5 TELECOMMUNICATIONS TECHNOLOGY
The telecommunications technology evolutions are focus on four areas of telecommunications: wireless communications, the convergence of voice and data networks, transmission speed and network access.

5.1 Wireless Communications Technology
5.1.1 Third Generation (3G) Mobile System
Malaysia has 2.4 million cellular subscribers. With projected growth of 15% a year, the government is focusing more on mobile. To date the full spectrum of services - NMT, analogue/digital AMPS, GSM and PCN - are represented on the market. The Malaysia government is considering the introduction of a 3rd generation wireless system based on the ITU IMT-2000. (17) But this may not necessarily be an addition to existing operators. All the operators will have to move towards fully digital systems before making their systems compatible with each other to facilitate domestic roaming. This will ensure a more efficient use of the frequency spectrum, while at the same time providing the customer with a better deal. This will be an important development, as it will also address the universal service issue, whereby communications and multimedia services need to become accessible even in the remotest parts of the country.

The existing GSM, D-AMPS and CDMA networks are based on the second generation of mobile systems. The move to third generation systems is a matter of evolution, not revolution, in terms of both network and service implementation. Equipment vendors recognise that network operators are not prepared to deploy third generation technology over night. Many operators have more immediate concerns to deal with, such as building out GSM network infrastructure which they have already begun, and paying off debts accrued from existing infrastructure build, before they consider major investment in next-generation networks.

The vendors are now examining a number of migration-paths, focusing on new technologies, which offer higher speeds on existing networks. In addition,
many manufacturers aim to incorporate most of the features needed for 3G data systems in users' terminal design well before networks are actually rolled out. These terminals include the videophones, handheld computers and interface cards between laptop computers and mobile phones. (7)

5.1.2 Wireless Location Technology

Sometimes the telecommunications industry regulator is forcing the wireless location technology into action as demonstrated in the wireless location technology. These services are designed to determine the physical location of a cellular phone user within a certain radius through technology embedded in either a handset or cellular base station. The Federal Communications Commission (FCC) of United States initiates it for tracing emergency calls.

There are two types of solutions on the market from a number of vendors. Some vendors use the network-based solutions which employ an old military method called triangulation that uses time difference of arrival (TDOA) to determine where a caller is in relation to a base station. Others use handset-based solutions that incorporate global positioning system (GPS) chips. GPS measurement is much more accurate, but it requires that a GPS chip be added to the phone. (5)

The big decision for service providers such as Telekom Malaysia is whether to implement a bare-bones approach just for emergency call tracing or install wireless intelligent network (WIN) capabilities. The WIN option is costly for service providers to implement, but it allows capabilities beyond emergency call tracing to be available throughout the network. This will enable future services such as location-sensitive billing, public safety, fleet vehicle monitoring, traffic reporting and a variety of concierge services, such as restaurant and hotel locators.
5.2 Convergence for voice and data networks

5.2.1 Industry Convergence

As noted by Dato Moggie, minister of Malaysian Ministry of Energy, Communications and Multimedia, the rationale for this the Communications and Multimedia Act (CMA) is that the communications, computing and broadcasting sectors are converging so much that it is no longer be able to distinguish between voice, data, and image. The establishment of the CMA necessitated the restructuring of all the existing policy, institutional, regulatory and legal structures and instruments pertaining to the telecommunications, broadcasting and computing sectors in the country. A new Malaysian Communications and Multimedia Commission was set up in 1998 to regulate the converging telecommunications, broadcasting and information technology industries. (17)

The key driver in convergence for voice and data network has been the proliferation of the PC and the Internet. (6) For operators such as Telekom Malaysia, the key roles in a convergent future lie within their network operation. Convergent services need high-speed access and are currently limited by bandwidth restrictions. The service providers will have to capture market share by offering customised suites of bundled or integrated services that might include voice, data, local and long distance, Internet access, videoconferencing, video broadcast, virtual private networks, intranets, and extranets.

As a traditional telecommunications vendor for voice networks Lucent is suffering from the lack of products for the data networks. The convergent of voice and data networks will force it to quickly develop the expertise in the data communications by either its own R&D or acquiring data network equipment vendors.

