MeshNetworks:

Wireless Ad Hoc Peer-to-Peer Networking

By Joshua Raha
Introduction

Orlando, Florida-based MeshNetworks was founded in January 2000 to commercialize wireless technology developed by DARPA and ITT for battlefield applications. The MeshNetworks solution – wireless ad hoc peer-to-peer networking – provides a simple, scaleable, inexpensively deployed voice and data network that can deliver data at speeds of up to 6 Mbps.

This paper will examine wireless ad hoc peer-to-peer networking – looking at the MeshNetworks solution, as well as those of other companies using the same concept. Further, I will also examine the firm’s business plan and its overall strategy. In addition, I will introduce competitive (and non-competitive) solutions to illustrate the industry landscape and identify some drawbacks of the MeshNetworks architecture.

What is ad hoc peer-to-peer networking?

A wireless ad hoc peer-to-peer network – or a “mesh” network – is a dynamic network of mobile wireless devices (e.g., laptops, PDAs, and cell phones), set up with no existing infrastructure (cellular base station) or centralized control (hence, ad hoc). Devices on the network also act as nodes through which other users can pass their data (peer-to-peer, or P2P), meaning each user device is also a router and repeater. Ad hoc peer-to-peer networking is an evolution from point-to-multipoint networks (“star” or “hub-and-spoke” networks), where all users must have direct access to a central access point (like a cell tower) to use the network. However, using mesh architecture, users can connect to the access point (the “base station”) by Multi-Hopping™ through other nodes on the network, even if no RF link can be directly established. Further, the mesh doesn’t even require such an access point – if two users can establish a radio frequency link, they can share files, email, video, or voice calls without any central network control (See Figure 1). This two-person “network” is easily expanded to include more users, supporting collaborative work environments or emergency response teams. Now we see the elements of a mesh forming, with any given node communicating with multiple other nodes (See Figure 2). Finally, those users can access the Internet or the PSTN (Public Switched Telephone Network) either directly or via other nodes (See Figure 3).
Add the mobility capability of wireless communication, and you have wireless users constantly moving through the network, constantly changing the landscape of the mesh. The mesh, then, is self-organized and self-healing – as users turn off or turn on, or as they move into and out of range, the links are recalculated and a new mesh is dynamically formed. The engine for this is MeshNetworks proprietary routing algorithm located at each node, which calculates the best radio frequency (RF) path to the next node, determines the fewest number of “hops” to reach a destination, and monitors capacity at each node to ensure packets are evenly distributed across the network.

Traditional wireless networks (such as cellular systems) require heavy infrastructure investment in the form of base stations placed all over a coverage area. In contrast, a mesh network requires only a few Internet/PSTN access points and, in the initial phases of deployment, the installation of “seed nodes” (MeshNetworks calls them “Wireless Routers”). Such seed nodes have the same hardware and software as the
user nodes, but would be fixed in certain locations around a city (i.e., on lampposts) to allow for early adopters to take advantage of the mesh right away. Conservative estimates show that installation of a Wireless Router is approximately $1/10^\text{th}$ the cost of a similarly performing cellular base station.\textsuperscript{1} As well, in a cellular network, each user competes for a limited number of channels provided by the base station; further, the more users there are, the more interference is introduced, and quality of service goes down for everyone. Conversely, users of an ad hoc P2P network cooperate, rather than compete for resources – the more users there are, the \textit{better} the system gets, as there are more alternate paths through the network.

If this network design seems familiar, it’s because it is. This is the same architecture upon which the entire public Internet is built. In that case, however, each node is a switch or router, but not necessarily a user.

The wireless mesh concept has several uses that are being marketed today. First, and most simply, industrial sensor and control applications allow factory managers to monitor systems and devices all over the plant without needing to run wires to every corner of the facility. As well, since a mesh allows nodes to “see around corners,” there is no need for line-of-sight RF access back to a single point. Second, a number of companies are pursuing fixed wireless access using mesh architecture. Fixed wireless refers to the lack of mobility; it is the use of wireless technology to deliver voice and data services to “fixed” customers – in both homes and office buildings. Wireless ISPs (WISPs) compete directly with DSL and cable modem providers in the residential and small business space, and with leased-line carriers (providers of T1, DS-3, lines etc.) in the large enterprise arena. Of course, a fixed wireless mesh network would be relatively staid, but the self-organizing, self-healing features of the mesh come into play at installation – where no point-to-point connections have to be set up between nodes – and in temporary outage situations, such as when heavy rain cells move through an area. Finally, wireless ad hoc P2P networking is being applied to the mobile Internet. In this case, a mesh-enabled PDA or mobile phone can access the network without direct access to the established infrastructure, instead linking up to global fixed networks via other users in the mesh.

