OCCUPATIONAL ANALYSIS

TELECOMMUNICATIONS INDUSTRY

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1. EXECUTIVE SUMMARY

An Occupational Analysis (OA) is a process of identifying the work scope of the occupational area in terms of competencies. It is used to analyse skilled human resource competency requirements for the industry. The development of the Occupational Framework is a preliminary process in developing relevant National Occupational Skills Standard (NOSS). The NOSS in turn will be developed to be used as the basis to conduct skills training and certification of competent personnel.

This document is divided into several chapters, the first being an introduction to the Malaysian Occupational Skills Qualification Framework that relates to the qualifications between skills training and academic higher education. The next chapter will explain the methodology of the Occupational Analysis and Occupational Description development. Then, a brief overview of the Telecommunications Industry will be given in the following chapter. This will highlight the definition and scope of the industry and its evolution, the current analysis of the local industry and its skilled worker requirements plus Government policies, Government bodies, and development plans supporting the growth of the industry. The final chapters will present the findings of the Occupational Analysis that is translated into the Occupational Frameworks, job titles, levels of competencies, critical job titles and Occupational Descriptions. These findings will in turn be the basis of reference for the development of the National Occupational Skills Standard (NOSS) document. The NOSS will serve

not only as a reference of skills standards for certification but also as a guide to develop the skills training curriculum.

In order to conduct the Occupational Analysis on the Telecommunications Industry, all the information related to the Malaysian Telecommunications Industry was gathered through literature survey and further discussed in workshop sessions with experts from the industry. Workshops were held to get a better understanding of the organisational structure, job titles, hierarchy objectives and primary activities of the job titles.

In Malaysia, the Telecommunications Industry is one of the main industries that has the most impact on the general population. As well as being a major employer, its effective operation impacts on the daily lives of individuals and businesses. Growing from its roots of offering voice and related services, it has now expanded well beyond that through provision of data and broadband services, and is a critical infrastructure and service platform for national development. Universal access to communication services and infrastructure is also a requirement for developing skills in all areas and bridging the digital divide, all of which are incorporated into the thrust of a number of Malaysian government initiatives.

The Telecommunications Industry has a large number of related industries and Malaysia has been providing a solid base for multinational corporations in the Telecommunications industry to establish a regional base here for Research & Development as well as regional support activities.

Key areas include development & manufacturing of mobile devices, development & manufacturing of network infrastructure equipment, applications and service development, test and measurement equipment development. These, coupled with the needs of the communications service providers, require a large pool of skilled workers to support their growth requirements to meet the needs of the nation and to support inward investment.

As an example, the mobile industry sector has seen a globally unprecedented growth over the last 10 years. The GSM (Global System for Mobile communication) family of technologies alone, which encompasses GSM, GPRS/EDGE (General Packet Radio Service/Enhanced Data GSM Environment), 3G/UMTS (Third Generation/Universal Mobile Telecommunication System), HSPA (High Speed Packet Access) and now Long Term Evolution (LTE), currently dominates with subscriber numbers at 2/3 of the global population. In Malaysia, this represents over 35 million subscribers at a penetration figure of 123.5%.

The current government initiative for national broadband has also excelled, achieving its targets well ahead of deadlines to achieve over 60% of household penetration by the middle of 2011. The massive expansion of broadband has been accommodated by the wide-scale deployment of fibre-optic networks. The mobile industry players are responsible for half of this figure with their efficient & quality roll-outs of mobile broadband technology.

Additionally, new national players offering WiMAX (Worldwide Interoperability Mobile Access) based networks have increased the options available for consumers wishing to obtain broadband access. This is indeed a very positive sign for the nation as a whole since in a recent report, the International Telecommunications Union (ITU) identified that a 10% increase in broadband penetration can boost Gross Domestic Product (GDP) by an average of 1.3%.

Additionally, skills in the areas identified in this Occupational Analysis are needed throughout a number of other organizations and industry sectors that rely heavily on a robust communications infrastructure to support data services. They include but are not limited to government agencies, banking & finance, oil & gas, broadcasting & media, Information Technology companies, armed forces & police.

It is critical that the skills development process in Telecommunications is conducted in a structured manner and that the job roles and related skills development frameworks had the buy-in of the relevant industry players. Also the framework must be inclusive and relevant to the needs of industry. Both government, Skills Training Centers and Institutes of Higher Learning (IHL) clearly have a role to play here to ensure relevant telecommunications skills training programs are developed. During the development workshops, the panel members had identified three (3) main job role sectors of Telecommunications in Malaysia. The three Telecommunications sectors are Access, Transmission and Core Network.

Table 1.0: Overview of Telecommunications Sectors

SECTOR	OVERVIEW/SCOPE
Access	This is to address job roles for both the mobile and fixed line industry related to the front-end of the infrastructure. This is the part of the network where the customers interface and is the most geographically distributed component of the infrastructure. Examples include GSM/3G mobile networks, WiMAX & other wireless broadband networks, fixed broadband including DSL (Digital Subscriber Line)and Fibre To The Home (FTTH) and a range of corporate network access solutions.
Transmission	This is to address job roles for the parts of the network that support the interrelationships between the access network and the core network. This needs to be a robust, dynamic infrastructure that must offer flexibility and cost-effectiveness to both internal and external customers. In addition, it needs to seamlessly support interconnect between different technologies and organizations both nationally & internationally. Examples include Synchronous Digital Hierarchy (SDH), Metro Ethernet, Multiprotocol Label Switching (MPLS), Dense Wavelength Division Multiplexing (DWDM) and wireless/microwave.

Table 1.0: Overview of Telecommunications Sectors (continued)

SECTOR	OVERVIEW/SCOPE
Core Network	This is to address job roles for the back-end of the network, mostly located in the provider's facility. This is the part of the network that must support the management & assurance of service delivery to customers as well as handling quality, billing and security features. Examples include switching platforms for voice & real-time service support, packet platforms for data services as well as provisioning & management systems for overall supervision and control of the network infrastructure and its related service platforms.

The Telecommunications organisations have made concerted efforts to maintain and expand their status as being "service providers" with increased flow of revenue to Internet service providers. The dilemma for the Telco is that the more investment they make in the network, the easier it is for customers to bypass their services to obtain them, often free, on the Internet.

This means that as they consolidate their position in the value chain with diversified service portfolios, they need to further develop skills in service/application, design, management, implementation either internally or through partnerships. This service aspect was seen as outside of the scope of this OA as it falls under the purview of the ICT industry. It should be noted that these ICT skills will need to be put in a "telecommunications context" from both the end user as well as the network operators point of view.

2. CONCEPT OF OCCUPATIONAL ANALYSIS (OA)

2.1 Introduction

OA is a process to identify job titles and levels for skilled workers needed in the industry sector. It is a preliminary stage for National Occupational Skills Standard (NOSS) development in which the identified job titles will be used as a basic reference. It requires inputs from all parties especially industry players, statutory bodies, training and institutions. Figure 1.0 shows the significance of OA for NOSS and policy development for skills training in Malaysia.

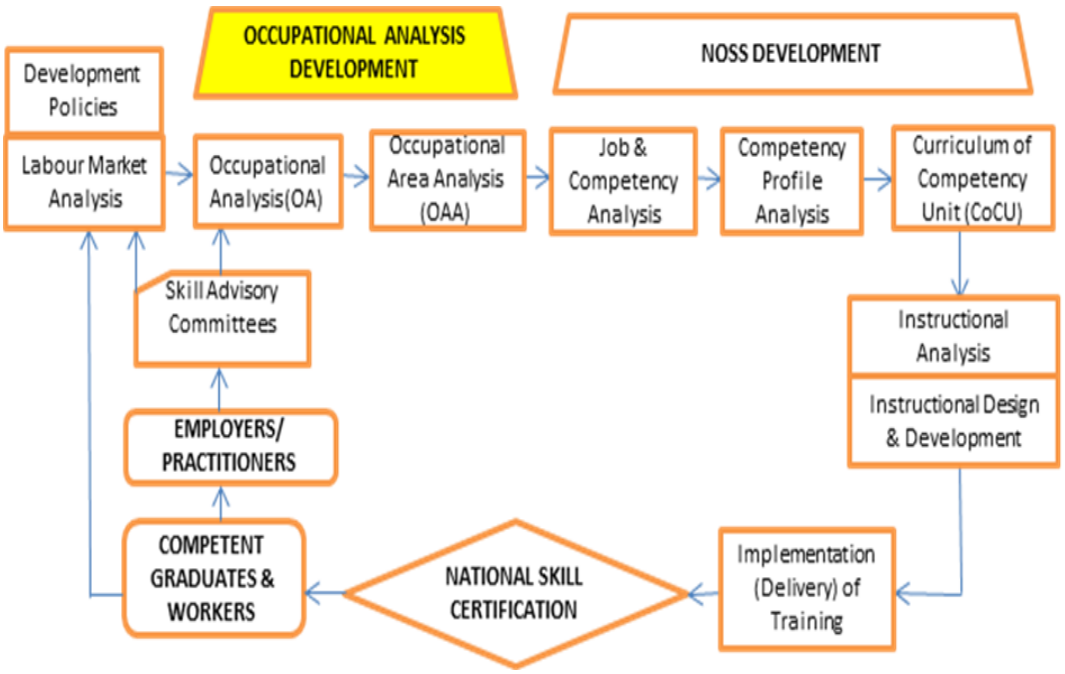


Figure 1.0: A Competency-Based Model for Skills Training in Malaysia

OA will identify sectors, sub-sectors, job areas and job titles for a particular industry in the form of Occupational Structure (OS) as illustrated in Table 2.0. Job scopes of each job title will be detail out in the Occupational Description (OD). Every job title will be identified according to its level defined in the Malaysian Occupational Skills Qualification Framework (MOSQF) level descriptor (refer to Annex 1).

SUB-SECTOR	FRONT OFFICE				
LEVEL/JOB AREA	**GUEST SERVICE**	**TELEPHONE OPERATION**	**FRONT OFFICE ASSISTANCE**	**CONCIERGE**	**RESERVATION**
LEVEL 5	Front Office Manager (FOM)				
LEVEL 4	Assistant Front Office Manager (AFOM)			Concierge Manager	Reservation Manager
LEVEL 3	Guest Service Officer	Telephonist Supervisor	Front Office Supervisor	Bell Supervisor	Reservation Officer
LEVEL 2	Guest Service Assistant	Telephonist	Front Office Assistant	Bell Captain	Reservation Clerk
LEVEL 1	No Level			Doorman	No Level

Table 2.0: Example of OS for Front Office in Hospitality and Tourism

OS can be further analysed to produce its Occupational Area Structure (OAS) through Occupational Area Analysis (OAA). The objective of OAA is to identify areas which have similar competencies among the job titles. The outcome of the OAA is the merging of job titles/areas (horizontally) and/or levels (vertically) within the sectors. This will eventually result in multi-skilling and multi-tasking due to common competencies among job titles/ areas and/or levels as shown in Table 3.0.

Table 3.0: Example of OAS for Front Office in Hospitality and Tourism

SUB-SECTOR	FRONT OFFICE				
LEVEL/ JOB AREA	GUEST SERVICE	TELEPHONE OPERATION	FRONT OFFICE ASSISTANCE	CONCIERGE	RESERVATION
LEVEL 5	Guest Services Management				
LEVEL 4	Guest Services Management				
LEVEL 3	Guest Services Operation				
LEVEL 2					
LEVEL 1					

All job titles in Level 1, 2 and 3 are actually the front liners that deal directly with customers. Therefore, they have common competencies which can be merged into the area of guest services operation. Ultimately, we are able to produce multi-skilling and multi-tasking workers required by the industry in line with the high income economy policy. Nevertheless, in certain cases, due to the requirement of industry or regulations, merging is not necessarily required.

2.2 Malaysian Occupational Skills Qualification Framework (MOSQF)

The development of the OA is closely monitored in order to comply with the MOSQF. MOSQF is a framework that describes all skills qualifications awarded under the Malaysian Skills Certification System. It is an 8-tier framework that consists of 8 levels which reflect skills competencies in an occupational area (refer to Annex 1).

However, for training purposes, only the first 5 levels are being offered with skills qualifications namely Malaysian Skills Certificate (MSC) Level 1, MSC Level 2, MSC Level 3, MSD Level 4 (Malaysian Skills Diploma) and MSAD Level 5 (Malaysian Skills Advanced Diploma).

MOSQF will serve as an instrument that develops and classifies skills qualifications based on a set of criteria guided by the National Skills Development Act 2006 (Act 652). It was benchmarked against international good practices in defining its level description and was developed in line with the Malaysian Qualifications Framework (MQF). It is aspired to become the national skills framework for all parties of interest such as individuals, skills training providers, the Government, associations, professional bodies, the industry sectors and the Malaysian communities.

2.3 OA Development Process

Below are the main steps involved in OA:

(i) Preliminary information gathering

(a) Literature survey

A literature survey is carried out to get some insight on the scope, policies, programs and activities in the context of the Malaysian scenario. The scope covered under this survey includes descriptions, current analysis of the sectors/sub-sectors, current status of the respective industry, skilled workers requirement in the local sector and the industrial competition at international level.

(b) Survey/Questionnaire

The purpose of the survey is to collect the data and feedback from the industries on the supply and demand on skilled workforce, job scope, nature of work, occupational description, occupational structure, career path, current and future trend of the industries.

(c) Interview

Interviews are one of the methods to reinforce the information gathered from the survey. The Interview focuses on the main industry players and stakeholders to seek their opinions and/or impressions.

(ii) Identifying industrial experts

Industrial experts who represent small, medium and large scale industries are identified and short listed for further communication and contact. Normally these experts are from Human Resources or managerial levels that have an overall view of the skilled workforce in the industry. They should have sufficient experience and substantial knowledge on industry growth.

(iii) Brainstorming session

The Developing a Curriculum (DACUM) technique is commonly used in OA. The session is attended by industrial experts where they will discuss exhaustively on the sub-sectors and areas involved. The facts obtained during the literature survey will be discussed and presented to the industry experts.

(iv) Analysing the information

Based on the activities done above, substantial data and information will then be collected. The data and information will then be discussed and analysed in development workshops attended by selected key persons or experts from the public and private sector. The presence of the key persons or experts ensures that the development of the Occupational Analysis is current and relevant. During this session, the respective industry is analysed using the DACUM and brainstorming methodology to identify the following:

(a) Scope of the Industry and its sub-sector;

(b) Main areas;

(c) Occupational groups of the sector;

(d) Job title;

(e) Critical job title;

(f) Hierarchy structure (Level 1 – 8); and

(g) Occupational Description.

(v) Finalising OA Documentation

Follow up discussions with the industrial experts and proofreader in a small group is vital to ensure all the findings of the occupational analysis are valid, reliable and sufficient. The final report of OA must be well presented with discussion, conclusion and recommendations in order to guide the general readers and interested parties to comprehend about the skilled workforce scenario in the industries. Details of the process flow in developing the OA is as shown in Figure 2.0.

