Remarks by the Head of the ICT WG[1]

Dear Friends,

It is a big pity that I am not able to join you today. After I had my stomach halved some 16 years ago, which helped me slim to the right shape, I must say, once in a few years I get into this trouble of intestinal blockage. I feel ashamed to confess that it usually happens when I eat some tasty snacks too much and too quickly on a Sunday afternoon. Actually the snack does not have to be so tasty, but anyhow the problem is that this old soldier never learns. Please do not worry, I am used to this, the situation is under control, and I should be out of the hospital in a couple of days time.

Professor Mikami has kindly agreed to take my place and be the main reporter as he did at the last meeting in Tokyo, and to read this message of mine to you. Professor Mikami will also touch upon history in his report, but what I would like to emphasise here about ICT is twofold. First, ICT is extremely important to Myanmar, and we cannot overemphasise its importance to the economy of Myanmar, and I would dare say also to the politics of Myanmar. Second, this understanding has won the strong support of our friends in Myanmar, and the strong support of the Myanmar government.

Parallel to the discussions we held in both Japan and Myanmar, the Japanese government and the Ministry of Economy and Industry in particular, implemented various programmes to overcome the Digital Divide and cooperated with the Myanmar government in meeting the Y2K challenge. I would like to point out that these achievements brought about a very positive effect on our discussions about policies for the development of ICT in Myanmar.

One specific example is that splendid ICT Park, which was established and brought to function swiftly under the instruction of His Excellency General Khin Nyunt, Secretary One of the State Peace and Development Council.

Today the annual sales of the Japanese software industry have reached 13.3 trillion yen, that is 100 billion US dollars. We can expect that Japan will be a huge market for the software industry of Myanmar. From China and Korea, a rapidly increasing number of young engineers have

[1] This is a message from the Head of the ICT WG, Mr. Tomoo Takahara, for the Final Workshop held in Yangon in December 2002.

come to work in Japan. The statistics are yet unavailable, but I expect that their number has reached several thousands this year. This is the situation that prompted us to place the development of human resources at the core of our proposals.

Finally, I sincerely hope that today's meeting will open a brilliant era of ICT cooperation between Japan and Myanmar. I wish you all the best, and look forward to visiting my beloved country in February when I come with the Chamber of Commerce delegation.

Tomoo Takahara

II. ICT Infrastructure in the Union of Myanmar

Chapter II is prepared as one of the activities of ICT Working Group, Myanmar-Japan Economic Structural Adjustment. It consists of two parts; Analysis of Telecommunication Infrastructure (Part I) and Telecommunication Case Studies (Part II).

Part I includes the comprehensive analysis of the current telecommunication infrastructure in Myanmar. The basic framework of the report was agreed in February 2002 by both Myanmar and Japan sides. It is prepared by the Japanese side, based on the intensive research made mainly in June and July 2002, in cooperation with Myanmar counterpart and MPT. Its findings and recommendations are partly incorporated into the summary of policy recommendations in the Final Report of ICT Working Group, after the review from Myanmar side.

Part II is the collection of four separate case studies for the installation of the telecommunication infrastructure. The basic framework of the report was agreed in September 2002 between Myanmar and Japan ICT Working Groups. It is prepared by the Japanese side, based on the intensive research made mainly in September and October 2002, in cooperation with Myanmar counterpart and MPT. These four selected case studies are expected to be exerted as useful examples for the actual, similar, or possible projects in Myanmar.

Part I

Analysis of Telecommunication Infrastructure

Table of Contents

Summary of Findings and Recommendations

1. Telecommunication infrastructure provides the basic and indispensable element for the development of whole information technologies. In Myanmar, its tele-density is only 0.6% and is the lowest in ASEAN countries. E-national task force aims at the rapid development of the telecommunication infrastructure. To attain this aim, the concrete institutional development is required.

2. Worldwide trend is toward the liberalisation and internationalisation of telecommunication. In the ASEAN area, too, Myanmar has committed to liberalise the industry by the target year of 2008. In Myanmar, telephone and the development of telecommunication infrastructure has been under the monopoly of MPT, although in IT areas such as internet services, liberalisation has been made partly. Development of the telecommunication infrastructure, which is currently well behind, will have to be the responsibility of the public sector. However, to aim at the efficient development, the telecommunication part should have the institutional framework to handle revenue and costs, and also to plan the development in an integrated way. It will constitute one alternative to transform the telecommunication part of MPT toward financially independent public corporation-type organisation.

3. The installation of telecommunication networks in rural areas requires a huge amount of funds. An effective means should be selected, taking into account prevailing technological trends. It is rather an advantage for Myanmar that the nation does not have much traditional legacy system. It is important to select the site-specific combination of suitable technologies through the accumulation of experience from case studies and pilot projects.

4. Domestic and International Telecommunication Tariffs
   Telecommunication tariffs should be changed to the tariff system based on market economy, gradually from the current tariff system.

   Although the development of the basic telecommunication infrastructure is the responsibility of the public sector, value-added services will be better promoted if they are provided by the private sector. In this field, more activities, higher efficiencies, lower prices, better qualities, and more diversity of services in the telecommunication sector must be encouraged through adequate policies such as the introduction of privatisation and competition. As a first step, MPT should examine the possibility of reorganising itself suitable for competition by, for

example, introducing profit center type structure by sector, so that the profitability by service becomes clear.

5. Internet Services

Internet service is still in its initial stage in Myanmar. Dialup is dominantly used as an access method, but some high-usage subscribers began to use dedicated access line using wireless system. For the meantime, dialup method will be the major way of expansion. ADSL method can provide another important method as a next step, although the existing copper-wire cable system may have to be replaced in some cases. At the same time, the possibility of broadband access network by radio must be examined.

The expansion of internet services requires the development of the telecommunication infrastructure and the upgrading of the quality. At the same time, policies to upgrade the internet environment are also important, which encourage the participation of the private sector entrepreneurs who will produce applications and contents.

Myanmar should make efforts to catch up in this field, and should also intend to work cooperatively with the outside world. For this purpose, the creation of specialised government organisation, which takes responsibility in this field, and the strengthening of research organisations are necessary.

6. International Network

The policy to develop international telecommunication links through sub-marine cable SEA-ME-WE 3 and Intelsat earth station should be maintained. In the case of the international links with ASEAN and neighboring countries, however, it is worth examining the introduction of other more efficient terrestrial telecommunication systems, depending on the future development of political and economic activities with these countries.

The possibility of installing international telecommunication facilities in Mandalay, in addition to Yangon, should be examined, too.

7. Backbone Network

It is natural that Yangon, the capital of the nation, will be the centre of the nationwide network. The backbone network, which connects Yangon, Mandalay, the second largest city, and other major cities, and lines which connects to backbone network, must be analysed

first. In each part of this nationwide network, the best method and the best facilities must be chosen in comparison with the communication capacity and the construction costs. Some candidates of networks using current technologies are shown below.

(a) Large scale fiber optic cable system using technologies using the technology of WDM (wave-length division multiplex) and SDH (synchronous digital hierarchy)
(b) Large scale microwave communication system using QAM (quadrature amplitude modulation) technology
(c) DOMSAT (domestic satellite system) and VSAT (very small aperture terminal) system suitable for remote thin-route communication network (this may not be for backbone, though)

8. Access Network

The method of access line, which connects each subscriber to the backbone network, must be chosen, considering the population density and the prospect of future economic development. Copper-wire cable and WLL will be the major alternatives. However, in the case of big users such as companies and research organisations, fiber optic cable constitutes the possible alternative.

xDSL (x digital subscriber line), which utilises the out-of-voice band of copper cable is an effective method for the internet access with broadband capability.

ISDN (integrated services digital network) has been recently provided in some parts of Myanmar. In the future, however, the whole telecommunication network will be more and more IP-based. So, the plan of developing ISDN network must be reconsidered.

9. Fixed Telephone Network

The delay of the development in telecommunication infrastructure has been quite visible. The tele-density in Myanmar is 0.6% and is among the lowest in ASEAN countries, only next to Cambodia. There are various reasons for this delay. One important reason is the lack of fund for the development due to insufficient foreign currency and the current tariff rate structure for telecommunication use. Telecommunication is now the basic social infrastructure and it must be developed under the responsibility of the nation. The long-run master plan with clear objectives must be made.

In developed countries, there are cases where the number of fixed line subscribers have leveled, or even have begun to decline due to the rapid expansion of mobile phone usage. In Myanmar, though, the development of fixed line network must be the first priority as a telecommunication infrastructure. The access line of the fixed line network does not have to be the installation of the actual line. Nowadays, there is an alternative of using radio-based access line, depending on the location and economic advantage.

Until recently, the access line of fixed line subscribers had been copper-wire cable. Nowadays, however, WLL (wireless local loop), the access line of fixed telephone by wave, is an example of the technology with relatively low cost and high performance, and is adequate in rural areas where population scarcely distributes. Further, the wireless alternative provides an advantage of the shorter installation period in comparison with the wire network.

Development of nationwide telecommunication network must be carefully planned with enough consideration of efficient resource usage. The master plan of telecommunication network must be formulated, reflecting the future development of telecommunication traffic after analysing the geographical distribution of the density of social and economic activities.

10. Cellular Mobile Network

AMPS (advanced mobile phone system) and D-AMPS (digital-AMPS) are the mainly used method of mobile phones in Myanmar. CDMA (code division multiple access) and GSM (global system for mobile communication), the second generation mobiles (2G), have been already introduced. The method with cost and quality advantages will prevail as 2G mobile phones.

Mobile phones are more expensive than fixed-line phones for users, so users will be limited at the beginning, although the applications well exceed the availability at this moment. However, the tariff of mobile phones can become lower, if the cost of 2G facilities becomes lower. Then, the usage of 2G mobile phones will expand gradually. There also exists demand for mobile phones for those who can not wait for the completion of fixed-line network.

Regarding 3G mobile phone development, it can be introduced as possible IT terminal in the future, while examining what happens in other countries.

11. Satellite Network

In Myanmar, DOMSAT and VSAT system is under operation as a telephone network to connect Yangon and remote ten to twenty cities. However, some equipment of the system often has failures, and the usage rate is rather low.

Satellite communication system will surely become more IP-based in the future in accordance with the tendency of the terrestrial network to be more and more IP-based. In the future satellite network system will have to also include internet transmission in addition to voice communication. Myanmar should examine the introduction of the IP-based satellite communication system, which is advantageous in usage of frequency resource.

12. Rural Network

Myanmar must correct the difference of tele-density by region. (However, this poses the issue of prioritisation under the situation that urban areas also have low tele-density in comparison with other countries.) Clear target figures must be shown by region. The selection of the best technologies suitable for each region is also important. At the same time, future expansion of IP-based system must be taken into consideration in the strategy of geographical expansion.

13. IP-based Network

At this moment the introduction of IP-related technologies is way behind in Myanmar. This is not simply due to the technological, or hardware problems, but rather due to the immaturity of policies and institutions to promote and administrate the spread of these new technologies. The conventional telecommunication technologies had developed with the involvement of the central government. However, these new IP-related technologies have developed in the atmosphere of democratic discussions of academic groups and of private sector. So, it is necessary to develop this environment of academic and private groups for the future introduction and development of these new technologies.

In addition to the historical evidence, there is no room for doubt, regarding the international trend that IP-based network will be developed as a common infrastructure for transmission and processing of all kind of information. There exists IP-based network in Mandalay and it provides the internet access point. Further expansion of internet-connecting service areas and the incease in IP access point are necessary.

From this point of view, Myanmar has to keep eyes on the development of internet-related technologies and institutional matters in the world, and also has to begin to create the adequate institutional structure.

14. Power Supply

There are many areas where commercial power is not yet available. So, when it is not financially realistic to complete the power system including household sector in the short run, another realistic alternative for the moment is to install stand-alone generating facilities in the public telephone office, tele-service centre, etc. Diesel engine generator is the most commonly used solution for this purpose, considering its sufficient generating capacity. When there is a problem of fuel transportation, however, the combination of solar cell panel and re-chargeable battery provides another alternative. The electrification of the area as a whole is of course the long-run pre-condition for the development of telecommunication infrastructure.

15. End User Terminal Equipment

Myanmar must import most telecommunication-related devices. However, certain areas, such as assembling of PCs, are suited for domestic production and have already begun. At the same time, the development of software industry based on the unique demand of Myanmar should be encouraged

16. Human Resource Development

Training centres for telecommunication technologies are operated under the umbrella of MPT. They emphasise IP training. However, the training should be expanded to cover new technologies such as broadband satellite communication, broadband IP switch, third generation mobiles, rural telecommunication, network planning, and intelligent network. It is important to study technologies such as VoIP (Voice over IP) and IP broadband network, if we consider the future transition to IP-based network. In this area, Japan and other developed countries can effectively help the human resource development of Myanmar through technical assistance by dispatching experts.

At the university level, educational system is not well established to teach technologies and institutional matters on telecommunication. Further, the educational system suitable for IT era, where information processing and telecommunication technologies are combined together, is far behind the necessity. The basic framework and the development of IP-

related environment will have to be the responsibility of the government, or the public sector. However, its actual introduction and spread requires the wide-range participation of the private sector, and the enlightenment of ordinary IT users. In this sense, it is necessary to examine policies of human resources development in various levels including from upstream to downstream.

1. Institutional Matters

1.1 Present status and problems of IT-related laws and regulations

1.1.1 Telecommunications law

The present telecommunications law stipulates that telecommunication services shall be provided solely by the Government; that is Myanmar Posts and Telecommunications Department (MPT), which is a part of Ministry of Communications, Posts and Telegraphs. But the law has an article stipulating that the government can outsource the work. This article allows other organisations to enter the telecommunications business. MPT has outsourced data communication to Bagan Cybertech (BCT). Their businesses look competing, for example both of them offer email and Internet services, but they are actually complementing. MPT offers GSM cellular phone service in cooperation with another company, Skylink, a Singapore-based company.

The government decides the telephone tariff. The tariff looks like not keeping up with the technological progress and cost reduction for the long and international calls and the change of a currency exchange rate. A local call costs 3 kyats per call (As of September 2002, a market rate is that US$ 1 equals about 1,000 kyats. 3 kyats is about 0.003 dollar). On the other hand, international direct dialing charges are high. (See Table 1.1.1-1)

Table 1.1.1-1 International telephone rates

Destination	Government (kyats)		Private (US$)	
	First 1 minute	Each additional 6 seconds	First 1 minute	Each additional 6 seconds
Japan	100 (about US$ 0.1)	10 (about US$ 0.01)	2.7	0.27

Notice at a hotel:
International direct dialing and long distance calls are expensive due to Myanmar Posts & Telecommunication charges. Your kind understanding is highly appreciated.
Approximate cost per minute for I.D.D. call
Japan US$ 4.79
Dear guest,
We would like to inform you that telecommunication charges in Myanmar, are notably higher compared to other countries.
(Excerpts from a hotel brochure. (Hotel is also taking a high margin))

The telecommunications law should be revised or newly prepared for the liberalisation of telecommunication business. In order to promote progress in IT industry, arrangement of competitive environment in telecommunications sector may be necessary. Keeping high international telephone rates will reduce the competitive edge of Myanmar industry.

1.1.2 Cyber laws

In order to promote e-Commerce, so called cyber laws are necessary. Traditional laws may not be able to punish fraud committed on the Internet. Myanmar, committed to promote IT, is now preparing for cyber laws that will be established in 2003. The background of establishing cyber laws is as follows:

- Myanmar with the other 9 ASEAN members set up e-ASEAN task force on 28 November 1999 to make proposals to heads of state and government that could ultimately lead to an Information Technology Agreement in ASEAN covering goods, services, and IT professionals.
- Myanmar formed e-National Task Force on 31 October 2000 to implement the e-ASEAN framework agreement.
- Working group for e-Legal infrastructure under e-National Task Force is preparing for cyber laws for e-Commerce development. The working group plans to complete them by 2003 in order to meet the timetable of e-ASEAN Framework Agreement.
- e-Legal infrastructure working group decided to develop a stopgap measures to speed up the implementation of e-Commerce activities in Myanmar before the cyber laws can be promulgated. The stopgap measures include special orders based on the detailed studies of existing laws to strengthen the e-Commerce activities.

The e-Legal infrastructure working group is envisaging e-Commerce laws as follows:

- e-Commerce laws should conform to international standards.
- They should be transparent and predictable so that there is no legal ambiguity between transacting parties in an electronic transaction.
- They should be technologically neutral, i.e. no discrimination between different types of technology.
- There should be no difference between electronic records and paper documents.
- An electronic record can replace a written document.
- Parties can contract electronically.

- Electronic documents are admissible as evidence in court.
- If the electronic record is sent, the recipient is entitled to act on the record.
- If the sending of an electronic record is conditional upon acknowledgement of receipt, the record is not sent until the acknowledgement has been received.
- When a sender receives the recipient's acknowledgement of receipt, the electronic record is deemed that the recipient received it.
- An electronic record is sent when it enters a computer server/router outside the sender's control. An electronic record is received when it enters the addressee's computer/router.
- An electronic record is sent from the sender's place of business and received at the recipient's place of business.

