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(51) INT CL:
H04L 29/08 (2006.01) ***H04L 29/06*** (2006.01)

(56) Documents Cited:
WO 2008/094377 A1 **US 20100162335 A1**
US 20100058412 A1 **US 20070282990 A1**
US 20070213046 A1 **US 20060092015 A1**
US 20040202206 A1

(58) Field of Search:
INT CL **H04L, H04M, H04N, H04W**
Other: **WPI, EPODOC**

(54) Title of the Invention: **A multimedia entertainment and communication system, apparatus and methods thereof**
Abstract Title: **A converged home network with context based delivery**

(57) In a fully Connected Home different varieties of networks such as conventional circuit-switched communication system, packet-switched data networks, Internet and home entertainment systems are converged together such that telephony, multimedia contents like TV, radio and user-specific Internet services should be made available to an end user using a single multi-functional communication/entertainment device. The arrangement described discloses automatic follow-me type service/ applications wherein a user can receive the multimedia sessions from the most appropriate network device according to a user context and in particular according to tracked user movement. The user's location may be tracked across the network using RDIF tags and readers and, for example, the room the user is currently located in used to determine the best device to provide the session. When the user changes location (e.g. moves to a different room) the current session is seamlessly migrated to the new most appropriate device. The multi-functional devices may operate in a peer-to-peer fashion with the peers themselves handling the migration of sessions.

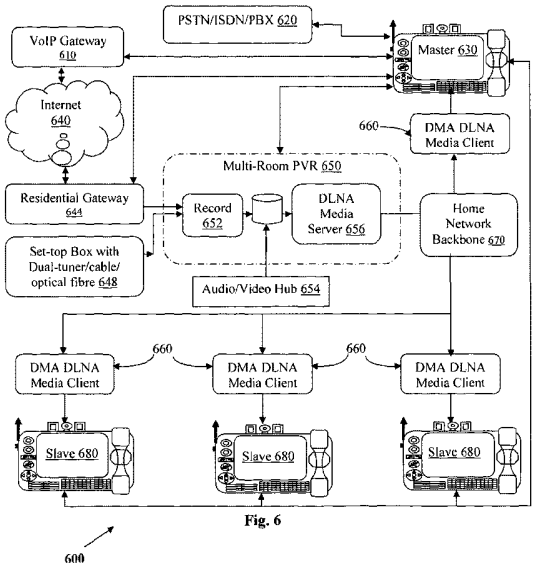

Fig. 6

GB 2483092 A

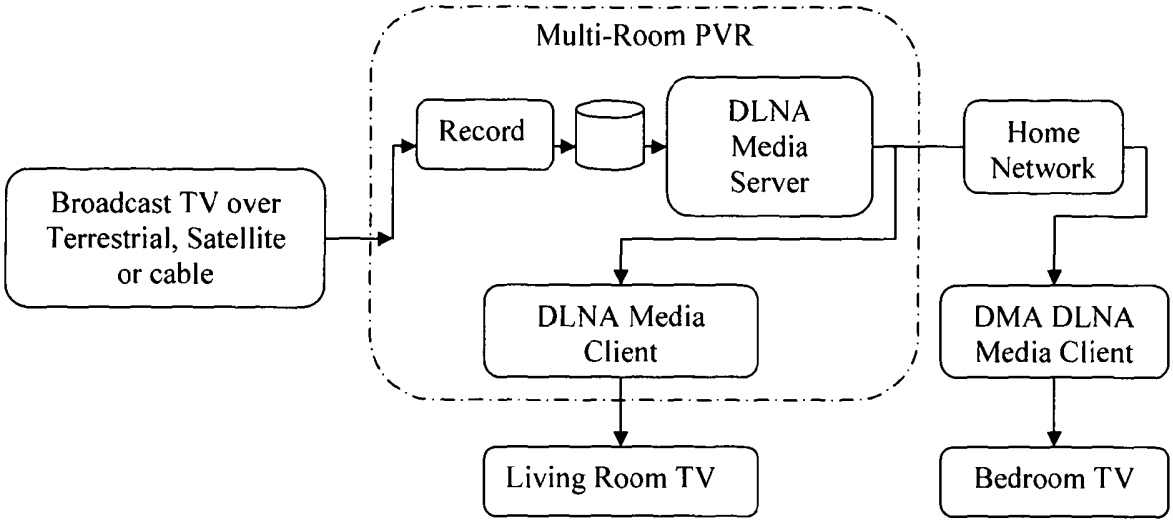
Multi-Room PVR
Record
DLNA Media Server
Home Network
Broadcast TV over Terrestrial, Satellite or cable
DLNA Media Client
DMA DLNA Media Client
Living Room TV
Bedroom TV

Fig. 1

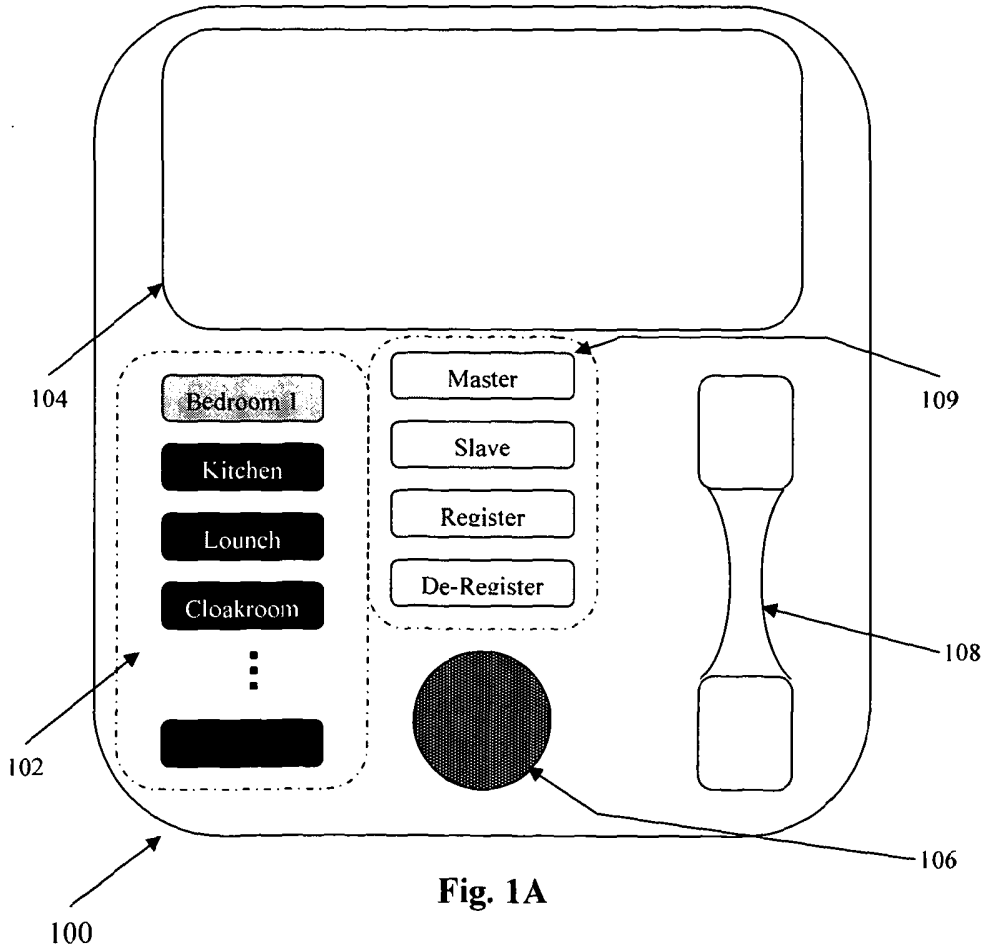
104
Bedroom 1
Kitchen
Lounch
Cloakroom
102
Master
Slave
Register
De-Register
109
108
106
100

Fig. 1A

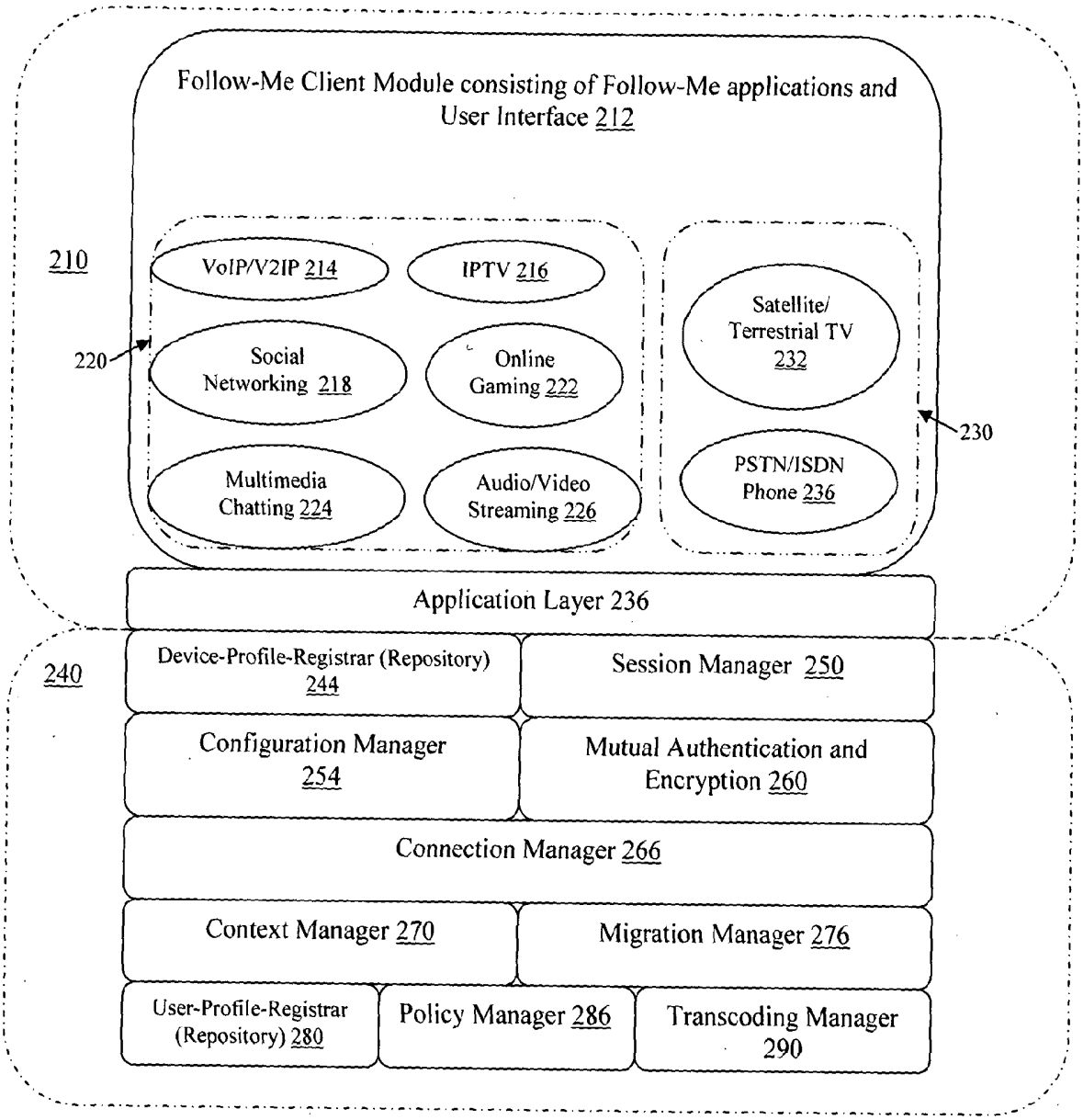
Follow-Me Client Module consisting of Follow-Me applications and User Interface 212
210
VoIP/V2IP 214
IPTV 216
220
Social Networking 218
Online Gaming 222
Multimedia Chatting 224
Audio/Video Streaming 226
Satellite/ Terrestrial TV 232
PSTN/ISDN Phone 236
230
Application Layer 236
240
Device-Profile-Registrar (Repository) 244
Session Manager 250
Configuration Manager 254
Mutual Authentication and Encryption 260
Connection Manager 266
Context Manager 270
Migration Manager 276
User-Profile-Registrar (Repository) 280
Policy Manager 286
Transcoding Manager 290

Fig. 2

200

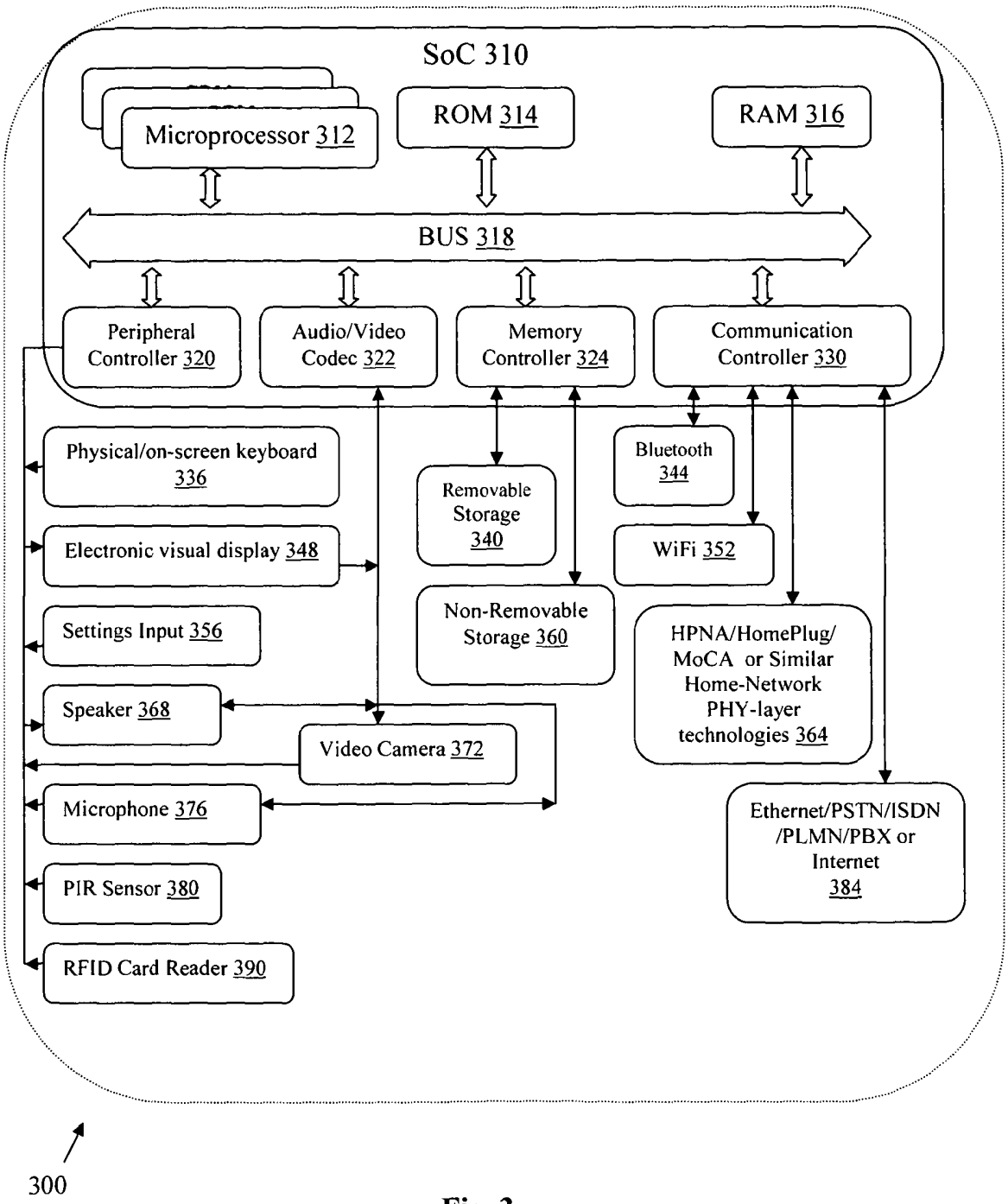
SoC 310
Microprocessor 312
ROM 314
RAM 316
BUS 318
Peripheral Controller 320
Audio/Video Codec 322
Memory Controller 324
Communication Controller 330
Physical/on-screen keyboard 336
Electronic visual display 348
Settings Input 356
Speaker 368
Microphone 376
PIR Sensor 380
RFID Card Reader 390
Removable Storage 340
Non-Removable Storage 360
Video Camera 372
Bluetooth 344
WiFi 352
HPNA/HomePlug/ MoCA or Similar Home-Network PHY-layer technologies 364
Ethernet/PSTN/ISDN /PLMN/PBX or Internet 384
300

Fig. 3

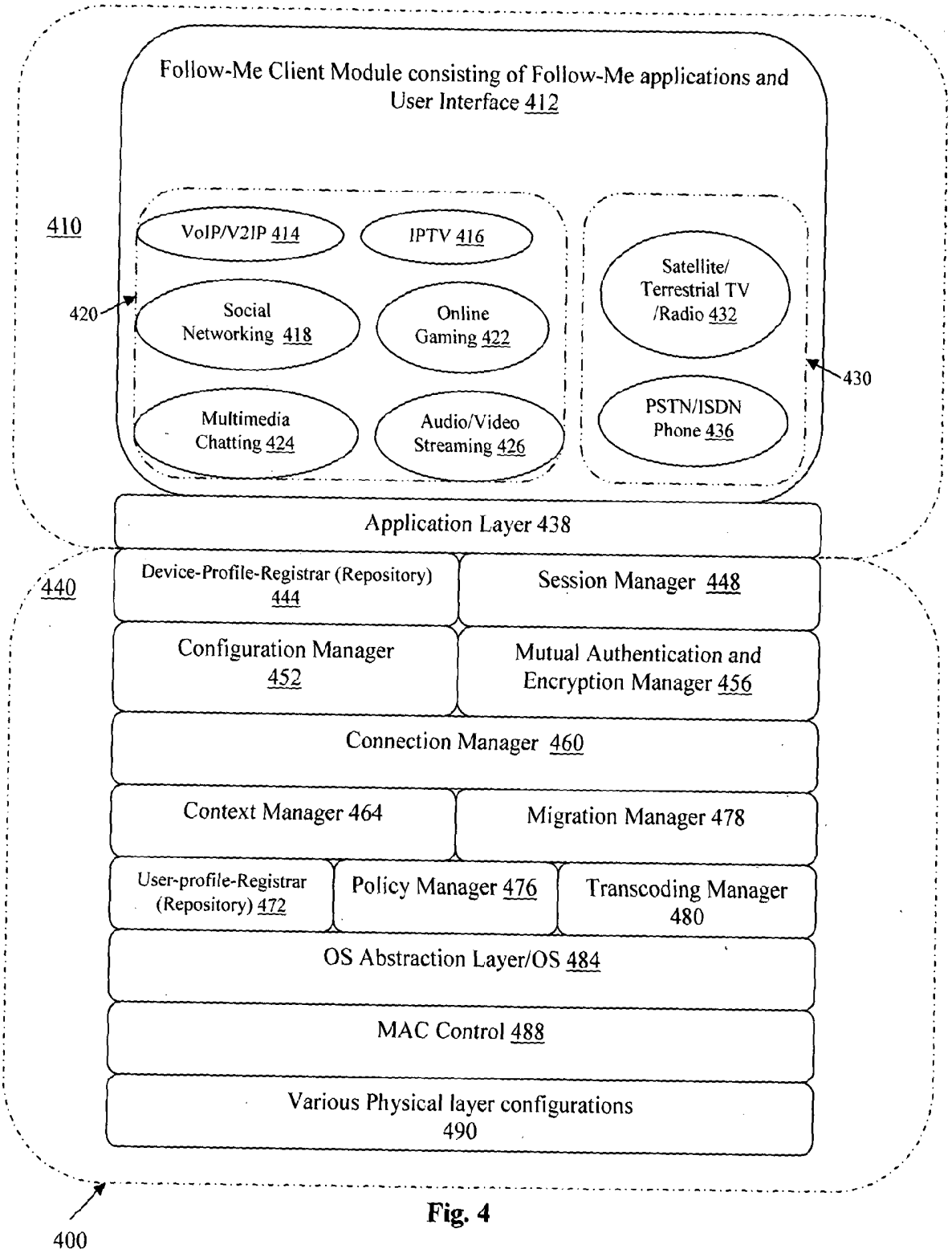
Follow-Me Client Module consisting of Follow-Me applications and User Interface 412
410
VoIP/V2IP 414
IPTV 416
420
Social Networking 418
Online Gaming 422
Multimedia Chatting 424
Audio/Video Streaming 426
Satellite/ Terrestrial TV /Radio 432
430
PSTN/ISDN Phone 436
Application Layer 438
440
Device-Profile-Registrar (Repository) 444
Session Manager 448
Configuration Manager 452
Mutual Authentication and Encryption Manager 456
Connection Manager 460
Context Manager 464
Migration Manager 478
User-profile-Registrar (Repository) 472
Policy Manager 476
Transcoding Manager 480
OS Abstraction Layer/OS 484
MAC Control 488
Various Physical layer configurations 490
400

Fig. 4

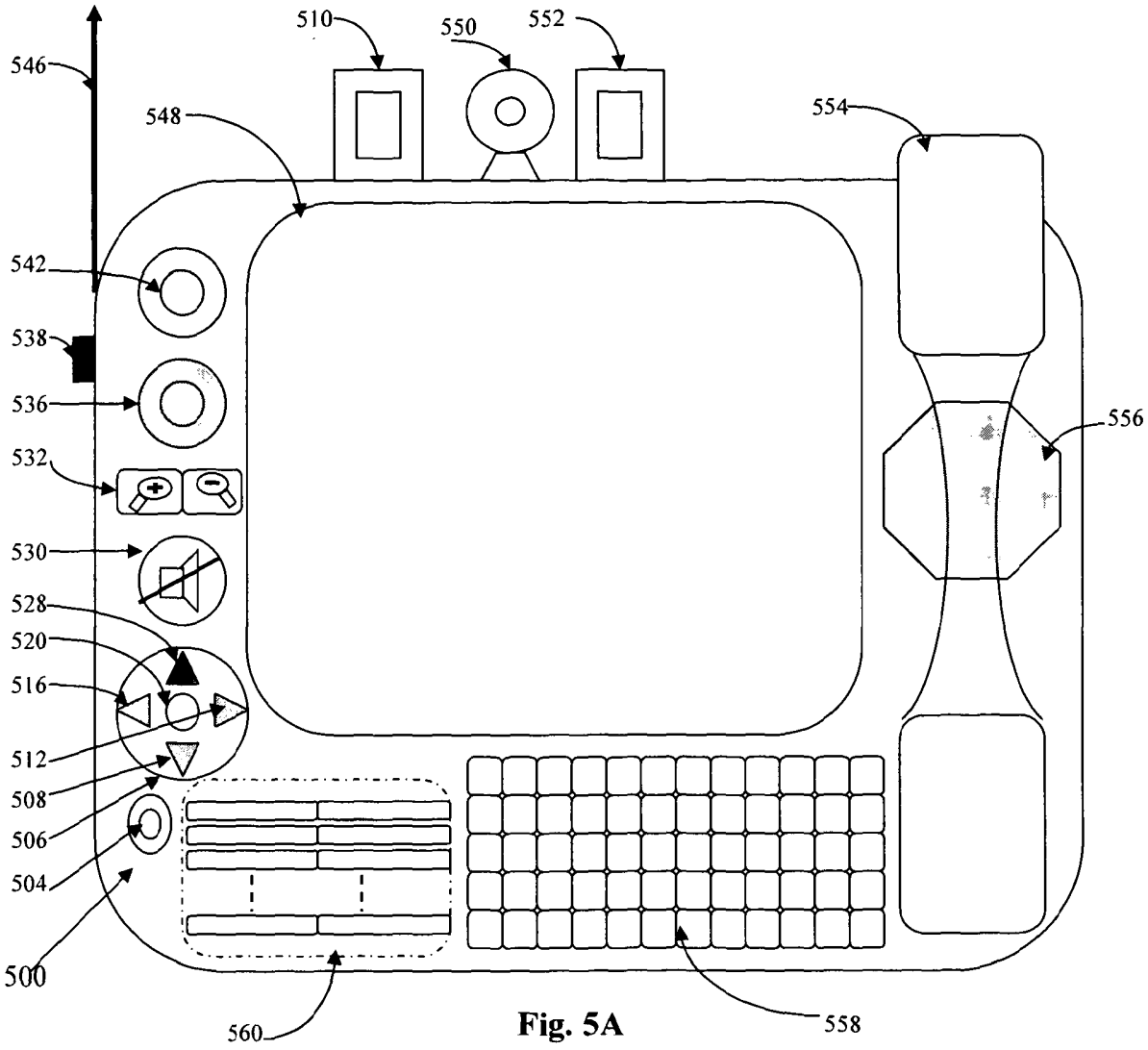
510
550
552
546
548
554
542
538
536
556
532
530
528
520
516
512
508
506
504
500
560
558

Fig. 5A

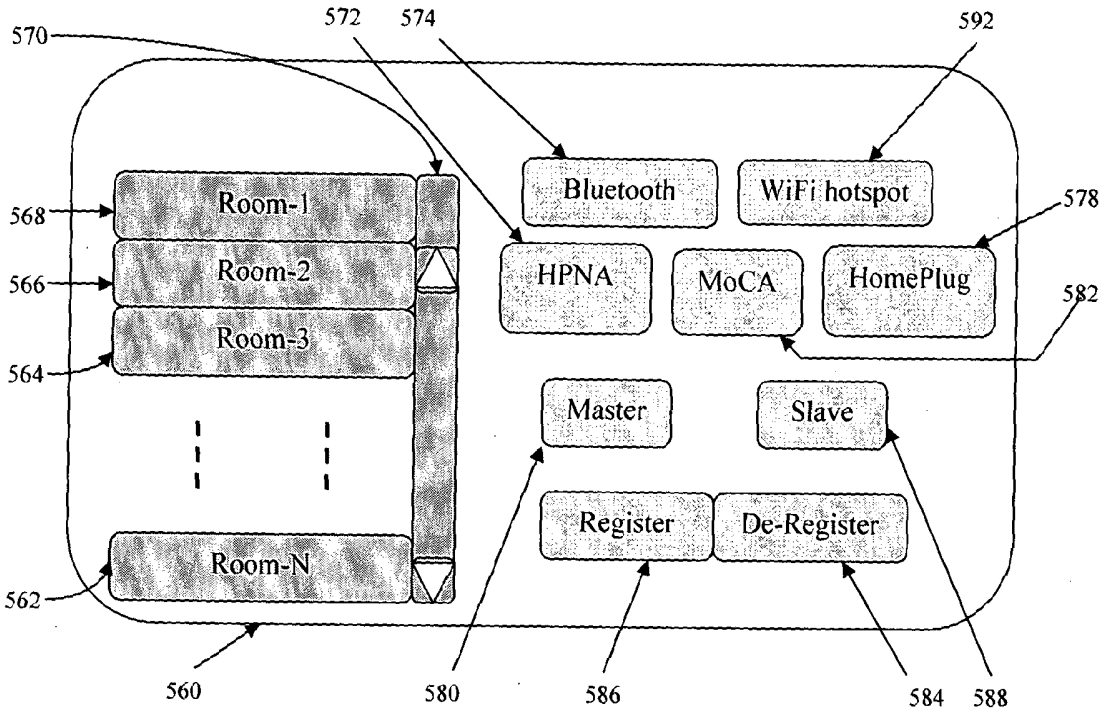
570
572
574
592
Bluetooth
WiFi hotspot
578
568
Room-1
566
Room-2
HPNA
MoCA
HomePlug
582
564
Room-3
Master
Slave
Register
De-Register
Room-N
562
560
580
586
584
588

Fig. 5B

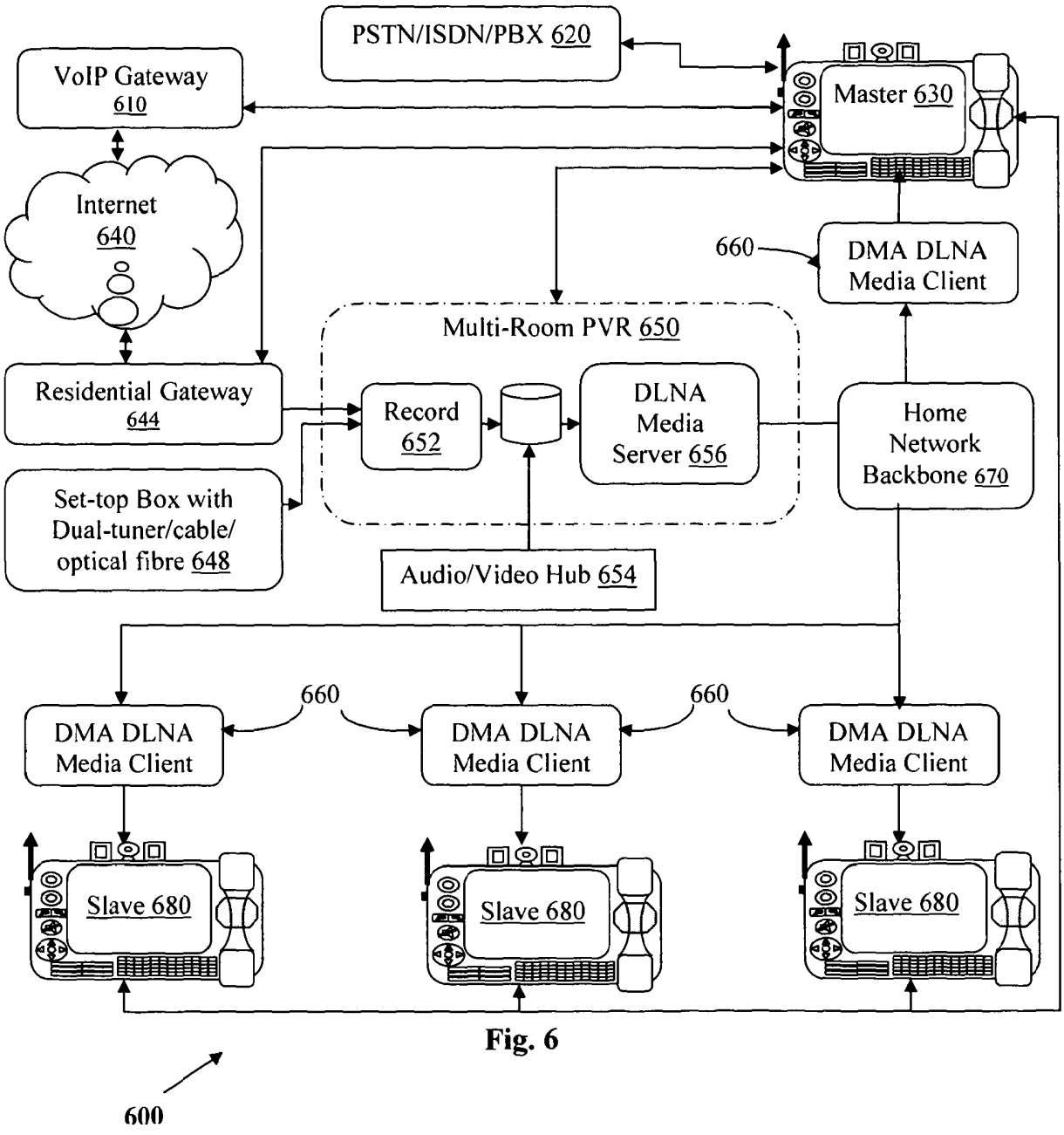
PSTN/ISDN/PBX 620
VoIP Gateway 610
Master 630
Internet 640
660
DMA DLNA Media Client
Multi-Room PVR 650
Residential Gateway 644
Record 652
DLNA Media Server 656
Home Network Backbone 670
Set-top Box with Dual-tuner/cable/ optical fibre 648
Audio/Video Hub 654
660
660
DMA DLNA Media Client
DMA DLNA Media Client
DMA DLNA Media Client
Slave 680
Slave 680
Slave 680
600

