CHAPTER 7

NETWORK DEVELOPMENT PLANNING

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7.1 Current Status of Network

This chapter states current status of the network in Lao P.D.R. studied by Laos Telecommunication Development Study Team from October 2001 to February 2002. The study was based on the filed survey of current network services, network configuration, and operation and maintenance. The network services are provided by PSTN (Public Switched Telephone Network), mobile telephone services and Internet services. The networks configuration includes ETL/LTC digital switching systems, transmission links, outside plants, mobile networks as well as Internet providers. Also, the Team analyzes the current problems through findings by field survey.

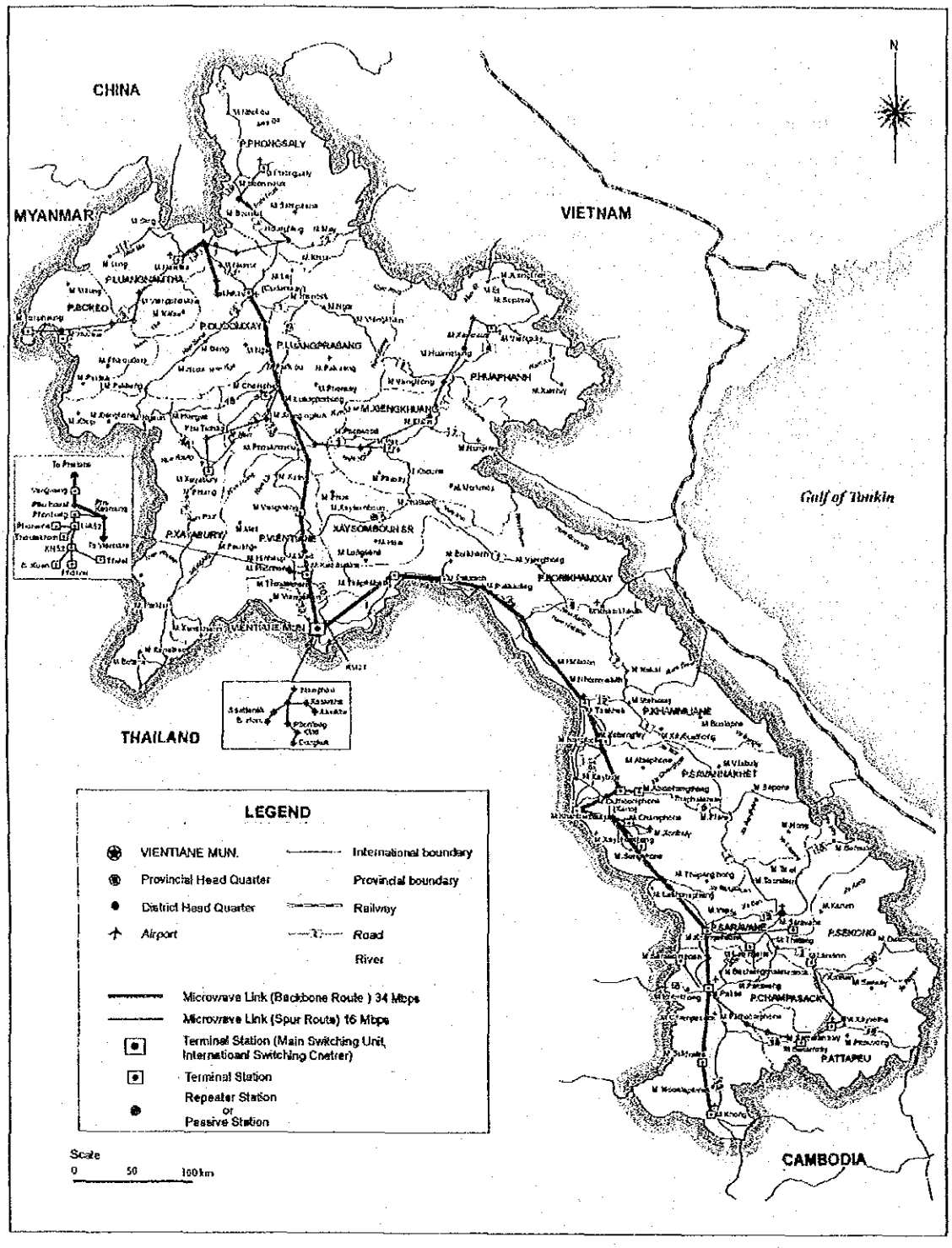


Fig. 7.1 Microwave Transmission Network (Current)

7.1.1 Current Status of the Network Services in Lao P.D.R.

(1) PSTN services

1) Basic service

Domestic direct dialing telephone service is provided. Demand on telephone service is growing rapidly in Lao P.D.R. in accordance with the recent economic growth.

2) International telephone services

An international telephone call is originated from the fixed telephone, the mobile phone and public telephone. International calls for Thailand and Vietnam are carried over CSC cable and other destinations are carried via satellite. The number of international calls is increasing. While the transit digital switch at Numphou provides the international telephone service with toll transit and local services, the limitation of gateway function and the amount of traffic handled may cause the problem in the future.

3) Special service

An urgent telephone call, inquiry (troubles, charges and the services) to the telephone company, operator calls utilizing the switchboard, the time announcement service and access to the dial up server are provided.

4) Public telephone service

LTC is providing a public phone service by the magnetic card and the IC card. The magnetic card-type system is being replaced by an IC card-type system due to errors caused by the magnetic card system. Because no coin is used in Lao P.D.R., a coin-type public telephone systems used in Japan and the United States is not available. In addition to this, the unit price of one IC card is too expensive for civilians to purchase.

ETL has a plan to install a public phone services in the future.

5) FAX service

The service contains the acceptance of documents to send, the reception documents from other stations and the delivery to the end client. The service is provided from 7:00 am to 21:00 pm on weekdays. There are more than 50

users a day, and FAX service is widely accepted by the enterprises (SME) and individuals.

6) Pre-paid card phone services

The pre-paid card phone service is provided with the fixed telephone, the cellular mobile phone and the public telephone through out the country. LTC provides the service named M-phone, while ETL started P-phone for mobile phone service in September 2002.

Both operators are eagerly promoting pre-paid card phone services because every user can utilize any telephone with special number and PIN code to charge their own account.

7) Operator, directory and guidance service

At present, the operator service is provided only for international in Numphou exchange office where manual operator-board is used. This service is widely accepted by many users. The usage of this service is observed more than 1,500 calls a month in 2002. However, operator service for domestic telephone users is not provided.

8) Intelligent network service

At present, a called party billing service and a virtual network service are not provided, because the intelligent network functions are not installed. From the interview to the executives of ETL, S12 Digital Switching Systems are possible to provide the intelligent network services with modifying software and signaling network, however the expecting profit does not seems to cover the modification and operation cost.

(2) Mobile Phone Service

The number of the users is increasing rapidly since the service has been started. It is expected for the number of mobile phones to exceed fixed telephone in 2010. At present, two companies, LTC and ETL, provide a cellular phone service. LAT (Lao Asian Telecommunications) is preparing for the service. Furthermore, Milicom, the foreign mobile operator will announce to offer the service. Therefore, four operators are competing with each other next year.

1) Interconnection with the fixed telephone (LTC and ETL).

The telephone calls from the mobile phone of every operator are inter-connected with each other or with fixed telephone network. International call from mobile is possible.

2) Roaming service

International roaming service enables to originate and terminate calls in Lao by the mobile handset that is contracted with foreign operator. This service is only provided by LTC with Thai mobile operator. Service requires the registration before utilizing the roaming service.

3) Data service over the mobile phone

Although, no data service is provided for cellular mobile at present, LTC is prepared to purchase the new mobile MSU which is able to provide data service over the network. The possibility to provide a data service in the near future is very high because this MSU can provide the data service (mail and the Internet access) called SMS (Short Message Service) though LTC does not announce about the data service.

(3) The Internet

An access service to the Internet is provided mainly by major three ISPs. (There are other ISPs such as the hotels and private companies that provide the resale services.) Access services are provided only for the registered users to dial up to connect from the fixed telephone or the cellular mobile phone. Service quality at present is facing line busy for being short of the dial-up lines as well as longer delay of access by the lack of backbone capacity. Dial up access are only available in Vientiane, Luangprabang, and Savannakhet.

Detail Internet services are stated in 7.1.6.

(4) Leased line service

Though it is not announced the availability of this services officially, Lao Aviation and some foreign embassies are provided this unofficial service. The difficulty of providing service is due to the lack of backbone capacity at present. LTC and ETL are intending to offer leased line services to the public after the backbone capacity will be increased. At present, the backbone that connects Vientiane with other cities is utilizing microwave link with 34Mbps while the whole capacity is occupied by PSTN.

(5) Data communication service

A data communication services is not currently provided as well as the leased line service because of shortage of capacity in the backbone.

Before offering future data communication services, it should be considered whether IP network is utilized.

7.1.2 Current Numbering Plan

(1) Current Numbering Plan for fixed telephone and mobile

Current numbering plan has followed to the ITU-T recommendation and allocated in the Table 7.1 and Fig. 7.2.

Observations;

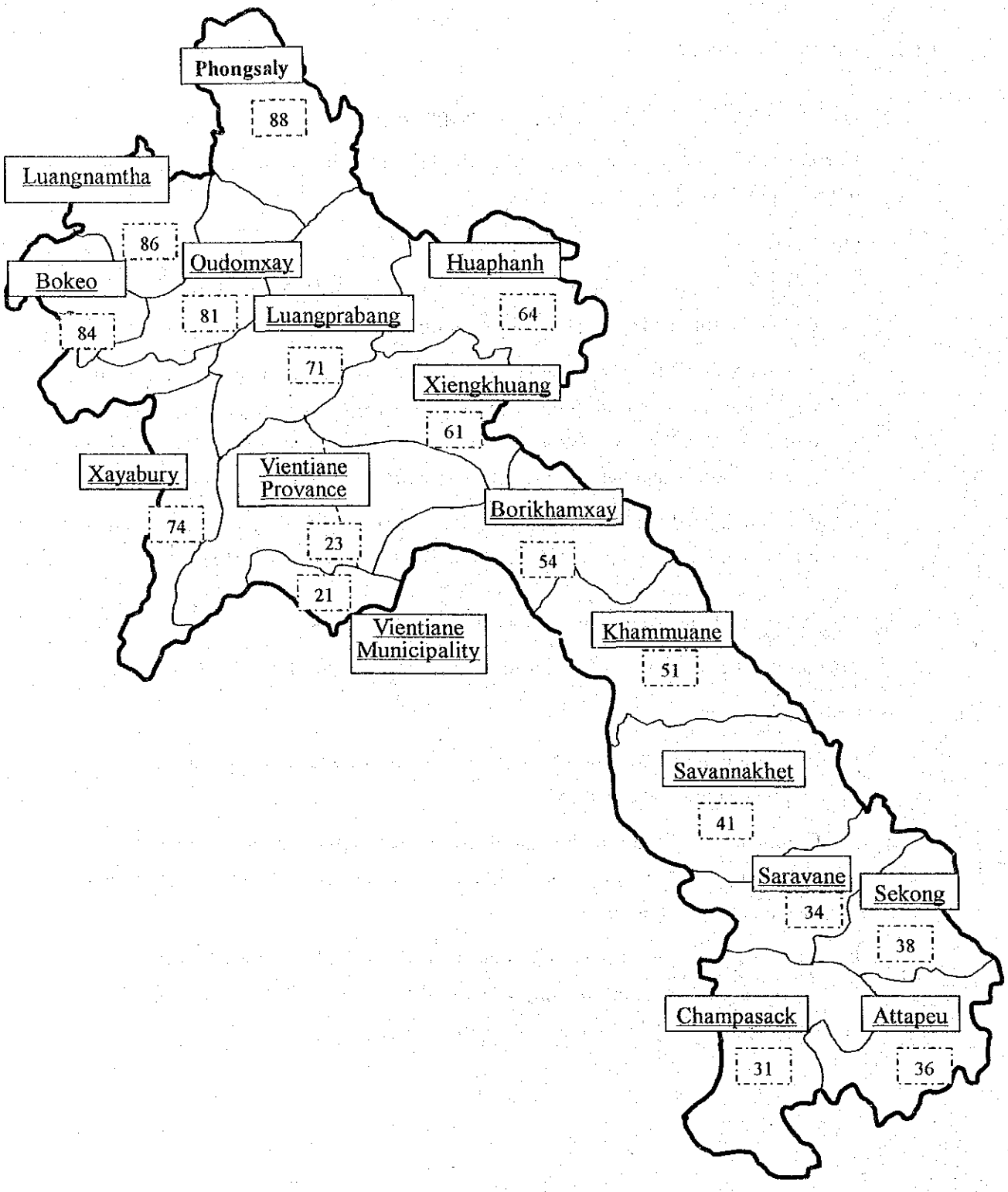
- The total number of population of Lao P.D.R. will not exceed 100,000,000 in the near future and current 8 digit is enough to cover.
- The number of fixed telephone for Vientiane will be in short. Like most of large cities in the world, prefix number may change to 3 digits from current 2 digits (ie. 23 22 xxxx to 2 322 xxxx). However, current numbering utilizing plan may not be applied because of "1" (ie. 21 22 xxxx to 2 122 xxxx).
- The number of mobile will be in short because the 7-digit number and 4 operator share the numbers. (8-digit number is necessary in 2015)

(2) Current Numbering Plan for Special Services

Current numbering plan for Special Service is shown in the Table 7.1-6.

Observations;

- Allocation of common numbers to all operators and separate operator oriented numbers should be separated
- Complain access for individual operator may cause confusion to users. It should be used common number and operators should talk the user and dispatch to the operator.
- Allocation of Special Service numbers to each ISP may eventually reduce the numbers available in the future with the increase of ISPs. It should be allocated by 4 digit special numbers such as 8888.



Source MCTPC.

Fig. 7. 2 Numbering Plan in the Lao P.D.R.

Table 7.1 Current Numbering Plan in Lao P.D.R.

AB	0	1	2	3	4	5	6	7	8	9
0										
1										
2	Current GSM	Vientiane Municipality Area		Vientiane Province Area						
3		Champasack Area			Saravane Area		Attapeu Area		Sekong Area	
4		Savannakhet Area								
5		Khammuane Area			Borikhamxay Area					
6		Xiengkhuang Area			Huaphanh Area					
7		Luangprabang Area			Xayabury Area					
8		Oudomxay Area			Bokeo Area		Luangnamtha Area		Phonsaly Area	
9										

Source: Original table is provided by MCTPC and 030, 050, 080 are given by the team

7.1.3 Switching System

(1) Fixed Line Network

As of December 2001, there were 31 main switching exchanges and 8 Remote Switching Unit (RSU) working in the Public Switched Telephone Network (PSTN) in Lao P.D.R.. The total switching capacities was 60,421 lines. Network expansion project of 38,446 subscribers with 48 exchanges is under progress. Total switching capacities come to about 100,000 lines after the project has completed in the year of 2004. It is required to install about 340,000 subscriber lines additionally to satisfy the telephone demand in 2015. In addition of expansion for the existing exchanges, the new installation for all district centre of each provinces is required.

