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Diab et al.

(54) **METHOD AND SYSTEM FOR UTILIZING A BROADBAND GATEWAY TO PROVIDE ENERGY EFFICIENT MANAGEMENT IN A HOME NETWORK**

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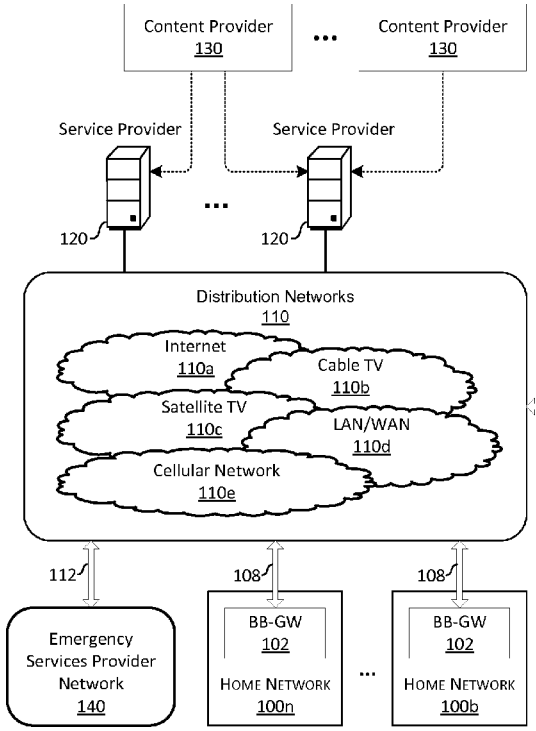
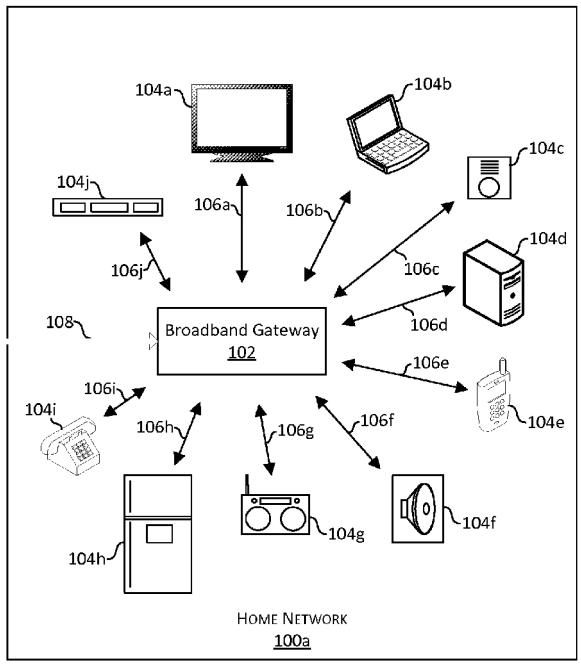
(57) **ABSTRACT**

A broadband gateway may provide energy management service within a home network. The energy management service may enable reducing and/or enhancing energy consumption within the home network. The energy management service may comprise managing one or more devices in the home network by the broadband gateway. The energy management service may be performed based on energy-related information associated with devices, and the information may be stored by the broadband gateway. At least some of the energy-related information may be acquired from the managed devices. The energy management service may comprise controlling and/or configuring the managed devices, and/or communications between the managed devices within the home network. The broadband gateway may track actual energy usage by the managed devices. Information corresponding to energy-related activities and/or usage may be displayed via a user interface. The information may also be reported to entities external to the home network.





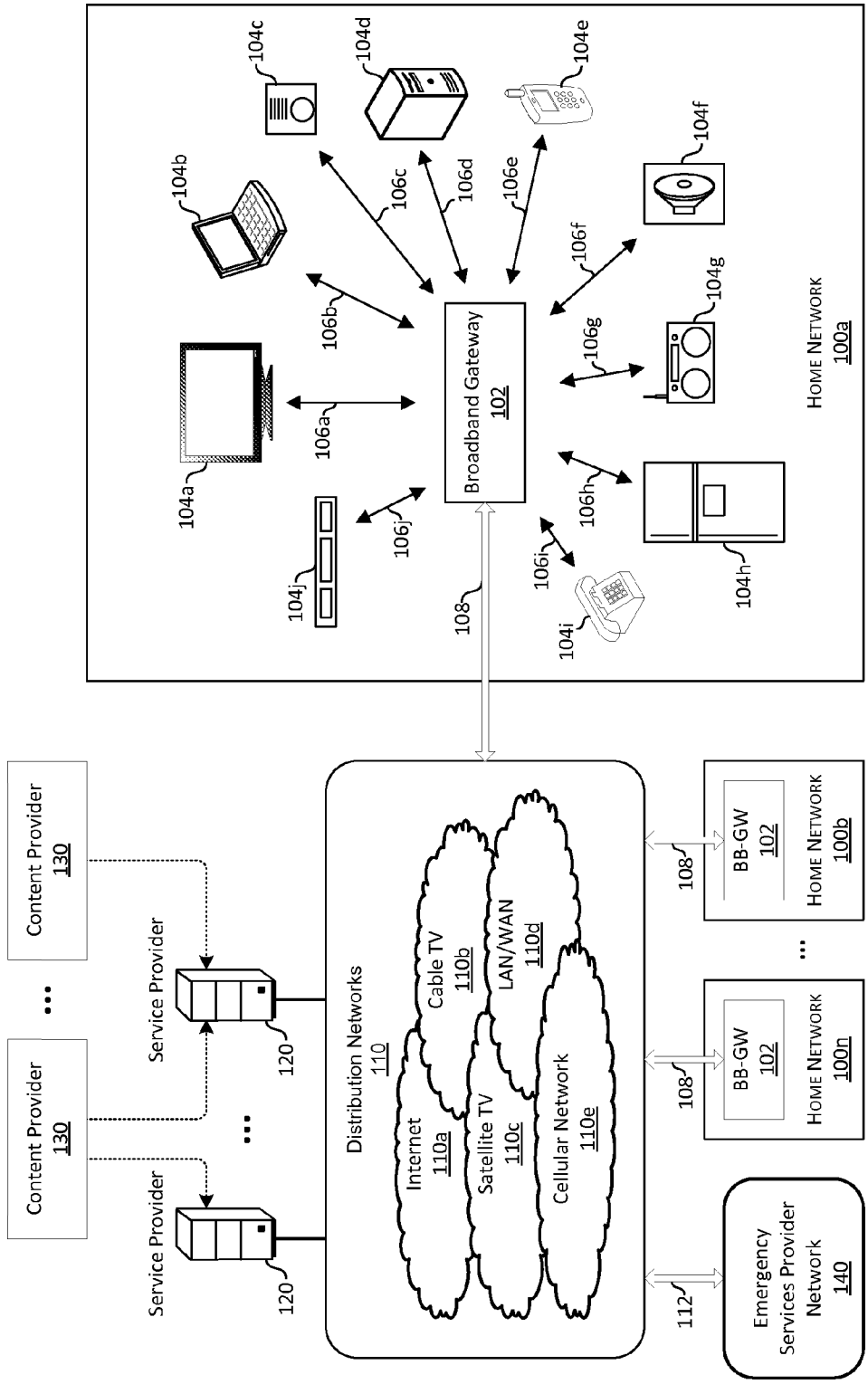

Broadband Gateway
102
HOME NETWORK
100a
104a
104b
104c
104d
104e
104f
104g
104h
104i
104j
106a
106b
106c
106d
106e
106f
106g
106h
106i
106j
108
Content Provider
130
Content Provider
130
Service Provider
120
Service Provider
120
Distribution Networks
110
Internet
110a
Cable TV
110b
Satellite TV
110c
LAN/WAN
110d
Cellular Network
110e
BB-GW
102
HOME NETWORK
100b
BB-GW
102
HOME NETWORK
100n
112
Emergency
Services Provider
Network
140

FIG. 1A

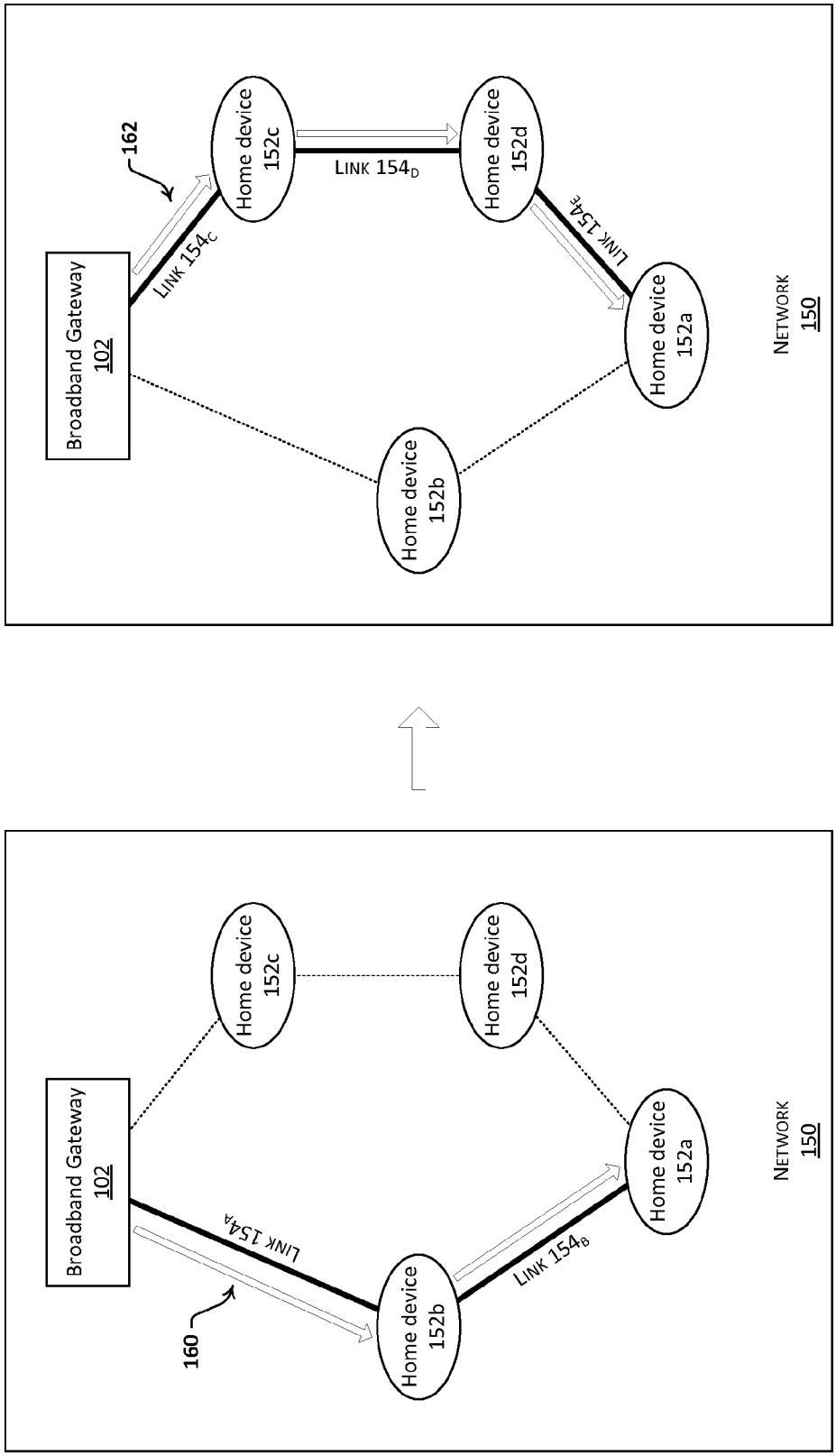

Broadband Gateway
102
162
LINK 154C
Home device
152c
LINK 154D
Home device
152d
LINK 154E
Home device
152a
Home device
152b
NETWORK
150
Broadband Gateway
102
160
LINK 154A
Home device
152b
LINK 154B
Home device
152a
Home device
152c
Home device
152d
NETWORK
150