**Introduction to MeshNetworks**

**Corporate history**

The technology that MeshNetworks uses was originally developed in a DARPA-funded ITT research project for battlefield communications applications. The military wanted a way to establish secure intra- and inter-unit broadband communications in remote and potentially dangerous locations without having to set up any infrastructure. Other requirements included end-to-end support for IP, support for voice and video, a geo-location feature (without using GPS), and support for mobility at speeds of 250 mph.\textsuperscript{2} The self-organizing mesh was an ideal solution to this problem. MeshNetworks was founded in January 2000, and in June of that year the company acquired an exclusive license to commercialize ITT’s technology in return for a 15% stake in the company.\textsuperscript{3} Until very recently, Mesh has been in development mode – working to miniaturize ITT’s technology into a commercially viable product and refine its own target market. In late 2002, the company changed CEOs in order to “transition from an R&D firm into a product company.”\textsuperscript{4} Other organizational changes at the time included an elimination of “skunk works” projects – with associated layoffs of scientific staff – and the introduction of a Product Management team focused on actual customer needs.
Two distinct product lines

MeshNetworks’ plan from inception has been to develop the ITT technology into two distinct commercial product lines. The flagship is the Mesh Enabled Architecture™ (MEA™) mobile broadband solution. MEA is essentially a protocol for wireless communications based on ITT’s QDMA™ radio frequency modulation and Mesh’s own routing algorithm, upon which the company owns most of its IP. A customer can license the chipsets and the protocol, apply them to their own radio devices, and build out a wide-area mesh network to support mobile data and voice applications at speeds of up to 6 Mbps.

The firm’s second product is the MeshLAN™ Multi-hopping 802.11b networking solution. Since the proprietary routing algorithm in “radio-agnostic” (i.e., it works regardless of the protocol and modulation schemes the transceivers use), it can be applied to any radio standard. In this case, MeshNetworks provides nothing more than the protocol for multi-hopping. The software is an overlay to all flavors of the 802.11 standard, effectively allowing for the extension of a wireless LAN. That is, MeshLAN turns the Wi-Fi network into a Mesh Wi-Fi network. (See the inset for a brief description of 802.11, a.k.a., Wi-Fi.) This application also allows for better mobility within a Wi-Fi network, as a moving user’s path to the Wi-Fi hub can be constantly altered based on signal strength and other routing criteria.

The company is quick to point out that the two product lines are distinct from one another. MeshLAN is meant as a Wi-Fi overlay, but MEA is completely separate from 802.11, as it is focused on mobility, which Wi-Fi was not designed to support.

Business model

The key for MeshNetworks is that it does not manufacture or sell radio devices – it simply licenses its intellectual property. This model worked for Qualcomm, which developed the CDMA standard for cellular phone networks, but made its money licensing that proprietary protocol. Once it caught on, it became a worldwide standard, and Qualcomm profited every time a base station or cell phone was sold. However, it is not clear if this model will work for MeshNetworks, as there are a number of P2P players on the market and each uses their own protocol for establishing the network. As with many technologies, a worldwide standard (either

**802.11.** The 802.11 standard is simply a protocol for communications on a wireless LAN. Popularly known as Wi-Fi (Wireless Fidelity), this IEEE standard calls for the use of unlicensed 2.4 GHz band, allowing anyone to build their own network – and anyone to employ their own wireless interface to such a network. There are two basic flavors of Wi-Fi.

- 802.11a allows for a bandwidth of 1 to 2 Mbps.
- 802.11b uses a different modulation scheme, and can support speeds of 5.5 and 11 Mbps.

Wi-Fi has become a ubiquitous global standard for wireless data communications, with applications in offices, homes, campuses, and even so-called “hotspots”.