1.1.3 Related laws

While cyber laws enable electronic transactions to take place with trust, confidence, and certainty in cyberspace, they have to be complemented by other related legislation to protect the interests of businesses and consumers. Related legislation, regulations or codes of practice include:

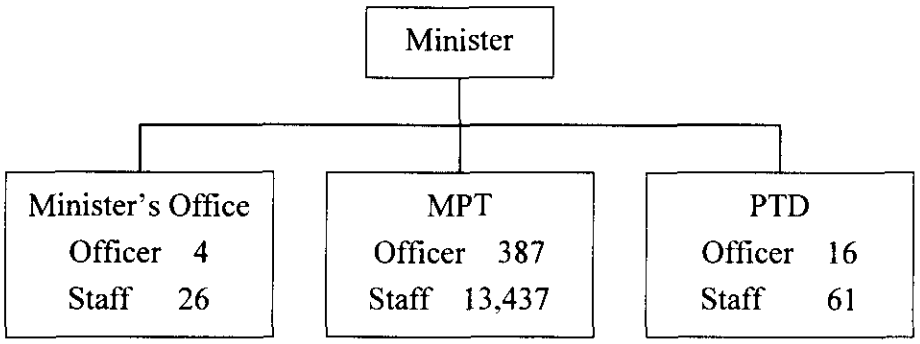
- Data privacy and protection
- Consumer protection
- Computer crimes/computer misuse
- Copyright, trademarks, and intellectual property rights
- Internet code of practice
- Advertising code of practice

It is important these laws be established. But, for the moment, even an intellectual property right is not enacted.

1.2 Regulating and operating organisations

Concerning telecommunications, Ministry of Communications, Posts and Telegraphs (MCPT) functions as regulating and operating organisations. Fig. 1.2-1 shows its organisation chart.

Fig. 1.2-1 Organisation chart of Ministry of Communications, Posts and Telegraphs.



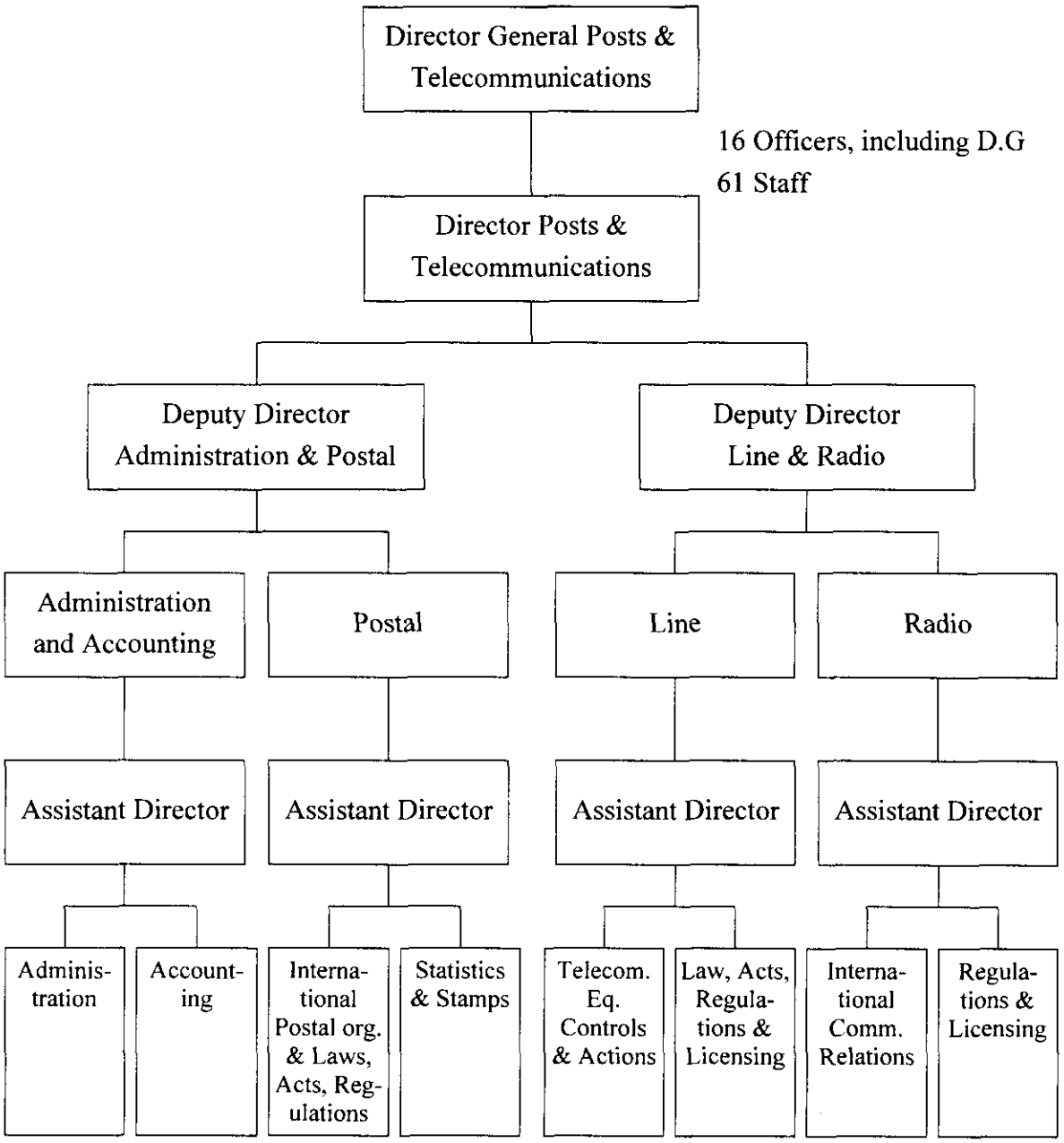
MPT: Myanmar Posts and Telecommunications Dept.
PTD: Posts and Telecommunications Dept.

In order to promote ICT industry in Myanmar, the Ministry is better to change its name as, for example, Ministry of Telecommunications and Information Technologies, and to undertake whole responsibility of ICT industry in Myanmar in an integrated way after necessary institutional building, including recruitment of policymaking administrators.

1.2.1 Posts and Telecommunications Department

As clear from the chart, the regulatory body of MCPT is its Posts and Telecommunications Department (PTD), which undertakes radio frequency assignment, monitoring, standardisation and licensing of telecommunication equipment, international cooperation, etc. PTD has 4 Divisions as shown in Fig. 1.2.1-1. They are Radio Division, Line Division, Postal Division and Administration and Accounting Division.

Fig. 1.2.1-1 Organization Chart of PTD



1.2.1.1 Radio frequency management and monitoring

Radio Division is in charge of radio frequency allotment, radio wave monitoring, licensing of radio equipment with transmitting power more than 25 W, and international relations relevant to telecommunications such as ITU, APT.

Already assigned frequency bands higher than UHF band are as follow:

(1) 312 MHz to 387 MHz and 410 MHz to 460 MHz for mobile communications and transceivers like walkie-talkie.
(2) 470 MHz to approximately 530 MHz for broadcasting.
(3) 820 MHz to 960 MHz for mobile services like GSM.
(4) 1260 MHz to 1300 MHz for Mobile service.
(5) 1700 MHz to 1980 MHz for Myanmar Posts and Telecommunications (MPT)
(6) 3 GHz to approximately 3.8 GHz for WLL.
(7) 4.4 GHz to 4.5 GHz, both approximate values, for satellite system.
(8) 6.7 GHz to 7.07 GHz and 7.75 GHz to 8.025 GHz, all approximate values, for microwave links of MPT
(9) 8.4 GHz 9.00 GHz approximately for BCT
(10) 10.45 GHz to 11.7 GHz for hub stations of BCT
(11) 17.7 GHz to 18.8 GHz approximately and 28.5 GHz to 30 GHz TELEDESIC, Australia.

Actual status of Radio Division is clear from the following hearing survey:

- PTD has a handbook for frequency management that complies with all items of Radio Regulations in August 2001. This handbook was prepared by 2 Iranian ITU consultants and they also made a frequency management plan.
- PTD does not have any monitoring station of international standard. However, PTD intends to establish a few in near future. Certainly, PTD cannot procure all necessary international standard equipment at once due to its budget constraint, but PDT has started procuring it gradually from 2000. This can be said an on-going project.
- PTD now has 2 direction finders for a band from 100 kHz to 30 MHz, 1 HF interference / field strength meter operating in a band from 9 kHz to 30 MHz, 1 VHF / UHF receiver for a band of 20 MHz to 3 GHz, 1 Microwave frequency counter covering from 10 Hz to 18 GHz, and 1 spectrum analyser from 100 Hz to 4.6 GHz. All of them are not installed yet. They will be installed in near future in the PTD building that will be the first monitoring

station in Yangon.

- Radio Division has 2 to 3 personal computers. Frequency data are stored in these PCs, however, the data were not shown to us this time.
- Myanmar local amateur bands are not assigned at all from 1974.
- Private people are not allowed to install a radio LAN by themselves. Anyway, private people should submit applications to install the radio LAN to MPT. If they allow the applications, then PTD issues licenses.

The field of radio frequency management requires the institutional capacity building in terms of number of trained personnel, procurement and installation of monitoring equipment, expansion of monitoring network, closer international cooperation, etc.

1.2.1.2 Technical standardisation based upon recommendations of ITU

PTD's Line Division administers laws, rules, regulations, and licensing related to telecommunications, and telecommunications equipment. It is also in charge of standardisation.

Although PTD belongs to MCPT, Communication Policy Advisory Committee controls the operation of licensing of PTD. Chairman of the Committee is Director of Signal Corps from Ministry of Defence, and its members are:
Director General of PTD,
Managing Director of MPT,
Director General of Department of Civil Aviation,
Director General of MRTV,
Director General of Department of Science and Technology, and,
4 Colonels from Navy, Air Force, Intelligence and Police.

Functions of the Committee are: to control import of telecommunications equipment, to control utilisation of the telecommunications equipment, and to prepare guidelines for the equipment. These guidelines are not available for commercial purpose, though. Results of its activities are shown in Tables 1.2.1.2-1 to 1.2.1.2-3 below.

Table 1.2.1.2-1 Radio set licensing

Particulars	1996	1997	1998	1999	2000
Licences issued	13,007	32,293	35,591	9,380	18,500
Total revenue (Million Kyats)	0.41	1.11	0.38	0.15	0.27

Source: Central Statistical Organisation "Myanmar Data CD-ROM 2001"

Table 1.2.1.2-2 Television and video set licensing

Particulars	1996	1997	1998	1999	2000
Television licences issued	282,504	284,642	260,724	278,161	296,353
Video licences issued	111,397	113,625	94,180	103,926	92,283
Total revenue (Million Kyats)	50.29	55.6	52.09	57.95	60.48
Licence fee for television set (Million Kyats)	33.93	35.4	32.54	34.77	31.78
Licence fee for video set (Million Kyats)	6.77	7.1	6.56	7.50	3.76
Fine (Million Kyats)	9.53	13.10	12.95	15.67	24.92
Duplicate (Million Kyats)	0.06	0.04	0.04	0.04	0.03

Source: Central Statistical Organisation "Myanmar Data CD-ROM 2001"

Table 1.2.1.2-3 Home satellite receiver licensing

Particulars	1996	1997	1998	1999	2000
Licences issued	1,823	1,754	1,411	1,679	1,758
Total revenue (Million Kyats)	24.96	20.4	18.49	25.42	29.47

Source: Central Statistical Organisation "Myanmar Data CD-ROM 2001"

According to a hearing study, the telecommunication business will be liberalised within 2 to 3 years. As liberalisation of the telecommunication business approaches, licensing of telecommunication business will have to be taken into account seriously. Business licensing should be treated fairly by capable personnel, and things such as monitoring of QOS and coverage are also required. Concerning licensing, institutional capacity building seems required.

If the liberalisation occurs, establishment of universal funds might be necessary to expand telecommunication services into rural areas. Staff in charge should have such policymaking capabilities, but they seem not yet prepared for these undertakings. As these problems are very important, urgent institutional capacity building is required in this field, too, in order to make the telecommunication business flourish through competition, if required.

Standardisation seems like another sector in which PTD should improve human resources development, technical measuring instruments preparation and documentations. Capacity building of the standardisation institute is really and urgently required. So far, standardisation and type approvals seem to be managed by MPT.

The results of hearing study are shown below:

- Committee controls RF output power to avoid interference. For example, TV, video and radio sets that have an output power of less than 5 W and radio equipment and mobile handsets which have an output power of less than 25 W in HF, VHF, UHF bands are controlled. Any individuals who want to import and use telecommunications equipment should submit applications to PTD. PTD processes the applications, and puts them up to the Committees to get its affirmative or negative decisions.
- Although PTD carries out type approval of telecommunications equipment, PTD does not charge at all for type approval. Applicants of telecommunications equipment should apply first to MPT, and, if they accept it, PTD just issues licenses for it.
- MPT's Training Centre has test and calibration equipment. Therefore, PTD asks the centre to test some equipment not commercially, if PTD thinks testing is necessary.

1.2.2 Myanmar Posts and Telecommunications

Myanmar Posts and Telecommunications (MPT) is an internal organisation of MCPT, and is the dominant provider of telecommunication services in Myanmar. It used to be the sole telecommunication service provider, but MPT has outsourced data communication services such as Internet and email services to Bagan Cybertech Co. Ltd. (BCT). It has started its operation since January 2002 and provides telephone service as an additional service of data communication services. MPT offers fixed telephone, mobile phone, and Internet services.

Fig. 1.2.2-1 is its organisational chart. Tables 1.2.2-1 and 1.2.2-2 are its financial statements.

Fig. 1.2.2-1 Organisation Chart of Myanmar Posts and Telecommunications

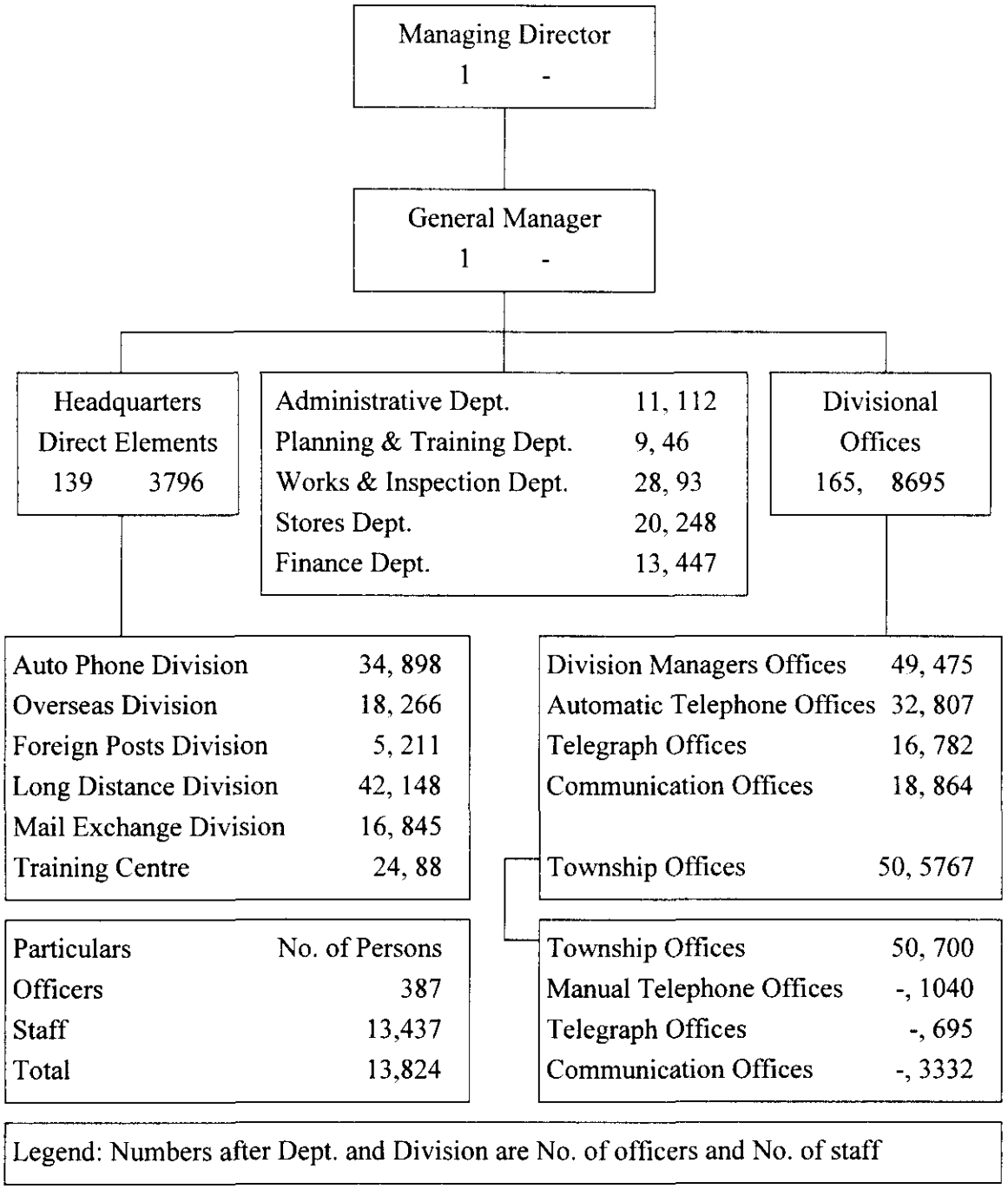


Table 1.2.2-1 Annual revenue and expenditure statement (Million Kyats for a fiscal year)

Particulars	1998	1999	2000	2001	2002 (Bgt.)
Postal revenue	397	409	371	582	510
Telecom revenue	4,250	5,582	8,069	10,192	11,450
Other revenue	21	30	43	35	40
Total revenue	4,668	6,021	8,483	10,809	12,000
Total expenditure	2,135	2,367	3,211	3,926	5,212
Profit	2,533	3,654	5,272	6,883	6,788
Operating ratio (%)	45.7	39.3	37.9	36.3	43.4

Source: Deputy Chief Accountant office / MPT

Table 1.2.2-2 Yearly revenue and expenditure statement for telecommunication services (Million Kyats for a fiscal year)

Particulars	2000	2001	2002
Total telecom service revenue	**5,582**	**8,069**	**10,192**
- Telephone & other services income	2,359	3,691	5,397
--- Telephone connection charges	162	255	283
--- Telephone subscription charges	465	2,565	4,154
--- International call settlement	72	87	105
--- Public telegram services revenue	28	31	34
--- Telex revenue	10	25	22
--- Data transmission revenue	24	35	46
--- Leased circuit revenue	21	24	33
--- Mobile service revenue	1,577	669	720
- Telephone call income	3,223	4,378	4,795
--- Local calls	960	1,553	1,608
--- National long distance calls	1,831	2,625	3,027
--- International calls	432	200	160
Total expenditure for telecom services	**2,082**	**2,724**	**3,178**
- Operational expenditure	131	488	496
- Interest paid	20	13	7
- Depreciation	1,130	1,138	1,519
Other expenditures	828	1,085	1,156

Note: Revenues in US$ are converted into Kyats by official exchange rate (1 US$ = 6.5 Kyats)

Source: Deputy Chief Accountant office / MPT

Table 1.2.2-3 shows examples of summarised balance sheets of MPT. In the table, MPT's capital increases yearly, joint venture investment means investment to DHL courier service, creditors signify payable expenses and domestic and foreign creditors, and suspense account includes remittance and advance payment.

