United States Patent	12395371
Kind Code	B2
Date of Patent	August 19, 2025
Inventor(s)	Chambers; Sean et al.

Systems and methods to aggregate broadband services at meter collar

Abstract

A system includes a consumer premise equipment (CPE) configured to couple to an electric meter at a premise. The CPE includes one or more first antennas and a first broadband over powerline (BPL) interface. The CPE is configured to receive data from a remote device, send, via the first BPL interface, a first portion of the data over electrical wiring of the premise, and send, via the one or more first antennas, a second portion of the data. A router one or more second antennas and a second BPL interface. The router is configured to receive, via the second BPL interface, the first portion of the data, receive, via the one or more second antennas, the second portion of the data, and aggregate the first portion of the data and the second portion of the data to extend broadband services to the premise.

Inventors: Chambers; Sean (Spokane, WA), Schafer; David Gregory (Spokane, WA), Gustafson; Mark Wayne (Spokane, WA), Har-nov; Yossi (Parkland, FL)

Applicant: Avista Edge, Inc. (Spokane, WA)

Family ID: 1000008763838

Assignee: Avista Edge, Inc. (Spokane, WA)

Appl. No.: 18/143274

Filed: May 04, 2023

Prior Publication Data

Document Identifier	Publication Date
US 20230275779 A1	Aug. 31, 2023

Related U.S. Application Data

continuation-in-part parent-doc US 17669242 20220210 ABANDONED child-doc US 18143274

Publication Classification

Int. Cl.: **H04L12/28** (20060101); **H04B3/54** (20060101); **H04W16/00** (20090101)

U.S. Cl.:

CPC   **H04L12/2801** (20130101); **H04B3/54** (20130101); **H04W16/00** (20130101);

Field of Classification Search

CPC: H04L (12/2801); H04B (3/54); H04W (16/00); Y04S (20/30)

USPC: 370/338

References Cited

U.S. PATENT DOCUMENTS

Patent No.	Issued Date	Patentee Name	U.S. Cl.	CPC
10530695	12/2019	Cioffi	N/A	H04L 47/13
2007/0147234	12/2006	Walter	370/389	H04L 45/24
2012/0052857	12/2011	Kumar	455/466	H04W 24/08
2015/0016260	12/2014	Chow	370/235	H04L 47/762
2015/0230275	12/2014	Kerpez	370/329	H04L 12/2869
2015/0372907	12/2014	Korhonen	370/254	H04L 45/02
2021/0297111	12/2020	Schafer et al.	N/A	N/A
2021/0297141	12/2020	Schafer	N/A	N/A
2022/0321604	12/2021	Majumdar	N/A	H04L 63/0227
2023/0254750	12/2022	Schafer	N/A	N/A

OTHER PUBLICATIONS

Office Action for U.S. Appl. No. 17/669,242, mailed on Dec. 20, 2023, Schafer, "Wide Area Network (WAN) and Local Area Network (LAN) Aggregator at Utility Service", 40 Pages. cited by applicant

PCT Search Report and Written Opinion mailed Apr. 18, 2023 for PCT application No. PCT/US22/53616, 13 pages. cited by applicant

Office Action for U.S. Appl. No. 17/669,242, mailed on Jul. 6, 2023, Schafer, "Wide Area Network (WAN) and Local Area Network (LAN) Aggregator at Utility Service", 29 Pages. cited by applicant

Primary Examiner: Yao; Kwang B

Assistant Examiner: Bokhari; Syed M

Attorney, Agent or Firm: Lee & Hayes, P.C.

Background/Summary

CROSS REFERENCE TO RELATED APPLICATIONS (1) This application is a continuation-in-part of, and claims priority to, U.S. patent application Ser. No. 17/669,242, filed Feb. 10, 2022, the entire contents of which are incorporated herein by reference.

BACKGROUND

(1) The proliferation of the Internet has resulted in individuals and business becoming more connected. As a result, the demand for services available on the Internet, and the availability of devices to access the Internet, has increased. However, despite this increase, much of the world may lack access to broadband services (e.g., DSL, cable, fiber-optic, satellite, etc.). This need has forced carriers, providers, and equipment manufacturers to develop high throughput solutions, such as fiber-optic networks, to keep up throughput demands. However, certain premises may be difficult and/or costly to access.

(2) Additionally, some providers utilize wireless technology to deliver high throughput, Internet services. As wireless technology evolves to higher frequencies to increase throughput and capacity, building penetration remains difficult and costly. For example, conventional systems may fail to penetrate structures when wireless signals are attenuated below useful levels.

(3) Future technological improvements may enhance access to broadband services and increase user experiences.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) The detailed description is set forth with reference to the accompanying figures. In the figures, the left-most digit(s) of a reference number identifies the figure in which the reference number first appears. The use of the same reference numbers in different figures indicates similar or identical items or features. The systems and devices depicted in the accompanying figures are not to scale and components within the figures may be depicted not to scale with each other.

(2) FIG. **1** illustrates an example environment, showing a base station radio device communicating with a customer premise equipment (CPE), and the CPE communicating with a router for extending broadband services to consumer device(s) within a premise, according to an example of the present disclosure.

(3) FIG. **2** illustrates an example diagram for providing broadband services to a premise, using conductive signal(s) and radio frequency (RF) signal(s), according to an example of the present disclosure.

(4) FIG. **3** illustrates example computing components of the base station radio device, the CPE, and the router of FIG. **1**, according to an example of the present disclosure.

(5) FIG. **4** illustrates an example diagram for aggregating one or more networks for providing conductive signal(s) and/or radio frequency (RF) signal(s), according to an example of the present disclosure.

(6) FIGS. **5** and **6** illustrate an example process for aggregating conductive signal and a radio frequency signals for extending broadband services to a premise, according to an example of the present disclosure.

DETAILED DESCRIPTION

(7) This application is directed, at least in part, to systems and methods that provide broadband services (e.g., high-speed internet) to premises, such as homes, multi-family units, and/or places of business, using wired and/or wireless connections. In some instances, the systems and methods discussed herein may aggregate broadband services delivered over the wired and/or wireless connections as a way to increase a throughput of broadband services at the premises. For example, the wired connection may utilize Broadband over Power Line (BPL) technology (alternatively

referred to a powerline communication (PLC) and/or internet over power line (IPL)) to deliver broadband services of a first throughput into the premises. Utilizing existing electrical wiring of the premise may alleviate the need to build broadband facilities, structures, and/or route cables into individual premises. The wireless connection, using 2.4 GHz and/or 5.0 GHz, for example, may additionally or alternatively be used to deliver broadband services of a second throughput into the premises. In such instances, the system and methods described herein may make use of both wired and wireless connections as a way to aggregate broadband services for an increased throughput at the premises.

(8) In some instances, the systems and methods described herein include a plurality of base station radio devices, customer premise equipment (CPEs), and/or routers. The plurality of base station radio devices may be placed atop vertical structures (e.g., utility poles, streetlights, etc.) and may communicatively connect with the CPEs placed at the premises. The CPEs communicatively connect with the routers located inside the premises, and the routers may generate one or more local area network (LANs) inside the premise. The LANs provide computing device(s) (e.g., computer, television, etc.) within the premises access to broadband services (e.g., the Internet). As will be explained herein, and as introduced above, the CPEs may have both a wired connection and a wireless connection with the routers inside the premises. In such instances, the CPE may extend the broadband services to the routers using both the wired connection via transmitting a conductive signal, and/or the wireless connection via transmitting a (e.g., radio frequency (RF)) signal, respectively.

(9) The base station radio devices may communicatively connect to an internet service provider (ISP), wide area network (WAN), and/or network service provider (NSP) that offers or otherwise provides the broadband services to consumers. In some instances, the base station radio devices may communicatively connect to the NSP via a backhaul network (e.g., fiber-optic, cables) and/or wireless technology (e.g., millimeter wave (mmWave)) technology. However, regardless of the specific implementation, the communication between the base station radio devices and the NSP may represent a high-speed communication path for providing broadband services.

