

Exhibit 1 - U.S. Patent No. 7,420,952 (Cisco Wireless Mesh Networks with Catalyst and Aironet Access Points)

Cisco Systems, Inc. (“Cisco”) has made, used, sold, offered for sale, and/or imported the Cisco Wireless Mesh Network including but not limited to Cisco’s Catalyst and Aironet Access Points, with related controllers and software (the “Cisco Accused Products,” *see* Exhibit 11), and infringed at least Claims 1-21 (the “Asserted Claims”) of U.S. Patent No. 7,420,952 (the “’952 Patent”).¹

Cisco has infringed (literally and/or under the doctrine of equivalents), directly and/or through subsidiaries, agents, representatives, or intermediaries, one or more claims of the ’952 Patent by making, using, testing, supplying, causing to be supplied, importing, selling, and/or offering for sale in the United States the Cisco Accused Products.

Cisco directly infringed under 35 U.S.C. § 271(a) by making, using, selling, offering for sale and importing the Cisco Accused Products. Cisco’s access points directly infringed at least claim 12 of the ’952 Patent when made, used, sold, offered for sale and imported into the United States. Cisco further directly infringed by testing, setting up, and using Cisco Wireless Mesh Networks on Cisco’s campuses and locations throughout the United States,² and/or assisting customers in setting up and servicing their Cisco Wireless Mesh Networks. On information and belief, Cisco has partnered with several customers to set up an infringing Cisco Wireless Mesh Network in the United States.

Cisco indirectly infringed under 35 U.S.C. § 271(b) by providing specific guidance and instructions to its customers and end users on how to infringe the ’952 Patent and make and use the infringing Cisco Wireless Mesh Network. Specifically, Cisco’s Wireless Mesh Access Points, Design and Deployment Guides, Technical Assistance Center, Cisco Tech Talks, technical support, Cisco Community, presentations, and technical documentation on Cisco’s website identified in the chart *infra* provide design and deployment guidelines for the deployment of, *e.g.*, secure enterprise, campus, and metropolitan Wi-Fi networks within the Cisco Wireless Mesh Network solutions. These guides and instructions specifically teach and describe each and every claim element of Claims 1-21 as demonstrated *infra*, including the necessary components to make and use the infringing Cisco Wireless Mesh Network, and the infringing configuration and operation of the controller, access points, and software that comprise the infringing Cisco Wireless Mesh Network. These guides and instructions were published and distributed by Cisco for its customers for the sole purpose to instruct and encourage its customers to purchase the Cisco components to make and use the infringing Cisco Wireless Mesh Network (and

¹ The identified Accused Products also include Cisco’s products, services, and systems that are considered sold or related to the infringement in the United States and subject to a reasonable royalty according to the Federal Circuit’s decisions in *Carnegie Mellon Univ. v. Marvell Tech. Group. Ltd.*, 807 F.3d 1283 (Fed. Cir. 2015), *Cal. Inst. of Tech. v. Broadcom Ltd.*, 25 F.4th 976 (Fed. Cir. 2022), and *Brumfield v. IBG LLC*, 97 F.4th 854 (Fed. Cir. 2024).

² *See, e.g.*, https://www.cisco.com/c/dam/en_us/about/ciscoatwork/downloads/ciscoatwork/pdf/Richardson_Topology.pdf.

directly infringe literally and/or under the doctrine of equivalents). Cisco has had knowledge of the '952 Patent since 2009 when Cisco executives met with MeshDynamics to discuss partnering opportunities and discussed the '952 Patent. MeshDynamics further put Cisco on actual notice of its infringement by its making, using, selling, offering for sale and importing the Cisco Accused Products that comprise the Cisco Wireless Mesh Networks in 2022. Cisco has knowingly and intentionally induced its customers to infringe the '952 Patent, or in the alternative, was willfully blind to the '952 Patent and the infringement, following the MeshDynamics meeting in 2009.

Cisco further indirectly infringed under 35 U.S.C. § 271(c) by supplying the components used in the infringing Cisco Wireless Mesh Network, with knowledge of its infringing use (as discussed *supra*) and without substantial non-infringing uses. Further, the Cisco Accused Products were designed specifically to be used in a manner that infringed the '952 Patent. Cisco Accused Products come enabled as mesh access points and automatically connect to the controller to establish an infringing wireless mesh network. Certain Cisco access points and proprietary software are particularly suited for Cisco's Wireless Mesh Network, and Cisco provides specific instructions and guides on how to make and use the Cisco Wireless Mesh Network using the Cisco Accused Products. As a result of Cisco's selling and/or offering for sale the Cisco Accused Products to other entities, the other entities use these products for their intended purpose and according to their instructions with the result that such entities directly infringed the '952 Patent, literally or under the doctrine of equivalents, for the reasons stated *infra*. Cisco's Accused Products are specially made and adapted for this use in an infringing manner, are not staple articles of commerce, and do not have substantial non-infringing uses.

MeshDynamics asserts that the Cisco Accused Products literally infringed the Asserted Claims of the '952 Patent. With respect to any claim limitation that may be found not to be literally infringed, MeshDynamics contends in the alternative that Cisco Accused Products infringed such claim limitations under the doctrine of equivalents and that any claim element not found to be literally met is equivalently met because any difference between the claim limitation and Cisco Accused Products is not a substantial difference. Accordingly, MeshDynamics contends that if any Cisco Accused Products is found not to have infringed any Asserted Claims literally it is nevertheless embodied by Cisco Accused Products under an operative doctrine of equivalents test (*e.g.*, function-way-result or insubstantial difference).

The below chart presents MeshDynamics's preliminary infringement analysis of Cisco Accused Products based solely on public information. MeshDynamics has not received any discovery from Cisco, including any confidential information or source code demonstrating the operation and structure of the Cisco Accused Products. All information contained in this disclosure is the result of publicly available information regarding the Cisco Accused Products. Based on these circumstances, MeshDynamics presents these infringement allegations reflecting its analysis of the facts

presently known to it. To the best of MeshDynamics’s knowledge, information, and belief, formed after an inquiry that is reasonable under the circumstances, the information contained in this disclosure is correct.

Certain information about Cisco Accused Products is not available without discovery, such as proprietary source code, documents, and deposition testimony, from Cisco. Accordingly, MeshDynamics reserves the right to supplement and/or amend this infringement contention claim chart as new information becomes available and as MeshDynamics has the opportunity to review Cisco document productions, including information related to the implementation of Cisco Accused Products, relationships with other parties who participated or contributed to the operation of Cisco Accused Products, and/or elements of Cisco Accused Products that cannot be fully examined based solely on publicly available information. Infringement investigations are ongoing, and MeshDynamics anticipates that additional facts and relevant documents will be uncovered and disclosed that create cause for supplementation and/or amendment.

#	Claim 1	Cisco’s Wireless Mesh Network with Catalyst and Aironet Access Points
1.pre	1. A method of controlling a wireless mesh network, comprising:	Cisco’s Wireless Mesh Network (a component of the Cisco Unified Wireless Network solution) comprises a plurality of Wi-Fi relay nodes (e.g., Cisco Catalyst 9100 and Aironet Access Points), which employ and provide a method of controlling a wireless mesh network. Cisco Catalyst 9100 and Aironet Access Points support Wi-Fi capabilities. The Catalyst series is a follow-up from the Cisco Aironet series access points, and the Aironet and Catalyst Access Points contain the same mesh networking capabilities, as shown below in Cisco’s documentation and guides that apply to both product lines: Q. Which Cisco access points support Wi-Fi 6? A. Cisco Catalyst 9100 enterprise-class access points support Wi-Fi 6 capabilities extending the power of intent-based networking with hardware and software innovations. The Cisco Catalyst 9100 APs offer resiliency and security while enabling intelligence at the network edge. Q. What is the portfolio transition from the Cisco Aironet Series to the Cisco Catalyst 9100 platform? A. The Cisco Catalyst 9100 Access Points consist of the Cisco Catalyst 9105, 9115, 9120, 9130, 9136, 9162, 9164, 9166 and 9166D1, and outdoor 9163E Series. These access points are the follow-ups to the Cisco Aironet 1815, 1850, 2800, and 3800 Series Access Points, respectively. The Cisco Catalyst 9100 Access Points come equipped with Wi-Fi 6/6E capabilities, a better industrial design, and improved RF performance, and deliver reliability, security, and intelligence at scale.

Source: <https://www.cisco.com/c/en/us/products/collateral/wireless/catalyst-9100ax-access-points/nb-06-802-11ax-faq-cte-en.html>

Cisco Aironet 1560 Series Outdoor Access Points

Product Type	Outdoor and Industrial Wireless
Status	End of Sale EOL Details
Series Release Date	05-JUL-2016
End-of-Sale Date	31-JAN-2023
End-of-Support Date	31-JAN-2028

This product is supported by Cisco, but is no longer being sold. Ready for an upgrade? The **Cisco Catalyst 9124AX Series Access Points** offer greater performance and functionality.

Source: <https://www.cisco.com/c/en/us/support/wireless/aironet-1560-series/series.html>

Mesh deployments are supported on the Cisco Catalyst 9100 Access Points:

Q. Will Mesh deployment be supported on the Catalyst 9124 Access Points?

A. Yes. Mesh deployments will be supported on the Catalyst 9124 Access Points. Embedded Wireless Controller deployment is also supported with the Catalyst 9124 Access Point acting as a controller for up to 100 APs.

Source: <https://www.cisco.com/c/en/us/products/collateral/wireless/catalyst-9100ax-access-points/nb-06-802-11ax-faq-cte-en.html>

In addition to the Wave 1 and Wave 2 access points, mesh deployments are supported on the Cisco Catalyst 9100 Access Points, including, *e.g.*, Catalyst 9124 Access Points, Catalyst 9130 Access Points and “AX” access points:

Families of mesh APs

The two families of mesh APs available are the Cisco Wave 1 APs and the Cisco Wave 2 APs + the AX APs. These two families of mesh APs have different capabilities and features, and they are not fully compatible with each other. The Cisco Wave 1 APs do not support the same feature set as the Cisco Wave 2 + AX APs.

Source: https://www.cisco.com/c/en/us/td/docs/wireless/controller/9800/17-15/config-guide/b_wl_17_15_cg/m_mesh_ewlc.html; *see also* https://www.cisco.com/c/en/us/td/docs/wireless/controller/9800/16-12/config-guide/b_wl_16_12_cg/mesh-access-points.html

From this release, mesh support is included in the Cisco Catalyst 9130AX Series Access Points. All traditional capabilities of mesh are included in the Cisco Catalyst 9130AX Series APs operating in Cisco IOS XE Dublin 17.12.1.

Source: https://www.cisco.com/c/en/us/td/docs/wireless/controller/ewc/17-13/config-guide/ewc_cg_17_13/mesh_access_points.html

A plurality of Cisco Catalyst 9100 and Aironet Access Points can be deployed in a Cisco Wireless Mesh Network with a controller and software, such as the Catalyst 9800 Controller and Cisco DNA and Prime Infrastructure:

Mesh Network Components

This section describes the mesh network components.

