



# **THE CHINESE UNIVERSITY OF HONG KONG**

Department of Information Engineering

*Seminar*

## **Altai City-wide WiFi Cellular Network Solution**

**by**

**Dr. Bill Wong**

**Chief Technology Officer**

**Altai Technologies Limited**

**Date : 9 February, 2007 (Fri.)**

**Time : 3:00pm – 4:00pm**

**Venue : Rm 833, Ho Sin Hang Engineering Building  
The Chinese University of Hong Kong**

### **Abstract**

There are increasing trends of city-wide wireless broadband network deployment across the globe, most notably in the North America and Asian-Pacific countries. Over 300 cities have already had their city-wide WiFi network and the number keeps growing. Altai, a Hong Kong based company is proud to be one of the WiFi cellular network system suppliers to take part in these metro scale projects.

The flagship product of Altai, A8 WiFi Cellular Base Station is deployed in outdoor environment to provide city-wide WiFi coverage for users to enjoy ubiquitous broadband connection. Equipped with 4 panel antennas (a total of 8 antennas), Altai A8 cellular base station can manipulate the signal that can be beamed on demand, resulting in radio frequency that is clearer and larger coverage than current leading vendors. Hence, Altai A8 cellular base station can blanket the city and country with wireless broadband for much lower CAPEX, and OPEX.

Altai's A8 WiFi cellular base station product has been widely adopted in various regions, including cities in the U.S, Europe, Africa, China and Asia-Pacific countries.

The presentation aims to give the audience an overview of Altai city-wide WiFi network solution and its network architecture. It will also discuss the difference between the WiFi cellular network and other wireless technology.

### **Special Note**

- 1) Students may be interested in this talk and meeting with Dr. Bill Wong because Altai Technologies will be recruiting summer interns as well as sponsoring some FYP projects for year 07-08.
- 2) Professors may be interested in sponsoring FYP proposed by Dr. Bill Wong (see attached FYP projects). Further details of the projects can be ironed out with Dr. Wong's R&D group.
- 3) Morningside recently donated 3 outdoor WiFi APs of Altai to the Department of Information Engineering. These APs will be mounted on the engineering building rooftops for experimental projects.

### **Biography**

Dr. Wong is leading the research & development of city-wide WiFi cellular network with smart antenna technologies at Altai, a spin-off company from Hong Kong Applied Science and Technology Research Institute (ASTRI).

Dr. Wong brings with him a successful track record in wireless startup business from the Silicon Valley. After obtaining his PhD degree from Stanford University in 1997, he co-founded Silicon Telecom, specializing in PACS and PHS smart antenna base station equipment. He was the co-founder and VP of R&D at Adaptive Telecom, developing CDMA and GSM wireless base stations. Adaptive Telecom of less than 20 people then was acquired by a Nasdaq listed company for US\$130M.

**\*\* ALL ARE WELCOME \*\***

Host: Professor Soung C. Liew (Tel: 2609-8352, Email: scliew@ie.cuhk.edu.hk)  
Enquiries: Information Engineering Dept., CUHK (Tel.: 2609-8385)

## **Proposed Final Year Projects to the Students of the Chinese University of Hong Kong**

Altai Technologies would like to invite final year students to work on their final year projects as proposed below. The projects are targeting for students majoring in Information Engineering or related discipline (Project 1A, 1B, 2, 3, 4) and majoring in Economics/Business or related discipline (Project 5). In the project period, Altai Technologies will collaborate with the faculty members to provide consultation support to the students.

### **Company Profile**

Altai Technologies is a high technology company focused in design, development, and marketing of innovative wireless broadband solution. We are targeting a WiFi based radio access network system to provide the most cost-effective wireless broadband solution for city-wide WiFi deployment. Our current flag ship product is the A8 smart antenna based extended range WiFi base station. We also provide an A0 product to facilitate wireless backhaul deployment. In order to manage all these elements, we have developed a scalable Altai wireless management system (AWMS) to provide the needed provisioning and fault management functionality.