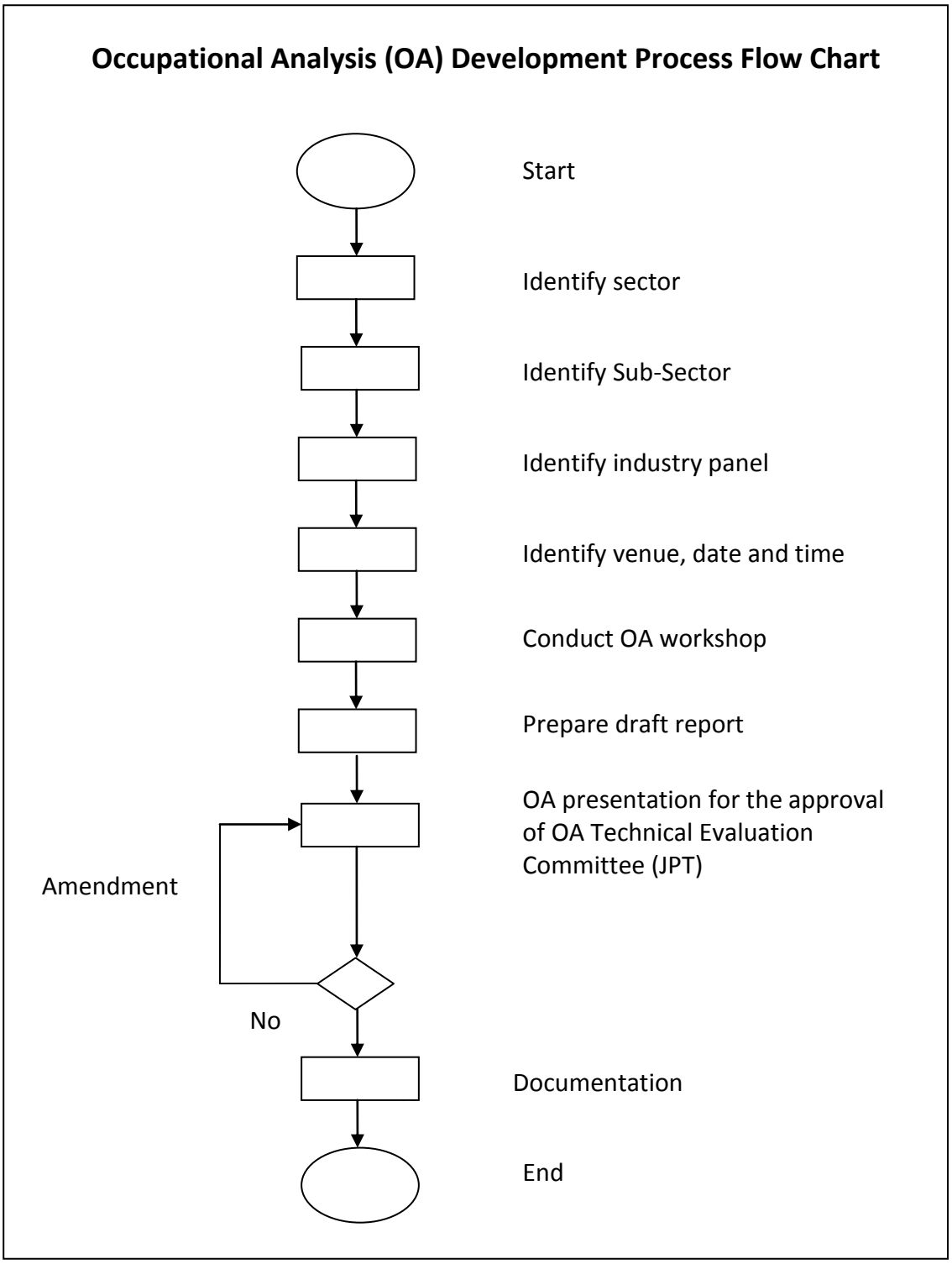


Figure 2.0: OA Development Process Flow Chart

2.4 Occupational Description (OD)

The Occupational Description (OD) is the detailed description of the main job scope of the job title. Below are the main steps in producing an OD for the respective job titles:

(i) determine the main sub-sectors and areas in the sector;

(ii) identify the job titles; and

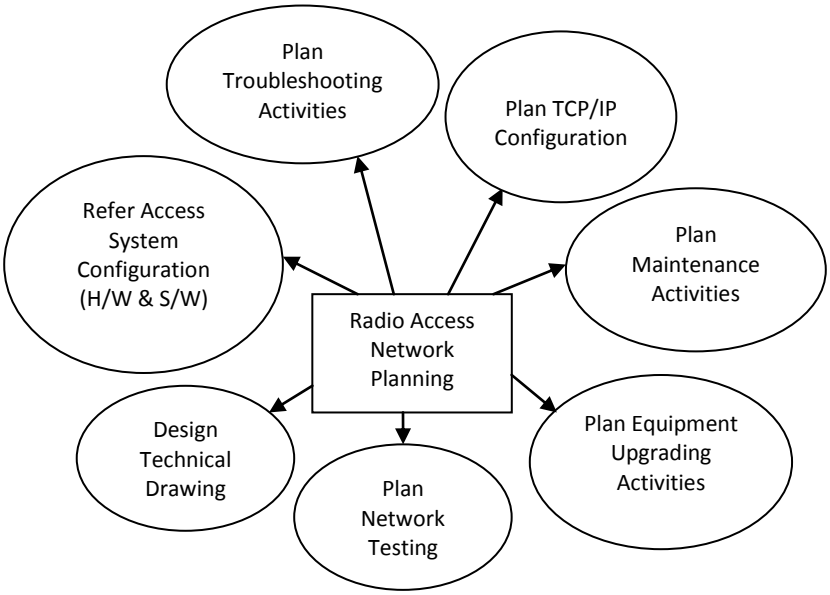
(iii) identify the job scope.

To describe the Occupational Description clearly, the statement must consist of a ***Verb, Object*** and ***Qualifier***. The rationale of determining the description attributes is to facilitate NOSS development especially in job and competency analysis.

a) Object

The object is determined first before the verb and qualifier. It is the main determinant to distinguish one job to another. For example, a demi chef (kitchen sub-sector of Hotel Sector), deals with food and cooking utensils as the objects in performing tasks. While a hairdresser deals with client's hair, hairdressing chemical, among others.

The objects are acquired from the industrial experts during a brainstorming session and written on DACUM cards so that all the experts can see the objects identified. Objects of those in the related area or sub-sector are determined as in the example below:



Legend:

: Sector/Sub-Sector/Area/Sub area

: Object

Figure 3.0: Example of Identifying Objects

b) Verb

The verb is then determined based on the level of difficulty of the identified job titles, such as below:

- ***Object*** *: Maintenance activities*
- ***Verb for Level 3 : Carry Out***

- ***Verb for Level 4 : Assist in planning***
- ***Verb for Level 5 : Plan***

Hence, the contents of the job definitions will be as below:

- Radio Access Network Planner (Level 5)
  - ✓ ***Plan*** *maintenance activities + (qualifier)*
- Radio Access Network Assistant Planner (Level 4)
  - ✓ ***Assist in planning*** *maintenance activities + (qualifier)*
- Access Network Technician (Level 3)
  - ✓ ***Carry out*** *maintenance activities + (qualifier)*

c) Qualifier

Based on the example above, the statement is not clear as there is no qualifier for the object, therefore a qualifier must be added to further clarify it. Below is an example:

- ***Plan*** *maintenance activities for* ***Radio Access Networks***

Figure 4.0 shows an example on how to write an appropriate Occupational Description (OD).

INSTALLATION & MAINTENANCE

TRANSMISSION SERVICES ASSISTANT ENGINEER*

LEVEL 4

A Transmission Services Assistant Engineer is designated to carry out set up of transmission services, perform test plans (regression tests, test of new features, acceptance of new nodes or parts), handle changes in the live network, operate the transmission network, maintain the transmission network, carry out network restoration and perform network performance enhancement.

A Transmission Services Assistant Engineer will be able to:

1. carry out set up of transmission services;
2. improve network functionality to the satisfaction of the customer;
3. perform test plans (regression tests, test of new features, acceptance of new nodes or parts);
4. handle changes in the live network, including the definition of command lines based on planning, consolidation, performance and debriefing of changes;
5. prepare report on actual network performance;
6. operate and maintain the transmission network; and
7. carry out network restoration or network performance enhancement.

Notes:

* Critical Job Title

Figure 4.0: Example of Occupational Description

2.5 Critical Job Titles

Critical job titles can be defined based on the following four main scenarios:

a) Shortage of skilled worker supply in the industries;

b) High demand for skilled workers in certain niche areas;

c) Mismatch of skills training; and

d) Decrease in number of skilled workers in certain areas such as in heritage and cultural activities.

Identified critical job titles should be categorised into short (1-3 years) and medium (4-5 years) terms and has to be supported with valid, reliable and sufficient data.

However, it must be highlighted that for this particular Medical & Pharmaceutical Healthcare Industry Occupational Analysis, the Critical Job Title section has been changed to two different sections which are Skilled Personnel Demand and Suggested Job Titles for Skills and Vocational Training. The reason is because not all job areas under this particular industry can be conducted and certified via skills training due to the nature of the work that involves the life and death and well being of humans based on direct contact and consultation. This area of work requires a high level of theoretical knowledge other than being skillful in one's area of skills.

3. METHODOLOGY OF OCCUPATIONAL ANALYSIS – TELECOMMUNICATIONS INDUSTRY

This chapter will explain more about the methodology of the overall Occupational Analysis process used when conducting the Occupational Analysis for the Telecommunications Industry. Below are details of each process in regards to the telecommunications industry.

(i) Literature survey

As outlined by the guidelines, a literature survey on the Telecommunications Industry was carried out to get some insight on the scope, policy, program, activities in the context of the Malaysian scenario. The scope covered under this search includes definitions, current analysis of the sectors/sub-sectors, current status of the Telecommunications Industry, skilled workers requirements in the local sector and the industrial competition at international level.

(ii) Identifying sector & public sector experts

The literature survey findings were used as a guide to identify the scope of occupational study and analysis. Experts from the Telecommunications Industry were identified and short listed for further communication and contact.

(iii) Establish contact with the Telecommunications Industry experts

A pool of Telecommunication experts from the industry was contacted. The lists of experts are included in Annex 2.

(iv) Information gathering

In the process of gathering the information, two (2) methods were adopted, namely; brainstorming and Developing a Curriculum (DACUM) session. The brainstorming and DACUM sessions is attended by panel experts who discuss the different Sub-Sectors and areas. Facts obtained during the literature survey were also discussed and presented to the development panel members. The information gathered was then used as input to the occupational analysis of the said sector.

(v) Analysing the information

Based on the activities done as above, substantial data and information were collected. The data and information were discussed and analysed in development workshops attended by selected key persons or experts from the public and private sector. The presence of the key persons or experts ensured that the development of the Occupational Analysis is current and relevant.

During this session, the Telecommunications Industry was analysed using the DACUM and brainstorming methodology to identify the following:

(a) Scope of the Telecommunications Industry and its sub-sectors;

(b) Main areas;

(c) Occupational groups of the sector;

(d) Job title;

(e) Hierarchy structure (Level 1 – 8); and

(f) Occupational Description.

(vi) Development Workshop with expert panels

Workshops were conducted during the development of the Occupational Analysis of the Telecommunications Industry. The details of the workshop are as below:

- Held on the 25th and 26th June 2011, at Professional & Technical Academy, Melaka. The outcome of the workshops were:
  - Preliminary findings (Occupational Analysis Session)
    - ✓ Outline of Job Title;
    - ✓ Career structure;
    - ✓ Hierarchy structure (Level 1 – 8);
    - ✓ Verification & proofreading of the findings; and
    - ✓ Occupational Description.

Follow up discussions with the expert panel members were done in smaller groups to verify the findings of the Occupational Analysis and Occupational Description.

4. TELECOMMUNICATIONS INDUSTRY IN MALAYSIA – BACKGROUND OF THE INDUSTRY

This chapter will focus on definitions of technologies in the telecommunications industry, the current scenario in Malaysia, introduction to government policies, development plans, government bodies and a brief section on skilled worker requirements pertaining to the telecommunications industry. However, the latter which is the section on skilled worker requirements will be further elaborated in Chapter 5, Findings, where the Occupational Framework and critical job titles will be presented. Following that will be the Occupational Descriptions that describe the job scopes of the respective job titles.

Findings in this chapter were obtained via literature review, observation, interviews with industry practitioners and discussions during workshops with development panel members. Most of the literature review was further discussed with panel members to obtain insight on the matters at hand from a practitioner's perspective. A list of references and glossary for abbreviations are included at the end of this document for easier comprehension of the terms and technologies.

4.1 Preamble

By its very nature, the telecommunications industry has always been at the forefront of technology and a leader of technical innovation and development. The industry has consistently been expected to provide a quality service and has

been a key enabler of economic development, being a catalyst for the growth of the nation's commercial and industrial sectors.

The convergence of the telecommunications and computer industries has also resulted in the rapid growth of sophisticated technology which has ushered in the Information Technology-based era where we are reliant on an “always connected” network where we have ready access to information and services and can communicate through a number of different media.

Organisations who are involved in the provision of telecommunications services have emerged as large scale national employers and act as “nation builders” through stimulation of innovation and entrepreneurship. In addition, the quality service that they provide has led to the inward investment of related communications industry players such as network equipment providers, device manufacturers, service providers and applications and content developers. Increasingly these companies are moving further up the service value chain and thus require a large pool of skilled talent to support this growth.

Growing from an industry that is over 100 years old, the Telecommunications sector has developed to become a pervasive, ubiquitous service provider. Besides the growing number of customers who make use of telecommunication facilities, the introduction of the latest value-added and downstream telecommunication services spur further growth in the nation's manufacturing and economic service sector.

Development of the public telecommunications network is not only confined to the urban areas, where efforts to expand public telecommunications network to the rural areas is actively carried out. The expansion and development of telecommunication services are important for the growth of the industrial and service sectors. To modernise and to increase telecommunications service growth rate, a competitive element was introduced in stages. (*The National Telecommunication Policy of Malaysia (1994 - 2020). Prime Minister's Department (Jabatan Perdana Menteri*)).

The government has taken measures for the implementation of the National Broadband Plan as a step to drive Malaysia into a knowledge-based society. (*National Broadband Plan. August 2006. Ministry of Energy, Water and Communications & Malaysian Communications and Multimedia Commission*)

4.2 Definition of Telecommunications

Telecommunications is the transmission of information such as voice, images and data over long distances. The facilities to support this communication include, but are not limited to, terrestrial and satellite radio, copper and optical fibre cables, as implemented in mobile networks, public switched telephone networks, radio and television broadcasting networks and others.

In terms of mobile networks which currently offer the most widely available service provision, they have been classified in terms of "generations". In general, this refers to a change in the technology implemented as well as an improvement in the network's ability to support services.

First generation (1G) is used to categorise the first analog mobile systems to emerge in the 1980s, such as the Advanced Mobile Phone System (AMPS) and Nordic Mobile Telephony (NMT). These systems provided a limited mobile solution for voice, but have major limitations, particularly in terms of interworking, security and quality.

The next wave, second generation (2G), arrived in the late 1980s and moved towards a digital solution which gave the added benefit of allowing the transfer of data, and provision of other non-voice services. Of these, GSM has been the most successful, with its global roaming model.

Third generation (3G) leverages on the developments in cellular to date, and combines them with complementary developments in both the fixed-line telecommunication networks, and from the world of the Internet. The result is the development of a more general purpose network, which offers the flexibility to provide and support access to any service, regardless of location. These services can be voice, video or data and combinations thereof, but as already stated, the emphasis is on the service provision as opposed to the delivery technology. 2011 saw the first roll-outs of new networks based on 4G technology. One of the 4G technologies that may be widely used in the near future is Long Term Evolution (LTE) which builds on the dominance globally of networks based on GSM and will support the global roaming and interworking that we have come to expect from existing mobile services.

For fixed telecommunications infrastructure, this has historically been based on provision of voice services, and as such has, like mobile, been an asset that is

regulated by the government. Networks supporting voice service have become very robust but unfortunately are inflexible when it comes to supporting new data and video services. This has led the industry to move forward with developing Next Generation Networks which provide an equally robust network which can simultaneously support services based around voice, video and data. Most recently, we have seen the expansion of this with high-speed access offered to home users through Fibre to the Home (FTTH).