FIG. 1B

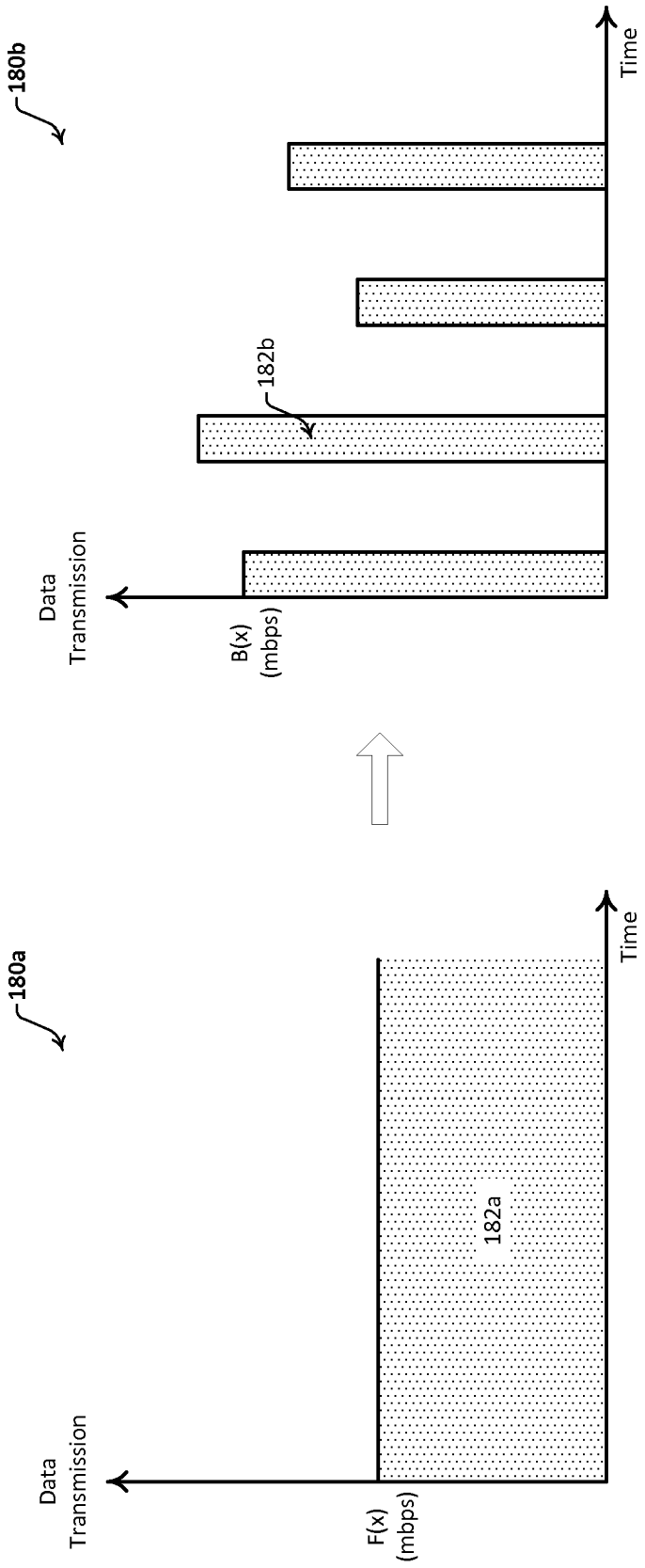

180b
Data Transmission
B(x) (mbps)
182b
Time
180a
Data Transmission
F(x) (mbps)
182a
Time

FIG. 1C

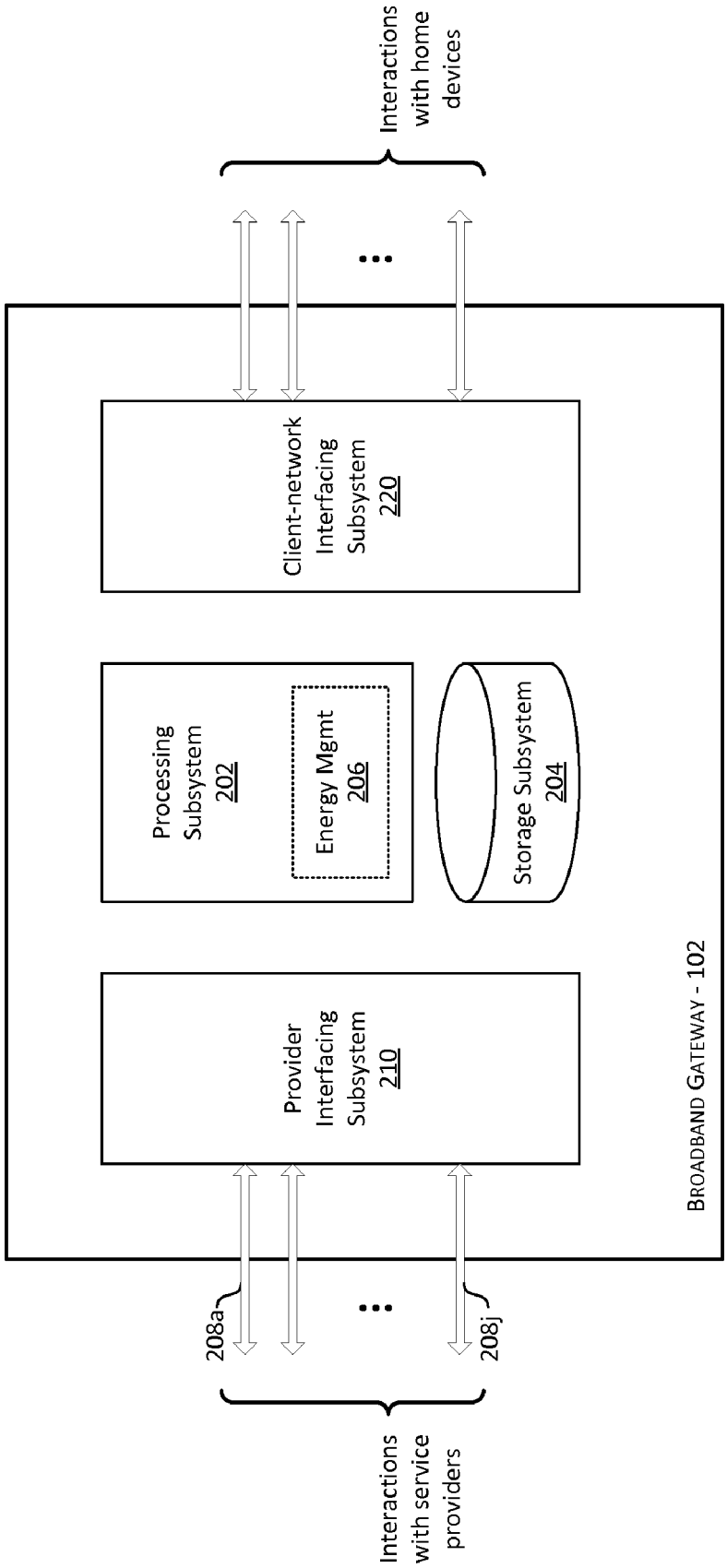

Interactions with home devices
Client-network Interfacing Subsystem 220
Processing Subsystem 202
Energy Mgmt 206
Storage Subsystem 204
Provider Interfacing Subsystem 210
BROADBAND GATEWAY - 102
208a
208j
Interactions with service providers

FIG. 2

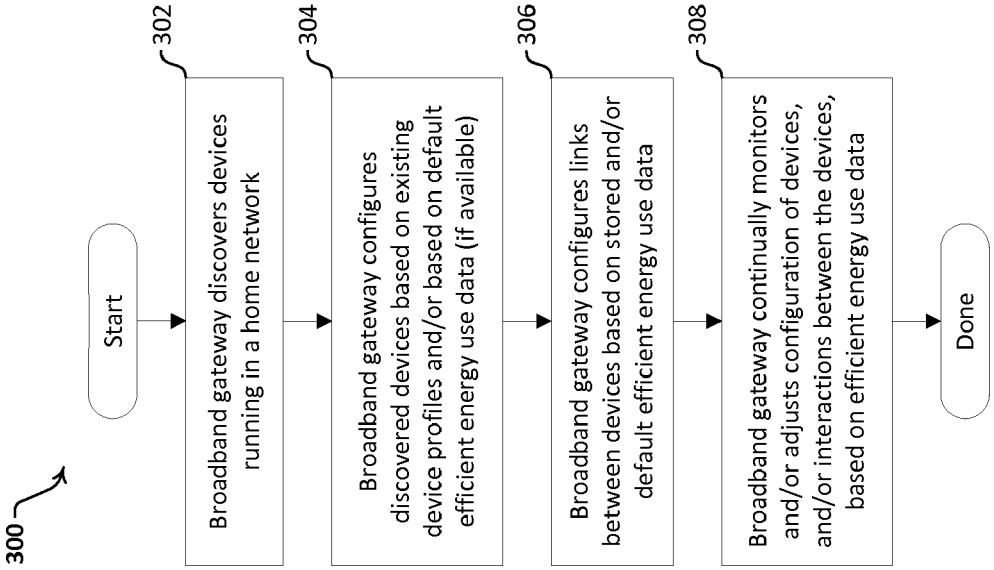

300
Start
302
Broadband gateway discovers devices running in a home network
304
Broadband gateway configures discovered devices based on existing device profiles and/or based on default efficient energy use data (if available)
306
Broadband gateway configures links between devices based on stored and/or default efficient energy use data
308
Broadband gateway continually monitors and/or adjusts configuration of devices, and/or interactions between the devices, based on efficient energy use data
Done

FIG. 3A

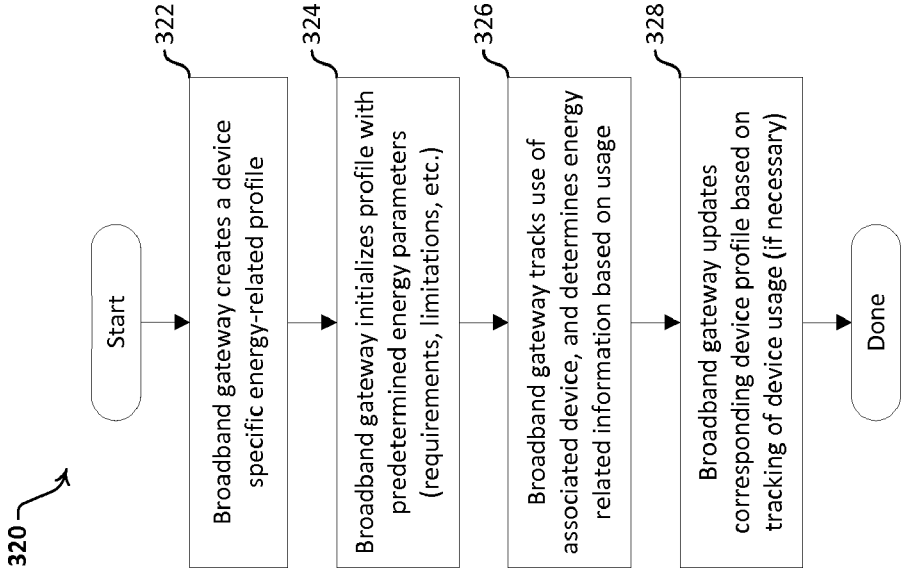

320
Start
322
Broadband gateway creates a device specific energy-related profile
324
Broadband gateway initializes profile with predetermined energy parameters (requirements, limitations, etc.)
326
Broadband gateway tracks use of associated device, and determines energy related information based on usage
328
Broadband gateway updates corresponding device profile based on tracking of device usage (if necessary)
Done