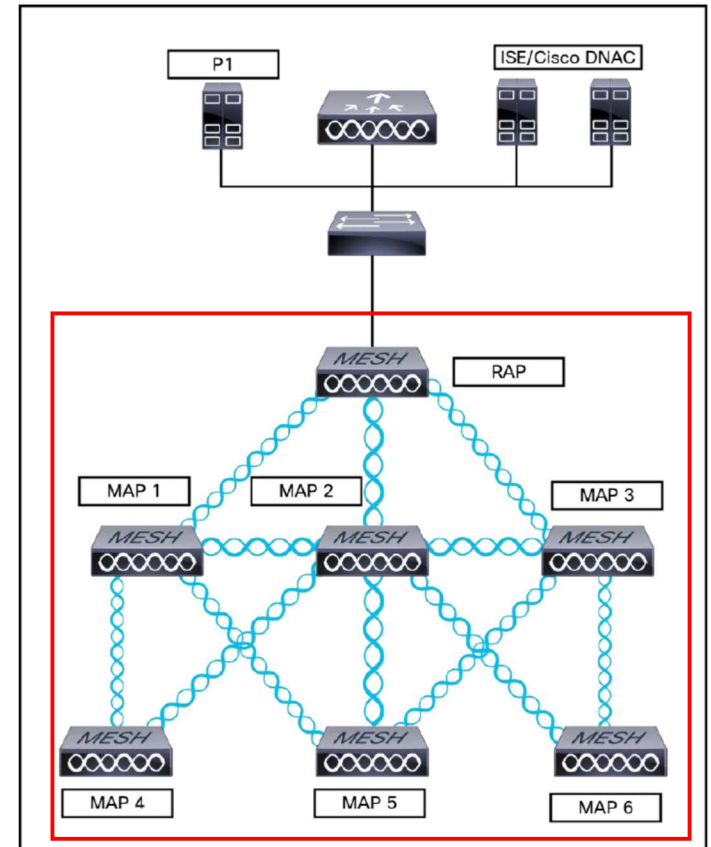
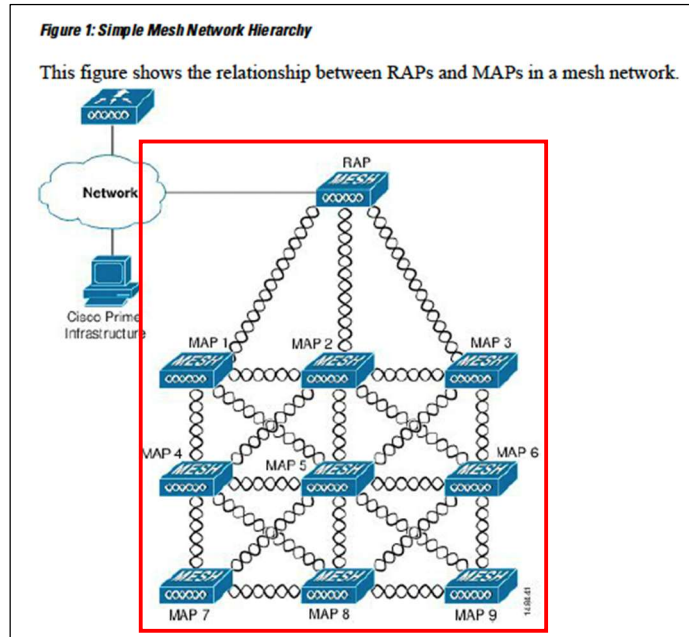
The Cisco wireless mesh network has four core components:

- Cisco C9800 and IOS-XE 17.1
- Cisco Aironet and Catalyst series access points
- Cisco PI and Cisco DNA Center
- Mesh software architecture

Mesh networking employs Cisco Aironet 1540, 1560, or 1570 Series access points and the latest Catalyst 9124AX Series outdoor mesh access points; Catalyst 9800 Series wireless controllers; and Cisco DNA Center to provide scalable, central management and mobility between indoor and outdoor deployments. The CAPWAP protocol manages the connection of mesh access points to the network.

- Cisco Aironet Wave 1 indoor APs: 1700, 2700, and 3700 series.
- Cisco Aironet Wave 2 indoor APs: 1815i, 1815m, 1830, 1850, 2800, 3800, and 4800 Series.

Source: <https://www.cisco.com/c/dam/en/us/td/docs/wireless/controller/9800/17-1/deployment-guide/c9800-mesh-rel-17-1.pdf>; <https://www.cisco.com/c/en/us/products/collateral/wireless/unified-wireless-network-sg.html#12Mesh>

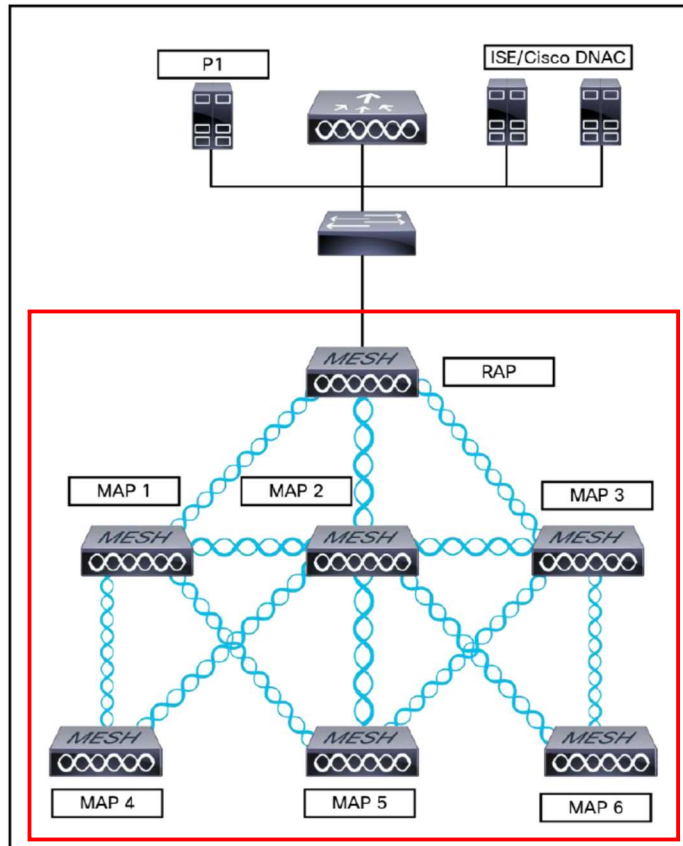


Source: https://www.cisco.com/c/en/us/td/docs/wireless/controller/technotes/8-8/b_mesh_88.pdf;
<https://www.cisco.com/c/en/us/products/collateral/wireless/unified-wireless-network-sg.html#12Mesh>

1.a a) configuring the wireless mesh network with a first configuration, the wireless mesh network comprising a plurality of relay nodes, each of the relay nodes being

Cisco's Wireless Mesh Network (as shown in the diagrams above and in Cisco's documentation) comprises a plurality of relay nodes (e.g., Cisco Catalyst 9100 or Aironet Access Points in the configuration shown above and below in red), which employ and provide a method of controlling a wireless mesh network comprising the step of configuring the wireless mesh network with a first configuration:

capable of relaying traffic from a child node associated with the relay node, each of the relay nodes including a first radio interface configurable to relay traffic to a parent relay node and a second dual purpose radio interface configurable to both relay traffic from the child relay node and to communicate with a client node that is not a relay node, and at least one of the relay nodes is configured in the first configuration to relay traffic from a child relay node to a parent relay node;



Source: <https://www.cisco.com/c/en/us/products/collateral/wireless/unified-wireless-network-sg.html#12Mesh>; see also https://www.cisco.com/c/en/us/td/docs/wireless/controller/technotes/8-8/b_mesh_88.pdf; <https://www.cisco.com/c/dam/en/us/td/docs/wireless/controller/9800/17-1/deployment-guide/c9800-mesh-rel-17-1.pdf>

Cisco Catalyst 9100 and Aironet Access Points within the Cisco Wireless Mesh Network operate as either a Root AP (RAP) or Mesh AP (MAP), and are capable of relaying traffic from a child node (e.g., MAP 5) associated with the parent relay node (e.g., MAP 2) and include a first radio interface configurable to relay traffic to the parent relay node (e.g., MAP 2 or RAP).

Cisco Catalyst 9100 and Aironet Access Points perform the step of configuring the Cisco Wireless Mesh Network in a first configuration, as the access points are configured in the “first configuration” shown

above to relay traffic from a child relay node to a parent relay node. All Cisco access points are configured and shipped as MAPs.

For Mesh mode, an AP should be configured with Bridge mode. Access points within a mesh network operate in one of the following two ways:

- Root AP (RAP)
- Mesh AP (MAP)

Note: All APs are configured and shipped as mesh APs. To use an APs as a RAP, you must reconfigure the mesh AP as a RAP. In all mesh networks, ensure that there is at least one RAP.

Network access

Wireless mesh networks can simultaneously carry two different traffic types:

- WLAN client traffic
- MAP Ethernet port traffic

WLAN client traffic terminates on the controller, and the Ethernet traffic terminates on the Ethernet ports of the mesh APs.

Source: <https://www.cisco.com/c/en/us/products/collateral/wireless/unified-wireless-network-sg.html#12Mesh>

MAPs communicate traffic among themselves and back to the RAP using wireless connections over the 802.11 a/n/ac/ax radio backhaul (“a first radio interface configurable to relay traffic”).

While the RAPs have wired connections to their controller, MAPs have wireless connections to their controller via the RAP or another MAP. MAPs communicate among themselves and back to the RAP using wireless connections over the 802.11a/n/ac/ax radio backhaul. MAPs use the Cisco Adaptive Wireless Path Protocol (AWPP) to determine the best path through the other mesh access points to the controller.

Source: <https://www.cisco.com/c/en/us/products/collateral/wireless/unified-wireless-network-sg.html#12Mesh>

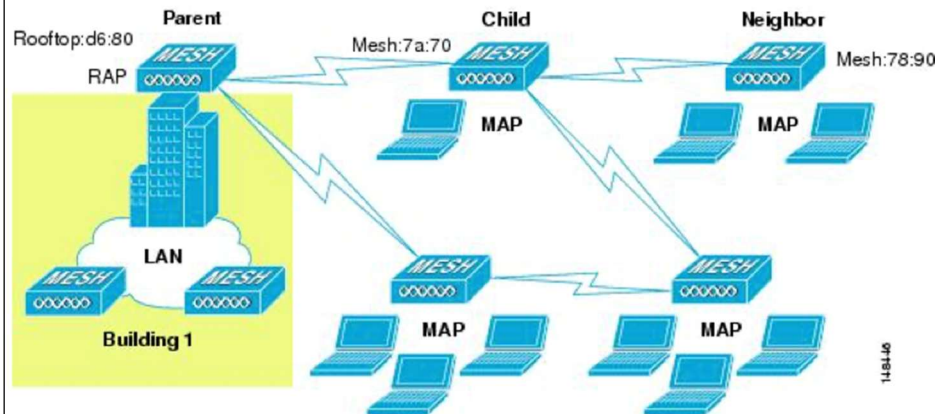
As described and shown in Cisco’s wireless mesh networking documentation, relationships among mesh access points are a parent, child or neighbor. A parent access point offers the best route back to the RAP based on ease values and signal strength, and a parent can be either the RAP or another MAP.

Relationships among mesh access points are as a parent, child, or neighbor (see Figure 6: Parent, Child, and Neighbor Access Points).

- A parent access point offers the best route back to the RAP based on its ease values. A parent can be either the RAP itself or another MAP.
 - Ease is calculated using the SNR and link hop value of each neighbor. Given multiple choices, generally an access point with a higher ease value is selected.

Source: <https://www.cisco.com/c/dam/en/us/td/docs/wireless/controller/9800/17-1/deployment-guide/c9800-mesh-rel-17-1.pdf>

Figure 6: Parent, Child, and Neighbor Access Points



Source: https://www.cisco.com/c/en/us/td/docs/wireless/controller/technotes/8-8/b_mesh_88.pdf; see also <https://www.cisco.com/c/en/us/products/collateral/wireless/unified-wireless-network-sg.html#12Mesh>

Cisco's Adaptive Wireless Path Protocol (AWPP) is designed specifically for mesh networking and enables each relay node (e.g., Cisco Catalyst 9100 or Aironet Access Point) to dynamically find the best path back to a RAP and relay traffic to a parent node.

AWPP enables a remote AP to dynamically find the best path back to a RAP for each MAP that is part of the RAP BGN. Unlike traditional routing protocols, AWPP takes RF details into account.

To optimize the route, a MAP actively solicits neighbor MAPs. During the solicitation, the MAP learns all the available neighbors back to a RAP, determines which neighbor offers the best path, and then synchronizes with that neighbor. The path decisions of AWPP are based on the link quality and the number of hops.

Source: https://www.cisco.com/c/en/us/td/docs/wireless/controller/technotes/8-8/b_mesh_88.pdf

Cisco Catalyst 9100 and Aironet Access Points also include a second dual purpose radio interface (e.g., 2.4 GHz or 5-GHz radio) configurable to both relay traffic from the child relay node (e.g., MAP 5) and to communicate with a client node (e.g., laptop) that is not a relay node:

Frequency bands

Both the 2.4-GHz and 5-GHz frequency bands are supported on the indoor and outdoor access points.