(10) In some instances, the base station radio devices may function as a gateway to extend broadband services to the CPEs (and ultimately, the premise) by wirelessly communicating with the CPEs. To wirelessly communicate with one another, the base station radio devices and the CPEs may include various modems, antenna(s), an array of antennas, transceiver systems, and so forth. In some instances, the antenna(s) of the base station radio devices and/or the antenna(s) of the CPEs may include a plurality of modems and/or antennas for communicating over a range of frequencies (e.g., mid frequencies, high frequencies, etc.). Additionally, the antenna(s) of the base station radio device(s) and/or the antennas of the CPEs may include antennas for any disparate number of communication technologies (e.g., 4G LTE, 5G, etc.). In some instances, the CPEs may include modular components for interchanging modems, antenna(s), and so forth depending on the communication technologies utilized within the system.

(11) The CPEs are installed at the premise of the consumer (e.g., home and/or place of business) and may represent a fixed wireless device. In some instances, the CPEs may be installed on an exterior side of the premises at a demarcation point in which services (e.g., power, phone, television, etc.) are provided into the premise. In some instances, the CPE may be installed within an existing electric meter panel to couple to the electric meter and the electrical wiring of the premise. For example, the CPE may include a housing that fits within an existing electric meter panel. In some instances, when installed, the CPE may be interposed between the electric meter panel and the electric meter. This connection serves to provide power to the CPE, transfer power to the electric meter for metering, and communicatively connects the CPE with (or to) the electrical wiring of the premise. Connecting to the electrical wiring forms the wired connection between the CPE and the router, and allows the CPE to provide wired signals into the premise (e.g., BPL).

(12) In some instances, in addition to communicatively connecting to one or more base station

radio device(s), the CPEs may communicatively connect to other devices adjacent to the premise via a wide area network (WAN). For example, the CPEs may communicatively connect to other routers, modems, devices, etc. via cellular (e.g., 3G, 4G, 4G LTE, 5G, etc.), Wi-Fi (e.g., 802.11), and so forth. The CPE may also be in wired connections with one or more networks (e.g., fiber optic, coaxial, etc.). In such instances, the CPEs may be configured to connect to any number of disparate networks (e.g., one, two, three, five, etc.) to receive the broadband services. In such instances, the CPE may aggregate broadband services received via the various networks as a way to increase throughput into the premise. For example, the CPE may include a broadband services aggregator component to aggregate the broadband services received via different networks (or different sources). Accordingly, the CPE may be configured to extend broadband services into the premise via communicatively connecting with base station radio device(s) as well as other devices.

(13) In some instances, the CPE is configured to transmit two signals to the router, such as a wired signal via the wired connection and a wireless signal via the wireless connection, for delivering the broadband services into the premise. For example, a first signal may represent a conductive signal (e.g., g.Math.hn) that is transmitted over the electrical wiring of the premise. A second signal may represent an RF signal (e.g., 2.4 GHz, 5.0 GHz, etc.) that is wirelessly transmitted into the premise. The first signal may deliver a first portion of the broadband services into the premise, while the second signal may deliver a second portion of the broadband services into the premise. Stated alternatively, a first portion of the broadband services provided into the premise is transmitted via the wired connection, while a second portion of the broadband services provided into the premise is transmitted via the wireless connection. For example, the conductive signal may provide a first broadband services speed, such as 100 megabits per second (mbps), while the RF signal may provide a second broadband services speed, such as 25 mbps. As such, by transmitting both signals into the premise, the broadband services may be aggregated to provide speeds up to 125 mbps.

(14) In some instances, the first signal and/or the second signal may be associated with the broadband services received at the CPE via the base station radio device(s). Additionally, or alternatively, the first signal and/or the second signal may be associated with broadband services received from other communicatively connected devices (e.g., WAN). In this manner, the CPE may receive broadband services from any number of disparate sources and may then may provide the broadband services into the premise via two signals.

(15) The two signals transmitted via the CPE are received by the router located within the interior of the premise. The router receives the conductive signal and the RF signal and aggregates the signals to provide broadband services into the premise. Similar to the CPE, the routers may include a broadband services aggregator component that aggregates the broadband services received via the wired connection and the wireless connection with the CPE. For example, the routers may receive the conductive signal from the CPE and the RF signal from the CPE, may aggregate these two signals, and then provide LANs into the premise. In some instances, the routers may provide any number of LANs (whether wired or wireless) into the premises. In some instances, signals may be aggregated based on their speeds, protocols, content (e.g., data), and so forth.

(16) In some instances, the routers may be plugged into an outlet within the interior of the premise and located proximate to the CPE and/or the service panel to reduce dissipation and/or noise transmitted over the wired connection. Additionally, locating the routers close to the CPE may reduce noise transmitted over the wireless connection (e.g., via building penetration). In some instances, the routers and the CPE may be paired with one another as part of an out of box experience (OOBE).

(17) The CPE and the routers may include respective interfaces for communicating with one another. For example, the CPE may include a BPL interface, a modem module coupled to antenna(s), and a transceiver. The BPL interface and the modem module may respectively transmit the conductive signal via the wired connection to the modem. As the antenna(s) of the CPE receives the broadband services from the base station radio device(s), for example, the BPL

interface communicates the broadband services to the BPL interface of the router. In some instances, the BPL interface and the modem module (and/or the antenna(s)) may be components of a system on a chip (SoC) of the CPE. Meanwhile, the transceiver of the CPE may transmit the RF signal via the wireless connection to the router. However, as the antenna(s) of the CPE may receive the broadband services from the base station radio device(s), the broadband services aggregator component of the CPE may be responsible for aggregating the broadband services provided to the router. In such instances, the broadband services aggregator component may communicatively connect with the modem module and the transceiver for providing the broadband services via the wired connection and the wireless connection, respectively.

(18) The router, which is located within the interior of the premise, may include a BPL interface for receiving the broadband services from the CPE. The BPL interface of the CPE and the BPL interface of the router therefore allows for the CPE and the router to communicate over the electrical wiring of the premise. The router also includes a transceiver for receiving the RF signals transmitted by the transceiver of the CPE. For example, the transceiver of the CPE may represent an 802.11 embedded device that communicates from outside of the premise to the router located inside the premise. The transceiver of the router may represent an 802.11 embedded device that receives signals from the transceiver of the CPE. Additionally, noted above, the router includes a broadband services aggregator component that aggregates the conductive signal and/or the RF signal as received from the CPE. By aggregating the conductive signal and the RF signal, the CPE is able to provide broadband services into the premise at an increased rate (e.g., speed).

(19) In some instances, the router may further include a wireless modem and antenna(s) for providing one or more LAN network(s) within the premise. In some instances, the antenna(s) of the router may include a Wi-Fi module for supplying the premise with Wi-Fi (e.g., 2.4 GHz Wi-Fi, 5 GHz Wi-Fi, 6 GHz, etc.). The antenna(s) may also be modular or interchangeable to provide additional Wi-Fi frequency bands into the premise. In some instances, the router may deliver wireless and/or wired network(s) inside the premise (e.g., Ethernet, coaxial cable, USB, twisted pair, plastic fiber, etc.). In some instances, the antenna(s), BPL interface, and/or modem of the router may be components of a SoC.

(20) In some instances, the CPE may transmit the conductive signal and/or the RF signal based at least in part on bandwidth capabilities. For example, while the CPE may transmit the conductive signal and the RF signal, the amount of data transmitted over each signal, respectively, may be based on bandwidth capabilities. For example, in some instances, depending on the application and/or the environment, the wired connection and/or wireless connection may have a limited bandwidth to deliver broadband services into the premise. For example, building materials (e.g., stucco, brick, etc.) may restrict the amount of broadband services provided into the premise via the wireless connection. In such instances, the CPE may utilize the wired connection to transmit a greater amount of the broadband services into the premise as compared to the wireless connection.

