

QuRiNet: Quail Ridge Natural Reserve Wireless Mesh Network

[Extended Abstract]

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ABSTRACT

This extended abstract describes our experiences in the deployment of QuRiNet, a wireless mesh network at the Quail Ridge Natural Reserve. Quail Ridge boasts 2,000 acres of untouched wilderness on a peninsula of Lake Berryessa, California. In deploying a mesh network at Quail Ridge, we seek to assist ecological research in the area by providing a communications infrastructure and also provide a platform for wireless mesh networks research. The network currently comprises of about six nodes and supports three video cameras and a few audio sensors. We plan to deploy five more nodes in the near future, with about twenty nodes being the final goal. This abstract will describe our work in deploying this network and give the reader an overview of our current system and deployment status.

Categories and Subject Descriptors

C.2.1 [Computer-communication Networks]: Network Architecture and Design—*wireless communication*

General Terms

design, experimentation

Keywords

wireless, mesh, testbed

1. INTRODUCTION

This paper will present our efforts in the installment of QuRiNet, a wireless mesh network at the Quail Ridge Natural Reserve. Quail Ridge is used for environmental research by the Department of Ecology at UC Davis. Our work in the reserve will provide wireless coverage over 2,000 acres of hilly terrain in the face of various topological and technological challenges. This network will be utilized for ecological research to study the flora and fauna in the region. The network will mostly support audio and video applications and help in collecting data from the sensors deployed in the reserve. Currently, the network is being utilized for

small projects by the Department of Land, Air and Water Resources and also for some undergraduate courses such as those on using remote networks for ecological research. Additionally, the mesh network will also provide us with an excellent testbed for carrying out further research in this area such as Layer 2 routing, scheduling scheme and new performance monitoring tools. We have currently setup six nodes in the reserve and plan to setup five more in the near future. All the access points are dual radio and utilize multiple channels to achieve higher throughput. The network currently supports three video cameras and few audio sensors that are being used to study the wild life in the area [4].

AP	Status	Neighbor Count	Power Src
fldstn	Active	1	wired
dfghill1	Active	2	solar
dfghill2	Active	4	solar
dkrpnd	Active	1	solar
dandrptr	Active	1	solar
dandpnd	Planned	1	solar
farhill	Active	3	solar
farpnd	Planned	1	solar
fordycerpnr	Planned	2	solar
fordycepnd	Planned	1	solar
dkrbuoy	Planned	1	solar

Table 1: Summary of Access Points

Our testbed at Quail Ridge is different from several existing implementations in terms of both its location and its usage. Unlike most of the current testbeds that are implemented in laboratory environment, our testbed is in a natural wild life reserve, which gives us a better opportunity to understand the nuances of wireless networks, variations in signal strengths, placement of antennas etc. Due to the lack of power supply in the reserve, our access points run entirely on solar power (figure 1), which sets us apart from most testbeds. The area of Quail Ridge is also free from interference and noise from other electronic devices, which enables us to measure more accurate results.

2. SYSTEM SETUP

Currently our Wireless Mesh Network is in its early prototype stage. As shown in Figure 2, we currently have eleven sites planned for mesh network nodes in Quail Ridge, with about twenty sites being the final goal. The sites that are



Figure 1: Decker Pond site at QR

currently deployed include the Field Station, DFG Hill (two nodes), Dan’s Repeater, Decker Pond and Far Hill Repeater. We are in the process of deploying the rest of the network.

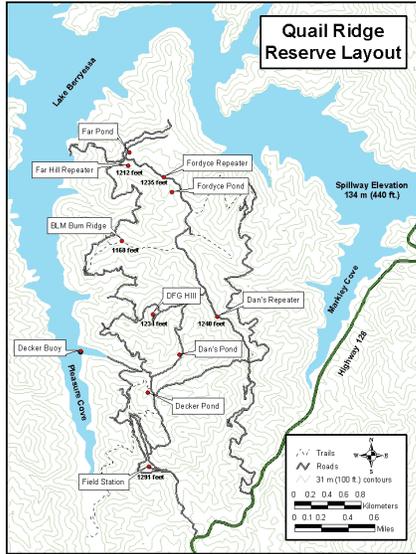


Figure 2: Quail Ridge Reserve Network Site Layout

The logical layout of the access points is shown in figure 3. The numbers next to the links are the 802.11g channels used on that link. This testbed at Quail Ridge was built using the Soekris [1] net4826 embedded devices. They are optimized for wireless communications with dual Mini-PCI Type III sockets. We selected the Ubiquiti Networks SuperRange2 802.11b/g 400mW High Power Atheros Wireless mini-PCI card as the wireless radios for our devices, keeping in mind the distances we must cover and the hilly forest covered terrain of the reserve. These boards are driven by a custom built Linux distribution [2] using a 2.6 Linux Kernel. We use the madwifi-ng driver [3] on our AP due to their level of programmability. The mesh network has been set up using static IP addresses, with the various radios acting as access points or stations. Each Soekris board has two 802.11 b/g radios, but acts as a single node in the network. Linux

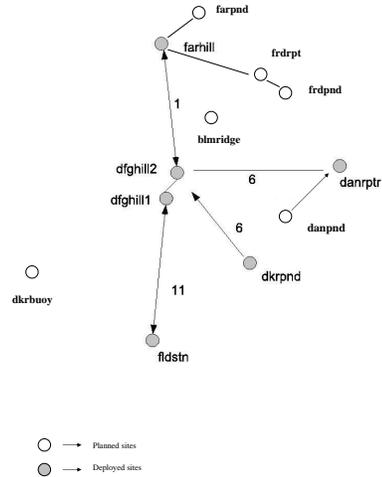


Figure 3: QuaRiNet Logical Connections

Bridging is used to bind the multiple network interfaces to one IP address. Due to the lack of power supply, we have installed solar panels at each site for powering the access points.

3. DEMO OVERVIEW

The network deployed at Quail Ridge is connected to the campus network with a T1 line, and is hence accessible via the internet. As part of the demonstration of our work, we would like to show the current sites that are up and running. We have enabled web-based access [4] of the three cameras currently deployed there and would be demonstrating how these cameras can be used. Apart from the cameras, we will also show the usage of some audio sensors and some weather collection equipment attached to the network. We have the ability to perform real-time measurements on the network and would be demonstrating some performance tests such as throughput and signal strength on various links. We would explain our setup, how the access points communicate with each other, how solar energy is being used to power these access points and other issues faced and various lessons learned in the process.

4. REFERENCES

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