Fig. 6

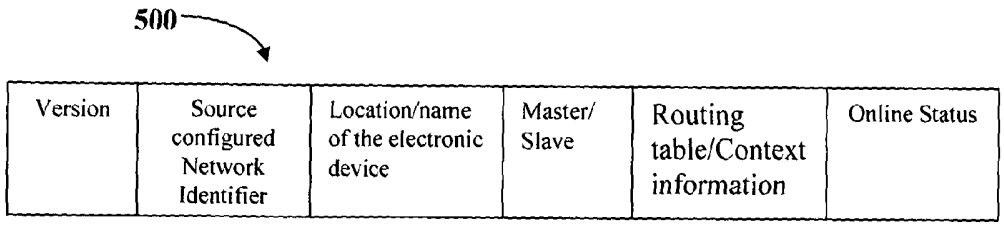

Fig. 7

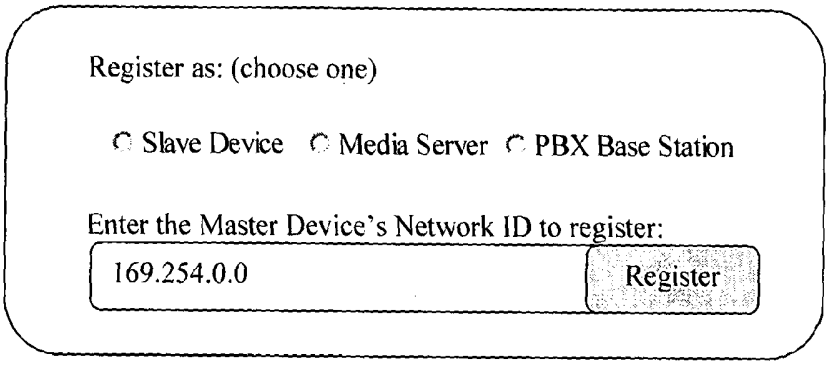

Fig. 8A

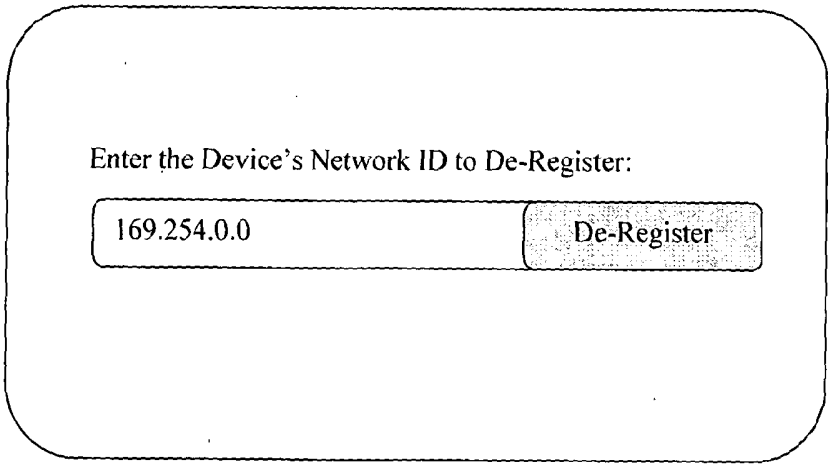

Fig. 8B

Location Name	Network Identifier	Device Type	Current Status	Last time Stamp	Main Interfaces Supported	Public Key	Private Key	User(s) detected / supported
Kitchen	169.254.0.2 on 802.11g, 169.254.0.124 on HomePlug, and so on...	Slave	Idle	-00:01:30	802.11g, MoCA, HomePlug, 802.11n, Bluetooth, WiMedia, DECT	Aaa111	Aaa222	-
Sitting room	169.254.0.4 on 802.11g, 169.254.0.126 on HomePlug, and so on...	Master	Engaged	00:00:00	802.11g, MoCA, HomePlug, 802.11n, Bluetooth, WiMedia, DECT	Bbb111	Bbb222	**AB46, CD55**
Sitting room	169.254.0.5 on Bluetooth, 169.254.0.128 on HomePlug, and so on...	PBX-Unit	Engaged	00:00:00	HPNA, Bluetooth, WiMedia, DECT	Bbb111	Bbb222	-
Bedroom 1	169.254.0.6 on 802.11g, 169.254.0.130 on HomePlug, and so on...	Slave	Idle	-00:01:12	802.11g, MoCA, HomePlug, 802.11n, Bluetooth, WiMedia, DECT	Ccc111	Ccc222	-
Bedroom 2	---	---	---	---		---	---	-
FF Toilet	---	---	---	---		---	---	-
Cloak room	---	---	---	---		---	---	-
---	---	---	---	---		---	---	-
Conservatory	169.254.0.22 on 802.11g, 169.254.0.136 on HomePlug, and so on...	Media Server	engaged	-00:01:58	802.11g, MoCA, HomePlug, 802.11n, Bluetooth, WiMedia, DECT	**Jjj111**	**Jjj222**	-

Fig. 9

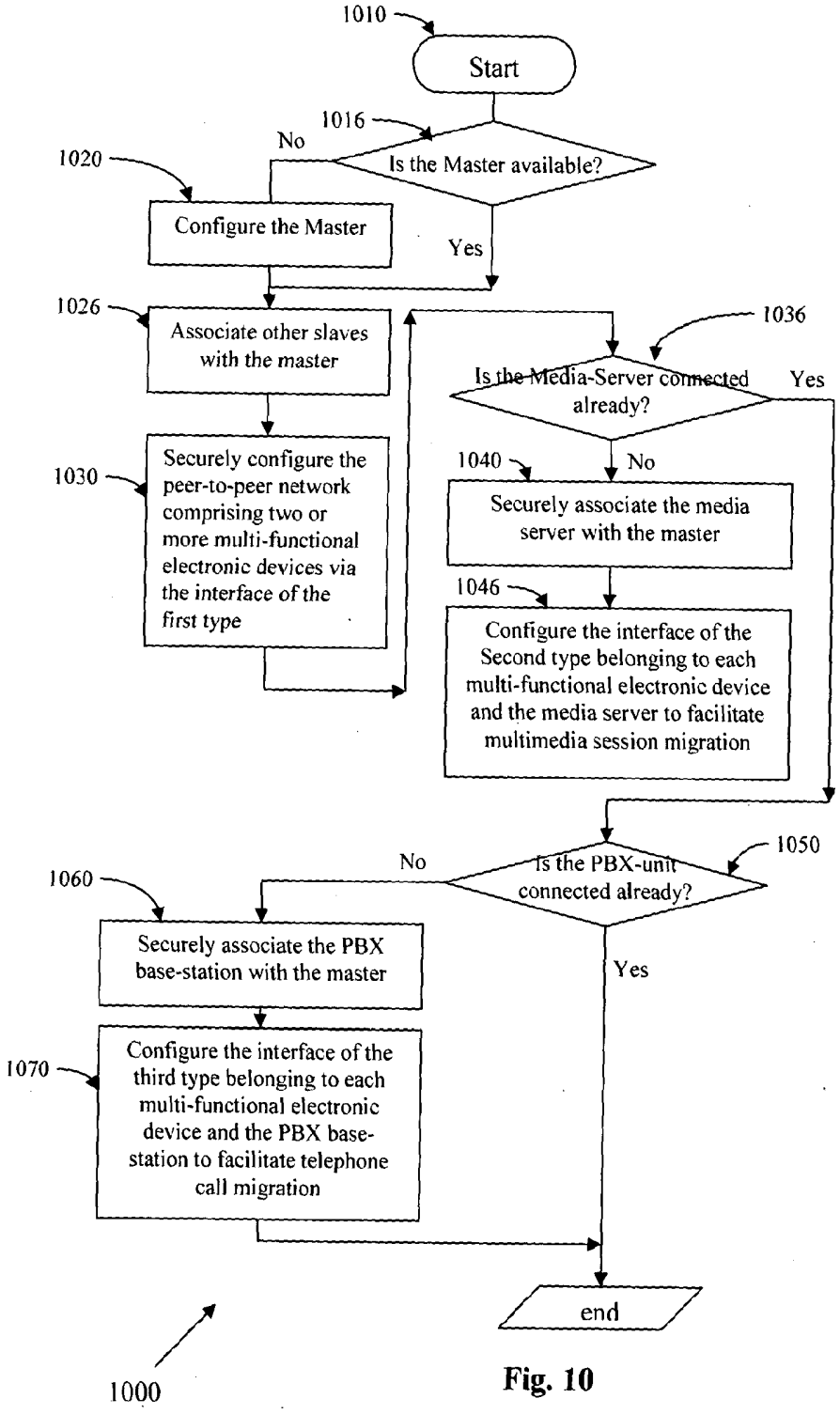
1010
Start
1016
No
Is the Master available?
1020
Configure the Master
Yes
1026
Associate other slaves with the master
1030
Securely configure the peer-to-peer network comprising two or more multi-functional electronic devices via the interface of the first type
1036
Is the Media-Server connected already?
Yes
1040
No
Securely associate the media server with the master
1046
Configure the interface of the Second type belonging to each multi-functional electronic device and the media server to facilitate multimedia session migration
1050
Is the PBX-unit connected already?
No
1060
Securely associate the PBX base-station with the master
Yes
1070
Configure the interface of the third type belonging to each multi-functional electronic device and the PBX base-station to facilitate telephone call migration
end
1000

Fig. 10

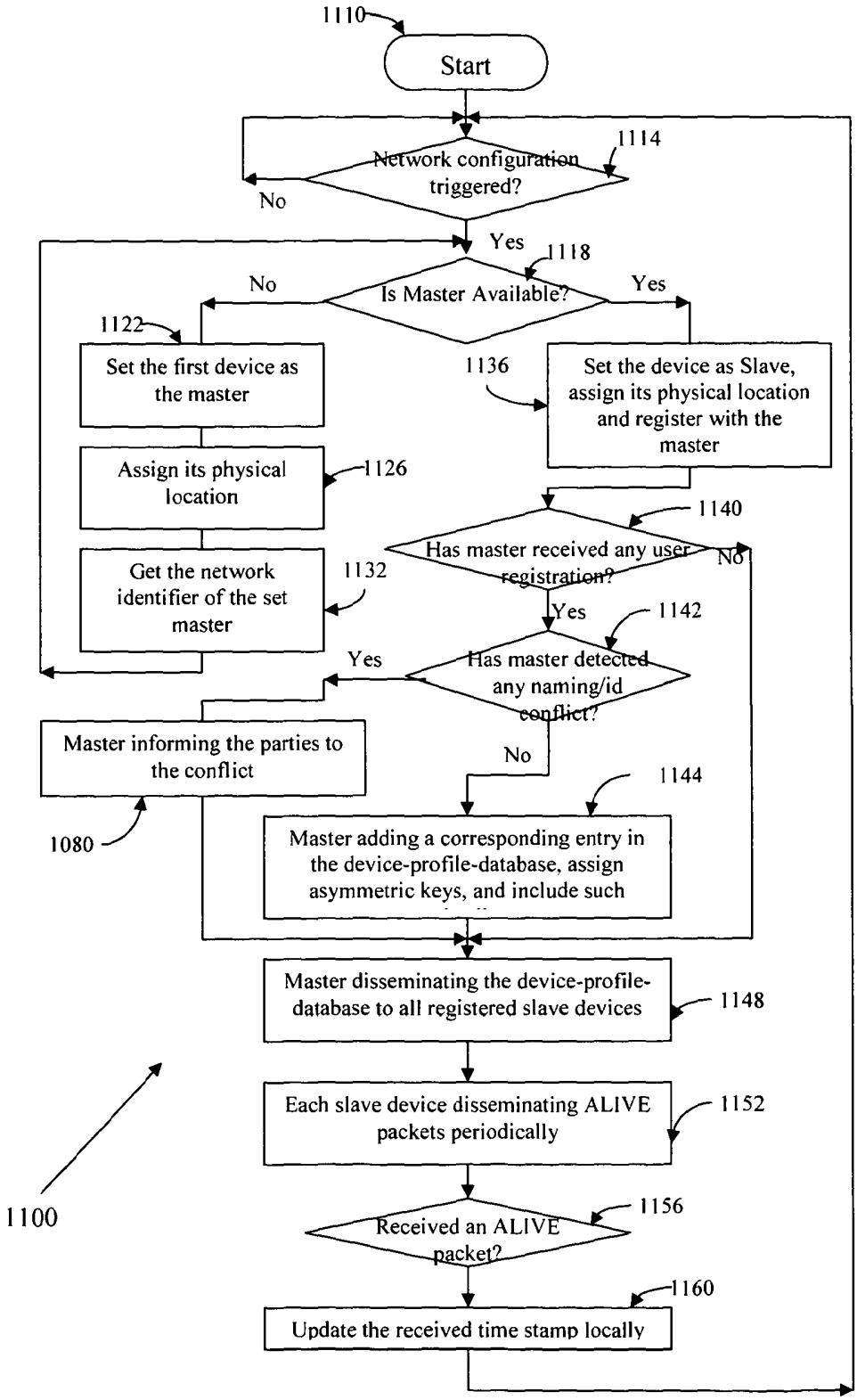
1110
Start
1114
Network configuration triggered?
No
Yes
1118
Is Master Available?
No
Yes
1122
Set the first device as the master
1136
Set the device as Slave, assign its physical location and register with the master
Assign its physical location
1126
1140
Has master received any user registration?
No
Yes
Get the network identifier of the set master
1132
1142
Has master detected any naming/id conflict?
Yes
No
Master informing the parties to the conflict
1080
1144
Master adding a corresponding entry in the device-profile-database, assign asymmetric keys, and include such
Master disseminating the device-profile-database to all registered slave devices
1148
Each slave device disseminating ALIVE packets periodically
1152
1156
Received an ALIVE packet?
1160
Update the received time stamp locally
1100

Fig. 11

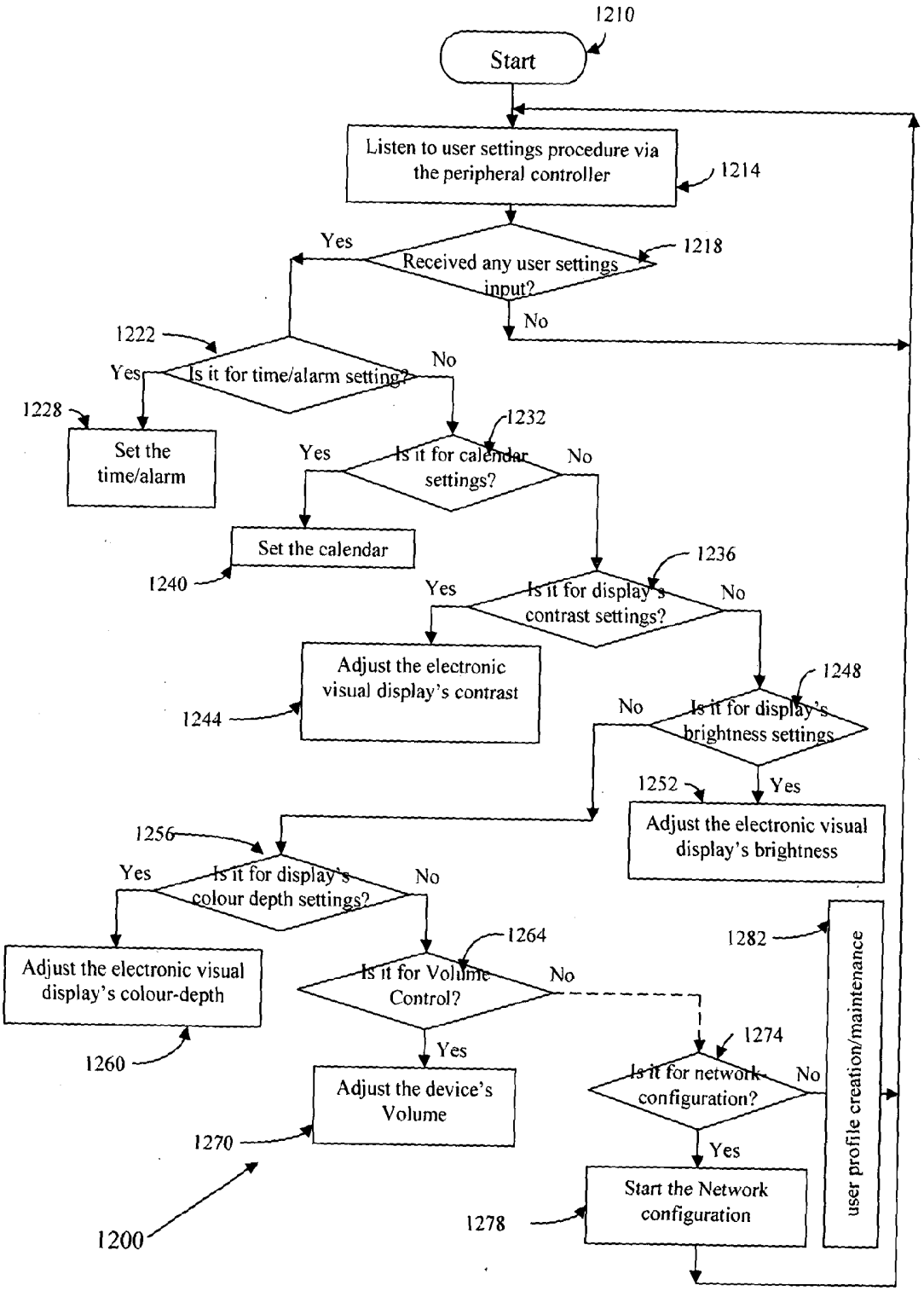
1210
Start
Listen to user settings procedure via the peripheral controller
1214
Received any user settings input?
1218
Yes
No
1222
Is it for time/alarm setting?
Yes
No
1228
Set the time/alarm
1232
Is it for calendar settings?
Yes
No
Set the calendar
1240
1236
Is it for display's contrast settings?
Yes
No
Adjust the electronic visual display's contrast
1244
1248
Is it for display's brightness settings
No
Yes
1252
Adjust the electronic visual display's brightness
1256
Is it for display's colour depth settings?
Yes
No
Adjust the electronic visual display's colour-depth
1260
1264
Is it for Volume Control?
No
Yes
Adjust the device's Volume
1270
1274
Is it for network configuration?
No
Yes
Start the Network configuration
1278
1282
user profile creation/maintenance
1200

Fig. 12

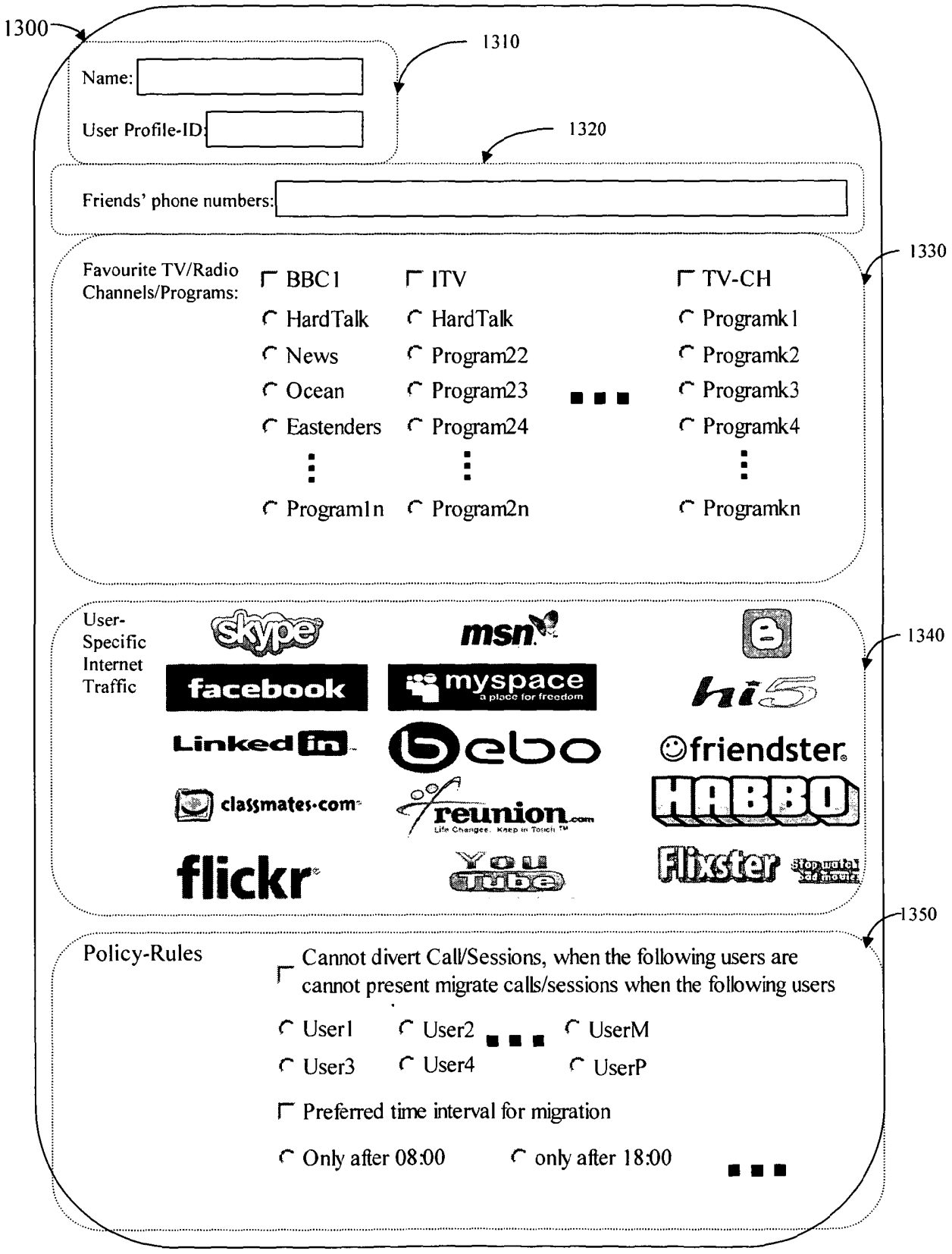
1300
1310
Name:
User Profile-ID:
1320
Friends' phone numbers:
1330
Favourite TV/Radio Channels/Programs:
BBC1
ITV
TV-CH
HardTalk
HardTalk
Programk1
News
Program22
Programk2
Ocean
Program23
Programk3
Eastenders
Program24
Programk4
Program1n
Program2n
Programkn
1340
User-Specific Internet Traffic
skype
msn
facebook
myspace
a place for freedom
hi5
LinkedIn
bebo
friendster
classmates.com
reunion
HABBO
flickr
YouTube
Flixster
1350
Policy-Rules
Cannot divert Call/Sessions, when the following users are
cannot present migrate calls/sessions when the following users
User1
User2
UserM
User3
User4
UserP
Preferred time interval for migration
Only after 08:00
only after 18:00

Fig. 13

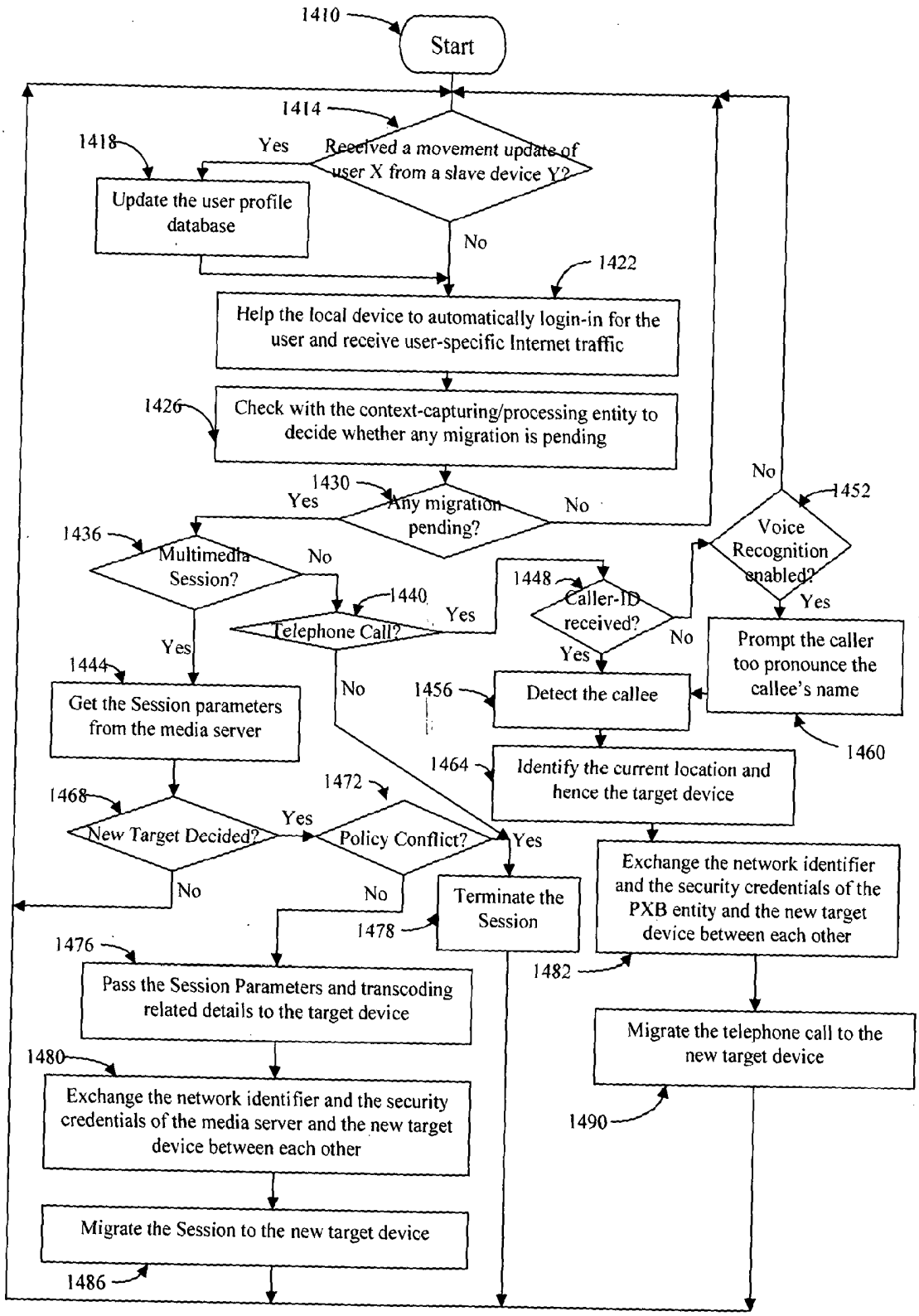
1410
Start
1414
Received a movement update of user X from a slave device Y?
Yes
1418
Update the user profile database
No
1422
Help the local device to automatically login-in for the user and receive user-specific Internet traffic
1426
Check with the context-capturing/processing entity to decide whether any migration is pending
1430
Any migration pending?
Yes
No
1436
Multimedia Session?
No
Yes
1440
Telephone Call?
Yes
No
1448
Caller-ID received?
Yes
No
1452
Voice Recognition enabled?
No
Yes
Prompt the caller too pronounce the callee's name
1460
1444
Get the Session parameters from the media server
1456
Detect the callee
1464
Identify the current location and hence the target device
1472
1468
New Target Decided?
Yes
Policy Conflict?
Yes
No
No
Terminate the Session
1478
Exchange the network identifier and the security credentials of the PXB entity and the new target device between each other
1482
1476
Pass the Session Parameters and transcoding related details to the target device
Migrate the telephone call to the new target device
1490
1480
Exchange the network identifier and the security credentials of the media server and the new target device between each other
Migrate the Session to the new target device
1486

Fig. 14

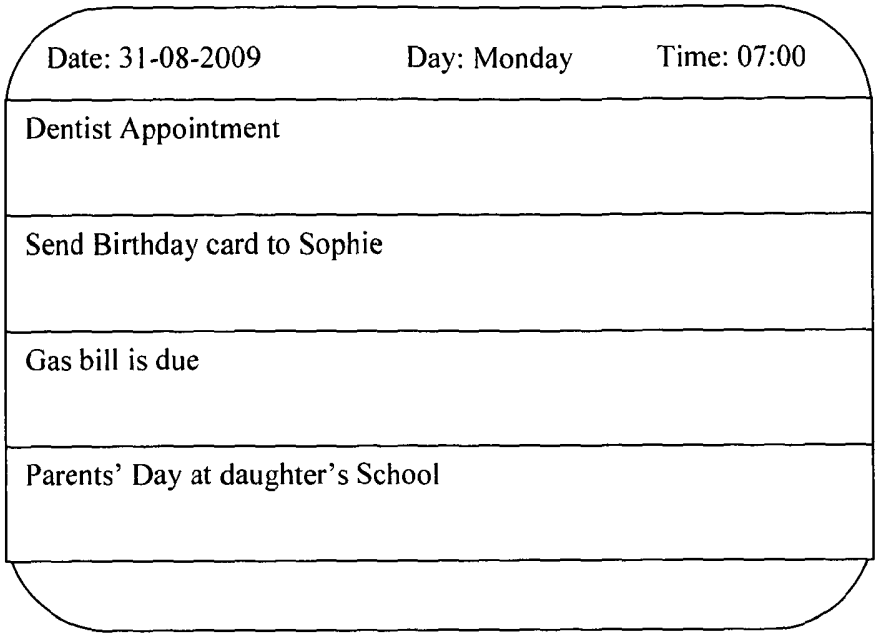
Date: 31-08-2009
Day: Monday
Time: 07:00
Dentist Appointment
Send Birthday card to Sophie
Gas bill is due
Parents' Day at daughter's School

Fig. 15

The following terms are registered trademarks and should be read as such wherever they occur in this document:

Bluetooth
Facebook
LinkedIn
Twitter
MSN
Google
Java
Microsoft
Palm OS
Windows Mobile
Android
Symbian
BREW

A Multimedia Entertainment and Communication System, Apparatus and Methods thereof

Technical Field

The present invention relates to a system, method and apparatus for providing unified in-house or in-building multifunctional multimedia communication and home entertainment facility.

Background

Technology truly changes the way in which people lead their lives in this modern era. More notably, there is a significant development in terms of the way people interact with each other and entertain themselves. It is hard to fathom how much the modern society has changed in the last fifty years. There have been technological innovations in multiple fronts that have changed the capabilities of today's modern homes. There are a number of gadgets which a modern household relies on so heavily for the daily life that hardly does a householder even realise that they are there. For instance, there are home theatre systems, centralised music systems and centralised home lighting systems, being ready and waiting to tempt people. Further, in addition to visible electronic gadgets, in reality, there will be numerous invisible electronic systems being hidden in a modern household creating a smart-space in order to enhance the quality of lives of the dwellers of modern homes

through automation. The vision is to unite devices, capabilities and services to create the ultimate integrated environment and blended services in a home environment. With the potential and desire to inter-connect various computing, communication and consumer electronics, the emergence of fully Connected-Home is coming of age.

To cater for the modern society's demands, with the technological advances in nanotechnology, hardware becomes increasingly cheaper – which in turn results in faster, smaller, more accessible, more affordable, and easier to use portable entertainment and communication devices. The availability of full, capacitive touch screen, LED display (i.e., organic electro luminescent device (OELD)), a flip out QWERTY keyboard and/or an on-screen/soft keyboard in lieu of a physical keyboard, a track ball for easy navigation, high resolution cameras/camcorders, and the like are becoming increasingly common in small portable communication/entertainment devices. It is therefore possible to add various functionalities to a small electronic device or for fusion of various electronic elements to produce one unified multi-functional device that turns out to be cheaper and convenient for the end-user. Such a multi-functional single device is capable enough to cater to the modern user's entertainment and communication demands.

