

4G Coverage in Malaysia

Nur Faizah Binti Ab Aziz¹, Noor Azian Mohamad Ali²

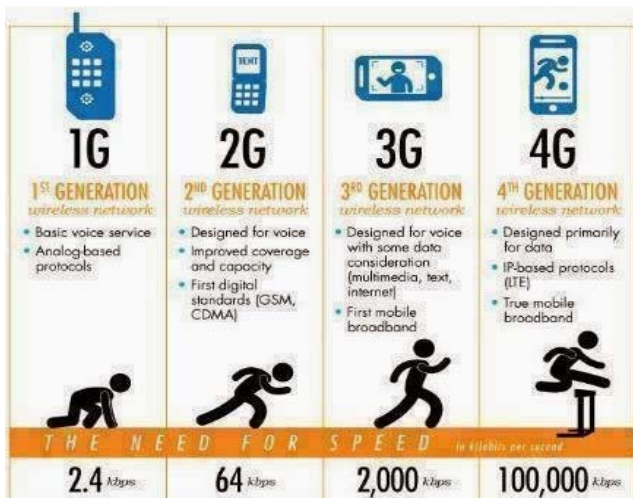
Department of Information Systems, Kulliyah of Information and Communication Technology, International Islamic University Malaysia

Abstract: Mobile phone is changing the way the world communicates. In the early 1990s, only one per cent of the world's population owned a mobile phone but today almost all using mobile phone to make phone calls and sending text message. 4G is one of the fastest growing technologies currently available with higher data consumption and increased connectivity. Malaysia continues to grow in tandem, riding on the telecommunications service evolution over the last 10 years. This includes a firm grounding for high-speed connection in the last few years. In this paper, we will discuss on 4G provided by Malaysia service providers.

Keywords: 4G, mobile phone, coverage, telecommunication, service provider

1. Introduction

1G was introduced in the late 1970s based on the analogue system. It then evolves to 2G using global system for mobile communications (GSM), first used in the early 1990s in Europe. It was where the first text messages (SMS) were sent [1]. Then in 2006, 3G was introduced which allowed providers to offer a huge range of advanced services. In late 2009, 4G network is introduced and become a service focus to the service provider globally. 4G is one of the fastest technologies currently available with higher data consumption and increased connectivity speed. The evolution of these technologies is summarized in Figure 1 [2]. From the figure, we can see the improvement on the speed and features throughout generation.



Reference: CareerShapers

Figure 1: Evolution of the generation

Now 4G network is in various stages of development and coverage. This network is built on one of three technologies: Long Term Evolution (LTE), Evolved High Speed Packet Access (HSPA+), and Worldwide Interoperability for Microwave Access (WiMAX) and has a theoretical maximum speed of 100Mbps. The main objectives of these technologies are to increase a high-data-rate, low-latency, improved spectrum efficiency, and improved coverage.

In order to enjoy 4G speeds, users will need to have a compatible 4G mobile phone and to be in the 4G coverage areas. A mobile phone needs to have ability to support 4G

networks, so user need to check the specifications needed for 4G. Here are some devices that are compatible and affordable like BlackBerry's Q5, HTC Desire 610 , HTC One SV, Huawei Ascend G6 , Huawei Honor 6, Motorola Moto G 4G , Nokia Lumia 635 , Nokia Lumia 735 , Samsung Galaxy Ace , Samsung Galaxy Note 4 , LG Optimus L90 , Apple iPhone 6 , Xperia SP , Sony Xperia E3 etc.

2. How a mobile phone call works?

Have you ever wondered how a mobile phone call works? When a mobile phone is switched on, it sends a signal that will be picked up by the nearby base station (BTS). BTS receives the signal together with the information to be transmitted. From the base station, the signal will then be processed by a few other components – a mobile switching centre / visitor location register (MSC/VLR) and home location register (HLR) before the mobile phone/subscriber identity module (SIM card) is granted access to connect to the network and make phone calls.

From BTS, the calls are routed onward to their destination. Calls made from a mobile phone to another mobile phone on the same network travel to their destination by being routed to the nearest base station to the receiver mobile phone. Calls made to a mobile phone on a different network or a fixed network (wired) have to follow lengthier path. The call might have to be routed through the main telephone network before it can reach their ultimate destination (receiver).