(21) Additionally, although described as transmitting the wired signal via BPL, the CPE may additionally or alternatively take advantage of other wired connections. For example, fiber optic cables, coaxial cables, and/or Ethernet cables extending between the exterior and interior of the house may be used to provide the wired connection with the router. As such, more than one wired connection (e.g., two wired connections) may exist between the CPE and the router. In such instances, the broadband services aggregator component of the CPE and the router may respectively aggregate the broadband services provided over the different wired signals for providing an increased throughout. Moreover, the same may be true for the wireless connections, and wireless signals of different frequencies may be communicated between the CPE and the router. For example, a first wireless signal (e.g., 2.4 GHz) and a second wireless signal (e.g., 5.0 GHz) may be transmitted between the CPE and the router to increase a throughput of broadband services. Here again, a broadband services aggregator component of the CPE and the router may respectively aggregate the broadband services provided over the different wireless signals for

providing an increased throughout.

(22) Accordingly, the systems and methods described herein may be configured to receive broadband services, and in some instances, aggregate the broadband services provided by those sources, and deliver signals into the premise via different connections. For example, a wired connection (e.g., g.Math.hn) may be used to provide a first throughput of broadband services, while a wireless connection (e.g., 2.4 GHz) may be used to provide a second throughput of broadband services. A router, may aggregate the broadband services provided by the different connections with the CPE to provide one or more LAN networks into the premise. The router and the CPE may therefore aggregate different signals (e.g., conductive and wireless) as a way to increase throughput into the premise.

(23) The present disclosure provides an overall understanding of the principles of the structure, function, device, and system disclosed herein. One or more examples of the present disclosure are illustrated in the accompanying drawings. Those of ordinary skill in the art will understand and appreciate that the devices, the systems, and/or the methods specifically described herein and illustrated in the accompanying drawings are non-limiting embodiments. The features illustrated or described in connection with one embodiment, or instance, may be combined with the features of other embodiments or instances. Such modifications and variations are intended to be included within the scope of the disclosure and appended claims.

(24) FIG. **1** illustrates an example environment **100** for providing broadband services (e.g., internet) to a premise **102** (e.g., building, house, multi-dwelling complex, etc.) by aggregating broadband services.

(25) In some instances, the environment **100** includes one or more base station radio device(s) **104**, one or more customer premise equipment (CPE) **106**, one or more router(s) **108**, and/or one or more consumer device(s) **110**. The base station radio device(s) **104** is shown coupled to structures **112** (e.g., utility pole structures) for being disposed above the ground, or overhead. In some instances, the base station radio device(s) **104** may be configured to mount to the structures **112** to vertically dispose the base station radio device(s) **104** above the ground. For example, the base station radio device(s) **104** may be disposed on a side of a building, a light pole, stop lights, telephone poles, and so forth.

(26) In some instances, the base station radio device(s) **104** may be disposed on the structures **112** for communicatively coupling to a network service provider (NSP) **114** (or other internet service provider (ISP)). In some instances, the NSP **114** may be accessed, for example, via a wide area network (WAN) **116**. The WAN **116** connects computers, or other devices, that span a wide geographical area. As explained herein, the WAN **116** provides access to the broadband services (e.g., the Internet), available by the NSP **114**, to the consumer device(s) **110** located within the premise **102**.

(27) In some instances, a backhaul may connect the base station radio device(s) **104** to the NSP **114**, over the WAN **116**. The backhaul may, in some instances, include cables (e.g., fiber-optic cables) that span between the structures **112**, computers, switches, hubs, and/or devices on the WAN **116**, whether wired and/or wirelessly, and which ultimately route to the NSP **114** for extending broadband services into the premise **102**. In some instances, the backhaul may route to a middle-mile location with broadband services (e.g., hospital, police station, etc.) before routing to the NSP **114**. In some instances, additionally or alternatively, the base station radio device(s) **104** may communicate with the NSP **114** via wireless technologies (e.g., mmWave). However, the backhaul may be routed differently than shown for communicating with the NSP **114**. For example, rather than the backhaul being disposed on the structures **112**, the backhaul (or portions thereof) may be buried and the base station radio device(s) **104** may connect to the backhaul. As such, it is to be understood that the NSP **114** provides access to the WAN **116** to extend the broadband services.

(28) Regardless of the specific implementation, the base station radio device(s) **104** may be

connected to the NSP **114**, over the WAN **116**, for accessing broadband services provided by the NSP **114**. Disposing the base station radio device(s) **104** on the structures **112** utilizes an existing network of vertical structures. Furthermore, discussed herein, disposing the base station radio device(s) **104** on the structures **112**, or other vertical structures, may provide an unobstructed transmission path (or reduced obstructed path) between the base station radio device(s) **104** and the CPEs **106**, vice versa. That is, disposing the base station radio device(s) **104** atop the structures **112** may increase a line of sight with the CPE **106**. Additionally, noted above, in communities that lack the structures **112**, the base station radio device(s) **104** may be disposed on other vertical structures, such as light poles.

(29) In some instances, a network of the base station radio device(s) **104** may function to extend broadband services to one or more premises. For example, a first base station radio device may be disposed on a first structure to extend broadband services to one or more first premises, while a second base station radio device may be disposed on a second structure to extend broadband services to one or more second premises. In some instances, the one or more first premises may be the same as, or include some of, the one or more second premises. For example, referring to FIG. **1**, the base station radio device **104** may provide broadband services to multiple premises, including the premise **102**. However, it is to be understood that more than two base station radio device(s) **104** may be included and any number of base station radio device(s) **104** may be installed for extending broadband services to a geographical region. For example, within densely populated areas, a larger number of base station radio device(s) **104** may be installed per block, radius, mile, etc. as compared to less densely populated areas. In this sense, the system may be scaled as needed depending on demand, usage, and/or throughput requirements.

(30) The base station radio device(s) **104** communicate with nearby CPEs, such as the CPE **106**, installed at the premise **102**. In some instances, the CPE **106** may be configured to attach as a meter collar within existing electric meters (or panels), which may be a smart meter of the premise **102**, on an exterior of the premise **102**. For example, the meter collar may include a power module configured to supply power to the CPE **106** and which couples to the electrical wiring of the premise **102** (e.g., as received from power lines spanning between the structures **112**). Alternatively, the CPE **106** may attach to the premise **102** at any demarcation point between a utility service and the premise **102** (e.g., electrical panel). As such, coupling the CPE **106** at or within the meter collar of the utility service panel couples the CPE **106** to electrical wiring of the premise **102**. Additional details of the meter collar are described in, for example, U.S. Pat. No. 17,202,526, entitled "Modular Customer Premises Equipment for Providing Broadband Internet," issued Oct. 4, 2022, the entirety of which is herein incorporated by reference.

(31) The base station radio device **104** may wirelessly communicate with the CPE **106** to extend broadband services offered by the NSP **114** into the premise **102**. In some instances, the base station radio device **104** and the CPE **106** communicate over a communication channel **118**, which may support any dynamically shared spectrum (DSS) (e.g. between 3100 MHz and 4200 MHz). In some instances, the communication channel **118** may support the Citizens Broadcast Radio Spectrum (CBRS) between 3550 MHz and 3700 MHz. In some instances, the communication channel **118** may include any low-band, mid-band and/or high-band frequencies, regardless of the DSS. In some instances, the communication channel **118** may represent a 5.0 GHz communication channel. However, it is to be understood that the communication channel **118** may support any range of frequencies for extending broadband services into the premise **102**.

(32) The CPE **106** includes first antenna(s) **120** (or a multi-antenna array) for communicating, via the communication channel **118**, with the base station radio device **104** and via an antenna of the base station radio device **104** (not shown in FIG. **1**.). In some instances, depending on the range of frequencies (or spectrum) at which the base station radio device **104** and the CPE **106** are configured to communicate, the CPE **106** may be configured accordingly. For example, the first antenna(s) **120** may be interchangeable to accommodate for the spectrum, or range of frequencies,

at which the base station radio device **104** and the CPE **106** communicate. In such instances, components of the CPE **106** may be modular or configurable to change antennas, modems, interfaces, and so forth. Multiple antennas, or antenna housings, may be configured to attach to the CPE **106**. Such configuration may make the CPE **106** modifiable to accommodate new technologies and communication protocols.

