ITG InfoStation

Information Technology Innovation Section

ITIS e-Newsletter　　　　　　　　　Issue 11

Wireless Everywhere

Author:　　　Prof. Gary Chan,
　　　　　　　Department of Computer Science and Engineering,
　　　　　　　Hong Kong University of Science and Technology

Hong Kong is a very connected city, with more than 80% of households have at least 2 choices of broadband services to use. But once you unplugged your computer and step out of your home or office, will you still be able to keep the connection? Luckily, WiFi access in Hong Kong is widely available in libraries, coffee shops and shopping malls. People can still keep connected while out and about.

But you may have frustrating experiences in some place where it claims to have WiFi access, but still fail to find a connection. One reason this happens is the strength of signal, which varies depending on the location. Blind spots created by outdoor and indoor barriers, such as moving lorries, walls, buildings or corners, are another obstacle to reception.

But help is potentially at hand through the innovative work of Prof Gary Chan, who is busy on a project called "A Lean Wireless Infrastructure Network for Aviation and Other Industries", or LAviNet for short.

To get rid of blind spots and enhance signal quality, Prof Chan and his research team are developing an intelligent wireless mesh network where a WiFi signal can "move" or relay from one hop to another, and extend the coverage. In other words, he is aiming to develop a "multi-hop" wireless network rather than using "single-hop" transmission. This is called "mesh" network, as the hops are highly interconnected similar to a lattice structure.

Mesh technology provides many new features over the traditional "single-hop" technology. Since there are multiple paths from hop to hop, this technology provides strong resilience so that if one path is blocked then a signal can still transmit via another path. New hops can be added to the existing mesh flexibly and automatically participate in relaying the signal transmission via the best path.

The research is regarded as having great possibilities for helping industry. Not only has the project been funded by the Hong Kong government's Innovation and Technology Fund, it has also received sponsorship from major business-sector partners, including US aircraft manufacturer Boeing and Hong Kong Aircraft Engineering Company (HAECO).

Demonstrations and trials have already been successfully carried out at various company sites. At Boeing and HAECO, for example, aircraft maintenance is a huge and complicated task. There is increasing bandwidth demand even for mobile users. However, parked planes, hangars and corners create many dynamic blind spots. By using a LAviNet-enabled wireless network, a great deal of time and effort currently spent on paperwork and commuting on foot between the aircraft and maintenance office to check records, update logbooks and sign off worksheets can be reduced. This enhances efficiency of aircraft maintenance operations, which in turn means more productive use of aircraft, and then helps to increase revenue.

At another industrial trial in the Modern Terminals (MTL), the environment is also full of dynamics. Large moving cranes, lorries and containers often form moving "metal walls" that blocks the signal transmission from hop to hop intermittently. One of the features of LAviNet is fast-switching. Every hop is actively calculating and searching for a best backup link. So at any time, each hop will have both a main link and a backup link. If the main link is down, the fall over to the backup link is almost instant. This mechanism ensures that during the restructuring of hop paths, the client connections are completely unaffected. This is critical to the busy operation on berth where the data submissions and verifications are very frequent.

The operation efficiency has been greatly improved.

LAviNet has also been shown to improve wireless coverage significantly in the HKUST campus. It constantly senses the quality of transmissions and automatically optimizes the network to achieve the highest data throughput.

LAviNet is a software implementation of the mesh technology. It is not bound to a particular brand of access point hardware. This enables the customers to plan their wireless deployment in a scalable manner, and allows the existing infrastructure to work seamlessly with the new mesh technology.

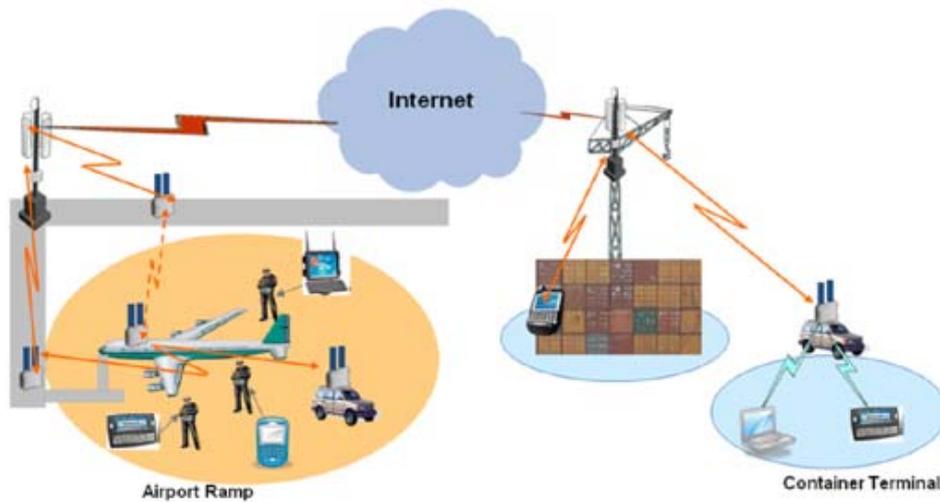Here is a diagram that shows an overview of LAviNet deployment scenario:

Figure 1. LAviNet Deployment

LAviNet is driven by two forces – the fruitful academic research results and strong industrial demands. Wireless access in parks, shopping malls and libraries is becoming part of our daily life. Wireless access in difficult environments like aviation and port terminals are also in acute needs. Prof Chan and his research team are working hard to realize our dream of "wireless everywhere".

Figure 2. Trial in Boeing (Seatle)

Figure 3.
LAviNet technology won Boeing Silver Award for its contributions in creating the future of aerospace

Figure 4. Trial in HAECO

Figure 5. Trial in MTL

Print this article

Back