Wireless Mesh Hardware Comparison: Cisco, Motorola, Proxim, Strix Systems

Ronen Isaac of Continental Computers/wlanmall.com
310-416-1200, ronen@wlanmall.com

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Brief Summary of Wireless Mesh System Architectures from Cisco, Motorola, Proxim and Strix System

Cisco : Aironet 1500 Series

This is Cisco's first attempt at a wireless MESH based on their acquisition of Airespace's LWAPP product line. There are three key components of the Aironet Mesh system.

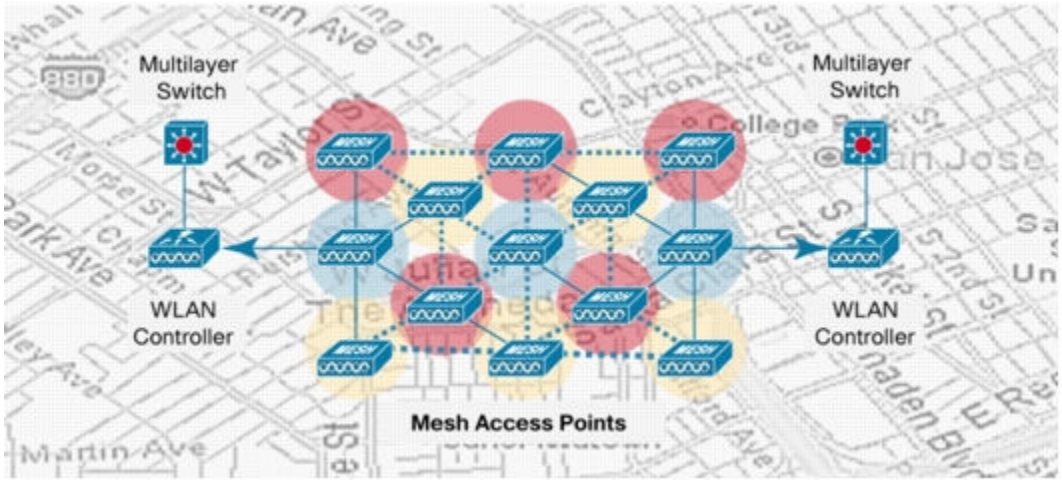
1) **Wireless LAN Controller:** This controller manages all aspects of the Cisco wireless mesh network including AP authentication, security policies and radio configurations.

2) **RAP (Rooftop AP):** This is the gateway between the wireless mesh and wired network.

3) **MAP (Mesh AP):** These APs have no physical connection to the wired Ethernet network but use the RAP as a gateway and automatically associate to the controller.

Known issues with the CISCO 1500s:

- No power LEDs
- POE and Ethernet comes over proprietary CAT5e cable with Milspec connector
- No RSSI or antenna alignment tools
- No client bridge that will pass VLANs
- Long lead times and very limited technical support



Motorola : Hot Zone Duo

The Hot Zone Duo was built from the ground up using technology acquired from Motorola's purchase of Mesh Networks. The Hot Zone Duo is the smallest form factor mesh AP currently on the market and has won the 2007 Wireless Broadband Innovation award for "Best Wireless Broadband Mobility Solution". This solution was just release in Q4 of 2006 and is currently being deployed in several pilot networks around the world. The Motorola Mesh is also made of three key components.