(33) As an example, the CPE **106** may include, or the first antenna(s) **120** of the CPE **106** may represent, a multi-antenna array having antennas (e.g., two, three, four, etc.). In some instances, the first antenna(s) **120** may be arranged with different polarizations. The first antenna(s) **120** may include sub-arrays having multiple patches or elements (e.g., two). In some instances, each sub-array of the multi-antenna array may include two or more orthogonally polarized elements and each element of the sub-array may include a dedicated antenna feed port. By selecting specific polarizations, and determining the phase and or amplitude of the antenna feeds, the first antenna(s) **120** may have a radiation pattern with a predetermined variable polarization. Additional details of polarization for increasing diversity is described in, for example, U.S. patent application Ser. No. 17/202,526, entitled "Modular Customer premise equipment for Providing Broadband Internet," filed Mar. 3, 2021, the entirety of which is herein incorporated by reference.

(34) The CPE **106** includes one or more interface(s) for communicatively connecting with the router **108** and extending the broadband services to the consumer device(s) **110**. In some instances, the interfaces communicatively connects the CPE **106** and the router **108** over the electrical wiring of the premise **102** for extending broadband services to the consumer device(s) **110** within the premise **102**. (e.g., personal computer, laptop, television, printer, audio/video receiver, audio equipment, video equipment, mobile devices, tablets, etc.). For example, the CPE **106** is shown including a first BPL interface **122** for communicating with a second BPL interface **124** of the router **108**. The BPL interfaces allow the CPE **106** and the router **108** to communicate over the electrical wiring of the premise **102** for communicatively coupling the consumer device(s) **110** to the NSP **114**.

(35) For example, the first BPL interface **122** may communicatively connects to the first antenna(s) **120** for receiving broadband services, signals, or data via the base station radio device(s) **104**. The first BPL interface **122** may then transmit the broadband services, signals, or data to the second BPL interface **124** of the router **108**. In some instances, the first BPL interface **122** communicatively connects to a first modem module **126** for communicating with the second BPL interface **124**. Correspondingly, the router **108** may also include a second modem module **128** that communicatively connects to the second BPL interface **124**.

(36) In addition to the BPL interfaces, the CPE **106** may include a first transceiver **130** for communicating with a second transceiver **132** of the router **108**. The first transceiver **130** and the second transceiver **132** act to wirelessly receive and transmit broadband services, signals, or data between the CPE **106** and the router **108**. In some instances, the CPE **106** may transmit data to the router **108** over a WAN/WAN using unlicensed spectrum (e.g. 5 Ghz, 2.4 Ghz, etc.). In some instances, the first transceiver **130** may communicatively connect to the first antenna(s) **120** and/or the first modem module **126** for transmitting and receiving broadband services, signals, or data from the second transceiver **132**. Here, the second transceiver **132** may communicatively connect to the second modem module **128** for transmitting and receiving broadband services, signals, or data. For example, the first transceiver **130** of the CPE **106** may represent an 802.11 embedded device that wirelessly communicates with router **108** located inside the premise **102**. The second transceiver **132** of the router **108** may represent an 802.11 embedded device that receives signals from the first transceiver **130** of the CPE **106**.

(37) The CPE **106** is shown including a first aggregator component **134** that may be configured to aggregate broadband services provided to or available at the premise **102**. The first aggregator component **134** may aggregate broadband services that are received via wired connections and/or wireless connections with the router **108**. For example, the first aggregator component **134** may

aggregate broadband services that are received at the first BPL interface **122** and via the electrical wiring of the premise **102** (from the second BPL interface **124**), and/or broadband services received at the first transceiver **130** (from the second transceiver **132**). In some instances, the first transceiver **130** may transmit (using the first antenna(s) **120** and/or the first modem module **126**), broadband services to the to the second transceiver **132** (using second antenna(s) **142** and/or the second modem module **128**).

(38) In some instances, the first aggregator component **134** is configured to aggregate the broadband services received from the different communication technologies. By aggregating the broadband services, the CPE **106** may provide the premise **102** with an increased throughput of broadband services. For example, in some instances, the first aggregator component **134** may aggregate broadband services received over disparate spectrums, frequencies, or communication protocols. For example, the CPE **106** may aggregate the WAN **116** received via the base station radio device **104** and/or other additional WANs **136** provided by remote devices **138**. For example, FIG. **1** illustrates that the additional WANs **136** may be provided from adjacent premises, cellular towers, or the remote devices **138**. As multiple networks may be received at the CPE **106**, the first aggregator component **134** may effectuate to aggregate the networks to provide an increased throughput of the broadband services into the premise **102**. Once the broadband services are aggregated, the CPE **106** may provide the broadband services to the router **108** via one or more conductive signal(s) (e.g., between the first BPL interface **122** and the second BPL interface **124**) and/or one or more RF signal(s) (e.g., between the first transceiver **130** and the second transceiver **132**).

(39) In this sense, a portion of the broadband services supplied into the premise **102** may come by way of the electrical wiring of the premise **102**, through the conductive signal provided by the first BPL interface **122** and the second BPL interface **124**, while another portion of the broadband services may come by way of the RF signal provided by the first transceiver **130** and the second transceiver **132**. To aggregate the broadband services at the router **108**, the router **108** may include a second aggregator component **140**. The second aggregator component **140** may aggregate the broadband services received via the conductive signal(s) and the RF signal(s). As such, the CPE **106** and the router **108** may transmit both conductive signals and RF signals as a way to increase throughput into the premise **102**.

(40) The consumer device(s) **110** may have corresponding antenna(s) to communicate with the second antenna(s) **142** of the router. The router **108** may include a Wi-Fi module to supply Wi-Fi into the premise **102**. The router **108**, however, may be configured to provide Wi-Fi other than 2.4 GHz and 5.0 GHz (e.g., Near Field Communication (NFC)). Additionally, or alternatively, in some instances, the router **108** may broadcast the broadband services to the consumer device(s) **110** via wired technologies such as Ethernet, USB, coaxial, fiber optic, and the like. In such instances, the router **108** may include plug-ins for receiving the wired technologies.

(41) In some instances, the router **108** may represent a wall plug-in or device that otherwise plugs into a power outlet within the premise **102**. The router **108** may receive power, via the power outlet, and ultimately via the electrical wiring of the premise **102**. As the CPE **106** couples to the electrical wiring of the premise **102**, via coupling to the electric meter, the CPE **106** may communicate with the router **108** over the electrical wiring within the premise **102**. For example, a meter collar of the CPE **106** may couple the CPE **106** with the neutral, earth ground wires and/or the line voltage wires that are fed into the premise **102** (or which feed into the breaker box of the premise **102**). Once the router **108** is plugged in, the CPE **106** may communicate with the router **108** using the electrical wiring (e.g., wires). The BPL interfaces of the CPE **106** and the router **108**, respectively, decipher, interpret, and communicate with one another for transmitting and receiving data. In some instances, the CPE **106** and the router **108** may be paired together as part of an installation process in order to provide the broadband services.

(42) In some instances, the CPE **106** or the first antenna(s) **120** may be configured to beam-form

for achieving optimum link properties with the base station radio device(s) **104** or the additional WANs **136** (or devices, systems, etc.). In some instances, the beam-forming may be achieved by using an antenna array or a multiple input multiple output (MIMO) antenna. Additionally, while one pathway of communication is described, it is to be understood that the router **108** may similarly communicate with the CPE **106** for transmitting data from the router **108** to the CPE **106**, from the CPE **106** to the base station radio device **104**, and/or from the CPE **106** to the additional WANs **136**.