- **Offices** – businesses are using Wi-Fi to extend their LANs within and around their office buildings.
- **Homes** – tech-savvy consumers have attached Wi-Fi hubs to their broadband Internet connections, allowing them to access the Internet from anywhere in the house.
- **Campuses** – universities use Wi-Fi to deliver an “always accessible” network to students and faculty.
- **Hotspots** – Other consumer-oriented companies and organizations, such as airports, cafes, and hotels have started to install Wi-Fi hubs, reselling broadband Internet access to their customers.

For all its success, Wi-Fi does have its limitations. First, it uses a star configuration; second, it’s not actively mobile, but is nomadic. That is, the base standard does not provide for cellular-style handovers between Wi-Fi hubs.
governmentally imposed or market-driven) will likely be required before there is mass adoption of any of the Mesh protocols. MEA may still be the winner, but that has yet to be determined.

**Target customers**

For ease of explanation, previous examples involved end users accessing the Mesh network as if it were part of the public mobile Internet. This is somewhat misleading, as the company is not targeting that market in the first phase. In fact, the MEA solution is aimed primarily at the niche markets of public safety & military organizations, Intelligent Transportation Services (ITS), and telematics, while MeshLAN focuses on campus and large enterprises. It is notable that Mesh does not intend to market to WISPs – in fact, the company often turns down inquiries from such companies, as Mesh believes that very few of them have viable business models. Furthermore, there is heavy competition in that space, with many solutions and even more equipment providers. As well, the market for such services – at prices that would make it profitable for all – has failed to materialize. A lot of people are losing a lot of money trying to sell broadband data services over RF, MeshNetworks does not intend to be one of them.

Meanwhile, Mesh’s target markets are under-served. Mesh believes that public safety organizations and the military require mobile and secure broadband applications. Because Mesh Multi-Hopping is proprietary, there is no publicly available equipment to intercept and decode signals on a MEA network. As well, since the terrorist attacks of September 11, 2001, public safety and military budgets have gone up, meaning that a former cash-poor market segment may be becoming quite lucrative. Finally, in emergency response situations, accurate locations of all staff can prove invaluable to coordinators – MEA’s geo-location feature works where GPS can’t: in tunnels, in buildings, etc. It is crucial, though, that MeshNetworks have robust, deployable products today, as public budgets only provide for a single upgrade of existing infrastructure – if these target customers choose competing technologies, the market is lost to Mesh.

ITS refers to traffic management functions performed by government and private organizations, such as video streams of traffic in key locations and traffic control signals. MeshNetworks sees these applications as perfect for an ad hoc P2P network.

Telematics refers to "those products, services, or support systems that provide information to cars and other vehicles." It is a relatively new market with promising potential. Enabling delivery vehicles with MEA devices can track packages down their exact street location. Applications like the OnStar system can be enhanced and expanded for end-users. Buses and trains can be fitted with MEA, allowing passengers to access Internet applications while on board. (If this sounds overly futuristic, consider that the shuttle train running between the Hong Kong airport and downtown has individual TV screens with up to 10 channels to choose from.) Further, the more vehicles that embed a MEA transceiver, the stronger a MEA network will be in any given area. Imagine if every car as a potential repeater or router for your data.

As for global reach, MeshNetworks is targeting Asia – specifically Japan and Korea – because of that region’s rapid adaptation of new communications technology and the heavy reliance on public transportation. This last reason is also why Mesh sees Europe as another target market. Mass transit is an interesting market for Mesh, as a Wi-Fi system within a train can be backhauled to an Internet access point using MEA.
technology. In this way, MEA transforms Wi-Fi from a nomadic solution into a mobile one.

Finally, MeshNetworks looks to diversify its customer base by aligning with strategically selected Value Added Resellers and System Integrators in target market segments. In this way, the company is trying to spread the installation of MeshNetworks products as widely as possible – note that the Qualcomm model only works if the technology becomes a de facto standard.

**Current status**

Mesh is in the process of transitioning from a development company to a product company and things look bright. A live network in Orlando was unveiled for the CTIA trade show in March 2002, which the company used to demonstrate broadband web browsing, peer-to-peer networking, streaming video, and location-aware applications.\(^7\) As well, in November they announced that they had shipped “commercial quantities” of both products to a variety of customers.\(^8\) This milestone marked the first non-beta product to be sold and shipped out the door. In addition, the MeshNetworks was recognized as “company to watch” by three different industry publications in the early part of 2003.\(^9\)

Currently, the company manufactures about 50% of its commercial gear, with the rest contracted out. Because large potential partners require that all factories be fully certified – and because manufacturing is not a MeshNetworks core competency – the company plans to fully outsource this function by the end of May 2003. This will open the way for more strategic and significant partnerships, as well as move the company towards its goal of simply selling reference designs, minimizing its internal infrastructure.

