Next Steps in Municipal Wireless Mesh Networks

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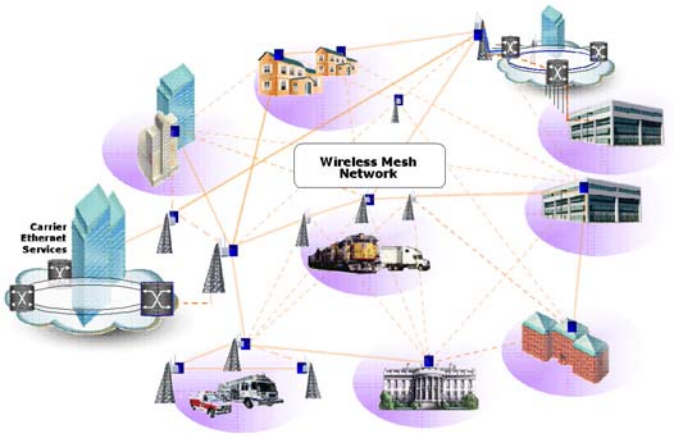
Wireless mesh networks are gaining momentum as hundreds of municipalities plan and implement mesh Wi-Fi for public Internet access, public safety, and business communications. Muniwireless.com reports that by February 2006, 186 U.S. cities and counties had implemented municipal wireless broadband networks, with more on the way. U.S. and international customers will adopt wireless mesh networks on a broad scale, as first generation wireless networks cannot provide the low latency, high bandwidth, and resilience the latest broadband applications require.



Vendors must address critical issues to enable networks to provide 100 percent reach-ability and mobility. High-quality voice needs low latency, while triple-play applications require high bandwidth and scalability. As subscribers increase, the network must automatically scale up while introducing zero performance loss and ensuring predictable Quality Of Service (QoS). The long-term viability of wireless mesh is a concern as new technologies such as WiMAX emerge. Wireless mesh networking addresses these issues; it is a mature technology that supports thousands of users, enables a broad range of applications, and scales and adapts to users' needs.

Mesh networks must be scalable, upgradeable

Today's wireless mesh networks provide the high performance, scalability, and resilience needed to serve hotspots, hot-zones, municipalities, and even countries. Compared to first and second generation wireless mesh network technologies, third generation technology is highly scalable and offers low latency, high performance, service-provider-grade QoS, and network resilience. Service providers can quickly and easily determine problems and upgrade devices to optimize the network for voice, video, high-speed roaming, or business-class services. Third generation technology also offers service delivery options; it can detect, report, and manage rogue network devices; and it can make changes on the fly.

Yesterday's single and dual-radio wireless mesh networks created limited, non-scalable "islands." Today's multi-radio mesh networks offer the modularity, scalability, and performance upgradeability needed for all deployments, from small-town networks to country-wide broadband systems for voice communications.

The latest hardware supports multiple radios, including 802.11 a/b/g/j, 802.16 d/e WiMAX, and 4.9 GHz for public safety. Sectorized array methodologies enable greater coverage than older systems do. A flexible, scalable, modular architecture enables any technology in any configuration; it also increases performance and the number of user associations. Service providers can upgrade existing nodes to new technologies such as WiMAX simply by plugging in new boards, thus accelerating deployment and reducing CAPEX and OPEX.

QoS gains in importance

VoIP over Wi-Fi is increasingly important to businesses and consumers. In Chittagong, Bangladesh, VoIP is the first step in delivering a complete array of broadband services. Although VoIP applications provide high-quality voice with lower bandwidth consumption and latency tolerance, mesh networks delivering voice must have minimal or zero impact on latency and provide QoS acceptable to consumers. IP Class Over Service (CoS) typically prioritizes all applications over the Internet and provides QoS to VoIP and business-critical communications. QoS is affected by aggregate bandwidth, and only multi-radio solutions dedicate radios to specific functions such as user access and Internet connectivity. Ultimately, service providers need to map performance to a particular application and user. On the backhaul side, they may map that application and node to QoS. The increasing popularity of video and other multimedia applications will also push the need for QoS.

Some wireless mesh products focus on the low latency and high performance benefits of layer 2. Others implement layer 3 routing, which utilizes large-scale routing techniques for routing updates to re-converge networks around unavailable paths. In contrast, today's scalable multi-radio wireless mesh network products make "instant" routing decisions at the nodes nearest the user to ensure the best-quality transmission and no downtime. Other significant improvements include instant roaming hand off, optimization features, and the ability to select the best path to the wired node regardless of network topology or size.

Public safety / public access

Single-radio wireless mesh networks compromise the security of municipal public safety networks, which share air space with public access networks. Municipalities and carriers must work together to define what a public safety network is and how it should work. For example, must an emergency technician obtain clearance before sending information about a patient in an ambulance to a hospital? Yet if too much time is spent qualifying the public service network, it may become too expensive to implement.

The 4.9 GHz band for public safety networks solves some of the problem of shared air space. However, with few 4.9 GHz devices on the market, many municipalities will continue to run their public safety networks on the 802.11 a/b/g bands. This will begin to change in 2006, as more 4.9 GHz devices become available. Also, public safety applications will become more reliable and flexible, and modular, multi-radio mesh networks will enable municipalities to create separate public safety networks simply by adding 4.9 GHz radios to existing nodes.

Adaptable and resilient mesh networking

The developments discussed here represent only a fraction of the changes affecting the evolving metropolitan wireless mesh network space. It is clear, however, that platforms must have the adaptability and resiliency to grow and change as new technologies and new services become available.