Central to the development of the telecommunication sector for both mobile and fixed line is the use of the Internet Protocol (IP). IP has traditionally been used in data communications networks and forms the backbone of the Internet. IP and its associated protocols have placed an emphasis on flexibility and cost effectiveness.

However, telecommunication organisations have historically used completely separate protocols and communications frameworks, which place an emphasis on reliability and quality delivery of voice services. The convergence of voice, video and data means that most telecommunication organisations are now migrating to IP-based networks which provide both the traditional reliability of the telecommunication infrastructure and the flexibility offered by data communications.

To date, this migration has focused on the use of IPv4 (Internet Protocol version 4), which is the same version the Internet is based on. IPv4 is now over 30 years old and while still supporting this rapidly increasing network evolution, may not be able to scale to this level in terms of both scope and service support.

This has reached an impasse this year where the available address space of IPv4 has been exhausted in the Asia-Pacific region as of April 2011. This requires that both new and existing service providers now migrate to IPv6 - Internet Protocol version 6 (the new version, there is no IPv5) and they need to ensure that both networks based on IPv4 and IPv6, coexist with as little impact to user applications and services as possible. It is anticipated that this coexistence will be a drawn out affair lasting at least 10 years.

The key telecommunication technologies for Malaysia are defined and summarized in the following tables. Note that IP is used throughout these technologies at both the service layer (e.g. web browsing, voice over IP and such) and as a transport layer (e.g. equipment interconnection, support of network management).

Table 4.0: Telecommunications Technologies - Access Sub-Sector (Wireless)

ACCESS – MOBILE/WIRELESS	
Technology	**Description**
GSM	**Global System for Mobile (GSM):** a second generation mobile technology that provides voice and Short Messaging Services (SMS). There is limited support for data. It uses Time Division Multiple Access (TDMA) technology and builds and incorporates many aspects of the fixed line telephone network, extending it with a wireless interface and adding mobility features such as handover and roaming. Standards are now maintained by the Third Generation Partnership Project (3GPP) – GSM is the dominant global system for mobile communications.
GPRS/EDGE	**General Packet Radio System/Enhanced Data GSM Environment (GPRS/EDGE)** for GSM/Global Evolution is an evolved system that builds on top of a GSM network and supports more efficient transport of data services. The EDGE enhancement increases the data rates to support richer service content. GPRS & EDGE support data services with the introduction of the Internet Protocol (IP) into the mobile network.
UMTS	**Universal Mobile Telecommunications System (UMTS)** again standardised by 3GPP, this is the dominant 3G system deployed globally. It builds on the GSM/GPRS/EDGE core network but adds in a new radio access network based on Code Division Multiple Access (CDMA) technology. UMTS also expands the use of IP in the mobile network.
HSPA	**High Speed Packet Access** (**HSPA)** this is an evolutionary stage to the UMTS architecture which adds in the ability to offer high speed to data services. It has been the main enabler of a mobile operator's ability to offer broadband mobile services.

Table 4.0: Telecommunications Technologies - Access Sub-Sector (Wireless)(continued)

ACCESS – MOBILE/WIRELESS	
Technology	**Description**
LTE	**Long Term Evolution (LTE)** this is the next stage in the evolution charted by 3GPP from GSM forward. This whole family of technologies is generally collectively referred to as 3GSM. LTE is considered to be a 4G technology. LTE introduces a new radio access technology based on Orthogonal Frequency Division Multiplexing Access (OFDMA) and reuses some of the existing network infrastructure, however the entire network architecture is based solely on IP.
WiFi	**Wireless Fidelity (WiFi)** the generic term for the IEEE 802.11 family of technologies, also known as Wireless Local Area Network (WLAN). WiFi is designed for short range wireless communications at relatively high speed. It uses unlicensed frequency spectrum, therefore WiFi equipment does not need to obtain a spectrum license from the government to operate. WiFi is widely available in laptop and tablet computers, and more recently in many smart-phone devices. It is also widely deployed in offices and homes. It can be seen as a complementary technology to the 3GSM family which can support user connectivity in limited areas.
WiMAX	**Worldwide Interoperability for Microwave Access** (**WiMAX)**: another family of technologies developed by the Institute of Electrical and Electronics Engineers (IEEE) under the 802.16 standard. WiMAX is designed to offer services over a similar national footprint to cellular technologies. Currently deployed networks have tended to compete in the broadband Internet access space, placing less emphasis on services such as voice. Like LTE, WiMAX is based on OFDMA and so is also considered to be a 4G technology. Also like LTE, WiMAX is based on IP network architecture. However, globally WiMAX has a much smaller number of operators and subscribers compared to 3GSM. As of 2Q/2011, WiMAX has approximately 20 million subscribers (Source: WiMAX Forum) whereas 3GSM has exceeded 5 billion (Source: GSM Association). This has led many WiMAX network operators and equipment manufacturers to decide to migrate to LTE.

Table 5.0: Telecommunications Technologies – Access Sub-Sector (Fixed)

ACCESS – FIXED	
Technology	**Description**
DSL	**Digital Subscriber Line (DSL)** a technology that uses the existing copper telephone line at a customer's premise to offer high speed data services on the same cable without affecting the telephone service. This is a very widely deployed access technology of which the Asymmetric DSL (ADSL) variant is the most popular for home and Smart Office Home Office access.
PON	**Passive Optical Network (PON)**: this is a fibre-based access solution that offers high speed access to customers. The technology is based on the use of optical splitters to distribute the fibre to customer's premises. The "passive" nature of the technology is that there is no need for any electrically powered device on the run between the provider's office and the customer's premises. The most widely deployed version is Gigabit PON (GPON) as standardized by the ITU-T. PON is the technology behind the Fibre to the X (FTTX) service which includes end-to-end fibre deployment, known as Fibre to the Home (FTTH).

Table 6.0: Telecommunications Technologies – Transport Sub-Sector

TRANSMISSION/ TRANSPORT	
Technology	**Description**
MPLS	**Multiprotocol Label Switching** (**MPLS)**: a technology which supports the transport of multiple types of traffic with different quality requirements more efficiently than legacy transport technologies. It is standardized by the Internet Engineering Task Force (IETF) very widely implemented in equipment and networks. It relies on IP and IP routing protocols for setting up connections.
Metro/Carrier Ethernet	**Metro or Carrier Ethernet** is a service, rather than a technology, in that it is implemented using other transmission technologies. It builds on the cost-effective, flexible nature of Ethernet technology, but extends its reach over greater distances. For telecommunication applications, it also builds in additional support for provisioning, monitoring, clocking, among others.
Microwave	**Microwave** is a generic term for transport built over radio frequencies from the microwave region of the spectrum. Since it is more flexible to deploy than cables, it is widely used to support the transmission for mobile access networks. Traditional microwave has been wireless versions of Plesiochronous Digital Hierarchy (PDH) and Synchronous Digital Hierarchy (SDH) technology. Currently, however, these have evolved to support both legacy and emerging services. Two popular variants are hybrid microwave, which offers a mix of legacy and emerging transport technologies; and packet microwave which uses IP as a common transport layer for multiple services.

Table 6.0: Telecommunications Technologies – Transport Sub-Sector (continued)

TRANSMISSION/TRANSPORT	
Technology	**Description**
Legacy PDH	**Plesiochronous Digital Hierarchy (PDH**) is a traditional transport technology designed for transporting voice calls and the related call control signaling. It is a hierarchy which offers transport of increasing number of calls. Most commonly deployed is the PDH basic level, the E1 line which supports 30 regular calls plus signaling and synchronization. While providing good support for voice traffic, it is inflexible when providing support for data services. It is an ITU-T standard.
SDH/Next Generation SDH	**Synchronous Digital Hierarchy (SDH):** this builds on the PDH principle but supports much greater number of calls over a fibre backbone. Again it is widely used for data transport because of its availability; however it has the same inefficiencies as PDH. A newer, enhanced form of SDH known as Next Generation SDH tries to address this with the introduction of more flexibility and support for newer services such as Metro Ethernet. It is an ITU-T standard.
DWDM/OTN	**Dense Wave Length Division Multiplexing (DWDM/OTN)**: this provides a mechanism to greatly increase the capacity of existing fibre by carrying data over light at different wavelengths (essentially different "colours"). This is widely deployed for backbone networks that are required to support enormous volumes of traffic. Historically many Dense Wavelength Division Multiplexing (DWDM) solutions have been proprietary, however recently it has been standardized through a framework that defines the system architecture and standardizes support mechanisms such as management and transport of multiple protocols and traffic types. Optical Transport Network (OTN) is an International Telecommunication Union - Telecommunication Standardization Sector (ITU-T) standard.

4.3 Current Analysis of the Telecommunications Industry In Malaysia

Over the past number of years, Malaysia has developed an advanced and diverse telecommunication environment, implementing the latest technologies and increasing the flexibility of service offered. The mobile environment in particular has seen enormous growth and now has one of the highest penetration rates in South East Asia. This does however present challenges due to high market saturation.

Malaysia is projected to continue this rapid growth through both mobile and fixed broadband adoption across Digital Subscriber Line (DSL), FTTx, HSPA, LTE and WiMAX technologies. For mobile, LTE and HSPA are likely to see the largest growth since they are both supported by a large and experienced ecosystem of GSM-based operators and vendors. For fixed-line, it is expected that FTTx will dominate in urban areas while a combination of fibre and copper based solutions will be used in other areas.

The following diagram, Figure 5.0, shows an example of the network architecture for a 3G/UMTS mobile network. This network is standardised by ITU-T and 3GPP and as mentioned, is the most widely deployed 3G network worldwide – in Malaysia it also dominates the local mobile communications market.

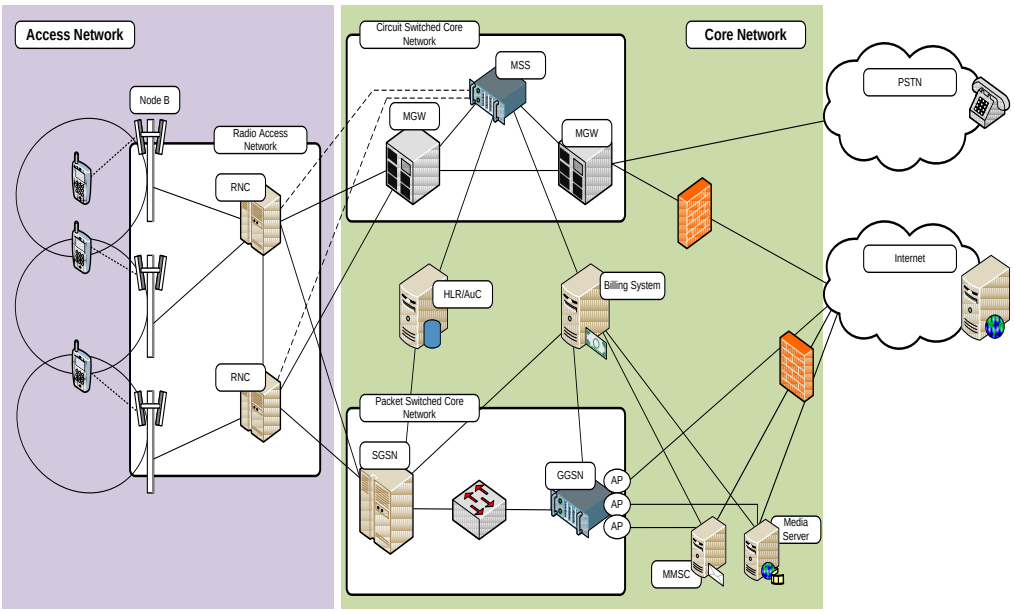


Figure 5.0: UMTS Mobile Network Architecture

(Source: Certified IP Associate Training Material, Orbitage Sdn. Bhd, 2011)

Note that in addition to the above network, Malaysia also has a number of other mobile network technologies including GSM and WiMAX as well as fixed line networks. Many of the technological aspects used as building blocks for this network are also used across all the networks used in Malaysia. This means that skills developed in one network are transferable across others. These include IP, MPLS, Metro Ethernet, Quality of Service mechanisms and aspects of network planning & design.

The underlying transmission network for the mobile network is also seeing dramatic changes as it migrates forward to offer more flexibility of service delivery.

In the first diagram, Figure 6.0, it shows the traditional transmission network for a mobile network supporting voice services only. It can be seen that this is a relatively straightforward implementation and the skills required for this are well established and widely available. However, these are not the skills that are required for next generation networks.

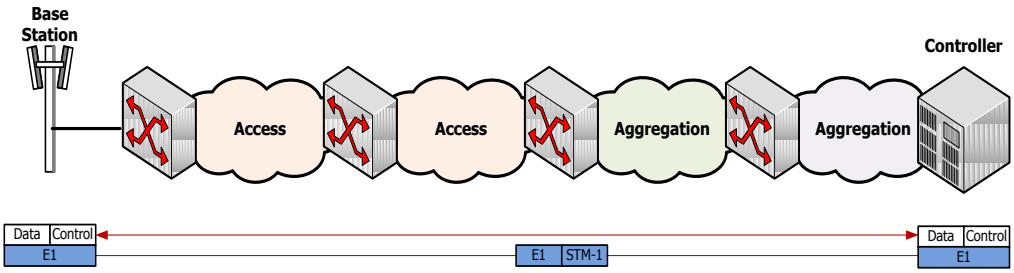


Figure 6.0: Legacy Transmission Network Architecture

(Source: Next Generation Transport Networks Training Material. Orbitage Sdn Bhd. 2011)

The second diagram, Figure 7.0, shows an evolved transmission network that offers the flexibility required of the next generation networks and implements a number of different technology building blocks. Note that this is only one example of many possible implementations that can be chosen to achieve the same purpose. As can be seen, to support this flexibility, the complexity of the network architecture has increased dramatically. Skills in these areas are in high demand since they are the building blocks of Next Generation Networks. There is a skills shortage in these technology areas, which needs to be address by industry, governments and training sectors working together.

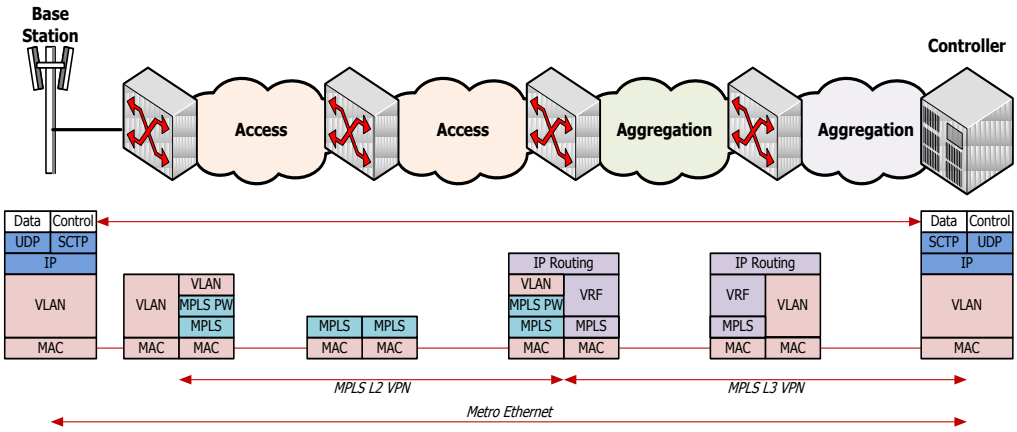


Figure 7.0: Next Generation Transmission Network Architecture

(Source: Next Generation Transport Networks Training Material.Orbitage Sdn. Bhd. 2011)

The advent of new technologies, by their nature, present additional technical challenges and operators need to properly manage the coexistence of networks, devices and services, at various levels and support backwards compatibility for legacy systems. Therefore the need for skilled personnel with the capability to adapt their skills according to the latest technologies is crucial. Even the most advanced technology and equipment will be useless without the skills of competent telecommunications personnel to utilise them effectively to maximise efficiency.

