

MetroFi

Executive Summary

MetroFi, a privately-held Silicon Valley firm, designs, builds, and operates community-area networks which provide low-cost broadband wireless access on a metropolitan-wide basis. To meet its challenging demands for performance, scalability, reliability, and affordability, MetroFi partnered with SkyPilot Networks. The successful deployments, with some 300 nodes operating over a 15-square mile area that passes 30,000 households, now serves as a model for future deployments by MetroFi in major cities throughout the U.S. and abroad.

Metropolitan-Area Broadband Wireless Access for the Price of Dial-up

SkyPilot Networks enables MetroFi to deliver affordable high-speed Internet access throughout Silicon Valley communities

MetroFi (www.metrofi.com), a wireless broadband service provider that designs, builds and operates community-area Wi-Fi networks, is delivering on the long-standing promise of affordable and reliable wireless Internet access. For a scant \$19.95 per month or less, residents of Cupertino and Santa Clara, California can now get broadband wireless access at 1 Mbps downstream and 256 kbps upstream rates. That's the same price as many 56K dial-up services and a lot less if you include the cost of an extra phone line. That's also the equivalent performance of some digital subscriber line (DSL) services for about half the price. How does MetroFi do it?

A Holistic Approach

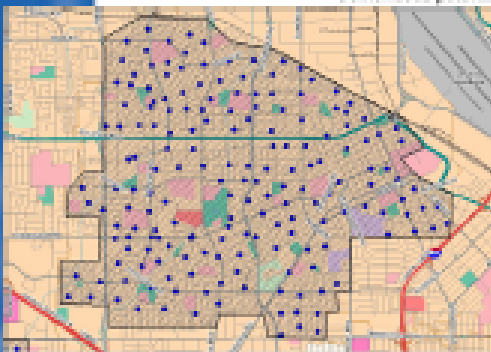
MetroFi's founders have extensive experience in building carrier-class DSL networks and believe that a similar approach is required to make wireless access competitive. "We know that the only way to design an optimal, carrier-class broadband wireless access network is to make it holistic—on a community-wide basis—from the very outset" commented Chuck Haas, MetroFi's co-founder and CEO. MetroFi also knows that the endeavor would require the cooperation of local governments. "Elected officials are beginning to understand the tremendous potential ubiquitous wireless access offers their communities," Haas noted.

"Wireless communications for public safety is clearly a consideration, of course. But with the Internet now so much a part of everyday life, there is also a desire to give everyone in the city more affordable options for broadband access."

Picocells for Peak Performance

To achieve high performance with standards-based (IEEE 802.11b/g) Wi-Fi access, MetroFi wanted access points deployed with a density of 20-25 cells per square mile. This spacing of picocells yields a superior level of performance over traditional wireless deployments. The relatively close spacing also achieves the objective of providing community-wide coverage while scaling to support large numbers of subscribers.

Now came the hard part for MetroFi: finding a broadband wireless access solution that could satisfy the application's demanding



requirements. To evaluate available offerings, MetroFi established five criteria encompassing performance, high availability, end-to-end security, low total cost of ownership, and ease of deployment and operation. MetroFi would consider any solution that met all five criteria to be sufficiently carrier-class to proceed with a deployment.

SkyPilot Networks: Purpose-built for Speed and Scale



After an extensive evaluation, MetroFi found only one solution able to fully satisfy all five criteria: SkyPilot's carrier-class broadband wireless system. The SkyPilot system consists of four purpose-built nodes. The SkyGateway is a base station that serves as the interface to the Internet. The SkyExtender is a mesh backhaul node that extends the reach of the base station, and can also perform double-duty as customer premises equipment (CPE) for subscriber access. The SkyExtender DualBand integrates a mesh backhaul node with a Wi-Fi access point.

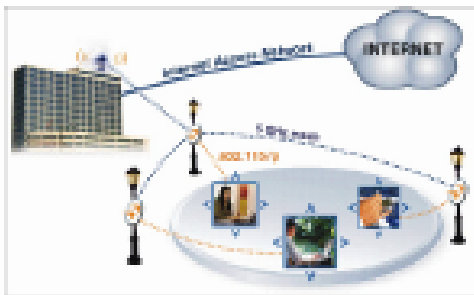
Three aspects of SkyPilot's design particularly appealed to MetroFi. The first is the use of different radio frequencies for access and backhaul. According to Haas, "separating these two distinct tasks – building fully-meshed node-to-node links and providing client access – on two distinct frequencies is absolutely essential to minimizing interference and maximizing performance. Anything less is destined to fail as the network scales."