Source: <https://www.cisco.com/c/en/us/products/collateral/wireless/unified-wireless-network-sg.html#12Mesh>

Cisco's Catalyst 9100 and Aironet Access Points support multiple radios, including one or more radios for client access and one or more radios for wireless backhaul and flexible radio assignment. For instance, Cisco Catalyst 9100 and Aironet Access Points can operate in tri-radio mode (known as split 5 GHz mode) or XOR mode (the ability to operate a single radio interface in many modes), which allows one 5 GHz radio to be split into two separate 5 GHz radios. The access point carries out the radio reassignment, and this enables the access point to utilize three radios simultaneously: one 2.4 GHz radio and two 5 GHz radios. The radios can serve different user groups on different channels.

Table 3. AP models and types of hardware managed by FRA

AP model	FRA radios	Functions
Cisco Aironet 2800 Series Access Points	2.4/5 XOR	2.4-GHz and 5-GHz or dual 5-GHz operations
Cisco Aironet 3800 Series Access Points	2.4/5 XOR	2.4-GHz and 5-GHz or dual 5-GHz operations
Cisco Aironet 4800 Series Access Points	2.4/5 XOR	2.4-GHz and 5-GHz or dual 5-GHz operations
Cisco Catalyst 9120 Series Access Points	2.4/5 XOR	2.4-GHz and 5-GHz or dual 5-GHz operations
Cisco Catalyst 9130 Series Access Points	5-GHz Tri-Radio	2.4-GHz 4x4 and single 5-GHz 8x8, or 2.4-GHz 4x4 and dual 5-GHz 4x4
Cisco Catalyst Wireless 9166 Access Points	5/6-GHz XOR	2.4-GHz 4x4 and dual 5-GHz 4x4, or 5-GHz 4x4 and 6-GHz 4x4

Source: <https://www.cisco.com/c/en/us/products/collateral/wireless/unified-wireless-network-sg.html>

For example, Cisco Catalyst 9130AX Wi-Fi 6 access point is tri-radio (2.4 GHz + 5 GHz with dual-5GHz using Flexible Radio Assignment) that supports mesh. One radio can be used for client access, the others used flexibly for backhaul (uplink and downlink) at different channels and client access.

Flexible Radio Assignment (FRA) with tri-radio mode

FRA allows the access points to intelligently determine the operating mode of serving radios based on the RF environment and traffic demands. The access points can operate in the following modes:

- Dual-radio mode: One 8x8 5 GHz and one 4x4 2.4 GHz. One radio will serve clients on the 5-GHz band, while the other serves clients on the 2.4-GHz band.
- Tri-radio mode: * Dual 4x4 5 GHz and one 4x4 2.4 GHz. With two 4x4 5-GHz and one 4x4 2.4-GHz radios (tri-radio) inside the access point, client device capacity can be increased on demand.

The access point's default mode is dual radio with 8x8 5 GHz and 4x4 2.4 GHz. It has the ability to split the 8x8 radio into two separate 4x4 5-GHz radios through software, thereby enabling the benefits of FRA while allowing the 2.4-GHz radio to remain active.

Source: <https://www.cisco.com/c/en/us/products/collateral/wireless/catalyst-9100ax-access-points/nb-06-cat-9130-ser-ap-ds-cte-en.html>

Cisco Access Points with Tri-Radio

This topic describes the Tri-Radio feature for Cisco Access Points (APs).

Access Points with three radios are designed for high density environments. The APs by default run one dedicated 2.4-GHz 4x4 mode radio and one 5-GHz 8x8 mode radio. In the default mode, the radios are managed by the Flexible Radio Assignment (FRA), and the Dual Radio Mode is in the disabled state indicating that the radios have either been assigned as client serving 8x8 radio or have not yet been evaluated by FRA.

When you enable the dual radio mode setting, the 8x8 radio is split to two independent 5-GHz 4x4 radios. In this mode, slot 1 and slot 2 are active independent 4x4 radio interfaces. They can serve different user groups with different assigned channels.

Source: https://www.cisco.com/c/en/us/td/docs/wireless/controller/9800/17-2/config-guide/b_wl_17_2_cg/cisco_access_points_with_tri_radio.pdf

In addition, while 5 GHz is often used for the primary backhaul (communication between access points), both the 2.4 GHz and 5GHz radios are configurable to be used for backhaul and client access (e.g., “second dual purpose radio interface”), for example, when Universal Backhaul Access (UBA) is enabled.

The Cisco indoor mesh access points are equipped with the following two simultaneously operating radios:

- From rel 8.2 2.4 GHz radio used for data backhaul and client access if UBA is enable
- 5-GHz radio used for data backhaul and client access if Universal Backhaul Access is enabled

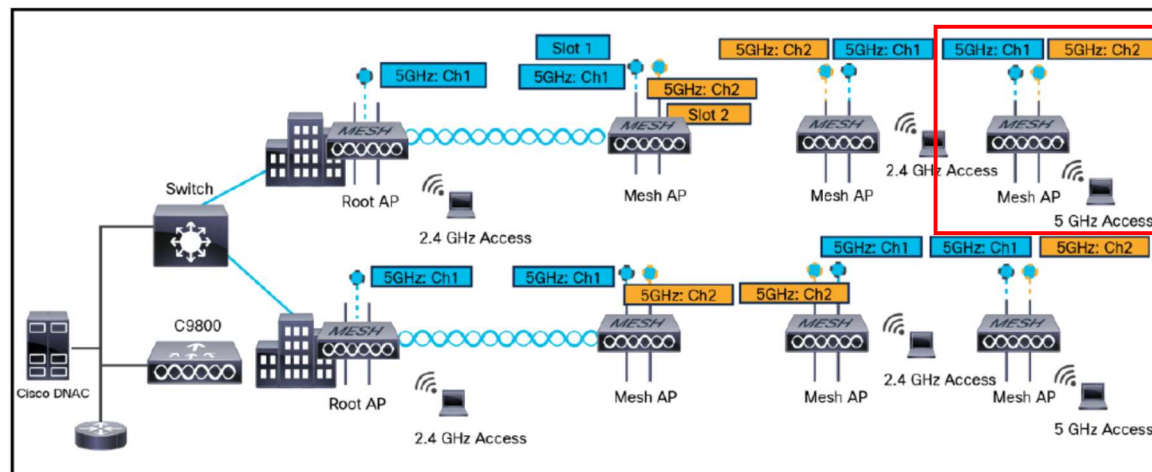
The 5-GHz radio supports the 5.15 GHz, 5.25 GHz, 5.47 GHz, and 5.8 GHz bands.

Source: https://www.cisco.com/c/en/us/td/docs/wireless/technology/mesh/8-6/b_mesh_86/m_mesh-network-components.html; <https://www.cisco.com/c/dam/en/us/td/docs/wireless/controller/technotes/8-5/cisco-enterprise-mobility-design-guide-8-5.pdf>

With Mesh Serial Backhaul, two of the radios are reserved for backhaul. The Mesh Serial Backhaul feature in a mesh access point (MAP) allows different channels for uplink (*e.g.*, “first radio interface”) and downlink access, thus improving backhaul bandwidth and extending universal access. One radio is used as the uplink radio and a different one is used as the downlink radio. Basic client access functionality is offered on the 2.4-GHz radio and the 5-GHz radio, which are not used in serial backhaul. Universal access is made available on the downlink radio (*e.g.*, “second dual purpose radio interface”).

Mesh serial backhaul

Serial backhaul enables us to use different channels on different backhauls, which helps in reducing interference and maximizing throughput. The intention is that in units with third and fourth radios, two of the radios are reserved for backhaul.



		Source: https://www.cisco.com/c/en/us/products/collateral/wireless/unified-wireless-network-sg.html#12Mesh; https://www.cisco.com/c/en/us/td/docs/wireless/controller/9800/17-7/config-guide/b_wl_17_7_cg/m_mesh_ewlc.html#mesh-backhaul-24ghz-5ghz If this claim element is not literally infringed, it is infringed under the doctrine of equivalents. Cisco’s Catalyst 9100 and Aironet Access Points perform the same function of establishing a first wireless mesh configuration of multiple relay nodes (each with dual radio interfaces for relaying traffic and serving client nodes) in the same way by using AWPP to deploy multiple nodes, each equipped with a backhaul radio and a dual-purpose radio (or tri-radio mode) and configuring at least one node (<i>e.g.</i>, an access point) to relay a child node’s traffic to a designated parent node (<i>e.g.</i>, another access point), and achieves the same result by creating a wireless mesh network in which a relay node forwards traffic from its child node to its parent node, while the child serves clients. Moreover, any differences between the functionality of the Cisco Accused Products and the claimed element are insignificant or insubstantial because Cisco’s AWPP is used to deploy multiple dual-radio (or tri-radio) mesh access points to relay traffic via backhaul links, achieving the same multi-node mesh configuration of relay nodes serving clients. A person skilled in the relevant art would consider any difference between the claimed invention and the Cisco Accused Products to be minor and insubstantial. MeshDynamics asserts that this claim element is a software limitation. Pursuant to P.R. 3-1(g) and Judge Schroeder’s standard discovery order, MeshDynamics will identify what Cisco source code satisfies this limitation 30 days after Cisco’s complete production of source code or at such other time as the parties may agree to.
1.b	b) determining that a first one of the plurality of relay nodes in the wireless mesh network requires a channel selection change;	Cisco Catalyst 9100 and Aironet Access Points in the Cisco Wireless Mesh Network employ and provide a method of controlling a wireless mesh network, comprising the step of determining that that a first one of the plurality of relay nodes in the wireless mesh network requires a channel selection change. Cisco Catalyst 9100 and Aironet Access Points (“plurality of relay nodes in the wireless mesh network”) can determine (<i>e.g.</i>, for parent optimization and upon the loss of a parent connection) that it should change channels and connect with a better potential parent across any channel to maintain its uplink with the best parent (<i>i.e.</i>, the best path back to the RAP based on signal strength and number of hops/ease criteria). This required “channel selection change” will choose the best parent.

Criteria to Choose the Best Parent

AWPP follows this process in selecting parents for a RAP or MAP with a radio backhaul:

- A list of channels with neighbors is generated by passive scanning in the scan state, which is a subset of all backhaul channels.
- The channels with neighbors are sought by actively scanning in the seek state and the backhaul channel is changed to the channel with the best neighbor.
- The parent is set to the best neighbor and the parent-child handshake is completed in the seek state.
- Parent maintenance and optimization occurs in the maintain state.

This algorithm is run at startup and whenever a parent is lost and no other potential parent exists, and is usually followed by CAPWAP network and controller discovery. All neighbor protocol frames carry the channel information.

Parent maintenance occurs by the child node sending a directed NEIGHBOR_REQUEST to the parent and the parent responding with a NEIGHBOR_RESPONSE.

Parent optimization and refresh occurs by the child node sending a NEIGHBOR_REQUEST broadcast on the same channel on which its parent resides, and by evaluating all responses from neighboring nodes on the channel.

A parent mesh access point provides the best path back to a RAP. AWPP uses ease to determine the best path. Ease can be considered the opposite of cost, and the preferred path is the path with the higher ease.

Source: <https://www.cisco.com/c/dam/en/us/td/docs/wireless/controller/9800/17-1/deployment-guide/c9800-mesh-rel-17-1.pdf>

On information and belief, when the backhaul “channel is changed to the channel with the best neighbor” (as shown in the preceding image), AWPP may work in conjunction with, or coordinate with, the “advance radio management features in the CAPWAP WLAN solution.” This may include working with Radio Resource Management (“RRM”) and/or Dynamic Channel Allocation (“DCA”). For instance, mesh path changes may be triggered by DCA-driven channel changes. AWPP may react by recalculating mesh paths, possibly selecting a new parent or RAP if the link quality changes.

AWPP takes advantage of the CAPWAP WLAN, where client traffic is tunneled to the controller and is therefore hidden from the AWPP process. Also, the advance radio management features in the CAPWAP WLAN solution are available to the wireless mesh network and do not have to be built into AWPP.

Source: <https://www.cisco.com/c/dam/en/us/td/docs/wireless/controller/9800/17-1/deployment-guide/c9800-mesh-rel-17-1.pdf>

Dynamic Channel Assignment

Two adjacent access points on the same channel can cause either signal contention or signal collision. In a collision, data is not received by the access point. This functionality can become a problem, for example, when someone reading an e-mail in a café affects the performance of the access point in a neighboring business. Even though these are separate networks, someone sending traffic to the café on channel 1 can disrupt communication in an enterprise using the same channel. Controllers can dynamically allocate access point channel assignments to avoid conflict and increase capacity and performance. Channels are *reused* to avoid wasting scarce RF resources. In other words, channel 1 is allocated to a different access point far from the café, which is more effective than not using channel 1 altogether.

