members of a particular community. For example, a CIA associated with a chess club might have a list of its members, as well as lists of members of other chapters of the club, and thus would be able to provide a convenient way to find and connect with other chess players.

A node may also locate other nodes by querying known neighbor nodes and asking them for addresses of nodes of which they have knowledge that meet certain criteria. For instance, a node may ask its neighbors for addresses of their neighbors that are members of a certain demographic. The process could then be repeated with that new set of addresses obtained in the responses.

A user **250** may attempt to discover the existence of members of one or more NDSNs by employing the Discover use case **971** (see FIG. **13**). Referring to FIG. **14**, the User **250** requests PIA**1** **211** to attempt to discover the existence of members of an NDSN by sending a DiscoverNDSN message to PIA**1** **211**. In order to satisfy this request, PIA**1** **211** utilizes a list (not shown) of candidate PIAs, i.e., those that may be members of an NDSN. This list may be generated by various techniques (not shown), e.g., by crawling the Internet or by contacting a registry that stores the identities of PIAs.

In the example of FIG. **14**, the list of candidate PIAs used by PIA**1** **211** includes PIA**2** **212** and PIA**3** **213**. PIA**1** **211** asks PIA**2** **212** if it is a member of an NDSN by sending a QueryNDSN message to PIA**2** **212**. PIA**2** **212** responds that it is a member of an NDSN by sending an NDSNMember message to PIA**1** **211** containing the argument ndsn which identifies the particular NDSN of which PIA**2** **212** is a member. Similarly, PIA**1** **211** sends a QueryNDSN message to PIA**3** **213**. PIA**3** **213** neither is a member of an NDSN nor understands the QueryNDSN message, and thus it does not respond to PIA**1** **211**. After a timeout period has elapsed, PIA**1** **211** sends itself a timeout message to note that PIA**3** **213** has not responded. PIA**1** **211** satisfies the request from the User **250** to discover the existence of members of an NDSN by sending a ReportNDSN message to the User **250** with an argument ndsn that identifies the discovered NDSN.

Those skilled in the art will recognize that techniques of crawling the Internet and providing a registry are well-known in the art, and furthermore that a variety of other techniques may be utilized to generate the list of candidate PIAs.

To connect to members of the NDSN, a user employs the Connect use case **972** (see FIG. **13**). In the example of FIG. **15**, the User **250** asks PIA**1** **211** to connect to an NDSN by sending a ConnectNDSN message to PIA**1** **211** with arguments that contain his user profile (UserProfile) and identify the NDSN (ndsn). PIA**1** **211** utilizes a list (not shown) of PIAs that belong to the NDSN. This list may be generated by various techniques (not shown), e.g., by crawling the Internet or by storing the identities of the PIA that have been discovered by employing the Discover use case **971** (see FIG. **13**).

In the example of FIG. **15**, the list of PIAs used by PIA**1** **211** includes PIA**2** **212**. PIA**1** **211** informs PIA**2** **212** that the User **250** is becoming a new member of, i.e., connecting to the NDSN, by sending a NewMember message to PIA**2** **212** with an argument ndsn identifying the NDSN, and an argument NewMember identifying the PIA (PIA**1** **211**) owned by the new user (User **250**). PIA**2** **212**, as a PIA of an existing member of the NDSN, has a list of PIAs owned by other members of the NDSN, which are unknown to the new member, User **250**. In the example of FIG. **15**, this list includes PIA**3** **213**. PIA**2** **212** sends a NewMember message to PIA**3** **213** and the other PIAs (not shown) on the list with an argument ndsn identifying the NDSN, and an argument NewMember identifying the PIA (PIA**1** **211**) owned by the new user (User **250**). Each PIA on the list sends the NewMember message to other PIAS (not shown), thus propagating the news of the new member to other members of the NDSN.

PIAs that are thus informed of the existence of the new member, User **250**, may decide to connect to PIA**1** **211**. In the example of FIG. **15**, PIA**3** **213** connects to PIA**1** **211** by sending a Connect message to PIA**1** **211** with arguments that contain a user profile corresponding to the owner of PIA**3** **213** (UserProfile) and identify the NDSN (ndsn).

FIG. **21** provides another example of a PIA connecting to the NDSN **100**. The User **250** instructs PIA**1** **211** to connect to other nodes of the NDSN **100** along a specific dimension by sending a connectNodes message with an argument dimension identifying the specified dimension to PIA**1** **211**. PIA**1** **211** searches the NDSN **100** for nodes along the specified dimension by sending itself a searchNodes message. In this example, PIA**2** **212** is included in the nodes found by PIA**1** **211**. PIA**1** **211** then requests to connect to PIA**2** **212** by sending a requestConnect message to PIA**2** **212**. PIA**2** **212** grants the connection request by sending a grantConnect message to PIA**1** **211**. PIA**1** **211** then connects to PIA**2** **212** by sending a Connect message to PIA**2** **212**. PIA**1** **211** informs the User **250** that the requested connections have been made by sending a connectedNodes message to the User **250**.

To invite a new member to connect to the members of the NDSN **100**, a user employs the Invite use case **974** (see FIG. **13**). In the example of FIG. **16**, the User **250** asks PIA**1** **211** to invite User**2** **252** to connect to the members of the NDSN by sending an InviteNewMember message to PIA**1** **211** with an argument ndsn identifying the ND SN, and an argument NewMember identifying the potential new user (User**2** **252**). PIA**1** **211** sends an Invite message to PIA**2** **212** with an argument ndsn identifying the NDSN.

PIA**2** **212** might inform User**2** **252** by displaying a user interface prompt announcing the invitation (not shown). To accept the invitation, PIA**2** **212** responds by sending a Connect message to PIA**1** **211** with arguments that contain

User2's user profile (UserProfile) and identify the NDSN (ndsn). If PIA2 212 were to decline the invitation, then PIA2 212 would respond by sending a Decline message (not shown) to PIA1 211.