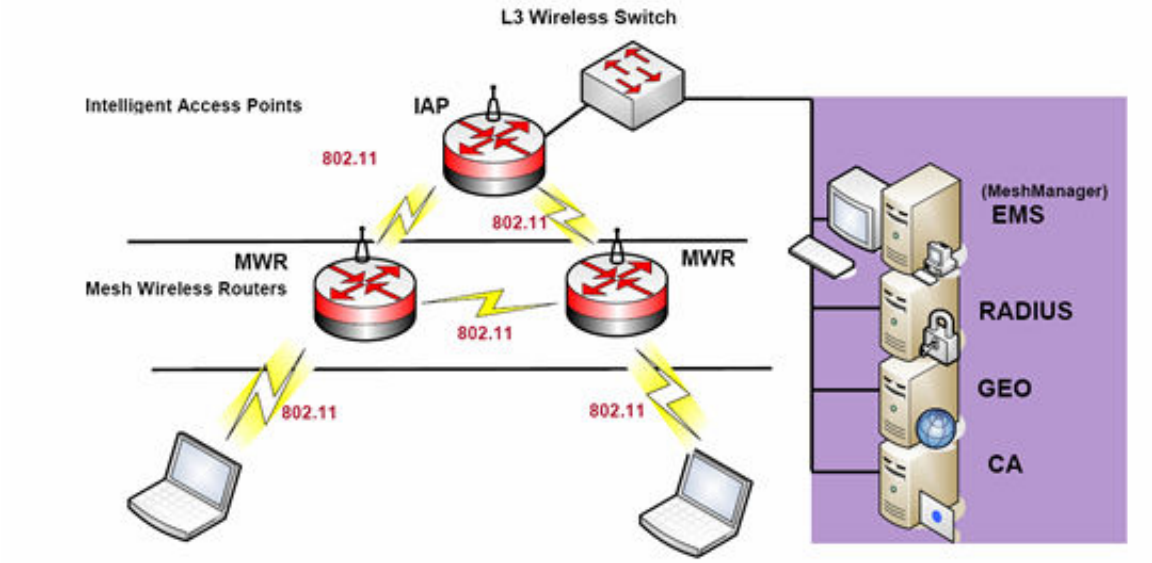
1) **IAP (Intelligent Access Point):** Like the Cisco RAP The Intelligent Access Point (IAP) acts as the transition point from the wireless network to the wired core network and from there, through media gateways, out to the Internet.

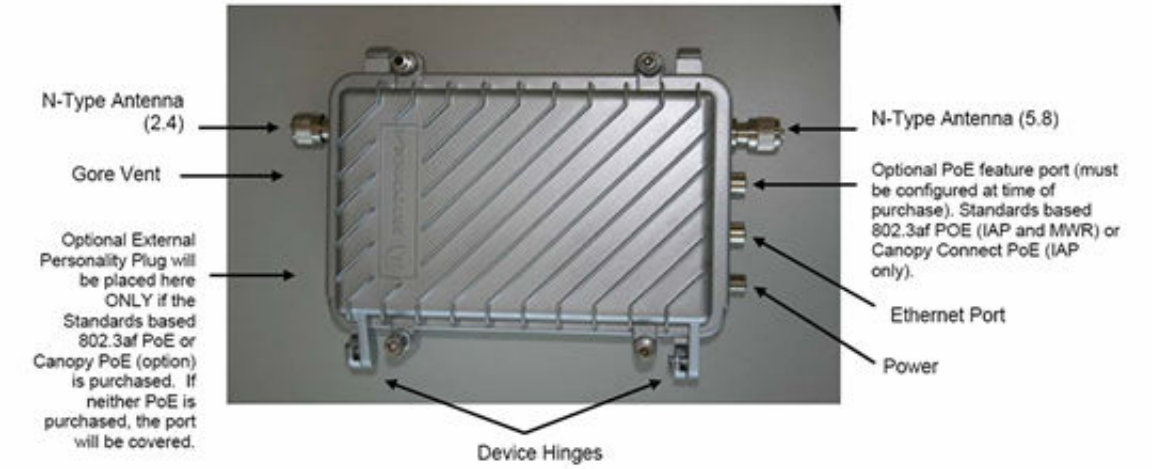
2) **MWR (Mobile Wireless Router):** The Mesh Wireless Router (MWR) is a wireless device that is primarily deployed to seed and extend the range between IAPs and Wireless Clients while simultaneously increasing the spectral efficiency of the network. The MWR includes an optional Ethernet connector. This allows a network of IP-enabled devices (such as a camera) to be directly addressed, accessed and managed over the HOTZONE DUO network.

