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Re: Utility Patent Application Transmittal
Inventors: Lin et al.
Title: *System and Method for Configuring Device Connections in an Extended Network Environment*
Assignee: NETGEAR, Inc.
USPTO Customer Account No.: 23598
Attorney Docket No.: 2188.047

Dear Sir:

Enclosed in connection with the above-identified utility patent application are:

- the patent application, consisting of:
  - 21 pages of specification,
  - 21 claims on 4 pages,
  - 6 Drawings on 4 sheets, and
  - 1 page Abstract;
- an Application Data Sheet; and
- authorization to charge Deposit Account 50-1170 in the amount of $1,820.00 including the filing fee ($280.00), the search fee ($600.00), the examination fee ($720.00), one claim in excess of twenty ($80.00), and the surcharge for late filing of a declaration ($140.00) as a large entity.

Documents to Follow:

- two Combined Declaration and Assignment forms, signed by the inventors.

Applicants:

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Assignment for Published Application:

NETGEAR, Inc.

Power of Attorney:

The patent practitioners associated with Customer Account No. 23598.

Small Entity Statement:

Not applicable.

Non-Publication Request:

Not applicable.

Deposit Account Authorization

The Director is hereby authorized to charge payment of any additional fees associated with this communication or credit any overpayment to Deposit Account No. 50-1170.

With best regards.

Respectfully Submitted,

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Enclosures

Non-Provisional Patent Application for

SYSTEM AND METHOD FOR CONFIGURING DEVICE CONNECTIONS IN AN EXTENDED NETWORK ENVIRONMENT

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SYSTEM AND METHOD FOR CONFIGURING DEVICE CONNECTIONS IN AN EXTENDED NETWORK ENVIRONMENT

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] None.

FIELD OF INVENTION

[0002] This invention generally relates to the field of providing a network connection between a network device and one of a plurality of wireless access devices in a network environment and more particularly to a system and method for providing a network connection between a network device and one of a plurality of wireless access devices based on the detection of an alternative access point providing one or more advantages over a current access point.

BACKGROUND OF THE INVENTION

[0003] In computer networking, a wireless access device (WAP) is a device that allows wireless devices to connect to a wired or wireless network using a wireless communication protocol, such as Wi-Fi or Bluetooth. The wireless access device typically connects to or is implemented as a component of a router connected to a wired external network, such as a local network or the Internet. A wireless access device connected to or implemented with a router is referred to as a WiFi router. A network device connected to an external network is referred to as a "gateway," while a wireless access device connected to an external network may be referred to as a "gateway wireless access device" or a "gateway." So a "gateway" device referenced in this document can have a wireless interface or have no wireless interface, but it is a device connecting the internal network and the external network.

[0004] Wireless access devices utilize a wireless connection between the wireless device and the wireless access device to transfer data. The area in which a wireless connection between the wireless device and the wireless access device can be established and maintained is the wireless coverage area or simply the "coverage area." However, even within the coverage area, the speed at which the data is transferred is dependent on the quality of the wireless connection. A high quality wireless connection relies on multiple different wireless connection quality factors. For example, the quality of a wireless connection may be determined based on the signal strength

that exists between the wireless access device and the wireless device. Additionally, the quality of a wireless connection may depend upon communication capability of the devices, determined by the wireless technology implemented on each device. For example, different devices implement different communication protocols, have different processing power, have different antenna configurations, etc. Users and provider of wireless access device continuously strive to maximize the quality of their wireless connection, particularly when using data intensive applications such as video streaming, telephony applications, etc.

[0005] Often, the area where a user wishes to use his or her wireless device is larger than the area providing a high quality wireless connection to the wireless access device. For example, the signal strength decreases based on the distance between the wireless access device and the wireless device. Additionally, certain areas that would otherwise receive a high quality wireless connection are subject to interference that reduces the quality of the wireless connection. Accordingly, users may add additional wireless access devices to their network, such as a WiFi extender, to increase the area where the user can maintain a high quality wireless connection.

[0006] WiFi extenders typically are similar to wireless access devices, but do not include an integral router connected to the external network. Instead, WiFi extenders typically rely on wired or wireless connections to the WiFi router to connect to the external network. The coverage area in which a user can connect to at least one wireless access device is considered the "extended network environment." A network including both a gateway wireless access device and one or more extender wireless access devices is referred to as an "extended network."

[0007] A WiFi extender is a wireless access device for wireless devices to connect to a network. Additionally, the WiFi extender acts as a wireless device to connect to another wireless access device in order to connect to a network. The "another wireless access device" may also be referred to as an "upstream wireless access device". Usually, a WiFi extender uses a single radio frequency device component to connect to both the wireless devices and the upstream wireless access device. Further, in order to avoid bad performance, the radio frequency device has to work in the same frequency to connect to the wireless devices as well as to connect to the upstream wireless access device. In such a usage, when a wireless device transmits or receives data from the upstream wireless access device, the transmission between the upstream wireless access device and the WiFi extender and the transmission between the WiFi extender and the wireless

device share the same frequency. Assuming there is no other usage on this frequency, the two transmissions must divide the time of using the frequency and so the end to end throughput is not as high as the wireless device can see from its connection to the WiFi extender. For example, if the speed between the wireless device and the WiFi extender and between the WiFi extender and the upstream wireless access device are the same like 100mbps, then the speed for transmitting data between the wireless device and the upstream wireless access device is cut in half, like to become around 50mbps.

[0008] Typically, wireless devices establish a connection with a single wireless access device in an extended network based on a determination of which wireless access device will provide the highest quality wireless connection. The single wireless access device having a wireless connection to the wireless device is referred to herein as a "current wireless access device." Once established, this wireless connection is maintained between the wireless access device and the wireless device until the connection is lost or degrades below a threshold quality level. The connection may be lost or degraded when the wireless device moves out of range of the wireless access device, moves to a location where there is interference, etc. Thereafter, the wireless device will attempt to establish a new wireless connection; again with whichever wireless access device will provide the highest quality wireless connection.

[0009] However, wireless devices often are transported to various areas within a coverage area covered by multiple wireless access devices without ever losing their connection to their current wireless access device. Because of variations in the quality of the wireless connection within the coverage area, users may not always be connected to the wireless access device that will provide the highest quality wireless connection. For example, a wireless device user connected to a first wireless access device may move to location that is remote from that wireless access device (although still maintaining a wireless connection), but is very close to a second wireless access device (that would provide a higher quality wireless connection at the new location). As a result, the wireless device will receive a signal that is weaker than optimal. .

[00010] In a home network, there is a router or gateway that connects the internal network, the home network, and the external network, the Internet. For a home network where there is more than one wireless access device for a wireless device to reach the gateway or the external network, almost no wireless device knows which wireless access device can give it better

connection to the network. This is because a wireless device does not know which access device has a better connection to the router/gateway and the interpretation of speed for different access devices could be different. For example, when a client sees one connection of 10mbps from one access device and one connection of 7mbps from another access device. If the 10mbps connection is from a gateway, then it is a better connection than the other. If the 10mbps connection is from an extender, as elaborated in [0007], the connection speed from the wireless device to the gateway (the upstream access device) could be just 5mbps, and so the 7mbps direct connection to the gateway is actually the better connection. In a general way, a home network has a tree topology. The root is the router/gateway, the nodes are extenders, and the leaves are wireless devices or wired devices. The whole tree is connected to the Internet through the router/gateway at the root. There could be multiple extenders connecting to the router/gateway directly and there could be extenders connecting to an upstream extender and then connecting to the router/gateway indirectly. For a wireless device, the connection quality provided by each node in the tree, including the root if it is a gateway wireless access device, is determined by not only the node's signal strength to the device, the wireless capability of the node … but also the connection quality between the node and the root.

[00011] What is needed is a system and method for configuring wireless connections in an extended network environment that optimizes connection quality to a wireless device in the coverage area. What is further needed is such a system and method configured to continuously monitor wireless connections between a wireless device and a plurality of wireless access devices to optimize the quality of a wireless connection to the wireless device.

SUMMARY

[00012] A wireless access device may be configured to determine wireless connection quality information for a wireless device in comparison to at least one other wireless access device. To achieve this functionality, a wireless access device can monitor all packets sent from the wireless device at a certain time for a certain period, even when the wireless device is not connected to the wireless access device or the wireless packets are not intentionally transmitted to the wireless access device. Advantageously, each wireless access device can contribute to the process of identifying the wireless access device providing the highest quality wireless connection

based on wireless connection quality information transmitted by or exchanged among the wireless access devices.

[00013] According to one embodiment of the invention, a network device is configured to facilitate wireless connection management in an extended wireless network. The network device includes a network device input connected at least indirectly to an internal network and configured to communicate a plurality of packets to and from at least one computer system, a network device output connected at least indirectly to an external network and configured to communicate the plurality of packets to and from at least one computer system. The network device could also be a device that includes a network device input connected directly to one or more wireless devices or wireless access devices and configured to communicate a plurality of packets to and from at least one computer system, a network device output connected at least indirectly to a network and configured to communicate the plurality of packets to and from at least one computer system (the network device input and the network device output could actually use the same hardware device). In addition, such a network device also includes a computer processor configured to execute steps stored in non-volatile memory. The computer processor is configured to receive packets from a wireless device, identify the wireless device within a table of wireless devices communicating with at least one wireless access device in an extended wireless network, and generate wireless connection quality information for the wireless device specific to the wireless access device that received the packets based on the received packets and based on the knowledge of the network topology related information.

[00014] In one embodiment, the computer processor is further configured to transmit the wireless connection quality information and partial network topology information to other wireless access devices in the network.

[00015] In another embodiment, the computer processor is further configured to exchange wireless connection quality information and partial network topology information with a plurality of other network devices and to identify a network device in the extended network providing the highest quality wireless connection for the wireless device. The processor may be further configured to exchange messages with other network devices to initiate a connection between the wireless device and the network device having the highest wireless connection quality.

[00016] In another aspect, the wireless connection quality that is detected includes at least one of a wireless signal strength, a connection capability, a utilization status and a connection patch quality.

[00017] According to another aspect of the invention, an extended network configured to implement an extended management function to identify a wireless access device providing a highest quality wireless connection to a wireless device. The extended network includes a gateway configured to enable communication between the extended network and an external network, at least two wireless access devices in the extended network (one could be the gateway if it is a gateway wireless access device), and at least one wireless device having a wireless connection to a least one of the wireless access devices. The wireless access device includes a processor executing the extended management function to identify the wireless access device providing the highest quality wireless connection based on wireless connection quality information and topology information exchanged among the wireless access devices.

[00018] According to yet another aspect, a computer implemented method for identifying a wireless access device providing a highest quality wireless connection to a wireless device is described. The method includes monitoring the relative signal strength of packets at a plurality of wireless access devices in an extended network from a wireless device having a current wireless connection to a current wireless access device in the plurality of wireless access devices and generating wireless connection quality information at each wireless access device in the plurality of wireless access devices describing the quality of a wireless connection between the wireless device and the wireless access device.

[00019] Other features and advantages of the invention will become apparent to those skilled in the art upon review of the following detailed description, claims and drawings in which like numerals are used to designate like features.

BRIEF DESCRIPTION OF THE DRAWINGS

[00020] Preferred exemplary embodiments of the invention are illustrated in the accompanying drawings in which like reference numerals represent like parts throughout, and in which:

[00021] FIG. 1 schematically illustrates an extended networking environment for communicating information between a wireless device and a plurality of wireless access devices, according to an exemplary embodiment;

[00022] FIG. 2 illustrates an embodiment of the gateway wireless access device of FIG. 1, configured to implement an extended network management function, shown in greater detail, according to an exemplary embodiment;

[00023] FIG. 3A and 3B are schematic illustrations of an extended networking environment including a plurality of wireless access devices configured to implement an extended network management function, according to an exemplary embodiment; and

[00024] FIG. 4 is a flowchart illustrating a method for configuring device connections in an extended network environment, according to an exemplary embodiment.

[00025] Before the embodiments of the invention are explained in detail, it is to be understood that the invention is not limited in its application to the details of construction and the arrangement of the components set forth in the following description or illustrated in the drawings. The invention is capable of other embodiments and of being practiced or being carried out in various ways. Also, it is to be understood that the phraseology and terminology used herein are for the purpose of description and should not be regarded as limiting. The use of "including" and "comprising" and variations thereof is meant to encompass the items listed thereafter and equivalents thereof as well as additional items and equivalents thereof.

DETAILED DESCRIPTION

[00026] Referring now to FIG. 1, a networking environment 100 for communicating information between at least one wireless device 110 and an external network 130 through an extended network 120 is shown. The extended network includes at least a gateway wireless access device 122 and one or more extended wireless access devices 124. The extended network 120 may further be utilized for communicating information with one or more additional wireless devices (not shown) connected with a wireless access device of the extended network 120.

[00027] Extended network 120 is a local area network configured to provide wireless communication of information with a plurality of devices and applications in relatively close proximity to each other, such as within a home, school, office building, etc. Wireless devices or "wi-fi clients" 110 communicating through extended network 120 may include a web application running on a personal computing device such as a desktop computer, a laptop computer, a tablet, etc, a smartphone, a game device, or a streaming media player. The web application may include a web browsing application, a video player application, a telephony application, a video telephony application, etc. It should be understood that although specific devices and applications are described, these are merely provided as examples. Any or all of these or other wireless devices 110 could be present in a given extended network 120.

[00028] The gateway wireless access device 122 of extended network 120 is a type of network device that manages the flow of data between extended network 120 and the external network 130. Gateway wireless device may comprise, for example, a router, a switch, or a gateway. Functionality described herein as being associated with gateway wireless access device 122 may be implemented using one or more devices. For example, gateway wireless access device 122 may be configured to include a router in communication with a network switch, either of which can be configured to perform some or all of the functions described herein.

[00029] When a data packet is received at either gateway wireless access device 122 or an extended wireless access device 124, an additional or second type of network device, the wireless access device reads address information in the packet to determine its ultimate destination. In a packet-switched network, a "router" is a device which receives packets on one or more input interfaces and which outputs those packets on one of a plurality of output interfaces so as to move those packets within the network from a source device to a destination device. Each packet includes header information, which indicates the destination device in either extended network 120 or external network 130. Additional information is provided by the physical layer to the device which receives a packet directly and that information can further include wireless connection quality information, described in detail below with reference to FIG. 2. The router includes routing information, which associates an output interface with information about the destination device. The router can also perform other operations on packets, such as rewriting the

packets' headers according to their routing protocol, or re-encapsulating the packets from a first routing protocol to a second routing protocol.

[00030] Gateway wireless access device 122 may be a gateway device that provides an exclusive communication channel between extended network 120 and external network 130. Accordingly, packets transmitted by extended wireless access devices 124 and/or wireless devices using extended network 120, can be viewed using the gateway wireless access device 122. Gateway wireless access device 122 and extended wireless access device 124 may further be configured to generate wireless connection quality information transmitted to a certain wireless access device (122 or 124) or exchanged among wireless access devices (122 and 124), as described below in further detail. Accordingly, some or all wireless access device (122 and/or 124) are further configured to implement an extended network management function for configuring device connections in an extended network environment, as described in detail below with reference to FIG. 2.

[00031] External network 130 may be a wide area telecommunication network covering a broad area, such as the Internet. External network 130 may be connected to network device 120 using a wired or wireless connection. For example, gateway wireless access device 122 may be connected to the external network 130 via a high-bandwidth connection such as a cable modem, a Digital Subscriber Line (DSL) modem, or a 3G/4G Long Term Evolution (LTE) modem connection to send and receive data with systems through external network 130.

[00032] External network 130 allows communication with one or more of a plurality of external systems including, for example an external web site, an external computing system, and/or an external database. These systems and applications may be accessible using an Internet Protocol address provided by any of the wireless devices on extended network 120 and used by network device 120 to determine a destination for data transmitted to and/or from extended network 120 to external network 130.

[00033] In operation, each wireless access device 122, 124 in extended network 120 is configured to monitor, store, and/or report wireless connection quality information. The wireless connection quality information may be generated at the wireless access device 122 or 124 and/or included in packet headers received at the wireless access device. For example, each access point

is configured to monitor the link rate of packets sent from the wireless device 110 and to check the signal strength it receives for those packets, no matter which wireless access device the packets are intentionally transmitted to. Accordingly, each wireless access device can provide wireless connection quality information indicating signal strength from the wireless device 110 and corresponding link rate for packets from the wireless device.

[00034] Each wireless access device 122 or 124 in extended network 120 may be further configured to periodically review the wireless connection between the wireless access device and any wireless devices communicating with the wireless access device. The connection check may be performed periodically such as every 5 seconds, based on a reported connection issue, such as an unusually slow connection, etc. A wireless access device can send and receive wireless connection information and a partial network topology with other wireless access devices periodically in an attempt to identify a better connection for a wireless device. In addition, a wireless access device can also monitor an existing connection to identify if the connection with a wireless device becomes bad. If the connection does become bad, the wireless access device starts looking for another wireless access device in the extended network that can provide better a better connection for the wireless device.

[00035] The wireless connection quality information received from the wireless device 110 may be stored in a memory of the wireless access device 122 or 124 and/or forwarded to a central repository, such as the memory for gateway wireless access device 122. The wireless connection quality information may be either a simple value, such as a connection speed, or a number of different values, such as connection speed and other quality information for the extended network 120, including the quality for connections between two wireless access devices, for example, for the connection between the gateway wireless access device 122 and an extended wireless access device 124. The wireless connection quality information may be forwarded when it is received, may be periodically forwarded in a batch operation, may be aggregated to provide wireless connection quality information over a defined period of time, etc. Advantageously, the stored wireless connection quality information may be used to determine the particular wireless access device 122 or 124 that can provide the highest quality wireless connection to the wireless device 110 at any particular time. Using the network management system described herein, extended

network 120 may be configured to utilize any tree topology including a gateway wireless access device 122 as a root, such as a hub/star configuration, a cascaded configuration, etc.

[00036] For example, in a tree topology, the extended network is configured in a tree topology including a gateway device as a root, one or more wireless access devices as nodes in the tree, and a wireless device as a leaf. The network tree topology can have several levels and each level can have several nodes. A node or a wireless access device connects to the network by connecting to its upstream node or wireless access device. A wireless access device can connect to its upstream node in any of a variety of different ways, for example through a wired connection (e.g. Ethernet, and the wireless access device is a Wi-Fi AP), through a wireless connection (e.g. Wi-Fi, and the wireless access device is a Wi-Fi extender), etc. In addition, a wireless access device may be configured to have only one wireless interface where it performs multiplexing on the single wireless interface and uses the same wireless to connect to the extended network as well as to wireless devices. One example of such a device is a Wi-Fi single-band extender.

[00037] Although the wireless device 110 will be connected to a single wireless access device 122 or 124 through an existing wireless connection, designated as the "current wireless access device." Establishing a wireless connection may include performance of a handshake protocol and the exchange of data packets as is well known in the art. Once a wireless connection is established, the wireless access device establishing the connection is considered the current wireless access device. Although connected with the current wireless access device, each wireless access device 122 or 124 on extended network 120 is configured to receive any packets transmitted to the current wireless access device from the wireless device 110 and store the observed quality information of these packets independent of whether the wireless access device is providing the wireless connection to the wireless device. Depending on the location/position of each access device relative to the wireless device, the observed signal strength at each access device for a packet from the wireless device (to the current access device) is different. In contrast, in a typical wireless network, this information would be discarded as packets from devices that are not transmitted to a wireless access device were dropped by that wireless access device.

[00038] Referring now to FIG. 2, a gateway wireless access device 122 or simply "gateway" configured to implement an extended network management function as described herein is shown in greater detail, according to an exemplary embodiment. Although gateway 122 is shown in FIG. 2 as including specific components in an exemplary configuration, it is important to recognize that gateway 122 may include more, fewer, and/or a different configuration of components to implement the functions described herein. Further, although the functionality described herein is described as being implemented on a gateway device, the extended network management function can be implemented on a gateway device 122 and/or an extender access device 124. In addition, an implementation may be centralized on one device or distributed among a plurality of devices. For simplicity, the functionality will be described herein below with reference to implementation on a gateway 122.

[00039] The functional components (not shown) of gateway 122 may be implemented using hardware including a processing unit, a system memory, and a system bus that couples various system components, including the system memory, to the processing unit. The system bus may be any of several types of bus structures including a memory bus or memory controller, a peripheral bus, and a local bus using any of a variety of bus architectures. Further, the described components may be implemented using hardware and/or software.

[00040] The processing unit may be any type of computer processor configured to implement the functionality described herein including the steps of identifying advertising content requests in network packets transmitted through gateway 122. The processing unit may be any type of processor, such as a MIPS processor.

[00041] The system memory of gateway 122 includes computer storage media in the form of volatile and/or nonvolatile memory such as read only memory (ROM) and random access memory (RAM). A basic input/output system (BIOS), containing the basic routines that help to transfer information between elements within gateway 122, such as during start-up or networking operations, is typically stored in ROM. RAM typically contains data and/or program modules that are immediately accessible to and/or presently being operated on by the processing unit. The gateway 122 may also include other removable/non-removable, volatile/nonvolatile computer storage media, such as flash memory. Although gateway 122 is shown and described herein as

including memory, gateway 122 may alternatively be implemented to store information in a network storage device.

[00042] Although gateway wireless access device 122 may be any of a variety of types of network devices, for clarity access point 122 is further described herein as a router type network device. Gateway wireless access device 122 includes a wireless client interface 202, a wireless connection analyzer 204, an extended network management system 206, an extended network management table 208, and an extended network interface 224. Although network device 122 is shown as including a number of functional embodiments represented as separate components, it should be understood that the same functional component may be used to implement one or more of the functional embodiments.

[00043] Wireless client interface 202 is an input/output port receiving/transmitting packets from/to the wireless devices 110. Extended network interface 224 is an input/output port receiving/transmitting packets from/to the extended network 120. Extended network interface 224 connects the access device to the extended network. Extended network interface 224 can be an Ethernet port, a wireless transmitter, or another device for receiving/transmitting packets from/to extended network 120. The physical device for the wireless client interface 202 and the extended network interface 224 can be the same. A simple extended access device 124 can be configured to have only one network interface (a wireless interface) such that both wireless client interface and extended network interface are through the only network interface.

[00044] Wireless connection analyzer 204 is a software component configured to analyze and determine wireless connection quality between the wireless access device 122 and a wireless device. Although shown specifically within gateway wireless access device 122, a wireless connection analyzer 204 is implemented in the extended network 120 on the wireless access devices 122 and 124 in the network. Accordingly, each wireless access device 122, 124 in the extended network is configured to be able to obtain information used to determine the wireless connection quality between that wireless access device and the wireless devices within the extended network 120.

[00045] The wireless connection analyzer 204 associated with each wireless access device 122, 124 is configured to generate a wireless connection quality table entry to be stored in an

extended network management table 208. The specific data used to generate the wireless connection quality table information is described in further detail below with reference to the extended network management table 208. The analyzer 204 may generate the table entry based on information received from the wireless device in packet headers, based on data received from components in the wireless access device, such as a signal strength detection system (not shown), based on data received from other wireless access devices in the extended network, etc.