Ongoing projects signify ongoing parts of investments by loan and own fund, the latter of which mainly consists of depreciations. Loan decreases in these 2 years, because MPT always repays not only interests but also principals of loans.

Table 1.2.2-3 Balance sheets of MPT (Million Kyats at the end of a fiscal year)

Credit			Debit		
	2000	2001		2000	2001
Fixed asset			Capital	12,543.6	14,273.9
- Land and buildings	2,448.8	2,636.5			
- Machinery equipment	8,566.7	8,317.4	Loan	884.7	792.5
- Vehicle	135.7	121.2	Creditors	289.1	449.9
- Furniture, tools and others			Suspense account	4,731.3	7,722.2
--- Furniture	21.4	23.0			
--- Office plant and tools	23.3	23.2			
--- Others	27.4	30.9			
- Ongoing projects	689.6	1,005.1			
- Joint venture investment	2.0	2.0			
Current asset					
- Cash	22.6	19.4			
- Debtors	577.6	666.8			
- Others	5,933.6	10,393			
Total	18,448.7	23,238.5		18,448.7	23,238.5

Source: Deputy Chief Accountant office / MPT

According to hearing survey, the following items are clarified:

- Investment of MPT amounts 1,620 million kyats.
- MPT has to pay tax to Ministry of Finance and Revenue, and its profit has to be submitted to State Government Account. Ministry of Finance and Revenue collects taxes and revenues to the State Government Account and appropriates them as State Budget to related governmental organisations.

- MPT earns about 42 million US$ per annum from international communication services as an average, but the amount should be submitted to Myanmar Foreign Trade Bank to get converted into kyats at an official rate of 6.5 kyats per dollar. Then the earning is summed up to total revenue of MPT, and the final profit of MPT goes to the State Government Account as mentioned earlier.
- Superiors of the State Government decide the allocation of the State Budget finally.
- MPT is usually allowed to use less than 0.5 million US$ per year for maintenance purposes, 6 million US$ for expenditure on satellite lease, and 8 million US$ for repayment of principals.

Worldwide trend orients to liberalisation and internationalisation of telecommunications business. Myanmar has committed to liberalise the business by the target year of 2008 in e-ASEAN Framework Agreement. In Myanmar, the telephone service and the development of telecommunication infrastructure have been under the monopoly of MPT, although liberalisation has been made partly in IT areas such as email and the Internet services.

For development of basic telecommunications infrastructure and provision of basic telecommunications services, the public sector or the Government naturally has to intervene in the investment plan of telecommunication operating entity so as not to cause a considerable divide between urban and rural areas. However, to aim at efficient development, the telecommunication operating entity should have an institutional framework to handle revenues and expenditures, and also to plan the development in an integrated way: it should be a public corporation with financial autonomy.

According to hearing study, the telecommunication business will be opened within 2 to 3 years. MPT is better preparing for the liberalisation, to compete with other incoming companies. Organisational change to cope with competition such as establishing corporate sales division by groups of active engineers and administrative staff seems to be required. Moreover, in order to ensure competitive environment in the ICT related business, MPT is better to adopt an accounting system that clarifies revenue and expenditure in terms of each telecommunication service.

1.2.3 Bagan Cybertech

Bagan Cybertech Company Limited (BCT) was established in 2000 with the primary function to assist in Myanmar's quest to establish a significant presence in the Information & Communication industry.

In early 2001, Myanmar committed on having an Information & Communication Technology (ICT) Park in Yangon. This ICT Park will provide the opportunity for various private IT companies to use cutting edge technologies to further develop software and other technological products, moreover to provide quality services to interested customers worldwide.

To ensure that the most modern telecommunication technology is available to the ICT Park and to further augment the networking of corporations nationwide, the government granted BCT the rights to establish a Teleport Facility. This Teleport Facility located adjacent to the ICT Park will highlight VSAT Technology for countrywide networking together with capabilities for the provision of other telecom services such as wireless and fibre optic local loops, VoIP gateway, Data Centre Services, and Internet & Intranet gateway services.

BCT's teleport features state-of-the-art VSAT hub equipment—including high powered antennas, a telecommunication tower and 480 square meters of data centre/co-location facilities.

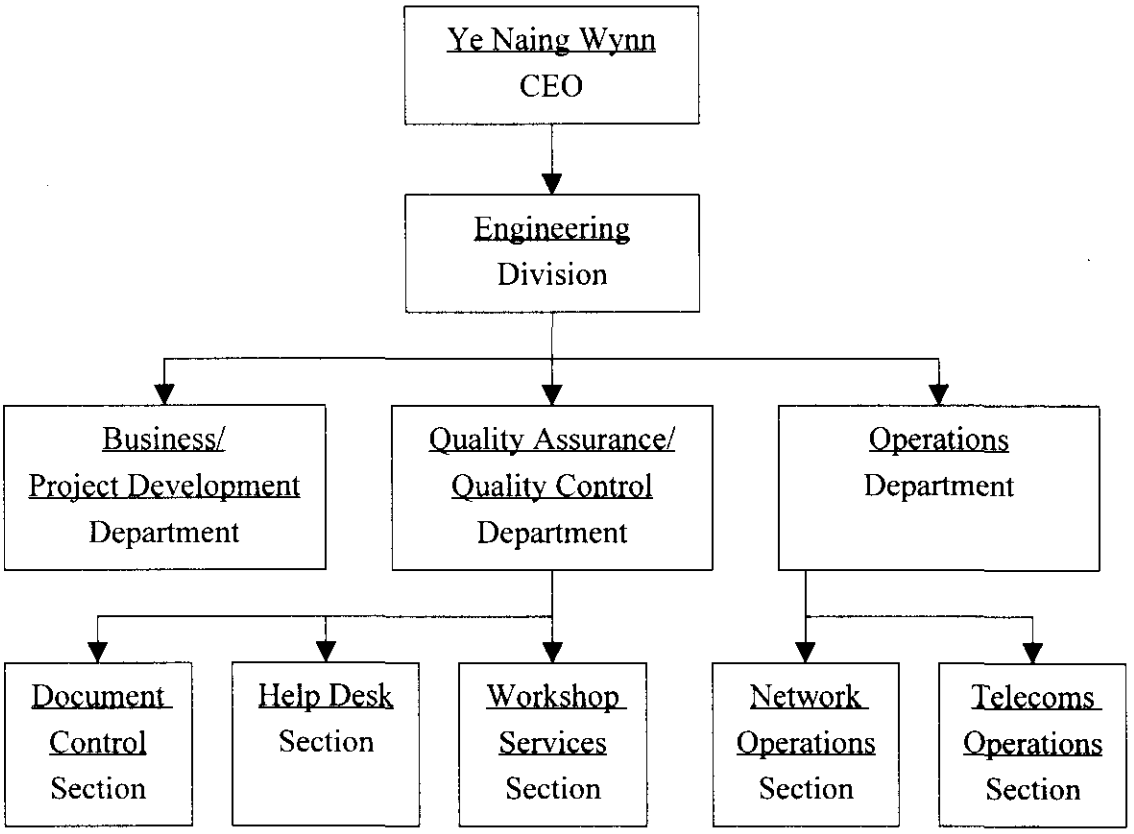
In mid-2001 BCT launched its Intranet operations. This Intranet is expected to develop rapidly, as the nationwide VSAT Network has been operational since Fourth Quarter 2001.

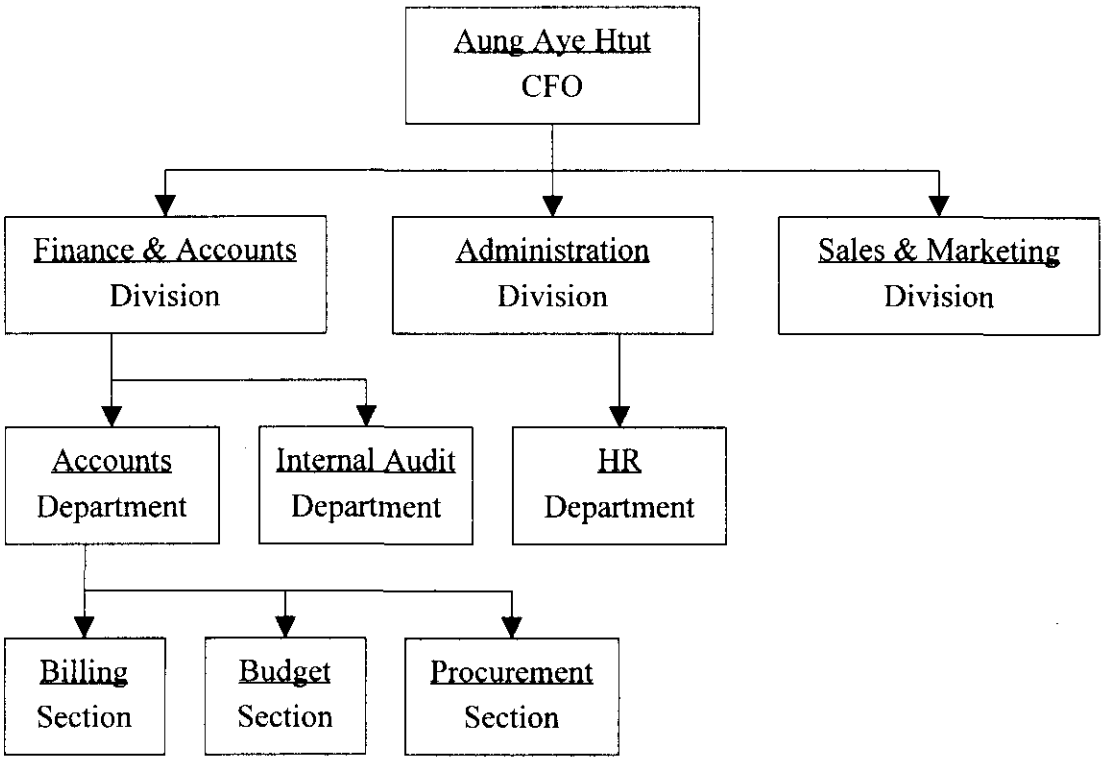
BCT is an Internet service provider and data communication career. BCT is a private company but the Government monitors its operation.

VSAT customers are 4 private banks and 2 ministry offices and use more than 250 remote terminals. One private bank and two ministry offices will use the service soon.
More than 200 users have dial-up Internet access service.

Fig. 1.2.3-1 shows BCT's organisation chart.

Fig. 1.2.3-1 BCT's organisation chart.





1.3 Size and potentiality of telecom- and IT-related industries

1.3.1 Size of telecom business, or present status of telecommunication services

MPT provides automatic and manual telephone services, FAX service, maritime radio telephone service, auto radio and DECT telephone service, mobile telephone service, CDMA radio telephone service, INMARSAT satellite phone service, X-25 data transmission service, telegraph and telex services, and Internet and email services.

Tables 1.3.1-1 to 1.3.1-5 show present status of main telecommunication services, which are compiled from the data of Central Statistical Organisation "Myanmar Data CD-ROM 2001"

Table 1.3.1-1 Telegraph service

Particulars	1996	1997	1998	1999	2000
Telegraph office	82	89	91	95	100
Post cum telegraph office	176	170	169	169	171
Wireless stations	155	159	164	169	168
Telegrams (000)					
Domestic	7,020	6,280	5,752	5,209	4,854
Foreign-received	4	5	4	3	2
Foreign-sent	8	11	8	11	10

Table 1.3.1-2 Telephone service

Particulars	1996	1997	1998	1999	2000
Telephone in use	199,017	225,315	240,673	260,579	282,853
Yangon	98,736	114,909	123,674	136,676	148,577
Others	100,281	110,406	116,999	123,903	134,276
Telephone exchange	495	517	528	539	556

Table 1.3.1-3 Telex service

Particulars	1996	1997	1998	1999	2000
Subscribers	211	201	182	26	34
Calls					
Incoming	165,733	99,134	105,339	66,505	58,299
Outgoing	115,098	68,035	67,535	60,532	48,816

Table 1.3.1-4 Facsimile service

Particulars	1996	1997	1998	1999	2000
Facsimile in use	1,525	1,774	2,278	2,540	2,875

Table 1.3.1-5 Domestic Satellite

Particulars	1996	1997	1998	1999	2000
Earth station	15	15	12	10	13

According to data presented by Overseas Div. of MPT, time sequential performances of service provision in recent fiscal years can be summarised as shown in Table 1.3.1-6.

Table 1.3.1-6 Present status of main telecommunication services

Description	1998	1999	2000	2001
Telex subscribers	181	26	34	30
Telex calls (Out-going)	66,210	53,735	48,816	48,444
Telex call durations (min.)	-	-	-	223,004
Telegraph messages (Domestic)	1,422,430	1,270,714	1,192,116	1,133,901
International telephone calls	5,961,153	4,984,326	4,734,231	4,113,072
International telegraph messages	5,682	8,739	9,907	8,471
International leased lines (Telegraph)	5	4	3	3
International leased lines (64k-data)	5	7	9	13
Post offices	1,256	1,275	1,293	1,294
Telegraph offices	424	433	439	446

Source: Overseas Div. of MPT

Subscribers to mobile phone systems and WLL systems are in Tables 1.3.1-7 to -10 as of 2002. MPT started GSM mobile phone service about 2 months ago, and thus, data on GSM mobile service are not available.

Table 1.3.1-7 Subscribers to analog and digital AMPS systems

Station	Capacity	Subscribers
Sagaing	100	1,142
Mandalay	900	
Yangon	7,000	7,419

Source: Long distance Div. of MPT

Table 1.3.1-8 Subscribers to CDMA systems

Station	Capacity	Subscribers
Yangon	20,000 (Fixed)	18,220
	10,000 (Mobile)	9,521
Mandalay	1,000 (Mobile)	976
Mogok	1,000 (Mobile)	1,000 (Mobile)
		10 (Fixed)

Source: Long distance Div. of MPT

Table 1.3.1-9 Subscribers to DECT-WLL systems

Station	Capacity	Subscribers
Yangon	450	450
Pakokku	400	408
Monya	350	268
Mandalay	1,700	1,425

Source: Long distance Div. of MPT

Table 1.3.1-10 Subscribers to auto radio telephone system (ARTS)

Station	Capacity	Subscribers
Yangon	2,000	1,980
Maubin	700	700
Bagan	650	650
Paan	225	225
Mandalay	250	250
Moulemyaing	225	225
Shinmataung	100	100
Tavoy	100	42

Source: Long distance Div. of MPT

1.3.2 Size of IT-related business, or present status of ISP services

As explained earlier, there are 2 Internet service providers in Myanmar now: one is MPT, mainly offering the service to Government organisations, and the other is BCT, mainly to the private sector. MPT started Internet and email services for governmental users in 2000. MPT now provides services to the government and private users from 2002, while BCT opened its service from January 2002. Time sequential trend of these services are shown in Table 1.3.2-1.

Table 1.3.2-1 Internet and email subscribers

Particulars	2000	2001	2002 (19 June)
Internet subscribers	40	62	68
Email subscribers	1,860	3,925	5,062

Source: Data Communication Dept. of MPT

Myanmar committed on having an ICT Park in Yangon, to provide opportunities for various private IT companies to use cutting-edge technologies to further develop software and other technological products, moreover to provide quality services to interested customers worldwide.