The controller's Dynamic Channel Assignment (DCA) capabilities are also useful in minimizing adjacent channel interference between access points. For example, two overlapping channels in the 802.11b/g band, such as 1 and 2, cannot simultaneously use 11 or 54 Mbps. By effectively reassigning channels, the controller keeps adjacent channels that are separated.

Source: https://www.cisco.com/c/en/us/td/docs/wireless/controller/8-9/config-guide/b_cg89/radio_resource_management.html

If this claim element is not literally infringed, it is infringed under the doctrine of equivalents. Cisco's Catalyst 9100 and Aironet Access Points perform the same function of determining when a first relay node (*e.g.*, a access point) in the mesh requires a channel selection change (*i.e.*, detecting that the node's current channel must be changed) in the same way by employing a dynamic channel selection mechanism that monitors wireless conditions and identifies when the relay node's channel needs to be switched, and achieves the same result by recognizing that a channel selection change is necessary to maintain proper network performance. Moreover, any differences between the functionality of the Cisco Accused Products and the claimed element are insignificant or insubstantial because Cisco's software continuously monitors wireless conditions and identifies when an access point's current channel must be changed, accomplishing the same function of determining that a channel selection change is required. A person skilled in the relevant art would consider any difference between the claimed invention and the Cisco Accused Products to be minor and insubstantial.

MeshDynamics asserts that this claim element is a software limitation. Pursuant to P.R. 3-1(g) and Judge Schroeder's standard discovery order, MeshDynamics will identify what Cisco source code satisfies this limitation 30 days after Cisco's complete production of source code or at such other time as the parties may agree to.

1.c	c) dynamically selecting a second one of the plurality of relay nodes in the wireless mesh network to form a parent-child relationship with the first relay node; and	Cisco Catalyst 9100 and Aironet Access Points in the Cisco Wireless Mesh Network employ and provide a method of controlling a wireless mesh network, comprising the step of dynamically selecting a second one of the plurality of relay nodes in the wireless mesh network to form a parent-child relationship with the first relay node. Cisco's Adaptive Wireless Path Protocol (AWPP) is designed specifically for mesh networking and enables each relay node (<i>e.g.</i>, Cisco Catalyst 9100 and Aironet Access Points) to dynamically select the best parent to form a parent-child relationship and the best path to the controller. AWPP enables a remote AP to dynamically find the best path back to a RAP for each MAP that is part of the RAP BGN. Unlike traditional routing protocols, AWPP takes RF details into account. To optimize the route, a MAP actively solicits neighbor MAPs. During the solicitation, the MAP learns all the available neighbors back to a RAP, determines which neighbor offers the best path, and then synchronizes with that neighbor. The path decisions of AWPP are based on the link quality and the number of hops. Source: https://www.cisco.com/c/en/us/products/collateral/wireless/unified-wireless-network-sg.html#12Mesh
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Criteria to Choose the Best Parent

AWPP follows this process in selecting parents for a RAP or MAP with a radio backhaul:

- A list of channels with neighbors is generated by passive scanning in the scan state, which is a subset of all backhaul channels.
- The channels with neighbors are sought by actively scanning in the seek state and the backhaul channel is changed to the channel with the best neighbor.
- The parent is set to the best neighbor and the parent-child handshake is completed in the seek state.
- Parent maintenance and optimization occurs in the maintain state.

This algorithm is run at startup and whenever a parent is lost and no other potential parent exists, and is usually followed by CAPWAP network and controller discovery. All neighbor protocol frames carry the channel information.

Parent maintenance occurs by the child node sending a directed NEIGHBOR_REQUEST to the parent and the parent responding with a NEIGHBOR_RESPONSE.

Parent optimization and refresh occurs by the child node sending a NEIGHBOR_REQUEST broadcast on the same channel on which its parent resides, and by evaluating all responses from neighboring nodes on the channel.

A parent mesh access point provides the best path back to a RAP. AWPP uses ease to determine the best path. Ease can be considered the opposite of cost, and the preferred path is the path with the higher ease.

Source: <https://www.cisco.com/c/dam/en/us/td/docs/wireless/controller/9800/17-1/deployment-guide/c9800-mesh-rel-17-1.pdf>; *see also* <https://www.cisco.com/c/en/us/products/collateral/wireless/unified-wireless-network-sg.html#12Mesh>; https://www.cisco.com/c/en/us/td/docs/wireless/controller/technotes/8-8/b_mesh_88.pdf

With Mesh Background Scanning and Auto parent selection, a MAP can better find and dynamically connect with a potential parent across any channels and maintain its uplink with the best parent all the time. After the detection of parent loss, a MAP can directly select a best parent from the neighbor list and establish the AWPP link.

Background scanning on Wave-2 APs

The Mesh Background Scanning and Auto parent selection will improve convergence times and parent selection reliability and stability. A MAP should be able to find and connect with a better potential parent across any channels and maintain its uplink with a best parent all the time.

With background scanning disabled, whenever a Mesh AP detects a parent loss, it has to scan all the channels of the regulatory domain to find a new parent and then has to get authenticated through the selected parent to the C9800. This will take a longer time for the mesh AP to connect back to the C9800.

With background scanning enabled, after the detection of parent loss, a mesh AP can avoid scan to find a best parent across other channels. It can directly select a best parent from the neighbor list and establish the AWPP link.

A child MAP maintains its uplink with its parent using AWPP - Neighbor Discovery Request/Response (NDReq/NDResp) messages which are acting as keep-alives. If there are consecutive losses of NDResp messages, a parent is declared to be lost and the child MAP tries to find its new parent. A MAP maintains a list of neighbors of current on-channel, and on losing its current parent, it will try roaming to next best potential neighbor in the same serving channel.

But if there are no other neighbors found in same channel, it has to do scan/seek across all/subset channels to find a parent. Each off-channel list node will have a neighbor list managing all neighbors heard in that channel. Upon each off-channel NDReq broadcasts, the neighbors will be updated with latest SNR values based on their NDResp packets.

Mesh background scanning tries to avoid finding a parent across other channels by scan/seek which are time consuming, but keeps the child MAP updated with all the neighbors across all channels and will help just 'switching' to a neighbor of any channel and use him as its next parent for its uplink.

Source: <https://www.cisco.com/c/dam/en/us/td/docs/wireless/controller/9800/17-1/deployment-guide/c9800-mesh-rel-17-1.pdf>; see also <https://www.cisco.com/c/en/us/products/collateral/wireless/unified-wireless-network-sg.html#12Mesh>; https://www.cisco.com/c/en/us/td/docs/wireless/controller/technotes/8-8/b_mesh_88.pdf

Mesh background scanning

Cisco MAPs are interconnected over wireless links in a spanning tree-like topology. A MAP connected to the network via Ethernet uplink is designated as the root AP. AWPP is used to maintain and form the tree. When a MAP comes up, it tries to look for another MAP (parent) to join to reach the gateway eventually via a RAP. The same happens when a MAP lose connectivity with its existing parent. This procedure is known as mesh tree convergence. This feature aims to make the convergence procedure faster and more robust.

This procedure is time consuming. To simplify the process, we have introduced mesh background scanning and automatic parent selection. This feature is available in Cisco IOS XE starting with Release 17.11.1 in the Aironet 1562 and Catalyst 9124AX APs. This mechanism allows the MAP to find and connect faster to a better potential parent across channels and always maintain its uplink with the best parent.

Source: <https://www.cisco.com/c/en/us/products/collateral/wireless/unified-wireless-network-sg.html#12Mesh>; see also <https://www.cisco.com/c/en/us/support/docs/wireless/embedded-wireless-controller-on-catalyst-9124ax-access-points/221557-configure-point-to-point-mesh-link-with.pdf>

		If this claim element is not literally infringed, it is infringed under the doctrine of equivalents. Cisco's Catalyst 9100 and Aironet Access Points perform the same function of dynamically selecting a second relay node (e.g., an access point) to form a parent-child relationship with the first relay node (e.g., an access point) in the same way by using AWPP or background scanning to evaluate available neighboring nodes and choose the best candidate as the new parent for the first node, and achieves the same result by establishing a parent-child link between the first node and the selected second node. Moreover, any differences between the functionality of the Cisco Accused Products and the claimed element are insignificant or insubstantial because Cisco's AWPP protocol dynamically selects the optimal neighboring access point to serve as a new parent, thereby forming the same parent-child relationship between the first node and the selected second node as claimed. A person skilled in the relevant art would consider any difference between the claimed invention and the Cisco Accused Products to be minor and insubstantial. MeshDynamics asserts that this claim element is a software limitation. Pursuant to P.R. 3-1(g) and Judge Schroeder's standard discovery order, MeshDynamics will identify what Cisco source code satisfies this limitation 30 days after Cisco's complete production of source code or at such other time as the parties may agree to.
1.d	d) making a channel selection change wherein prior to being dynamically selected, the second relay node was a sibling node of the first relay node; and making a channel selection includes making a channel selection change to meet a performance requirement.	Cisco Catalyst 9100 and Aironet Access Points in the Cisco Wireless Mesh Network employ and provide a method of controlling a wireless mesh network, comprising the step of making a channel selection change wherein prior to being dynamically selected the second relay node (e.g., a MAP) was a sibling node of the first relay node (e.g., a neighboring MAP); and making a channel selection includes making a channel selection change to meet a performance requirement (e.g., reducing latency in backhaul data traffic). AWPP follows a dynamic process for selecting a parent to make any necessary channel selection change, including making a channel selection change to meet a performance requirement (i.e., by choosing a parent based on the best path based on signal strength and number of hops). The AWPP sets the parent (e.g., changes or selects the backhaul channel) to the best neighbor (e.g., "sibling") and completes the parent-child handshake. AWPP enables a remote AP to dynamically find the best path back to a RAP for each MAP that is part of the RAP BGN. Unlike traditional routing protocols, AWPP takes RF details into account. To optimize the route, a MAP actively solicits neighbor MAPs. During the solicitation, the MAP learns all the available neighbors back to a RAP, determines which neighbor offers the best path, and then synchronizes with that neighbor. The path decisions of AWPP are based on the link quality and the number of hops. Source: https://www.cisco.com/c/en/us/products/collateral/wireless/unified-wireless-network-sg.html#12Mesh

Criteria to Choose the Best Parent

AWPP follows this process in selecting parents for a RAP or MAP with a radio backhaul:

- A list of channels with neighbors is generated by passive scanning in the scan state, which is a subset of all backhaul channels.
- The channels with neighbors are sought by actively scanning in the seek state and the backhaul channel is changed to the channel with the best neighbor.
- The parent is set to the best neighbor and the parent-child handshake is completed in the seek state.
- Parent maintenance and optimization occurs in the maintain state.

This algorithm is run at startup and whenever a parent is lost and no other potential parent exists, and is usually followed by CAPWAP network and controller discovery. All neighbor protocol frames carry the channel information.

Parent maintenance occurs by the child node sending a directed NEIGHBOR_REQUEST to the parent and the parent responding with a NEIGHBOR_RESPONSE.

Parent optimization and refresh occurs by the child node sending a NEIGHBOR_REQUEST broadcast on the same channel on which its parent resides, and by evaluating all responses from neighboring nodes on the channel.

A parent mesh access point provides the best path back to a RAP. AWPP uses ease to determine the best path. Ease can be considered the opposite of cost, and the preferred path is the path with the higher ease.

Source: <https://www.cisco.com/c/dam/en/us/td/docs/wireless/controller/9800/17-1/deployment-guide/c9800-mesh-rel-17-1.pdf>; *see also* <https://www.cisco.com/c/en/us/products/collateral/wireless/unified-wireless-network-sg.html#12Mesh>; https://www.cisco.com/c/en/us/td/docs/wireless/controller/technotes/8-8/b_mesh_88.pdf

On information and belief, when the backhaul “channel is changed to the channel with the best neighbor” (as shown in the preceding image), AWPP may work in conjunction with, or coordinate with, the “advance radio management features in the CAPWAP WLAN solution.” This may include working with Radio Resource Management (“RRM”) and/or Dynamic Channel Allocation (“DCA”). For instance, mesh path changes may be triggered by DCA-driven channel changes. AWPP may react by recalculating mesh paths, possibly selecting a new parent or RAP if the link quality changes.