The mobile switching centre (MSC) is responsible for handling the entire connection, including routing calls, ringing through to the end connection, and registering the billing data. It also perform call services such as call forwarding, call waiting, or group calls. MSC will determine either to hand the call over to the fixed network or to another MSC that will transmit the call to the closest BTS then to the called party. This is how mobile phone can be reached. Figure 2 indicates the process when phone call is made.



Figure 2: Process on how mobile phone call works

Network provider is the telecommunication company that provides network services. In most areas there will be more than one network available depends on the number provider exist.

One feature of the mobile network, any user regardless of which service provide, can make an emergency call by dialling '112' as long as there are mobile network coverage. Nowadays, mobile phone has a feature-enabling user to dial emergency number, even with no SIM card inserted, and even when the phone is locked.

3. How Mobile Phone Data Works?

Whenever we are browsing the web, sending an email, checking Facebook, watching videos on YouTube and streaming music or TV programme by phone, we are using mobile data. Mobile data volumes are majority consumed by video traffic due to the growing availability of video content that can be streamed to mobile devices [3].

Mobile data is using the same technology that makes mobile phones call work. Mobile phones and BTS send packets of digital information back and forth to each other via radio waves. In the case of a phone call, the packets of information carry voice data. For mobile data, the packets of information would be other types of data like e-mails, Web pages, music files and streaming video. In 4G network, a few new components have to be added into the network such as Node B, SGSN and GGSN to enable the fast and higher speed data transfer.

4. What if user is outside coverage area?

What will happen when 4G subscribers move to a place with no 4G service? Mobile phone has indicators to show the strength of the network coverage signal which is shown by "bars" on the display screen and the signal strength will change as we move around with the mobile phone. When

users are connected to the 4G LTE network, their device should display "4G" or "4G LTE" as figure 3.



Figure 3: Data connection-icon on mobile phones

4G coverage might be available at cities or at high population area. As we move, our phone will connect to the nearest BTS with the strongest signal. If users been in the area with no 4G network, their current 4G network will dropped to either 2G or 3G network based on the current location network availability without user notice the change.

5. What will happen to the network during catastrophe?

Floods are regular natural disasters in Malaysia which happen nearly every year during the monsoon season. On 15 December 2014, as part of the northeast monsoon the worst floods in decades hit Malaysia. The situation continues to worsen due to heavy rain and most roads in the affected areas have been closed. The number of evacuees nationwide reached more than 100,000 people by 26 December 2014 [4].

Usually when disaster struck, it will directly affect telecommunication service. When there are no power supplies, all network components will also ceased to function. For the remaining components that are still in service, network congestion will happen because more users are trying to connect and make calls [5].

Since floods are common in Malaysia, the network providers were prepared to respond to the situation by configuring the data/call usage priority at the affected areas. Let say for a normal day the network configuration maybe is divide by 50:50 for call and data activities, the configuration will be change and calls will be given more capacity and priority during disaster to ensure users are able to communicate. Data traffic will be directly restricted because of less capacity allocated.

Communication Tips during Floods by MCMC:

1. Limit data uploads and voice calls to reduce congestion of communication lines.
2. Listen to the radio for important announcements during a flood.
3. Use mobile phone for important call only to conserve battery.

In case if the towers are damaged, COWs (Cellular on Wheels) can be placed at the affected area to restore and increase mobile coverage and capacity during disasters. Figure 4 indicates COW installation at the flood affected area in Pahang.



Reference: MCMC Facebook Page on 22nd December 2014
Figure 4: Installation COW (Cellular on Wheels) in Pahang during flood

6. Network coverage in Malaysia

According to a report issued by ITU entitled Measuring the Information Society (MIS) 2013; ICT Development Index (IDI) of the Malaysia has recorded the 5.04 point, which is more than the global average of 4.35 points. It means that Malaysia has successfully surpassed the level targeted of the developing countries and also the average level of the world and the Asia-Pacific region. Achievements values of this index have also increased compared with the previous year's report to the index 4.82 points. Malaysia has improved the infrastructure and use of ICT in terms of achieving a positive growth of broadband subscribers and the number of internet users [3] [6].

In Malaysia, the regulatory body incharge of telecommunication is The Malaysian Communications and Multimedia Commission (MCMC). MCMC was formed in 1998 and its key role is govern the regulation of the communications and multimedia industry based on the powers provided for in the Malaysian Communications and Multimedia Commission Act (1998), the Communications and Multimedia Act (1998), and the Strategic Trade Act (2010). Pursuant to these Acts its role is also to implement and promote the Government's national policy objectives for the communications and multimedia sector [7].