The landscape of telecommunications service provision has now changed in a number of ways. Platforms such as the IMS (IP Multimedia Subsystem) offer similar voice and video facilities as offered through the Internet, but with the ability to manage service quality and security more effectively.

The close relationship and cooperation between the Government and private sector are critical to the development of the telecommunications sector. Therefore, there is a need for the Government-Private sector synergy, working together to create a modern, sophisticated, efficient and productive telecommunications sector in making available services to every segment of society at a reasonable cost.

The realisation of social objectives in particular to increase and upgrade rural telecommunications facilities should not be neglected, and indeed all licensed telecommunications companies are responsible to achieve this end. The Malaysian Communications and Multimedia Commission (MCMC) has implemented the Universal Service Provision system to promote the widespread availability and use of network services and/or applications services throughout Malaysia by encouraging the installation of network facilities and the provision of services in underserved areas or for underserved groups within the community.

Malaysian telecommunications companies already have a substantial regional presence with considerable investment in many other countries. Having a skilled workforce as well as a structured framework for skills development promoted at a national level plays a valuable role in supporting this continued expansion.

4.4 Policies, Governing Bodies and Development Plan for the Telecommunications Industry

4.4.1 Governing Bodies / Relevant Act

(i) Ministry Of Information Communications And Culture

The Ministry of Information Communications and Culture is a ministry that combines the previous Ministry of Information, Ministry of Unity, Culture, Arts and Heritage and the Communications component from the Ministry of Energy, Water and Communications. The Information Communications and Culture Ministry is divided into three sectors: Information Sector, Culture Sector and Communications Sector. These three sectors comprise the Departments and agencies under the ministry. The management and support services are placed under the Management sector.

(ii) The Malaysian Communications and Multimedia Commission

The Malaysian Communications and Multimedia Commission is the regulator for the converging communications and multimedia industry. At the time it was created its key role was the regulation of the communications and multimedia industry based on the powers provided for in the Malaysian Communications and Multimedia Commission Act (1998) and the Communications and Multimedia Act (1998).

Pursuant to these Acts the role of the Malaysian Communications and Multimedia Commission is to implement and promote the Government's national policy objectives for the communications and multimedia sector.

The Malaysian Communications and Multimedia Commission will oversee the new regulatory framework for the converging industries of telecommunications, broadcasting and on-line activities.

The Malaysian Communications and Multimedia Commission are responsible for technical regulation, which includes efficient frequency spectrum assignment, the development and enforcement of technical codes and standards, and the administration of numbering and electronic addressing.

The Malaysian Communications and Multimedia Commission are also responsible for economic regulation, which includes the promotion of competition and prohibition of anti-competitive conduct, as well as the development and enforcement of access codes and standards. It also includes licensing, enforcement of license conditions for network and application providers and ensuring compliance to rules and performance/service quality.

In November 1998, Malaysia adopted a convergence regulation model with regards to the communications and multimedia industry. Two legislations were enacted to give effect to the new regulatory model: the Communications and Multimedia Act 1998 which set out a new regulatory licensing framework for a convergent communications and multimedia industry and the Malaysian Communications and Multimedia Commission Act (1998) which created a new regulatory body, the Malaysian Communications and Multimedia Commission.

The Communications and Multimedia Act (1998) came into effect on 1 April 1999, and the Telecommunications Act (1950) and the Broadcasting Act (1988) were repealed.

The regulation of the communications and multimedia industry is now undertaken by the Malaysian Communications and Multimedia Commission.

(iii) Communication and Multimedia Act 1998 (CMA**)**

Malaysia's IT and telecommunication regulatory environment underwent a major change with the enactment of the Communication and Multimedia Act 1998 (CMA). The Act defines a regulatory framework in support of ten national policy objectives for the communication industry:

(a) To establish Malaysia as a major global centre and hub for communication and multimedia information and content services;
(b) To promote a civil society where information-based services will provide the basis of continuing enhancements to quality of work and life;
(c) To grow and nurture local information resources and cultural representation that facilitates the national identity and global diversity;
(d) To regulate the long-term benefit of the end-user;
(e) To promote a high level of consumer confidence in service delivery from the industry;

(f) To ensure provision of affordable services over ubiquitous national infrastructure;

(g) To create a robust applications environment for end-users;

(h) To facilitate the efficient allocation of resources such as skilled labor, capital, knowledge and national assets;

(i) To promote the development capabilities and skills within Malaysia's convergence industries; and

(j) To ensure information security and network reliability and integrity.

4.4.2 Policies & Development Plans

(i) The National Telecommunication Policy (1994 - 2020)

The National Telecommunication Policy (NTP) will function as a catalyst towards the growth and development of the telecommunications sector in its efforts to become a modern, sophisticated and dynamic sector. The NTP will formulate general outlines for the development of the telecommunications sector not only at national but also at international levels. This will serve as a guideline to all parties involved including providers, investors and the government particularly with regards to the requirements of investment, human resource development, network and service facilities, absorption of new technology and research and development.

At the national level, the NTP will coordinate the emergence of a competitive atmosphere in an orderly manner to ensure the optimum use of the country's

resources. For the domestic service, the NTP will outline the creation of quality, high technology, cost effective and sophisticated telecommunications services at par with that found in developed countries.

In the international arena, the NTP will ensure that Malaysia is regarded as a competitive telecommunications service supplier and a premier market leader known throughout the Asia Pacific region and the world.

The NTP will be the main catalyst towards the creation of an information-rich and intelligent nation. The objectives of the NTP are divided into macro and micro objectives.

- **Macro Objective**

The macro objectives support national unity and integration by encouraging interaction between the races and regions through telecommunication facilities and services. In addition, the NTP also helps to realise the objectives of Vision 2020 in creating an educated and information-rich society through the application of modern and sophisticated telecommunications network. Besides information technology, the application of all types of telecommunications technology in all sectors of the nation's economy will be enhanced.

- **Micro Objective**

The micro objectives are:

✓ Provision of modern, sophisticated and quality communications services at a reasonable cost;

- ✓ Ensuring that telephone services are expanded to the rural and urban population at a reasonable cost;
- ✓ Ensuring that the telecommunication is adequate and effective in supporting the country's industrialisation efforts;
- ✓ Encouraging the growth of value-added services;
- ✓ Ensuring that human resource development is in tandem with the needs of the telecommunications sector;
- ✓ Ensuring that local manufacturing industries for the manufacturing of telecommunications equipment continues to expand and grow;
- ✓ Ensuring the use of local products by the telecommunications sector;
- ✓ Encouraging research and development (R & D) to facilitate the absorption of new technology and to upgrade telecommunication facilities and services;
- ✓ Promoting better ties between nations towards making Malaysia an international telecommunications hub;
- ✓ Encouraging the healthy participation of telecommunications companies in the international market and investment in other countries in the fields of telecommunications;
- ✓ Ensuring that radio telecommunications spectrum resource management is administered in an effective and fair manner; and
- ✓ Encouraging the active participation of Bumiputera entrepreneurs in the development of all sectors of telecommunications, in line with the government's policy to create a Bumiputera Business and Industrial society.

(ii) National Broadband Initiative

The National Broadband Implementation Strategy or better known as the National Broadband Initiative (NBI) puts in place a national strategy that will bring broadband to the whole nation. With the target for broadband set to 50% household penetration by 2011, the Government of Malaysia has identified a strategy that encompass both the supply and demand aspects of broadband.

The delivery of services is through wired and wireless connectivity. In the mean time, the existing broadband and cellular coverage will be expanded. For the high economic impact areas, the current broadband services will be upgraded to provide higher speed of more than 10Mbps. The Government has launched a project providing a high speed broadband infrastructure at selected areas. The project is called High Speed Broadband (HSBB) Project.

In order to achieve household penetration of 50%, emphasis on supply alone is insufficient. There must be an effective strategy to encourage demand for broadband. Therefore, emphasis will be given to three aspects of demand, which are Awareness, Attractiveness and Affordability.

The approach for creating awareness will be through continuous government and private sector involvement in the awareness programs and capacity building initiatives. In order to improve the attractiveness of the online content, efforts will be focused to enhance and promote e-Government, e-Education and e-Commerce. Efforts are also on the way to digitalise the traditional information resources such as libraries or archives to be available online.

The affordability factor and bridging the digital divide is being improved by developing various incentives to reduce the broadband access costs and widening the community access. (*The National Telecommunication Policy of Malaysia (1994 - 2020, Jabatan Perdana Menteri*)).

(iii) National Broadband Plan

In October 2004, after almost two years of careful deliberations, consultations and planning with more than 10 Government agencies, NGOs, and not forgetting the industry stakeholders and even members of the public, the Malaysian Cabinet approved the National Broadband Plan, together with instructions to implement it over a 10 year period.

The National Broadband plan is used to facilitate the achievement of the NBP's objective, a full time NBP Secretariat was formed within the Ministry of Energy, Water and Communications (MEWC) working closely with the MCMC who would continue to be the chief regulating agency, especially in terms of regulatory and implementing matters.

These are the National Broadband Plan's initial objectives:

- Generate adequate supply in terms of broadband infrastructure, via various available technologies;
- Stimulate demand to ensure efficient take-up of broadband services via suitable content & applications services;
- Explore various funding mechanisms to finance the project; and

- Identify gaps in existing regulations and where necessary, introduce new ones to facilitate broadband rollout. (National Broadband Plan. August 2006. Ministry of Energy, Water and Communications & Malaysian Communications and Multimedia Commission)

(iv) The Third Industrial Malaysia Plan (IMP3)

The government expects the service sector to assume a major role in driving the growth of the economy during the Third Industrial Master Plan (IMP3) spanning from 2006 to 2020.

Eight service sub-sectors have been identified for further development during the IMP3 period namely business and professional services, distributive trade, construction, education and training, healthcare services, tourism services, ICT services and logistics.

The ICT and other related sectors will be developed further under the Third Industrial Master Plan (IMP3), 2006-2020, to transform them into a strategic enabler to support and contribute directly to the growth of the economy. The focus areas are namely biotechnology, Shared Services and outsourcing, digital content development, bioinformatics, e-commerce, services and applications, nanotechnology, radio frequency identification, wireless technology, micro-electromechanical system, photonics and robotics.

Voice over Internet Protocol (VoIP) and Internet telephony services would be further enhanced to provide higher quality services and the demand to be created would lead to cheaper voice services.

Digital content development will also be expanded rapidly, in tandem with the integrated broadband infrastructure to be created under the strategy. Under the second phase of the development of MSC Malaysia, business-friendly environment, wireless broadband facility and other transportation and infrastructure amenities would be further enhanced.

(v) The Malaysia Information, Communication and Multimedia Services Strategy (MyICMS 886)

The *MyICMS 886* (Malaysian Information, Communication and Multimedia Services 886) Strategy identifies eight (8) service areas which have been targeted to propel Malaysia in the delivery of advanced information, communication and multimedia services towards improving the quality of life of Malaysians and at boosting Malaysia's global competitiveness.

The MyICMS 886 aims to create a catalystic cycle by enhancing the existing investments in ICMS infrastructure that will support future growth of ICMS services.

The introduction of the eight (8) new services catalyses promotes the development of eight (8) essential infrastructures - both *hard and soft.* These new services and infrastructures are aimed at generating growth in six (6) areas

that have been identified as a key for the consumers and businesses in Malaysia.

(a) High Speed Broadband

The High Speed Broadband Service encompasses both last mile wire line and wireless access services. The service provides high speed and high capacity portable Internet service while on the move or stationary.

(b) 3G & Beyond

For 3G & Beyond, the services will encompass voice, video and high-speed data services. The 3G services will continue to be expanded for extensive nationwide coverage and enhanced to cater for higher data speeds.

(c) Mobile TV

Arising from the hype surrounding the possibilities with he Internet over the last ten years, there is an increasing interest in offering extensive multimedia services to mobiles.

(d) Digital Multimedia Broadcasting

Digital multimedia broadcasting will cover both Terrestrial and Satellite TV and Audio services. Digital multimedia broadcasting will provide quality audio and video services over TV sets as well as handheld devices or mobile phones and other radio receivers.

(e) Digital Home

Digital homes use networking technologies to integrate appliances, devices, and services within the home to control and monitor the entire living space from within the home as well as from remote locations.

(f) Short Range Communication (e.g. RFID-based)

The Short Range Communication services will support the creation of short-range wireless connections type of applications which use very low power. Among the technologies categorised under this service are RFID (Radio Frequency Identification) and UWB (Ultra Wideband), Bluetooth. Examples of applications that would include use are inventory management, the supply chain management, transportation and logistics, livestock management and security and access control.

(g) VoIP/Internet Telephony

VoIP (Voice over Internet Protocol) and Internet Telephony in general, offers cheaper phone services over the Internet. VoIP phones can integrate with other services available over the Internet, including sending and receiving messages or data files in parallel with the voice conversation, audio conferencing, managing address books and passing of information on whether other users (e.g. friends or other associates) are available online to interested parties.

Note that now different parts of the MyICMS886 plan are implemented separately through the Economic Transformation Programme under the National Key Economic Areas (NKEA).

4.5 Skilled Worker Requirement in the Local Sector

Malaysia offers a pool of talented human resources. However, as with other countries, the Telco industry in Malaysia faces a major skills shortage in emerging areas of the technology roadmap, and in particular, skills such as planning, optimizing and troubleshooting in the following areas:

- The Internet Protocol (IP);
- Radio technologies (such as HSPA+, WiMAX and LTE); and
- Transmission technologies (MPLS, Metro Ethernet, Next Generation SDH).

It is projected that 84,000 personnel are required in these fields by the year 2018. As it has already been mentioned, IP is critical across the entire telecommunications sector. The skills shortage has been exacerbated this year by the exhaustion of the IPv4 address space and therefore skills that deal with the "interaction" of the IPv4 and IPv6 protocols are already in high demand and this is expected to continue for the foreseeable future.

With the support of a Malaysian Government that plans to turn the country to a knowledge economy, the Malaysian Telecommunications companies have been very proactive. Starting in 2007/2008, they (as well as a number of other interested organizations) concluded that there was a need for a skills-based, certification program to develop relevant technical skills in a structured manner. A Certified IP framework was developed through collaboration between subject matter experts across the industry.

Table 7.0: Certified IP Framework

CIPP	Certified Professional: Applied IP Security	Certified IP Professional: Implementing MPLS
	Certified IP Professional: QoS & Traffic Engineering	Certified IP Professional: Practical Networking with IPv6
	Certified IP Professional: Configuring IMS	Certified IP Professional: Troubleshooting IP Services
	Certified Professional: Implementing Metro BHEMET	Certified IP Professional: Configuring DHCP & DNS
CIPE	Certified IP Engineer VLANs Routing, Switching	
CIPA	Certified IP Associate Networking Principles, BHEMET, IP Addressing, IP Protocol Suite	

(*Source: Orbitage Sdn. Bhd*.)