[00046] Each wireless connection analyzer 204 is further configured to generate the wireless connection quality table entry for each wireless device 110 associated with any wireless access device on the extended network. The analyzer 204 associated with each wireless access device 122 or 124 can be configured to generate the table entry independent of whether the associated wireless access device is connected to the wireless device 110, being used in the connection path to gateway wireless access device 122, etc. The analyzer 204 associated with each wireless access device 122 or 124 can be further configured to generate the wireless connection quality table entry for each other wireless access device 122 or 124 that connects to it.

[00047] Extended network management system 206 is a software application implemented in a root or central wireless access device for an extended network, such as gateway wireless access device 122. In an alternative embodiment, network management system 206 may be implemented as a distributed system in a plurality of wireless access devices. Management system 206 is configured to implement a management protocol in the extended mesh network to determine the wireless access device that can provide the highest quality wireless connection to a wireless device at any particular time. Accordingly, management system 206 is configured to store and maintain the extended network management table 208 based on connection quality data received by the wireless access devices in the network and exchanged among wireless access devices in the network. Table 208 may also be generated to include data connection quality data generated locally at each wireless access device 122 or 124.

[00048] Extended network management table 208 is generated and stored with the memory of gateway 122 and/or any other wireless access device. Table 208 includes a unique wireless access device record 210 for each wireless access device 122, 124 communicating through the extended network 120. Each record 210 includes a plurality of wireless connection quality table

entries 212, one for each wireless device in the extended network 120. Accordingly, table 208 may be stored and maintained in memory remote from device 122, such as would be implemented in a cloud computing environment.

[00049] Each wireless connection quality table entry 212 in the network management table 208 is specific to the wireless connection between one wireless access device 122 or 124 and one wireless device 110. Accordingly, table entries 212 include a wireless access device identifier 214, a signal strength data field 216, and a wireless capability field 218 for the wireless device 110. Each wireless access device record 210 for a wireless access device 122, 124 includes a utilization status data field 220 for each wireless band (e.g., 2.4 GHz, 5GHz), a noise field 222 for each wireless band, a wireless capability field 224 for the wireless access device, and a connection path quality data field 226 describing the connection path for each wireless access device 124 in the path to the gateway wireless access device 122, (i.e., determined by the connection quality between any two contiguous wireless access devices on the path between the current wireless access device and the gateway wireless access device 122). For the gateway wireless access device 124, this field is set to the highest value in the extended network 120.

[00050] According to a specific implementation, table 208 includes one record 210 for each wireless access device in the extended network. In each record for an access device, there is a table for the wireless clients connected to that access device. Each table entry 212 corresponds to a wireless client connected to the access device. Some fields (214, 216, 218) are associated with a table entry since they are specific to a wireless client, while other fields (220, 222, 224) are associated with a record since they are not specific to a wireless client but are specific to a wireless access device.

[00051] Extended network management system 206 is configured to identify the wireless access device that can provide the highest quality wireless connection with a wireless device at any given time. According to exemplary embodiment, management system 206 identifies highest-quality wireless connection based on at least the capability of the wireless device 110, the capability of the gateway wireless access device 122, and the capability of each wireless access device 122, 124 in the extended network 120, the path quality from the wireless access device to the gateway, etc.

[00052] Referring now also to FIG. 3A, a schematic illustration of an exemplary extended wireless network 300 network topology including a wireless device 310, a gateway wireless access device 320 in the form of a router, and extended wireless access devices 330-336 is illustrated. The network topology may be generated based on exchanged messages communicated between the components of network 300. Each message may include a partial network topology based on the messages received by the component that is transmitting the topology.

[00053] Extended wireless network 300 further includes a representation of connection speed 340~350 between wireless communication elements within the extended network 300. Accordingly, the connection speed 340 between gateway wireless access device 320 and a first extended wireless access device 330 is 60 Mega bits per second (Mbps), while the connection speed 342 between gateway wireless access device 320 and a second wireless access device 332 is 20 Mbps. The connection speed is dependent on several factors, including at least the hardware and software installed on each endpoint (i.e. the connection type and the capability of each endpoint) and the distance between the endpoints if it's a wireless connection.

[00054] Where wireless device or "Wi-Fi client" 310 is positioned at a first location 308 as shown in ghost form in Fig. 3A, the wireless device 310 may be already connected to the extended wireless access device 334. The wireless connection is designated as 350. However, management system 206 will continually evaluate available wireless connections while the wireless device 310 is moving.

[00055] For example, when the wireless device 310 moves to the second location depict in Fig. 3A, (location #2), the wireless connections 350 becomes weak and the wireless device 310 may suffer from the weak wireless connection. Dependent on the wireless device 310's implementation, wireless device 310 may determine if the wireless device 310 needs to try to a different wireless access device to get a better connection based on any of a variety of factors. Such continuous searching for an optimal connection is referred to as roaming in the wireless environment. For example, some implementations are configured to use the existing connection to avoid disruption until that connection is too weak to maintain the connection. The weak wireless connection 350 may be identified by the wireless access devices 334 based on detected poor

signal strength between the wireless access device 334 and the wireless device 310. The poor signal strength information may be communicated among the wireless access devices and the management system 206 implemented by each wireless access device 122, 124 will put the poor signal strength information in its table as discussed above.

[00056] Further, at the second location, wireless device 310 may have a good wireless connection if it connects to wireless access device 336 or wireless access device 332. This can be detected by the wireless access device 332, 336 by monitoring the signal strength from all the wireless packets sent from the wireless device 310, even if the packets are not transmitted to the wireless access device 332, 336 intentionally. Accordingly, management system 206 is configured to check if the wireless access device 332 or 336 can provide a better connection to the wireless device 310. Generally, the connection speed for a wireless device 310 to the gateway wireless access device 320 is determined by determining the lowest speed among all links (between any two contiguous devices) in the connection path between that wireless device and the gateway wireless access device 320, divided by the number of links between the gateway wireless access device 320 and the wireless device the network device 310. Accordingly, at the second location, the lowest speed in the connection path through wireless access device 336 (path#1) is 20 Mbps, and the connection speed for path#1 is 20 Mbps divided by the three links, which gets 6.67 Mbps. In contrast, while the lowest speed in the connection path through wireless access device 332 (path#2) is also 20 Mbps, the connection speed for path#2 is 20 Mbps divided by the two links, which gets 10.0 Mbps. Accordingly, management system 206 will initiate a wireless connection between the wireless access device 332 and the wireless device 310 based on the higher 10.0 Mbps connection speed.

[00057] However, referring now to FIG. 3B, where if the wireless device 310 is capable of creating connections with a higher speed to the wireless access device 332 and 336, and the connection speed 346 and 348 for the wireless connection between wireless device 310 and wireless access device 332, 336 is both 60 Mbps. The higher speed of the link will result in a higher connection speed for the path#1 and the consequent connection speed is 60 Mbps divided by 3, which gets 20.0 Mbps. However the connection speed for the path#2 remains at 10Mbps, even the connection speed 346 has been increased to 60mbps. That is due to the connection 342 now becomes the bottleneck of the path#2 and that keeps the connection speed for path#2 on

10Mbps. Accordingly, management system 206 will initiate a wireless connection between the wireless access device 336 and the wireless device 310 based on the higher 20.0 Mbps link rate.

[00058] Referring now to FIG. 3C, a schematic illustration of another exemplary extended wireless network 300 including a wireless device 364, a gateway wireless access device 360 in the form of a router, and an extended wireless access devices 362 is illustrated. If the wireless device 364 connects to the wireless access device 362, the connection speed between the wireless device 364 and the gateway wireless access device 360 is 20 mbps divided by 2, which is 10 Mbps. If the wireless device 364 connects to the gateway wireless access device 360 directly, the connection speed is 15 Mbps. The management system 206 will consider the wireless access device 360 provides a better connection for the wireless device 364, even though, from the wireless device 364's point of view, the wireless access device 362 provides a better connection. As shown in FIG. 3C, in a wireless extended network, a wireless device has multiple wireless access devices to connect to and a wireless access device that has stronger signal may not be a better choice to provide a faster connection speed to the gateway device.

[00059] Referring now to FIG. 4, a flowchart 400 illustrating a method for implementing the extended network management system 100 of FIG. 1 to identify a high quality wireless connection for a wireless device 110 is shown, according to an exemplary embodiment. Although flowchart 400 includes multiple steps performed in a defined order, the functions described herein can be performed using more, less and/or a different ordering of steps.

[00060] In a first step 402, wireless device 110 (FIG. 1) creates a wireless connection with one wireless access device 122 or 124 in the extended network 120. The wireless connection may be created based on an initial use of the wireless device 110, based on establishment of a new connection following a loss in connection, based on a specific elapsed time, etc. Establishing a wireless connection may include performance of a handshake protocol and the exchange of data packets as is well known in the art. Once a wireless connection is established, the wireless access device establishing the connection is considered the current wireless access device.

[00061] In a step 404, upon establishment of the wireless connection, the current wireless access device, including at least gateway wireless access device 122 and possibly additionally including one or more extended wireless access devices 124, is configured to transmit the

establishment of the wireless connection and the identity of the wireless device to other access devices within the extended network 120.

[00062] In a step 406, each wireless access device in extended network 120 that is within wireless range of the wireless device 110 will begin receiving data packets from the wireless device 110 based on the wireless connection to the current wireless access device. Generally, wireless access devices in extended network 120 other than the current wireless access device will not process the data packets transmitted to the current wireless access device; they typically discard those packets. However, based on the received data packets, each wireless access device in extended network 120 is configured to generate wireless connection quality information describing a real or theoretical wireless connection between that wireless access device and the wireless device 110. Step 406 may be performed for an indefinite time or a defined period of time, such as 3 seconds.

[00063] In a step 408, each wireless access device having wireless connection quality information for wireless device 110 exchanges the generated information with each other wireless access device in the extended network 120, and those information is kept in a repository such as network management table 208 and/or network management system 206, described above with reference to FIG. 2. According to an exemplary embodiment, the repository could be located in the memory of any wireless access device 122 or 124, such as table 210 of FIG. 2.

[00064] In a step 410, the gateway wireless access device 122 or the current wireless access device 122 or 124 analyzes the received wireless connection quality information to identify the wireless access device that can provide the highest quality wireless connection to the wireless device 110. It is important to recognize that the highest quality connection may vary dependent upon the intended use of the wireless connection. For example, if wireless device 110 is utilized to implement an IP telephony application, a link rate may be the primary factor in identifying a high quality wireless connection. Alternatively, if wireless device 110 does not include the capability to manage an excess amount of dropped packets, the wireless connection quality may be identified based on the fewest number of dropped packets.

[00065] In a step 412, a wireless access device 122 or 124 that does centralized control or the current wireless access device identifies any change in the condition of the wireless

connection to the current wireless access device. The connection check may be performed using the method described above with reference to FIG. 1. Alternatively, the central control wireless access device 122 or 124 or the current wireless access device may be configured to periodically determine whether to change the wireless connection from the current wireless access device to a new wireless access device based on a determination that the new wireless access device can provide a higher quality wireless connection and the connection transfer will not disrupt the applications running on the wireless device 110.

[00066] In a step 414, a wireless connection is established to the wireless access device providing the highest quality wireless connection. The connection may be established based on a message transmitted from the central control wireless access device 122 or 124 to the new wireless access device. Alternatively, the connection may be established based on a determination made at the current wireless access device. In either event, the resulting "current" wireless access device may be the same wireless access device to which the wireless device 110 was connected prior to the connection query of step 410 or a different wireless access device. The process then returns to step 404, where the steps 404-414 are repeated on an ongoing basis.

[00067] When a wireless device 110 is joining an extended network 120 (that is, during the step 402), similar mechanism can also be used to determine the best wireless access device 122 or 124 for the wireless device 110. When a wireless device 110 attempts to join a network, it usually sends out some packets to discover the environment and it has to send out a request packet for joining a network. By observing the signal strength from these packets and examining the packet contents, a wireless access device 122 or 124 can estimate the connection quality if the wireless device 110 connects to it. Furthermore, a wireless access device 122 or 124 can estimate the data transmission speed between the wireless device 110 and the gateway wireless device 122 if the wireless device 110 reaches the gateway wireless device 122 through it.

[00068] According to an alternative embodiment, network management system 206 may be implemented as a distributed management system, such that an embodiment of the network management system 206 is resident in every wireless access device within extended network 120. In such a system, wireless access devices exchange information with each other and each wireless

access device is aware of which wireless access device can provide the highest quality wireless connection to the wireless device 110.

[00069] Certain terminology is used herein for purposes of reference only, and thus is not intended to be limiting. For example, terms such as "network device" refer to any system or device receiving and retransmitting information packets in a computer network.

[00070] References to "a server" and "a processor" can be understood to include one or more controllers or processors that can communicate in a stand-alone and/or a distributed environment(s), and can thus be configured to communicate via wired or wireless communications with other processors, where such one or more processor can be configured to operate on one or more processor-controlled devices that can be similar or different devices. Furthermore, references to memory, unless otherwise specified, can include one or more processor-readable and accessible memory elements and/or components that can be internal to the processor-controlled device, external to the processor-controlled device, and can be accessed via a wired or wireless network. It should be understood that a computer program may embrace constituent programs and that multiple programs may be implemented as a single or multiple programs.

[00071] Various features of the invention are set forth in the following claims. It should be understood that the invention is not limited in its application to the details of construction and arrangements of the components set forth herein. The invention is capable of other embodiments and of being practiced or carried out in various ways. Variations and modifications of the foregoing are within the scope of the present invention. It also being understood that the invention disclosed and defined herein extends to all alternative combinations of two or more of the individual features mentioned or evident from the text and/or drawings. All of these different combinations constitute various alternative aspects of the present invention. The embodiments described herein explain the best modes known for practicing the invention and will enable others skilled in the art to utilize the invention.

CLAIMS

What is claimed is:

1. A network device configured to facilitate wireless connection management in an extended wireless network, comprising:

a network device input connected at least indirectly to an internal network and configured to communicate a plurality of data packets to and from at least one computer system;

a network device output connected at least indirectly to an external network and configured to communicate the plurality of data packets to and from at least one computer system; and

a computer processor configured to execute steps, including

receiving packets from a wireless device,

identifying the wireless device within a table of wireless devices connected to a wireless access device in an extended wireless network,

generating wireless connection quality information for the wireless device specific to the wireless access device.

2. The network device of claim 1, wherein the computer processor is further configured to transmit the wireless connection quality information to other wireless access devices in the extended network.

3. The network device of claim 1, wherein the computer processor is further configured to receive wireless connection quality information from a plurality of other network devices and to identify network device in the extended network providing the highest quality wireless connection for the wireless device.

4. The network device of claim 3, wherein the processor is further configured to initiate a wireless connection between the network device having the highest wireless connection quality and the wireless device.

5. The network device of claim 4, wherein the processor is further configured to initiate the wireless connection with the network device having the highest wireless connection quality based on a connection check between the network device and the wireless device.

6. The network device of claim 1, wherein the wireless connection quality information includes at least one of a wireless signal strength, a connection capability, a utilization status, a network topology, and a connection patch quality.

7. An extended network configured to implement an extended management function to identify a wireless access device providing a highest quality wireless connection to a wireless device, comprising:

a gateway device configured to enable communication between the extended network and an external network;

at least two wireless access devices in the extended network; and

at least one wireless device having a wireless connection to a least one of the wireless access devices,

wherein the gateway device and/or wireless access devices include a processor executing the extended management function to identify the wireless access device providing the highest quality wireless connection based on wireless connection quality information transmitted by or exchanged among the wireless access devices.

8. The extended network of claim 7, wherein the extended network is configured in a tree topology including a gateway device as a root, one or more wireless access devices as nodes in the tree, and a wireless device as a leaf.

9. The extended network of claim 7, wherein each wireless access device is configured to generate wireless connection quality information for received packets from the wireless device in consideration and to transmit the wireless connection quality information to one or more wireless access devices in the extended network.

10. The extended network of claim 7, wherein at least one wireless access device is configured to initiate a connection between the wireless access device having the highest quality wireless connection for the wireless device and the wireless device.

11. The extended network of claim 10, wherein at least one wireless access device is further configured to initiate the connection to the wireless access device having the highest wireless connection quality based on a connection check between at least one the wireless device and the wireless device.

12. The extended network of claim 10, wherein the current wireless access device is further configured to check the connection quality for the wireless device on a periodic interval.

13. The extended network of claim 7, wherein the wireless connection quality includes at least one of a wireless signal strength, a noise level, a connection capability for a wireless device, a connection capability for a wireless access device, an extended network topology, a utilization status and a connection path quality.

14. The connection quality of claim 13, wherein the connection path quality for a wireless device is the connection quality between the wireless device and the gateway device.

15. The extended network of claim 10, wherein a first wireless access device is further configured to initiate the connection between the wireless access device having the highest wireless connection quality and the wireless device based on a connection check between at least one wireless access device and the wireless device, wherein the wireless access device having the highest wireless connection quality may be the first wireless access device.

16. A computer implemented method for identifying a wireless access device providing a highest quality wireless connection to a wireless device, comprising

receiving data at a plurality of wireless access devices in an extended network from a wireless device having a current wireless connection to a current wireless access device amongst the plurality of wireless access devices; and

generating wireless connection quality information at each wireless access device in the plurality of wireless access devices describing the quality of a wireless connection between the wireless device and the wireless access device generating the quality information.

17. The method of claim 16, further including transmitting or exchanging the wireless connection quality information from a wireless access device to/with other wireless access devices in the extended network.

18. The method of claim 17, wherein at least one wireless access device is configured to initiate a wireless connection between the wireless access device having the highest quality wireless connection for the wireless device and the wireless device.

19. The method of claim 18, wherein at least one wireless access device is further configured to initiate the wireless connection with the wireless device having the highest wireless connection quality based on a connection check between at least one wireless access device and the wireless device.

20. The method of claim 16, wherein the wireless connection quality includes at least one of a wireless signal strength, a noise level, a connection capability for a wireless device, a connection capability for a wireless access device, an extended network topology, a utilization status and a connection patch quality.

21. The method of claim 17, wherein a first wireless access device is further configured to initiate the wireless connection between the wireless access device having the highest wireless connection quality and the wireless device based on a connection check between at least one wireless access device and the wireless device., wherein the wireless access device having the highest wireless connection quality may be the first wireless access device.

ABSTRACT

An extended network is configured to implement an extended management function to identify a wireless access device providing a highest quality wireless connection to a wireless device. The extended network includes a gateway wireless access device configured to enable communication between the extended network and an external network, at least one additional wireless access device in the extended network, and at least one wireless device having a wireless connection to a least one of an additional wireless access device and the gateway wireless access device. At least one wireless access device includes a processor executing the extended management function to identify the wireless access device providing the highest quality wireless connection based on wireless connection quality information transmitted from each wireless access device.

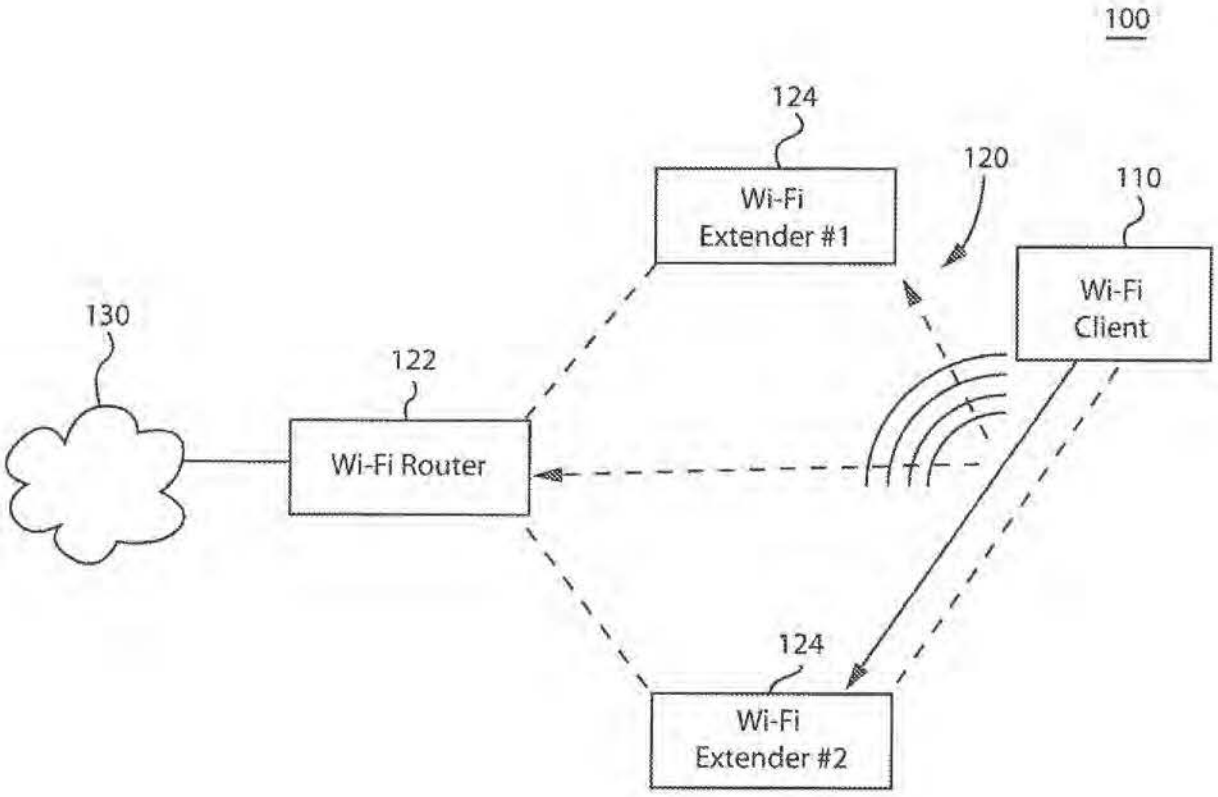

100
124
Wi-Fi
Extender #1
120
110
Wi-Fi
Client
130
122
Wi-Fi Router
124
Wi-Fi
Extender #2