To ensure the most modern telecommunication technologies available to the ICT Park, and to further augment networking of corporations nationwide, the Government granted BCT the right to establish a Teleport facility. This Teleport located adjacent to the ICT Park features VSAT technology for countrywide networking together with capabilities for provision of other telecommunication services such as wireless and fibre optic local loops, VoIP gateway, data centre services, Internet and Intranet gateway services.

BCT established fibre optic network in the area of the ICT Park to provide broadband services to the companies in the Park. Each room of the ICT Park buildings has fibre optic terminals.

Customers of BCT include banks, Ministry of Education, Ministry of Health, off-shore oil and gas mining companies in general, and software companies in Myanmar ICT Park. Its customers as a total amount a few tens companies and organisations at present. BCT is now endeavouring to acquire more users such as Ministry of Interior, Ministry of Foreign Affairs, Ministry of Immigration and Population.

The results of hearing study are shown below:

- Explanations on a block schematic diagram of IDC & Teleport. Main explanations are as follows:
  1) BCT Teleport started its operation in January 2002.
  2) BCT uses THAICOM 2 and THAICOM 1A satellites.
  3) THAICOM 2 is used for domestic communications with a transmission speed of uplink 2 Mbps and downlink 128 kbps for 1 user group. 1 user group includes 40 remote stations.
  4) THAICOM 1A is used as the Internet backbone to Hong Kong at a transmission speed of 1 Mbps for both up and down links.
  5) 1000 Base T fibre optic link of 1+1 and STM 1 fibre optic link of 1+1 connect 5-km distance between BCT Teleport and MPT Mayangon ITMC. 1000 Base T system is used for IT applications and STM-1 system is used for voice communications.
  6) 400 MHz PTP radio systems, which have transmission speeds ranging from 256 kbps to 786 kbps, connect between BCT Teleport and Client Headquarters. Typical remote stations of VSAT system are composed of 1.8-m diameter antennas, PES, DMR, Hub, WS, etc.
  7) BCT Teleport is mainly composed of 2 parts that are interconnected through a distribution switch; one is system for VSAT called Hughes Network System having IP gateway, and the other is fibre optic LAN within BCT and neighbouring MICT Park. BCT provides fibre optic LAN that has optical terminals in each room of buildings in MICT Park.
  8) Voice signals are converted into IP telephony at VoIP gateway and are transmitted through LAN and VSAT systems in the form of IP telephony.
  9) 100,000 telephone numbers have been allocated to BCT from MPT for the purpose of IP telephony. IP telephony has speech interruptions and delays more than 500 ms.
  10) BCT charges 200 US$ / site / month to users. Government users can have special discount from 25 to 50 %.
  11) Customers of BCT at present have sufficient electric power supply, as well as their own generator. As a solar system is still costly, it is not used in Myanmar at all.
  12) Although BCT provides domain names to its customer, domain names themselves are controlled by MPT.
  13) Present users of VSAT are banks like AWB, KBZ, YOMA, MMB, and Ministry of Education.
- BCT plans to introduce BREEZECOM as wireless local loop in the end of July, which has transmission speed from 128 kbps to 2 Mbps.
- BCT expects about 1,000 customers in Yangon, Mandalay and major cities. BCT plans to

establish networks of BREEZECOM systems first in business areas and second in whole municipal area of Yangon.

- BCT plans to introduce Broadband Satellite Data Service using iPSTAR by means of Thaicom 4 satellite this year. BCT wants to rent a transponder and to provide finally 5,000 users with 128 kbps to 2 Mbps connections. BCT expects 500 users within this year. BCT installs 11-m diameter Antenna here in the IDC & Teleport and users install a satellite terminal with 1.2-m to 1.8-m diameter antenna, because BCT utilises Ku band for this service.
- BCT considers there are a lot of Internet service needs in rural areas. The above system can provide people in rural areas with required services.
- BCT plans to introduce GMPCS (Global Mobile Personal Communications via Satellite) by joining ACES (Asia Cellular Satellite) Service using Indonesia's Garuda 1 geo-stationary satellite, which was already launched by companies of Indonesia, Thailand, and Philippines and Lockheed Martin of USA about 1 year ago. BCT wants to use its terminal equipment as mobile terminals of the Internet service, too. The system uses L band, and handsets are of model R190 made by ERICSSON, which has 2 W transmitting power and cost less than 1,000 US$. Users pay 25 cents per domestic call, here domestic means within above countries participated in the project, 75 cents per call to all Asia, and 1 to 1.5 US$ per call for Europe and America. However, all charges have to be in US$.
- BCT plans to install a multiplexing system for this service in Myanmar. The multiplexing system is connected via an E1 system to International Telecommunication Maintenance Centre for calls to Myanmar PSTN. Other calls are directed to a gateway centre to be installed in one of the above 3 countries.
- In actuality, this project was originally for MPT, but MPT handed it over to BCT.
- In order to increase its customers, BCT is now contacting with Ministry of Interior, Ministry of Population and Immigration, and Ministry of Foreign Affairs concerning e-visa, e-passport, smart card as ID card, etc.
- Problem here relates to power supply system. Especially in remote cities and rural areas, it has frequent interruptions of service, considerable voltage fluctuations. Because of this poor power supply system, remote VSAT stations sometimes cannot use air-conditioning system for communication and information systems. In remote areas, dust and heat are also other problems.

Although BCT does not compete against MPT at present, generation of a competitive environment is necessary for more promotion of ISP business. MPT and BCT are better to compete with each other, and to prepare for real competition with foreign companies in the near future.

1.3.3 Potentiality of telecom business

Although MPT supplies telephones under budget constraint and telephone density is low, MPT plans to increase the number of telephones rapidly. Table 1.3.3-1 shows MPT's telecommunications service plan.

Table 1.3.3-1 MPT's telecommunications service plan

Year	Existing (as of 31 March 2002)	As of 31 March 2006	As of March 2011
Population (million)	51.226	55.204	60.949
Telephone (million)	0.307	0.878	5.144
Telephone density (%)	0.59	1.59	8.44

Source: Overseas Div. of MPT

Business demand for telephone service always surpasses that of residential houses in Myanmar. However, both demands will take almost equal values at the end of 2012. In order to meet the business demand, MPT is better to place emphasis upon provision of business telecommunication services. This policy is to promote industrial vitalisation in Myanmar as well as to strengthen financial status of MPT as a public corporation, so as to tolerate huge investments for rural areas later. Certainly the Government should undertake bridging the divide between urban and rural areas in provision of telecommunication services by providing subsidies or raising the universal service fund, guaranteeing foreign loans of MPT, etc.

Table 1.3.3-2 shows the telephone densities of ASEAN countries in 2000.

Table 1.3.3-2 Telephone densities of ASEAN countries in 2000

Cambodia	Indonesia	Lao PDR	Malaysia	Myanmar	Philippines	Thailand	Vietnam
1.23	4.87	0.98	41.23	0.58	12.44	14.26	4.17

Source: The World Bank Group, Country data file.

The above telephone density includes mobile and fixed telephones. It seems considerably difficult for Myanmar to catch up the other ASEAN countries. However, telephone densities in certain countries above seem to have increased mainly by the liberalisation of mobile phone service. Hence, urgent liberalisation of at least mobile telephone service is indispensable for the catch-up purpose. It should be noted that MPT and/or BCT should be given an equal chance to compete with possible newcomers, otherwise decline of morale in personnel might hinder development

of fixed telecommunication services.

1.3.4 Potentiality of IT business

The World Bank says that PC density in Myanmar was about 1.1 per 1,000 people in 1999 and it was also 1.1 in 2002. ITU shows a bit different but almost equal value. Therefore, the data of the World Bank are used here. The result of forecast is shown in Table 1.3.4-1. As a conclusion, personal computers in Myanmar in 2011 will range from 780,000 to 1,550,000. This forecast supposes that 1 personal computer costs about 700,000 Kyats in accordance with a result of hearing survey, that is, prices of a personal computer range from about 400,000 Kyats to about 1 million Kyats. Obviously, business users exceed residential users. Business users will be about 4 times more than residential users even in 2012.

Table 1.3.4-1 Personal computer density per 1,000 people forecast

Year	2002	2006	2011
PC density per 1,000 people	0.98 - 1.96	2.95 - 5.89	12.70 - 25.40

PC densities of ASEAN countries in 2000 are shown in Table 1.3.4-2 below.

Table 1.3.4-2 Personal computer density per 1,000 people of ASEAN countries in 2000

Cambodia	Indonesia	Lao PDR	Malaysia	Myanmar	Philippines	Thailand	Vietnam
1.1	9.9	2.6	103.1	1.1	19.3	24.3	8.8

As it is clear from the above 2 tables, Myanmar will reach Thailand 2000 level in 2011. In order to get out of this pitfall, the Government should:

1) Support PC assembly industry to reduce cost and price of personal computers through competition, subsidy, etc.
2) Popularise benefits of personal computer through seminars, etc. especially for business people.
3) Popularise benefits of the Internet services through seminars, etc. especially for business people.
4) Develop information and communication infrastructure through competition and/or subsidy, etc.
5) Open the Internet services to the public with confidence in them, so as for any Myanmar

people to be able to access any sites in the world.

6) Promote usage of personal computers and/or the Internet services through governmental project like e-National project.

Certainly, it is true that younger people have to be trained in computers, but, in order to catch up the average ASEAN country level as soon as possible, innovation of business people's mind and development of ICT infrastructure seem to be classified into the most important undertakings of the Government.

1.4 IT policies

1.4.1 Historical background

- In 1971, Myanmar established Universities Computer Studies. In 1983, Computing Development Project was implemented financed by UNDP. The purpose of the project is computerisation of Government organisations. Unfortunately, these early efforts stopped before producing tangible results.
- In 1996, Myanmar Computer Science Development Law was promulgated and consequently Myanmar Computer Science Development Council was formed. In 1998, Myanmar formed three NGOs: Myanmar Computer Scientists Association (MCSA), Myanmar Computer Industry Association (MCIA), and Myanmar Computer Enthusiast Association. With the representatives from theses associations Myanmar Computer Federation (MCF) was formed in the same year. The federation and associations did a very good job in improving the awareness of the power of IT.
- In 1997, Ministry of Science and Technology was newly created. It is specifically responsible for IT human resource development. It established two universities and twenty regional computer colleges dedicated for IT professional education.
- In November 2000, heads of ASEAN countries signed e-ASEAN Framework Agreement. The Myanmarese government formed e-National Task Force to coordinate the efforts towards the implementation of the Agreement. The task force includes six working groups: IT Infrastructure, IT Legal Infrastructure, IT Education, IT Application, IT Standardisation, and IT Liberalisation.
- The Myanmar Computer Science Development Council approved IT Master Plan prepared and submitted by MCF. The Master Plan is the guiding principles for all IT development efforts in Myanmar.
- In 2001, a consortium of private companies established Myanmar ICT Park.

- Myanmar e-Government projects have started and the projects are expected to provide the impetus for ICT application and ICT industry development.

1.4.2 ICT policies

Myanmar recognises IT as the key element in implementing political, economic, and social objectives. IT has become the biggest economic sector by itself and it is growing rapidly. Myanmar has a very good chance to compete effectively in the international IT industry especially in software. Systematic efforts on development of IT will provide Myanmar opportunities for leapfrogging to catch up with developed countries. Developments in IT in the latest couple of years indicate that there are dedicated and concrete efforts on IT development in Myanmar, both in the public and private sectors. Unfortunately, there is no reliable information on IT status and trend in Myanmar. There is an urgent need to fill this gap as Myanmar needs to have good strategy.

Key elements of the national IT strategy are as follows:

- To facilitate IT diffusion in the public and private sectors.
- To support bottom-up initiatives and pilot applications.
- To promote IT industry and support institutions relating to promising key segments of the industry such as software.
- Incentives and investments in developing human resources for IT users and suppliers.
- Investments and reforms in telecommunications.

The Government of Myanmar decided to catch up in IT with, especially, ASEAN countries. It signed e-ASEAN Framework Agreement and is endeavouring to meet the undertakings stated in the Agreement, for example, liberalisation of telecommunication market by 2008. The actual liberalisation will take place within these 2 to 3 years partly or completely.

In early 2001, Myanmar committed on having an Information & Communication Technology (ICT) Park in Yangon. This ICT Park will provide the opportunity for various private IT companies to use cutting-edge technologies to further develop software and other technological products, moreover to provide quality services to interested customers worldwide. Modeled to develop Myanmar's software industry, the ICT Park facility is designed to provide tenants the opportunity to create products & services in order to compete in today's global market place. Broadband Internet will be available to ICT Park residents together with instant connectivity to all regions

of Myanmar via VSAT communications. ICT Park has 3 buildings accommodating 24 software companies, which actively expanding their business with Myanmar tourism companies, airlines companies, etc.

The Government also established BCT as well as Myanmar ICT Park, in which venture or software enterprises can enjoy the latest IT infrastructure, through fibre optic network supplied by neighbouring IDC & Teleport of BCT.

1.5 Cooperation with neighbouring countries

1.5.1 Myanmar's participation in international affairs

In accordance with its independence and active foreign policy, Myanmar has constantly participated in international and regional affairs. Peace in the region and the world as a whole is the unaltered and unchangeable principle of the foreign policy of Myanmar. Myanmar is working actively and enthusiastically to the best of its ability and capability for prevalence of peace in the world. Myanmar has been working persistently for friendship with world nations particularly with neighbouring countries. Shorten animosity, prolong amity, a saying in Myanmar, is a principle of Myanmar's foreign policy.

The foreign policy of Myanmar is based on the Five Principles of Peaceful Coexistence. The essence of the Five Principles rests on respect for Myanmar's sovereignty and territorial integrity and solving international problems peacefully between nations. Myanmar has given priority to friendly relations with neighbouring countries and dealing with them as good neighbours. The problem of demarcation of boundaries with neighbouring countries has been handled and solved in a discreet and intelligent manner.

1.5.2 Myanmar's participation in ASEAN

Myanmar was invited to become a member of ASEAN in 1967 when the Association of South-East Asian Nations was founded. But due to the policies and priorities of Myanmar and then international and regional situations, Myanmar placed greater emphasis on promoting bilateral ties with ASEAN member countries rather than the entry to ASEAN. In line with the present changes in the international situation and in consonance with policies, aims, and objectives, the government started to work earnestly for regional cooperation. Accordingly, Myanmar took steps for its entry into the regional group. Myanmar became a full-fledged member of ASEAN at the acceptance ceremony on 23 July 1997.

As a member of ASEAN, Myanmar will be able to present its views and can have more economic opportunities with the help of member nations and it will no longer be necessary to pay heed to the other half of the globe for investment as there will be greater cooperation among friendly nations of the region in every field.

1.5.3 Myanmar's participation in BIMST-EC

Although Myanmar is a South-East Asian nation, it is geographically situated as a bridge between South Asia and South-East Asian regions. Myanmar decided to become the member of economic group BIMST-EC comprising Bangladesh, India, Myanmar, Sri Lanka, and Thailand on 22 December 1997. Myanmar hopes to achieve positive results from economic cooperation among member countries and the programme for transfer of research and technology.

1.5.4 Cooperation in telecommunication

PTD is a window for the contact with such telecommunications related international organisations as ITU, APT. However, relations with the above international organisations do not seem so close as to contribute something from a viewpoint of personnel disposed in PTD.

MPT, as a principal national organisation, also cooperates with the above international organisations as well as regional and sub-regional cooperation programmes like submarine optical fibre project, SEA-ME-WE 3. Needless to say, MPT participates in INTELSAT, INMARSAT and has close relations with countries like Singapore, Thailand, Japan, UK, Saudi Arabia for establishing international telecommunication channels. MPT is utilising satellites launched by the fund of a Thai company.

According to BCT plan, it is under negotiation on Global Mobile Personal Communication via Satellite (GMPCS) with a consortium of Indonesia, Philippines, Thailand and USA companies. At present BCT uses satellites launched by the fund of a Thai company, too.

Myanmar is managing six corporations. Related countries are India, China, Malaysia, South Korea, Singapore, and Japan.
Myanmar has close relation with China and India. Especially, certain telecommunication network expansion projects are now on-going by using Chinese systems. South Korea has offered a US$ 12-million soft loan to finance telephone expansion in Yangon and Mandalay.

Myanmar seems to have good and close relations with neighbouring countries.

Initiative for ASEAN Integration (IAI) is a joint project by ASEAN and three (Japan, China, and South Korea). Ministry of Foreign Affairs Japan states "Japan's Cooperation to 'Initiative for ASEAN Integration (IAI)'" as follows: (Excerpts of home page as of November 2001)

"Overview: Japan has already been extending various bilateral assistance (ODA) to the new member countries of ASEAN. Japan actively cooperates with ASEAN in their efforts to promote ASEAN Integration by assisting ASEAN new member countries.