(2) International Switching

The international service is provided by FETEX-150 in Numpou exchange. However, this switch is utilized as a combined function of local, transit for the most important areas in the central area of Vientiane. The switch often experiences overload for outgoing traffic to the Internet and mobile calls. Such traffic congestion of national traffic may cause deterioration of international telephone service.

With the rapid increase of telephone service in the Lao P.D.R., international telephone services have become more important for the people and the country. It is inevitable that reliability will have to be increased and service be improved. Separation of functions and the international traffic stream from the local traffic, and the introduction of a new international switching system, is urgently needed.

(3) Rural Communications Services

A rural telecommunications system (Rurtel system) has been installed in the Lao telecommunications network. 13 central stations with 122 Subscriber stations with a total capacity of approx. 2,000 subscribers are in service. The central stations are connected to different exchanges via line interface.

Phase V is under planning to be executed from Year 2002 – 2004. The total capacity for Phase V is 29 subscriber Stations in 13 provinces with 804 subscribers.

One central operation and maintenance center controls the Equipment in the central region, while two O&M centers in Luangphabang and Khanthabouli control the Northern and the Southern regions respectively.

(4) Mobile switching

1) Existing GSM system of LTC

Mobile telephone service was launched by LTC in 1993 utilizing GSM technology with an initial capacity of 5,000 subscribers. The number of subscribers is increasing as shown in Table 7.2.

Table 7.2 Number of Mobile subscribers

	1996	1997	1998	1999	2000
Number of Mobile subscribers	3,790	4,915	6,453	9,048	20,000

LTC has expanded its service area to cities as such Savannakehet, Pakse, Oudomxay, Xienkhuang, Saravane, Huaphanh,Thakhek and Bokeo. It is estimated to have exceeded 20,000 in the year 2000. A new MSC was installed in Vientiane and is planned to expand further to 45,000 subscribers in 2003. One Base Station Controller (BSC) collocated to the Mobil Switch Center (MSC) serves 23 Base Transceiver Station (BTS) in Central and Northern areas of P.D.R..

The southern part of the Lao P.D.R. is served by one BSC with 6 BTS. The equipment is of the C&C08 type of Huawei, a Chinese manufacturer.

Prepaid cards are available for travelling business customers, Roaming is introduced to Thailand only and should be extended to more countries to enhance international reach ability and make the system more attractive for business customers.

The system is controlled by an O&M centre collocated to the MSC in Saylom.

2) GSM system for ETL

A second GSM network is established by ETL. It owns an initial capacity of 15,000 subscribers and consists of two MSC, two BSC and 36 BTS installed in all country. All equipment is of the S-12 system supplied by Shanghai Bell.

The system shall provide basic service functions such as postpaid, prepaid. An O&M centre for the control of the whole system installed at the KM21 and Nongphaya in Vientiane municipality.

3) Future Expansion

National Mobile telephone demand in year of 2005, 2010, 2015 are forecasted as 120,000, 278,000 and 662,000. To satisfy the demand, it is required to install new MSC for mobile in the main areas as follows,

Table 7.3 Demand of Mobile subscribers

Main area	2005	2010	2015	Coverage Area (Province)
North (Luangprabang)	12,000	31,000	82,000	Provinces of Phongsaly, Luangnamtha, Odomxay, Bokeo, Luangprabang, Huapanh, Xayabury, Xiengkhang
Vientiane	81,000	176,000	404,000	Vientiane Municipality, Vientiane Province, Xaysomboun, Bolikhamxay
South 1 (Savannakhet)	22,000	47,000	108,000	Khammuane, Savannakhet
South 2 (Champasack)	5,000	25,000	67,000	Champasack, Saravane, Sekong, Attapau

Unit: Number of Demand at the end of the year

7.1.3.1 Telephone Network Structure

(1) Existing Network Structure and Hierarchy

The existing network hierarchy of the telephone network in Lao P.D.R. consists of 4 levels.

Level 1 International switching
Level 2 National transit centre
Level 3 Local switching centres
Level 4 Remote switching stages and rural equipment

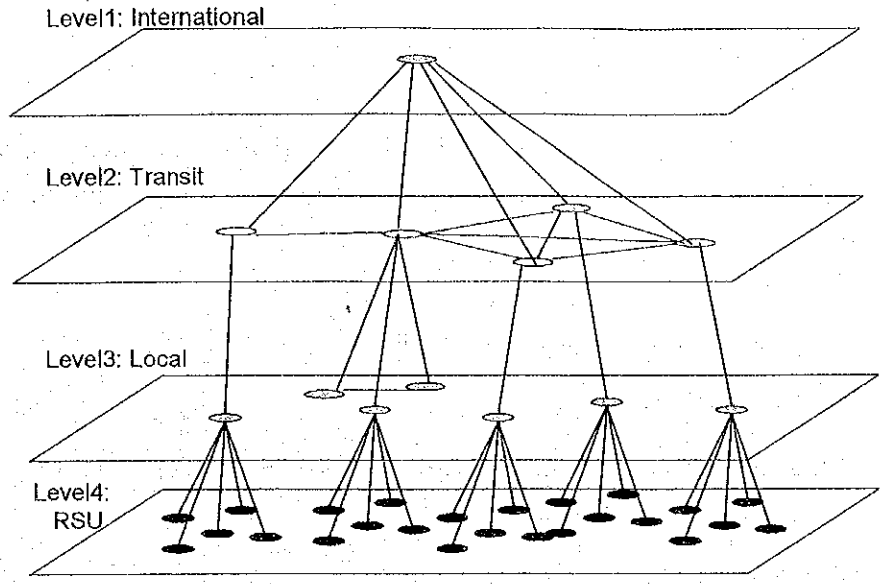


Fig. 7.3 Schematic Diagram of the Existing Telephone Network Structure

Existing switching systems perform several hierarchical functions simultaneously. The Fig. 7.3 shows a typical example. The switching system in Numpou exchange provides local switching, transit switching, local tandem and international switching functions.

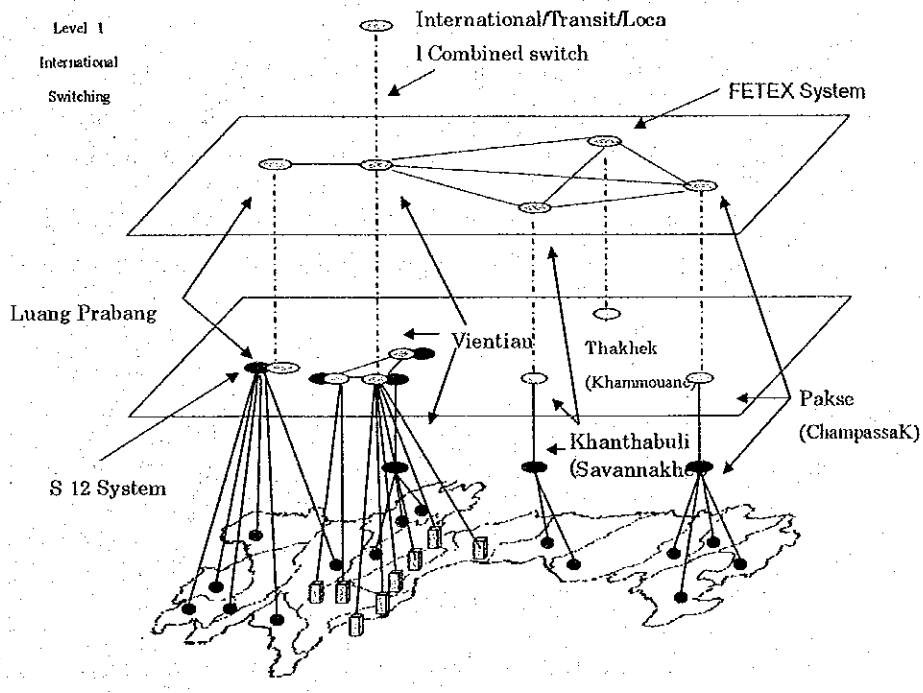


Fig.7. 4 Existing Telephone Network

7.1.4 Current Transmission Network

ETL and LTC have installed a number of transmission and wireless system throughout Lao P.D.R., which consist of Microwave communications and OFC transmission.

7.1.4.1 Current Microwave Transmission Networks

(1) Backbone Networks

Backbone networks consist of two main routes, which connect southern and northern provincial regions via Vientiane as shown in Fig. 7.5.

This microwave communications system is a conventional PDH (Plesiochronous Digital Hierarchy) system, processing at a capacity of 34 Mbps at 2 GHz and/or 7 GHz frequency band as shown in Table 7.4.

The communication network between Vientiane and Paxan has been replaced by the CSC (China South-East Asia Cable) network and has been reconfigured primarily as backup network.

(2) Spur Networks

Spur networks consist of 5 nationwide routes in the northern and southern regions in Lao P.D.R., which relay and distribute a transmission signal from backbone microwave network towards the provincial regions as shown in Fig. 7.5.

This microwave communication system is also a conventional PDH system, processing at a capacity of 16 Mbps at 7 GHz frequency band as shown in Table 7.4.

7.1.4.2 OFC Transmission Network

The current OFC Transmission Networks are shown in Fig. 7.14. The details are as follows:

(1) OFC Transmission Network

1) Intra-provincial OFC transmission network

The OFC network in Vientiane are configured a star shape between MSU and RSU. On the other hand, the OFC network configurations between three

MSUs (at Numphou, Xaisetta, and Sisattank) uses a ring topology (Refer to Fig. 7.6 and Table 7.5).

Table 7.4 Current Microwave Network Facilities

Section		System	Capacity	Note
Backbone Networks				
Southern Route				
Vientiane (VTE)	Pakane (PAK)	2 GHz Microwave	34 Mbps 1+1	Numphou = Vientiane
Pakxanh (PAK)	Thakhek (THA)	- do -	- do -	
Thakhek (THA)	Xeno (XEN)	- do -	- do -	
Xeno (XEN)	Ban Nafong (NAP)	- do -	- do -	
Ban Nafong (NAP)	Salavane (SAL)	- do -	- do -	
Ban Nafong (NAP)	Pakse (PAX)	- do -	- do -	
Pakse (PAX)	Khong (KHG)	- do -	- do -	
Northern Route				
Vientaine (VTE)	P.Kaonan (KAO)	2 GHz Microwave	34 Mbps 1+1	Numphou = Vientiane
P.Kaonang (KAO)	Phonhong (PHO)	- do -	- do -	
P.Kaonang (KAO)	Vangvieng (VAN)	- do -	- do -	
Vangvieng (VAN)	Ban Kioukacham (KIO)	- do -	- do -	
Ban Kioukacham (KIO)	Phonsavane (PHN)	7 GHz Microwave	- do -	Pek = Phonsavan
Ban Kioukacham (KIO)	Xayabury (XBI)	- do -	- do -	
Ban Kioukacham (KIO)	Lungprabang (LPB)	2 GHz Microwave	- do -	
Luangprabang (LPB)	Oudomxai (Xai)	7 GHz Microwave	- do -	
Oudomxai (Xai)	Namtha (NTH)	- do -	- do -	
Spur Networks				
Southern Route				
Pakse (PAX)	Phousan	7 GHz Microwave	16 Mbps 1+1	Pase = Lamam
Phousan	Kochanto	- do -	- do -	
Kochanto	Samakkhixai	- do -	- do -	
Sanamxai	Sanamxai	- do -	- do -	
Xaisetha	Houy hodam	- do -	- do -	
Houy hodam	Lamom	- do -	- do -	
Other Route				
Parse	Xongmex	7 GHz Microwave	2 Mbps 1+1	Pax = Xongmei
Northern Route				
P.Kaonong	Km 52	7 GHz Microwave	16 Mbps 1+1	B.52 = Phonmee
Km 52	Thoulakom	- do -	- do -	Lausl = Ban 52
Km 52	B.Km 52	- do -	- do -	
Spur Networks				
Northern Route				
Phonsavane	P.Thom	7 GHz Microwave	16 Mbps 1+1	Phonsavan = Xamneu
P.Thom	P.Ha-Gey	- do -	- do -	
P.Ha-Gey	Sanphatap	- do -	- do -	
Sanphatap	Phou pan-noi	- do -	- do -	
Phoupan-noi	Ph loupe	- do -	- do -	
Ph loupe	*Xamneua*	- do -	- do -	
B.Don	Namsing	- do -	- do -	B.Don = Bonkeo
Namsing	Nan Khant	- do -	- do -	
Nam Khant	Nanphek	- do -	- do -	
Namphek	Houngteng	- do -	- do -	
Houng	Ayakao	- do -	- do -	
Ayakao	Phongsaly	- do -	- do -	
Namphek	Phou 606 (Huoixai)	- do -	- do -	
Phou 606	Tonpheung	- do -	- do -	

Note: (1) 2 GHz & 7 GHz 34 Mbps = Alcatee DM 3000, 7 GHz 16 Mbps Plessy 7516
(2) Relay and passive station are not shown in the table.