FIG. 1

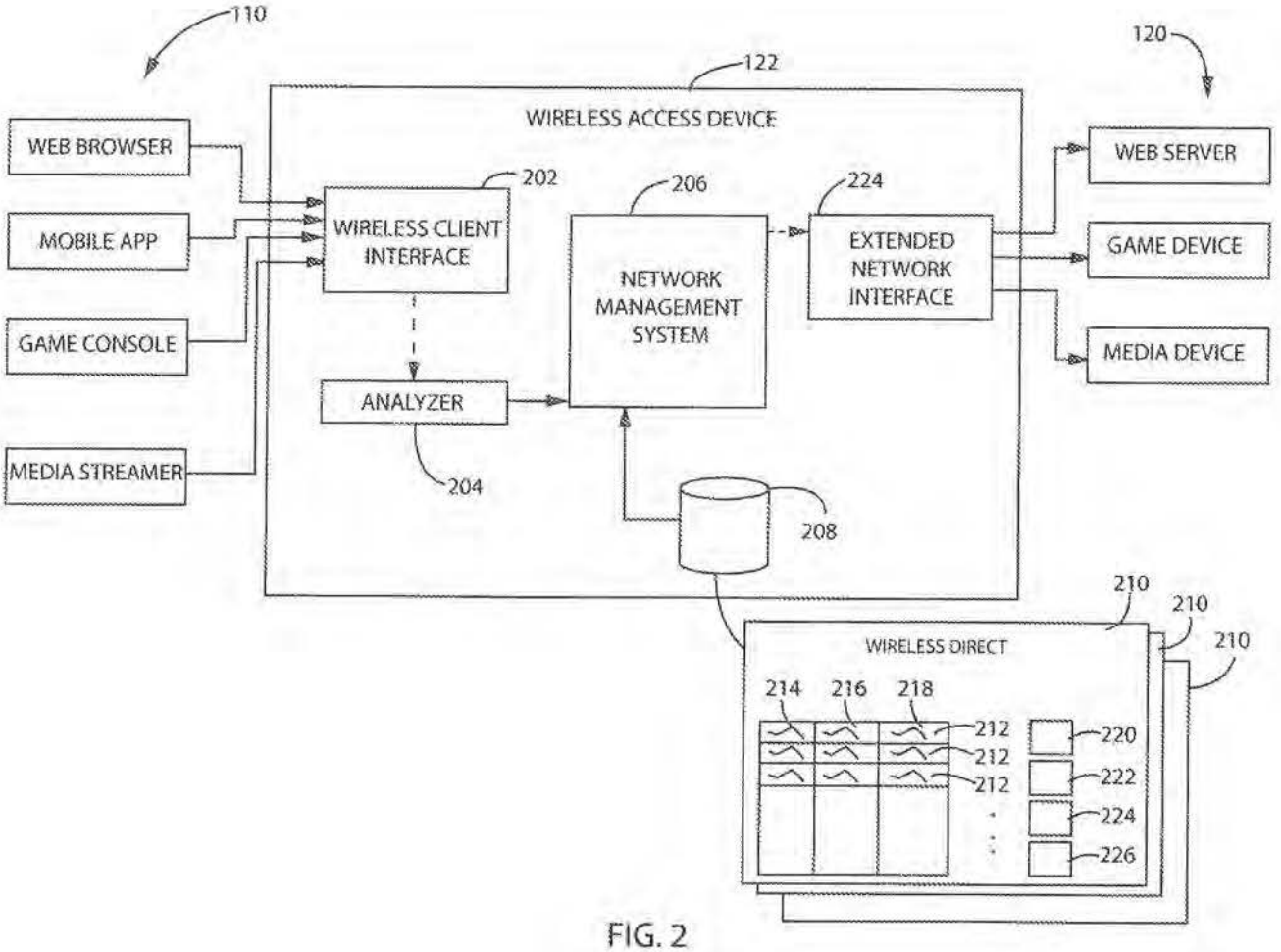

110
120
122
WIRELESS ACCESS DEVICE
WEB BROWSER
MOBILE APP
GAME CONSOLE
MEDIA STREAMER
202
WIRELESS CLIENT INTERFACE
206
NETWORK MANAGEMENT SYSTEM
224
EXTENDED NETWORK INTERFACE
WEB SERVER
GAME DEVICE
MEDIA DEVICE
ANALYZER
204
208
210
210
210
WIRELESS DIRECT
214
216
218
212
212
212
220
222
224
226

FIG. 2

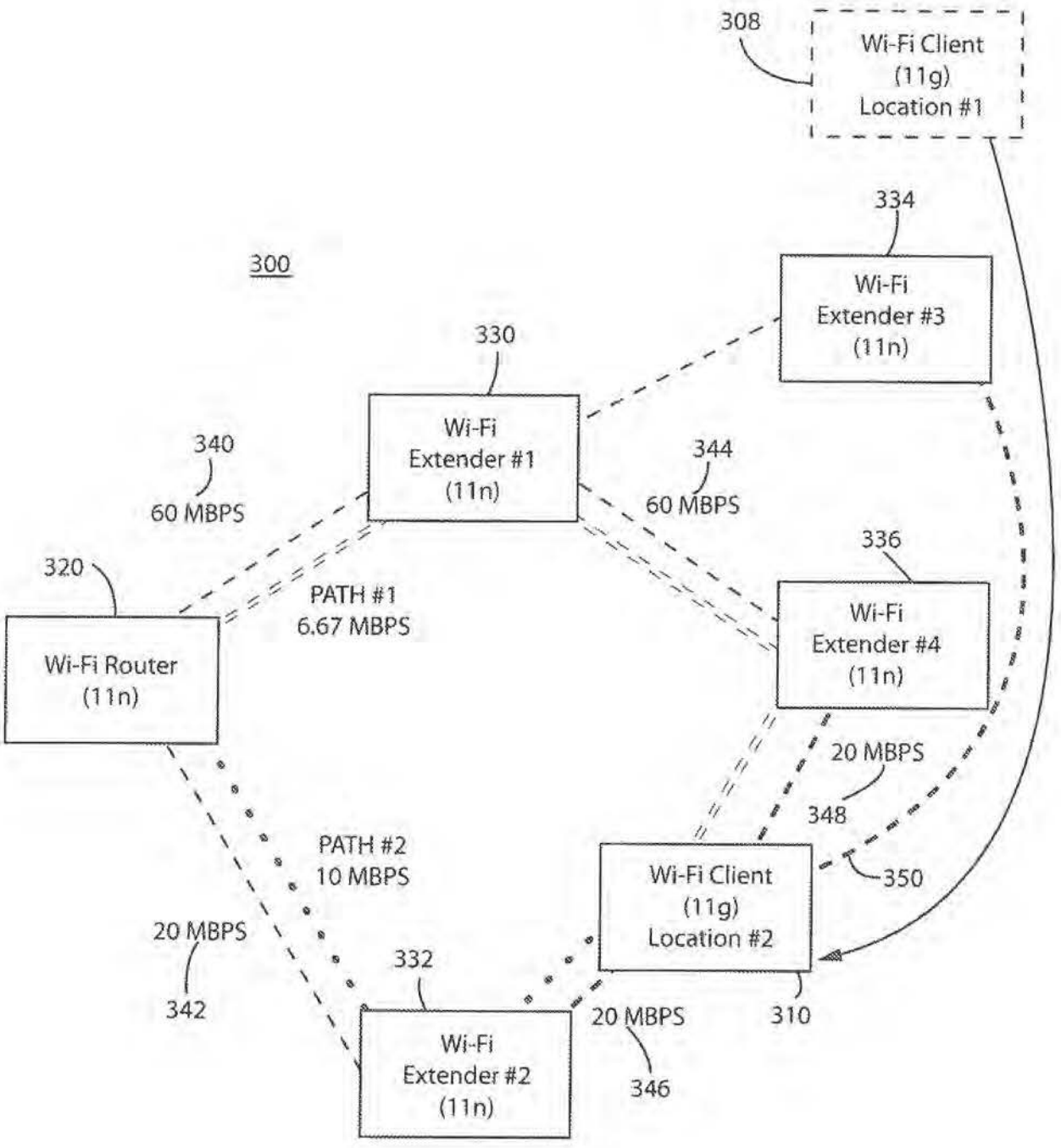

308
Wi-Fi Client
(11g)
Location #1
334
300
Wi-Fi
Extender #3
(11n)
330
Wi-Fi
Extender #1
(11n)
340
60 MBPS
344
60 MBPS
336
320
PATH #1
6.67 MBPS
Wi-Fi Router
(11n)
Wi-Fi
Extender #4
(11n)
20 MBPS
348
PATH #2
10 MBPS
350
Wi-Fi Client
(11g)
Location #2
20 MBPS
342
332
20 MBPS
310
Wi-Fi
Extender #2
(11n)
346

FIG. 3A

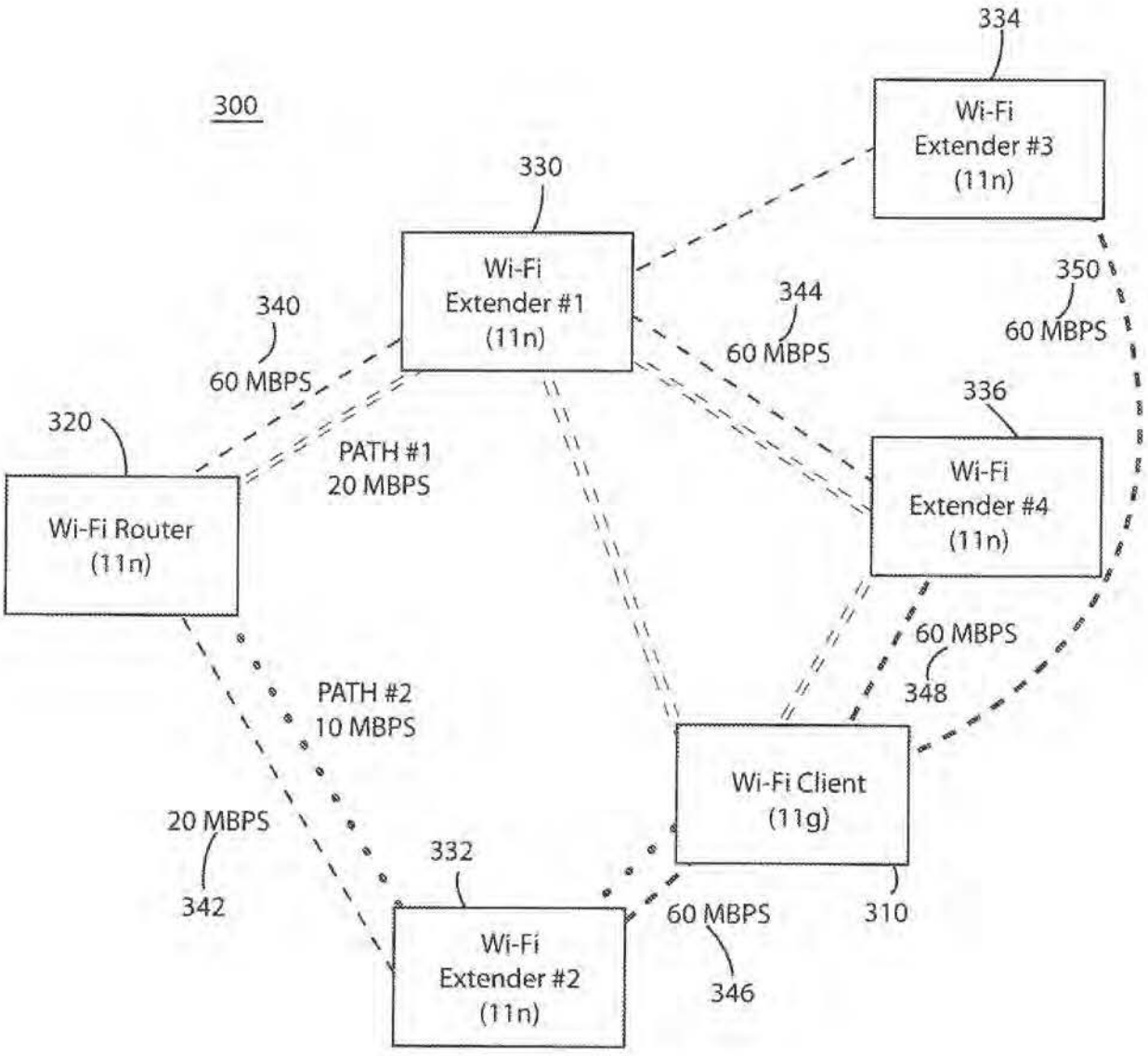

300
334
Wi-Fi
Extender #3
(11n)
330
Wi-Fi
Extender #1
(11n)
340
60 MBPS
344
60 MBPS
350
60 MBPS
320
PATH #1
20 MBPS
336
Wi-Fi
Extender #4
(11n)
Wi-Fi Router
(11n)
60 MBPS
348
PATH #2
10 MBPS
Wi-Fi Client
(11g)
20 MBPS
342
332
60 MBPS
310
Wi-Fi
Extender #2
(11n)
346

FIG. 3B

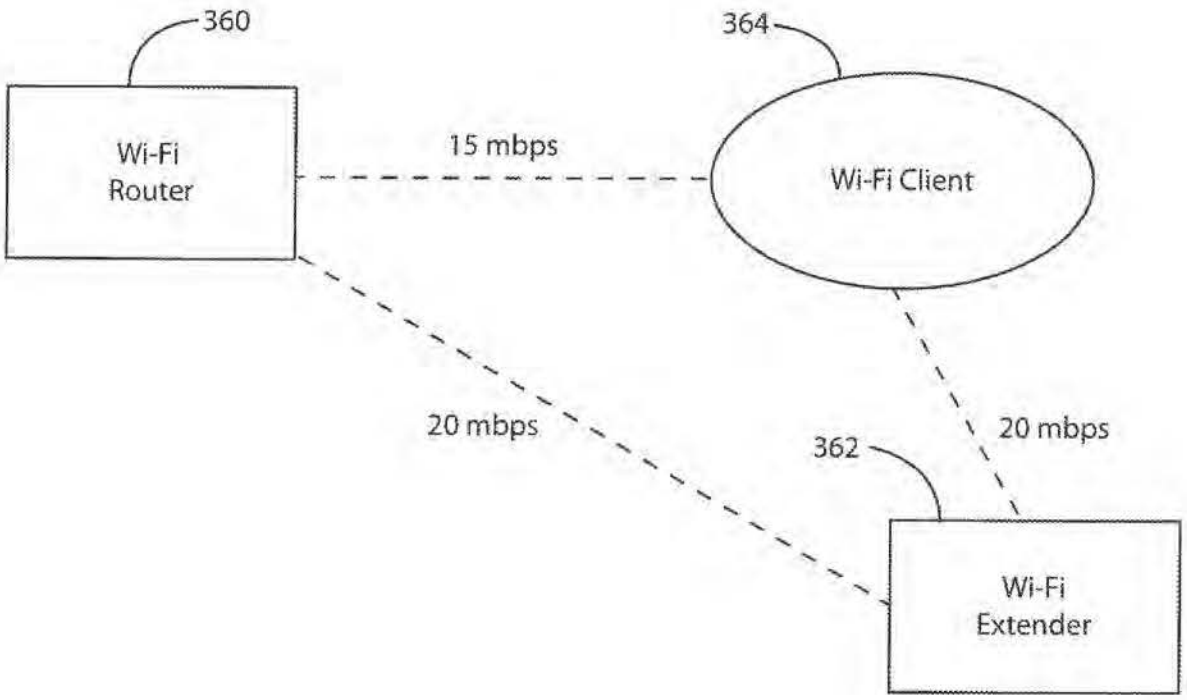

360
364
Wi-Fi
Router
15 mbps
Wi-Fi Client
20 mbps
20 mbps
362
Wi-Fi
Extender

FIG. 3C

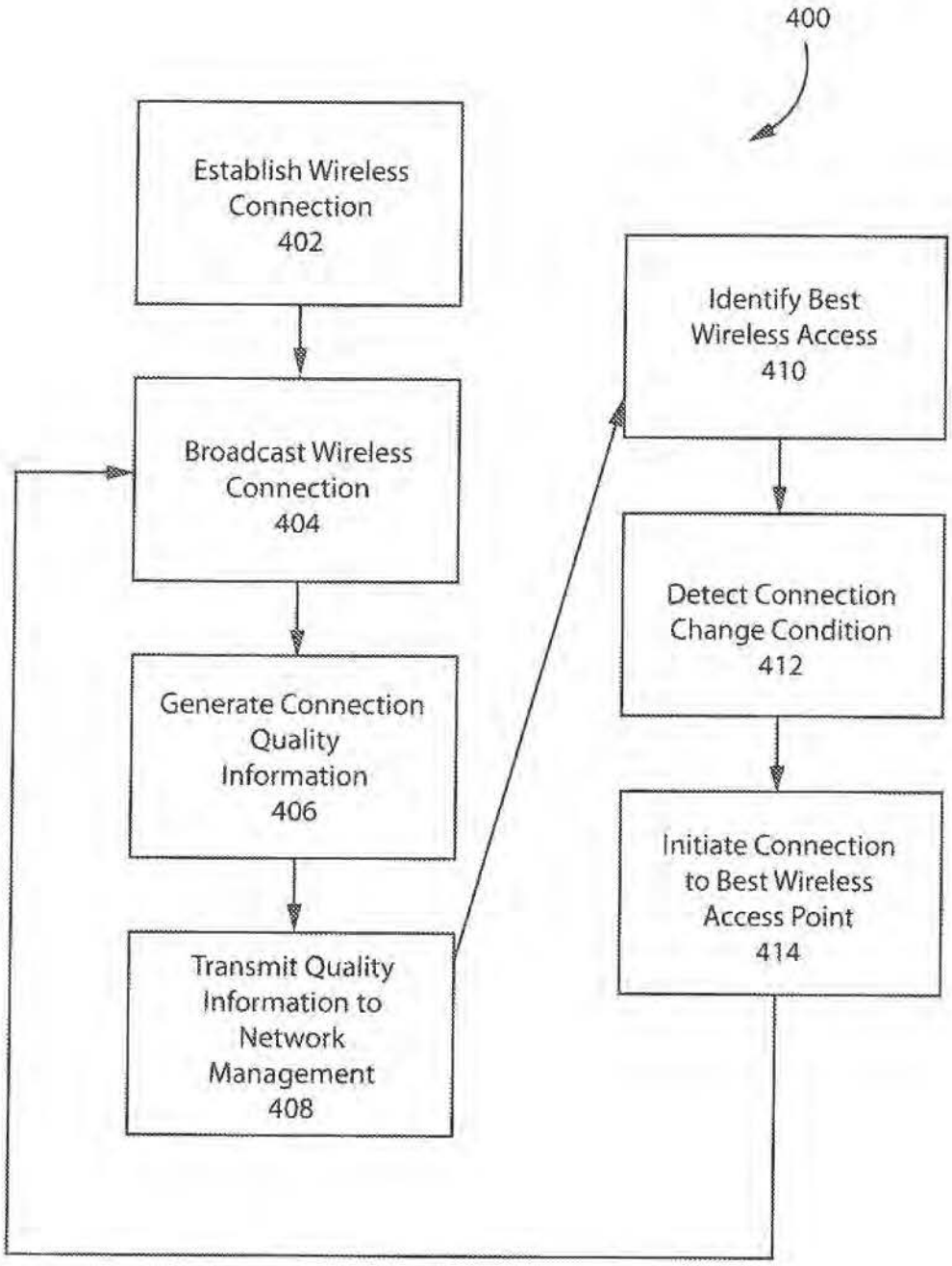

400
Establish Wireless Connection 402
Broadcast Wireless Connection 404
Generate Connection Quality Information 406
Transmit Quality Information to Network Management 408
Identify Best Wireless Access 410
Detect Connection Change Condition 412
Initiate Connection to Best Wireless Access Point 414

FIG. 4

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	2188.047
	Application Number	
Title of Invention	System and Method for Configuring Device Connections in an Extended Network Environment	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

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☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

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All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Correspondence Information:

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	Application Number	
Title of Invention	System and Method for Configuring Device Connections in an Extended Network Environment	

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Email Address	docketing@boylefred.com	Add Email	Remove Email

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Title of the Invention	System and Method for Configuring Device Connections in an Extended Network Environment		
Attorney Docket Number	2188.047	**Small Entity Status Claimed** ☐	
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	4	**Suggested Figure for Publication (if any)**	3A

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)
☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

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Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	◉ Customer Number	○ US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	23598		

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This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

Prior Application Status			Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	2188.047
	Application Number	
Title of Invention	System and Method for Configuring Device Connections in an Extended Network Environment	

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Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55(d). When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)[i] the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(h)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Remove

Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[j] (if applicable)

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button.

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

Authorization to Permit Access:

☐ Authorization to Permit Access to the Instant Application by the Participating Offices

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	2188.047
	Application Number	
Title of Invention	System and Method for Configuring Device Connections in an Extended Network Environment	

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Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Applicant 1

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

(◉) Assignee	( ) Legal Representative under 35 U.S.C. 117	( ) Joint Inventor
( ) Person to whom the inventor is obligated to assign.	( ) Person who shows sufficient proprietary interest	

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor :	
If the Applicant is an Organization check here.	☒
Organization Name	NETGEAR, Inc.

Mailing Address Information For Applicant:

Address 1	350 East Plumeria Drive		
Address 2			
City	San Jose	**State/Province**	CA
Country	US	Postal Code	95134
Phone Number		Fax Number	

PTO/AIA/14 (03-13)
Approved for use through 01/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	2188.047
	Application Number	
Title of Invention	System and Method for Configuring Device Connections in an Extended Network Environment	

Email Address	

Additional Applicant Data may be generated within this form by selecting the Add button.

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not subsitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Assignee 1

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication . An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

If the Assignee is an Organization check here. ☐

Prefix	**Given Name**	Middle Name	**Family Name**	Suffix

Mailing Address Information For Non-Applicant Assignee:

Address 1			
Address 2			
City		**State/Province**	
Country i		Postal Code	
Phone Number		Fax Number	
Email Address			

Additional Assignee Data may be generated within this form by selecting the Add button.

Signature:

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Signature	/Timothy E. Newholm/			Date (YYYY-MM-DD)	2013-08-23
First Name	Timothy E.	Last Name	Newholm	Registration Number	34400

Additional Signature may be generated within this form by selecting the Add button.

PTO/AIA/14 (03-13)
Approved for use through 01/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	2188.047
	Application Number	
Title of Invention	System and Method for Configuring Device Connections in an Extended Network Environment	

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	SYSTEM AND METHOD FOR CONFIGURING DEVICE CONNECTIONS IN AN EXTENDED NETWORK ENVIRONMENT
First Named Inventor/Applicant Name:	Yu-Te Lin
Filer:	Timothy E Newholm/Nicole Bey
Attorney Docket Number:	

Filed as Large Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Utility application filing	1011	1	280	280
Utility Search Fee	1111	1	600	600
Utility Examination Fee	1311	1	720	720
Pages:				
Claims:				
Claims in Excess of 20	1202	1	80	80
Miscellaneous-Filing:				
Late Filing Fee for Oath or Declaration	1051	1	140	140

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	1820

Electronic Acknowledgement Receipt

EFS ID:	16666573
Application Number:	13974090
International Application Number:	
Confirmation Number:	4517
Title of Invention:	SYSTEM AND METHOD FOR CONFIGURING DEVICE CONNECTIONS IN AN EXTENDED NETWORK ENVIRONMENT
First Named Inventor/Applicant Name:	Yu-Te Lin
Customer Number:	23598
Filer:	Timothy E Newholm/Nicole Bey
Filer Authorized By:	Timothy E Newholm
Attorney Docket Number:	
Receipt Date:	23-AUG-2013
Filing Date:	
Time Stamp:	09:11:24
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$1820
RAM confirmation Number	7795
Deposit Account	501170
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		00642183.PDF	14761883 f72d0b9ace88838353de8e1058aeec37a57732	yes	41

Multipart Description/PDF files in .zip description

Document Description	Start	End
Transmittal of New Application	1	2
Miscellaneous Incoming Letter	3	3
Specification	4	24
Claims	25	28
Abstract	29	29
Drawings-only black and white line drawings	30	35
Application Data Sheet	36	41

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	38280 dd10dc145aad6407047594191 1fb43fcb6d07ae4	no	2

Warnings:

Information:

Total Files Size (in bytes):	14800163

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Serial No.:	13/974,090	Confirmation No. 4517
Filing Date:	August 23, 2013	Group Art Unit: N/A
Inventor:	Lin et al.	Attorney Docket No. 2188.047
Invention:	*System and Method for Configuring Device Connections in an Extended Network Environment*	

TRANSMISSION OF DECLARATIONS FOR NONPROVISIONAL APPLICATION

Commissioner for Patents
Post Office Box 1450
Alexandria, VA 22313-1450

Sir:

In follow-up to the filing of the non-provisional patent application on August 23, 2013 referenced above, applicant submits the following:

1) two executed combined Declaration and Assignment for Non-Provisional Application forms

The $140 fee for the late filing of the Declarations was paid when filing the non-provisional patent application. However, the Director is hereby authorized to charge payment of any additional fees associated with this or any other communication or credit any overpayment to Deposit Account No. 50-1170.

