Infrastructure development using wireless technology

This article will demonstrate the path and experiences in facilitating a community movement to build its own communication infrastructure.

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A glimpse of the past

"PaguyubanNet", the earliest form on Internet in Indonesia was established in 1993, as a result of considerable effort and expertise contributed by a handful of national digital pioneers. *"Paguyuban"* is a Bahasa Indonesian word meaning "helping each other".

Prior to the establishment of PaguyubanNet, in 1986, early network development was inspired leading amateur radio pioneers. This inspiration was carried forward by similar radio experiments performed by students at the Amateur Radio Club (Institute of Technology of Bandung (ITB).

As a result of financial restrictions, all experiments were run on first generation personal computers (with 64KB of RAM) and used radio for data communications. The speed of transmission was 1/10000 of the speed of WiFi today. Since 2001, the Director for Vocational Schools at the Ministry of Education has been leading the integration of more than 1500 vocational schools to the Internet through WiFi. Much ground is left to be covered with a total of 1300 colleges / universities, 10,000 high schools, 10,000 Islamic schools, 4,000 vocational schools yet to be connected.

This journey towards achieving low-cost connectivity was complemented with many talented and dedicated Indonesians who enjoyed sharing their knowledge, expertise and resources for the betterment of Indonesian society. Today, the learning and development process is continued through various Indonesian mailing lists, such as, orari-news@yahoogroups.com, indowli@yahoogroups.com, and genetika @groups.or.id.

WiFi to bypass Telco last mile

Over half of the Internet infrastructure operating costs goes for paying the Telco last mile. This phenomenon is what drives communities to seek alternate solutions to build their own network to bypass the Telco last mile. One of the easiest ways to accomplish this is to use the off-the-shelf low cost WiFi (Wireless Fidelity) technology running at 2.4GHz & 5.8GHz band. WiFi wireless Internet solutions can be found on the Web at http://sandbox.bellanet.org/~onno/, http://www.wavelan.com, http://www.ydi.com, and http://www.wipop.com. WiFi equipment is originally designed for indoor usage. However, it is also used outdoors. Unlike indoor installations, there is an outdoor external antenna used along with a 20-30 meter tower to extend the range of coverage to reach 5-8 km distances. Building low cost homemade 2.4GHz antenna is not very difficult; a tin can with 90 mm diametre, and 215 mm length can be easily used as a 2.4GHz antenna for 1-2 km distances. It costs approximately US$5-10 per antenna. Someone with a strong Linux background may easily build a low cost gateway / router to integrate a LAN or a community to the Internet at 11Mbps.

Community neighbourhood network model

The Community Neighbourhood Network model moves away from the conventional Telecentre model, which centralizes all connectivity in a single room. The new WiFi Community Network distributes connectivity throughout the neighbourhood thereby reducing monthly costs for 24 hour

Internet access. As more houses or computers in the neighbourhood will be connected to the neighbourhood network, the operating cost as well as the initial investment cost will decline.

To get a better idea of the savings one can achieve by developing an outdoor WiFi neighbourhood network, let us conduct a price comparison. Broadband 24 hour Internet access from the Indonesian Telco costs US$400-800/month/user. This price allows the user to exchange limited traffic over the network with a high level QoS (Quality of Service). In comparison, WiFi Neighbourhood Network broadband 24 hour Internet access costs US$15-45/month[1] /neighbour. This low price includes the ability for users to exchange unlimited traffic on the network with variable QoS (Quality of Service), depending on the level of traffic at that time.

Currently, there are over 5000 institutions including broadband Internet cafes, schools, and residential neighbourhoods using WiFi technologies as an alternative to conventional connectivity options.

Regional Networks

Now that we know how to link individual communities, we can take a step back to look at how to connect the communities to one another through a broader regional network. The two (2) most common technologies to build the regional network are satellite and fibre optics.

DVB-RCS satellite backbone is the cheapest solution currently available to Indonesia is selling for US$200-700 at 64Kbps, depending on the agreement on the satellite ground station. Fibre optics/microwave backbone can be rented from cellular operators. The excess capacity is used for our data traffic between cities. The local ISP (Internet Service Provider) normally rents the backbone from the cellular operators, and then resells it to the community.

Capacity building: Encouraging local knowledge producers

In creating a self-financed knowledge cycle, there are basically two (2) critical strategies, namely: transforming local youth into knowledge producers; and supply-created-by-demand strategy.
Without skilled and dedicated people to drive this movement, the deployment of such innovative infrastructure would not be possible. This infrastructure model thrives only because it is invested, built, and run by the people for the people. Having easy access to low cost technology is not enough. In Indonesia, ICT knowledge in local language is limited.

A key component for the successful deployment of WiFi technologies in the Indonesian context is the development of young students to become local knowledge producers. These knowledge producers (young authors) acquire WiFi knowledge from various sources, experiment with them, and then author their experiences into publications in the local language (Bahasa Indonesia). To sustain young authors to continue producing knowledge materials they are compensated with US$15-25/article and US$500-700/book. The typical monthly living cost for a student is US$80-95 (including tuition, books, housing and meals).

The impact of knowledge producers is felt on many levels. Not only do their publications educate people, but they also open people's minds to new ideas and help reaffirm the feasibility of investing their own money in such infrastructure models. Once people are convinced to deploy community neighbourhood networks, they can utilize knowledge produced by the young authors to assist in building their capacities. These capacities include initial set up, operation, and maintenance of the infrastructure.