However, even with all the positive news, the fact remains that there has yet to be a wide-scale, third party deployment that conclusively proves (or disproves) that MeshNetworks technology lives up to its promises.

**Competition, Substitutes, and Others who use Mesh**

**Other practitioners of ad hoc peer-to-peer architecture**

As previously stated, one of the applications of mesh architecture is broadband fixed wireless. While MeshNetworks has specifically avoided this market (Rick Rotondo, VP of Technical Marketing, has pointed out that there’s no point in doing wireless if you’re not taking advantage of mobility applications\(^10\)), there are a number of equipment vendors that are using the mesh approach to serve this segment.

**Nokia’s RoofTop** – In September 1999, telecommunications giant Nokia acquired RoofTop Communications of Mountain View, California. Using the 2.4 GHz (unlicensed) frequency band, the RoofTop product was meant to be a mesh-based broadband solution, delivering 500 kbps to 1 Mbps of symmetrical bandwidth to homes and offices. Up to that point, many fixed-wireless solutions were hub-and-spoke configurations, which required that every user must have direct wireless access to the Internet access point (See Figure 4). As illustrated in Figure 5, the mesh architecture allows sites that cannot “see” the Internet access point – due to either distance or line-of-sight issues – to reach it via multi-hopping.
The product was released in 2001 and by November 2002 Nokia bragged that it had over 100 customers\textsuperscript{11}, including a successful community rollout in Santa Rosa, CA.\textsuperscript{12} However, in early part of 2003 the company abruptly disbanded the product line, announcing only that it would support the existing installed base.

**Radiant Networks** – Cambridge, England-based Radiant Networks is still intent on delivering a fixed wireless mesh solution. In fact, the only difference between the RoofTop product and Radiant’s “MESHWorks” is that the latter uses the 28GHz licensed band. While RoofTop can be used by anybody, MESHWorks customers must own the government-issued licenses to use the radio band before they deploy. Radiant, though well funded and over four years old, has still yet to prove its technology. In fact, in January 2003, British Telecom scrapped their plans for build-out, citing “immature” technology after an extended trial in South Wales.\textsuperscript{13}

There are other mesh practitioners that are still somewhat active – all of which are focusing on the fixed wireless arena.\textsuperscript{a} SkyPilot is a brand new player in this space; and SRI’s more mature PacketHop system has been licensed for sale by SPEEDCOM, but without any kind of mass market acceptance. As well, Ricochet just emerged from bankruptcy and, seeing that traditional service providers have been reticent to deploy new technologies, have built out networks themselves (using their own radio products).\textsuperscript{14} While the success of this model is still up in the air, it can safely be said that nothing in this space has been very successful to date. I believe it is a wise decision of MeshNetworks to stay out of fixed wireless and away from WISPs. However, the question remains. When big players like Nokia fail with “mesh” architecture, what does that do for the credibility of a such a small player like MeshNetworks, whose very name associates them with such ventures?

MeshNetworks’ Senior Sales Engineer R. Gene Apelado points out that the company’s target customers – public safety organizations, mass transit entities, and the like – are “outside the loop” when it comes to communications. As such, they aren’t necessarily aware of Nokia’s failures with “mesh” technology. There may be some merit there, but it’s a hopeful argument. The fact is, by starting to pay attention to the space, those unsophisticated customers could learn “enough to be dangerous;” and a young firm like Mesh could find it difficult to disassociate itself from the repeated failures of others in its industry.

\textsuperscript{a} It should be noted that there are also a large number of fixed wireless equipment vendors that do not use mesh architecture. This is a very crowded space.
This highlights the marketing problem at MeshNetworks. It is not immediately clear what they do – it took an interview with an internal source before I realized that their target end user is not a consumer with a PDA in his car (who I call "Joe Laptop"), buying flowers for his wife on his way home. They also don’t target (as previously noted) end users that want broadband to their homes. Rather, the applications that the company wants to facilitate are more enterprise-oriented. This, in my opinion, is a strong differentiating factor that should first be made clear, and then leveraged. The message should be something like the following.