This framework not only deals with IP but ties in the associated new technologies that are required by today's telecommunications industry. The framework provides a holistic approach to hands-on training and skills development and has been adopted by the Department of Skills Development. The following presents a summary overview of the elements of the Certified IP framework.

i. Certified IP Associate (CIPA)

The CIPA identifies & develops competence and the underpinning knowledge to analyse, troubleshoot & plan basic IP-based networks. After successful completion of the CIPA assessment (theory and practical) participants who require further knowledge and skills can proceed to the CIPE level. It is expected that all NOSS Level 3 and above should be CIPA certified where this is deemed necessary by the perspective organizations and dependent on their specific job roles.

ii. Certified IP Engineer (CIPE)

The CIPE identifies & develops competence and the underpinning knowledge to troubleshoot & plan more complex networks that include multiple routers and switches and related protocols. After successful completion of the CIPE assessment (theory and practical) participants who require further knowledge and skills can proceed to the CIPP level. It is expected that all NOSS Level 4 and above should be CIPE certified where this is deemed necessary by the perspective organizations and dependent on their specific job roles.

iii. Certified IP Professional (CIPP)

Unlike the CIPA and CIPE, the CIPP level consists of a number of different competence areas. An individual will need to show competence in a number of these to be awarded a CIPP level certification. Individuals will follow a CIPP pathway (consisting of a number of modules) that is specifically related to their current or expected job role.

The CIPP level identifies & develops competence in the following areas:

- Practical Networking with IPv6;
- Applied IP Security;
- QoS & Traffic Engineering;
- Configuring the IP Multimedia System (IMS/NGN)/ Voice over IP;
- Implementing MPLS;
- Troubleshooting IP Services;
- Implementing Metro Ethernet; and
- Configuring DHCP & DNS for IPv4/v6.

A similar framework for communications, Communications Convergence, is also to be incorporated. This is particularly important for planning and optimization for technologies such as LTE or WiMAX, transmission since many billions of Ringgit will be invested here.

Key to the success of this framework is an effective assessment mechanism to enable organisations to track and measure their staff development. The process also builds skills in analysis and inculcates a culture of lifelong learning.

The Certified IP framework has been running since 2009 and to date has certified over 2,500 Malaysian technical staff currently working in the telecommunications sector. It has recently been expanded to encompass other industry sectors where such skills are also in high demand.

An independent body, the Communications Convergence Professionals Society (CCPS), in collaboration with the Department of Skills Development ensures the maintenance of quality and consistency across all aspects of the certification.

The Government has set aside funds to provide loans for school leavers and workers intending to undergo skills training programmes over the next five years. At present, the Ministry of Human Resources produces some 18,000 skilled workers via its skills training courses. Working professionals also need to be aligned with skills training and certification via intensive short courses. This requires flexibility in program structure to accommodate part time study and qualification.

The next 10 years will see a greater emphasis on human resource enhancement as availability of skilled and knowledge workers are a major pre-requisite to transform Malaysia from a production-based into a knowledge-based economy.

Malaysia offers investors a young, educated and productive workforce at costs competitive with other countries in Asia. Backed by the government's continued support of human resource development in all sectors, the quality of Malaysia's workforce is one of the best in the region. Literacy levels are high at more than 94% and school leavers entering the job market have at least 11 years of basic education.

The Department of Skills Development (DSD) formerly known as the National Vocational Training Council under the Ministry of Human Resources coordinates the setting up of all public and private training institutions, evaluates the demand for existing and future skills, identifies future vocational and industrial

training needs and will continue to develop standards under the National Occupational Skills Standards (NOSS).

Besides the increasing number of public training institutions such as technical schools, polytechnics, industrial training institutes and skills development centres to meet the growing requirements of the industrial sector, collaborative efforts between the Malaysian government, enterprises and foreign governments have resulted in the establishment of several advanced skills training institutes.

4.6 International Benchmarks for the Occupational Framework

A "benchmark" is a comparative tool of measurement. It is a standard or point of reference used in measuring and judging quality or value. "Benchmarking" is the process of comparison. The process of continuously comparing and measuring an organisation against business leaders anywhere in the world to gain information that will help the organization take action to improve its performance. In practice it is the *process* of undertaking benchmarking that generates most benefits because it challenges current norms. Benchmarking data can be obtained from international, regional, and national sources. International organisations are one source of benchmarking data, and increasingly make information available for online access through the Internet.

In order to develop a skilled and efficient telecommunications workforce, a benchmark of the occupational structure with other countries must be done in order to measure whether the occupational structure of Malaysia's telecommunications occupational framework is at par with other developing and advanced countries.

The findings for this section were obtained via a combination of analysis done by job matching organisations and observation of job openings offered in each country's job agency portals. Advanced countries such as the United States, Britain, Australia and Japan generally have similar job titles and occupational framework for the telecommunications industry. As shown in the example below, the entry levels are as Telecommunications Technicians, Telecommunications Engineers, Telecommunications Supervisors, Telecommunications Analysts and finally as Telecommunications Specialists. (Telecom Crossing. Employment Crossing. Employment Research Institute. Date Accessed: 13 August 2011).

Table 8.0: Example of Telecommunications Job Titles In Advanced Countries (i.e. United States)

TELECOMMUNICATIONS
Telecommunication Specialist
Telecommunication Analyst
Telecommunication Supervisor
Telecommunication Engineer
Telecommunication Assistant Engineer
Telecommunication Technician

Table 9.0: Example of Telecommunications Job Titles In Advanced Countries (i.e. Britain)

TELECOMMUNICATIONS
Telecommunication Specialist
Telecommunication Analyst
Telecommunication Supervisor
Telecommunication Engineer
Telecommunication Assistant Engineer
Telecommunication Technician

As for developing countries, the entry level is also as Telecommunication Technicians then they advance as Engineers, however, not all countries and organisations have any (or not at all) Telecommunication Analyst or Specialists positions.

Table 10.0: Example of Telecommunications Job Titles In Developing Countries (i.e. Indonesia)

TELECOMMUNICATIONS
Telecommunication Engineer
Telecommunication Assistant Engineer
Telecommunication Technician
Telecommunication Assistant Technician

Therefore, the development of Malaysia's Telecommunications' Occupational framework is done with these international benchmarks in mind, but is specifically guided by the local Telecommunications Industry and government human capital development plans.

4.7 Industrial Competition at International Level

Telecommunications plays an important role in the world economy. The service revenue of the global telecommunications industry is expected to touch $2.7 trillion by 2013.

The Government provides licenses for companies to supply infrastructure and services in accordance with the strategic plans of the telecommunications sector. An integrated and reliable transmission network that offers national coverage and is capable of supporting multiple converged services is critical for supporting other business operations and international inward investment.

To strengthen the nation's economic growth and spur technological transfer, local manufacturing and assembly of telecommunication equipments are encouraged. In addition, there are huge opportunities for Malaysian companies to develop applications and services to support the telecommunications ecosystem. Malaysia is seeing an increase of telecommunications service companies establishing a base in Malaysia because of the skill levels of the local workforce. As well as providing employment locally and developing products and services for the domestic market, the local telecommunications industry is expected to take more advantage of Malaysia's reputation to further enhance the export market. Those involved in telecommunication are encouraged to carry out research and development (R & D) to support local industrial growth and to speed up transfer of technology. At least 1% of the annual expenditure should be allocated for R & D purposes. Continued or expanded R&D in telecommunications should be encouraged.

The telecommunications sector has been deregulated to allow competition where basic infrastructure and telecommunications services are now operated by private enterprises. The main objective of deregulation has been to encourage competition in the telecommunications sector in order to achieve efficiency and to provide high quality, cost effective services to consumers.

Malaysia possesses good telecommunications links with the rest of the world. Currently, these are supported through cable systems such as the Asia American Gateway (AAG), South Africa Far East Cable (SAFE), Fibre-Optic Link around the Globe (FLAG) which provides flexibility of access globally and supports services such as IDD, mobile roaming, Internet access and such.

As Malaysia undergoes the transformation from being industrial-based to being a knowledge-based economy, telecommunications is acknowledged as one of the key engines of this growth. Malaysia has been ranked globally as the third most favored location for outsourcing of business processes. Progressive Government policies and efforts in offering a world-class environment and attractive incentives through special zones will continue to attract business from around the globe.

5. FINDINGS

The findings from the research of the Telecommunications Industry's Occupational Analysis are presented in the following sections. Firstly, the newly identified sectors will be elaborated and each Sub-Sector will be presented in the Occupational Framework. Then, there will be a section on supporting industries pertaining to the Telecommunications Industry, following that will be a section of the mapping between the telecommunications Industry and other industries in terms of sub-sectors, areas and job titles. Finally, there will be an elaboration on the entry level and critical job titles to focus development on in the near future.

5.1 Identified Sectors

The identified sectors for the Telecommunications Industry were obtained through literature research and discussions with industry experts during the development workshop sessions. During the development workshop, the panel members had identified three (3) main sectors of the Telecommunications industry The three (3) Telecommunications sectors are listed as below:-

(a) Access Networks
(b) Transmission
(c) Core Network

As previously discussed, service aspects were seen as outside of the scope of this OA as it falls under the purview of the ICT industry and these are already addressed in the ICT Occupational Framework. Although services such as media and content, messaging, IPTV, Voice over IP, are important for telecommunications networks, they overlap with ICT services. It should be noted that ICT skills will need to be put in a "telecommunications context" from both the end user as well as the network operators' point of view.

The OA matrices for these sectors are included in this section. A total of 29 job titles exist in the proposed Sub-Sectors. The Telecommunications Industry expert panel members observe that the new framework offers a clearer framework and career pathway for the future workforce of the Telecommunications Industry. Below are the descriptions of each of the different sectors:

a) Access Networks

This Sub-Sector is further divided into 2 areas which are:

i) Radio Access Network

ii) Customer Access Network

The access network is huge in scope, as it is geographically distributed across the country and connects a large number of subscriber equipment via related provider equipment. This equipment may include mobile devices, laptop computers and tablet devices, desktop PCs or home access gateways. All of these geographically distributed networks will be combined together towards a

core network, which must support and manage vast amounts of data travelling through at high speed. This access network has historically only needed to support “slow” services such as telephone calls, SMS and limited data services. However this is currently changing as the amount of data over access networks is increasing exponentially as new services such as IPTV and high-speed broadband are offered to customers. Due to its distributed nature, the access network is expensive to deploy, upgrade and maintain and requires large numbers of skilled personnel.

In general, Access Networks support customer connectivity to the services offering security and quality. In the Customer Access Network, this is done via wired media, whereas for the Radio Access Network it is via wireless and may include additional support functions such as mobility and paging for users.The radio access network consists of the radio (air) connection, the base stations and any controllers performing management functions and supporting the connection to the core network & services – these pieces of equipment are connected together by the transmission network.

The Customer Access Network consists of the wired connection to customers via copper or fibre cabling, the CPE (Customer Premises Equipment) devices performing management functions and controllers at the provider’s premises supporting the connection to the services platforms. Again as with the Radio Access Network, these pieces of equipment are connected together by the transmission network. It should be noted that the Customer Access Network also often uses radio technology in providing services to customers – examples include WiFi and Femto Cells.

The personnel under this Sub-Sector will enter at Level 2 as Access Network Assistant Technicians until Level 3, Access Network Technicians whereby from this level they can further pursue specialised career paths either as Radio Access Network Planners, Radio Access Network Engineers, Customer Access Network Engineers or Customer Access Network Planners. The top most level is at Level 6 as an Access Network Specialist where they act as consultants to plan, design, set up and provide consultancy in providing a quality access network for end users.

b) Transmission

There are a total of 15 job titles under the Transmission sector. This Sub-Sector is further divided into 2 areas which are:

i) Transmission Infrastructure

ii) Transmission Services

The existing infrastructure that has been in place for the last 40-50 years is currently being upgraded to support the new service requirements. In Malaysia, billions of ringgit are being invested in this network upgrade. This includes the national broadband plan as well as investments being made by the many Malaysian service providers. The transmission infrastructure is critical since both the access and core networks are dependent on it.

Traditionally, the transmission network has been built and designed to support telephony services, both mobile and fixed. The technologies employed for this purpose were designed and optimized to transport phone calls and related call

control messages, however they have a number of critical issues when it comes to supporting other services, including:

i) Cost

ii) Efficiency

iii) Flexibility

iv) Scalability

It is for these reasons that a major change in the infrastructure is required. This involves the introduction of a range of new technologies as described previously. The scale of this upgrade cannot be underestimated. In Malaysia alone, it is tens of billions of dollars and worldwide it is expected to be $850,000 Million USD in the next 5 years. Telecommunications providers must weigh up the myriad of transmission technology choices. This requires staff that are highly competent – the Telco's are actively addressing the skills shortage however as mentioned in the introduction, both government and IHLs clearly have a role to play here.

The Transmission Infrastructure Sub-Sector is divided into 2 main categories which are Wired and Wireless. In order to ensure an effective, efficient and comprehensive design and implementation of the Transmission Infrastructure, personnel are divided into 2 sub areas which are:

i) Planning

ii) Installation & Maintenance

These personnel begin their careers at Level 2 as Transmission Assistant Technicians, where they progress as Transmission Technicians until at the Assistant Engineer level they can choose to specialise under Wired Transmission or Wireless Transmission Infrastructure.

The Transmission Services Sub-Sector personnel are responsible for the Planning and Installation & Maintenance of Transmission Services for end users based on the current and evolving technologies. The highest level of competency is defined and acquired at Level 6 as a Transmission Specialist who must have extensive skills across, and understand the relationships between, all of these transmission technologies.

c) Core Network

As discussed, the access network is geographically distributed, usually in a hierarchical manner, with potentially thousands or millions of end points. All of these are connected together through to the core network. The core network is responsible for connecting these end customers to the services they require and must support a number of features, including the following:

i) Provision of billing
ii) Provision of quality
iii) Subscription management
iv) Security procedures
v) External network interconnect

The core network must support an ever increasing volume of traffic as the access network offers higher speed services. The reliability of the core network is critical as any outages or failures at this level will affect huge numbers of customers, potentially the service provider's entire customer base. In addition, the core network must simultaneously support multiple services (voice, video and data) which place different demands on the network in terms of resource usage and quality requirements. Traditionally, this has been done by providing two separate core network domains: one to support voice and other real-time traffic and one to support data traffic. However, now these domains are merging together to provide a unified core network based on the Internet Protocol (IP) and its associated technologies and services (e.g. MPLS, Metro Ethernet, IMS/SIP, routing).

Personnel under the Core Network Sub-Sector are responsible for the planning, design, deployment and management of the core network. There are a total of 5 job titles starting at Level 2 as a Switching Assistant Technician until they progress as Switching Engineers at Level 5 until the highest level of competency which is as a Core Network Specialist at Level 6.