The same level of innovation can be witnessed in networking technologies – especially in the design of new physical (PHY) layer technologies being capable of pumping vast amount of data within a fraction of a second. As a

result, new short-range radio communication standards such as ZigBee, WiMedia Ultra Wide Band (UWB) and WiFi-Direct are emerging while promising hundreds of megabits per second data rate with low power consumption – hence are more suitable for portable communication/ entertainment devices. This can lead to a widespread availability of portable communication/entertainment devices that are equipped with one or plurality of wireless transceivers employing such short-range radio standards as WiFi (IEEE 802.11 and its variants), Bluetooth (IEEE 802.15.1), ZigBee (IEEE 802.15.4), Infrared, WiMedia UWB and the like.

In another front, different types of PHY-layer technologies that use phone line, power-lines, and coaxial cable are emerging as well in addition to new short-range wireless technologies. Home Phoneline Networking Alliance (HPNA™) offers specifications for interoperable home-networked devices using telephone wiring already in place. HomePlug® is an emerging specification for a technology that connects devices to each other via electrical power lines at home. Multimedia over Coax Alliance (MoCA®) is a developing set of specifications that will tap into the vast amount of unused bandwidth being available in coax cabling at home. The underlying technologies that make up MoCA are capable enough to distribute DVD-quality entertainment throughout the home environment.

All these technological breakthroughs provide new opportunities for new way of collaborations and entertainment. For instance, in the case of IPTV, for a competitive multi-channel TV service, a connection speed of 20 Mbps is likely to be required. The increasing popularity of high definition TV (with twice the data of Standard Definition (SD) video) increases connection speed requirements, or limits IPTV service quality and connection eligibility, yet further. With the advent of recent IEEE 802.11n-based home-networking or similar wired solutions that can support a raw data rate of 600 Mbps, multi-channel TV becomes feasible.

With increasing digital connectivity and intelligent devices in and around the home, in terms of the ability to entertain dwellers of modern home through seamless migration of multimedia services and sessions, it is important to question whether the full-potential of the Connected-Home proposition has been realised. If not, the objective is to see how the Connected-Home can improve the quality of lives in a home environment in terms of the abilities of occupants to entertain themselves or interact with each other. Hence, the objective of this patent at a high-level point of view is to ascertain whether the evolution of Broadband Access, the emergence of Converged Digital Devices and advances within Home Entertainment and communication/interaction mechanisms is ripe to explode into a full blown Connected-Home revolution.

In a fully Connected-Home different varieties of networks such as conventional circuit-switched communication system, packet-switched data

networks, Internet and home entertainment systems are converged together such that telephony, multimedia contents like TV, radio and Internet services can be easily and readily available to an end user in a single multi-functional communication/entertainment device. More over due to the technological advancement as explained before, these communication/entertainment devices become thick in terms of the functionalities they support – but thin in terms of their size. Although in such a Connected-Home environment multimedia entertainment library increases with hundreds of albums, movies, games, occupants of a house do not spend all their time in a single location. Occupants move around in a home environment and hence there is a need to either make the multitude of multimedia contents, on-going calls and sessions automatically move along with the user. It means that it is important to make them available in multiple locations or to route the multimedia contents/calls/sessions depending on users' movements seamlessly in order to ensure the availability of true connected services all the time.

As mentioned in the previous paragraphs, modern day lifestyle has changed dramatically due to technological advancement. Modern multimedia contents, Internet Services, and telephone calls are seen as the key drivers of the digital Connected-Home today. Checking social networking websites such as Facebook, LinkedIn and the like, receiving tweets in order to know the current status of interesting people, events, and friends, listening to conventional radio stations, albums being played on a HiFi located in the

sitting room, Internet radio and watching terrestrial, Satellite, Internet (e.g., IPTV) and cable TVs and accessing stored digital entertainment while moving, receiving calls via VoIP (e.g., Skype), playing multi-player interactive online games, or standard telephone networks on a regular basis have become the typical day-to-day life activities of a modern day adult/kid irrespective of where the user is within the home environment. Ensuring continuity of such services within a home environment using a single system irrespective of whether users are/aren't moving around is important. Moreover, the control element of the Connected-Home should constantly control where, when and on what devices the personalised digital multimedia content should be made available depending on users' personalised settings and instantaneous movement within the home environment.

Also, in a Connected-Home environment different users may have different personalisation/preferences in terms of what they want to watch, listen and how the incoming calls need to be routed. In addition, the essence of the Connected-Home will be realised only when the multimedia content also migrates automatically without expecting any user inputs depending on each user's movements. Although people tend to spend most of their time at home, there does not exist a convenient Connected-Home system or device that automatically makes the user-specific multimedia contents follow a given user. On the other hand, although ideally mobile phones can be used to render the personalised multimedia content of anybody in an "any-time and any-

where" manner, people do not tend to carry their mobile phones with them all the time especially when they are at home. Under such circumstances, there has to be an alternative system in place that can enable anybody to get the desired multimedia content followed depending on their movement within a given building, dwelling, office and the like.

This is the feature of true Connected-Home that is enriched with communication/entertaining sessions and services that follow a user depending on the latter's movement within the home environment. The ability to migrate an ongoing communication/entertaining session/services enables a wide variety of "Follow-Me" type applications/services. Typical examples of Follow-Me applications/services are Follow-Me-Phone, Follow-Me-Chat, Follow-Me-Radio, Follow-Me-TV and the like.

The system that empowers a user through Follow-Me type applications and services will enable any occupant of a Connected-Home to start a multimedia session, call, chat, social networking using Facebook, LinkedIn, and similar technologies, TV, radio and the like in one location of the Connected-Home (say, Sitting-Room) and continue to engage in the same session in another location probably using a different communication/entertainment device. For instance, a user can start watching a movie in the sitting room and continue to do so even when the user moves to the main bed room.

In this respect, the view of true connectivity by the present invention within a Connected-Home environment is about seamlessly/automatically migrating multimedia contents, sessions, calls, high-speed data, information and similar entertainment/communication services from one location or device to another. For this purpose, the present invention proposes an apparatus, system and associated methodologies, whereby a plurality of multi-functional communication/entertainment devices are registered per each geographical location (i.e., physically dispersed devices) of a private dwelling and compose into a purposeful system providing the real Connected-Home experience to the end user. In such a Connected-Home environment as proposed by the present invention, a variety of multimedia contents is seamlessly routed/migrated to appropriate multi-functional communication/entertainment device depending on the user's identity, personal settings and movement pattern (more accurately variety of multimedia contents are migrated based on the actual context-information). In other words, the main objective of this present invention is to propose methods, apparatus and system framework to support automatic follow-me applications/services and to connect users to all their multimedia contents and services while making sure that the user experience of individuals is personalized no matter where they are in the Connected-Home. The vision is to transfer media content and services from one multi-functional communication/entertainment device to another seamlessly and automatically over wired and/or wireless broadband communication media without expecting any manual intervention. IP-based

solutions are preferred because of the ability to conveniently interwork with other systems.

This requires identifying each user, individual user's personal preferences, the user's current location, proximity of a user to suitable communication/ entertainment devices. This type of information is commonly referred to as context information. Once such user's context information is known, the control element of the Connected-Home has to coordinate with the Media-Server that constantly maintains connectivity with a set-top box, various tuner circuits, Internet via residential gateway and a local PBX-unit to divert the multimedia content or call to the required media client device depending on the user's movement, personal settings and other relevant context information.

The necessity to make different multimedia sessions/contents follow a given user depending on the user's current location supports different varieties of "follow-me" type services such as Follow-me-call, Follow-me-VoIP, Follow-me-chat, Follow-me-tweet, Follow-me-TV, Follow-me-Radio, Follow-me-Audio and the like.

An exemplary connected-home from the perspectives of delivering TV content that requires manual input for migrating a session is illustrated with the use of Fig. 1. The networked Multi Room Personal Video Recorder (MR-PVR) is responsible for recording both Standard Definition (SD) and High Definition content to hard disk, time-shifting of live content and instant

replay. This arrangement includes Universal Plug and Play (uPnP) based Media-Server that can store and share digital multimedia, such as photographs, movies, music and the like. Accessing the stored multimedia content is possible by employing any connected media client such as a Digital Media Adapter (DMA). With the availability of new Digital Living Network Alliance (DLNA) standards, it is possible to start or program recording on the MR-PVR from a media client. This arrangement allows a user to temporarily pause a given TV program and continue watching it in another room by getting the user to press one or more buttons. On the other hand, the apparatus, system and methodologies as proposed by the present invention, allows the multimedia content to migrate automatically with the user depending on the user's movement within the Connected-Home environment.

In order for the control element of the Connected-Home to identify a particular user Radio-frequency identification (RFID) is used. RFID technology allows the bearer to be identified and traced using radio-waves. Accordingly, each user has an active RFID tag that uniquely identifies a given user with 16-digit alphanumeric character within the home environment. Each location-specific multi-functional communication/entertainment device has an RFID reader (interrogator) and notifies the control element of the Connected-Home whenever a particular user is detected in a location where the given multi-functional communication/entertainment device is registered. Each user can carry an RFID tag as a small hand-chain or a pendant. On being informed

about the current location of a particular user, the control element of the Connected-Home will coordinate with the Media-Server to push the required multimedia content to the multi-functional communication/entertainment device registered at the location where the particular user is currently detected. Each multi-functional communication/entertainment device registered at each location (e.g., kitchen, main bathroom and the like) of a Connected-Home functions as a media client.

In order to ease the task of an RFID reader (interrogator), each multi-functional communication/entertainment device registered per physical location of a Connected-Home is equipped with one or plurality of Passive Infrared (PIR) Sensors. Accordingly, the RFID reader attached to each multi-functional communication/entertainment device does not have to be active constantly – but the PIR sensor arrangement should. Instead, on detecting a movement, the PIR sensor arrangement will wake up the RFID reader for the latter to correctly identify the user and to notify the control element of the Connected-Home. This way the possibility for one location-dependent communication/entertainment device to be activated by a user movement in another location will be minimised.

Hence, the objective of the present invention is to first ensure the availability of location-specific multi-functional communication/entertainment device per every key nook and corner of a Connected-Home, equip each of such devices to correctly identify the user identity and location within the Connected-Home

environment and to ensure that the multimedia sessions follow a given user depending on the latter's instantaneous movement. This requires augmenting the components of the present Connected-Home system.

Although the use case scenario of the system, apparatus and the methodologies as proposed by the present invention is quite different from those of other current Connected-Home or similar systems, the following paragraphs explain the main differences by way of making comparisons with different representative systems found in the prior art. US Patent US 2007/0282990 A1 proposes a very generic theoretical mechanism for migrating communication session especially in IP Multimedia Subsystem (IMS). The idea was to migrate a communication session from a fixed device to a mobile device or vice-versa. Instead, the present invention proposes a very pragmatic and complete system, apparatus and methodologies that will allow multi-functional communication/entertainment devices to compose into a purposeful Connected-Home system, where automatic migration of different varieties of multimedia sessions (such as call, TV, radio, Internet social networking traffic like Facebook, tweets and the like) are possible with the use of radio frequency identification of users within a Connected-Home environment.

Another US patent US 2009/0073965 A1 envisages a system where a user using a smartcard can get a virtual home environment based telephony services when the user travels to different countries/places. Again this system

does not provide the same level of follow-me type multimedia experience to a user that embraces telephony, multimedia entertainment services like IPTV, Internet traffic pertaining to Social Networking Sites such as Facebook, LinkedIn and the like within the Connected-Home environment as proposed by the present invention.

A framework for mediating between one or plurality of IPTV content providers and subscribers in order to get the required content from the providers depending on the subscriber's entitlement privileges, encoding it to create IP-compatible content with access restriction and transmitting the content towards the user is proposed in US patent 2009/0252329 A1. On the other hand, the present invention deals with the issue of how to deliver such multimedia content that may have been received based on the principles as proposed in US 2009/0252329 A1 to different multi-functional physically dispersed communication/entertainment devices that can be found within the boundaries of a Connected-Home environment depending on instantaneous user movement.

A method for migrating a video session from a fixed device to a mobile device that operates on different communication protocol devices is proposed in US patent 2010/0058412 A1. Again this mechanism is not same as the system, apparatus and methodologies as proposed in the present invention to enable true Follow-Me applications and services in an in-door Connected-Home environment.

Please note that terms such as Connected-Home, Connected-Home system, Connected-Home network and Connected-Home environment are used interchangeably throughout this document.

Disclosure of the Invention

According to the first aspect of the present invention there is provided a an electronic device of first type having multi-functional communication and entertainment capabilities to form a controlled-network within the premises of a private dwelling, office, apartment and the like, and the said controlled-network consisting of:

i) one or more electronic device of first type being configured to operate from a specific location of a private dwelling, office, apartment and the like;

ii) an electronic device of the second type maintaining a multimedia hub; and,

iii) an electronic device of the third type maintaining constant connectivity with traditional telephony networks such as PSTN/PLMN/ISDN and the like;

wherein one or more electronic devices of first type form peer-to-peer backbone for the controlled-network to operate via the communication interface of the first type, every electronic device of the first type maintaining connectivity with the electronic device of the second type via the communication interface of second type and every electronic device of first

type communicate with the electronic device of third type via communication interface of third type.

Preferably the said multi-functional electronic device of first type running the said middleware, wherein each said multi-functional electronic device of first type comprising:

i) a bus,

ii) a peripheral controller being coupled to said bus for connecting a multitude of I/O peripheral devices;

iii) one or plurality of microprocessors being coupled to said bus and said microprocessors configured to perform the required signal processing associated with the multimedia traffic and to provide control functions of said electronic device of first type;

iv) a communication controller being coupled to said bus for connecting to one or plurality of communication interfaces; and,

v) a memory that is coupled to said bus into which a plurality of instructions are loaded,

and the said middleware is operable to provide a framework and to control on-the-fly formation of a peer-to-peer backbone for the said controlled-network, wherein each said electronic device of first type having the necessary hardware and/or software functionalities for them to be registered and operate per each unique geographic location of a private dwelling, office, building premises and the like, and the said middleware comprising:

a) a registrar functionality of first type for maintaining the details of every electronic device being part of the said controlled-network formed on-demand such as the location-specific-identifier identifying the location of a private dwelling where it is configured to operate, one or plurality of network identifiers pertaining to one or plurality of communication interfaces it supports, roles, security credentials, current activity and the like in a device-profile-database;

b) a network configuration functionality for configuring the said peer-to-peer backbone for the said controlled-network;

c) a connection establishment functionality for establishing a secure physical communication between two or more of said electronic devices of first type;

d) a session establishment functionality for establishing and maintaining logical connection in an end-to-end manner as requested by a specific application;

e) mutual authentication and encryption functionality to liaise with the said registrar functionality of first type to make sure that each electronic devices being part of the said controlled-network has been assigned security credentials for mutual authentication and encryption purposes;

f) a registrar functionality of second type for maintaining the details of each registered user of the said controlled-network such as the user-profile-identifier (i.e., Profile-ID) that uniquely identifies each registered user, entertainment preference in terms of favourite TV/Radio channels/programs, one or plurality of login details, preferred caller/friend list, current activity,

current location in terms of proximity to any of said electronic device of first type being part of the said peer-to-peer backbone of the said controlled-network and the like in a user-profile-database;

g) a policy-management functionality for enforcing each registered user's rule in the said controlled-network while avoiding/resolving any conflict with other registered users' set rules;

h) a context-management functionality for capturing, processing and providing the context information pertaining to each registered user and each of said electronic devices of first type;

i) a migration-management functionality for taking responsibility for the successful, seamless and automatic migration of multimedia sessions within the said controlled-network without expecting any user input;

j) a transcoder functionality for handling the transcoding of multimedia contents if needed, for instance when migration of multimedia content takes place between heterogeneous devices supporting varying codec/bit-rate/resolutions and/or involving different processing/communication protocols of the said controlled-network;

k) a Client-Module to be running in each said multi-functional electronic device of first type for rendering the multimedia content when a call/Internet/multimedia session is migrated by liaising with the respective application modules and for notifying the user identity whenever detected;

wherein the said middleware is operable to dynamically compose one or more electronic devices into a peer-to-peer backbone for the said controlled-

network using a communication interface of first type and the purpose of each of said electronic device of first type is to render the multimedia content being directed to it dynamically based on some criteria.

It is preferred that the said multi-functional electronic device of first type running the said middleware comprises a unique device-specific-identifier pertaining to a communication interface of first type, a specific set of keys/buttons connected via the peripheral controller to the said bus and the said specific set of keys/buttons include Master/Slave, Register and typical names of different physical locations of a house/building/office and the like for setting a given said multi-functional electronic device of first type as a Master/slave, registering/associating a given said multi-functional electronic device of first type with the said master, and registering a given said multi-functional electronic device of first type per a given physical location of a private dwelling and the like where the said controlled-network is set to operate respectively for the said middleware to compose a purposeful secure peer-to-peer backbone for the said controlled-network with the help of the user, wherein the said network configuration functionality of the said middleware is operable to compose a purposeful backbone out of two or more of the said multi-functional electronic devices of first type when triggered automatically at the time of turning on the said multi-functional electronic device of first type for the first time or manually, and the said middleware's configuration of the said peer-to-peer backbone comprising the steps of:

i) prompting the user to set one said multi-functional electronic device of first type to be the master device by pressing one of the said specific set of keys/buttons, if the master does not exist already;

ii) getting the said network configuration functionality to display the said device-specific-identifier of the said master device pertaining to the communication interface of first type;

iii) prompting the user to turn on each of the other multi-functional electronic devices of first type, to register each of them as a slave device with the master in a physical location-specific manner by entering the said device-specific-identifier of the said master pertaining to the communication interface of first type and, subsequently pressing a physical location specific key and the registration key of the said specific set of keys/buttons simultaneously on the slave device;

iv) on the registration key on the slave device being pressed, prompting the corresponding network configuration functionality to transmit the location-specific-identifier and the said unique device-specific-identifier of the slave device pertaining to the communication interface of first type to the master device;

v) on reception of the location-specific and device-specific-identifiers of each registered slave device pertaining to the communication interface of first type, getting the said network configuration functionality of the said middleware running on the said master device to pass this device specific information on

to the said registrar functionality of first type for it to prepare a device-profile-database;

vi) continuing operations (iii) to (v) for every other slave device;

vii) periodically disseminating the device specific details maintained in a device-profile-database to all the registered devices of the network by the network configuration functionality of the said master device for all devices to know the important details of the of other devices of the formed peer-to-peer backbone;

wherein (de-)registering a new slave device to the existing master can take place asynchronously at the user's discretion and once being part of the said peer-to-peer backbone each said multi-functional electronic device of first type periodically disseminating context information packet to all the other devices in the network informing its current status.

It is preferred that the said multi-functional electronic device of first type running the said middleware for the formation of said peer-to-peer backbone by first configuring one said multi-functional electronic device of first type as the master and other devices as slaves, wherein certain middleware functionalities such as a registrar functionality of the first type, context-management, policy-management and migration- management functionalities are activated only when the said multi-functional electronic device of first type operates as the master whereas the Client-Module and the said transcoder

functionality will be running in each of said multi-functional electronic device of first type.

Preferably the said multi-functional electronic device of first type running the said middleware, wherein once the said peer-to-peer backbone is formed by first configuring one said multi-functional electronic device of first type as the master and other devices as slaves, wherein associating/registering the electronic device of second type with the said master via the communication interface of the second type comprising the steps of:

i) prompting the user to get the unique device-specific-identifier of the said electronic device of the second type pertaining to the communication interface of second type;

ii) prompting the user to connect the said electronic device of the second type to the said master via the communication interface of second type and to enter the unique device-specific-identifier of the said electronic device of the second type on the master Device;

wherein once associated, the electronic device of second type will be assigned security credentials for mutual authentication and encryption purposes by the said master and an entry corresponding to the electronic device of second type containing its role, device/network-specific-identifier pertaining to the communication interface of second type will be included in the centralised device-profile-database being maintained by the said master for every

electronic device of first type to communicate with the electronic device of second type via the communication interface of second type.

Preferably the said multi-functional electronic device of first type running the said middleware, wherein the said controlled-network is Connected-Home and the electronic device of second type is a Media-Server maintaining connectivity with one or plurality of multimedia content sources, wherein the the said Media-Server constantly maintains connectivity with one or more of the following:

i) Set-top box consisting of dual tuner for receiving terrestrial and satellite broadcast/telecast and maintaining cable network connectivity;

ii) Residential Gateway via the said Set-top box or not for the reception of broadband digital TV and multimedia applications;

iii) Multi-Room Personal Video Recorders (MR-PVR); and,

iv) multimedia sources like Media Personal Computer (PC), Personal Media Players, mobile phone, Personal Digital Assistants (PDAs) and similar devices;

wherein the said Media-Server supports home networking standards as specified by Digital Living Network alliance (DLNA), G.hn (also known as G.9960) of ITU-T or similar standardisation bodies like ETSI, and protocols like Universal Plug-and-Play (uPnP) enabling it to network with various multimedia sources on-the-fly in order to create/maintain its multimedia library.

Preferably the said multi-functional electronic device of first type running the said middleware, wherein the interface of the first type is IEEE 802.11g including WiFi-direct.

It is preferred that the said multi-functional electronic device of first type running the said middleware being composed into a purposeful Connected-Home network, wherein the interface of the second type can be provided on the existing telephone wiring supporting the necessary communication protocols as specified by the Home Phone-line Networking Alliances (HPNA), power-line supporting the necessary communication protocols as specified as part of HomePlug consortium, IEEE 802.11n or coax cabling supporting the necessary communication protocols as specified by the Multimedia over Coax Alliance (MoCA) wherein in order to use power-line each electronic device of first type and second type shall be equipped with a power-line Ethernet or similar adaptors.

It is preferred that the said multi-functional electronic device of first type running the said middleware possesses a number of peripheral devices connected via the peripheral controller to the said bus, and the said peripheral devices comprise a microphone being configured to receive an audio signal input supporting a wide variety of appropriate audio codecs, a video camera being configured to receive an video signal input supporting a wide variety of appropriate video codecs, a speaker being configured to playback the received audio signal, a Thin-Film Transistor (TFT) colour electronic visual display

panel (e.g., preferably employing Quarter Video Graphics Array) being configured to playback the received video signal in an appropriate format, and a on-screen or physical keypad being configured for the said middleware to get user inputs in connection with turning the said device on/off, device/user-registration and configuration, volume control, picture quality control and the like.

Preferably the said multi-functional electronic device of first type running the said middleware being composed into a purposeful Connected-Home network where each said multi-functional electronic device of first type possesses the necessary user interfaces realised through hardware and/or software means along with an electronic visual display unit having a big form-factor/screen-size, an RFID smartcard reader and a Passive Infra-Red (PIR) sensor that are coupled to said bus via the said peripheral controller for rendering the received video content, for the purpose of reading the contents of RFID smartcard tag being carried by each registered user and detecting especially the human body movement respectively, wherein any new occupant can register with the formed Connected-Home network by following the user-registration procedure only when a given user is given an RFID smartcard tag bearing the unique user-profile-identifier (e.g., Profile-ID) and the said user-registration procedure can be carried out on the said master device or any registered slave device and it comprising the steps of:

i) the user triggering/initiating the user-registration procedure by correctly pressing the corresponding key (i.e., continuously pressing the Settings key until it is triggered);

ii) the user first entering the user-profile-identifier (e.g., Profile-ID) that can be found on the RFID smartcard tag when prompted;

iii) the user having the option to storing the login details associated with various Social Networking Sites such as Facebook, MySpace, LinkedIn, twitter, and the like, Instantaneous Messaging clients such as MSN, Google Chat and the like, web email clients, VoIP client such as Skype, online gaming client, and the like either on the master device or RFID smartcard tag being carried by the user;

iv) the user specifying the favourite TV/Radio channels/programs on terrestrial, satellite and IPTV channels;

v) the user setting rules in terms of when and where to migrate telephone/Internet/multimedia sessions, whether migration to a given device can take place in the presence of one or more other registered users, parental control and the like, and such information will be available to the policy-management functionality of the said master;

wherein all the user-specific details will be stored by the said registrar functionality of second type centrally in the user-profile-database being created and maintained in the said master that is to be indexed using the user-profile-identifier (e.g., Profile-ID).

It is preferred that the said multi-functional electronic device of first type running the said middleware being composed into a purposeful Connected-Home network where each said multi-functional electronic device of first type possesses the necessary user interfaces realised through hardware and/or software means along with an electronic visual display unit having a big form-factor/screen-size, an RFID smartcard reader and a Passive Infra-Red (PIR) sensor that are coupled to said bus via the said peripheral controller for rendering the received video content, for the purpose of reading the contents of RFID smartcard tag being carried by each registered user and detecting especially the human body movement respectively, wherein the Client-Module of every multi-functional electronic device of first type updates the master periodically and this updating procedure comprising the steps of:

i) liaising with the said session establishment functionality to check the device's current status in terms of whether it handles any on-going multimedia session like over-the-air telecast TV, IPTV or streaming video or listening to any over-the-air broadcast radio station, web audio album, Internet radio or any streaming audio, telephone call, and if so, information pertaining to the user and the application type associated with the session being handled along with the unique user-profile-identifier (e.g., Profile-ID), location-specific-identifier of the device, its unique network/device-specific-identifier pertaining to different communication interfaces will be transmitted to the context-management functionality of the said master via the

communication interface of first type for it to be processed and subsequently stored in both the user-profile-database and device-profile-database;

ii) in the middle of an on-going session when a user vanishes abruptly without any trace, the said electronic device of first type that originally handled the user session informing the said migration-management functionality of the said master via the communication interface of first type;

wherein whenever there is a need to migrate an on-going session, the decision as to when and where to migrate will be taken by the said migration-management functionality running in the said master device after having liaised with the said context-management functionality, the said policy-management functionality and the associated application module.

It is preferred that the said multi-functional electronic device of first type running the said middleware where each said multi-functional electronic device of first type possesses an RFID smartcard reader and a Passive Infra-Red (PIR) sensor unit that are coupled to said bus via the said peripheral controller for the purpose of reading the contents of RFID smartcard tag being carried by each registered user and detecting especially the human body movement respectively, wherein once the said Connected-Home is formed by first configuring one said multi-functional electronic device of first type as the master and other devices of first type as slaves and each occupant has individually registered himself/herself with the formed Connected-Home incorporating a Media-Server, wherein migrating an on-going multimedia

session from one said multi-functional electronic device of first type to another or directing a new multimedia session comprising the steps of:

i) PIR sensor unit of each multi-functional electronic device of first type constantly monitoring a given geographical location/region of the formed Connected-Home and on detecting any user movement, it triggering the RFID reader;

ii) RFID Smartcard reader of the given multi-functional electronic device of first type getting activated and trying to read the RFID smartcard tag, if any is around, within the configured geographical location/region of the formed Connected-Home;

iii) On detecting an RFID smartcard tag, the RFID reader reading the unique user-profile-identifier (e.g., Profile-ID), and the Client-Module of the device informing the master about the user's identity by passing on the read unique user-profile-identifier (e.g., Profile-ID);

iv) the said master in turn referring to the user-profile-database and trying to find out whether the given user has been busy/active in terms of being engaged in any on-going session (TV/radio/Internet/call) or any new session is due using the unique user-profile-identifier (e.g., Profile-ID) as the index;

v) on detecting that the given user is currently watching/listening to a multimedia content probably after having been informed by the Client-Module of the said electronic device of first type (i.e., the source device) which originally handled the session for the user or from the TV/radio/VoD/AoD preference list as indicated by the user in the user-

profile-database, time of the day, and the electronic program guide (EPG) the said context-management functionality gathers that a new/on-going session needs to be directed, the automatic and seamless migration of the on-going/new session comprising the steps of:

a) getting the said migration-management functionality of the master to first gather the required parameters associated with the on-going/new session from the Media-Server via the communication interface of second type;

b) the said migration-management functionality deciding whether migration of the on-going session or routing of the new session to the new multi-functional electronic device of first type (i.e., the target device) which has detected the recent/latest movement of the given user is possible by liaising with the said policy-management and context-management functionalities;

c) the said migration-management functionality finding out the unique device-specific-identifier of the new multi-functional electronic device (i.e., the target device) pertaining to the communication interface of second type that has detected the recent/latest movement of the given user from the device-profile-database;

d) if there is no policy conflict and the new target is ready and capable enough, the said migration-management functionality passing the collected session related parameters pertaining to the on-going/new session on to the new target multi-functional electronic device of first type along with the transcoding-related information in case transcoding is needed;

e) the said migration-management functionality notifying the device/network-specific identifiers of both the Media-Server and target device pertaining to the communication interface of second type to each other;

f) the said migration-management functionality coordinating with the said Media-Server and the new target device to ensure the timely migration/ routing of the on-going/new session respectively.

Wherein the automatic migration of on-going/new session takes place without expecting any user input in order for the session to follow the user depending on the user's movement pattern within the formed Connected-Home network.

Preferably the said multi-functional electronic device of first type running the said middleware, wherein once the said peer-to-peer backbone is formed by first configuring one said multi-functional electronic device of first type as the master and other devices as slaves, wherein associating/registering the electronic device of third type with the said master via the communication interface of the third type comprising the steps of:

i) prompting the user to get the unique device-specific-identifier of the said electronic device of the third type pertaining to the communication interface of third type;

ii) prompting the user to connect the said electronic device of the third type to the said master via the communication interface of third type and to enter the unique device-specific-identifier of the said electronic device of the third type on the master Device;

wherein once associated, the electronic device of third type will be assigned security credentials for mutual authentication and encryption purposes by the said master and an entry corresponding to the electronic device of third type containing its role, device/network-specific-identifier pertaining to the communication interface of third type will be included in the centralised device-profile-database being maintained by the said master for every electronic device of first type to communicate with the electronic device of third type via the communication interface of third type.

Preferably the said multi-functional electronic device of first type running the said middleware, wherein the electronic device of third type is a PBX-unit being the control entity for the conventional telephone services provided via PSTN, ISDN, PLMN or the like wherein the interface of third type can be provided on the existing telephone wiring supporting the necessary communication protocols as specified by the Home Phone-line Networking Alliances (HPNA), DECT being developed as part of ETSI's CAT-iq 2.0 standardization or Bluetooth, wherein if the interface of the third type is implemented based on Bluetooth specification, it has the following features:

i) unique network identifiers of each electronic device of first type and the PBX-unit pertaining to the interface of third type are the Bluetooth device address; and,

ii) before any possible interaction, the communicating parties need to pair.