PIA1 211 also sends a NewMember message to PIA3 213 and other members of the NDSN (not shown), with an argument ndsn identifying the NDSN, and an argument NewMember identifying the PIA (PIA2 212) owned by the new user (User2 252). As described in the example of FIG. 15, the news of the new member is thus propagated to other members of the NDSN. PIA1 211 sends an Accepted message to the User 250, informing the User 250 that User2 252 has accepted the invitation to connect to members of the NDSN.

To disconnect from other members of the NDSN, the user may employ the Disconnect use case 976 (see FIG. 13). In some embodiments, a user's PIA stores the addresses of PIAs that belong to the members to whom the user is connected. In the example of FIG. 17, the User 250 asks PIA1 211 to disconnect from the members of the NDSN by sending a DisconnectNDSN message to PIA1 211 with arguments ndsn and Member identifying the NDSN and the member. PIA1 211 sends a Disconnect message to PIA2 212 and other PIAs (not shown) that it is connected to, with an argument ndsn that identifies the NDSN.

The user 250 may configure the PIA to permit a connection for one or more specific user attributes between him and other users. In this manner, users can easily connect with each other based on common interests, demographics or other factors. A user employs the Configure use case 973 (see FIG. 13) to configure his NDSN node. For example, a user may configure his PIA to allow connections to any PIA that belongs to a user who coaches volleyball.

As discussed above, an embodiment of a situational network may be formed using the framework of an NDSN. Within the framework of the NDSN, the event or situation becomes associated with a node of the NDSN, referred to as an event node 3010. Referring to FIG. 35, the event node corresponding to an event node server 3011 may be established, or hosted, by a situation authority 207 or trusted provider, such as news source (e.g., CNN or weather.com) or a government agency. The event node may be discovered by a user's PIA 404 corresponding to the user 250 based on the PIA 404 searching or crawling the network for information about the situation or event if the connection can not be automatically established based on the configurations of the PIA 404 and the event node server 3011. A user 250 can then request connection to the event node server 3011 through the PIA 404 in order to receive and share information about the situation with the situation authority 207. A user 250 may also share information related to the situation with another user in the NDSN using a connection established between the user's PIA 404 and another PIA 406. PIA 406 may or may not be connected to the event node server 3011. In one embodiment, the connection request may be denied based on available computer network resources and the users' perceived need to access or share information on the SitNet. Alternately, users may automatically be invited to connect to the event node corresponding to the event as shown in FIG. 34. The automatic invitation may be based on a stored user profile accessible to a situation authority server 3011 associated with the event node may crawl the network for user PIAs 404, 406 that would likely be interested in the information about the event. The user 250 may accept or decline the invitation based on their interest in the event or situation. In one embodiment, the situation authority 207 may have the authority to override a decline by the user 250 in order to share vital information, as is described in more detail below.

A situation or event may be associated with more than one event node, hosted by the same or different trusted provider, within a SitNet. Each event node may provide a source of different information based on the specialty of the trusted provider. For example, a hurricane may be associated with a first event node by a provider of weather information, such as The Weather Channel, a second by a source of news information, such as CNN, and a third by a source of emergency management information, such as FEMA. Within the SitNet, users may be connected to some or all of the event nodes corresponding to the situation in order to obtain and share the most relevant information pertaining to them.

Links established between the nodes in situational network may be temporally limited. The temporal limit of the links may be established at the event node 3010 based on a predicted or known duration of the event or situation. The temporal limit of a link may also be determined by the user. Links established between PIAs of SitNet users may also be temporally limited. For example, users with a first order link to each other that resulted from their connection to the event node may only wish to share information for the duration of the event. The link between the two users can be disconnected when either is disconnected or disconnects from the event node, or the link may have a pre-determined connection time, established by one or both users at the time of creating the link. Referring to FIG. 29, PIAs at nodes corresponding to Ted 3042, Fred 3040, and Ed 3041 are all connected to the event node 3010 along storm dimensions 3046, 3048, and 3043, respectively. Ed 3041 discovers Fred 3040 and a link along the storm dimension 3045 is established until either link 3048 or 3043 is disconnected.

In one embodiment, the temporal limitation of a link may be based on geographic location or itinerary of the user. For example, a PIA is connected to the SitNet by invitation or request. The position of the user is monitored using a geographic positioning device, such as a GPS system, which may be included in the PIA. The connection with the event node is maintained while the user is within a predetermined distance of the situation. This distance may be determined at the event node or by the user. Since the situation and the user may both be moving, it is possible that the user may be disconnected and reconnected to the SitNet over a period of time. If the position of the user exceeds the predetermined distance, the connection to the event node is terminated. For example, a user connecting to a SitNet related to a snow storm may be connected to the SitNet when his PIA determines he is in proximity of the snow storm based on current location coordinates of the user and the current location or forecast trajectory of the snow storm. The PIA may then disconnect or be disconnected from the SitNet when it has been determined that the user has a low probability of experiencing any further affects of the snowstorm. In an alternate embodiment, the user is invited to connect to an event node of a SitNet based on their predicted proximity to a situation. If the user accepts the invitation, the position of the user is monitored as described above, and the connection to the event node is established when the location of the user is within a pre-determined distance of the situation.

In order to maintain links between the nodes belonging to users in the SitNet during an unintentional disconnection of the user nodes with the event node, such as failure or destruction of the systems hosing the event node, the users may choose to extend or renew the temporally limited link that would be terminated due to the disconnection from the event node to remain connected to each other in order to share and exchange information regarding the situation.

Links may also be created in a SitNet between users or between a user and the event node with a temporally limited raised affinity. If there are multiple dimensions connecting the users, the dimension related to interests in the event or situation (e.g., travel) may have a temporally raised affinity or a new temporally limited dimension with a raised affinity may be established. During the situation or event, users may have a greater need for information about the event or situation and are more likely to share or provide information to other users in the SitNet. The other dimensions, such as music or art, may have less importance during the situation or event, such that the user's PIA will utilize most if its resource sharing or searching for information about the situation or event. The raised affinity between the user devices **404**, **406** is maintained for the duration of the connection of the PIAs with the event node server is shown, for example, in FIG. **37**. The level of affinity may be changed based on the geographic proximity of the users. In an embodiment, the affinity is raised along the dimension for only some users in the SitNet, for example, users with PIA belonging to nodes of a particular projection of the SitNet.