1. Cooperation with the ASEAN Secretariat

Following projects are carried out or under consideration in cooperation with ASEAN Secretariat to assist CLMV (Cambodia, Laos, Myanmar, and Vietnam) countries by utilising the Japan-ASEAN General Exchange Fund (JAGEF).

i. ICT Cooperation to Cambodia, Laos, Myanmar, and Vietnam (Provision of IT equipment to Ministries of Foreign Affairs of the CLMV).
ii. Attachment Programme at the ASEAN Secretariat for Junior Diplomats of CLMV.
iii. Human Capacity Building Workshop for MFA (Ministry of Foreign Affairs) personnel of the CLMV.
iv. HRD Workshop for non-MFA personnel of the CLMV.
v. Workshop to Formulate a Work plan for the Integration of ASEAN New Member Countries: CLMV into ASEAN."

1.6 Tariffs of telecommunication services (Source: Myanmar telephone directory 2002)

1.6.1 Telephone tariff

Table 1.6.1-1 Local call fees

Particulars	Rates in Kyats
Automatic services	3.00 per call
Manual services	No charge
Local call from public booth	3.00 per call

Table 1.6.1-2 Long distance call fees (Rates in Kyats)

Distance in miles	For the first 3 minutes	For additional minutes
1 to 50	6.30	2.10
51 to 100	9.00	3.00
101 to 200	16.20	5.40
201 to 300	19.80	6.60
301 and above	24.30	8.10

Table 1.6.1-3 Public call office

Particulars	Charge per call
Local call	3.00 Kyats
Long distance call	Existing long distance call fee (+ Booking fees 3.00)

Table 1.6.1-4 Subscription and shifting charges

Particulars	Rates
Subscription fee	200,000 Kyats
Drop wire within 200 m	7,000 Kyats
For every 10 m exceeding 200 m	350 Kyats
Phone (All in FEC)	60 US$

Table 1.6.1-5 Casual telephone connection

Particulars	Rates
Drop wire within 200 m	7,000 Kyats
For each 10 m exceeding 200 m	350 Kyats

Flat rate Kyats 150 per day up to maximum period of 3 months.

International telephone charges are curtailed because they compose a long list depending upon called countries. However, all overseas call charges must be paid in US$, according to international telephone rates.

1.6.2 Public overseas FAX service

Public domestic FAX service is offered at 97 cities and towns, including Yangon and Mandalay.

Table 1.6.2-1 Public overseas FAX service

Country	Rates in US$	
	First 6 seconds	Each additional 6 seconds
Brazil, Canada, Egypt, Gambia, Guinea Bissau, Guinea Rep., Ivory Coast, Kenya, Lesotho, Mexico, Nigeria, South Africa, Tanzania, UAE, USA	0.45	0.45
Australia, Austria, Belgium, Cyprus, Czech Rep., Denmark, Fiji, Finland, France, Germany, Greece, Guam, Hawaii, Iran, Ireland, Israel, Italy, Jordan, Kiribati, Micronesia, Netherlands, New Zealand, Norway, Omen, Poland, Qatar, Romania, Russian Federation, Saudi Arabia, Spain, Sri Lanka, Sweden, Switzerland, Turkey, United Kingdom, Yugoslavia	0.32	0.32
Indonesia, Korea, Philippines	0.29	0.29
Bangladesh, Japan, Laos, Macao, Maldives, Taiwan, Vietnam	0.27	0.27
China, Nepal	0.23	0.23
India	0.19	0.19
Brunei, Hong Kong, Malaysia, Pakistan, Singapore	0.18	0.18
Thailand	0.14	0.14

A service charge of 10 % is levied in addition to the above.

1 US$ is charged for every 2 pages (A4 size) of incoming message.

1.6.3 Maritime radio telephone tariff

Table 1.6.3-1 Maritime radio telephone tariff in US$

From land to ship	First 3 minutes	1 additional minute
Yangon to ship	4.7	1.6
Other towns of Myanmar to ship	7.1	2.4

1.6.4 Auto radio and DECT telephone tariff

Table 1.6.4-1 For private radio telephone charges

Particulars	Rates in Kyats	Remarks
Subscription fees	200,000	
Annual charge	3,000	
Shifting fees	5,000	
Reconnection fees	240	
Local call for first 3 minutes	3	
Local call for each additional min.)	1	
Trunk call per minute rate	1	+ Existing trunk call rate

1.6.5 Mobile telephone tariff

Table 1.6.5-1 Mobile telephone charge in Kyats

Particulars	Rates in Kyats	Remarks
Subscription fees	500,000	
Annual charges	12,000	
CLI annual charges	6,000	
Local call fees per minute	4	
Trunk call fees per minute	4	+ Existing trunk call rate
Incoming call fees per minute	2	

Table 1.6.5-2 Mobile telephone charge (All in US$)

Particulars	Rates in US$	Remarks
Subscription fees		
Annual charges	600	
CLI annual charges	300	
Local call fees per minute	0.30	
Trunk call fees per minute	0.30	+ Existing trunk call rate equivalent to US$
Incoming call fees per minute	0.15	

1.6.6 CDMA radio telephone tariff

Table 1.6.6-1 CDMA rate for Government organisations and private in Kyats

Particulars	Rates in Kyats	Remarks
Subscription fees	(200,000)	
Annual charges	6,000	
Local call fees for first 5 min.	6	
Local call fees for each additional min.	2	
Trunk call fees for first 5 min.	6	+ Existing trunk call rate
Trunk call fees for each additional min.	2	+ Existing trunk call rate
FAX installation fees	6,000	
FAX annual charges	6,000	

Table 1.6.6-2 CDMA rate for All in US$

Particulars	Rates in US$	Remarks
Subscription fees		
Annual charges	300	
Local call fees for first 5 min.	0.20	
Local call fees for each additional min.	0.05	
Trunk call fees for first 5 min.	0.20	+ Existing trunk call rate
Trunk call fees for each additional min.	0.05	+ Existing trunk call rate

1.6.7 INMARSAT satellite phone tariff

Table 1.6.7-1 INMARSAT satellite phone call fees

Particulars	Rate in US$ / min.
INMARSAT - A	6.95
INMARSAT - B	3.73
INMARSAT - M	4.13
INMARSAT - Mini M	3.49

1.6.8 X-25 data tariff

Table 1.6.8-1 Connection fees

Particulars	Rate in US$		Rate in Kyats	
	Initial fees	Annual fees	Initial fees	Annual fees
Dedicated access				
(Leased line connection)				
9.6 kbps	300	1,000	30,000	100,000
19.2 kbps	300	3,000	30,000	300,000
64 kbps	600	10,000	60,000	1,000,000

Table 1.6.8-2 Usage fees

Particulars	Rates in US$		Rates in Kyats
	Local	Overseas	Local
Usage duration	0.07 (3 min.)	0.12 (1 min.)	7 (3 min.)
Usage volume	0.04 (K seg.)	0.03 (10 seg.)	4 (K seg.)

1.6.9 Internet service tariff

Table 1.6.9-1 Email service fees

Particulars	Rates in US$			Rates in Kyats		
	Initial fee	Annual fee	Deposit fee	Initial fee	Annual fee	Deposit fee
Email service	200	60	30	40,000	12,000	6,000
Own DN registration		120			24,000	
Pilot a/c registration	200	60	30	40,000	12,000	6,000
Additional a/c registration						
(Under own DN)	100	60	30	20,000	12,000	6,000
Web hosting						
a. 500 kBytes		200			40,000	
b. 1 Mbytes		400			80,000	
c. Additional 100 kBytes		40			8,000	

Note: DN = domain name, a/c = account

Table 1.6.9-2 Email usage fees

Particulars	Rates in US$		Rates in Kyats	
	Local	Overseas	Local	Overseas
Email usage charges per hour	3	3	600	600

1.6.10 Telegraph and telex tariff

Table 1.6.10-1 Inland telegraph

Particulars	Rates in Kyats
Telegram in Myanmar: First (16) words	2.00
Telegram in Myanmar: Each additional word	0.15
Telegram in English: First (8) words	2.00
Telegram in English: Each additional word	0.30
Press telegram in Myanmar: First (50) words	3.80
Press telegram in Myanmar: Each additional pair of (10) words	0.50
Press telegram in English: First (40) words	3.80
Press telegram in English: Each additional pair of (5) words	0.50

Table 1.6.10-2 Overseas telegraph

Particulars	Rates in Kyats per word	
	Minimum	Maximum
Europe	4	7
Africa	4	12
Arabian Gulf	4	5
UAE	5	7
Asia	3	8
Oceania	4	11
America (Central, North & South)	4	12
Caribbean, etc.	4	11

Table 1.6.10-3 Telex long line service

Particulars	Government	Private
	Rates in Kyats	Rates in US$
Installation fees		
For each direct telex connected to an exchange	500	85
Subscription fees		
Monthly rental charge for telex machine	500	85
Monthly rental charge for line (Within Yangon area)	1000	52
Shifting fees		
For each telex machine	175	
Programming fees		In equivalent US$
For each change of automatic answer back code	450	
For each change of memory capacity	450	

Table 1.6.10-4 International / inland telex collection charges

Destination	Government (Kyats)		Private (US$)	
	First (1) minute	Each additional (1) minute	First (1) minute	Each additional (1) minute
All countries in Asia, Australia, & Papua New Guinea	480	480	2.40	2.40
All countries in Oceania, Europe, Africa (Except Central / South / South West Africa), North / South / Central America, also Afghanistan, Bahrain, Indonesia, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Portuguese, (Timor,) Qatar, Saudi Arabia, Syria, Yemen	640	640	3.20	3.20
Central Africa, Congo, Kenya, South Africa, South West Africa, Swaziland & UAE	800	800	4.00	4.00
Inland	200	200	1.00	1.00

Table 1.6.10-5 Incoming call / min.

Government	=	Kyats 30.00
Private	=	US$ 0.15

1.6.11 Observations

Regarding telecommunication tariffs, the tariff system should be changed to one based upon market economy gradually from the current one. More activities, higher efficiencies, lower prices, better qualities, and more diversity of services in the telecommunication sector must be encouraged through adequate policies such as the introduction of privatisation and competition.

The tariff can be charged in US$ as shown in tables above. However, the tariff should be competitive from a viewpoint of international standard, or ASEAN countries standard. Provided US$ tariffs were more expensive than the other ASEAN countries, ICT would not vitalise Myanmar economy, but place burdens on Myanmar enterprises.

Table 1.6.11-1 Telephone tariff comparison with ASEAN countries

(Unit: in US dollars)

Particular	Myanmar	Cambodia	Laos	Vietnam	Indonesia	Philippines	Thailand
Residential telephone connection	250	69.52	38.03	115.47	35.03	12.03	83.52
Business telephone connection	250	69.52	38.03	115.47	53.4	21.81	83.52
Residential telephone monthly subscription	5.63	8.07	1.27	1.91	2.72	13.79	2.49
Business telephone monthly subscription	5.63	8.07	1.27	1.91	4.64	28.09	2.49
3-minute local call	0.004	0.03	0.02	0.03	0.02		0.07
Cellular connection	625	59.36		76.93	23.75	37.34	24.93
Cellular monthly subscription	1.25	24.73	15.59	12.84	7.72	13.58	12.47
Cellular 1-minute local call	0.005	0.56	0.06	0.35	0.17	0.54	0.22

Source: ITU year book, comparison year of 2000 except Myanmar. Figures of Myanmar is calculated with 2002 MPT tariffs and an exchange rate of 800 Kyats/dollar.

2. Telecommunication Infrastructure

2.1 International network

2.1.1 Present status of telecommunication facilities and technology

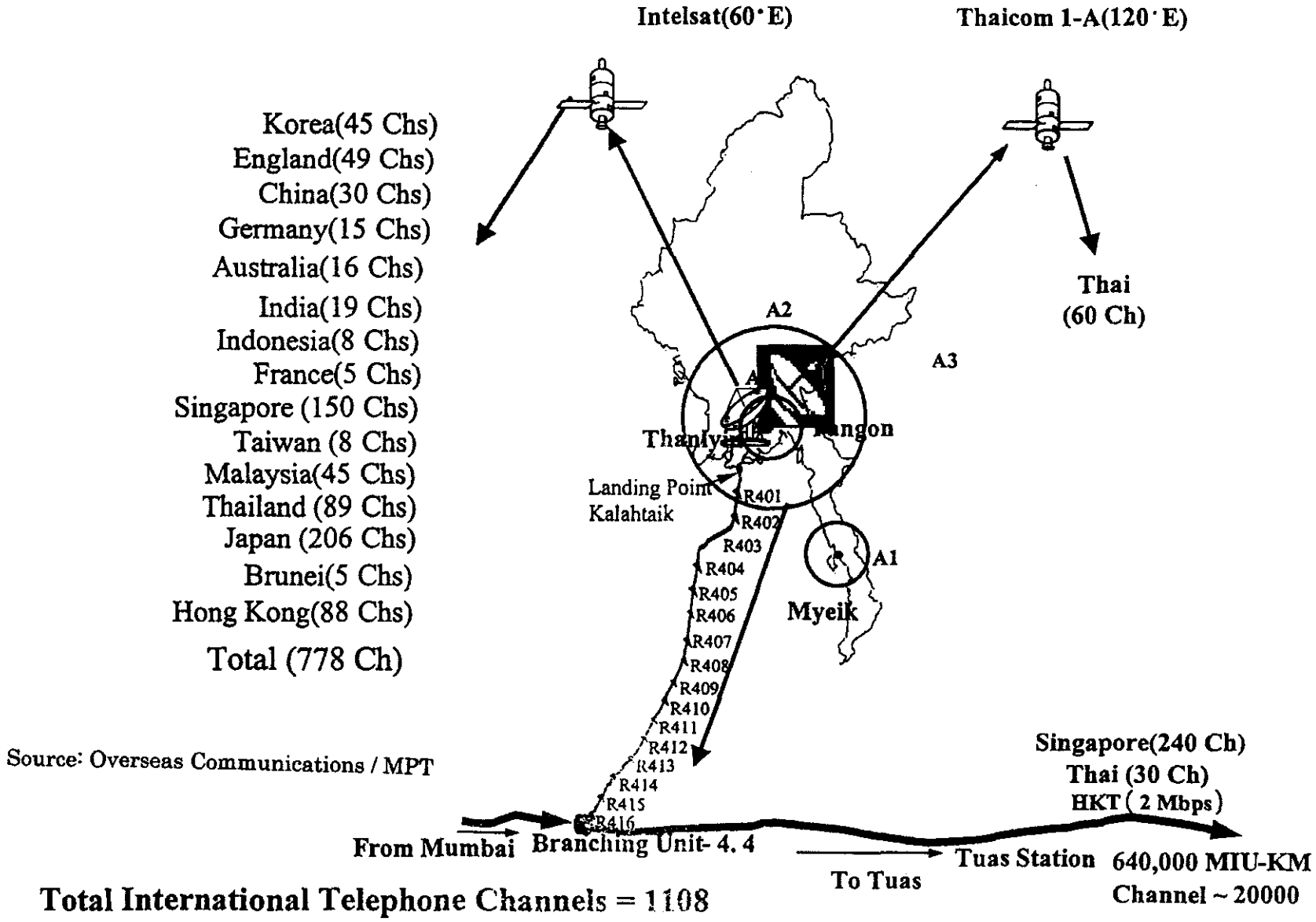
All out-going and in-coming calls to the country go through the only one international gateway switch housed by Mayangon exchange in Yangon. The switch connects with an international submarine cable and a satellite earth station near Yangon.

There are three international routes: INTELSAT satellite system (over Indian Ocean) has been providing communication channels to many operators in various countries for a long time, THAICOM 1-A gives access to Telephone Organization of Thailand, and a new SEA-ME-WE 3 optical submarine cable system has started to supply communication channels recently. Fig. 2.1.1-1 shows the international communication routes.

Using the submarine cable, new international channels are being activated. Telephone channels to Singapore and Thailand were the first to have started service. The Internet backbone to Hong Kong has also started its service.

Table 2.1.1-1 describes international channels to foreign countries and Fig. 2.1.1-2 shows the cable route of SEA-ME-WE 3.

