CHAPTER 3

OUTLOOK OF TELECOMMUNICATIONS SECTOR

CHAPTER 3 OUTLOOK OF TELECOMMUNICATIONS SECTOR

3.1 Current Structure of Telecommunications Sectors

3.1.1 Outline of Sector

The Department General of Posts and Telecommunications (DGPT) is a state regulatory body which administrates and regulates all kinds of Posts and Telecommunications activities, and spectrum management in Vietnam.

As for the operating enterprise, Vietnam Posts and Telecommunications (VNPT) is a state organization charged with the responsibility of providing, managing and operating all public telecommunications facilities and services in Vietnam. In addition, the enterprise is also responsible for manufacturing telecommunications equipment. VNPT have the following subsidiaries:

Vietnam Telecom International (VTI) is responsible for the international telecommunication network.
Vietnam Telecom National (VTN) is responsible for the national long distance telecommunication network.
Vietnam Data Communication (VDC) is responsible for the establishment of data communication services. VDC has installed a national X.25 data network and is also responsible for providing Internet services.
Vietnam Mobile Telecom Services (VMS) is responsible for providing mobile telecommunications in Vietnam.
Vietnam Telecom Services (GPC) is responsible for providing nation-wide telecommunications of mobile, paging and cardphone.
Provincial P&Ts are responsible for the provincial telecommunications network as well as the postal services. Each provincial P&T is again sub-divided into P&T organizations by administrative units.

Besides VNPT and its subsidiaries, two (2) companies are granted licenses and in preparation for telecommunications services: VIETEL (Military Electronic and Telecommunications Company) and SAIGON POSTEL (Saigon Posts and Telecommunications Service Company).

3.1.2 National Telecommunications Development Plan

Vietnamese Government has decided to build up a modern and synchronous P&T network throughout the country that can provide diversified and flexible services to meet all demands of socio-economic development of the country.

For this purpose, DGPT has set the policy and targets for National Telecommunications Development Plans up to 2000 and 2010 as described in the followings:

(1) Priority of Telecommunications Development in the National Development Plan
Vietnamese Government has defined that telecommunication is an infrastructure of national economy. Therefore, it is necessary for the telecommunication to go a step ahead in order to serve the development of other branch of National Economy.

(2) Development Plan (up to 2000)

(a) By the year 2000, Vietnam will have 4 telephone sets per 100 inhabitants.

(b) Develop telecommunications network by the direction of modernization of the subscriber network towards state-of-the-art technology, supply high quality services and multi-form services to serve the fields of education, health, training and tele-examining and treating diseases. Almost all villages have been provided with telephone; by the year 2000, 90-95% of provinces will have the inter-province transmission by optical fiber cable.

(c) Continue to upgrade and expand the national communication axis network in order to satisfy every communication demand of the society, ensure national communications safety in all circumstances. There are bypass and preventing lines operating by the procedures 1+1, 1+2.

(d) Develop and expand domestic and international services (basic and value-added services) in order to satisfy in maximum the demand of customers and society. Pay attention in supplying modern communication services to export processing zones, concentrated industrial parks, new developed urban centers.

(3) Development Plan (up to 2010)

(a) By the year 2010, Vietnam will have 12-15 telephone sets per 100 inhabitants.

(b) Telecommunications services will be provided to 100% villages throughout the

country.

(4) Technology and System Development

(a) Carry out the managing of national technology standard after the direction of uniform and synchronism, suited with the international standards.

(b) Research in combination with the application of new technologies and new systems:

i) CDMA
ii) ATM
iii) Fiber optical cable to home
iv) Modern management system and others

(c) As regards the new services, the following new services will be introduced:

i) Internet
ii) ISDN
iii) Electronic Commerce
iv) GMPCS
v) Video on demand and others

3.1.3 On-going Projects

With view of promoting the national telecommunications development plans, VNPT and the affiliated P&T companies are performing various kinds of the on-going projects with participation of foreign investors.

(1) BCC Projects

For the telecommunication business with foreign partner, the Business Cooperation Contract (BCC) scheme has been introduced to enhance the foreign investment in Vietnam. This scheme of BCC is applied to the foreign investors who are able to take returns of the investment from the profits based on the agreement between Vietnamese side and the investors in the form of revenue sharing.

Up to April 1998, nine (9) BCC projects were signed and put into operation. Outlines of these projects are listed in Table 3.1.3-1.

Table 3.1.3-1 On-going BCC Projects between VNPT and Foreign Partners

No.	Project Name	Partner (Country)	Contract Duration	Foreign Capital Contribution
①	Developing International Telecommunications Network and Services	Telstra (Australia)	10 years (1990~2000)	US$ 237 Million
②	Developing Nationwide GSM Network	KINNEVIK (Sweden)	10 years (1995~2005)	US$ 127.8 Million
③	Setting up the Paging Network in the HCMC Area	Voice International (Australia)	9 years (1989~1998)	US$ 725,000
④	Developing and Operating the Public Cardphone Service in HCMC area	Sapura Holding SDN-BHD (Malaysia)	8 years (1993~2001)	US$ 3.571 Million
⑤	Providing Telephone Directory and Yellow Page Directory Services	WORLDCORP HOLDING (Singapore)	5 years (1995~2000)	US$ 842,000
⑥	Developing and Operating the Local Telecom Network in Hai Phong, Hai Duong, Quang Ninh and Hung Yen	Korea Telecom (Korea)	10 years (1996~2006)	US$ 40 Million
⑦	Developing and Operating the Local Telecom Network in the North-East of Ha Noi	NTT Corporation (Japan)	15 years (1997~2012)	US$ 194 Million
⑧	Developing and Operating the Local Telecom Network in the East of Ho Chi Minh City	FCR-France Telecom (France)	15 years (1997~2012)	US$ 467 Million
⑨	Developing and Operating the Local Telecom Network in the West of Ha Noi	Cable & Wireless (U. K)	15 years (1997~2012)	US$ 207 Million

Source: DGPT

VNPT is in negotiation with Telstra (Australia) for a BCC project to develop local telephone network in the East of Ho Chi Minh City (450,000 telephone line).

(2) Joint Venture Project

By April 1998, there have been 8 Joint Venture Companies in the industrial field of VNPT, as shown in Table 3.1.3-2.

Table 3.1.3-2 P&T Joint Venture Companies

No.	Company's Name	Joint-Venture Partner	Address	Investment Capital
①	Vietnam Korea Exchange Ltd.	LG Corporation (Korea)	9th km Hoang Liet, Thanh Tri - Ha Noi	US$ 4 million Vietnamese Party:50%
②	VINADAESUNG Joint Venture Company	Daesung Cable Company (Korea)	Yen Vien - Ha Noi	US$ 7.2 million Vietnamese Party:45.2%
③	Optical Fiber Cable Manufacturing J.V Company (VINA-GSC)	GSC and LGIC	Yen Vien - Ha Noi	US$ 8.1 million Vietnamese Party:50%
④	ALCATEL Network System Vietnam(ANSV)	Alcatel Corp. (France)	Nghia Tan - Ha Noi	US$ 4.7 million Vietnamese Party:49%
⑤	Fiber Optic Cable and Accessories Ltd. (Focal)	Siemens Corp. (Germany)	Thuan An - Binh Duong	US$ 10 million Vietnamese Party:49%
⑥	Telecommunications Equipment Ltd.(TELEQ)	Siemens Corp. (Germany)	Thuan An - Binh Duong	US$ 4 million Vietnamese Party:40%
⑦	VNPT-Fujitsu Telecommunications Systems Ltd. (VFT)	Fujitsu Corporation (Japan)	Hoai Duc - Ha Tay	US$ 12 million Vietnamese Party:50%
⑧	VINECO	NEC Corporation (Japan)	Tu Liem - Ha Noi	US$ 12 million Vietnamese Party:50%

Source: DGPT

(3) Projects of VNPT State Member Companies

Operation enterprises of VNPT State Member Companies such as P&Ts, VTN, VTI, VDC, VMS, GPC, etc. are executing each operation business in the field of telecommunications for two kinds of the projects: ① on a basis of own fund and ② on a basis of foreign supplier credit of funding.

3.2 Current Status of Telecommunications Services

3.2.1 Services Classified by Organizations

(1) General

Under the VNPT, there are five (5) major State Telecommunications Service Operating Companies in Vietnam: VTN (Vietnam Telecom National), VTI (Vietnam Telecom International), VDC (Vietnam Data Communication), VMS (Vietnam Mobile Telecom Services) and GPC (Vietnam Telecom Services).

The structural organization and the providing services are illustrated in Figure 3.2.1-1.

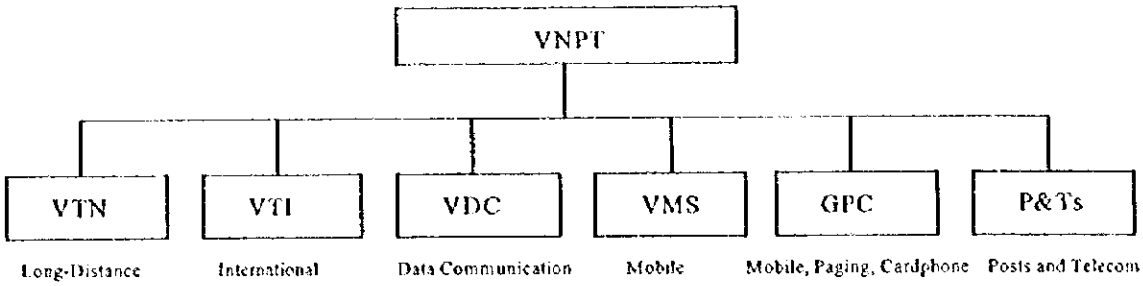


Figure 3.2.1-1 Telecommunications Service Operating Companies

(2) Classification of Providing Services by Operator

The services by operator are listed in Table 3.2.1-1 in relation to the services in operation and under development.

Table 3.2.1-1 Services Classification by Operators

Services	In Service	Planning	Operators
-Basic Telephone Domestic	○		VTN, P&T
- Telephone International	○		VTI, P&T
- Video Phone	○		VTN, P&T
- Card Pay Phone	○		P&T, GPC
- Facsimile	○		P&T
- ISDN, - ATM		○ under study	VTN, VTI, VDC
- Telegram	○		P&T
- Mobile Communication - CDMA	○	○	VMS, GPC
- Paging	○		6 operators
- Data Communication - Packet Switching	○ ○		VDC, others VDC, others
- Leased Circuits	○		VTN, VDC, VTI
- Inter. Frame Relay		○	VTI,VDC
- E-Mail	○		VDC, others
- Internet	○		VDC, FPT, Saigon Postel, Information Technology Institution, VIETEL

3.2.2 Telephone Service

(1) Breakdown of the Domestic Telephone Services

Telephone service is provided to 100% of districts with digital exchanges and about two-third of communes are able to access to the telephone at the end of 1997. The telephone service provided are tabulated as follows:

Table 3.2.2-1 Domestic Telephone Services

Item	Service	Detailed Service Items	Remark
①	Addressing Related	- Abbreviated Dialing - Fixed destination dialing	Automatic
②	Call Completion	- Call completion to no-reply - Call waiting	Automatic
③	Call Diversion	- Call forwarding busy - Call transfer	Automatic
④	Number Identification	- Calling line ID presentation - Malicious call Identification	Automatic
⑤	Call Charge	- Ring back pricing	Automatic
⑥	Multi-Party	- Multi-party conference - Three-party conference	Automatic
⑦	Restriction	- Call transfer restriction - Outgoing call barring	Automatic
⑧	Priority service	- Very urgent - Urgent - National safety	Manual
⑨	Invitation Card Service	- The caller requests the receiver to speak from - A public phone (with operator)	Semi-automatic
⑩	Lease Line	Post office leases the secret line	

Source DGPT/VNPT

(2) New Services

Following new services are under development:

(a) N-ISDN

(b) Mobile and WLL (CDMA)

(c) Video Conference

(d) Electronic Commerce

(3) Capacity for Telephone Service

Present conditions of Telephone Service by provinces such as Number of Capacity, Number of Subscriber and Usage Ratio of Facilities are shown in Table 3.2.2-2.

Table 3.2.2-2 Telephone Service

No	Province	Abbreviation	Capacity of Facility	Number of Subscriber	Usage Ratio of Facility	Remark
1	Ha Noi	HNI	359,160	268,748	74.8%	
2	Hoa Binh	HBH	10,880	6,313	58.0%	
3	Lao Cai	LCI	8,900	6,049	68.0%	
4	Lang Son	LSN	14,516	9,707	66.9%	
5	Bac Ninh	BNH	13,888	11,294	81.3%	
6	Bac Giang	BGG	18,324	11,835	64.6%	
7	Cao Bang	CBG	6,532	3,779	57.9%	
8	Thai Nguyen	TNN	18,468	13,523	73.2%	
9	Bac Can	BCN	3,752	1,902	50.7%	
10	Phu Tho	PTO	27,333	20,902	76.5%	
11	Vinh Phuc	VPC	11,662	8,631	74.0%	
12	Tuyen Quang	TQG	8,434	4,912	58.2%	
13	Yen Bai	YBI	10,156	5,995	59.0%	
14	Son La	SLA	9,056	6,049	66.8%	
15	Lai Chau	LCU	6,110	3,934	64.4%	
16	Ha Giang	HGG	4,960	3,849	77.6%	
17	Ha Tay	HTY	32,846	25,963	79.0%	
18	Ha Nam	HNM	10,896	5,658	51.9%	
19	Nam Dinh	NDH	21,456	17,330	80.8%	
20	Thai Binh	TBH	18,106	13,387	73.9%	
21	Hai Duong	HDG	33,812	27,607	81.6%	
22	Hung Yen	HYN	11,472	7,513	65.5%	
23	Hai Phong	HPG	50,432	40,080	79.5%	
24	Quang Ninh	QNH	39,580	24,643	62.3%	
25	Ninh Binh	NBH	10,560	6,250	59.2%	
26	Thanh Hoa	THA	28,336	20,011	70.6%	
27	Nghe An	NAN	59,891	37,084	61.9%	
28	Ha Tinh	HTH	13,088	7,849	60.0%	
29	Quang Binh	QBN	12,924	9,006	69.7%	
30	Quang Tri	QTI	13,802	9,700	70.3%	
31	Thua Thien Hue	TTH	23,592	20,761	88.0%	
32	Da Nang	DNG	35,283	32,421	91.9%	
33	Quang Nam	QNM	19,060	13,731	72.0%	
34	Quang Ngai	QNI	17,696	15,423	87.2%	
35	Binh Dinh	BDH	29,972	23,232	77.5%	
36	Gia Lai	GLI	19,734	13,411	68.0%	
37	Dac Lac	DLC	22,580	12,699	56.2%	
38	Phu Yen	PYN	16,600	9,561	57.6%	
39	Khanh Hoa	KHA	40,471	32,371	80.0%	
40	Kon Tum	KTM	6,072	4,487	73.9%	
41	Lam Dong	LDG	33,834	28,048	82.9%	
42	Binh Thuan	BTN	28,009	21,008	75.0%	
43	Ninh Thuan	NTN	14,790	10,294	69.6%	
44	TP Ho Chi Minh	HCM	415,035	343,241	82.7%	
45	Dong Nai	DNI	61,104	46,120	75.5%	
46	Binh Duong	BDG	39,180	26,826	68.5%	
47	Binh Phuoc	BPC	7,872	6,336	80.5%	
48	Tay Ninh	TNH	23,668	18,127	76.6%	
49	Ba Ria - Vung Tau	VTU	34,278	28,009	81.7%	
50	Long An	LAN	24,341	19,384	79.6%	
51	Tien Giang	TGG	27,482	21,101	76.8%	
52	Ben Tre	BTE	26,176	16,881	64.5%	
53	Tra Vinh	TVH	16,220	10,843	66.8%	
54	Vinh Long	VLG	15,006	11,952	79.6%	
55	Can Tho	CTO	37,352	29,674	79.4%	
56	Dong Thap	DTP	26,484	17,190	64.9%	
57	An Giang	AGG	40,609	31,028	76.4%	
58	Kien Giang	KGG	35,826	27,266	76.1%	
59	Ca Mau	CMU	21,761	13,844	63.6%	
60	Bac Lieu	BLU	12,714	10,033	78.9%	
61	Soc Trang	STG	18,757	12,922	68.9%	
Grand Total			*2,080,893*	*1,567,727*	*75.3%*	

Source: DGPT (as of August 1998)

(4) Rural / Remote Telecommunications Services

The telephone penetration ratios are indicated district by district based on the result of site survey. These values are largely different in urban and rural/remote areas. The telephone penetration ratio is more than several tens of times in district by district, i.e., that in urban area such as provincial capital is high, but that in rural/remote area is extremely low in penetration. (See Figure 7.1.1-7)

It can be considered that the difference is caused by the following factors:

- Difference of demand scale between urban and rural/remote areas
- Expensive construction cost in rural/remote areas
- Difficulty of construction from the viewpoint of geographical conditions

3.2.3 Mobile Communications Services

(1) Cellular Mobile Telephone Services (CMTS)

(a) General

At present, cellular mobile telephone services are provided by three (3) providers and planned to be provided by two (2) new providers in Vietnam as follows:

Table 3.2.3-1 Cellular Mobile Service Providers

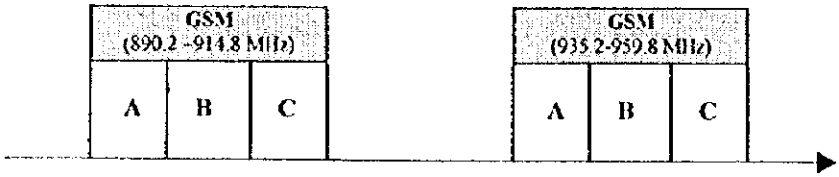
Name of Provider		Type of System	Remarks
VMS (MobiFone)	Vietnam Mobile Service (VMS) provides services based on business cooperation contract between VNPT and Comvik, which is a Swedish company. VMS provides GSM cellular services as a brand of "**MobiFone**".	GSM	
GPC (VinaPhone)	Vietnam Telecom Service Company (or GSM, Paging and Card (GPC)), which is a subsidiary company of VNPT and branded "**VinaPhone**", provides GSM cellular services nation-wide. VinaPhone provides services not only in profitable areas, but also in non-profitable areas nation-wide.	GSM	
Saigon Mobile Telephone Company (Call Link)	Saigon Mobile Telephone Company, which is a joint venture branded "**Call Link**" of Singapore Telecom and Ho Chi Minh P&T, provides analog cellular services in Ho Chi Minh City.	Analog AMPS/ D-AMPS	
VIETEL	VIETEL, which was granted a license in 1996, and plan to provide cellular mobile service nation-wide.	CDMA (800 MHz)	Plan
Saigon Postel	Saigon Postel, which was granted a license in 1996, and plan to provide cellular mobile service in Mekong Delta region, then nation-wide.	CDMA (800 MHz)	Plan

Source: DGPT

The radio frequency for cellular mobile services is assigned among these

providers as follows:

[GMS Frequency Band]



A: VinaPhone (8 x 2 MHz), C: MobiFone (8 x 2 MHz)

B band (8.6 x 2 MHz) is not used.