Preferably the said multi-functional electronic device of first type running the said middleware, where each said multi-functional electronic device of first type possesses an RFID smartcard reader and a Passive Infra-Red (PIR) sensor unit that are coupled to said bus via the said peripheral controller for the purpose of reading the contents of RFID smartcard tag being carried by each registered user and detecting especially the human body movement respectively, wherein once the said Connected-Home is formed by first configuring one said multi-functional electronic device of first type as the master and other devices as slaves, the said master takes an extra functionality to operate as a master base station that is being configured to communicate with a PBX-unit via an interface of third type for directing/migrating a telephone call to the correct multi-functional electronic device of first type depending on instantaneous user movement within the formed Connected-Home network, wherein the automatic and seamless migration of the on-going/new telephone call comprising the steps of:

i) PIR sensor unit of each multi-functional electronic device of first type constantly monitoring a given geographical location/region of the formed Connected-Home and on detecting any user movement, it triggering the RFID reader;

ii) RFID Smartcard reader of the given multi-functional electronic device of first type getting activated and trying to read the RFID smartcard tag, if any is around, within the configured range;

iii) On detecting an RFID smartcard tag, the RFID reader reading the unique user-profile-identifier (e.g., Profile-ID) and informing the local Client-Module which in turn notifying the master about the user's identity;

iv) the said master in turn updating the local user-profile-database and device-profile-database for the said context-management functionality to know the current communication status of each device and the user within the Connected-Home network;

wherein the said migration-management functionality of the said master on deciding that directing a new call or migrating an on-going telephone call is imminent on being notified by the local PBX-unit maintaining connectivity with PSTN, ISDN or PLMN along with the caller-ID or on detecting a user movement notification by the Client-Module of one said slave electronic device of first type in the middle of an on-going telephone session, the said migration-management functionality will handle directing a new call or migration of on-going call by following the call routing/migration procedure comprising the steps of:

a) referring to the user-profile-database and trying to find out from each registered user's friend/caller list as to who the call should be directed/migrated based on the caller-ID;

b) identifying from the user-profile-database, the exact user to whom the call should be directed/migrated along with the user's current location in terms of the neighbouring electronic device of first type that has notified the latest user movement;

c) the said migration-management functionality finding out the unique device-specific-identifier of the new multi-functional electronic device of first type (i.e., the target device) pertaining to the communication interface of third type that has detected the recent/latest movement of the given user from the device-profile-database;

d) the said migration-management functionality deciding whether directing/migration of the new or on-going session to the new multi-functional electronic device of first type (i.e., the target device) which has detected the recent/latest movement of the given user is possible by liaising with the policy-management and context-management functionalities;

e) On seeing that there is no policy conflict and the new target is ready and capable enough, the said migration-management functionality of the said master passing on to each other the unique network identifiers of both the new electronic device of first type (i.e., the target device) to which the call is going to be directed/migrated and the PBX-unit (i.e., the parties concerned) pertaining to the interface of the third type for the new/on-going telephone call to be directed/migrated from the PBX-unit via the interface of the third type;

Wherein the automatic routing/migration of new or on-going telephone call takes place from the PBX-unit to target device of first type without expecting any user input in order to follow the user depending on the user's movement pattern within the formed Connected-Home network.

Preferably the said multi-functional electronic device of first type running the said middleware, where each said multi-functional electronic device of first type possesses an RFID smartcard reader and a Passive Infra-Red (PIR) sensor unit that are coupled to said bus via the said peripheral controller for the purpose of reading the contents of RFID smartcard tag being carried by each registered user and detecting especially the human body movement respectively, wherein once the said Connected-Home is formed by first configuring one said multi-functional electronic device of first type as the master and other devices as slaves, wherein one of the communication interfaces being coupled by the said communication controller of the said multi-functional electronic device of first type to said bus has an IP network connectivity and has a globally unique IP address assigned and the assignment of such an IP address can be by an external entity having the Dynamic Host Configuration Protocol (DHCP) functionality, wherein pushing the user-specific Internet traffic pertaining to a multitude of Social Networking Sites (SNSs), Instantaneous Messaging (IM), online gaming, email, and VoIP/V2IP clients to one of the multi-functional electronic devices comprising the steps of:

i) PIR sensor unit of each multi-functional electronic device of first type constantly monitoring a given geographical location/region of the formed Connected-Home and on detecting any user movement, it triggering the RFID reader;

ii) RFID Smartcard reader of the given multi-functional electronic device of first type getting activated and trying to read the RFID smartcard tag, if any is around, within the configured range;

iii) On detecting an RFID smartcard tag, the RFID reader reading the unique user-profile-identifier (e.g., Profile-ID) and informing the local Client-Module which in turn notifying the master about the user's identity;

iii) the local Client-Module coordinating with the said master to retrieve all the login information of the user pertaining to a multitude of Social Networking Sites (SNSs) and Instantaneous Messaging (IM), online gaming, email, and VoIP/V2IP clients along with the information of each application type and/or the URL to which each login details are associated with;

iv) the local Client-Module liaising with the corresponding application module to automatically executing the user login-on a multitude of Social Networking Sites (SNSs) and Instantaneous Messaging (IM), online gaming, email, and VoIP/V2IP clients;

v) the local Client-Module liaising with the corresponding application module to pull the Internet traffic, if any, pertaining to a multitude of Social Networking Sites (SNSs) and Instantaneous Messaging (IM), online gaming, email, and VoIP/V2IP clients;

wherein depending on the instantaneous movement pattern, each registered user has the benefit of getting the user-specific Internet traffic dynamically routed to one of said multi-functional electronic devices of first type that

serves the geographical area of the Connected-Home network where the user is currently located and detected.

Preferably the said multi-functional electronic device of first type running the said middleware being composed into a purposeful Connected-Home network, wherein the network configuration procedure by the said network configuration functionality of the said middleware running in the said master device is operable to liaise with the said registrar functionality of first type to create a device-profile-database initially in the said master device and the said device-profile-database creation process comprising the steps of:

i) creating an entry corresponding to the master;

ii) On reception of registration request from each slave device, and other heterogeneous devices such as the Media-Server, PBX-unit and the like, creating an entry corresponding to each successfully registered device;

wherein each entry consists of location identifier, unique device/network-specific-identifiers pertaining to a variety of communication interfaces, role (i.e., whether Master, slave, Media-Server, PBX-unit), public and private keys assigned by the said mutual authentication and encryption functionality of the master, main communication interfaces supported, current status pertaining to each and every registered device of the purposeful Connected-Home network being composed into in terms of the identifiers of the users being served/detected.

It is preferred that the said multi-functional electronic device of first type running the said middleware being composed into a purposeful Connected-Home network, wherein the network configuration procedure by the said network configuration functionality of the said middleware running in the said master device is operable to broadcast the contents of the device-profile-database excluding the private key details of each device after each new addition/removal of devices to/from the said purposeful Connected-Home network for each of the registered devices to maintain its own local device-profile-database that does not have the information of private keys pertaining to other heterogeneous electronic devices being part of the Connected-Home.

Preferably the said multi-functional electronic device of first type running the said middleware being composed into a purposeful Connected-Home network, wherein the network configuration procedure by the said network configuration functionality of the said middleware running in each multi-functional electronic device is operable to broadcast a context information packet periodically to inform its current communication status to all the registered devices of the formed purposeful Connected-Home network.

It is preferred that the said multi-functional electronic device of first type running the said middleware being composed into a purposeful Connected-Home network, wherein the network configuration procedure by the said network configuration functionality of the said middleware running in the said master device is operable to liaise with the said mutual authentication and

encryption functionality to assign asymmetric keys to every slave device of first type at the time of registration, to the Media-Server/PBX-unit when it was associated with the said master, and to the master when the said master was configured and the private key being assigned is notified by the master to the owner whereas all public keys are notified to every registered device.

Preferably the said multi-functional electronic device of first type running the said middleware, wherein once the purposeful Connected-Home network is formed, an automatic migration of a multimedia session to one multi-functional electronic device of first type requires the said session establishment functionality of the said middleware running in the said multi-functional electronic device of first type to interact with the Media-Server using the interface of second type, and as part of this process the said session establishment functionality interacts with the said connection establishment functionality of a multi-functional electronic device to establish the secure communication channels between the multi-functional electronic device of first type and the Media-Server and on being contacted, the said connection establishment functionality of the multi-functional electronic device of first type:

i) will perform the mutual authentication using the asymmetric keys assigned by the master at the time of device registration;

ii) on successful device authentication, the said connection establishment functionality will notify the said session establishment functionality and the

said Media-Server of the outcome of the mutual authentication attempt and is made responsible for the encryption/decryption of the multimedia data traffic.

It is preferred that the said multi-functional electronic device of first type running the said middleware comprises a specific set of keys connected via the peripheral controller to the said bus and the said specific set of keys include Settings keys and side/up/down arrow keys, wherein the said middleware running locally in each said multi-functional electronic device of first type liaises with other driver/firmware and enables the user to adjust the picture quality, manipulate the volume control, network setup, and user profile creation/maintenance depending on how the side-arrow and down/up arrow keys are pressed by the user and this is governed by the following preset setting process:

i) the first short-pressing of the right-hand side-arrow key will let user set time using down/up arrow keys and the middle enter button;

ii) the Second short-pressing of the right-hand side-arrow key will let user set day/date using down/up arrow keys and the middle enter button;

iii) the third short-pressing of the right-hand side-arrow key will let user adjust contrast of the electronic visual display unit using down/up arrow keys and the middle enter button;

iv) the fourth short-pressing of the right-hand side-arrow key will let user adjust brightness of the electronic visual display unit using down/up arrow keys and the middle enter button;

iv) the fifth short-pressing of the right-hand side-arrow key will let user adjust colour-depth of the electronic visual display unit using down/up arrow keys and the middle enter button;

vi) the sixth short-pressing of the right-hand side-arrow key will let user adjust the volume using down/up arrow keys and the middle enter button;

vi) the seventh short-pressing of the right-hand side-arrow key will let user perform network setup procedure;

vi) the eighth short-pressing of the right-hand side-arrow key will let user perform user profile creation/maintenance; and,

Wherein continuous short pressing of the right-hand side-arrow key rotates through all the setting options (i.e., the setting sequence goes through a cycle) and this sequence cycle enables any user to skip any of these setting options and get/revisit to the preferred setting sequence with a continuous short pressing of the right-hand side-arrow key and once the middle enter button is pressed each setting is locally stored in a non-volatile memory for them to be effective in every subsequent power cycle.

According to the Second aspect of the present invention there is provided a physical location specific multi-functional electronic system on a chip to form a purposeful Connected-Home network where each said multi-functional electronic device is registered to operate from a given geographic location in a private dwelling, office, building premises and the like to facilitate direct device-to-device interactions in a peer-to-peer manner for control signalling

purposes and to support seamless migration of a variety of multimedia sessions/interactions from one of said multi-functional electronic devices to another without relying on any intermediate base station or user input, and the System on a chip comprising:

i) a bus,

ii) a peripheral controller being coupled to said bus for connecting a multitude of I/O peripheral devices;

iii) one or plurality of microprocessors being coupled to said bus and said microprocessors configured to perform the required signal processing associated with the multimedia traffic and to provide control functions of said multi-functional electronic device;

iv) a communication controller being coupled to said bus for connecting to one or plurality of communication interfaces for transmitting and receiving multimedia traffic via the communication interfaces; and,

v) a memory that is coupled to said bus into which a plurality of instructions are loaded,

wherein the said System on a chip composes a purposeful Connected-Home system on-the-fly by getting each said multi-functional electronic device to join while providing mechanisms for operations such as:

a) configuring a unique network identifier for each of the said multi-functional electronic devices;

b) setting exactly one of said multi-functional electronic devices to be the master device and the rest as slave devices just for the purpose of secure

registering/associating of said multi-functional electronic devices with one another;

c) associating/registering each slave device with the said master device in a physical location-specific manner using the set unique network identifier of the latter and this process passes information such as each slave device's specific location name along with its unique network identifier on to the said master device via the said preferred communication interface;

d) letting the said master device maintain a device-profile-database in its memory that maps location-specific name of each registered multi-functional electronic device along with the corresponding said unique network identifier;

e) letting the said master device exchange the said device-profile-database with all the other associated/registered slave devices periodically via the said preferred communication interface;

wherein each said multi-functional electronic device has the necessary hardware and/or software functionalities for the System on chip to register each said multi-functional electronic per a given geographic location of a private dwelling, office, building premises and the like to form a purposeful Connected-Home system.

It is preferred that the said physical location-specific multi-functional electronic system on a chip form the said Connected-Home system by first configuring one of said multi-functional electronic devices as the master and other devices as slaves, where the said master constantly interacts with the

Media-Server, wherein the said multi-functional electronic system on a chip further handles such operations as:

i) providing a user interface for each occupant to register with the Connected-Home system and the said master automatically maintaining such details of each registered user as the unique user-profile-identifier (i.e., Profile-ID), entertainment preference in terms of favourite TV/Radio channels/programs, one or plurality of login details, preferred caller/friend list, current activity, current location, proximity to any of said multi-functional electronic device being part of Connected-Home system and the like in a user-profile-database;

ii) capturing, processing and providing the context information pertaining to each registered user and each of said electronic devices;

iii) handling the transcoding of multimedia contents if needed, for instance when migration of multimedia content takes place between heterogeneous devices supporting varying codec/bit-rate/resolutions and/or involving different processing/communication protocols; and,

iv) incorporating a Client-Module for rendering the multimedia content when a call/Internet/multimedia session is migrated by liaising with the respective application modules, periodically updating the master with the unique user-profile-identifiers of the users being detected within is service region and the like,

wherein once the purposeful Connected-Home system is formed, the said system on chip is operable to liaise with varying entities in order to enable seamless and automatic migration of call/Internet/multimedia session from

one said electronic device to another depending on user movement within a Connected-Home environment without expecting any user input.

Preferably the said physical location-specific multi-functional electronic system on a chip forms the Connected-Home system by first configuring one of said multi-functional electronic devices as the master and other devices as slaves, wherein certain functionalities of the system on a chip such as maintaining detailed databases pertaining to each registered user/device centrally and total control of session migration are activated only when the said multi-functional electronic device operates as the master whereas the Client-Module functionality along with local transcoding will be running in each of said multi-functional electronic device.

It is preferred that the said physical location-specific multi-functional electronic system on a chip, where each said multi-functional electronic device possesses an RFID smartcard reader and a Passive Infra-Red (PIR) sensor unit that are coupled to said bus via the said peripheral controller for reading the unique user-profile-identifier (e.g., Profile-ID) of the RFID smartcard tag being carried by each registered user and detecting especially the human body movement respectively, wherein once the said Connected-Home is formed by first configuring one said multi-functional electronic device as the master and other devices as slaves and the user carried out the user-registration procedure to register each individual occupant with the formed Connected-Home incorporating a Media-Server, wherein migrating an

on-going multimedia session seamlessly from one said multi-functional electronic device to another or directing a new multimedia session without expecting any manual intervention comprising the steps of:

i) PIR sensor unit of each multi-functional electronic device constantly monitoring a given location and on detecting any user movement, it triggering the RFID reader;

ii) RFID Smartcard reader of the given multi-functional electronic device getting activated and trying to read the RFID smartcard tag, if any is around, within the configured range;

iii) On detecting an RFID smartcard tag, the RFID reader reading the user-profile-identifier (e.g., Profile-ID) and informing the master about the user's identity;

iv) the said master in turn referring to the user-profile-database and trying to find out whether the given user has been busy/active in terms of being engaged in any on-going session (TV/radio/Internet/call) or any new session is due using the unique user-profile-identifier (e.g., Profile-ID) as the index;

v) on detecting that the given user is currently watching/listening to a multimedia content probably after having been informed by the said electronic device (i.e., the source device) that originally handled the session for the user or from the user TV preference list, time of the day, and the electronic program guide (EPG) the said context-management functionality gathers that a new/on-going session needs to be directed, the actual automatic migration of a session comprising the steps of:

a) getting the master to first gather the required parameters associated with the on-going/new session from the Media-Server,

b) getting the master to decide whether migration of the on-going session or routing of the new session to the new multi-functional electronic device (i.e., the target device) which has detected the recent/latest movement of the given user is possible;

c) getting the master to find out the unique device-specific-identifier of the new multi-functional electronic device (i.e., the target device) which has detected the recent/latest movement of the given user from the device-profile-database;

d) getting the master to pass the collected on-going/new session related parameters on to the new target multi-functional electronic device along with the transcoding-related information in case transcoding is needed;

e) getting the master to notify the device/network-specific identifiers of both the Media-Server and target device to each other;

f) getting the master to coordinate with the said Media-Server and the new target device to ensure the timely migration/routing of the on-going/new session respectively.

Wherein the automatic migration of on-going/new session takes place without expecting any user input in order to follow the user depending on the user's movement pattern within the formed Connected-Home network.

According to the third aspect of the present invention there is provided a method for transforming two or plurality of multi-functional electronic devices having the required hardware/software features into a purposeful Connected-Home system enabling direct device-to-device interaction in a peer-to-peer manner for control signalling purposes that are required to support seamless migration of a variety of multimedia sessions/interactions from one of said multi-functional electronic devices to another, wherein different multi-functional electronic devices are connected via one or variety of interfaces with each other, wherein forming a purposeful Connected-Home system has a pre-set start-up procedure/method that can be triggered either automatically on the very first switch on or manually and to support this each multi-functional electronic device has the necessary user interface realised through appropriate hardware, software or combination of both, and the said pre-set start-up procedure/method comprising the steps of:

i) getting each peer multi-functional electronic device assigned a globally unique network identifier (e.g., IP Address) by connecting to an existing network server (e.g., having DHCP functionality and the like);

ii) choosing one device as the master device and subsequently registering/associating one or more of other peer multi-functional electronic devices as slaves with a master by manually entering the said unique network identifier (e.g., IP address) of the said master device in the required place as requested by the registration process window in each of slave devices, and the registration process comprises the following steps:

a) Getting the user to choose each slave device's preferred geographical location where it is going to be located and operating from the menu/keys provided by the user interface of each multi-functional electronic device;

b) if no user-preferred location name exists in the standard menu provided by the default user interface, allowing the user to make new addition or to edit the existing names such that the preferred location name will appear;

c) prompting the user to press the preferred location name and register button to get the new device registered/associated with the said master device;

d) registration process of each slave device (c) above automatically passing information such as each slave device's specific location name along with its unique network identifier on to the said master device in a peer-to-peer manner via any preferred communication interface;

e) the said master device maintaining the device-profile-database by mapping the location name of each registered slave multi-functional electronic device with the latter's unique network identifier (i.e., IP address) on reception of registration request of each slave device;

f) the said master device making sure that each registered slave device has correct information about other peer devices in terms of their location name and the configured network addresses;

g) on detecting name and/or identifier dispute, the said master device notifying the nature of dispute to the devices that are in conflict in order to change their network identifier or name of the location or location where the slave device is to be registered; and,

iii) periodically exchanging the said device-profile-database maintained by the master device with every registered slave device;

wherein once a given slave multi-functional electronic device is associated with the said master device, its current status on the home-screen will appear as registered, and this way once a purposeful Connected-Home system is initially built by following the said stipulated steps, further addition of slave devices to the existing said master device is possible by subjecting every new device to go through the same steps, and de-registration of a slave device is possible by letting the user press the de-register key on the device that is going to be de-registered.

It is preferred that the said method for transforming two or plurality of multi-functional electronic devices having the required hardware/software features into a purposeful Connected-Home system enabling direct device-to-device interaction in a peer-to-peer manner for control signalling purposes that are required to support seamless migration of a variety of multimedia sessions/interactions from one of said multi-functional electronic devices to another, wherein while getting the said master to constantly interact with the Media-Server, the said method handles such operations as:

i) getting each occupant to register with the Connected-Home system via appropriate user interfaces and the said master automatically maintaining such details of each registered user as the unique user-profile-identifier (i.e., Profile-ID), entertainment preference in terms of favourite TV/Radio

channels/programs, one or plurality of login details, preferred caller/friend list, current activity, current location, proximity to any of said multi-functional electronic device being part of Connected-Home system and the like in a user-profile-database;

ii) capturing, processing and providing the context information pertaining to each registered user and each of said electronic devices;

iii) handling the transcoding of multimedia contents if needed, for instance when migration of multimedia content takes place between heterogeneous devices supporting varying codec/bit-rate/resolutions and/or involving different processing/communication protocols; and,

iv) empowering a local client running in each said multi-functional electronic device for rendering the multimedia content when a call/Internet/multimedia session is migrated by liaising with the respective application modules, periodically updating the said master with the unique user-profile-identifiers of the users being detected within the service region and the like,

wherein once the purposeful Connected-Home system is formed, the said method is operable to liaise with varying entities in order to enable seamless migration of call/Internet/multimedia session from one said electronic device to another depending on user movement within a Connected-Home environment without expecting any user input.

Preferably the said method for transforming two or plurality of multi-functional electronic devices having the required hardware/software features

into a purposeful Connected-Home system enabling direct device-to-device interaction in a peer-to-peer manner for control signalling purposes that are required to support seamless migration of a variety of multimedia sessions/interactions from one of said multi-functional electronic devices to another, wherein certain functionalities of the said method such as maintaining detailed databases pertaining to each registered user/device (e.g., user-profile-database and device-profile-database) centrally and total control of session migration/routing are activated only when the said multi-functional electronic device operates as the master whereas each said multi-functional electronic device runs a client module being empowered to perform transcoding whenever needed at the time of multimedia session migration.

It is preferred that the said method for transforming two or plurality of multi-functional electronic devices having the required hardware/software features into a purposeful Connected-Home system enabling direct device-to-device interaction in a peer-to-peer manner for control signalling purposes that are required to support seamless migration of a variety of multimedia sessions/interactions from one of said multi-functional electronic devices to another, wherein if each said multi-functional electronic device possesses an RFID smartcard reader and a Passive Infra-Red (PIR) sensor unit for the purpose of reading the contents of RFID smartcard tag being carried by each registered user and detecting especially the human body movement respectively, wherein the said method is augmented to migrate/route an on-

going/new multimedia session from one said multi-functional electronic device to another comprising the steps of:

i) getting the PIR sensor unit of each multi-functional electronic device to constantly monitor a given region and on detecting any user movement, getting it to trigger the RFID reader;

ii) activating the RFID Smartcard reader of the given multi-functional electronic device and getting it to read the RFID smartcard tag, if any is around, within the configured region;

iii) On detecting an RFID smartcard tag, getting the RFID reader to read the unique user-profile-identifier (e.g., Profile-ID) being stored in the RFID smartcard tag and informing the master about the user's identity;

iv) getting the said master in turn to refer to the user-profile-database and trying to find out whether the given user has been busy/active in terms of being engaged in any on-going session (TV/radio/Internet/call) or any new session is due using the unique user-profile-identifier (e.g., Profile-ID) as the index;

v) on detecting that the given user is currently watching/listening to a multimedia content probably after having been informed by the said electronic device (i.e., the source device) that originally handled the session for the user or from the user TV preference list, time of the day and the electronic program guide (EPG) the migration method gathers that a new/on-going session needs to be directed, the actual migration comprising the steps of:

a) getting the master to first gather the required parameters associated with the on-going/new session from the Media-Server,

b) getting the master to decide whether migration of the on-going session or routing of the new session to the new multi-functional electronic device (i.e., the target device) which has detected the recent/latest movement of the given user is possible;

c) getting the master to find out the unique device-specific-identifier of the new multi-functional electronic device (i.e., the target device) which has detected the recent/latest movement of the given user from the device-profile-database;

d) getting the master to pass the collected on-going/new session related parameters on to the new target multi-functional electronic device along with the transcoding-related information in case transcoding is needed;

e) getting the master to notify the device/network-specific identifiers of both the Media-Server and target device to each other;

f) getting the master to coordinate with the said Media-Server and the new target device to ensure the timely migration/routing of the on-going/new session respectively.

Wherein the automatic migration of on-going/new session takes place without expecting any user input in order to follow the user depending on the user's movement pattern within the formed Connected-Home network.

Description of the Drawings

Non-limited and non-exhaustive embodiments are described with reference to the following figures, wherein like reference numerals refer to like parts throughout the various views unless otherwise specified.

For a better understanding of the present invention, reference will be made to the following detailed description of the invention, which is to be read in association with the accompanying drawings, wherein:

Figure 1 is an exemplary illustration of the various components of a basic connected-home from the perspectives of delivering TV content that requires manual input for migrating a session as applicable in the prior art.

Figure 1A shows the exemplary front view of the basic/elementary version of the electronic device of first type to be used to compose a purposeful Connected-Home network as proposed according to one embodiment of the present invention.

Figure 2 is an exemplary illustration of the various components of the middleware that is necessary to compose a purposeful Connected-Home network facilitating direct device-to-device interaction in a peer-to-peer manner for control signalling purposes and to support seamless and automatic migration of a variety of multimedia sessions and conventional telephone calls from one of said multi-functional electronic devices to another as proposed according to one embodiment of the present invention.

Figure 3 is an exemplary schematic block diagram illustrating the internal components of a multi-functional electronic device to be used as part of a Connected-Home network operating on a Reduced Instruction Set Computer (RISC) microprocessor according to another embodiment of the present invention.

Figure 4 is an exemplary illustration of the various components of the software stack of a RISC microprocessor according to one another embodiment of the present invention.

Figure 5A shows the exemplary front view of a multi-functional electronic device to be used as part of a Connected-Home consisting of electronic visual display unit for rendering a video signal received, PIR sensor unit, an RFID smartcard reader, a speaker, transceiver antenna, a number of settings button namely for setting up the Connected-Home, registering users and manipulating video/audio received locally according to one embodiment of the present invention.

Figure 5B is an exemplary illustration of the special keys needed for the multi-functional electronic device to configure an electronic device either as the master or a slave, to set and to register/de-register each electronic device in a location specific manner facilitating automatic migration/routing of telephone call, multimedia sessions and user-specific Internet traffic depending on user's instantaneous movement within the formed Connected-Home network according to one embodiment of the present invention;

Figure 6 is an illustrative Connected-Home network environment where various embodiments of the present invention is said to work.

Figure 7 is an exemplary illustration depicting a packet type mainly used to disseminate context information pertaining to each multi-functional electronic device and/or the user it supports periodically or at the time of device/user-registration, network configuration or session migration according to one embodiment of the present invention.

Figure 8A is an exemplary illustration for a user interface having a small electronic visual display unit or an on-screen graphical user interface having touch-screen facility for a user to register/associate a slave multi-functional electronic device, a Media-Server or a PBX-unit with the master multi-functional electronic device according to one embodiment of the present invention.

Figure 8B is an exemplary illustration for user interface having a small electronic visual display unit or an on-screen graphical user interface having touch-screen facility for a user to de-register/disassociate a slave multi-functional electronic device, a Media-Server or a PBX-unit from the master multi-functional electronic device according to one embodiment of the present invention.

Figure 9 is an exemplary illustration of a device-profile-database maintained by the master device centrally according to one embodiment of the present invention.

Figure 10 is a flow chart illustrating the high-level operational procedure involved when forming the Connected-Home being capable of migrating multimedia sessions and telephone calls according to one embodiment of the present invention.

Figure 11 is a flow chart illustrating the operational procedure involved when composing one or more multi-functional electronic devices into a purposeful peer-to-peer backbone of the Connected-Home being used mainly for disseminating control signalling messages required for the timely migration/routing of multimedia sessions and/or conventional telephone calls within the Connected-Home according to one embodiment of the present invention.

Figure 12 is a flow chart illustrating the operational procedure involved when the user wants to make various settings of the multi-functional electronic device being considered as the basic building block of the peer-to-peer backbone of the Connected-Home according to one embodiment of the present invention.

Figure 13 is an exemplary illustration for a user to indicate various preferences for the Connected-Home to automatically act upon and to set the user policies at the time of user-registration process using any multi-functional electronic device according to one embodiment of the present invention.

Figure 14 is a flow chart illustrating the operational procedure involved when an automatic/seamless migration/routing of a new or on-going telephone call,

multimedia session and user-specific Internet traffic takes place within the boundaries of the formed Connected-Home depending on the instantaneous movement pattern of a registered user according to one embodiment of the present invention.

Figure 15 shows the exemplary task-list or an online diary that can be displayed on the electronic visual display panel of an enhanced version of the electronic device of first type according to one embodiment of the present invention.

The figures are provided for ease of explanation of the basic proposals of the present invention only; the extensions of the figures with reference to number, position, relationship and dimensions of the parts to form the preferred embodiment will be explained or will be within the skill of the art after the following proposals/findings of the present invention have been read and understood.

Description of Specific Embodiments

The present invention will now be described in a more elaborative manner hereinafter with reference to the accompanying figures, which form a part hereof, and which show, by way of illustration, specific exemplary embodiments by which the invention may be practised. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are

provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art.

Various embodiments of the present invention provide system, apparatus and methodologies for capable electronic devices having multi-functional communication and entertaining capabilities to be registered, configured per a given geographical location of a private dwelling, small office and an apartment in order to create a unified Connected-Home system that can support real "Follow-Me" applications and services such as "Follow-Me-Telephone", "Follow-Me-Chat", "Follow-Me-Social-Networking", "Follow-Me-TV", "Follow-Me-Radio", "Follow-Me-Video-on-Demand (VoD)", "Follow-Me-Audio-on-Demand (AoD)", "Follow-Me-On-line-Gaming", and the like. The unified Connected-Home provides mechanisms for seamless and automatic migration of a variety of in-house multimedia sessions/interactions, telephone calls, user-specific Internet traffic without expecting any user-input at run-time. This is possible with the correct capturing, processing and passing on of correct context information on time.

According to one embodiment of the present invention, a new communication paradigm is envisaged by way of empowering an electronic device having multi-functional communication and entertaining capabilities through appropriate hardware and/or software means to enable on-the-fly formation of Connected-Home network. Such a Connected-Home network supports direct device-to-device interaction in a peer-to-peer manner for control signalling

purposes in order to enable seamless and automatic migration of a variety of multimedia sessions/interactions from one of said multi-functional electronic devices to another without relying on any intermediate base station or user input. Such an empowered multi-functional electronic device is hereinafter referred to as iEntertainer throughout this document for easy identification. Each such empowered new iEntertainer device enables the user to register it per a given geographical location of a dwelling, office, building, apartment, flats and the like in order for important multimedia applications and services (i.e., Follow-Me-Services) to follow a user within the Connected-Home environment depending on user movement.

According to the second embodiment of the present invention, there is provided a physical location specific multi-functional electronic system on a chip (SoC) to form a purposeful Connected-Home network where each said multi-functional electronic device is registered per a given geographic location in a private dwelling, office, building premises and the like to facilitate direct device-to-device interaction in a peer-to-peer manner for control signalling purposes that is required to support seamless migration of a variety of multimedia sessions/interactions from one of said multi-functional electronic devices to another without relying on any intermediate base station or user input. Through subsequent embodiments of the present invention new functionalities are added to extend the capabilities of the said SoC 310 to get a conventional telephone call and other services migrated/routed to the

appropriate multi-functional electronic device that serves the area where the given user is currently detected.

According to the third embodiment, methods and procedures are introduced to make any existing communication/entertainment device such as a smart-phone, a personal digital assistant (PDA), a notebook and the like, so long as it has the necessary hardware and software functionalities, to form a Connected-Home network that can support seamless migration of a variety of multimedia sessions/interactions, user-specific Internet traffic, telephone calls and the like from one of said multi-functional electronic devices to another without relying on any intermediate base station or run-time user input.

Fig. 1 is an exemplary illustration of the various components of a basic connected-home being applicable as one of the current prior art that allows the user to transparently access stored digital media entertainment from any connected device in the home. This connected-home consists of broad range of connected living devices from HD digital TVs, PCs, set-top boxes, personal video recorders (PVR) and digital media adaptors to digital picture frames, personal media players, PDAs, mobile phones and the like where digital contents are aggregated in a media server. In order ensure compatibility between devices from different manufacturers, media servers and media clients of the connected home are standards-based and the relevant standard body being Digital Living Network alliance (DLNA).

This connected-home as depicted in Fig. 1 does not however support the true "Follow-Me" applications and services in the same way as it is intended by the Connected-Home in the present invention. The prior-art connected-home needs the manual intervention and hence expects a user input when a user wants a media content to be followed to the user's desired location. This input can be given via a remote controller. For instance, when one user of this connected-home that currently watches a TV program in the living room wants to continue watching it in the bedroom, the user has to manually indicate the intension via a remote controller. In contrast, this situation is handled in the present invention automatically by the Connected-Home network.