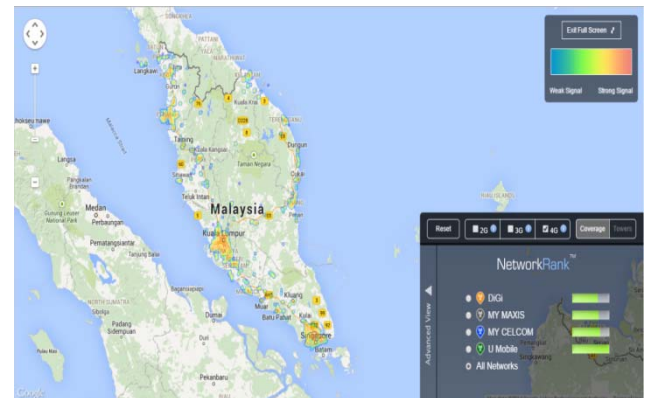
One of National Policy Objectives of the Communications and Multimedia in Malaysia is to make Malaysia as a major global centre and hub for communications and multimedia information and content services [8]. Therefore, MCMC regulate all telecommunications services and prepare guideline to ensure the provision of services in accordance with Acts.

4G became commercially available in Malaysia in 2013. To date, Malaysia's telecommunication market has four major network providers competing for business. These include: Celcom, Maxis, DiGi, U Mobile, YES and P1.

Celcom has been seen as the premium brand with the best stability in Malaysia. Maxis has generally known to have the best network coverage in Peninsular Malaysia and East Malaysia. DiGi was a telecommunication company ranked 100th on Forbes World's Most Innovative Companies 2014

[10]. U Mobile is the value added mobile telecommunication brand in the market that has gained a place in the hearts of consumers.

U Mobile offers HSPA+ services, but the company doesn't directly associate itself with 4G services. WiMAX is offered by YES and P1. Maxis, DiGi, and Celcom are offering 4G LTE services in Malaysia [9]. All four major providers now offer 4G services along with all the older mobile Internet connectivity technologies like 2G and 3G. Figure 5 indicates 4G coverage in Peninsular Malaysia and Figure 6 indicates 4G in East Malaysia.



Reference: opensignal.com

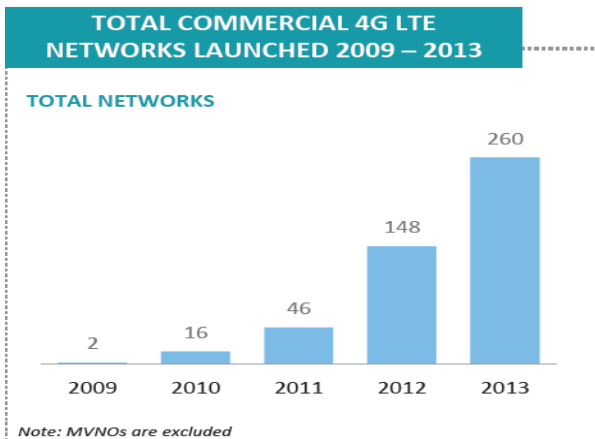
Figure 5: 4G coverage in Peninsular Malaysia



Reference: opensignal.com

Figure 6: 4G coverage in East Malaysia

In 2013, Celcom mobile subscriptions amounted to 13.1 million or 30% of the market share, followed by Maxis with 12.3 million subscriptions (28.2%), DiGi with 11 million subscriptions (25.2%) and U Mobile held 4.5 million subscriptions (10.3%). The balance belong Mobile Virtual Network Operators (MVNO) at 2.7 million subscriptions (6.2%) [3]. The main difference between 3G and 4G is the data speed. The quality of mobile phone coverage in the Malaysia is improving with the increase deployment of base stations for a better network service. Figure 7 indicates the 4G LTE network launched until 2013. However, there are still some areas especially rural areas where networks provider offers weaker mobile coverage especially 4G network. In the remaining section of this paper, we will take a look at each of the major carriers and outline the 4G coverage and connection speeds user will receive.