Respectfully submitted,

Timothy E. Newholm
Registration No. 34,400

Dated: August 30, 2013

BOYLE FREDRICKSON S.C.
840 North Plankinton Avenue
Milwaukee, Wisconsin 53203
Telephone: (414) 225-9755
Facsimile: (414) 225-9753
Email: *docketing@boylefred.com*

DECLARATION AND ASSIGNMENT
NON-PROVISIONAL PATENT APPLICATION

Title of Invention: *System and Method for Configuring Device Connections in an Extended Network Environment*

I. Declaration of Inventor

As the below named inventor, I hereby declare that:

This declaration is directed to the following APPLICATION:

____ The attached United States non-provisional patent application, or

X United States non-provisional patent application or PCT international application Serial Number - 13/974,090, filed on August 23, 3013.

The APPLICATION was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the APPLICATION.

I have reviewed and understand the contents of the APPLICATION, including the claims.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations §1.56.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

II. Assignment of the Invention

In consideration of the sum of One Dollar ($1.00) and other good and valuable considerations, the receipt of which is hereby acknowledged, I hereby do sell, assign and transfer to NETGEAR, Inc. (hereinafter referred to as "ASSIGNEE"), a corporation organized under the laws of the state of California, and located and doing business at 350 East Plumeria Drive, San Jose, CA 95134, its successors and assigns, my entire right, title and interest in said invention in my capacity as an inventor or as otherwise acquired by me, to the above identified invention as set forth in the APPLICATION for United States Letters Patent therefore and any divisions or continuations thereof, and any Letters Patent obtained for the said invention in the United States and foreign countries, or issuing out of said application or any such division or continuation thereof, and any reissues or extensions of any such Letters Patent.

The Commissioner of Patents is hereby authorized and requested to issue Letters Patent for said invention to the ASSIGNEE, as assignee of the entire right, title and interest therein.

I covenant that I have full right to convey my entire title and interest in said invention as an inventor, and that I have not executed and will not execute any agreement in conflict herewith.

I further covenant that I will, at any time, upon request, execute and deliver any and all papers that may be necessary or desirable to perfect the title in ASSIGNEE to said invention or any Letters Patent that may be granted therefore, and that if ASSIGNEE, or its assignee, desires to make a substitute, divisional or continuation application for said invention, or to secure a reissue or extension of said Letters Patent, to file a disclaimer relating thereto, or an application for a corresponding patent in any foreign country, and that I will, upon request, sign all papers, make all rightful oaths, and do all lawful acts requisite for the said purpose, but at the expense of the ASSIGNEE.

I further covenant and acknowledge that the entire beneficial interest in the invention to which the above referenced application relates is irrevocably vested in the ASSIGNEE including the right to make applications for protection in all countries abroad and to claim priority under the International Convention for such applications and hereby assent to the making of any such applications, with or without priority claim, and of any divisional applications resulting therefrom.

I further covenant that I will at all times, communicate to the ASSIGNEE, its successors, assigns, or legal representatives, all facts relating to said invention and Letters Patent, or the history thereof, known to me, and testify as to the same in administrative actions or other litigation when requested so to do.

I hereby authorize the ASSIGNEE or the attorney of record to insert the filing date and serial number of the APPLICATION in this instrument:

Executed and delivered this 26 day of August, 2013.

Yu-Te Lin 2013/08/26

Inventor Name: Yu-Te Lin

STATE OF _____)
)
COUNTY OF _____)

On this ____ day of _____, 2013, before me, a notary public in and for said county, appeared the person identified above, who is personally known to me to be the same person whose name is subscribed to the foregoing instrument, and the person who acknowledged that the person signed, sealed and delivered the said instrument as a free and voluntary act for the uses and purposes therein set forth.

(SEAL)

_____
Notary Public, State of _____
My Commission: _____

DECLARATION AND ASSIGNMENT
NON-PROVISIONAL PATENT APPLICATION

Title of Invention: *System and Method for Configuring Device Connections in an Extended Network Environment*

I. Declaration of Inventor

As the below named inventor, I hereby declare that:

This declaration is directed to the following APPLICATION:

____ The attached United States non-provisional patent application, or

X United States non-provisional patent application or PCT international application Serial Number 13/974,090, filed on August 23, 3013.

The APPLICATION was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the APPLICATION.

I have reviewed and understand the contents of the APPLICATION, including the claims.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations §1.56.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

II. Assignment of the Invention

In consideration of the sum of One Dollar ($1.00) and other good and valuable considerations, the receipt of which is hereby acknowledged, I hereby do sell, assign and transfer to NETGEAR, Inc. (hereinafter referred to as "ASSIGNEE"), a corporation organized under the laws of the state of California, and located and doing business at 350 East Plumeria Drive, San Jose, CA 95134, its successors and assigns, my entire right, title and interest in said invention in my capacity as an inventor or as otherwise acquired by me, to the above identified invention as set forth in the APPLICATION for United States Letters Patent therefore and any divisions or continuations thereof, and any Letters Patent obtained for the said invention in the United States and foreign countries, or issuing out of said application or any such division or continuation thereof, and any reissues or extensions of any such Letters Patent.

The Commissioner of Patents is hereby authorized and requested to issue Letters Patent for said invention to the ASSIGNEE, as assignee of the entire right, title and interest therein.

I covenant that I have full right to convey my entire title and interest in said invention as an inventor, and that I have not executed and will not execute any agreement in conflict herewith.

I further covenant that I will, at any time, upon request, execute and deliver any and all papers that may be necessary or desirable to perfect the title in ASSIGNEE to said invention or any Letters Patent that may be granted therefore, and that if ASSIGNEE, or its assignee, desires to make a substitute, divisional or continuation application for said invention, or to secure a reissue or extension of said Letters Patent, to file a disclaimer relating thereto, or an application for a corresponding patent in any foreign country, and that I will, upon request, sign all papers, make all rightful oaths, and do all lawful acts requisite for the said purpose, but at the expense of the ASSIGNEE.

I further covenant and acknowledge that the entire beneficial interest in the invention to which the above referenced application relates is irrevocably vested in the ASSIGNEE including the right to make applications for protection in all countries abroad and to claim priority under the International Convention for such applications and hereby assent to the making of any such applications, with or without priority claim, and of any divisional applications resulting therefrom.

I further covenant that I will at all times, communicate to the ASSIGNEE, its successors, assigns, or legal representatives, all facts relating to said invention and Letters Patent, or the history thereof, known to me, and testify as to the same in administrative actions or other litigation when requested so to do.

I hereby authorize the ASSIGNEE or the attorney of record to insert the filing date and serial number of the APPLICATION in this instrument:

Executed and delivered this 26th day of August, 2013.

Bing Cheng 8/26/2013

Inventor Name: Bing-Huang Cheng

STATE OF _____)
)
COUNTY OF _____)

On this ____ day of _____, 2013, before me, a notary public in and for said county, appeared the person identified above, who is personally known to me to be the same person whose name is subscribed to the foregoing instrument, and the person who acknowledged that the person signed, sealed and delivered the said instrument as a free and voluntary act for the uses and purposes therein set forth.

(SEAL)

_____
Notary Public, State of _____
My Commission: _____

Electronic Acknowledgement Receipt

EFS ID:	16733384
Application Number:	13974090
International Application Number:	
Confirmation Number:	4517
Title of Invention:	SYSTEM AND METHOD FOR CONFIGURING DEVICE CONNECTIONS IN AN EXTENDED NETWORK ENVIRONMENT
First Named Inventor/Applicant Name:	Yu-Te Lin
Customer Number:	23598
Filer:	Timothy E Newholm/Nicole Bey
Filer Authorized By:	Timothy E Newholm
Attorney Docket Number:	
Receipt Date:	30-AUG-2013
Filing Date:	
Time Stamp:	14:04:47
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		00644040.PDF	1707094 b60a07d7606cec5d72ecaab06910cad9579da7ef	yes	5

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Applicant Response to Pre-Exam Formalities Notice	1	1
	Oath or Declaration filed	2	5
Warnings:			
Information:			
	Total Files Size (in bytes):	1707094	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PATENT ASSIGNMENT

Electronic Version v1.1
Stylesheet Version v1.1

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	ASSIGNMENT

CONVEYING PARTY DATA

Name	Execution Date
Yu Te Lin	08/26/2013
Bing Huang Cheng	08/26/2013

RECEIVING PARTY DATA

Name:	NETGEAR, Inc.
Street Address:	350 East Plumeria Drive
City:	San Jose
State/Country:	CALIFORNIA
Postal Code:	95134

PROPERTY NUMBERS Total: 1

Property Type	Number
Application Number:	13974090

CH $40.00 13974090

CORRESPONDENCE DATA

Fax Number: 4142259753
Correspondence will be sent via US Mail when the fax attempt is unsuccessful.
Phone: 414-225-9755
Email: docketing@boylefred.com
Correspondent Name: BOYLE FREDRICKSON S.C.
Address Line 1: 840 North Plankinton Avenue
Address Line 4: MILWAUKEE, WISCONSIN 53203

ATTORNEY DOCKET NUMBER:	2188.047
NAME OF SUBMITTER:	Timothy E. Newholm
Signature:	/Timothy E. Newholm/
Date:	08/30/2013

	This document serves as an Oath/Declaration (37 CFR 1.63).

Total Attachments: 4
source=00644046#page1.tif
source=00644046#page2.tif
source=00644046#page3.tif
source=00644046#page4.tif

DECLARATION AND ASSIGNMENT
NON-PROVISIONAL PATENT APPLICATION

Title of Invention: *System and Method for Configuring Device Connections in an Extended Network Environment*

I. Declaration of Inventor

As the below named inventor, I hereby declare that:

This declaration is directed to the following APPLICATION:

__ The attached United States non-provisional patent application, or

_X_ United States non-provisional patent application or PCT international application Serial Number - 13/974,090, filed on August 23, 3013.

The APPLICATION was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the APPLICATION.

I have reviewed and understand the contents of the APPLICATION, including the claims.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations §1.56.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

II. Assignment of the Invention

In consideration of the sum of One Dollar ($1.00) and other good and valuable considerations, the receipt of which is hereby acknowledged, I hereby do sell, assign and transfer to NETGEAR, Inc. (hereinafter referred to as "ASSIGNEE"), a corporation organized under the laws of the state of California, and located and doing business at 350 East Plumeria Drive, San Jose, CA 95134, its successors and assigns, my entire right, title and interest in said invention in my capacity as an inventor or as otherwise acquired by me, to the above identified invention as set forth in the APPLICATION for United States Letters Patent therefore and any divisions or continuations thereof, and any Letters Patent obtained for the said invention in the United States and foreign countries, or issuing out of said application or any such division or continuation thereof, and any reissues or extensions of any such Letters Patent.

The Commissioner of Patents is hereby authorized and requested to issue Letters Patent for said invention to the ASSIGNEE, as assignee of the entire right, title and interest therein.

I covenant that I have full right to convey my entire title and interest in said invention as an inventor, and that I have not executed and will not execute any agreement in conflict herewith.

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I further covenant and acknowledge that the entire beneficial interest in the invention to which the above referenced application relates is irrevocably vested in the ASSIGNEE including the right to make applications for protection in all countries abroad and to claim priority under the International Convention for such applications and hereby assent to the making of any such applications, with or without priority claim, and of any divisional applications resulting therefrom.

I further covenant that I will at all times, communicate to the ASSIGNEE, its successors, assigns, or legal representatives, all facts relating to said invention and Letters Patent, or the history thereof, known to me, and testify as to the same in administrative actions or other litigation when requested so to do.

I hereby authorize the ASSIGNEE or the attorney of record to insert the filing date and serial number of the APPLICATION in this instrument:

Executed and delivered this 26th day of August, 2013.

Yu-Te Lin 2013/08/26

Inventor Name: Yu-Te Lin

STATE OF _____)
)
COUNTY OF _____)

On this ___ day of _____, 2013, before me, a notary public in and for said county, appeared the person identified above, who is personally known to me to be the same person whose name is subscribed to the foregoing instrument, and the person who acknowledged that the person signed, sealed and delivered the said instrument as a free and voluntary act for the uses and purposes therein set forth.

(SEAL)

_____
Notary Public, State of _____
My Commission: _____

DECLARATION AND ASSIGNMENT
NON-PROVISIONAL PATENT APPLICATION

Title of Invention: *System and Method for Configuring Device Connections in an Extended Network Environment*

I. Declaration of Inventor

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I have reviewed and understand the contents of the APPLICATION, including the claims.

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Executed and delivered this 26th day of August, 2013.

Bing Cheng 8/26/2013

Inventor Name: Bing-Huang Cheng

STATE OF _____)
)
COUNTY OF _____)

On this ___ day of _____, 2013, before me, a notary public in and for said county, appeared the person identified above, who is personally known to me to be the same person whose name is subscribed to the foregoing instrument, and the person who acknowledged that the person signed, sealed and delivered the said instrument as a free and voluntary act for the uses and purposes therein set forth.

(SEAL)

_____
Notary Public, State of _____
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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 13/974,090

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	280
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	600
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	720
TOTAL CLAIMS (37 CFR 1.16(i))	21 minus 20 =	* 1			OR	x 80 =	80
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3 minus 3 =	*				x 420 =	0.00
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
* If the difference in column 1 is less than zero, enter "0" in column 2			TOTAL			TOTAL	1680

APPLICATION AS AMENDED - PART II

AMENDMENT A		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT B		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE($)	ADDITIONAL FEE($)		RATE($)	ADDITIONAL FEE($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
13/974,090	08/23/2013	2656	1820	2188.047	21	3

CONFIRMATION NO. 4517

23598
BOYLE FREDRICKSON S.C.
840 North Plankinton Avenue
MILWAUKEE, WI 53203

FILING RECEIPT

OC0000000063697450

Date Mailed: 09/13/2013

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Yu-Te Lin, Taipei City, TAIWAN;
Bing-Huang Cheng, Taichung, TAIWAN;

Applicant(s)

NETGEAR, Inc., San Jose, CA

Assignment For Published Patent Application

NETGEAR, Inc., San Jose, CA

Power of Attorney: None

Domestic Applications for which benefit is claimed - None.
A proper domestic benefit claim must be provided in an Application Data Sheet in order to constitute a claim for domestic benefit. See 37 CFR 1.76 and 1.78.

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

If Required, Foreign Filing License Granted: 09/10/2013

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/974,090**

Projected Publication Date: To Be Determined - pending completion of Corrected Papers

Non-Publication Request: No

Early Publication Request: No

Title

SYSTEM AND METHOD FOR CONFIGURING DEVICE CONNECTIONS IN AN EXTENDED NETWORK ENVIRONMENT

Preliminary Class

379

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

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Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

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TP Link Ex. 1004
Page 63

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/974,090	08/23/2013	Yu-Te Lin	2188.047

CONFIRMATION NO. 4517

23598
BOYLE FREDRICKSON S.C.
840 North Plankinton Avenue
MILWAUKEE, WI 53203

FORMALITIES LETTER

OC000000063697451

Date Mailed: 09/13/2013

NOTICE TO FILE CORRECTED APPLICATION PAPERS

Filing Date Granted

An application number and filing date have been accorded to this application. The application is informal since it does not comply with the regulations for the reason(s) indicated below. Applicant is given TWO MONTHS from the date of this Notice within which to correct the informalities indicated below. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

The required item(s) identified below must be timely submitted to avoid abandonment:

- A substitute specification in compliance with 37 CFR 1.52, 1.121(b)(3), and 1.125, is required. The substitute specification must be submitted with markings and be accompanied by a clean version (without markings) as set forth in 37 CFR 1.125(c) and a statement that the substitute specification contains no new matter (see 37 CFR 1.125(b)). The specification, claims, and/or abstract page(s) submitted is not acceptable and cannot be scanned or properly stored because:
  - The application contains drawings, but the specification does not contain a brief description of the several views of the drawings as required by 37 CFR 1.74 and 37 CFR 1.77(b)(7).

Applicant is cautioned that correction of the above items may cause the specification and drawings page count to exceed 100 pages. If the specification and drawings exceed 100 pages, applicant will need to submit the required application size fee.

Replies must be received in the USPTO within the set time period or must include a proper Certificate of Mailing or Transmission under 37 CFR 1.8 with a mailing or transmission date within the set time period. For more information and a suggested format, see Form PTO/SB/92 and MPEP 512.

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/atesfaye/

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Application	Document	Mailroom Date	Attorney Docket No.
13974090	APP.FILE.REC	09/13/2013	2188.047
	NT.CR.APP.PA	09/13/2013	2188.047

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PATENT APPLICATION INFORMATION RETRIEVAL SYSTEM

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Inventor: Lin et al. Art Unit: 2656

Serial No.: 13/974,090 Conf. No.: 4517

Filed: August 23, 2013 Atty. Docket No.: 2188.047

Title: *System and Method for Configuring Device Connections in an Extended Network Environment*

RESPONSE TO NOTICE TO FILE CORRECTED APPLICATION PAPERS

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Dear Sir:

In response to the "Notice to File Corrected Application Papers", mailed September 13, 2013, a substitute specification and markup in accordance with 37 CFR 1.125 are attached hereto. The amendments are found at paragraph [00023] and provide a brief description of the figure attached with the filed application. No new matter has been added

No fees are believed payable with this submission. However, the Commissioner is hereby authorized to charge any fees in connection herewith to Deposit Account No. 50-1170.

Respectfully submitted,

Timothy E. Newholm
Registration No. 34,400

Dated: November 11, 2013

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SYSTEM AND METHOD FOR CONFIGURING DEVICE CONNECTIONS IN AN EXTENDED NETWORK ENVIRONMENT

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] None.

FIELD OF INVENTION

[0002] This invention generally relates to the field of providing a network connection between a network device and one of a plurality of wireless access devices in a network environment and more particularly to a system and method for providing a network connection between a network device and one of a plurality of wireless access devices based on the detection of an alternative access point providing one or more advantages over a current access point.

BACKGROUND OF THE INVENTION

[0003] In computer networking, a wireless access device (WAP) is a device that allows wireless devices to connect to a wired or wireless network using a wireless communication protocol, such as Wi-Fi or Bluetooth. The wireless access device typically connects to or is implemented as a component of a router connected to a wired external network, such as a local network or the Internet. A wireless access device connected to or implemented with a router is referred to as a WiFi router. A network device connected to an external network is referred to as a "gateway," while a wireless access device connected to an external network may be referred to as a "gateway wireless access device" or a "gateway." So a "gateway" device referenced in this document can have a wireless interface or have no wireless interface, but it is a device connecting the internal network and the external network.

[0004] Wireless access devices utilize a wireless connection between the wireless device and the wireless access device to transfer data. The area in which a wireless connection between the wireless device and the wireless access device can be established and maintained is the wireless coverage area or simply the "coverage area." However, even within the coverage area, the speed at which the data is transferred is dependent on the quality of the wireless connection. A high quality wireless connection relies on multiple different wireless connection quality factors. For example, the quality of a wireless connection may be determined based on the signal strength

that exists between the wireless access device and the wireless device. Additionally, the quality of a wireless connection may depend upon communication capability of the devices, determined by the wireless technology implemented on each device. For example, different devices implement different communication protocols, have different processing power, have different antenna configurations, etc. Users and provider of wireless access device continuously strive to maximize the quality of their wireless connection, particularly when using data intensive applications such as video streaming, telephony applications, etc.

[0005] Often, the area where a user wishes to use his or her wireless device is larger than the area providing a high quality wireless connection to the wireless access device. For example, the signal strength decreases based on the distance between the wireless access device and the wireless device. Additionally, certain areas that would otherwise receive a high quality wireless connection are subject to interference that reduces the quality of the wireless connection. Accordingly, users may add additional wireless access devices to their network, such as a WiFi extender, to increase the area where the user can maintain a high quality wireless connection.

[0006] WiFi extenders typically are similar to wireless access devices, but do not include an integral router connected to the external network. Instead, WiFi extenders typically rely on wired or wireless connections to the WiFi router to connect to the external network. The coverage area in which a user can connect to at least one wireless access device is considered the "extended network environment." A network including both a gateway wireless access device and one or more extender wireless access devices is referred to as an "extended network."

[0007] A WiFi extender is a wireless access device for wireless devices to connect to a network. Additionally, the WiFi extender acts as a wireless device to connect to another wireless access device in order to connect to a network. The "another wireless access device" may also be referred to as an "upstream wireless access device". Usually, a WiFi extender uses a single radio frequency device component to connect to both the wireless devices and the upstream wireless access device. Further, in order to avoid bad performance, the radio frequency device has to work in the same frequency to connect to the wireless devices as well as to connect to the upstream wireless access device. In such a usage, when a wireless device transmits or receives data from the upstream wireless access device, the transmission between the upstream wireless access device and the WiFi extender and the transmission between the WiFi extender and the wireless

device share the same frequency. Assuming there is no other usage on this frequency, the two transmissions must divide the time of using the frequency and so the end to end throughput is not as high as the wireless device can see from its connection to the WiFi extender. For example, if the speed between the wireless device and the WiFi extender and between the WiFi extender and the upstream wireless access device are the same like 100mbps, then the speed for transmitting data between the wireless device and the upstream wireless access device is cut in half, like to become around 50mbps.

[0008] Typically, wireless devices establish a connection with a single wireless access device in an extended network based on a determination of which wireless access device will provide the highest quality wireless connection. The single wireless access device having a wireless connection to the wireless device is referred to herein as a "current wireless access device." Once established, this wireless connection is maintained between the wireless access device and the wireless device until the connection is lost or degrades below a threshold quality level. The connection may be lost or degraded when the wireless device moves out of range of the wireless access device, moves to a location where there is interference, etc. Thereafter, the wireless device will attempt to establish a new wireless connection; again with whichever wireless access device will provide the highest quality wireless connection.

[0009] However, wireless devices often are transported to various areas within a coverage area covered by multiple wireless access devices without ever losing their connection to their current wireless access device. Because of variations in the quality of the wireless connection within the coverage area, users may not always be connected to the wireless access device that will provide the highest quality wireless connection. For example, a wireless device user connected to a first wireless access device may move to location that is remote from that wireless access device (although still maintaining a wireless connection), but is very close to a second wireless access device (that would provide a higher quality wireless connection at the new location). As a result, the wireless device will receive a signal that is weaker than optimal. .