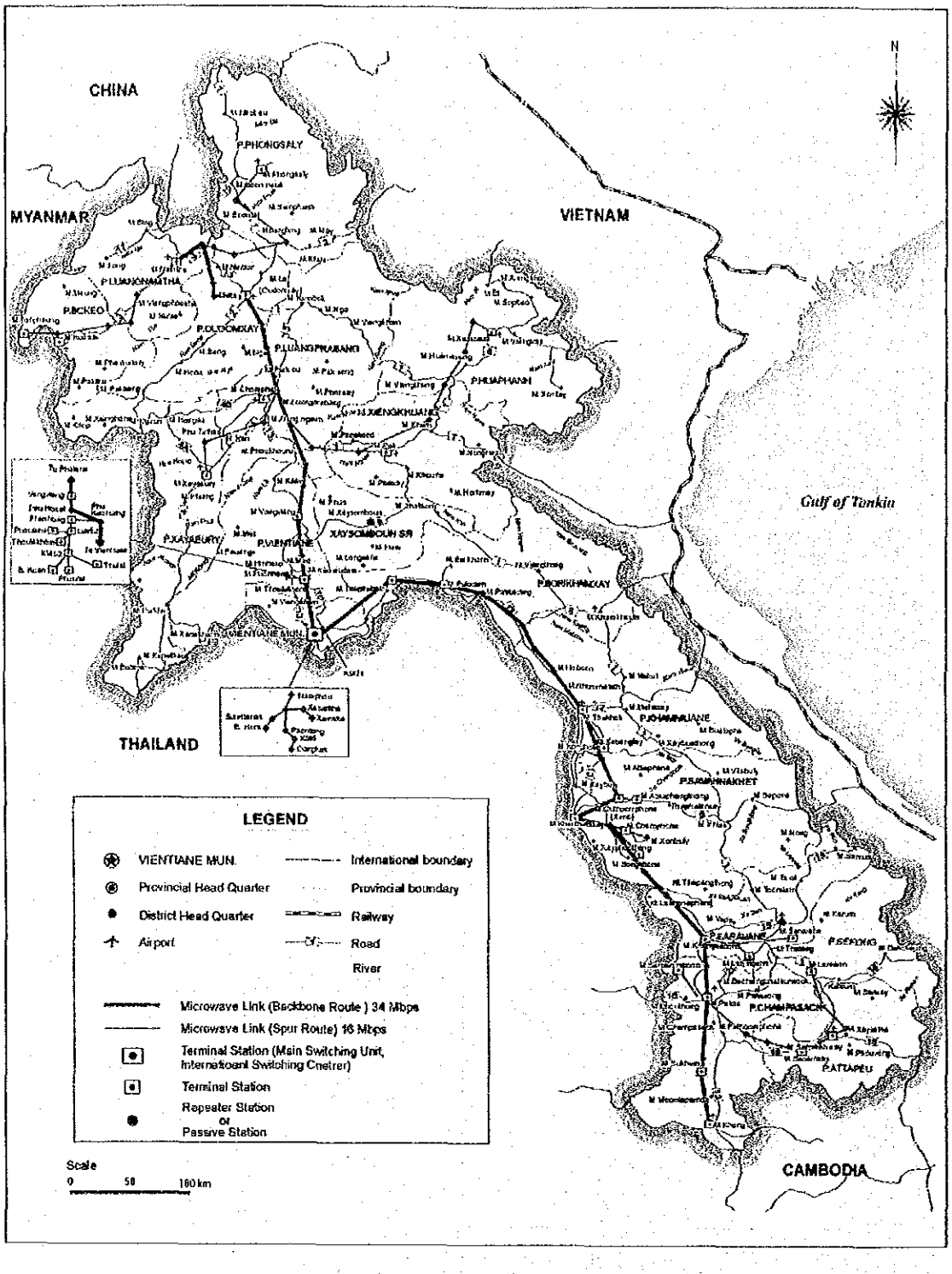


Fig. 7.5 Microwave Transmission Network (Current)

Table 7.5 Intra-Provincial Network

Section		System	Capacity	Note
Junction Network in Vientiane Mun	**To connect with**			
Numphou (VTE)	Air port	FOT	2 Mbps 1+0	
Numphou (VTE)	Thongpong	FOT	8 Mbps 1+0	
Numphou (VTE)	Naxaythong	FOT	8 Mbps 1+1	
Numphou (VTE)	Mobile center	FOT	2 Mbps 1+1	
Numphou (VTE)	Xaisetta (VTX)	FOT	140 Mbps 1+1	
Numphou (VTE)	Sisattanak (VTS)	FOT	140 Mbps 1+1	
Xaisetta (VTX)	Donnoun	FOT	8 Mbps 1+0	
Xaisetta (VTX)	Thangon	FOT	8 Mbps 1+0	
Sisattanak (VTS)	Nahai	FOT	8 Mbps 1+1	
Sisattanak (VTS)	Thadeua	FOT	8 Mbps 1+1	
KM6	Donkok Univ.	FOT	8 Mbps 1+1	

2) OFC international transmission network

The CSC (China South-East Asia Cable) transmission network had been installed and operated as one of main international transmission networks since March 2000.

The section of this cable between Vientiane (KM-21) and Paksan has been used as Inter-Provincial Network (backbone route), instead of being used Microwave Communication Network. (Refer to Fig. 7.6).

3) On-going OFC Transmission Networks Project

ETL is now implementing to OFC transmission networks on the ETL Phase-2 Project. Installation will start on the end of 2002.

(2) Issue and Problem for the Present OFC Transmission Networks

1) Microwave Transmission Network

a) A 34 Mbps capacity will not be sufficient to accommodate increasing demand in the backbone networks. As well, 16 Mbps is also same situation in the Spur networks.

b) Low operational reliability due to difficulty to maintenance and operate solar power battery system, spare parts supply and lightning strike problem in the backbone and spur networks.

c) Difficulty to operate and maintenance remote place facilities. To observe that maintenance staffs can be very difficult to access until relay station due to steep mountain road when happens the trouble of system down, therefore the recovery will be required by long time.

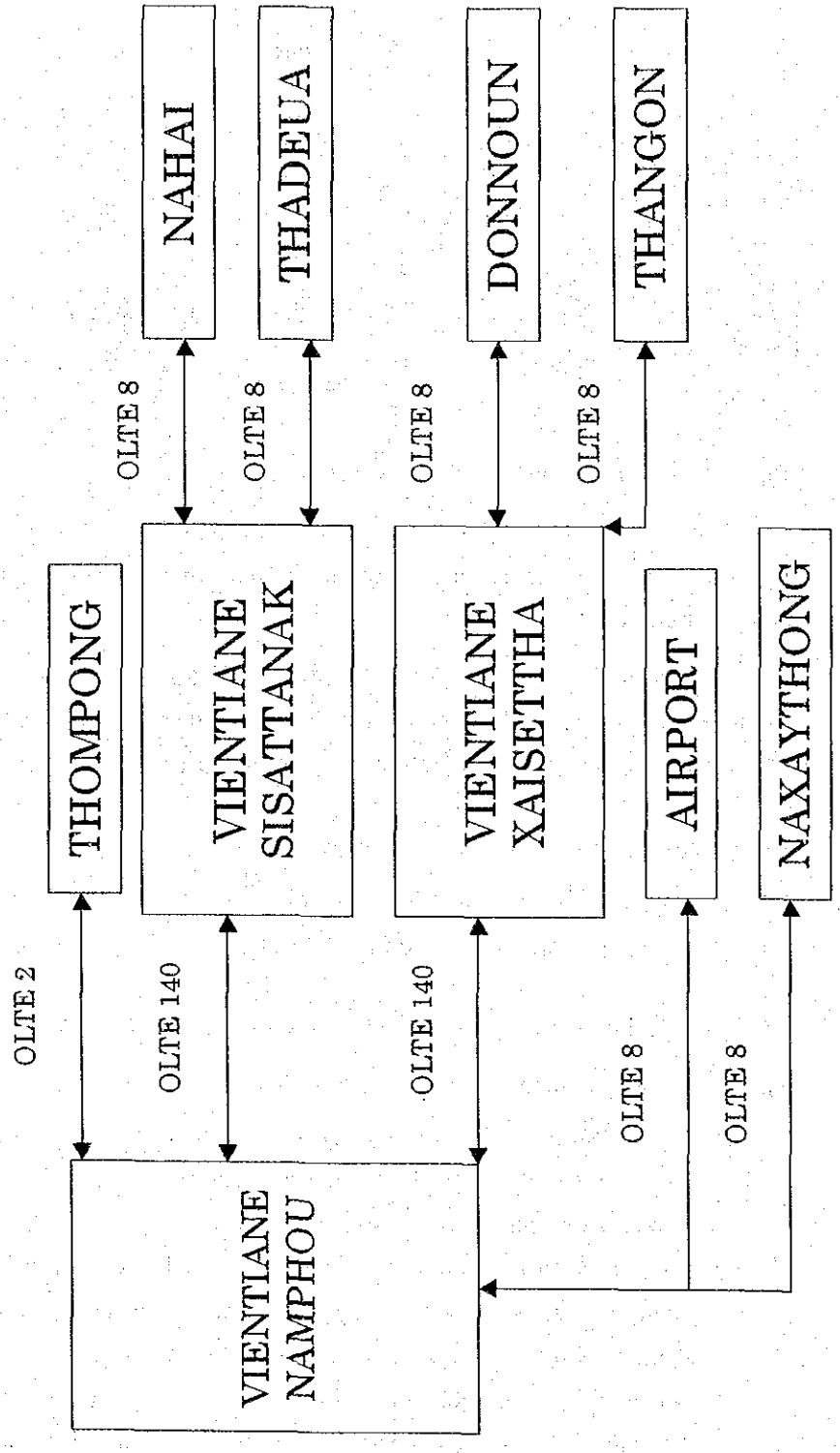


Fig. 7.6 OFC Transmission Network ETL in Lao P.D.R.

2) OFC Networks

a) Physically disconnection of land line of OFC caused by environmental condition in Lao P.D.R..
b) It takes long time to recover and fix transmission failure.
c) There should be a redundancy transmission network for backup in the case of transmission failure.

3) HF SSB Radio Communications Facility

HF SSB radio communications network is used for point-to-point communications in major districts where no microwave communications networks nor rural subscriber communications network are available.

The HF SSB radio network operates as a simplex voice communication system operating at the 5 to 7 MHz bands.

In addition, this SSB radio communications network will be used as a backup communication facility in all districts when main network is rendered out-of-service in case of trouble.

The team observed the average number of calls processed in one hour is 6.21 in February 2002, from operator log, which shows HF SSB system is accepted for necessary communication for the people in rural areas.

4) Other Microwave Networks

Satellite Earth Communication System

The connection between Satellite Earth Communication System at Nathom and ITLS at Namphou is using the a microwave radio link (PDH, 7GHz, 34Mbps) from Nathom to Saylon and optical fiber cable from Saylon to Namphou.

The facility is a STD-01A type satellite earth communications, accessing with IOR-INTELSAT located at 64.0 degrees east in the space of equator line providing direct channels (IDR Carrier) for access to 10 countries.

Problem identified and possible countermeasures

There is no backup route between Nathom and Saylon. The fiber optics should be installed to save the important international calls when microwave link is in trouble.

7.1.5 Outside Plant

7.1.5.1 Present Situation and Problems

(1) Shortage of Distribution Cables and Terminal Strips

Conducting field Surveys, the Study Team observed shortages of distribution cables and terminal strips in every city and town without exception. In resulted there are so many cases of exaggerated use of drop wires in place of cables which inevitably invite increases of faults and Troubles rate of telephone lines very steeply. In similar cases in many countries, 80 to 90% of faults and troubles of cables should come from out of this section with similar character and feature. Improvement and rehabilitation to cope with the matter shall be most urgently required for Lao.

(2) Duplicated Layout of Distribution Cables by ETL and LTC

The Study Team observed duplicated lay out of independent distribution cables by ETL and LTC in the same districts of the same city. This means not only duplicated investment of big amount of budget by both entities economically saying, this means a national loss, but also shall often times come to be causes of confusion and inconvenience on the occasion of maintenance and connection works of new subscribers.

The Study Team should like to recommend establishing a certain reasonable agreement between the entities to evade confusion and double investments in the same district for the same purpose.

(3) Regulated Use of Electric and Telephone Poles and Use of Underground Distribution Cables

More than 80% of telephone aerial cables share poles with electric cables. In most of these cases, electric poles are under use as a natural tendency.

There are clear and reasonable regulation in Lao to maintain exact space and height from the earth for these poles to be shared between electric and telephone cables.

But besides an expansion of both telecom and electric cables in many districts, even this basic regulation is not observed. These breaches of regulation inevitably cause contacts of lines and inductive interferences between cables.

To keep quality of lines from out of these troubles and faults, telephone lines should be separated from electric poles by establishing independent poles where

there may be difficulty to preserve regulated space between electric and telephone cables because of congestion.

Also, underground distribution cable system should be taken into consideration in future for construction at those very bustling commercial zones where, even separation of these cables should be very difficult because of congestion of space and land.

(4) Primary cables, secondary cables, cabinet

1. The primary and secondary cables are interconnected in the cabinet by jumper wires. In the cabinet, the team observed that the number of pairs in primary cables is equal or a little bit greater than that of secondary cables.
2. The numbers of pairs (primary, secondary) are 300 ~ 3000 pairs, 10 ~ 300 pairs, respectively, including aerial cables and underground cables.
3. Current designing principle is as follows;

   i) Transmission Loss

   The maximum transmission loss for subscriber cable is generally specified as; 9 dB.

   In the cable design, the uni-gauge system is employed basically and the wire diameter of 0.4m.m is used as a first choice up to 4 km in distance and 0.65 mm cable is used in the distance over 4 km.

   ii) Cable Loop Resistance

   The maximum cable loop resistance is specified as; 1,500 ohm

   In case of that, the user is located far from the local exchange, and the maximum resistance is allowed up to; 1,800 ohm.

Problem identified

1. As a whole, the occupancy rate of the primary cable in Vientiane Area is 72.1%, this figure is very critical for supplying necessary pairs for expanding demand at present, the situation is the same in provincial areas.
2. In many Provinces, there are many waiting applicants because of lack of spare pairs (except Attapu).
3. Design principle exits, however, it is not applied appropriately.
4. Ratio of primary cable and secondary cable in the cabinet is close, e.g.

600 primary and 600 secondary, or 700 primary and 400 secondary. This can be seen widely in the country.

5. The new secondary cable from new S12 switch at Naxaythong2 and existing cable from FETEX RSU at Naxaythong have been laid on the same poles. Especially cables are laid opposite direction and may introduce confusion for maintenance work in the future, because there are no clear marks on the specific cables and drop wires.

(5) Slippage and Damage of Cables at Pakkadine

The new RSU Pakkadine is going to open on the edge of the cliff. 8 ducts, one manhole and riser ducts have been constructed. However, if cables are laid in present condition from the edge of cliff to downward, the cable sheath and cores will slip at the section of duct and may be damaged at the part of riser duct, because ducts are laid along sharp slope, hence, the weight of the cables may be added in the end. In the long run, cables may be cut and/or may slide down.

Problem identified and possible countermeasures

Possible countermeasures, are (i) additional one manhole shall be made near the riser ducts and (ii) at the occasion of cable laying, tightening with fixtures in two manhole shall be done. (iii) The cables shall be self-supporting type with messenger wires to fix with.

7.1.6 Internet

There exist four kinds of access to the Internet in the Lao P.D.R. as follows;

1. "Through ISP"

   There are three ISPs (LaoTel, Planet Online and GlobeNet) in the Lao P.D.R..

2. "Through Internet Café "

   There are approximately 50 places that provide the Internet access for the public such as Internet Café, hotel, guest houses, travel agency and so forth in Vientiane.