5.2.2 Multimedia Super Corridor (MSC)

MSC is a green-field "corridor" 15 kilometres wide and 50 kilometres long, that starts from the Kuala Lumpur City Centre (KLCC) down south to the Kuala
Lumpur International Airport (KLIA) (16). Two cities are being developed in the Corridor:
- Putrajaya, the new seat of government and administrative capital of Malaysia where the concept of electronic government will be introduced;
- Cyberjaya, an intelligent city with multimedia industries, R&D centres, a Multimedia University and operational headquarters for multinationals wishing to direct their worldwide manufacturing and trading activities using multimedia technology.

The MSC is a test-bed green area where the very best in world-class telecommunications infrastructure and incentives are located, so that the benefits of IT can be fully utilised and eventually spread out to the rest of the country. Within this corridor, the Malaysian government provides four key elements:
- an attractive physical infrastructure,
- new sets of a soft infra-structure of supporting laws, policies and practices,
- world-class information infrastructures with a 2.5-10 gigabit open multimedia network, using the latest ATM switches
- a fully empowered one-stop shop called the Multi-media Development Corporation to manage and market the project.

The MSC shall become a multi-cultural web of mutually dependent international and Malaysian companies collaborating to deliver new products and services to customers across the region and the world. The government has established seven goals that it expects to achieve through the MSC by the year 2000:
- to make Malaysia a pioneer in electronic commerce;
- provide the world’s first national multi-purpose smart card;
- introduce a comprehensive programme for smart schools;
- create a regional centre for tele-medicine;
- boost Malaysia’s presence as a marketing and multi-media customer service hub and
- transform Malaysia into a remote manufacturing, coordination and engineering support web.
Since the introduction of the MSC initiative, the local IT industry has undergone rapid transformation. A number of new multimedia-based industries have emerged. The MSC project involves companies from different industries: software companies, content providers, systems integration, telecommunications, post-production/animation and film, training and education, and heavy users of multimedia. Out of the total 212 MSC status companies, 27% are foreign-owned, 27% are joint ventures, while 46% are local companies. (16) Although MSC mainly affects the IT industry, the telecommunications industry should gain a lot of benefits from it due to the fact that most of the data communications backbone are built on the telecommunications networks. Therefore Telekom Malaysia should enjoy high revenue and profit growth during the implementation of the project. Lucent Technologies is one of the MSC status companies that benefit from (16):

- access to the world-class physical and information infrastructure;
- unrestricted hiring and entry of foreign specialists with no employment restrictions;
- freedom of ownership of IT companies located in the MSC;
- freedom of sourcing capital globally for MSC infrastructure;
- competitive financial incentives, including exemption from income tax, investment tax for up to 10 years;
- no duties on the import of multi-media equipment; intellectual property protection and cyberlaws;
- no censorship of the Internet;
- globally competitive telecoms tariffs;
- key MSC infrastructure contracts to leading companies willing to use the MSC as their regional hub; and
- a high-powered implementation agency as a one-stop shop to meet company needs.

5.2.3 Unified Messaging Systems

Messaging systems is another area where convergence of technology is anticipated. People should be able to access their voice mail, e-mail and fax messages through a single source and respond to them the same way.
regardless of whether they are using their computers in a hotel room or calling from payphones in the airport. Unified messaging systems combine a number of technologies previously used for single medium messaging (e.g., message servers), but leverage new technologies for multimedia conversion. The technologies include the text-to-speech systems, interactive voice response, and voice over IP. Text-to-speech systems enable e-mail headers and text to be received over a standard telephone. Whereas, the interactive voice response provides for complex commands to be given quickly and efficiently from a telephone. The voice over IP technology allows voice messages to be transmitted to a PC over the Internet. Telekom Malaysia has just introduced the public voice mail in its telecommunications services. It still has a long way to go to see the real benefit of having unified messaging systems. Lucent as one of the world leader in producing messaging systems will be in the leadership position in driving the unified messaging technology. Lucent has a lot to gain from if it could maintain its leadership.