Table 11.0: Overall Telecommunications Occupational Structure (OS)

SUB-SECTOR / LEVEL	ACCESS				TRANSMISSION						CORE NETWORK
AREA	RADIO ACCESS NETWORK		CUSTOMER ACCESS NETWORK		TRANSMISSION SERVICES		TRANSMISSION INFRASTRUCTURE				
							WIRED		WIRELESS		
SUB AREA	PLANNING	INSTALLATION & MAINTENANCE	PLANNING	INSTALLATION & MAINTENANCE	PLANNING	INSTALLATION & MAINTENANCE	PLANNING	INSTALLATION & MAINTENANCE	PLANNING	INSTALLATION & MAINTENANCE	
LEVEL 8	*~ No Level ~*				*~ No Level ~*						*~ No Level ~*
LEVEL 7	*~ No Level ~*				*~ No Level ~*						*~ No Level ~*
LEVEL 6	Access Network Specialist				Transmission Specialist						Core Network Specialist
LEVEL 5	Radio Access Network Planner	Radio Access Network Engineer	Customer Access Network Planner	Customer Access Network Engineer*	Transmission Services Planner	Transmission Services Engineer*	Transmission Infrastructure Engineer*		Transmission Infrastructure Planner	Transmission Infrastructure Engineer*	Switching Engineer
LEVEL 4	Radio Access Network Assistant Planner	Radio Access Network Assistant Engineer	Customer Access Network Assistant Planner	Customer Access Network Assistant Engineer*	Transmission Services Assistant Planner	Transmission Services Assistant Engineer*	Transmission Infrastructure Assistant Engineer*		Transmission Infrastructure Assistant Planner	Transmission Infrastructure Assistant Engineer*	Switching Assistant Engineer
LEVEL 3	Access Network Technician				Transmission Technician*						Switching Technician
LEVEL 2	Access Network Assistant Technician				Transmission Assistant Technician*						Switching Assistant Technician
LEVEL 1	*~ No Level ~*				*~ No Level ~*						*~ No Level ~*

Note:
* Critical Job Title

Table 12.0: Telecommunications OA Matrix (Access Sub-Sector)

SUB-SECTOR/LEVEL	ACCESS			
AREA	RADIO ACCESS NETWORK		CUSTOMER ACCESS NETWORK	
SUB AREA	PLANNING	INSTALLATION & MAINTENANCE	PLANNING	INSTALLATION & MAINTENANCE
LEVEL 8	*~ No Level ~*			
LEVEL 7	*~ No Level ~*			
LEVEL 6	Access Network Specialist			
LEVEL 5	Radio Access Network Planner	Radio Access Network Engineer	Customer Access Network Planner	Customer Access Network Engineer*
LEVEL 4	Radio Access Network Assistant Planner	Radio Access Network Assistant Engineer	Customer Access Network Assistant Planner	Customer Access Network Assistant Engineer*
LEVEL 3	Access Network Technician			
LEVEL 2	Access Network Assistant Technician			
LEVEL 1	*~ No Level ~*			

Note:
* Critical Job Title

Table 13.0: Telecommunications OA Matrix (Transmission Sub-Sector)

SUB-SECTOR/ LEVEL	TRANSMISSION					
AREA	TRANSMISSION SERVICES		TRANSMISSION INFRASTRUCTURE			
SUB AREA			WIRED		WIRELESS	
	PLANNING	INSTALLATION & MAINTENANCE	PLANNING	INSTALLATION & MAINTENANCE	PLANNING	INSTALLATION & MAINTENANCE
LEVEL 8	*~ No Level ~*					
LEVEL 7	*~ No Level ~*					
LEVEL 6	Transmission Specialist					
LEVEL 5	Transmission Services Planner	Transmission Services Engineer*	Transmission Infrastructure Engineer*		Transmission Infrastructure Planner	Transmission Infrastructure Engineer*
LEVEL 4	Transmission Services Assistant Planner	Transmission Services Assistant Engineer*	Transmission Infrastructure Assistant Engineer*		Transmission Infrastructure Assistant Planner	Transmission Infrastructure Assistant Engineer*
LEVEL 3	Transmission Technician*					
LEVEL 2	Transmission Assistant Technician*					
LEVEL 1	*~ No Level ~*					

Note:
* Critical Job Title

Table 14.0: Telecommunications OA Matrix (Core Network Sub-Sector)

SUB-SECTOR/ LEVEL	CORE NETWORK
LEVEL 8	*~ No Level ~*
LEVEL 7	*~ No Level ~*
LEVEL 6	Core Network Specialist
LEVEL 5	Switching Engineer
LEVEL 4	Switching Assistant Engineer
LEVEL 3	Switching Technician
LEVEL 2	Switching Assistant Technician
LEVEL 1	*~ No Level ~*

5.2 Support Industries for the Telecommunications Industry

5.2.1 Value Added Services

Value-added services (VAS) are telecommunication services that are offered by the network beyond voice calls. Traditionally these include services that are related to enhancing existing voice services, including:

(a) Voice mail

(b) Call waiting services

(c) Call barring services

With the advent of new enablers in the network, the scope of VAS has increased to include a huge range of new services such as location based services, payment services and presence services. Hand in hand with this have been developments in billing systems to allow for much greater flexibility in charging policies, allowing for services such as prepaid billing, content-based charging or location-based charging. VAS is a growing area for skills development, particularly as IP opens the network more to third party development partnerships and operators move up the services value chain. Many of the skills required here come from the ICT sector, such as programming, application development or cloud computing, however telecommunications is at the forefront in many aspects of this convergence with platforms such as the IMS and policy control. These telecommunication aspects need to be taken into consideration when developing for mobile devices and telecommunications platforms.

5.2.2 Broadcasting Industry

Unlike personal communication, broadcasting provides a means of delivery of a variety of information to the public through wired and wireless technologies. Common examples of services availing of broadcasting include television and commercial radio. Due to its impact on society, the issue of its public nature has always been prominent. As such, communication and broadcasting were defined as separate sectors. With the development of technologies, the overlap between these two sectors has been accelerated in recent years. Currently, the broadcasting industry is also using the telecommunication infrastructure as a carrier to transmit content to the end user. Television and radio content is now available on the internet and can be accessed from laptops and hand phones.

In particular, the broadcasting sector is now implementing networks based around IP to enable offering of enhanced, interactive services such as Video on Demand, Over the Top services or triple play. Many traditional broadcast service providers, most notably TV companies, are now offering Internet access and often voice services as a bundled package. This is also true of telecommunications providers, who are integrating TV and video services into their portfolio. This process of convergence is referred to as “triple play”. Content licensing is arguably one of the most difficult issues facing this converged market.

It must be noted that the Telecommunications Industry Occupational Framework is different from the Value Added Services and Broadcasting Industries. This is because these industries have their own Occupational Framework which address different job scopes and skills sets.

However, the broadcasting industry can avail of the Communications skills defined in the NOSS covering telecommunications. The existing Occupational Frameworks for the ICT industry is shown below. Table 15.0 shows an excerpt from the ICT Occupational Framework depicting the areas relevant to the Telecommunication Industry.

Table 15.0: Excerpt From the ICT Occupational Framework Related to Telecommunications Industry's Supporting Area

SUB-SECTOR / LEVEL AREA	DATA MANAGEMENT	ICT SECURITY	ICT SYSTEM		APPLICATION SYSTEM DEVELOPMENT		
			ICT COMPUTER SYSTEM	ICT NETWORK SYSTEM	MULTIMEDIA PROGRAMMING	WEB BASED / WAP PROGRAMMING	SERVER PROGRAMMING
LEVEL 8	*~ No Level ~*	*~ No Level ~*	ICT System Principal Specialist *		Application System Development Principal Specialist *		
LEVEL 7	Database Manager *	ICT System Security Specialist *	ICT System Specialist *		Application System Development Specialist *		
LEVEL 6	Database Administrator (Data Management) *	ICT System Security Principal Technologist *	ICT Computer System Principal Technologist *	ICT Network System Principal Technologist *	System Analyst *		
LEVEL 5	*~ No Level ~*	ICT System Security Technologist *	ICT Computer System Technologist *	ICT Network System Technologist *	Multimedia Analyst Programmer *	Web Based/WAP Analyst Programmer	
LEVEL 4	*~ No Level ~*	*~ No Level ~*	ICT System Senior Technician		Multimedia Programmer *	Web Based/WAP Programmer	
LEVEL 3	*~ No Level ~*	*~ No Level ~*	ICT System Technician		Junior Programmer		
LEVEL 2	*~ No Level ~*	*~ No Level ~*	ICT System Assistant Technician		*~ No Level ~*		
LEVEL 1	*~ No Level ~*	*~ No Level ~*	*~ No Level ~*		*~ No Level ~*		

Note:
* Critical Job Title

5.3 Mapping Between The Proposed Occupational Framework To Existing Occupational Frameworks

Due to the development of the Telecommunications Industry, the current sectors available in the NOSS register have been reviewed and restructured in order for skilled workers to adapt to the current working environment. The review is also to further ensure that the framework shows a clearer career pathway and to define the segregation between industries.

It can be seen in Table 16.0 that most of the proposed areas can be mapped to the existing areas under the Telecommunications Industry. The proposed Radio Access Network and Customer Access Network areas can directly be mapped to the existing areas and the Transmission Services area can be mapped to Wireless Telecommunication and Fibre Optic Services. Transmission Infrastructure is mapped to the Structured Cabling and Wireless Telecommunication areas, whereas. 3G Switching and Switching Operation are mapped to Core Network. The National Competency Standard (NCS) for Certified IP Associate and Certified IP Engineer are mapped to all the proposed areas due to the fact that these NCS are applicable to all relevant telecommunications areas especially with the advancement of IP based networks.

However, Electronic Communication is not mapped to this framework because this occupation mainly utilises telecommunication and acts more as end users of communication services.

Table 16.0: Mapping between Proposed Telecommunication Areas and Existing Telecommunication Areas

PROPOSED TELECOMMUNICATIONS AREAS / EXISTING TELECOMMUNICATIONS AREAS	ACCESS NETWORK		TRANSMISSION			CORE NETWORK
	RADIO ACCESS NETWORK	CUSTOMER ACCESS NETWORK	SERVICES	WIRED	WIRELESS	
Customer Access Network (D-215)						
Fibre Optic Services (D-400)						
Telecommunication Installation (D-210)						
Telecommunication Maintenance (D-211)						
Radio Access Network (EE-033)						
Electronic Communication (D-030)						
Switching Operation (D-217)						
Structured Cabling System (Passive) (D-500)						
Wireless Telecommunication (D-200)						
3G Switching (EE-032)						
Radio Frequency						
Certified IP Associate (CIPA)						
Certified IP Engineer (CIPE)						

5.4 Entry Level

Entry Level at Level 2

Sub-Sector: Access, Transmission and Core Network

Access	Transmission	Core Network
Level 6	Level 6	Level 6
Level 5	Level 5	Level 5
Level 4	Level 4	Level 4
Level 3	Level 3	Level 3
Level 2	Level 2	Level 2
No Level	No Level	No Level

The Access, Transmission and Core Network sub-sectors begin at Level 2, because the job scope and duties of the Assistant Technician are non routine and require autonomy and responsibility. They usually can choose areas of specialization at Level 4 as Assistant Engineers based on their level of competency. The top most level is Level 6 as Specialists for their respective sub-sectors.

5.5 Critical Job Titles & Non Critical Job Titles

For the Telecommunications sector, a total of **10 job titles** are considered to be critical and **19 job titles are** non critical.

5.5.1 Critical Job Titles

Based on input from the expert panel members, it can be summarised that the critical job titles under the Transmission Sub-Sector and Customer Access Network area have an immediate need for skilled and certified personnel.

The reason why the personnel under these sub-sectors are deemed critical is because as the demand for high speed access is increasing, the need for competent and skilled personnel to conduct the installation and maintenance of these high speed networks also increases. The existing Customer Access Skills Standards must also be reviewed and updated so that the competencies stated are in line with the fast emerging technologies that enable high speed and reliable access currently available in Malaysia. Telecommunications Transmission is highlighted as an $850,000 Million USD industry worldwide in the next 5 years. Therefore there will be a demand for Transmission personnel in the near future.

The list of Critical Job Titles can be referred to in the following tables below:

a) Area: Wired Transmission Infrastructure – Installation & Maintenance

No.	Job Title	Level
1	Transmission Infrastructure Engineer	L5
2	Transmission Infrastructure Assistant Engineer	L4

b) Area : Wireless Transmission Infrastructure – Installation & Maintenance

No.	Job Title	Level
1	Transmission Infrastructure Engineer	L5
2	Transmission Infrastructure Assistant Engineer	L4

c) Sector : Transmission

No.	Job Title	Level
1	Transmission Technician	L3
2	Transmission Assistant Technician	L2

d) Area : Transmission Services - Installation & Maintenance

No.	Job Title	Level
1	Transmission Services Engineer	L5
2	Transmission Services Assistant Engineer	L4

e) Area : Customer Access Network

No.	Job Title	Level
1	Customer Access Network Engineer	L5
2	Customer Access Network Assistant Engineer	L4

5.5.2 Non Critical Job Titles

The job titles under this category do not reflect that they are not critical in the industry but only represent categories of job titles that have a sufficient supply of skilled workers in the near future and do not require immediate revision of the National Occupational Skills Standards documents or skills training. The list of Non Critical Job Titles can be referred to in the following tables below:

a) Sector : Transmission

No.	Job Title	Level
1	Transmission Specialist	L6

b) Area: Wireless Transmission Infrastructure – Planning

No.	Job Title	Level
1	Transmission Infrastructure Planner	L5
2	Transmission Infrastructure Assistant Planner	L4

c) Area : Transmission Services - Planning

No.	Job Title	Level
1	Transmission Infrastructure Planner	L5
2	Transmission Infrastructure Assistant Planner	L4

d) Sector : Access

No.	Job Title	Level
1	Access Network Specialist	L6
2	Access Network Technician	L3
3	Access Network Assistant Technician	L2

e) Area : Radio Access Network - Planning

No.	Job Title	Level
1	Radio Access Network Planner	L5
2	Radio Access Network Assistant Planner	L4

f) Area : Radio Access Network – Installation & Maintenance

No.	Job Title	Level
1	Radio Access Network Engineer	L5
2	Radio Access Network Assistant Engineer	L4

g) Area : Customer Access Network - Planning

No.	Job Title	Level
1	Customer Access Network Planner	L5
2	Customer Access Network Assistant Planner	L4

h) Sub-Sector : Core Network

No.	Job Title	Level
1	Core Network Specialist	L6
2	Switching Engineer	L5
3	Switching Assistant Engineer	L4
4	Switching Technician	L3
5	Switching Assistant Technician	L2

Table 17.0: Summary of Critical Job Titles According to Sub-Sector Schedule

SUB-SECTOR			LEVEL						TOTAL
			L1	L2	L3	L4	L5	L6	
1	Access	*Critical*	0	0	0	1	1	0	2
		Non-Critical	0	1	1	3	3	1	9
2	Transmission	*Critical*	0	1	1	3	3	0	8
		Non-Critical	0	0	0	1	3	1	5
3	Core Network	*Critical*	0	0	0	0	0	0	0
		Non-Critical	0	1	1	1	1	1	5
			Critical						10
			Non-Critical						19
Total			0	3	3	9	11	3	29

6. OCCUPATIONAL DESCRIPTIONS OF JOB TITLES IN THE TELECOMMUNICATIONS INDUSTRY

Under the Telecommunications industry, job titles have been identified. Each job title is given a job description as specified by the industry. The methodology to construct the Occupational Description is based on input from the industry practitioners. This chapter will include the Occupational Descriptions for each of the job titles specified in the previous Chapter 5, Findings. The Occupational Descriptions are included in Annex 3 of this report.

These Occupational Descriptions can be used as a reference, listing of competencies for the personnel of the respective job titles and should also be used as reference during the development of the NOSS document.

The Occupational Descriptions are divided and presented according to the sub-sectors; Access Network, Transmission and Core Network.

7. CONCLUSION AND RECOMMENDATION

As a result of the Telecommunications Industry's Occupational Analysis conducted together with expert panel members from various Telecommunications Sub-Sectors and organisations, a total of 29 job titles and 3 main sectors have been identified.

The Telecommunications Industry is an industry with a great potential. The government's keen interest in developing the Telecommunications Industry will allow the workforce in this sector to be formally trained at all levels specified and in turn develop a more progressive and competent workforce for the industry and country.

Based on the findings obtained, it is strongly recommended that the skills training for this sector should be conducted immediately. This is to ensure that there will be a sector outline for the purpose of industrial recognition, development of the National Occupational Skill Standard (NOSS) and skills development.

Endowed with strong government support and a substantial human resource, this industry could expand by the tight corporation between government, Telecommunications companies and training centres.

