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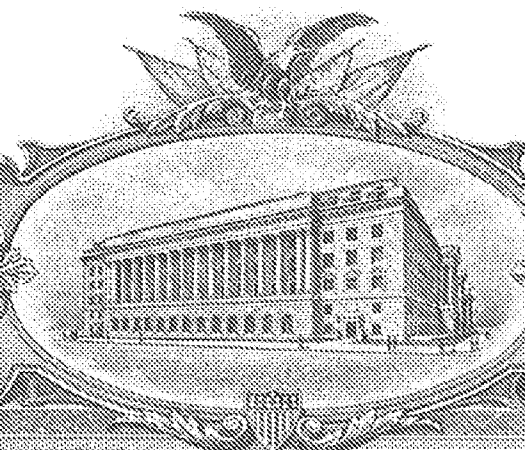
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Application Number	
Filing Date	July 26, 2019
First Named Inventor	Kevin Ross
Title	METHODS FOR PROVIDING POWER TO WIRELESS MESH NETWORK NODES
Art Unit	TBA
Examiner Name	TBA
Attorney Docket Number	Welink-00031

SIGNATURE of Applicant or Patent Practitioner

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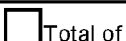
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Signature	Ahsan Naim	Date (Optional)	12/05/2016
Name	Muhammad Ahsan Naim		
Title			

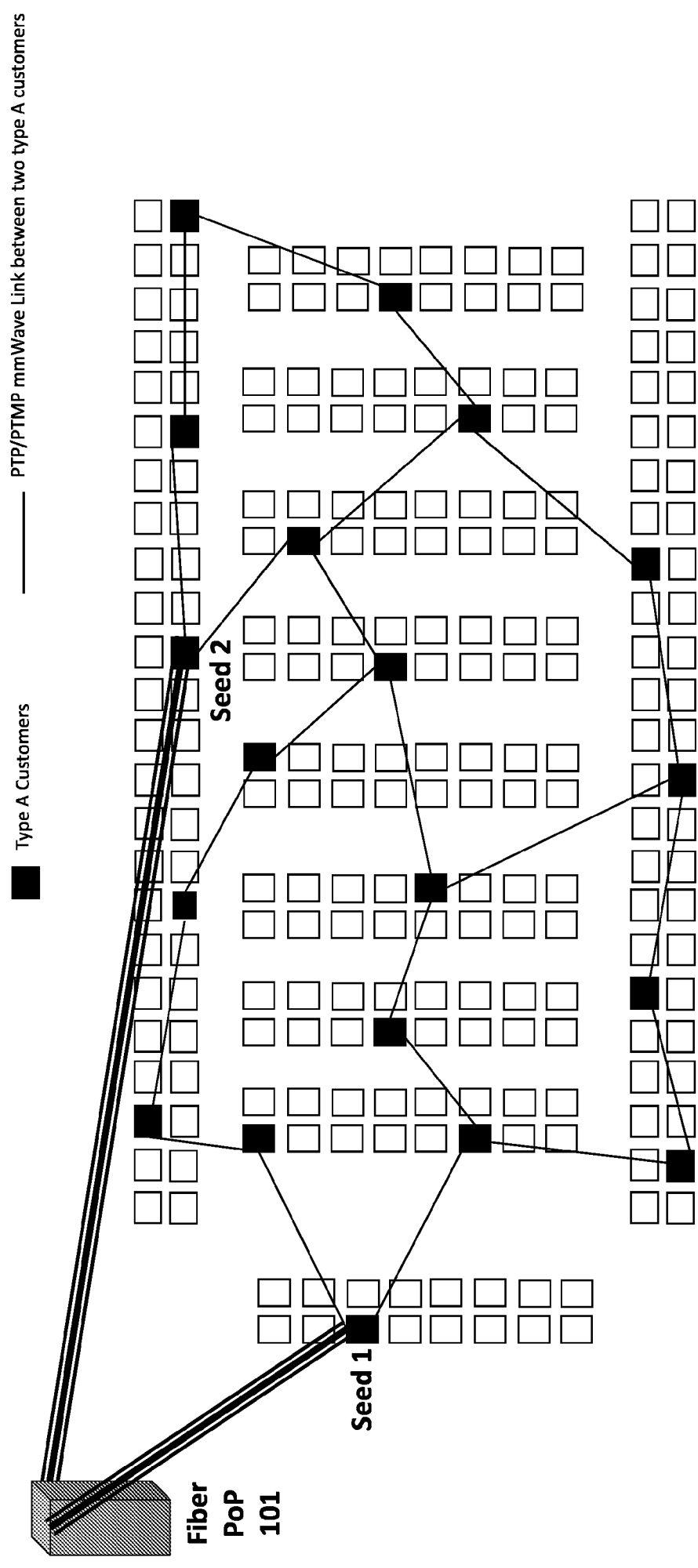
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Communication network 100