A PIA connected to a SitNet may discover another PIA that it has previously established a connection with along one or several dimensions in an NDSN. The connection may be a first order connection, or the connection may be a higher order such that the two PIAs have never directly exchanged personal information. Based on the previous connection, the affinity along a dimension related to the situation may be elevated or raised for a period of time that the two PIAs are connected to the event node of the SitNet, or a new temporally limited dimension with an elevated affinity may be established. The degree of separation may also be decreased to a first order connection if the two PIAs have not previously communicated directly.

Referring again to FIG. **29**, Ted **3042** and Fred **3040** have previous links (shown by the solid lines) along the dimensions of hobbies **3044** and travel **3047**. Upon discovering that they are connected to the event node **3010** along the storm dimensions **3046** and **3048** (shown by the dashed lines), a new link between Ted **3042** and Fred **3040** along a storm dimension **3049** is established with an affinity higher than along either of hobbies **3044** or travel **3048** dimensions, as depicted with the thicker dashed line in FIG. **29**. In one embodiment, the level of affinity is changed based on the proximity of the PIAs to each other, with a higher affinity being assigned as the proximity between the users decreases.

Users connected to an event node of a SitNet in an NDSN through a PIA may also request a "projected" view, also referred to as a projection, of the SitNet using procedures described above. The projected view may be created by a server **3011** at an event node as shown in FIG. **38**. After receiving the projection from the event node server **3011**, the PIA **404** may established connections with another PIA **406** included in the projection. Alternately, the PIA **404** of user **250** or a PIA **406** of a different user connected to the SitNet may create the projection. The projected view may be created along one or several dimensions of the NDSN. A user may want to share information with only a subset of the total number of users connected to the situational network, and thus may request or create a projection representing those other users that the user has the most interest in sharing information. For example, the user might request a projection for a SitNet based on location, allowing or requesting a connection with only those users in a certain zip code. As another example, a traveler connected to an event node for accident may want a projected view of the SitNet based on final travel destination in order to share or solicit alternate travel routes around the accident. The user may also share the projection with other users connected to nodes contained in that projection. An example of a geographic projection **3050** of nodes of a SitNet **3000** is shown in FIG. **30**. The SitNet **3000** includes the 10 nodes labeled (a) through (j). Nodes a, b, c, e, f, and i are included in geographic projection **3050** based on their location with respect to boundary **3052**. An example of such a situation **3005** is a severe rain storm (the situation **3005**) that poses a flood threat to persons located on one side of a river (the boundary **3052**). A geographic projection **3050** is formed including only those nodes (labeled a, b, c, e, f, and i) where a user is threatened by flood waters. In one embodiment, a server at the event node of the SitNet creates a set of geographic projections of users connected to the SitNet **3000**, and distributes those geographic projections to the appropriate PIAs of users in the corresponding locations based upon the node belong to the PIA being included in that projection. If a node of a PIA is included in more than one geographic projection (e.g., two different projections that include overlapping geographic areas), the PIA **400** may receive more than one geographic projection. This enables a targeted distribution of geographically relevant information, including advertisements, to the connected users by allowing critical information to be passed to users who will receive the most benefit from knowing that information. For example, during a severe winter blizzard, the local effects of the blizzard may vary considerably over the affected area. Some areas may be without power, while other areas may experience road closures. Information of each of these conditions can independently be reported to the relevant users, such as when power is expected to be restored or when the roads will be re-opened by creating projections of users for each of the affected areas.

A SitNet can be used to provide navigation information, such as potential navigation hazards, optimal routes, alternate routes, traffic conditions, or unexpected occurrences (i.e., a herd of cows blocking a country road). A navigator can create an event node corresponding to their probable itinerary, which includes start, intermediate, and ending locations, as well as travel routes. PIAs of other navigators can crawl the network to discover event nodes corresponding to their own itineraries in order to determine if any relevant information has been reported. Each navigator may have requirements for the information most relevant to their travel. Requirements include estimated maximum time of travel, avoidance of hazards or detours, preferred itineraries or routes, avoidance of particular areas or routes, need for special services, or need for child or pet friendly establishments. Information that may be provided includes messages or other communications originating from the navigator, and data provided by the vehicle through on-board devices and sensors understood by one skilled in the art, such as vehicle speed, vehicle location, and travel itinerary and routes. The other navigators can then use this information in their navigation plans, such as estimating time of arrival, or adjusting the itinerary or route to avoid potential hazards or unexpected conditions. Navigation can include transportation by air, water, or land. As an example, a pilot in a small aircraft traveling from Philadelphia to Chicago creates an event node for his flight. The PIAs corresponding to pilots of several other aircraft connect to this node. Some are traveling nearly the same flight route as the pilot, others flying a reverse route from Chicago to Philadelphia, and some others having a route that will cross the first route at some time. The pilot who established the event node experiences severe turbulence at 20,000 ft over central Ohio and reports the turbulence to the SitNet through his PIA. The other pilots can make in-flight decisions to change their own attitude or heading based on this information. The other pilots

also can share their information with other users of the SitNet that is not related to the turbulence over Ohio. For example, one pilot may report a strong northwestern headwind over Cincinnati, while another may report localized severe thunderstorm activity just north of Pittsburgh, allowing all the pilots of the SitNet to assess to their own flight routes in view of these potential reported hazards.

