

SUCCESS STORY: *Wifi Citywide with Mesh Deployment for Metro Manila, Philippines - Part 1*

The City of Makati is one of the cities and municipalities that make up Metro Manila, the greater metropolitan area of the national capital of the Philippines. It is the major financial, commercial and economical hub in the Philippines, often referred to as the financial capital of the Philippines since many global companies have their offices and headquarters in the city. Makati is also home to the influential Makati Business Club and the Philippine Stock Exchange. Ayala Avenue, running through the heart of the Central Business District is often called the Wall Street of the Philippines.



Wi-Air (www.wi-air.asia) and VIO (www.vio.com.ph) are carriers of Metro Manila that plan to deploy wifi citywide for Makati and adjacent cities for wireless services. They team up with WiBorne for pilot field installation from August, 2008.



Site specific criteria are:

- Range: 5 X 5 KM with highly dense population
- At least existing 40 high raise buildings with fiber optics connection for backhails
- Broadcast with voice/video/data. Supported end devices such as laptops, wifi phones, hand hold.
- Fixed/Nomadic/Mobile roaming services



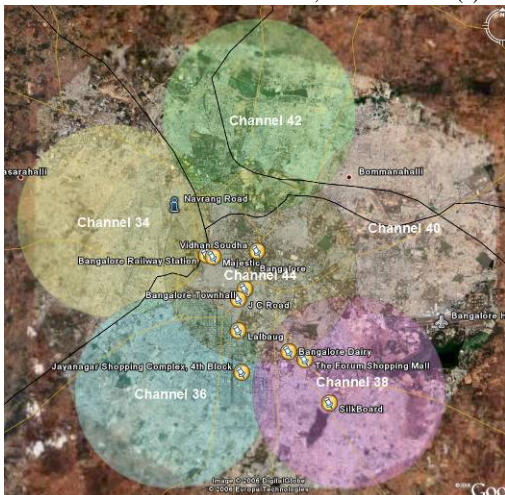
- 802.11 b/g broadcast for point to multiple points
- Backhaul with TripBox SIP server
- Non Line-of-Sight (NLoS), need mesh deployment for base stations without backhaul
- Heavy interference
- EIRP: 250mW without antenna, or 1W as max.
- Initial target subscribers as 2,500 users, up to maximum as 50,000 users
- Pre-paid card services with hotzone controllers, media access control
- Other profitable wifi applications (video surveillance, automatic meter reading, RFID security tracking, Real-time Location System RTLS, garbage container tracking, etc.

Design Consideration

Wireless LAN technology is expanding rapidly in the commercial sector with the introduction of products that will allow enterprise customers to build a secure, reliable wireless infrastructure for metro area such as Makati City, Metro Manila. Design for such wireless infrastructure should provide a comprehensive consideration of the products, technologies, and design techniques that are used in enterprise wireless LANs. The full range of wireless LAN applications need to be covered along with practical descriptions of capacities, access protocols, radio issues, design and management tools. It should provide a solid foundation in radio and a detailed understanding of the products and technologies that will be used to build and maintain WLAN voice and data networks.

Cell Layout

- A micro cell topology is applied for coverage areas:
- Each cell (or block) is ranged in few hundred meters, depends on terrain and range of end devices.
 - Each Cell has at least one tower / base station, and corresponding CPEs.
 - Height of tower can be on roof of buildings equipped with fiber, depends on coverage range.
 - Mesh node(s) for NLoS or backhaul is required
 - Each cell serves hundreds of concurrent users, which is dependent on types of equipments / budget.
 - Backhaul of cells can be fiber, or mesh node(s).

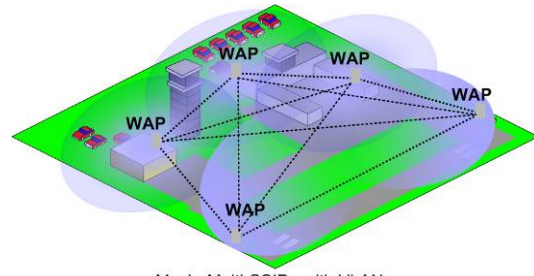


Wi-Fi Mesh Architectures

Mesh deployment would be applied for areas that are NLoS, interference, or place that is lack of backhaul internet. Detailed discussion of mesh deployment can be found from www.wiborne.com/techpubs/Mesh_deployment_with_WAP.pdf. We plan to apply Layer 2 mesh network protocol IEEE 802.11s draft standard, this is to ensure loop-free optimal routing.

Layout and Coverage

A typical layout for dense area such as Makati City could be similar with following diagram. The WAP is either single or dual radio. Single radio AP (e.g., WAP-192 or WAP-520), has existing backhaul connected with for internet, while dual or multiple radio AP (WAP-520) can act as mesh for NLoS, or locations that are lack of backhaul.