Fig. 1 shows the exemplary front view of the basic/elementary version of the electronic device of first type 100 – a fundamental element to make the basic Connected-Home as proposed according to one embodiment of the present invention. Every basic/elementary version of the electronic device of first type 100 has a user interface of first type consisting of specific set of keys/buttons and the said specific set of keys/buttons includes Master/Slave and Register/De-Register 109 for the purpose of configuring a given electronic device of first type 100 as a master/slave, registering/associating or de-registering a said electronic device of first type 100 with/from the said master. The specific set of keys/buttons of the user interface of first type further includes keys 102 being embossed with the typical names of different

physical locations of a house/building/office and the like for the purpose of registering a given electronic device of first type 100 per a given physical location. Once registered in physical location specific way, each basic/elementary version of the electronic device of first type 100 will be configured to operate from the respective location of a house, dwelling, building and the like. In other words, they will be physically located in their respective locations. The elementary version of the electronic device of first type 100 further includes an electronic visual display panel 104 to render any received multimedia content, a speaker 106 and a handset 108 to make/receive calls.

Each electronic device of first type 100 has multi-functional communication and entertainment capabilities to form a controlled-network 600 within the premises of a private dwelling, office, apartment and the like, and the said controlled-network consisting of:

i) one or more electronic device of first type 100 being configured to operate from a specific location of a private dwelling, office, apartment and the like;

ii) an electronic device of the second type 654 maintaining a multimedia hub; and,

iii) an electronic device of the third type 620 maintaining constant connectivity with traditional telephony networks such as PSTN/PLMN/ISDN and the like.

According to this arrangement, one or more electronic devices of first type 100 form peer-to-peer backbone 670 for the controlled-network 600 to operate via the communication interface of the first type, every electronic device of the first type 100 maintains connectivity with the electronic device of the second type 654 via the communication interface of second type and every electronic device of first type 100 communicates with the electronic device of third type 620 via communication interface of third type.

Each of the said electronic devices of first type 100 comprises a unique device-specific-identifier pertaining to a communication interface of first type, a user interface of first type consisting of a specific set of keys/buttons and the said specific set of keys/buttons include 102 and 109 for setting a given said electronic device of first type 100 as a Master/slave, registering/associating a given electronic device of first type 100 with the said master, and registering a given said electronic device of first type 100 per a given physical location of a private dwelling and the like where the said controlled-network 600 is set to operate respectively in order to compose a purposeful secure peer-to-peer backbone 670 for the said controlled-network with the help of the user. The composition of a purposeful backbone 670 out of two or more of the said electronic devices of first type 100 is triggered automatically when turning on the said electronic device of first type 100 for the first time or manually, and the formation of the said peer-to-peer backbone 670 employs a configuration procedure comprising the steps of:

i) prompting the user to set one of said electronic device of first type 100 to be the master device by pressing one of the said specific set of keys/buttons 109, if the master does not exist already;

ii) getting the configured master to display the said device-specific-identifier of the said master device pertaining to the communication interface of first type in 104;

iii) prompting the user to turn on each of the other electronic devices of first type 100, to register each of them as a slave device with the configured master in a physical location-specific manner by entering the said device-specific-identifier of the said master pertaining to the communication interface of first type and, subsequently pressing a physical location specific key 102 and the registration key 109 of the said specific set of keys/buttons simultaneously on the slave device;

iv) on receiving the registration request when the registration key of 109 on each of said slave devices being pressed, prompting each slave device to transmit the location-specific-identifier and the said unique device/network-specific-identifier of the slave device pertaining to the communication interface of first type to the master device;

v) on reception of the location-specific and device-specific-identifiers of each registered slave device pertaining to the communication interface of first type, getting the said master device to prepare a device-profile-database;

vi) continuing operations (iii) to (v) for every other slave device;

vii) periodically disseminating the device specific details maintained in a device-profile-database to all the registered devices of the network by the said master device for all devices to know the important details of the of other devices of the formed peer-to-peer backbone 670;

According to this arrangement, (de-)registering a new slave device from the existing master can take place asynchronously at the user's discretion and once being part of the said peer-to-peer backbone 670 each of said electronic device of first type 100 periodically disseminating context information packet to all the other devices in the network informing its current status.

According to one embodiment of the oresent invention, once the peer-to-peer backbone 670 is formed, associating/registering the electronic device of second type 654 with the said master via the communication interface of the second type comprising the steps of:

i) prompting the user to get the unique device-specific-identifier of the said electronic device of the second type 654 pertaining to the communication interface of second type;

ii) prompting the user to connect the said electronic device of the second type 654 to the said master via the communication interface of second type and to enter the unique device-specific-identifier of the said electronic device of the second type 654 on the master device.

Once associated, the electronic device of second type 654 will be assigned security credentials for mutual authentication and encryption purposes by the

said master and an entry corresponding to the electronic device of second type 654 containing its role, device/network-specific-identifier pertaining to the communication interface of second type will be included in the centralised device-profile-database being maintained by the said master for every electronic device of first type 100 to communicate with the electronic device of second type 654 via the communication interface of second type. The electronic device of second type 654 is a Media-Server maintaining connectivity with one or plurality of multimedia content sources.

According to one embodiment of the present invention, each of said electronic devices of first type 100 possesses the necessary user interfaces realised through hardware and/or software means along with an electronic visual display unit having a big form-factor/screen-size, an RFID smartcard reader and a Passive Infra-Red (PIR) sensor for rendering the received video content, for the purpose of reading the contents of RFID smartcard tag being carried by each registered user and detecting especially the human body movement respectively. In this arrangement, any new occupant can register with the formed Connected-Home network 600 by following the user-registration procedure only when a given user is given an RFID smartcard tag bearing the unique user-profile-identifier (e.g., Profile-ID) and the said user-registration procedure can be carried out on the said master device or any registered slave device and it comprises the steps of:

i) the user triggering/initiating the user-registration procedure by correctly pressing the corresponding key (i.e., continuously pressing the Settings key until it is triggered);

ii) the user first entering the user-profile-identifier (e.g., Profile-ID) that can be found on the RFID smartcard tag when prompted;

iii) the user having the option to storing the login details associated with various Social Networking Sites such as Facebook, MySpace, LinkedIn, twitter, and the like, Instantaneous Messaging clients such as MSN, Google Chat and the like, web email clients, VoIP client such as Skype, online gaming client, and the like either on the master device or RFID smartcard tag being carried by the user;

iv) the user specifying the favourite TV/Radio channels/programs on terrestrial, satellite and IPTV channels;

v) the user setting rules in terms of when and where to migrate telephone/Internet/multimedia sessions, whether migration to a given device can take place in the presence of one or more other registered users, parental control and the like, and such information will be available to the policy-management functionality of the said master.

According to one embodiment, all the user-specific details will be stored centrally in the user-profile-database being created and maintained in the said master that is to be indexed using the user-profile-identifier (e.g., Profile-ID).

According to another embodiment of the present onvention, every electronic device of first type 100 updates the master periodically and this updating procedure comprising the steps of:

i) checking the device's current status in terms of whether it handles any on-going multimedia session like over-the-air telecast TV, IPTV or streaming video or listening to any over-the-air broadcast radio station, web audio album, Internet radio or any streaming audio, telephone call, and if so, information pertaining to the user and the application type associated with the session being handled along with the unique user-profile-identifier (e.g., Profile-ID), location-specific-identifier of the device, its unique network/device-specific-identifier pertaining to different communication interfaces will be transmitted to the said master via the communication interface of first type for it to be processed and subsequently stored in both the user-profile-database and device-profile-database;

ii) in the middle of an on-going session when a user vanishes abruptly without any trace, the said electronic device of first type 100 that originally handled the user session informing the said master via the communication interface of first type.

In such an arrangement whenever there is a need to migrate an on-going session, the decision as to when and where to migrate will be taken by the said master device. Migrating an on-going multimedia session from one of the

said electronic devices of first type 100 to another or directing a new multimedia session comprising the steps of:

i) PIR sensor unit of each electronic device of first type 100 constantly monitoring a given geographical location/region of the formed Connected-Home 600 and on detecting any user movement, it triggering the RFID reader;

ii) RFID Smartcard reader of the given electronic device of first type 100 getting activated and trying to read the RFID smartcard tag, if any is around, within the configured geographical location/region of the formed Connected-Home 600;

iii) On detecting an RFID smartcard tag, the RFID reader reading the unique user-profile-identifier (e.g., Profile-ID), and the currently serving device 100 informing the master about the user's identity by passing on the read unique user-profile-identifier (e.g., Profile-ID);

iv) the said master in turn referring to the user-profile-database and trying to find out whether the given user has been busy/active in terms of being engaged in any on-going session (TV/radio/Internet/call) or any new session is due using the unique user-profile-identifier (e.g., Profile-ID) as the index;

v) on detecting that the given user is currently watching/listening to a multimedia content probably after having been informed by the electronic device of first type (i.e., the source device) 100 which originally handled the session for the user or from the TV/radio/VoD/AoD preference list as indicated by the user in the user-profile-database, time of the day, and the electronic program guide (EPG) if it is decided that a new/existing session

needs to be directed, the automatic and seamless migration of the on-going/new session comprising the steps of:

a) getting the master to first gather the required parameters associated with the on-going/new session from the Media-Server 654 via the communication interface of second type;

b) the said master deciding whether migration of the on-going session or routing of the new session to the new electronic device of first type (i.e., the target device) 100 which has detected the recent/latest movement of the given user is possible;

c) the said master finding out the unique device-specific-identifier of the new electronic device (i.e., the target device) of first type 100 pertaining to the communication interface of second type that has detected the recent/latest movement of the given user from the device-profile-database;

d) if there is no policy conflict and the new target is ready and capable enough, the said master passing the collected session related parameters pertaining to the on-going/new session on to the new target electronic device of first type 100 along with the transcoding-related information in case transcoding is needed;

e) the said master notifying the device/network-specific identifiers of both the Media-Server 654 and target device 100 pertaining to the communication interface of second type to each other;

f) the said master coordinating with the said Media-Server 654 and the new target device 100 to ensure the timely migration/ routing of the on-going/new session respectively.

The automatic migration of on-going/new session takes place without expecting any user input in order for the session to follow the user depending on the user's movement pattern within the formed Connected-Home network 600.

According to another embodiment of the present invention, associating/registering the electronic device of third type 620 with the said master via the communication interface of the third type comprises the steps of:

i) prompting the user to get the unique device-specific-identifier of the said electronic device of the third type 620 pertaining to the communication interface of third type;

ii) prompting the user to connect the said electronic device of the third type 620 to the said master via the communication interface of third type and to enter the unique device-specific-identifier of the said electronic device of the third type 620 on the master device.

According to this arrangement, once associated, the electronic device of third type 620 will be assigned security credentials for mutual authentication and encryption purposes by the said master and an entry corresponding to the

electronic device of third type containing its role, device/network-specific-identifier pertaining to the communication interface of third type will be included in the centralised device-profile-database being maintained by the said master for every electronic device of first type 100 to communicate with the electronic device of third type 620 via the communication interface of third type. The electronic device of third type 620 is a PBX-unit being the control entity for the conventional telephone services provided via PSTN, ISDN, PLMN or the like. In this environment, the said master takes an extra functionality to operate as a master base station that is being configured to communicate with a PBX-unit 620 via an interface of third type for directing/migrating a telephone call to the correct electronic device of first type 100 depending on instantaneous user movement within the formed Connected-Home network 600, wherein the automatic and seamless migration of the on-going/new telephone call comprises the steps of:

i) PIR sensor unit of each electronic device of first type 100 constantly monitoring a given geographical location/region of the formed Connected-Home 600 and on detecting any user movement, it triggering the RFID reader;

ii) RFID Smartcard reader of the given electronic device of first type 100 getting activated and trying to read the RFID smartcard tag, if any is around, within the configured range;

iii) On detecting an RFID smartcard tag, the RFID reader reading the unique user-profile-identifier (e.g., Profile-ID) and the given electronic device of first type 100 notifying the master about the user's identity;

iv) the said master in turn updating the local user-profile-database and device-profile-database to know the current communication status of each device and the user within the Connected-Home network 600.

Accordingly, the said master on deciding that directing a new call or migrating an on-going telephone call is imminent on being notified by the local PBX-unit 620 maintaining connectivity with PSTN, ISDN or PLMN along with the caller-ID or on detecting a user movement notification by any electronic device of first type 100 in the middle of an on-going telephone session, the said master will handle directing a new call or migration of on-going call by following the call routing/migration procedure comprising the steps of:

a) referring to the user-profile-database and trying to find out from each registered user's friend/caller list as to who the call should be directed/migrated based on the caller-ID;

b) identifying from the user-profile-database, the exact user to whom the call should be directed/migrated along with the user's current location in terms of the neighbouring electronic device of first type 100 that has notified the latest user movement;

c) finding out the unique device-specific-identifier of the new electronic device of first type 100 (i.e., the target device) pertaining to the communication interface of third type that has detected the recent/latest movement of the given user from the device-profile-database;

d) deciding whether directing/migration of the new or on-going session to the new electronic device of first type 100 (i.e., the target device) which has detected the recent/latest movement of the given user is possible without having to be concerned about any policy conflict;

e) On seeing that there is no policy conflict and the new target is ready and capable enough, the said master passing on to each other the unique network identifiers of both the new electronic device of first type (i.e., the target device) to which the call is going to be directed/migrated and the PBX-unit 620 (i.e., the parties concerned) pertaining to the interface of the third type for the new/on-going telephone call to be directed/migrated from the PBX-unit 620 via the interface of the third type.

According to this arrangement, the automatic routing/migration of new or on-going telephone call takes place from the PBX-unit 620 to target device of first type 100 without expecting any user input in order to follow the user depending on the user's movement pattern within the formed Connected-Home network 600.

According to one embodiment of the present invention, one of the communication interfaces being supported by the said electronic device of first type has an IP network connectivity and has a globally unique IP address assigned and the assignment of such an IP address can be by an external entity having the Dynamic Host Configuration Protocol (DHCP) functionality. With this setup, pushing the user-specific Internet traffic pertaining to a multitude

of Social Networking Sites (SNSs), Instantaneous Messaging (IM), online gaming, email, and VoIP/V2IP clients to one of the electronic devices of first 100 type comprises the steps of:

i) PIR sensor unit of each electronic device of first type 100 constantly monitoring a given geographical location/region of the formed Connected-Home 600 and on detecting any user movement, it triggering the RFID reader;

ii) RFID Smartcard reader of the given electronic device of first type getting activated and trying to read the RFID smartcard tag, if any is around, within the configured range;

iii) On detecting an RFID smartcard tag, the RFID reader reading the unique user-profile-identifier (e.g., Profile-ID) and the given electronic device of first type 100 notifying the master about the user's identity;

iii) the given electronic device of first type 100 coordinating with the said master to retrieve all the login information of the user pertaining to a multitude of Social Networking Sites (SNSs) and Instantaneous Messaging (IM), online gaming, email, and VoIP/V2IP clients along with the information of each application type and/or the URL to which each login details are associated with;

iv) the given electronic device of first type 100 liaising with the local corresponding application module to automatically executing the user login-on a multitude of Social Networking Sites (SNSs) and Instantaneous Messaging (IM), online gaming, email, and VoIP/V2IP clients;

v) the given electronic device of first type 100 liaising with the corresponding application module to pull the Internet traffic, if any, pertaining to a multitude of Social Networking Sites (SNSs) and Instantaneous Messaging (IM), online gaming, email, and VoIP/V2IP clients.

Accordingly, depending on the instantaneous movement, the registered user has the benefit of getting the user-specific Internet traffic dynamically routed to one of the said electronic devices of first type 100 that serves the geographical area of the Connected-Home network 600 where the user is currently located and detected.

According to another embodiment of the present invention, under normal circumstances the electronic device of first type 100 operates in sleep mode when idling. However, when the PIR sensor and the RFID smartcard reader arrangement correctly identifies a particular registered user in the near vicinity of an electronic device of first type 100 as explained before, the electronic device of first type 100 will function as a digital photo frame displaying a sequence of user-uploaded photos on its electronic visual display panel or displaying a set of user-set task-list or an online diary with an objective to remind the users of important house-hold/personal jobs that needs to be done on time. Accordingly, if user-specific task-list or online diary is stored on the master, displaying the user-specific task-list to one of the electronic devices of first type 100 comprises the steps of:

i) PIR sensor unit of each electronic device of first type 100 constantly monitoring a given geographical location/region of the formed Connected-Home and on detecting any user movement, it triggering the RFID reader;

ii) RFID Smartcard reader of the given electronic device of first type 100 getting activated and trying to read the RFID smartcard tag, if any is around, within the configured range;

iii) On detecting an RFID smartcard tag, the RFID reader reading the unique user-profile-identifier (e.g., Profile-ID) and the given electronic device of first type 100 notifying the master about the user's identity;

iii) the given electronic device of first type 100 coordinating with the said master to retrieve user-specific task-list of the user being detected;

iv) the given electronic device of first type 100 displaying the user-specific task-list or online diary or photo-album in its electronic visual display until the given user is detected by the RFID reader.

According to this arrangement, depending on the instantaneous movement pattern, each registered user has the benefit of getting the user-specific task-list or an on-line diary or photo-album dynamically routed to one of said electronic devices of first type 100 that serves the geographical area of the Connected-Home network 600 where the given user is currently located and detected and displayed as a way to remind the user/occupant about/of the tasks that are yet to be completed with the time-relevance. This feature is exemplarily shown in Fig. 15.

The functionalities of the electronic device of first type 100 can be realised using hardware, software or combination of both. According to one embodiment of the present invention, a purpose-built middleware is used to realise the intended functionalities of a electronic device of first type 100.

Fig. 2 depicts various functional blocks of the middleware 240 which is necessary to provide a framework and to control on-the-fly secure spontaneous composition of one or more of multi-functional electronic devices of first type having the necessary hardware and/or software functionalities for each of them to be registered per given geographic location in a private dwelling, office, building premises and the like to form a purposeful peer-to-peer backbone 670 for a Connected-Home network 600 that can enable seamless migration of a variety of multimedia sessions/interactions from one of said electronic devices to another via a preferred communication interface according to one embodiment of the present invention. The said peer-to-peer backbone 670 uses communication interface of first type for interacting with each other for the purpose of disseminating control signalling messages.

In this arrangement, each of said electronic devices of first type having multi-functional communication and entertaining capabilities maintains connectivity with one or plurality of multimedia content sources via a Media-Server using the communication interface of second type. The middleware 240 consists of the following functional elements, which are:

i) a registrar of first type 244 (referred to as Device-Profile-Registrar from now onwards) for maintaining the details of each said electronic device of first type 100 being part of Connected-Home formed on-demand along with their location-specific-identifiers, communication interfaces that can be supported, one or plurality of network identifiers pertaining to one or plurality of communication interfaces, roles, security credentials, current activity and the like in a device-profile-database;

ii) a Configuration-Manager 254 having the network configuration functionality to take care of underlying on-the-fly network configuration of the Connected-Home;

iii) a Connection-Manager 266 having the connection establishment functionality for establishing a secure physical communication either between two or more of said electronic devices or between one said electronic device and the said Media-Server;

iv) a Session-Manager 250 having session establishment functionality for establishing and maintaining logical connection in an end-to-end manner as requested by a specific application,

v) Mutual Authentication and Encryption Manager 260 having mutual authentication and encryption functionality to liaise with the said Device-Profile-Registrar 244 to make sure that each said electronic device and the Media-Server have been assigned security credentials for mutual authentication and encryption purposes.

vi) a registrar functionality of second type (referred to as User-Profile-Registrar from now onwards) 280 for maintaining the details of each registered user such as the unique user-profile-identifier (i.e., Profile ID), entertainment preference in terms of favourite TV/Radio channels/programs, one or plurality of login details, preferred caller-/friend-list, current activity, current location, proximity to any of said electronic device of first type 100 being part of Connected-Home and the like in a user-profile-database;

vii) a Policy-Manager 286 having the policy-management functionality for enforcing each user's rule within the Connected-Home environment while avoiding/resolving any conflict with other registered users' set rules;

viii) a Context-Manager 270 having the context-management functionality for capturing, processing and providing the context information pertaining to each registered user and each of said electronic devices forming part of the Connected-Home;

ix) a Migration-Manager 276 having the migration-management functionality for taking responsibility for the successful seamless and automatic migration of on-going multimedia sessions or for automatically directing new calls without expecting any user input; and,

x) a Transcoding-Manager 290 having the transcoder functionality for handling the transcoding of multimedia contents if needed, for instance when migration of multimedia content takes place between heterogeneous devices supporting different codec/bit-rate/resolutions and/or involving different processing/communication protocols.

xi) a Client-Module and the associated user interface 212 to be running in each said multi-functional electronic device of first type 100 for rendering the multimedia content when a call/Internet/multimedia session is migrated by liaising with the respective application modules, for periodically updating the identity of each registered user whenever detected and the like.

Each of the said multi-functional devices of first type running the said middleware 240 comprises a unique device-specific-identifier pertaining to a communication interface of first type and a specific set of keys/buttons, and the said specific set of keys/buttons include Master/Slave, Register and names of different physical locations of a house/building/office and the like for setting a given said multi-functional device of first type as a master/slave, registering/associating a said multi-functional electronic device of first type 100 with the said master, and registering a said multi-functional device of a first type per a given physical location respectively. With the help of the user, the Configuration-Manager 254 of the said middleware 240 is operable to compose a purposeful peer-to-peer backbone 670 for the Connected-Home network 600 out of two or more said multi-functional devices of first type when triggered on first turning on the said multi-functional electronic device of first type 100 for the first time or manually, and this peer-to-peer backbone 670 configuration via the communication interface of first type has a preset procedure comprises the following steps:

i) prompting the user to set one said multi-functional electronic device of first type 100 to be the master device by pressing one of the said specific set of keys/buttons, if the master does not exist already;

ii) getting the Configuration-Manager 254 to display the said device-specific-identifier of the said master device pertaining to the communication interface of first type;

iii) prompting the user to turn on each of the other multi-functional electronic devices, to register each of them as a slave device with the master in a physical location-specific manner by entering the said device-specific-identifier of the said master pertaining to the communication interface of first type and, subsequently pressing a physical location specific key and the registration key of the said specific set of keys/buttons simultaneously on the slave device;

iv) on the registration key on the slave device being pressed, prompting the corresponding Configuration-Manager 254 to transmit the location-specific-identifier and the said unique device-specific-identifier of the slave device pertaining to the communication interface of first type to the master device;

v) on reception of the location-specific and device-specific-identifiers of each registered slave device pertaining to the communication interface of first type, getting the said Configuration-Manager 254 of the said middleware 240 running on the said master device to pass this device specific information on to the Device-Profile-Registrar 244 for it to prepare a device-profile-database;

vi) continuing operations (iii) to (v) for every other slave device;

vii) periodically disseminating the device specific details maintained in a device-profile-database to all the registered devices of the network by the Configuration-Manager 254 of the said master device for all devices to know the important details of the peer devices of the formed network.

Once the peer-to-peer backbone 670 consisting of one or plurality of multi-functional electronic devices of first type is configured by the middleware 240, each multi-functional electronic device needs to be placed where it is supposed to be within the Connected-Home in accordance with its location-specific registration. For example, if a multi-functional device is registered to serve the kitchen, it needs to be placed in the kitchen after the successful network configuration. This peer-to-peer backbone 670 is responsible for periodic context information transfer and disseminating the control signalling at the time of network configuration and user-specific session migration between one or more multi-functional electronic device. Each multi-functional electronic device of first type 100 uses an interface of first type for communicating in a peer-to-peer manner with another.

Certain functionalities of the middleware 240 such as User-Profile-Registrar 280, Context-Manager 270, Policy-Manager 286 and Migration Manager 276 are activated only when the said multi-functional electronic device operates as the master whereas the Client-Module 212 comprising mainly the APIs to a variety of Follow-Me type applications and services and the Transcoding

Manager 290 will be running in each of said multi-functional electronic device.

When a Client-Module 212 running locally in each multi-functional electronic device first type updates the location of each detected user to the master maintaining the device-/user-profile database, it simply indicates with its own device/network-specific-identifier the detected user's user-profile-identifier – it does not need to specify where exactly in the Connected-Home the user is detected. From the device/network-specific-identifier of the device that updates the location of a detected user having a unique user-profile-identifier the master will know exactly where to migrate a user-specific session when it is required.

Once the said peer-to-peer backbone 670 is formed by first configuring one said multi-functional electronic device of first type 100 as the master and other devices as slaves, associating/registering the Media-Server with the said master via the communication interface of the second type comprises the following steps:

i) prompting the user to get the unique device-specific-identifier of the Media-Server pertaining to the communication interface of second type;

ii) prompting the user to connect the Media-Server to the said master via the communication interface of second type and to enter the unique device-specific-identifier of the said electronic device of the second type on the master Device;

Once associated, the Media-Server will be assigned security credentials for mutual authentication and encryption purposes by the said master and an entry corresponding to the Media-Server containing its role, device/network-specific-identifier pertaining to the communication interface of second type will be included in the centralised device-profile-database being maintained by the said master for every electronic device of first type 100 to communicate with the Media-Server via the communication interface of second type.

The said master constantly interacts with the said Media-Server to facilitate the timely migration of multimedia contents and the said Media-Server constantly maintains connectivity with one or more of the following:

i) Set-top box consisting of dual tuner for receiving terrestrial and satellite broadcast/telecast and maintaining cable network connectivity;

ii) Residential Gateway via the said Set-top box or not for the reception of broadband digital TV and multimedia applications;

iii) Multi-Room Personal Video Recorders (MR-PVR); and,

iv) multimedia sources like Media Personal Computer (PC), Personal Media Players, mobile phone, Personal Digital Assistants (PDAs) and similar devices;

In addition, the said Media-Server supports home networking standards as specified by Digital Living Network alliance (DLNA), G.hn (also known as

G.9960) of ITU-T or similar standardisation bodies like ETSI, and protocols like Universal Plug-and-Play (uPnP) enabling it to network with various multimedia sources on-the-fly in order to create/maintain its video/audio hub.

At least two different interfaces are used to maintain connectivity among various devices of the Connected-Home:

a) each of the said multi-functional electronic device of first type 100 is provided with an interface of first type to support direct device-to-device interaction there between in a peer-to-peer manner for control signalling purposes;

b) each of the said multi-functional electronic device of first type 100 and the said Media-Server are equipped with another interface of second type to communicate with the said Media-Server for the purpose of migrating/routing multimedia contents to one of the said multi-functional electronic device of first type 100 from the Media-Server depending on user movement.

The interface of the first type can be IEEE 802.11g including WiFi-direct, whereas the interface of the second type can be provided on the existing telephone wiring supporting the necessary communication protocols as specified by the Home Phone-line Networking Alliances (HPNA), power-line supporting the necessary communication protocols as specified as part of HomePlug consortium, IEEE 802.11n or coax cabling supporting the necessary communication protocols as specified by the Multimedia over Coax

Alliance (MoCA). In order to use power-line each said multi-functional electronic device shall be equipped with a power-line Ethernet or similar adaptors.

The said middleware 240 running in each of said multi-functional electronic devices of first type runs a Client-Module 212 for rendering the multimedia content when a call/Internet/multimedia session is migrated by liaising with the respective application modules, for periodically updating the master with a user-profile-identifier whenever a registered user is detected within its coverage area and the like. This Client-Module 212 has Digital Media Adapter (DMA) functionality that allows the user to start or program recordings on the MR-PVR in case the Connected-Home has it.

According to one embodiment of the present invention, the said middleware 240 is operable on TCP/IP protocol suite. The IP-based platform offers significant advantages, including the ability to integrate television with other IP-based services like high speed Internet access, user-specific social networking traffic, instantaneous messaging, online gaming and VoIP. Another advantage of an IP-based network is the opportunity for integration and convergence. This opportunity is amplified when using IMS-based solutions. Converged services implies interaction of existing services in a seamless manner to create new value added services. IP-based services will help to enable efforts to provide consumers anytime-anywhere access to content such as user-specific social networking traffic, instantaneous

messaging, online gaming along with IPTV, VoIP and the like over said location-specific multi-functional devices of first type, and to integrate services and content to tie them together.

The said middleware 240 supports a wide variety of multimedia applications such as Voice over IP (VoIP) and Voice & Video over IP (V2IP) 114, IPTV 216, Social Networking 218, Online Gaming 222, Multimedia chatting 224, audio/video streaming 226 via the application layer 236 as it will be described later. In addition, it handles the migration/routing of conventional telephone (e.g., PSTN/ISDN) call 236 and terrestrial/satellite TV 236 to the appropriate multi-functional device of first type depending on the user movement. For supporting terrestrial/satellite TV 236, the Media-Server being part of the Connected-Home network should have dual-tuner equipped set-top-box connection.

Once one or more of said multi-functional electronic devices of first type have formed into a purposeful Connected-Home network on-the-fly and once being part of the Connected-Home, the Configuration-Manager 254 of the said middleware 240 running in each said multi-functional electronic device of first type 100 periodically disseminates context information packet to all the other devices in the network informing its current status to facilitate seamless migration of on-going or pushing of new call/Internet/multimedia content.

The unique network specific identifier of the said multi-functional electronic device on the preferred interface can be a MAC address. On the other hand, if the said multi-functional electronic device has a Bluetooth interface or IP connectivity, the unique network specific identifier can be Bluetooth device address or IP address respectively. In case each of the said multi-functional electronic device has a WiFi transceiver and is configured to be part of a basic service set (BSS), the unique network identifier can be obtained by getting the WLAN router to assign the network identifier provided the latter supports Dynamic Host Configuration Protocol (DHCP) functionality. In this case, the network identifier is going to be more likely an IP address, the network composition as described before will be preceded by registering with a local WLAN and getting each multi-functional electronic device assigned an IP address.

In case Bluetooth is the main radio interface being used between different multi-functional electronic devices to form the backbone 670 of the Connected-Home 600, at the time of backbone composition, each slave multi-functional electronic device and the master multi-functional electronic device needs to be paired prior to getting a slave device registered/associated with the master device.

The Configuration-Manager 254 of the middleware 240 running in the master device is operable to liaise with the Device-Profile-Registrar 244 to create a

device-profile-database initially in the said master device and the said device-profile-database creation process comprises the following steps:

i) creating an entry corresponding to the master;

ii) On reception of registration request from each device, create an entry corresponding to the successfully registered device.

each entry consists of location identifier, one or plurality of unique device-specific-identifier pertaining to each communication interface the registered device supports, role (i.e., whether master or slave), public and private keys assigned by the Mutual Authentication and Encryption Manager 260 of the master, current status pertaining to each and every registered device of the purposeful Connected-Home network being composed into in terms of the identifiers of the users being served/detected. As it will be explained, the Configuration-Manager 254 of the middleware 240 running in the said master device is operable to broadcast the contents of the device-profile-database excluding the private key details of each multi-functional electronic device after each new addition/removal of slave devices to/from the said purposeful Connected-Home network for all the registered devices to maintain their local device-profile-databases and to know their neighbouring multi-functional electronic devices with which peer-to-peer multimedia interaction is possible. The Configuration-Manager 254 of the said master may use different communication interfaces for such dissemination as different devices maintain different interfaces with each other.

The Configuration-Manager 254 of the middleware 240 running in the said master device is operable to liaise with the Mutual Authentication and Encryption Manager 260 to assign asymmetric keys to every slave multi-functional electronic device at the time of registration, to the Media-Server when it was associated with the said master, and to the master when the said master was configured and the private key being assigned is notified by the master to the owner.

According to one preferred embodiment of the present invention, each of said multi-functional electronic devices of first type that runs the Client-Module 212 of the said middleware 240 possesses the necessary user interfaces realised through hardware and/or software means along with an electronic visual display unit having a big form-factor/screen-size, an RFID smartcard reader and a Passive Infra-Red (PIR) sensor that are coupled to said bus via the said peripheral controller for rendering the received video content, for the purpose of reading the contents of RFID smartcard tag being carried by each registered user and detecting especially the human body movement respectively. The said client module 212 is operable to updates the master periodically and this updating procedure comprises the following steps:

i) liaising with the Session-Manager 250 to check the device's current status in terms of whether it handles any on-going multimedia session like over-the-air telecast TV, IPTV or streaming video or listening to any over-the-air broadcast radio station, web audio album, Internet radio or any streaming

audio, and if so, information pertaining to the user and the application type associated with the session being handled along with the unique user-profile-identifier (e.g., Profile-ID), location-specific-identifier of the device, its unique network/device-specific-identifier will be transmitted to the Context-Manager 270 of the said master for it to be processed and subsequently stored in both the user-profile-database and device-profile-database; and,

ii) in the middle of an on-going session when a user vanishes abruptly without any trace, the said electronic device that originally handled the user session informing the Migration-Manager 276 of the said master making it ready for migrating the on-going session to the most appropriate multi-functional electronic device of first type 100.