FIG. 3B

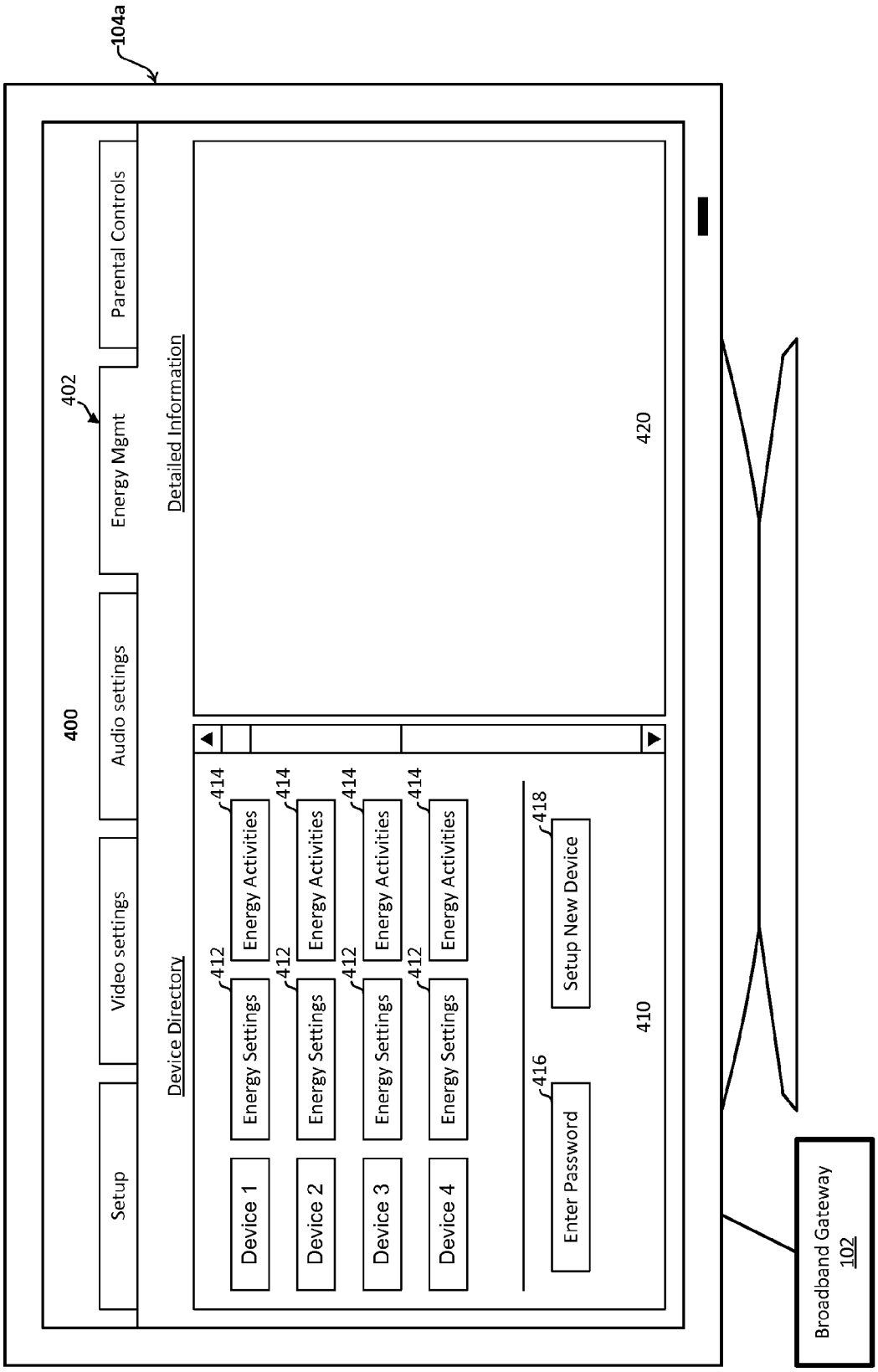

104a
400
402
Setup
Video settings
Audio settings
Energy Mgmt
Parental Controls
Device Directory
Detailed Information
Device 1
Device 2
Device 3
Device 4
Energy Settings
Energy Activities
412
414
416
Enter Password
418
Setup New Device
410
420
Broadband Gateway
102

FIG. 4

METHOD AND SYSTEM FOR UTILIZING A BROADBAND GATEWAY TO PROVIDE ENERGY EFFICIENT MANAGEMENT IN A HOME NETWORK

CROSS-REFERENCE TO RELATED APPLICATIONS/INCORPORATION BY REFERENCE

[0001] This patent application makes reference to, claims priority to and claims benefit from U.S. Provisional Application Ser. No. 61/351,696 filed on Jun. 4, 2010. This application also makes reference to:

[0002] U.S. patent application Ser. No. 12/355,377 (Attorney Docket No. 19545US01) filed on Jan. 16, 2009;

[0003] U.S. patent application Ser. No. 12/355,413 (Attorney Docket No. 19897US01) filed on Jan. 16, 2009;

[0004] U.S. patent application Ser. No. 12/355,480 (Attorney Docket No. 19902US01) filed on Jan. 16, 2009;

[0005] U.S. patent application Ser. No. 12/395,383 (Attorney Docket No. 19910US01) filed on Feb. 27, 2009;

[0006] U.S. patent application Ser. No. _____ (Attorney Docket No. 23398US02) filed on even date herewith;

[0007] U.S. patent application Ser. No. _____ (Attorney Docket No. 23399US02) filed on even date herewith;

[0008] U.S. patent application Ser. No. _____ (Attorney Docket No. 23400US02) filed on even date herewith;

[0009] U.S. patent application Ser. No. _____ (Attorney Docket No. 23401US02) filed on even date herewith;

[0010] U.S. patent application Ser. No. _____ (Attorney Docket No. 23402US02) filed on even date herewith;

[0011] U.S. patent application Ser. No. _____ (Attorney Docket No. 23403US02) filed on even date herewith;

[0012] U.S. patent application Ser. No. _____ (Attorney Docket No. 23399US02) filed on even date herewith;

[0013] U.S. patent application Ser. No. _____ (Attorney Docket No. 23404US02) filed on even date herewith;

[0014] U.S. patent application Ser. No. _____ (Attorney Docket No. 23405US02) filed on even date herewith;

[0015] U.S. patent application Ser. No. _____ (Attorney Docket No. 23406US02) filed on even date herewith;

[0016] U.S. patent application Ser. No. _____ (Attorney Docket No. 23407US02) filed on even date herewith;

[0017] U.S. patent application Ser. No. _____ (Attorney Docket No. 23408US02) filed on even date herewith;

[0018] U.S. patent application Ser. No. _____ (Attorney Docket No. 23409US02) filed on even date herewith;

[0019] U.S. patent application Ser. No. _____ (Attorney Docket No. 23410US02) filed on even date herewith;

[0020] U.S. patent application Ser. No. _____ (Attorney Docket No. 23411US02) filed on even date herewith;

[0021] U.S. patent application Ser. No. _____ (Attorney Docket No. 23412US02) filed on even date herewith;

[0022] U.S. patent application Ser. No. _____ (Attorney Docket No. 23413US02) filed on even date herewith;

[0023] U.S. patent application Ser. No. _____ (Attorney Docket No. 23414US02) filed on even date herewith;

[0024] U.S. patent application Ser. No. _____ (Attorney Docket No. 23415US02) filed on even date herewith;

[0025] U.S. patent application Ser. No. _____ (Attorney Docket No. 23416US02) filed on even date herewith;

[0026] U.S. patent application Ser. No. _____ (Attorney Docket No. 23417US02) filed on even date herewith;

[0027] U.S. patent application Ser. No. _____ (Attorney Docket No. 23418US02) filed on even date herewith;

[0028] U.S. patent application Ser. No. _____ (Attorney Docket No. 23419US02) filed on even date herewith;

[0029] U.S. patent application Ser. No. _____ (Attorney Docket No. 23420US02) filed on even date herewith;

[0030] U.S. patent application Ser. No. _____ (Attorney Docket No. 23421US02) filed on even date herewith;

[0031] U.S. patent application Ser. No. _____ (Attorney Docket No. 23422US02) filed on even date herewith;

[0032] U.S. patent application Ser. No. _____ (Attorney Docket No. 23423US02) filed on even date herewith;

[0033] U.S. patent application Ser. No. _____ (Attorney Docket No. 23424US02) filed on even date herewith;

[0034] U.S. patent application Ser. No. _____ (Attorney Docket No. 23425US02) filed on even date herewith;

[0035] U.S. patent application Ser. No. _____ (Attorney Docket No. 23426US02) filed on even date herewith;

[0036] U.S. patent application Ser. No. _____ (Attorney Docket No. 23427US02) filed on even date herewith;

[0037] U.S. patent application Ser. No. _____ (Attorney Docket No. 23428US02) filed on even date herewith;

[0038] U.S. patent application Ser. No. _____ (Attorney Docket No. 23429US02) filed on even date herewith;

[0039] U.S. patent application Ser. No. _____ (Attorney Docket No. 23430US02) filed on even date herewith;

[0040] U.S. patent application Ser. No. _____ (Attorney Docket No. 23431US02) filed on even date herewith;

[0041] U.S. patent application Ser. No. _____ (Attorney Docket No. 23432US02) filed on even date herewith;

[0042] U.S. patent application Ser. No. _____ (Attorney Docket No. 23433US02) filed on even date herewith;

[0043] U.S. patent application Ser. No. _____ (Attorney Docket No. 23434US02) filed on even date herewith; and

[0044] U.S. patent application Ser. No. _____ (Attorney Docket No. 23435US02) filed on even date herewith.

[0045] Each of the above stated applications is hereby incorporated herein by reference in its entirety.

FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0046] [Not Applicable].

MICROFICHE/COPYRIGHT REFERENCE

[0047] [Not Applicable].

FIELD OF THE INVENTION

[0048] Certain embodiments of the invention relate to audio processing. More specifically, certain embodiments of the invention relate to a method and system for utilizing a broadband gateway to provide energy efficient management in a home network.

BACKGROUND OF THE INVENTION

[0049] With the continuous growth of digital television or broadcast multimedia, and/or broadband access, which may be used in conjunction with online businesses, social networks, and/or other online services and applications, users may desire having access to a larger number of providers and/or a broader range of content in a manner that is flexible and/or suits the users' lifestyles. Most users connect to the Internet using web browsers running on personal computers (PCs) and/or mobile devices such as Smartphones. Furthermore, most households may have one or more televisions that may be used to view television broadcasts and/or multimedia

content. Television broadcasts may include terrestrial TV, Cable-Television (CATV), satellite TV and/or Internet Protocol television (IPTV) based broadcasts. To protect against unauthorized reception and/or use of multimedia content, service providers may require use of dedicated set-top boxes (STBs) that may be used to encrypt broadcast signals communicated from the service providers to generate suitable video and/or audio streams that may be played via televisions and/or other display/playback devices in the household.

[0050] Further limitations and disadvantages of conventional and traditional approaches will become apparent to one of skill in the art, through comparison of such systems with some aspects of the present invention as set forth in the remainder of the present application with reference to the drawings.

BRIEF SUMMARY OF THE INVENTION

[0051] A system and/or method is provided for utilizing a broadband gateway to provide energy efficient management in a home network, substantially as shown in and/or described in connection with at least one of the figures, as set forth more completely in the claims.

[0052] These and other advantages, aspects and novel features of the present invention, as well as details of an illustrated embodiment thereof, will be more fully understood from the following description and drawings.