We have a strong management team that has in-depth experience from major communication service providers and equipment suppliers. Our technologists' capabilities span the whole spectrum of RF systems and networking. Our business leadership has years of marketing and sales expertise in Fortune 500 global organizations.

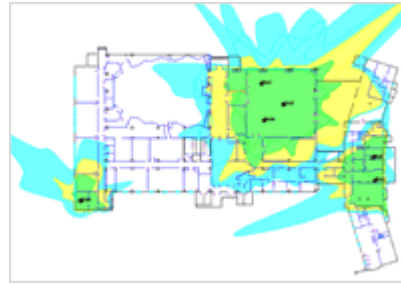
In addition to the strong in-house technical team, Altai is collaborating with Hong Kong Applied Science and Technology Research Institute (ASTRI) in innovative wireless broadband technology. ASTRI has the full financial support from the Hong Kong Special Administrative Region Government, and is governed by a Board of Directors comprising key representatives from the industry, as well as members from the academia and the Government.

### **Project 1A: Channel Prediction Application Development**

Channel modeling and prediction are always critical to deployment for all kind of wireless network. This project aims to build an algorithm model and software engine to predict channel propagation scenario under a given environment ranged from indoor office structure to outdoor urban area. This helps engineers to decide the possible deployment site, power setting and orientation setting for various network including 3G, WiMax and WiFi. In addition, the model

may include:

- Antenna pattern modeling
- Material modeling
- Path loss model
- Absorption/Reflection/diffraction modeling



### **Project 1B: Channel Measurement Toolset**

This project aims to build a toolset which can assist engineer to perform site survey and channel measurement over a given indoor/outdoor environment. The toolset should include a handheld location aware (via map/GPS) measurement tool and a statistics collection server with user-friendly GUI. This project would carry out closely with Project 1A and develop correction algorithm with the aim of enhancing channel prediction accuracy with real measurement. The measurement tools used in this project would be based on widely adopted wireless standard, WiFi.

### **Project 2: WiMax Simulation Platform Development**

This project aims to build a software simulation platform for WiMax standard based on NS/2 network simulation software. The platform should focus on building a complete WiMax medium access layer structure with sufficient physical layer modeling in order to perform simulation under various network deployment scenarios and environment. After the platform is built, students would continue investigate a range of WiMax specified advance algorithm including admission control, dynamic bandwidth assignment, packet scheduling, etc

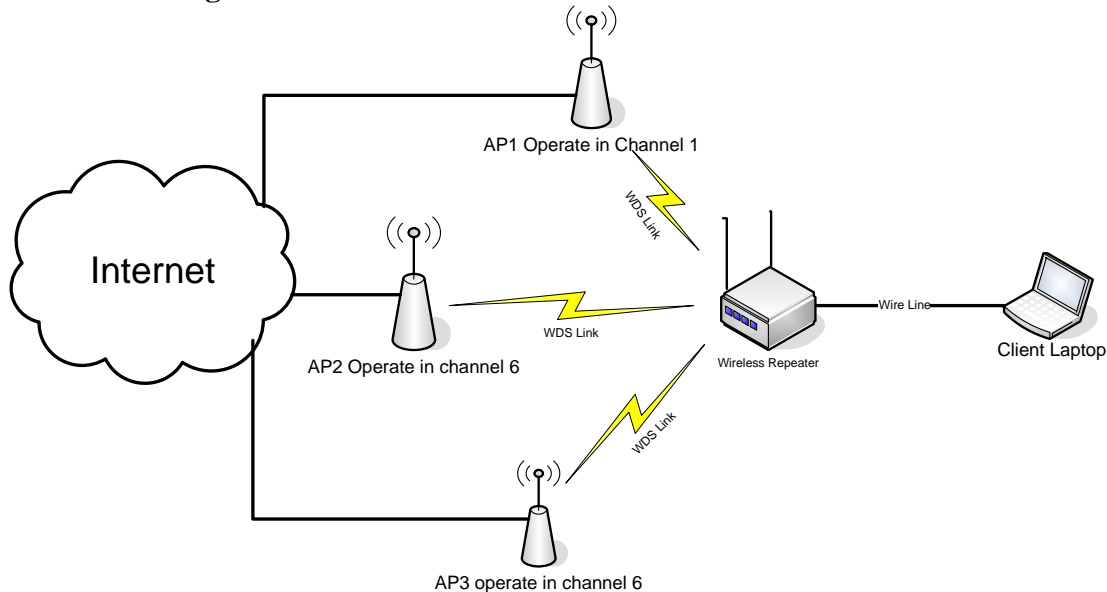
### **Project 3: Traffic Shaping Technique Investigation on WiFi**

