

Four Proven Techniques to Wirelessly Deploy WiFi Across a Community

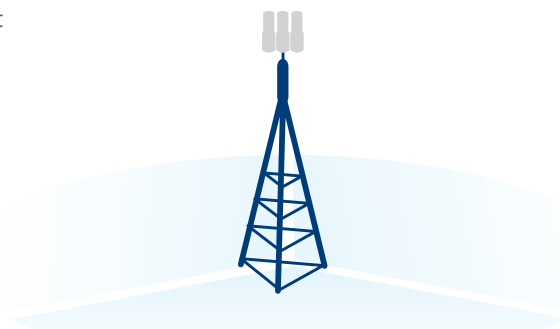
It's an exciting time for new technologies like balloons, drones, and solar-powered airships that beam WiFi to the earth's surface. Meanwhile, proven, affordable techniques are already successful in deploying hundreds of thousands of hotspots across the world.



1 THE WIFI CANOPY

This technology applies when the coverage area is small (less than 1 mile in diameter). One approach is to deploy WiFi Access Points (AP) throughout the community, but this implementation requires providing backhaul to these APs. A wired backhaul solution deployment can be expensive and time-consuming, and wireless backhaul consumes scarce wireless spectrum. Alternately, if an elevated, centrally located mounting site exists - a tower, high-rise building, or pole - WiFi APs can be positioned about 20 feet higher than rest of the community, but a much more efficient solution is to install three dual-band WiFi APs with 120° sector antennas in a central location.

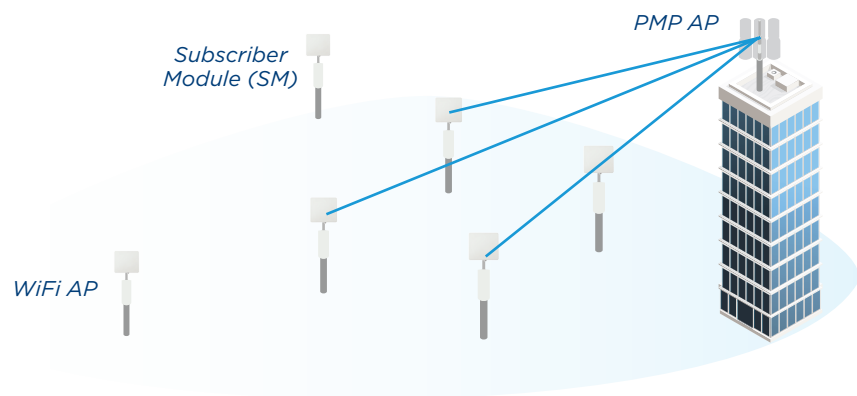
The three APs should each use different, non-overlapping channels (recall that only three non-overlapping channels exist in 2.4 GHz). For this type of deployment, 21 dBm transmit power and 15 dBi antenna gain would give optimum results (assuming that the EIRP limits are around 36 dBm, which is true of most regions). In general, always prioritize lower transmit power and higher gain antennas because the connecting devices have very low transmit power.



Three WiFi access points with 120degree sector antennas using three different channels

2 POINT TO MULTIPOINT (PMP) BACKHAUL

This strategy is applicable for a larger community (spanning around 2-7 miles). In this case, a tower, high rise building, or hill can be used to deploy Point to Multipoint APs. These PMP Access Points wirelessly connect to subscriber modules (SM) deployed at the installation site of the WiFi hotspot. Each WiFi AP is installed on or adjacent to the same pole as its paired PMP SM.