3) **MiSC (Mobile Internet Switching Controller):** This is a Linux RedHat server that is running Motorola's Mesh Manger software. The MeshManager element management system (EMS) provides a complete solution for configuration, fault, performance and security management for all Motorola mesh networks. Consisting of a Java™based graphical user interface (GUI) and a series of software servers, the MeshManager suite gives you streamlined, point-and-click access to the tools needed for complete network configuration and Control.

Features:

- High Power Radio 26 dbm
- Ultra bright red power LED
- Support for 16 SSIDs and VLAN trunking
- Supports advanced QoS 802.11e + 802.1p for Voice and Video
- VLAN to SSID tagging
- Best in class security (WPA2 + AES) for the client and backhaul





Proxim: AP-4000M Wi-Fi Mesh

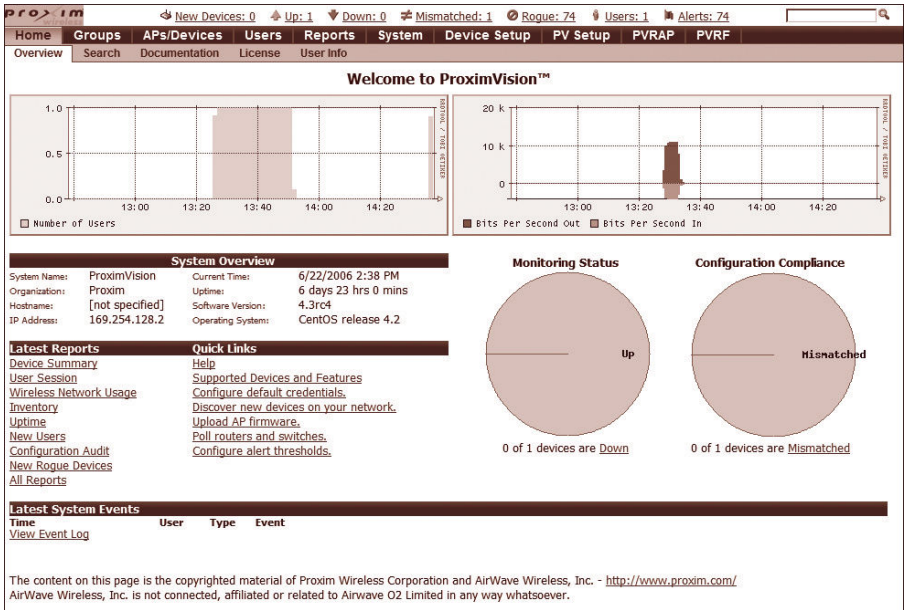
The Proxim AP-4000M outdoor MESH access point was derived from the massively deployed Proxim AP-4000 indoor WLAN AP. With an already popular dual radio AP already in deployment Proxim decided to release a software upgrade that turned each APs in to a wireless mesh node. Proxim uses their proprietary Orinoco Mesh Creation Protocol (OMCP) to route packets from node to node across the wireless network. Leveraging their market leading WLAN deployment Proxim has one of the largest MESH deployment bases in the industry. The Proxim MESH architecture is very simple and is composed of the AP and an optional management system.

1) **AP-4000M MESH Access Point:** This is the ONLY type of node needed in the Proxim MESH architecture. This is achieved by having a "smart" Ethernet port. By that I mean that the AP knows if a device is attached to the RJ45 port and enables the device as a network access node.

2) **ProximVision (optional):** Proxim is a open management system based on SNMP and is used to plan, install, manage and secure wireless network. Proxim vision comes in an appliance form and can not only manage the Proxim APs but any device on the network that is SNMP enabled.