AWPP takes advantage of the CAPWAP WLAN, where client traffic is tunneled to the controller and is therefore hidden from the AWPP process. Also, the advance radio management features in the CAPWAP WLAN solution are available to the wireless mesh network and do not have to be built into AWPP.

Source: <https://www.cisco.com/c/dam/en/us/td/docs/wireless/controller/9800/17-1/deployment-guide/c9800-mesh-rel-17-1.pdf>

Dynamic Channel Assignment

Two adjacent access points on the same channel can cause either signal contention or signal collision. In a collision, data is not received by the access point. This functionality can become a problem, for example, when someone reading an e-mail in a café affects the performance of the access point in a neighboring business. Even though these are separate networks, someone sending traffic to the café on channel 1 can disrupt communication in an enterprise using the same channel. Controllers can dynamically allocate access point channel assignments to avoid conflict and increase capacity and performance. Channels are *reused* to avoid wasting scarce RF resources. In other words, channel 1 is allocated to a different access point far from the café, which is more effective than not using channel 1 altogether.

The controller's Dynamic Channel Assignment (DCA) capabilities are also useful in minimizing adjacent channel interference between access points. For example, two overlapping channels in the 802.11b/g band, such as 1 and 2, cannot simultaneously use 11 or 54 Mbps. By effectively reassigning channels, the controller keeps adjacent channels that are separated.

Source: https://www.cisco.com/c/en/us/td/docs/wireless/controller/8-9/config-guide/b_cg89/radio_resource_management.html

If this claim element is not literally infringed, it is infringed under the doctrine of equivalents. Cisco's Catalyst 9100 and Aironet Access Points perform the same function of making a channel selection change that promotes a neighboring node to become the new parent of the first node in order to meet a performance requirement in the same way by dynamically reassigning the first node's backhaul connection to an optimal neighboring relay node based on metrics such as signal quality, latency, throughput, etc. and achieves the same result by improving the mesh network's performance (for example, reducing latency or hop count) through the channel selection change while establishing the second node as the first node's parent. Moreover, any differences between the functionality of the Cisco Accused Products and the claimed element are insignificant or insubstantial because Cisco's AWPP protocol automatically switches a first node's backhaul connection to the "best" neighboring node (previously a sibling node) as a new parent whenever needed to meet network performance requirements (such as better signal or fewer hops), thereby making the same performance-driven channel selection change to a new parent. A person skilled in the relevant art would consider any difference between the claimed invention and the Cisco Accused Products to be minor and insubstantial.

		MeshDynamics asserts that this claim element is a software limitation. Pursuant to P.R. 3-1(g) and Judge Schroeder's standard discovery order, MeshDynamics will identify what Cisco source code satisfies this limitation 30 days after Cisco's complete production of source code or at such other time as the parties may agree to.
	Claim 2	
2	2. A method as recited in claim 1, wherein the second node is selected to be a parent node of the first node.	Cisco Catalyst 9100 and Aironet Access Points in the Cisco Wireless Mesh Network, in addition to the steps of claim 1 as shown above, employ and provide a method of controlling a wireless mesh network, wherein the second node is selected to be a parent node of the first node. Cisco Catalyst 9100 and Aironet Access Points in a mesh network implement this limitation by dynamically selecting a neighboring node to serve as a new parent for the first node. The Adaptive Wireless Path Protocol (AWPP) running on each mesh AP will set the parent to the "best" neighboring AP and establish a parent-child link, thereby selecting the second node as the parent node of the first node. AWPP enables a remote AP to dynamically find the best path back to a RAP for each MAP that is part of the RAP BGN. Unlike traditional routing protocols, AWPP takes RF details into account. To optimize the route, a MAP actively solicits neighbor MAPs. During the solicitation, the MAP learns all the available neighbors back to a RAP, determines which neighbor offers the best path, and then synchronizes with that neighbor. The path decisions of AWPP are based on the link quality and the number of hops. Source: https://www.cisco.com/c/en/us/products/collateral/wireless/unified-wireless-network-sg.html#12Mesh

Criteria to Choose the Best Parent

AWPP follows this process in selecting parents for a RAP or MAP with a radio backhaul:

- A list of channels with neighbors is generated by passive scanning in the scan state, which is a subset of all backhaul channels.
- The channels with neighbors are sought by actively scanning in the seek state and the backhaul channel is changed to the channel with the best neighbor.
- The parent is set to the best neighbor and the parent-child handshake is completed in the seek state.
- Parent maintenance and optimization occurs in the maintain state.

This algorithm is run at startup and whenever a parent is lost and no other potential parent exists, and is usually followed by CAPWAP network and controller discovery. All neighbor protocol frames carry the channel information.

Parent maintenance occurs by the child node sending a directed NEIGHBOR_REQUEST to the parent and the parent responding with a NEIGHBOR_RESPONSE.

Parent optimization and refresh occurs by the child node sending a NEIGHBOR_REQUEST broadcast on the same channel on which its parent resides, and by evaluating all responses from neighboring nodes on the channel.

A parent mesh access point provides the best path back to a RAP. AWPP uses ease to determine the best path. Ease can be considered the opposite of cost, and the preferred path is the path with the higher ease.

Source: <https://www.cisco.com/c/dam/en/us/td/docs/wireless/controller/9800/17-1/deployment-guide/c9800-mesh-rel-17-1.pdf>; *see also* <https://www.cisco.com/c/en/us/products/collateral/wireless/unified-wireless-network-sg.html#12Mesh>; https://www.cisco.com/c/en/us/td/docs/wireless/controller/technotes/8-8/b_mesh_88.pdf

If this claim element is not literally infringed, it is infringed under the doctrine of equivalents. Cisco's Catalyst 9100 and Aironet Access Points perform the same function of selecting the second node to serve as the parent node of the first node in the same way by utilizing AWPP to dynamically designate the best neighboring access point as the new parent for the first access point, and achieves the same result by establishing the second node as the first node's parent within the wireless mesh topology. Moreover, any differences between the functionality of the Cisco Accused Products and the claimed element are insignificant or insubstantial because Cisco's mesh nodes dynamically choose a neighboring access point to act as the new parent node for the first node (via AWPP's parent selection algorithm), fulfilling the same function of selecting the second node as a parent for the first node. A person skilled in the relevant art would consider any difference between the claimed invention and the Cisco Accused Products to be minor and insubstantial.

MeshDynamics asserts that this claim element is a software limitation. Pursuant to P.R. 3-1(g) and Judge Schroeder's standard discovery order, MeshDynamics will identify what Cisco source code satisfies this

		limitation 30 days after Cisco's complete production of source code or at such other time as the parties may agree to.
	Claim 3	
3	3. A method as recited in claim 1, wherein the second node is selected to be a child node of the first node.	Cisco Catalyst 9100 and Aironet Access Points in the Cisco Wireless Mesh Network, in addition to the steps of claim 1 as shown above, employ and provide a method of controlling a wireless mesh network, wherein the second node is selected to be a child node of the first node. Cisco Catalyst 9100 and Aironet Access Points in a mesh network implement this limitation by dynamically selecting the first node to serve as a new parent for the second node. The Adaptive Wireless Path Protocol (AWPP) running on each mesh AP will set the parent to the "best" neighboring AP and establish a parent-child link, thereby selecting the second node as the child node of the first node. AWPP enables a remote AP to dynamically find the best path back to a RAP for each MAP that is part of the RAP BGN. Unlike traditional routing protocols, AWPP takes RF details into account. To optimize the route, a MAP actively solicits neighbor MAPs. During the solicitation, the MAP learns all the available neighbors back to a RAP, determines which neighbor offers the best path, and then synchronizes with that neighbor. The path decisions of AWPP are based on the link quality and the number of hops. Source: https://www.cisco.com/c/en/us/products/collateral/wireless/unified-wireless-network-sg.html#12Mesh

Criteria to Choose the Best Parent

AWPP follows this process in selecting parents for a RAP or MAP with a radio backhaul:

- A list of channels with neighbors is generated by passive scanning in the scan state, which is a subset of all backhaul channels.
- The channels with neighbors are sought by actively scanning in the seek state and the backhaul channel is changed to the channel with the best neighbor.
- The parent is set to the best neighbor and the parent-child handshake is completed in the seek state.
- Parent maintenance and optimization occurs in the maintain state.

This algorithm is run at startup and whenever a parent is lost and no other potential parent exists, and is usually followed by CAPWAP network and controller discovery. All neighbor protocol frames carry the channel information.

Parent maintenance occurs by the child node sending a directed NEIGHBOR_REQUEST to the parent and the parent responding with a NEIGHBOR_RESPONSE.

Parent optimization and refresh occurs by the child node sending a NEIGHBOR_REQUEST broadcast on the same channel on which its parent resides, and by evaluating all responses from neighboring nodes on the channel.

A parent mesh access point provides the best path back to a RAP. AWPP uses ease to determine the best path. Ease can be considered the opposite of cost, and the preferred path is the path with the higher ease.

Source: <https://www.cisco.com/c/dam/en/us/td/docs/wireless/controller/9800/17-1/deployment-guide/c9800-mesh-rel-17-1.pdf>; see also <https://www.cisco.com/c/en/us/products/collateral/wireless/unified-wireless-network-sg.html#12Mesh>; https://www.cisco.com/c/en/us/td/docs/wireless/controller/technotes/8-8/b_mesh_88.pdf

If this claim element is not literally infringed, it is infringed under the doctrine of equivalents. Cisco's Catalyst 9100 and Aironet Access Points perform the same function of selecting the second node (*e.g.*, an access point) to be a child node of the first node (*e.g.*, another access point) in the same way by dynamically reconfiguring the mesh so that the first access point becomes the parent and the second access point is assigned as its child by using AWPP, and achieves the same result by establishing a new parent-child relationship in which the second node is connected as a child under the first node. Moreover, any differences between the functionality of the Cisco Accused Products and the claimed element are insignificant or insubstantial because Cisco's algorithm can equivalently reconfigure node roles such that the first access point becomes a parent and the second access point is assigned as its child (using AWPP's dynamic reconfiguration), achieving the same result of establishing a new parent-child relationship with the second node as the child under the first node. A person skilled in the relevant art would consider any difference between the claimed invention and the Cisco Accused Products to be minor and insubstantial.

		MeshDynamics asserts that this claim element is a software limitation. Pursuant to P.R. 3-1(g) and Judge Schroeder’s standard discovery order, MeshDynamics will identify what Cisco source code satisfies this limitation 30 days after Cisco’s complete production of source code or at such other time as the parties may agree to.
	Claim 4	
4	4. A method as recited in claim 1, wherein making a channel selection includes making a channel selection change to meet a latency requirement.	Cisco Catalyst 9100 and Aironet Access Points in the Cisco Wireless Mesh Network, in addition to the steps of claim 1 as shown above, employ and provide a method of controlling a wireless mesh network, wherein making a channel selection includes making a channel selection change to meet a latency requirement, including Cisco’s “ease calculation” functionality, which considers the latency related to the “hop count” or “hop value” back to the RAP. Ease Calculation Ease is calculated using the SNR and hop value of each neighbor, and applying a multiplier based on various SNR thresholds. The purpose of this multiplier is to apply a spreading function to the SNRs that reflects various link qualities. Source: https://www.cisco.com/c/en/us/td/docs/wireless/controller/technotes/8-8/b_mesh_88.pdf Parent Decision A parent mesh access point is chosen by using the adjusted ease, which is the ease of each neighbor divided by the number of hops to the RAP: adjusted ease = min (ease at each hop) Hop count Source: https://www.cisco.com/c/en/us/td/docs/wireless/controller/technotes/8-8/b_mesh_88.pdf Cisco Catalyst 9100 and Aironet Access Points perform channel selection changes to meet specific performance requirements such as latency. For example, when using AWPP, Cisco’s Catalyst 9100 and Aironet Access may switch the backhaul channel (following the “parent decision” shown above) in order to reduce latency or hop value thereby making a channel selection change to satisfy a latency requirement as recited.