Fig. 2.1.1-1 Overseas Communications



Source: Overseas Communications / MPT

Table 2.1.1-1 Overseas communications channels

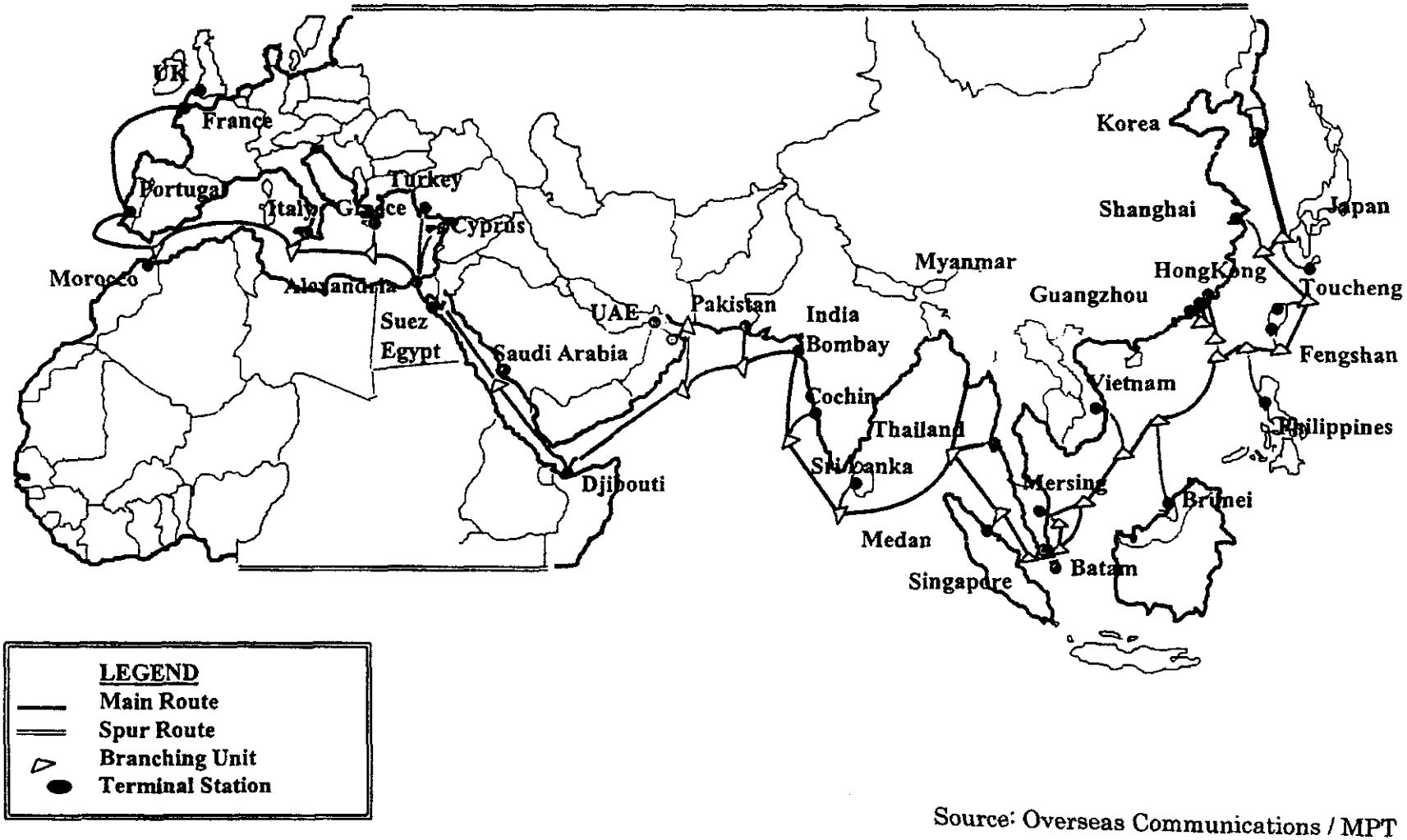
Organisation	Route	Destination	Number of Channels
MPT	SEA-ME-WE 3	Singapore	240 Ch
		Thailand	30 Ch
		Hong Kong	2 Mbps (Internet)
	Intelsat	Korea	45 Ch
		England	49 Ch
		China	30 Ch
		Germany	15 Ch
		Australia	16 Ch
		India	19 Ch
		Indonesia	8 Ch
		France	5 Ch
		Singapore	150 Ch
		Taiwan	8 Ch
		Malaysia	45 Ch
		Thailand	89 Ch
		Japan	206 Ch
		Brunei	5 Ch
		Hong Kong	88 Ch
	THAICOM 1-A	Thailand	60 Ch
		Thailand	1 Mbps (Internet)
	THAICOM III	Hong Kong	1 Mbps (Internet)
BCT	THAICOM 1-A	Hong Kong	1 Mbps (Internet)

2.1.2 Introduction plans of technology

MPT plans to build an additional satellite earth station and gateway switch in Mandalay, in order to increase reliability of the international telecommunications network.

Myanmar envisages connecting by fibre cable links with the neighbouring countries under Greater Mekong Sub-regional Telecommunications Network Projects.

Fig. 2.1.1-2 Cable Route of SEA-ME-WE 3



Source: Overseas Communications / MPT

2.2 Backbone network

2.2.1 Present status of telecommunication facilities and technology

Yangon, the capital and the biggest city of Myanmar is the centre of not only administration and economy but also the telecommunication network. Yangon being in the south, Mandalay, the second largest city located about 700 km north of Yangon, is the northern centre of the country. Being the main artery, there are two links between Yangon and Mandalay. From Yangon, the link goes south to Daewi. From townships between Yangon and Mandalay, two links branch off: one goes east from Meiktila to Kentong and the other goes west from Pyay to Sittwe. Three links start from Mandalay: one goes northeast to Lashiho, another goes north to Myitkyina, and the other goes northwest to Hakha. These eight links are considered as backbone links here, although there are relatively shorter other backbone links. (See Fig. 2.2.1-1 Microwave links)

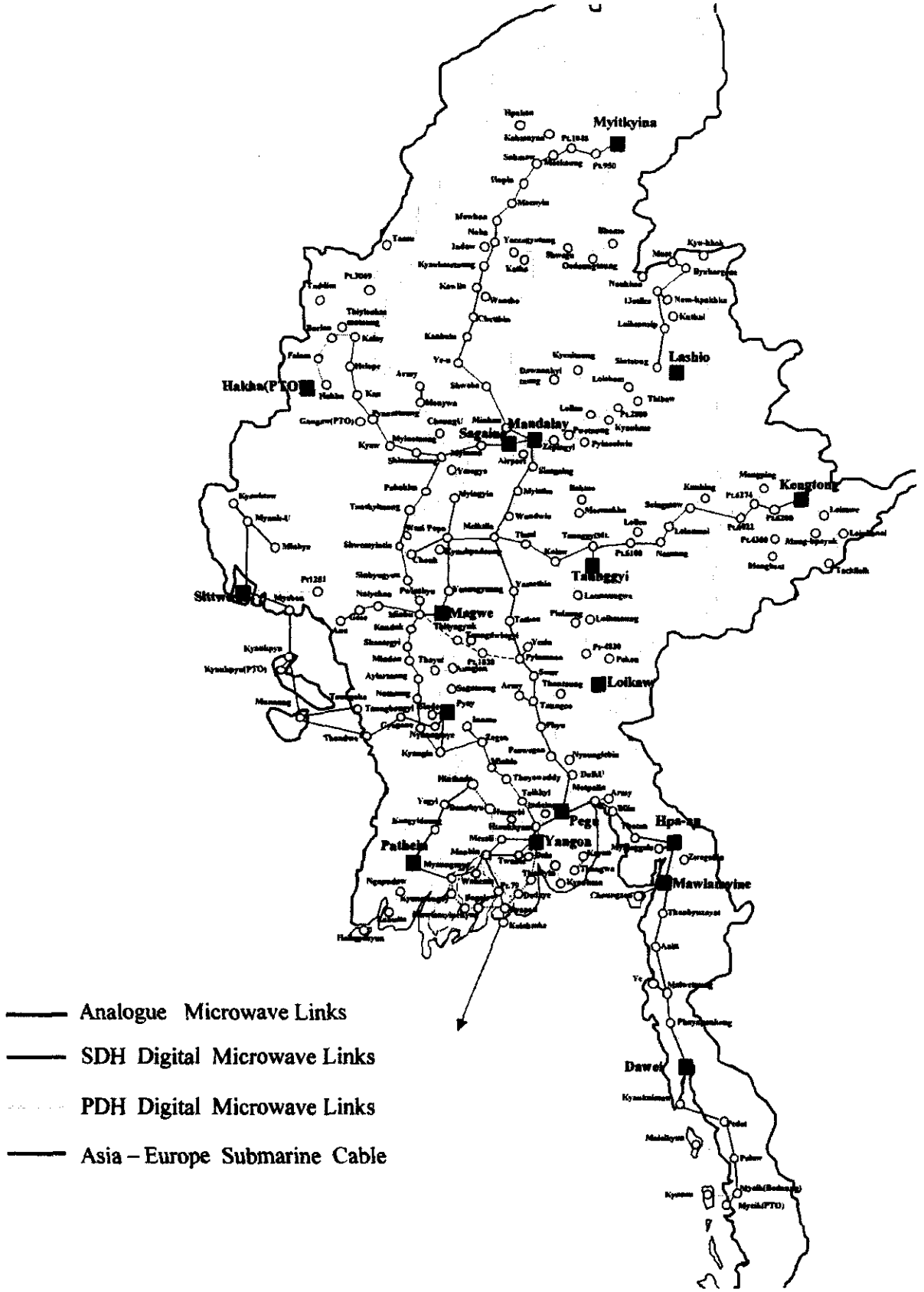
Table 2.2.1-1 shows the situation of backbone links. Yangon and Mandalay is connected with two microwave links. The west of the two links is a digital microwave link using 6 GHz-156 Mbps (STM-1) SDH (synchronous digital hierarchy) systems. The link commissioned in 2000 has three systems: one system connects between Yangon and Mandalay directly, another drops off at stations to branch off spur links and accommodate local telephone demands, and the other is a standby for a fault. The east of the two links is an analogue microwave link.

Table 2.2.1-1 System situation of backbone links

	Section	System	Analogue/Digital
1	Yangon - Mandalay	Radio: 6GHz 156 Mbps SDH	Digital
2	Yangon - Mandalay	Radio:	Analogue
3	Yangon - Daewi	Radio:	Analogue
4	Meiktila - Kentong	Radio: 6GHz 156 Mbps SDH	Digital
5	Pyay - Sittwe	Radio:	Analogue
6	Mandalay - Lashiho	Radio: 7GHz 34 Mbps PDH	Digital
7	Mandalay - Myitkyina	Radio: 6GHz 156 Mbps SDH	Digital
8	Mandalay - Hakha	Radio: 6GHz 156 Mbps SDH	Digital
	Total	Radio: 8, SDH: 4, PDH: 1	Analogue: 3, Digital: 5 Digital ratio=63%

All the links are still microwave. Optical fibre cable is not introduced to the backbone network yet.

Fig. 2.2.1-1 Microwave links



2.2.2 Introduction plans of technology

Digitalisation of the backbone network is going on. MPT plans to digitalise southern half of the analogue microwave route connecting Yangon and Mandalay. The system will be 6 GHz-156 Mbps (STM-1) SDH, and it will compose a ring SDH network by being connected with southern part of the existing SDH link between Yangon and Mandalay. Digitalisation of the northern half route has to wait. MPT will digitalise the analogue backbone route going to the south with 6 GHz-156 Mbps SDH.

Many backbone routes that connect State / Division capitals have not been included in SDH digital network. There are many analogue spur routes with analogue open wire carrier systems and analogue microwave, UHF and VHF radio systems seem to still remain as well. Although it might be difficult to accommodate all State / Division capitals into SDH digital network and to digitalise all spur routes, gradual digitalisation is necessary. Meanwhile, MPT should engineer method of utilisation of these analogue systems as a part of IT infrastructure. The possible way seems to use a part of them as leased lines to lend bandwidth.

MPT has a plan to build a fibre optic link between Yangon and Mandalay as the national backbone. This plan should be implemented first of all, and then, MPT is better to adopt more optical fibre backbone routes for future demands in telephony as well as in IT data transmission.

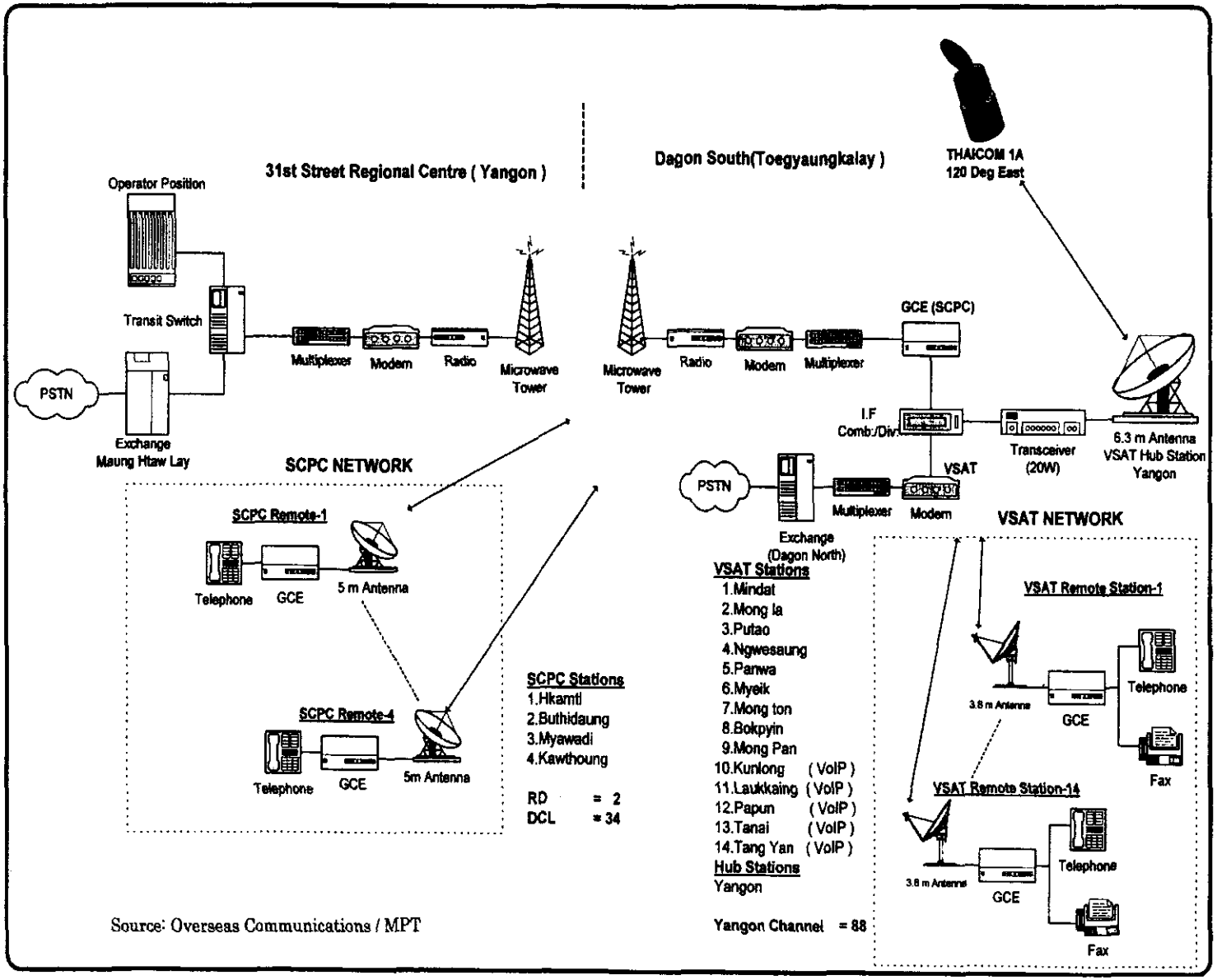
2.3 Access network

2.3.1 Present status of telecommunication facilities and technology

Although copper cable is the major medium for an access network, Wireless Local Loop (WLL) is also used. WLL is better suited than copper cable for rural areas where population density is low. For rural areas where terrestrial links connecting to exchanges are difficult to build, communication channels via satellite are made. MPT has two types of satellite communication systems: one is DOMSAT (Domestic Satellite) system and the other is VSAT system. There are four DOMSAT remote stations and 14 VSAT stations. They provide vital telephones to remote areas. (See Fig. 2.3.1-1)

On the other hand, BCT provides VSAT remote stations for data transmission. They are mainly used at branch offices of major banks.

Fig. 2.3.1-1 Link Diagram of Domestic Satellite Communications System



Source: Overseas Communications / MPT

Optical fibre is already used as an access line in a limited scale. BCT has laid down optical fibre cable to its next-door Information Communication Technology Park (ICT Park), where three buildings house eight companies each. Each company, many of them are software developers, is connected to BCT's router with its optical fibre cores. BCT offers microwave access to its major clients with its 60-m tower. Major clients have their branch offices networked with VSAT systems BCT serves.