With a sound knowledge base and strong network of knowledge producers, communities can become self-sustaining, by developing and maintaining their own equipment and services. Similar initiatives from large top-down institutions often result in failure because the methodology they use treats people as customers, rather than empowering them to participate in achieving a sustainable solution.

Policy influence: Liberating 2.4GHz and 5.8GHz WiFi band

The diffusion of WiFi neighbourhood networks in Indonesia not only depends on the people, but also on the government and policy regulation. This interdependency has made an impacted on the movement for quite some time. The issue at hand is liberating WiFi band (2.4GHz and 5.8GHz) from harsh government regulations.

Prior to 1999, licenses for running WiFi nodes cost US$2200/yr/node. This price was reduced to US$270/yr/node after some negotiations in 2001. However, WiFi licenses continue to be awarded only to ISPs. Those who run WiFi without a license have their equipment revoked by the government.

In October 2003, the Ministry of Telecommunications wrote a

Figure 1: Potential Impact of WiFi Liberation in Indonesia

Impact	Current	Future (if liberalization occurs)
WiFi based Internet users	1 million	17.8 million
Potential ISP tax revenue	US$120,000/yr	US$2.5 million/yr
Potential revenue from ISP VAT (Value Added Tax)	US$800,000/yr	US$15 million/yr
Potential revenue from supplier VAT	US$2.1 million	US$70 million
Computers 50,000 units	2 million units	
WiFi Equipment	5,500 units	130,000 units

An active WiFi community shares its experiences

An online virtual discussion forum in English on practical issues of WiFi and Voice over Internet Protocol (VoIP) is currently hosted by IDRC and Bellanet at wifi4d@dgroups.org. This discussion list is open for all international practitioners to share their experiences and knowledge as well as documents. This workspace is for discussions on practical WiFi and VOIP infrastructure implementation in developing countries. This group has 122 members currently participating in the discussion. There are some interesting deliberations going on in this discussion group - both technical and pedagogical.

You may like to join this group. Send e-mail to join-wifi4d@dgroups.org to become a member of the wifi4d discussion list.

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draft decree on WiFi. The decree is still open and many Indonesians hope that the Ministry will consider the numerous benefits, both economical and social, that will emerge if the WiFi band is liberated. 1 US$400 to ISP for 24 hours/day divided by 10-30 neighbours From the chart above one can see the significant increase in WiFi equipment upon liberalization of the WiFi band. Currently neighbourhood networks encourage local SMEs (Small and Medium Sized Enterprises) to manufacture antennas and towers at a lower cost than their foreign competitors. With the increase from 5,500 units to 130,000 units, manufacturers will be able to provide a lower price to the end consumer due to the principle of economies of scale. The current demand of 5,500 units is not sufficient to provide incentive for new manufacturers to enter the market. However, the increase in demand to 130,000 units will translate into a lower per unit manufacturing cost.

Furthermore, as studies have indicated, the additional revenue the government can generate from the volume of ISP and vendor taxes will be more than sufficient to compensate for the loss of revenue from WiFi licensing.

Conclusion

Over the past 10 years, Onno Purbo and his colleagues have worked very hard to make all the pieces fit into the Indonesian WiFi Neighbourhood Network puzzle. This process is quite involved and requires equal amounts of attention to capacity building of the people, research of new technologies, and engaging in the policy arena. ■

Contacts

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'Wi-Fi'ying the Dal Lake - A project that was killed within days of its birth

The recent reports about the Dal Lake WiFi projects in the newspapers and the Internet highly publicized it as the Lake in the world with wireless Internet Access. The project is conceived by the Dax Networks and is being implemented in partnership with Jammu & Kashmir Department of Tourism and IPEAKS, a leading ISP of the state.

According to reports "it is the first such instance in the world where a lake has been converted into a hot spot." The idea behind the project was to ensure that Kashmiris at large are not denied of what the rest of the country has access to. The promoters of the project hoped that this project would give a new dimension to Kashmir and will lead to an increase in the foreign tourists to the valley. The project conceived that , people and tourists alike can access Internet while staying in House boats as well as while moving on the very popular Shikara Boats.

Enthused by the reports the author had gone all prepared with his WiFi enabled Laptop to access the Internet in the midst of the beautiful and scenic Dal Lake. However to his disappointment no such project existed. The CEO of IPEAKS, the ISP partner of the project, revealed, "Yes, we WiFied the Dal Lake, but , it is not functional anymore . I had fixed all the equipments and it worked well for 12 days. Then we got a call from the DoT (Department of Telecom, Government of India) asking to remove all the equipment immediately. According to DoT the project was illegal as it violates the policies regarding WiFi. The DoT has asked IPEAKS to obtain a WPC license to use WiFi at the Dal Lake. However according to experts there no such violation as using WiFi within a complex is allowed and Dal lake is a single complex under the control of J & K Tourism department. Irfan Raza, CEO of IPEAKS says" We were using 3 antennas which covered a range of about 4 km . Had this project been allowed to work ,we had further plans like setting up Wi-Fi in Gulmarg , mini set ups at the tourist spots ,Wi-Fi in Katra (a very popular Hindu Pilgrimage) and elsewhere in the valley ."

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