BRIEF DESCRIPTION OF SEVERAL VIEWS OF THE DRAWINGS

[0053] FIG. **1**A is a block diagram illustrating an exemplary communication system that comprises a home network serviced by a broadband gateway, in accordance with an embodiment of the invention.

[0054] FIG. **1**B is a block diagram illustrating reconfiguration of connectivity between a broadband gateway and a home device based on energy consumption, in accordance with an embodiment of the invention.

[0055] FIG. **1**C is a diagram illustrating energy consumption that may result from utilizing burst mode during transmission within a home network, in accordance with an embodiment of the invention.

[0056] FIG. **2** is a block diagram illustrating an exemplary broadband gateway, in accordance with an embodiment of the invention.

[0057] FIG. **3**A is a flow chart that illustrates exemplary steps for utilizing the gateway to provide energy efficient management in a home network, in accordance with an embodiment of the invention.

[0058] FIG. **3**B is a flow chart that illustrates exemplary steps for utilizing the gateway to generate and/or update device profiles for use in conjunction with energy efficient management services in a home network, in accordance with an embodiment of the invention.

[0059] FIG. **4** is a block diagram illustrating an exemplary user interface generated by a broadband gateway for configuring energy efficient management in a home network, in accordance with an embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0060] Certain embodiments of the invention may be found in a method and system for utilizing a broadband gateway to provide energy efficient management in a home network. In various embodiments of the invention, a broadband gateway, which may communicatively coupled to a plurality of devices in a home network, and/or which may be operable to handle at least one physical layer connection to at least one corresponding network access service provider, may be utilized to provide energy management service within the home network. The energy management service may comprise managing one or more of the plurality of devices in the home network. In this regard, the broadband gateway may maintain energy-related information associated with the serviced devices, and may manage the serviced devices, based on the maintained energy-related data for example. At least some of the energy-related information may be acquired, from at least some of the serviced devices for example. The energy-related information may comprise energy requirements, energy limitations, and/or energy related usage data. The energy management service may comprise controlling and/or configuring the serviced devices, and/or their operations. The energy management service may enable adjusting and/or controlling energy consumption within the home network, such that energy consumption may be reduced and/or optimized. The energy management service may also comprise controlling and/or configuring inter-device communications and/or links within the home network. The broadband gateway may track actual energy use by each of the one or more serviced devices, and the broadband gateway may update and/or modify the stored energy-related information based on that tracking.

[0061] The stored energy-related information may comprise device profiles corresponding to each of the one or more serviced devices. The device profile comprising a plurality of settings for controlling and/or managing energy use in an associated device. The device profiles may be configurable, wherein the profile configuration may comprise initializing and/or modifying one or more of a plurality of settings for controlling and/or managing energy use in an associated device. The broadband gateway may display activity associated with the energy management service via a user interface. This may comprise displaying energy related activities and/or data associated with each of the managed devices. A dedicated energy-related messaging protocol may be used for exchanging energy-related messages and/or data within the home network.

[0062] FIG. **1**A is a block diagram illustrating an exemplary communication system that comprises a home network serviced by a broadband gateway, in accordance with an embodiment of the invention. Referring to FIG. **1**A, there is shown a home network **100***a*, a plurality of distribution networks **110**, a plurality of service providers **120**, and a plurality of content providers **130**. The home network **100***a* may be serviced by a broadband gateway **102**. Also shown in FIG. **1**A are additional home networks **100***b*, . . . , **100***n*, and an emergency services provider network **140**. Each of the home networks **100***b*, . . . , **100***n* may also be serviced by a broadband gateway **102**.

[0063] The service providers **120** may comprise various entities which may provide, using different access technologies, various services to broadband gateways **102** and/or to devices serviced by the broadband gateways **102**, such as the plurality of home devices **104***a*-**104***j*. The services may include, but are not limited to, multimedia, television, Internet, phone, Ethernet, multimedia over coax alliance (MoCA), passive optical network (PON), and/or cellular services, for example. Some of the service providers **120** may comprise network access service providers which provide physical layer connections to the broadband gateway **102**. Such physi-

cal layer connections may then be utilized to access content provided by the content providers **130**, access services provided by other ones of the service providers **120**, and/or access an intranet or the Internet at-large. In this regard, "network access service provider" as utilized herein, is distinguished from the more generic term "service provider" which may encompass services other than providing physical layer access to a network. Cable television providers, plain old telephone service (POTS) providers, digital subscriber line (DSL) providers, cellular providers, WiMAX providers, and satellite providers are examples of network access service providers. In an exemplary embodiment of the invention, the broadband gateway **102** may enable connecting to multiple service providers **120** to facilitate receiving content originating from one or more of the content providers **130**.

[0064] The content providers **130** may comprise various entities and/or networks which may generate, capture, and/or package content that may be distributed to end-users (i.e. "subscribers"), via the service providers **120** and/or the distribution networks **110**. In this regard, content may comprise audio, video, multimedia, e-book, gaming, and/or other content. Exemplary content providers may comprise commercial providers of multimedia content, such as major film or television production and/or distribution companies (e.g. Paramount Pictures or Warner Bros.), and/or providers of personal content (e.g. user-generated content). The content may be, for example, downloadable and/or streaming, rented and/or purchased. Content originating from the content providers **130** may be distributed to the end-users (e.g. consumers) by the service providers **120**. In some instances, content providers **120** and service providers **120** may be separate entities. In some instances, however, a single provider may provide both content and services. That is, an entity that functions as a network access service provider may also provide content and/or services other than network access and, thus, that entity may also be accurately referred to as a "content provider" and/or a "service provider." The content and/or services that are provided by the content provider and/or the service provider may be provided to the broadband gateways **102** via one or more physical connections provided by a network access service provider.

[0065] The plurality of distribution networks **110** may comprise one or more networks that may be operable to enable wireless and/or wired communication among a plurality of local and/or remote entities, based on one or more networking and/or communication infrastructures. In this regard, the plurality of distribution network **110** may be utilized to enable distributing multimedia content generated by the content providers **130**, directly and/or via the service providers **120**, to end-users. The network connectivity available via the plurality of distribution networks **110** may be based on one or more communication standards and/or protocols. The plurality of distribution networks **110** may comprise, for example, Internet **110***a*, the Cable Television (CATV) network **110***b*, Satellite Television (TV) network **110***c*, wireless local network area/wide network area (LAN/WAN) **110***d*, and/or cellular network **110***e*.

[0066] The Internet **110***a* may comprise a system of interconnected networks to enable exchange of data among a plurality of nodes, based on one or more networking standards, including, for example, the Internet Protocol (IP). The Internet **110***a* may enable connectivity among a plurality of private and public, academic, business, and/or government nodes and/or networks. The physical connectivity in the Internet **110***a* may be provided via, for example, the Public Switched Telephone Network (PSTN), copper wires, fiber-optic cables, wireless interfaces, and/or other protocols and/or standards-based interfaces. The transport functionality in the Internet **110***a* may be performed based on, for example, one or more transport protocols, such as the Transmission Control Protocol/IP (TCP/IP), for example. The CATV network **110***b* may comprise suitable distribution nodes, systems, and/or subnetworks that may enable forwarding of communication between CATV providers and a plurality of cable-TV consumers. For example, the CATV network **110***b* may comprise a network of fiber optics and/or coaxial cables for use in CATV broadcasts. The satellite TV network **110***c* may comprise suitable distribution nodes, systems, and/or subnetworks that may enable communication of satellite TV broadcast by satellite TV providers to a plurality of consumers. For example, the satellite network **110***c* may comprise a plurality of orbiting satellite nodes and/or one or more terrestrial centers in a satellite-TV system.

[0067] The LAN/WAN network **110***d* may comprise suitable logic, circuitry, interfaces, and/or code that may be operable to enable implementation of one or more wired and/or wireless LAN or WAN standards and/or protocols. Exemplary WAN technologies comprise, for example, WiMAX-based networks. Exemplary LAN technologies may comprise, for example, those based on IEEE 802.11 standards, including, for example, WiFi-based networks. The cellular network **110***e* may comprise suitable logic, circuitry, interfaces and/or code that may be operable to enable communication via one or more cellular technologies. Exemplary cellular technologies may comprise Code Division Multiple Access (CDMA), wideband CDMA (WCDMA), CDMA1000, High-Speed Downlink Packet Access (HSDPA), Global System for Mobile Communications (GSM), General Packet Radio Services (GPRS), Enhanced Data Rates for Global Evolution (EDGE), and/or Universal Mobile Telecommunication System (UMTS). The cellular network **110***e* may comprise, for example, a plurality of control and/or switching nodes, and a plurality of base stations that enable transmission and/or reception of cellular based communications between the cellular network **110***e* and cellular capable devices.

[0068] Each of the home networks **100***a*-**100***n* may correspond to a location that may comprise a plurality of devices, such as a plurality of home devices **104***a*-**104***j* in the home network **100***a*, which may be serviced and/or managed by an instance of the broadband gateway **102**. In this regard, the location may be a residence (e.g., home, apartment), a small business, a school, a library, and/or other like settings in which users may want to obtain access to service and/or to content provider networks. The broadband gateway **102** may be utilized in a home network, such as the home network **100***a*, to provide connectivity between the home network and one or more of the service providers **120** (and/or one or more of the content providers **130**) via the distribution networks **110**.

[0069] The broadband gateway **102** may comprise suitable logic, circuitry, interfaces, and/or code that may be operable to implement various aspects of the invention. In this regard, the broadband gateway **102** may be operable to communicate with the content providers **130**, the service providers **120**, and the plurality of home devices **104***a*-**104***j*. In this manner, the broadband gateway **102** may enable bidirectional communication of content and/or other information between the con-

tent providers **130**, the service providers **120** and the devices **104***a*-**104***j*. Communications between the broadband gateway **102** and the content providers **130** and/or service providers **120** may be carried over optical, wired, and/or wireless links of the distribution network(s) **110**. Similarly, Communications between the broadband gateway **102** and the devices **104***a*-**104***j* may be carried over optical, wired, and/or wireless links. In an exemplary aspect of the invention, a single broadband gateway **102** may be operable to handle multiple physical layer (i.e., layer 1 of the open-systems interconnection model (OSI)) connections **108** to multiple ones, or portions, of the distribution network(s) **110**, where different ones or portions of the distribution network(s) **110** may be owned, operated, leased, or otherwise associated with different ones of the network access service providers **120**. For example, a first network access service provider may provide network access to the broadband gateway **102** via a DSL connection over twisted-pair cabling, and a second network access service provider may provide network access to the broadband gateway **102** via a cable television connection over coaxial cabling. In some instances, the broadband gateway **102** may be operable to concurrently communicate over the multiple physical layer connections provided by the multiple network access service providers.

[0070] The broadband gateway **102** may operate as an interface device that may allow one or more service and/or content providers to interact with various devices in the home network. In this regard, the broadband gateway **102** may be operable to perform and/or provide various services that may pertain to enabling and/or facilitating reception of content from one or more content providers **130**, wherein the content may be delivered through one or more services providers **120**. For example, the broadband gateway **102** may be operable to perform such operations as network access related processing (e.g. PHY/MAC, and/or transport layer processing), encryption and/or decryption, user and/or account authentication, and/or at least some of video and/or audio processing operations which may be necessary for consumption of multimedia content.