In such an arrangement whenever there is a need to migrate an on-going session, the decision as to when and where to migrate will be taken by the Migration-Manager 276 running in the said master device after having liaised with the Context-Manager 270, the Policy-Manager 286 and the associated application module. Accordingly whenever there is a need to migrate an on-going multimedia session from one said multi-functional electronic device to another, such a migration process comprises the following steps:

i) PIR sensor unit of each multi-functional electronic device constantly monitors a given geographical location/region of the formed Connected-Home and on detecting any user movement, it triggers the RFID reader;

ii) RFID Smartcard reader of the given multi-functional electronic device gets activated and tries to read the RFID smartcard tag, if any is around, within the configured geographical location/region of the formed Connected-Home;

iii) On detecting an RFID smartcard tag, the RFID reader reads the unique user-profile-identifier (e.g., Profile-ID) and informing the master about the user's identity;

iv) the said master in turn refers to the user-profile-database and tries to find out whether the given user has been busy/active in terms of being engaged in any on-going session (TV/radio/Internet/call) using the user Profile ID as the index;

v) on detecting that the given user is currently watching/listening to a multimedia content probably after having been informed by the said electronic device of the first type (i.e., the source device) which originally handled the session for the user, the actual seamless migration of the on-going session comprises the steps of:

a) getting the Migration-Manager 276 of the master to first gather the required parameters associated with the on-going session from the Media-Server,

b) the Migration-Manager 276 deciding whether migration of the on-going session to the new multi-functional electronic device (i.e., the target device) which has detected the recent/latest movement of the given user is possible by liaising with the policy-manager 286 and the context manager 270;

c) the Migration-Manager 276 finding out the unique device-specific-identifier of the new multi-functional electronic device of first type 100 (i.e.,

the target device) pertaining to the communication interface of second type that has detected the recent/latest movement of the given user from the device-profile-database;

d) if there is no policy conflict and the new target is ready and capable enough, the migration manager 276 passing the collected on-going session related parameters on to the new target multi-functional electronic device along with the transcoding-related information in case transcoding is needed;

e) notifying the device/network-specific identifiers of both the Media-Server and target device pertaining to the communication interface of second type to each other;

f) coordinating with the said Media-Server and the new target device to ensure the migration/routing of the on-going session.

Accordingly, the automatic migration of on-going session takes place without expecting any user input in order for the session to follow the user depending on the user's movement pattern within the formed Connected-Home network.

Once the said peer-to-peer backbone 670 is formed by first configuring one said multi-functional electronic device of first type 100 as the master and other devices as slaves, in order for the Connected-Home to migrate traditional telephone calls, the said master is configured to maintain constant connectivity with a PBX-unit which in turn maintains connectivity with traditional telephony systems like PSTN, ISDN or PLMN. According to one embodiment of the present invention, associating/registering the PBX-unit

with the said master via the communication interface of third type comprises the following steps:

i) prompting the user to get the unique device-specific-identifier of the said electronic device of the third type pertaining to the communication interface of third type;

ii) prompting the user to connect the said electronic device of the third type to the said master via the communication interface of third type and to enter the unique device-specific-identifier of the said electronic device of the third type on the master Device;

Once associated, the PBX-unit will be assigned security credentials for mutual authentication and encryption purposes by the said master and an entry corresponding to the PBX-unit containing its role, device/network-specific-identifier pertaining to the communication interface of third type will be included in the centralised device-profile-database being maintained by the said master for every electronic device of first type 100 to communicate with the said PBX-unit via the communication interface of third type.

In this arrangement, the automatic and seamless migration of the on-going/new telephone call to the correct multi-functional electronic device of first type 100 depending on instantaneous user movement within the formed Connected-Home network, comprises the following steps:

i) PIR sensor unit of each multi-functional electronic device constantly monitoring a given geographical location/region of the formed Connected-Home and on detecting any user movement, it triggering the RFID reader;

ii) RFID Smartcard reader of the given multi-functional electronic device getting activated and trying to read the RFID smartcard tag, if any is around, within the configured range;

iii) On detecting an RFID smartcard tag, the RFID reader reading the unique user-profile-identifier (e.g., Profile-ID) and informing the local Client-Module 212 which in turn notifying the master about the user's identity;

iv) the said master in turn updating the local user-profile-database and device-profile-database for the Context-Manager 270 to know the current communication status of each device and user within the Connected-Home network.

In such an arrangement, when the Migration-Manager 276 of the said master determines that directing a new call or migrating an on-going telephone call is imminent on being notified by the local PBX-unit maintaining connectivity with PSTN, ISDN or PLMN along with the caller-ID or on detecting a user movement notification by one said slave electronic device of first type 100 in the middle of an on-going telephone session, the Migration-Manager 276 will handle directing a new call or migration of on-going call by following the call routing/migration procedure comprising the steps of:

a) referring to the user-profile-database and trying to find out from each registered user's friend/caller list as to who the call should be directed/migrated based on the caller-ID;

b) identifying from the user-profile-database, the exact user to whom the call should be directed/migrated along with the user's current location in terms of the neighbouring electronic device that has notified the latest user movement;

c) the migration manager 276 finding out the unique device-specific-identifier of the new multi-functional electronic device of first type 100 (i.e., the target device) pertaining to the communication interface of third type that has detected the recent/latest movement of the given user from the device-profile-database;

d) the migration manager 276 deciding whether directing/migration of the new or on-going session to the new multi-functional electronic device of first type 100 (i.e., the target device) which has detected the recent/latest movement of the given user is possible by liaising with the Policy-Manager 286 and the Context-Manager 270;

e) if there is no policy conflict and the new target is ready and capable enough, the Migration-Manager 276 of the said master passing on to each other the unique network identifiers of both the new electronic device of first type 100 (i.e., the target device) to which the call is going to be directed/migrated and the PBX-unit (i.e., the parties concerned) pertaining to the interface of the third type for the new/on-going telephone call to be directed/migrated from the PBX-unit via the interface of the third type.

Again this routing/migration of a new or on-going telephone call takes place without expecting any user input and the Policy-Manager 286 plays a significant role to see whether the recipient of the diverted call is comfortable when the call is diverted to a given location where a number of other registered users are present. This information and user set policy rules are obtained by the Policy-Manager 286 from the user-profile-database in order to take the user preferred migration decision.

In case the interface of the third type for directing/migrating a telephone call to the correct multi-functional electronic device of first type 100 depending on instantaneous user movement within the formed Connected-Home network can be provided on the existing telephone wiring supporting the necessary communication protocols as specified by the Home Phone-line Networking Alliances (HPNA), DECT (the one being developed as part of ETSI's CAT-iq 2.0 standardization) or Bluetooth, wherein if the interface of the third type is implemented based on Bluetooth specification, it has the following features:

i) unique network identifiers of each electronic device and the PBX-unit are the Bluetooth device address; and,

ii) before any possible interaction, the communicating parties need to pair.

According to one another preferred embodiment of the present invention, whenever one of the communication interfaces being coupled by the said communication controller of the said multi-functional electronic device to

said bus has an IP network connectivity and has a globally unique IP address assigned and the assignment of such an IP address can be by an external entity having the Dynamic Host Configuration Protocol (DHCP) functionality. Under such circumstances pushing the user-specific Internet traffic pertaining to a multitude of Social Networking Sites (SNSs) and Instantaneous Messaging (IM), email, online gaming, and VoIP/V2IP clients to one of the multi-functional electronic devices comprises the steps of:

i) PIR sensor unit of each multi-functional electronic device constantly monitoring a given geographical location/region of the formed Connected-Home and on detecting any user movement, it triggering the RFID reader;

ii) RFID Smartcard reader of the given multi-functional electronic device getting activated and trying to read the RFID smartcard tag, if any is around, within the configured range;

iii) On detecting an RFID smartcard tag, the RFID reader reading the unique user-profile-identifier (e.g., Profile-ID) and informing the local client module 212 which in turn notifying the master about the user's identity;

iii) the local Client-Module 212 coordinating with the said master to retrieve all the login information of the user pertaining to a multitude of Social Networking Sites (SNSs) and Instantaneous Messaging (IM), online gaming, email, and VoIP/V2IP clients along with the information of each application type and/or the URL to which each login details are associated with;

iv) the local Client-Module 212 liaising with the corresponding application module to automatically execute the user login-on a multitude of Social

Networking Sites (SNSs) and Instantaneous Messaging (IM), online gaming, email, and VoIP/V2IP clients;

v) the local Client-Module 212 liaising with the corresponding application module to pull the Internet traffic, if any, pertaining to a multitude of Social Networking Sites (SNSs) and Instantaneous Messaging (IM), online gaming, email, and VoIP/V2IP clients.

With this arrangement, depending on the instantaneous movement pattern, each registered user has the benefit of getting the user-specific Internet traffic dynamically routed to one of said electronic devices of first type that serves the geographical area of the Connected-Home network where the user is currently located and detected. On the other hand, after a login in a multi-functional electronic device of first type 100, if the PIR/RFID-reader cannot detect the same user for a given amount of time-period, the local Client-Module 212 liaising with the one or plurality of corresponding application modules to automatically log out from a multitude of Social Networking Sites (SNSs) and Instantaneous Messaging (IM), online gaming, email, and VoIP/V2IP clients.

As mentioned before, the Session-Manger 250 interacts with the Connection-Manager 266 in order to establish a secure communication channels among the participating electronic devices for the purpose of migration and this secure connection establishment process involves getting the Connection-Manager 266 of each of the said multi-functional electronic devices of first

type to perform mutual authentication using the assigned asymmetric keys and once mutually authenticated getting the Session-Manager 250 to encrypt/decrypt traffic.

Fig. 3 depicts the basic components of physical location-specific multi-functional electronic system on a chip (SoC) 310 using one or plurality of microprocessors according to one embodiment of the present invention that can be configured in any form as those having ordinary skill in the art will appreciate. Any multi-functional electronic device of first type 300 includes the SoC 310 for performing multimedia processing and control functionality that are needed for supporting migration of telephone calls, multimedia sessions, user-specific Internet traffic in a Connected-Home environment depending on user movement patterns. Various described embodiments provide seamless migration of a variety of multimedia sessions/interactions from one of said multi-functional electronic devices of first type 300 to another without relying on any intermediate base station or user input that is performed as software executed on a general purpose microprocessor, such as a Reduced Instruction Set Computer (RISC) microprocessor. Location-specific multi-functional electronic SoC 310 includes one or plurality of microprocessors 312, system peripheral controller 320, system memory controller 324, audio/video codec 322 and a communication controller 330 – all of which are communicatively coupled over bus 318. It should be appreciated that location-specific multi-functional electronic SoC 310 may

include additional components, as understood by those of skill in the art. These additional components are not described herein in order not to obscure the embodiments described herein.

In one embodiment the location-specific multi-functional electronic SoC 310 with its microprocessor containing the software stack as shown in Fig. 4 is operable to perform all the necessary registration and configuration functions related to forming the basic Connected-Home network on the fly and subsequent user location-based migration/routing of multimedia sessions, conventional telephone calls, user-specific Internet traffic. The digital signal processing and control functions associated with a variety of multimedia traffic can be handled by a dedicated DSP or by the same microprocessor 312.

With the software stack as shown in Fig. 4, the physical location-specific multi-functional electronic system on a chip (SoC) 310 of Fig. 3 comprising a bus 318, peripheral controller 320 being connected to the said bus, one or plurality of microprocessors 312 being coupled to the said bus, a communication controller 330 having connectivity to a variety of communication interfaces being connected to the said bus, and a memory 314/316 composes a purposeful Connected-Home system on-the-fly by getting each said multi-functional electronic device of first type 300 to join while providing mechanisms for operations such as:

a) configuring a unique network identifier pertaining to a preferred communication interface for each of the said multi-functional electronic devices 300;

b) setting exactly one of said multi-functional electronic devices of first type 300 to be the master device and the rest as slave devices just for the purpose of secure registering/associating of said multi-functional electronic devices 300 with one another;

c) associating/registering each slave device with the said master device in a physical location-specific manner using the set unique network identifier and this process passes information such as each slave device's specific location name along with its unique network identifier on to the said master device via the said preferred communication interface;

d) letting the said master device maintain a device-profile-database in its memory that maps location-specific name of each registered multi-functional electronic device of first type 300 along with the corresponding said unique network identifier;

e) letting the said master device exchange the said device-profile-database with all the other associated/registered slave devices periodically via the said preferred communication interface.

With the software stack as shown in Fig. 4, the physical location-specific multi-functional electronic system on a chip (SoC) 310 of Fig. 3 form the said Connected-Home system by first configuring one of said multi-functional

electronic devices of first type 300 as the master and other devices as slaves, where the said master constantly interacts with the Media-Server, wherein the said multi-functional electronic system on a chip further handles such operations as:

i) providing a user interface for each occupant to register with the Connected-Home system and maintaining such details of each registered user as the unique user-profile-identifier (i.e., Profile-ID), entertainment preference in terms of favourite TV/Radio channels/programs, one or plurality of login details, preferred caller/friend list, current activity, current location, proximity to any of said multi-functional electronic device being part of Connected-Home system and the like in a user-profile-database;

ii) capturing, processing and providing the context information pertaining to each registered user and each of said electronic devices 300;

iii) handling the transcoding of multimedia contents if needed, for instance when migration of multimedia content takes place between heterogeneous devices supporting different codec/bit-rate/resolutions and/or involving different processing/communication protocols; and,

iv) incorporating a media client module for rendering the multimedia content when a call/Internet/multimedia session is migrated by liaising with the respective application modules, periodic location updating of each registered user with the master and the like.

Once the purposeful Connected-Home system is formed, the said system on chip 310 is operable to liaise with various entities in order to enable seamless migration of call/Internet/multimedia session and user-specific Internet traffic from one said electronic device of first type 300 to another depending on user movement within a Connected-Home environment without expecting any user input.

Certain functionalities of the system on a chip 310 such as maintaining detailed databases pertaining to each registered user/device centrally and total control of session migration are activated only when the said multi-functional electronic device of first type 300 operates as the master whereas the media client module functionality along with local transcoding will be running in each of said multi-functional electronic device of first type 300.

Depending on the exact configuration of the said multi-functional electronic device of first type 300, system memory may be volatile (such as RAM 316), non-volatile (such as ROM 314, flash memory and like) or some combination of the two. The system memory typically includes an operating system, a middleware 240 facilitating a variety of functionalities as it will be described later, one or more program modules and may include program data.

The said multi-functional electronic device of first type 300 may have additional features or functionalities. For example, the said device of first type 300 may also include additional data storage device (removable 340 and/or

non-removable 360), which can be used to store the desired information and which can be accessed via the memory controller 324.

The said multi-functional electronic device of first type 300 shall also have input devices such as physical or on-screen soft keyboard 336, mouse, pen, electronic visual display unit having a touch screen 348, and/or Settings input 356 connected via the peripheral controller 320. The peripheral controller 320 may have additional peripherals such a speaker 368, microphone 376, video camera 372, a PIR sensor 380 and an RFID card reader 390. The audio and video codecs 322 are necessary to encode and decode audio and video data respectively and for rendering the received multimedia content in the required format using the electronic visual display unit 348 and the speaker 368. The said multi-functional electronic device of first type 300 can have panic button functionality that is connected via the peripheral controller 320, so that when pressed it will alert the other occupants of the Connected-Home, police, security, friends and the like via the communication controller 330 if it maintains any external network connection.

The said multi-functional electronic device of first type 300 also contains communication controller 330 which is an aggregate of conventional controllers for facilitating an interaction between microprocessor 312 and one or plurality of interfaces 364 that can be provided via the existing telephone wiring supporting the necessary communication protocols as specified by the Home Phone-line Networking Alliances (HPNA), power-line supporting the

necessary communication protocols as specified as part of HomePlug consortium, IEEE 802.11n 352 or coax cabling supporting the necessary communication protocols as specified by the Multimedia over Coax Alliance (MoCA) wherein in order to use power-line each said multi-functional electronic device of first type 300 shall be equipped with a power-line Ethernet or similar adaptors.

With the software stack as shown in Fig. 4, each said multi-functional electronic device of first type 300 possesses an RFID smartcard reader 390 and a Passive Infra-Red (PIR) sensor unit 380 that are coupled to said bus via the said peripheral controller for reading the contents of RFID smartcard tag being carried by each registered user and detecting especially the human body movement respectively. In such an arrangement, once the said Connected-Home is formed by first configuring one said multi-functional electronic device of first type 300 as the master and other devices 300 as slaves and the user carried out the user-registration procedure to register each individual occupant with the formed Connected-Home incorporating a Media-Server, migrating an on-going multimedia session seamlessly from one said multi-functional electronic device of first type 300 to another or directing a new multimedia session without expecting any manual intervention comprises the following steps:

i) PIR sensor unit 380 of each multi-functional electronic device of first type 300 constantly monitoring a given location and on detecting any user movement, it triggering the RFID smartcard reader 390;

ii) RFID Smartcard reader 390 of the given multi-functional electronic device getting activated and trying to read the RFID smartcard tag, if any is around, within the configured range;

iii) On detecting an RFID smartcard tag, the RFID reader 390 reading the unique user-profile-identifier (e.g., Profile-ID) and informing the master about the user's identity;

iv) the said master in turn referring to the user-profile-database and trying to find out whether the given user has been busy/active in terms of being engaged in any on-going session (TV/radio/Internet/call) or any new session is due using the unique user-profile-identifier (e.g., Profile-ID) as the index;

v) on detecting that the given user is currently watching/listening to a multimedia content probably after having been informed by the said electronic device of first type 300 (i.e., the source device) which originally handled the session for the user or from the TV/radio/VoD/AoD preference list as indicated by the user in the user-profile-database, time of the day, and the electronic program guide (EPG) the Context-Manager gathers that a new/on-going session needs to be directed, the automatic and seamless migration of the on-going/new session comprising the steps of:

a) getting the master to first gather the required parameters associated with the on-going/new session from the Media-Server,

b) getting the master to decide whether migration/routing of the on-going/new session to the new multi-functional electronic device of first type 300 (i.e., the target device) which has detected the recent/latest movement of the given user is possible;

c) getting the master to find out the unique device-specific-identifier of the new multi-functional electronic device of first type 300 (i.e., the target device) pertaining to the preferred communication interface that has detected the recent/latest movement of the given user from the device-profile-database;

d) getting the master to pass the collected on-going/new session related parameters on to the new target multi-functional electronic device of first type 300 along with the transcoding-related information in case transcoding is needed;

e) getting the master to notify the device/network-specific identifiers of both the Media-Server and target device pertaining to the preferred communication interface to each other;

f) getting the master to coordinate with the said Media-Server and the new target device of first type 300 to ensure the migration/routing of the on-going/new session.

The automatic migration of on-going/new session takes place in a timely manner without expecting any user input in order for the session to follow the user depending on the user's movement pattern within the formed Connected-Home network.

With the software stack as shown in Fig. 4, the said physical location-specific multi-functional electronic system on a chip 310 is augmented to support the routing of a new call or migration of an on-going telephone. Accordingly, once the said Connected-Home is formed by first configuring one said multi-functional electronic device as the master and other devices as slaves, the said master takes an extra functionality to operate as a master base station that is being configured to communicate with a telephony system like PSTN, ISDN or PLMN directly or through an intermediate PBX-unit 384 via an interface of third type for directing/migrating a telephone call to the correct multi-functional electronic device of first type 300 depending on instantaneous user movement within the formed Connected-Home network.

On being notified of the imminent call migration/routing by the local PBX-unit 384 maintaining connectivity with PSTN, ISDN or PLMN along with the caller-ID or on detecting a user movement notification by one said slave electronic device of first type 300 in the middle of an on-going telephone session, the master will handle directing a new call or migration of on-going call by following the call routing/migration procedure comprising the steps of:

a) referring to the user-profile-database and trying to find out from each registered user's friend/caller list as to who the call should be directed/migrated based on the caller-ID;

b) identifying from the user-profile-database, the exact user to whom the call should be directed/migrated along with the user's current location in terms of

the neighbouring electronic device of first type 300 that has notified the latest user movement;

c) finding out the unique device-specific-identifier of the new multi-functional electronic device of first type 300 (i.e., the target device) which has detected the recent/latest movement of the given user from the device-profile-database;

d) deciding whether directing/migration of the new or on-going session to the new multi-functional electronic device of first type 300 (i.e., the target device) which has detected the recent/latest movement of the given user will create any policy clashes;

e) if there is no policy conflict and the new target is ready and capable enough, the said master passing on to each other the unique network identifiers of both the new electronic device (i.e., the target device) to which the call is going to be directed/migrated and the PBX-unit 384 (i.e., the parties concerned) pertaining to the interface of the preferred type for the new /on-going telephone call to be directed/migrated from the PBX-unit 384 via the interface of the preferred type.

Again such an automatic routing/migration of new or on-going telephone call takes place without expecting any user input in order for the telephone call to follow the user depending on the user's movement pattern within the formed Connected-Home network.

With the software stack as shown in Fig. 4, the said physical location-specific multi-functional electronic system on a chip 310 is augmented to support the

routing of a user-specific Internet traffic depending on the instantaneous movement pattern of each registered user within the Connected-Home environment. Accordingly, the said physical location-specific multi-functional electronic system on a chip 310 enables any multi-functional electronic device of first type 300 to maintain IP/Internet connection and automatically let a registered user login in on being detected in its configured region. On identifying the user through the PIR sensor 380 and the RFID reader 390 arrangement, the multi-functional device of first type 300 that has detected/identified the user will contact the master or RFID smartcard tag depending on where the login information is stored. On getting the given user's login information pertaining to a number of Social Networking Sites such as Facebook, MySpace, LinkedIn, twitter, and the like, Instantaneous Messaging clients such as MSN, Google Chat and the like, web email clients, VoIP client such as Skype, online gaming and the like, the multi-functional device of first type 300 that has detected the user within its configured region will automatically open one or plurality of the corresponding local client applications and login the user locally as long as IP/Internet connection is possible. Once the user being automatically signed in using the retrieved login credentials, all the user-specific Internet traffic such as that pertains to a number of Social Networking Sites such as Facebook, MySpace, LinkedIn, twitter, and the like, Instantaneous Messaging clients such as MSN, Google Chat and the like, web email clients, VoIP client such as Skype, online

gaming and the like will automatically be routed to the current device of first type 300 that has detected/identified the given user.

Each wireless transceiver of the said multi-functional electronic device of first type 300 in each case should possess the necessary baseband unit, and such a baseband unit may include the corresponding physical layer (PHY) entity and a medium access control (MAC) entity (not shown). The medium access control (MAC) entity is coupled to the said bus 318 to interact with the said PHY entity to serve real-time multimedia traffic wherein one or more of the said microprocessors 312 may exert the necessary control over the MAC entity and the said MAC entity provides the necessary fragmentation/re-assembly of said multimedia traffic depending on the maximum frame-size as stipulated by the said PHY entity and regulates the channel access.

In addition, the said MAC entity employs a packet filtering mechanism, wherein on receiving a MAC frame from the said PHY entity the said MAC entity will inspect the address to which the MAC frame is destined to and on recognising that the received MAC frame is not destined to the local MAC entity the MAC frame will be dropped.

In one embodiment the said multi-functional electronic device of first type 300 has the said middleware 240 that runs as a daemon. This middleware liaises with other hardware and software modules to get one or more said multi-functional electronic devices 300 to form a location-specific purposeful

Connected-Home system. This involves enabling a user to configure and register each multi-functional electronic device of first type 300 per a geographic location in a private dwelling, office, building premises where multimedia applications such as Voice over IP (VoIP)/V2IP 214, Online Gaming 222, IPTV 216, multimedia streaming 226, and Instantaneous Messaging (IM) 224 and the like of 210 as shown in Fig. 2 seamlessly follow the user depending on the movement.

In order for each multi-functional electronic device of first type 300 to identify registered user within the Connected-Home network, each device of first type 300 is equipped with the necessary electronic circuitries and a variety of driver software to first detect any human body movement and subsequently to identify the user using RFID card reader 390. For the purpose of detecting human intrusion, each multi-functional electronic device of first type 300 is equipped with a pyroelectric sensor 380 which can detect the heat rays being emitted from a human body such that it can sense the presence of even a stationary human body. When a human body is detected, the RFID card reader 390 will be activated to read the unique user-profile-identifier (i.e., Profile-ID) from the RFID smartcard tag. In the same way an RFID smartcard tag is used to identify a given user, a user-specific mobile-phone or PDA being carried by the user can also be used as long as the mobile-phone or the PDA has the necessary interface to notify the multi-functional electronic device of first type 300 about the presence of a registered user. For

instance, if the user-profile-identifier (e.g., Profile-ID) is stored in the mobile-phone/PDA, it can be read by the multi-functional electronic device of first type 300 using infra red (IR), near-field-communication (NFC) or similar short-range radio interface in order to identify the user and act accordingly.

The middleware 240 may be developed according to a number of known technologies and/or operating systems that may be installed on the said multi-functional electronic device of first type 300, such as Java platform, openwave WAP push library for wireless application protocol, binary runtime environment for wireless, Microsoft .Net compact framework, Palm OS, Windows Mobile, Android, Chrome, Symbian, BREW and the like.

Those having ordinary skill in the art will appreciate alternative embodiments of the said multi-functional electronic device of first type 300 for implementing the principles of the present invention.

Fig. 4 depicts the software stack 400 of an embedded microprocessor in accordance with one embodiment of the present invention. The microprocessor can be multipurpose such as a CPU or in contrary it can be a RISC microprocessor. The software stack 400 demonstrates the operations and applications executed by one RISC microprocessor, e.g., 312 of Fig. 3. According to one embodiment, the software stack 400 comprises a "Follow-Me" client module 412 incorporating a multitude of "Follow-Me" applications and one or plurality of associated user interfaces, application

layer 438, a device profile registrar 444, a session manager 448, configuration manager 452, mutual authentication and encryption manager 456, connection manager 460, context manager 464, migration manger 478, user profile registrar 472, policy manager 476, transcoding manager 480, OS abstraction layer 484, MAC control layer 488, and physical layer configurations 490.

The "Follow-Me" applications of 412 consists of VoIP/V2IP 414, IPTV 416, Social Networking 418, online gaming 422, multimedia chatting (e.g., IM client) 424, and multimedia streaming 426. In addition, the client module 412 has the necessary hardware/software functionalities to support satellite/terrestrial TV/Radio 432, and the traditional telephony via PSTN/ISDN 436. In one embodiment, the RISC processor may have TCP/IP and transport protocols such as UDP/SCTP/TCP in addition to MAC and PHY layers.

The Software stack 400 may also include voice/video processing applications and procedures and can have another DSP processor that can be used in conjunction with a general purpose RISC microprocessor. These are not included in order not to obscure the described embodiments – but the details of which are well understood by those of skill in the art.

The device profile registrar 444 of the software stack 400 maintains the details of each multi-functional electronic device of first type 300 that becomes part of the Connected-Home network formed on-demand along with

their location-specific-identifiers, one or plurality of device-/network-specific-identifiers pertaining to one or plurality of communication interfaces each device supports, roles, security credentials, current activity and the like in a device-profile-database. The configuration manager 452 forms the network by first configuring one electronic device of first type 300 as the master and the rest as slaves and subsequently registering/ associating each slave device with the master. The connection manager 460 of the software stack 400 is for establishing a secure physical communication between two or more multi-functional electronic devices prior to any multimedia session migration/routing. The session manager 448 establishes and maintains logical connection in an end-to-end manner as requested by a specific application while the authentication and encryption manager 456 liaises with the device profile registrar 444 to make sure that each electronic device of first type 300 and the Media-Server have been assigned security credentials for mutual authentication and encryption purposes. As it will be noted, only the mutual authentication and encryption manager 456 of the master device assigns security credentials (e.g., asymmetric keys) to each slave electronic device of first type 300 and the Media-Server/PBX-unit at the time of their registration/association with the master, and once assigned the resident mutual authentication and encryption manager 456 of each electronic device of first type 300 enforces mutual authentication and encryption using the asymmetric keys as understood by those of skill in the art.

The user profile registrar 472 of the software stack 400 maintains the details of each registered user such as the unique user-profile-identifier (i.e., Profile ID), entertainment preference in terms of favourite TV/Radio channels/programs, one or plurality of login details, preferred caller/friend list, current activity, current location, proximity to any of said electronic device being part of Connected-Home and the like in a user-profile-database. The policy manager 476 enforces each user's set rules within the Connected-Home environment while avoiding/resolving any conflict with other registered users' set rules. The context manager 464 is included for capturing, processing and providing the context information pertaining to each registered user and each of said electronic devices 300. The migration manager 478 takes responsibility for the successful seamless migration of on-going multimedia sessions or for directing new calls without expecting any user input. The transcoding manager 480 handles the transcoding of multimedia contents if needed, for instance when migration of multimedia content takes place between heterogeneous devices supporting varying codec/bit-rate/resolutions and/or involving different processing/communication protocols.

The mutual authentication and encryption manager 456 is mainly needed for the purpose of ensuring the authenticity of each electronic device of first type 300 and the Media-Server/PBX-unit registered/associated to form a

purposeful Connected-Home network and subsequently to encrypt the multimedia traffic. This aspect is essential from a consumer point of view.

Although this patent does not introduce anything new from public key cryptographic perspectives nor is it within its scope, this section is provided for completeness. The asymmetric key algorithms are used to create a mathematically related key pair: a secret private key and a published public key – these are assigned to each electronic device of first type 300 and the Media-Server/PBX-unit at the time of registration. Use of these keys allows protection of the authenticity of a message originating from any registered electronic device of first type 300 by creating a digital signature of a message using the private key, which can be verified using the public key. It also allows protection of the confidentiality and integrity of a message by encrypting the message using the public key, which can only be decrypted using the private key.

The unique network identifier and location-identifier of each electronic device of first type 300 binds the device's identity. In one embodiment, the location-identifier takes 16-character alphanumeric and the combination of these two identifiers can be used as an index to find the corresponding public keys of another electronic device of first type 300 from the device-profile-database as shown in Fig. 9.

Fig. 5A depicts an exemplary external view of the said multi-functional electronic device of first type 300. The electronic device of first type 300 may have one or more input structures such as push buttons, toggle switches or dials on the outside of its electronic housing. Each input structure may be configured to activate a different function. The said electronic device of first type 300 consists of a electronic visual display unit 548 (i.e., video panel/screen) to render the multimedia content being migrated/routed via/from Media-Server or streamed directly from external servers, a pair of speakers 556, one or plurality of wireless transceiver antenna 546, a main settings button 520 and associated arrow keys 508, 512, 516, and 528, for making different configuration/multimedia/user settings. The electronic visual display unit 548 can also be used to display the current status of various settings, configuration of the device like whether it is a master device or slave device, whether it has been registered with any master device, and/or time/date/day/calendar.

The said electronic device of first type 300 has a microphone 504 configured to receive an audio signal input supporting a wide variety of appropriate audio codecs, a video camera 550 configured to receive an video signal input supporting a wide variety of appropriate video codecs, a speaker 556 configured to playback the received audio signal. In one embodiment the electronic visual display unit 548 can be based on Thin-Film Transistor (TFT)

preferably employing Quarter Video Graphics Array configured to playback the received video signal in an appropriate format.