3. "Through Private Network"

   Some international organizations and embassies have Internet access through their private network usually using VSAT.

4. "Through dial up to foreign ISP"

   Some users such as Thai businessmen who have account of foreign ISP to make international call by dial up to access to foreign ISPs.

The Study Team studied the current status of networks and configurations of the three ISPs (LaoTel, Planet Online and GlobeNet) and conducted survey on Internet Café in Vientiane.

(1) LaoTel[1]

The network for the Internet connection of LaoTel is shown in Fig 7.7. Connection to LaoTel is only dial up through the normal telephone system.[2] Internet access calls from PSTN as well as from mobile network are concentrated at the switch located in the Vientiane and connected to the modem pool by four (4) E1 interfaces which corresponds to 180 telephone lines. Modems are interconnected to Router through the Ether Switch to accesses to the Internet. Actual Internet connection has been made over the satellite link to the SingNet in Singapore with 512Kbps interface. The satellite link via ThaiCom with 1Mbps to HongKong Telecom in Hong Kong is planning to start from March, 2002. The number of subscribers is 2,271 as of January 31, 2002.[3] Since LaoTel started ISP in 1999,

[1] LaoTel is an ISP known as "LAO Internet" established as a division of Lao Telecommunications Co.,Ltd in 1999.

[2] According to Mr. Southsavath VANTHANOUVOUNG, Chief of Internet Center, Lao Telecommunications Co., Ltd., they plan to provide lease-line services using copper line for Lao Plaza Hotel.

[3] The number was confirmed by Mr. Nouansy SOUNTHALA, Chief of Telecom Sales & Services Center, Lao

they enjoyed rapid growth of number of subscribers and expect 25% growth annually from 2001. The number of subscriber per one telephone line is 12.6 subscribers. [4] As the standard that AOL (American Online) applies is 12 subscribers per one telephone line, LaoTel reached the standard by this adding capacity of 120 telephone lines. LaoTel's basic dial up service with 10 hours access time starts from US$12 per month.

Access points have been provided at the Vientiane, Luangphrabang, and Savannnakhet. User can access to the service provider by dialing 8888. Those calls are routed to the modem pool in the Vientiane.

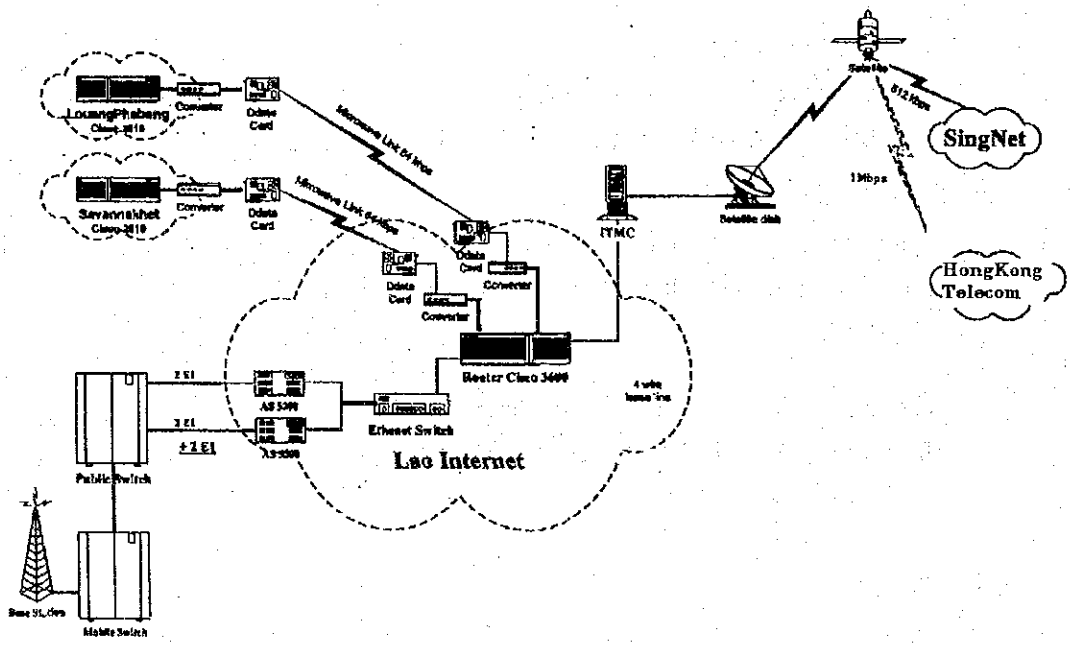


Fig 7. 7 LaoTel Internet Connection

Table 7.6 shows LaoTel Internet connection equipment and channels.

Telecommunications Co., Ltd in February 18, 2002.

[4] LaoTel had 60 telephone lines for 1900 subscribers in 2000. The number of Subscribers per one telephone line was about 32.

Table 7.6 LaoTel Internet Connection Equipment and Channels

Province	LAC	Exch.name	Maker	Model	Type	Owner	capacity
Vientiane Municipality	21	Numphou	Cisco	AS-5200	Router	LTC/LaoNet	180 modems
Luangphrabang	71	Luangphrabang	Cisco	AS-2600	Router	LTC/LaoNet	8 modems
Savannakhet	41	Khanthabouli	Cisco	AS-2600	Router	LTC/LaoNet	8 modems

(2) Planet Online

The network for the Internet connection of Planet Online is shown in Fig 7.8. Connection to the Internet is only dial up through the normal telephone system. Internet access calls from PSTN at the switch located at ETL Saylom in the Vientiane and connected to the modem pool by one E1 interface to ETL Namphou. Modems are interconnected to Router through the Ether Switch to accesses to the Internet. Actual Internet connection has been made over CSC Link. Plant Online started dial-up Internet access from January 6th, 2002. The number of subscribers is 210 as of February 2002. The number of subscriber per one telephone line is 7 subscribers. Planet Online keep level of 10 subscribers per one telephone line. Plant Online's basic dial up service with 10 hours access time starts from US$9.5 per manth. Plant Online see tendancy of rapid increasing of subscribers and predict that reach 400 by the end of April 2002.

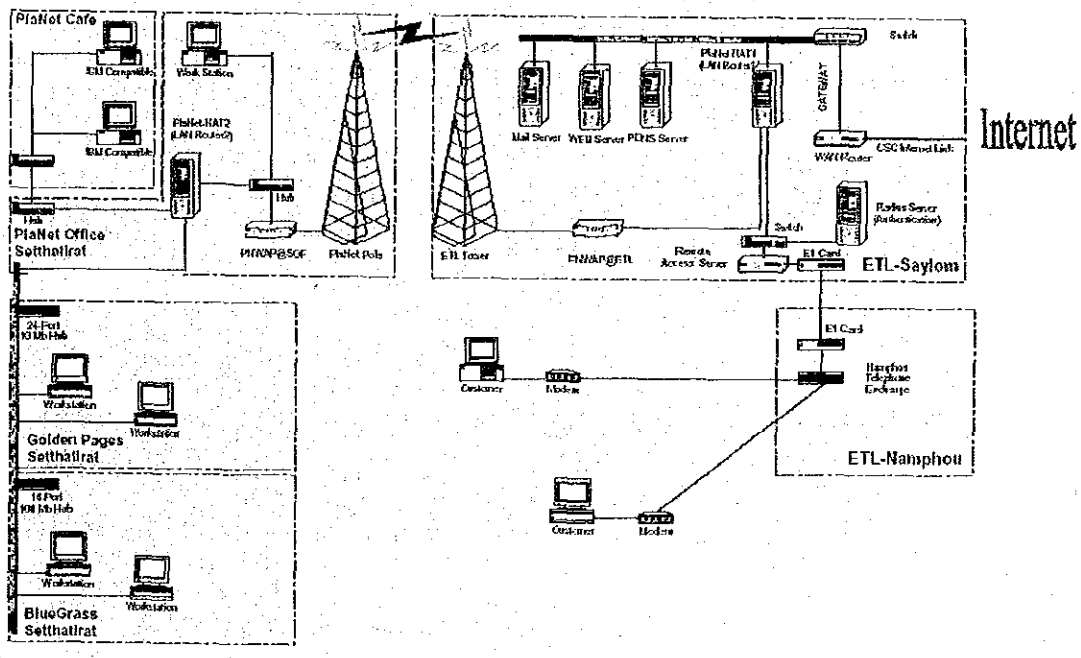


Fig 7. 8 Planet Online Internet Connection

(3) GlobeNet

GlobeNet provide two types of services; one is dial-up Internet service and another is wireless network internet access service.

Dial-up Internet Service

The network for the Internet connection of GlobeNet is shown in Fig 7.9. GlobeNet has only 16 telephone lines provided by LTC. They have 500 subscribers as of February 2002. The number of subscriber per one telephone line is 31 subscribers. GlobeNet's basic dial up service with 21 hours access time starts from US$12 per month. Once they had 800 subscribers, however, many of their subscribers moved to LaoTel because of difficulty to dial up to access the Internet due to lacking telephone line.

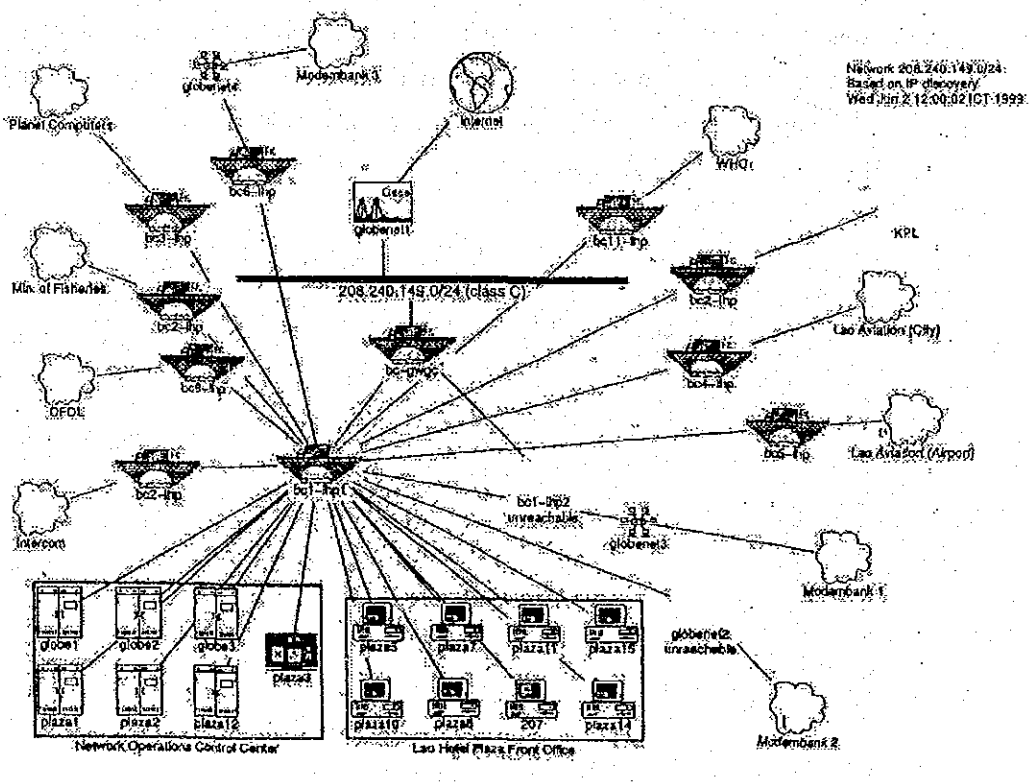


Fig 7. 9 GlobeNet Internet Connections

Wireless Internet Access

GlobeNet provides the Wireless Internet access as shown in Fig 7.10. GlobeNet have promoted the Wireless Internet access since 1998. However, user need to pay US$2,393 for its transmission equipments including 24 dBi Antenna on contract in addition to US$300 of monthly service charge , only International organization, embassies and Internet Café can afford to use the Wireless Internet access. As of February 2002, there are 50 users of the Wireless Internet access.

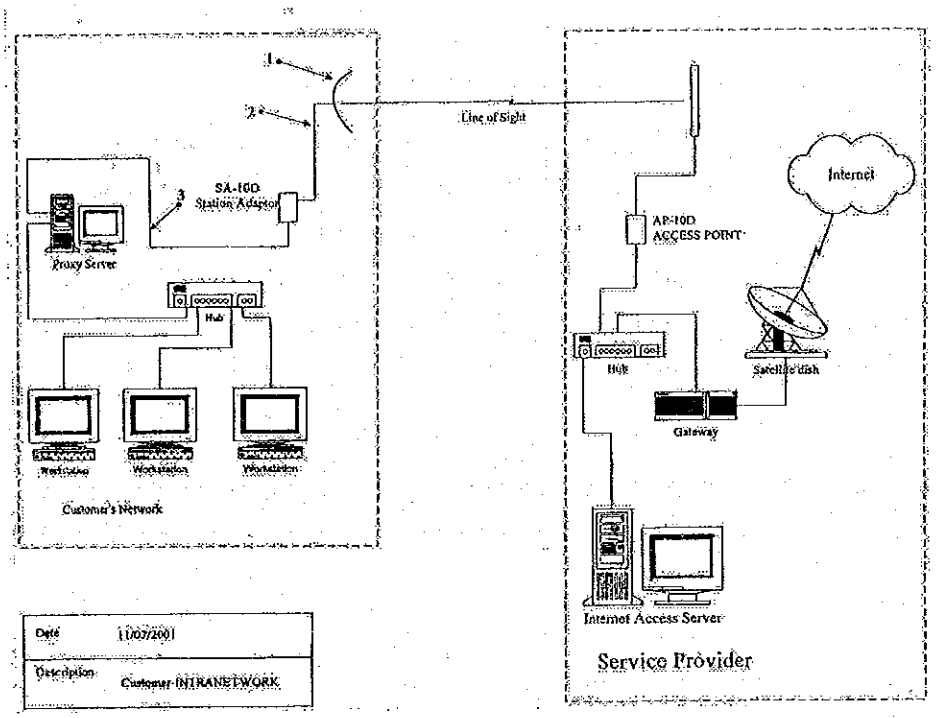


Fig 7. 10 GlobeNet Wireless Internet Access

(4) Overall observation on ISPs

1. Number of ISP subscriber
   The tendency of increasing of ISP subscribers from the year of 1999 to the year of 2000 was observed but the number of subscribes keep going up at slow but steady rate from the year 2001.
2. High cost of international link for ISP
   Leasing for international link is too expensive for ISP.
3. Lacking in telephone line for dial up
   Limited number of telephone line provided by ETL and LTC is one of constraint of those ISPs to promote the business.