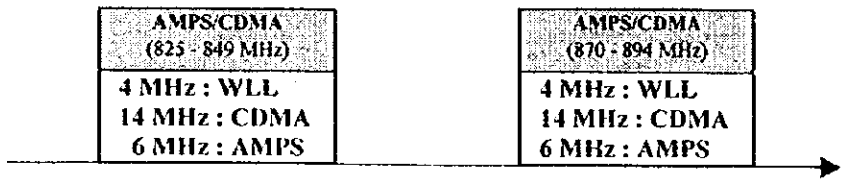
[AMPS/CDMA Frequency Band]

The frequency bands for AMPS and CDMA have been modified in Vietnam, and are narrowed down to 20 MHz x 2 at present, 24 MHz x 2 in the future from 25 MHz x 2 for co-existence with GSM frequency bands, respectively.

At present

5 MHz is assigned to a WLL (GMH 2000), and 10 MHz is assigned to AMPS (Call Link).

In future



4 MHz is assigned to a WLL (GMH 2000), 6 MHz is assigned to AMPS including D-AMPS (Call Link) and 14 MHz is assigned to CDMA (Mobile & WLL) by VIETEL and Saigon Postel.

Figure 3.2.3-1 Frequency Assignment for Cellular Mobile Services

(b) Service Conditions

i) Service Areas

The service areas of the cellular mobile telephone services are shown in Figure 3.2.3-2 and Table 3.2.3-2.

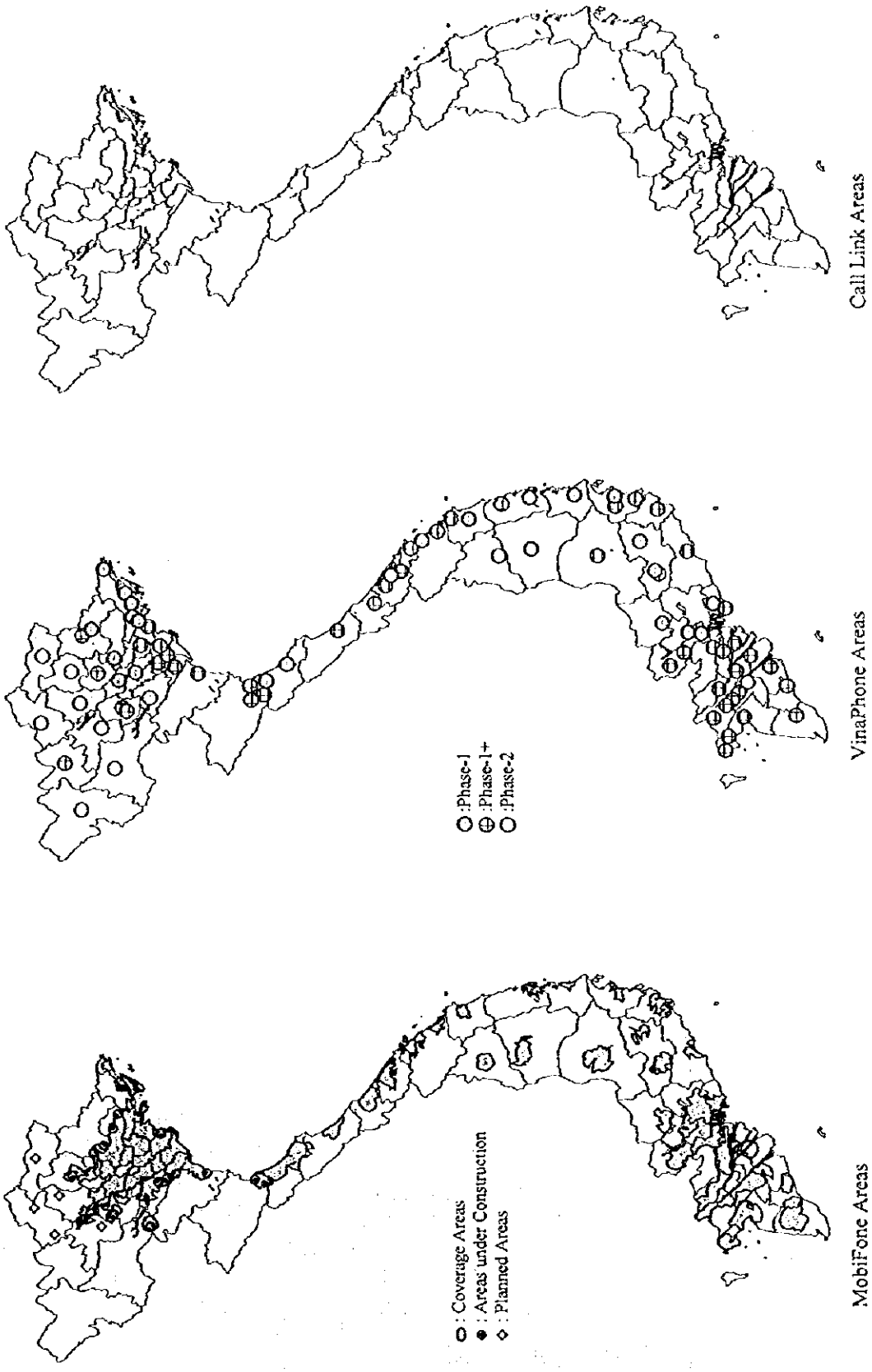


Figure 3.2.3-2 Service Areas of Cellular Mobile Telephone Services

Table 3.2.3-2 Service Areas of Cellular Mobile Telephone Services

Service Provider	Service Areas	Remarks
MobiFone	Ha Noi, Ha Dong, Phu Lo, Van Dien, Hai Duong, Bac Giang, Gia Lam, San bay Noi Bai, Lang Son, Mong Cai, Cam Pha, Bai Chay, Ha Long, Hai Phong, Do Son, Ninh Binh, Thanh Hoa, Viet Tri, Son Tay, Phu Ly, Nam Dinh, Ha Tinh, Vinh, Dong Hoi, Dong Ha, Huong Tra, Hue, Huong Thuy, Da Nang, Non Nuoc, Hoi An, Hoa Khanh, Tam Ky, Quang Ngai, An Nhon, Dieu Tri, Qui Nhon, Kon Tum, Pleiku, Buon Me Thuot, Tuy Hoa, Nha Trang, Phan Rang, Phan Thiet, Da Lat, Bao Loc, Long Khanh, Long Binh, Long Thanh, Dong Xoai, Thuan An, Tay Ninh, Go Dau, Tan Bien, Thu Dau Mot, Thu Duc, Bien Hoa, San Golf VN, Ba Ria, Phu My, Vung Tau, TP. HCM, Hoc Mon, Cu Chi, Binh Chanh, Binh Dien, Tan An, Ben Tre, My Tho, Tra Vinh, Vinh Long, Cao Lanh, Hong Ngu, Chau Doc, Long Xuyen, Rach Gia, Ha Tien, Can Tho, Soc Trang, Bac Lieu, Ca Mau	As of June 1998 Total No. of Provinces & Cities: 98
VinaPhone	Ha Noi, Ha Tay, Lao Cai, Phu Tho, Vinh Phuc, Lang Son, Thai Nguyen, Bac Giang, Bac Ninh, Hai Duong, Hung Yen, Quang Ninh, Hai Phong, Thai Binh, Ha Nam, Nam Dinh, Ninh Binh, Thanh Hoa, Nghe An, Ha Tinh, Quang Binh, Quang Tri, Thua Thien Hue, Da Nang, Quang Nam, Quang Ngai, Binh Dinh, Phu Yen, Khanh Hoa, Gia Lai, Dac Lac, Tay Ninh, Binh Phuoc, Binh Duong, Long An, Tien Giang, Ba Ria – Vung Tau, Ho Chi Minh, Dong Nai, Ninh Thuan, Binh Thuan, Lam Dong, Can Tho, Dong Thap, An Giang, Vinh Long, Soc Trang, Ca Mau, Bac Lieu, Kien Giang, Tra Vinh, Ben Tre	As of end of June 1997 Total No. of Provinces: 52
Call Link	Ho Chi Minh, Ding Nai, Ba Ria Vung Tau, Song Be	

Source: DGPT

Most of the provinces, especially provincial capitals, are covered by cellular mobile services as mentioned-above.

ii) Number of subscribers

The annual trend of the number of subscribers is shown in Table 3.2.3-3.

Table 3.2.3-3 Number of Subscribers

Year	1993	1994	1995	1996	1997	June 1998	Dec.1998	June1999
No. of Subscribers	4,060	10,000	25,830	59,000	108,200	167,500	234,032	266,293

Source: DGPT

Based on the newest data, of which date is different, the number of subscribers in each province are summarized in Table 3.2.3-4 and

Appendix I-3-1.

Table 3.2.3-4 Number of Subscribers in Each Zone

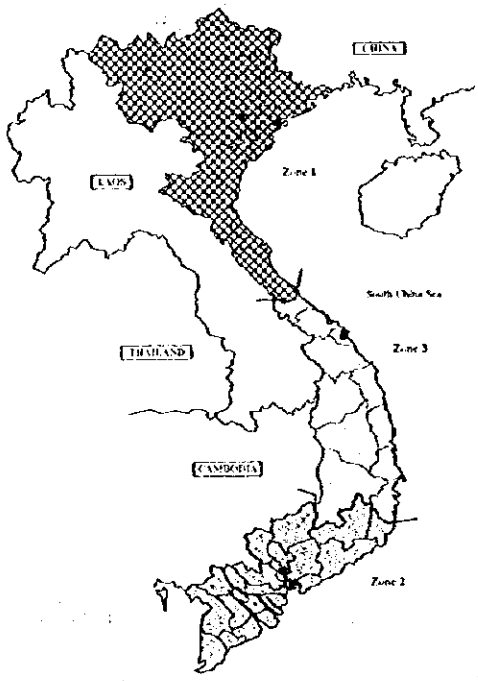
Province	VinaPhone (5 Aug. 98)	MobiFone (Sep. 98)	Call Link (30 June 98)	Total	Remarks
North Total	24,147	32,289	0	56,436	
South Total	19,801	116,379	13,610	149,790	
Central Total	4,405	4,614	0	9,019	
Total	48,353	153,282	13,610	215,245	

Source: DGPT

Subscribers of cellular mobile services are concentrated in Ha Noi and Ho Chi Minh City, especially more than half of total is being used in Ho Chi Minh City. These conditions show that the number of subscribers is strongly linked with economic activities in urban areas.

iii) Zone for tariff

The tariff of cellular mobile service is established by DGPT, so tariffs of service providers are the same among service providers. Appendix I-3-2 shows the tariff of cellular mobile service.



The service areas are divided into three (3) zones in nation-wide as shown in Figure 3.2.3-3.

Zone 1: Northern region from Quang Binh province

Zone 2: Southern region from Lam Dong province and Ninh Thuan province

Zone 3: Region between Quang Tri province and Khanh Hoa province including highland areas

Source: DGPT

Figure 3.2.3-3 Zone of Cellular Mobile Area

iii) Traffic Conditions

Based on the data obtained through the survey, traffic for cellular mobile service in nine (9) provinces is derived as shown Table 3.2.3-5 with an average of 0.0021 erlang per subscriber, this value is not so high.

Table 3.2.3-5 Traffic of Cellular Mobile Service

Item / Province	No. of Subscribers	Call Minutes in 1997	Traffic (erl/sub)	Remarks
Nghe An	775	566,828	0.0014	VinaPhone subscribers
Thua Thien-Hue	214	442,665	0.0039	
Da Nang	1,221	3,342,636	0.0052	
Quang Ngai	308	155,070	0.0010	
Khanh Hoa	816	886,304	0.0021	
Ria-Vung Tau	835	830,462	0.0019	
An Giang	761	13,010	0.0000	
Can Tho	1,137	948,175	0.0016	
Ho Chi Minh City	101,917	112,463,000	0.0021	All Mobile subscribers
Total	107,984	119,650,147	0.0021	

Source: DGPT

(2) Maritime Mobile Services

(a) General

Maritime mobile services are provided by VINAMARINE (Vietnam Maritime Bureau) under the control of the Ministry of Transport.

As maritime mobile service, GMDSS (Global Maritime Distress and Safety System) is introduced in Vietnam. However, the services have been suffered from operational and functional deficiency due to shortage of facilities/equipment.

The GMDSS provides a global communications network to support search and rescue activities. The coverage by the GMDSS is classified into the following areas:

i) Area A1

A range of shore-based VHF coast stations (20 – 30 nautical miles)

ii) Area A2

A range of shore-based MF coast stations (about 100 nautical miles excluding A1 area)

iii) Area A3

A coverage of geostationary communication satellites INMARSAT

(approximately between latitude 70° north - 70° south, excluding A1 and A2 areas)

iv) Area A4

The remaining sea areas outside A1, A2 and A3 areas

(b) Service Conditions

In Vietnam the service of GMDSS is limited in an Area A1, and the expansion project of the GMDSS is on-going.

(3) Radio Paging Service

(a) General

The radio paging services are provided by the several companies as follows:

Table 3.2.3-6 Radio Paging Service Providers

Provider		Type of System	Remarks
Vietnam Paging Center	Paging service provided by Vietnam Telecom Services Company (GPC).	280 MHz band POCSAG	
Phone Link	N.A.	170 MHz band POCSAG	
Epro	N.A.	280 MHz band POCSAG	
MCC	JV of Voice International (Australia) and Ho Chi Minh P&T	POCSAG	
Ha Noi ABC	JV of ABC Communications and Ha Noi P&T	280 MHz band POCSAG	
Saigon ABC	JV of ABC Communications (Hong Kong) and Ho Chi Minh P&T	280 MHz band POCSAG	

Source: DGPT

(b) Service conditions

i) Service areas

Table 3.2.3-7 Radio Paging Service Areas

Provider	Service Areas	Remarks
Vietnam Paging Center	Nationwide	
Phone Link	All provinces have been covered by January 1998.	
Epro	N.A.	
MCC	N.A.	
Ha Noi ABC	Ha Noi area	
Saigon ABC	Ho Chi Minh area	

Source: DGPT

The detailed service areas by Vietnam Paging Center is shown in Figure 3.2.3-4 and Table 3.2.3-8.

Table 3.2.3-8 Service Areas by Vietnam Paging Center

Region	Service Area	Remarks
North	9 areas Ha Noi, Hai Doung, Hai Phong, Quang Ninh, Ninh Binh, Thanh Hoa, Nghe An, Bac Giang, Lang Son	
Central	5 areas Da Nang, Tam Ky, Hue, Qui Nhon, Nha Trang	
South	7 areas Ho Chi Minh City, Vung Tau, Can Tho, Song Be, Lam Dong, Tay Ninh, Dong Nai	
Total	21 areas (provinces/cities)	

Figure 3.2.3-4 Provinces/Cities of Paging by Vietnam Paging Center's

ii) Number of subscribers

The annual trend of the number of paging subscribers is shown in Table 3.2.3-9. The number is less than that of cellular services.

Table 3.2.3-9 Number of Subscribers

Year	1993	1994	1995	1996	1997	6/1998
No. of Subscribers	13,800	40,000	71,950	111,000	120,000	126,400

Source: DGPT

The number of subscribers by service provider is attached in Appendix I-3-1.

Through the survey, the number of paging subscribers was obtained in seven (7) provinces as shown Table 3.2.3-10.

Table 3.2.3-10 Number of Paging Subscribers

Province	No. of Subscribers	Remarks
Thua Thien-Hue	185	
Da Nang	1,870	
Quang Ngai	141	
Khanh Hoa	495	
Ba Ria-Vung Tau	723	
An Giang	452	
Can Tho	787	
Ho Chi Minh City	96,416	PhoneLink: 22,407, Epro: 14,000 Vietnam: 19,820, MCC: 15,757 ABC: 24,432 (as Of 30 June 1998)
Total	101,069	

Source: DGPT through Site Survey

3.2.4 Non-Voice Services

Various kinds of non-voice services are being provided by several providers. The major service provider of non-voice services is VDC (Vietnam Data Communication Company, a subsidiary of VNPT), and VDC provides the following services in Vietnam:

- VIETPAC : The national packet switched data network, which supports X.25 and X.28.
- VNN : Vietnam Net/Internet service.
- VNMAIL : online X.400 email service.
- WEB. : Homepage design and programming.
- Integrated solutions: LAN, WAN, INTRANET, MAN
- Software applications
- Electronic Yellow Pages and directories

(1) Packet Service

The packet services, named "VIETPAC" were launched in 1993.

(a) Service Menu

The following types of Packet services are provided:

Table 3.2.4-1 Types of Packet Services

Type of Service		Speed	Service Areas
X.28 Interface	Direct-Access type (Domestic, International)	300, 1200, 2400, 4800, 9600 bps	Ha Noi Ho Chi Minh Da Nang
	Dialup-Access type (Domestic, International)	300, 1200, 2400, 4800, 9600 bps	Ha Noi Ho Chi Minh Da Nang
X.25 Interface	Direct-Access type (Domestic, International)	2400, 4800, 9600, 19200, 48000, 64000 bps	Ha Noi Ho Chi Minh Da Nang

Source: DGPT

(b) Number of Subscribers

Table 3.2.4-2 Number of Subscribers of Packet Services (as of 30 June 1998)

Type of Service		Speed	No. of Subscribers	Remarks
X.28 Interface	Direct-Access type (Domestic, International)	300 bps	N.A.	
		1200 bps		
		2400 bps		
		4800 bps		
		9600 bps		
	Dialup-Access type (Domestic, International)	300 bps	113	
		1200 bps		
		2400 bps		
		4800 bps		
		9600 bps		
X.25 Interface	Direct-Access type (Domestic, International)	2400 bps	116	
		4800 bps		
		9600 bps		
		19200 bps		
		48000 bps		
		64000 bps		

Source: DGPT

(2) Internet Services

(a) General

Internet services can be classified into the following providers:

- Internet Access Provider (IAP): In Vietnam, IAP is limited to VDC.
- Internet Service Provider (ISP)
- Internet Content Provider (ICP)

Internet services, especially ISP, have been provided by the following five (5) companies:

i) VDC

Internet service named "VNN" is provided by VDC from November 1997.