The second feature is an intelligent, high-power eight-antenna array that employs orthogonal frequency-division multiplexing (OFDM). The use of an array mitigates interference and substantially enhances network scalability and flexibility by allowing each node to communicate in a directional, sectorized fashion. This also allows the network itself to form a scalable and self-healing mesh topology. "Directionality in a mesh topology is the best way to overcome line-of-sight obstructions, minimize the effects of interference, and deliver peak performance," Haas noted.

Third is the use of a synchronous protocol to further minimize interference and, thereby, further increase the overall throughput. SkyPilot's Synchronous Mesh Protocol (SMP), together with the dual radios and directional antenna array, maximize the potential for spectral reuse and spatial segmentation throughout the network. "Large, densely-populated metropolitan areas could not be covered adequately without such provisions," Haas added.

A Model for Success

Headquartered in Silicon Valley's Mountain View, California, MetroFi decided to undertake this project right in its own back yard—in the neighboring communities of Cupertino and Santa Clara. Given the many benefits for the residents in each community, Haas was not surprised to get the full cooperation of government agencies in both cities.



Now, equipped with both a solution and permission to proceed, MetroFi was ready to deploy the network. To keep prices affordable for subscribers, cost-effective deployment and operation is critically important to MetroFi. "Our philosophy is that we want to design, build, and operate the network, not engineer it," emphasized Haas. "In other words, we want the deployment to be based on simple network planning and not on complex radio frequency planning."

In a relatively short period of time, MetroFi built out a wireless network of some 300 nodes extending over 15 square miles throughout the residential neighborhoods of Cupertino and Santa Clara. With the network now fully operational, MetroFi has been able to leverage additional features of the SkyPilot solution. Fast packet processing keeps latency below MetroFi's aggressive goal of 60 milliseconds.

Quick Facts

- The MetroFi High Speed Internet access service is available today for \$19.95 per month – or less – for most residents in Cupertino and Santa Clara, California. The service delivers performance equivalent to DSL, for the price of dial-up.
- Providing low-cost broadband wireless access on a large scale demands carrier-class equipment with advanced capabilities. After an exhaustive search, MetroFi selected SkyPilot Networks as its partner.
- Although MetroFi's initial service offering is broadband Internet access, current plans to support public safety, video surveillance and voice over IP (VoIP) applications placed additional demands on the wireless network.
- The SkyPilot Carrier-Class Broadband Wireless System provides a complete solution by combining standards-based Wi-Fi access with a high-performance, scalable and self-healing mesh backhaul network.
- SkyPilot's intelligent, high-power eight-antenna array readily overcomes line-of-sight obstructions, minimizes the effects of interference and eliminates the need to "engineer" the network based on complex radio frequency (RF) planning.
- The MetroFi business model involves cooperation with local governments. Once deployed, the community-wide network is available on an open access basis for Internet Service Providers and other carriers.

roundtrip across five hops through the mesh. Centralized management gives MetroFi the ability to monitor and control the entire network from a single console. Robust security based on the 128-bit Advanced Encryption Standard (AES) protects both the network infrastructure and the growing number of subscribers. And each subscriber can be added without a costly truck roll based on the ease of installation.

The Sky's the Limit

The residents of Cupertino and Santa Clara now have a choice of a "no-bills" access service, offered directly by MetroFi, value-added services from different Internet Service Providers (ISPs) in open access arrangements with MetroFi, or free Internet access provided at several community Hot Zones.

For SkyPilot, the success of the pilot project was never in doubt. "The SkyPilot system was designed specifically for companies like MetroFi that operate access networks over large geographies," commented Bob Machin, president and CEO of SkyPilot. "The SkyPilot architecture delivers the scalability, reliability, flexibility and affordability needed to make broadband wireless access competitive with DSL, on performance, yet profitable for the carriers."

Based on this initial success, MetroFi is forming plans to expand its footprint throughout the San Francisco Bay Area, and deploy networks in other metropolitan areas both in the U.S. and abroad. MetroFi also expects to utilize Virtual LANs (VLANs) to keep public Internet traffic and private data traffic separate, and various Quality of Service (QoS) features to add public safety, video surveillance, public HotSpot and Voice over IP (VoIP) capabilities to each of its networks.

"With SkyPilot's system, MetroFi is able to offer commercial broadband wireless access for the price of a dial-up service. So there is no doubt we will be equally successful in other communities," Hain concluded. SkyPilot's Machin agrees. "The price-performance of wireless access now leads the industry, which makes the future very exciting for SkyPilot and our partner MetroFi."