[0071] The broadband gateway **102** may communicate with various devices in the home networks using optical, wired and/or wireless communication links. Devices serviced by, and/or connected with the broadband gateway **102** may comprise content consuming devices and/or other, non-content consuming household or home devices that may be operable to interact with the broadband gateway **102**. For example, the broadband gateway **102** may service, and/or may communicate with the plurality of home devices **104***a*-**104***j* in the home network **100***a*. The home devices may comprise, for example, one or more of a television **104***a*, a laptop computer **104***b*, a smoke detector, a carbon monoxide detector, and/or a security alarm **104***c*, a computer and/or server **104***d*, a mobile phone **104***e*, a speaker **104***f*, an AM/FM radio **104***g*, an appliance **104***h* (e.g., refrigerator), a phone **104***i*, and a digital video recorder (DVR) or personal video recorder (PVR) **104***j*. The broadband gateway **102** may interact with each of the home devices **104***a*-**104***j* via corresponding links **106***a*-**106***j*, which may be supported by the broadband gateway **102** and the corresponding home device. For example, the link **106***a* between the broadband gateway **102** and the television **104***a* may comprise a High-Definition Multimedia Interface (HDMI) cable and/or 60 GHz WiGig wireless connection/interface. The link **106***b* may comprise, for example, a wired Ethernet link, a wireless Ethernet link, a Universal Serial Bus (USB) link, or an IEEE 1394 link. The link **106***c* may comprise, for example, a two-wire link or a wireless link. The link **106***d* may comprise, for example, a wired Ethernet link, a wireless Ethernet link, a USB link, or an IEEE 1394 link. The link **106***e* may comprise, for example, a wireless Ethernet link, a USB link, or a cellular link. The link **106***f* may comprise speaker wire and/or a wireless link. The link **106***g* may comprise, for example, AM and/or FM radio transmissions broadcast received using the broadband gateway **102**. The link **106***h* may comprise, for example, a wired or wireless link. The link **106***i* may comprise, for example, a phone line. The link **106***j* may comprise, for example, a wired or a wireless link. Although in the embodiment illustrated in FIG. **1**A the home devices **104***a*-**104***j* are shown as being communicatively coupled to only the broadband gateway **102**, the invention may not be so limited. Accordingly, the devices **104***a*-**104***j* may be communicatively coupled to multiple broadband gateways in a local or home network, and/or may be communicate directly, without departing from the spirit and scope of various embodiments of the invention.

[0072] The broadband gateway **102** may also be operable to provide and/or support various other, non-content related services in the home network **100***a*. For example, the broadband gateway **102** may provide emergency-related services in the home network **100***a*. For example, the emergency services provider network **140** may be connected to the distribution networks **110** via a link **112**. The emergency services provider network **140** may be associated with one or more emergency service provider entities. For example, a public entity such as a 911 center and/or a private entity such as a security company may be able to interact with the broadband gateway **102** in the home network **100***a* via the distribution networks **110**.

[0073] The broadband gateway **102** may also be operable to provide energy related services in the home network **100***a*. In this regard, the energy related services provided by the broadband gateway may enable optimizing energy use and/or reducing overall energy consumption in the home network **100***a*, or by serviced devices therein, and/or may enable capturing, claiming, and/or redeeming energy saving and/or efficiency credits/rewards that may be available. For example, the broadband gateway **102** may be operable to provide energy management services within the home network **100***a*. In this regard, as described hereafter in more details, the energy management service may comprise controlling and/or configuring one or more devices in the home network **100***a*, and/or operations thereof, to enable reducing energy consumption for example.

[0074] While the broadband gateway **102** is shown in FIG. **1**A as a single and separate device, the invention need not be so limited. In one embodiment of the invention, the broadband gateway functionality may be implemented in a distributed manner over two or more devices. Furthermore, the broadband gateway may be implemented as a virtual platform, for example in instances where it may be implemented in distributed manner. In another embodiment of the invention, some or all of the functionality of the broadband gateway may be implemented within one of the televisions available in the home.

[0075] As illustrated in FIG. **1**A, a plurality of home networks **100***b*, . . . , **100***n*, may also be connected to the distribution networks **110**. These home networks **100***b*, . . . , **100***n* may operate in substantially the same manner as the home network **100***a*. By having multiple home networks connected to the distribution networks **110**, various applications, such as

peer-to-peer communication and/or data aggregation operations may be possible by utilizing the broadband gateways **102** in the home networks.

[0076] In operation, the broadband gateway **102** may be utilized as an interface device that may allow one or more service providers **120**, content providers **130**, and/or emergency service provider networks **140** to interact with various devices in a home network, such as in the home network **100***a*. In this regard, the broadband gateway **102** may support configuring and/or using the plurality of broadband connections **108**. The broadband connections **108** may comprise optical, wired and/or wireless connections between the broadband gateway **102** and the distribution networks **110**, to enable communication between the broadband gateway **102** and the service providers **120**, content providers **130**, and/or emergency service provider networks **140** for example. The broadband gateway **102** may be operable to perform and/or provide various services that may pertain to enabling and/or facilitating reception of data, such as multimedia content, for example, from one or more content providers, wherein the content may be delivered through one or more services providers. The broadband gateway **102** may distribute the received content to one or more devices in a home network, for consumption, and/or may perform, directly and/or indirectly using other devices, any processing and/or operations (e.g., decryption and/or account validation) that may be needed to ensure that the content may be consumed by the target home device(s).

[0077] The broadband gateway **102** may also provide and/or support various other services in the home network **100***a* beyond, and/or in conjunction with supporting or facilitating reception, download, and/or consumption of content. For example, the broadband gateway **102** may provide energy related services in the home network **100***a*. In this regard, the energy related services provided by the broadband gateway may enable optimization of energy consumption and/or reducing overall energy consumption in the home network **100***a*, and/or may enable capturing, claiming, and/or redeeming energy saving and/or efficiency credits/rewards that may be available. The broadband gateway **102** may be operable to provide, for example, energy management service within the home network **100***a*. In this regard, the energy management service provided by the broadband gateway **102** may comprise configuring, managing, and/or controlling one or more of the plurality of home devices **104***a*-**104***j*, and/or operations performed thereby, to enable reducing and/or optimizing energy consumption. The power management service may also comprise managing, configuring and/or adjusting interactions between the broadband gateway **102** and the home devices **104***a*-**104***j*, and/or among the home devices **104***a*-**104***j*, to enable reducing and/or optimizing energy consumption. In this regard, optimal paths and/or optimal communication configuration may be selected based on energy consumption parameters and/or criteria for example, as shown in more details in FIG. 1B.

[0078] For example, at least some of the home devices **104***a*-**104***j* may be configured and/or utilized in a plurality of ways, with corresponding different energy needs, limitations, configuration parameters, and/or energy-related device usage data, which may comprise use pattern and/or temporal related information. Some devices, such as the refrigerator **104***h* for example, may operate at different modes and/or settings. For example, with respect to the refrigerator **104***h*, the different settings may correspond to different temperature ranges at which the refrigerator **104***h* may maintain items stored within it. Operating at each of these temperature ranges may translate to different energy consumption profile. Some devices, such as the laptop computer **104***b* or the server **104***d*, may be operable to operate in and/or transition to different states, which may comprise low-power or power-saving states. In this regard, exemplary low-power and/or power-saving states may comprise disabling, shutting down, and/or reducing power consumption of the devices, and/or components and/or resources thereof, transitioning to these states. Accordingly, the broadband gateway **102** may be operable to determine when and/or if devices within the home network **100***a*, can be configured, setup and/or transitioned to operate in power-saving mode, setting, and/or state. The broadband gateway **102** may then communicate commands to corresponding home device to effectuate any such configuration, setup, and/or transition.

[0079] The power management service may also comprise managing, configuring and/or adjusting interactions between the broadband gateway **102** and the home devices **104***a*-**104***j*, and/or among the home devices **104***a*-**104***j*, which may enable reducing and/or optimizing energy consumption in the home network **100***a*. In this regard, certain characteristics and/or parameters of communications within the home network **100***a* may have energy efficiency implications, and may be adaptively configured and/or adjusted by the broadband gateway **102** accordingly to reduce and/or optimize energy consumption. Exemplary characteristics and/or parameters that may have energy efficiency implications may comprise transmission bitrates, type of physical layer (PHY) used, mode of operation and/or transmission, and/or communication paths or routes. For example, the broadband gateway **102** may determine, with regard to each link utilized in communicating data within the home network **102**, whether each of both devices utilizing a particular link have the capability to reconfigure the physical (PHY) layer speed and/or scheduling of packet transmission, which may enable realizing energy saving by taking advantage of these capabilities. Discovery of capability may be performed as PHY layer based discovery, such as with extended page auto-negotiation; layer 2 (L2) based discovery, such as by utilizing Link Layer Discovery Protocol (LLDP) messages; and/or layer 3 (L3) based discovery. Accordingly, based on discovered capabilities, the broadband gateway **102** may adjust, modify, and/or reconfigure PHY layer(s), transmission scheduling, and/or network stack based buffering corresponding to each link. Accordingly, managing, configuring and/or adjusting inter-device interactions may comprise performing bitrate selection, PHY layer selection, and/or mode selection. For example, a serviced home device, such as the server **104***d*, may support links that enable communication at high bitrates and/or with certain features (e.g. full-duplex), such as 10 GBASE-T links for example. Handling such links, however, may necessitate extensive processing and/or buffering, which may translate to higher power consumption. Accordingly, in instances where the broadband gateway **102** may determine bitrates and/or features actually required, based on limitations within the home network **100***a* and/or external to it for example, the broadband gateway **102** may communicate with the corresponding devices to enable configuring links to support only anticipated required bitrates and/or to turn off some features deemed unnecessary, such that energy consumption may be reduced.

[0080] The broadband gateway **102** may also configure operations of links utilized by serviced devices to enable incorporating use of modes of operation that may be more energy efficient. For example, the broadband gateway **102** may detect whether serviced devices support use of such modes as sleep mode and/or burst-and-batch mode, and may configure the serviced device to incorporate use of any such mode during data communication to and/or from the serviced devices to enable reducing energy consumption during data communication, as shown in more details in FIG. **1**C. In this regard, in sleep modes, the links may become inactive, thus saving energy. Incorporating and/or scheduling transitions to sleep states on links may be based on awareness by broadband gateway **102** of, for example, operations in the devices utilizing the link, and the application(s) running therein and/or utilizing the links. Incorporating and/or scheduling use of burst-and-batch on links may be based on awareness by broadband gateway **102** of resources and/or capabilities of the devices utilizing the links, and the application(s) running therein and/or utilizing the links.

[0081] The broadband gateway **102** may also adaptively manage, control, and/or configure delivery of data (e.g. content) to and/or between home devices **104***a*-**104***j*. For example, the broadband gateway **102** may adaptively and/or dynamically select the type of PHY layers utilized for data communication, based on one or more requirements of the communication, such as latency requirement for example, to enable reducing energy consumption during the data communication. In this regard, selection of PHY layers may have energy implications since each PHY layer may require different amount of energy for transmitting the same amount of data. For example, wired based PHY layers generally require less power than wireless based PHY layers. Also, within each category, such as within wired or wireless category, different types of connections may require different energy consumption. For example, within wired based connections, fibre based PHY layer typically require less power than copper based PHY layers. Similarly, cellular based PHY layers generally require less power than WiFi based PHY layers.

[0082] The broadband gateway **102** may also provide energy-aware routing management, such that the communicate data would be delivered using the energy saving connections. In this regard, the broadband gateway **102** may evaluate and/or determine energy costs associated with each of one or more routes that may be established and/or utilized to communicate data between the broadband gateway **200** and managed devices and/or to communicate data between the managed devices. The broadband gateway **102** may then select the route that provide the most efficient energy use. For example, because wired connections typically require less power than wireless connections, the broadband gateway **102** may determine that communicating data between two managed device using a first route that comprises wired connections traversing one or more intermediary devices (not involved in the actual communication) may be more energy efficient than a second route that comprises a direct wireless connection between the two devices exchanging the data.