The said electronic device of first type 300 has a power-on switch 538 to turn itself on and off, one set of on-off toggle switch 542 to turn on/off the video camera 550, and another set of on-off toggle switch 536 to turn the microphone 504 on/off. The electronic device of first type 300 has its own power supply.

Electronic buttons 532 are used to zoom in and zoom out the instantaneous multimedia content being viewed on the electronic visual display unit 548. Electronic toggle switch 530 is used to activate/deactivate muting of the speaker 556. The said electronic device of first type 300 contains two sets of soft/physical keypads. In 500, only the physical keypads 558 and 560 are shown although they can be soft or on-screen in case the electronic visual display unit 548 is equipped with touch sensor or used to work with a stylus.

According to one embodiment of the present invention, the said multi-functional electronic device of first type 300 takes extra functionality to accept migrated/directed telephone call, and hence has the handset 554. In this respect, as it will be explained the chosen master base station will maintain a connection to the standard PSTN/PLMN/ISDN directly or via a PBX-unit. Connection to the standard PSTN/PLMN/ISDN is possible with an RJ-11

connector, a T1 line interface connector, an ISDN line connector, a wireless cellular subscriber air interface connector or the like.

In order to monitor the user movement within the Connected-Home, unit 552 houses one or plurality of pyroelectric sensors which can detect the heat rays being emitted from a human body such that it can sense the presence of even a stationary human body. As mentioned before, its purpose is to detect a human body movement and activate the RFID reader 510 for correctly identifying the user.

Each multi-functional electronic device of first type 300 has a plurality of setting keys/buttons 506, 508, 512, 516, 520 and 528 that allow the user to locally change the brightness, contrast and colour depth of the video footage being viewed in the electronic visual display unit 548, to manipulate the volume control locally, configure the initial Connected-Home network, and create/maintain a user profile. The middle button 520 of the button-set 506 is the main settings button and the long-press of that allows the user to set the final value. Once set, the final values will be stored automatically in an internal non-volatile memory.

Also, the continuous short pressing of the right/left-hand side-arrow key 512/516 cycles through all these setting operations, and this can be viewed on the electronic visual display unit 548. Once a particular setting is selected, the user preferred values for each chosen setting are set with the help of up-and-

down arrow keys 508 and 528 – again this can be viewed on the electronic visual display unit 548. For instance, in order to set the brightness, the user has to continuously short-press right/left-hand side-arrow key 512/516 until the brightness setting mode is selected and subsequently to correct the value for the chosen mode, the user has to set using the down-up arrow keys of 506.

In order to setup the Connected-Home and to support the physical location specific registration of each multi-functional electronic device of first type 300, each device of first type 300 is equipped with a unique set of keys/buttons as shown in 560 of Fig. 5B. At the time of forming the purposeful Connected-Home system, the user is given the chance to specify whether the user wants to operate a given multi-functional electronic device of first type 300 as a master or slave using keys 580 and 588.

In case a given multi-functional electronic device of first type 300 is used as slave, in order to register/associate it with the master device, a user has to first enter the unique network identifier of the master device when prompted in the electronic display 548 followed by pressing the register key 586. An associated user interface used in this process is exemplarily shown in Fig. 8A. This interface will also allow the user to register a Media-Server or a PBX-unit as well. Also the user has to simultaneously press the preferred location-specific key in order to indicate to the master as to where the given slave device is going to be used within a building/house/office and the like. Location-specific keys/buttons are exemplarily shown by 562, 564, 566 and

568. In case of these keys are on-screen ones, the user has the flexibility to change the name of the location where a given device of first type 300 is to be registered and used instead of using the default location names. For instance, in case a user would like to use a given multi-functional electronic device of first type 300 in the garage, and if this location name is not found in the default location menu, the user can add a new location name or modify the existing one. On the other hand, with the physical keys, the user has to attach a sticker displaying the user-preferred location name onto any of the location keys. De-registration of a slave multi-functional electronic device of first type 300, Media-Server 656 or a PBX-unit 620 from a given master device is possible with the De-Register key 584 – this de-registration process of a multi-functional electronic device of first type 300, Media-Server 656 or a PBX-unit 620 can take place asynchronously at the user's discretion and the associated user interface used in this process is exemplarily shown in Fig. 8B.

Fig. 6 exemplarily illustrates the basic purposeful Connected-Home 600 network formed on-demand. In this location-specific network, one or plurality of slave multi-functional electronic devices 680 are associated with the master device 630 via an interface of first type allowing peer-to-peer interaction between the master device 630 and any slave device 680. Such peer-to-peer interaction is needed for control signalling purposes. Control signalling allows the dissemination of context information including both device and user

specific details (e.g., user location information, public key information), exchange of session related details prior to migration and the like.

In addition to a plurality of multi-functional electronic devices of fist type 300 that take either the master 630 or slave 680 roles, the Connected-Home 600 also consists of a Media-Server 656 that maintains connectivity with the set-top box 648, a residential gateway 644 maintaining connectivity with the Internet 640 and a VoIP gateway 610, an audio/video hub 654, multi-room personal video recorder (PVR) 650 using an interface of the second type. Each slave device 680 and the master 630 can be connected to the Media-Server via a DMA DLNA media client when the Media-Server 656 supports DLNA specification. The set-top box 648 of the Connected-Home 600 can be equipped with a dual tuner for receiving satellite and terrestrial channels while maintaining connectivity with the cable and optical fibre networks and the like.

The master device 630 and each slave device 680 maintain constant connectivity with the Media-Server 656 via an interface of the second type in order to enable migration of multimedia contents (e.g., "Follow-Me-TV/IPTV", "Follow-Me-Chat", "Follow-Me-Social-Networking", "Follow-Me-Radio", "Follow-Me-Video-on-Demand (VoD)", "Follow-Me-Audio-on-Demand (AoD)", "Follow-Me-On-line-Gaming", and the like). Similarly the master 630 and each slave device 680 maintains connectivity with the

standard telephony via a PBX-unit 620 via an interface of the third type in order to support "Follow-Me-Phone".

It is preferred that the interface of the first type is IEEE 802.11g including WiFi-direct. The interface of the second type can be provided on the existing telephone wiring supporting the necessary communication protocols as specified by the Home Phone-line Networking Alliances (HPNA), power-line supporting the necessary communication protocols as specified as part of HomePlug consortium, IEEE 802.11n or coax cabling supporting the necessary communication protocols as specified by the Multimedia over Coax Alliance (MoCA) wherein in order to use power-line each said multi-functional electronic device shall be equipped with a power-line Ethernet or similar adaptors. The interface of third type for directing/migrating a telephone call to the correct multi-functional electronic device of first type 300 depending on instantaneous user movement within the formed Connected-Home network can be implemented based on DECT or Bluetooth specification. If it is based on Bluetooth, it has the following features. Accordingly, the unique network identifiers of each electronic device of first type 300 on the third interface and the PBX-unit are the Bluetooth device address and before any possible interaction, the communicating parties need to pair.

Fig. 7 depicts the exemplary protocol packet being exchanged by the said physical location-specific multi-functional electronic system on a chip (SoC)

310 with its microprocessor containing the software stack as shown in Fig. 4 or each multi-functional electronic device of first type 300 running the said middleware 240 in order to form and maintain the purposeful Connected-Home network and for the purpose of disseminating context information pertaining to each connected device and each registered user. Such a protocol packet can also be used for the purpose of exchanging session related information and device/network-specific identifiers between the target electronic device of first type 300 and the Media-Server 656 or the PBX-unit 620 prior to the migration of a follow-me session.

Fig. 9 illustrates the device specific information the master electronic device 630 holds per each registered slave electronic device 680 in addition to details pertaining to itself, other major functional components of the Connected-Home 600 such as the Media-Server 656 and the PBX-unit 620. Such device specific information is exhaustive and may include location-specific-identifiers, one or plurality of network identifiers pertaining to one or plurality of communication interfaces, roles, security credentials, current activity and the like. These device-specific details are stored in the device-profile-database which can preferably collocate with the master entity 630. Some of the information can form the routing-table needed for directing packets to the correct recipient. For instance, in this example the multi-functional electronic device of first type 300 identified by 169.254.0.4 functions as the master device and holds information such as location-identifier/name, unique

network identifier, operating role (whether master or slave), current communication availability status (i.e., whether engaged or available), recently heard time-stamp, public and private keys (i.e., asymmetric keys) pertaining to each registered/associated slave device. The device specific information as maintained by a slave device holds similar information belonging to neighbouring other devices of the Connected-Home 600 apart from their private keys.

The flow-chart 1000 of Fig. 10 illustrates the high-level steps involved in the formation of Connected-Home 600 being capable of seamlessly migrating an on-going or directing a new telephone call, multimedia session and/or user-specific Internet traffic pertaining to a variety of social networking sites, multimedia chatting, VoIP, online gaming and the like to one of said electronic devices of first type depending on user movement. The existence of the master device 630 is vibrant to the automatic migration of different sessions in the Connected-Home environment. This is why its existence is checked at the decision making stage of 1016 in Fig. 10. If a master functionality does not exist already, an appropriate multi-functional electronic device of first type 300 needs to be first configured as a master at stage 1020. Subsequently other multi-functional electronic devices of first type need to be associated/registered with the master 630 as slave devices 680 in step 1026. This process makes sure that a communication interface of the first type is configured in each device to enable peer-to-peer interaction between any two

multi-functional electronic devices of first type 300. This peer-to-peer network setup is illustrated/discussed in more detail with the help of Fig. 11.

Once the peer-to-peer backbone 670 network is configured using the interface of the first type, the attachment/configuration of the Media-Server 656 will start with the decision making stage of 1036. In the same way a slave device 680 is registered/associated with master 630, a Media-Server 656 will also be associated with the master 630 in step 1040 – but via an interface of the second type. It is preferred that every multi-functional electronic device of first type 300 has IP/Internet connectivity via the interface of the second type. If the master maintains a direct connectivity with a residential gateway 644 having dynamic host configuration functionality, the master will coordinate with the gateway to get ever device assigned a globally unique IP address. Once associated, the mutual authentication and encryption manager functionality of the master 630 will assign the necessary asymmetric keys for the purpose of mutual authentication and encryption. Once it is complete, similar attachment of the PBX-unit via an interface of the third type will follow in steps 1050, 1060 and 1070.

The flow-chart 1100 of Fig. 11 illustrates the steps involved in the formation of purposeful location-specific peer-to-peer backbone network 670 needed to support automatic and seamless migration of follow-me type services and application sessions. This operational network configuration procedure/method can be triggered either manually or when a new device is

turned on for the first time. It is assumed here that physical location-specific multi-functional electronic system on a chip (SoC) 310 with its microprocessor containing the software stack as shown in Fig. 4 or each multi-functional electronic device of first type 300 running the said middleware 240 comprises a unique network identifier pertaining to the communication interface of first type, a specific set of keys connected via the peripheral controller 320 to the device bus 318 and the said specific set of keys include namely Master, Slave, Register and names of different physical locations of a house/building/office and the like for setting a given multi-functional electronic device of first type 300 as a master/slave, registering/associating a multi-functional electronic device of first type 300 with the said master, and registering a given multi-functional electronic device per a given physical location respectively for the physical location-specific multi-functional electronic system on a chip (SoC) 310 with its microprocessor containing the software stack as shown in Fig. 4 for each multi-functional electronic device of first type 300 running the said middleware 240 to compose a purposeful secure peer-to-peer communication backbone 670 with the help of the user.

As shown in Fig. 11, this network configuration procedure/method starts with 1110. At the decision making stage 1114, it will be decided by the physical location-specific multi-functional electronic system on a chip (SoC) 310 with its microprocessor containing the software stack as shown in Fig. 4 or each

multi-functional electronic device of first type 300 running the said middleware 240 whether network configuration has been triggered. If it has already been, at the decision making stage of 1118, the SoC 310 with its microprocessor containing the software stack as shown in Fig. 4 or each multi-functional electronic device of first type 300 running the said middleware 240 will prompt the user to specify whether a master device already exists. In the absence of already configured master 630, one of the first powered on multi-functional electronic device of first type 300 will be set as the master device 630 in the processing step 1122. Once the preferred physical location is chosen for the given multi-functional electronic device of first type 300 in 1126, the unique network identifier of the master 630 pertaining to the communication interface of first type will be displayed in step 1132 for the user to make note of it.

If, on the other hand, a master device 630 already exists, the decision stage 1118 will prompt the user to register every other multi-functional electronic device of first type 300 as a slave 680 once the physical location of each device of first type 300 is decided in step 1136. At the time of slave device 680 registration, information such as the location-specific-identifier and the unique network identifier of each multi-functional electronic device of first type 300 being registered/associated with a master device 630 will be passed on to the master device 630 via the communication interface of first type. Once such information is received, the master 630 will check whether there is

any naming/location-identifier/device-identifier conflict in step 1142. If there is any type of naming/identifier conflict, the parties to the conflict will be notified by the said master 630 to take remedial action in 1180. If, on the other hand, there is no such conflict, the master 630 will assign asymmetric keys to each successfully registered slave device 680 and create a corresponding entry in its device-profile-database or device-specific context information as the processing stage 1144 shows. After each and every successful slave 680 registration/de-registration, the master 630 will disseminate the device-profile-database to every other members of the formed network in step 1148. However, the private keys belonging to each multi-functional electronic device of first type 300 will not be distributed to any peer device other than to their respective owners.

Each slave device 680 periodically disseminates context information packets to indicate that it is still alive along with its communication status (i.e., whether it is already engaged or available for any migration/routing of session) and the user identify if it supports any as indicated in step 1152. On reception of such context information packets, a neighbouring multi-functional electronic device of first type 300 will update the time stamp at which the context information packet is received in step 1160, and such time stamp information is used to trigger an alarm in case the master 630 has not received a context information packet after a time out. The purpose of this alarm is to draw the attention of the user to the faulty condition of a given

multi-functional electronic device of first type 300 that has failed to disseminate context information packets.

The SoC 310 with its microprocessor containing the software stack as shown in Fig. 4 or each multi-functional electronic device of first type 300 running the said middleware 240 comprises a unique device-specific-identifier and a specific set of keys/buttons connected via the peripheral controller 320 to the bus 318 and the said specific set of keys include Settings keys. Such an arrangement liaises with other driver/firmware and enables the user to adjust the picture quality, manipulate the volume control, network setup, user-registration along with preference settings and activate/deactivate various features of the multi-functional electronic device of first type 300 depending on how the settings button and down/up/side arrow keys are pressed by the user and this is governed by the preset setting process as illustrated using the flow-chart 1200 of Fig. 12.

Accordingly, each peer-to-peer SoC 310 with its microprocessor containing the software stack as shown in Fig. 4 or each multi-functional electronic device of first type 300 running the said middleware 240 listens to user settings input via the peripheral controller 320 as shown by the processing stage 1214 of Fig. 12. The continuous short pressing of the right/left-hand side-arrow key 512/516 will cycle through different setting modes. This sequence cycle enables any user to skip any of these setting options and get/revisit to the preferred setting sequence with a continuous short pressing

of the right/left-hand side-arrow key 512/516. The first short-pressing of the right-hand side-arrow key 512 is related to time settings, whereas the Second short-pressing of the right-hand side-arrow key 512 is related to day/date (i.e., calendar) settings; the third short-pressing of the right-hand side-arrow key 512 is meant for adjusting the contrast of the electronic visual display unit 548; the fourth short-pressing of the right-hand side-arrow key 512 will let user adjust the brightness of the electronic visual display unit 548; the fifth short-pressing of the right-hand side-arrow key 512 will let user adjust the colour-depth of the electronic visual display unit 548; the Sixth short-pressing of the right-hand arrow key 512 is related to volume control; the seventh short-pressing of the right-hand side-arrow key 512 will let user perform network setting up procedure to configure a multi-functional electronic device as illustrated by 1000 of Fig. 10; and the eighth short-pressing of the right-hand side-arrow key 512 will let user set user preference in terms of specifying the telephone numbers of the probable callers, preferred TV channels and programs and one or more login credentials pertaining to a wide varieties of Internet sites. It is important to be noted that the new additions can be added to the original sequence or its order of execution can be altered depending on the availability of new additional features that the multi-functional electronic device of first type 300 can incorporate.

Fig. 13 is an exemplarily user interface used by the user-registration procedure. If a regular occupant of a house or any other private

dwelling/settings would like to register with the Connected-Home 600, that occupant has to use one of the multi-functional electronic devices of first type 300 for this purpose. The registration user interface first expects the user to enter the name (user name) along with the unique user-profile-identifier (e.g., Profile ID) of the RFID tag that the given occupant is going to wear or carry around all the time within the Connected-Home 600 environment for this purpose in the spaces provided as shown by 1310. The occupant is also given a chance to specify the telephone numbers of the possible people (i.e., friends, colleagues and the like) from whom the given occupant can expect telephone calls. Each phone number has to be separated by commas and entered in 1310. Then the occupant can optionally specify the favourite TV/Radio channels along with the programs – radio buttons and tick boxes that allow the user to choose more than one choice can be used as shown in 1330 for this purpose to indicate the preferences. The electronic program guide (EPG) can be used to populate the TV/Radio programmes dynamically under each favourite TV/Radio channel. The user is given a chance to enter the login details of one or plurality of Social Networking Sites such as Facebook, MySpace, LinkedIn and the like, multimedia chatting (i.e., IM) clients such as MSN and GoogleChat, VoIP clients such as Skype, Online gaming and the like after clicking each icon as shown in 1340. Various policy rules such as the one that governs the seamless migration of a call/adult-TV when one or plurality of other users are around and the like can be specified in 1350. The list as shown by 1300 is non-exhaustive and can be modified in the future depending on

current trends. All these details are stored centrally in the user-profile-database of the master device 630.

According to one embodiment of the present invention, the provision of a possible caller list will enable the master to infer/identify the right callee whenever a new telephone call is received from the PBX-unit and forward the call automatically to the correct multi-functional electronic device of first type 300 that has detected the latest movement of the callee. In addition, the name of the occupant as specified in 1310 can be used to route a telephone call in case an unknown caller specifies the name of the callee. If the master is equipped with the voice recognition software, on correctly pronouncing the name, it will divert the call to the correct location where the callee is currently around.

According to another embodiment of the present invention, based on each occupant's/user's TV/Radio channel/programme preferences as stored in the user data profile, the master 630 can make the favourite TV/Radio programmes automatically follow a given user in a timely manner within the Connected-Home environment depending on the current movement of that particular user. As mentioned before, each multi-functional electronic device of first type 300 monitors each user movement and notifies the identity of each user to the master device 630 when detected within the serving region. From the current user location information, time of the day and the EPG, the Context-Manager 270/464 of the master device 630 will decide whether any

TV/Radio channel/programme needs to be directed to any user. If it is needed, the Context-Manager 270/464 will coordinate the migration from the Media-Server 656 to the appropriate multi-functional electronic device of first type 300 which has detected the given user's recent movement as long as there is no policy conflict emanating from the migration of the favourite TV/radio channel/programme.

Fig. 14 illustrates the operations carried out by the master 630 in order to seamlessly and automatically migrate a multimedia session (terrestrial/ satellite TV, IPTV, VoD, radio, AoD), telephone call and user-specific Internet traffic pertaining to Social Networking Sites such as Facebook, MySpace, LinkedIn, twitter, and the like, Instantaneous Messaging clients such as MSN, Google Chat and the like, web email clients, VoIP client such as Skype, online gaming and the like. As mentioned before, the PIR sensor unit 380 of each multi-functional electronic device of first type 300 constantly monitors its service region and on detecting the presence of a user it will activate the RFID card reader 390. The RFID reader will in turn identify the user by reading the unique user-profile-identifier (e.g., Profile-ID) as long as the user has registered with the Connected-Home 600. The Client-Module 212/412 immediately informs the master device 630 about the identity of the user being detected by passing the read unique user-profile-identifier (e.g., Profile-ID). The master device 630 will check at the decision making stage 1414 whether it has received any notification by any Client-Module 212/412.

On receiving such notification, the master device 630 will update the user/device-profile-databases with the received information in the processing step 1418. The master will coordinate with the Client-Module 212/412 of the multi-functional electronic device of first type 300 that has detected the user in the processing step 1422 to retrieve all the login information of the user pertaining to a multitude of Social Networking Sites (SNSs) and Instantaneous Messaging (IM), online gaming, email, and VoIP/V2IP clients along with the information of each application type and/or the URL to which each login details are associated with. The Client-Module 212/412 of the device of first type 300 that has detected the user will subsequently let the identified user automatically login in the multitude of applications. This will ensure that all user-specific Internet traffic such as FaceBook, tweets, online gaming, emails, IM and the like will be automatically routed to the device of first type 300 which has detected and identified the user.

In step 1426, through timely capturing and processing of context information pertaining to each registered user and each location-specific electronic device or from the user/device-profile-database 300 the master device 630 checks to see whether the given user has been busy/active in terms of being engaged in any on-going session (TV/radio/Internet/call) or any new follow-me session is due using the unique user-profile-identifier (e.g., Profile-ID) as the index. In case the user is not currently engaged with any session, the master 630 can find out whether any new multimedia session is due to follow the given user

by referring to the user preferences as specified by the user in the user-profile-database, time of the day and the EPG. The master will subsequently check whether any migration/routing of on-going/new session is pending in the decision making step 1430. If there is one, it will be checked subsequently in another decision-making step 1436 whether the session to be migrated/routed falls under the category of follow-me-TV/Radio/IPTV/ VoD/AoD or telephone call. If it is a telephone call, it will be further checked whether the PBX-unit 620 provided the master 630 with a caller-ID in step 1448.

If the caller-ID is provided, the master device 630 will refer to the user-profile-database and try to find out from each registered user's friend/caller list as to who (callee) the call should be directed/migrated based on the caller-ID in step 1456. Once the callee's identity is determined, the master 630 will subsequently determine the callee's current location in terms of the neighbouring electronic device of first type 300 that has notified the latest user movement and hence the target device again from the user/device-profile-databases in step 1464. Once the identity of the possible target device is determined the master can now refer to the user/device-profile-databases to see whether the migration can create any policy conflict (not shown in Fig. 14 though). In the processing step 1482, the master 630 will pass on to each other the unique network identifiers and encryption keys of both the target device to which the call is going to be directed/migrated and the PBX-unit 620 (i.e., the parties concerned) pertaining to the interface of the third type for the

telephone call to be directed/migrated from the PBX-unit via the interface of the third type.

If, on the other hand, in the decision-making step 1448, it is determined that the caller-ID was not provided by the PBX-unit 620, it will be further checked in 1452 whether the master device 630 is capable of recognising voice (i.e., whether it is voice-recognition enabled). If that is the case, it will prompt the caller to pronounce the name of the callee in the processing step 1460. Once the callee's identity is found from the user-profile-database using the user-name as the index, the call can be directed to the device of first type 300 that has detected the callee's recent movement.

If, on the other hand, in the processing step it was figured out that it is a multimedia session like terrestrial/satellite/IP TV or radio channel, VoD, AoD that needs to be migrated, the appropriate entity of the master device 630 will gather the required parameters associated with the on-going/new session from the Media-Server 656. Then the appropriate entity of the master device 630 will determine the suitability of the multi-functional electronic device (i.e., the target device) 300 which has detected the recent/latest movement of the given user for the migration of the on-going session or routing of the new session by considering the user preferences (including the user-set policy rules) and the current context. This decision-making is carried out in step 1468. Once the suitability of the new target device of first type 300 is decided, the policy-conflict issue is checked at another decision-making stage 1472. If the target

device is determined, and on seeing that there will be no policy conflict in relation to migrating/routing the follow-me session, the appropriate entity of the master device 630 will pass the collected on-going/new session related parameters on to the new target multi-functional electronic device of first type 300 along with the encryption details and the transcoding-related information in case transcoding is needed in step 1476. This will then be followed by the notification of the device/network-specific identifiers of both the Media-Server and target device pertaining to the communication interface of second type to each other by the appropriate entity of the master device 630 in step 1480. Once this initial path setup is complete, the appropriate entity of the master device 630 will coordinate with the Media-Server 656 and the new target device of first type 300 for the timely migration/routing of the follow-me multimedia session in step 1486 via the communication interface of second type.

In this arrangement, in order to for the Media-Server 656 to route/re-direct a variety of new/on-going sessions that use either RTSP or SIP to different multi-functional electronic devices of first type 300, the Media-Server 656 has one or more of the following functionalities:

i) Session Border Control

ii) Re-Direct Server

iii) Back-to-back user Agent (B2BUA)

iv) Proxy Server

v) Network Address Translation (NAT) and the like

Fig. 15 shows the exemplary task-list or an online diary that can be displayed on the electronic visual display panel of an enhanced version of the electronic device of first type 100 according to one embodiment of the present invention. According to one embodiment of the present invention, the enhanced version of the electronic device of first type 100 will function as a digital photo frame displaying a sequence of user-uploaded photos on the said electronic visual display panel or displaying a set of user-set task-list (as shown in Fig. 13) with an objective to remind the users of important house-hold/personal jobs that needs to be done on time. The task-list can be created/maintained/deleted manually in case each electronic device of first type 100 possesses a keypad. According to another embodiment, the task-list can be automatically transferred from a mobile-phone, smart-phone, PDA, laptop or similar device by synchronising such an external device with the said master. The master will subsequently store each user-specific task-list locally and push it for it to be displayed by the electronic device of first type 100 that has detected a given user within its configured serving region and informed the master about it.

Claims

1. There is provided a an electronic device of first type having multi-functional communication and entertainment capabilities to form a controlled-network within the premises of a private dwelling, office, apartment and the like, and the said controlled-network consisting of:

iv) one or more electronic device of first type being configured to operate from a specific location of a private dwelling, office, apartment and the like;

v) an electronic device of the second type maintaining a multimedia hub; and,

vi) an electronic device of the third type maintaining constant connectivity with traditional telephony networks such as PSTN/PLMN/ISDN and the like;

wherein one or more electronic devices of first type form peer-to-peer backbone for the controlled-network to operate via the communication interface of the first type, every electronic device of the first type maintaining connectivity with the electronic device of the second type via the communication interface of second type and every electronic device of first type communicate with the electronic device of third type via communication interface of third type.

2. The said electronic device of first type forming the said controlled-network according to claim 1,wherein each of the said electronic devices of first type comprising a unique device-specific-identifier pertaining to a communication interface of first type, a user interface of first type consisting of a specific set of keys/buttons and the said specific set of keys/buttons include Master/Slave, Register and typical names of different physical locations of a house/building/office and the like for setting a given said electronic device of first type as a Master/slave, registering/associating a given electronic device of first type with the said master, and registering a given said electronic device of first type per a given physical location of a private dwelling and the like where the said controlled-network is set to operate respectively in order to compose a purposeful secure peer-to-peer backbone for the said controlled-network with the help of the user, wherein the composition of a purposeful backbone out of two or more of the said electronic devices of first type is triggered automatically when turning on the said electronic device of first type for the first time or manually, and the formation of the said peer-to-peer backbone employing a configuration procedure comprising the steps of:

i) prompting the user to set one of said electronic device of first type to be the master device by pressing one of the said specific set of keys/buttons, if the master does not exist already;

ii) getting the configured master to display the said device-specific-identifier of the said master device pertaining to the communication interface of first type;

iii) prompting the user to turn on each of the other electronic devices of first type, to register each of them as a slave device with the configured master in a physical location-specific manner by entering the said device-specific-identifier of the said master pertaining to the communication interface of first type and, subsequently pressing a physical location specific key and the registration key of the said specific set of keys/buttons simultaneously on the slave device;

iv) on receiving the registration request when the registration key on each of said slave devices being pressed, prompting each slave device to transmit the location-specific-identifier and the said unique device/network-specific-identifier of the slave device pertaining to the communication interface of first type to the master device;

v) on reception of the location-specific and device-specific-identifiers of each registered slave device pertaining to the communication interface of first type, getting the said master device to prepare a device-profile-database;

vi) continuing operations (iii) to (v) for every other slave device;

vii) periodically disseminating the device specific details maintained in a device-profile-database to all the registered devices of the network by the said master device for all devices to know the important details of the of other devices of the formed peer-to-peer backbone;

wherein (de-)registering a new slave device from the existing master can take place asynchronously at the user's discretion and once being part of the said peer-to-peer backbone each of said electronic device of first type periodically disseminating context information packet to all the other devices in the network informing its current status..

3. The said electronic device of first type forming the said controlled-network according to claim 1 or 2, wherein once the said peer-to-peer backbone is formed by first configuring one said electronic device of first type as the master and other devices as slaves, wherein associating/registering the electronic device of second type with the said master via the communication interface of the second type comprising the steps of:

i) prompting the user to get the unique device-specific-identifier of the said electronic device of the second type pertaining to the communication interface of second type;

ii) prompting the user to connect the said electronic device of the second type to the said master via the communication interface of second type and to enter the unique device-specific-identifier of the said electronic device of the second type on the master device;

wherein once associated, the electronic device of second type will be assigned security credentials for mutual authentication and encryption purposes by the said master and an entry corresponding to the electronic device of second type containing its role, device/network-specific-identifier pertaining to the

communication interface of second type will be included in the centralised device-profile-database being maintained by the said master for every electronic device of first type to communicate with the electronic device of second type via the communication interface of second type.

4. The said electronic device of first type forming the said controlled-network according to claim 1 or 3, wherein the said controlled-network is Connected-Home and the electronic device of second type is a Media-Server maintaining connectivity with one or plurality of multimedia content sources, wherein the said Media-Server constantly maintains connectivity with one or more of the following:

i) Set-top box consisting of dual tuner for receiving terrestrial and satellite broadcast/telecast and maintaining cable network connectivity;

ii) Residential Gateway via the said Set-top box or not for the reception of broadband digital TV and multimedia applications;

iii) Multi-Room Personal Video Recorders (MR-PVR); and,

iv) multimedia sources like Media Personal Computer (PC), Personal Media Players, mobile phone, Personal Digital Assistants (PDAs) and similar devices;

wherein the said Media-Server supports home networking standards as specified by Digital Living Network alliance (DLNA), G.hn (also known as G.9960) of ITU-T or similar standardisation bodies like ETSI, and protocols like Universal Plug-and-Play (uPnP) enabling it to network with various

multimedia sources on-the-fly in order to create/maintain its multimedia library.

5. The said electronic device of first type forming the said controlled-network according to claim 1 or 4, wherein the interface of the first type is IEEE 802.11g including WiFi-direct.

6. The said electronic device of first type forming the said controlled-network according to claim 1 or 4, possesses a number of peripheral devices, and the said peripheral devices comprise a microphone being configured to receive an audio signal input supporting a wide variety of appropriate audio codecs, a video camera being configured to receive an video signal input supporting a wide variety of appropriate video codecs, a speaker being configured to playback the received audio signal, an electronic visual display panel being configured to playback the received video signal in an appropriate format, and a on-screen or physical keypad being configured for the said electronic device of first type to get user inputs in connection with turning the said device on/off, device/user-registration and configuration, volume control, picture quality control and the like.