Figure 1

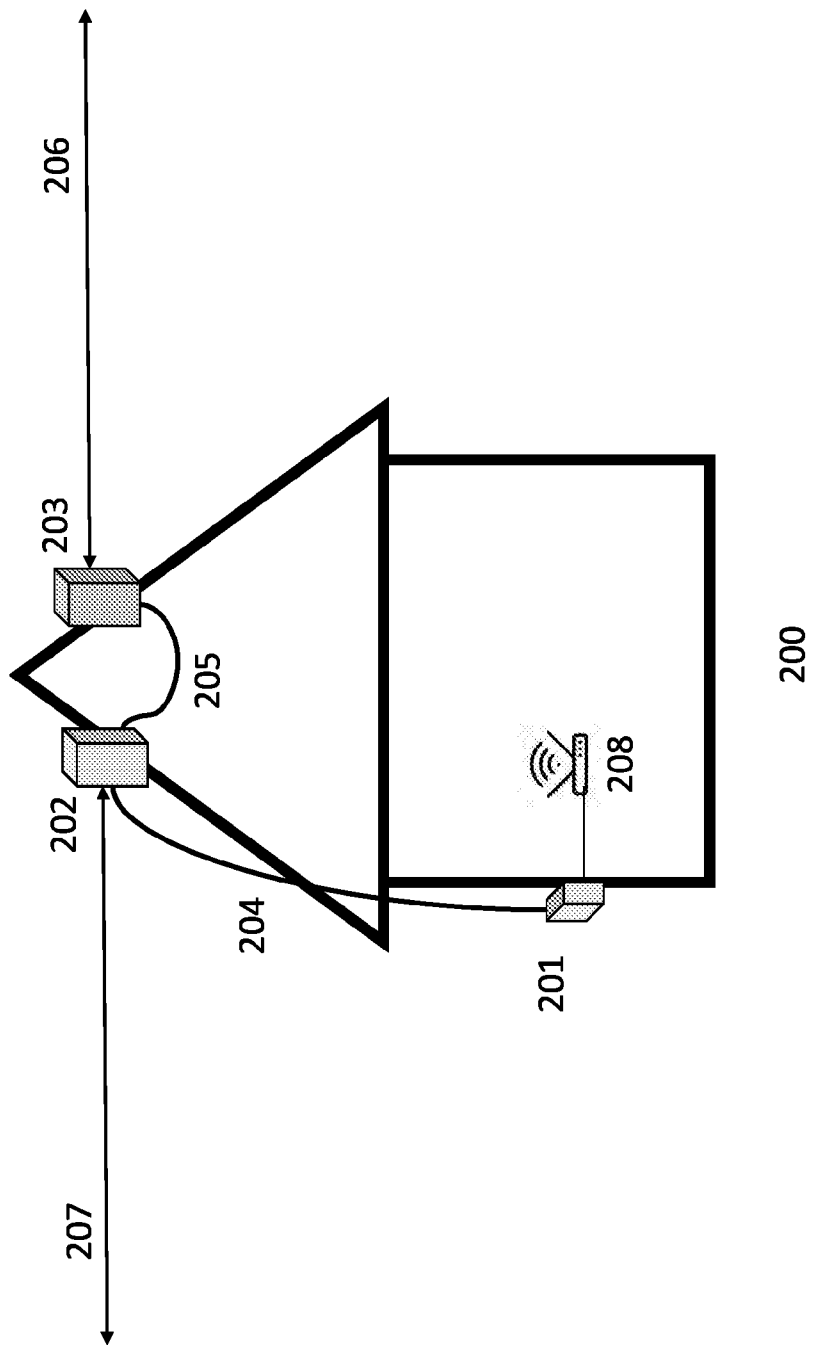


Figure 2



300

Figure 3

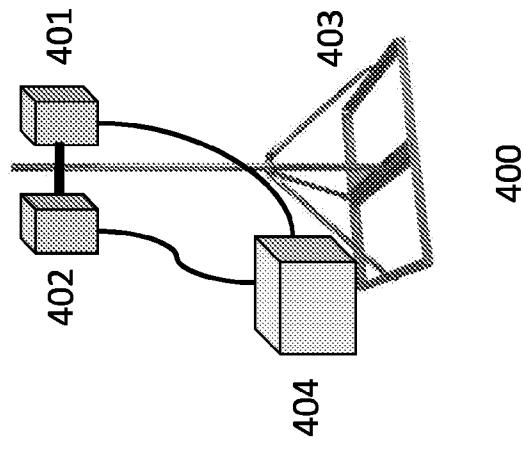


Figure 4

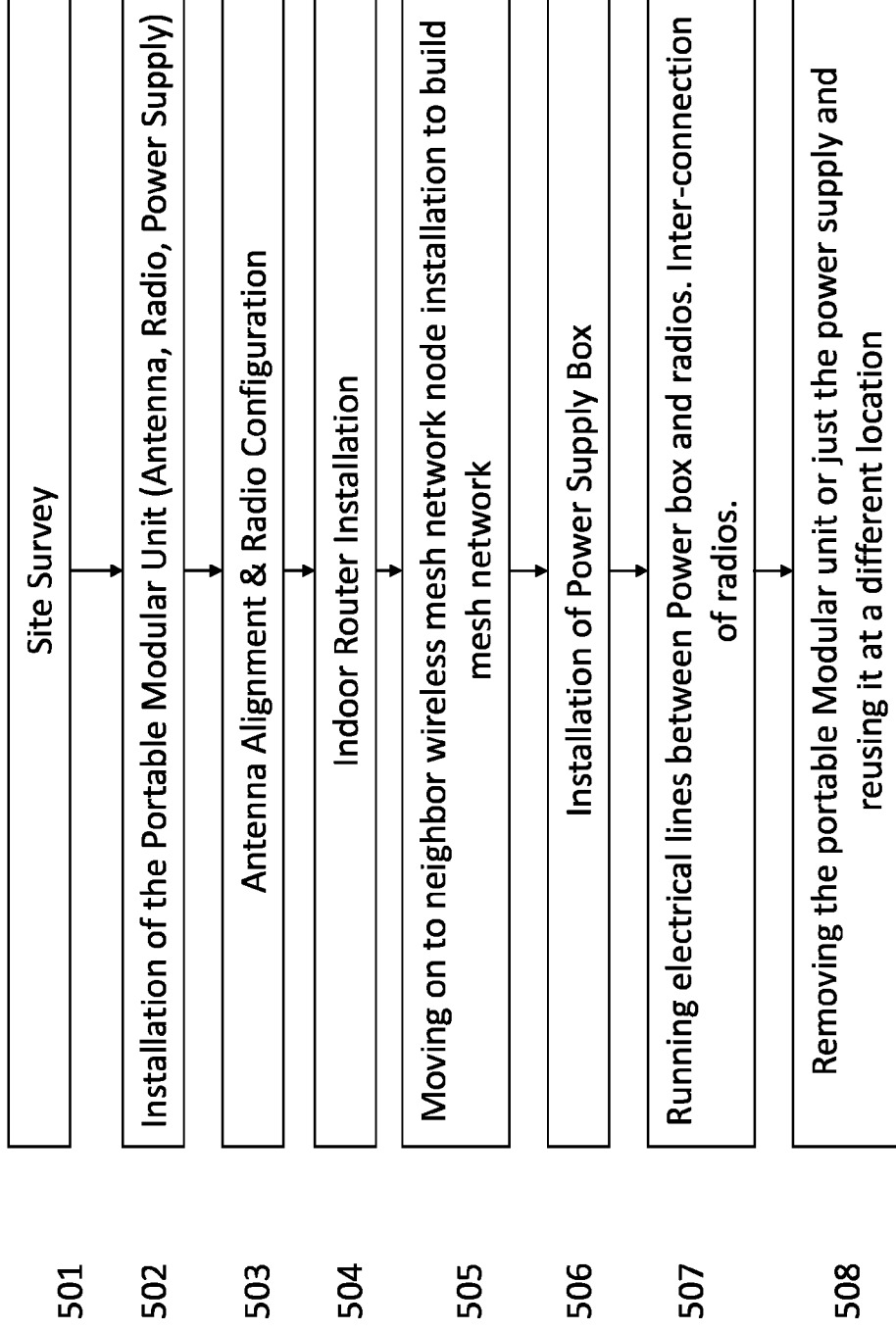


Figure 5

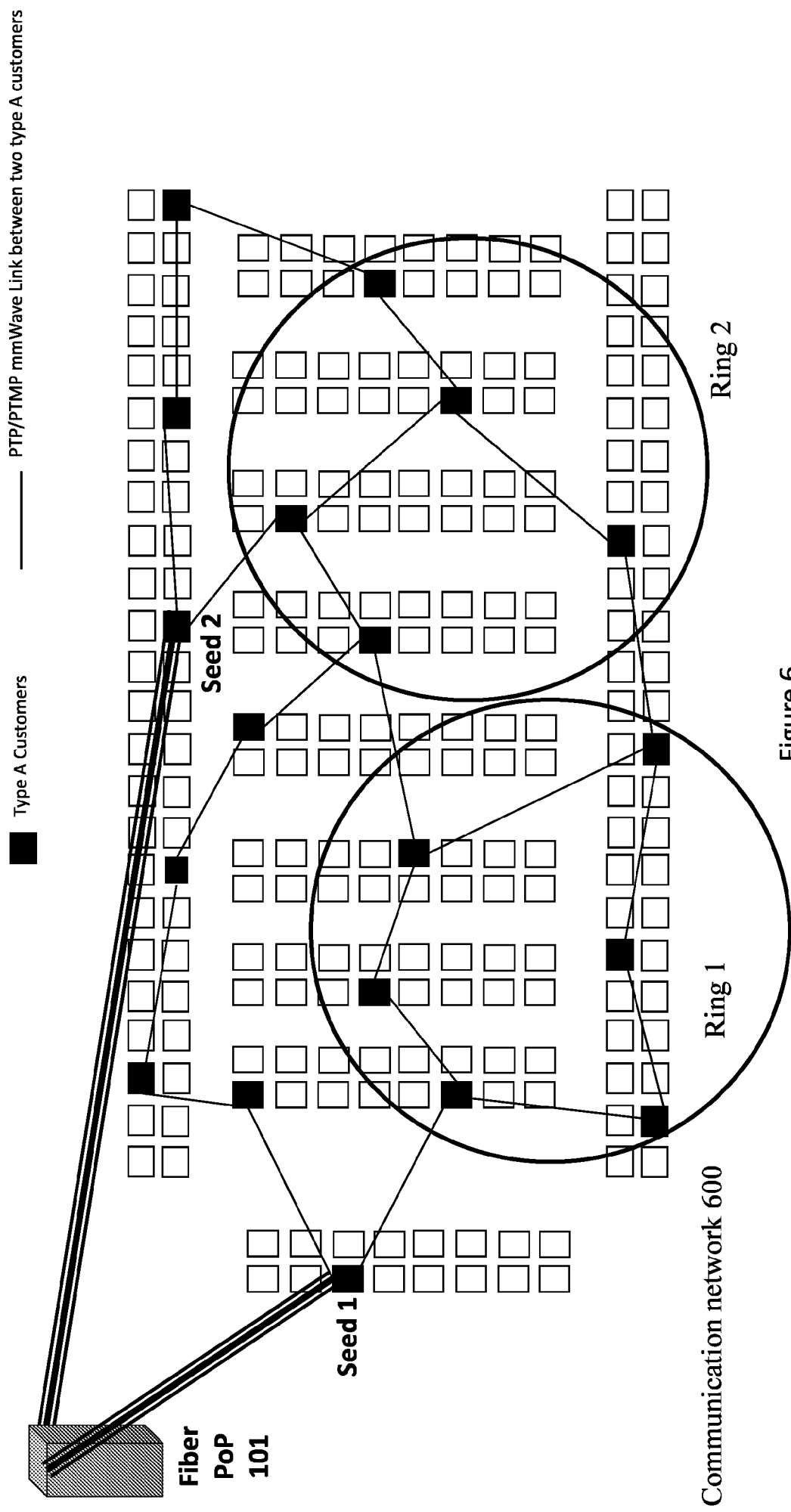


Figure 6

Provisional Application for United States Patent

TITLE: METHODS FOR PROVIDING POWER TO WIRELESS MESH

NETWORK NODES

INVENTOR(S): Kevin Ross, Lehi, UT 84043

Muhammad A. Naim, South Jordan, UT 84095

BACKGROUND

[0001] The present disclosure, for example, relates to wireless networks and communications including, but not limited to, broadband internet services to end user, security and/or automation systems, and more particularly to narrow beam mesh networking and related operations and techniques.