[00010] In a home network, there is a router or gateway that connects the internal network, the home network, and the external network, the Internet. For a home network where there is more than one wireless access device for a wireless device to reach the gateway or the external network, almost no wireless device knows which wireless access device can give it better

connection to the network. This is because a wireless device does not know which access device has a better connection to the router/gateway and the interpretation of speed for different access devices could be different. For example, when a client sees one connection of 10mbps from one access device and one connection of 7mbps from another access device. If the 10mbps connection is from a gateway, then it is a better connection than the other. If the 10mbps connection is from an extender, as elaborated in [0007], the connection speed from the wireless device to the gateway (the upstream access device) could be just 5mbps, and so the 7mbps direct connection to the gateway is actually the better connection. In a general way, a home network has a tree topology. The root is the router/gateway, the nodes are extenders, and the leaves are wireless devices or wired devices. The whole tree is connected to the Internet through the router/gateway at the root. There could be multiple extenders connecting to the router/gateway directly and there could be extenders connecting to an upstream extender and then connecting to the router/gateway indirectly. For a wireless device, the connection quality provided by each node in the tree, including the root if it is a gateway wireless access device, is determined by not only the node's signal strength to the device, the wireless capability of the node ... but also the connection quality between the node and the root.

[00011] What is needed is a system and method for configuring wireless connections in an extended network environment that optimizes connection quality to a wireless device in the coverage area. What is further needed is such a system and method configured to continuously monitor wireless connections between a wireless device and a plurality of wireless access devices to optimize the quality of a wireless connection to the wireless device.

SUMMARY

[00012] A wireless access device may be configured to determine wireless connection quality information for a wireless device in comparison to at least one other wireless access device. To achieve this functionality, a wireless access device can monitor all packets sent from the wireless device at a certain time for a certain period, even when the wireless device is not connected to the wireless access device or the wireless packets are not intentionally transmitted to the wireless access device. Advantageously, each wireless access device can contribute to the process of identifying the wireless access device providing the highest quality wireless connection

based on wireless connection quality information transmitted by or exchanged among the wireless access devices.

[00013] According to one embodiment of the invention, a network device is configured to facilitate wireless connection management in an extended wireless network. The network device includes a network device input connected at least indirectly to an internal network and configured to communicate a plurality of packets to and from at least one computer system, a network device output connected at least indirectly to an external network and configured to communicate the plurality of packets to and from at least one computer system. The network device could also be a device that includes a network device input connected directly to one or more wireless devices or wireless access devices and configured to communicate a plurality of packets to and from at least one computer system, a network device output connected at least indirectly to a network and configured to communicate the plurality of packets to and from at least one computer system (the network device input and the network device output could actually use the same hardware device). In addition, such a network device also includes a computer processor configured to execute steps stored in non-volatile memory. The computer processor is configured to receive packets from a wireless device, identify the wireless device within a table of wireless devices communicating with at least one wireless access device in an extended wireless network, and generate wireless connection quality information for the wireless device specific to the wireless access device that received the packets based on the received packets and based on the knowledge of the network topology related information.

[00014] In one embodiment, the computer processor is further configured to transmit the wireless connection quality information and partial network topology information to other wireless access devices in the network.

[00015] In another embodiment, the computer processor is further configured to exchange wireless connection quality information and partial network topology information with a plurality of other network devices and to identify a network device in the extended network providing the highest quality wireless connection for the wireless device. The processor may be further configured to exchange messages with other network devices to initiate a connection between the wireless device and the network device having the highest wireless connection quality.

[00016] In another aspect, the wireless connection quality that is detected includes at least one of a wireless signal strength, a connection capability, a utilization status and a connection patch quality.

[00017] According to another aspect of the invention, an extended network configured to implement an extended management function to identify a wireless access device providing a highest quality wireless connection to a wireless device. The extended network includes a gateway configured to enable communication between the extended network and an external network, at least two wireless access devices in the extended network (one could be the gateway if it is a gateway wireless access device), and at least one wireless device having a wireless connection to a least one of the wireless access devices. The wireless access device includes a processor executing the extended management function to identify the wireless access device providing the highest quality wireless connection based on wireless connection quality information and topology information exchanged among the wireless access devices.

[00018] According to yet another aspect, a computer implemented method for identifying a wireless access device providing a highest quality wireless connection to a wireless device is described. The method includes monitoring the relative signal strength of packets at a plurality of wireless access devices in an extended network from a wireless device having a current wireless connection to a current wireless access device in the plurality of wireless access devices and generating wireless connection quality information at each wireless access device in the plurality of wireless access devices describing the quality of a wireless connection between the wireless device and the wireless access device.

[00019] Other features and advantages of the invention will become apparent to those skilled in the art upon review of the following detailed description, claims and drawings in which like numerals are used to designate like features.

BRIEF DESCRIPTION OF THE DRAWINGS

[00020] Preferred exemplary embodiments of the invention are illustrated in the accompanying drawings in which like reference numerals represent like parts throughout, and in which:

[00021] FIG. 1 schematically illustrates an extended networking environment for communicating information between a wireless device and a plurality of wireless access devices, according to an exemplary embodiment;

[00022] FIG. 2 illustrates an embodiment of the gateway wireless access device of FIG. 1, configured to implement an extended network management function, shown in greater detail, according to an exemplary embodiment;

[00023] FIGS. 3A-3C are schematic illustrations of an extended networking environment including a plurality of wireless access devices configured to implement an extended network management function, according to an exemplary embodiment; and

[00024] FIG. 4 is a flowchart illustrating a method for configuring device connections in an extended network environment, according to an exemplary embodiment.

[00025] Before the embodiments of the invention are explained in detail, it is to be understood that the invention is not limited in its application to the details of construction and the arrangement of the components set forth in the following description or illustrated in the drawings. The invention is capable of other embodiments and of being practiced or being carried out in various ways. Also, it is to be understood that the phraseology and terminology used herein are for the purpose of description and should not be regarded as limiting. The use of "including" and "comprising" and variations thereof is meant to encompass the items listed thereafter and equivalents thereof as well as additional items and equivalents thereof.

DETAILED DESCRIPTION

[00026] Referring now to FIG. 1, a networking environment 100 for communicating information between at least one wireless device 110 and an external network 130 through an extended network 120 is shown. The extended network includes at least a gateway wireless access device 122 and one or more extended wireless access devices 124. The extended network 120 may further be utilized for communicating information with one or more additional wireless devices (not shown) connected with a wireless access device of the extended network 120.

[00027] Extended network 120 is a local area network configured to provide wireless communication of information with a plurality of devices and applications in relatively close proximity to each other, such as within a home, school, office building, etc. Wireless devices or "wi-fi clients" 110 communicating through extended network 120 may include a web application running on a personal computing device such as a desktop computer, a laptop computer, a tablet, etc, a smartphone, a game device, or a streaming media player. The web application may include a web browsing application, a video player application, a telephony application, a video telephony application, etc. It should be understood that although specific devices and applications are described, these are merely provided as examples. Any or all of these or other wireless devices 110 could be present in a given extended network 120.

[00028] The gateway wireless access device 122 of extended network 120 is a type of network device that manages the flow of data between extended network 120 and the external network 130. Gateway wireless device may comprise, for example, a router, a switch, or a gateway. Functionality described herein as being associated with gateway wireless access device 122 may be implemented using one or more devices. For example, gateway wireless access device 122 may be configured to include a router in communication with a network switch, either of which can be configured to perform some or all of the functions described herein.

[00029] When a data packet is received at either gateway wireless access device 122 or an extended wireless access device 124, an additional or second type of network device, the wireless access device reads address information in the packet to determine its ultimate destination. In a packet-switched network, a "router" is a device which receives packets on one or more input interfaces and which outputs those packets on one of a plurality of output interfaces so as to move those packets within the network from a source device to a destination device. Each packet includes header information, which indicates the destination device in either extended network 120 or external network 130. Additional information is provided by the physical layer to the device which receives a packet directly and that information can further include wireless connection quality information, described in detail below with reference to FIG. 2. The router includes routing information, which associates an output interface with information about the destination device. The router can also perform other operations on packets, such as rewriting the

packets' headers according to their routing protocol, or re-encapsulating the packets from a first routing protocol to a second routing protocol.

[00030] Gateway wireless access device 122 may be a gateway device that provides an exclusive communication channel between extended network 120 and external network 130. Accordingly, packets transmitted by extended wireless access devices 124 and/or wireless devices using extended network 120, can be viewed using the gateway wireless access device 122. Gateway wireless access device 122 and extended wireless access device 124 may further be configured to generate wireless connection quality information transmitted to a certain wireless access device (122 or 124) or exchanged among wireless access devices (122 and 124), as described below in further detail. Accordingly, some or all wireless access device (122 and/or 124) are further configured to implement an extended network management function for configuring device connections in an extended network environment, as described in detail below with reference to FIG. 2.

[00031] External network 130 may be a wide area telecommunication network covering a broad area, such as the Internet. External network 130 may be connected to network device 120 using a wired or wireless connection. For example, gateway wireless access device 122 may be connected to the external network 130 via a high-bandwidth connection such as a cable modem, a Digital Subscriber Line (DSL) modem, or a 3G/4G Long Term Evolution (LTE) modem connection to send and receive data with systems through external network 130.

[00032] External network 130 allows communication with one or more of a plurality of external systems including, for example an external web site, an external computing system, and/or an external database. These systems and applications may be accessible using an Internet Protocol address provided by any of the wireless devices on extended network 120 and used by network device 120 to determine a destination for data transmitted to and/or from extended network 120 to external network 130.

[00033] In operation, each wireless access device 122, 124 in extended network 120 is configured to monitor, store, and/or report wireless connection quality information. The wireless connection quality information may be generated at the wireless access device 122 or 124 and/or included in packet headers received at the wireless access device. For example, each access point

is configured to monitor the link rate of packets sent from the wireless device 110 and to check the signal strength it receives for those packets, no matter which wireless access device the packets are intentionally transmitted to. Accordingly, each wireless access device can provide wireless connection quality information indicating signal strength from the wireless device 110 and corresponding link rate for packets from the wireless device.

[00034] Each wireless access device 122 or 124 in extended network 120 may be further configured to periodically review the wireless connection between the wireless access device and any wireless devices communicating with the wireless access device. The connection check may be performed periodically such as every 5 seconds, based on a reported connection issue, such as an unusually slow connection, etc. A wireless access device can send and receive wireless connection information and a partial network topology with other wireless access devices periodically in an attempt to identify a better connection for a wireless device. In addition, a wireless access device can also monitor an existing connection to identify if the connection with a wireless device becomes bad. If the connection does become bad, the wireless access device starts looking for another wireless access device in the extended network that can provide better a better connection for the wireless device.

[00035] The wireless connection quality information received from the wireless device 110 may be stored in a memory of the wireless access device 122 or 124 and/or forwarded to a central repository, such as the memory for gateway wireless access device 122. The wireless connection quality information may be either a simple value, such as a connection speed, or a number of different values, such as connection speed and other quality information for the extended network 120, including the quality for connections between two wireless access devices, for example, for the connection between the gateway wireless access device 122 and an extended wireless access device 124. The wireless connection quality information may be forwarded when it is received, may be periodically forwarded in a batch operation, may be aggregated to provide wireless connection quality information over a defined period of time, etc. Advantageously, the stored wireless connection quality information may be used to determine the particular wireless access device 122 or 124 that can provide the highest quality wireless connection to the wireless device 110 at any particular time. Using the network management system described herein, extended

network 120 may be configured to utilize any tree topology including a gateway wireless access device 122 as a root, such as a hub/star configuration, a cascaded configuration, etc.

[00036] For example, in a tree topology, the extended network is configured in a tree topology including a gateway device as a root, one or more wireless access devices as nodes in the tree, and a wireless device as a leaf. The network tree topology can have several levels and each level can have several nodes. A node or a wireless access device connects to the network by connecting to its upstream node or wireless access device. A wireless access device can connect to its upstream node in any of a variety of different ways, for example through a wired connection (e.g. Ethernet, and the wireless access device is a Wi-Fi AP), through a wireless connection (e.g. Wi-Fi, and the wireless access device is a Wi-Fi extender), etc. In addition, a wireless access device may be configured to have only one wireless interface where it performs multiplexing on the single wireless interface and uses the same wireless to connect to the extended network as well as to wireless devices. One example of such a device is a Wi-Fi single-band extender.

[00037] Although the wireless device 110 will be connected to a single wireless access device 122 or 124 through an existing wireless connection, designated as the "current wireless access device." Establishing a wireless connection may include performance of a handshake protocol and the exchange of data packets as is well known in the art. Once a wireless connection is established, the wireless access device establishing the connection is considered the current wireless access device. Although connected with the current wireless access device, each wireless access device 122 or 124 on extended network 120 is configured to receive any packets transmitted to the current wireless access device from the wireless device 110 and store the observed quality information of these packets independent of whether the wireless access device is providing the wireless connection to the wireless device. Depending on the location/position of each access device relative to the wireless device, the observed signal strength at each access device for a packet from the wireless device (to the current access device) is different. In contrast, in a typical wireless network, this information would be discarded as packets from devices that are not transmitted to a wireless access device were dropped by that wireless access device.

[00038] Referring now to FIG. 2, a gateway wireless access device 122 or simply "gateway" configured to implement an extended network management function as described herein is shown in greater detail, according to an exemplary embodiment. Although gateway 122 is shown in FIG. 2 as including specific components in an exemplary configuration, it is important to recognize that gateway 122 may include more, fewer, and/or a different configuration of components to implement the functions described herein. Further, although the functionality described herein is described as being implemented on a gateway device, the extended network management function can be implemented on a gateway device 122 and/or an extender access device 124. In addition, an implementation may be centralized on one device or distributed among a plurality of devices. For simplicity, the functionality will be described herein below with reference to implementation on a gateway 122.

[00039] The functional components (not shown) of gateway 122 may be implemented using hardware including a processing unit, a system memory, and a system bus that couples various system components, including the system memory, to the processing unit. The system bus may be any of several types of bus structures including a memory bus or memory controller, a peripheral bus, and a local bus using any of a variety of bus architectures. Further, the described components may be implemented using hardware and/or software.

[00040] The processing unit may be any type of computer processor configured to implement the functionality described herein including the steps of identifying advertising content requests in network packets transmitted through gateway 122. The processing unit may be any type of processor, such as a MIPS processor.

[00041] The system memory of gateway 122 includes computer storage media in the form of volatile and/or nonvolatile memory such as read only memory (ROM) and random access memory (RAM). A basic input/output system (BIOS), containing the basic routines that help to transfer information between elements within gateway 122, such as during start-up or networking operations, is typically stored in ROM. RAM typically contains data and/or program modules that are immediately accessible to and/or presently being operated on by the processing unit. The gateway 122 may also include other removable/non-removable, volatile/nonvolatile computer storage media, such as flash memory. Although gateway 122 is shown and described herein as

including memory, gateway 122 may alternatively be implemented to store information in a network storage device.

[00042] Although gateway wireless access device 122 may be any of a variety of types of network devices, for clarity access point 122 is further described herein as a router type network device. Gateway wireless access device 122 includes a wireless client interface 202, a wireless connection analyzer 204, an extended network management system 206, an extended network management table 208, and an extended network interface 224. Although network device 122 is shown as including a number of functional embodiments represented as separate components, it should be understood that the same functional component may be used to implement one or more of the functional embodiments.

[00043] Wireless client interface 202 is an input/output port receiving/transmitting packets from/to the wireless devices 110. Extended network interface 224 is an input/output port receiving/transmitting packets from/to the extended network 120. Extended network interface 224 connects the access device to the extended network. Extended network interface 224 can be an Ethernet port, a wireless transmitter, or another device for receiving/transmitting packets from/to extended network 120. The physical device for the wireless client interface 202 and the extended network interface 224 can be the same. A simple extended access device 124 can be configured to have only one network interface (a wireless interface) such that both wireless client interface and extended network interface are through the only network interface.

[00044] Wireless connection analyzer 204 is a software component configured to analyze and determine wireless connection quality between the wireless access device 122 and a wireless device. Although shown specifically within gateway wireless access device 122, a wireless connection analyzer 204 is implemented in the extended network 120 on the wireless access devices 122 and 124 in the network. Accordingly, each wireless access device 122, 124 in the extended network is configured to be able to obtain information used to determine the wireless connection quality between that wireless access device and the wireless devices within the extended network 120.

[00045] The wireless connection analyzer 204 associated with each wireless access device 122, 124 is configured to generate a wireless connection quality table entry to be stored in an

extended network management table 208. The specific data used to generate the wireless connection quality table information is described in further detail below with reference to the extended network management table 208. The analyzer 204 may generate the table entry based on information received from the wireless device in packet headers, based on data received from components in the wireless access device, such as a signal strength detection system (not shown), based on data received from other wireless access devices in the extended network, etc.

[00046] Each wireless connection analyzer 204 is further configured to generate the wireless connection quality table entry for each wireless device 110 associated with any wireless access device on the extended network. The analyzer 204 associated with each wireless access device 122 or 124 can be configured to generate the table entry independent of whether the associated wireless access device is connected to the wireless device 110, being used in the connection path to gateway wireless access device 122, etc. The analyzer 204 associated with each wireless access device 122 or 124 can be further configured to generate the wireless connection quality table entry for each other wireless access device 122 or 124 that connects to it.

[00047] Extended network management system 206 is a software application implemented in a root or central wireless access device for an extended network, such as gateway wireless access device 122. In an alternative embodiment, network management system 206 may be implemented as a distributed system in a plurality of wireless access devices. Management system 206 is configured to implement a management protocol in the extended mesh network to determine the wireless access device that can provide the highest quality wireless connection to a wireless device at any particular time. Accordingly, management system 206 is configured to store and maintain the extended network management table 208 based on connection quality data received by the wireless access devices in the network and exchanged among wireless access devices in the network. Table 208 may also be generated to include data connection quality data generated locally at each wireless access device 122 or 124.

[00048] Extended network management table 208 is generated and stored with the memory of gateway 122 and/or any other wireless access device. Table 208 includes a unique wireless access device record 210 for each wireless access device 122, 124 communicating through the extended network 120. Each record 210 includes a plurality of wireless connection quality table

entries 212, one for each wireless device in the extended network 120. Accordingly, table 208 may be stored and maintained in memory remote from device 122, such as would be implemented in a cloud computing environment.

[00049] Each wireless connection quality table entry 212 in the network management table 208 is specific to the wireless connection between one wireless access device 122 or 124 and one wireless device 110. Accordingly, table entries 212 include a wireless access device identifier 214, a signal strength data field 216, and a wireless capability field 218 for the wireless device 110. Each wireless access device record 210 for a wireless access device 122, 124 includes a utilization status data field 220 for each wireless band (e.g., 2.4 GHz, 5GHz), a noise field 222 for each wireless band, a wireless capability field 224 for the wireless access device, and a connection path quality data field 226 describing the connection path for each wireless access device 124 in the path to the gateway wireless access device 122, (i.e., determined by the connection quality between any two contiguous wireless access devices on the path between the current wireless access device and the gateway wireless access device 122). For the gateway wireless access device 124, this field is set to the highest value in the extended network 120.

[00050] According to a specific implementation, table 208 includes one record 210 for each wireless access device in the extended network. In each record for an access device, there is a table for the wireless clients connected to that access device. Each table entry 212 corresponds to a wireless client connected to the access device. Some fields (214, 216, 218) are associated with a table entry since they are specific to a wireless client, while other fields (220, 222, 224) are associated with a record since they are not specific to a wireless client but are specific to a wireless access device.

[00051] Extended network management system 206 is configured to identify the wireless access device that can provide the highest quality wireless connection with a wireless device at any given time. According to exemplary embodiment, management system 206 identifies highest-quality wireless connection based on at least the capability of the wireless device 110, the capability of the gateway wireless access device 122, and the capability of each wireless access device 122, 124 in the extended network 120, the path quality from the wireless access device to the gateway, etc.

[00052] Referring now also to FIG. 3A, a schematic illustration of an exemplary extended wireless network 300 network topology including a wireless device 310, a gateway wireless access device 320 in the form of a router, and extended wireless access devices 330-336 is illustrated. The network topology may be generated based on exchanged messages communicated between the components of network 300. Each message may include a partial network topology based on the messages received by the component that is transmitting the topology.

[00053] Extended wireless network 300 further includes a representation of connection speed 340~350 between wireless communication elements within the extended network 300. Accordingly, the connection speed 340 between gateway wireless access device 320 and a first extended wireless access device 330 is 60 Mega bits per second (Mbps), while the connection speed 342 between gateway wireless access device 320 and a second wireless access device 332 is 20 Mbps. The connection speed is dependent on several factors, including at least the hardware and software installed on each endpoint (i.e. the connection type and the capability of each endpoint) and the distance between the endpoints if it's a wireless connection.

[00054] Where wireless device or "Wi-Fi client" 310 is positioned at a first location 308 as shown in ghost form in Fig. 3A, the wireless device 310 may be already connected to the extended wireless access device 334. The wireless connection is designated as 350. However, management system 206 will continually evaluate available wireless connections while the wireless device 310 is moving.

[00055] For example, when the wireless device 310 moves to the second location depict in Fig. 3A, (location #2), the wireless connections 350 becomes weak and the wireless device 310 may suffer from the weak wireless connection. Dependent on the wireless device 310's implementation, wireless device 310 may determine if the wireless device 310 needs to try to a different wireless access device to get a better connection based on any of a variety of factors. Such continuous searching for an optimal connection is referred to as roaming in the wireless environment. For example, some implementations are configured to use the existing connection to avoid disruption until that connection is too weak to maintain the connection. The weak wireless connection 350 may be identified by the wireless access devices 334 based on detected poor

signal strength between the wireless access device 334 and the wireless device 310. The poor signal strength information may be communicated among the wireless access devices and the management system 206 implemented by each wireless access device 122, 124 will put the poor signal strength information in its table as discussed above.

[00056] Further, at the second location, wireless device 310 may have a good wireless connection if it connects to wireless access device 336 or wireless access device 332. This can be detected by the wireless access device 332, 336 by monitoring the signal strength from all the wireless packets sent from the wireless device 310, even if the packets are not transmitted to the wireless access device 332, 336 intentionally. Accordingly, management system 206 is configured to check if the wireless access device 332 or 336 can provide a better connection to the wireless device 310. Generally, the connection speed for a wireless device 310 to the gateway wireless access device 320 is determined by determining the lowest speed among all links (between any two contiguous devices) in the connection path between that wireless device and the gateway wireless access device 320, divided by the number of links between the gateway wireless access device 320 and the wireless device the network device 310. Accordingly, at the second location, the lowest speed in the connection path through wireless access device 336 (path#1) is 20 Mbps, and the connection speed for path#1 is 20 Mbps divided by the three links, which gets 6.67 Mbps. In contrast, while the lowest speed in the connection path through wireless access device 332 (path#2) is also 20 Mbps, the connection speed for path#2 is 20 Mbps divided by the two links, which gets 10.0 Mbps. Accordingly, management system 206 will initiate a wireless connection between the wireless access device 332 and the wireless device 310 based on the higher 10.0 Mbps connection speed.

[00057] However, referring now to FIG. 3B, where if the wireless device 310 is capable of creating connections with a higher speed to the wireless access device 332 and 336, and the connection speed 346 and 348 for the wireless connection between wireless device 310 and wireless access device 332, 336 is both 60 Mbps. The higher speed of the link will result in a higher connection speed for the path#1 and the consequent connection speed is 60 Mbps divided by 3, which gets 20.0 Mbps. However the connection speed for the path#2 remains at 10Mbps, even the connection speed 346 has been increased to 60mbps. That is due to the connection 342 now becomes the bottleneck of the path#2 and that keeps the connection speed for path#2 on

10Mbps. Accordingly, management system 206 will initiate a wireless connection between the wireless access device 336 and the wireless device 310 based on the higher 20.0 Mbps link rate.