Mesh is a company rooted in the present that will help you deliver data to and from traffic systems, maintain your fleet of vehicles, monitor your factory systems, communicate with other public safety personnel in emergencies, and enable your Wi-Fi network to “go mobile.” We are not another group of pseudo-visionaries, predicting unrealistic and futuristic things you can do with your laptop on your way to work.

Direct competitors to MEA

Outside of the many fixed wireless companies, there are also a number of vendors who are looking to deliver a solution for the “mobile Internet.” As previously noted, this is not the target application for the MEA product today, but as it’s a possibility in the future, these firms do pose a threat to the MEA.

Flarion – A spin-off from Lucent Technologies, Flarion is approximately the same age as MeshNetworks. The company has designed a radio product to overlay on existing mobile wireless systems. Though still in customer-trial mode, it is expected to deliver data at up to 1.5 Mbps at very low latencies using an all-IP network. This is an unproven solution and it remains to be seen how the build-out of a Flarion network might progress. It should be noted, however, that the technology is only slightly less mature than that of MeshNetworks.

Moteran Networks – A joint project of Mitsubishi and Detecon, little is known about this new offering. Claims include 2 Mbps and mobile overlay on many existing wireless networks, including Wi-Fi, but there is no product on the market as yet. Still, this is a mesh solution, which ensures that MeshNetworks will keep an eye on it.

High Altitude Platform Station (HAPS) – With the unmitigated failure of satellite companies to deliver affordable broadband data services (Globalstar, Teledesic), the next goal is the Airborne Internet. Flying at heights of 60,000 feet – above commercial air travel but within the Earth’s atmosphere – HAPS vessels carry the same promises as satellites did, only with better latency, cheaper “launches,” and better opportunities for maintenance and upgrades. There are several ideas being pursued – manned planes, unmanned balloons, “zero-gravity” balloons tethered to the Earth, etc. – two of which have a reasonable chance of ever launching service. The first is SkyStation, a company founded by former Secretary of State Alexander Haig that is designing balloons that will act as high-in-the-sky repeaters of voice and data. The balloons will be at the core of a broadband data network, delivering up to 2 Mbps (uplink) and 10 Mbps (downlink) to fixed wireless customers and true 3G services (see later section on 3G for a definition) to mobile customers. The plan is that these customers will be able to use off-the-shelf 3G mobile handsets to access the SkyStation platform, and service is expected to be launched in 2005.

Meanwhile, SkyTower, a joint project of NASA and the Japanese Ministry of Telecommunications, has developed a new type of high-altitude unmanned “plane”
that was unveiled for live tests in July 2002. At that time, the demonstration included live HDTV and 3G mobile applications, using an off-the-shelf NTT DoCoMo iMode (see later section iMode for more information) handset. The company also plans on launching service by the end of 2005.

MeshNetworks currently scoffs at these solutions, as they boast theoretical maximum data rates on the order of 2 Mbps (while Mesh promises 6 Mbps) and they are at least three years from service launch. However, it is not unreasonable to think that the time can be used to upgrade the bandwidth on the HAPS systems, rendering a ubiquitous broadband service – not unlike the MeshNetworks solution. If MEA is not a Qualcomm-like standard by 2005, these two companies could be a real threat to Mesh’s planned dominance of the market.

**Direct competitors to MeshLAN**

Still other groups have the potential to undermine the value of MeshNetworks’ other product – MeshLAN.

**LocustWorld** – Perhaps the most direct threat to a MeshNetworks offering comes from English developer Jon Anderson’s LocustWorld. Anderson has developed MeshBox, a Linux-based PC-and-transceiver-in-one that runs the 802.11b protocol – and he’s selling the units at cost. His software (MeshAP), which is free for download on the Internet, is not unlike MeshLAN in that it overlays mesh capability onto a traditional Wi-Fi network. The difference is that MeshAP is open-source code and MeshBox is open architecture – anyone can copy what Anderson is doing. Already in place in a few villages in England, a single access point in the town has given way to an ever-expanding “cloud” of broadband users – people who can’t reach the access point, but can reach each other with their MeshBox transceivers.\(^{15}\) MeshAP may not be as sophisticated as MeshLAN, but the fact that a Mesh-over-Wi-Fi product can be given away certainly reduces the value of MeshNetworks’ IP.