Another example of the SitNet **3000** in a travel related situation is shown in FIG. **28**. Several travelers **3026**, **3027**, **3028**, **3029** along a stretch of highway are sharing or probing for information related to a situation **3005**, a snow storm, affecting travel along that highway using SitNet **3000**. The situation authority **207** establishes an event node corresponding to the situation **3005** using the create use case. This event node may be identified with the highway number, a specific mile post along the highway, or even a specific exit along a highway. For example, the event node may correspond to Mile Marker 50 on Interstate 91 in Vermont, which may be particularly hazardous during a snow storm. Travelers may discover the event node server using the discover use case, or alternately may be invited to participate in the SitNet **3000** by the event node server using the invite use case if they are within a pre-determined distance from the event node identifier. The connect use case is included in both the invite and discover use cases. The travelers **3026**, **3027**, **3028**, **3029** and the situation authority **207** share information related to the situation using the share use case. In the example of FIG. **28**, some travelers (**3027**, **3028**) have been invited to join the SitNet **3000** by the situation authority **207**, while other travelers (**3026**, **3029**) have joined the SitNet **3000** based on a discovery of the event node by their own devices. The situation authority **207** may be a trusted provider of weather or traffic information, or a state or local DOT, who can also augment the information shared between the travelers with the latest information regarding weather updates or real-time road conditions. In an alternate embodiment, an event node corresponding to the situation may be established by one of the travelers **3026**, **3027**, **3028**, **3029** along the highway.

A situational network may be established to provide traffic information to connected users. Event nodes for receiving traffic information may be established for the occurrence of an accident, road construction, police or other emergency activities, or even a stretch of highway or city or zip code. The PIA of a traveler might be constantly crawling the NDSN to discover information related traffic conditions is proximity to the vehicle or in intended route of the vehicle to its destination. The source of the traffic information may be other users' PIAs reporting traffic conditions or information from a traffic or other agency such as a state or local Department of Transportation (DOT) that might provide traffic information. When the PIA receives information concerning a potential travel delay it alerts the user so the user can evaluate if an alternate route should be taken. In one embodiment, the PIA suggests an alternate route.

A SitNet may be used to provide common travel routes to users. This is especially useful to users that are unfamiliar with the roadways in the area where they are traveling and a situation such as an accident or road construction is blocking their only known route through the area. By connecting to a SitNet with other users familiar with local roads, the user may learn of the most time efficient alternate routes around the situation. Users may also discover popular short cuts through a normal congested area. In one embodiment, a traffic accident or construction zone is associated with the event node of a SitNet. The event node is created by trusted provide, such as a traffic agency or state or local DOT. Pre-determined alternate routes may be stored in a database connected to a server associated with the host of the event node. A user is connected to the event node may be presented with alternate routes based on their current location and destination.

A situational network can be established for users traveling to and/or from the same location. A PIA for one of the users may crawl the network looking for other PIAs that have information indicative of an expected travel to or from the same location on or around certain range of dates. The user may be offering a ride to the location or seeking a ride to the location. If the PIA discovers one or a set of other PIAS, it may invite the other users of other PIAS to connect to the network to determine the feasibility of sharing transportation, which may include all forms of air, water, or land transport. In one embodiment, the situational network is encompassed by a PIA associated with a shared vehicle, such a car shares that are popular in many urban areas. A user's PIA can determine availability of vehicles in the area parked in their home space, or they might be able to obtain availability of a vehicle that was signed out by someone else but it might be available for a short time from a different location while the users that checkout the vehicle are not using the car.

Users can access information regarding travel delays using a PIA connected to an event node of a SitNet. The event nodes can correspond to commercial transportation routes, such as a scheduled commercial airline flight, a specific commuter train or bus run, can be established by a transportation company, DOT, or traffic reporting agency. In an embodiment, the event node is created by a traveler. An event node can also be established for a highway accident or road construction event. A user can request a connection to a server corresponding to the event node in order to obtain most recent arrival time or delay time estimated for the situation corresponding to that event node. Alternatively, a user's PIA may automatically connect to the event node, such as the event node for a commuter train that the user's spouse likely uses everyday. The user's PIA would then alert the user if there is any expected delay in the arrival of the commuter train. Similarly, a user can request a connection to an event node established for a commercial airline flight. The connection would allow the user to be updated of most recent flight status for that particular airline flight. Travel delay notifications can also be reported for highway delays, such as those caused by accidents or road construction. A user expecting guests might request that her PIA crawl the network and seek event nodes related to expected travel routes for the guests and automatically notify her if there are any unexpected delays.

A situational network may be used to broadcast emergency information to users connected through into the situational network. In one embodiment, a user's home page is automatically re-directed to a website where most current information regarding the emergency event can be found. Similarly, emergency information can be directed to users' cell phones and PDA's. In an alternate embodiment, the emergency information provider establishes an event node of the situational network. A user is invited to connect to the event node to receive updated information. Once the user accepts the invitation, new updates are automatically delivered to the user as they are made available. In one embodiment, the server at the event node has the authority to override a declined invitation to connect to the event node. In order to protect personal privacy to the greatest extent possible, such an override utility might be limited to be activated by a very select few individuals or trusted providers and can be activated only in the direst of emergency situations, such as when imminent loss of life may be a probable result of the event or situation.

Referring to FIG. **24**, a situational network may be formed for an emergency event or situation. The SitNet **3000** for the

emergency event may have multiple tiers or access levels to allow for more effective sharing and propagation of information between users of the SitNet **3000**. A first level of access (L1) **3034** is provided to L1 users **3030** such as emergency responders. Emergency responders include entities such as fire, police, EMT, and rescue personnel at or in transit to the location of an emergency. Emergency responders may also include government (e.g., FEMA) or other emergency management agencies that may be involved in crisis management during a disaster. A 911 dispatcher or medical personnel may also be granted L1 access to the SitNet **3000**. A second level of access (L2) **3036** is provided for L2 users **3031**, such as those individuals with a physical proximity to the emergency event. These individuals are also referred to as affected individuals. For example, those in the forecast track of a hurricane, those enveloped by the hurricane, and those in the wake of the hurricane are all classified as affected individuals and granted L2 access to the SitNet **3000**. Similarly, those within a certain radius of the epicenter of an earthquake may be classified as affected individuals and granted L2 access to a SitNet **3000** established in response to the earthquake. A third level of access (L3) **3038** is provided to L3 users **3032**, such as relief agencies and those materially affected by the disaster. Examples of organizations or individuals who might be granted level 3 access include The American Red Cross, insurance companies and their adjustors, and those individuals with family or property in the affected location who do not reside in the affected area (those residing in the affected area have L2 access). The different levels of access allow for efficient sharing of the most relevant information between the different individuals directly and indirectly involved in the SitNet **3000**. L1 access allows emergency responders to access to information shared between all members of the SitNet **3000**, plus provides a trusted connection for emergency responders to share information that may be critical in providing emergency service to the L2 individuals. L2 individuals can provide location information that may be useful for a rescue or conditions inside the situation or event that may be invaluable or otherwise unknown to emergency responders. The different levels of access can also allow for the most effective use of limited network resources, such as bandwidth, that may result from situation or event, for example ensuring that L1 access has the greatest resource allocation so that emergency responders can exchange vital information regarding the situation. In an embodiment, information in the emergency event SitNet **3000** is exchanged using the PIAs corresponding to the different individuals participating in the event or situation. A PIA corresponding to a user with L1 access may a have a higher affinity along the dimension related to the emergency event to another L1 access PIA that it would have with L2 or L3 access PIA, allowing the more efficient and trusted sharing of information among the emergency responders.