8. LIST OF ABBREVIATIONS

ABBREVIATION	DEFINITION
3GPP	Third Generation Partnership Project
1G	First Generation
2G	Second Generation
3G	Third Generation
4G	Fourth Generation
AAG	Asia American Gateway
ADSL	Asymmetric Digital Subscriber Line
AMPS	Advanced Mobile Phone System
CDMA	Code Division Multiple Access
DSL	Digital Subscriber Line
DWDM	Dense Wavelength Division Multiplexing
EPC	Evolved Packet Core
EDGE	Enhanced Data GSM Environment
FLAG	Fibre-Optic Link Around The Globe
FTTH	Fibre To The Home
GDP	Gross Domestic Product
GSM	Global System For Mobile Communication
GPON	Gigabit PON
GPRS	General Packet Radio Service
GW	Gateway
H/W	Hardware
HSPA	High Speed Packet Access
IETF	Internet Engineering Task Force
IHL	Institute Of Higher Learning
IT	Information Technology
ITU	International Telecommunications Union
ITU-T	International Telecommunication Union - Telecommunication Standardization Sector
IP	Internet Protocol
IPv4	Internet Protocol Version Four (4)
IPv6	Internet Protocol Version Six (6)
IMS	IP Multimedia Subsystem
IMT	International Mobile Telecommunications
IEEE	Institute Of Electrical And Electronics Engineers
LAN	Local Area Network
LTE	Long Term Evolution

ABBREVIATION	DEFINITION
LTE	Long Term Evolution
MPLS	Multiprotocol Label Switching
NOSS	National Occupational Skill Standard
NMT	Nordic Mobile Telephony
OA	Occupational Analysis
WIMAX	Worldwide Interoperability Microwave Internet Access
OFDMA	Orthogonal Frequency Division Multiplexing Access
OTN	Optical Transport Network
PDH	Plesiochronous Digital Hierarchy
PON	Passive Optical Network
PSDN	Public Switched Data Network
PSTN	Public Switched Telephone Network
QoS	Quality Of Service
RF	Radio Frequency
S/W	Software
SAFE	South Africa Far East Cable
SDH	Synchronous Digital Hierarchy
SMS	Short Messaging Service
SONET	Synchronous Optical Networking
TDMA	Time Division Multiple Access
TCP/IP	Transmission Control Protocol/Internet Protocol
UMTS	Universal Mobile Telecommunication System
VOIP	Voice Over Internet Protocol

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ANNEX 1: MALAYSIAN OCCUPATIONAL SKILLS QUALIFICATION FRAMEWORK (MOSQF) LEVEL DESCRIPTOR

MALAYSIAN OCCUPATIONAL SKILLS QUALIFICATION FRAMEWORK (MOSQF) LEVEL DESCRIPTOR

Level	Level Description
1	Achievement at this level reflects the ability to use relevant knowledge, skills and procedures to **complete routine and predictable tasks** that include responsibility for completing tasks and procedures subject to **direction or guidance**
2	Achievement at this level reflects the ability to select and use relevant knowledge, **ideas**, skills and procedures to **complete well-defined tasks and address straightforward problem**. It includes **taking responsibility** for completing tasks and procedures, **and exercising autonomy** and **judgment** subject to overall direction or guidance
3	Achievement at this level reflects the ability to **identify and use relevant understanding,** methods and skills to **complete task** and address problems that are well defined with a **measure of complexity.** It includes taking responsibility for initiating and completing tasks and procedures as well as exercising autonomy and judgments **within limited parameter.** It also reflects awareness of different perspectives or approaches within an area of study or work
4	Achievement at this level reflects the ability to identify and use relevant understanding, methods and skills to address problems that are well defined but **complex and non-routine**. It includes taking responsibility for overall courses of action as well as exercising autonomy and **judgment within fairly broad** parameters. It also reflects **under-standing of different** perspective or approaches within an area of study or work
5	Achievement at this level reflects the ability to identify and use relevant understanding, methods and skills to address **broadly-defined, complex problem**s. It includes taking responsibility for **planning and developing courses** of action as well as exercising autonomy and judgment within broad parameters. It also reflects **understanding of different perspectives, approaches or schools of thought and the reasoning behind them**
6	Achievement at this level reflects the ability to **refine** and use relevant understanding, methods and skills to address **complex problems that have limited definition**. It includes taking responsibility for planning and developing courses of action **that are able to underpin substantial change or development, as well as exercising broad autonomy and judgment.** It also reflects an understanding of different perspectives, **approaches of schools of thought and the theories that underpin them**
7	Achievement at this level reflects the ability to **reformulate** and use relevant understanding, methodologies and approaches to address **problematic situations** that involve many interacting factors. It includes taking responsibility for **planning and developing** courses of action that initiate or underpin substantial change or development, as well as exercising broad autonomy and judgment. It also reflects an understanding **of theoretical and relevant methodological perspectives, and how they affect their area of study or work**
8	Achievement at this level reflects the **ability to develop original understanding** and extend an area of knowledge or professional practice. It reflects the ability to address problematic situations that involve many complexes, interacting factors through initiating, designing and undertaking research, development or strategic activities. It involves the exercise of broad autonomy, judgement and leadership in sharing responsibility for the development of a field of work or knowledge, or for creating substantial professional or organisational change. It also reflects a critical understanding of relevant theoretical and methodological perspectives and how they affect the field of knowledge or work

ANNEX 2: LIST OF INDUSTRY PANEL AND FACILITATORS OF THE TELECOMMUNICATIONS INDUSTRY OCCUPATIONAL ANALYSIS DEVELOPMENT

LIST OF INDUSTRY PANEL OF THE TELECOMMUNICATIONS INDUSTRY OCCUPATIONAL ANALYSIS DEVELOPMENT

NO	NAME	POSITION	EXPERTISE	ORGANISATION
1	MR AZMI BIN SAMSURI	PLANNER	TRANSMISSION INFRASTRUCTURE PLANNER	CELCOM
2	MR NORDIN BIN ZAKARIA	NETWORK & TECHNOLOGIES CONSULTANT	ELECTRONIC AND TELECOMMUNICATION	M TECH NETWORK SOLUTION SDN BHD & NBI MENTARI AMAN SDN BHD
3	MR. CHIA WON CHEE	HEAD OF INFORMATION SECURITY	INTERNET SECURITY SPECIALIST	CYBER SECURITY
4	MR. WAHAB BIN ISA	MANAGER	TELECOMMUNICATION ENGINEERING	TELEKOM MALAYSIA
5	MR ZULKIFLI BIN MUHAMMAD	MANAGER	BROADBAND SPECIALIST	TELEKOM MALAYSIA
6	MR. ABU BAKAR BIN MANSOR	TELECOMMUNICATION EXECUTIVE	TELECOMMUNICATION	MAXIS MOBILE SDN. BHD.
7	MR. SURIA RAMADHAN BIN ROSMAN	TECHNICAL DIRECTOR	NETWORKING SOLUATION AND TELECOMMUNICATION	SURIA IT AND NETWORK SERVICES
8	DR. JEFFREY BANNISTER	TELECOMMUNCIATION SPECIALIST	TELECOMMUNICATION	MANAGEMENT SDN. BHD
9	MR. PAUL MATHER	CHIEF EXECUTIVE DIRECTOR	NETWORKING AND TELECOMMUNICATION	ORBITAGE SDN. BHD
10	MDM NORMAH BINTI JALIL	HEAD OF TRAINING DEPARTMENT	TELECOMMUNICATION ENGINEERING	INSTITUT LATIHAN PERINDUSTRIAN, MERSING
11	MR. NIZAM BIN MOHD NOOR	MANAGING DIRECTOR	TRANSMISSION INFRASTRUCTURE INSTALLATION & MAINTENANCE	I-CONVERGENCE SDN. BHD

LIST OF FACILITATORS OF THE TELECOMMUNICATIONS INDUSTRY OCCUPATIONAL ANALYSIS DEVELOPMENT

EVARINA BINTI AMIRON

FACILITATOR

PRITEC ACADEMY

FAHISZAM BIN SAAD

CO-FACILITATOR

PRITEC ACADEMY

RAFIDAH AMIRRUDIN

NORFADILAH BINTI ITHNIN

ZOLHELMY BIN ZOLKEPLY

SECRETARIAT

PRITEC ACADEMY

ANNEX 3: OCCUPATIONAL DESCRIPTIONS (OD) FOR THE TELECOMMUNICATIONS INDUSTRY

ACCESS

LEVEL 6

ACCESS NETWORK SPECIALIST

An access network specialist is designated to design access network solutions, recommend cost effective installation, maintenance and service of access networks, liaise with clients on access network solutions and act as information distributors, client representatives, construction supervisors and maintenance liaisons, propose new technology and solutions based on customers' existing network & infrastructure and feasible timeline for implementation of access network solution.

An Access Network Specialist will be able to:

1. design access network solutions;
2. recommend cost effective installation, maintenance and service of access networks;
3. liaise with clients on access network solutions and act as information distributors, client representatives, construction supervisors, and maintenance liaisons;
4. propose new technology and solutions based on customer's existing network and infrastructure;
5. study and analyse customer's requirements and existing environment; and
6. propose feasible timeline for implementation of access network solution.

PLANNING

LEVEL 5

RADIO ACCESS NETWORK PLANNER

A radio access network planner is designated to conduct radio frequency planning, cell planning, capacity planning, Base Station Controller (BSC) /Radio Network Controller (RNC) planning and network analysis, design IP management, prepare network yearly plan based on marketing and management requirements, analyse access system configuration (hardware & software) coordinate legacy network analysis in view of performance and planning strategy and propose solutions that include new features, potential capacity expansion, or equipment swap out.

A Radio Access Network Planner will be able to:

1. conduct radio frequency planning, cell planning and capacity planning;
2. conduct Base Station Controller (BSC)/Radio Network Controller (RNC) planning;
3. design IP management plan;
4. prepare network yearly plan based on marketing and management requirements;
5. design access system configuration (hardware & software);
6. conduct network analysis (i.e. network performance traffic, statistical data analysis, drive test data analysis, signal tracing data analysis and RF parameters analysis);
7. conduct legacy network analysis in view of performance and planning strategy;
8. propose solutions that include new features, potential capacity expansion, or equipment swap out;
9. responsible for planning results and its competitiveness;
10. design bill of quantity for new deployment, upgrading or migration; and
11. plan for migration & fall back plan.

PLANNING

LEVEL 4

RADIO ACCESS NETWORK ASSISTANT PLANNER

A radio access network planner is designated to analyse Radio Frequency (RF), radio access network plan, perform network analysis (i.e. network performance statistic data analysis, drive test data analysis, signal tracing data analysis and RF parameters analysis), prepare network analysis report, plan site configuration perform coverage analysis (using RF planning & prediction tools) and IP planning, design technical drawing (i.e. flow layout, cable routing, power source location) and coordinate legacy network analysis in view of performance and planning strategy.

A Radio Access Network Assistant Planner will be able to:

1. analyse radio frequency;
2. analyse radio access network plan;
3. perform network analysis (i.e. network performance statistic data analysis, drive test data analysis, signal tracing data analysis and RF parameters analysis);
4. prepare network analysis report;
5. plan site configuration;
6. perform coverage analysis (using RF planning & prediction tools);
7. perform IP planning;
8. interpret Bill Of Quantity;
9. study access system configuration (hardware & software);
10. design technical drawing (i.e. flow layout, cable routing, power source location);
11. coordinate legacy network analysis in view of performance and planning strategy; and
12. coordinate optimisation activities.

PLANNING

LEVEL 5

CUSTOMER ACCESS NETWORK PLANNER

A customer access network planner is designated to design technical drawing, plan network testing activities, virtual private network, customer relations and advanced IP routing.

A Customer Access Network Planner will be able to:

1. plan technical drawing;
2. analyse Bill Of Quantity;
3. analyse access system configuration (hardware & software);
4. plan TCP/IP configuration;
5. plan network testing activities;
6. plan equipment upgrading activities;
7. conduct troubleshooting activities in order to improve network;
8. plan Virtual Private Network;
9. plan customer relations activities; and
10. plan advanced IP routing.

PLANNING

LEVEL 4

CUSTOMER ACCESS NETWORK ASSISTANT PLANNER

A customer access network assistant planner is designated to design technical drawing, coordinate equipment upgrading activities, coordinate virtual private network, liaise with customer and coordinate routing.

A Customer Access Network Assistant Planner will be able to:

1. design technical drawing;
2. interpret Bill Of Quantity;
3. interpret access system configuration (hardware & software);
4. coordinate TCP/IP configuration;
5. coordinate network testing activities;
6. coordinate equipment upgrading activities;
7. coordinate virtual private network;
8. liaise with customer; and
9. coordinate IP routing.

INSTALLATION & MAINTENANCE

LEVEL 5

RADIO ACCESS NETWORK ENGINEER

A radio access network engineer is designated to establish Radio Frequency (RF) communications systems by analysing demographics data, validate measurement data including location, antenna placement and line of sight conditions, calibrate the signal propagation model, conduct TCP/IP configuration, network testing activties and equipment upgrading activities.

A Radio Access Network Engineer will be able to:

1. interpret technical drawing;
2. interpret Bill Of Quantity;
3. interpret access system configuration (hardware & software);
4. establish Radio Frequency (RF) communications systems by analysing demographics data;
5. validate measurement data including location, antenna placement, and line of sight conditions;
6. calibrate the signal propagation model;
7. conduct TCP/IP configuration;
8. conduct network testing activties; and
9. conduct equipment upgrading activities.

INSTALLATION & MAINTENANCE

LEVEL 4

RADIO ACCESS NETWORK ASSISTANT ENGINEER*

A radio access network assistant engineer is designated to coordinate maintenance activties, coordinate equipment dismantling activities, equipment installation, network testing activties and equipment upgrading activities, perform TCP/IP configuration and troubleshooting activties, establish Radio Frequency (RF) communications systems, collect and study demographics data.

A Radio Access Network Assistant Engineer will be able to:

1. refer technical drawing;
2. refer Bill Of Quantity;
3. refer access system configuration (hardware & software);
4. coordinate maintenance activties;
5. coordinate equipment dismantling activities;
6. coordinate equipment installation;
7. perform TCP/IP configuration;
8. coordinate network testing activties;
9. coordinate equipment upgrading activities;
10. perform troubleshooting activties;
11. establish Radio Frequency (RF) communications systems; and
12. collect and study demographics data.

* Critical Job Title

INSTALLATION & MAINTENANCE

LEVEL 5

CUSTOMER ACCESS NETWORK ENGINEER*

A customer access network engineer is designated to conduct maintenance activties, equipment installation, TCP/IP configuration and technical housekeeping activties. This person is also designated to conduct troubleshooting activties, virtual private network and advanced IP routing.

A Customer Access Network Engineer will be able to:

1. refer technical drawing;
2. refer Bill Of Quantity;
3. refer access system configuration (hardware & software);
4. conduct maintenance activties;
5. conduct equipment dismantling activities;
6. conduct equipment installation;
7. conduct TCP/IP configuration;
8. conduct network testing activties;
9. conduct equipment upgrading activities;
10. conduct technical housekeeping activties;
11. conduct troubleshooting activties;
12. conduct Virtual Private Network;
13. coordinate customer service; and
14. conduct advanced IP routing.

* Critical Job Title

INSTALLATION & MAINTENANCE

LEVEL 4

CUSTOMER ACCESS NETWORK ASSISTANT ENGINEER*

A customer access network assistant engineer is designated to refer to access system configuration (H/W & S/W), coordinate maintenance activties, equipment installation and equipment dismantling activities. This person also is designated to set up virtual private network liase with customer and coordinate IP routing.