[0002] Wired and wireless networking and communications systems are widely deployed to provide various types of communication and functional features, including but not limited to those for security and automation, and/or others. These systems may be capable of supporting communication with a user through a communication connection or a system management action.

[0003] Current wireless mesh networks design approaches face many challenges. Due to relatively short length of a wireless link mainly due to use of millimeter wave (mmWave) spectrum, a large number of hops of point-to-point (ptp) or point-to-multipoint (ptmp) links are required to connect end customer to the core network or data center. This results in requirement of large number of wireless mesh network nodes to cover a medium to large size coverage area. Each wireless mesh network node hosting a single or multiple ptp/ptmp mm Wave communication equipment requires uninterrupted supply of power for

operations. Almost every wireless mesh network node not only carries data of its own end user (customer at the node location) but also carries data of other wireless mesh network nodes. Hence interruption in power supply to one wireless mesh network node can impact multiple wireless mesh network nodes. This requires backup power supply and cable run from radios to the power supply unit for every key node of the wireless mesh network. Using a flexible approach to power the wireless mesh network radios can result in swift rollout of the wireless mesh network for the wireless mesh network operator due to reduction in installation time and cost. Thus, there exists multiple needs in the art for improved systems and methods relating to wireless communication mesh network design.

OVERVIEW

[0004] The present system and methods relate to narrow beam mesh networks, associated systems, and operations relating to network communication, including, in some embodiments, adjustments and modifications. The present systems and methods may facilitate designing, operating and/or adjusting/modifying wireless networking communications. In some embodiments, the present systems and methods relate to and account for wireless communication nodes with capability of establishing point-to-point extremely narrow beam communication link, point-to-point steerable extremely narrow beam communication link, point-to-point multiple extremely narrow beam communication link, point-to-multipoint narrow beam communication links, ultra-wide-band point-to-point communication link and combination of point-to-point and point-to-multipoint communication links, among other things.

[0005] In one embodiment, the construction of the wireless mesh network node may involve performing the site survey of the building (mesh node) to validate the line-of-sight connectivity between the building and the neighboring building (nodes) to ensure the bi-directional communication links that form part of a wireless mesh network can be established. In a different embodiment, site survey may involve validation of a certain minimum signal threshold from neighboring building (nodes) instead of the strict line-of-sight. In addition, the construction of wireless mesh network node involves outdoor installation of wireless mesh network radios. In one embodiment, outdoor installation of the wireless mesh network radios can take place on the roof of the building/home with the help of antenna mounts. In other embodiment, installation can take place at a different outdoor location of the building/home. The construction of the wireless mesh network node also involves running the cable from wireless mesh network radio or radios to the power supply box, to provide power to the wireless mesh network radios and to also carry data between the customer router and the data center of the wireless mesh network, installing the power supply box, alignment of the wireless mesh network radios to establish line-of-sight links with the neighbor wireless mesh network node radios. Final step involved in the construction of the wireless mesh network node is the inside installation of the customer routers and activation of the service. The steps of construction of the wireless mesh network node described above in the present disclosure can occur in a variety of the different orders. Also, in a different embodiment, the steps of construction of the wireless mesh network node can include a subset of the steps described in the above disclosure. In yet another embodiment, the steps of construction of the wireless mesh network node can include additional steps not described above in the present disclosure.

[0006] In general, a wireless mesh network node is dependent on other neighboring wireless mesh network nodes to carry its end user data between the customer router and the data center of the wireless mesh network node. Essentially, majority of the wireless mesh network nodes not only carry their own end user's data, but also help transfer data belonging to the other users (nodes) of the wireless mesh network. Hence, wireless mesh network nodes cannot be completely built in isolation and their end to end provisioning and testing is dependent on the provisioning, testing and powering of wireless mesh network radios belonging to the at least immediate neighbor wireless mesh network nodes.

[0007] Among the various steps described earlier in the disclosure, the electrical work required to provide power to the wireless mesh network node radios involve a significant amount of installation time. In one embodiment, this may involve only outside the building installation without any requirement to access the inside of the building involving the dwellers of the building. In this case, it requires installation of the power supply box, running the electrical and data cables from the power supply box to the roof of the building where wireless mesh network radios are planned to be installed. In a different embodiment, this may also involve accessing the building from inside to complete the electrical job to ensure the supply of required power to wireless mesh network radios. In this case that involves accessing the building from inside, additional steps that require scheduling and coordination with the resident or owner of the buildings in also required.

[0008] The successful completion of the wireless mesh network node depends on completion of the various steps that have been discussed earlier in the current disclosure. And for a number of these steps, the prerequisite is the completion of the electrical work. For example, a wireless mesh network radio configuration can only be completed after the

electrical work as wireless mesh network radios require power to communicate with the neighbor wireless mesh network node radio to establish bi-directional links that collectively form the wireless mesh network. But, even after the wireless mesh network radio configuration, the wireless mesh network radio may still not be able to have line-of-sight with the neighbor wireless mesh network radio, or the building owner or customer may decide not to be part of wireless mesh network, etc. In any case of failure in the installation of the wireless mesh network node after the electrical work, the wireless mesh network radios and antenna masts can be removed and can be used to build a different wireless mesh network node; however the electrical work done to provide power to the wireless mesh network node involving running electrical cables and installing power supply box generally cannot be reused and results in wastage of CAPEX for the wireless mesh network operator.