Information shared by the various individuals participating in the event or situation may include audio and video data. This audio and video data can be aggregated by a server, which in one embodiment may correspond to the event node of the SitNet, to provide a geographic "snapshot" of the situation. By tagging each piece of video or audio data with a location and time coordinates, it is possible to create a spatial map of the situation. The time evolution of the situation can be obtained by aggregating the geographic snapshots for different times. Access to the geographic snapshot data is unrestricted for emergency responders with L1 access to the SitNet. Limited access to the geographic snapshot data may be provided individuals with L2 or L3 access, depending on bandwidth available within the SitNet. An external portal, such as an Internet website, may be established by a situation authority for the emergency event where some or all of the geographic snapshot data is made available, if system and network resources permit, to persons not connected to the SitNet.

A "roll-call" or "check-in" feature can be included in a situational network for a disaster or emergency event to establish a list of persons that might be missing or need assistance. A server corresponding to the event node of the situational network may invite users determined to be physically threatened by a disaster or emergency event to check-in. The server or CIA of the event node **3010** may determine which user PIAs to contact through stored lists, such as apartment or office building occupancy record, or postal record for streets or zip codes. Those people identified with a PIA are sent an unsolicited message to reply if they are alright, also referred to a positive response. A user may also respond to the check-in that they need assistance and provide location information to emergency responders. Non-responding PIAs are reported to emergency management officials to decide what further actions may be required to locate those individuals. Referring to FIG. **32**, a PIA **400** displays an alert warning **3070** requiring user input that they are either ok **3074** or need assistance **3072**. The user may also be presented with an option to display the current status of the roll call list **3076** so the she may be able to provide information on users that have not responded to the roll call query. In the example of FIG. **32**, "Building Property Management" has provided a list of building occupants for "1 Tower Place" to the trusted provider "Springfield Fire Company" which has established an event node and provided the roll call query to the PIA.

A situation authority or trusted provider establishing an event node **3010** for a server that hosts the roll call or check-in feature described above may provide a searchable message board to users connected to the SitNet as well visitors not connected to the SitNet that allows sharing of information about individuals in the SitNet **3000** with persons outside the SitNet. Referring to FIG. **40**, Situation Authority **207**, User **1 254**, and User **2 256** are connected through a situational network. Visitor **3 258** is not connected to the situational network, but can access certain information made available by the situation authority via the message board, and post comments viewable by the participants of the situational network. The searchable message board may be used as in interface to gain access to information from one or more situational networks for different emergency events or disasters. Referring to FIG. **33**, the message board **3080** may be accessible by a website on the internet (outside the SitNet). A visitor to the website can search **3082** the message board for information related to a specific situation or event. The information may be tagged with a location coordinate so that check-in and other information can be searched and obtained down to a zip code, street or even individual household level **3084**. The searchable message board also allows visitors not connected or unable to connect to the SitNet the opportunity to post **3088** or view **3086** messages that are relevant to a specific situation, such as searching for information on a missing family member or friend. Other visitors with information about the situation can respond to those messages with any information that they can share. In one embodiment, the most recent roll-call list for the search criteria entered by the visitor is available using a link **3089** on the webpage.

During a disaster or crisis, relief agencies may establish a node of a SitNet **3000** for rapid deployment of emergency information. The server of the relief agency obtains the list of users connected to the SitNet **3000** from the server encompassing the event node **3010** corresponding to the situation.

From this list, the relief agency can determine which users are likely affected by the disaster and invite those users to establish a connection with a node associated with the relief agency. The relief agency may also be able to determine to what goods and services are most needed in different areas based on information about the users obtained from stored profiles. The relief agency may then provide information such as nearest shelter, location where emergency supplies are being distributed, or service or goods providers may still be in operation. The user may also be able to provide information to the relief agency such as what services or utilities are still available at their location, what type of relief supplies are most needed, the extent of damage, etc. In one embodiment, the relief agency may be an insurance company, which provides claims information to it affected clients or a schedule of when and where adjustors will be visiting.

Referring generally to FIG. **42**, targeted advertisements from an advertising entity **208** may be delivered to devices of users **254**, **256** connected through a SitNet using profile and location information relating to the users **254**, **256** collected by the situation authority **207**, and determining an ad opportunity based on an affiliation between the user and the situation. An affiliation that a user has with the situation is used as a basis for delivering the targeted advertisements. The affiliation between the user and the situation is determined from one or more factors, including but not limited to, proximity of the user to the situation, role of the user within the situation, affect of the situation on the user, affect of the situation on property of the user, and projection of the SitNet in which the user is included. In some cases, one of the preceding factors alone may not be sufficient to determine an affiliation of the user to the situation. Many users within the same proximity of a situation may be affected very differently by the situation. For example, a homeowner and vacationer within the same city may have very different needs during a weather crisis such as a hurricane, even though their proximity to the situation is essentially the same. Affiliation information may be determined in part by analyzing personal data about the user, such as contained in a stored profile or found in a PIA. Information about a user's actual or predicted location may also be used in determining the affiliation. Once the advertisements are selected for a user, the targeted advertisements may be delivered to users of the SitNet using methods well understood by one skilled in the art.

