

Wireless Perak – State Wide WiFi Deployment

Introduction

The Wireless Perak Project was initiated by the Perak State Government as one of its main thrust in realizing the KPerak 2010 ICT Strategic blueprint. The main objective of the project is to provide wireless facilities in urban and rural areas to where the demand for ICT broadband connectivity is required and to provide equal access to ICT for the community in Perak. This is in line with Perak's aspiration of providing a fully connected and wireless K-Environment which would dramatically improve communication, exchange of information and further strengthens and creates a powerful tool for new economic and social networks. The Wireless Perak deployment is to provide a cost-effective WiFi network solution which can provide internet coverage for households in sizeable towns and cities in the state of Perak in order to bridge the "Digital Gap" between age groups and socio-economic sub groups and open up economic possibilities for its citizens. The Red Snapper (M) Sdn Bhd, of which the Perak SEDC has a 40% equity stake, is entrusted to accomplish the realization of the project.

The intended coverage is on all the streets and residential areas of targeted towns and area so there is potential for internet access inside homes. Owners of key commercial and government buildings/infrastructure will be asked to donate space, cost of base station installations and other facilities as able, to the project. In order to provide indoor coverage for the people within the housing area, they will require a CPE (customer premise equipment) to detect the signals for accessing the internet.

Of all the deployments in Perak, the highest concentration of base station (BTS) deployment is in the city of Ipoh where based on the design considerations, there are 25 units of base stations covering the whole Ipoh city with a total area of 12.5 sq km and one unit is capable covering 0.5 sq km.

Demographics in Ipoh

A WiFi Micro Cellular System was deployed in Ipoh at Kinta district. It is an **extended range** BTS which one BTS can provide up to 500m range. This has resulted in a 9X increase in coverage of one BTS compared to most earlier generation Mesh BTS. This makes the micro-cellular architecture most suitable for the city of Ipoh. According to the Perak State Government, the city has a total area of 1958 km². From the statistics of the Perak District Administration for the year 2005, there were 800,100 people and 118,814 households. The population density was 408.6 per square km.

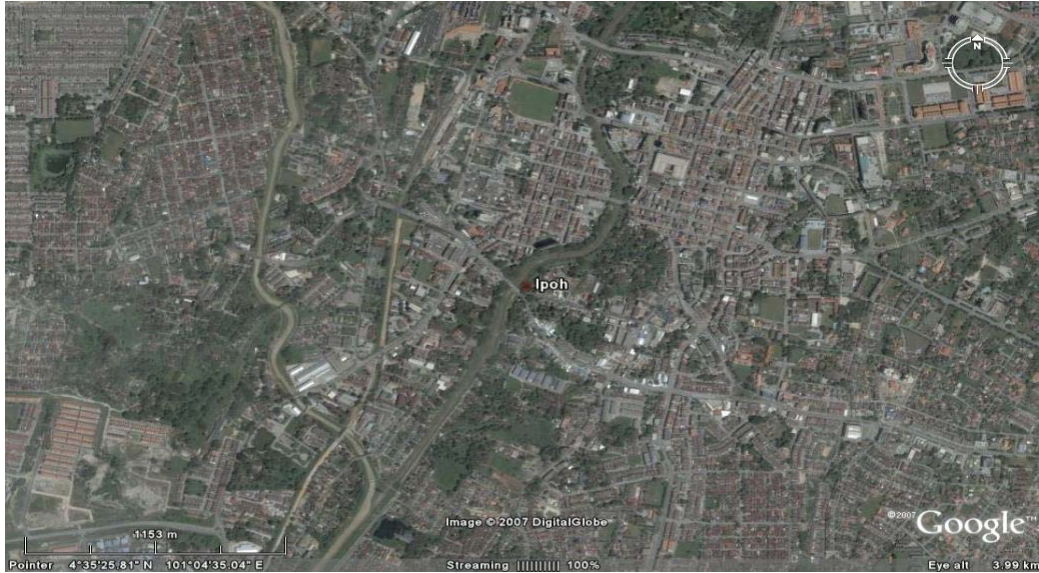


Figure 1: City of Ipoh

Radio Access Network Architecture



Figure 2: Wireless Coverage of Wireless Ipoh

The figure below shows the current deployment in Ipoh city. Eighteen radio sites have covered approximately 75% of the residential area. Photos in site 1 and 2 were taken and shown.