7. The said electronic device of first type forming the said controlled-network according to claim 1 or 6, where each of said electronic device of first type possesses the necessary user interfaces realised through hardware and/or software means along with an electronic visual display unit having a

big form-factor/screen-size, an RFID smartcard reader and a Passive Infra-Red (PIR) sensor for rendering the received video content, for the purpose of reading the contents of RFID smartcard tag being carried by each registered user and detecting especially the human body movement respectively, wherein any new occupant can register with the formed Connected-Home network by following the user-registration procedure only when a given user is given an RFID smartcard tag bearing the unique user-profile-identifier (e.g., Profile-ID) and the said user-registration procedure can be carried out on the said master device or any registered slave device and it comprising the steps of:

i) the user triggering/initiating the user-registration procedure by correctly pressing the corresponding key (i.e., continuously pressing the Settings key until it is triggered);

ii) the user first entering the user-profile-identifier (e.g., Profile-ID) that can be found on the RFID smartcard tag when prompted;

iii) the user having the option to storing the login details associated with various Social Networking Sites such as Facebook, MySpace, LinkedIn, twitter, and the like, Instantaneous Messaging clients such as MSN, Google Chat and the like, web email clients, VoIP client such as Skype, online gaming client, and the like either on the master device or RFID smartcard tag being carried by the user;

iv) the user specifying the favourite TV/Radio channels/programs on terrestrial, satellite and IPTV channels;

v) the user setting rules in terms of when and where to migrate telephone/Internet/multimedia sessions, whether migration to a given device can take place in the presence of one or more other registered users, parental control and the like, and such information will be available to the policy-management functionality of the said master;

wherein all the user-specific details will be stored centrally in the user-profile-database being created and maintained in the said master that is to be indexed using the user-profile-identifier (e.g., Profile-ID).

8. The said electronic device of first type forming the said controlled-network according to claim 1 or 7, where each of the said electronic devices of first type possesses the necessary user interfaces realised through hardware and/or software means along with an electronic visual display unit having a big form-factor/screen-size, an RFID smartcard reader and a Passive Infra-Red (PIR) sensor for rendering the received video content, for the purpose of reading the contents of RFID smartcard tag being carried by each registered user and detecting especially the human body movement respectively, wherein every electronic device of first type updates the master periodically and this updating procedure comprising the steps of:

i) checking the device's current status in terms of whether it handles any on-going multimedia session like over-the-air telecast TV, IPTV or streaming video or listening to any over-the-air broadcast radio station, web audio album, Internet radio or any streaming audio, telephone call, and if so,

information pertaining to the user and the application type associated with the session being handled along with the unique user-profile-identifier (e.g., Profile-ID), location-specific-identifier of the device, its unique network/device-specific-identifier pertaining to different communication interfaces will be transmitted to the said master via the communication interface of first type for it to be processed and subsequently stored in both the user-profile-database and device-profile-database;

ii) in the middle of an on-going session when a user vanishes abruptly without any trace, the said electronic device of first type that originally handled the user session informing the said master via the communication interface of first type;

wherein whenever there is a need to migrate an on-going session, the decision as to when and where to migrate will be taken by the said master device.

9. The said electronic device of first type forming the said controlled-network according to claim 1 or 6, where each of the said electronic devices of first type possesses an RFID smartcard reader and a Passive Infra-Red (PIR) sensor unit for the purpose of reading the contents of RFID smartcard tag being carried by each registered user and detecting especially the human body movement respectively, wherein once the said Connected-Home is formed by first configuring one said electronic device of first type as the master and other devices of first type as slaves and each occupant has individually registered himself/herself with the formed Connected-Home

incorporating a Media-Server, wherein migrating an on-going multimedia session from one said electronic device of first type to another or directing a new multimedia session comprising the steps of:

i) PIR sensor unit of each electronic device of first type constantly monitoring a given geographical location/region of the formed Connected-Home and on detecting any user movement, it triggering the RFID reader;

ii) RFID Smartcard reader of the given electronic device of first type getting activated and trying to read the RFID smartcard tag, if any is around, within the configured geographical location/region of the formed Connected-Home;

iii) On detecting an RFID smartcard tag, the RFID reader reading the unique user-profile-identifier (e.g., Profile-ID), and the currently serving device informing the master about the user's identity by passing on the read unique user-profile-identifier (e.g., Profile-ID);

iv) the said master in turn referring to the user-profile-database and trying to find out whether the given user has been busy/active in terms of being engaged in any on-going session (TV/radio/Internet/call) or any new session is due using the unique user-profile-identifier (e.g., Profile-ID) as the index;

v) on detecting that the given user is currently watching/listening to a multimedia content probably after having been informed by the electronic device of first type (i.e., the source device) which originally handled the session for the user or from the TV/radio/VoD/AoD preference list as indicated by the user in the user-profile-database, time of the day, and the electronic program guide (EPG) if it is decided that a new/existing session

needs to be directed, the automatic and seamless migration of the on-going/new session comprising the steps of:

a) getting the master to first gather the required parameters associated with the on-going/new session from the Media-Server via the communication interface of second type;

b) the said master deciding whether migration of the on-going session or routing of the new session to the new electronic device of first type (i.e., the target device) which has detected the recent/latest movement of the given user is possible;

c) the said master finding out the unique device-specific-identifier of the new electronic device (i.e., the target device) pertaining to the communication interface of second type that has detected the recent/latest movement of the given user from the device-profile-database;

d) if there is no policy conflict and the new target is ready and capable enough, the said master passing the collected session related parameters pertaining to the on-going/new session on to the new target electronic device of first type along with the transcoding-related information in case transcoding is needed;

e) the said master notifying the device/network-specific identifiers of both the Media-Server and target device pertaining to the communication interface of second type to each other;

f) the said master coordinating with the said Media-Server and the new target device to ensure the timely migration/ routing of the on-going/new session respectively.

Wherein the automatic migration of on-going/new session takes place without expecting any user input in order for the session to follow the user depending on the user's movement pattern within the formed Connected-Home network.

10. The said electronic device of first type forming the said controlled-network according to claim 1 or 6. wherein once the said peer-to-peer backbone is formed by first configuring one said electronic device of first type as the master and other devices as slaves, wherein associating/registering the electronic device of third type with the said master via the communication interface of the third type comprising the steps of:

i) prompting the user to get the unique device-specific-identifier of the said electronic device of the third type pertaining to the communication interface of third type;

ii) prompting the user to connect the said electronic device of the third type to the said master via the communication interface of third type and to enter the unique device-specific-identifier of the said electronic device of the third type on the master device;

wherein once associated, the electronic device of third type will be assigned security credentials for mutual authentication and encryption purposes by the said master and an entry corresponding to the electronic device of third type

containing its role, device/network-specific-identifier pertaining to the communication interface of third type will be included in the centralised device-profile-database being maintained by the said master for every electronic device of first type to communicate with the electronic device of third type via the communication interface of third type.

11. The said electronic device of first type forming the said controlled-network according to claim 1 or 10, wherein the electronic device of third type is a PBX-unit being the control entity for the conventional telephone services provided via PSTN, ISDN, PLMN or the like wherein the interface of third type can be provided on the existing telephone wiring supporting the necessary communication protocols as specified by the Home Phone-line Networking Alliances (HPNA), DECT being developed as part of ETSI's CAT-iq 2.0 standardization or Bluetooth, wherein if the interface of the third type is implemented based on Bluetooth specification, it has the following features:

i) unique network identifiers of each electronic device of first type and the PBX-unit pertaining to the interface of third type are the Bluetooth device address; and,

ii) before any possible interaction, the communicating parties need to pair.

12. The said electronic device of first type forming the said controlled-network according to claim 1 or 11, where each of the said electronic devices of first type possesses an RFID smartcard reader and a Passive Infra-Red

(PIR) sensor unit for the purpose of reading the contents of RFID smartcard tag being carried by each registered user and detecting especially the human body movement respectively, wherein once the said Connected-Home is formed by first configuring one said electronic device of first type as the master and other devices as slaves, the said master takes an extra functionality to operate as a master base station that is being configured to communicate with a PBX-unit via an interface of third type for directing/migrating a telephone call to the correct electronic device of first type depending on instantaneous user movement within the formed Connected-Home network, wherein the automatic and seamless migration of the on-going/new telephone call comprising the steps of:

i) PIR sensor unit of each electronic device of first type constantly monitoring a given geographical location/region of the formed Connected-Home and on detecting any user movement, it triggering the RFID reader;

ii) RFID Smartcard reader of the given electronic device of first type getting activated and trying to read the RFID smartcard tag, if any is around, within the configured range;

iii) On detecting an RFID smartcard tag, the RFID reader reading the unique user-profile-identifier (e.g., Profile-ID) and the given electronic device of first type notifying the master about the user's identity;

iv) the said master in turn updating the local user-profile-database and device-profile-database to know the current communication status of each device and the user within the Connected-Home network;

wherein the said master on deciding that directing a new call or migrating an on-going telephone call is imminent on being notified by the local PBX-unit maintaining connectivity with PSTN, ISDN or PLMN along with the caller-ID or on detecting a user movement notification by any electronic device of first type in the middle of an on-going telephone session, the said master will handle directing a new call or migration of on-going call by following the call routing/migration procedure comprising the steps of:

a) referring to the user-profile-database and trying to find out from each registered user's friend/caller list as to who the call should be directed/migrated based on the caller-ID;

b) identifying from the user-profile-database, the exact user to whom the call should be directed/migrated along with the user's current location in terms of the neighbouring electronic device of first type that has notified the latest user movement;

c) finding out the unique device-specific-identifier of the new electronic device of first type (i.e., the target device) pertaining to the communication interface of third type that has detected the recent/latest movement of the given user from the device-profile-database;

d) deciding whether directing/migration of the new or on-going session to the new electronic device of first type (i.e., the target device) which has detected the recent/latest movement of the given user is possible without having to be concerned about any policy conflict;

e) On seeing that there is no policy conflict and the new target is ready and capable enough, the said master passing on to each other the unique network identifiers of both the new electronic device of first type (i.e., the target device) to which the call is going to be directed/migrated and the PBX-unit (i.e., the parties concerned) pertaining to the interface of the third type for the new/on-going telephone call to be directed/migrated from the PBX-unit via the interface of the third type;

Wherein the automatic routing/migration of new or on-going telephone call takes place from the PBX-unit to target device of first type without expecting any user input in order to follow the user depending on the user's movement pattern within the formed Connected-Home network.

13. The said electronic device of first type forming the said controlled-network according to claim 1 or 12, where each of the said electronic devices of first type possesses an RFID smartcard reader and a Passive Infra-Red (PIR) sensor unit for the purpose of reading the contents of RFID smartcard tag being carried by each registered user and detecting especially the human body movement respectively, wherein once the said Connected-Home is formed by first configuring one of the said electronic devices of first type as the master and other devices as slaves, wherein one of the communication interfaces being supported by the said electronic device of first type has an IP network connectivity and has a globally unique IP address assigned and the assignment of such an IP address can be by an external entity having the

Dynamic Host Configuration Protocol (DHCP) functionality, wherein pushing the user-specific Internet traffic pertaining to a multitude of Social Networking Sites (SNSs), Instantaneous Messaging (IM), online gaming, email, and VoIP/V2IP clients to one of the electronic devices of first type comprising the steps of:

i) PIR sensor unit of each electronic device of first type constantly monitoring a given geographical location/region of the formed Connected-Home and on detecting any user movement, it triggering the RFID reader;

ii) RFID Smartcard reader of the given electronic device of first type getting activated and trying to read the RFID smartcard tag, if any is around, within the configured range;

iii) On detecting an RFID smartcard tag, the RFID reader reading the unique user-profile-identifier (e.g., Profile-ID) and the given electronic device of first type notifying the master about the user's identity;

iii) the given electronic device of first type coordinating with the said master to retrieve all the login information of the user pertaining to a multitude of Social Networking Sites (SNSs) and Instantaneous Messaging (IM), online gaming, email, and VoIP/V2IP clients along with the information of each application type and/or the URL to which each login details are associated with;

iv) the given electronic device of first type liaising with the local corresponding application module to automatically executing the user login-

on a multitude of Social Networking Sites (SNSs) and Instantaneous Messaging (IM), online gaming, email, and VoIP/V2IP clients;

v) the given electronic device of first type liaising with the corresponding application module to pull the Internet traffic, if any, pertaining to a multitude of Social Networking Sites (SNSs) and Instantaneous Messaging (IM), online gaming, email, and VoIP/V2IP clients;

wherein depending on the instantaneous movement, the registered user has the benefit of getting the user-specific Internet traffic dynamically routed to one of the said electronic devices of first type that serves the geographical area of the Connected-Home network where the user is currently located and detected.

14. The said electronic device of first type forming the said controlled-network according to claim 1 or 13, wherein the said master device is operable to create a device-profile-database initially in the said master device and the said device-profile-database creation process comprising the steps of:

i) creating an entry corresponding to the master;

ii) On reception of registration request from each slave device, and other heterogeneous devices such as the Media-Server, PBX-unit and the like, creating an entry corresponding to each successfully registered device;

wherein each entry consists of location identifier, unique device/network-specific-identifiers pertaining to a variety of communication interfaces, role (i.e., whether master, slave, Media-Server, PBX-unit), public and private keys

assigned by the said mutual authentication and encryption functionality of the master, main communication interfaces supported, current status pertaining to each and every registered device of the purposeful Connected-Home network being composed into in terms of the identifiers of the users being served/detected.

15. The said electronic device of first type forming the said controlled-network according to claim 1 or 14, wherein the said master device is operable to broadcast the contents of the device-profile-database excluding the private key details of each device after each new addition/removal of devices to/from the said purposeful Connected-Home network for each of the registered devices to maintain its own local device-profile-database that does not have the information of private keys pertaining to other heterogeneous electronic devices being part of the Connected-Home.

16. The said electronic device of first type forming the said controlled-network according to claim 1 or 15, wherein each electronic device is operable to broadcast a context information packet periodically to inform its current communication status to all the registered devices of the formed purposeful Connected-Home network.

17. The said electronic device of first type forming the said controlled-network according to claim 1 or 16, wherein the said master device is operable to assign asymmetric keys to every slave device of first type at the

time of registration, to the Media-Server/PBX-unit when it was associated with the said master, and to the master when the said master was configured and the private key being assigned is notified by the master to the owner whereas all public keys are notified to every registered device.

18. The said electronic device of first type forming the said controlled-network according to claim 1 or 17, an automatic migration of a multimedia session to one electronic device of first type requires an interaction with the Media-Server using the interface of second type, and as part of this process secure communication channels will be established between the electronic device of first type and the Media-Server and on being contacted, the given electronic device of first type:

i) will perform the mutual authentication using the asymmetric keys assigned by the master at the time of device registration;

ii) on successful device authentication, the said Media-Server will b informed of the outcome of the mutual authentication attempt and is made responsible for the encryption/decryption of the multimedia data traffic.

19. The said electronic device of first type forming the said controlled-network according to claim 1 or 18, comprises a specific set of keys and the said specific set of keys include Settings keys and side/up/down arrow keys in order to enable the user to adjust the picture quality, manipulate the volume control, network setup, and user profile creation/maintenance depending on

how the side-arrow and down/up arrow keys are pressed by the user and this is governed by the following preset setting process:

i) the first short-pressing of the right-hand side-arrow key will let user set time using down/up arrow keys and the middle enter button;

ii) the Second short-pressing of the right-hand side-arrow key will let user set day/date using down/up arrow keys and the middle enter button;

iii) the third short-pressing of the right-hand side-arrow key will let user adjust contrast of the electronic visual display unit using down/up arrow keys and the middle enter button;

iv) the fourth short-pressing of the right-hand side-arrow key will let user adjust brightness of the electronic visual display unit using down/up arrow keys and the middle enter button;

iv) the fifth short-pressing of the right-hand side-arrow key will let user adjust colour-depth of the electronic visual display unit using down/up arrow keys and the middle enter button;

vi) the sixth short-pressing of the right-hand side-arrow key will let user adjust the volume using down/up arrow keys and the middle enter button;

vi) the seventh short-pressing of the right-hand side-arrow key will let user perform network setup procedure;

vi) the eighth short-pressing of the right-hand side-arrow key will let user perform user profile creation/maintenance; and,

Wherein continuous short pressing of the right-hand side-arrow key rotates through all the setting options (i.e., the setting sequence goes through a cycle)

and this sequence cycle enables any user to skip any of these setting options and get/revisit to the preferred setting sequence with a continuous short pressing of the right-hand side-arrow key and once the middle enter button is pressed each setting is locally stored in a non-volatile memory for them to be effective in every subsequent power cycle.

20. The said electronic device of first type forming the said controlled-network according to claim 1 or 19, where each of the said electronic devices of first type possesses an RFID smartcard reader and a Passive Infra-Red (PIR) sensor unit for the purpose of reading the contents of RFID smartcard tag being carried by each registered user and detecting especially the human body movement respectively, wherein once the said Connected-Home is formed by first configuring one of the said electronic devices of first type as the master and other devices as slaves, wherein if user-specific task-list or online diary is stored on the master, displaying the user-specific task-list to one of the electronic devices of first type comprising the steps of:

i) PIR sensor unit of each electronic device of first type constantly monitoring a given geographical location/region of the formed Connected-Home and on detecting any user movement, it triggering the RFID reader;

ii) RFID Smartcard reader of the given electronic device of first type getting activated and trying to read the RFID smartcard tag, if any is around, within the configured range;

iii) On detecting an RFID smartcard tag, the RFID reader reading the unique user-profile-identifier (e.g., Profile-ID) and the given electronic device of first type notifying the master about the user's identity;

iii) the given electronic device of first type coordinating with the said master to retrieve user-specific task-list of the user being detected;

iv) the given electronic device of first type displaying the user-specific task-list in its electronic visual display until the given user is detected by the RFID reader;

wherein depending on the instantaneous movement pattern, each registered user has the benefit of getting the user-specific task-list or an on-line diary dynamically routed to one of said electronic devices of first type that serves the geographical area of the Connected-Home network where the given user is currently located and detected and displayed as a way to remind the user/occupant about/of the tasks that are yet to be completed with the time-relevance.

21. There is provided a physical location specific multi-functional electronic system on a chip to form a purposeful Connected-Home network where each said multi-functional electronic device is registered to operate from a given geographic location in a private dwelling, office, building premises and the like to facilitate direct device-to-device interactions in a peer-to-peer manner for control signalling purposes and to support seamless migration of a variety of multimedia sessions/interactions from one of said

multi-functional electronic devices to another without relying on any intermediate base station or user input, and the System on a chip comprising:

i) a bus,

ii) a peripheral controller being coupled to said bus for connecting a multitude of I/O peripheral devices;

iii) one or plurality of microprocessors being coupled to said bus and said microprocessors configured to perform the required signal processing associated with the multimedia traffic and to provide control functions of said multi-functional electronic device;

iv) a communication controller being coupled to said bus for connecting to one or plurality of communication interfaces for transmitting and receiving multimedia traffic via the communication interfaces; and,

v) a memory that is coupled to said bus into which a plurality of instructions are loaded,

wherein the said System on a chip composes a purposeful Connected-Home system on-the-fly by getting each said multi-functional electronic device to join while providing mechanisms for operations such as:

a) configuring a unique network identifier for each of the said multi-functional electronic devices;

b) setting exactly one of said multi-functional electronic devices to be the master device and the rest as slave devices just for the purpose of secure registering/associating of said multi-functional electronic devices with one another;

c) associating/registering each slave device with the said master device in a physical location-specific manner using the set unique network identifier of the latter and this process passes information such as each slave device's specific location name along with its unique network identifier on to the said master device via the said preferred communication interface;

d) letting the said master device maintain a device-profile-database in its memory that maps location-specific name of each registered multi-functional electronic device along with the corresponding said unique network identifier;

e) letting the said master device exchange the said device-profile-database with all the other associated/registered slave devices periodically via the said preferred communication interface;

wherein each said multi-functional electronic device has the necessary hardware and/or software functionalities for the System on chip to register each said multi-functional electronic per a given geographic location of a private dwelling, office, building premises and the like to form a purposeful Connected-Home system.

22. The said physical location-specific multi-functional electronic system on a chip forming the said Connected-Home system by first configuring one of said multi-functional electronic devices as the master and other devices as slaves according to claim 21, where the said master constantly interacts with the Media-Server, wherein the said multi-functional electronic system on a chip further handles such operations as:

i) providing a user interface for each occupant to register with the Connected-Home system and the said master automatically maintaining such details of each registered user as the unique user-profile-identifier (i.e., Profile-ID), entertainment preference in terms of favourite TV/Radio channels/programs, one or plurality of login details, preferred caller/friend list, current activity, current location, proximity to any of said multi-functional electronic device being part of Connected-Home system and the like in a user-profile-database;

ii) capturing, processing and providing the context information pertaining to each registered user and each of said electronic devices;

iii) handling the transcoding of multimedia contents if needed, for instance when migration of multimedia content takes place between heterogeneous devices supporting varying codec/bit-rate/resolutions and/or involving different processing/communication protocols; and,

iv) incorporating a Client-Module for rendering the multimedia content when a call/Internet/multimedia session is migrated by liaising with the respective application modules, periodically updating the master with the unique user-profile-identifiers of the users being detected within is service region and the like,

wherein once the purposeful Connected-Home system is formed, the said system on chip is operable to liaise with varying entities in order to enable seamless and autonomous migration of call/Internet/multimedia session from one said electronic device to another depending on user movement within a Connected-Home environment without expecting any user input.

23. The said physical location-specific multi-functional electronic system on a chip forming the said Connected-Home system according to claim 21 or 22, wherein certain functionalities of the system on a chip such as maintaining detailed databases pertaining to each registered user/device centrally and total control of session migration are activated only when the said multi-functional electronic device operates as the master whereas the Client-Module functionality along with local transcoding will be running in each of said multi-functional electronic device.

24. The said physical location-specific multi-functional electronic system on a chip forming the said Connected-Home system according to claim 21 or 23, where each said multi-functional electronic device possesses an RFID smartcard reader and a Passive Infra-Red (PIR) sensor unit that are coupled to said bus via the said peripheral controller for reading the unique user-profile-identifier (e.g., Profile-ID) of the RFID smartcard tag being carried by each registered user and detecting especially the human body movement respectively, wherein once the said Connected-Home is formed by first configuring one said multi-functional electronic device as the master and other devices as slaves and the user carried out the user-registration procedure to register each individual occupant with the formed Connected-Home incorporating a Media-Server, wherein migrating an on-going multimedia session seamlessly from one said multi-functional electronic device to another

or directing a new multimedia session without expecting any manual intervention comprising the steps of:

i) PIR sensor unit of each multi-functional electronic device constantly monitoring a given location and on detecting any user movement, it triggering the RFID reader;

ii) RFID Smartcard reader of the given multi-functional electronic device getting activated and trying to read the RFID smartcard tag, if any is around, within the configured range;

iii) On detecting an RFID smartcard tag, the RFID reader reading the user-profile-identifier (e.g., Profile-ID) and informing the master about the user's identity;

iv) the said master in turn referring to the user-profile-database and trying to find out whether the given user has been busy/active in terms of being engaged in any on-going session (TV/radio/Internet/call) or any new session is due using the unique user-profile-identifier (e.g., Profile-ID) as the index;

v) on detecting that the given user is currently watching/listening to a multimedia content probably after having been informed by the said electronic device (i.e., the source device) that originally handled the session for the user or from the user TV preference list, time of the day, and the electronic program guide (EPG) the context manager gathers that a new/on-going session needs to be directed, the actual autonomous migration of a session comprising the steps of:

a) getting the master to first gather the required parameters associated with the on-going/new session from the Media-Server,

b) getting the master to decide whether migration of the on-going session or routing of the new session to the new multi-functional electronic device (i.e., the target device) which has detected the recent/latest movement of the given user is possible;

c) getting the master to find out the unique device-specific-identifier of the new multi-functional electronic device (i.e., the target device) pertaining to the preferred communication interface that has detected the recent/latest movement of the given user from the device-profile-database;

d) getting the master to pass the collected on-going/new session related parameters on to the new target multi-functional electronic device along with the transcoding-related information in case transcoding is needed;

e) getting the master to notify the device/network-specific identifiers of both the Media-Server and target device pertaining to the preferred communication interface to each other;

f) getting the master to coordinate with the said Media-Server and the new target device to ensure the timely migration/routing of the on-going/new session respectively.

Wherein the autonomous migration of on-going/new session takes place without expecting any user input in order to follow the user depending on the user's movement pattern within the formed Connected-Home network.

25. There is provided a method for transforming two or plurality of multi-functional electronic devices having the required hardware/software features into a purposeful Connected-Home system enabling direct device-to-device interaction in a peer-to-peer manner for control signalling purposes that are required to support seamless migration of a variety of multimedia sessions/interactions from one of said multi-functional electronic devices to another, wherein different multi-functional electronic devices are connected via one or variety of interfaces with each other, wherein forming a purposeful Connected-Home system has a pre-set start-up procedure/method that can be triggered either automatically on the very first switch on or manually and to support this each multi-functional electronic device has the necessary user interface realised through appropriate hardware, software or combination of both, and the said pre-set start-up procedure/method comprising the steps of:

i) getting each peer multi-functional electronic device assigned a globally unique network identifier (e.g., IP Address) by connecting to an existing network server (e.g., having DHCP functionality and the like);

ii) choosing one device as the master device and subsequently registering/associating one or more of other peer multi-functional electronic devices as slaves with a master by manually entering the said unique network identifier (e.g., IP address) of the said master device in the required place as requested by the registration process window in each of slave devices, and the registration process comprises the following steps:

a) Getting the user to choose each slave device's preferred geographical location where it is going to be located and operating from the menu/keys provided by the user interface of each multi-functional electronic device;

b) if no user-preferred location name exists in the standard menu provided by the default user interface, allowing the user to make new addition or to edit the existing names such that the preferred location name will appear;

c) prompting the user to press the preferred location name and register button to get the new device registered/associated with the said master device;

d) registration process of each slave device (c) above automatically passing information such as each slave device's specific location name along with its unique network identifier on to the said master device in a peer-to-peer manner via any preferred communication interface;

e) the said master device maintaining the device-profile-database by mapping the location name of each registered slave multi-functional electronic device with the latter's unique network identifier (i.e., IP address) on reception of registration request of each slave device;

f) the said master device making sure that each registered slave device has correct information about other peer devices in terms of their location name and the configured network addresses;

g) on detecting name and/or identifier dispute, the said master device notifying the nature of dispute to the devices that are in conflict in order to change their network identifier or name of the location or location where the slave device is to be registered; and,

iii) periodically exchanging the said device-profile-database maintained by the master device with every registered slave device;

wherein once a given slave multi-functional electronic device is associated with the said master device, its current status on the home-screen will appear as registered, and this way once a purposeful Connected-Home system is initially built by following the said stipulated steps, further addition of slave devices to the existing said master device is possible by subjecting every new device to go through the same steps, and de-registration of a slave device is possible by letting the user press the de-register key on the device that is going to be de-registered.

26. The said method for transforming two or plurality of multi-functional electronic devices having the required hardware/software features into a purposeful Connected-Home system according to claim 25, wherein while getting the said master to constantly interact with the Media-Server, the said method handles such operations as:

i) getting each occupant to register with the Connected-Home system via appropriate user interfaces and the said master automatically maintaining such details of each registered user as the unique user-profile-identifier (i.e., Profile-ID), entertainment preference in terms of favourite TV/Radio channels/programs, one or plurality of login details, preferred caller/friend list, current activity, current location, proximity to any of said multi-

functional electronic device being part of Connected-Home system and the like in a user-profile-database;

ii) capturing, processing and providing the context information pertaining to each registered user and each of said electronic devices;

iii) handling the transcoding of multimedia contents if needed, for instance when migration of multimedia content takes place between heterogeneous devices supporting varying codec/bit-rate/resolutions and/or involving different processing/communication protocols; and,

iv) empowering a local client running in each said multi-functional electronic device for rendering the multimedia content when a call/Internet/multimedia session is migrated by liaising with the respective application modules, periodically updating the said master with the unique user-profile-identifiers of the users being detected within the service region and the like,

wherein once the purposeful Connected-Home system is formed, the said method is operable to liaise with varying entities in order to enable seamless migration of call/Internet/multimedia session from one said electronic device to another depending on user movement within a Connected-Home environment without expecting any user input.

27. The said method for transforming two or plurality of multi-functional electronic devices having the required hardware/software features into a purposeful Connected-Home system according to claim 25 or 26, wherein certain functionalities of the said method such as maintaining detailed

databases pertaining to each registered user/device (e.g., user-profile-database and device-profile-database) centrally and total control of session migration/routing are activated only when the said multi-functional electronic device operates as the master whereas each said multi-functional electronic device runs a client module being empowered to perform transcoding whenever needed at the time of multimedia session migration.

28. The said method for transforming two or plurality of multi-functional electronic devices having the required hardware/software features into a purposeful Connected-Home system according to claim 25 or 27, wherein if each said multi-functional electronic device possesses an RFID smartcard reader and a Passive Infra-Red (PIR) sensor unit for the purpose of reading the contents of RFID smartcard tag being carried by each registered user and detecting especially the human body movement respectively, wherein the said method is augmented to migrate/route an on-going/new multimedia session from one said multi-functional electronic device to another comprising the steps of:

i) getting the PIR sensor unit of each multi-functional electronic device to constantly monitor a given region and on detecting any user movement, getting it to trigger the RFID reader;

ii) activating the RFID Smartcard reader of the given multi-functional electronic device and getting it to read the RFID smartcard tag, if any is around, within the configured region;

iii) On detecting an RFID smartcard tag, getting the RFID reader to read the unique user-profile-identifier (e.g., Profile-ID) being stored in the RFID smartcard tag and informing the master about the user's identity;

iv) getting the said master in turn to refer to the user-profile-database and trying to find out whether the given user has been busy/active in terms of being engaged in any on-going session (TV/radio/Internet/call) or any new session is due using the unique user-profile-identifier (e.g., Profile-ID) as the index;

v) on detecting that the given user is currently watching/listening to a multimedia content probably after having been informed by the said electronic device (i.e., the source device) that originally handled the session for the user or from the user TV preference list, time of the day and the electronic program guide (EPG) the migration manager gathers that a new/on-going session needs to be directed, the actual migration comprising the steps of:

a) getting the master to first gather the required parameters associated with the on-going/new session from the Media-Server,

b) getting the master to decide whether migration of the on-going session or routing of the new session to the new multi-functional electronic device (i.e., the target device) which has detected the recent/latest movement of the given user is possible;

c) getting the master to find out the unique device-specific-identifier of the new multi-functional electronic device (i.e., the target device) which has

detected the recent/latest movement of the given user from the device-profile-database;

d) getting the master to pass the collected on-going/new session related parameters on to the new target multi-functional electronic device along with the transcoding-related information in case transcoding is needed;

e) getting the master to notify the device/network-specific identifiers of both the Media-Server and target device to each other;

f) getting the master to coordinate with the said Media-Server and the new target device to ensure the timely migration/routing of the on-going/new session respectively.

Wherein the autonomous migration of on-going/new session takes place without expecting any user input in order to follow the user depending on the user's movement pattern within the formed Connected-Home network.

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Claims searched:	*See covering letter*	**Date of search:**	8 December 2010

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	-	US 2007/0282990 A1 (Kumar et al.) See the whole document and in particular the abstract and paragraphs 3, 4, 11, 13, 19, 23, 31-40, 57 & 60
X	-	WO 2008/094377 A1 (Microsoft Corporation) See in particular the abstract and paragraphs 5, 7, 26-29, 36, 39, 44-47, 50, 71 & 81
X	-	US 2007/0213046 A1 (Li et al.) See in particular the abstract and paragraphs 53, 66, 68, 74, 83 & 92
X	-	US 2004/0202206 A1 (Lee) See the whole document and in particular paragraphs 14, 34, 35, 39, 47 & 66-76
A	-	US 2010/0058412 A1 (Maisonneuve) See the whole document
A	-	US 2006/0092015 A1 (Agrawal et al.) See in particular the abstract and paragraphs 5, 6, 41, 44, 45, 48 & 94
A	-	US 2010/0162335 A1 (Davis) See in particular the abstract

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
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Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{X} :

Worldwide search of patent documents classified in the following areas of the IPC

H04L; H04M; H04N; H04W

The following online and other databases have been used in the preparation of this search report

WPI, EPODOC

International Classification:

Subclass	Subgroup	Valid From
H04L	0029/08	01/01/2006
H04L	0029/06	01/01/2006