Proper Equipments

Here we describe possible radio / boards for deployment of this project.

Antennas:

- Broadcast: 10 to 14 dBi sectors or 6 to 8 dBi omni
- Backhaul for mesh deployment: 6 to 8 dBi omni antennas
- Consideration of using downtilt 8 dBi omni antennas.

WAP-520: Multiple radio mesh AP

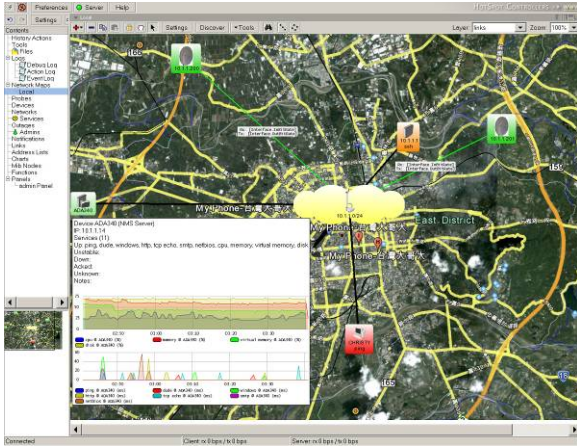
- High concurrent subscribers, up to 60 for single radio
- High bandwidth, can be up to 150Mbps with dual radio for P2P
- Very long range, to 100KM or more, dependent on terrain
- Layer 2 Mesh node for up to 20 hops
- Channel width (5/10/20/40 MHz), or proprietary protocols with free license bands to reduce interference
- Support variety of miniPCI modules for low cost or best quality radio, dependent on requirement.

Network Management Systems (NMS)

The Network Management System (NMS) should provide a single point of administration to control the entire network. This means that administrator seats in a sole control room then he/she can administrate and monitors whole nodes in network.

Thus we offer [NMS-2000](#) or [HSG-1000](#) that can manage whole network from one control location without visiting individual radio node for maintenance

The [NMS-2000](#) network monitoring & management utilities, is a network monitor which can dramatically improve the way you manage your network environment. It will automatically



Ortigas City: Triangular Area Testbed

Test Bed

3 APs were installed on top floor of following three buildings as triangular area:

- CAEG Building, 24 floors (CAEG, or JMT)
- Philippine Stock Exchange, 35 floors (PSE)
- PBCom Tower, 57 floors (PBC). This is the tallest building in Philippines.

Equipments Installed

- WAP-520 with dual radio, 800mW b/g as maximum power
- 6-9 dBi omni antennas
- 14-18 dBi sector antennas
- Discone antenna for straight down coverage

Test Objectives

- Mesh with backhaul for internet service
- Ground coverage with regular laptop, gadgets (PDA, WiFi phone)
- NLoS
- Latency
- Internet access for audio, video, and data
- Interference with Dynamic Frequency Selection (DFS), or Auto Channel
- Stable link between gadget and WAP
- Bandwidth



Photo taken from top floor of CAEG BLDG (JMT)



Photo taken from top floor of PBCom

Test Result

- Mesh with backhaul for internet service: we have gain very successful backhaul link from internet by Layer 2 (802.11s) mesh algorithm
- Ground coverage with regular laptop, gadgets (PDA, WiFi phone): laptop with built in 50mW wifi card, can access audio/video/data from internet with acceptable quality. Further range beyond 200 meters, we would need to use high power wifi USB dongle to access data. PDA (35mW) shows similar performance.
- NLoS: Nearly 100% we can claim that as long you can view the antenna (LoS) then gadgets / laptop would be able to sense good signal from transmitter. We would need to install more transmitters for area of NLoS. Strong signal or high gain sector do not improve to solve NLoS.
- Latency: we have pretty impressive result for ping time –
 - o From backhaul (Netgear router): **4-6ms**. This produced superior quality for voice data
 - o From www.yahoo.com: 150-200ms. Yahoo.com is located in the States.
- Internet access for audio, video, and data: testers can listen music and video clearly.
- Interference with Dynamic Frequency Selection (DFS), or Auto Channel: we have use DFS that reduces

interference dramatically. DFS with radar detection would be tested on next run

- Stable link between gadget and WAP: with either built in wifi radio or high power USB dongle, we have experienced stable link for laptop / PDA users.
- Bandwidth: about 200Kbps that we tested one time by using internet bandwidth test site. Dependent on where the site located, other bandwidth test sites may produce better or worse result. The backhaul bandwidth is less than 1Mbps.

With successful deployment of above triangular area, we will have fully deployment for surrounding cities for rest of this year and early next year.

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Sept. 10, 2008