4. Slow network speed and narrow bandwidth
   As the Internet backbone speed is limited, many subscribers are suffering from low speed and unable to enjoy new services. Also, slow network speed and narrow bandwidth limit ISPs opportunity to provide new services utilizing the Internet.
5. Lacking in human resource
   Human resource for the operation and maintenance of the network is limited.

Problem identified and possible countermeasures

Internet service is an important infrastructure for the future of Lao P.D.R.. However, for the non-carrier ISPs, it is not enough telephone lines for modem connection. Limited speed to abroad and most user experience low speed connection. In addition to this, there is not inter exchange ISP and hence all the mails between different ISPs in Lao P.D.R. have to go once to the foreign countries and come back again.

Customers in some provinces should pay for long distance charges for dial up connection to the Internet. Transmission lines are limited and it is difficult to connect.

In the mean time, some support should be necessary in order ISPs to provide better and faster services to the users. The team proposes that the fiber optics should be provided for those ISPs to access not only to the Internet by reasonable price, but also to access main servers and routers to interconnect with each other ISPs.

7.1.7 Other Networks

7.1.7.1 Mobile Telephone Networks

(1) LTC and ETL provided mobile telephone networks currently in Lao P.D.R. as shown in Fig. 7.11.

1) Vientiane and Northern provincial regions

The mobile telephone center (BSC1) as LTC is located at Saylom in Vientiane and is controlling up to 7 BTS (Base TRX Station) including those in Saylom, Chomphet, Thalad, Bankeun and other districts.

Those stations at Xiengkhuang, Oudomxay, Luangprabang and other districts. in the Northern provincial region are controlled by the Vientiane mobile telephone center (BSC 1).

Their BTSs through microwave transmission networks at the present time as shown in Fig. 7.12 and the subscriber capacity will be approximately 80,000 altogether.

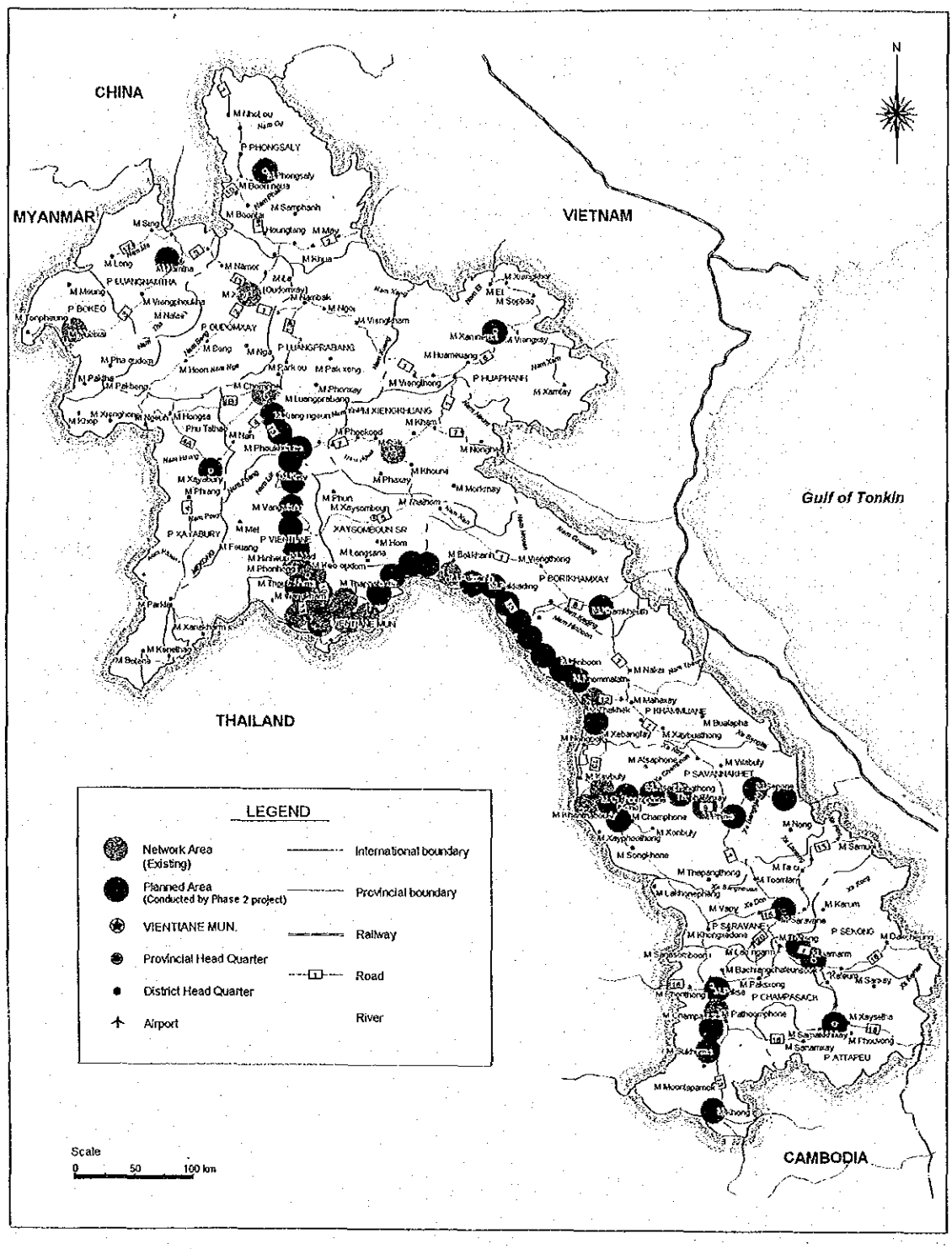


Fig. 7.11 Mobile Subscriber Telephone Network (Current)

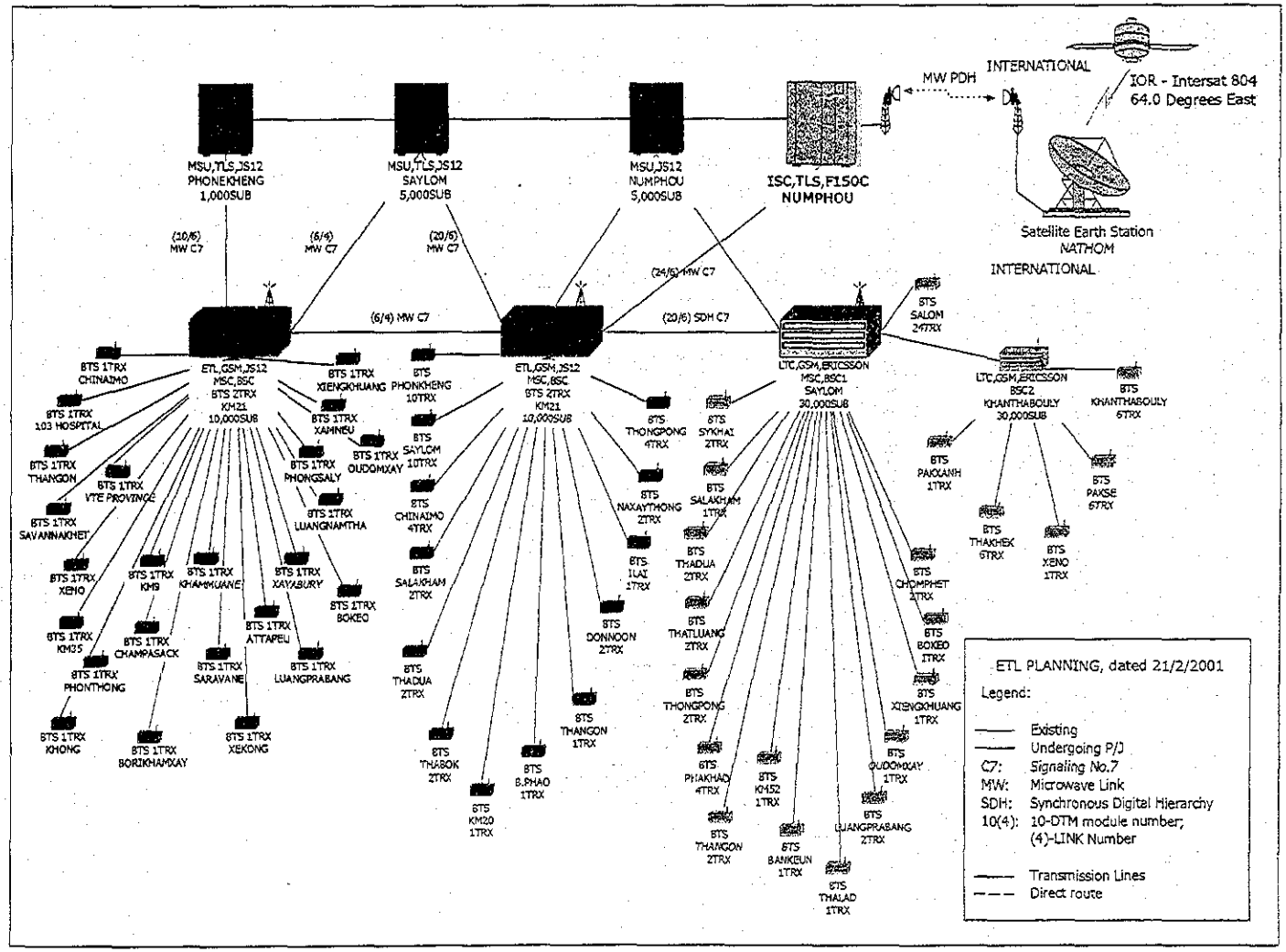


Fig. 7. 12 Configuration of Mobile Subscriber Telephone Network (Current)

7.1.7.2 Satellite Earth Communications Facility

(1) Current Operating Condition

Satellite Earth Communications Facility is located at Nathom in Vientiane and was installed with Microwave radio link (7 GHz, PDH 34 Mbps) between the actual facility and Saylom site at the end of 1996. All the facilities, including installation, were aid grants by the Japanese Government through JICA. The Currently the good operating condition is maintained by ETL maintenance staff.

The facility is a STD-A type Satellite Earth Communications System, accessing with IOR-INTELSAT located at 64.0 degrees east over the equator as shown in Fig. 7.13, providing direct channels (IDR Carrier) for access to the following countries showed by Table 7.7.

Table 7.7 Direct Channels (IDR Carrier for 10 countries)

Country	Capacity
Australia	2,048 Kbps
China	512 Kbps
Germany	512 Kbps
Hong Kong	512 Kbps
Japan-KDDI	2,048 Kbps
South Korea	512 Kbps
Singapore	512 Kbps
Singapore	1,020 Kbps
Taipei	512 Kbps
Vietnam	512 Kbps

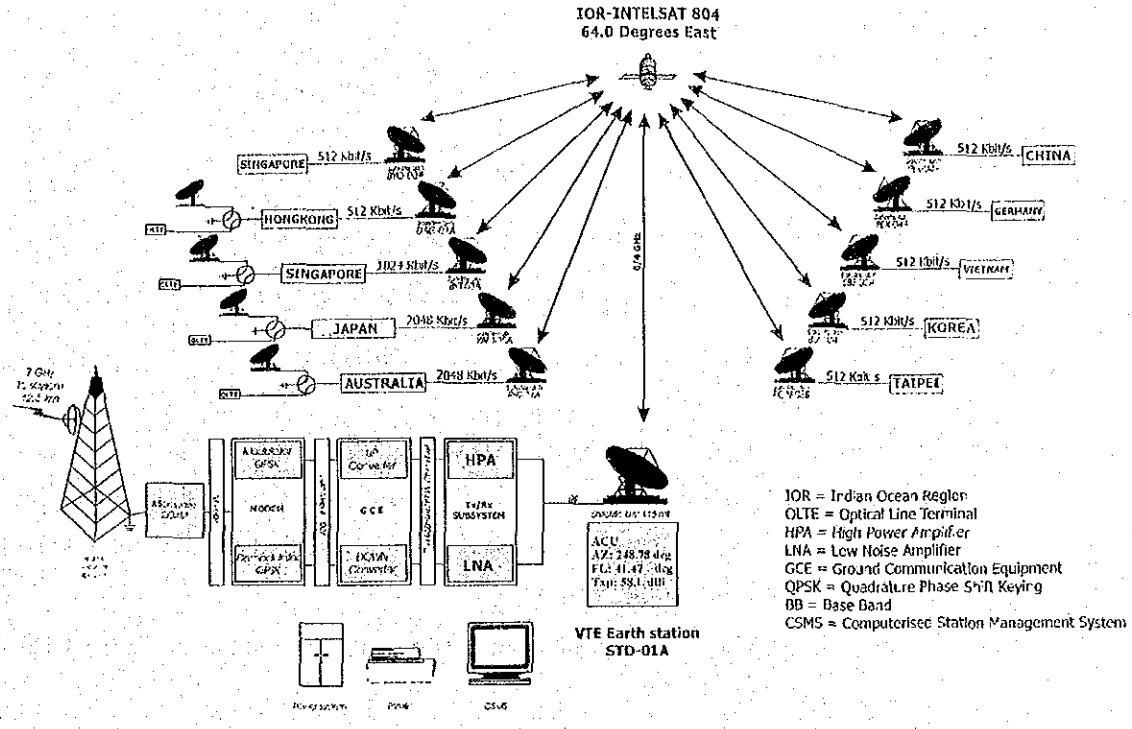


Fig. 7. 13 Satellite Earth Communications Facility

(2) Issue and Problem for the Present Satellite Earth Communications System

The facility has been configured with a duplicate system, except for the antenna and access link. Therefore, the facility requires a back up antenna with antenna changeover and controlling equipment, as well as additional access links in the case of trouble or maintenance service schedules.

These should be designed to maintain more reliable operations because of very important facility. Descriptions of which are shown in Fig. 7.50.

7.2 Current ETL Planning

ETL has established the network planning for the following phases.