Reference: MCMC Industry Performance Report 2013
Figure 7: 4G LTE networked launched 2009-2013

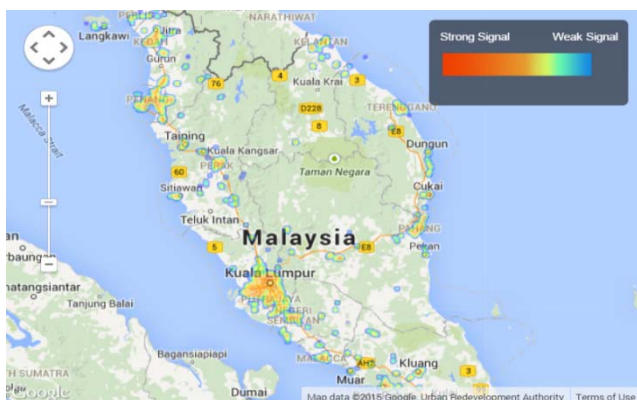
6.1 Celcom

Celcom started their telecommunication service in Malaysia since 1988. Celcom claims to provide the widest and most extensive coverage in Malaysia. In 2013, the 4th generation standard of LTE was deployed gradually nationwide and is first recorded on the 19th of February 2014.



Reference: opensignal.com
Figure 8: Celcom 4G coverage in Malaysia as January 2015

Celcom is bringing 4G LTE to cities and cover wide area in Peninsular Malaysia as shown in Figure 8 and Figure 9. Celcom reported that their network covered 1.79% population coverage.



Reference: opensignal.com
Figure 9: Celcom 4G coverage in Peninsular Malaysia as December 2014

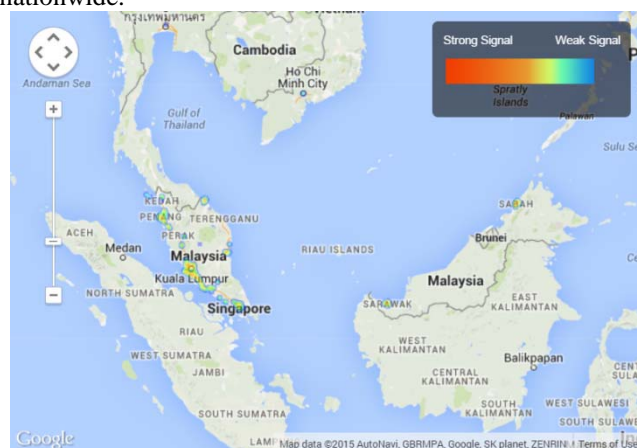
On the connectivity aspect, Celcom used fibre for 14 of their 4G LTE sites [3]. Celcom has an average 4G download speed of 10.1 Mb/s and upload speed of 4.6 Mb/s [11]. Table 1 shows the difference between 3G and 4G by Celcom.

Table 1: Comparison 3G and 4G by Celcom

Features	3G	4G
Download Speed	1.4 Mb/s	10.1 Mb/s
Upload Speed	0.5 Mb/s	4.6 Mb/s
Latency	655 ms	48 ms

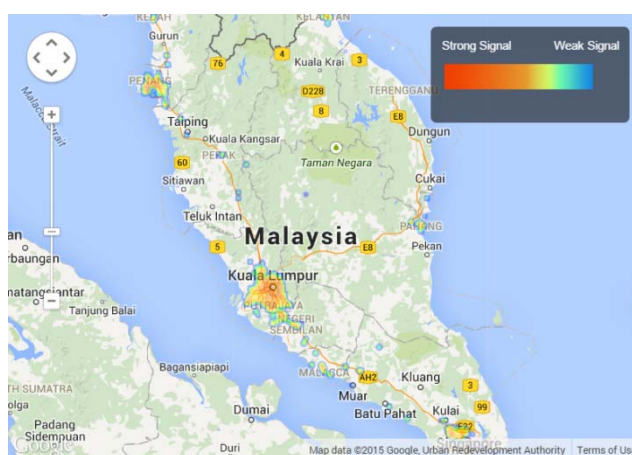
6.2 Maxis

Maxis is also currently offering 4G LTE to cities in Peninsular Malaysia and East Malaysia (Sabah and Sarawak). 4G LTE network was launched on January 2013 with aims to expand its 4G LTE population coverage nationwide.



Reference: opensignal.com
Figure 10: Maxis 4G coverage in Malaysia as January 2015

As at December 2013, Maxis 4G LTE services has 11.2% of population coverage (Figure 10 & Figure 11), with 0.3 million subscriptions and now available in Penang Kuala Lumpur & Johor Bahru.