[0009] In the present disclosure, in one embodiment, a portable outdoor power supply device can be used to efficiently provide power to the wireless mesh network radio installed on the roof of the building or the outdoor location. In a preferred embodiment, the portable power supply can include the solar panel. In a different embodiment, the power supply can include other types including battery backup. In another embodiment, a portable modular structure can be used that can include the antenna mounts, wireless mesh network radios, portable power supply, etc. that can be quickly placed on the wireless mesh network rooftop. This can quickly provide power to the wireless mesh network radios and installers can move to the next steps of configuring the wireless mesh network radios, activating the wireless mesh network node site and moving to neighbor wireless mesh network nodes to build the wireless mesh network without doing the electrical work. In one embodiment,

the portable power supply can provide power to radios for multiple days or weeks. In another embodiment, the power supply can perpetually provide the power to wireless mesh network radios (e.g. solar panels). Regardless of the type of power supply, this approach allows wireless mesh network operator to quickly build sites/nodes and turn on wireless mesh network customers. Once a particular section of the wireless mesh network is completed, wireless mesh network operator can go back to these newly built wireless mesh sites and replace the portable power with the a electrical line run from the power supply box that draws power from the main power line of the building. The other elements of the modular structure including the radios can in one embodiment be also removed from the portable modular structure and installed using roof mounts. In a different embodiment, portable modular structure can still be used and only the power supply is removed and can be used to provide power to the wireless mesh network radios to quickly build other wireless mesh network nodes quickly in a similar fashion.

[00010] The foregoing has outlined rather broadly the features and technical advantages of examples according to this disclosure so that the following detailed description may be better understood. Additional features and advantages will be described below. The conception and specific examples disclosed may be readily utilized as a basis for modifying or designing other structures for carrying out the same procedures of the present disclosure. Characteristics of the concepts disclosed herein including their organization and method of operation together with associated advantages will be better understood from the following description when considered in connection with the accompanying figures. Each of the figures in provided for the purpose of illustration and description only, and not as a definition of the limits of the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[00011] A further understanding of the nature and advantages the present disclosure may be realized by reference to the following drawings.

[00012] **Figure 1.** Figure 1 shows a diagram relating to wireless networking and communication systems, in accordance with various aspects of this disclosure;

[00013] **Figure 2.** Figure 2 shows designs illustrating exemplary methods relating to wireless networking and communication systems, in accordance with various aspects of this disclosure;

[00014] **Figure 3.** Figure 3 shows designs illustrating exemplary methods relating to wireless networking and communication systems, in accordance with various aspects of this disclosure;

[00015] **Figure 4.** Figure 4 shows designs illustrating exemplary methods relating to wireless networking and communication systems, in accordance with various aspects of this disclosure;

[00016] **Figure 5.** Figure 5 shows designs illustrating exemplary methods relating to wireless networking and communication systems, in accordance with various aspects of this disclosure;

[00017] **Figure 6.** Figure 6 shows designs illustrating exemplary methods relating to wireless networking and communication systems, in accordance with various aspects of this disclosure;

DETAILED DESCRIPTION

[00018] Current wireless mesh networks design approaches face many challenges. Due to relatively short length of a wireless link mainly due to use of mmWave spectrum, a large number of hops of ptp or ptmp links are required to connect end customer to the core network or data center of the wireless mesh network. This results in requirement of large number of wireless mesh network nodes to cover a medium to large size coverage area. Each wireless mesh network node hosting a single or multiple ptp/ptmp mm Wave communication equipment requires uninterrupted supply of power for operations. Almost every wireless mesh network node not only carries data of its own end user (customer at the node location) but also carries data of other wireless mesh network nodes. Hence, as a part of site installation, an electrical cable line is run from radios (mounted on the customer's roof top) to the power supply box installed at the customer location. In case of an existing cable line (e.g. due to an existing satellite dish), running a new cable line can be avoided. Thus, there exists multiple needs in the art for improved systems and methods relating to wireless communication mesh network design.

[00019] Referring to Figure 1, the communication network 100 based on ptp/ptmp wireless mesh links is shown. Communication network 100 has fiber PoP (point of presence) 101 that represents a location with the availability of fiber/dark fiber or very high capacity backbone links to the CORE network or data center. Another consideration in the selection of site 101 is the height of the building and typically multistory buildings that provide line-of-sight to a large surrounding area are selected. Figure 1 also shows that fiber PoP 101 has two high capacity narrow beam width nodes that provide capability of establishing two ptp/ptmp high capacity bi-directional links between fiber PoP 101 and

seed nodes 1 and 2. All wireless mesh network nodes are represented by solid black squares and white squares represent those homes in the neighborhood that are not selected (at least initially) to be part of wireless mesh communication network 100. Seed nodes 1 and 2 are special wireless mesh network nodes. Seed nodes 1 and 2 host at least two types of communication equipment: 1) for supporting ptp/ptmp mmWave wireless links, represented in Figure 1 with thin black line, with other regular wireless mesh network nodes called type A customer nodes and/or seed homes and 2) for supporting high capacity ptp/ptmp mmWave links, represented in Figure 1 with triple compound lines, with the fiber PoP node to provide connectivity to the CORE network. Communication network 100 of Figure 1 shows two seed homes and two high capacity ptp/ptmp mmWave connecting these two seeds homes to the fiber PoP 101. However, in general, the communication network 100 can consist of any positive integer number of seed homes and corresponding number of links for connectivity to fiber PoP 101 or multiple fiber PoPs. Figure 1 also shows seventeen type A customers and two seed home nodes in the communication network 100. However, in general, communication network 100 can have any positive integer number of wireless mesh network nodes including seed homes can type A customers.

[00020] The wireless mesh network communication equipment (antennas, RF and digital circuitry, routers, switches, etc.) deployed on the type A customer nodes and seed homes are typically powered using the same power source that provides power to the home hosting the wireless mesh network node. Moreover, there is also a back up power supply that can provide power for some time (usually 1~2 hours) in an event of power outage to the home hosting a wireless mesh network node.