This project aims to investigate the effect of various traffic usage patterns (web browsing, voice traffic, video streaming, etc) on WiFi network. Students would be given chance to observe and monitor real-time traffic in a live network and discover the most common traffic pattern. Based on the observed traffic pattern, students would develop advance

algorithm to enhance different aspects (throughput, latency, packet loss rate, etc) under the WiFi standards. In addition, WiFi development platform would be provided for student to carry out algorithm development and real-life experiment.

## **Project 4: Embedded Software Development of Smart Wireless Repeater**

### **1 Network Diagram**



Above is the conceptual network architecture diagram of the project. The client laptop uses a wireless repeater connecting to a remote AP to access the internet. There are multiple APs operate in different channels or in same channel. The wireless repeater uses smart algorithm to select the best AP to connect.

### **2 Requirements**

Wireless Repeater side:

- Maintain a AP candidates list based on multiple criteria like received signal strength, connectivity etc.
- In foreground, always connects to a AP by using WDS link, in back ground talk to the other AP in its idle time to maintain the connectable AP list
- When the current connected AP has been shut down or has significant signal drop, the repeater will switch to the current best AP immediately within 5 seconds as long as there are APs available

AP side:

- The APs will share the client authentication information between them to support the fast hand-off of clients
- Maintain a handshake mechanism to authenticate the other APs and Repeaters.

### **3. Resources**



#### **Altai Technologies Limited**

The concept proof implementation is built in Linux, the Linksys wrt54G can be used as the hardware platform to build the APs and repeater mentioned in the above diagram. Reference code for Linksys wrt54G can be got from Linksys website under GPL license.

Two students are required to finish the project in one year.

#### **4. Purposes**

This project can help the students to gain the basic development knowledge and skills as an embedded wireless firmware developer.

1. The skills to debug the embedded software by console and JTAG interface
2. The deep understanding of WiFi protocol
3. Team work
4. Good programming habits

#### **5. Delivery**

After the project, the following items will be checked

1. Requirements document
2. System Architecture document
3. System Design document
4. Unit test cases document
5. Test result document
6. A real demo in the situation of remote AP failure and client move

#### **Project 5: Economic Analysis of City-wide WiFi network in Hong Kong**

(for students majoring in Economics/Business or related discipline)

There are increasing trends of deploying city-wide WiFi network overseas, including the US cities, Taipei City in Taiwan and Singapore, etc. The project aims at conducting a feasibility study of deploying city-wide WiFi network in Hong Kong and evaluating any economic benefits to the City. The scope of work will include detailed financial, operational, and technical analysis of this infrastructure investment in Hong Kong.

The structured project approach may include but not limit to the following:

- What are the business models and service offerings of city-wide WiFi network overseas?
- What is the regulatory environment of outdoor public WiFi services in Hong Kong compared with overseas?
- What are the key market drivers and business opportunities & impacts for different stakeholders in Hong Kong? (e.g. Government, service providers/network operators, commercial sector, tourism industry, citizens)
- What are the key elements and applications of city-wide WiFi network?
- What would be the viable public/private partnership arrangement and return on investment for building out and operating this city-wide network?