



Just Meshing Around Mesh Communications: The Next “Best Thing”

Mark my words, sooner rather than later, someone in your chain of command is going to ask you about “Mesh” communications.

Motorola just signed on with MeshNetworks of Maitland, Florida to push Mesh as the newest and best answer to emergency communications and when Motorola speaks a lot of ears pay attention.

So, what is Mesh? First it isn’t really a new technology; rather it is a new application.

Mesh or mobile ad hoc peer-to-peer networking was originally created for the U.S. military. The Defense Advanced Research Projects Agency (DARPA) issued a proposal to create an ad hoc wireless network with high broadband data rates, end-to-end IP support, support for voice and video, built-in position location (without GPS) and support for vehicular mobility up to 250 mph

This represented a significant attempt to break with our present communications technologies, most of which use point-to-point or multipoint transmission protocols. Today’s systems are essentially rigid structures with fixed transmission assets such as base stations and antennas. These networks require meticulous planning before deployment. The fixed infrastructure also represents “points of failure” that can bring an entire system to its knees. The number of users of any given system is limited and fixing problems usually requires a maintenance response.

Mesh, on the other hand, is a multi-hop, ad hoc system that uses every device in the network to assist every other one in transmitting packets of data. In fact, Mesh turns every user into a router/repeater. As users join the network they improve network coverage and increase network throughput. It can be employed using any 802.xx radio platform.

Like the Internet and other peer-to-peer router-based solutions, Mesh employs redundant communications paths. If one link fails, the network automatically routes messages through alternative paths. Mesh seeks the shortest route and this can dramatically improve signal quality. For example, if Mesh finds a path that cuts the distance between communicators by half, effective signal power is increased by two.

Mesh is self organizing. New “nodes” are created when a user signs on. The network discovers the new guy automatically and incorporates him/her into the existing system. The military, for example, could parachute 50 troopers into a combat zone and they become an instant network using nothing more than their Mesh-enabled radios.

In a major emergency where all normal utilities are down, first responders could form their own instant network and using strategically placed personnel would be able to communicate over great distances regardless of topography, weather or infrastructure damage.

Mesh is self-healing. If one node fails, the system reroutes messages. Human hands are not required. Restoration of nets damaged in disasters can occur in hours rather than days. Since a Mesh application does not depend upon a central control point, it can be scaled to meet large and small requirements and everything in between.

Communications experts like Mesh for several other reasons:

- **It solves the range vs. data rate dilemma.** Usually broadband wireless communications involves a trade-off between data rate and radio range for any given transmitter power output. That is, for a specified transmit power, the data rate available (i.e. throughput) will decrease as range from the transmitter increases. Meshing, on the other hand, offers both long end-to-end range and high data rates by hopping through a series of intermediate nodes. Since the distances between each node (i.e. hop) is relatively short compared to the distance between the end transmitter and receiver, each hop can be completed at much higher data rates than is possible with a direct connection.



- **Mesh reduces spectral interference.** Since nodes in a mesh network transmit over much shorter distances (via hopping through intermediate nodes) than is typical in cellular or centralized networks, they also transmit at much lower power levels. This reduces system wide interference and enables spectrum to be reused with greater density.
- **It mitigates non-Line of Sight and Congestion.** Hopping through intermediate nodes allows mesh networks to route around obstacles and local network congestion.

Security concerns have been addressed. Many Mesh solutions meet federal and local government standards for data privacy are resilient to interference, attacks, and failures and can be adapted to employ current and projected security safeguards.

The cost of Mesh systems is coming down as more applications come on line. Today a system will cost about \$50K per square mile for total coverage. Obviously, this remains outside many budgets but remember, few agencies will require complete coverage of every square mile of their jurisdiction.

The first step in considering Mesh is to find a consultant or advisor who will provide a requirements survey. Then, if this is your piece of cake, you too can become a Meshie!

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