5.3 Network Access Technology

Telekom Malaysia as well as other operators must also be able to provide support for a combination of access configurations including PSTN, Internet, corporate networks, local content, and peer-to-peer connectivity. To do this, service providers will look to multi-service delivery systems that combine voice, data, and video capabilities while being able to handle multiple technologies. These systems will have to interface with the circuit-switched network because the current and future technologies will coexist within the new public infrastructure. (8)

5.3.1 Integrated Access Devices

The new access technologies will integrate data, voice, and video services as network functionality migrates out from the network core toward the edge of the network. Integrated access devices mean fewer devices on the network, which translates into fewer potential failure points and simpler management. These products will need to support multiple protocols and a combination of
technologies including TDM and frame- and cell-based service, while simultaneously connecting customers to the PSTN using standard interfaces, and connecting to the corporate network via the Internet.

The access platforms will be software upgradeable to provide new services, which means operators will need to buy new software, not new equipment, for these platforms. Software will also play a major role in the access network to ensure that service policies (including security and QoS) are defined and applied. The Internet and the explosion of data are prompting operators and service providers to standardise more on packet-based technologies than on circuit-switched technologies. As operator such as Telekom Malaysia’s revenues shift from predominantly voice to data, the trend will force changes in access devices. The focus may change from integrated access service platforms that support traditional circuit-switched services to platforms that support ATM- and IP-based integrated services. (8)

5.3.2 Internet Protocol (IP) Switching

New standard in IP switching provides a customer-acceptable framework for delivering IP services with the security and Quality of Service (QoS) assurance of circuit switched services. The new IP switching protocol should reduce the overall network costs by up to 50 percent. Major carriers such as AT&T, MCI WorldCom and UUnet have begun testing the protocol. (5) The protocol can also be used to create an explicit end-to-end route in the network that enables frame-like IP VPNs. The new protocol may greatly impact the Internet by reducing network congestion and providing better end-to-end service. It offers a public IP data network that will serve as the foundation for those company VPN applications. Some analysts believe that virtually all intra-company traffic in public IP services will be served by the new standard. (5)

Even though Internet has been introduced into Malaysia for more than seven years now, general public awareness of Internet only began several years ago. Internet is one of the applications that are based on IP technology. While the developed countries are just start to experimenting the new IP switching
protocol, as a follower in telecommunications and IT industry, Malaysian operators will be taking the observing position for quite some time. However, as the leader in the telecommunications industry in Malaysia, Telekom Malaysia should have the IT infrastructure (especially the IP-based one) really so that the migration to the new technology will be taking place smoothly. The fast growth in IP based market has threaten traditional voice networking equipment supplier such as Lucent. In order not to be left behind by the change of technology, Lucent has start to evolve itself into more diversified company. This has been seen in its acquisition strategies in the recent years. Acquiring a leading technology start up company should be viewed positively as no one can predict exactly which technology will prevail in the future. (12)

5.4 Fibre optic transmission technology
5.4.1 Higher speed in fibre transmission link
As part of the natural evolution of progressive bandwidth expansion, data transmission consumption and IT management, it is prudent for Telekom Malaysia to plan for a fibre optic system that can cost-effectively support 40-Gbps in the near future. Some analysts are reasonably confident of breakthroughs in optical amplifier and regenerator distance performance that would increase performance to 200 km or more. (5) Equipment vendor such as Lucent is trying to get the high-speed links on conventional single mode fibres and at traditional amplifiers and repeaters spacings in order to make it attractive to PTOs. New operators will likely spring up to take advantage of new fibres to implement the new transmission scheme.

5.4.2 Reusing the existing optical fibres for higher speed
The installation of more fibre has been a traditional choice of operators in the face of growing demand for bandwidth. But operators now have a new choice of expanding the capacity of their fibres using the dense wavelength division multiplexing (DWDM) technology. (5) The technology is able to tap into the innate ability of optical fibre to carry trillions of bits of information without the need to lay new cable or upgrade existing infrastructure.
So far the technology has been applied principally on long distance routes in the US. But the credibility of the technology has resulted in the growing acceptance outside the US and in its usage in the short-haul routes. The equipment vendors including Lucent are moving the technology away from the wide area network (WAN) and positioning it in the metropolitan area network (MAN). Operators will gravitate to the technology so long as it remains attractive for them to send more data at lower transmission costs. At the same time, the growth in data traffic and bandwidth-hungry applications, such as multimedia and video, will require capacity-enhancing technologies in campus and inter-office environments. Telekom Malaysia should be aware of the technology and be prepared to introduce it into Malaysia.