[00021] Referring to Figure 2, a type A customer node 200 is shown. In one embodiment, installation of a type A customer node 200 may involve performing the site survey for checking the line-of-sight profile between type A customer node 200 and a second neighbor customer node (not shown in the Figure 2) in the direction represented by the bi-directional arrow 207, for checking the line-of sight profile between type A customer node 200 and a third neighbor customer node (not shown in the Figure 2) in the direction represented by the bi-directional arrow 206 to ensure the bi-directional communication links that form part of a wireless mesh network can be established. In a different embodiment, site survey may involve validation of a certain minimum signal threshold from neighboring building (nodes) instead of the strict line-of-sight. In addition, the construction of wireless mesh network node 200 involves outdoor installation of wireless mesh network radios 202 and 203. In one embodiment, outdoor installation of the wireless mesh network radios can take place on the roof of the building/home with the help of antenna mounts. In other embodiment, installation can take place at a different outdoor location of the building/home. Another step involved in the construction of the wireless mesh network in the installation of the power supply box 201. The construction of the wireless mesh network node 200 also involves running the cable from wireless mesh network radio or radios to the power supply box 201, to provide power to the wireless mesh network radios 202, 203 and to also carry data between the customer router and the data center of the wireless mesh network, interconnecting the radios 202 and 203 via cable 205, powering the radio 202 from power supply box 201 via the cable 204, etc. It should be noted that Figure 2 shows a simplified picture of the type A customer node. In other embodiments, type A customer node 200 can have more than 2 ptp/ptmp links, more than

two radios and a different number of cables interconnecting and powering the radios. As shown in Figure 2, powering the radio 202 involves running a cable from radio 202 installed on the customer rooftop to the power supply box installed and attached to the outside of the exterior wall or inside the exterior wall of the customer building. Depending on the distance between the power supply box, the radio installed on the rooftop and other constraints, this step may represent a noticeable part of the site installation. It should be noted that customer node 2 in Figure 2 is described as a type A anchor home. However, in other embodiments, 200 can represent a seed home or any other private infrastructure where wireless mesh network node radios are installed. Next, alignment and configuration of the wireless mesh network radios to establish line-of-sight links with the neighbor wireless mesh network node radios takes place. Final step involved in the construction of the wireless mesh network node is the inside installation of the customer routers 208 and activation of the service. The steps of construction of the wireless mesh network node described above in the present disclosure can occur in a variety of the different orders. Also, in a different embodiment, the steps of construction of the wireless mesh network node can include a subset of the steps described in the above disclosure. In yet another embodiment, the steps of construction of the wireless mesh network node can include additional steps not described above in the present disclosure.

[00022] Referring to Figure 3, one example of sequence of steps involved in the construction of the wireless mesh network node discussed earlier in the present disclosure is described. Box 301 in Figure 3 represents the steps where site survey to determine the line-of sight (or certain signal threshold) validation is performed. Box 302 represents the installation of the wireless mesh network radios using antenna mounts on the roof top or

other outside location of the wireless mesh network node. Box 303 represents installation of the power supply box at a suitable (indoor or outdoor) location of the wireless mesh network node. Box 304 of the Figure 3 represents the step where electric cable line run is performed to provide data and power connectivity between the radios and the power supply box and also the inter-connection of the wireless mesh radios. Box 305 represents the step where fine antenna alignment is performed to ensure the desired signal strength at the receiver radio and wireless mesh network radios are also configured to establish bi-directional links with the wireless mesh network radios belonging to the neighbor wireless mesh network nodes. Lastly, indoor router installation is performed represented by the box 306 which is followed by the activation of the broadband internet services at the customer location. The steps of construction of the wireless mesh network node described in the Figure 3 can occur in a variety of the different orders. Also, in a different embodiment, the steps of construction of the wireless mesh network node can include a subset of the steps described in the Figure 3. In yet another embodiment, the steps of construction of the wireless mesh network node can include additional steps not described above in Figure 3.

[00023] In general, a wireless mesh network node is dependent on other neighboring wireless mesh network nodes to carry its end user data between the customer router and the data center of the wireless mesh network node. Essentially, majority of the wireless mesh network nodes not only carry their own end user's data, but also help transfer data belonging to the other users (nodes) of the wireless mesh network. Hence, wireless mesh network nodes cannot be completely built in isolation and their end to end provisioning and testing is dependent on the provisioning, testing and powering of wireless mesh network radios belonging to the at least immediate neighbor wireless mesh network nodes.

[00024] Among the various steps described earlier in the present disclosure, the electrical work represented by box 303 and 304 of the Figure 3 required to provide power to the wireless mesh network node radios involve a significant amount of installation time. In one embodiment, this may involve only outside the building installation without any requirement to access the inside of the building involving the dwellers of the building. In this case, it requires installation of the power supply box, running the electrical and data cables from the power supply box to the roof of the building where wireless mesh network radios are planned to be installed. In a different embodiment, this may also involve accessing the building from inside to complete the electrical job to ensure the supply of required power to wireless mesh network radios. In this case that involves accessing the building from inside, additional steps that require scheduling and coordination with the resident or owner of the buildings in also required.

[00025] The successful completion of the wireless mesh network node depends on completion of the various steps that have been discussed earlier in the current disclosure and shown in Figure 3. And for a number of these steps, the prerequisite is the completion of the electrical work. For example, a wireless mesh network radio configuration, i.e. box 305 in Figure 3 can only be completed after the electrical work as wireless mesh network radios require power to communicate with the neighbor wireless mesh network node radio to establish bi-directional links that collectively form the wireless mesh network. But, even after the wireless mesh network radio configuration, the wireless mesh network radio may still not able to have line-of-sight with the neighbor wireless mesh network radio, or the building owner or customer may decide not to be part of wireless mesh network, etc. In any case of failure in the installation of the wireless mesh network node after the electrical

work, the wireless mesh network radios and antenna masts can be removed and can be used to build a different wireless mesh network node; however the electrical work done to provide power to the wireless mesh network node involving running electrical cables and installing power supply box generally cannot be reused and results in wastage of CAPEX for the wireless mesh network operator.

[00026] In another scenario, electric work on site 200 in Figure 2 may be delayed due to various reasons. In one embodiment, site 200 in Figure 2 may be doing a major renovation involving turning electricity on and off frequently impacting the steady power supply to the mesh network radios. In a different embodiment, there can be a different reason preventing the power supply to the wireless mesh network radios of the site 200 of the Figure 2. This not only impacts the site 200 of the Figure 2 but also other neighbor wireless mesh network nodes such as those represented by links 207 and 206 in Figure 2 and can impact the roll out of the wireless mesh network.