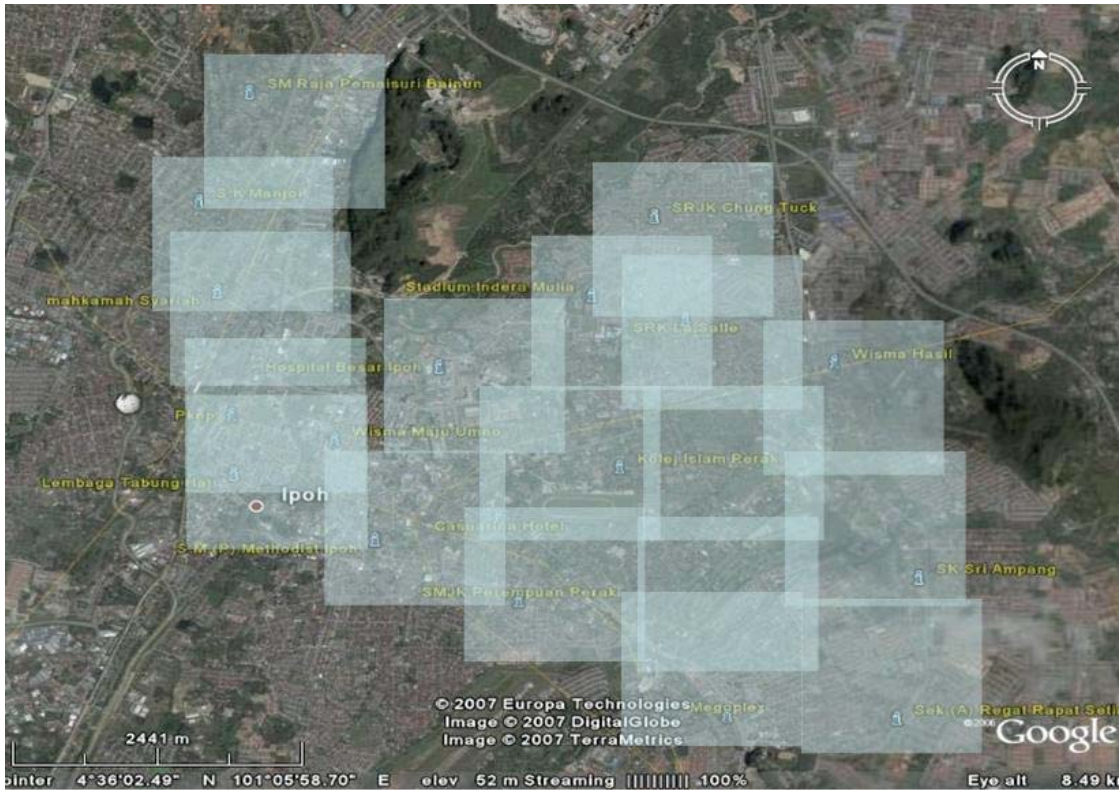


Figure 3: Currently Deployed Areas



Figure 4: Deployment sites at Ipoh

The sites acquired for locating the Base Stations include:

1. The Schools in the City
2. Public buildings
3. Local Hotels
4. Government Offices
5. Stadium

Backhaul in the area is provided through 802.11a WiFi bridges and the corresponding 802.11a bridge radios inside the BTS. This helps in a very efficient deployment of the network in a hub and spoke architecture. There are a total of 3 Hubs deployed for this network.

All these locations have microwave backhaul in a ring starting from the network provider central station where the backhaul is fiber. These locations are currently operating at 34 mbps but are capable of a maximum of 155 mbps throughput. The microwave backhaul is distributed to the BTS using 802.11a bridges that are connected to the microwave.

The main hub has a total of 6 802.11a A0 bridges currently on a bandwidth of 34 mbps. Each of these bridges is capable of supporting 3 BTS. Hence a total of 15 A8s are backhauled to the main hub. This architecture provides for easy extensibility of the network by connecting 15 BTS to each of the hub sites.

The DHCP, DNS, radius server and billing systems are located in the main hub (Hub1). After authentication, the WiFi users can access the Internet through the backhaul in Hub1. The network configuration diagram is shown below



Figure 5: Distance between the Hubs

The WiFi bridges location are designed to be able to provide a minimum of 10 mbps backhaul throughput. The distance between the WiFi bridges and BTS is kept less than 4 km in order to ensure a link that can provide this throughput. There are plans to expand the network to cover the entire city. This architecture allows for such plans to be successfully implemented.