Features:

- Enhanced QoS: 802.11e + 802.1p for Voice and Video
- 4 SSIDs, 16 VLANs
- On Board RSSI readings
- Power and activity lights
- Standard POE – NO Proprietary Ethernet or power connector
- Rouge AP detection
- Has an indoor mesh AP for extending the network indoors



Indoor Proxim MESH AP

Strix Systems : Multi-Radio Outdoor Wireless Mesh
Strix systems can be considered a start up company but it has one of the most innovative and highest performing mesh radios on the market today. This claim is not only mentioned in their marketing material but also but several independent mesh tests (see the IOMetrix score card below). Strix achieves its incredible backhaul performance by using one 802.11a radio for ingress traffic and one for egress. This is opposed to the norm used by Motorola, Proxim, Cisco, Tropos, Firetide, etc who only use one radio for both ingress and egress traffic. To prove this IOMetrix did a comprehensive real world test putting Strix and Firetide head to head. Strix in this case was using two 802.11a radios for backhaul per node and Firetide was only using one. The tests show that at 4 hops the Firetide network had a throughput of about 8 Mbps while Strix was still standing strong at 35Mbps at 4 hops. On converged voice, video, data network the stable throughput of the Strix is a must.

The Strix Systems MESH system is made up of 2 basic components the OWS AP and the Network Server.

1) **OWS 2400 Mesh Node:** This Mesh node is made up of one, two or three radio boards and each radio board is made up of one 802.11a and one 802.11b/g radio. So a fully loaded Strix OWS 2400 node has 3 x 802.11a for backhaul and 3 x 802.11b/g radios for dense access.

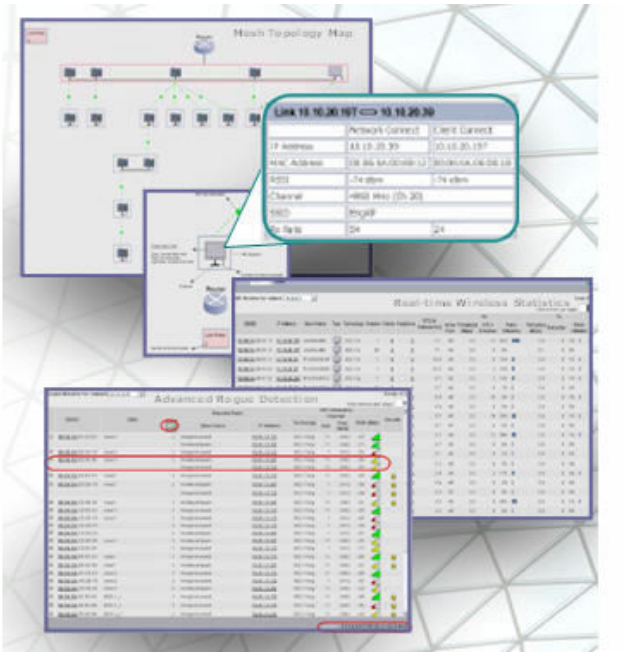
2) **OWS Network Server:** The Strix network server is the brains of the operation and sits inside one or more nodes of the network. It manages the central security policies, establishes the best path for data to move through the network, assigns traffic prioritization and more…

Features:
- Up to 3 x 802.11a and 3 x 802.11b/g radios
- Strix traffic prioritization for QoS – Voice and video
- Fast roaming for seamless VoWiFi and mobile applications
- High power 26 dbm radios

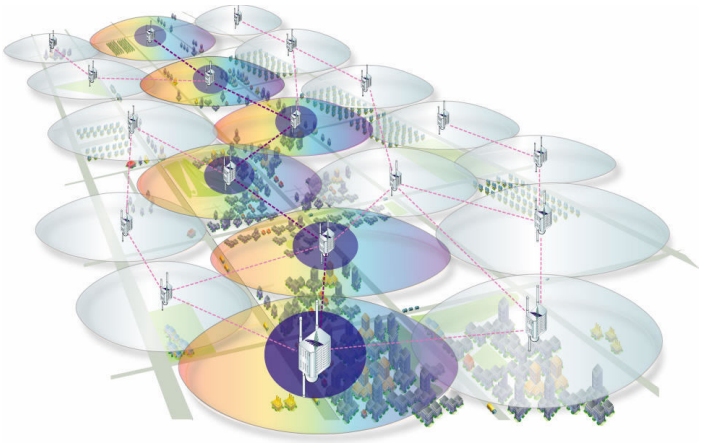
Purpose	Result	Comments
Backhaul performance and node capacity		
Backhaul throughput	★★★★★	Maximum throughput levels achieved independently of the number of hops with multiple radios
Backhaul throughput with simulated clients	★★★★★	Same throughput level as for the previous test, with as many as 127 clients per radio
Fully loaded single node capacity	★★★★★	Can even saturate a Fast Ethernet uplink using six radios (test was performed with two)
Voice call capacity		
Call capacity without any background traffic	★★★★★	36 excellent quality calls maintained over four hops
Call capacity with background traffic	★★★★	Voice prioritization guarantees highest MOS score over four hops on 23 calls with added data traffic
Mobility handoff		
Mobility handoff delay	★★★★★	Under the 50 millisecond industry mantra so short enough to maintain high quality voice call during handoff
Failover roaming		
Failover roaming delay	★★★★	1 second failover comparable to Rapid Spanning Tree on wired Ethernet