[00027] In the present disclosure, in one embodiment, a portable outdoor power supply device can be used to efficiently provide power to the wireless mesh network radio installed on the roof of the building or the outdoor location. In a preferred embodiment, the portable power supply can include the solar panel. In a different embodiment, the power supply can include other types including battery backup. In another embodiment, a portable modular structure can be used that can include the antenna mounts, wireless mesh network radios, portable power supply, etc. that can be quickly placed on the wireless mesh network node's rooftop.

[00028] Referring to Figure 4, a portable modular unit 400 is shown that can be quickly installed on the wireless mesh network node's customer rooftop. Modular unit 400

includes wireless mesh network radios 401 and 402. Only two wireless mesh network radios are shown in Figure 4 however portable modular unit 400 can carry N number of wireless mesh network radios where N is an integer greater than zero. Portable modular unit 400 also includes an antenna mount 403. In one embodiment, antenna mount can be non-penetrating and in a different embodiment, antenna mount 403 can be penetrating. Lastly a portable power supply unit 404 is shown as a part of the portable modular unit 400. In one embodiment, the power supply unit 404 can be based on solar energy but using solar panels to provide the electrical power to the wireless mesh network radios 401 and 402 via electric cables. In a different embodiment, power supply module 404 can use a different power source such as back up batteries to power the radios. Portable modular unit 400 may also include other parts that are not shown for the sake of simplicity.

[00029] This portable module 400 of the Figure 4 can quickly provide power to the wireless mesh network radios and installers can move to the next steps of configuring the wireless mesh network radios, activating the wireless mesh network node site and moving to other neighbor wireless mesh network nodes to build the wireless mesh network without doing the electrical work. In one embodiment, the portable power supply can provide power to radios for multiple days or weeks. In another embodiment, the power supply can perpetually provide the power to wireless mesh network radios (e.g. solar panels). Regardless of the type of power supply, this approach allows wireless mesh network operator to quickly build sites/nodes and turn on wireless mesh network customers. Once a particular section of the wireless mesh network is completed, wireless mesh network operator can go back to these newly built wireless mesh sites and replace the portable power with the a electrical line run from the power supply box that draws power from the

main power line of the building. The other elements of the modular structure including the radios can in one embodiment be also removed from the portable modular structure and installed using roof mounts. In a different embodiment, portable modular structure can still be used and only the power supply is removed and can be used to provide power to the wireless mesh network radios to quickly build other wireless mesh network nodes quickly in a similar fashion.

[00030] Referring to Figure 5, a process flow 500 of the new approach proposed in the present disclosure is described. Box 501 represents the steps of the site survey. Box 502 represents the installation of the portable modular unit described earlier in the disclosure and discussed in the context of Figure 4 of this current disclosure. Box 503 represent the step where antenna alignment and configuration of the radios is performed that enables the establishment of the bi-directional radio links between wireless mesh network radios that ultimately forms the wireless mesh network. This is followed by the box 504 that represents the indoor router installation and the activation of the broadband internet service at the customer homes. After this step, essentially wireless mesh network node can be integrated in the wireless mesh network and the installers and field technicians of the wireless mesh network operator can move to the other wireless mesh network nodes for installation which is represented by the box 505. After building a complete ring or a portion of the wireless mesh network, the installers or field technicians can come back to the wireless mesh network node that was build using the portable modular approach and complete the hard electrical line run, interconnection of the radios and installation of the power supply box as represented by the box 506 and 507 of the Figure 5 and begin supplying electric power to the radios using the main power supply line of the building

where wireless mesh network node is installed. Once the hard-line installation is complete, the wireless mesh network node installers can either remove the complete portable modular unit or simple remove the power supply part of the portable unit and reuse it for quickly building a new wireless mesh network node of the network as shown by the box 508. This modular portable unit can also be used or quickly restoring sites that have longer unanticipated power outages.

[00031] Referring the Figure 6, a communication network 600 is shown that is similar to the communication network 100 described in the context of the Figure 1. The method proposed in the current disclosure can be explained with the help of Figure 6. Ring 1 of the Figure 6 represent first cluster of wireless mesh network nodes and ring 2 of the Figure 6 represent a second cluster of the wireless mesh network nodes. The installation of the wireless mesh network nodes belonging to the ring 2 (especially configuration and access to the core network) is dependent on the complete installation of the wireless mesh network nodes that belong to the ring 1. If for some reason the electrical work of one or multiple wireless mesh network nodes is delayed due to some issue as discussed earlier in the present disclosure the installation of the sites belonging to the ring 2 will get impacted. Hence, with the proposed approach, all the wireless mesh network nodes of the ring 1 can be quickly built using the portable modular approach as discussed in the current disclosure and then installers can quickly move to the installation of the wireless mesh network nodes that are part of ring 2. At a later time, the installers or field technicians can revisit the wireless mesh network nodes of the ring 1 and perform a hard electrical line run thereby enabling the supply of electric power to the wireless mesh network radios from the main power supply of the building and remove the portable modular unit or the power supply

unit and reuse it for the construction of the new wireless mesh network nodes. This approach provides a lot of flexibility of scheduling various different phases of the wireless mesh network node construction without impacting the speed and efficiency of the wireless mesh network rollout.

[00032] The concepts disclosed herein have been described in an illustrative manner, and it is to be understood that the terminology which has been used is intended to be in the nature of words of description rather than of limitation. Obviously, many modifications and variations of the disclosed concepts are possible in light of the above teachings. It is, therefore, to be understood that within the scope of the claims (to be added later), the disclosed concepts may be practiced otherwise than as specifically described.

ABSTRACT

Methods, apparatuses, and systems relating to narrow beam communications and wireless networking are disclosed. Specifically, ways to power the wireless mesh network node radios using a portable power supply is described that can make the process of building wireless mesh network node more efficient.