[0083] In one embodiment of the invention, the broadband gateway **102** may create and/or maintain a energy related database which may be utilized in conjunction with energy management services provided within the home network **100***a*. In this regard, the energy related database may be utilized to store energy related information corresponding to devices serviced by the broadband gateway **102**, and/or to operations performed thereby. For example, the energy related database may comprise device profiles, each of which corresponding to a device in the home network **100***a*, which may be populated with energy related information. Accordingly, the energy related information may be utilized to enable configuring the serviced devices, and/or configuring various aspects of the operations of the serviced devices, such as configuring interactions between the broadband gateway **102** and the serviced devices and/or interactions between the serviced devices.

[0084] Furthermore, users of the broadband gateway **102**, within the home network **100***a*, may be able to interact with the broadband gateway **102**, via a user interface for example, to view and/or configure the energy related database, or certain parts thereof such as the device profile, to adjust and/or modify energy management services provided by the broadband gateway **102**.

[0085] The broadband gateway **102** may continually monitor and/or track operations of home devices **104***a*-**104***j*, to determine and/or update energy related information corresponding thereto that may be utilized in conjunction with energy management services provided by the broadband gateway **102**. In this regard, broadband gateway **102** may create and/or update corresponding device profiles in the energy related database. The broadband gateway **102** may utilize the monitoring and/or tracking of the home devices **104***a*-**104***j* to tally up actual power consumptions, for individual devices and/or for the home network **100***a* as a whole, and/or may maintain corresponding data. The generated and/or maintained actual use data may be made available, and/or may be reported within the home network **100***a*, such as by a user of the broadband gateway **102**, and/or external to the home network **100***a*, such as to energy providers.

[0086] In one exemplary embodiment of the invention, a dedicated protocol and/or interface may be utilized during energy related communications between the broadband gateway **102** and the home devices **104***a*-**104***j*. In this regard, the energy protocol may define specific messages for requesting and/or reporting energy related information, and/or may define specific command to trigger energy related operations, such as during device or link configuration.

[0087] FIG. **1**B is a block diagram illustrating reconfiguration of connectivity between a broadband gateway and a home device based on energy consumption, in accordance with an embodiment of the invention. Referring to FIG. **1**B, there is shown the broadband gateway **102**, which may be utilized to service and/or manage a network **150**. In this regard, the network **150** may correspond to a home network, such as the home network **100***a*, or a portion such as comprising home devices **152***a*, **152***b*, **152***c*, and **152***d*.

[0088] The home devices **152***a*, **152***b*, **152***c*, and **152***d* may be similar to the home device **104***a*-**104***j*, and may be managed by the broadband gateway **102**, substantially as described with regard to FIG. **1**A. In an exemplary aspect of the invention, the home device **152***a* may be selected for consuming content delivered via the broadband gateway **102**, In this regard, the content may be delivered via one or more other home devices, such as the home devices **152***b*, **152***c*, and/or **150***d*.

[0089] In one exemplary embodiment of the invention, the broadband gateway **102** may be utilized for managing, configuring and/or adjusting communications between the broadband gateway **102** and home devices, or among the home device, to enable reducing and/or optimizing energy

consumption. In this regard, the broadband gateway may configure and/or modify various communication related parameters and/or criteria within the network **150**, to reduce and/or optimize energy consumption therein. These operations may be performed by the broadband gateway **102** adaptively and/or dynamically, and may comprise selection or configuration of transmission bitrates, compression rates or modes, type of physical layer (PHY) used, mode of operation and/or transmission, and/or communication paths or routes. For example, in instances where the broadband gateway **102** is requested to deliver a particular content to the home device **152***a* within the network **150**, the broadband gateway may initially select and/or configure route **160**, which may comprise utilizing links $\mathbf{152}_A$ and $\mathbf{154}_B$. In this regard, the broadband gateway **102** may configure and/or modify operations of the route **160**, which may utilize home device **152***b* as routing intermediary for delivery the requested content to the home device **152***a*, by configuring and/or modifying one or more of the links $\mathbf{152}_A$ and $\mathbf{154}_B$ for example, to enable optimization energy consumption. This may comprise selecting the most energy efficient physical (PHY) layer, transmission bitrate, mode of operation and/or transmission, and/or data (content) compression rates or modes, in instances where various alternatives thereof may be available, while still ensuring satisfactory delivery of content, based on quality of service criteria for example. The broadband gateway **102** may continue to monitor and/or track operations of the home devices in the network **150**, to enable enhancing energy consumption optimization where possible. For example, the broadband gateway **102** may determine that transitioning to route **162**, which may utilize home devices **152***c* and **152***d* as routing intermediaries, may provide more energy efficient delivery of content within the network **150**. This may be based on determination that the combined energy cost of utilizing links $\mathbf{154}_C$, $\mathbf{154}_B$, and $\mathbf{154}_E$ may be less than the combined energy cost of utilizing links $\mathbf{154}_A$ and $\mathbf{154}_B$ for performing the same delivery of requested content. The transition from route **160** to **162** may require only changing the hopping nodes. Alternatively, enhancing energy optimization may require additional modification and/or configuration, such as modifying the requested content to lower compression rate, which may be available when using the route **162** for example.

[0090] In one exemplary embodiment of the invention, the broadband gateway **102** may determine capabilities corresponding to one or more of the links $\mathbf{154}_A$-$\mathbf{154}_E$, and/or may determine whether the two devices utilizing each of these links (e.g. home devices **152***c* and **152***d* with respect to link $\mathbf{154}_D$) both have the capability to reconfigure the physical (PHY) layer speed and/or scheduling of packet transmission, to realize, for example, additional energy saving by taking advantage of these capabilities. In this regard, discovery of capability may be performed as PHY layer based discovery, such as with extended page auto-negotiation; layer 2 (L2) based discovery, such as by utilizing Link Layer Discovery Protocol (LLDP) messages; and/or layer 3 (L3) based discovery. Accordingly, based on discovered capabilities, the broadband gateway **102** may adjust, modify, and/or reconfigure PHY layer(s), transmission scheduling, and/or network stack based buffering corresponding to each link.

[0091] FIG. **1**C is a diagram illustrating energy consumption that may result from utilizing burst mode during transmission within a home network, in accordance with an embodiment of the invention. Referring to FIG. **1**C, there is shown 2-dimensional plans **180***a* and **180***b*, each comprising two axis. In this regard, the vertical axis may correspond to transmission bitrate.

[0092] The plans **180***a* and **180***b* may demonstrate energy consumption optimization that may result from configuring links utilized in a network managed or serviced by a broadband gateway, such as the broadband gateway **102**, to incorporate energy efficient based modes. For example, the broadband gateway **102** may detect whether one or more of the home devices **152***a*-**152***d* may support use of burst-and-sleep transmissions during communications via one or more of the links $\mathbf{154}_A$-$\mathbf{154}_E$. Accordingly, the broadband gateway **102** may configure the home device(s) to incorporate use of any such mode during communications via one or more of the links $\mathbf{154}_A$-$\mathbf{154}_E$. For example, the plane **180***a* may demonstrate energy consumption resulting from utilizing continuation transmissions, at a fixed rate, such as F(x). In this regard, energy consumption associated with data transmission and/or reception related operations may be represented, for example, with the shaded area **182***a*. The plane **180***b* may demonstrate energy consumption resulting from utilizing burst-type transmission at variable rates. In this regard, energy consumption associated with data transmission and/or reception related operations may be represented, for example, with the shaded areas **182***b*. Accordingly, while transmissions may be performed at higher rates during burst-and-sleep based operations, overall energy consumption may actually be reduced as a result of incorporating sleep periods in between the bursts, during which no transmission and/or reception related operations are performed.

[0093] FIG. **2** is a block diagram illustrating an exemplary broadband gateway, in accordance with an embodiment of the invention. Referring to FIG. **2**, there is shown a broadband gateway **200** that may be substantially similar to the broadband gateway **102** described above with respect to FIG. **1**A.

[0094] The broadband gateway **200** may comprise suitable logic, circuitry, code, and/or interfaces that may be operable to provide connectivity between one or more external networks, such as the distribution networks **110** shown in FIG. **1**A, for example, and one or more devices in a home network, such as the home devices **104***a*-**104***j* in the home network **100***a* shown in FIG. **1**A. In this regard, the broadband gateway **200** may operate as an interface device that allows one or more service providers **120**, content providers **130**, and/or emergency service providers **140**, to interact with various devices in a home network serviced by the broadband gateway **200**, and/or among the home devices themselves within the serviced home network.

[0095] The broadband gateway **200** may interact with serviced devices in a home network, such as the home network **100***a*, via wired and/or wireless communication links, to support communicating between the broadband gateway **200** and the home devices, and/or among the home devices via the broadband gateway **200**. In this regard, the broadband gateway **200** may comprise suitable hardware and/or software to provide some or all of the functions and/or operations of one or more of a modem, a router, and a switch. The modem functions and/or operations may be those of a digital subscribed line (DSL) modem, a cable modem, or a wireless cable modem, for example. The router functions and/or operations may be those of a wireless router, for example. The switch functions and/or operations may be those of a network switch, or a local area network (LAN) switch, for example. In

some instances, the broadband gateway **200** may communicate with the various devices in the home via more than one home network.

[0096] The broadband gateway **200** may comprise a plurality of modules, each of which may comprise hardware, software, or a combination thereof that may be utilized to perform various operations associated with the broadband gateway **200**. For example, in an embodiment of the invention, shown in FIG. **2**, the broadband gateway **200** may comprise a processing subsystem **202**, a storage subsystem **204**, a provider interfacing subsystem **210**, and a client-network interfacing subsystem **220**. In some instances, the broadband gateway **200** may be such that the various modules listed above may be distributed over multiple devices. Moreover, the modules listed above are provided by way of illustration and not of limitation. Other configurations and/or architectures of the broadband gateway **200** may be implemented. For example, the broadband gateway **200** may be a virtual gateway setup in a network by utilizing virtual machines (VMs) and/or next-generation (NG) data centers.

[0097] The processing subsystem **202** may comprise suitable logic, circuitry, interfaces, and/or code that may be operable to process data received from the service and/or content providers and/or data received from one or more devices in the home network **100***a*. In this regard, the processing subsystem **202** may comprise one or more portions that are suitable to handle certain types of data such as video data and/or audio data, for example. The processing subsystem **202** may also be operable to control and/or manage operations of the broadband gateway **200**, and/or performing tasks and/or applications therein. For example, the processing subsystem **202** may enable execution of applications, programs and/or code, which may be stored in the storage subsystem **204** for example. In this regard, the processing subsystem **202** may be operable to configure and/or control operations of various components and/or subsystems of the broadband gateway **200**, and/or other devices managed by and/or connected to broadband gateway **200**, by utilizing, for example, one or more control signals. The processing subsystem **202** may also control data transfers within the broadband gateway **200**, in the course of performing various applications and/or tasks for example. The processing subsystem **202** may comprise, for example, a plurality of processors, which may be general and/or specialized processors (e.g. CPU, video processors, and/or audio processors). While the processing subsystem **202** is shown herein as a single block, the invention needs not be so limited. Accordingly, in instances where the broadband gateway **200** is implemented a distributed platform, some of the operations and/or functions described herein with regard to the processing subsystem **202** may be performed by different components that may be located in different devices. In an exemplary aspect of the invention, the processing subsystem **202** may comprise an energy management block **206**. In this regard, the energy management block **206** may comprise suitable logic, circuitry, interfaces, and/or code that may be operable to perform, control, and/or manage energy related services provided by the broadband gateway **200**, substantially as described with regard to FIG. **1**A.