Criteria to Choose the Best Parent

AWPP follows this process in selecting parents for a RAP or MAP with a radio backhaul:

- A list of channels with neighbors is generated by passive scanning in the scan state, which is a subset of all backhaul channels.
- The channels with neighbors are sought by actively scanning in the seek state and the backhaul channel is changed to the channel with the best neighbor.
- The parent is set to the best neighbor and the parent-child handshake is completed in the seek state.
- Parent maintenance and optimization occurs in the maintain state.

This algorithm is run at startup and whenever a parent is lost and no other potential parent exists, and is usually followed by CAPWAP network and controller discovery. All neighbor protocol frames carry the channel information.

Parent maintenance occurs by the child node sending a directed NEIGHBOR_REQUEST to the parent and the parent responding with a NEIGHBOR_RESPONSE.

Parent optimization and refresh occurs by the child node sending a NEIGHBOR_REQUEST broadcast on the same channel on which its parent resides, and by evaluating all responses from neighboring nodes on the channel.

A parent mesh access point provides the best path back to a RAP. AWPP uses ease to determine the best path. Ease can be considered the opposite of cost, and the preferred path is the path with the higher ease.

Source: <https://www.cisco.com/c/dam/en/us/td/docs/wireless/controller/9800/17-1/deployment-guide/c9800-mesh-rel-17-1.pdf>; *see also* <https://www.cisco.com/c/en/us/products/collateral/wireless/unified-wireless-network-sg.html#12Mesh>; https://www.cisco.com/c/en/us/td/docs/wireless/controller/technotes/8-8/b_mesh_88.pdf

If this claim element is not literally infringed, it is infringed under the doctrine of equivalents. Cisco's Catalyst 9100 and Aironet Access Points perform the same function of making a channel selection change to meet a latency requirement in the same way by automatically switching the first node's wireless backhaul to a better channel or alternate parent node whenever network latency exceeds a defined threshold and achieves the same result by reducing communication latency so that the mesh network maintains the required performance. Moreover, any differences between the functionality of the Cisco Accused Products and the claimed element are insignificant or insubstantial because the Cisco access points automatically trigger a channel selection change (or parent switch) whenever network latency rises above a defined threshold – for example, the mesh software will select and switch the first node's backhaul channel or parent to a better option if latency becomes too high – thereby meeting the same latency requirement as the claimed method. A person skilled in the relevant art would consider any difference between the claimed invention and the Cisco Accused Products to be minor and insubstantial.

		MeshDynamics asserts that this claim element is a software limitation. Pursuant to P.R. 3-1(g) and Judge Schroeder's standard discovery order, MeshDynamics will identify what Cisco source code satisfies this limitation 30 days after Cisco's complete production of source code or at such other time as the parties may agree to.
	Claim 5	
5	5. A method as recited in claim 1, wherein making a channel selection includes making a channel selection change to meet a throughput requirement.	Cisco Catalyst 9100 and Aironet Access Points in the Cisco Wireless Mesh Network, in addition to the steps of claim 1 as shown above, employ and provide a method of controlling a wireless mesh network, wherein making a channel selection includes making a channel selection change to meet a throughput requirement. Cisco Catalyst 9100 and Aironet Access Points perform channel selection changes to meet specific performance requirements such as throughput based on link hop values and/or signal strength. For example, when using AWPP the access point may switch the backhaul channel in order to meet throughput requirements associated with high link hop values and lower signal strength in backhaul data traffic, thereby making a channel selection change to satisfy a throughput requirement as recited. • A parent access point offers the best route back to the RAP based on its ease values. A parent can be either the RAP itself or another MAP. ○ Ease is calculated using the SNR and link hop value of each neighbor. Given multiple choices, generally an access point with a higher ease value is selected. Source: https://www.cisco.com/c/dam/en/us/td/docs/wireless/controller/9800/17-1/deployment-guide/c9800-mesh-rel-17-1.pdf.

Criteria to Choose the Best Parent

AWPP follows this process in selecting parents for a RAP or MAP with a radio backhaul:

- A list of channels with neighbors is generated by passive scanning in the scan state, which is a subset of all backhaul channels.
- The channels with neighbors are sought by actively scanning in the seek state and the backhaul channel is changed to the channel with the best neighbor.
- The parent is set to the best neighbor and the parent-child handshake is completed in the seek state.
- Parent maintenance and optimization occurs in the maintain state.

This algorithm is run at startup and whenever a parent is lost and no other potential parent exists, and is usually followed by CAPWAP network and controller discovery. All neighbor protocol frames carry the channel information.

Parent maintenance occurs by the child node sending a directed NEIGHBOR_REQUEST to the parent and the parent responding with a NEIGHBOR_RESPONSE.

Parent optimization and refresh occurs by the child node sending a NEIGHBOR_REQUEST broadcast on the same channel on which its parent resides, and by evaluating all responses from neighboring nodes on the channel.

A parent mesh access point provides the best path back to a RAP. AWPP uses ease to determine the best path. Ease can be considered the opposite of cost, and the preferred path is the path with the higher ease.

Source: <https://www.cisco.com/c/dam/en/us/td/docs/wireless/controller/9800/17-1/deployment-guide/c9800-mesh-rel-17-1.pdf>; see also <https://www.cisco.com/c/en/us/products/collateral/wireless/unified-wireless-network-sg.html#12Mesh>; https://www.cisco.com/c/en/us/td/docs/wireless/controller/technotes/8-8/b_mesh_88.pdf

If this claim element is not literally infringed, it is infringed under the doctrine of equivalents. Cisco's Catalyst 9100 and Aironet Access Points perform the same function of making a channel selection change to meet a throughput requirement in the same way by dynamically adjusting the channel or route based on throughput-related metrics (for example, detecting excessive link hops or low signal strength and switching to a channel that provides higher capacity), and achieves the same result by increasing the data throughput so that the mesh network satisfies the required throughput level. Moreover, any differences between the functionality of the Cisco Accused Products and the claimed element are insignificant or insubstantial because Cisco's channel selection algorithms dynamically adjust the wireless backhaul (by changing the channel and routing path) based on throughput-related metrics – for example, detecting excessive link hops or load or low signal strength and switching to a higher-capacity channel – thereby making the same kind of channel selection change to satisfy a throughput requirement. A person skilled in the relevant art would consider any difference between the claimed invention and the Cisco Accused Products to be minor and insubstantial.

		MeshDynamics asserts that this claim element is a software limitation. Pursuant to P.R. 3-1(g) and Judge Schroeder's standard discovery order, MeshDynamics will identify what Cisco source code satisfies this limitation 30 days after Cisco's complete production of source code or at such other time as the parties may agree to.
	Claim 6	
6	6. A method as recited in claim 1, wherein determining that the first node requires a channel selection change includes determining that the channel selection change is required due to a performance requirement change.	Cisco Catalyst 9100 and Aironet Access Points in the Cisco Wireless Mesh Network, in addition to the steps of claim 1 as shown above, further employ and provide a method of controlling a wireless mesh network, wherein determining that the first node requires a channel selection change includes determining that the channel selection change is required due to a performance requirement change (<i>e.g.</i>, a performance requirement change associated with an updated link hop value). As shown above for claims 4 and 5 (incorporated herein by reference), Cisco Catalyst 9100 and Aironet Access Points perform channel selection changes to meet specific performance requirements such as throughput and/or latency. For example, when using AWPP, the access points may switch the backhaul channel in order to meet performance requirements associated with high link hop values in backhaul data traffic, thereby making a channel selection change to satisfy a performance requirement change (<i>e.g.</i>, a high hop value) as recited. Criteria to Choose the Best Parent AWPP follows this process in selecting parents for a RAP or MAP with a radio backhaul: • A list of channels with neighbors is generated by passive scanning in the scan state, which is a subset of all backhaul channels. • The channels with neighbors are sought by actively scanning in the seek state and the backhaul channel is changed to the channel with the best neighbor. • The parent is set to the best neighbor and the parent-child handshake is completed in the seek state. • Parent maintenance and optimization occurs in the maintain state. This algorithm is run at startup and whenever a parent is lost and no other potential parent exists, and is usually followed by CAPWAP network and controller discovery. All neighbor protocol frames carry the channel information. Parent maintenance occurs by the child node sending a directed NEIGHBOR_REQUEST to the parent and the parent responding with a NEIGHBOR_RESPONSE. Parent optimization and refresh occurs by the child node sending a NEIGHBOR_REQUEST broadcast on the same channel on which its parent resides, and by evaluating all responses from neighboring nodes on the channel. A parent mesh access point provides the best path back to a RAP. AWPP uses ease to determine the best path. Ease can be considered the opposite of cost, and the preferred path is the path with the higher ease.

Source: <https://www.cisco.com/c/dam/en/us/td/docs/wireless/controller/9800/17-1/deployment-guide/c9800-mesh-rel-17-1.pdf>; *see also* <https://www.cisco.com/c/en/us/products/collateral/wireless/unified-wireless-network-sg.html#12Mesh>; https://www.cisco.com/c/en/us/td/docs/wireless/controller/technotes/8-8/b_mesh_88.pdf

As another example, when using AWPP, Cisco Catalyst 9100 and Aironet Access Points may switch the backhaul channel in order to reduce latency in backhaul data traffic, thereby making a channel selection change due to a performance requirement change as recited.

- A parent access point offers the best route back to the RAP based on its ease values. A parent can be either the RAP itself or another MAP.
 - Ease is calculated using the SNR and link hop value of each neighbor. Given multiple choices, generally an access point with a higher ease value is selected.

Source: <https://www.cisco.com/c/dam/en/us/td/docs/wireless/controller/9800/17-1/deployment-guide/c9800-mesh-rel-17-1.pdf>; *see also* <https://www.cisco.com/c/en/us/products/collateral/wireless/unified-wireless-network-sg.html#12Mesh>; https://www.cisco.com/c/en/us/td/docs/wireless/controller/technotes/8-8/b_mesh_88.pdf

If this claim element is not literally infringed, it is infringed under the doctrine of equivalents. Cisco's Catalyst 9100 and Aironet Access Points perform the same function of determining that a channel selection change is required due to a change in a performance requirement in the same way by monitoring network performance and identifying when an updated performance requirement indicates the current channel is inadequate, and achieves the same result by detecting that the first node must switch channels in response to the changed performance requirement. Moreover, any differences between the functionality of the Cisco Accused Products and the claimed element are insignificant or insubstantial because the Cisco Accused Products monitor network performance criteria and can tell when an updated performance requirement makes the current channel inadequate, thus detecting the need for a channel change due to the changed performance requirement in essentially the same way as the claimed invention. A person skilled in the relevant art would consider any difference between the claimed invention and the Cisco Accused Products to be minor and insubstantial.

MeshDynamics asserts that this claim element is a software limitation. Pursuant to P.R. 3-1(g) and Judge Schroeder's standard discovery order, MeshDynamics will identify what Cisco source code satisfies this limitation 30 days after Cisco's complete production of source code or at such other time as the parties may agree to.

	Claim 7	
7	7. A method as recited in claim 1, wherein determining that the first node requires a channel selection change includes determining that the channel selection change is required due to congestion.	Cisco Catalyst 9100 and Aironet Access Points in the Cisco Wireless Mesh Network, in addition to the steps of claim 1 as shown above, employ and provide a method of controlling a wireless mesh network, wherein determining that the first node requires a channel selection change includes determining that the channel selection change is required due to congestion. Cisco Catalyst 9100 and Aironet Access Points channel selection process accounts for congestion and will change channels to alleviate noise and interference problems associated with congestion when needed. Cisco Catalyst 9100 and Aironet Access Points in the Cisco Wireless Mesh Network determine that the first node requires a channel selection change by determining that the channel selection change is required due to congestion by considering “SNR” and/or “load values” based on their parent selection algorithm. This feature tries to avoid finding a parent across other channels by scan/seek which are time consuming, but keeps the child MAP updated with all the neighbors across all channels and will help just 'switching' to a neighbor of any channel and use him as its next parent for its uplink. This 'switching' parent procedure need not be a triggered event like parent loss detection, but also on identifying a better parent using 'Auto parent selection algorithm' when the child MAP still has its current parent uplink active. The " Auto Parent selection algorithm" is based on the new "ease" values. For better convergence calculation in rel 8.3 a new "Ease" value introduced for smoother and faster parent or neighbor finding and auto parent connection algorithm. The Ease value is based on SNR, number of Hops, Timers and load values. For the off-channel neighbors the AdjustedEase value will be used and a best neighbor per off-channel shall be identified based on its highest AdjustedEase value. StickyEase shall be applicable only for on-channel parent. Source: https://www.cisco.com/c/en/us/td/docs/wireless/controller/technotes/8-8/b_mesh_88.pdf AWPP's and the AP's focus on factors like link quality/signal strength, reducing the number of hops and load value helps to minimize and avoid congestion in the mesh network. For example, lower throughput is an indication of congestion. By choosing the “best” path to the wired network based on these criteria, and switching parents, AWPP's addresses the level of network congestion experienced by an available parent node. Following the parent selection algorithm shown in the previous image, Cisco Catalyst 9100 and Aironet Access Points determine that an AP requires a channel selection as shown in the image below:

Criteria to Choose the Best Parent

AWPP follows this process in selecting parents for a RAP or MAP with a radio backhaul:

- A list of channels with neighbors is generated by passive scanning in the scan state, which is a subset of all backhaul channels.
- The channels with neighbors are sought by actively scanning in the seek state and the backhaul channel is changed to the channel with the best neighbor.
- The parent is set to the best neighbor and the parent-child handshake is completed in the seek state.
- Parent maintenance and optimization occurs in the maintain state.