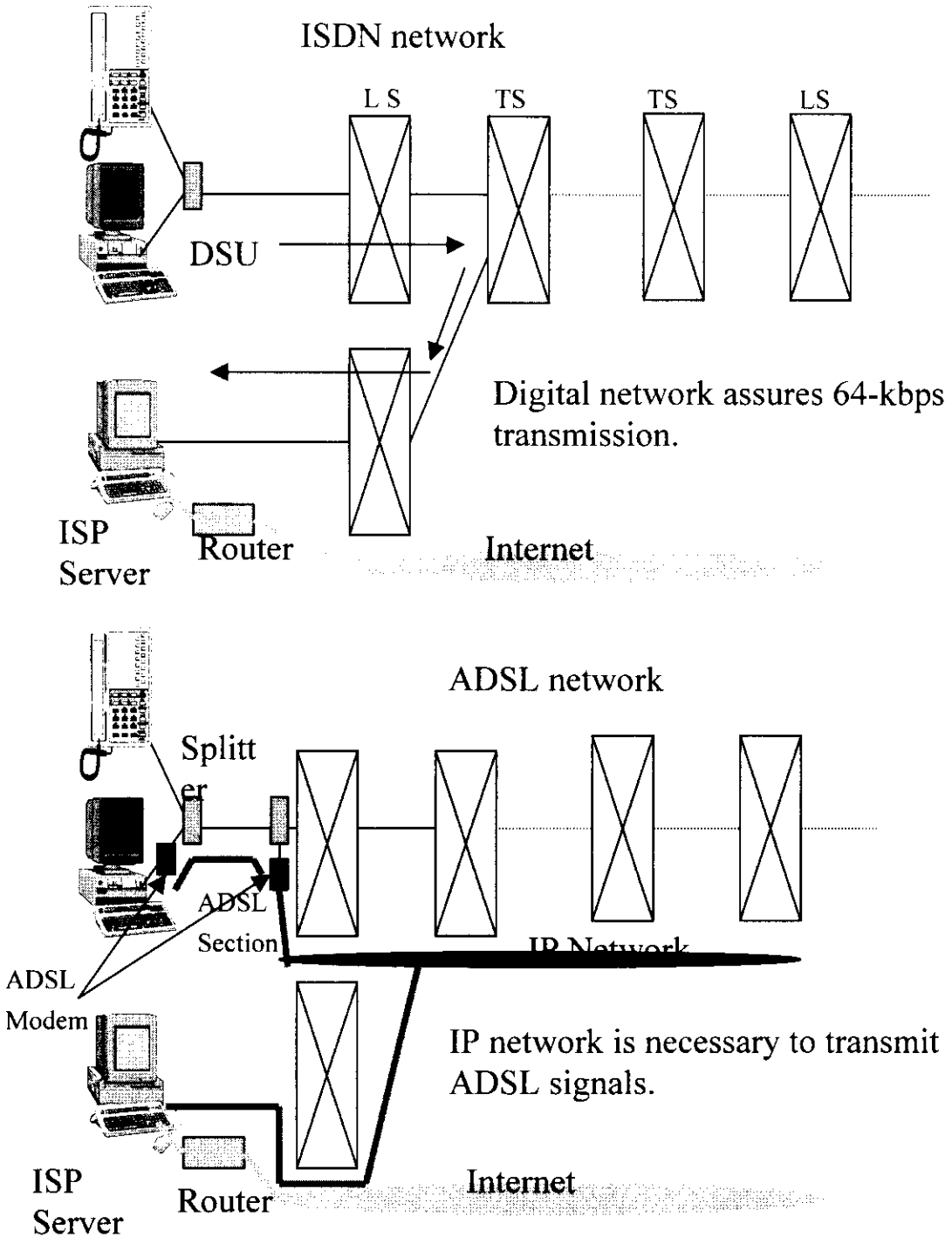
2.3.2 Introduction plans of technology

When an access network is used for the telephone network, the main concerns are costs and maintainability among other things. However, its transmission speed becomes an additional requirement when it is used for the Internet. The combination of a modem and copper cable gets a transmission speed of 56 kbps at the most. ISDN (Integrated Services Digital Network), served in the country already, offers 64 kbps or 128.

In certain countries, DSL (Digital Subscriber Line) technology has gotten support from Internet users. It uses a higher frequency band than voice over copper cable. It can utilise existing copper cable and is an economical alternative to access the Internet. MPT is on trial of the technology. Although there are many types with different transmission speeds, ADSL (Asynchronous Digital Subscriber Line) is common for individual users. ADSL technology with its full specification distributes signals downward as fast as 8 Mbps. However, DSL technology only applies to the subscriber network and it requires an IP network from the telephone office. (See Figure 2.3.2-1 ISDN & DSL) Therefore, adopting the technology and construction of the IP network will be considered together.

Some cable access networks are old and not so recommendable. However, cable access networks are the most convenient way to ensure prompt access lines. MPT should make more effort to reduce fault rates of cable access networks, especially drop wire portion of them. Of course, introduction of new radio access systems are recommendable, because of their short construction period.

Figure 2.3.2-1 ISDN & DSL



2.4 Fixed telephone network

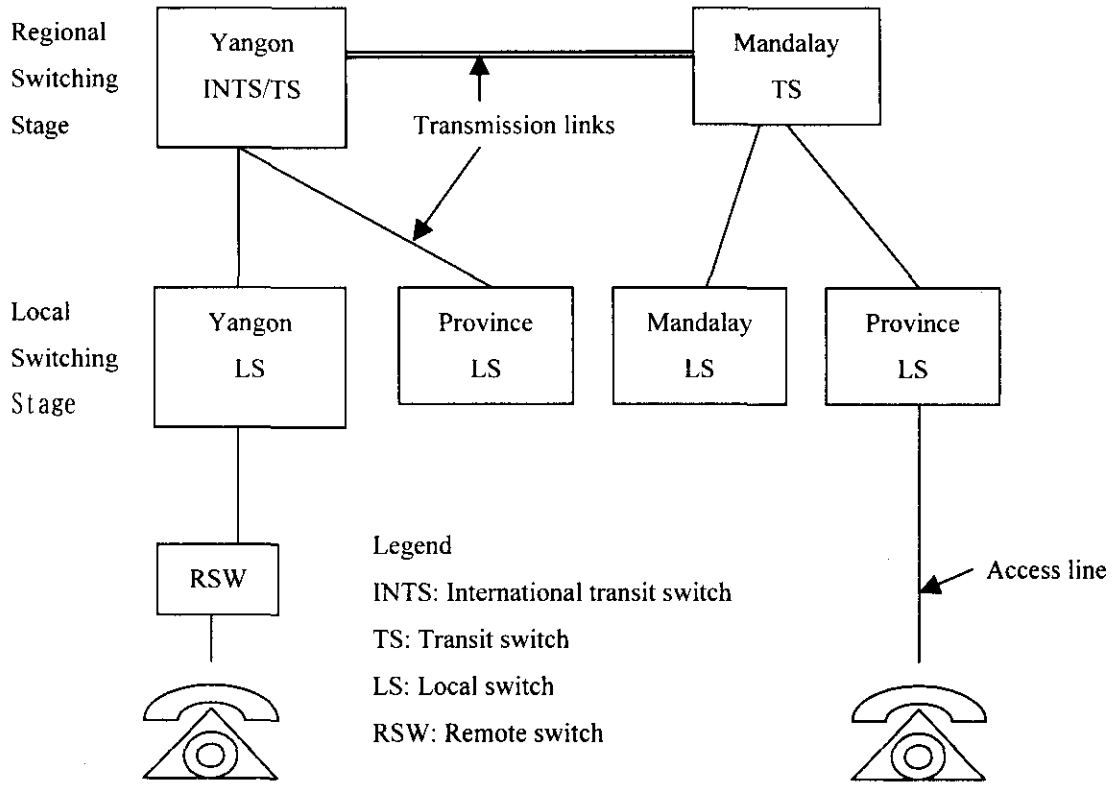
2.4.1 Network configuration

The fixed telephone network is composed of telephone switches, transmission links, and access lines. The network is classified into a two-level switching hierarchy: a regional switching stage and a local switching stage. (See Fig. 2.4.1-1) In the local stage, some local switches act as hosts to accommodate remote switches as their remote terminals.

In order to study digital readiness, the telecommunication network is reviewed from the points of how much the network is digitalised as well as if the telephone supply is enough and if transmission quality is good enough.

Future telecommunications network will be principally an optical fibre network using MPLS (Multi-Protocol Label Switch), providing first / last one mile accesses by FTTH. Myanmar is better to take into account this trend for developing its telecommunications network.

Figure 2.4.1-1 Basic network configuration in Myanmar



2.4.2 Switching facilities

2.4.2.1 Present status of telecommunication facilities and technology

In a regional switching stage, there are four transit switches (TSs): two in Yangon and two in Mandalay. One TS in Yangon used as an international gateway switch, too. Two cities have two TSs each, so that, even if one switch fails, the other switch can process calls, avoiding total communication cut off. TSs are all digital switches.

MPT operates 96 digital switches, 13 crossbar switches (analogue switches), 3 electronic analogue switches, and 512 manual switches. (See Table 2.4.2.1-1 Changes in number of switches) Because of many manual switches, digital ratio of switches is 15 %.

The number of crossbar switches is gradually decreasing, but it will take several years for MPT to replace all of them with digital switches. On the other hand, the number of manual switches is increasing. It is because that service areas of the fixed line telephone are expanding and manual switches are built. Newly covered areas are small townships and villages where electricity is often not provided. Manual switches are less expensive and use less electricity than digital switches.

Table 2.4.2.1-1 Changes in number of switches

Year	Manual switch	Automatic				Grand total
		XB (analogue)	Analogue switch	Digital switch	Total	
1993	349	18	3	30	51	400
1998	428	15	3	74	92	520
2002	512	13	3	96	112	624
Digital ratio in 2002	Analogue switch: 528			Digital: 96	Digital ratio= 96/624 = 15.4 %	

Source: Yangon Auto Telephone / MPT

Table 2.4.2.1-2 shows the number of fixed telephones: 307,056. The number of telephones accommodated in digital switches share 67% and this number is digital ratio of telephones. With population of 51 million, telephone density (number of telephones per 100 people) is 0.6. The low telephone density is the problem for the development of IT. IT is also called ICT because it is closely connected to communication technology. But without a telephone line, no email or

Internet is available.

Table 2.4.2.1-2 Number of fixed telephones

Accommodating telephones switches	Direct Exchange Lines	Number of Phones	Total	Remark
Manual switches	54,603	55,143	101,967 (33%)	Number of people: 51 million Tele-density: 0.6/100 people Digital ratio: 67%
Crossbar switches	39,797	45,961		
Analog switches	858	863		
Digital switches	199,976	205,089	205,089 (67%)	
Total	295,234	307,056	307,056 (100%)	

Source: Overseas Div. of MPT

There is an industrial park called Industrial City in the suburbs of Yangon. Many factories are there, and one of the biggest problems is shortage of telephone lines: they can get only one telephone line. Factories have a fax and computers, and many of them think email is useful for their work. However, to use IT at a factory, it may need a few telephone lines.

2.4.2.2 Introduction plans of technology

Digitalisation of switches is progressing. As life span of crossbar switches will end in several years, they will be replaced with digital switches.

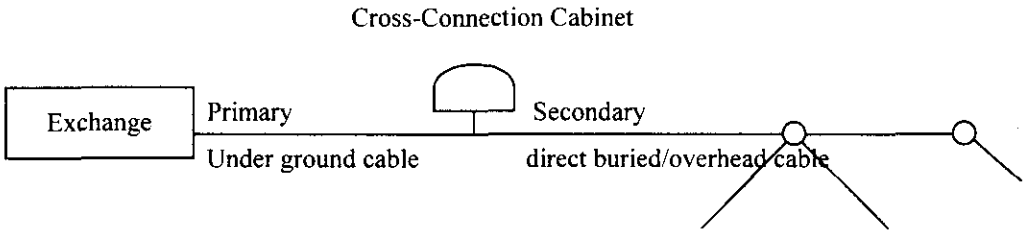
Manual switches are a kind of problem. In a short run, it may be a cheaper solution. But it may be replaced in the future. Introduction of a combination of a simple gateway to PSTN and a LAN or WAN system for IP telephony in a rural area should be investigated. This system might be installed at as reasonable cost as a manual switch system in rural areas.

China National Electronics Import & Export Shanghai Company has been awarded the "Installation of New Digital Exchange Systems in Provincial Area" project. This project is now implementing digitalisation of existing analogue switches in 4 areas including Yangon. The size of the project is 55,000 lines in total. The project employs remote switching units (RSUs) instead of primary cable.

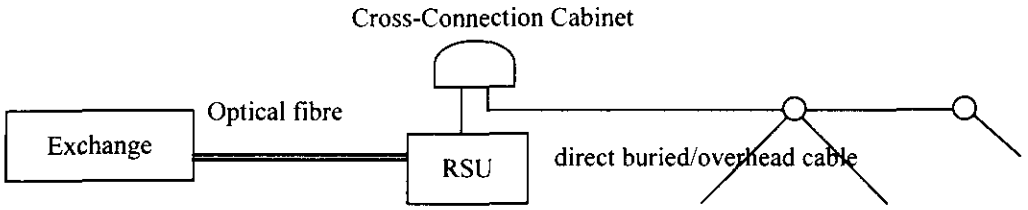
Figure 2.4.2.2-1 shows the configuration difference after the introduction of RSUs. The loss

from telephone office to customers will be reduced and a coverage area of the exchange will expand.

Fig. 2.4.2.2-1 Access line configuration



(a) Cable access line configuration



(b) Access line configuration after introduction of RSU

2.4.3 Transmission facilities

2.4.3.1 Present status of telecommunication facilities and technology

Analogue transmission links are not suitable for data transmission, and so digitalisation of transmission circuits are the most important for digital readiness.

The digitalisation of microwave links is fast progressing. There are 165 digital microwave stations and 40 analogue microwave stations. Table 2.4.3.1-1 describes radio systems by route.

Table 2.4.3.1-1 Radio systems by route

System	Number of routes	Analogue/Digital	Total
Analogue microwave	6	Analogue	23
Analogue UHF	17	Analogue	
SDH Microwave	8	Digital	54
PDH Microwave	35	Digital	
Digital UHF	11	Digital	
Total	77	Digital ratio (digital routes/total): 70%	

Source: Long Distance Div. of MPT

The land part between Yangon and Kalahtat, the cable landing point, of SEA-ME-WE 3 is the first national long distance optical fibre link. The length is 172.4 km. It employs SDH STM-16.

On the other hand, optical fibre cable is extensively used in the junction network. Most of intra-city junction links in Yangon and Madalay have already been replaced mainly with optical fibre cable systems of 34 Mbps and140 Mbps PDH.

2.4.3.2 Introduction plans of technology

Although long distance transmission links are microwave, optical fibre cable started to penetrate into. Optical fibre links are expensive at first, but once optical fibre cable is installed, as the optical fibre system between Yangon and Kalahtat transmits STM-16 (2.5 Gbps) signals, the capacity increases by multi-fold. In addition to it, it makes easy to add more capacity by WDM technology.

Optical fibre may solve one of the problems microwave links have: power supply. Microwave relay stations are sometimes built in rural areas or tops of mountains without electric power supply. On the other hand, an optical fibre cable system has longer spacing between repeaters, and repeater stations are generally at townships. In the period when IT applications are fully developed, telecommunication traffic will increase multi-fold and require optical fibre links. From the viewpoint of digital readiness, MPT's move to laying out optical fibre cable is desirable.

2.4.4 Access facilities

2.4.4.1 Present status of telecommunication facilities and technology

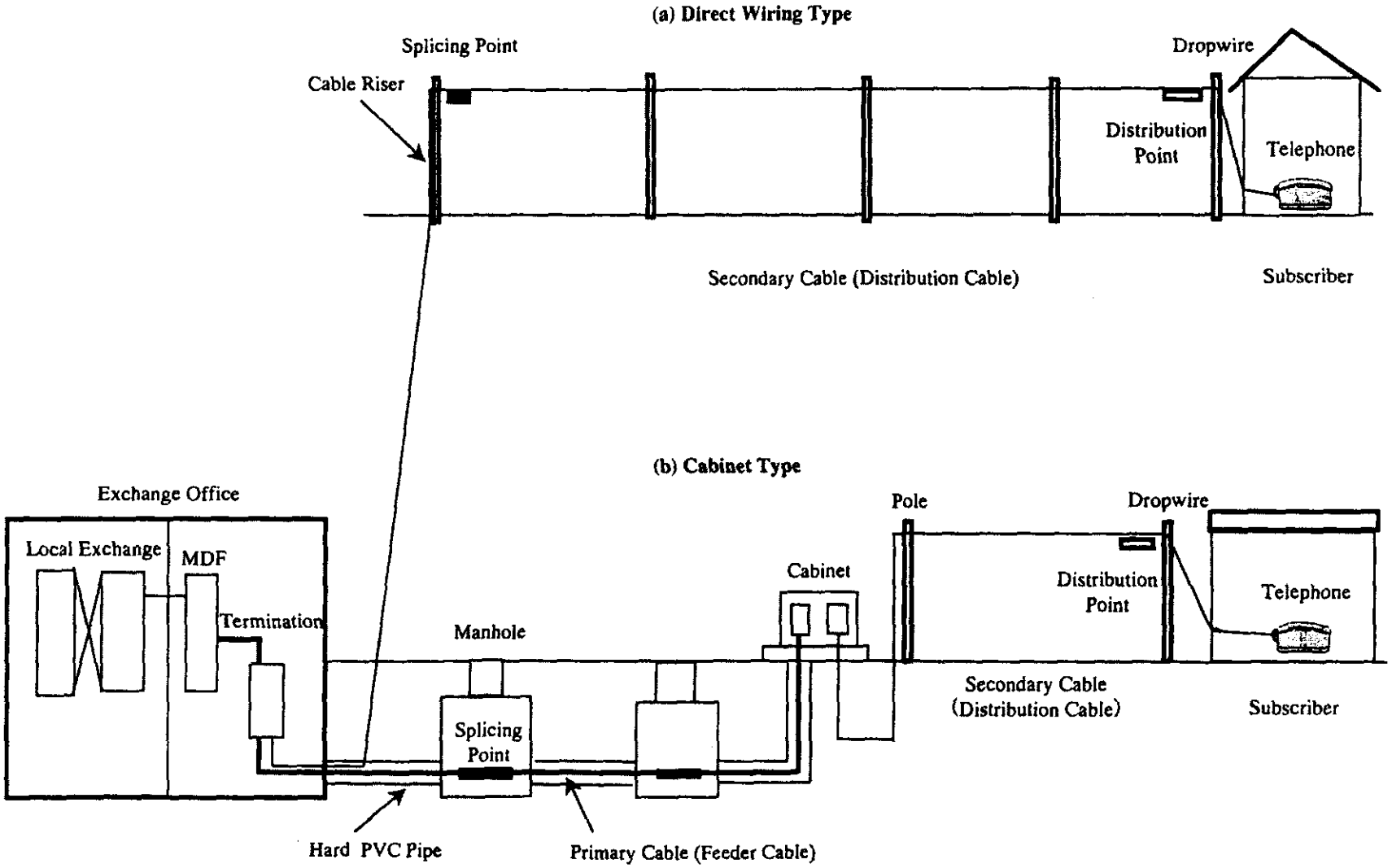
2.4.4.1.1 Subscriber line facilities

Subscriber lines have gotten attention since DSL (Digital Subscriber Line) technology was introduced. DSL technology requires good copper cable. From the viewpoint of the digital readiness too, it is important to keep subscriber line facilities in a good condition.