[0098] The storage subsystem **204** may comprise suitable logic, circuitry, interfaces, and/or code that may be operable to store data utilized in the operations of the broadband gateway **200**. In this regard, the storage subsystem **204** may comprise one or more memory devices that may enable permanent and/or non-permanent storage, buffering, and/or fetching of data, code and/or other information which may be used, consumed, and/or handled in the broadband gateway **200**. For example, the storage subsystem **204** may be utilized to store configuration data, parameters, device information, tracking and/or monitoring information, security information, and intermediate processing data, for example. The storage subsystem **204** may comprise storage media integrated in the broadband gateway **200** and/or one or more removable storage devices. The storage subsystem **204** may comprise different memory technologies, including, for example, read-only memory (ROM), random access memory (RAM), and/or Flash memory. In an exemplary aspect of the invention, the storage subsystem **204** may be utilized to store energy-related data and/or code, which may be utilized in conjunction with energy related services provided by the broadband gateway **200**, substantially as described with regard to FIG. **1**A.

[0099] The provider interfacing subsystem **210** may comprise suitable logic, circuitry, interfaces, and/or code that may be operable to communicate data via one or more physical layer connections **208***a*-**208***j*, to one or more corresponding network access service providers via the distribution networks **110** for example. The provider interfacing subsystem **210** may be operable to support multiple communication protocols, standards, and/or data transport technologies. In this regard, each of the physical layer connections **208***a*-**208***j* may connect the gateway **200** to different network access service provider, and may comprise a wired, optical, or wireless connection. Each of the physical layer connections **208***a*-**208***j* may utilize different physical media and/or different physical layer protocols. For example, the connection **208***a* may comprise a DSL over twisted-pair connection whereas and the connection **208***j* may comprise a CATV over coaxial cable connection. Accordingly, the provider interfacing subsystem **210** may enable accessing and/or communicating with one or more service providers **120** and/or content providers **120**, via the distribution networks **110**. The provider interfacing subsystem **210** may also be utilized to communicate data to and/or from third parties. In this regard, the provider interfacing subsystem **210** may enable gateway-to-gateway communication and/or interactions between the broadband gateway **200** and communication devices located outside the home network **100***a*, directly and/or indirectly through distribution networks corresponding to one or more service providers. The provider interfacing subsystem **210** may enable concurrently communicating with multiple and/or different service/content providers and/or devices.

[0100] The client-network interfacing subsystem **220** may comprise suitable logic, circuitry, interfaces, and/or code that may be operable to send data to one or more devices in the home network serviced and/or managed by the broadband gateway, such as the home network **100***a*. The client-network interfacing subsystem **220** may also be operable to receive data from one or more devices in the home network **100***a*. The client-network interfacing subsystem **220** may be operable to support multiple communication protocols, standards, and/or data transport technologies. For example, the client-network interfacing subsystem **220** may support the links **106***a*-**106***j*.

[0101] In operation, the broadband gateway **200** may be utilized as an interface device that may interact with a plurality of devices in a home network, such as such as the devices **104***a*-**104***j* in the home network **100***a*, and/or may provide connectivity between the devices in the home network and service and/or content providers. The broadband gateway **200** may also interact with a plurality of home devices in a home

network, such as the devices **104***a*-**104***j* in the home network **100***a*, using the client-network interfacing subsystem **220**. In this regard, the client-network interfacing subsystem **220** may support use of one or more of the links **106***a*-**106***j*. Furthermore, the broadband gateway **200** may interact with one or more service providers **120** via the provider interfacing subsystem **210**, to enable exchanging messages and/or content for example, via one or more of the distribution networks **110**. Accordingly, the broadband gateway **200** may enable and/or facilitate obtaining content (e.g. multimedia content) from one or more content providers **130**, wherein the content may be delivered through one or more services providers **120**. The broadband gateway **200** may distribute the received content to one or more of the plurality of home devices **104***a*-**104***j*, for content consumption, and/or may perform, directly via the processing subsystem **202** and/or indirectly utilizing other devices communicatively coupled to the broadband gateway **200**, any processing and/or procedures (e.g. decryption and/or account validation) that may be necessary to ensure that the content may be consumed by the home device (s).

[0102] The broadband gateway **200** may be operable to run or execute an agent to extract content, rating, copyright, language, privacy rules, and automatically add user generated content, for example. Such agent may be run or executed in connection with the processing subsystem **202** of the broadband gateway **200**, for example. Furthermore, the broadband gateway **200** may be operable to combine and/or blend multiple contents for use as single content in the home network. Such combination may be performed in one or more of the modules of the broadband gateway **200**. For example, the broadband gateway **200** may blend different video and audio contents for an event by accessing one or more service/content providers and providing automatic and/or manual content synchronization.

[0103] The broadband gateway **200** may also provide various services and/or tasks beyond, in addition to, and/or in conjunction with content delivery to home devices. For example, the broadband gateway **200** may perform content search, transport discovery, ranking, and/or sorting. In this regard, some operations may be performed based on content quality, price, quality-of-service (QoS), and network protocols supported by the devices in the home network, such as service level agreements (SLAs), for example.

[0104] The broadband gateway **200** may provide user interface services in the home network. In this regard, the broadband gateway **200** may be operable to support user interfaces, and/or to generate and/or store data corresponding thereto, which may be utilized to enable interactions between the broadband gateway **200** and users, such as in the home network **100***a* for example. Exemplary user interfaces may comprise graphic user interfaces (GUIs), which may enable visually displaying and/or providing interaction with users, to provide visual interaction with customized content for example. Information inputted and/or outputted using the user interfaces may be stored in the broadband gateway **200**, via the storage subsystem **204** for example. The user interfaces may enable configuring the broadband gateway **200**, and/or any applications and/or services provided thereby, and/or may also be utilized to configure and/or adjust other devices in the home network **100***a*. GUIs, and like interfaces, may be displayed using one or more devices coupled to the broadband gateway **200**. For example, interfaces generated and/or used by the broadband gateway **200** may be displayed using the television **104***a*.

[0105] The broadband gateway **200** may also be utilized to create, maintain, and/or update a plurality of profiles corresponding to users, devices, and/or services available in the home network **100***a*. Furthermore, user interfaces supported and/or used by the broadband gateway **200** may be utilized to enable displaying and/or modifying user, device, and/or service profiles. Data corresponding to these profiles may be stored in the storage subsystem **204** of the broadband gateway **200**. For example, device-profiles may be utilized to store information associated with particular devices that may be coupled to and/or serviced by the broadband gateway **200**. In this regard, device-profiles may be utilized for storage of information pertaining to device capabilities, limitations, requirements, and/or configuration parameters therefor. User-profiles may be utilize to store information associated with particular users, such as setting preferences for various devices and/or services that may be utilized by a particular user in conjunction with the broadband gateway **200**. The broadband gateway **200** may utilize user and/or home device profile information to, for example, select layered video service(s) and/or transmission. In some instances, the programming and/or enhanced video layers received by the broadband gateway **200** may be aggregated midstream by one or more network or routing nodes.

[0106] The gateway functionality associated with a user, such as security features, preferences, applications, electronic programming guides (EPGs), and user profile, for example, may be ported from the broadband gateway **200** to one or more other broadband gateways **200** in other locations. In some instances, a visitor may be allowed access to their content outside their service/content provider service area by, for example, classifying the access level for different users and/or by providing limited access to content. Moreover, the broadband gateway **200** may allow multiple user interface software structures by, for example, standardizing an interface to service/content providers and devices in the home network.

[0107] In various embodiments of the invention, the broadband gateway **200** may provide, via the energy management block **206** for example, energy related services in a network serviced by the broadband gateway **200**, such as the home network **100***a* for example, substantially as described with regard to FIG. **1**A. In this regard, the energy management block **206** may be utilized to provide energy management service within a network serviced by the broadband gateway **200**. The energy management service may comprise configuring, managing, and/or controlling one or more devices therein, and/or operations performed thereby, to enable reducing and/or optimizing energy consumption. Data and/or code utilized in these operations may be stored in, and/or retrieved from the storage subsystem **204**. Furthermore, the broadband gateway **200** may interact with the managed devices via the client-network interfacing subsystem **220** when providing the energy management service.

[0108] For example, the broadband gateway **200** may be operable to configure one or more devices in a serviced network, such as one or more the home devices **104***a*-**104***j* within the home network **100***a*, based on such criteria as energy needs, limitations, and/or default or predetermined configuration parameters, substantially as described with regard to FIGS. **1**A, **1**B, and/or **1**C. In this regard, the energy manage-

ment block **206** may determine when and/or if the serviced devices can be configured, setup and/or transitioned to operate in power-saving mode, setting, and/or state. Furthermore, the energy management block **206** may communicate, via the client-network interfacing subsystem **220**, commands to the devices to effectuate any such configuration, setup, and/or transition.

[0109] The power management service may also comprise managing, configuring and/or adjusting interactions between the broadband gateway **200** and the managed devices, and/or among the managed devices within the serviced network, substantially as described with regard to FIGS. **1**A, **1**B, and/or **1**C. In this regard, the energy management block **206** may be utilized to evaluate and/monitor characteristics and/or parameters of communications that may have energy efficiency implications, such as transmission bitrates, type of PHY layer used, and/or mode of operation or transmission in used link. The broadband gateway **200** may adaptively select, configure, and/or adjust corresponding communications, or parameters thereof, to enable reducing and/or optimizing energy consumption within the serviced network.

[0110] The energy management block **206** may also be utilized to enable providing energy-aware routing management by the broadband gateway **200**. In this regard, the energy management block **206** may evaluate and/or determine energy costs associated with each of one or more routes that may be established between the broadband gateway **200** and managed devices and/or among the managed devices to perform a required data communication. This may enable selecting the most energy efficient means of performing that data communication within the serviced network.

[0111] In an exemplary embodiment of the invention, the broadband gateway **200** may be operable to create and/or maintain an energy related database, which may be utilized in conjunction with energy management services provided by the broadband gateway **200**. In this regard, the energy related database may be utilized to store energy related information corresponding to devices serviced by the broadband gateway **200**, and/or to operations performed thereby, substantially as described with regard to, for example, FIGS. **1**A, **1**B, and/or **1**C. The energy related database, or portions thereof, may be stored into, and/or retrieved from the storage subsystem **204** for example.

[0112] The broadband gateway **200** may continually monitor and/or track, via the energy management block **206** for example, operations of managed devices, to determine and/or update energy related information corresponding thereto which may be utilized in conjunction with energy management services provided by the broadband gateway **200**. In this regard, the broadband gateway **200** may create and/or update corresponding device profiles in the energy related database. Furthermore, actual power consumption may be tracked and/or aggregated, to create actual usage data for each of the managed devices and/or for the serviced network as a whole. The actual usage data may be made available, and/or may be reported within the serviced network, and/or external to the serviced network, such as to energy providers, using the provider interfacing subsystem **210** for example.

[0113] In an exemplary embodiment of the invention, a dedicated protocol and/or interface may be utilized during energy related communications between the broadband gateway **200** and managed devices, substantially as described with regard to FIGS. **1**A, **1**B, and/or **1**C. In this regard, the client-network interfacing subsystem **220** may be configured to support and/or incorporate any such energy protocol.

[0114] FIG. **3**A is a flow chart that illustrates exemplary steps for utilizing a gateway to provide energy efficient management in a home network, in accordance with an embodiment of the invention. Referring to FIG. **3**A, there is shown a flow chart **300** comprising a plurality of exemplary steps that may be performed to enable utilizing the gateway to provide energy efficient management in a home network.

[0115] In step **302**, existing devices in a network serviced by a broadband gateway may be discovered. For example, the broadband gateway **102** may determine which of the home devices **104***a*-**104***j* in the home network **100***a* may be running. Furthermore, the broadband gateway **102** may also determine which of the discovered device may be configured and/or managed to enhance energy consumption efficiency within the home network **100***a*. In step **304**, the discovered devices may be configured based on existing device profiles and/or based on default efficient energy use data (if available). For example, the broadband gateway **102** may configure the refrigerator **104***h*, the laptop **104***b*, and/or the server **104***d*, substantially as described with regard to FIGS. **1**A, **1**B, and/or **1**C. In step **306**, links between devices may be configured based on stored and/or default efficient energy use data. For example, the broadband gateway **102** may configure communications between the broadband gateway **102** and one or more managed devices of the plurality of the home devices **104***a*-**104***j*, substantially as described with regard to FIGS. **1**A, **1**B, and/or **1**C. In step **308**, the broadband gateway may continually monitor and/or adjust configuration and/or setting of devices, and/or interactions between the devices based on efficient energy use data.

