TROPOS networks
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March 9, 2006

The Honorable Nancy J. Victory
Chair of the Independent Panel Reviewing the
Impact of Hurricane Katrina on Communications Networks
c/o Federal Communications Commission
Washington, D.C. 20554

Dear Chairwoman Victory:

On behalf of Tropos Networks, thank you for the opportunity to make a presentation at the Committee's field hearing in Jackson, Mississippi on March 6, 2006. This letter supplements the oral presentation of Mr. Ben Moebes of Tropos Networks.

As reflected in the comments of Committee members and participants at the hearing, the need for affordable diverse and resilient networks, capable of expeditious recovery, and able to deliver the myriad of applications is critical. This need has placed wireless mesh technology in a pivotal position for emergency response communications. Wireless mesh embraces the universal standard built around the non-proprietary 802.11 protocols allowing laptops, PDAs, VOIP phones and other devices, to be left to the discretion of the user. Combined with its ease of deployment, the technology presents innate flexibility and affordability while promoting interoperability across networks and devices. Tropos urges that the Committee's recommendations embrace the tangible benefits wireless mesh networks have in providing the redundant and diverse networks crucial to in emergency environment.

Mesh Networks in a Disaster Environment

Prior to Hurricane Katrina, Wi-Fi mesh technology was in place in New Orleans. 80% of the capacity was devoted to delivering surveillance and 20% devoted to voice communications. These wireless mesh routers serving survived Katrina. In the hurricane's aftermath the technology demonstrated a most robust communications system—one that will stay up the longest when a catastrophic event occurs and can be restored first to aid rescue efforts. Working with computer chip and equipment manufacturers, an Internet backbone provider, a provider of proprietary 5 GHz equipment, and a satellite provider, Tropos mesh technology was deployed in 22 locations in the Gulf region in a matter of days at costs (borne by these companies), of less than $100,000 for each deployment.

Mesh technology delivered tangible service in an environment where the critical infrastructure supporting wireline and wireless communications had collapsed. At sites in downtown New Orleans, Louis Armstrong Airport and the Chalmette Refinery, for example, 80% of capacity use was devoted to voice and 20% to data transmission. The technology was also deployed in other areas of Louisiana and Texas. Wi-Fi networks provided critical communications capability to emergency services, assisting agencies and those evacuated. The ease and speed by which these networks were deployed reflects the vibrancy and innovation of the technology. The response and recovery resulted from the combined efforts of government agencies, incumbent wireline and wireless companies, legacy radio and computer equipment manufacturers, and new entrant manufacturers and service providers. It reflects the dedication of government and industry and the willingness to choose innovation over the status quo. A schematic setting forth how the network operated is attached.

Detailed below is a description of the evolution of wireless mesh technologies to a facilities based provider and how today the technology is providing affordable broadband services to a range of sectors, the most significant of which are first responders.

Wireless Mesh Technology

At the center of mesh technology is the ability to transmit information, at high speeds and high service standards, through the most efficient route to its destination. Mesh technologies emerged in the late 1970s from the military, which had used it for interconnected communications from mobile point A to point B on a field of engagement. The technology was focused on ad hoc, peer to peer networks and used proprietary end user devices. The routing protocols were premised on communicating between mobile points, rather than accessing a wired network such as the Internet and therefore emphasized reducing if not eliminating the number of hops a communication would take across the network to its destination.

It is in the routing protocols where enormous efficiencies and capabilities have evolved to deliver wireless broadband. These advances have eliminated the excessive routing overhead and signal degradation associated with multiple hops, making possible much larger metro scale networks. It is the ability of the information to be transmitted over multiple hops that optimizes the data path between the wireless client device and the wireline servers. Because of the speed and quality of transmission between hops, an enormous broadband cost factor is eliminated - the need to connect each router point to the wired network. Instead, the information is transmitted across the wireless routers to the wireline connection. In a Tropos system, approximately 10-20% of the routers are connected to wireline backhaul.

A critical strength of the Tropos software is dynamically identifying the most efficient path from router to router across multiple hops to achieve the highest throughput between the user's device and the wired backhaul connection. The routing protocol adapts based on changing interference or fading conditions or when new backhaul is added to expand coverage. In contrast to wireline networks, the technology encompasses

a built in resiliency against link and node outages and ensures that there is no system-level point of failure.