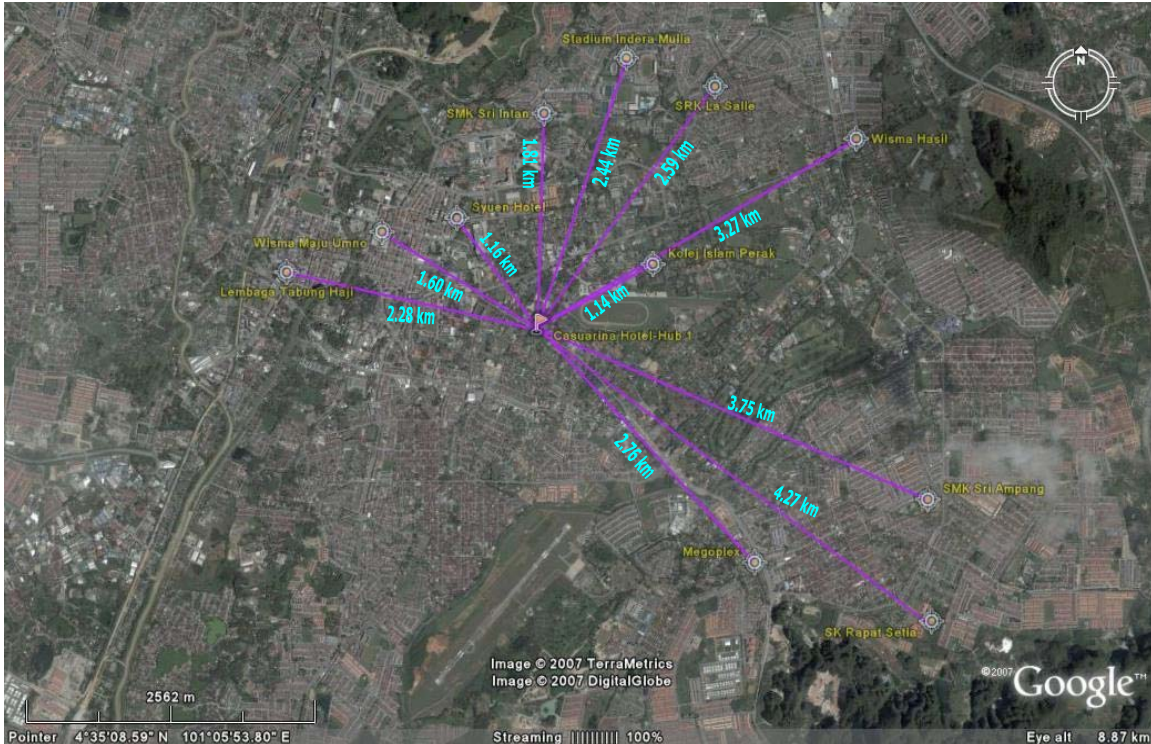


Figure 6: Distance between Hub1 and BTS

Conceptual System Architecture & Deployment

The RF network is deployed with the Base Stations in the field. The backbone of the network is Fiber where available. Fiber is available widely in the deployment area and hence we consider this to be the back bone. Some areas where Fiber is not available, Microwave backhaul are used. For “in city” backhaul, we are using 802.11a WiFi bridges. Hence deployment architecture for RF access will look like:

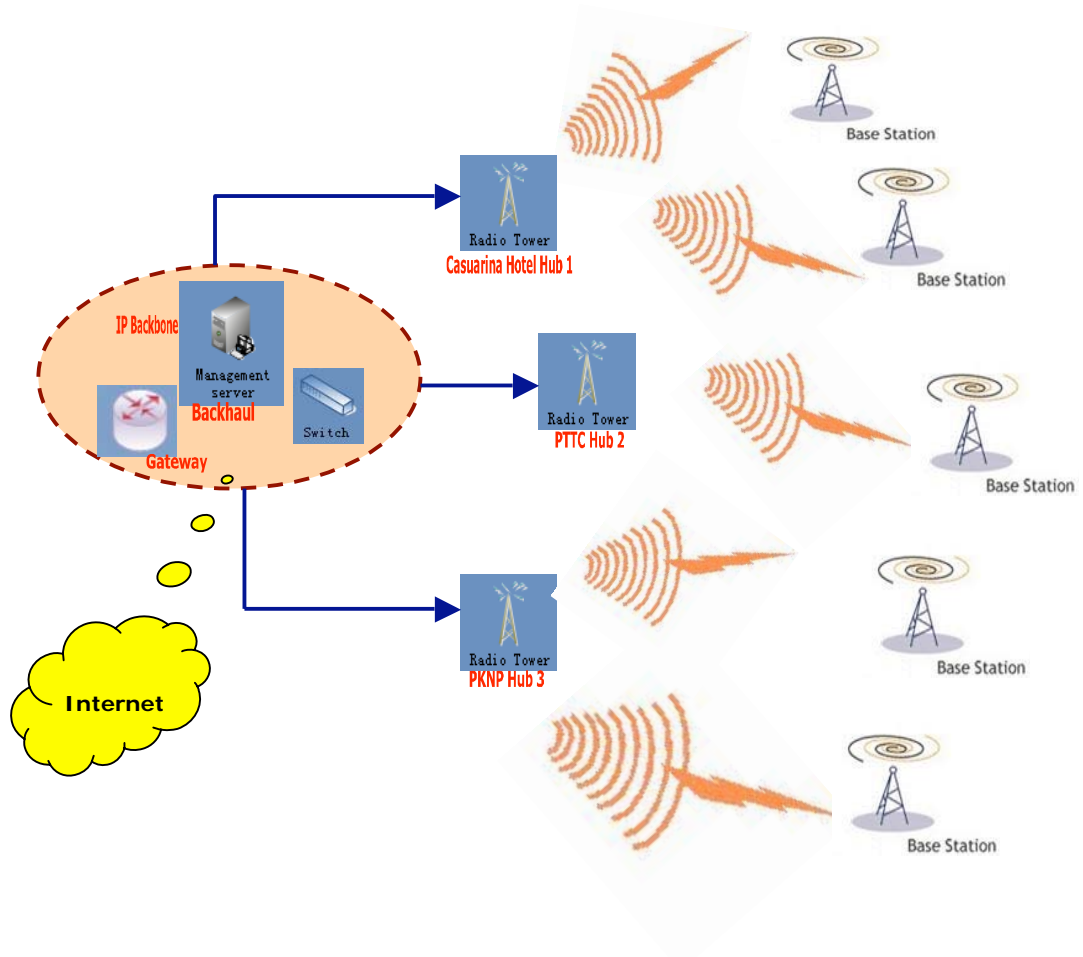


Figure 7: Conceptual RF Network Architecture

Deployment Schedule and Methodology

As mentioned earlier, the plan is to deploy WiFi in the entire state of Perak. City of IPOH is the biggest city in the state and will be extended in the next phase. Other parts of the state are also being deployed and we have a well defined plan for the deployment of these locations. In order to explain our deployment methodology, it is important to understand the geography and the demographics of the cities we are covering.

Network Architecture:

The architecture of this system is similar to that of a 3-layer cellular network. The field layer is the base stations which are then controlled by a base station controller and the overall system is managed by a network management system. (Fig. 10 & 11)