Keeping outside plant in a good condition is not easy. Outside plant is exposed to severe weather, such as direct sunshine, heat wave, strong wind, and heavy rain. In spite of these severe conditions, outside plant is used for a long time. Even though copper wires are protected, cable gradually deteriorates in the quality such as insulation.

International telecommunication statistics tells that regarding fault, Myanmar is one of the worst countries in Asia. (Reference: World Telecommunications Visual Data Book 2002; the ITU Association of Japan) About 28% of faults occur in a cable section and 67% occur in a drop wire section. Some reasons of high faults in the cable section may be old cable and lack of spare wires to replace bad wires. The lack of spare wires may force a repairman to replace bad wires with a good pair of wires that is used by another subscriber, causing another fault. The lack of spare wires may prolong duration for fault rectification. Among all the faults, 15% took more than 3days to have been repaired. Drop wires are one of the weakest components of the network.

Fig. 2.4.4.1.1-1 Subscriber Line Facilities



2.4.4.1.2 Wireless local loop facilities

The recent radio technology made the entry into an access network between a local exchange and subscribers. Fig. 2.4.4.1.2-1 shows a WLL diagram. WLL systems are more economical than copper cable distribution when population (telephone) density is low. The increase of facilities for new customers is easier than cable distribution. One demerit is subscriber stations need electricity.

Myanmar saw various radio access systems until now. (See Table 2.4.4.1.2-1)
TDMA wireless local loop (WLL) was introduced in 1995. CDMA-WLL was introduced in Yangon in October 1997. DECT WLL found the way into Myanmar in 1997.

Table 2.4.4.1.2-1 Introduced WLL systems

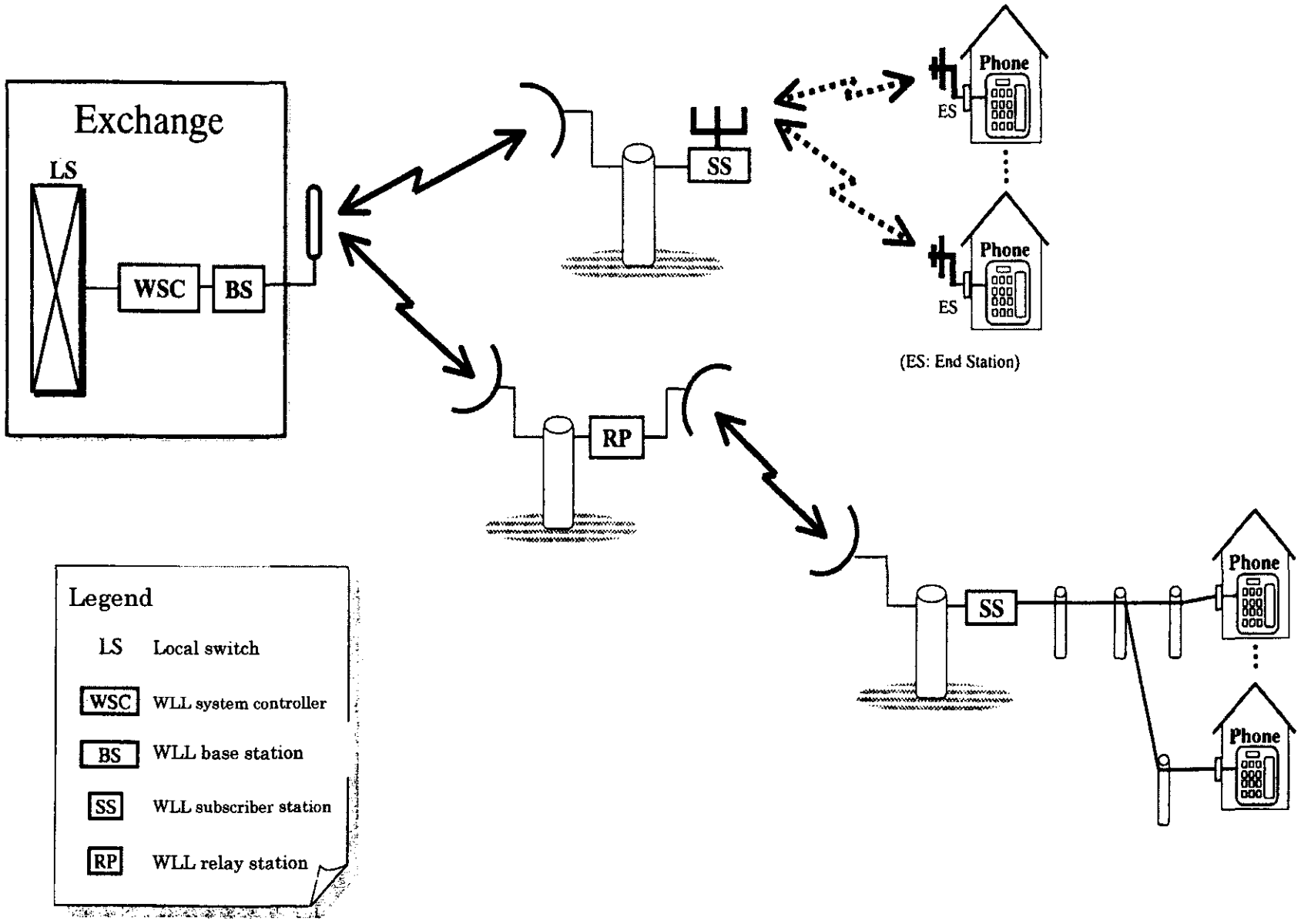
System	No. of terminals	Area	Introduction year
(WLL) Wireless in Local Loop automatic radio telephone system (TDMA)	4,300	Yangon, Delta area, Bagan, others	1995
Digital European Cordless Telecommunication (DECT) radio telephone system	2,900	4 towns	1996
CDMA radio telephone system Mobile application	20,000 3,000	Yangon	1997

2.4.4.2 Introduction plans of technology

The majority of faults occur in drop wires. Some drop wires are very long and they are not properly installed at present. Appropriate hardware to hold drop wires and protectors to cover drop wires should be used. MPT employees' workmanship and attitude need to be improved. It is important to train employee on not only new technologies but also traditional skills. Moreover, in order to reduce long drop wires, cable should be laid more. Where several drop wires go to the same building, built-in cable should be installed.

When a WLL system is introduced, its capability of high speed data transmission should be taken into account. In order to use WLL as IT infrastructure, it is better to support 64-kbps transmission speed. In addition, as mobile systems and WLL systems utilise similar radio frequency bands, it is important to avoid interference among them.

Fig. 2.4.4.1.2-1 WLL diagram



2.5 Cellular mobile network

2.5.1 Present status of telecommunication facilities and technology

Cellular phones are also served by MPT. AMPS cellular phone systems were introduced in Yangon and Mandalay in 1993. CDMA cellular phone systems were then introduced in both cities. GSM cellular phone systems were introduced recently. The reason of adoption of GSM is easiness of roaming with neighbouring countries. (See Table 2.5.1-1 Adopted mobile phone systems)

Table 2.5.1-1 Adopted mobile phone systems

System	Area	Capacity	Service Start	Frequency	Analogue/Digital
AMPS	Yangon	2,000	1993	800MHz	Analogue
D-AMPS	Yangon	5,000	1997	800MHz	Digital
D-AMPS	Mandalay	1,000	1996	800MHz	Digital
CDMA	Yangon	20,000	1998	800MHz	Digital
CDMA	Mandalay	1,000	1998	800MHz	Digital
GSM	Yangon	70,000	2002	900MHz	Digital
GSM	Mandalay	30,000	2002	900MHz	Digital

Cellular phones are used as value added services to the fixed telephones and also compensate slow progress of the fixed telephone network. Because the real expansion requires only additional base stations unlike fixed telephone networks that require subscriber lines, expansion is easy and quick. So far there is no mobile data access service, like WAP, available in Myanmar.

2.5.2 Introduction plans of technology

MPT has just started GSM cellular phone service and is expanding its service area now. Cellular phone services are only available in Yangon and Mandalay. MPT plans to expand GSM cellular phone services to 20 cities in border areas with 100,000 users. It also plans to expand GSM services to 20 cities in coastal regions with 20,000 subscribers. On the other hand, big cities will see CDMA cellular phone systems.

BCT, specialised in data communication, might start mobile data service in the future. BCT is under negotiation on Global Mobile Personal Communication via Satellite (GMPCS) service. A multinational consortium provides international mobile services using satellites. BCT may become a service provider for Myanmar. The consortium uses geo-stationary satellite.

There are two options: one is to expand service areas and the other to provide a data communication service through mobile terminals. MPT and BCT seem to complement each other by planning to offer each of the two options. However, as satellite mobile systems are difficult to disseminate, MPT is better to start a data communication service through mobile terminals shortly.

2.6 Satellite network

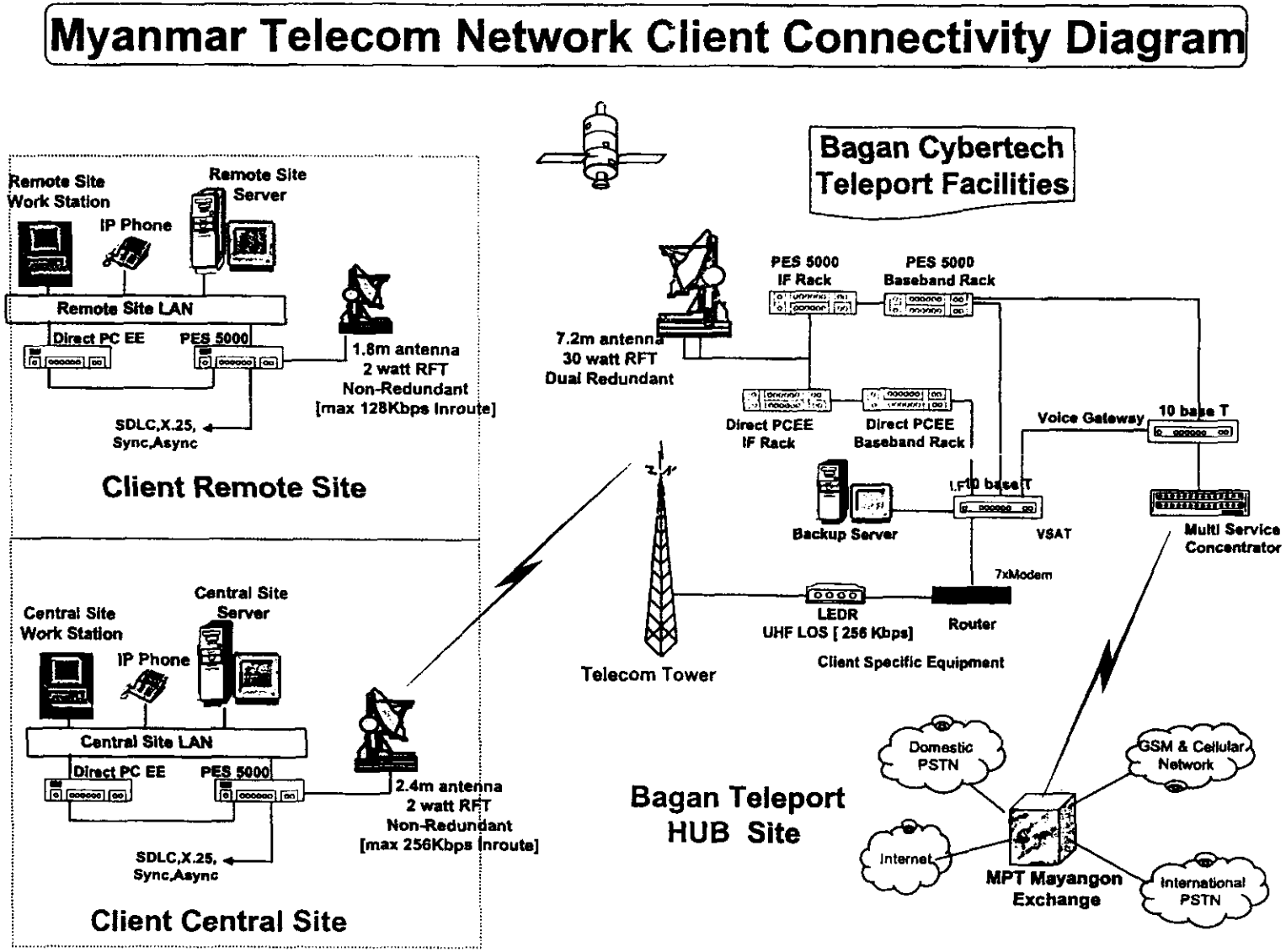
2.6.1 Present status of telecommunication facilities and technology

Satellite telecommunication services are not only offered by MPT but also by BCT. Although the two organisations offer satellite telecommunication services, their services are different and both companies are rather complementing each other than competing.

Having DOMSAT and VSAT systems, MPT gives telephone access to the people, especially for those living in remote and far-flung areas of the country. (See Fig. 2.6.1-1 Link diagram of domestic satellite communications system)

BCT has its hub station with a 7.2-m antenna in the premises in Yangon. It also has 60-m tower with antennas to communicate with client towers. The satellite services have banks and ministries as their clients. Their head offices are connected to the hub station of BCT, and their branches are connected to Very Small Aperture Terminals (VSATs). Banks use this satellite communication network for business transaction such as settlement. Ministry of Education uses the network for distance learning.

Fig. 2.6.1-1 Link diagram of domestic satellite communications system



One of the interesting points is that the system has a voice gateway and changes time division transmission to the IP based transmission so that it can use the bandwidth efficiently. Another interesting point is the fact that BCT is given 100,000 telephone numbers. It provides telephone numbers for remote stations so that remote stations have telephones. This is important because some remote areas do not have telephones otherwise. Although BCT is specialised in data communication, it can provide a telephone service as a value added service. Even though it uses IP transmission, the system employs telephone adapters to use ordinary telephones instead of IP telephones for the moment.

Table 2.6.1-1 describes the specifications of satellite telecommunication.

Table 2.6.1-1 BCT's VSAT system

Item	Specification	Remark
Bandwidth	128 kbps-2 Mbps	
Frequency band	C band	Up link: 6.305 GHz Down link: 4.080 GHz
Antenna diameter	Hub station: 7.2 m VSAT station: 1.8 m	
Transmission output	Hub station: 400 W	

2.6.2 Introduction plans of technology

BCT has launched broadband satellite data service since 20 September 2002. It leases THAICOM 4, or iPSTAR, which uses Internet Protocol. It will serve 128 kbps-2 Mbps. It uses Ku-band, and the size of antennas is 11 m for the hub station and only 1.2 m or 1.8 m for remote stations. Because of using Ku-band, it may have difficulty in transmission when it rains heavily. However, the biggest sales point is its affordability; the price will be 1/5 of the current system.

MPT is planning to use iPSTAR service, leasing 200 terminals from BCT. It uses them for rural telecommunication.

Present telecommunication network seems insufficient. Hence, plan of BCT to expand IT services to the whole country seems reasonable. However, satellite communication always needs foreign currency expenditure for leasing of a transponder or a bandwidth of a satellite. From this viewpoint, MPT is better to expand its telecommunications network as well as to expand leased line services for the promotion of the IT industry.

2.7 IP-based network

2.7.1 Present status of telecommunication facilities and technology

MPT offers Internet service and packet service, but it does not have in IP network. On the other hand, BCT uses its IP-based network for its satellite communication and broadband wireless access (BWA) service. BCT started BWA in Yangon in September 2002, and will start the service in Mandalay soon. It connects two cities with a radio link leased from MPT. (See Fig. 2.7.1-1 BCT's IP network) People in Mandalay have to call access points in Yangon to access to the Internet and email, paying long distance charges. This discourages many people to use email and the Internet.

2.7.2 Introduction plans of technology

People around the country is able to access the Internet through iPSTAR by BCT, and the service is a less expensive alternative to the existing method. But it may be still too expensive for ordinary people. Start of a special number service to make Internet access a local call and increase of IP access points in big cities for Internet connection are required to disseminate Internet services to more people in Myanmar.

Fig. 2.7.1-1 BCT's IP network