Reference: opensignal.com
Figure 11: Maxis 4G coverage in Peninsular Malaysia as January 2015

Out of 243 sites by Maxis, 49% or 120 sites are fully using fibre. Meanwhile, the other 42% or 102 sites using One Hop to Fibre (OHF) optic nodes and remaining 8.6% or 21 sites using two hops to fibre optic nodes [3]. Maxis has an

average 4G download speed of 8.9 Mb/s and upload speed of 2.7 Mb/s [12]. Comparison on the 3G and 4G features can be seen on table 2.

Table 2: Comparison 3G and 4G by Maxis

Features	3G	4G
Download Speed	1.5 Mb/s	8.9 Mb/s
Upload Speed	0.4 Mb/s	2.7 Mb/s
Latency	638 ms	42 ms

6.3. DiGi

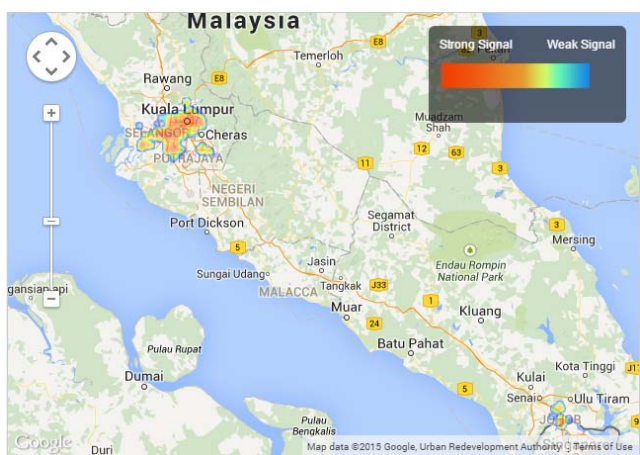
Since December 2011, DiGi began upgrading its 5,000 network sites to LTE as its aims to be the first fully LTE equipped network in Malaysia upon completion in 2013.



Reference: opensignal.com

Figure 12: 4G coverage in Malaysia as January 2015

Digi has commercially launched their 4G LTE services covering specified areas in Klang Valley, Johor Bahru and Sabah. DiGi has population coverage of 2.58% and a total number of 32,000 subscriptions as in Figure 12 and Figure 13 [3].



Reference: opensignal.com

Figure 13: DiGi 4G coverage in Peninsular Malaysia as January 2015

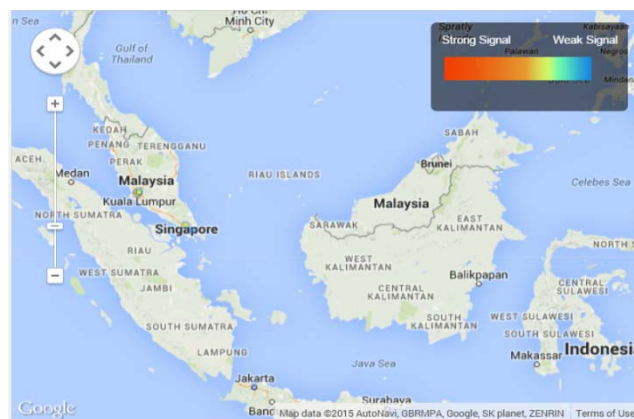
DiGi has an average 4G download speed of 7.7 Mb/s and upload speed of 3.4 Mb/s [13]. Table 3 indicates the difference between 3G and 4G network by DiGi.

Table 3: Comparison 3G and 4G by DiGi

Features	3G	4G
Download Speed	1.4 Mb/s	7.7 Mb/s
Upload Speed	0.3 Mb/s	3.4 Mb/s
Latency	657 ms	45 ms

6.4 U Mobile

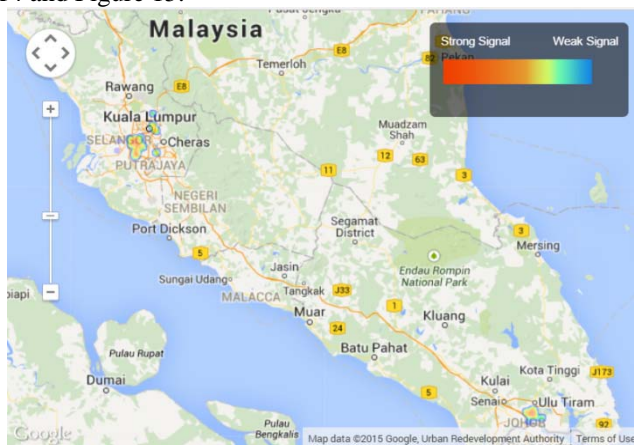
U Mobile was founded in 1998. In December 2013, U Mobile officially announced the availability of their 4G LTE Internet services. U Mobile LTE first recorded on the 17th of Mar 2014 [14].