[00058] Referring now to FIG. 3C, a schematic illustration of another exemplary extended wireless network 300 including a wireless device 364, a gateway wireless access device 360 in the form of a router, and an extended wireless access devices 362 is illustrated. If the wireless device 364 connects to the wireless access device 362, the connection speed between the wireless device 364 and the gateway wireless access device 360 is 20 mbps divided by 2, which is 10 Mbps. If the wireless device 364 connects to the gateway wireless access device 360 directly, the connection speed is 15 Mbps. The management system 206 will consider the wireless access device 360 provides a better connection for the wireless device 364, even though, from the wireless device 364's point of view, the wireless access device 362 provides a better connection. As shown in FIG. 3C, in a wireless extended network, a wireless device has multiple wireless access devices to connect to and a wireless access device that has stronger signal may not be a better choice to provide a faster connection speed to the gateway device.

[00059] Referring now to FIG. 4, a flowchart 400 illustrating a method for implementing the extended network management system 100 of FIG. 1 to identify a high quality wireless connection for a wireless device 110 is shown, according to an exemplary embodiment. Although flowchart 400 includes multiple steps performed in a defined order, the functions described herein can be performed using more, less and/or a different ordering of steps.

[00060] In a first step 402, wireless device 110 (FIG. 1) creates a wireless connection with one wireless access device 122 or 124 in the extended network 120. The wireless connection may be created based on an initial use of the wireless device 110, based on establishment of a new connection following a loss in connection, based on a specific elapsed time, etc. Establishing a wireless connection may include performance of a handshake protocol and the exchange of data packets as is well known in the art. Once a wireless connection is established, the wireless access device establishing the connection is considered the current wireless access device.

[00061] In a step 404, upon establishment of the wireless connection, the current wireless access device, including at least gateway wireless access device 122 and possibly additionally including one or more extended wireless access devices 124, is configured to transmit the

establishment of the wireless connection and the identity of the wireless device to other access devices within the extended network 120.

[00062] In a step 406, each wireless access device in extended network 120 that is within wireless range of the wireless device 110 will begin receiving data packets from the wireless device 110 based on the wireless connection to the current wireless access device. Generally, wireless access devices in extended network 120 other than the current wireless access device will not process the data packets transmitted to the current wireless access device; they typically discard those packets. However, based on the received data packets, each wireless access device in extended network 120 is configured to generate wireless connection quality information describing a real or theoretical wireless connection between that wireless access device and the wireless device 110. Step 406 may be performed for an indefinite time or a defined period of time, such as 3 seconds.

[00063] In a step 408, each wireless access device having wireless connection quality information for wireless device 110 exchanges the generated information with each other wireless access device in the extended network 120, and those information is kept in a repository such as network management table 208 and/or network management system 206, described above with reference to FIG. 2. According to an exemplary embodiment, the repository could be located in the memory of any wireless access device 122 or 124, such as table 210 of FIG. 2.

[00064] In a step 410, the gateway wireless access device 122 or the current wireless access device 122 or 124 analyzes the received wireless connection quality information to identify the wireless access device that can provide the highest quality wireless connection to the wireless device 110. It is important to recognize that the highest quality connection may vary dependent upon the intended use of the wireless connection. For example, if wireless device 110 is utilized to implement an IP telephony application, a link rate may be the primary factor in identifying a high quality wireless connection. Alternatively, if wireless device 110 does not include the capability to manage an excess amount of dropped packets, the wireless connection quality may be identified based on the fewest number of dropped packets.

[00065] In a step 412, a wireless access device 122 or 124 that does centralized control or the current wireless access device identifies any change in the condition of the wireless

connection to the current wireless access device. The connection check may be performed using the method described above with reference to FIG. 1. Alternatively, the central control wireless access device 122 or 124 or the current wireless access device may be configured to periodically determine whether to change the wireless connection from the current wireless access device to a new wireless access device based on a determination that the new wireless access device can provide a higher quality wireless connection and the connection transfer will not disrupt the applications running on the wireless device 110.

[00066] In a step 414, a wireless connection is established to the wireless access device providing the highest quality wireless connection. The connection may be established based on a message transmitted from the central control wireless access device 122 or 124 to the new wireless access device. Alternatively, the connection may be established based on a determination made at the current wireless access device. In either event, the resulting "current" wireless access device may be the same wireless access device to which the wireless device 110 was connected prior to the connection query of step 410 or a different wireless access device. The process then returns to step 404, where the steps 404-414 are repeated on an ongoing basis.

[00067] When a wireless device 110 is joining an extended network 120 (that is, during the step 402), similar mechanism can also be used to determine the best wireless access device 122 or 124 for the wireless device 110. When a wireless device 110 attempts to join a network, it usually sends out some packets to discover the environment and it has to send out a request packet for joining a network. By observing the signal strength from these packets and examining the packet contents, a wireless access device 122 or 124 can estimate the connection quality if the wireless device 110 connects to it. Furthermore, a wireless access device 122 or 124 can estimate the data transmission speed between the wireless device 110 and the gateway wireless device 122 if the wireless device 110 reaches the gateway wireless device 122 through it.

[00068] According to an alternative embodiment, network management system 206 may be implemented as a distributed management system, such that an embodiment of the network management system 206 is resident in every wireless access device within extended network 120. In such a system, wireless access devices exchange information with each other and each wireless

access device is aware of which wireless access device can provide the highest quality wireless connection to the wireless device 110.

[00069] Certain terminology is used herein for purposes of reference only, and thus is not intended to be limiting. For example, terms such as "network device" refer to any system or device receiving and retransmitting information packets in a computer network.

[00070] References to "a server" and "a processor" can be understood to include one or more controllers or processors that can communicate in a stand-alone and/or a distributed environment(s), and can thus be configured to communicate via wired or wireless communications with other processors, where such one or more processor can be configured to operate on one or more processor-controlled devices that can be similar or different devices. Furthermore, references to memory, unless otherwise specified, can include one or more processor-readable and accessible memory elements and/or components that can be internal to the processor-controlled device, external to the processor-controlled device, and can be accessed via a wired or wireless network. It should be understood that a computer program may embrace constituent programs and that multiple programs may be implemented as a single or multiple programs.

[00071] Various features of the invention are set forth in the following claims. It should be understood that the invention is not limited in its application to the details of construction and arrangements of the components set forth herein. The invention is capable of other embodiments and of being practiced or carried out in various ways. Variations and modifications of the foregoing are within the scope of the present invention. It also being understood that the invention disclosed and defined herein extends to all alternative combinations of two or more of the individual features mentioned or evident from the text and/or drawings. All of these different combinations constitute various alternative aspects of the present invention. The embodiments described herein explain the best modes known for practicing the invention and will enable others skilled in the art to utilize the invention.

SYSTEM AND METHOD FOR CONFIGURING DEVICE CONNECTIONS IN AN EXTENDED NETWORK ENVIRONMENT

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] None.

FIELD OF INVENTION

[0002] This invention generally relates to the field of providing a network connection between a network device and one of a plurality of wireless access devices in a network environment and more particularly to a system and method for providing a network connection between a network device and one of a plurality of wireless access devices based on the detection of an alternative access point providing one or more advantages over a current access point.

BACKGROUND OF THE INVENTION

[0003] In computer networking, a wireless access device (WAP) is a device that allows wireless devices to connect to a wired or wireless network using a wireless communication protocol, such as Wi-Fi or Bluetooth. The wireless access device typically connects to or is implemented as a component of a router connected to a wired external network, such as a local network or the Internet. A wireless access device connected to or implemented with a router is referred to as a WiFi router. A network device connected to an external network is referred to as a "gateway," while a wireless access device connected to an external network may be referred to as a "gateway wireless access device" or a "gateway." So a "gateway" device referenced in this document can have a wireless interface or have no wireless interface, but it is a device connecting the internal network and the external network.

[0004] Wireless access devices utilize a wireless connection between the wireless device and the wireless access device to transfer data. The area in which a wireless connection between the wireless device and the wireless access device can be established and maintained is the wireless coverage area or simply the "coverage area." However, even within the coverage area, the speed at which the data is transferred is dependent on the quality of the wireless connection. A high quality wireless connection relies on multiple different wireless connection quality factors. For example, the quality of a wireless connection may be determined based on the signal strength that exists between the wireless access device and the wireless device. Additionally, the quality

of a wireless connection may depend upon communication capability of the devices, determined by the wireless technology implemented on each device. For example, different devices implement different communication protocols, have different processing power, have different antenna configurations, etc. Users and provider of wireless access device continuously strive to maximize the quality of their wireless connection, particularly when using data intensive applications such as video streaming, telephony applications, etc.

[0005] Often, the area where a user wishes to use his or her wireless device is larger than the area providing a high quality wireless connection to the wireless access device. For example, the signal strength decreases based on the distance between the wireless access device and the wireless device. Additionally, certain areas that would otherwise receive a high quality wireless connection are subject to interference that reduces the quality of the wireless connection. Accordingly, users may add additional wireless access devices to their network, such as a WiFi extender, to increase the area where the user can maintain a high quality wireless connection.

[0006] WiFi extenders typically are similar to wireless access devices, but do not include an integral router connected to the external network. Instead, WiFi extenders typically rely on wired or wireless connections to the WiFi router to connect to the external network. The coverage area in which a user can connect to at least one wireless access device is considered the "extended network environment." A network including both a gateway wireless access device and one or more extender wireless access devices is referred to as an "extended network."

[0007] A WiFi extender is a wireless access device for wireless devices to connect to a network. Additionally, the WiFi extender acts as a wireless device to connect to another wireless access device in order to connect to a network. The "another wireless access device" may also be referred to as an "upstream wireless access device". Usually, a WiFi extender uses a single radio frequency device component to connect to both the wireless devices and the upstream wireless access device. Further, in order to avoid bad performance, the radio frequency device has to work in the same frequency to connect to the wireless devices as well as to connect to the upstream wireless access device. In such a usage, when a wireless device transmits or receives data from the upstream wireless access device, the transmission between the upstream wireless access device and the WiFi extender and the transmission between the WiFi extender and the wireless device share the same frequency. Assuming there is no other usage on this frequency, the two

transmissions must divide the time of using the frequency and so the end to end throughput is not as high as the wireless device can see from its connection to the WiFi extender. For example, if the speed between the wireless device and the WiFi extender and between the WiFi extender and the upstream wireless access device are the same like 100mbps, then the speed for transmitting data between the wireless device and the upstream wireless access device is cut in half, like to become around 50mbps.

[0008] Typically, wireless devices establish a connection with a single wireless access device in an extended network based on a determination of which wireless access device will provide the highest quality wireless connection. The single wireless access device having a wireless connection to the wireless device is referred to herein as a "current wireless access device." Once established, this wireless connection is maintained between the wireless access device and the wireless device until the connection is lost or degrades below a threshold quality level. The connection may be lost or degraded when the wireless device moves out of range of the wireless access device, moves to a location where there is interference, etc. Thereafter, the wireless device will attempt to establish a new wireless connection; again with whichever wireless access device will provide the highest quality wireless connection.

[0009] However, wireless devices often are transported to various areas within a coverage area covered by multiple wireless access devices without ever losing their connection to their current wireless access device. Because of variations in the quality of the wireless connection within the coverage area, users may not always be connected to the wireless access device that will provide the highest quality wireless connection. For example, a wireless device user connected to a first wireless access device may move to location that is remote from that wireless access device (although still maintaining a wireless connection), but is very close to a second wireless access device (that would provide a higher quality wireless connection at the new location). As a result, the wireless device will receive a signal that is weaker than optimal. .

[00010] In a home network, there is a router or gateway that connects the internal network, the home network, and the external network, the Internet. For a home network where there is more than one wireless access device for a wireless device to reach the gateway or the external network, almost no wireless device knows which wireless access device can give it better connection to the network. This is because a wireless device does not know which access device

has a better connection to the router/gateway and the interpretation of speed for different access devices could be different. For example, when a client sees one connection of 10mbps from one access device and one connection of 7mbps from another access device. If the 10mbps connection is from a gateway, then it is a better connection than the other. If the 10mbps connection is from an extender, as elaborated in [0007], the connection speed from the wireless device to the gateway (the upstream access device) could be just 5mbps, and so the 7mbps direct connection to the gateway is actually the better connection. In a general way, a home network has a tree topology. The root is the router/gateway, the nodes are extenders, and the leaves are wireless devices or wired devices. The whole tree is connected to the Internet through the router/gateway at the root. There could be multiple extenders connecting to the router/gateway directly and there could be extenders connecting to an upstream extender and then connecting to the router/gateway indirectly. For a wireless device, the connection quality provided by each node in the tree, including the root if it is a gateway wireless access device, is determined by not only the node's signal strength to the device, the wireless capability of the node … but also the connection quality between the node and the root.

[00011] What is needed is a system and method for configuring wireless connections in an extended network environment that optimizes connection quality to a wireless device in the coverage area. What is further needed is such a system and method configured to continuously monitor wireless connections between a wireless device and a plurality of wireless access devices to optimize the quality of a wireless connection to the wireless device.

SUMMARY

[00012] A wireless access device may be configured to determine wireless connection quality information for a wireless device in comparison to at least one other wireless access device. To achieve this functionality, a wireless access device can monitor all packets sent from the wireless device at a certain time for a certain period, even when the wireless device is not connected to the wireless access device or the wireless packets are not intentionally transmitted to the wireless access device. Advantageously, each wireless access device can contribute to the process of identifying the wireless access device providing the highest quality wireless connection based on wireless connection quality information transmitted by or exchanged among the wireless access devices.

[00013] According to one embodiment of the invention, a network device is configured to facilitate wireless connection management in an extended wireless network. The network device includes a network device input connected at least indirectly to an internal network and configured to communicate a plurality of packets to and from at least one computer system, a network device output connected at least indirectly to an external network and configured to communicate the plurality of packets to and from at least one computer system. The network device could also be a device that includes a network device input connected directly to one or more wireless devices or wireless access devices and configured to communicate a plurality of packets to and from at least one computer system, a network device output connected at least indirectly to a network and configured to communicate the plurality of packets to and from at least one computer system (the network device input and the network device output could actually use the same hardware device). In addition, such a network device also includes a computer processor configured to execute steps stored in non-volatile memory. The computer processor is configured to receive packets from a wireless device, identify the wireless device within a table of wireless devices communicating with at least one wireless access device in an extended wireless network, and generate wireless connection quality information for the wireless device specific to the wireless access device that received the packets based on the received packets and based on the knowledge of the network topology related information.

[00014] In one embodiment, the computer processor is further configured to transmit the wireless connection quality information and partial network topology information to other wireless access devices in the network.

[00015] In another embodiment, the computer processor is further configured to exchange wireless connection quality information and partial network topology information with a plurality of other network devices and to identify a network device in the extended network providing the highest quality wireless connection for the wireless device. The processor may be further configured to exchange messages with other network devices to initiate a connection between the wireless device and the network device having the highest wireless connection quality.

[00016] In another aspect, the wireless connection quality that is detected includes at least one of a wireless signal strength, a connection capability, a utilization status and a connection patch quality.

[00017] According to another aspect of the invention, an extended network configured to implement an extended management function to identify a wireless access device providing a highest quality wireless connection to a wireless device. The extended network includes a gateway configured to enable communication between the extended network and an external network, at least two wireless access devices in the extended network (one could be the gateway if it is a gateway wireless access device), and at least one wireless device having a wireless connection to a least one of the wireless access devices. The wireless access device includes a processor executing the extended management function to identify the wireless access device providing the highest quality wireless connection based on wireless connection quality information and topology information exchanged among the wireless access devices.

[00018] According to yet another aspect, a computer implemented method for identifying a wireless access device providing a highest quality wireless connection to a wireless device is described. The method includes monitoring the relative signal strength of packets at a plurality of wireless access devices in an extended network from a wireless device having a current wireless connection to a current wireless access device in the plurality of wireless access devices and generating wireless connection quality information at each wireless access device in the plurality of wireless access devices describing the quality of a wireless connection between the wireless device and the wireless access device.

[00019] Other features and advantages of the invention will become apparent to those skilled in the art upon review of the following detailed description, claims and drawings in which like numerals are used to designate like features.

BRIEF DESCRIPTION OF THE DRAWINGS

[00020] Preferred exemplary embodiments of the invention are illustrated in the accompanying drawings in which like reference numerals represent like parts throughout, and in which:

[00021] FIG. 1 schematically illustrates an extended networking environment for communicating information between a wireless device and a plurality of wireless access devices, according to an exemplary embodiment;

[00022] FIG. 2 illustrates an embodiment of the gateway wireless access device of FIG. 1, configured to implement an extended network management function, shown in greater detail, according to an exemplary embodiment;

[00023] FIGS. 3A-3C ~~and 3B~~ are schematic illustrations of an extended networking environment including a plurality of wireless access devices configured to implement an extended network management function, according to an exemplary embodiment; and

[00024] FIG. 4 is a flowchart illustrating a method for configuring device connections in an extended network environment, according to an exemplary embodiment.

[00025] Before the embodiments of the invention are explained in detail, it is to be understood that the invention is not limited in its application to the details of construction and the arrangement of the components set forth in the following description or illustrated in the drawings. The invention is capable of other embodiments and of being practiced or being carried out in various ways. Also, it is to be understood that the phraseology and terminology used herein are for the purpose of description and should not be regarded as limiting. The use of "including" and "comprising" and variations thereof is meant to encompass the items listed thereafter and equivalents thereof as well as additional items and equivalents thereof.

DETAILED DESCRIPTION

[00026] Referring now to FIG. 1, a networking environment 100 for communicating information between at least one wireless device 110 and an external network 130 through an extended network 120 is shown. The extended network includes at least a gateway wireless access device 122 and one or more extended wireless access devices 124. The extended network 120 may further be utilized for communicating information with one or more additional wireless devices (not shown) connected with a wireless access device of the extended network 120.

[00027] Extended network 120 is a local area network configured to provide wireless communication of information with a plurality of devices and applications in relatively close proximity to each other, such as within a home, school, office building, etc. Wireless devices or "wi-fi clients" 110 communicating through extended network 120 may include a web application running on a personal computing device such as a desktop computer, a laptop computer, a tablet,

etc, a smartphone, a game device, or a streaming media player. The web application may include a web browsing application, a video player application, a telephony application, a video telephony application, etc. It should be understood that although specific devices and applications are described, these are merely provided as examples. Any or all of these or other wireless devices 110 could be present in a given extended network 120.

[00028] The gateway wireless access device 122 of extended network 120 is a type of network device that manages the flow of data between extended network 120 and the external network 130. Gateway wireless device may comprise, for example, a router, a switch, or a gateway. Functionality described herein as being associated with gateway wireless access device 122 may be implemented using one or more devices. For example, gateway wireless access device 122 may be configured to include a router in communication with a network switch, either of which can be configured to perform some or all of the functions described herein.

[00029] When a data packet is received at either gateway wireless access device 122 or an extended wireless access device 124, an additional or second type of network device, the wireless access device reads address information in the packet to determine its ultimate destination. In a packet-switched network, a "router" is a device which receives packets on one or more input interfaces and which outputs those packets on one of a plurality of output interfaces so as to move those packets within the network from a source device to a destination device. Each packet includes header information, which indicates the destination device in either extended network 120 or external network 130. Additional information is provided by the physical layer to the device which receives a packet directly and that information can further include wireless connection quality information, described in detail below with reference to FIG. 2. The router includes routing information, which associates an output interface with information about the destination device. The router can also perform other operations on packets, such as rewriting the packets' headers according to their routing protocol, or re-encapsulating the packets from a first routing protocol to a second routing protocol.

[00030] Gateway wireless access device 122 may be a gateway device that provides an exclusive communication channel between extended network 120 and external network 130. Accordingly, packets transmitted by extended wireless access devices 124 and/or wireless devices

using extended network 120, can be viewed using the gateway wireless access device 122. Gateway wireless access device 122 and extended wireless access device 124 may further be configured to generate wireless connection quality information transmitted to a certain wireless access device (122 or 124) or exchanged among wireless access devices (122 and 124), as described below in further detail. Accordingly, some or all wireless access device (122 and/or 124) are further configured to implement an extended network management function for configuring device connections in an extended network environment, as described in detail below with reference to FIG. 2.

[00031] External network 130 may be a wide area telecommunication network covering a broad area, such as the Internet. External network 130 may be connected to network device 120 using a wired or wireless connection. For example, gateway wireless access device 122 may be connected to the external network 130 via a high-bandwidth connection such as a cable modem, a Digital Subscriber Line (DSL) modem, or a 3G/4G Long Term Evolution (LTE) modem connection to send and receive data with systems through external network 130.

[00032] External network 130 allows communication with one or more of a plurality of external systems including, for example an external web site, an external computing system, and/or an external database. These systems and applications may be accessible using an Internet Protocol address provided by any of the wireless devices on extended network 120 and used by network device 120 to determine a destination for data transmitted to and/or from extended network 120 to external network 130.

[00033] In operation, each wireless access device 122, 124 in extended network 120 is configured to monitor, store, and/or report wireless connection quality information. The wireless connection quality information may be generated at the wireless access device 122 or 124 and/or included in packet headers received at the wireless access device. For example, each access point is configured to monitor the link rate of packets sent from the wireless device 110 and to check the signal strength it receives for those packets, no matter which wireless access device the packets are intentionally transmitted to. Accordingly, each wireless access device can provide wireless connection quality information indicating signal strength from the wireless device 110 and corresponding link rate for packets from the wireless device.

[00034] Each wireless access device 122 or 124 in extended network 120 may be further configured to periodically review the wireless connection between the wireless access device and any wireless devices communicating with the wireless access device. The connection check may be performed periodically such as every 5 seconds, based on a reported connection issue, such as an unusually slow connection, etc. A wireless access device can send and receive wireless connection information and a partial network topology with other wireless access devices periodically in an attempt to identify a better connection for a wireless device. In addition, a wireless access device can also monitor an existing connection to identify if the connection with a wireless device becomes bad. If the connection does become bad, the wireless access device starts looking for another wireless access device in the extended network that can provide better a better connection for the wireless device.

[00035] The wireless connection quality information received from the wireless device 110 may be stored in a memory of the wireless access device 122 or 124 and/or forwarded to a central repository, such as the memory for gateway wireless access device 122. The wireless connection quality information may be either a simple value, such as a connection speed, or a number of different values, such as connection speed and other quality information for the extended network 120, including the quality for connections between two wireless access devices, for example, for the connection between the gateway wireless access device 122 and an extended wireless access device 124. The wireless connection quality information may be forwarded when it is received, may be periodically forwarded in a batch operation, may be aggregated to provide wireless connection quality information over a defined period of time, etc. Advantageously, the stored wireless connection quality information may be used to determine the particular wireless access device 122 or 124 that can provide the highest quality wireless connection to the wireless device 110 at any particular time. Using the network management system described herein, extended network 120 may be configured to utilize any tree topology including a gateway wireless access device 122 as a root, such as a hub/star configuration, a cascaded configuration, etc.