[0116] FIG. **3**B is a flow chart that illustrates exemplary steps for utilizing a gateway to generate and/or update device profiles for use in conjunction with energy efficient management services in a home network, in accordance with an embodiment of the invention. Referring to FIG. **3**B, there is shown a flow chart **300** comprising a plurality of exemplary steps that may be performed to enable generating and/or updating efficient energy related device profiles.

[0117] In step **322**, a broadband gateway may create a device specific energy-related profile for a device serviced by the broadband gateway. For example, the broadband gateway **200** may create a device profile, as entry in the energy management database for example, for each discovered and/or managed device in a network serviced by the broadband gateway **200**. The device profile may be utilized to store energy related parameters and/or information, such as energy requirements and/or limitations related data and/or energy related configuration information. In step **324**, the broadband gateway may initialize device profile, with preconfigured, predetermined, and/or default energy parameters, such as energy requirements, energy limitations, energy related configuration information. In step **326**, use of associated device may be tracked, and energy related information may be determined based on the tracked usage. In step **328**, corresponding device profile may be updated and/or modified based on tracking of device usage (if necessary).

[0118] FIG. **4** is a block diagram illustrating an exemplary user interface generated by a broadband gateway for configuring energy efficient management in a home network, in accordance with an embodiment of the invention. Referring to FIG. **4**, there is shown a user interface **400**.

[0119] The user interface **400** may, for example, be displayed as part of an on-screen display (OSD) and/or may be accessible via a "menu" button. The user interface **400** may be generated directly by the broadband gateway **102**, and/or by other devices based on data provided by the broadband gateway **102**, to enable interactions between the broadband gateway **102** and users associated with the broadband gateway **102**, in the home network **100***a* for example. The user interface **400** may be displayed using a display device connected to the broadband gateway **102**, such as the television **104***a* for example. In this regard, the link **106***a* may be utilized to communicate data and/or messages between the broadband gateway **102** and the television **104***a*, to enable communicating data that may be displayed using the user interface **400**, and/or receiving user input, selection, and/or feedback which may be provided based on interactions with the user interface **400**.

[0120] The exemplary user interface **400** may be utilized to enable users to setup the broadband gateway **102**, and/or to control, configure and/or modify various applications and/or tasks, or aspects thereof, which may provided by the broadband gateway **102**. In an exemplary aspect of the invention, the user interface **400** may incorporate an energy management function **402**, which may be utilized to setup, configure, and/or manage energy usage in a plurality of home devices serviced by the broadband gateway **102**.

[0121] The energy management function **402** may comprise, for example, frames **410** and **420**. The frame **410** may display a device directory which may be associated with energy management profile for managing energy in a plurality of home devices. The device directory may comprise a listing of available devices. Associated with each device entry may be two buttons **412** and **414**. Upon selection or activation of button **412** by a user, by clicking on it for example, detailed information regarding energy settings for the corresponding device may be displayed in the frame **420**. This may comprise energy requirements and/or limitations related data and/or energy related configuration information. Some of these parameters may be configurable by the user, using corresponding fields and/or buttons in the frame **420** for example. Other parameters may not be configurable, and may simply be populated based on information provided by the associated device. For example, in instances where a device profile correspond to the refrigerator **104***h*, the frame **420** may display energy requirements and/or limitations corresponding to each of available modes of operation.

[0122] Selection and/or activation of button **414**, by clicking on it for example, may enable displaying energy activities for the corresponding device in the frame **420**. In this regard, in instances where the broadband gateway **102** is utilized to track and/or tally actual energy consumption, substantially as described with regard to FIG. **1**A, the information corresponding to each managed device may be displayed in the frame **420** upon selection and/or activation of the button **414** in the corresponding device entry. The information may be arranged in verity of ways, and/or the display setting may be configurable and/or adjustable by the user using appropriate buttons and/or fields in the frame **420**. For example, the user may be able to specify whether to display the average and/or actual energy consumption rates, for example monthly, weekly, daily, and/or daily, for a specific device within a specific duration.

[0123] The frame **410** may also comprise a button **416** which may selected to enable entering one or more passwords before proceeding with any selection of buttons **412** or **414**. In this regard, a user password may be required before displaying any of the details on frame **410**. Accordingly, failure to provide the correct password may prevent displaying frame **420**. The frame **410** may also comprise a button **418** which may be selected to enable setting up a new device entry. Device setup may be performed as a step-by-step procedure based on interactions using frame **420**.

[0124] Various embodiments of the invention may comprise a method and system for utilizing a broadband gateway to provide energy efficient management in a home network. The broadband gateway **102** may be utilized to provide, via the energy management block **206** for example, energy management service within a home network, such as the home network **100***a*. The energy management service may enable reducing and/or optimizing energy consumption within the home network **100***a*. In this regard, the energy management service provided by the broadband gateway **102** may comprise managing one or more of the plurality of devices **104***a*-**104***j* in the home network **100***a*, to enable reducing and/or optimizing energy consumption by the managed devices. The broadband gateway **102** may perform device management via the energy management block **206** for example, based on energy-related data that may be maintained by the broadband gateway **102**, using the storage subsystem **204** for example. The energy-related information may be associated with each of the managed devices, and may be utilized to control the managed devices based on the maintained energy-related data for example. In this regard, at least some of the energy-related information may be acquired, from one or more of the managed devices for example. The energy-related information may comprise energy requirements, energy limitations, and/or energy related usage parameters. The energy management service may comprise controlling and/or configuring, via the energy management block **206** for example, managed devices and/or operations thereof. The energy management service may also comprise controlling and/or configuring communications and/or links within the home network **100***a*, among the managed devices and/or between broadband gateway **102** and at least one of the managed devices. The broadband gateway **102** may track and/or tally or aggregate, via the energy management block **206** for example, actual energy usage by each of managed devices, and the broadband gateway **102** may update and/or modify the stored energy-related information based on that tracking.

[0125] The stored information may comprise device profiles corresponding to each of managed devices. The device profile may comprise a plurality of settings for controlling and/or managing energy use in an associated device. The device profiles may be configurable, via the user interface **400** for example, wherein the profile configuration may comprise initializing and/or modifying one or more of a plurality of settings for controlling and/or managing energy use in an associated device. The broadband gateway **102** may display activity associated with the energy management service, via the user interface **400** for example. This may comprise display energy related activities and/or data associated with each of the managed devices. A dedicated energy-related messaging protocol may be used for exchanging energy-related messages and/or data within the home network.

[0126] Other embodiments of the invention may provide a non-transitory computer readable medium and/or storage medium, and/or a non-transitory machine readable medium and/or storage medium, having stored thereon, a machine

code and/or a computer program having at least one code section executable by a machine and/or a computer, thereby causing the machine and/or computer to perform the steps as described herein for utilizing a broadband gateway to provide energy efficient management in a home network.

[0127] Accordingly, the present invention may be realized in hardware, software, or a combination of hardware and software. The present invention may be realized in a centralized fashion in at least one computer system, or in a distributed fashion where different elements are spread across several interconnected computer systems. Any kind of computer system or other apparatus adapted for carrying out the methods described herein is suited. A typical combination of hardware and software may be a general-purpose computer system with a computer program that, when being loaded and executed, controls the computer system such that it carries out the methods described herein.

[0128] The present invention may also be embedded in a computer program product, which comprises all the features enabling the implementation of the methods described herein, and which when loaded in a computer system is able to carry out these methods. Computer program in the present context means any expression, in any language, code or notation, of a set of instructions intended to cause a system having an information processing capability to perform a particular function either directly or after either or both of the following: a) conversion to another language, code or notation; b) reproduction in a different material form.

[0129] While the present invention has been described with reference to certain embodiments, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted without departing from the scope of the present invention. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the present invention without departing from its scope. Therefore, it is intended that the present invention not be limited to the particular embodiment disclosed, but that the present invention will include all embodiments falling within the scope of the appended claims.

What is claimed is:

1. A method comprising:

in a broadband gateway communicatively coupled to a plurality of devices, wherein said broadband gateway is operable to handle at least one physical layer connection to at least one corresponding network access service provider:

providing an energy management service to said plurality of devices, wherein said provided energy management service comprises:

storing energy-related information associated with one or more of said plurality of devices; and

managing operation of said one or more of said plurality of devices based on said energy-related information, wherein said management enables adjusting energy consumption of one or more of said plurality of devices.

2. The method according to claim **1**, comprising controlling and/or configuring said one or more of said plurality of serviced devices during said management of said operation of said one or more of said plurality of devices.

3. The method according to claim **1**, comprising controlling and/or configuring communications between at least some of said one or more of said plurality of devices during said management of said operation of said one or more of said plurality of devices.

4. The method according to claim **1**, comprising tracking energy use in said one or more of said plurality of serviced devices.

5. The method according to claim **4**, comprising updating and/or modifying said energy-related information based on said tracking.

6. The method according to claim **1**, wherein said stored information comprises a device profile corresponding to each of said one or more of said plurality of serviced devices, said device profile comprising a plurality of settings for controlling and/or managing energy use in an associated device.

7. The method according to claim **6**, wherein said device profile is configurable, said configuration comprising initializing and/or modifying one or more of a plurality of settings for controlling and/or managing energy use in an associated device.

8. The method according to claim **1**, comprising displaying activity associated with said energy management service via a user interface.

9. The method according to claim **1**, wherein said energy-related information comprises energy requirements, energy limitations, device use patterns, and/or temporal related use data.

10. The method according to claim **1**, comprising communicating energy-related messages based on energy-specific protocol during said energy management service.

11. A system comprising:

one or more circuits and/or processors for use in a broadband gateway communicatively coupled to a plurality of devices, wherein said broadband gateway is operable to handle at least one physical layer connection to at least one corresponding network access service provider, said one or more circuits and/or processors being operable to provide an energy management service to said plurality of devices, said provided energy management service comprising:

storage of energy-related information associated with one or more of said plurality of devices; and

management of operation of said one or more of said plurality of devices based on said energy-related information, wherein said management enables adjusting energy consumption of one or more of said plurality of devices.

12. The system according to claim **11**, wherein said one or more circuits and/or processors are operable to control and/or configure said one or more of said plurality of serviced devices during said management of said operation of said one or more of said plurality of devices.

13. The system according to claim **11**, wherein said one or more circuits and/or processors are operable to control and/or configure communications between at least some of said one or more of said plurality of devices during said management of said operation of said one or more of said plurality of devices.

14. The system according to claim **11**, wherein said one or more circuits and/or processors are operable to track energy use in said one or more of said plurality of serviced devices.

15. The system according to claim **14**, wherein said one or more circuits and/or processors are operable to update and/or modify said energy-related information based on said tracking.

16. The system according to claim **11**, wherein said stored information comprises a device profile corresponding to each of said one or more of said plurality of serviced devices, said device profile comprising a plurality of settings for controlling and/or managing energy use in an associated device.

17. The system according to claim **16**, wherein said device profile is configurable, said configuration comprising initializing and/or modifying one or more of a plurality of settings for controlling and/or managing energy use in an associated device.

18. The system according to claim **11**, wherein said one or more circuits and/or processors are operable to display activity associated with said energy management service via a user interface.

19. The system according to claim **11**, wherein said energy-related information comprises energy requirements, energy limitations, device use patterns, and/or temporal related use data.

20. The system according to claim **11**, wherein said one or more circuits and/or processors are operable to communicate energy-related messages based on energy-specific protocol during said energy management service.

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