IOMetrix Scorecard for Strix Systems Mesh APs

Outdoor Strix Mesh AP



Indoor Strix Mesh AP



	Cisco Aironet 1500	Motorola Hotzone Duo	Proxim AP-4000M	Strix OWS 2400
Size	624 cu. In.	231 cu. In	369 cu. In	1344 cu in
Weight	10 lbs	4.5 lbs	6 lbs	14.5
Transmit Power Max	802.11a 26 dbm 802.11b/g: 24 dbm	802.11a 26 dbm 802.11b/g: 26 dbm	802.11a 24 dbm 802.11b/g: 24 dbm	802.11a 26 dbm 802.11b/g: 26 dbm
Receiver Sensitivity @ 1Mbps	-98dBm	-100dBm	N/A	-98
Upgradeable	No: Nothing Announced	Yes: Over the Air	Yes: Over the Air	Yes: Over the Air
Power LED	No	Yes	Yes	Yes
PoE for Powering AP	Yes	No	Yes	No
POE Interface	Proprietary Connector, Milspec	N/A	RJ-45	N/A
PoE (for powering other co-located devices)	No	Yes: both Canopy PoE & 802.3af	No	No
Need a separate WLAN Controller	Yes	No, but requires MiSC	No, ProximVision Recommended	Network Server Required
Routing Protocol	Adaptive Wireless Path	Mesh Connex (Layer 2)	Orinoco Mesh Creation Protocol	Dynamic Mesh Architecture
No. of Radios	2 (a + b/g)	2 (a + b/g)	2 (a + b/g)	Up to 6 (3 a + 3 b/g)
No. of SSIDs	16	16	4	16
Supports VLANs	Yes (but clients don't associate)	Yes	Yes - 16 VLANs per Radio - No Trunking?	Yes
Client Security	WPA2	WPA2	WPA	WPA
Intra-Mesh Security	X.509 digital certification w/ AES	SecureMesh (WPA2 w/ AES)	WPA w/ AES	WPA w/ AES
EMS Management Security	SNMPv3	SNMPv3	SNMPv3, SSH, SSL	SNMP v1 and v2, SSH, SSL
QoS	802.11e	802.11e + 802.1p	802.11e + 802.1p	Yes, Standards not Stated
RSSI/Antenna Alignment	No	According to SE, Yes, assumed from MeshManager only though	Yes	Confirm
VLAN to SSID Assoc	Not Documented	Yes	Confirm	Yes
Indoor Mesh Gateway	No	Scheduled	Yes	Yes
Interoperable w/ Wi-Fi clients	No	According to SE Yes	Yes	Yes
Rogue AP Detection and Prediction	No	No	Yes	Yes
Contents of Box	Just the AP	IAP: 1 x IAP (b/g only), 12 ft Power Cord, 2.4 GHz 8 dbi Omni WMR: 1 x WMR (b/g only), 8 ft Power Cord, 2.4 GHz 8 dbi Omni	(1) AP-4000MR-LR (1) Power injector (1) Mini-DIN to RJ11 serial connector (1) Cable termination kit (1) Wall/Pole Mounting bracket	1 x 2400 AP 1 x pole mounting kit 1 x Sun Shield
Price (dual radio configuration)	$3,999	$2,820	$1,995	$3,635