[00036] For example, in a tree topology, the extended network is configured in a tree topology including a gateway device as a root, one or more wireless access devices as nodes in the tree, and a wireless device as a leaf. The network tree topology can have several levels and each level can have several nodes. A node or a wireless access device connects to the network by

connecting to its upstream node or wireless access device. A wireless access device can connect to its upstream node in any of a variety of different ways, for example through a wired connection (e.g. Ethernet, and the wireless access device is a Wi-Fi AP), through a wireless connection (e.g. Wi-Fi, and the wireless access device is a Wi-Fi extender), etc. In addition, a wireless access device may be configured to have only one wireless interface where it performs multiplexing on the single wireless interface and uses the same wireless to connect to the extended network as well as to wireless devices. One example of such a device is a Wi-Fi single-band extender.

[00037] Although the wireless device 110 will be connected to a single wireless access device 122 or 124 through an existing wireless connection, designated as the "current wireless access device." Establishing a wireless connection may include performance of a handshake protocol and the exchange of data packets as is well known in the art. Once a wireless connection is established, the wireless access device establishing the connection is considered the current wireless access device. Although connected with the current wireless access device, each wireless access device 122 or 124 on extended network 120 is configured to receive any packets transmitted to the current wireless access device from the wireless device 110 and store the observed quality information of these packets independent of whether the wireless access device is providing the wireless connection to the wireless device. Depending on the location/position of each access device relative to the wireless device, the observed signal strength at each access device for a packet from the wireless device (to the current access device) is different. In contrast, in a typical wireless network, this information would be discarded as packets from devices that are not transmitted to a wireless access device were dropped by that wireless access device.

[00038] Referring now to FIG. 2, a gateway wireless access device 122 or simply "gateway" configured to implement an extended network management function as described herein is shown in greater detail, according to an exemplary embodiment. Although gateway 122 is shown in FIG. 2 as including specific components in an exemplary configuration, it is important to recognize that gateway 122 may include more, fewer, and/or a different configuration of components to implement the functions described herein. Further, although the functionality described herein is described as being implemented on a gateway device, the extended network management function can be implemented on a gateway device 122 and/or an

extender access device 124. In addition, an implementation may be centralized on one device or distributed among a plurality of devices. For simplicity, the functionality will be described herein below with reference to implementation on a gateway 122.

[00039] The functional components (not shown) of gateway 122 may be implemented using hardware including a processing unit, a system memory, and a system bus that couples various system components, including the system memory, to the processing unit. The system bus may be any of several types of bus structures including a memory bus or memory controller, a peripheral bus, and a local bus using any of a variety of bus architectures. Further, the described components may be implemented using hardware and/or software.

[00040] The processing unit may be any type of computer processor configured to implement the functionality described herein including the steps of identifying advertising content requests in network packets transmitted through gateway 122. The processing unit may be any type of processor, such as a MIPS processor.

[00041] The system memory of gateway 122 includes computer storage media in the form of volatile and/or nonvolatile memory such as read only memory (ROM) and random access memory (RAM). A basic input/output system (BIOS), containing the basic routines that help to transfer information between elements within gateway 122, such as during start-up or networking operations, is typically stored in ROM. RAM typically contains data and/or program modules that are immediately accessible to and/or presently being operated on by the processing unit. The gateway 122 may also include other removable/non-removable, volatile/nonvolatile computer storage media, such as flash memory. Although gateway 122 is shown and described herein as including memory, gateway 122 may alternatively be implemented to store information in a network storage device.

[00042] Although gateway wireless access device 122 may be any of a variety of types of network devices, for clarity access point 122 is further described herein as a router type network device. Gateway wireless access device 122 includes a wireless client interface 202, a wireless connection analyzer 204, an extended network management system 206, an extended network management table 208, and an extended network interface 224. Although network device 122 is shown as including a number of functional embodiments represented as separate components, it

should be understood that the same functional component may be used to implement one or more of the functional embodiments.

[00043] Wireless client interface 202 is an input/output port receiving/transmitting packets from/to the wireless devices 110. Extended network interface 224 is an input/output port receiving/transmitting packets from/to the extended network 120. Extended network interface 224 connects the access device to the extended network. Extended network interface 224 can be an Ethernet port, a wireless transmitter, or another device for receiving/transmitting packets from/to extended network 120. The physical device for the wireless client interface 202 and the extended network interface 224 can be the same. A simple extended access device 124 can be configured to have only one network interface (a wireless interface) such that both wireless client interface and extended network interface are through the only network interface.

[00044] Wireless connection analyzer 204 is a software component configured to analyze and determine wireless connection quality between the wireless access device 122 and a wireless device. Although shown specifically within gateway wireless access device 122, a wireless connection analyzer 204 is implemented in the extended network 120 on the wireless access devices 122 and 124 in the network. Accordingly, each wireless access device 122, 124 in the extended network is configured to be able to obtain information used to determine the wireless connection quality between that wireless access device and the wireless devices within the extended network 120.

[00045] The wireless connection analyzer 204 associated with each wireless access device 122, 124 is configured to generate a wireless connection quality table entry to be stored in an extended network management table 208. The specific data used to generate the wireless connection quality table information is described in further detail below with reference to the extended network management table 208. The analyzer 204 may generate the table entry based on information received from the wireless device in packet headers, based on data received from components in the wireless access device, such as a signal strength detection system (not shown), based on data received from other wireless access devices in the extended network, etc.

[00046] Each wireless connection analyzer 204 is further configured to generate the wireless connection quality table entry for each wireless device 110 associated with any wireless

access device on the extended network. The analyzer 204 associated with each wireless access device 122 or 124 can be configured to generate the table entry independent of whether the associated wireless access device is connected to the wireless device 110, being used in the connection path to gateway wireless access device 122, etc. The analyzer 204 associated with each wireless access device 122 or 124 can be further configured to generate the wireless connection quality table entry for each other wireless access device 122 or 124 that connects to it.

[00047] Extended network management system 206 is a software application implemented in a root or central wireless access device for an extended network, such as gateway wireless access device 122. In an alternative embodiment, network management system 206 may be implemented as a distributed system in a plurality of wireless access devices. Management system 206 is configured to implement a management protocol in the extended mesh network to determine the wireless access device that can provide the highest quality wireless connection to a wireless device at any particular time. Accordingly, management system 206 is configured to store and maintain the extended network management table 208 based on connection quality data received by the wireless access devices in the network and exchanged among wireless access devices in the network. Table 208 may also be generated to include data connection quality data generated locally at each wireless access device 122 or 124.

[00048] Extended network management table 208 is generated and stored with the memory of gateway 122 and/or any other wireless access device. Table 208 includes a unique wireless access device record 210 for each wireless access device 122, 124 communicating through the extended network 120. Each record 210 includes a plurality of wireless connection quality table entries 212, one for each wireless device in the extended network 120. Accordingly, table 208 may be stored and maintained in memory remote from device 122, such as would be implemented in a cloud computing environment.

[00049] Each wireless connection quality table entry 212 in the network management table 208 is specific to the wireless connection between one wireless access device 122 or 124 and one wireless device 110. Accordingly, table entries 212 include a wireless access device identifier 214, a signal strength data field 216, and a wireless capability field 218 for the wireless device 110. Each wireless access device record 210 for a wireless access device 122, 124 includes a

utilization status data field 220 for each wireless band (e.g., 2.4 GHz, 5GHz), a noise field 222 for each wireless band, a wireless capability field 224 for the wireless access device, and a connection path quality data field 226 describing the connection path for each wireless access device 124 in the path to the gateway wireless access device 122, (i.e., determined by the connection quality between any two contiguous wireless access devices on the path between the current wireless access device and the gateway wireless access device 122). For the gateway wireless access device 124, this field is set to the highest value in the extended network 120.

[00050] According to a specific implementation, table 208 includes one record 210 for each wireless access device in the extended network. In each record for an access device, there is a table for the wireless clients connected to that access device. Each table entry 212 corresponds to a wireless client connected to the access device. Some fields (214, 216, 218) are associated with a table entry since they are specific to a wireless client, while other fields (220, 222, 224) are associated with a record since they are not specific to a wireless client but are specific to a wireless access device.

[00051] Extended network management system 206 is configured to identify the wireless access device that can provide the highest quality wireless connection with a wireless device at any given time. According to exemplary embodiment, management system 206 identifies highest-quality wireless connection based on at least the capability of the wireless device 110, the capability of the gateway wireless access device 122, and the capability of each wireless access device 122, 124 in the extended network 120, the path quality from the wireless access device to the gateway, etc.

[00052] Referring now also to FIG. 3A, a schematic illustration of an exemplary extended wireless network 300 network topology including a wireless device 310, a gateway wireless access device 320 in the form of a router, and extended wireless access devices 330-336 is illustrated. The network topology may be generated based on exchanged messages communicated between the components of network 300. Each message may include a partial network topology based on the messages received by the component that is transmitting the topology.

[00053] Extended wireless network 300 further includes a representation of connection speed 340~350 between wireless communication elements within the extended network 300. Accordingly, the connection speed 340 between gateway wireless access device 320 and a first extended wireless access device 330 is 60 Mega bits per second (Mbps), while the connection speed 342 between gateway wireless access device 320 and a second wireless access device 332 is 20 Mbps. The connection speed is dependent on several factors, including at least the hardware and software installed on each endpoint (i.e. the connection type and the capability of each endpoint) and the distance between the endpoints if it's a wireless connection.

[00054] Where wireless device or "Wi-Fi client" 310 is positioned at a first location 308 as shown in ghost form in Fig. 3A, the wireless device 310 may be already connected to the extended wireless access device 334. The wireless connection is designated as 350. However, management system 206 will continually evaluate available wireless connections while the wireless device 310 is moving.

[00055] For example, when the wireless device 310 moves to the second location depict in Fig. 3A, (location #2), the wireless connections 350 becomes weak and the wireless device 310 may suffer from the weak wireless connection. Dependent on the wireless device 310's implementation, wireless device 310 may determine if the wireless device 310 needs to try to a different wireless access device to get a better connection based on any of a variety of factors. Such continuous searching for an optimal connection is referred to as roaming in the wireless environment. For example, some implementations are configured to use the existing connection to avoid disruption until that connection is too weak to maintain the connection. The weak wireless connection 350 may be identified by the wireless access devices 334 based on detected poor signal strength between the wireless access device 334 and the wireless device 310. The poor signal strength information may be communicated among the wireless access devices and the management system 206 implemented by each wireless access device 122, 124 will put the poor signal strength information in its table as discussed above.

[00056] Further, at the second location, wireless device 310 may have a good wireless connection if it connects to wireless access device 336 or wireless access device 332. This can be detected by the wireless access device 332, 336 by monitoring the signal strength from all the

wireless packets sent from the wireless device 310, even if the packets are not transmitted to the wireless access device 332, 336 intentionally. Accordingly, management system 206 is configured to check if the wireless access device 332 or 336 can provide a better connection to the wireless device 310. Generally, the connection speed for a wireless device 310 to the gateway wireless access device 320 is determined by determining the lowest speed among all links (between any two contiguous devices) in the connection path between that wireless device and the gateway wireless access device 320, divided by the number of links between the gateway wireless access device 320 and the wireless device the network device 310. Accordingly, at the second location, the lowest speed in the connection path through wireless access device 336 (path#1) is 20 Mbps, and the connection speed for path#1 is 20 Mbps divided by the three links, which gets 6.67 Mbps. In contrast, while the lowest speed in the connection path through wireless access device 332 (path#2) is also 20 Mbps, the connection speed for path#2 is 20 Mbps divided by the two links, which gets 10.0 Mbps. Accordingly, management system 206 will initiate a wireless connection between the wireless access device 332 and the wireless device 310 based on the higher 10.0 Mbps connection speed.

[00057] However, referring now to FIG. 3B, where if the wireless device 310 is capable of creating connections with a higher speed to the wireless access device 332 and 336, and the connection speed 346 and 348 for the wireless connection between wireless device 310 and wireless access device 332, 336 is both 60 Mbps. The higher speed of the link will result in a higher connection speed for the path#1 and the consequent connection speed is 60 Mbps divided by 3, which gets 20.0 Mbps. However the connection speed for the path#2 remains at 10Mbps, even the connection speed 346 has been increased to 60mbps. That is due to the connection 342 now becomes the bottleneck of the path#2 and that keeps the connection speed for path#2 on 10Mbps. Accordingly, management system 206 will initiate a wireless connection between the wireless access device 336 and the wireless device 310 based on the higher 20.0 Mbps link rate.

[00058] Referring now to FIG. 3C, a schematic illustration of another exemplary extended wireless network 300 including a wireless device 364, a gateway wireless access device 360 in the form of a router, and an extended wireless access devices 362 is illustrated. If the wireless device 364 connects to the wireless access device 362, the connection speed between the wireless device 364 and the gateway wireless access device 360 is 20 mbps divided by 2, which is 10

Mbps. If the wireless device 364 connects to the gateway wireless access device 360 directly, the connection speed is 15 Mbps. The management system 206 will consider the wireless access device 360 provides a better connection for the wireless device 364, even though, from the wireless device 364's point of view, the wireless access device 362 provides a better connection. As shown in FIG. 3C, in a wireless extended network, a wireless device has multiple wireless access devices to connect to and a wireless access device that has stronger signal may not be a better choice to provide a faster connection speed to the gateway device.

[00059] Referring now to FIG. 4, a flowchart 400 illustrating a method for implementing the extended network management system 100 of FIG. 1 to identify a high quality wireless connection for a wireless device 110 is shown, according to an exemplary embodiment. Although flowchart 400 includes multiple steps performed in a defined order, the functions described herein can be performed using more, less and/or a different ordering of steps.

[00060] In a first step 402, wireless device 110 (FIG. 1) creates a wireless connection with one wireless access device 122 or 124 in the extended network 120. The wireless connection may be created based on an initial use of the wireless device 110, based on establishment of a new connection following a loss in connection, based on a specific elapsed time, etc. Establishing a wireless connection may include performance of a handshake protocol and the exchange of data packets as is well known in the art. Once a wireless connection is established, the wireless access device establishing the connection is considered the current wireless access device.

[00061] In a step 404, upon establishment of the wireless connection, the current wireless access device, including at least gateway wireless access device 122 and possibly additionally including one or more extended wireless access devices 124, is configured to transmit the establishment of the wireless connection and the identity of the wireless device to other access devices within the extended network 120.

[00062] In a step 406, each wireless access device in extended network 120 that is within wireless range of the wireless device 110 will begin receiving data packets from the wireless device 110 based on the wireless connection to the current wireless access device. Generally, wireless access devices in extended network 120 other than the current wireless access device will not process the data packets transmitted to the current wireless access device; they typically

discard those packets. However, based on the received data packets, each wireless access device in extended network 120 is configured to generate wireless connection quality information describing a real or theoretical wireless connection between that wireless access device and the wireless device 110. Step 406 may be performed for an indefinite time or a defined period of time, such as 3 seconds.

[00063] In a step 408, each wireless access device having wireless connection quality information for wireless device 110 exchanges the generated information with each other wireless access device in the extended network 120, and those information is kept in a repository such as network management table 208 and/or network management system 206, described above with reference to FIG. 2. According to an exemplary embodiment, the repository could be located in the memory of any wireless access device 122 or 124, such as table 210 of FIG. 2.

[00064] In a step 410, the gateway wireless access device 122 or the current wireless access device 122 or 124 analyzes the received wireless connection quality information to identify the wireless access device that can provide the highest quality wireless connection to the wireless device 110. It is important to recognize that the highest quality connection may vary dependent upon the intended use of the wireless connection. For example, if wireless device 110 is utilized to implement an IP telephony application, a link rate may be the primary factor in identifying a high quality wireless connection. Alternatively, if wireless device 110 does not include the capability to manage an excess amount of dropped packets, the wireless connection quality may be identified based on the fewest number of dropped packets.

[00065] In a step 412, a wireless access device 122 or 124 that does centralized control or the current wireless access device identifies any change in the condition of the wireless connection to the current wireless access device. The connection check may be performed using the method described above with reference to FIG. 1. Alternatively, the central control wireless access device 122 or 124 or the current wireless access device may be configured to periodically determine whether to change the wireless connection from the current wireless access device to a new wireless access device based on a determination that the new wireless access device can provide a higher quality wireless connection and the connection transfer will not disrupt the applications running on the wireless device 110.

[00066] In a step 414, a wireless connection is established to the wireless access device providing the highest quality wireless connection. The connection may be established based on a message transmitted from the central control wireless access device 122 or 124 to the new wireless access device. Alternatively, the connection may be established based on a determination made at the current wireless access device. In either event, the resulting "current" wireless access device may be the same wireless access device to which the wireless device 110 was connected prior to the connection query of step 410 or a different wireless access device. The process then returns to step 404, where the steps 404-414 are repeated on an ongoing basis.

[00067] When a wireless device 110 is joining an extended network 120 (that is, during the step 402), similar mechanism can also be used to determine the best wireless access device 122 or 124 for the wireless device 110. When a wireless device 110 attempts to join a network, it usually sends out some packets to discover the environment and it has to send out a request packet for joining a network. By observing the signal strength from these packets and examining the packet contents, a wireless access device 122 or 124 can estimate the connection quality if the wireless device 110 connects to it. Furthermore, a wireless access device 122 or 124 can estimate the data transmission speed between the wireless device 110 and the gateway wireless device 122 if the wireless device 110 reaches the gateway wireless device 122 through it.

[00068] According to an alternative embodiment, network management system 206 may be implemented as a distributed management system, such that an embodiment of the network management system 206 is resident in every wireless access device within extended network 120. In such a system, wireless access devices exchange information with each other and each wireless access device is aware of which wireless access device can provide the highest quality wireless connection to the wireless device 110.

[00069] Certain terminology is used herein for purposes of reference only, and thus is not intended to be limiting. For example, terms such as "network device" refer to any system or device receiving and retransmitting information packets in a computer network.

[00070] References to "a server" and "a processor" can be understood to include one or more controllers or processors that can communicate in a stand-alone and/or a distributed environment(s), and can thus be configured to communicate via wired or wireless

communications with other processors, where such one or more processor can be configured to operate on one or more processor-controlled devices that can be similar or different devices. Furthermore, references to memory, unless otherwise specified, can include one or more processor-readable and accessible memory elements and/or components that can be internal to the processor-controlled device, external to the processor-controlled device, and can be accessed via a wired or wireless network. It should be understood that a computer program may embrace constituent programs and that multiple programs may be implemented as a single or multiple programs.

[00071] Various features of the invention are set forth in the following claims. It should be understood that the invention is not limited in its application to the details of construction and arrangements of the components set forth herein. The invention is capable of other embodiments and of being practiced or carried out in various ways. Variations and modifications of the foregoing are within the scope of the present invention. It also being understood that the invention disclosed and defined herein extends to all alternative combinations of two or more of the individual features mentioned or evident from the text and/or drawings. All of these different combinations constitute various alternative aspects of the present invention. The embodiments described herein explain the best modes known for practicing the invention and will enable others skilled in the art to utilize the invention.

Electronic Acknowledgement Receipt

EFS ID:	17362748
Application Number:	13974090
International Application Number:	
Confirmation Number:	4517
Title of Invention:	SYSTEM AND METHOD FOR CONFIGURING DEVICE CONNECTIONS IN AN EXTENDED NETWORK ENVIRONMENT
First Named Inventor/Applicant Name:	Yu-Te Lin
Customer Number:	23598
Filer:	Timothy E Newholm/Nicole Bey
Filer Authorized By:	Timothy E Newholm
Attorney Docket Number:	2188.047
Receipt Date:	11-NOV-2013
Filing Date:	23-AUG-2013
Time Stamp:	11:44:52
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		00668661.PDF	19184014 ef71b0cab77b116646d34e17a7285ab6d37 0fa47	yes	43

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Applicant Response to Pre-Exam Formalities Notice	1	1
	Specification	2	22
	Specification	23	43
Warnings:			
Information:			
	Total Files Size (in bytes):	19184014	

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New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 13/974,090

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	280
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	600
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	720
TOTAL CLAIMS (37 CFR 1.16(i))	21 minus 20 =	* 1			OR	x 80 =	80
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3 minus 3 =	*				x 420 =	0.00
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
* If the difference in column 1 is less than zero, enter "0" in column 2			TOTAL			TOTAL	1680

APPLICATION AS AMENDED - PART II

AMENDMENT A		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT B		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE($)	ADDITIONAL FEE($)		RATE($)	ADDITIONAL FEE($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
13/974,090	08/23/2013	2656	1820	2188.047	21	3

CONFIRMATION NO. 4517

23598
BOYLE FREDRICKSON S.C.
840 North Plankinton Avenue
MILWAUKEE, WI 53203

UPDATED FILING RECEIPT

OC000000064967291

Date Mailed: 11/18/2013

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Yu-Te Lin, Taipei City, TAIWAN;
Bing-Huang Cheng, Taichung, TAIWAN;

Applicant(s)

NETGEAR, Inc., San Jose, CA

Assignment For Published Patent Application

NETGEAR, Inc., San Jose, CA

Power of Attorney: None

Domestic Applications for which benefit is claimed - None.
A proper domestic benefit claim must be provided in an Application Data Sheet in order to constitute a claim for domestic benefit. See 37 CFR 1.76 and 1.78.

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

If Required, Foreign Filing License Granted: 09/10/2013

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/974,090**

Projected Publication Date: 02/26/2015

Non-Publication Request: No

Early Publication Request: No

Title

SYSTEM AND METHOD FOR CONFIGURING DEVICE CONNECTIONS IN AN EXTENDED NETWORK ENVIRONMENT

Preliminary Class

379

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

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Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

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TP Link Ex. 1004
Page 115

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Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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To: docketing@boylefred.com,,
From: PAIR_eOfficeAction@uspto.gov
Cc: PAIR_eOfficeAction@uspto.gov
Subject: Private PAIR Correspondence Notification for Customer Number 23598

Nov 18, 2013 05:35:31 AM

Dear PAIR Customer:

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840 North Plankinton Avenue
MILWAUKEE, WI 53203
UNITED STATES

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The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

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Application	Document	Mailroom Date	Attorney Docket No.
13974090	APP.FILE.REC	11/18/2013	2188.047

To view your correspondence online or update your email addresses, please visit us anytime at https://sportal.uspto.gov/secure/myportal/privatepair.

If you have any questions, please email the Electronic Business Center (EBC) at EBC@uspto.gov with 'e-Office Action' on the subject line or call 1-866-217-9197 during the following hours:

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/974,090	08/23/2013	Yu-Te Lin	2188.047

CONFIRMATION NO. 4517

23598
BOYLE FREDRICKSON S.C.
840 North Plankinton Avenue
MILWAUKEE, WI 53203

PUBLICATION NOTICE



Title:SYSTEM AND METHOD FOR CONFIGURING DEVICE CONNECTIONS IN AN EXTENDED NETWORK ENVIRONMENT

Publication No.US-2015-0055566-A1
Publication Date:02/26/2015

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently http://pair.uspto.gov/. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

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From: PAIR_eOfficeAction@uspto.gov
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Feb 27, 2015 05:48:01 AM

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MILWAUKEE, WI 53203
UNITED STATES

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Application	Document	Mailroom Date	Attorney Docket No.
13974090	NTC.PUB	02/26/2015	2188.047

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/974,090	08/23/2013	Yu-Te Lin	2188.047	4517

23598 7590 06/09/2015

BOYLE FREDRICKSON S.C.
840 North Plankinton Avenue
MILWAUKEE, WI 53203

EXAMINER	
HAILE, AWET A	

ART UNIT	PAPER NUMBER
2474	

NOTIFICATION DATE	DELIVERY MODE
06/09/2015	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

docketing@boylefred.com

Office Action Summary	Application No. 13/974,090	Applicant(s) LIN ET AL.	
	Examiner AWET HAILE	Art Unit 2474	AIA (First Inventor to File) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *August 23, 2013*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5)☒ Claim(s) *1-21* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1-21* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

4) ☐ Other: _____.