Electronic Acknowledgement Receipt

EFS ID:	36705690
Application Number:	62879295
International Application Number:	
Confirmation Number:	9476
Title of Invention:	METHODS FOR PROVIDING POWER TO WIRELESS MESH NETWORK NODES
First Named Inventor/Applicant Name:	Kevin Ross
Customer Number:	130085
Filer:	Jaeyoung Pak
Filer Authorized By:	
Attorney Docket Number:	Welink-00031
Receipt Date:	26-JUL-2019
Filing Date:	
Time Stamp:	18:08:20
Application Type:	Provisional

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$ 140
RAM confirmation Number	072619INTEFSW18102400
Deposit Account	506632
Authorized User	Jaeyoung Pak
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37 CFR 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	Application Data Sheet	Welink-00031_ADS.pdf	1255837	no	8
			c8c94427d1bc416c47b831e62086f7de66e77256		

Warnings:

Information:

2	Provisional Cover Sheet (SB16)	Welink-00031_ProvCoverSheet.pdf	2032329	no	3
			f23b766731910918bf406abe01e953f13dbff3b2		

Warnings:

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3	Power of Attorney	Welink-00031_POA_ForFiling.pdf	840001	no	3
			74ac9bb0383a60f37407cb2f5e6bb421c7a7c869		

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4	Drawings-only black and white line drawings	Welink-00031_Figures_22nd_Patent_Final.pdf	305110	no	6
			9f1cff27c84d3f9f9ed279bbebe4a2a165018cc9c		

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Information:

5		Welink-00031_WeLink_22nd_Provisional_Specification_FINAL.pdf	165505	yes	19
			379ec62d78c3c852b87ef47832c532201073a848		

Multipart Description/PDF files in .zip description

	Document Description		Start	End
	Specification		1	18
	Abstract		19	19

Warnings:

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6	Fee Worksheet (SB06)	fee-info.pdf	29558 30243345b3e57e21b81df36557ed33d179832888	no	2
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Total Files Size (in bytes):			4628340		
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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	Welink-00031
		Application Number	
Title of Invention	METHODS FOR PROVIDING POWER TO WIRELESS MESH NETWORK NODES		
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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	Kevin		Ross			
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Address 2						
City	Lehi	State/Province	UT			
Postal Code	84043	Country	US			
Inventor	2				Remove	
Legal Name						
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Mailing Address of Inventor:						
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		Application Number	
Title of Invention	METHODS FOR PROVIDING POWER TO WIRELESS MESH NETWORK NODES		

☐ An Address is being provided for the correspondence information of this application.

Customer Number	130085		
Email Address	ls3_docketing@cardinal-ip.com	Add Email	Remove Email

Application Information:

Title of the Invention	METHODS FOR PROVIDING POWER TO WIRELESS MESH NETWORK NODES		
Attorney Docket Number	Welink-00031	Small Entity Status Claimed ☒	
Application Type	Provisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	6	Suggested Figure for Publication (if any)	

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

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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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	Welink-00031
		Application Number	
Title of Invention	METHODS FOR PROVIDING POWER TO WIRELESS MESH NETWORK NODES		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim 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.

When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status		Remove
Application Number	Continuity Type	Prior Application Number
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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. 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(i)(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).

Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove
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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.
--

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	Welink-00031
		Application Number	
Title of Invention	METHODS FOR PROVIDING POWER TO WIRELESS MESH NETWORK NODES		

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

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The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	Welink-00031
		Application Number	
Title of Invention	METHODS FOR PROVIDING POWER TO WIRELESS MESH NETWORK NODES		

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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 Remove			
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:				
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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	Welink-00031
		Application Number	
Title of Invention	METHODS FOR PROVIDING POWER TO WIRELESS MESH NETWORK NODES		

Assignee	1
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First Name	Jaeyoung	Last Name	Pak	Registration Number
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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	Welink-00031
		Application Number	
Title of Invention	METHODS FOR PROVIDING POWER TO WIRELESS MESH NETWORK NODES		

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6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Provisional Application for Patent Cover Sheet

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c)

Inventor(s)

Inventor 1

Remove

Given Name	Middle Name	Family Name	City	State	Country j
Kevin		Ross	Lehi	UT	US

Inventor 2

Remove

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Muhammad	Ahsan	Naim	South Jordan	UT	US

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

Add

Title of Invention

METHODS FOR PROVIDING POWER TO WIRELESS MESH NETWORK
NODES

Attorney Docket Number (if applicable)

Welink-00031

Correspondence Address

Direct all correspondence to (select one):

☒ The address corresponding to Customer Number

☐ Firm or Individual Name

Customer Number

130085

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

- ☒ No.
- Yes, the invention was made by an agency of the United States Government. The U.S. Government agency name is:
- Yes, the invention was under a contract with an agency of the United States Government. The name of the U.S. Government agency and Government contract number are:

Entity Status**Applicant asserts small entity status under 37 CFR 1.27 or applicant certifies micro entity status under 37 CFR 1.29**

- ☒ Applicant asserts small entity status under 37 CFR 1.27
- ☐ Applicant certifies micro entity status under 37 CFR 1.29. Applicant must attach form PTO/SB/15A or B or equivalent.
- ☐ No

Warning

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

Signature

Please see 37 CFR 1.4(d) for the form of the signature.

Signature	Jaeyoung Pak/		Date (YYYY-MM-DD)	2019-07-26	
First Name	Jaeyoung	Last Name	Pak	Registration Number (If appropriate)	72428

This collection of information is required by 37 CFR 1.51. 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 1.11 and 1.14. This collection is estimated to take 8 hours to complete, including gathering, preparing, and submitting the completed application 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. **This form can only be used when in conjunction with EFS-Web. If this form is mailed to the USPTO, it may cause delays in handling the provisional application.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that : (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

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3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
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5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
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