Reference: opensignal.com

Figure 14: U Mobile 4G coverage in Malaysia as January 2015

U Mobile 4G LTE reported has 0.65% population coverage with a total of 50 4G LTE sites [3]. U Mobile 4G coverage is covering Subang Jaya, Sunway, Puchong, Berjaya Time Square (Klang Valley) and Johor Bahru as shown on Figure 14 and Figure 15.



Reference: opensignal.com

Figure 15: U Mobile 4G coverage in Peninsular Malaysia as January 2015

U Mobile has an average 4G download speed of 13.3 Mb/s and upload speed of 3.4 Mb/s. comparison between 3G and 4G by U Mobile can be seen in table 4 [14].

Table 4: Comparison 3G and 4G by U Mobile

Features	3G	4G
Download Speed	1.7 Mb/s	13.3 Mb/s
Upload Speed	0.4 Mb/s	3.4 Mb/s
Latency	630 ms	31 ms

Even though all telecommunication companies provide 4G LTE service in Malaysia, differences between providers can be seen in the download speed, upload speed and latency. The full comparison between the service providers can be referred on Table 5.

Table 5: Statistical on the 4G features by providers

Features	Celcom	Maxis	DiGi	U Mobile
Download Speed	10.1 Mb/s	8.9 Mb/s	7.7 Mb/s	13.3 Mb/s
Upload Speed	4.6 Mb/s	2.7 Mb/s	3.4 Mb/s	3.4 Mb/s
Latency	48 ms	42 ms	45 ms	31 ms
First Seen on	19 th Feb 2014	7 th Feb 2014	19 th Mar 2014	17 th Mar 2014

As at end 2013, 4G LTE networks were launched globally. The number of global 4G LTE subscriptions reached 200 million in 2013. The strong take-up of 4G LTE is supported by fast increasing varieties of 4G LTE enabled devices [3]. However, Malaysian have other alternatives for 4G service which are from 'YES' and 'P1'. Both providers provide WiMax network. YES is the brand name of YTL Corporation in Malaysia was launched on November 2010. P1 or Packet One Networks was launched on August 2008. The table below shows the WiMAX subscriber growth from December 2008 until March 2013 [8].

Table 6: WiMAX subscriber growth from December 2008 until March 2013

WiMAX Operator	Population Coverage
P1	89.32%
YES	107.43%

The best mobile phone coverage is generally in the cities, although cities still have 'dead zones' where there is no network coverage. 'Dead zones' normally occur when network signal is blocked due to tunnels, hills, or dense tall buildings. Rural areas with a smaller population have less physical interference but often are far away from BTS for a good signal. This is constantly improving as more BTSs are set up around Malaysia but what will happen if the required coverage like 4G not available in the area?

7. Conclusion

At the current state of coverage, 4G LTE is only available in selected areas and these are mainly around Kuala Lumpur, Johor Baru and Pulau Pinang and other main cities. Everywhere else is still mostly using 3G. This is understandable as most telecommunications in Malaysia only just announced their 4G LTE packages this year (2014).

Furthermore, most mobile phone users in Malaysia do not have 4G service and one of the main reasons is coverage. When this improves especially coverage, then 4G will change everything, but for now it is safer to get a good 3G network and compatible device. To speed up the coverage of 4G, service providers may well take innovative measures by entering into various partnerships such as infrastructure sharing, network sharing, and other forms of collaborative measures to save costs and ensure timely delivery of services [15].

It is important that in Malaysia, the spill over effect from high connectivity and Internet usage is the requirement to ensure greater awareness of Internet abuse and their prevention [15]. A future study on network coverage in Malaysia shall be done so that comparison can be made. It can show the improvement in mobile telecommunication network and comparison with other developing countries.

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Author Profile



Nur Faizah Binti Ab. Aziz, Master of Information Technology, Department of Information Systems, Kulliyah of Information and Communication Technology, International Islamic University Malaysia



Noor Azian Mohamad Ali, Academic Fellow, Department of Information Systems, Kulliyah of Information and Communications Technology, International Islamic University Malaysia