DETAILED ACTION

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

> A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102 of this title, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

3. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103 are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

4. This application currently names joint inventors. In considering patentability of the claims the examiner presumes that the subject matter of the various claims was commonly owned as of the effective filing date of the claimed invention(s) absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and effective filing dates of each claim that was not commonly owned as of the effective filing date of the later invention in order for the examiner to consider the applicability of 35 U.S.C. 102(b) (2) (C) for any potential 35 U.S.C. 102(a) (2) prior art against the later invention.

5. **Claims 1-21** are rejected under 35 U.S.C. 103 as being unpatentable over Bharghavan et al (US 2015/0043530 A1) in view of Smadi (US 2014/0241182 A1).

Regarding claims 1 and 16, Bharghavan '530 teaches, a network device configured to facilitate wireless connection management in an extended wireless network (see para 24, 38-44 and Figs.1-3, i.e., the coordinator 260 for wireless connection management) comprising: a network device input connected at least indirectly to an internal network and configured to communicate a plurality of data packets to and from at least one computer system(see para 23-25 and Figs. 1-2, i.e., system coordinator communicating to and from the AP's); and a computer processor configured to execute steps, including receiving packets from a wireless device(see para 41-44 and Figs. 1-3, i.e., each of the AP and the coordinator receiving messages from the wireless devices), identifying the wireless device within a table of wireless devices connected to a wireless access device in an extended wireless network (see para 38-44 and Figs. 1-3, i.e., each of the AP's and coordinator 260 comprising the data structure and identifying each of the wireless devices) , generating wireless connection quality information for the wireless device specific to the wireless access device(see para 38-44 and Figs. 1-3, i.e., based on message received form the wireless device determining signal quality for each of wireless device to AP communication). Bharghavan '530 does not explicitly teach , a network device output connected at least indirectly to an external network and configured to communicate the plurality of data packets to and from at least one computer system.

Smadi '182 teaches, a network device output connected at least indirectly to an external network and configured to communicate the plurality of data packets to and from at least one computer system (see para 20-22 and Figs. 1-2, i.e., gateway 110 communicatively coupled with the external network 120).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was filed to incorporate, the teaching of Smadi '182 into the communication system of Bharghavan '530, since such modification would provide techniques for reducing RF interference of communications with multiple Access points in in multiple networks, as suggested by Smadi '182(see para 16).

Regarding claim 2, the combination of Bharghavan '530 and Smadi '182 teaches, wherein the computer processor is further configured to transmit the wireless connection quality information to other wireless access devices in the extended network(see Bharghavan '530, para 40-44 and Fig.2-3, i.e., each of the AP receiving data structure 270).

Regarding claim 3, the combination of Bharghavan '530 and Smadi '182 teaches wherein the computer processor is further configured to receive wireless connection quality information from a plurality of other network devices and to identify network device in the extended network providing the highest quality wireless connection for the wireless device).

Regarding claim 4, the combination of Bharghavan '530 and Smadi '182 teaches, wherein the processor is further configured to initiate a wireless connection between the network device having the highest wireless connection quality and the wireless device(see Bharghavan '530, para 40-41, 48 and Figs. 1-3, i.e., initiating handoff procedure to the AP with highest quality).

Regarding claim 5, the combination of Bharghavan '530 and Smadi '182 teaches, wherein the processor is further configured to initiate the wireless connection with the network device having the highest wireless connection quality based on a connection check between the

network device and the wireless device(see Bharghavan '530, para 40-41, 48 and Figs. 1-3, i.e., initiating handoff procedure to the AP with highest quality).

Regarding claim 6, the combination of Bharghavan '530 and Smadi '182 teaches, wherein the wireless connection quality information includes at least one of a wireless signal strength, a connection capability, a utilization status, a network topology, and a connection patch quality(see Bharghavan '530, para 24, 40, 44 and Figs. 1-3, i.e., determining connection quality based on signal strength).

Regarding claim 7, Bharghavan '530 teaches, an extended network configured to implement an extended management function to identify a wireless access device providing a highest quality wireless connection to a wireless device(see para 24, 38-44 and Figs. 1-3, method and system for determining the highest QoS providing AP), comprising:
at least two wireless access devices in the extended network(see para 31-36 and Figs. 1-3, i.e., multiple APs); and at least one wireless device having a wireless connection to a least one of the wireless access devices(see para 38-44 and Figs. 1-3, i.e., wireless device 240 having connection to the AP), wherein the gateway device and/or wireless access devices include a processor executing the extended management function to identify the wireless access device providing the highest quality wireless connection based on wireless connection quality information transmitted by or exchanged among the wireless access devices(see para 38-44 and Figs. 1-3, the AP and the coordinator 260 communicating signal strength and other QoS parameter's to determine the best quality providing AP).

Bharghavan '530 does not explicitly teach , a gateway device configured to enable communication between the extended network and an external network.

Smadi '182 teaches, a gateway device configured to enable communication between the extended network and an external network (see para 20-22 and Figs. 1-2, i.e., gateway 110 communicatively coupled with the external network 120).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was filed to incorporate, the teaching of Smadi '182 into the communication system of Bharghavan '530, since such modification would provide techniques for reducing RF interference of communications with multiple Access points in in multiple networks, as suggested by Smadi '182(see para 16).

Regarding claim 8, the combination of Bharghavan '530 and Smadi '182 teaches, wherein the extended network is configured in a tree topology including a gateway device as a root, one or more wireless access devices as nodes in the tree, and a wireless device as a leaf(see Bharghavan '530, para 24, 27, 31-34 and Fig. 2, i.e., the system coordinator, APs and wireless devices as shown in Fig. 2).

Regarding claim 9, the combination of Bharghavan '530 and Smadi '182 teaches,, wherein each wireless access device is configured to generate wireless connection quality information for received packets from the wireless device in consideration and to transmit the wireless connection quality information to one or more wireless access devices in the extended network (see Bharghavan '530, para 38-44 and Figs. 1-3, each of the APs generating quality information based on messages received from the wireless device and transmitting the quality information to other AP/coordinator).

Regarding claim 10, the combination of Bharghavan '530 and Smadi '182 teaches, wherein at least one wireless access device is configured to initiate a connection between the wireless access device having the highest quality wireless connection for the wireless device and the wireless device (see Bharghavan'530, para 40-41, 48 and Figs. 1-3, i.e., initiating handoff procedure to the AP with highest quality).

Regarding claim 11, the combination of Bharghavan '530 and Smadi '182 teaches, wherein at least one wireless access device is further configured to initiate the connection to the wireless access device having the highest wireless connection quality based on a connection check between at least one the wireless device and the wireless device (see Bharghavan'530, para 40-41, 48 and Figs. 1-3, i.e., initiating handoff procedure to the AP with highest quality).

Regarding claim 12, the combination of Bharghavan '530 and Smadi '182 teaches, wherein the current wireless access device is further configured to check the connection quality for the wireless device on a periodic interval (see Bharghavan '530, 101, 102, periodically checking connection quality).

Regarding claim 13, the combination of Bharghavan '530 and Smadi '182 teaches, wherein the wireless connection quality includes at least one of a wireless signal strength, a noise level, a connection capability for a wireless device, a connection capability for a wireless access device, an extended network topology, a utilization status and a connection path quality(see Bharghavan '530, para 24, 40, 44 and Figs. 1-3, i.e., determining connection quality based on signal strength).

Regarding claim 14, the combination of Bharghavan '530 and Smadi '182 teaches, wherein the connection path quality for a wireless device is the connection quality between the

wireless device and the gateway device(see Bharghavan '530, para 24, 40, 44 and Figs. 1-3, i.e., determining connection quality based on signal strength).

Regarding claim 15, the combination of Bharghavan '530 and Smadi '182 teaches, wherein a first wireless access device is further configured to initiate the connection between the wireless access device having the highest wireless connection quality and the wireless device based on a connection check between at least one wireless access device and the wireless device, wherein the wireless access device having the highest wireless connection quality may be the first wireless access device(see Bharghavan'530, para 40-41, 48 and Figs. 1-3, i.e., initiating handoff procedure to the AP with highest quality).

Regarding claim 17, the combination of Bharghavan '530 and Smadi '182 teaches, further including transmitting or exchanging the wireless connection quality information from a wireless access device to/with other wireless access devices in the extended network (see Bharghavan '530, para 38-44 and Figs. 1-3, each of the APs generating quality information based on messages received from the wireless device and transmitting the quality information to other AP/coordinator).

Regarding claim 18, the combination of Bharghavan '530 and Smadi '182 teaches,, wherein at least one wireless access device is configured to initiate a wireless connection between the wireless access device having the highest quality wireless connection for the wireless device and the wireless device (see Bharghavan '530, para 40-41, 48 and Figs. 1-3, i.e., initiating handoff procedure to the AP with highest quality).

Regarding claim 19, the combination of Bharghavan '530 and Smadi '182 teaches,, wherein at least one wireless access device is further configured to initiate the wireless

connection with the wireless device having the highest wireless connection quality based on a connection check between at least one wireless access device and the wireless device(**see** Bharghavan '530, para 40-41, 48 and Figs. 1-3, i.e., initiating handoff procedure to the AP with highest).

Regarding claim 20, the combination of Bharghavan '530 and Smadi '182 teaches, wherein the wireless connection quality includes at least one of a wireless signal strength, a noise level, a connection capability for a wireless device, a connection capability for a wireless access device, an extended network topology, a utilization status and a connection patch quality(see Bharghavan '530, para 24, 40, 44 and Figs. 1-3, i.e., determining connection quality based on signal strength).

Regarding claim 21, the combination of Bharghavan '530 and Smadi '182 teaches,, wherein a first wireless access device is further configured to initiate the wireless connection between the wireless access device having the highest wireless connection quality and the wireless device based on a connection check between at least one wireless access device and the wireless device., wherein the wireless access device having the highest wireless connection quality may be the first wireless access device(see Bharghavan '530, para 40-41, 48 and Figs. 1-3, i.e., initiating handoff procedure to the AP with highest quality).

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Awet Haile whose telephone number is (571)270-3114. The examiner can normally be reached on Monday through Friday 8:30 AM - 4:30 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Thier can be reached on (571) 272-2832. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/AWET HAILE/
Primary Examiner, Art Unit 2474

Notice of References Cited	Application/Control No. 13/974,090	Applicant(s)/Patent Under Reexamination LIN ET AL.	
	Examiner AWET HAILE	Art Unit 2474	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2014/0241182 A1	08-2014	Smadi, Mohammed Nawaf	370/252
*	B	US-2015/0043530 A1	02-2015	BHARGHAVAN et al.	370/331
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

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*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
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CONFIRMATION NO. 4517

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
13/974,090	08/23/2013 RULE	370	2474	2188.047

APPLICANTS
NETGEAR, Inc., San Jose, CA;

INVENTORS
Yu-Te Lin, Taipei City, TAIWAN;
Bing-Huang Cheng, Taichung, TAIWAN;

** CONTINUING DATA **********

** FOREIGN APPLICATIONS **********

** IF REQUIRED, FOREIGN FILING LICENSE GRANTED **
09/10/2013

Foreign Priority claimed ☐ Yes ☑ No 35 USC 119(a-d) conditions met ☐ Yes ☑ No Verified and Acknowledged /AWET A HAILE/ Examiner's Signature	☐ Met after Allowance Initials	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
		TAIWAN	6	21	3

ADDRESS
BOYLE FREDRICKSON S.C.
840 North Plankinton Avenue
MILWAUKEE, WI 53203
UNITED STATES

TITLE
SYSTEM AND METHOD FOR CONFIGURING DEVICE CONNECTIONS IN AN EXTENDED NETWORK ENVIRONMENT

FILING FEE RECEIVED		
1820	FEES: Authority has been given in Paper No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13974090	LIN ET AL.
	Examiner	Art Unit
	AWET HAILE	2474

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	05/29/2015								
	1	✓								
	2	✓								
	3	✓								
	4	✓								
	5	✓								
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	14	✓								
	15	✓								
	16	✓								
	17	✓								
	18	✓								
	19	✓								
	20	✓								
	21	✓								

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	7	(patent near2 examiner near2 tool) and (@ad<="20141010" @pd<="20141010" @rlad<="20141010" @prad<="20141010")	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT	OR	ON	2015/03/04 10:31
S2	1	"13974090"	US-PGPUB; USPAT	OR	ON	2015/05/26 09:32
S3	12388	(H04W24/10 OR H04W76/02).CPC.	US-PGPUB; USPAT	OR	ON	2015/05/26 09:33
S4	22759	((Access near point) or AP or (Access near2 device) or BS or BSS or (access near2 gateway)) with (((channel or signal or connection) near2 quality) or QOS or (quality near2 service))	US-PGPUB; USPAT	OR	ON	2015/05/26 09:39
S5	6720	S4 and (Handover or handoff)	US-PGPUB; USPAT	OR	ON	2015/05/26 09:40
S6	1179	((Access near point) or AP or (Access near2 device) or BS or BSS or (access near2 gateway)) with (((channel or signal or connection) near2 quality) or QOS or (quality near2 service)) with (Handover or handoff)	US-PGPUB; USPAT	OR	ON	2015/05/26 09:41
S7	419	((Access near point) or AP or (Access near2 device) or (access near2 gateway)) with (((channel or signal or connection) near2 quality) or QOS or (quality near2 service)) with (Handover or handoff)	US-PGPUB; USPAT	OR	ON	2015/05/26 09:42
S8	416	S7 and (@ad<="20130823" @pd<="20130823" @rlad<="20130823" @prad<="20130823")	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT	OR	ON	2015/05/26 09:43
S9	5	((Access near point) or AP or (Access near2 device) or (access near2 gateway)) with (((channel or signal or connection) near2 quality) or QOS or (quality near2 service)) with (Handover or handoff) with extend$4	US-PGPUB; USPAT	OR	ON	2015/05/26 10:53
S10	5	S9 and (@ad<="20130823" @pd<="20130823" @rlad<="20130823" @prad<="20130823")	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT	OR	ON	2015/05/26 10:54
S11	11	((Access near point) or AP or (Access near2 device) or (access near2 gateway)) with (((channel or signal or connection) near2 quality) or QOS or (quality near2 service)) with (Handover	US-PGPUB; USPAT	OR	ON	2015/05/26 10:55

		or handoff) same extend$4				
S12	4	((Access near point) or AP or (Access near2 device) or (access near2 gateway)) with (((channel or signal or connection) near2 quality) or QOS or (quality near2 service)) with (Handover or handoff) and extend$4 with wifi	US-PGPUB; USPAT	OR	ON	2015/05/26 10:57
S13	2	"20070116094"	US-PGPUB; USPAT	OR	ON	2015/05/26 11:09
S14	1	"12311530"	US-PGPUB; USPAT	OR	ON	2015/05/26 11:09
S15	1	"14074266"	US-PGPUB; USPAT	OR	ON	2015/05/26 13:03
S16	1	"20040196861"	US-PGPUB; USPAT	OR	ON	2015/05/26 14:16
S17	0	"14032694"	US-PGPUB; USPAT	OR	ON	2015/05/26 18:39
S18	1	"8542703".pn.	US-PGPUB; USPAT	OR	ON	2015/05/26 18:40
S20	1647	(amount or quant$4) with ((dummy or pad$3) near2 (data or bit))	US-PGPUB; USPAT	OR	ON	2015/05/26 19:51
S21	214	(amount or quant$4) with ((dummy or pad$3) near2 (data or bit)) with process$4	US-PGPUB; USPAT	OR	ON	2015/05/26 19:52
S22	81	S21 and (@ad<="20011010" @pd<="20011010" @rlad<="20011010" @prad<="20011010")	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT	OR	ON	2015/05/26 19:53
S23	6	"20070116094"	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT	OR	ON	2015/05/26 23:51
S24	80	extended adj wireless adj network	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT	OR	OFF	2015/05/28 14:58
S25	76	S24 and (@ad<="20130823" @pd<="20130823" @rlad<="20130823" @prad<="20130823")	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT	OR	ON	2015/05/28 14:59
S26	142	((Xinzhou) near2 (Wu)).INV.	USPAT; USOCR	OR	OFF	2015/05/29 14:17
S27	898	((Junyi) near2 (Li)).INV.	US-PGPUB; USPAT	OR	OFF	2015/05/29 14:17
S28	34	((Pramod) near2 (Viswanath)).INV.	US-PGPUB; USPAT	OR	OFF	2015/05/29 14:17
S29	0	(S26 S27 S28) and ((Access near point) or AP or (Access near2 device) or (access near2 gateway)) with (((channel or signal or connection) near2 quality) or QOS or (quality near2 service)) with (Handover or handoff) and extend$4 with wifi	US-PGPUB; USPAT	OR	ON	2015/05/29 14:18

S30	123	(S26 S27 S28) and ((Access near point) or AP or (Access near2 device) or BS or BSS or (access near2 gateway)) with (((channel or signal or connection) near2 quality) or QOS or (quality near2 service))	US-PGPUB; USPAT	OR	ON	2015/05/29 14:19
S31	3	(S26 S27 S28) and (((Access near point) or AP or (Access near2 device) or BS or BSS or (access near2 gateway)) with (((channel or signal or connection) near2 quality) or QOS or (quality near2 service))).clm.	US-PGPUB; USPAT	OR	ON	2015/05/29 14:19

5/ 29/ 2015 2:39:12 PM
C:\ Users\ ahaile1\ Documents\ EAST\ Workspaces\ 13974090.wsp

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13974090	LIN ET AL.
	Examiner	Art Unit
	AWET HAILE	2474

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES		
Search Notes	Date	Examiner
NPL search(Google and IP.com)	5/29/2015	A.H
East CPC text search(H04W24/10, H04W76/02)	5/29/2015	A.H
Inventor search(edan and east)	5/29/2015	A.H

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

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Application	Document	Mailroom Date	Attorney Docket No.
13974090	CTNF	06/09/2015	2188.047
	892	06/09/2015	2188.047

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/974,090	08/23/2013	Yu-Te Lin	2188.047	4517

23598 7590 10/01/2015

BOYLE FREDRICKSON S.C.
840 North Plankinton Avenue
MILWAUKEE, WI 53203

EXAMINER	
HAILE, AWET A	

ART UNIT	PAPER NUMBER
2474	

NOTIFICATION DATE	DELIVERY MODE
10/01/2015	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Applicant-Initiated Interview Summary	Application No.	Applicant(s)	
	13/974,090	LIN ET AL.	
	Examiner	Art Unit	
	AWET HAILE	2474	

All participants (applicant, applicant's representative, PTO personnel):

(1) *AWET HAILE*. (3)_____.

(2) *Michael S. Brayer*. (4)_____.

Date of Interview: *24 September 2015*.

Type: ☒ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☒ No.
If Yes, brief description: _____.

Issues Discussed ☐101 ☐112 ☐102 ☒103 ☐Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: *1-21*.

Identification of prior art discussed: *Bharghavan et al (US 2015/0043530 A1) and Smadi (US 2014/0241182 A1)* .

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

Applicant's representative explained the differences between the present invention and the cited references. However, no immediate agreement was reached regarding the allowability of the pending claims. .

Applicant recordation instructions: The formal written reply to the last Office action must include the substance of the interview. (See MPEP section 713.04). If a reply to the last Office action has already been filed, applicant is given a non-extendable period of the longer of one month or thirty days from this interview date, or the mailing date of this interview summary form, whichever is later, to file a statement of the substance of the interview

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☐ Attachment

/AWET HAILE/ Primary Examiner, Art Unit 2474	

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record
A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews
Paragraph (b)

In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

37 CFR §1.2 Business to be transacted in writing.
All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiner's responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:
- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:
1) A brief description of the nature of any exhibit shown or any demonstration conducted,
2) an identification of the claims discussed,
3) an identification of the specific prior art discussed,
4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
5) a brief identification of the general thrust of the principal arguments presented to the examiner,
   (The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
6) a general indication of any other pertinent matters discussed, and
7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicant's record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, "Interview Record OK" on the paper recording the substance of the interview along with the date and the examiner's initials.

To: docketing@boylefred.com,,
From: PAIR_eOfficeAction@uspto.gov
Cc: PAIR_eOfficeAction@uspto.gov
Subject: Private PAIR Correspondence Notification for Customer Number 23598

Oct 01, 2015 05:33:42 AM

Dear PAIR Customer:

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The following USPTO patent application(s) associated with your Customer Number, 23598 , have new outgoing correspondence. This correspondence is now available for viewing in Private PAIR.

The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

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Application	Document	Mailroom Date	Attorney Docket No.
13974090	INTV.SUM.APP	10/01/2015	2188.047

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Thank you for prompt attention to this notice,

UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT APPLICATION INFORMATION RETRIEVAL SYSTEM

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Serial No.:	13/974,090	Examiner: Haile, Awet
Filing Date:	Aug. 23, 2013	Group Art Unit: 2474
Inventor:	Lin, et al.	Attorney Docket No.: 2188.047
Confirmation No.:	4517	Customer Account No.: 23598
Title:	*System and Method for Configuring Device Connections in an Extended Network Environment*	

RESPONSE TO NON-FINAL OFFICE ACTION MAILED JUNE 9, 2015

Mail Stop Amendment
Commissioner for Patents
Post Office Box 1450
Alexandria, VA 22313-1450

Dear Sir:

This amendment is being submitted in response to the Non-Final Office Action mailed June 9, 2015. This response is being filed with a Petition for a one (1) month Extension of Time.

Amendments to the claims begin on page 2 of this paper.

Remarks begin on page 7 of this paper.

AMENDMENTS TO THE CLAIMS

The following listing of claims replaces all previous listings of claims in the present application.

1. (Currently Amended) A ~~network device~~ gateway router configured to facilitate wireless connection management in an extended wireless network, comprising:

a network device input connected at least indirectly to an internal network and configured to communicate a plurality of data packets to and from at least one computer system;

a network device output connected at least indirectly to an external network and configured to communicate the plurality of data packets to and from at least one computer system; and

a computer processor configured to execute steps, including

receiving packets from a wireless device,

identifying the wireless device within a table of wireless devices connected to a wireless access device in an extended wireless network,

generating wireless connection quality information for the wireless device specific to the wireless access device, the wireless connection quality information including wireless connection quality information for at least one indirect communication path.

2. (Original) The network device of claim 1, wherein the computer processor is further configured to transmit the wireless connection quality information to other wireless access devices in the extended network.

3. (Original) The network device of claim 1, wherein the computer processor is further configured to receive wireless connection quality information from a plurality