VNN can be connected through PSTN, VIETPAC and dedicated line, and includes the following services:

- E-mail
- World Wide Web (WWW)
- FTP

ii) FPT (Financing and Promoting Technology)

iii) Saigon Postel

iv) Information Technology Institution

v) VIETEL

(b) Service conditions

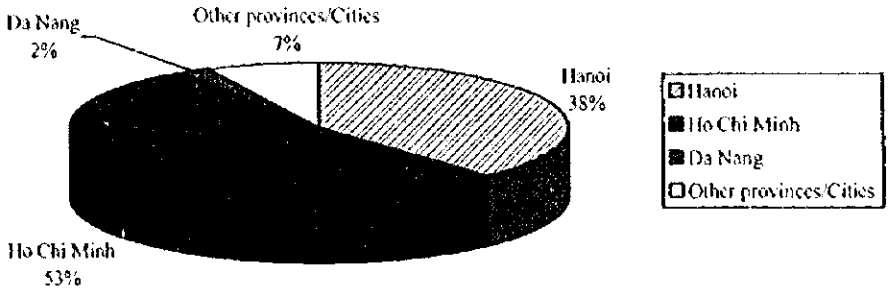
The numbers of users are summarized by provider and by area in Table 3.2.4-3.

Table 3.2.4-3 Number of Internet Users

Provider	Area	No. of Users	Remarks
VDC (VNPT)	Ha Noi	1,448	
	Ho Chi Minh	3,208	
	Da Nang	153	
	Other provinces/Cities	585	
	Sub-Total	5,394	
FPT (Financing and Promoting Technology)	Ha Noi	905	
	Ho Chi Minh	850	
	Sub-Total	1,755	
Saigon Postel	Ho Chi Minh	190	
	Sub-Total	190	
Information Technology Institution	Ha Noi	743	
	Sub-Total	743	
Total	Ha Noi	3,096	Total 18,170 as of Dec.1998 30,142 as of June 1999
	Ho Chi Minh	4,248	
	Da Nang	153	
	Other provinces/Cities	585	
	Grand Total	8,082	

As of 20 June 1998
Source: DGPT

The detailed data by province is shown in Appendix I-3-1.



Source: DGPT

Figure 3.2.4-1 Internet Users by Area

Most of users are concentrated in Ha Noi and Ho Chi Minh City, it means that the users are significantly linked with business activities as same as cellular mobile services.

In addition to the above macroscopic data of users, the number of users in several provinces was obtained through the survey as shown in Table .3.2.4-4.

Table 3.2.4-4 Internet Users in Provinces

Province	No. of Internet Users	Remarks
Thua Thien-Hue	24	
Da Nang	170	
Khanh Hoa	73	
Ria-Vung Tau	57	E-Mail: 22
An Giang	5	

Source: DGPT

The Internet service was commenced in November 1997, but the number of users is not increased compared with the expected demand.

In addition, many Vietnamese worried about the availability of decadent materials on the net.

3.2.5 Leased Line Services

The leased line services are classified into domestic and international leased line services. Each service is mentioned below:

(1) Domestic Leased Line Services

(a) Service Menu

The following domestic leased line services are provided by VDC:

Table 3.2.5-1 Domestic Leased Line Services

Service Menu			Remarks
Voice Channel			
Data Channel (Low Speed)		Up to 9600 bps	
		9600 bps	
		64 kbps or more	
Intra-city	High speed	64, 128, 256, 384, 1544, 2048 kbps	
Long Distance	Low speed	up to 64 kbps	
	High speed	64, 128, 256, 384, 1544, 2048 kbps	

Source: DGPT

(b) Number of Subscribers

The number of domestic leased line subscribers is shown in Table 3.2.5-2.

Table 3.2.5-2 Number of Domestic Leased Line Subscribers

Service Menu			No. of Subscribers	Remarks
Voice Channel			0	
Data Channel (Low Speed)		Up to 9600 bps	0	
		9600 bps	0	
		64kbps -	9	
Intra-city	High speed	64 kbps	0	
		128 kbps	0	
		256 kbps	0	
		384 kbps	0	
		1544 kbps	0	
		2048 kbps	3	Ha Noi-HCM for VMS
Long Distance	Low speed	up to 64 kbps	1	19.2 kbps
Others & unknown speed			1,901	
Total			1,914	

Source: DGPT

The detailed data and information regarding transmission speed could not be obtained through this stage, but the number of high speed leased lines is not so large. (2 Mbps leased lines are mainly used for approach links of cellular mobile telephone services, and other leased lines are of 64 kbps or lower.)

(2) International Leased Line Services

(a) Service Menu

International leased line services are provided by VDC, and their connection centers are located at the international gateways (Ha Noi, Ho Chi Minh, Da Nang).

Table 3.2.5-3 International Leased Line Services

Service Menu		Remarks
Telephone	M1040 class	
	M1020 class	
Telex	Simplex	
	Duplex	
Data (Low Speed)	300, 1200, 2400, 4800, 9600 bps	
Data (High Speed)	56, 64, 128, 192, 256, 384, 512, 768, 1024, 1152, 1544, 2048 kbps	

Source: DGPT

(b) Number of Subscribers

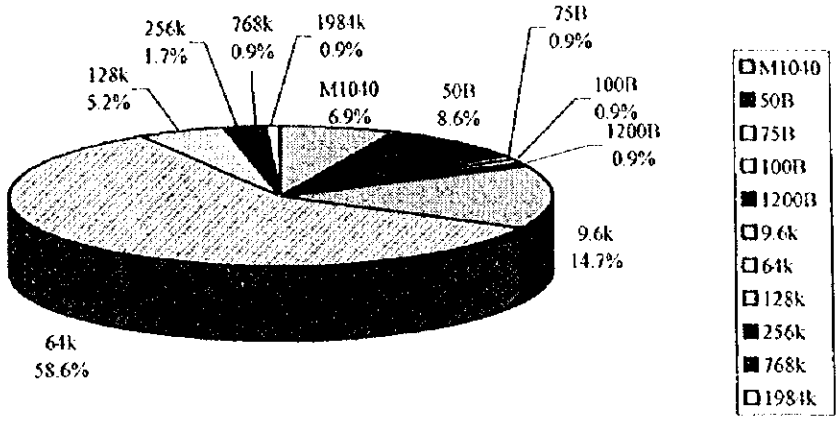
The number of international leased line subscribers is shown in Table 3.2.5-4.

Table 3.2.5-4 Number of International Leased Line Subscribers

Service Menu		No. of Subscribers	Remarks
Telephone	M1040 class	11	
	M1020 class	0	
Telex	Simplex	0	
	Duplex	0	
Data (Low Speed)	50 bps	11	
	75 bps	1	
	100 bps	1	
	300 bps	0	
	1200 bps	1	
	2400 bps	0	
	4800 bps	0	
	9600 bps	17	
Data (High Speed)	56 kbps	0	
	64 kbps	68	
	128 kbps	6	
	192 kbps	0	
	256 kbps	2	
	384 kbps	0	
	512 kbps	0	
	768 kbps	1	
	1024 kbps	0	
	1152 kbps	0	
	1544 kbps	1	
	1984 kbps	1	
	2048 kbps	0	
Unknown speed		5	
Total		125	

Source: DGPT, as of 30 June 1998

The distribution of transmission speed is shown in Figure 3.2.5-1.

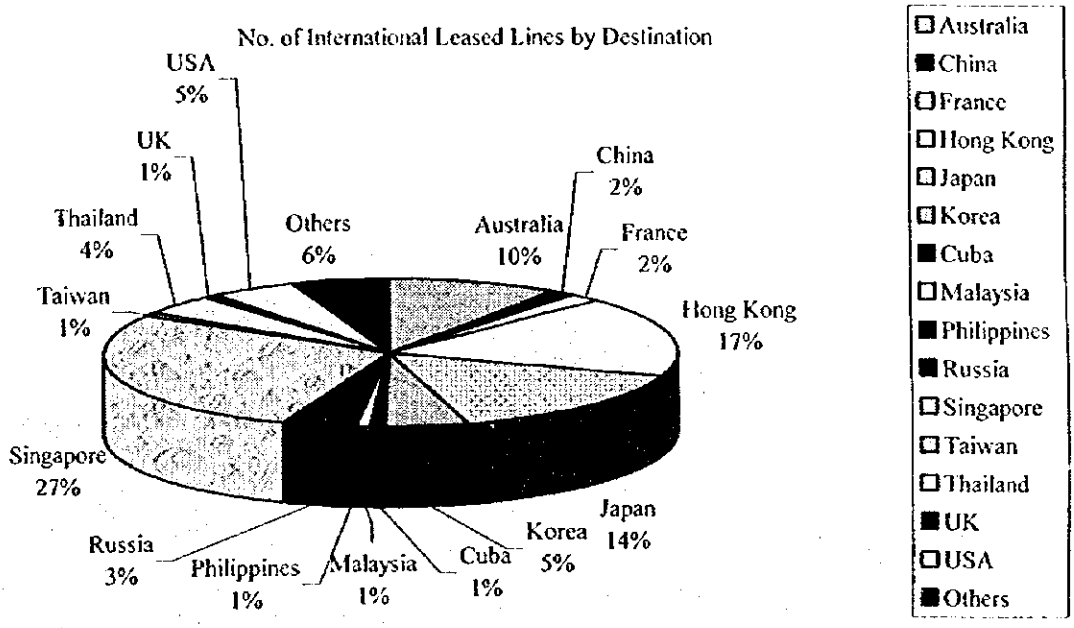


Source: DGPT, as of 30 June 1998

Figure 3.2.5-1 Distribution by Transmission Speed

More than half of subscribers uses 64 kbps leased lines, and maximum speed is 1,984 kbps.

The distribution of destinations is shown in Figure 3.2.5-2.



Source: DGPT, as of 30 June 1998

Figure 3.2.5-2 Distribution by Destination

Most of the destinations of international leased lines are Asian countries, especially Singapore, Hong Kong, Japan, and number of destinations is not large, i.e., destinations are limited to specific countries.

3.2.6 Card-Phone

Since 15 August 1991, trial service for cardphone has been introduced in Ha Noi. The service is based on Trial Agreement between Hanoi P&T and Sapura Corporation. Sapura planned to install 100 sets of cardphone in Hanoi and negotiated with VNPT to expand the service to other provinces like Hai Phong, etc.

Sapura Corp. and Ho Chi Minh P&T jointed together under a 8-year BCC contract for cardphone service in Ho Chi Minh city. The service area also covers Vung Tau, Song Be, Tay Ninh provinces. Total investment is 5.2 million US$ with Sapura holding 62% and HCM P&T 38%. The project is to install more than 1200 cardphone booths till the end of 1996.

Table 3.2.6-1 Number of Cardphones

Year	Number of cardphones
1991	Trial service started
1993	332
1994	500
1995	812

The service has yellow booths named "Uniphonekad", and telephone cards are sold at 30,000 VND, 100,000 VND, and 300,000 VND each.

In 1997, VNPT set up Vietnam Telecom Service Company (GPC) as a State-own subsidiary company. Its main functions are as follows:

- Organizing, installing, managing and exploiting nation-wide telecommunication networks including mobile communication, paging and cardphone.
- Consulting, researching, designing, installing, maintaining and repairing specialized equipment for mobile communication, paging and cardphone.
- Importing, exporting and trading telecom material and equipment necessary for the company activities.
- Business in other fields allowed by VNPT and Government Laws.

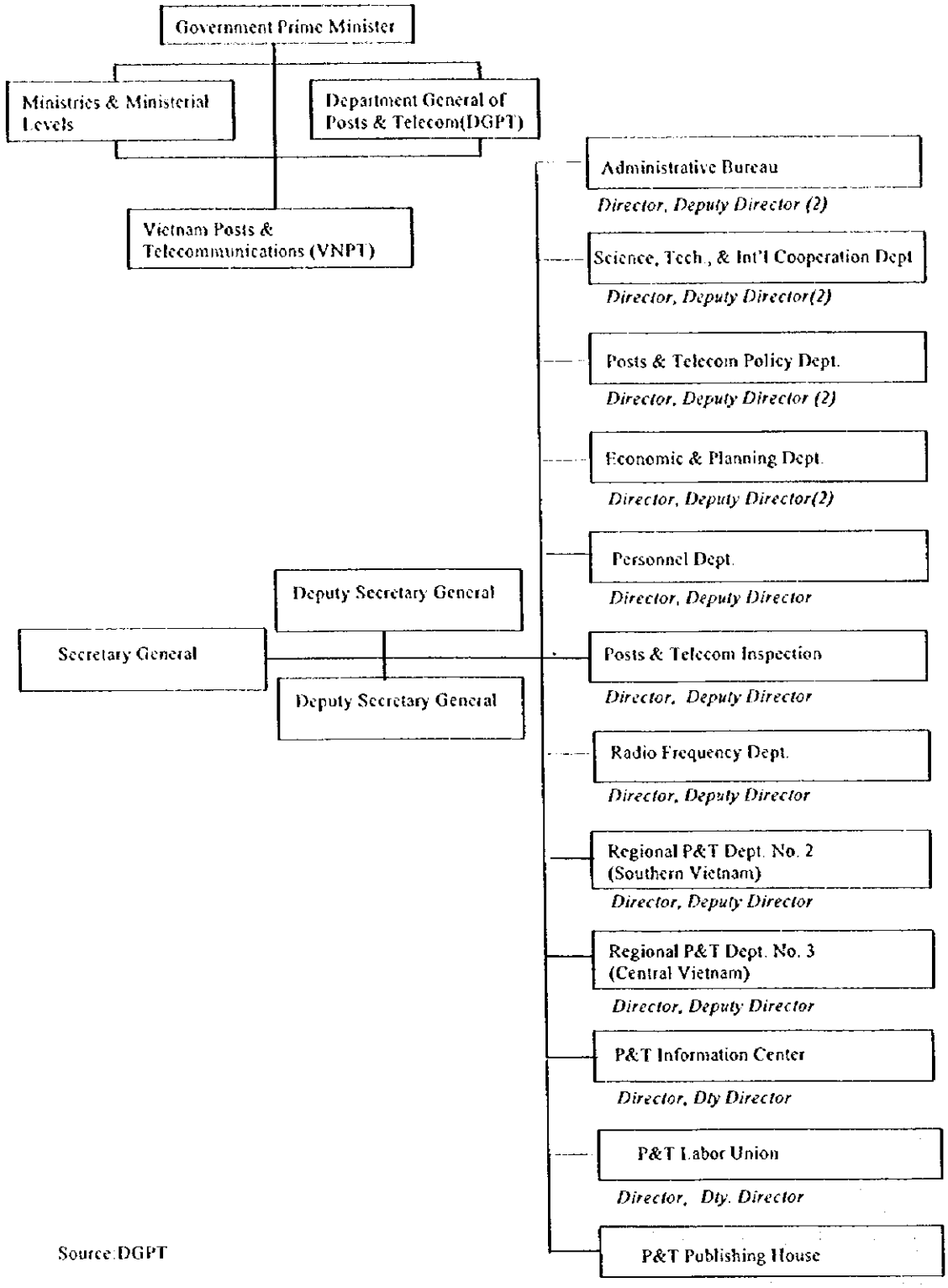
In 1998, GPC has installed about 4,000 cardphone booths nationwide, especially in big cities like Ha Noi, Ho Chi Minh, and Da Nang.

3.3 Organization of Telecommunications Operators

3.3.1 Background of DGPT and VNPT

In 1995, the Department General of Posts and Telecommunications (DGPT) was split into a regulatory state entity which kept name DGPT and an operating entity which is named as Vietnam Post and Telecommunication Corporation (VNPT).
The headquarters of DGPT and VNPT are located in Ha Noi.

The DGPT is organized in accordance with Vietnamese laws and regulations. DGPT is the state body which consolidates the role of state management in the P&T field and sets up the regulations, policies, standards in the field of P&T to submit them to the Vietnam's Government for approval.
The total staff of DGPT is about 500 as of end of 1997. The DGPT organization is illustrated in Figure 3.3.1-1.



Source:DGPT

Figure 3.3.1-1 Organization of DGPT

3.3.2 Telecommunications Operators

(1) General

Vietnam Posts and Telecommunications (VNPT) is organized, as a State Entity, in accordance with Vietnamese laws and regulations. In addition to VNPT, two (2) companies are allowed to deal with P&T services: VIETEL (Military Electronic and Telecommunications Company) and SAIGON POSTEL (Saigon Posts and Telecommunications Service Company). The scope of business of other two (2) companies -VIETEL and SAIGON POSTEL- are regulated by DGPT, and the two companies plan to start their business in 1999.

(2) Vietnam Posts and Telecommunications (VNPT)

VNPT is a leading state-own enterprise which is responsible for the functions of (i) Establishing plans of development, investment and funding, (ii) Managing the operation of national public network for P&T service, (iii) Conduction of the survey, research, design and construction, (iv) Industrial production and procurement of equipment/materials, (v) R &D and Training activities .