By way of example, referring to FIG. **27**, individuals participating in a SitNet for a hurricane event are directed to a source of information, which may be a web page. Based on the affiliation of the user with the situation, an advertising entity associated with the SitNet may deliver target advertisement to each user. A homeowner in the direct path of the hurricane may be shown ad for a hardware store that still has an ample supply of plywood **3080**. The targeted ads may be location based (e.g., in a zip code) so that all SitNet users do not rush to the same store which quickly will be depleted of its plywood supply leaving latecomers to undertake a costly and time-consuming hunt for the plywood elsewhere. A user perceived to be a traveler in the area of the hurricane may be displayed an advertisement for the nearest hotel with vacancies **3082**. Someone with an interest in the hurricane, maybe with family members or friends in the area, who is connected to the SitNet but is not in proximity to the hurricane, may be delivered a targeted ad to donate to a relief fund **3084**. In one embodiment, targeted advertisements are delivered when a user connects to the SitNet using a PIA based on access to personal information or a user profile on the PIA accessible by the targeting ad server. If access to all personal information is restricted, the targeted ad service may display a default advertisement to the user. In an alternate embodiment, advertisements can be targeted for presentation to users connected through the SitNet using the projections of the SitNet. All users in one projection of the SitNet may receive different advertisements on their PIAs than users of a different projection of the SitNet based on targeted criteria specific for each of the projections. Targeting criteria may include, but are not limited to, type of situation, location of the situation, and aggregate projection user demographics, such as average age, median household income, an percentage of households with children.

A situational network may be used to effectively manage the distribution of information regarding availability of limited goods and services as a result of an event or situation, such as disruptive weather or natural disaster. Based on the locations of the users in the SitNet, goods and services can be offered to users participating in a SitNet. All the users within a certain nearby geographic proximity, such as a zip code, town, or street, to providers of the goods and services, may receive notifications regarding the availability of the goods or services at those locations. As a user changes position, updated information may be provided based on most recent location coordinates associated with the user. A change in availability of goods and services at different locations may also be provided to the users of the SitNet based on information provided by the providers of the goods and services themselves, or alternately, the users of the SitNet. As the supplies of the goods are depleted and services become unavailable, users of the SitNet are automatically notified of other nearby providers. Anticipated availability of good and services may also be distributed to the users of the SitNet in a similar manner. For example, in advance of a hurricane during a large scale evacuation, gasoline may be in short supply. To compound this difficulty people may waste both gasoline and time searching for a location that is selling gasoline. By connecting to SitNet associated with the hurricane, users may be presented with the location of the nearest provider with a supply of gasoline, or alternately several nearby locations. In addition, nearby users may be presented with different lists of available filling stations to help reduce a rush to a single location by all the users that will soon deplete its gasoline supply as a result. When a filling station no longer has a supply of gasoline, users in the vicinity may be notified based on information provided by the owner of the filling station, or by other users at that location who may have been waiting in line when the supply runs out.

In one embodiment, user profile information is used with the user location information to determine the nearest provider of goods and services that fulfill actual or perceived needs of the user. The user profile information can be stored on a user device, such as a cell phone or PIA, or at a central site, such as a server associated with a situation authority or communications provider. The user profile information may contain, but is not limited to, number and ages of individuals in the user's household, number and type of pets owned by the user, languages spoken, medical conditions of the user and his/her dependent (e.g., diabetes), and special services need by the user and his/her dependents (e.g., dialysis). Such information can be used in directing a user to a provider of the nearest service that fulfills some or all the needs of the user during or as a result of the situation. For example, during a hurricane evacuation, a user with two dogs can be directed toward the nearest evacuation center that accepts pets, which may not be the nearest evacuation center to the user if other centers that are closer do not accept pets.

In addition to the location of the nearest provider of goods and services, situational dependent information, such related

hazards, can be distributed to the user. The related hazards may impede the user from gaining access to the goods or services, such as flooded or otherwise impassable roads on the most probable route to a storm evacuation center. In one embodiment, alternate routes to the provider of the goods or services are suggested, minimizing the hazards that a user might encounter enroute to obtain the goods or services.

Location based goods and service notifications may be delivered to user devices in a language that is understood by the user. The selection of the language in which to deliver the notification may be based on information contained in the user profile. The user may have previously selected the delivery language which is then stored in the user profile, or the notification sender may automatically determine the delivery language based on the personal information contained in the user profile.

Notifications of the service may be delivered on GPS-enabled portable device, such as a cell phone or PDA, so that a traveling user can receive notifications of services most relevant to his current location. In one embodiment, the portable device, can notify the provider of the service that the user in enroute, including any special considerations, such as those included in the user profile. The user may also communicate additional special considerations, such as injuries or special needs, to the service provider.

In an alternate embodiment, location based services can be offered to users connected to an event node of a SitNet using a PIA. Using positional coordinates associated with the user of the PIA, a server located at the event node can create a set of projected views of the SitNet, such that the nodes in each of the projected views of the SitNet are within close geographic proximity, such as a zip code, town, or street. A distribution of providers of limited goods and services that might be available after the occurrence of a situation or event can then be delivered in a targeted manner to the users of the SitNet using the projected views. As the users' location changes, location coordinates are provide to the event node server so that the projected views are updated, and user always receives the most up to date location based service information for their current location.

A situational network can be used to efficiently deliver and propagate a message or notification from a single user related to a situation or event to an expanded group of individuals who are directly or indirectly affected by the event or situation. The message may be created and distributed by a situation authority, or alternately created by an individual in response to receiving information about occurrence or expected occurrence of the situation. Each recipient of the message or notification may have pre-defined groupings of other users, such as family, friends, co-workers, neighbors, etc, so that an incoming notification can be forwarded to only to the selected groups of users. The groups that are displayed to the user for propagation of the notification may be dependent on the situation, with the displayed groups either being pre-selected by the user or determine automatically by the receiving device, which in one embodiment is a PIA and the groups correspond to users at nodes in an NDSN. For example, a user will likely need to notify one set of groups of users in their NDSN if school is being closed, and another set of groups of users if she is delayed by a traffic accident. Automatic determination of groups may be accomplished via creating projections of the PIA user's NDSN that are relevant to the situation of the incoming notification, for example, projections along the dimensions corresponding to family, friends, or business contacts.