Apelado defends the company’s IP by pointing out that there are may LocustWorld-type software overlays that “compete” with MeshLAN and all of them have the same problem. Namely, they are based on old (wired) Internet routing protocols, which assume that the wire connecting the nodes is present and intact. Apelado’s point is that there is no wire in this case, and the RF environment can change – something these algorithms cannot address. The MeshLAN algorithm does address this, by also taking into account RF measures (e.g., signal strength and interference levels) when making routing decisions. While this is a slight advantage, the relatively stationary nature of nodes in a Wi-Fi network would lead one to believe that good routes can be found using traditional (wired) Internet measures, such as latency and retransmissions. That is, one does not need to know that the received RF signal level is high to see that the performance of the link is good. RF measurements may be useful for troubleshooting, but I believe they add very little value in the non-mobile world of Wi-Fi.

**Substitutes / Current mobile Internet solutions**

So far, I’ve primarily focussed on immature solutions that have not yet gained mass acceptance. This ignores the fact that there are mobile data applications in use today.
2.5G and 3G - “3G” has become a generic term referring to the long-promised broadband data capabilities of existing cellular networks. However, the term has its roots in actual global standards, where UMTS (for GSM networks) and CDMA2000 (for CDMA networks) call for data rates of 2Mbps over mobile phone networks. Mobile operators have been slow to deliver these services, however, largely due to a combination of the high cost of equipment & installation, as well as a lack of real demand for the services from consumers.

In the meantime, General Packet Radio Service (GPRS – dubbed “2.5G”) is a data standard that has been widely rolled out in Europe and the Americas. It works on all non-CDMA networks. Part of the reason for its rollout (over true 3G) is its cost-effectiveness, which, in turn, is due to its lower performance – GPRS delivers theoretical data rates of 172.2 kbps, with actual performance being about 40 kbps. Note that the CDMA version of “2.5G” (1XRTT) delivers similar data rates and has also been widely implemented. An enhancement of GPRS is EDGE. As with everything else, it has its pros and cons – it can deliver up to 384 kbps, but is not widely deployed.16

iMode – No discussion of wireless data can be complete without mentioning NTT DoCoMo’s iMode, the wildly successful mobile Internet service in Japan. DoCoMo, Japan’s leading cellular service provider, launched iMode in February 1999; within six months, there were over 2 million subscribers.17 The service is relatively simple – it allows for web browsing using a mobile phone, though the data rate is extremely slow, at 9.6 kbps.

The bottom line is following paradox: there are deployed solutions that are not true broadband, and there are true broadband solutions that have not yet been deployed. There may be some cellular-based mobile Internet application someday, but the cost of deployment and the risk of consumer rejection have left network operators in a perpetual “wait-and-see” mode. 3G and iMode is likely not a threat to MeshNetworks (though the next DoCoMo data product will be very strong).

Drawbacks of the MeshNetworks Architecture and Strategy

While the Mesh architecture provides a number of benefits, there are some clear drawbacks to the network design.

Technical issues

Latency – Multi-Hopping might allow data to get to where it’s going, but it may not get there soon enough. It stands to reason that the more nodes a packet has to go through, the longer it will take to arrive at its destination; for time-sensitive applications (like voice calls), this can pose a real problem. It is not clear how heavily Mesh’s proprietary routing algorithms weight the measurement of the time it takes for a packet to get through the system, but this is a major concern.
No proof of technology – Since there has not yet been an independent mass deployment of Mesh’s product line, it is still unknown as to whether this gear does what it says it will. Shipping commercial product and proving that you have a sustainable and saleable product are two completely different things.

Proprietary technology – The Qualcomm model doesn’t work that often. That is, it is very difficult for a small company like MeshNetworks to create mass demand and drive global adoption of a closed standard unless it (a) has unparalleled technology and/or (b) has unrivaled marketing prowess. The former is as yet unproven, while I’ve already shown how the company could improve the latter.

The first two items will be addressed if MEA becomes more widely accepted in the market place. The third, as illustrated, is a good news/bad news situation – nonetheless, as an investor, I would not count on Mesh to even approach the level of success that Qualcomm enjoys.

Market issues

No real value in MeshLAN – As I stated earlier, I fail to see any real value in the MeshLAN product. With so many software houses developing overlays that turn Wi-Fi into a mesh architecture – and some even doing it with open-source code – I see very little market for the MeshLAN product.