This algorithm is run at startup and whenever a parent is lost and no other potential parent exists, and is usually followed by CAPWAP network and controller discovery. All neighbor protocol frames carry the channel information.

Parent maintenance occurs by the child node sending a directed NEIGHBOR_REQUEST to the parent and the parent responding with a NEIGHBOR_RESPONSE.

Parent optimization and refresh occurs by the child node sending a NEIGHBOR_REQUEST broadcast on the same channel on which its parent resides, and by evaluating all responses from neighboring nodes on the channel.

A parent mesh access point provides the best path back to a RAP. AWPP uses ease to determine the best path. Ease can be considered the opposite of cost, and the preferred path is the path with the higher ease.

Source: <https://www.cisco.com/c/dam/en/us/td/docs/wireless/controller/9800/17-1/deployment-guide/c9800-mesh-rel-17-1.pdf>; see also <https://www.cisco.com/c/en/us/products/collateral/wireless/unified-wireless-network-sg.html#12Mesh>; https://www.cisco.com/c/en/us/td/docs/wireless/controller/technotes/8-8/b_mesh_88.pdf

On information and belief, when the backhaul “channel is changed to the channel with the best neighbor” (as shown in the preceding image), AWPP may work in conjunction with, or coordinate with, the “advance radio management features in the CAPWAP WLAN solution.” This may include working with Radio Resource Management (“RRM”) and/or Dynamic Channel Allocation (“DCA”). For instance, mesh path changes may be triggered by DCA-driven channel changes due to channel interference or congestion. AWPP may react by recalculating mesh paths, possibly selecting a new parent or RAP if the link quality changes.

If this claim element is not literally infringed, it is infringed under the doctrine of equivalents. Cisco’s Catalyst 9100 and Aironet Access Points perform the same function of determining that a channel selection change is required due to congestion in the same way by analyzing channel utilization (via Cisco’s parent selection algorithms that consider metrics like traffic load) to decide when the first node’s channel is overly congested and must be changed, and achieves the same result by triggering a channel switch whenever the current channel becomes too congested, thereby alleviating congestion in the mesh network. Moreover, any differences between the functionality of the Cisco Accused Products and the claimed element are insignificant or insubstantial

		because the Cisco Accused Products' parent selection algorithm takes congestion into account by measuring load values, and it automatically switches the first node's backhaul to a less-loaded channel when the current channel becomes overly congested, thereby performing the same congestion-triggered channel change as in the claim. A person skilled in the relevant art would consider any difference between the claimed invention and the Cisco Accused Products to be minor and insubstantial. MeshDynamics asserts that this claim element is a software limitation. Pursuant to P.R. 3-1(g) and Judge Schroeder's standard discovery order, MeshDynamics will identify what Cisco source code satisfies this limitation 30 days after Cisco's complete production of source code or at such other time as the parties may agree to.
	Claim 8	
8	8. A method as recited in claim 1, wherein the channel selection change is made to avoid channel interference.	Cisco Catalyst 9100 and Aironet Access Points in the Cisco Wireless Mesh Network, in addition to the steps of claim 1 as shown above, employ and provide a method of controlling a wireless mesh network, wherein the channel selection change is made to avoid channel interference. Cisco Catalyst 9100 and Aironet Access Points channel selection process accounts for channel interference and will change channels to alleviate channel interference problems when needed. Cisco Catalyst 9100 and Aironet Access Points in the Cisco Wireless Mesh Network determine that the first node requires a channel selection change by determining that the channel selection change is required due to interference by considering "SNR" and/or "load values" based on their parent selection algorithm. This feature tries to avoid finding a parent across other channels by scan/seek which are time consuming, but keeps the child MAP updated with all the neighbors across all channels and will help just 'switching' to a neighbor of any channel and use him as its next parent for its uplink. This 'switching' parent procedure need not be a triggered event like parent loss detection, but also on identifying a better parent using 'Auto parent selection algorithm' when the child MAP still has its current parent uplink active. The " Auto Parent selection algorithm" is based on the new "ease" values. For better convergence calculation in rel 8.3 a new "Ease" value introduced for smoother and faster parent or neighbor finding and auto parent connection algorithm. The Ease value is based on SNR, number of Hops, Timers and load values. For the off-channel neighbors the AdjustedEase value will be used and a best neighbor per off-channel shall be identified based on its highest AdjustedEase value. StickyEase shall be applicable only for on-channel parent. Source: https://www.cisco.com/c/en/us/td/docs/wireless/controller/technotes/8-8/b_mesh_88.pdf Following the parent selection algorithm shown in the previous image, Cisco Catalyst 9100 and Aironet Access Points determine that an AP requires a channel selection as shown in the image below:

Criteria to Choose the Best Parent

AWPP follows this process in selecting parents for a RAP or MAP with a radio backhaul:

- A list of channels with neighbors is generated by passive scanning in the scan state, which is a subset of all backhaul channels.
- The channels with neighbors are sought by actively scanning in the seek state and the backhaul channel is changed to the channel with the best neighbor.
- The parent is set to the best neighbor and the parent-child handshake is completed in the seek state.
- Parent maintenance and optimization occurs in the maintain state.

This algorithm is run at startup and whenever a parent is lost and no other potential parent exists, and is usually followed by CAPWAP network and controller discovery. All neighbor protocol frames carry the channel information.

Parent maintenance occurs by the child node sending a directed NEIGHBOR_REQUEST to the parent and the parent responding with a NEIGHBOR_RESPONSE.

Parent optimization and refresh occurs by the child node sending a NEIGHBOR_REQUEST broadcast on the same channel on which its parent resides, and by evaluating all responses from neighboring nodes on the channel.

A parent mesh access point provides the best path back to a RAP. AWPP uses ease to determine the best path. Ease can be considered the opposite of cost, and the preferred path is the path with the higher ease.

Source: <https://www.cisco.com/c/dam/en/us/td/docs/wireless/controller/9800/17-1/deployment-guide/c9800-mesh-rel-17-1.pdf>; see also <https://www.cisco.com/c/en/us/products/collateral/wireless/unified-wireless-network-sg.html#12Mesh>; https://www.cisco.com/c/en/us/td/docs/wireless/controller/technotes/8-8/b_mesh_88.pdf

On information and belief, when the backhaul “channel is changed to the channel with the best neighbor” (as shown in the preceding image), AWPP may work in conjunction with, or coordinate with, the “advance radio management features in the CAPWAP WLAN solution.” This may include working with Radio Resource Management (“RRM”) and/or Dynamic Channel Allocation (“DCA”). For instance, mesh path changes may be triggered by DCA-driven channel changes due to channel interference or congestion. AWPP may react by recalculating mesh paths, possibly selecting a new parent or RAP if the link quality changes.

If this claim element is not literally infringed, it is infringed under the doctrine of equivalents. Cisco’s Catalyst 9100 and Aironet Access Points perform the same function of making a channel selection change to avoid channel interference in the same way by continually evaluating the interference on the current channel (using Cisco’s AWPP algorithm or DCA to monitor interference) and switching the first node to a cleaner channel when interference is excessive, and achieves the same result by maintaining communications on a channel with substantially reduced interference. Moreover, any differences between the functionality of the Cisco Accused

		Products and the claimed element are insignificant or insubstantial because the Cisco Accused Products continually evaluate interference on the current channel and switches the first node to a cleaner channel whenever the existing channel suffers excessive interference, achieving the same result of avoiding channel interference as the claimed method. A person skilled in the relevant art would consider any difference between the claimed invention and the Cisco Accused Products to be minor and insubstantial. MeshDynamics asserts that this claim element is a software limitation. Pursuant to P.R. 3-1(g) and Judge Schroeder’s standard discovery order, MeshDynamics will identify what Cisco source code satisfies this limitation 30 days after Cisco’s complete production of source code or at such other time as the parties may agree to.
	Claim 9	
9	9. A method as recited in claim 1, wherein the channel selection change is made based on a change to network topology.	Cisco Catalyst 9100 and Aironet Access Points in the Cisco Wireless Mesh Network, in addition to the steps of claim 1 as shown above, employ and provide a method of controlling a wireless mesh network, wherein the channel selection change is made based on a change to network topology. Cisco Catalyst 9100 and Aironet Access Points implement this step by dynamically selecting a neighboring node to serve as a new parent for the first node. The Adaptive Wireless Path Protocol (AWPP) running on each node will set the parent to the “best” neighboring AP and establish a parent-child link, thereby selecting the second node as the parent node of the first node. AWPP enables a remote AP to dynamically find the best path back to a RAP for each MAP that is part of the RAP BGN. Unlike traditional routing protocols, AWPP takes RF details into account. To optimize the route, a MAP actively solicits neighbor MAPs. During the solicitation, the MAP learns all the available neighbors back to a RAP, determines which neighbor offers the best path, and then synchronizes with that neighbor. The path decisions of AWPP are based on the link quality and the number of hops. Source: https://www.cisco.com/c/en/us/products/collateral/wireless/unified-wireless-network-sg.html#12Mesh If a MAP’s current parent “is lost” (e.g., a topology change), the AP detects the loss and scans other channels to find and connect to a new parent on a different channel. In this way, a channel selection change is performed when the network topology changes. A new and better neighbor is another example of a topology change.

Criteria to Choose the Best Parent

AWPP follows this process in selecting parents for a RAP or MAP with a radio backhaul:

- A list of channels with neighbors is generated by passive scanning in the scan state, which is a subset of all backhaul channels.
- The channels with neighbors are sought by actively scanning in the seek state and the backhaul channel is changed to the channel with the best neighbor.
- The parent is set to the best neighbor and the parent-child handshake is completed in the seek state.
- Parent maintenance and optimization occurs in the maintain state.

This algorithm is run at startup and whenever a parent is lost and no other potential parent exists, and is usually followed by CAPWAP network and controller discovery. All neighbor protocol frames carry the channel information.

Parent maintenance occurs by the child node sending a directed NEIGHBOR_REQUEST to the parent and the parent responding with a NEIGHBOR_RESPONSE.

Parent optimization and refresh occurs by the child node sending a NEIGHBOR_REQUEST broadcast on the same channel on which its parent resides, and by evaluating all responses from neighboring nodes on the channel.

A parent mesh access point provides the best path back to a RAP. AWPP uses ease to determine the best path. Ease can be considered the opposite of cost, and the preferred path is the path with the higher ease.

Source: <https://www.cisco.com/c/dam/en/us/td/docs/wireless/controller/9800/17-1/deployment-guide/c9800-mesh-rel-17-1.pdf>; see also <https://www.cisco.com/c/en/us/products/collateral/wireless/unified-wireless-network-sg.html#12Mesh>; https://www.cisco.com/c/en/us/td/docs/wireless/controller/technotes/8-8/b_mesh_88.pdf.