A user can create separate notifications that are added to the message for each group before forwarding the message. The notifications for each group are separately composed on a device used to propagate the message before the message is forward to the different groups. The notifications are all preferably composed on a single screen of the device. The message and the corresponding notifications composed on the device are then all transmitted to the users of the selected groups at substantially the same time using a single action on the device such as actuating an actuator of the device. The single action on the device causes each notification composed on the device to be attached to the message, and subsequently transmitted to the appropriate users for each group. Examples of actuators include mechanical buttons or touch sensitive display panels. In an embodiment, the user may also reply to the sender of the message with a personal response. The reply may be transmitted using the same single action as described above, or transmitted at a separate time using a different action on the device.

Notifications may be distributed in the SitNet **300** using a peer to peer connections, or through connections to a centralize service, such as one that includes the situation authority.

Referring to FIG. **25**, a school district superintendent creates a node in the situational network using a PIA **3060** to inform a group of users that school will be closed tomorrow. He creates a message **3066** that is propagated to a first set of users in selected groups (teachers, staff, parents, and snow removal). In this example, the groups are selectable by the superintendent, and different notifications are added to the message for each group, and propagated using the [NOTIFY] actuator **3068** on the PIA. The superintendent has chosen not to inform the superintendents of other school districts of his decision, overriding the automatic selection of that group by the PIA. Jane Doe, a parent who has a child in the Springfield School District receives the message from the superintendent on her PIA **3062**, which is included in her cell phone. She propagates the message to her pre-defined group of users with additional notifications, also using the [NOTIFY] actuator **3068**. Jane Doe's friend receives the original message **3066** propagated through Jane Doe's PIA **3063** on her PIA**3064**, which is included in her PDA with an additional notification **3069** added by Jane Doe. She replies **3067** to Jane Doe's notification using the [REPLY] actuator and notifies her friends using the [NOTIFY] actuator **3068** that she will be at Jane Doe's house tomorrow.

A situational network may be established where the situation is a social event, such as a concert or festival. Users attending the event are alerted when other members of the NDSN are also in attendance at the same event. In one embodiment, the situational network is a proximity based network. Users are alerted to the presence of other members included in their NDSN by their PIA when they are both in attendance at the same event based on the sharing of position coordinated between the PIAs. In one embodiment, the situational network is used to facilitate personal introductions. A user's NDSN may contain many contacts that are personally unknown to a user possible due to a higher order degree of separation in the NDSN or because of physical distance between the two users, but nonetheless the two users share an affinity along at least one dimension where they exchange personal information. When the two users are connected to the event node in the same situational network, and are or will soon be in close proximity, an alert may be presented by the users' PIAs so that the users may decide if they would like to meet in person. The PIAs may determine future proximity based on a common event scheduled in both calendars of the users PIAs. Instantaneous proximity may be determined by sharing location coordinates obtained using a geographic location device, such as GPS, included in the PIA. In one

embodiment, a user pre-selects other users in their social network that are personally unknown to them and that they would like to personally meet. When those pre-selected individual are in proximity, the user is notified of their location even in the absence of a connection to an event node. The connection between the two users creates a proximity situational network. For example, when two users' PIAS are crawling the NDSN and one discovers that the other is within a pre-determined range due to sharing of GPS position coordinates between the two PIAs, an alert can be sent to that user to facilitate a personal introduction between the two users.

Users interested in the same weather event may be connected in a situational network for social interaction. A user may be connected to this weather driven social network using a link on an internet site displaying information about that weather event. Other users can be connected to the same social network from different links on different websites also displaying information about the weather event. Referring to FIG. **26**, a user interested in a forecasted snow storm may visit a webpage **3070** of a weather website for weather information related to that event. When viewing the weather event details page **3072**, the user interested in skiing at a popular ski destination may click on a link **3074** and be connected to a centralized social networking website **3076** related to the weather event. The social networking website allows users to share and exchange information for a number of topics including lodging, transportation, social events, or popular meeting locations. Alternately, the PIA may be used to connect to an event node server of the situational network for the weather event, or the PIA may create a node for the weather event. The user may invite other users with similar interests to join the SitNet using the PIA. Additionally, the user's PIA may also crawl the network along a dimension in its NDSN, such as outdoor activities, to discover other users interested in the weather event and request a connection. The SitNet established in the NDSN though the PIA may be used to share information similar to that obtained on the website discussed above, but the information is shared in a peer to peer manner instead of controlled by a centralize source.

Those skilled in the art will recognize that the interactions employed to perform the various functions associated with the SitNet **3000**, PIA, CIA and the NDSN (Discover, Connect, Invite, Configure, etc.) may be executed in a variety of ways not limited to the examples described herein.

FIG. **22** illustrates a block diagram of a computer system **1150** for realization of a computer-implemented apparatus that may form all or a part of one or more implementation(s) or embodiment(s) of the present invention. The computer system **1150** includes a computer **131**, a keyboard **132**, a mouse **133**, and a monitor **134**. The computer **131** has a network port **138** for connecting to the computer network **900** (not shown). The computer **131** is connected to a storage device **135** which contains the program instructions **136** for the software application that provides the logical functions of the computer-implemented apparatus. The storage device **135** also contains a database **137** for storing data.

Those skilled in the art will recognize that the program instructions **136** for software applications implementing all or a portion of one or more embodiment(s) of the present invention may be written in a programming language such as Java or C++, and that the database **137** may be implemented with a database package such as Microsoft Access™ or a database management system (DBMS) such as Microsoft SQL Server™, Microsoft SQL Server CE™, IBM DB2™, mySQL or postgreSQL.