(1) Phase 1: 2000-2002 (ETL finished project)

- Introduction of optical fiber loop in the Vientiane and its suburb
- Transmission systems over the optical fiber loop with STM1 and STM4
- MSUs for fixed and mobile networks (Vientiane)

(2) Phase 2: 2002-2004 (ETL project, approved by the government)

- Introduction of the fiber optic cable from Luangprabang to Vientiane, from Vientiane to Pakse along with route 13 and from Savannakhet to Vietnam boarder along with route 9
- Transmission systems along optical fiber cable stated above with STM16 and STM-4
- MSUs for fixed networks in Luangprabang, Savannakhet, and Pakse, RSUs for major district cities along the optical fiber cable
- MSU and BTS for GSM mobile networks in major cities along with optical fiber cable

(3) Phase 3: 2003-2004 (ETL project plan)

- Extend the fiber optic cable from Luangprabang to northern provinces
- Extend the fiber optic cable to China for international connection based on GMS (Greater Mekong Sub regions) project.
- Increase RSUs and BTSs for major district cities along the optical fiber cable
- International Digital Switch for functional separation with transit switch

(4) Phase 4: 2003-2005 (ETL project plan)

- Extend the fiber optic cable from Pakse to southern province cities
- Extend the fiber optic cable to Cambodia for international connection
- Extend the fiber optic cable to Thai for international connection over the bridge at Savannakhet
- Increase RSUs and BTSs for major district cities along the optical fiber cable

LTC has similar network plan to expand the network. LTC, however, is the private company and there is no obligation to announce long term planning. The Study Team had interviewed LTC, which only showed near term development. Recent and the most remarkable plan is to introduce new cellular mobile telephone MSU with 45,000 lines the later half of this year.

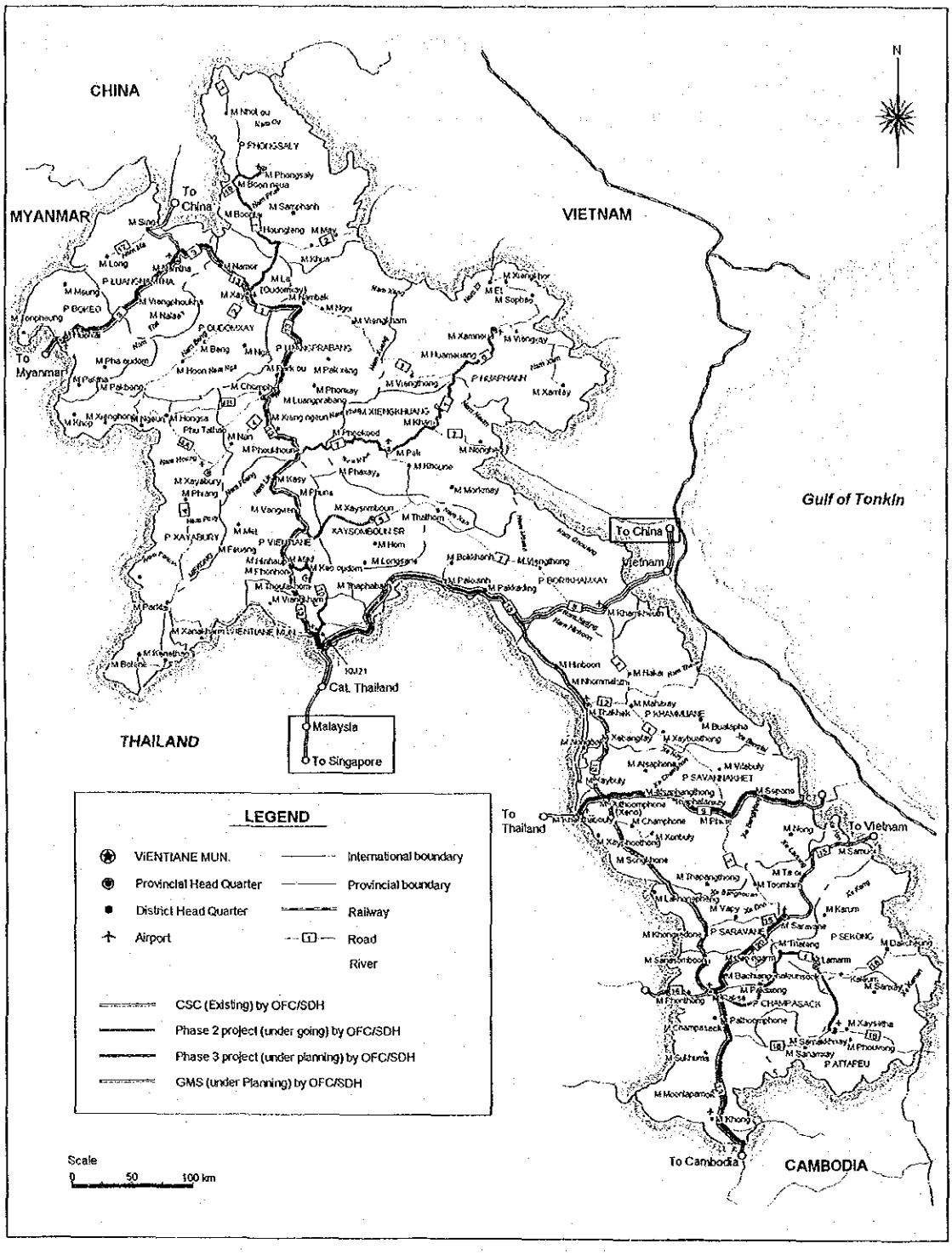


Fig. 7.14 Planned Period of OFC Transmission Network (Current, undergoing, planning)

7.2.1 ETL Network Planning

(1) Transmission

Transmission is the key component for the coming backbone network. ETL plan for phase2 is the most important and the current plan is appropriate to install because the route 13 and 9 are the one of the most advanced road in Lao and its feasibility has been checked by ETL. Thus, the Study Team recommends that the earliest introduction of this optical fiber cable and transmission systems. On the other hand, the Study Team worries about the ETL plan phase3 and 4, because both regions are isolated by heal mountains and the road is not maintained in good condition especially in rainy season.

The Study Team recommends that basic strategy is to introduce optical fiber together with SDH systems. Some places where optical fibers are not possible to introduce should be connected by other means, such as microwave or satellite links.

Current transmission network has not spurs, however, the network will become more important in 2015 due to the increase of users and ICT services on which Lao government heavily depends. Backup scheme should be applied as soon as possible. For the optical fiber cable with SDH equipment, the Study Team recommends that loop structure for the backbone network. Until the completion of fiber loop, the Study Team recommends that existing microwave may be utilized such as backup some important communications selectively.

Detail is discussed in the chapter 7.4.5.

(2) Switching

Digital Switching systems should be introduced and expanded to cover the whole land in order to provide better services to the users. The team recommends the followings;

- Introduce MSUs to the large cities until 2005 (Luangprabang, Savannakhet, and Pakse), after the introduction of MSUs in 2005.
- Introduce RSUs to the district cities unitil 2010, and if needed until 2015.
- Introduce first VoIP type(c) switch from 2010 if available and replace old Digital Switching Systems from 2010 if needed. Those switches should be utilized as long as the lifetime remains.
- Reduce the number of transit switching node

Detail is shown in the chapter 7.4.4.

(3) Outside plant

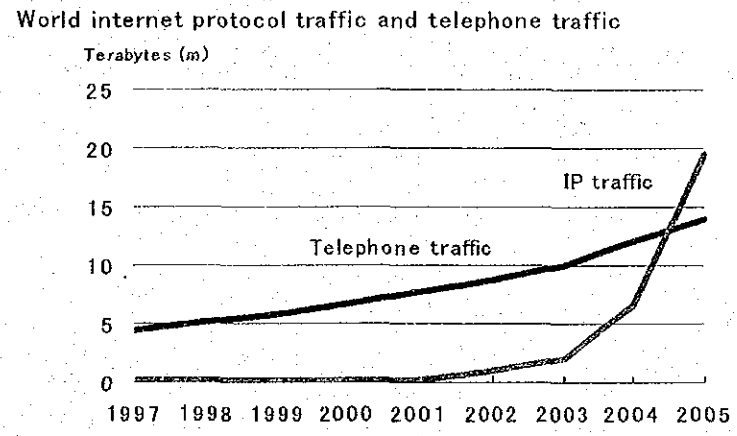
Introduce new metallic subscriber cables for fixed telephone and ADSL subscribers. Also, rehabilitation for existing metallic cable is necessary. Detail is shown in the chapter 7.3.

7.3 Transition to the IP integrated Network

(1) World Trend for the IP network

At present, a switchover from the circuit switched network to the IP packet based network is occurring and the network is going to be integrated by IP protocols in the world. It should be assessed an impact of the IP network, transition to and integration is meaningful in Lao P.D.R..

It is commonly pointed out that data traffic increases rapidly and exceeds voice traffic. This is first mentioned in Financial Times of 1999, and is commonly referred as to show the increase of the IP shown in Fig. 7.15.

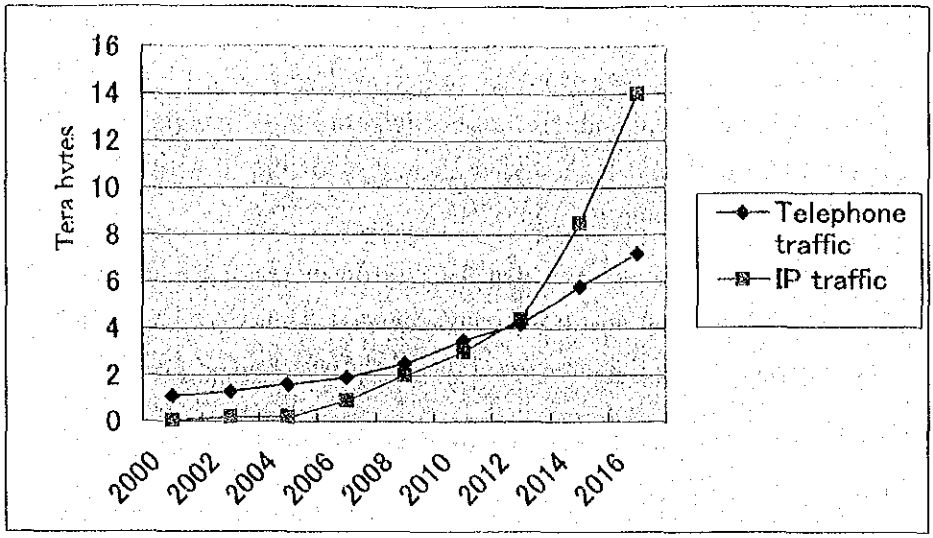


Source: Analysis Reuters; April 26, 1999 FINANCIAL TIMES

Fig. 7.15 Voice and Data traffic growth (World)

In this article the world IP traffic will surpass the telephone traffic in volume from 2004 to 2005, this phenomenon is actually confirmed in many countries such as US, and Japan (The communication White Paper in 2001, MPT). Also, the same is expected in the ASEAN countries in this decade.

For Lao P.D.R., it is estimated in 2012 when IP traffic exceeds telephone traffic as shown in the Fig. 7.16. For the development of the future Internet and the development of ICT, this should be taken into consideration.



Source : Study Team (estimated from demand forecast)

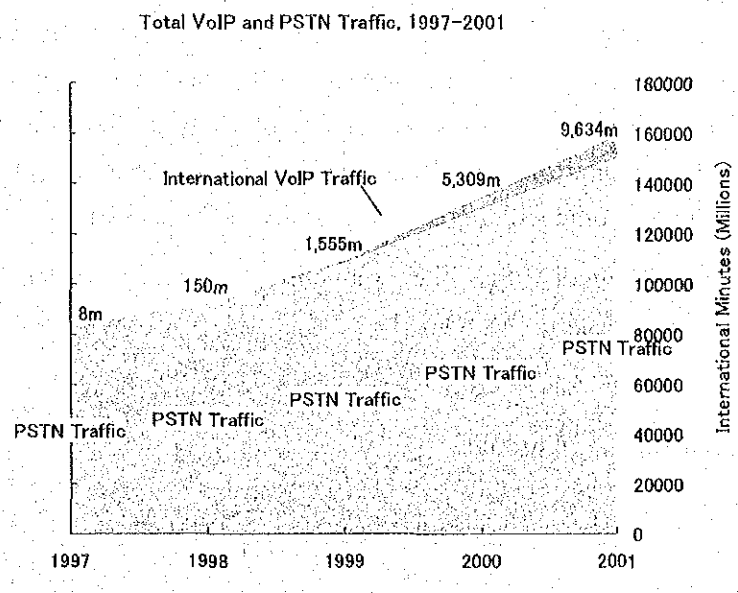
Fig. 7.16 Voice and Data traffic growth in Lao P.D.R.

(2) The problem of the manufactures

Most of all the telecommunication equipment manufacturers except few in the world have withdrawn from producing the Digital Switching System. They are focusing for the production of the cellular mobile and IP equipment. This may cause problem for telecom operators to procure additional equipment and purchase maintenance parts in the future. Once introduced, the telecom operator should utilize equipment for more than 10 to 15 years.

NTT has decided to stop procuring Digital Switching Systems form major manufactures because of their withdrawal from the market and took the countermeasure to purchase the necessary repairing parts that will be necessary for next 10 years at one time in 2002. The major operators like NTT are more or less foreseen this matter and are shifting their network from digital circuit switching to IP based packet switching. It is also true to ETL and LTC as well to be the same.

(3) Introduction of VoIP .



Source : TeleGeography2002

Fig. 7.17 VoIP and PSTN Traffic

As VoIP has become popular and widely used, voice traffic is gradually shifting from the existing fixed telephone network to VoIP. It is estimated at least 6% of total international calls are VoIP world wide at present shown in Fig. 7.17 , and it is also estimated 25% in the 2004. (Source: TeleGeography 2002)

VoIP are used for voice communications in three types; (a) transit calls, (b) calls from ISP to fixed line network, and (c) IP switching systems. In 2002, (a) and (b) are used for the communication, however, (c) are only available for office use and large carrier class switch is under development by manufactures. (Diagrams and detail explanation is given in the supporting document)

In Japan and Korea, where broadband access has advanced, VoIP service is provided by type (b) over the high-speed accesses network such as ADSL, CATV or optical fiber cable to the home.

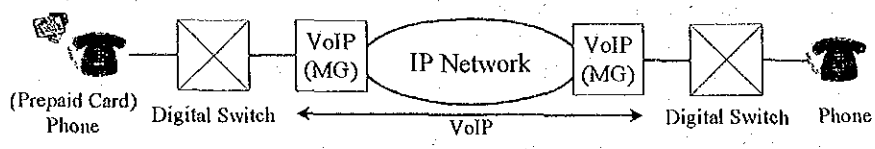
The price and service for long-distance VoIP in type (a) are fiercely competing for charged service among 200 companies in Singapore and more than 50 companies in Hong Kong.