(43) FIG. **2** illustrates an example diagram **200** for providing broadband services into the premise **102**. As discussed above, the CPE **106** may be disposed on an exterior of the premise **102** while the router **108** may be disposed on an interior of the premise **102**. The CPE **106** communicatively connects to the router **108** via a wired or conductive signal **202** (e.g., through the first BPL interface **122** and the second BPL interface **124**) and a wireless or RF signal **204** (e.g., through the first transceiver **130** and the second transceiver **132**).

(44) The CPE **106** is shown communicatively connected to the base station radio device **104** via the communication channel **118** for communicatively coupling to the WAN **116**. The communication channel **118** between the base station radio device **104** and the CPE **106** may represent a wireless signal or wireless communication pathway. Additionally, the CPE **106** may communicatively connect to the additional WANs **136**. Such communication may be wireless and/or wired. That is, as noted above, the CPE **106** may wirelessly connect to the additional WANs **136**, in addition to the WAN **116** provided by the NSP **114**.

(45) Further, as introduced above, the CPE **106** may aggregate the broadband services provided via the WAN **116** and/or the additional WANs **136**. For example, the CPE **106** may receive broadband services from the additional WANs **136** and may aggregate these broadband services with broadband services from the WAN **116**. The first aggregator component **134** of the CPE **106**, for example, may aggregate the broadband services. In some instances, the first aggregator component **134** may correspond to, or the CPE **106** may include, a multi-WAN router (MWR). Additionally, the first aggregator component **134** of the CPE **106** may aggregate broadband services received across a plurality of frequencies (e.g., 5.0 GHz, 2.4 GHz, 4G LTE, etc). For example, the CPE **106** may receive first broadband services or data over a first frequency and second broadband services or data over a second frequency, and aggregate such broadband services. Of course, the CPE **106** may also aggregate the broadband services received via the base station radio device **104**.

(46) After aggregating the broadband services, the CPE **106** may transmit the conductive signal **202** using a wired connection with the router **108**, and/or the RF signal **204** using a wireless connection with the router **108**. For example, the CPE **106** may transmit a first portion of the broadband services to the router **108** via the conductive signal **202** and a second portion of the broadband services to the router **108** via the RF signal **204**. In some instances, the CPE **106** may transmit the first portion of the broadband services via the conductive signal **202** and/or the second portion of the broadband services via the RF signal **204** based at least in part on a bandwidth of the wired connection and the wireless connection, respectively. For example, if building penetration is untenable, the CPE may transmit a greater portion of the broadband services to the router **108** via the conductive signal **202**. Moreover, in some instances, the CPE **106** may transmit multiple conductive signals **202** (e.g., BPL, Ethernet, etc.) and/or multiple RF signals **204** (e.g., 2.4 Ghz, 5 Ghz, etc.). As such, the CPE **106** may transmit multiple signals to the router **108** as a way to increase a throughput of broadband services into the premise **102**.

(47) Inside the premise **102**, in some instances, the router **108** aggregates the conductive signal **202** and the RF signal **204**. For example, the second aggregator component **140** of the router **108** may receive the conductive signal **202** and the RF signal **204** and combine the conductive signal **202** and the RF signal **204** to provide one or more networks into the premise **102**. This network, as shown in FIG. **2**, may be a LAN **206** (e.g., Wi-Fi, 2.4 GHz, 5.0 GHz, NFC, etc.) to which the consumer device(s) **110** are able to communicatively connect. In some instances, the router **108**

may provide multiple networks to the premise **102**, whether wirelessly or wired.

(48) In some instances, rather than wirelessly receiving broadband services via the base station radio device **104**, the CPE **106** may wirelessly connect to an ISP wireless device **208**, or wireless services. Additionally, although the CPE **106** is describe as aggregating multiple wireless WAN, the CPE **106** may aggregate other WANs provided by other communication technologies. For example, the additional WANs **136** may come by way of coaxial cables, twisted pair cables, fibers, and so forth. In this sense, the CPE **106** may represent a hub that is utilized aggregate the additional WANs **136**, whether the additional WANs **136** are wired or wireless, for providing the conductive signal **202** and/or the RF signal **204** into the premise **102**.

(49) FIG. **3** illustrates example components of the base station radio device **104**, the CPE **106**, and the router **108**. Discussed above, the base station radio device **104** may be in communication via wired technologies (e.g., a fiber-optic cable network) and/or wireless technologies (e.g., mmWave) with the NSP **114**, or the WAN **116** provided by the NSP **114**.

(50) The base station radio device **104** may include one or more processor(s) **300**, computer-readable media **302**, interface(s) **304**, and/or third antenna(s) **306**. The processor(s) **300** may include a central processing unit (CPU), a graphics processing unit (GPU), both a CPU and a GPU, or other processing units or components. Additionally, each of the processor(s) **300** may possess its own local memory, which also may store program modules, program data, and/or one or more operating systems.

(51) The processor(s) **300** may be coupled to the computer-readable media **302** and execute computer executable instructions stored in the computer-readable media **302**. The processor(s) **300** may also couple modules and components of the base station radio device **104** to one another and may perform various functions including instructing and causing the modules and components of the base station radio device **104** to perform their associated functions. For example, the processor(s) **300** may cause components of the base station radio device **104** to transmit and receive broadband services from the NSP **114**, as well as transmit and receive broadband services from the CPE **106**.

(52) As the base station radio device **104** may communicatively connect to multiple CPEs **106** to provide broadband services, the base station radio device **104** may store, in the computer-readable media **302**, indicators and/or identifying information of individual CPEs **106**. Such information may be utilized for communicating (e.g., routing) with respective CPEs **106** at a respective premise **102**. For example, a particular base station radio device **104** may provide broadband services to multiple premises. As the base station radio device **104** extends broadband services to respective premises, or receives data from the respective premises, the base station radio device **104** may tag or otherwise mark outgoing and incoming broadband services. This marking may indicate which premise is the recipient and/or originator of the broadband services. As such, the base station radio device **104** may transmit the broadband services to the respective premises, or to the proper recipients.

(53) The interface(s) **304** connect the base station radio device **104** to the NSP **114** (e.g., via the fiber-optic broadband network) for accessing broadband services. Additionally, the interface(s) **304** may connect the base station radio device **104** to the CPE **106**. For example, the interface(s) **304** may be coupled to the processor(s) **300** and the third antenna(s) **306** for communicating with the CPE **106** (and/or a plurality of CPEs **106**) to provide broadband services. In some instances, the interface(s) **304** may include modems, modules, or other components for wirelessly coupling with the CPE **106**. For example, the interface(s) **304** may include a DSS modem module, a CBRS modem module, C-band modem module, a WWAN modem module, and/or any other modem/module for communicating, via the communication channel **118**, with the CPE **106** (e.g., mid frequencies, high frequencies, etc.). The base station radio device **104** may therefore include a plurality of interface(s) **304** for communicating with corresponding interfaces (e.g., the first modem module **126**) of the CPE **106**.

(54) In some instances, the interface(s) **304** may include interfaces for interacting with WANs, cellular networks, and so forth. The third antenna(s) **306** may include an array of antennas for otherwise transmitting data to, and receiving data from, the CPE **106**. In some instances, the third antenna(s) **306** may beam-form for achieving optimum link properties with the CPE **106** and/or the NSP **114**. The base station radio device **104** may include additional interface(s) for communicating with other base station radio device(s) **104** (and ultimately the NSP **114**) using wired and/or wireless technologies. Additionally, the third antenna(s) **306** may be capable of receiving signals with varying polarizations from the CPE **106** (e.g., vertical, horizontal, elliptical, etc.).

(55) In some instances, the base station radio device **104** may include input/output (I/O) components coupled to the processor(s) **300**. The I/O components may be configured to communicate with a computing device, such as a computing device loaded with appropriate applications for programming or checking the status of the base station radio device **104**. For example, the computing device may be operated by a utility service or company providing the broadband services into the premise **102**, and which is used for monitoring and/or troubleshooting issues experienced by the base station radio device **104** and/or the CPE **106**. The I/O components may also provide other information from the premise **102**, such as usage data, data generated by appliances within the premise **102** (e.g., IoT), for use in energy savings, system management, and/or load to service determination.