FIG. **23** illustrates a block diagram of the computer **131**. A system bus **1002** transports data amongst the Central Processing Unit (CPU) **1004**, RAM **1006**, the Read Only Memory Basic Input Output System (ROM-BIOS) **1008** and other components. The CPU **1004** can contain a cache memory component **1024**. The computer **131** may include one or more external storage ports **1017** for accessing a hard disk drive, optical storage drive (e.g., CD-ROM, DVD), flash memory, tape device or other storage device (not shown). The relevant storage device(s) are connected through the external storage port **1017** which is connected to the system bus **1002** via a disk controller **1022**. The keyboard **132** and the mouse **133** can be connected to the keyboard port **1012** and mouse port **1013**, respectively, which are connected to the system bus **1002** through the I/O controller **1010**. The monitor **134** can be connected to a monitor port **1014** which is connected to the system bus **1002** through the video controller **1015**. A network device (not shown), including but not limited to an Ethernet device or other device having networking capability, can be connected to the network port **138** which is connected through the network controller **1016** to the system bus **1002**. Additional ports, such as parallel or serial ports (not shown), may be utilized through the I/O controller **1010**. The computer **131** may include one or more USB ports **1023**. A USB device (not shown), including but not limited to a printer, scanner, keyboard, mouse, digital camera, storage device, PDA and webcam, can be connected to the USB port **1023** which is connected to the system bus **1002** through the USB controller **1011**. Expansion slots **1018** can be comprised of Industry Standard Architecture (ISA) slots, Peripheral Component Interconnect (PCI) expansion slots, PCI Express expansion slots, Accelerated Graphics Port (AGP) slots or any other slot generally known in the art to allow additional cards to be placed into the computer **131**. These slots can be used to connect network cards, video cards, sound cards, modems and any other peripheral devices generally used with a computer. Detailed descriptions of these devices have been omitted for convenience only and should not be considered limiting.

Those skilled in the art will recognize that a part of, or the entirety of, the embodiments of the present invention may be implemented as a web-based application that includes a web server and a browser application residing on a client computer.

The embodiments of the present invention may be implemented with any combination of hardware and software. If implemented as a computer-implemented apparatus, the present invention is implemented using means for performing all of the steps and functions described above.

The embodiments of the present invention can be included in an article of manufacture (e.g., one or more computer program products) having, for instance, computer useable media. The media has embodied therein, for instance, computer readable program code means for providing and facilitating the mechanisms of the present invention. The article of manufacture can be included as part of a computer system or sold separately.

While specific embodiments have been described in detail in the foregoing detailed description and illustrated in the accompanying drawings, it will be appreciated by those skilled in the art that various modifications and alternatives to those details could be developed in light of the overall teachings of the disclosure and the broad inventive concepts thereof. It is understood, therefore, that the scope of the present invention is not limited to the particular examples and implementations disclosed herein, but is intended to cover modifications within the spirit and scope thereof as defined by the appended claims and any and all equivalents thereof.

The invention claimed is:

1. A method of creating a projection of a situational network, the method comprising:

(a) establishing, by a first personal information aggregator, a connection with one or more other personal information aggregators based on an occurrence of a situation, each personal information aggregator corresponding to a node in a multi-dimensional personal information network;

(b) obtaining, by the first personal information aggregator, a geographic location for each of the one or more other personal information aggregators; and

(c) forming, by the first personal information aggregator, one or more projections of nodes of the multi-dimensional personal information network based on the geographic locations of each of the other personal information aggregators.

2. The method of claim 1, further comprising:

(d) exchanging a first set of information about the situation with the other personal information aggregators corresponding to nodes in a first projection; and

(e) exchanging a second set of information about the situation with the other personal information aggregators corresponding to nodes in a second projection.

3. The method of claim 2, wherein at least one of the nodes in the first projection is included in the second projection.

4. The method of claim 1, further comprising:

(d) providing one of the one or more projections to a subset of the other personal information aggregators.

5. The method of claim 1, wherein at least one of the projections of nodes includes an event-node established by a situation authority in response to an identification of the situation.

6. A method of propagating information in a situational network, the method comprising:

(a) receiving by a second personal information aggregator from a first personal information aggregator, a message relating to a situation, the first and second personal information aggregators corresponding to nodes in a multi-dimensional personal information network;

(b) automatically creating by the second personal information aggregator one or more projections of nodes of the multi-dimensional personal information network based on the situation; and

(c) concurrently transmitting notifications to a set of third personal information aggregators corresponding to the nodes of the one or more projections, wherein each projection receives a different notification.

7. The method of claim 6, further comprising:

(d) concurrently transmitting with the notifications in step (c), a reply to the first personal information aggregator.

8. The method of claim 6, wherein the notifications include the message.

9. The method of claim 6, wherein the situation is a weather phenomenon.

10. The method of claim 6, wherein the first personal information aggregator corresponds to an event node of the situational network established by a situation authority.

11. The method of claim 6, wherein the nodes corresponding to the first personal information aggregator and the second personal information aggregator are separated by an order of one.

12. The method of claim 6, wherein the nodes corresponding the second personal information aggregator and the set of third personal information aggregators are separated by an order of one.

13. The method of claim 6, wherein the notifications are transmitted using a single action by a user of the second personal information aggregator.

14. The method of claim 6, wherein each projection of nodes are related to the second personal information aggregator along a common dimension.

15. The method of claim 6, wherein each of the one or more projections of nodes corresponds to a set of users with a shared interest with a user of the second personal information aggregator.

16. A system for propagating information within a situational network, the system comprising:

a first device configured to receive a message with information related to a situation, determine at least one subset of a plurality of second devices to receive notifications corresponding to the situation, wherein the notifications include the message, generate a different notification for each of the at least one subset of the second devices, and concurrently transmit, via the situational network, the different notifications to the at least one subset of the second devices,

wherein each of the second devices is configured to receive, via the situational network, one of the different notifications from the first device.

17. The system of claim 16, wherein the first device is a personal information aggregator.

18. The system of claim 16, wherein at least one of the second devices is a personal information aggregator.

* * * * *