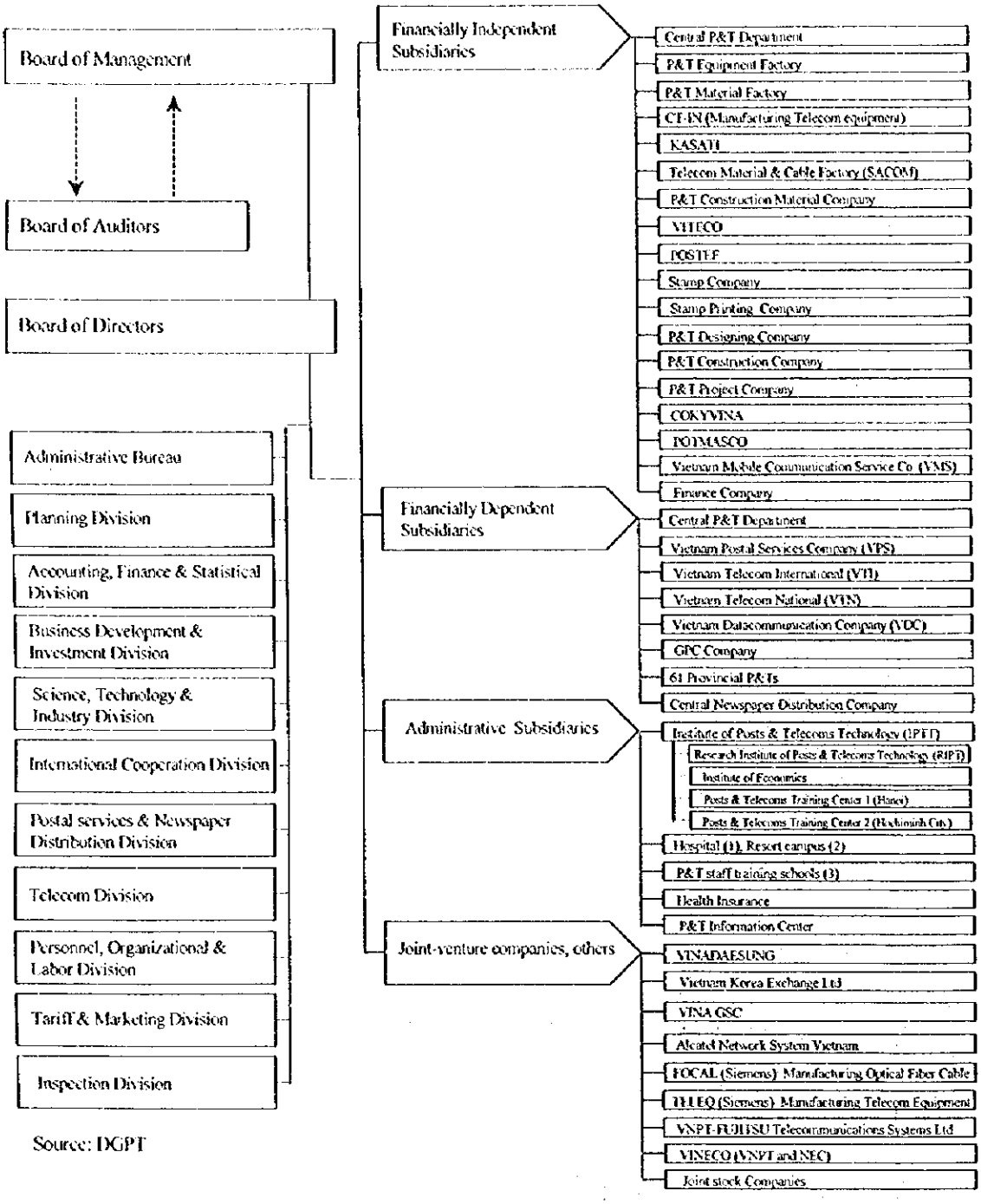
VNPT is composed of institutional organizations: Board of Management which is a supreme organization of VNPT to make a final decision for VNPT, Board of Directors which is responsible for deciding management policies and very important person's assignments, C.E.O (Chief Executive Officer and President of VNPT), Headquarters Functional Divisions and four (4) subsidiaries (financially independent subsidiary, financially dependent subsidiary, administrative organization and joint-venture companies).

Under VNPT, there are business operating management companies such as Vietnam Telecom International Company (VTI), Vietnam Telecom National Company (VTN), Vietnam Data Communication Company (VDC), Vietnam Mobile Telecom Services Company (VMS), Vietnam Telecom Services Company (GPC), etc.

In addition, as a provincial P&T operation enterprise, there are 4 major city P&Ts and 57 province P&Ts together with about 2,800 P&T offices throughout the country.

All P&T employees of VNPT account for about 80,000 persons, of which about 40,000 are engaged in telecommunications.

The VNPT Organization Chart is shown in Figure 3.3.2-1.



Source: DGPT

Figure 3.3.2-1 Organization of VNPT

(3) Vietnam Telecom National (VTN)

Vietnam Telecom National (VTN) is a state member entity which is responsible for operation and management of the long distance telephone networks and the services.

(4) Vietnam Telecom International (VTI)

As one of the major subsidiaries of VNPT, Vietnam Telecom International (VTI) is responsible for providing the international telecommunications services - IDD, Telex, IPLC (International Private Leased Circuit), Satellite Communications Services, Value-Added Services, ISDN (Tele/Videoconferencing), International Television Transmission service, etc. VTI has also a responsibility for managing, operating and developing the international telecommunications network and associated services.

The total staff of VTI is about 1000. As for the institutional organizations, under Managing Director, there are three (3) Deputy Managing Directors who are responsible for six (6) main administration divisions, as given in the followings:

(a) Business Division
(b) Network Engineering & Operation Division
(c) Finance & Accounting Division
(d) Planning & Investment Division
(e) Human Resource Division
(f) Administration Division

Under these administration divisions, there are five (5) operation and management organizations, including regional centers:

(a) ITC (International Telecommunications Center) 1 - Ha Noi
(b) ITC 2 - Ho Chi Minh
(c) ITC 3 - Da Nang
(d) Project Management Division - No.1 (Ha Noi)
(e) Project Management Division - No.2 (Ho Chi Minh)

(5) Vietnam Data Communication (VDC)

VDC is an operation enterprise of Data Communication and Internet Services. In Vietnam, Data Communication Services have been already deregulated and the end user terminals equipment such as a telephone terminal set, data terminal equipment and the like are also already put on a free market, though the terminal equipment usage is subject to approval by VNPT/DGPT.

The total staff of VDC is about 400 employees. Out of them, about 200 are staff

of newcomers on one side who are just recruited in 1998 and fresh staff with 2-3 year experience of works on other side.

As for the company's organization of VDC, under the Head Office of VDC, there are three (3) regional organizations as given in the followings:

(a) VDC 1 - Ha Noi
(b) VDC 2 - Ho Chi Minh
(c) VDC 3 - Da Nang

(6) Vietnam Mobile Telecom Service (VMS)

Mobile communication services were inaugurated in Vietnam in 1993. Present mobile communication services are provided by VMS with MobiFone, GPC with VinaPhone and Call Link under the administration of VNPT.

Vietnam Mobile Telecommunication Services Company (VMS) will invest over 300 million US$ together with Swedish partner Comvik to expand GSM digital standard in the MobiFone networks which provides both international and domestic mobile communications services. VMS has a total staff of about 800 throughout the whole country.

(7) Vietnam Telecom Services (GPC)

GPC was founded in June 1997 as a State-owned company, which is a subsidiary of VNPT. GPC provides mobile services by the name of VinaPhone. VinaPhone is using the same tariff as MobiFone under the control VNPT.

(8) Posts and Telecommunications Institute of Technology (PTIT)

The Posts and Telecommunications Institute of Technology (PTIT) was officially established on 17 September 1977 by the Governmental Prime Minister's decision. This is considered as an important landmark in both the vital development for Research and in the Human Resource Development; personnel training cause for the present and future progress of telecommunications sector.

(9) Other Operators

The first step in ending the monopoly in telecommunication services was taken back in 1996 as DGPT granted licenses for the operation of two joint stock companies, Vietel in Hanoi and Saigon Postel in Ho Chi Minh City.

(a) Saigon Post and Telecommunications Services Joint Stock Corporation (Saigon Postel)

Saigon Postel is established on December 1995 as a joint-stock corporation with starting capital of US$ 4.2 million from 11 State-own enterprises, including VNPT with a share of 18%. The scope of its activities is as follows:

i) Manufacturing and assembling telecommunications, electronics, and informatics equipment, raw materials, spare parts.
ii) Undertaking import, export, and trade of post and telecommunications products, equipment.
iii) Designing, installing, maintaining subscribers' equipment systems and post and telecommunications network. Implementing post and telecommunications works.
iv) Providing post and telecommunications services.

Its operational area is nationwide. In telecommunications services, Saigon Postel will develop its services in areas allowed by the Government and planned by DGPT.

On May 1995, Saigon Postel officially gained license for telecommunications services as follows:

- mobile phone service
- fixed wireless telephone service
- paging service
- internet service provider
- other value-added services including fax, voice-mail, CATV.

Saigon Postel also gained license for postal services later on, and is applying for trunk radio trial service with an estimated 2,000 subscribers in Ho Chi Minh city.

At present, Saigon Postel has activities in import and export, postal service, Internet service provider (4% share of Internet subscribers). Saigon Postel has already set up its own post office in Ho Chi Minh city and Vung Tau, the coastal resort south-east of Ho Chi Minh city, to provide postal services like express deliveries of mail and parcels. In 1998, its import turnover reached US$ 10 million, and revenue US$ 1.5 million.

With staffs of 170 persons, 60 persons are now concentrating on developing business as well as new services. Its organization structure is as follows:

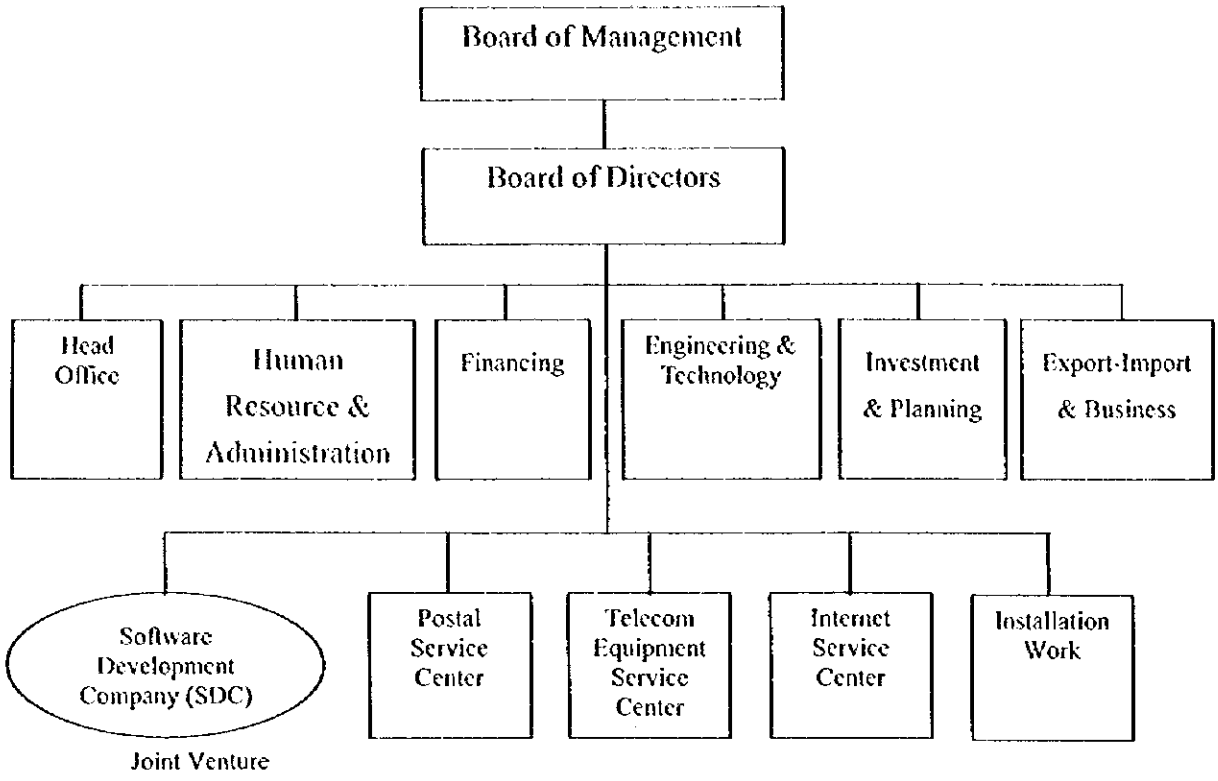


Figure 3.3.2-2 Organization of Saigon Postel

Saigon Postel is calling for foreign investment and cooperation in the following fields:

i) Development of Telecommunications Network: to develop 400,000 subscribers until 2005 with an estimated total investment of US$400 million by applying CDMA technology at frequency of 800 MHz.
The project has been listed by DGPT as one of major projects calling for foreign investment in period 1998~2000 under Business Cooperation Contract.

ii) Postal Service: Package Forwarding Services, Express Postal Services, Money Remittance which will base on Business Cooperation Contract.

iii) Manufacturing telecommunications, informatics, electronics equipment: based on Joint-Venture Contract.

(b) Vietnam Military Electronics-Telecoms Corporation (VIETEL)
Vietel, formerly known both as Sigelco and as the Army Telecommunications

Company (ATC), is a subsidiary of the Ministry of Defense and it is organized under the Peoples Army of Vietnam's Signal Corps . Initially established on June 1989 as a telecommunication construction company providing private network telecom service and equipment procurement to the Vietnamese army, the company changed its name to Vietel in 1995 to restart as a new carrier when granted license for telecommunication services from Government. Like VNPT, Vietel can enter services such as mobile, fixed WLL, paging, trunk radio, postal services, Internet service provider and some other value-added services.

Though established in 1995, Vietel only obtained official licenses for telecommunications services in February 1998, due to lack of appropriate regulations and law for competition in telecommunications field. Since receiving its licenses, Vietel has looking for business chances with foreign partners under Business Cooperation Contract. In the meanwhile, it is focusing on manufacturing and distributing equipment, and completing turn-key network installation projects While it main customer is the Ministry of Defense, the company is not limited in whom it can serve. Other customers have included the Marines Telecom Company and the Vietnamese Railway.

Vietel is calling for foreign investment and cooperation in telecommunication project, which is to develop about 300,000 lines until 2005 with an estimated total investment of US$300 million by applying CDMA technology at frequency of 800 MHz. The project has been listed by DGPT as one of major projects calling for foreign investment in period 1998~2000 under Business Cooperation Contract.

As for other services, Vietel will not provide Internet service at this stage though it has Internet service license. Vietel is now preparing to launch its initial service "trunk radio" in Hanoi and neighboring towns. Its customers will be domestic and joint venture service companies such as taxi companies, etc.

Vietel has staffed with 150 employees at the end of 1998, most of them are former military. And because it belongs to Ministry of Defense, all of its business plans must be approved by its direct authorities before getting approved by DGPT.

3.4 Financial Performance of Telecommunications Operators

This review of financial performance of telecommunications operators in Vietnam is intended to be followed by projection of revenues and operational expenses in the Chapter 14. In order to conduct a financial analysis of telecommunications sector, it is essential, in general, to secure Income Statements, Cash Flow Statements, and Balance Sheets with regards to VNPT and other telecommunications operators in Vietnam. Since financial statements of the operators other than VNPT are not available for this report, only VNPT is financially analyzed.

Although overall objective of this section is to examine the financial situation of the whole telecommunications operators in Vietnam. However, since VNPT can be considered as an overall umbrella organization with some telecommunications subsidiaries, such as VTI, VTN, VDS, and VMS, and it is as a whole almost monopoly in Vietnam, the results of the analyses for the VNPT's revenue and expenses can be applied to the business plans for the whole telecommunications operators in Vietnam to be examined. At the same time, revenue sharing scheme of BCC was summarized in this chapter.

3.4.1 Source of Information

Generally, a financial analysis requires access to the detailed accounts of the operators. Annual accounting reports or detailed accounts (information on revenues and expenses) and detailed debt repayment schedules are required for such analyses.

(1) Data acquired from the counterparts

Financial related data which were provided by the counterparts from DGPT and VNPT upon our requests were summarized in Table 3.4.1-1 to Table 3.4.1-8.

However, Balance Sheet is not included in their financial statements of VNPT. Only total amount of fixed assets can be seen as a balance sheet items in the Table 3.4.1-1, "Financial summary of VNPT (Telecommunications)" at the ends of 1996 and 1997.

Table 3.4.1-1 Financial Summary of VNPT (Telecommunications)

Unit : Million VND

Description	1993	1994	1995	1996	1997
Revenues	1,527,265	2,597,636	4,083,890	5,647,337	6,862,969
Expenses	1,025,643	1,557,551	2,113,625	2,939,542	3,580,453
Revenue tax	-	-	-	338,840	411,778
Gross profit	-	-	-	2,368,955	2,870,730
Profit tax	-	-	-	1,066,029	1,291,832
Net profit	-	-	-	1,302,926	1,578,898
Fixed Assets (Total)	-	-	-	7,565,990	11,183,971

Source: VNPT

In terms of the details of revenues, they were summarized in the Table 3.4.1-2.

Table 3.4.1-2 Details of Revenues for VNPT

Unit: Million VND

Description	1993	1994	1995	1996	1997
Subscription charge (fixed tel.)	123,084	249,731	437,252	664,221	886,921
Local call charge (sir charge)	26,072	55,051	116,530	160,682	187,518
Long distance call (inter-district)		71,426	188,890	264,885	338,245
Long distance call (inter-province)	332,303	617,115	962,067	1,281,840	1,549,801
International call	581,593	921,510	1,285,433	1,492,119	1,579,162
Other telephone revenues	26,494	27,925	27,704	44,705	45,678
International account		396,397	766,229	1,006,498	1,151,528
Telephone revenues	1,089,546	2,339,155	3,784,105	4,914,950	5,738,853
Subscription charge (mobile)		4,164	11,065	9,203	65,937
Mobile phone (domestic call)		4,164	0	131,700	352,253
Mobile phone (international call)		0	0	146,316	22,184
Mobile phone revenues	0	8,328	11,065	287,219	440,374
Paging revenues		0	0	53,854	79,467
Other telecom. revenues	395,902	251,967	276,003	391,314	568,275
Total revenues	1,485,448	2,599,450	4,071,173	5,647,337	6,826,969
Installation charge	112,000	335,000	332,000	600,000	850,000

Source: VNPT

Regarding the details of expenses of VNPT, the descriptions of expenses have been changed a little bit since the year 1996. Those details were summarized in the Table 3.4.1-3 and Table 3.4.1-4.