If this claim element is not literally infringed, it is infringed under the doctrine of equivalents. Cisco's Catalyst 9100 and Aironet Access Points perform the same function of making a channel selection change based on a change in network topology in the same way by automatically detecting topology changes (for example, the loss of the first node's parent or the appearance of a new neighboring node) and scanning for an alternative parent on a different channel to reroute the first node's traffic, and achieves the same result by reestablishing the mesh link via a new parent-child connection after the topology change, thereby preserving network connectivity and performance. Moreover, any differences between the functionality of the Cisco Accused Products and the claimed element are insignificant or insubstantial because the Cisco Accused Products automatically detect changes in network topology (for example, if the first node's parent is lost or a new neighbor becomes available) and responds by selecting an alternate parent on a different channel to reroute the first node's traffic, thus making the same kind of channel selection change based on a topology change as described in the claim. A person skilled in the relevant art would consider any difference between the claimed invention and the Cisco Accused Products to be minor and insubstantial.

		MeshDynamics asserts that this claim element is a software limitation. Pursuant to P.R. 3-1(g) and Judge Schroeder's standard discovery order, MeshDynamics will identify what Cisco source code satisfies this limitation 30 days after Cisco's complete production of source code or at such other time as the parties may agree to.
	Claim 10	
10	10. A method as recited in claim 1, further comprising repeating b)-d).	Cisco Catalyst 9100 and Aironet Access Points in the Cisco Wireless Mesh Network, in addition to the steps of claim 1 as shown above, employ and provide a method of controlling a wireless mesh network further comprising repeating steps b)-d). Cisco Catalyst 9100 and Aironet Access Points repeatedly perform steps (b)–(d) as an ongoing adaptive process. In particular, the AWPP-based parent selection algorithm runs initially at network startup and then again whenever conditions require it (for example, when a parent is lost or during periodic optimization of the mesh). Thus, the sequence of steps (b)–(d) is continually repeated by the access points in the Cisco Wireless Mesh Network to maintain optimal routing. Criteria to Choose the Best Parent AWPP follows this process in selecting parents for a RAP or MAP with a radio backhaul: • A list of channels with neighbors is generated by passive scanning in the scan state, which is a subset of all backhaul channels. • The channels with neighbors are sought by actively scanning in the seek state and the backhaul channel is changed to the channel with the best neighbor. • The parent is set to the best neighbor and the parent-child handshake is completed in the seek state. • Parent maintenance and optimization occurs in the maintain state. This algorithm is run at startup and whenever a parent is lost and no other potential parent exists, and is usually followed by CAPWAP network and controller discovery. All neighbor protocol frames carry the channel information. Parent maintenance occurs by the child node sending a directed NEIGHBOR_REQUEST to the parent and the parent responding with a NEIGHBOR_RESPONSE. Parent optimization and refresh occurs by the child node sending a NEIGHBOR_REQUEST broadcast on the same channel on which its parent resides, and by evaluating all responses from neighboring nodes on the channel. A parent mesh access point provides the best path back to a RAP. AWPP uses ease to determine the best path. Ease can be considered the opposite of cost, and the preferred path is the path with the higher ease. Source: https://www.cisco.com/c/dam/en/us/td/docs/wireless/controller/9800/17-1/deployment-guide/c9800-mesh-rel-17-1.pdf; see also https://www.cisco.com/c/en/us/products/collateral/wireless/unified-wireless-

		network-sg.html#12Mesh; https://www.cisco.com/c/en/us/td/docs/wireless/controller/technotes/8-8/b_mesh_88.pdf If this claim element is not literally infringed, it is infringed under the doctrine of equivalents. Cisco’s Catalyst 9100 and Aironet Access Points perform the same function of repeatedly performing steps (b)–(d) of the channel changing process as needed in the same way by using AWPP to continuously run Cisco’s mesh routing algorithm (initially at network startup and again whenever conditions require, such as upon parent node failure or during periodic optimization) to re-execute the detection and channel-selection steps on an ongoing basis, and achieves the same result by continually reapplying steps (b)–(d) to adapt the mesh network and maintain optimal routing of traffic over time. Moreover, any differences between the functionality of the Cisco Accused Products and the claimed element are insignificant or insubstantial because Cisco’s AWPP protocol continuously runs the mesh routing algorithm such that it repeatedly performs the channel-change process (steps of detecting need, selecting new node, and selecting channel) whenever conditions require – for example, at startup, upon parent failures, or during periodic optimizations – which is effectively the same repetitive execution of steps (b)–(d) as needed to maintain optimal routing. A person skilled in the relevant art would consider any difference between the claimed invention and the Cisco Accused Products to be minor and insubstantial. MeshDynamics asserts that this claim element is a software limitation. Pursuant to P.R. 3-1(g) and Judge Schroeder’s standard discovery order, MeshDynamics will identify what Cisco source code satisfies this limitation 30 days after Cisco’s complete production of source code or at such other time as the parties may agree to.
	Claim 11	
11	11. A method as recited in claim 1, further comprising receiving a monitoring signal that includes information about available nodes from which the second node is selected.	Cisco Catalyst 9100 and Aironet Access Points in the Cisco Wireless Mesh Network, in addition to the steps of claim 1 as shown above, employ and provide a method of controlling a wireless mesh network, further comprising receiving a monitoring signal that includes information about available nodes from which the second node is selected. Cisco Catalyst 9100 and Aironet Access Points receive and utilize “neighbor” signals carrying information about other available nodes to facilitate the dynamic selection of a new parent node. In particular, a MAP or child sends out Neighbor Discovery requests and receives Neighbor Response messages from nearby APs, which provide information (e.g., identity and signal strength of neighboring nodes) that is used to identify and select the next parent node.

Criteria to Choose the Best Parent

AWPP follows this process in selecting parents for a RAP or MAP with a radio backhaul:

- A list of channels with neighbors is generated by passive scanning in the scan state, which is a subset of all backhaul channels.
- The channels with neighbors are sought by actively scanning in the seek state and the backhaul channel is changed to the channel with the best neighbor.
- The parent is set to the best neighbor and the parent-child handshake is completed in the seek state.
- Parent maintenance and optimization occurs in the maintain state.

This algorithm is run at startup and whenever a parent is lost and no other potential parent exists, and is usually followed by CAPWAP network and controller discovery. All neighbor protocol frames carry the channel information.

Parent maintenance occurs by the child node sending a directed NEIGHBOR_REQUEST to the parent and the parent responding with a NEIGHBOR_RESPONSE.

Parent optimization and refresh occurs by the child node sending a NEIGHBOR_REQUEST broadcast on the same channel on which its parent resides, and by evaluating all responses from neighboring nodes on the channel.

A parent mesh access point provides the best path back to a RAP. AWPP uses ease to determine the best path. Ease can be considered the opposite of cost, and the preferred path is the path with the higher ease.

Source: <https://www.cisco.com/c/dam/en/us/td/docs/wireless/controller/9800/17-1/deployment-guide/c9800-mesh-rel-17-1.pdf>; see also <https://www.cisco.com/c/en/us/products/collateral/wireless/unified-wireless-network-sg.html#12Mesh>; https://www.cisco.com/c/en/us/td/docs/wireless/controller/technotes/8-8/b_mesh_88.pdf

If this claim element is not literally infringed, it is infringed under the doctrine of equivalents. Cisco's Catalyst 9100 and Aironet Access Points perform the same function of receiving a monitoring signal that includes information about available nodes from which the second node is selected in the same way by utilizing AWPP's neighbor discovery mechanism in which mesh access points exchange signals (*e.g.*, the first node receives neighbor response messages containing identifiers, etc.) to learn which nodes are available, and achieves the same result by obtaining information about candidate neighboring nodes so that the second node can be identified and selected as the new parent node based on that information. Moreover, any differences between the functionality of the Cisco Accused Products and the claimed element are insignificant or insubstantial because the Cisco Accused Products exchange neighbor discovery signals carrying information about other available access points (such as identifiers and signal strengths of nearby nodes), so that each node receives data about which neighboring nodes are available for selection – an equivalent mechanism to the claimed monitoring signal with information about available nodes from which the second node is selected. A person skilled in the relevant

		art would consider any difference between the claimed invention and the Cisco Accused Products to be minor and insubstantial. MeshDynamics asserts that this claim element is a software limitation. Pursuant to P.R. 3-1(g) and Judge Schroeder's standard discovery order, MeshDynamics will identify what Cisco source code satisfies this limitation 30 days after Cisco's complete production of source code or at such other time as the parties may agree to.
	Claim 12	
12.pr e	12. A computer program product for controlling a wireless mesh network, the computer program product being embodied in a computer readable medium and comprising computer instructions for:	<i>See</i> 1.Pre-1.d above, the contents of which are incorporated herein by reference. Cisco Catalyst 9100 and Aironet Access Points comprise a computer program product (Cisco's proprietary AWPP algorithms and related software, <i>e.g.</i>, IOS XE and/or a universal IOS XE image or other firmware) for controlling a wireless mesh network, the computer program product being embodied in a computer readable medium (<i>e.g.</i>, the storage device or memory on the Catalyst 9100 and Aironet Access Points) with all of the claimed computer instructions, as shown in claim 1 <i>supra</i>. MeshDynamics asserts that this claim element is a software limitation. Pursuant to P.R. 3-1(g) and Judge Schroeder's standard discovery order, MeshDynamics will identify what Cisco source code satisfies this limitation 30 days after Cisco's complete production of source code or at such other time as the parties may agree to.
12.a	a) configuring the wireless mesh network with a first configuration, the wireless mesh network comprising a plurality of relay nodes, each of the relay nodes being capable of relaying traffic from a child node associated with the relay node, each of the relay nodes including a first radio interface configurable to relay	<i>See</i> 1.a above, the contents of which are incorporated herein by reference.

	traffic to a parent relay node and a second dual purpose radio interface configurable to both relay traffic from the child relay node and to communicate with a client node that is not a relay node, and at least one of the relay nodes is configured in the first configuration to relay traffic from a child relay node to a parent relay node;	
12.b	b) determining that a first one of the plurality of relay nodes in the wireless mesh network requires a channel selection change;	<i>See 1.b above, the contents of which are incorporated herein by reference.</i>
12.c	c) dynamically selecting a second one of the plurality of relay nodes in the wireless mesh network to form a parent-child relationship with the first relay node; and	<i>See 1.c above, the contents of which are incorporated herein by reference.</i>
12.d	d) making a channel selection change; wherein prior to being dynamically selected, the second relay node	<i>See 1.d above, the contents of which are incorporated herein by reference.</i>

	was a sibling node of the first relay node; and making a channel selection includes making a channel selection change to meet a performance requirement.	
Claim 13		
13	13. A computer program product as recited in claim 12, wherein the second node is selected to be a parent node of the first node.	<i>See claims 2 and 12 above, the contents of which are incorporated herein by reference.</i>
Claim 14		
14	14. A computer program product as recited in claim 12, wherein the second node is selected to be a child node of the first node.	<i>See claims 3 and 12 above, the contents of which are incorporated herein by reference.</i>
Claim 15		
15	15. A computer program product as recited in claim 12, wherein making a channel selection includes making a channel selection change to meet a latency requirement.	<i>See claims 4 and 12 above, the contents of which are incorporated herein by reference.</i>

Claim 16		
16	16. A computer program product as recited in claim 12, wherein making a channel selection includes making a channel selection change to meet a throughput requirement.	<i>See claims 5 and 12 above, the contents of which are incorporated herein by reference.</i>
Claim 17		
17	17. A computer program product as recited in claim 12, wherein determining that the first node requires a channel selection change includes determining that the channel selection change is required due to a performance requirement change.	<i>See claims 6 and 12 above, the contents of which are incorporated herein by reference.</i>
Claim 18		
18	18. A computer program product as recited in claim 12, wherein determining that the first node requires a channel selection change includes determining that the channel selection change is required due to congestion.	<i>See claims 7 and 12 above, the contents of which are incorporated herein by reference.</i>

Claim 19		
19	19. A computer program product as recited in claim 12, wherein the channel selection change is made based on network topology.	<i>See claims 9 and 12 above, the contents of which are incorporated herein by reference.</i>
Claim 20		
20	20. A computer program product as recited in claim 12, the computer program product further comprising computer instructions for repeating b)-d).	<i>See claims 10 and 12 above, the contents of which are incorporated herein by reference.</i>
Claim 21		
21	21. A computer program product as recited in claim 12, the computer program product further comprising computer instructions for receiving a monitoring signal that includes information about available nodes from which the second node is selected.	<i>See claims 11 and 12 above, the contents of which are incorporated herein by reference.</i>