Moreover, TOT and CAT have introduced VoIP in type (a) service for the long distance and the international communication with pre-paid card, and have already placed order for the VoIP equipment equivalent to 200,000 ports in total. (Source: Phone + International 2001 Symposium)

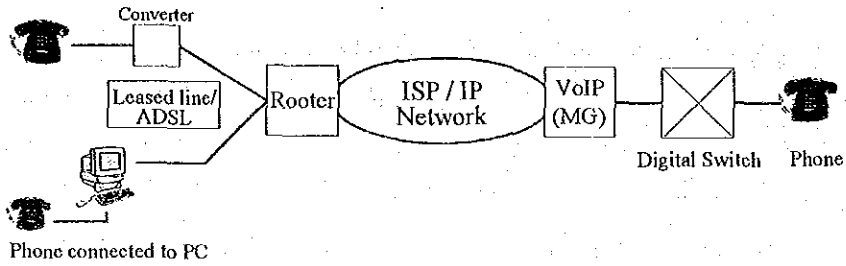
In addition, ETL is planning to introduce international call by VoIP type (a) with Thailand and neighboring countries. Estimated VoIP traffic will grow very rapidly because the relations of both countries are intimate and VoIP makes telephone charge cheaper. Of course, the income from international telephone calls toward Thailand decreases because those are carried by existing digital switching systems. However, the amount of telephone calls to Thailand increase with lower charges and as a whole income will increase eventually in the near future.

It should be reminded that the competition becomes harder because many providers are entering in this market.

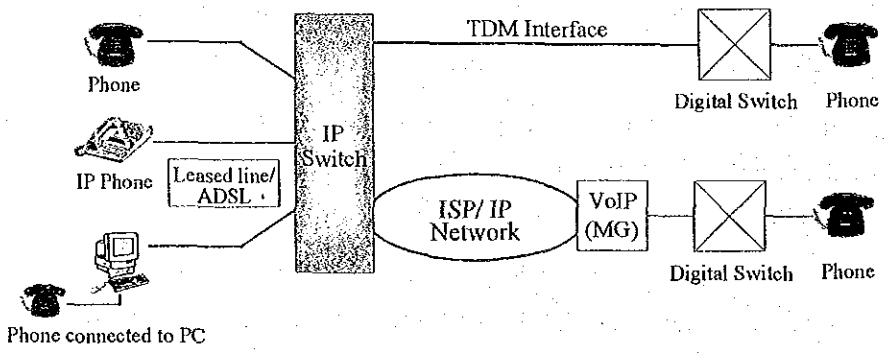
(a) Transit / International



(b) IP Network to PSTN



(c) IP Switching System



Source: Study Team

Fig. 7.18 Type of VoIP

(4) Integration to the IP network

For this study, the Study Team carried out user survey and investigated the possible demand of IP network services in Lao P.D.R.. This estimation is based on the questionnaire and the GDP per capita. Resulting figure for possible IP users including ICT and the Internet access is about 140,000 in the year 2015. A scale is smaller comparing with fixed telephone or cellular mobile telephone.

Active argument was carried out about VoIP at the ITU-D specialist meeting in October 2001. Some useful comments are raised in the following.

1) Expecting profit does not meet the investment cost, if IP network is introduced only for VoIP. (Teria, a Swedish telecom operator)
2) It is economical and profitable when IP network is introduced both VoIP and access to the Internet. (Costa Rica)
3) Incomes of the telecom operator and international settlement have decreased when VoIP is utilized for the international calls. Even tariff should be reconsidered.

The time when VoIP is introduced and when Digital switch is replaced by IP equipment is very important for Lao P.D.R., this is because ETL and LTC is procuring the Digital Switching Systems from Shanghai Bell. It is sure that manufacturing of Digital Switching Systems by Shanghai Bell is continued from a huge demand in China and the Southeast Asia for the time being.

ETL and LTC are eagerly introducing Shanghai Bell equipment to extend the telephone network for the present. As for the advantage of Shanghai Bell MSU, it is reasonable to introduce MSU and extend it with RSU if the capacity of lines is large and installation cost is economically.

It is also considered that ICT developments become more actively in Lao after 2005, and IP infrastructure becomes indispensable. Therefore, investment to IP network will be the key to the future. After 2005, it should be better to cope with existing telephone manufactures whether they continues or deduce production toward 2010. In the year 2005, only few manufactures remain in the digital switching market with less competition, in consequence, the price may increase.

Therefore, it is important when to suspend introducing the existing systems. The Study Team recommends that MSUs for large cities will be introduced until 2005 and stopped, however, RSUs are continued to introduce until 2010 or 2015 to meet the demand in small cities. Service of VoIP is confined only to provide minimum level of service and is used for alternative of existing telephone service in 2005-2010. It is because current switching technology is able to provide voice communication by a simple terminal without local powering. VoIP type (b)

terminal needs powering in user site and is not possible to be used in rural areas.

Moreover, the large-scale VoIP type (c) system for replacing Digital Switching Systems is under development and is completed in 2006-2008. Shanghais Bell or some current digital switching supplier may develop IP interface to interconnect with IP equipment and digital switching system or IP based RSUs to interconnect with existing MSU.

It is recommended that introduction of VoIP will be from 2010 when IP infrastructure is able to handle VoIP. Also, it should be checked and evaluated the available technology, level of the quality of service and the status of manufactures at every 2005, 2010 and 2015.

From 2005 to 2010, transit traffic will be growing rapidly and new transit switching systems may become necessary. In such case, the Study Team recommends that ATM/MPLS system that is able to integrate both circuit switching and IP routing should be introduce instead of MSU. ATM/MPLS system can be used after all MSU has been replaced.

Also, the Study Team summarized the Table 7.8 for the technology and important decision items to be considered for reference. The detail explanation of the technology is stated in the appendix.

Table 7.8 For the Technology and Important Decision Items

	2002	2003/2004	2005	2010	2015	2020
Digital Switching	Major Manufactures withdrawal			All Manufactures withdrawal		Manufactures stop maintenance parts
Technology Available	IP/MPLS		IP/GMPLS	Optical MPLS	Next generation Optical IP	
	SDH/WDM(10Gbps)		WDM(40Gbps)	WDM(2Tbps)	Optical (100Tbps)	Optical (1Pbps)
	Optical (single wave)		Optical (multi wave)	Optical (multi wave)	Optical (soliton)	Optical (soliton)
VoIP Technology	Gateway application (Media GW, Signaling GW)	Soft Switch and Gateway application	Integrated Gateway application	IP Integration Dedicated Systems with direct access	Completion of IP Integration	
VoIP Problems and standardization	QOS (delay, jitter), interconnection	QOS(delay)				
VoIP applicability	Toll calls	Toll and IP origination calls	Toll, IP origination and termination calls			
IP Infrastructure	Infrastructure in major cities	Infrastructure in large provinces	Complete IP Infrastructure in all provinces			
Switching	Digital Switching		Stop introduction of MSUs	Stop introduction of SLTs	Replace existing Digital SW to VoIP	
VoIP	VoIP for experiment	VoIP for toll calls	VoIP for toll and origination from IP to existing	VoIP Switching system introduction		
Mobile	GSM	GSM/GPRS	GSM/GPRS	Introduction of 3G or 4G	Upgrade all network to 4G	

Source: JICA Study Team

7.4 Network Planning for the Future

7.4.1 Improvement of Future Telecommunication Services

Presently, contents of services and service levels of PSTN and the cellular mobile phone are generally sufficient except large amount of backlogs. The Study Team recommends followings;

(1) International telephone service

First, it is recommended that with the existence of many telecommunication operators, gateway function should be developed to present single interface to all operators. In addition to the future growth of international calls, the international switching functions should be separated and new systems should be introduced.

(2) Public telephone service

A public telephone service is still key communication tools for the people who do not own the fixed telephone or cellular mobile telephone in the Lao P.D.R.. Public telephone is important even for the emergency communication. The development of the public telephone should be carried out by both LTC and ETL with the introduction of MSUs and RSUs.

(3) Introduction of intelligent service

While the intelligent services are fully utilized in many developed countries, it is the one choice to introduce a called party billing service for the operators to increase profit. However, being large amount of investment is required for installing intelligent network, it should give more priority to the expansion of the existent telephone network than the introduction of advanced services. First of all, the full satisfaction of waiter shall be considered before introduction of advanced services.

(4) IP and Internet services

The Internet is critically important for the Lao people not only for business, but also for education, social development, and social welfare in the future. The Study Team recommends that the earliest development of IP infrastructure is necessary. Also, the Study Team recommends that the following expansion should be carried out to the local province cities systematically.

1) Improvement of the internet access environment in Vientiane: Increase the number of dial up serves and high speed internet access lines in Vientiane.
2) Improvement of the internet access environment in province centers: In

Luangprabang and Savannakhet, the number of dial up access lines should be increased. Introducing dial up serves to other local province centers. It should be gradually expanded the local dial up servers in accordance with the expansion of backbone and leased line services to those cities.

In the following Table 7.9, the Study Team has summarized the recommendation on network services.

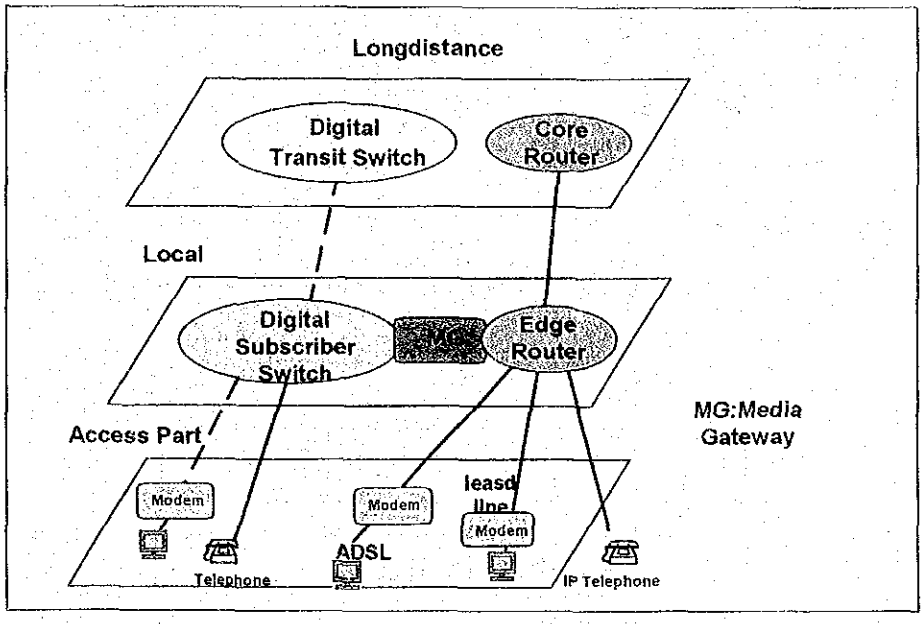
Table 7.9 Network Services for Lao P.D.R.

Network Service	Direction	Solutions
PSTN and the cellular Mobile	Basic services for the ordinal Lao people to use	Expand the service areas to increase the public utility Cover from whole district cities to whole villages
Public telephone	Necessary communication for general and emergency Communications for whole Lao people in every where else and at any time	Public spaces where people gathers and use (especially in rural areas where the number of telephone lines is limited)
International telephone	Earliest introduction of gateway service function to every telecommunication operators and introduction of international leased line services	To separate international telephone getaway function from transit switching function. Provide international leased line services.
Internet and IP services	To enhance IP and internet environment for the education and ICT. To increase access speed and accelerate dial-up servers in local province centers. International IX and Official DNS which represent Lao to international internet users should be introduced should be controlled and operated by officials	High speed Internet access: ADSL or wireless services in Vientiane Internet access: more dial-up servers in province centers International IX (Internet exchange) and DNS (Domain Name Systems) should be controlled by MCTPC and operated by ETL
Leased line services	Introduce leased line services officially to the government, embassies, and large companies	First, introduce of international and domestic service in Vientiane and major cities. Next, expand to the district cities based on the demand.
Operator, directory and guidance service	Operator or guidance for users who first use the telephone service (especially early users) and directory services for all cities are introduced in order to increase the usability.	International operator service should be provided at Vientiane Local directory and guidance service is provided in local cities Service should be introduced with profit and cost consideration English directory should be considered to increase the usage for foreigner and tourists
Intelligent Network services	It should be decided to introduce with the cost and profit analysis	Check the necessity for services
Data Communications	Provide the services by utilizing IP protocols. It should be decided to introduce with the cost and profit analysis	IP infrastructure introduced for ICT and Internet is utilized for data communication

7.4.2 Network Architecture.

(1) Network Architecture until 2005

Network architecture for this period is the parallel development of digital switching technology and IP technology shown in the Fig. 7.19. VoIP available in this period is type (a) and (b). IP network should be developed separately with telephone network, however it should be considered for the future expansion and integration with telephone network. The strategic planning is very important.



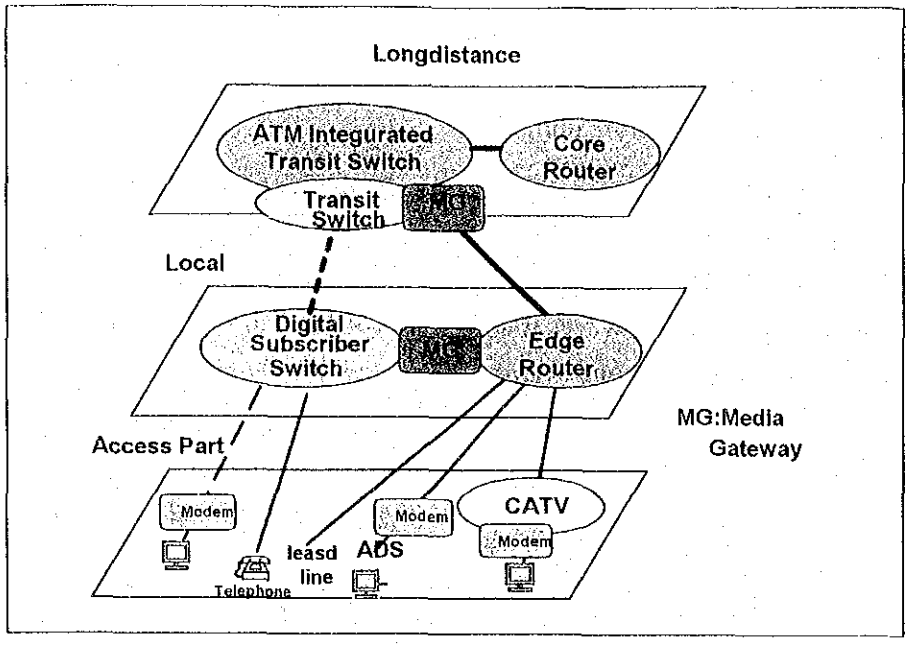
Source: Study Team

Fig. 7.19 Network Architecture for 2005

(2) Network Architecture 2006-2010

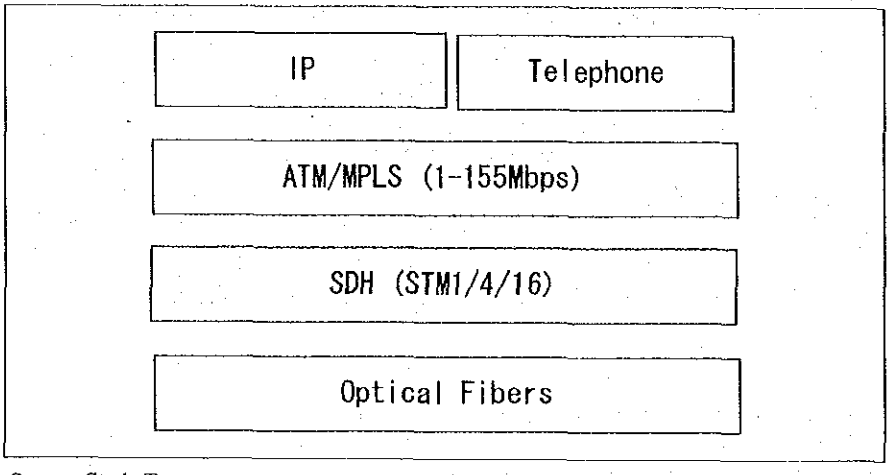
Network architecture for this period is the introduction of large capacity ATM/MPLS for common backbone for telephone and IP if additional capacity less than 155 Mbps is necessary between switches and routers shown in Fig. 7.20. The important point of this period is that no further development on exiting transit switching network shall be made. Instead, if needed, ATM/MPLS systems should be introduced. It should be made good plan for the future integration with the new VoIP type (c) equipment.