(56) The base station radio device **104** communicatively connects to the CPE **106** via the communication channel **118**. As shown, the CPE **106** may include one or more processor(s) **308**, computer-readable media **310**, the first antenna(s) **120**, the first BPL interface **122**, and the first modem module **126**, as discussed above with regard to FIG. **1**. In some instances, the processor(s) **308** may include a CPU and/or a GPU. Additionally, the processor(s) **308** may possess its own local memory, which also may store program modules, program data, and/or one or more operating systems. The processor(s) **308** may be coupled to the computer-readable media **310** and execute computer executable instructions stored in the computer-readable media **310**.

(57) The processor(s) **308** may be also coupled modules and components of the CPE **106** and may perform various functions including instructing and causing the modules and components of the CPE **106** to perform their associated functions. For example, the processor(s) **308** may cause components of the CPE **106** to send and receive broadband services to and from the base station radio device **104**, and to send and receive broadband services to and from the router **108**. For example, as the first antenna(s) **120** receive broadband services from the base station radio device **104**, via the communication channel **118**, the processor(s) **308** may cause the broadband services to be sent to the router **108** via the first BPL interface **122**. Such transmission may occur via the conductive signal **202**, between the first BPL interface **122** and the second BPL interface **124**. For example, the first BPL interface **122** of the CPE **106** is shown communicating with the second BPL interface **124** of the router **108**. A communication channel exists between the first BPL interface **122** and the second BPL interface **124**, representative of the conductive signal **202**. Noted above, this communication channel may represent a communication channel over the electrical wiring of the premise **102**, whereby the broadband services are transmitted over wires or other cables within the premise **102**.

(58) In some instances, the first BPL interface **122** communicatively connects to the first modem module **126** and the second BPL interface **124** communicatively connects to the second modem module **128**. The first modem module **126** may include a corresponding module for communicating with the interface(s) **304** of the base station radio device **104** (e.g., DSS, CBRS, G.hn, WWAN, C-band, etc.). As the first modem module **126** receives broadband services, via the first antenna(s) **120**, the first modem module **126** may interpret the broadband services. The first BPL interface **122** then transmits the broadband services to the second BPL interface **124**, whereby the second modem module **128** may interpret the broadband services.

(59) Additionally, the first transceiver **130** may transmit the broadband services to the second

transceiver **132** of the router **108**. Such transmission may occur via the RF signal **204**, between the first transceiver **130** and the second transceiver **132**. A communication channel exists between the first transceiver **130** and the second transceiver **132**, representative of the RF signal **204**, and the CPE **106** and the router **108** may wirelessly communicate with one another. In some instances, the first transceiver **130** communicatively connects to the first modem module **126** and the second transceiver **132** communicatively connects to the second modem module **128**. As the first modem module **126** receives broadband services, via the first antenna(s) **120** and the additional WANs **136**, the first modem module **126** may interpret the broadband services. The first transceiver **130** then transmits the broadband services to the second transceiver **132**, whereby the second modem module **128** may interpret the broadband services. The processor(s) **308** may therefore route broadband services from the first antenna(s) **120** to interfaces of the CPE **106**, and vice versa, for communicatively coupling with the router **108**

(60) Additionally, as the first antenna(s) **120** receive broadband services from the additional WANs **136** and via the remote devices **138**, the first aggregator component **134** may aggregate the additional WANs **136**, with broadband services received via the base station radio device **104**, and the processor(s) **308** may cause the broadband services to be aggregated.

(61) As the router **108** receives the broadband services from the CPE **106**, the router **108** may provide the one or more LANs (e.g., the LAN **206**) to the premise **102**. For example, the router **108** may include the second aggregator component **140** that aggregates the broadband services received via the conductive signal **202** and the broadband services receive via the RF signal **204**. In some instances, the second aggregator component **140** may communicatively connect to the second modem module **128** in order to provide the LANs via the second antenna(s) **142**. In some instances, the second modem module **128** may represent a 2.4 GHz and/or 5.0 GHz Wi-Fi module communicatively connects to the second BPL interface **124**.

(62) Although the first BPL interface **122**, the first modem module **126**, and the first transceiver **130** are shown as separate components, in some instances, the first BPL interface **122**, the first modem module **126**, and/or the first transceiver **130** may be integrated as a single component. In some instances, the first BPL interface **122**, the first modem module **126**, and/or the first transceiver **130** may be components of a SoC. Noted above, the first modem module **126** may also be modular and interchangeable depending on the frequencies which the first modem module **126** communicates with the base station radio device **104** and/or the additional WANs **136**. Additionally, or alternatively, the second BPL interface **124**, the second modem module **128**, and/or the second transceiver **132** may be integrated as a single component. In some instances, the second BPL interface **124**, the second modem module **128**, and/or the second transceiver **132** may be components of a SoC. The second modem module **128** may also be modular and interchangeable depending on the network provided into the premise **102**.

(63) The CPE **106** includes a power module **312** coupled to the processor(s) **308**. The power module **312** may be coupled to the electric meter of the premise **102** to supply electrical power from the electric meter to some or all components and modules of the CPE **106**. The CPE **106**, or a housing of the CPE **106** may be configured to attach as a meter collar to the electric meter. Coupling the CPE **106** to the electric meter in this manner also communicatively connects the first BPL interface **122** with the second BPL interface **124** via the electrical wiring of the premise **102**. In this sense, the power module **312** may tap into the electrical wiring of the premise **102** for sending broadband services through the wiring of the premise **102**, for delivery to the router **108**. Using this form of communication allows broadband services to penetrate the premise **102** using existing wiring networks and alleviates the building penetration problem. Examples of coupling the CPE **106** to electric meter are discussed in, for example, U.S. patent application Ser. No. 17/202,526, the entirety of which is herein incorporated by reference.

(64) The CPE **106** may additionally include input/output (I/O) components **314** coupled to the processor(s) **308**. The I/O interface components **314** may be configured to communicate with a

programming device, such as a computing device of the utility service, or other device loaded with appropriate applications for programming or checking the status of the CPE **106** (or the broadband services). This communication may provide for testing, system upgrades, reboots, and so forth. The communication may also include data from an IoT within the premise **102** for use in load to service determination, energy savings, system usage, and so forth. In such instances, a user interface (UI) may be provided for interfacing with the CPE **106**. In some instances, the I/O components **314** may comprise a connector, such as a telco connector, a USB connector, a RJ45 connector, and the like, and/or an RF communication module such as a NFC, Bluetooth communication, or Wi-Fi communication module for such communication.

(65) The router **108** may include one or more processor(s) **316**, computer-readable media **318**, and the second BPL interface **124**, the second modem module **128**, and the second aggregator component **140** as discussed above with regard to FIG. **1**. In some instances, the processor(s) **316** may include a CPU and/or a GPU. Additionally, the processor(s) **316** may possess its own local memory, which also may store program modules, program data, and/or one or more operating systems. The processor(s) **316** may be coupled to the computer-readable media **318** and execute computer executable instructions stored in the computer-readable media **318**. The processor(s) **316** also be coupled to modules and components of the router **108** and may perform various functions including instructing and causing the modules and components of the router **108** to perform their associated functions.

(66) The router **108** includes a power module **320** coupled to the processor(s) **316**. The power module **320** may be coupled to a power supply of the premise **102** (e.g., the electrical wiring) and receive electrical power to power components and modules of the router **108**. Coupling the router **108** to the electrical wiring in this manner couples the second BPL interface **124** with the first BPL interface **122** via electrical wiring of the premise **102**.