Table 3.4.1-3 Details of Expenses (until 1995)

Unit: Million VND

Description	1993	1994	1995
1. Fixed Assets Depreciation	591,145	762,868	650,225
2. Material	18,574	33,292	45,352
3. Fuel	6,642	7,675	10,963
4. Machine	18,449	21,248	32,901
5. Tool	10,226	23,131	37,013
6. Fixed Assets Mending	81,210	143,719	196,642
7. Salary	146,550	209,967	555,299
8. Social Insurance	9,747	16,852	13,223
9. Labour Protection	8,603	14,408	22,751
10. Transportation	2,574	2,967	3,803
11. Working fees	5,712	9,134	11,652
12. Commission on press and stamp distribution	1,038		
13. Others	34,201	27,997	147,910
14. Interest on securities, bond issues	22,371	50,512	187,254
15. Capital tax	12,760	15,182	34,356
Sub Total	968,803	1,338,952	1,940,343
General administrative expenses	101,642	142,731	298,166
Grand Total	1,069,446	1,481,682	2,247,509

Source: VNPT

Table 3.4.1-4 Details of Expenses (after 1996)

Unit: Million VND

Description	1996	1997
I. Expense on Labour	851,770	542,159
Salary	832,071	519,672
Social Insurance, Trade Union operation	19,699	22,487
II. Expense on Material	245,848	247,606
Material of Manufacture	78,068	82,052
Material of Assets Mending	154,465	149,746
Fuel	13,316	15,808
III. Expense on Tool	58,853	59,905
IV. Fixed Assets Depreciation	724,931	1,046,909
V. Expense on Purchase Service	335,992	390,738
Fixed Assets Mending Lease	200,355	217,547
Power, Water utilities	54,469	71,376
Transport Loading Unloading	10,297	8,426
Other Leases	70,871	93,390
VI. Other Expenses	225,408	496,200
Labour Protection	81,590	24,822
Publicity and Advertisement	31,087	22,290
Commissions	20,612	41,133
Training	38,127	9,162
Interest on Security issues	8,719	177,010
Others	45,273	58,530
Sub Total	2,442,802	2,620,263
Distribution of Administrative Expenses	496,740	163,253
Grand Total	2,939,543	2,783,516

Source: VNPT

The number of telephone subscribers by category for the years of 1996 and 1997 provided through the counterpart from DGPT can be summarized as follows. The telephones were categorized into four, fixed telephones, non-chargeable telephones, telephones at post offices, and public telephones. The fixed telephones also can be divided into four categories, PBX, business, residential, and facsimile subscribers.

Table 3.4.1-5 Number of Telephone Subscribers by Category

Unit: Million VND

Description	1993	1994	1995	1996	1997
Non-chargeable subscribers	-	-	-	16,593	19,176
Post office	-	-	-	4,749	5,421
Public	-	-	-	17,937	20,541
Fixed telephone	-	-	-	1,031,526	1,347,388
PBX	-	-	-	*97,581*	*111,215*
Business	-	-	-	*145,771*	*163,219*
Residential	-	-	-	*517,073*	*660,287*
Facsimile	-	-	-	*14,240*	*16,650*

Note: Data from DGPT include numbers of PBX, business and residential telephone, and facsimile subscribers. However, the sum of them are not equal to the total number of fixed telephones provided by DGPT as of October 11, 1998.
The sum of PBX, business, residential, and facsimile is not equal to the total number of fixed telephones because of lack of data for some provinces.

Source: DGPT

On the other hand, the numbers of subscribers for telephone, mobile telephone, paging and internet services were summarized in the Table 3.4.1-6.

Table 3.4.1-6 Number of Subscribers

	1993	1994	1995	1996	1997
Number of telephone subscribers (at the end)	254,506	442,658	734,355	1,110,115	1,407,534
Number of telephone subscribers (average)	205,553	348,582	588,507	922,235	1,258,825
Number of mobile subscribers (at the end)	-	-	-	69,910	146,550
Number of mobile subscribers (average)	-	-	-	34,955	108,230
Number of paging subscribers (at the end)	-	-	-	21,900	45,000
Number of paging subscribers (average)	-	-	-	10,950	33,450
Number of internet subscribers (at the end)	-	-	-	-	1,200
Number of internet subscribers (average)	-	-	-	-	600

Note: Average numbers were estimated by adding a half of increase for the year to the number at the end of previous year.

Source: VNPT

The number of staffs of VNPT can be summarized in the Table 3.4.1-7. In 1997, among the total of 86,831 employees, 37,400 persons were engaged in

telecommunications services and 78% of the total staffs were categorized into workers.

Table 3.4.1-7 Number of Staffs in VNPT

	1993	1994	1995	1996	1997
Total staffs	59,618	66,773	75,278	80,780	86,831
Telecommunications	23,840	27,376	31,610	35,500	37,400
Workers	50,675	55,755	61,083	64,453	67,689
Share of workers	85.0%	83.5%	81.1%	79.8%	78.0%

Note: Numbers at the end of each year
Source: VNPT

The DGPT also provided a valuable information with their statistical yearbook. Inter-province and international traffic as number of calls and call minutes.

Table 3.4.1-8 Summary of "DGPT Statistical Yearbook 1986 - 1995"

		1993	1994	1995
Number of telephones (end of year)		254,506	445,560	746,467
Number of telephone subscribers	(telephone sets)	97,907	191,054	300,907
Inter-province traffic	(number of calls)	68,858,941	118,853,773	206,513,125
	(Thousands call minutes)	231,423	375,546	610,026
International traffic	(number of calls)	3,556,393	8,344,152	12,615,358
	(Thousands call minutes)	11,927,702	24,555,202	35,591,793
Telecom. revenue of VNPT	(Million VND)	1,527,265	2,597,636	4,083,890
Telecom. expenses of VNPT	(Million VND)	1,025,643	1,557,551	2,113,625

Source: "DGPT Statistical Yearbook 1986 - 1995", pp.140-141, 166-167, 168-175, & 179

3.4.2 Financial Trends of VNPT

(1) Increase of subscribers

Number of telephone subscribers has increased rapidly for the last 5 years. In the Table 3.4.1-6, however, showed decreasing tendency in the rate of increase from 73.9% in 1994 to 26.8% in 1997.

In terms of subscribers by category, the share of residential subscribers has been increasing against business users. If PBX and facsimile subscribers are considered to be business users, the share of residential subscribers was increased to 69.4 percent in 1997 from 66.7 percent in 1996. Accordingly, the decrease of revenues can be anticipated for the future.

(2) Revenues and profits

(a) Revenue and profit

Telecommunications revenue and profit of VNPT have been increasing rapidly between 1993 and 1997. The rate of increase, however, has tendency to be reduced, from 70.1% in 1994 to 21.5% in 1997.

Profit percentage to revenue has attained rather high level. In addition, it has been rather stable between 32.8% to 48.2% for the last 5 years.

Table 3.4.2-1 Trends of Telephone Revenues

		1993	1994	1995	1996	1997
Telecom. revenue of VNPT (1)	(Bill. VND)	1,527	2,598	4,084	5,647	6,863
Telephone revenue of VNPT (2)	(Bill. VND)	*1,374*	*2,338*	*3,676*	4,918	5,742
Rate of increase		-	*70.1%*	*57.2%*	38.3%	21.5%
(1)/(2)		*90.0%*	*90.0%*	*90.0%*	87.1%	84.1%
Telecom. revenue per telephone	(USD/Year)	700	681	621	576	519
Telephone revenue per telephone	(USD/Year)	630	612	559	498	431

Note: Telephone revenue for the years of 1996 and 1997 is sum of revenues from long distance calls, international calls, collect calls, subscription fees, sir charges, 108 services, line removal, and settlement of international account because no detailed data was available for the revenues.
Telephone revenues for the year of 1995 and before are estimations.

Source: VNPT

Table 3.4.2-2 Profit Percentage to Revenues (VNPT)

	1993	1994	1995	1996	1997
Profit percentage to revenue	32.8%	40.0%	48.2%	41.9%	41.8%

(a) Revenue by sector

In terms of revenue structure of VNPT, telecommunications revenue by sector and telephone revenue by sector were summarized and analyzed as follows.

As summarized in the Table 3.4.2-3, 87.1% and 84.1% of the total telecommunications revenues were derived from telephone services in 1996 and 1997 respectively. Although you can see a slight decline tendency in the share against the spread of mobile telephones, telephone revenue is still the most important revenue source to be analyzed.

Table 3.4.2-3 Telecommunications Revenue Structure of VNPT by Sector

Unit: Million VND for revenues, %

Description	1996		1997	
Telephone revenue	**4,917,589**	**87.1%**	**5,741,906**	**84.1%**
Mobile phone revenues	287,219	5.1%	440,374	6.5%
Paging services revenues	53,854	1.0%	79,467	1.2%
Data transmission revenue	25,747	0.5%	32,111	0.5%
Leased line revenues	135,114	2.4%	189,993	2.8%
Other revenues	227,814	4.0%	343,118	5.0%
Total telecommunications revenues	5,647,337	100.0%	6,826,969	100.0%

In terms of telephone revenue structure, the sum of revenues from international calls and international settlement were VND 2,499 Billion in 1996 and 2,731 Billion in 1997. Those shares of revenues from international services against the total telecommunications revenues were 50.8 percent and 47.6 percent in the years of 1996 and 1997 respectively. 20.5 percent of the total telephone revenues in 1996 and 20.1 percent in 1997 was derived from the net accounting balance from international traffic. Therefore, the international revenues can be currently considered as the main source of revenue for the VNPT.

The revenue from international settlements is a consequence of a big imbalance between in coming and out going traffic. Furthermore, the current international charges of VNPT are extremely high in the world.

Therefore, the revenues from international settlements cannot be expected to expand for long as Vietnam economically grows and participates in the international organizations.

In addition, it can be said to be still potentially dangerous to rely on the international traffic as a source of revenue and domestic revenues need to be enhanced.

Table 3.4.2-4 Telephone Revenue Structure

Unit: Million VND for revenues, %

Description	1996		1,997	
Monthly subscription	666,860	13.6%	889,974	15.5%
International call	**1,492,119**	**30.3%**	**1,579,162**	**27.5%**
International settlement	**1,006,498**	**20.5%**	**1,151,528**	**20.1%**
Long distance call	1,546,725	31.5%	1,888,046	32.9%
Local call (Sir charge)	160,682	3.3%	187,518	3.3%
Others	44,705	0.9%	45,678	0.8%
Total telephone revenues	4,917,589	100.0%	5,741,906	100.0%

(3) Revenue per telephone subscriber

As Detecon mentioned in their telecommunications master plan in 1993, determining that the average revenue per line in Vietnam is not straightforward because of the method of accounting and the difficulty in establishing what the number of subscriber lines was in the specific time period. Furthermore, some shared revenues and expenses were not included in their financial summaries.

The telecommunications and telephone revenue per line for 1996 and 1997 can also be roughly estimated as follows.

(a) Telecommunications revenue per line

Assuming that the average number of subscriber lines in 1996 and 1997 was 922,235 and 1,258,825 respectively, as estimated in the Table 3.4.1-6, the total telecommunications revenue per main line was about USD 557 in 1996 and USD 493 at the exchange rate of VND 11,000 = USD 1.

(b) Telephone revenue per line

Telephone revenue per line as far as the VNPT is concerned can be approximately summarized as follows:

Table 3.4.2-5 Details of Revenues per Subscriber

Unit: Thousand VND

Description	1993	1994	1995	1996	1997
Subscription charge (fixed telephone)	599	716	743	720	705
Local call charge (sir charge)	127	158	198	174	149
Long distance call (inter-district)	0	205	321	287	269
Long distance call (inter-province)	1,617	1,770	1,635	1,390	1,231
Other telephone revenues	129	80	47	48	36
International call	2,829	2,644	2,184	1,618	1,254
(USD)	261	239	198	147	107
International account	0	1,137	1,302	1,052	842
(USD)	0	103	118	95	72
Telephone revenues	5,301	6,710	6,430	5,329	4,559
Subscription charge (mobile phone)				263	609
Mobile phone (domestic call)				3,768	3,255
Mobile phone (international call)				4,186	205
Mobile phone revenues				8,217	4,069
Paging revenues		0	0	4,918	2,376
Installation charge	1,144	1,780	1,138	1,597	2,858

Source: VNPT

Revenue per telephone subscriber has been decreased steadily since 1994. It

has decreased from approximately VND 6,710 thousand (USD 612) in 1994 to VND 4,559 thousand (USD 389) in 1997 with rather stable exchange rates against US Dollars for the period.

Comparing with the present Five-year Telecommunications Development Plan summarized as Table 3.4.4-6, it can be said that the targets were not far from the actual trend.

Table 3.4.2-6 Five-Year Telecommunications Development Plan

		1996	1997	1998	1999	2000
Number of subscribers		1,166,000	1,716,000	2,406,000	3,216,000	4,410,000
Penetration ratio	(%)	1.56%	2.24%	3.06%	4.00%	5.00%
Domestic traffic	(Thou. Minutes)	11,860	16,200	22,400	29,600	37,500
International traffic	(Thou. Minutes)	2,680	3,200	3,800	4,500	5,400
Revenue of VNPT	(Bill. VND)	6,546	8,489	10,640	12,768	15,030
	(Mill. USD)	595	771	967	1,160	1,366
Annual revenue / subscriber	(USD)	510	449	402	360	309
Investment	(Bill. VND)	4,500	6,500	7,000	7,300	7,900
	(Mill. USD)	409	591	636	664	718

Source: VNPT (Research Institute of Telecommunications and Economics, Japan, "Telecommunications in Vietnam", p.31, October, 1997)

In general, it can be said that there is almost no correlation between revenue per line and the level of economic development. According to the Asian Wall Street Journal, the world average in 1995 was USD 859, which was almost same as the average of Asia, USD 846. While the telecommunications revenue per line was just USD 547.

Table 3.4.2-7 Comparison of Telecom Revenue and International Traffic in 1995

	Telecommunications revenue			Outgoing international traffic	
	Total (USD Million)	Per capita (USD)	Per line (USD)	Total (Mill. of min.)	Per line (Minutes)
China	13,603.4	11	334	1,339.1	32.9
Indonesia	2,735.0	14	831	205.9	62.6
Korea	8,727.8	195	469	557.3	30.0
Malaysia	2,097.5	104	629	369.2	110.8
Philippines	982.0	15	697	172.3	122.2
Taiwan	5,644.6	265	615	593.0	64.6
Thailand	2,040.0	34	586	221.9	63.7
Vietnam	**142.1**	**2**	**547**	**24.0**	**54.3**
Asia	150,250.8	45	846	10,372.4	57.2
World	588,526.3	106	856	61,895.4	90.7

Source: Dow Jones Publishing Company (Asia) Inc., Asian Infrastructure (1997)

(4) Operational expenses

As noted, the descriptions of expenses have been changed a little bit since the year 1996. For the future projection of the operational expenses will be followed the current descriptions. Among the total operational expenses, except distribution of administrative expense, personnel expense and depreciation expense shared more than 60% in 1996 and 1997. Therefore, in the personnel expenses was analyzed as follows:

Personnel expenses of VNPT were VND 851,770 million in 1996 and VND 542,159 million in 1997. They were equivalent to approximately USD 77 million and USD 46 million respectively.

Calculated with the number of employees of 33.6 thousand in 1996 and 36.5 thousand in 1997, the annual personnel expenses per staff was about VND 25 million (USD 2,300) and VND 15 million (USD 1,269) respectively.

In order to consider the efficiency of manpower, comparing the numbers of telephone lines per staff, about 27.5 lines in 1996 and 34.5 lines in 1997, with other countries in the region, it is still low level. However, it can be generally expected to be improved as the number of subscribers increases in the future.

Table 3.4.2-8 Number of Telephone Lines per Staff in Asia in 1995

	Penetration ratio of main line telephones	# of telephone lines per staff
Indonesia	1.69%	82.6
Korea	41.47%	299.6
Malaysia	16.56%	115.5
The Philippines	2.09%	72.7
Taiwan	43.07%	256.5
Thailand	5.86%	99.7

Source: ITU, "Yearbook of Statistics, Telecommunication Services 1986 - 1995"

3.4.3 Business Cooperation Contracts

While manufacturing joint ventures are allowed in Vietnam, foreign telecom firms wishing to invest in fixed or mobile communications networks are limited to Business Cooperation Contract (BCC). These contracts offer limited management rights in return for shared revenues but no equity. This BCC scheme was introduced by the Government to introduce foreign capital for infrastructure construction without increase of foreign debt.

Basically, the Vietnamese operators conduct operation of the telecommunications network.

Foreign partners for each contract, contractual term, investment amount, and revenue share scheme are summarized as follows. The BCC projects are classified into three main categories: the first category is those which have already implemented, the second one is those which have already signed and to be implemented, and the last one is those to be signed. For the sake of simplification, VNPT's subsidiaries as Vietnamese operators for BCCs were mentioned as "VNPT".