The range of wireless mesh broadband applications currently being used by public safety agencies include video, photographs, VOIP, Internet access, secured data base access, surveillance, report transmission and monitoring. The technology delivers symmetrical service up to 10-15 MBs of concurrent subscriber capacity per square mile, with speeds up to 54 Mbps. In a typical public safety environment there are 20-25 fixed routers per square mile, or approximately 10 routers per square mile in a thin mesh system using mobile routers, with the costs per square mile in the range of $100,000 or less.

Deployment

Contributing to the significant cost savings of wireless mesh networks is the ease of construction and build out. This is a critical element in constructing resilient, diverse and economical networks. Each router of the mesh network is the size of a breadbox and is attached to a lamppost, telephone pole or other fixture with a power source. There are no large towers. There are no zoning ordinance or variance approvals required. No specialized skills are needed; installation can be completed in 15 minutes per pole. There are no multiple truck rolls needed once installation is completed. Back up power supply, whether through battery or solar panels, can be affixed at the time of installation or later. The equipment is designed and built for environmental extremes. If the network expands or is altered, there is no need to return to adjust the routers already in place. Expeditious and straightforward construction, combined with the lack of wireline connection to each router presents not only enormous cost savings over wireline and licensed wireless alternatives but a deployment timeframe conducive to recovery circumstances.

Deployment efficiencies also emanate from the non-proprietary character of the technology. Designed and built around the 802.11 Wi-Fi standard, an agency is able to select the laptop, PDA device, VOIP phone or other device, virtually all of which are now manufactured to the standard, contributing further to affordability and ease by which it can be installed and made operational.

Moreover, the base of 802.11 Wi-Fi equipment now in service in the public safety sector and broader commercial markets stems from a competitive environment among broadband providers, including incumbents. The investment base in the 802.11 standard and supporting devices is enormous; currently 802.11 radios are a 100^{+} million unit per year market. That agencies are protected against obsolescence is reflected by the backward integration of improvements in 802.11 technology. In five years, a backwardly compatible 802.11g chip offers about 25x the performance at about 1/20th of the price from first generation radios. These low price points are leading to increased market opportunities, lower prices and more services.

Expeditious Restoration of Communications Capability

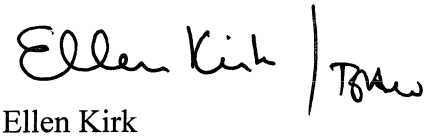
The great challenge to public safety communications is that it operates in an environment of scarce spectrum resources yet demands diverse and redundant networks with the ability to communicate across agencies, networks and devices. Expeditiously dispatching the proper resources and expertise depends on quality wireless communications among agencies. Because spectrum is so valuable, it also must be used for daily operations. Added to the challenge is the catastrophic event, such as Hurricane Katrina, that destroys the infrastructure, where the priority turns to restoring capability immediately. Proprietary networks and devices run counter to fulfilling these demands and propound the silo effect of current networks. The image of stockpiling radios and distributing them at an event defies the reality that more is possible.

Hurricane Katrina's aftermath showed that a functioning broadband communications system can be deployed from scratch in just a few days. The infrastructure consisting of wireless mesh routers, laptop computers, VOIP and satellite phones, 5 GHz licensed spectrum and 2.4 GHz unlicensed spectrum and a wireline connection provided real time access to the Internet, voice and data communications to public safety, assisting agencies and victims. The fundamental underlying this capability is the open standards radio technology reflected by Wi-Fi. It should be the underpinning of large and small scale communications needs. The lack of need for proprietary devices and the flexible deployment capability of wireless mesh delivering the range of broadband applications provide agencies expeditious and effective communications capability.

Summary

The Committee's deliberations have rightfully focused on maintaining and restoring communications capability in the range of emergencies. Ensuring that there is no single point of failure, that back up power can be readily accessed, that infrastructure is resilient, and that connecting to other networks and devices can be gracefully accomplished have emerged as fundamentals. Mesh networks represent these attributes. Tropos urges the Committee, in its recommendations to the Commission, to embrace mesh networks as a vital part of emergency response and recovery.

Respectfully submitted,



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