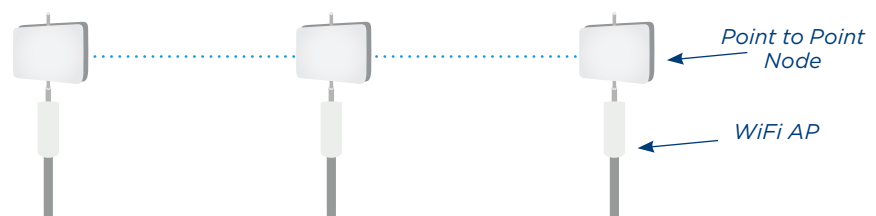


In these cases, network designers should ensure the following:

- One management system (controller) should manage both the PMP system and WiFi APs.
- The PMP system should be based on Time Division Multiple Access (TDMA) technology rather than commercial WiFi, to ensure reliable and deterministic backhaul.
- The PMP system should be capable of high throughput, possible with such techniques as Massive MU-MIMO when the deployment includes more than thirty WiFi hotspots.
- The WiFi AP should have a second Ethernet port that can supply power to a connected PMP SM. Running two power cables per location for each of the WiFi AP and the PMP SM streamlines deployment.

3 POINT TO POINT (PTP) BACKHAUL FOR A LONG SPAN

This technique is ideal for deploying long-distance WiFi along a road, railway line, or beach.

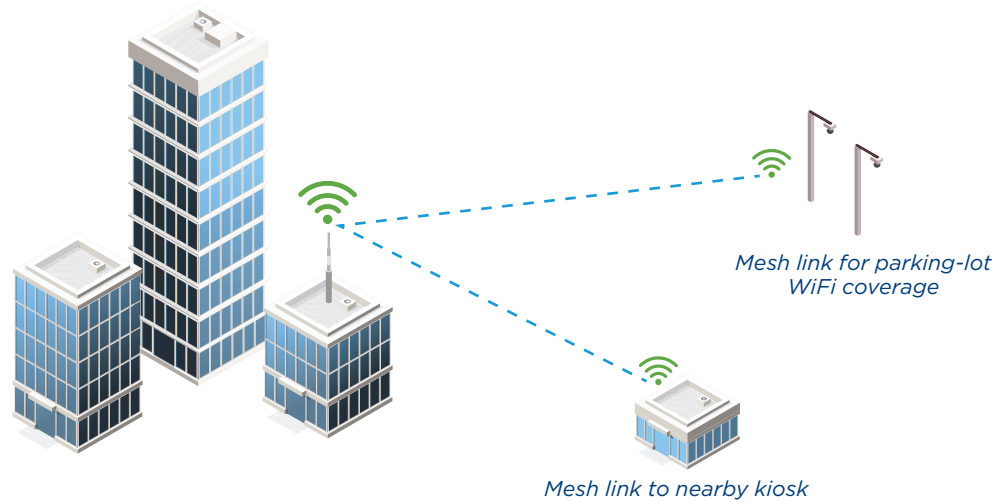


In these cases, network designers should ensure that

- One management system (controller) should manage both the PTP system and WiFi APs.
- The PTP system should be based on TDMA technology to provide reliable and deterministic backhaul.
- The PTP antenna should form a narrow beam to reduce interference and increase range.
- The PTP antennas should have good front to back ratio to avoid self-interference.
- Alternating links should use two different channels.
- As in the PMP case, the WiFi access point should have a second Ethernet port that can supply power to a connected PMP SM. Running two power cables per location for each of the WiFi AP and the PMP SM streamlines deployment.

4 WIFI MESH

The appeal of a WiFi Mesh configuration is use of the same technology as WiFi APs to talk to wireless clients. However, limitations of this implementation include vulnerability to external and self-interference when mesh APs use omnidirectional antennas. As backhaul and access share the same radio, each hop decreases available throughput and increases latency, limiting total system scalability to two hops. That being said, WiFi mesh configurations can provide adequate performance conveniently in some cases. For instance, the mesh technique easily extends the primary coverage to other small areas without available wire, such as a restaurant patio.



An extended deployment requires combining the above techniques, which compounds the importance of a centralized management system that deploys, manages and troubleshoots the equipment used in all the above scenarios.



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