(1) BCC implemented

(a) Telestra (formerly named OTC), Australia

i) Contractual term: 10 years (1990–2000)
(1992-2002 for Vietnam-USA channel)

ii) Investment
USD 197 million for development of international telecommunications networks and services

iii) Revenue share
[Turnover from international account]
Telestra: 32%, VNPT: 68%
[Turnover form outbound link]
Telestra: 18%, VNPT: 82%
[Share of expenses by Telestra]
- 32% of the total rent of international satellite channels
- 32% of annual administrative expenses related to international telecommunications management
- USD 500,000 each year for training, maintenance, transfer of business and marketing secrets

(b) Kinnevik, Sweden

i) Contractual term: 10 years (1995 to 2005)

ii) Investment
USD 127.8 million for development of the nation-wide mobile phone network and services

iii) Revenue share
[first to fifth year]
Kinnevik: 50%, VNPT: 50%
[sixth to tenth year]

Kinnevik: 40%, VNPT: 60%

(c) Voice International-Australia

i) Contractual term: 9 years (1989 to 1998)

ii) Investment

USD 725,000 for development and exploitation of pager services in Ho Chi Minh City area

iii) Revenue share

[1990 to 1994]

Voice International-Australia: 70%, VNPT: 30%

[1995 to 1998]

Voice International-Australia: 48%, VNPT: 52%

(d) Sapura Holding Sdn Bhd

i) Contractual term: 8 years (1993 to 2001)

ii) Investment

USD 3,571,000 by Sapura, USD 1,615,000 by VNPT for development and exploitation of the public card phone services in Ho Chi Minh City area

iii) Revenue share: Sapura: 62%, VNPT: 38%

(e) Korea Telecom

i) Contractual term: 10 years (1996 to 2006)

ii) Investment

USD 40 million for development of internal communications networks in Hai Phong City and the provinces of Hai Hung and Quang Ninh

iii) Revenue share: Korea Telecom: 32%, VNPT: 68%

(f) Singapore Telecom International (STI)

i) Experiment: Started April 1, 1992

ii) Investment

USD 4.8 million by STI, USD 2.3 million by VNPT for mobile call-link project

(2) BCC to be implemented (signed)

(a) Nippon Telegraph and Telephone (NTT)

i) Contractual term: 15 years

ii) Investment

NTT pledges to invest USD 194 million for the construction of 240,000 new telephone lines in northern Hanoi

iii) Revenue share: NTT: 47%, VNPT: 53%

(b) France Telecom (FT)

i) Contractual term: 15 years

ii) Investment

FT pledges to invest USD 467 million for the construction of 540,000 new telephone lines in eastern Ho Chi Minh City

iii) Revenue share: FT: 47%, VNPT: 53%

(3) BCC to be signed

(a) Telestra

i) Contractual term: 15 years

ii) Investment

Telestra has pledged to invest USD 360 million for the construction of 450,000 new telephone lines in western Ho Chi Minh City

iii) Revenue share: Telestra: 47%, VNPT: 53%

3.5 Tariff Structure of Telephone Service

3.5.1 Current Tariff (Telephone Services)

The General Department of Posts and Telecommunications (DGPT) has issued a list of rates for telephone calls and leasing international telecommunications channels. The announced rates are in accordance with Decision 358/1999/qd-tcbd issued on June 1,1999. In addition to this, DGPT issued a new local telephone tariff for foreign organizations, individuals and joint ventures with foreign organization operating in Vietnam on June, 22 with Decision No.427/1999/QD-TCBD. The effective date is from July 1,1999.

In terms of domestic tariff, the rates of long distance call had not been revised since May 2, 1993.

The rates for telephone calls and leasing international telecommunications channels as well as the domestic calls do not include the 10 percent Value-Added Tax (VAT)

In this chapter, tariffs of main telephone services were summarized as follows:

(1) Telephone Installation Fees

Installation fee described in the Table 3.5.1-1 is applied for fixed telephone installation. The same rates shall be applied for facsimile installation.

Table 3.5.1-1 Installation Fees (Fixed Telephone)

Unit: VND

		for Vietnamese	for Foreigners
1	Ha Noi, HCM, Hai Phong, Dong Nai, Bung Tau	1,800,000	1,800,000
2	Da Nang, Binh Duong	1,200,000	
3	Thai Nguyen, Ninh Ninh, Ha Tay, Hoa Binh, Ben Tre, Hue	1,100,000	
4	Lang Son, Hung Yen, Hai Duong, Ha Tinh, Tien Giang, Thanh Hoa, Bac Ninh, Quang Nam, Nghe An, Can Tho, An Giang, Dac Lac	1,000,000	
5	Tuen Quang, Yan Bai, Bac Ginag, Ha Nam, Nam Dinh, Thai Binh, Quang Ninh, Vinh Long, Long An, Lam Dong, Dong Thap, Binh Phuoc	850,000	
6	Others	700,000	

Source: "Domestic Post and Telecommunications Rates (Effective 2nd May 1993)"

(2) Monthly Subscription Fees

Monthly subscription fees applied for telephone services are described in the Table 3.5.1-2. Telephone lines accommodated in PBX are applied VND 136,000 as a

monthly subscription fee. On the other hand, monthly subscription for facsimile line with exchange capacity of more than 10,000 is VND 135,000.
(Refer to DGPT Decision No. 427/1999/QD-TCBD, dated June 22,1999)

Table 3.5.1-2 Telephone Monthly Subscription Rates

Unit: VND/month

Capacity of exchange	Direct	Operator-assisted
up to 100	23,500	17,200
101 to 500	33,000	22,800
501 to 3,000	40,000	29,700
3,001 to 5,000	50,000	-
5,001 to 10,000	60,000	-
10,001 and over	68,000	-

Note: - 300 minutes of local calls (100 calls roughly) are included in monthly subscription charges for the area of exchange capacity with 500 or less.
- 450 minutes of local calls (150 calls roughly) are included in monthly subscription charges of the area of exchange capacity with 501 and more.
Source: "Domestic Post and Telecommunications Rates (Effective 2nd May 1993)"

(3) Telephone Call Charges

(a) Local Calls

Local call charges are applied by minute. Local calling fee is 120 VND/minute for foreigners.

Local call rates described in the Table 3.5.1-3 is applied for local calls made from each subscriber's fixed telephones.

Table 3.5.1-3 Local Call Rates

Vietnamese	Foreigners
VND 65/min	VDN 120/min

Source: DGPT Decision No.427/1999/QD-TCBD

(b) Long distance calls

Long distance call rates, both inter-district and inter-province calls, are described in the Table 3.5.1-4.

Table 3.5.1-4 Long Distance Call Rates

(Unit: VND/min)

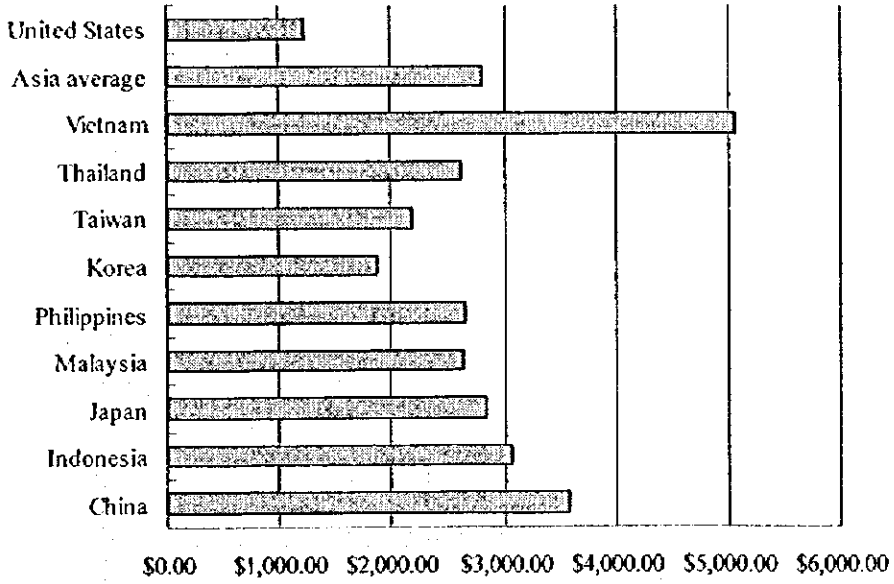
Distance level	Direct call		Operator-Assisted Call	
	Minimum rate (1 min)	Each additional minute	Minimum rate (3 mins)	Each additional minute
Up to 20 km	700	470	1,400	470
From 20 to 50 km	1,000	650	1,950	650
From 50 to 100 km	1,200	780	2,350	780
From 100 to 400 km	1,500	1,100	3,300	1,100
From 400 to 800 km	2,380	1,750	5,250	7,750
From 800 to 1,200 km	3,180	2,340	7,000	2,340
From 1,000 to 1,800 km	4,410	2,250	9,750	3,250
1,800 km and over	5,300	3,900	11,700	3,900

Source: DGPT, "Domestic Posts and Telecommunications Rate (Effective 2nd May, 1993)"

(c) International calls

International call rates are summarized as the Table 3.5.1-5 below.

As is shown in the Figure 3.5.1-1, Vietnam's international rates are very high. It is almost double of Asian average and more than 4 times as the rates of the United States.



Note: IDD annual charges above consist of 10-minute call every month to each of the other 15 countries at daytime rates.

Source: Dow Jones Publishing Company (Asia) Inc., The Asian Wall Street Journal, "Asian Infrastructure", (1997)

Figure 3.5.1-1 Comparison of IDD Annual Charges

Table 3.5.1-5 International Call Tariffs

Unit: USD

	Telephone										Telex	Telegram
	From 07:00 – 23:00 (Mondays – Saturdays)					From 23:00 – 07:00 (Mondays – Saturdays), Holidays, Sundays						
	DIRECT DIALING		Operator assisted call			DIRECT DIALING		Operator assisted call				
			First 3 min.		DIALING			First 3 min.		Each		
	First 1 min.	Each add. min.	Station call	Person call	add. min.	First 1min.	ADDI. BLOCK	Station call	Person call	add. min.	(Each min.)	(Each word)
	1	2	3	4	5	6	7	8	9	10	11	12
Asia-Pacific- Oceania											Revised	Revised
Thailand, Malaysia, Hong Kong, Singapore	2.45	2.20	6.45	8.45	2.00	1.96	0.16	5.16	6.76	1.60		
Australia, Brunei, China	3.10	0.22	7.50	9.70	2.20	2.48	0.18	6.00	7.76	1.76		
Japan	3.15	0.23	7.75	10.05	2.23	2.52	0.18	6.20	8.04	1.84		
India	3.36	0.25	8.36	10.86	2.50	2.69	0.20	6.69	8.69	2.00		
Pakistan	3.45	0.26	8.65	11.25	2.60	2.76	0.21	6.92	9.00	2.08		
Europe											Revised	Revised
Bulgaria, Poland, Russia, Romania, Hungary	3.15	0.23	7.75	10.05	2.23	2.52	0.18	6.20	8.04	1.84		
Austria, Belgium, France, Germany	3.36	0.25	8.36	10.86	2.50	2.69	0.20	6.69	8.69	2.00		
Italy, Norway, Sweden, UK, Switzerland Greece, Iceland, Spain, Turkey	3.45	0.26	8.65	11.25	2.60	2.76	0.21	6.92	9.00	2.08		
North America											Revised	Revised
USA, Canada	3.10	0.22	7.50	9.70	2.20	2.48	0.18	6.00	7.76	1.76		
Latin America											Revised	Revised
Argentina, Brazil, Mexico, Peru, Colombia	3.55	0.28	9.15	11.95	2.80	2.84	0.22	7.32	9.56	2.24		
Africa											Revised	Revised
Algeria, Central Africa, Egypt, South Africa	3.55	0.28	9.15	11.95	2.80	2.84	0.22	7.32	9.56	2.24		
Middle East											Revised	Revised
Iran, Iraq, Israel, Kuwait, Qatar, Saudi Arabia	3.55	0.28	9.15	11.95	2.80	2.84	0.22	7.32	9.56	2.24		

CHAPTER 4

CURRENT STATUS OF FUNDAMENTAL TECHNICAL PLAN

CHAPTER 4 CURRENT STATUS OF FUNDAMENTAL TECHNICAL PLAN

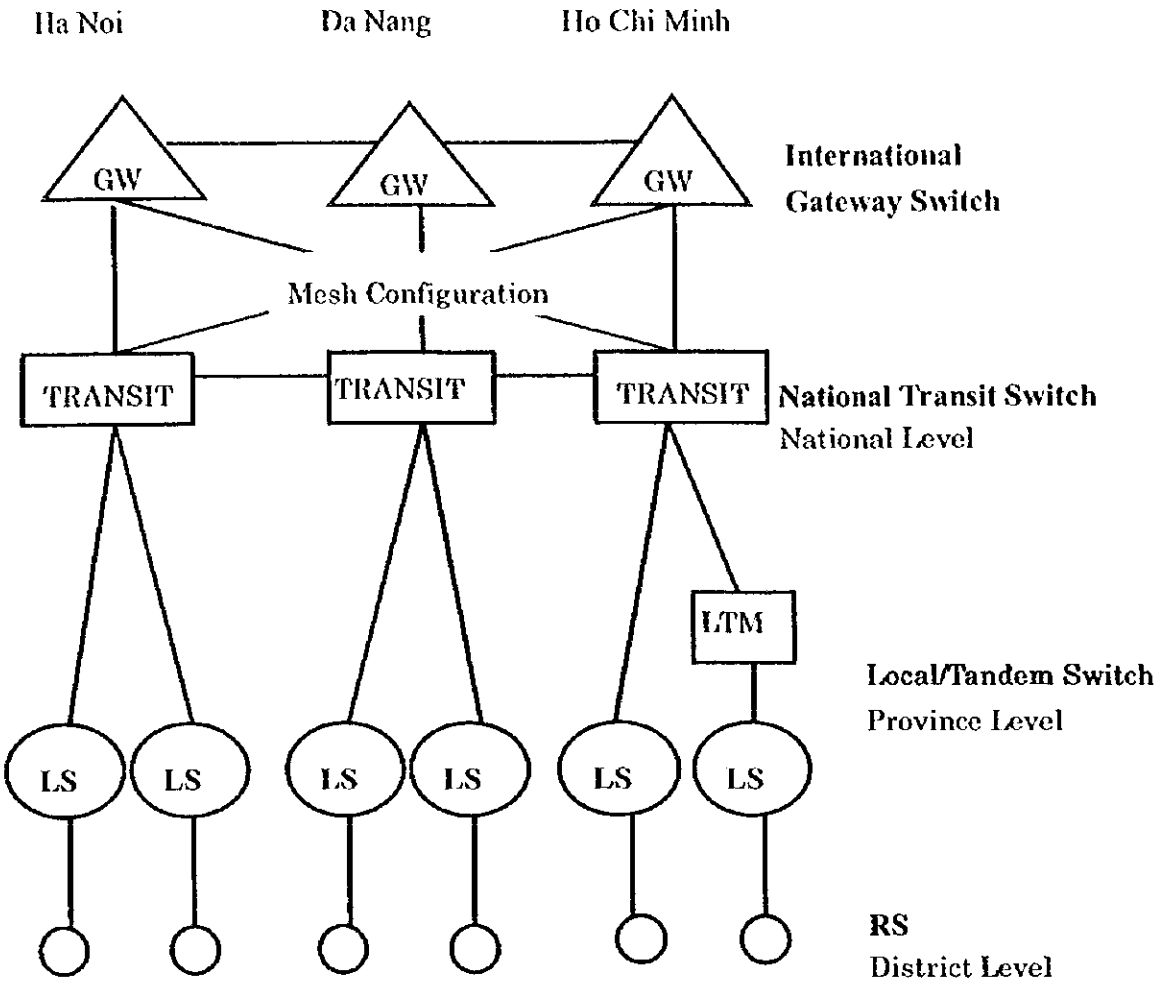
This Chapter outlines and reviews the existing situations of fundamental telephone network plan and technical standards adapted in Vietnam for planning the future development of telephone network and for introduction of new services and technology.

4.1 Network Configuration

Existing telephone network consists of four levels such as International Gateway Switching Center, National Transit Switching Center, Local/Tandem Switching Center and Remote Switching (Small Switch) Center. Figure 4.1-1 shows the hierarchical structure of existing telephone network of Vietnam.

Telephone networks are operated by VNPT's subsidiary companies: VTI, VTN and Provincial P&T. There are three International Switching Centers operated by VTI, and situated in Ha Noi, Ho Chi Minh, and Da Nang. There are other three National Transit Switching Centers operated by VTN, and situated in Ha Noi, Ho Chi Minh, and Da Nang. VTN operates not only national transit switching system but also inter-provincial transmission system as well. In Vietnam there are 61 provinces. In each province except the three new provinces (Vinh Phuc, Hung Yen and Binh Phuoc), there is at least one Local / Tandem Switching Center which are concentrated to remote switching and small type of Switching, and these provincial networks are operated by provincial P&T. In the province of Ho Chi Minh City, there are now nine (9) Local Exchanges (Host Exchanges) and one (1) Tandem Exchange operated by Ho Chi Minh P&T, and in Ha Noi City there are six (6) Local Exchanges (Host Exchange) operated by Ha Noi P&T. Network configurations of Ho Chi Minh, and Ha Noi are shown in Figure 4.1-2 and Figure 4.1-3. The provincial network configurations are vary, depending on the size of exchanges.

Network configuration up to the year 2010 would be studied in Telecommunications Network Plan in Chapter 10, considering the demand and traffic forecasting. When deciding the number of stages such as LE (Local Exchange), Primary Center (PC), and Secondary Center (SC), the number of exchanges and stages are also used as parameters. And optimum Center locations should be located at a site where traffics concentrate, considering administrative area such as provincial capitals. ITU-T says that fully digital network structure tends to reduce the network level to non-hierarchical considering the exchange functions and cost.