(67) In some instances, the router **108** may include input/output (I/O) components **322** coupled to the processor(s) **316**. The I/O components **322** may be configured to communicate with a computing device, such as a computing device loaded with appropriate applications for programming or checking the status of the router **108**. For example, the computing device may be operated by a utility service providing the broadband internet into the premise **102**, and which is used for monitoring and/or troubleshooting issues experienced by the base station radio device **104** and/or the CPE **106**. Discussed above, the router **108** includes the second antenna(s) **142** for broadcasting the broadband services within the premise **102**. Additionally, or alternatively, the router **108** may include plug-ins (e.g., Ethernet) for coupling to the consumer device(s) **110**.

(68) As used herein, a processor, such as the processor(s) **300**, **308**, and/or **316** may include multiple processors and/or a processor having multiple cores. Further, the processor(s) may comprise one or more cores of different types. For example, the processor(s) may include application processor units, graphic processing units, and so forth. In one implementation, the processor(s) may comprise a microcontroller and/or a microprocessor. The processor(s) may include a graphics processing unit (GPU), a microprocessor, a digital signal processor or other processing units or components known in the art. Alternatively, or in addition, the functionally described herein can be performed, at least in part, by one or more hardware logic components. For example, and without limitation, illustrative types of hardware logic components that may be used include field-programmable gate arrays (FPGAs), application-specific integrated circuits (ASICs), application-specific standard products (ASSPs), system-on-a-chip systems (SOCs), complex programmable logic devices (CPLDs), etc. Additionally, each of the processor(s) may possess its own local memory, which also may store program components, program data, and/or one or more operating systems.

(69) Computer-readable media, such as the computer-readable media **302**, **310**, and/or **318** may include volatile and nonvolatile memory, removable and non-removable media implemented in any method or technology for storage of information, such as computer-readable instructions, data

structures, program component, or other data. Such memory may include, but is not limited to, RAM, ROM, EEPROM, flash memory or other memory technology (e.g., embedded Multi-Media Controller (eMMC), SPI NOR), CD-ROM, digital versatile disks (DVD) or other optical storage, magnetic cassettes, magnetic tape, magnetic disk storage or other magnetic storage devices, RAID storage systems, DDR-SDRAM or any other medium which can be used to store the desired information and which can be accessed by a computing device. The memory may be implemented as computer-readable storage media ("CRSM"), which may be any available physical media accessible by the processor(s) to execute instructions stored on the memory. In one basic implementation, CRSM may include random access memory ("RAM") and Flash memory. In other implementations, CRSM may include, but is not limited to, read-only memory ("ROM"), electrically erasable programmable read-only memory ("EEPROM"), or any other tangible medium which can be used to store the desired information and which can be accessed by the processor(s).

(70) FIG. **4** illustrates an example diagram **400** for aggregating multiple networks as a way to increase broadband services provided into the premise. As shown, the base station radio device **104** provides the CPE **106** with access to the WAN **116**. Additionally, the CPE **106** has access to a first additional WAN **136**(**1**), a second additional WAN **136**(**2**), up to an nth additional WAN **136**(N). These additional WANs **136**(**1**)-(N) may be provided by the remote devices **138**, which in some instances, represent devices, computers, servers, switches, and so forth in surrounding buildings, residences, and so forth. For example, the first additional WAN **136**(**1**) may be provided by a first device **138**(**1**), the second additional WAN **136**(**2**) may be provided by a second device **138**(**2**), and the nth additional WAN **136**(N) may be provided by a n.sup.th device **138**(N). The devices **138**(**1**)-(N) may be routers, modems, switches, and the like.

(71) The additional WANs **136**(**1**)-(N) may be within range of the CPE **106**, and the CPE **106** may take advantage of the additional WANs **136**(**1**)-(N) to provide an increased throughput of broadband services into the premise **102**. In some instances, the additional WANs **136**(**1**)-(N) may be 802.11. However, the additional WANs **136**(**1**)-(N) may be any 802.11 protocol (e.g., 802.11ac). Additionally, the CPE **106** may communicatively connect to other networks, whether wirelessly or via wired connections.

(72) In some instances, the CPE **106** is configured to aggregate the WAN **116** and/or the additional WANs **136**(**1**)-(N) for providing the conductive signal **202** and/or the RF signal **204** into the premise **102**. For example, using the first aggregator component **134**, the CPE **106** may aggregate wireless, infrared (IR), DSL, or RF signals associated with the additional WANs **136**(**1**)-(N). In some instances, the CPE **106** is configured to aggregate broadband services from any number of networks from any number of desperate sources as a way to increase broadband services at the premise **102**. In some instances, the amount of broadband services provided via the conductive signal **202** and/or the RF signal **204** may be based on specifics of the premise **102**. After aggregating, the CPE **106** transmits the conductive signal **202** and/or the RF signal **204** to the router **108**. Therein, the router **108**, using the second aggregator component **140**, for example, aggregates the conductive signal **202** and/or the RF signal **204** to broadcast the LAN **206**.

(73) FIGS. **5** and **6** illustrate a process **500** related to increasing a throughput of broadband services to a premise. The process **500** described herein are illustrated as collections of blocks in logical flow diagrams, which represent a sequence of operations, some or all of which may be implemented in hardware, software, or a combination thereof. In the context of software, the blocks may represent computer-executable instructions stored on one or more computer-readable media that, when executed by one or more processors, program the processors to perform the recited operations. Generally, computer-executable instructions include routines, programs, objects, components, data structures and the like that perform particular functions or implement particular data types. The order in which the blocks are described should not be construed as a limitation, unless specifically noted. Any number of the described blocks may be combined in any order and/or in parallel to implement the process, or alternative processes, and not all of the blocks need

be executed. For discussion purposes, the process **500** is described with reference to the environments, architectures and systems described in the examples herein, such as, for example those described with respect to FIGS. **1-4**, although the process **500** may be implemented in a wide variety of other environments, architectures and systems.

(74) In FIGS. **5** and **6**, certain operations are shown and described as being performed by the CPE **106** or the router **108**. However, although certain operations are shown and described as being performed by the CPE **106** or the router **108**, it is to be understood that the CPE **106** and/or the router **108** may perform different steps than those illustrated.

(75) At **502**, the process **500** may include receiving, from a first device, a first signal associated with a first portion of broadband services to be provided to a premise. For example, the CPE **106** may receive the first signal from the base station radio device **104**. The CPE **106** may wirelessly receive the first signal from the base station radio device **104**. Ultimately, the base station radio device **104** communicatively connects to the WAN **116** provided by the NSP **114**.

(76) At **504**, the process **500** may include receiving, from a second device, a second signal associated with a second portion of broadband services to be provided into the premise. For example, the CPE **106** may receive the second signal from a second device (e.g., switch, router, etc.) that provides an additional WAN. In some instances, the second signal may be associated with a 802.11 WAN, however, other internet protocols may be used. Additionally, although described as receiving the first signal and the second signal, the CPE **106** may only receive one of the first signal or the second signal for extending the broadband services into the premise **102**. Furthermore, the CPE **106** may receive other signals from any number of other devices or sources (e.g., the remote devices **138**) for increasing a throughput of broadband services at the premise **102**.

(77) At **506**, the process **500** may include aggregating the first portion of the broadband services and the second portion of the broadband services. For example, upon receipt of the first signal and the second signal, the first aggregator component **134** of the CPE may aggregate the broadband services. For example, if the first signal provides 100 mbps and the second signal provides 25 mbps, the CPE **106** may deliver speeds of up to 125 mbps into the premise **102**. In this manner, the CPE **106** aggregates the first signal and the second signal as a way to increase throughput into the premise **102**. However, noted above, the CPE **106** may not aggregate signals (e.g., the CPE **106** may receive broadband services from a single device) or may aggregate more than two signals.