A Customer Access Network Assistant Engineer will be able to:

1. refer technical drawing;
2. refer Bill Of Quantity;
3. refer access system configuration (hardware & software);
4. coordinate maintenance activities;
5. coordinate equipment dismantling activities;
6. coordinate equipment installation;
7. coordinate TCP/IP configuration;
8. coordinate network testing activties;
9. coordinate equipment upgrading activities;
10. coordinate technical housekeeping activties;
11. coordinate troubleshooting activties;
12. set up Virtual Private Network;
13. liase with customer; and
14. coordinate IP routing.

* Critical Job Title

INSTALLATION & MAINTENANCE

LEVEL 3

ACCESS NETWORK TECHNICIAN

An access network technician is designated to install access network equipment, carry out network testing, access network equipment upgrading and technical housekeeping.

An Access Network Technician will be able to:

1. install access network equipment;
2. carry out network testing;
3. carry out equipment maintenance;
4. carry out access network equipment upgrading;
5. carry out equipment dismantling activities;
6. carry out TCP/IP configuration;
7. carry out technical housekeeping;
8. refer technical drawing;
9. refer Bill Of Quantity; and
10. refer access system configuration (hardware & software).

INSTALLATION & MAINTENANCE

LEVEL 2

ACCESS NETWORK ASSISTANT TECHNICIAN

An access network assistant technician is designated to assist access network equipment installation, assist equipment maintenance and assist equipment dismantling activities.

An Access Network Assistant Technician will be able to:

1. assist access network equipment installation;
2. assist network testing;
3. assist equipment maintenance;
4. assist access network equipment upgrading;
5. assist equipment dismantling activities;
6. assist TCP/IP configuration; and
7. assist technical housekeeping.

TRANSMISSION

LEVEL 6

TRANSMISSION SPECIALIST*

A transmission specialist is designated to design transmission solutions, recommend cost effective installation, maintenance and service of transmission technologies, liaise with clients on transmission technologies solutions and act as information distributors, client representatives, construction supervisors and maintenance liaisons, propose new technology and solutions based on customers' existing network & infrastructure and feasible timeline for implementation of a transmission technology solution.

A Transmission Specialist will be able to:

1. design transmission technology solutions;
2. recommend cost effective installation, maintenance and service of transmission technologies;
3. liaise with clients on transmission technology solutions and act as information distributors, client representatives, construction supervisors, and maintenance liaisons;
4. propose new technology and solutions based on customer's existing network and infrastructure;
5. study and analyse customer's requirements and existing environment; and
6. propose feasible timeline for implementation of transmission technology solution.

* Critical Job Title

WIRED INSTALLATION & MAINTENANCE

LEVEL 5

TRANSMISSION INFRASTRUCTURE ENGINEER*

A wired transmission infrastructure engineer is designated to conduct wired transmission infrastructure problem solving, wired transmission infrastructure predictive & preventive maintenance planning, wired transmission project management, project sales management and conduct project testing tools management.

A Wired Transmission Infrastructure Engineer will be able to:

1. conduct wired transmission infrastructure problem solving;
2. conduct wired transmission infrastructure predictive and preventive maintenance planning;
3. conduct wired transmission project management;
4. conduct project sales management; and
5. conduct project testing tools management.

* Critical Job Title

WIRED INSTALLATION & MAINTENANCE

LEVEL 4

TRANSMISSION INFRASTRUCTURE ASSISTANT ENGINEER*

A wired transmission infrastructure assistant engineer is designated to perform high end wired transmission equipment installation and maintenance, conduct wired transmission equipment local testing & commissioning, wired transmission equipment end to end testing & commissioning, network management system provisioning & monitoring, TCP/IP configuration, wired transmission equipment upgrading activities and conduct wired transmission equipment troubleshooting activities.

A Wired Transmission Infrastructure Assistant Engineer will be able to:

1. perform high end wired transmission equipment installation;
2. perform high end wired transmission equipment maintenance;
3. conduct wired transmission equipment local testing and commissioning;
4. conduct wired transmission equipment end to end testing and commissioning;
5. conduct network management system provisioning and monitoring;
6. conduct TCP/ IP configuration;
7. conduct wired transmission equipment upgrading activities; and
8. conduct wired transmission equipment troubleshooting activities.

* Critical Job Title

WIRELESS PLANNING

LEVEL 5

TRANSMISSION INFRASTRUCTURE PLANNER

A wireless transmission infrastructure planner is designated to plan technical drawing, plan wireless transmission infrastructure implementation, wireless transmission infrastructure installation, IP management, network testing activities & wireless transmission equipment upgrading activities and analyse traffic information, facility locations, circuit availability & subscriber concentration.

A Wireless Transmission Infrastructure Planner will be able to:

1. plan technical drawing;
2. plan Bill Of Quantity;
3. plan wireless transmission system configuration (hardware & software);
4. plan wireless transmission infrastructure implementation;
5. plan wireless transmission infrastructure installation;
6. plan IP management;
7. plan network testing activities;
8. plan wireless transmission equipment upgrading activities; and
9. analyse traffic information, facility locations, circuit availability, and subscriber concentration.

WIRELESS PLANNING

LEVEL 4

TRANSMISSION INFRASTRUCTURE ASSISTANT PLANNER

A wireless transmission infrastructure assistant planner is designated to design technical drawing, plan wireless transmission infrastructure installation, maintenance and upgrading activities and coordinate network testing activities.

A Wireless Transmission Infrastructure Assistant Planner will be able to:

1. design technical drawing;
2. refer Bill Of Quantity;
3. refer system configuration (hardware & software);
4. plan wireless transmission infrastructure installation activities;
5. plan wireless transmission infrastructure maintenance activties;
6. coordinate network testing activities; and
7. plan wireless transmission infrastructure equipment upgrading activities.

WIRELESS INSTALLATION & MAINTENANCE

LEVEL 5

TRANSMISSION INFRASTRUCTURE ENGINEER*

A transmission infrastructure engineer is designated to conduct wireless transmission infrastructure problem solving, wireless transmission infrastructure predictive & preventive maintenance planning, wireless transmission project management, project sales management and conduct project testing tools management.

A Wireless Transmission Infrastructure Engineer will be able to:

1. conduct wireless transmission infrastructure problem solving;
2. conduct wireless transmission infrastructure predictive and preventive maintenance planning;
3. conduct wireless transmission project management;
4. conduct project sales management; and
5. conduct project testing tools management.

* Critical Job Title

WIRELESS INSTALLATION & MAINTENANCE

LEVEL 4

TRANSMISSION INFRASTRUCTURE ASSISTANT ENGINEER*

A transmission infrastructure assistant engineer is designated to perform high end wireless transmission equipment installation and maintenance, conduct wireless transmission equipment local testing & commissioning, wireless transmission equipment end to end testing & commissioning, network management system provisioning & monitoring, TCP/IP configuration, wireless transmission equipment upgrading activities and conduct wireless transmission equipment troubleshooting activities.

A Wireless Transmission Infrastructure Assistant Engineer will be able to:

1. perform high end wireless equipment installation;
2. perform high end wireless equipment maintenance;
3. conduct wireless transmission equipment local testing and commissioning;
4. conduct wireless transmission equipment end to end testing and commissioning;
5. conduct network management system provisioning and monitoring;
6. conduct TCP/IP configuration;
7. conduct wireless transmission equipment upgrading activities; and
8. conduct wireless transmission equipment troubleshooting activities.

* Critical Job Title

PLANNING

LEVEL 5

TRANSMISSION SERVICES PLANNER

A transmission services planner is designated to design fibre optic routes, associated optical transport networks and circuits, and microwave transmission systems, develop transmission services project plans, including scope, schedule, and budget, analyse system capacities and reliabilities, as well as technical parameters, liaise with internal and external stakeholders to communicate project status and updates, develop solutions and comply with established processes and standards and provide strategic engineering recommendations regarding transmissions services.

A Transmission Services Planner will be able to:

1. design fibre optic routes, associated optical transport networks (e.g. SONET) and circuits, and microwave transmission systems;
2. develop transmission services project plans, including scope, schedule, and budget;
3. analyse system capacities and reliabilities, as well as technical parameters;
4. liaise with internal and external stakeholders to communicate project status and updates, develop solutions, and comply with established processes and standards; and
5. provide strategic engineering recommendations regarding transmissions services.

PLANNING

LEVEL 4

TRANSMISSION SERVICES ASSISTANT PLANNER

A transmission services assistant planner is designated to assist designing fibre optic routes, associated optical transport networks (e.g. SONET) and circuits and microwave transmission systems, implement the design of facilities (e.g. communications rooms, power systems) to meet project and system objectives, assist analysing system capacities and reliabilities, as well as technical parameters and liaise with customers, vendors & technical staff to determine telecommunications requirements.

A Transmission Services Assistant Planner will be able to:

1. assist designing fibre optic routes, associated optical transport networks (e.g SONET) and circuits, and microwave transmission systems;
2. implement the design of facilities (e.g. communications rooms, power systems) to meet project and system objectives, while considering a variety of complex factors (e.g. environmental constraints, availability of power);
3. assist analysing system capacities and reliabilities, as well as technical parameters; and
4. liaise with customers, vendors, and technical staff to determine telecommunications requirements.

INSTALLATION & MAINTENANCE

LEVEL 5

TRANSMISSION SERVICES ENGINEER*

A transmission services engineer is designated to conduct set up of transmission services, improve network functionality to the satisfaction of the customer, conduct test plans, manage changes in the live network, prepare report on actual network performance, conduct maintenance of the transmission network and network restoration & network performance enhancement.

A Transmission Services Engineer will be able to:

1. conduct set up of transmission services;
2. improve network functionality to the satisfaction of the customer;
3. conduct test plans (regression tests, test of new features, acceptance of new nodes or parts);
4. conduct change of management in the live network, including the definition of command lines based on planning, consolidation, performance and debriefing of changes;
5. produce report on actual network performance;
6. conduct maintenance of the transmission network; and
7. conduct network restoration and network performance enhancement

* Critical Job Title

INSTALLATION & MAINTENANCE

LEVEL 4

TRANSMISSION SERVICES ASSISTANT ENGINEER*

A transmission services assistant engineer is designated to carry out set up of transmission services, perform test plans (regression tests, test of new features, acceptance of new nodes or parts), handle changes in the live network, prepare report on actual network performance, operate and maintain the transmission network and carry out network restoration and network performance enhancement.

A Transmission Services Assistant Engineer will be able to:

1. carry out set up of transmission services;
2. improve network functionality to the satisfaction of the customer;
3. perform test plans (regression tests, test of new features, acceptance of new nodes or parts);
4. handle changes in the live network, including the definition of command lines based on planning, consolidation, performance and debriefing of changes;
5. prepare report on actual network performance;
6. operate and maintain the transmission network; and
7. carry out network restoration or network performance enhancement.

* Critical Job Title

INSTALLATION & MAINTENANCE

LEVEL 3

TRANSMISSION TECHNICIAN*

A transmission technician is designated to carry out network testing, carry out transmission infrastructure equipment maintenance, carry out transmission infrastructure equipment upgrading and carry out TCP/IP configuration. This person is also designated to refer to technical drawing, Bill Of Quantity and system configuration.

A Transmission Technician will be able to:

1. install transmission infrastructure equipment;
2. carry out network testing;
3. carry out transmission infrastructure equipment maintenance;
4. carry out transmission infrastructure equipment upgrading;
5. carry out transmission infrastructure equipment dismantling activities;
6. carry out TCP/IP configuration;
7. carry out technical housekeeping;
8. refer technical drawing;
9. refer Bill Of Quantity;
10. refer system configuration (hardware & software);and
11. measure signal strength, transmission capacity, interference, and signal delay.

* Critical Job Title

INSTALLATION & MAINTENANCE

LEVEL 2

TRANSMISSION ASSISTANT TECHNICIAN*

A transmission assistant technician is designated to assist transmission infrastructure equipment installation, assist network testing, assist transmission infrastructure equipment upgrading and assist technical housekeeping.

A Transmission Infrastructure Assistant Technician will be able to:

1. assist transmission infrastructure equipment installation;
2. assist network testing;
3. assist transmission infrastructure maintenance;
4. assist transmission infrastructure equipment upgrading;
5. assist transmission infrastructure equipment dismantling activities;
6. assist TCP/IP configuration; and
7. assist technical housekeeping.

* Critical Job Title

CORE NETWORK

LEVEL 6

CORE NETWORK SPECIALIST

A core network specialist is designated to design and propose networking solutions and core network infrastructure. This person is also designated to advise on policies and standards to ensure that current policies remain relevant and provide technical advice regarding complex core network related problems and applications.

A Core Network Specialist will be able to:

1. design and propose core network solutions;
2. advise on the policies and standards to ensure that current policies remain relevant;
3. provide technical advice regarding complex core network related problems and applications;
4. recommend cost effective installation, maintenance and service of core network solutions;
5. liaise with clients on core network solutions and act as information distributors, client representatives, construction supervisors, and maintenance liaisons;
6. propose new technology and solutions based on customer's existing network and infrastructure;
7. study and analyse customer's requirements and existing environment; and
8. propose feasible timeline for implementation of core network solution.

CORE NETWORK

LEVEL 5

SWITCHING ENGINEER

A switching engineer is designated to manage and configure switch server, to develop installation and configuration procedures, research and recommend innovative solutions, configure hardware, peripherals, services, settings, directories and storage in accordance with standards and project requirement.

A Switching Engineer will be able to:

1. manage and configure switch server;
2. configure hardware, peripherals, services, settings, directories and storage in accordance with standards and project requirement;
3. develop and maintain installation and configuration procedures;
4. contribute to and maintain system standards;
5. research and recommend innovative solutions and where possible automated approaches for switch tasks; and
6. assist project teams with technical issues in the initiation, planning and implementation phases in required projects.

CORE NETWORK

LEVEL 4

SWITCHING ASSISTANT ENGINEER

A switching assistant engineer is designated to ensure switch system hardware, operating systems software systems and databases are functioning, install and configure switch system as required, perform routine maintenance within department, diagnose and repair equipment and system faults and ensure that the necessary action is taken to isolate faulty equipment and restore traffic with minimum outage time.

A Switching Assistant Engineer will be able to:

1. ensure switch system hardware, operating systems software systems and databases are functioning;
2. install and configure switch system as required;
3. perform routine maintenance within department;
4. diagnose and repair equipment and system faults;
5. coordinate installation of equipment; and
6. ensure that the necessary action is taken to isolate faulty equipment and restore traffic with minimum outage time.

CORE NETWORK

LEVEL 3

SWITCHING TECHNICIAN

A switching technician is designated to assemble and install communication equipment, test repaired, newly installed or updates equipment to ensure it functions properly, repair faulty equipment, respond to any inquiries or complaints, test connections to ensure that power supplies are adequate, communications links function and measure distances from landmarks to identify exact installation sites for equipment.

A Switching Technician will be able to:

1. assemble and install communication equipment;
2. test repaired, newly installed or update equipment to ensure it functions properly and confirms to specification;
3. repair faulty equipment;
4. inspect equipment on a regular basis in order to ensure proper functioning;
5. test connections to ensure that power supplies are adequate and that communications links function;
6. designate cables available for use; and
7. measure distances from landmarks to identify exact installation sites for equipment.

CORE NETWORK

LEVEL 2

SWITCHING ASSISTANT TECHNICIAN

A switching assistant technician is designated to perform maintenance such as to clean switches and replace contact points, perform maintenance on equipment and measure distances from landmarks to identify exact installation sites for equipment.

A Switching Assistant Technician will be able to:

1. clean switches and replace contact points, using vacuum hoses, solvents, and hand tools;
2. perform routine maintenance on equipment, including adjusting and lubricating components, and painting worn or exposed areas;
3. maintain computer and manual records pertaining to facilities and equipment;
4. measure distances from landmarks to identify exact installation sites for equipment; and
5. remove and replace plug-in circuit equipment.