GW	International Gateway Switching Center
TOLL	National Transit Switching Center
LS/TM	Local Switching Center / Tandem Switching Center
RS	Remote Switching (Small Switching) Center

Source VNPT

Figure 4.1-1 Hierarchical Structure of Telephone Network

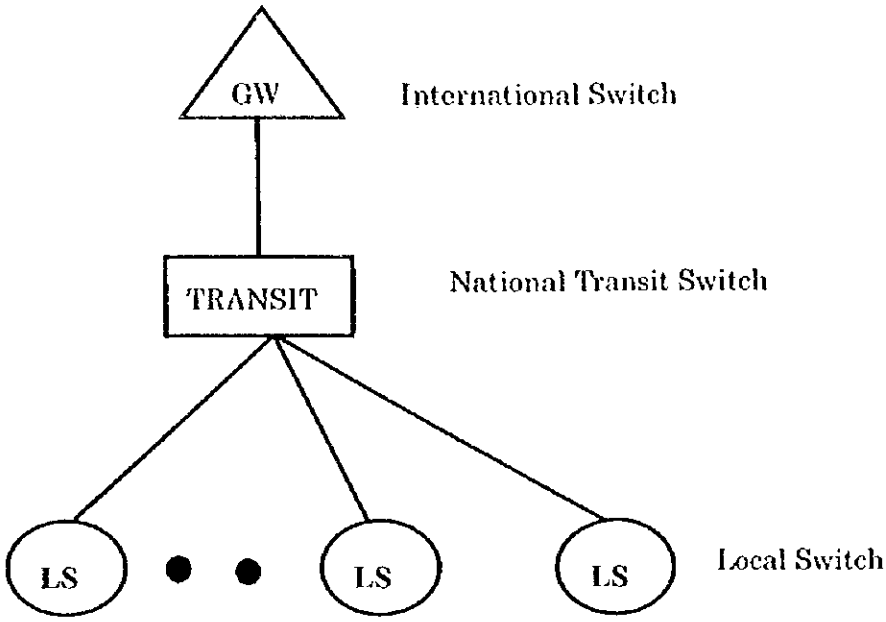


Figure 4.1-2 Network Configuration in Ha Noi City

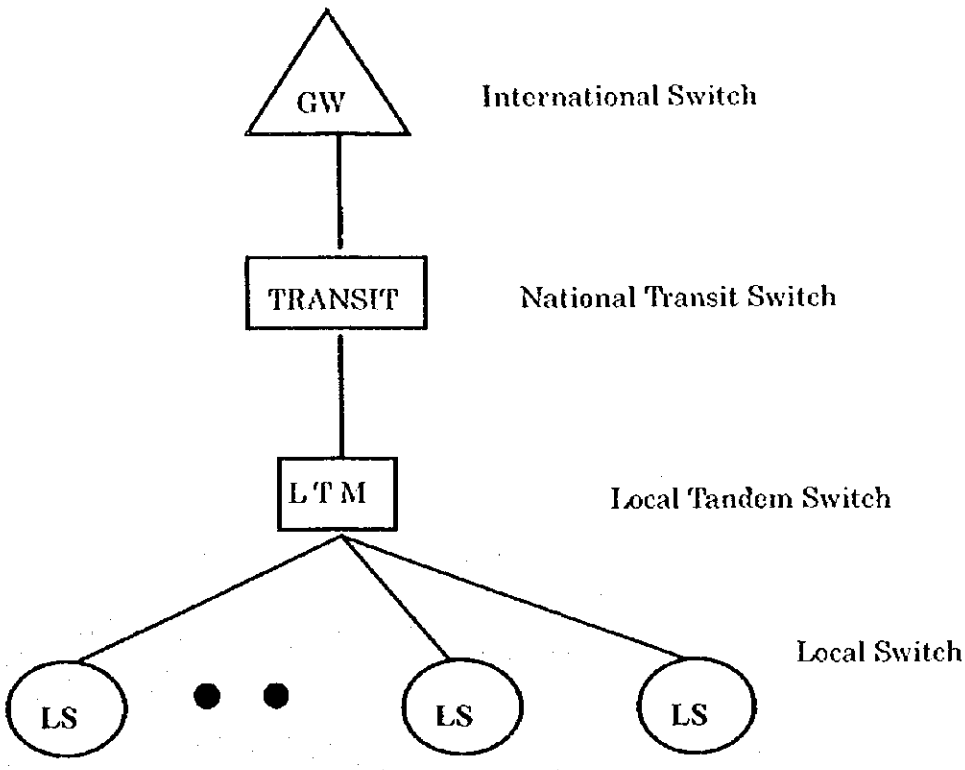


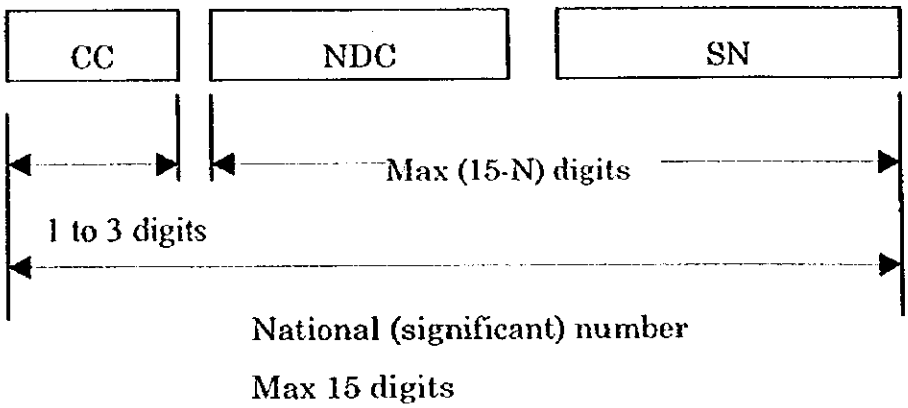
Figure 4.1-3 Network Configuration in Ho Chi Minh City

4.2 Numbering Plan

Numbering Plan for international telecommunications number for geographic areas is recommended in ITU-T Recommendation E.164. This Recommendation provide the number structure and functionality which detailed the components of the numbering structure and digit analysis required to successfully route the call. National numbering plan in Vietnam follows this Recommendation.

4.2.1 International Public Telecommunication Number Structure

The ITU-T recommends that the maximum number of digits should be 15 (excluding the international prefix). Administrations are invited to do their utmost to limit the digits to be dialed to the degree possible consistent with the service needs.
According to the ITU-T Recommendation, an international number consists of the following elements : Country Code (CC), National (Significant) Number N(S)N. Figure 4.2.1-1 shows the international public telecommunication number structure.



CC Country Code
NDC National Destination Code
SN Subscriber Number
N Number of digits in the country code

Figure 4.2.1-1 Telecommunication Number Structure

4.2.2 Numbering Plan in Vietnam

On March 1, 1996, VNPT completed the changing of national numbering plan. The

national numbering plan for Vietnam is as follows:

(1) International Prefix : 00

Dialed by a calling subscriber from Vietnam making a call to another country to obtain access to the automatic outgoing international equipment. Dialing procedure for international call is:

International Prefix + Country Code + Trunk Code + Subscriber's Number

(2) National (Trunk) Prefix : 0

Dialed by a calling subscriber making a call to a subscriber outgoing his own numbering area (Province). It provides access to the automatic outgoing trunk equipment. Dialing procedure for national call is:

Trunk prefix + Trunk Code + Subscriber's Number

(3) Country Code :

Vietnam's country code is 84 (decided by ITU-T)

(4) Trunk Code : (with prefix 0)

A combination of digits (not including the national (trunk) prefix) characterizing the numbering area within Vietnam territory. Vietnam consists of 61 trunk codes (Area Codes) characterizing 61 provinces and cities (see Figure 4.2.2-1 and Table 4.2.2-2).

(5) Trunk code for private network (with prefix 0)

In this numbering plan specified another trunk code as follows:

69 : Private network access code.

90 : Vietnam Mobile Service (VMS) Co. trunk code.

91 : GSM Co. trunk code.

125 : Vietnam Data Company trunk code for access to the network by dial-up modem.

(6) Subscriber Number

In this numbering plan, a combination of 6 digits will be used for subscriber in 59 provinces and a combination of 7 digits will be used for subscriber in Ha Noi and Ho Chi Minh City. The subscriber number is shown in Table 4.2.2-1, where each digit of the national number is represented by the Code: A, B, C, D, E, F G , H or I. A closed numbering system is adopted within the same Province.

(7) Mobile Telephone Subscriber Number :

In the mobile network, the subscriber number is the combination of 6 digits.

(8) Code for Special Services :

An special service numbers "1XY" are adopted for subscriber's use.(Table 4.2.2-3)

Table 4.2.2-1 Subscriber Number

Area Code	Subscriber Number	Application Area
A	B C D E F G H	Ha Noi HCMC
A B	C D E F G H	Hai Phong
A B C	D E F G H I	Da Nang Quang Nam

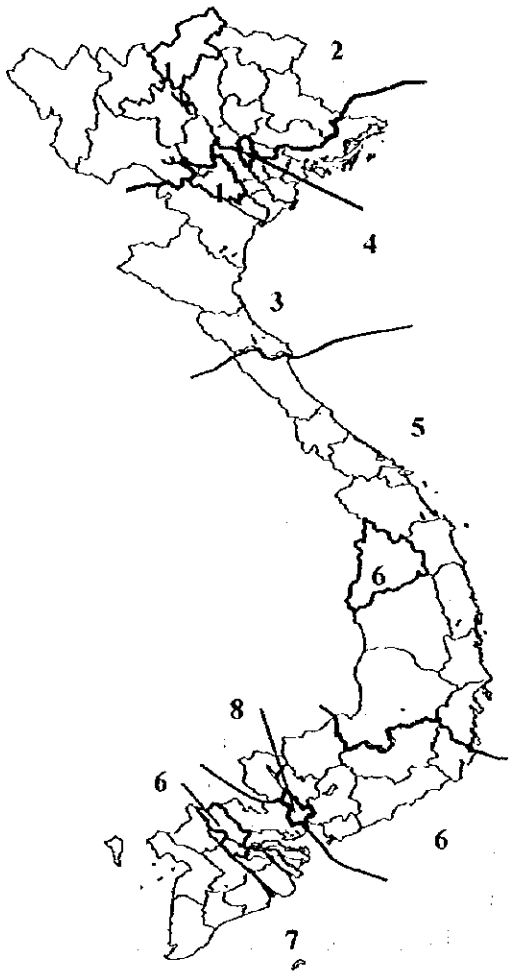


Figure 4.2.2-1 A Code Allocation in Vietnam

Table 4.2.2-2 Area Code (Trunk Code)

	Province Name	A CODE	Area Code	Note
1	HNI (Ha Noi)	4	4	
2	HCM (Ho Chi Minh City)	8	8	
3	HPG (Hai Phong)	3	31	
4	DNG (Da Nang)	5	511	Q. Nam-Da Nang 51
5	HGG (Ha Giang)	1	19	
6	TQG (Tuyen Quang)	2	27	
7	CBG (Cao Bang)	2	26	
8	LSN (Lang Son)	2	25	
9	LCU (Lai Chau)	2	23	
10	YBI (Yen Bai)	2	29	
11	LCI (Lao Cai)	2	20	
12	BCN (Bac Can)	2	281	Bac Thai 28
13	TNN (Thai Nguyen)	2	280	Bac Thai 28
14	SLA (Son La)	2	22	
15	PTO (Phu Tho)	2	21	Vinh Phu
16	VPC (Vinh Phuc)	2	21	Vinh Phu
17	BGG (Bac Giang)	2	240	Ha Bac 24
18	BNH (Bac Ninh)	2	241	Ha Bac 24
19	QNI (Quang Ninh)	3	33	
20	HTY (Ha Tay)	3	34	
21	HBH (Hoa Binh)	1	18	
22	HDG (Hai Duong)	3	32	Hai Hung
23	HYN (Hung Yen)	3	32	Hai Hung
24	TBH (Thai Binh)	3	36	
25	HNM (Ha Nam)	3	35	Nam Ha
26	NDH (Nam Dinh)	3	35	Nam Ha
27	NBH (Ninh Binh)	3	30	
28	THA (Thanh Hoa)	3	37	
29	NAN (Nghe An)	3	38	
30	HTH (Ha Tinh)	3	39	
31	QBN (Quang Binh)	5	52	
32	QTI (Quang Tri)	5	53	
33	HUE (Thua Thien Hue)	5	54	
34	QNM (Quang Nam)	5	510	Q. Nam-Da Nang 51
35	QNI (Quang Ngai)	5	55	
36	BDN (Binh Dinh)	5	56	
37	PYN (Phu Yen)	5	57	
38	KHA (Khanh Hoa)	5	58	
39	GLI (Gia Lai)	5	59	
40	KTM (Kon Tum)	6	60	
41	DLC (Dak Lak)	5	50	
42	LDG (Lam Dong)	6	63	
43	BDG (Binh Duong)	6	65	Son Be
44	BPC (Binh Phuoc)	6	65	Son Be
45	NTN (Ninh Thuan)	6	68	
46	BTN (Binh Thuan)	6	62	
47	TNI (Tay Ninh)	6	66	
48	DNI (Dong Nai)	6	61	
49	LAN (Long An)	7	72	
50	DTP (Dong Thap)	6	67	
51	AGG (An Giang)	7	76	
52	TGG (Tien Giang)	7	73	
53	BTE (Ben Tre)	7	75	
54	CTO (Can Tho)	7	71	
55	STG (Soc Trang)	7	79	
56	VLG (Vinh Long)	7	70	
57	TVH (Tra Vinh)	7	74	
58	KGG (Kien Giang)	7	77	
59	BLU (Bac Lieu)	7	78	Minh Hai
60	CMU (Ca Mau)	7	78	Minh Hai
61	VTU (Ba Ria Vung Tau)	6	64	

Source: VNPT

Table 4.2.2-3 Subscriber Special Code

Code	Code for special services	Note
101	Long distance domestic telephone service	
102	National long distant call – operator support	
105	Domestic Paging service (English)	
106	Paging service inquiries (Information)	
107	Domestic Paging service(Vietnamese)	
108	Information Service	
110	International call – operator support	
113	Police	
114	Fire	
115	Ambulance	
116	Directory Inquiry	
117	Time inquiries	
118	Bell checking (Ring Back Test)	
119	Telephone repair service	
120	HCD (Home Country Direct)	
130		
131		
132		
133	Ha Noi ABC paging service	
134		
135		
136		
137		
138		
139		
140		
141	VinaPhone paging service	
142	International telephone service rate	
143	International telephone service inquiries	

Source: VNPT

4.3 Signaling System

In Vietnam two types of signaling system are adapted between digital exchanges:

(a) R-2 Signaling System and

(b) No. 7 Signaling System National version for Vietnam National Network

with the latest relevant ITU-T Recommendations as approved by ITU-T in March 1993. Signaling System No.7 Vietnam Version was introduced recently between Local Exchange and Transit Exchange in Ha Noi, Ho Chi Minh and Da Nang Cities.

4.3.1 R-2 Signaling System for National Network

An in-band signaling system is applied to sections wherein digital time division multiplex

is employed. The system transmits supervisory signals by means of bit "0" or "1".
In Vietnam, the Channel associated signaling system ITU-T R-2 with digital line and fully compelled resister signaling is used for interworking between the transit exchanges and local exchanges in provinces.

(a) Network signaling supported by the exchanges shall include and be in accordance with the relevant ITU-T R-2 signaling Q400 to Q490 and Supplements to the Series Q Recommendation.

(b) The performance of the signaling equipment in the exchange shall comply with the requirement of ITU-T Blue Book, Recommendations Q.440 to Q458.

(c) Line Signaling
The line signaling system to be used for inter-connection shall be by means of the channel-associated system described in ITU-T Blue Book, Recommendation Q.421 (with national signals added). It uses 2 out of 4 signaling channels in each direction and transmission per speech circuit.

(d) Register Signaling
The register signaling to be used is a form of ITU-T R2 channel associated multi-frequency compelled signaling. The Vietnam variant is generally in compliance with the options given in the ITU-T Blue Book, recommendations Q441. The frequencies used are standard, but some meanings of the codes are nationally defined and others differ from the ITU-T Recommendations.

4.3.2 Vietnam CCS No.7 Signaling System

Vietnam CCS No.7 Signaling System includes the following ITU-T Recommendations :

(a) Message Transfer Part (MTP) Q701 to Q737
(b) ISDN - User Part (ISUP) Q761 to Q764. Q730 to Q737 and separately Q767.

It is likely that during operational life of the exchange, the ITU-T will further develop recommendations dealing with ITU-T No.7 signaling. Sufficient flexibility shall exist within the exchange to permit the implementation of the updates to the ITU-T No.7 signaling system and its services without disruption to the exchange or the need for costly hardware modification. The Exchange shall also be capable of interworking with existing exchanges using R2 signaling system.
ITU-T Recommendation indicate the CCS No.7 protocols which provide the signaling

functions required to support services in a telephone network, data communication network, as well as basic bearer services and supplementary services for voice and non-voice applications in an integrated services digital network (ISDN).

(1) Present Situation of CCS No.7 Application

Replacing conventional R-2 Signaling by CCS No.7 is a world trend to step into the ISDN era. In Vietnam, the new networks were linked by applying standard CCS No.7 recommended by ITU-T in 1997, where the destination switch can meet this requirement. These links are between Gateway Switches (AXE-10) and Toll Switches (AXE-10, TDX-10) and between Local Switches (E-10) and Toll Switches (AXE-10. TDX-10).

(2) Features of A Common Channel Signaling System

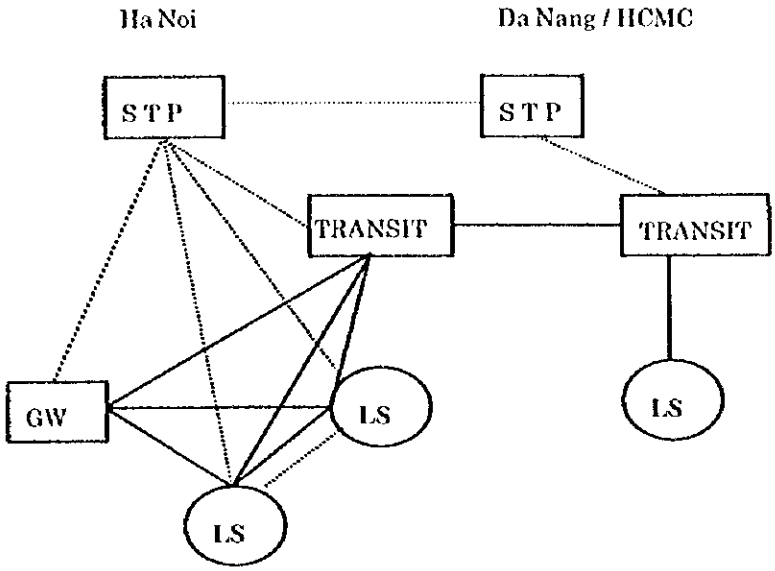
A common channel signaling system has the following features in comparison with conventional signaling systems such as both way operation of speech circuits, and available application to future technological trends or services (IN, ISDN). In Vietnam both way operation of speech circuits are available for all CCS circuits.

(3) CCS Network Configuration

A common channel signaling network is composed of an associated mode and a non-associated mode of operation in Vietnam. Existing signaling network is shown in Figure 4.3.2-1.

Vietnam is in the process of building up common channel signaling network in its telephone networks in accordance with the ITU-T Recommendation. These signaling networks configured in a non-associated mode of operation to make more efficient use of signaling circuits. Some exchanges have both an associated mode of operation and non-associated mode of operation and in case of a fault in a channel associated signaling system, non-associated signaling system will back up the signaling system for reliability.

