ECE 191 Project – Spring 2009
Development of CogAP 2.0 for Wi-Fi Hotspots

Sponsor: CALIT2

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Introduction

Access points (APs) are specially configured wireless devices that are connected to a wired LAN and act as central transmitter and receiver of radio signals in wireless local area networks (WLANs). The WLAN deployment involves selecting locations for placing APs and (for each AP) selecting operating radio channel (802.11b/g and a based APs have 11 and 13 channels, respectively, to choose from), transmit power (which decides the coverage area of AP), data rate, and medium access control (MAC) layer related parameters such as beacon interval, RTS/CTS threshold, CW parameters, Retry limits, and etc. But, due to dynamic and shared nature of wireless medium (shared with APs in the same WLAN, with APs in other WLANs, and with devices that are not APs at all), parameters controlling the wireless medium on each AP must be monitored frequently and modified in a coordinated fashion to maximize WLAN performance. Manually monitoring the network traffic and determining an optimum configuration for the parameters related to the wireless medium is a task that takes significant time and effort; for this reason, autonomic network control has attracted a lot of attention from the research community.

Autonomic network control can be seen as the automation of the network reconfiguration process carried out by an intelligent centralized network controller without manual interactions for performance enhancement purposes. Centralized cognitive controller system is very expensive for small scale WLAN systems such as wireless hotspots and home networks which typically contain only one AP for providing wireless services to the client nodes. For these wireless network environments, an autonomous AP with cognitive functionality is more appropriate to keep the cost of WLAN infrastructure at minimum.

Project Description

In this project, the ECE 191 students will develop the following capabilities for CogAP 2.0: (a) network traffic prediction and (b) decision making. They will also study the performance of prototype CogAP and the effect of dynamic reconfigurations on over all network performance. The CogAP is expected to be able to predict the evolution of the communication environment for all the channels. Students will make use of artificial neural network or Bayesian graphical network libraries for the prediction purpose. Once

the cognitive AP has an understanding of the dependency between the network status and the performance it needs to take its decisions to select the most desirable network configuration (e.g., best wireless channel). Figure 2 shows the components required for building a prototype CogAP. The central piece of the CogAP is the ALIX 3c3 system board shown in Figure 2 (a). ALIX 3c3 boards have better computing resources, comprised of a 500 MHz processor, compared to CalNodes that are used in the development of UCSD-CogNet testbed, therefore we expect that there are able to provide enough computing resources for realizing autonomous cognitive APs.

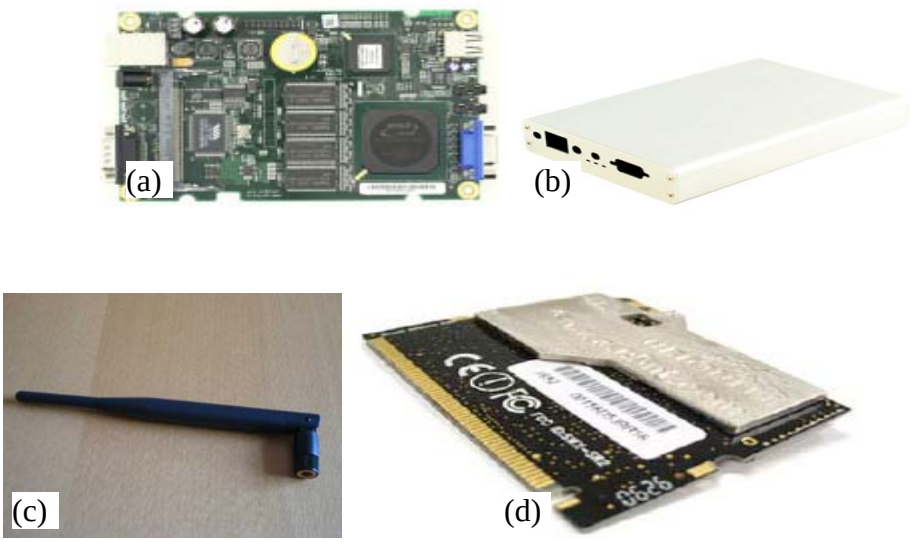

Figure 2. A view of components that will be used to build the CogAP 2.0: (a) Alix 3c3 embedded system board, (b) Enclosure for CogAP 2.0, (c) Omni-directional antenna, (d) Atheros chipset-based 802.11a/b/g wireless interface card.

During this project, the students will understand real protocols and standards used in today's wireless networks, and familiarize with the CalNode platform, MadWiFi driver, and the modified *tcpdump* software (*http://www.cognet.info*). Further they will learn how to build embedded-platform based prototype wireless network devices and developing system software for cognitive wireless network functionality.

Summary: This project focuses on developing an improved version of cognitive AP for Wi-Fi hotspots and home networks. Students participating in this project may get significant exposure to various aspects of Cognitive wireless networking.

Software skills required: C programming skills, Linux scripting skills, and MATLAB

The project will be sponsored by CALIT2.