Introducing ATM/MPLS systems, the network is layered shown in Fig. 7.20.



Source: Study Team

Fig. 7.20 Network Architecture for the year 2006-2010



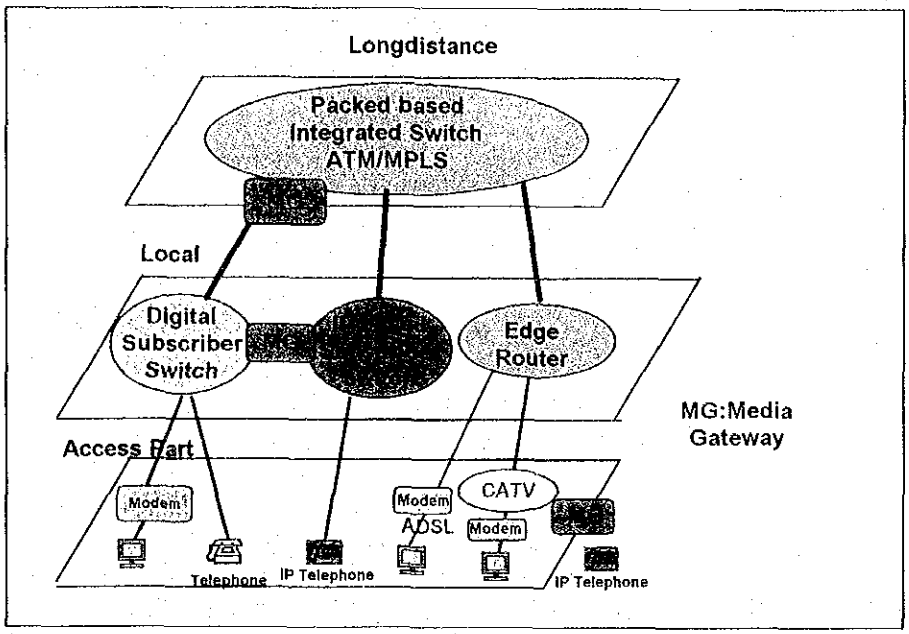
Source: Study Team

Fig. 7.21 Layered structure IP/ATM/MPLS/SDH

(3) Network Architecture 2011-2015

Network architecture for this period is the introduction of large capacity ATM/MPLS for common backbone for telephone and IP if it is necessary shown in Fig. 7.22. The important point of this period is that no further introduction of existing digital switches is made. Only Routers or ATM/MPLS systems together

with IP based RSU or IP based subscriber system (VoIP type (c) equipment) are introduced for the coming IP integration. Also, Fig. 7.22 shows that CATV is also used to access to the Internet. MG (media gateway) will integrate VoIP with the existing telephone system (VoIP type (b)).



Source: Study Team

Fig. 7.22 Network Architecture for the year 2011-2015

(4) International Gateway Systems

Telephone Gateway

- International Switching Systems in Vientiane

Internet Gateway

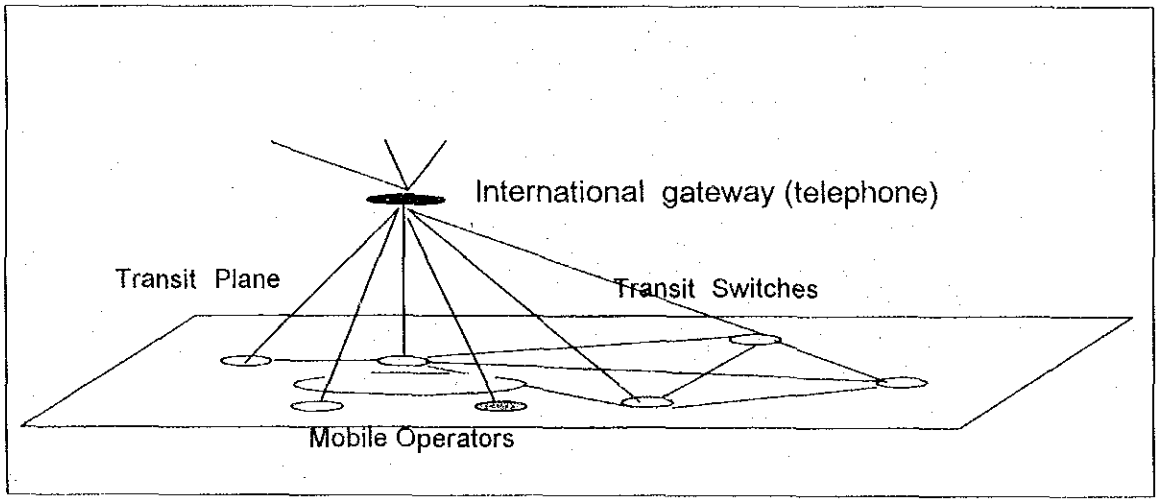
- International IX in Vientiane

1) Gateway for telecommunication

The current international gateway for telephone and leased lines is provided by the transit switching system FETEX150 in Numphou. Due to limitations of the system, FETEX150 is designed for local and transit telephone services and not for international service. The full international gateway function has not been necessary because there is only a single telecommunications provider. However, as there are several telecommunications providers requesting international switching functions, a gateway function has become necessary. To provide an international gateway functions, a new international gateway should be introduced

(Fig. 7.23). As the international traffic is estimated to become large, introduction of the international switch should be completed by 2004.

One single gateway is not sufficient from the point of reliability, the Study Team recommend that second international gateway should be introduced by 2010. From the reliability, international calls are diverted if there are some problems in the main international switching system. Second international gateway should be located in Savannakhet where there are alternative international connections to the Thailand and Vietnams.



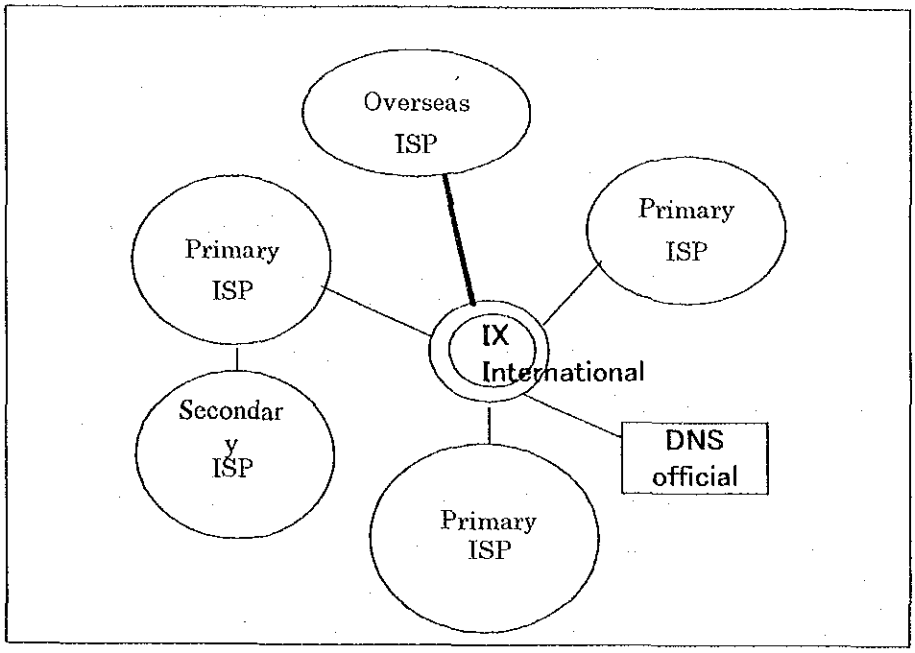
Source: Study Team

Fig. 7.23 International Gateway

2) Gateway for Internet

IX that interconnect ISP with the foreign IXs or ISPs and DNS that handles the official domain name for Lao P.D.R. should be necessary to represent official gateway interface to the foreign countries shown in Fig. 7.24. Providers or operators are able to set their own DSN to keep the copy of the content of official DNS for their use. It is because that the official DNS provides the only information of all the domain names admitted by the government (or official) in Lao P.D.R. to the world. Assuring continuous administration, operation, and maintenance is very important. The Study Team recommends that IX and DNS should be controlled by MCTPC and operated by the public operators (presumably ETL). The necessary equipment is stated in chapter 7.3. Same with the international telephone gateway, second international IX and DNS should be

located in Savannakhet where there are alternative international connections to the Thailand and Vietnams.



Source: Study Team

Fig. 7.24 International Gateway for the Internet

7.4.3 Numbering Plan

The team proposes the reform of numbering plan shown in Table 7.10 for the concept and actual proposal in Table 7.11.

The Study Team allocated in the followings;

- The numbering structure are the same structure for fixed and cellular mobile
- Allocation are made for Vientiane and adjacent areas for "2X", southern parts for "3X", and northern parts for "4X" in order to the people to remember easily.
- Expansion is available for Vientiane from "22" to "2" for future 3 digit local prefix.
- Large cities (Luangprabang, Savannakhet, and Pakse) are allocated two adjacent numbering pools.
- Reallocation is easier when the number of subscriber is small than in 2015 when the total subscriber exceeds one million.
- VoIP numbering
  - VoIP type (c): IP switches are interconnected to the existing PSTN and therefore same numbering scheme is applied. Toll prefix should be assigned different way such as to allocate opposite direction from the end.
  - VoIP type (b): "050" is allocated for the users form computer connecting through IP network.

The number of fixed telephone for Vientiane will be in short. Like most of large cities in the world, prefix number may change to 3 digits from current 2.

MCTPC role

The MCTPC should control the whole numbering structure. If a telecom operator needs new numbers, they request with the MCTPC, and the MCTPC shall assign the prefix and range of the numbers. If the telecom operator needs further reassignment of the numbers, all the arbitration shall be carried out by the MCTPC. The MCTPC will introduce additional numbering scheme such as VoIP numbers, and international settlement of numbers, if necessary.

Table 7.10 Concept for Future Numbering Plan for Lao P.D.R.

A B	0	1	2	3	4	5	6	7	8	9
0										
1										
2		Allocated for the fixed telephone services								
3										
4										
5	IP Telephony for future use	Reserved for the future VoIP services								
6		Allocated for the GSM cellular mobile services								
7										
8	Free phone for future use									
9										

Source: Study Team

Table 7.11 Possible Future Numbering Plan for Lao P.D.R. detail allocation example

A B	0	1	2	3	4	5	6	7	8	9
0										
1										
2			Vientiane Municipality Area						Vientiane Province Area	Special Zone
3		Champasack Area		Saravane Area	Attapeu Area	Sekong Area	Savannakhet Area		Khammuane Area	Borikhamxay Area
4		Xiengkhuang Area	Huaphanh Area	Luangprabang Area		Xayabury Area	Oudomxay Area	Bokeo Area	Luangnamtha Area	Phonsaly Area
5	IP Telephony for future use									
6			Vientiane Municipality Area						Vientiane Province Area	Special Zone
7		Champasack Area		Saravane Area	Attapeu Area	Sekong Area	Savannakhet Area		Khammuane Area	Borikhamxay Area
8	Free phone for future use	Xiengkhuang Area	Huaphanh Area	Luangprabang Area		Xayabury Area	Oudomxay Areea	Bokeo Area	Luangnamtha Area	Phonsaly Area
9										

Fixed Telephone

Mobile Telephone

Note: codes (2 to 3) are allocated to the fixed telephone and codes (6 to 8) are allocated to the mobile

Source: Study Team

Table 7.12 Special special numbering chart for Fixed line services

Code	Emergency service /Special service	Operator	Location
100	ETL Complain (SW & Mobile)	ETL	Several
101	ETL Local / Area Information	ETL	Several
102	ETL National & International Information	ETL	Several
110	MCTPC Internet Dial-Up		Several
111	Education Internet Dial		Several
112	LTC GSM Emergency	LTC	Several
115	Automatic Line Test	ETL/LTC	Several
131	LTC Lao Link for Automatic	LTC	Several
132	LTC Lao Link for Operator	LTC	Several
133	LTC Lao Link for Voice Mail Box	LTC	Several
141	Exactly Time	ETL/LTC	Several
150	ETL Survey & Installation	ETL	Each Local / Area
170	LTC International Operator	LTC	Several
171	LTC National Operator	LTC	Each areas
172	LTC Public Telephone Control	LTC	Several
173	LTC Telephone Installation Survey	LTC	Each Local / Area
175	LTC Telephone Complain	LTC	Each Local / Area
178	LTC Local or Area Information	LTC	Each Local / Area
179	LTC National / International Information	LTC	Several
180	ETL I-Card	ETL	for VOIP
190	Fire Service	ETL/LTC	Each Local / Area
191	Police Service	ETL/LTC	Each Local / Area
195	Ambulance Service	ETL/LTC	Each Local / Area
199	Electricity Complain	ETL/LTC	Each Local / Area

How to use Special Number:

- Dial only 3 digits, it will service you for each service facility
- For Local or Area service: the number can be use only Local or Area.
- For Service: the number can be use for all area with the same service information

Source: MCTPC and ETL, edited by the team

7.4.4 Switching Plan

Estimated installation plan for districts is shown in following Figures. (Fig. 7.25, 7.26, 7.27)