(78) At **508**, the process **500** may include transmitting, to a third device, a first conductive signal associated with providing the broadband services into the premise. For example, the CPE **106** (using the first BPL interface **122**, the first antenna(s) **120**, the first modem module **126**, etc.) may transmit the first conductive signal to the router **108**. In some instances, the first conductive signal is transmitted through the electrical wiring of the premise **102**. That is, as the CPE **106** may communicatively connect to the electrical wiring of the premise **102**, the first conductive signal may be transmitted over the electrical wiring of the premise **102**. In some instances, the speed of broadband services provided into the premise **102** via the first conductive signal may be variable, or based on specifics of the premise **102**.

(79) At **510**, the process **500** may include transmitting, to the third device, a first RF signal associated with providing the broadband services into the premise. For example, the CPE **106** (using the first antenna(s) **120**, the first modem module **126**, the first transceiver **130**, etc.) may transmit the first RF signal to the router **108**. In some instances, the speed of broadband services provided into the premise **102** via the first RF signal may be variable, or based on specifics of the premise **102**.

(80) At **512**, the process **500** may include aggregating the first conductive signal and the first RF signal. For example, the router **108**, or the second aggregator component **140**, may aggregate the first conductive signal and the first RF signal. For example, if the first conductive signal provides 100 mbps and the first RF signal provides 25 mbps, the router **108** may provide the premise **102** with speeds of up to 125 mbps.

(81) At **514**, the process **500** may include providing at least one network to the premise. For example, the router **108** may broadcast, using the second antenna(s) **142**, the LAN **206** to the premise **102** for extending the broadband services to the consumer device(s) **110**. In some instances, the LAN **206** may be delivered wirelessly to the consumer device(s) **110**, or via one or more wired connections (e.g., Ethernet).

(82) From **514**, the process **500** may proceed to "A", which is discussed in FIG. **6**. At **516**, the process **500** may include transmitting, to a fourth device, a second conductive signal associated with providing the broadband services into the premise. For example, the router **108** (using the second BPL interface **124**, the second antenna(s) **142**, the second modem module **128**, etc.) may transmit the second conductive signal to the CPE **106**. In some instances, the second conductive signal is transmitted through the electrical wiring of the premise **102**.

(83) At **518**, the process **500** may include transmitting, to the fourth device, a second RF signal associated with providing the broadband services into the premise. For example, the router **108** (using the second antenna(s) **142**, the second modem module **128**, the second transceiver **132**, etc.) may transmit the second RF signal to the CPE **106**.

(84) At **520**, the process **500** may include aggregating the second conductive signal and the second RF signal. For example, the CPE **106**, or the first aggregator component **134**, may aggregate the second conductive signal and the second RF signal. In this sense, as the router **108** takes advantage of multiple connections with the CPE **106**, after receiving the signals from the router **108** associated with providing broadband services into the premise **102**, the CPE **106** may aggregate the signals.

(85) At **520**, the process **500** may include transmitting, to at least one of the first device or the second device, a third signal associated with providing the broadband services into the premise. For example, the CPE **106** may communicate with at least one of the base station radio device **104** or the remote devices **138** in order to provide the broadband services into the premise **102**.

(86) While the foregoing invention is described with respect to the specific examples, it is to be understood that the scope of the invention is not limited to these specific examples. Since other modifications and changes varied to fit particular operating requirements and environments will be apparent to those skilled in the art, the invention is not considered limited to the example chosen for purposes of disclosure, and covers all changes and modifications which do not constitute departures from the true spirit and scope of this invention.

(87) Although the application describes embodiments having specific structural features and/or methodological acts, it is to be understood that the claims are not necessarily limited to the specific features or acts described. Rather, the specific features and acts are merely illustrative some embodiments that fall within the scope of the claims of the application.

Claims

1. A system, comprising: a first device including: a body configured to couple to an electric meter at a premise; a first power module disposed within the body, the first power module configured to couple to electrical wiring at the premise; a first antenna communicatively coupled to the first power module; a first broadband over powerline (BPL) interface communicatively connected to the first power module and the first antenna; a first transceiver communicatively connected to the first antenna; one or more first processors; and one or more first non-transitory computer readable media storing computer-executable instructions, that when executed by the one or more first processors, cause the first device to perform first operations comprising: receiving, from a second device via the first antenna, data associated with providing broadband services into the premise, sending, to a third device via the first BPL interface, a conductive signal over the electrical wiring of the premise, and sending, to the third device via the first transceiver, a radio frequency (RF) signal; and the third device, including: a second power module configured to couple to the

electrical wiring at the premise; a second antenna communicatively coupled to the second power module; a second BPL interface communicatively connected to the second power module and the second antenna; a second transceiver communicatively connected to the second antenna; one or more second processors; and one or more second non-transitory computer readable media storing computer-executable instructions, that when executed by the one or more second processors, cause the third device to perform second operations comprising: receiving, from the first device via the second BPL interface, the conductive signal, receiving, from the first device via the second transceiver, the RF signal, and aggregating the conductive signal and the RF signal to provide a local area network (LAN) into the premise.

2. The system of claim 1, wherein: the second operations further comprise: sending, to the first device via the second BPL interface, a second conductive signal over the electrical wiring of the premise, and sending, to the first device via the second transceiver, a second RF signal; and the first operations further comprise: receiving, from the third device via the first BPL interface, the second conductive signal, receiving, from the third device via the first transceiver, the second RF signal, aggregating the second conductive signal and the second RF signal.

3. The system of claim 1, wherein: the conductive signal is associated with a first frequency; the first operations further comprise sending, to the third device via the first transceiver, a second RF signal associated with a second frequency that is different than the first frequency; and the second operations further comprising aggregating the conductive signal, the RF signal, and the second RF signal to provide the LAN.

4. The system of claim 1, wherein the first operations further comprise: receiving, from a fourth device, second data associated with providing the broadband services into the premise; and aggregating the data and the second data to provide the broadband services into the premise.

5. The system of claim 1, wherein: the conductive signal provides a first portion of the broadband services into the premise; and the RF signal provides a second portion of the broadband services into the premise.

6. A system, comprising: a consumer premise equipment (CPE) configured to couple to an electric meter at a premise, the CPE including: one or more first antennas, a first broadband over powerline (BPL) interface, one or more first processors, and first memory storing computer-executable instructions, that when executed by the one or more first processors, cause the CPE to perform first operations comprising: receiving first data from a remote device, sending, via the first BPL interface, a first portion of the first data over electrical wiring of the premise, sending, via the one or more first antennas, a second portion of the first data; receiving, via the first BPL interface, a first portion of second data, receiving, via the one or more first antennas, a second portion of the second data, aggregating the first portion of the second data and the second portion of the second data, and a router including: one or more second antennas, a second BPL interface, one or more second processors, and second memory storing computer-executable instructions, that when executed by the one or more second processors, cause the router to perform second operations comprising: receiving, via the second BPL interface, the first portion of the first data, receiving, via the one or more second antennas, the second portion of the first data, aggregating the first portion of the first data and the second portion of the first data to extend broadband services into the premise, receiving the second data, sending, via the second BPL interface, the first portion of the second data over electrical wiring of the premise, and sending, via the one or more second antennas, the second portion of the data.

7. The system of claim 6, wherein the first operations further comprise: receiving third data from a second remote device; and aggregating the first data and the third data.

8. The system of claim 6, wherein: the CPE is located externally to the premise; and the router is located internally to the premise.

9. The system of claim 6, wherein: the first portion of the first data sent by the first BPL interface represents a conductive signal sent to the router over the electrical wiring of the premise; and the

second portion of the first data sent by the one or more first antennas represents a radio frequency (RF) signal sent to the router.

10. The system of claim 6, wherein the router includes an aggregator component, the aggregator component being configured to aggregate the first portion of the first data and the second portion of the first data to generate at least one LAN to the premise.

11. The system of claim 6, wherein the CPE is configured to aggregate a plurality of wide area networks (WANs) to extend the broadband services to the premise.

12. The system of claim 6, wherein the first operations further comprise sending at least one of: third data to the remote device, the third data representing at least a portion of the second data; or fourth data to a second remote device, the fourth data representing at least a portion of the second data.