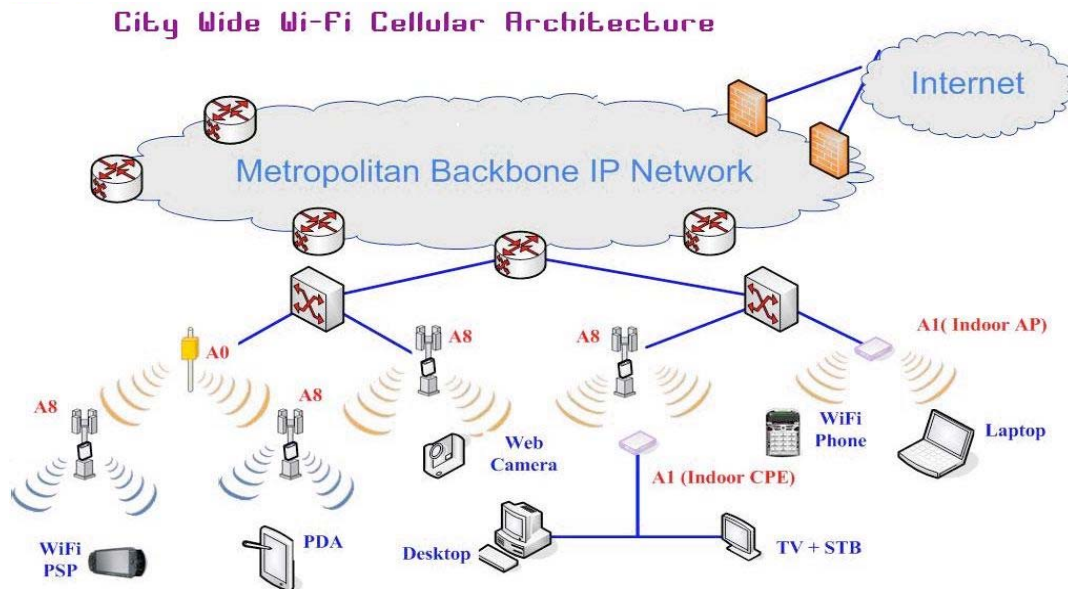


Fig 8: Network Architecture

Network Channel Assignments

The current setups of channel assignments are using the standard mode of assigning non-overlapping channels of 1, 6, and 11. This is important in a metro wide deployment where base stations were designed to have overlapping coverage for users. Non overlapping channel assignment would eliminate in-band interference between TRS BTSs. However, in some cases, where there are a number transmissions using such channels, the BTS would be assigned a new channel (which may include others than channel 1, 6, 11).

The Wireless Network Requirement

QoS - The network gives priority to the data access of terminal operational support applications. Other applications such as web browsing and email should be given lower priority without affecting the terminal operations.

Coverage - The wireless network will provide full coverage in the deployed area, so that wherever the people go, they can still be able to access information to perform internet activities

Reliability - The high availability of wireless is essential to keep the terminal operations up and running

Cost Effective - This is the key consideration in making decision, and a key success factor in driving business growth under competitive environment.

Acceptance and Coverage Test

Preliminary UAT test are conducted by TRS engineers upon commissioning of any base station. These preliminary tests would then be reconfirmed by the technical team using the following tools; (Fig 9)

Using Wireless Centrino Laptop (Model : CL51-15)

Bandwidth Test

- -FTP to Server that been connected directly to BTS (Internal Network)

Record figures: DL RSSI, SNR, Ping results

Utilized Network Stumbler for SNR and Signal Strength measurement

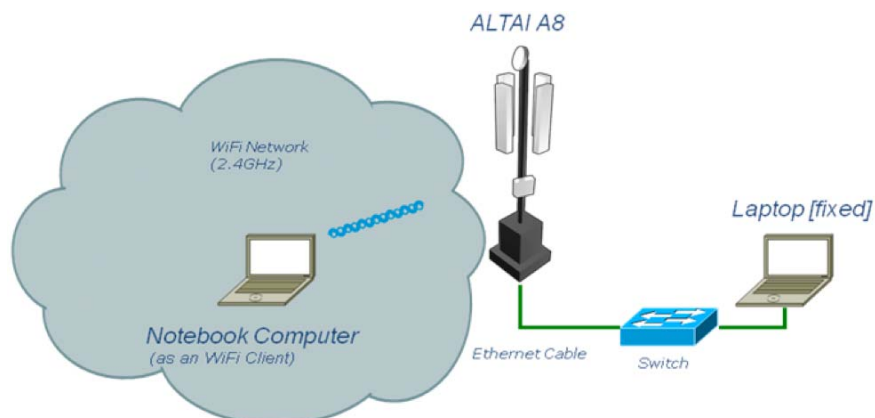


Fig 9 : Methodology of UAT

These UAT test are important to ascertain the coverage areas not only for sales purposes but as guideline for further network coverage plans.

Base Station Sites

As the Wireless Perak Project is a State Government Project for the people of Perak, owners of building are invited to assist in providing rental free access to their buildings for installation for base station. To date, all BTS installed are on a rental free basis which includes State Government buildings (e.g. PKNP, Mahkamah Syariah, Local council owned buildings), Federal Government buildings (e.g. LHDN, LUTH) private owned buildings (e.g. Syuen Hotel, Casuarina Hotel, Wisma Taiko), and schools or campuses.

All contact points for these sites are through TRS which keeps a full list of contact person in charge of each site should there be an urgent need to access the equipment.

Sites Acquisition

One of the major factor that TRS has to deal with is securing the permission of site (building) owners to place its base station at their premise. To facilitate this, the State government machinery, namely the State Secretary's Office, Perak State Development Corporation (PKNP) and the local councils has extended their assistance by providing rights of access to their building and introducing TRS as the company given the task to deploy the Perak state Wireless Project to owners of private buildngs. For sites that TRS could not secure for installation of BTS, TRS team of engineers have adapted to alternate and innovative ways to achieve the desired result.

Other government bodies and state government organization that has given full cooperation for the usage of their buildings for deployment sites are Perak State Education Department, TNB, LUTH, LHDN and LAP. Meetings with local councils and district offices have yielded very encouraging response for buildings own by them.