Failure of tangentially similar solutions – I’ve already touched on this point – How will MeshNetworks respond to the failures of Nokia’s RoofTop Mesh Radio and Radiant’s MeshWorks product? They are, admittedly, different products with different applications. However, unless MeshNetworks clearly defines its position in the marketplace, it is very possible that the firm will have to fight doubters and detractors that lump them in with the other (failed) ventures.

Wait-and-see mentality – AT&T was extremely late in joining the cellular game, but few people remember that now. The lesson is that you don’t always have to be the first mover to have a sustainable advantage – and potential customers of MeshNetworks may be taking heed. This is a weak market, with low corporate spending on most levels. Is it really the time to make a technology gamble? Or can a company wait and see? In this market, does FedEx really need to know the exact location of every truck? Do police cruisers need better bandwidth than they have right now? Is now the time to choose a technology, or can I sit back and see what develops? It is this slowdown in decision making that can kill a startup, even if it does have good technology. The only way to overcome this is to market yourself well and have reasonable price points for your potential customers.

All three of these points can be addressed by strong, focussed marketing. The company needs to market and sell its solutions to overcome a possible bad stigma (due to association with other mesh companies) and to convince customers that MEA is the solution.

Customer issues

Target market – While I believe MeshNetworks has made the absolute right decision to not target the fixed wireless market and to avoid the “Joe Laptop” end user, I am not convinced that the public safety, ITS, and telematics are the right markets, either. Even with greater budgets for homeland security, public safety and ITS companies are still very budget conscious (as both are basically underwritten by local governments) – not the typical profile of an early adopter of technology. Meanwhile, government organizations are notoriously slow at making buying
decisions – and long sales cycles are especially hard on young companies. The threat, of course, is that the longer it takes for the early-adoption phase to transition to the early mass market phase, the better the chance for competitors to develop and steal market share. Even worse, if Mesh is forced to exclusively focus on the telematics market, I fear there isn’t enough demand in that sector to sustain the company.

Reliance on education – Because the wireless mesh is such a new concept – a disruptive technology, if you will – MeshNetworks is forced to spend a lot of time educating customers on the benefit of the solution. In addition, skeptical and unsophisticated customers have nowhere else to turn – there are no outside sources to back up the company’s claims. The upshot is longer sales cycles (and lost sales), and makes it more difficult to get the company off the ground.

This is a matter for market research. If my doubts are correct, Mesh is yet another solution company looking for a problem!

End-user issues

Penetration – The most obvious criticism of the Mesh architecture is its requirement for many deployed nodes before the system can work as planned. Without that critical mass of users, a large number of Wireless Routers will be required, raising deployment costs dramatically. The unanswered question is this: How do you penetrate the market quickly and deeply enough to make the network a success from day one?

Users’ cooperation – Even though it is clear that more “on” devices is better for everyone, people are still relatively selfish beings. As such, many users may resent draining battery life as other users send and receive packets through their devices. Moreover, RF safety is a concern for some – many are concerned about the health risks of RF radiation. It is reasonable, then, to think that users would turn off their devices to avoid – as much as possible – having them transmit as much as possible.

These are relatively obvious points that will have to be monitored by MeshNetworks as MEA becomes more and more common in the market in order to confirm or deny these assumptions.

Conclusion

In the final analysis, MeshNetworks’ ad hoc peer-to-peer network architecture is an intriguing and elegant solution for rapidly deployable, affordable, robust, and reliable broadband wireless networks. The company’s claims are as-yet unsubstantiated by impartial sources, but tend to be believable. Furthermore, the firm has successfully avoided going after the illusion of revenue that is the fixed wireless (“last mile”) market.

A strategy to attack under-served niche markets is sound, particularly if its customer base is relatively unsophisticated. As well, I like the basic strategy to outsource manufacturing and make an attempt to be a low-overhead marketing and sales house (as well as the recent concerted effort to transition from R&D focus to customer focus).

However, there are two places for improvement – the first is with the current marketing plan, which seems unfocussed and a somewhat contradictory. The second is with the market, itself. That is, while the technology is great, the business model is solid, and the execution of corporate strategy is strong, it is still unclear if there is
an actual need for the kinds of solutions that MeshNetworks is offering. In my opinion, the same question that has been the downfall of countless technology companies over the past five years has not yet been answered by Mesh: “Am I really filling a need in the market, or do I have a highly advanced solution looking for a problem?”

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