In view of it's importance and to ensure reliability, the signaling network is recommended to be mesh in duplicated homing arrangements, which are shown in Figure 4.3.2-2 Typical Configuration of Basic Mesh Network and Figure 4.3.2-3 Typical Configuration of Two-plane Network as sample networks.



———	Communication Line
.....	Signaling Circuit
STP	Signal Transfer Point
GW	Gate way Switch
TOLL	Transit Exchange
LS	Local Switch

Note: STP processor is integrated with the processor of TRANSIT exchanges.

Source : DGPT

Figure 4.3.2-1 Existing Common Channel Signaling Network

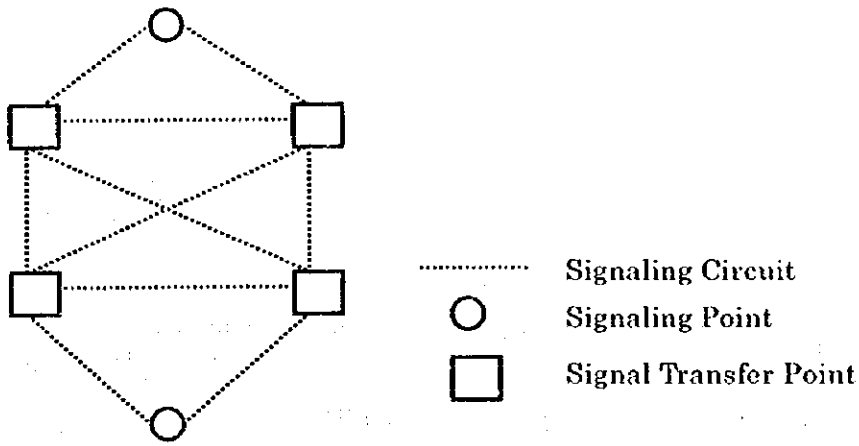


Figure 4.3.2-2 Typical Configuration of Mesh Network

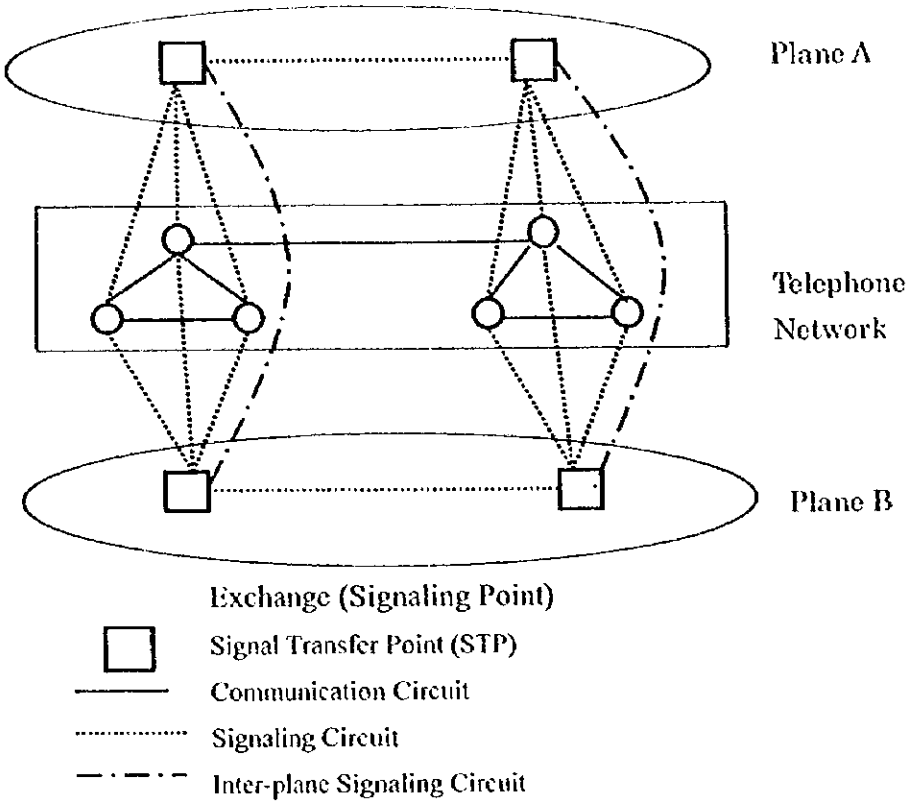


Figure 4.3.2-3 Typical Configuration of Signaling Network

4. 4 Routing Plan

Between subscribers or between exchanges, there are usually several routing through transit / tandem exchanges. Routing is a means to select economically and logically the most advantageous route.

The following general conditions are applied for routing in Vietnam.

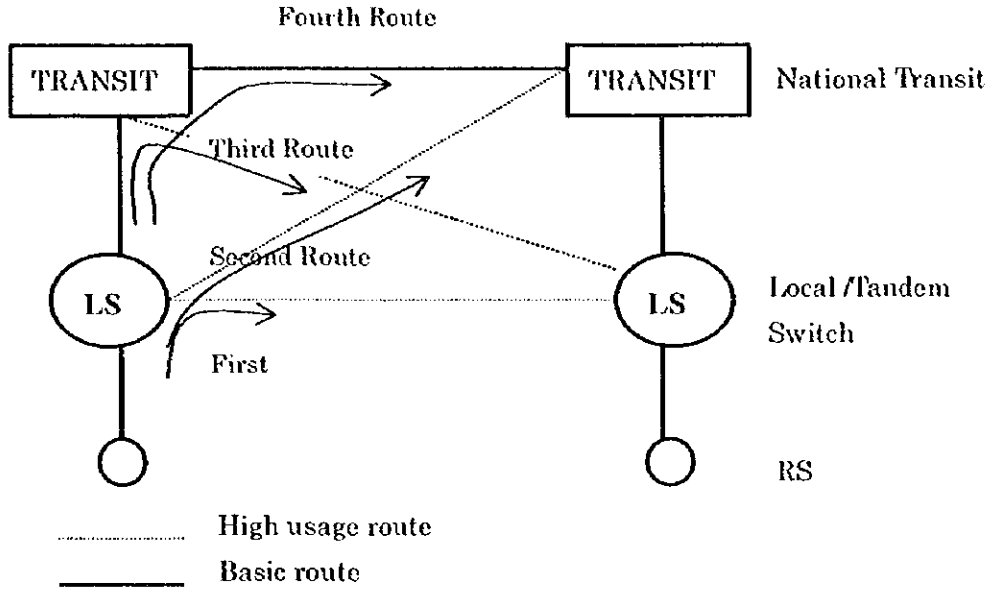
i) No return or loop should generate between two exchanges.
ii) The selection process and control procedure should be simple.
iii) The circuit should be efficiently used.
iv) The network design and management should be easy.

4.4.1 Existing Routing Method in Vietnam Telephone Network

Alternative Routing, and Far-to-Near Rotation Method are applied for routing.

(1) Alternative Routing

As shown in Figure 4.4.1-1, when all of the first route's circuits are busy, the second route is selected. If the second route is busy, the third route is selected, and so on. The process repeats itself until an available route is found, or until the last route is discovered to be busy and the call is lost.



Source DGPT

Figure 4.4.1-1 Concept of Alternative Routing

(2) Far-to-Near Rotation (Far-shaped rotation)

As shown in Figure 4.4.1-1, the route to the furthest exchange from originating exchange is first selected (the route that passes the fewest transit exchange). If this route is busy, the second furthest route is selected. This method is called "Far-to-near rotation" and is used in Vietnam and many other countries.

(3) Dynamic Routing

Route selection is flexible according to the congestion and the busy hour of the point-to-point traffic. Dynamic routing is not applied in Vietnam.

4.4.2 Homing Plan

In Vietnam, network is composed based on the hierarchical formation. In this hierarchical network organization, the exchange rank of each layer is called the office rank. The area in charge is called the zone. Routing, and circuit settlement are based on this organization (see Figure 4.4.2-1).

There are three levels of zone, local exchange zone, provincial zone and transit exchange area zone. Transit Exchange areas are divided into three, Ha Noi, Da Nang and Ho Chi Minh City as shown in Figure 4.4.2-2.

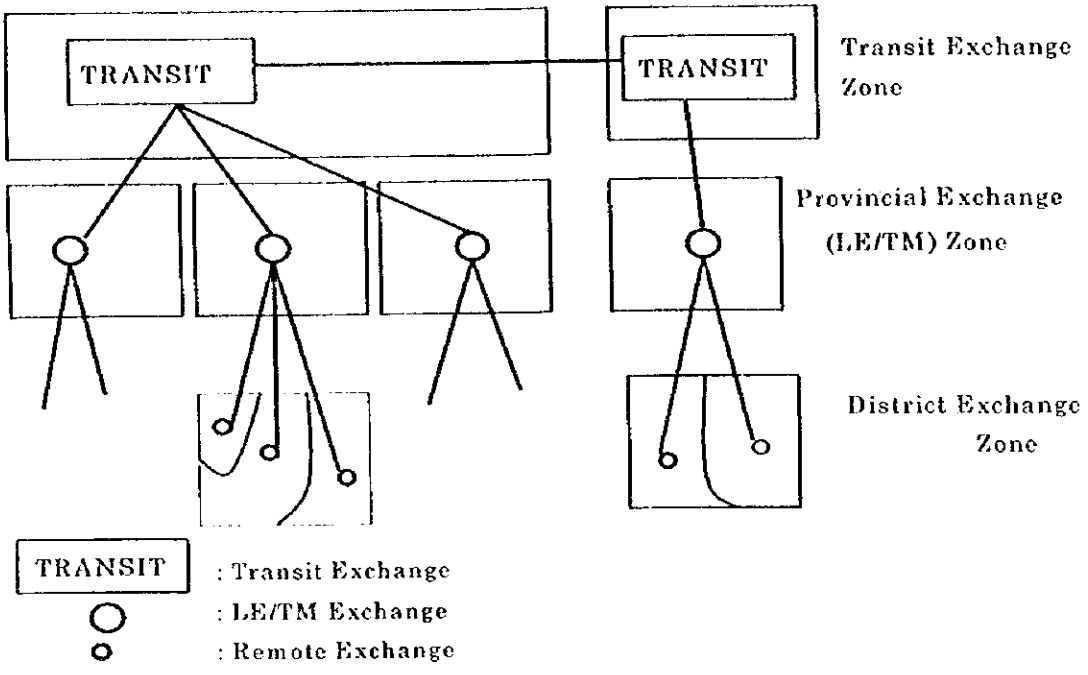
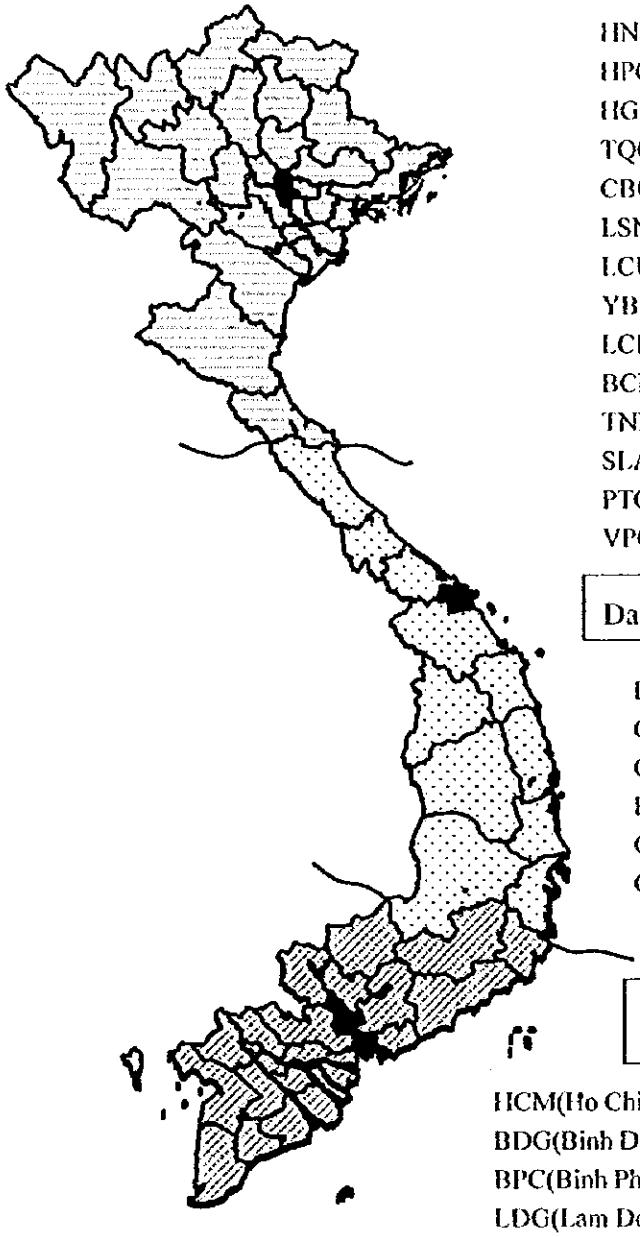


Figure 4.4.2-1 Hierarchical Network Organization



Ha Noi Transit Exchange

HNI(Ha Noi)	BGG(Bac Giang)
HPG(Hai Phong)	BNN(Bac Ninh)
HGG(Ha Giang)	QNH(Quang Ninh)
TQG(Tuyen Quang)	HTY(Ha Tay)
CBG(Cao Bang)	HBH(Hoa Binh)
LSN(Lang Son)	HDG(Hai Duong)
LCU(Lai Chau)	HYN(Hung Yen)
YBI(Yen Bai)	TBH(Thai Binh)
LCI(Lao Cai)	HNM(Ha Nam)
BCN(Bac Can)	NDH(Nam Dinh)
TNN(Thai Nguyen)	NBH(Ninh Binh)
SLA(Son La)	THA(Thanh Hoa)
PTO(Phu Tho)	NAN(Nghe An)
VPC(Vinh Phuc)	HTH(Ha Tinh)

Da Nang Transit Exchange

DNG(Da Nang)	BDN(Binh Dinh)
QBN(Quang Binh)	PYN(Phu Yen)
QTI(Quang Tri)	KHA(Khanh Hoa)
HUE(Thua Thien Hue)	GLI(Gia Lai)
QNM(Quang Nam)	KTM(Kon Tum)
QNI(Quang Ngai)	DLC(Dak Lak)

HCMC Transit Exchange

HCM(Ho Chi Minh City)	AGG(An Giang)
BDG(Binh Duong)	BTE(Ben Tre)
BPC(Binh Phuoc)	TGG(Tien Giang)
LDG(Lam Dong)	CTO(Can Tho)
NTN(Ninh Thuan)	STG(Soc Trang)
BTN(Binh Thuan)	VLG(Vinh Long)
TNH(Tay Ninh)	TVH(Tra Vinh)
DNI(Dong Nai)	KGG(Kien Giang)
LAN(Long An)	BLU(Bac Lieu)
DTP(Dong Thap)	CMU(Ca Mau)
	VTU(Ba Ria Vung Tau)

Figure 4.4.2-2 Transit Exchange Zone

4.5 Charging System Plan

4.5.1 Existing Charging System

International and national automatic telephone service is charged based on distance, call duration and time. For local calls, 450 minutes per month for telephones of above 500 lines capacity systems are free of charge (within a basic monthly charge). The charging method is pulse metering or Automatic Message Accounting (AMA). It is also possible to use both method for the same call.

Charging data of subscribers are stored on magnetic tape (or floppy disc) in local exchanges. These tapes are transferred to billing center where billing will be performed. Billing is done at post-processing billing centers separated from the exchanges. Billing center is located at each Province and the handling of billing tape is different in Province by Province. All bills, international and domestic are prepared at the billing center as a combined bill including for FAX and INTERNET services.

4.5.2 Exchange Function for Charging

VNPT specifies that facility shall be provided in the exchange to record details of every call offered to the exchange and to transfer this data via data link to remote center. It shall also be possible to transfer this data onto cartridges, magnetic tapes, hard disk, high-density floppy disk or optical disks.

The exchange shall be equipped to send periodic metering pulses from the exchange to subscribers equipped with private meters or accumulators and to Payphones. Facilities shall also provide in the exchange to ensure the secure and audit transfer of call event recording information. This transfer of information shall occur to two destinations: one is for division of revenue, and another is for real time traffic analysis.

For each call, it shall be possible to perform the charging services "immediate price advice" and "call specification".

(1) Immediate Price Advice

With "immediate price advice" is meant that after the call, the subscriber will be provided with information of the price for the call. The price information shall be calculated automatically by the exchange after release of the call and printed out to a "price information operator".

(2) Call Specification

With "call specification" is meant that a subscriber can for calls charged by pulse metering have a detailed specification of charging data for these calls.

4.5.3 Call Data Record

Call Data Record (CDR) contents of Local Exchange are specified for following items, in VNPT format:

- Call Duration Information (time in seconds)
- Calling Party Information
- Called Party Information
- Subscriber Service Information
- Exchange Related Information

4.6 Network Synchronization Plan

This clause introduces the technical standards stipulated in ITU-T for Network synchronization. The object of network synchronization is to ensure that all elements in the network use the common timing clock to avoid slips. This scheme contains following technical methods.

4.6.1 Synchronization Structure

(1) Structure of Synchronization Networks

International networks usually work in the plesiochronous mode one with another. The synchronization of national networks may be of the following types

- Fully synchronized, controlled by one or several primary reference clocks

(2) Master-slave Synchronization Methods

The master-slave synchronization system has a single primary reference clock to which all other clocks are phase-locked. Synchronization is achieved by conveying the timing signal from one clock to the next clock. Hierarchies of clocks can be established with some clocks being slaved from higher order clocks and in turn acting as master clocks for lower order clocks.

(3) Hierarchical Synchronization Network

Hierarchical synchronization network, which consist of PRC, Transit and local

layers for centralized clock concept. (See Fig.4.6.1-1)

(a) Synchronization trails must originate from the PRC and clocks in the telecommunication must be synchronized to the Master Clock (PRC).

(b) The slave system adjusts the own clock to the incoming timing signal. The incoming timing signal contains both the clock and data information.

(c) The hierarchical levels are:

- PRC (G.811) $\pm 1 \times 10^{-11}$
- Slave clock (G.812)
  - Transit node clock $\pm 5 \times 10^{-10}$
  - Local node clock $\pm 1 \times 10^{-8}$
- SDH network element clock (G.813) $\pm 4.6 \times 10^{-6}$

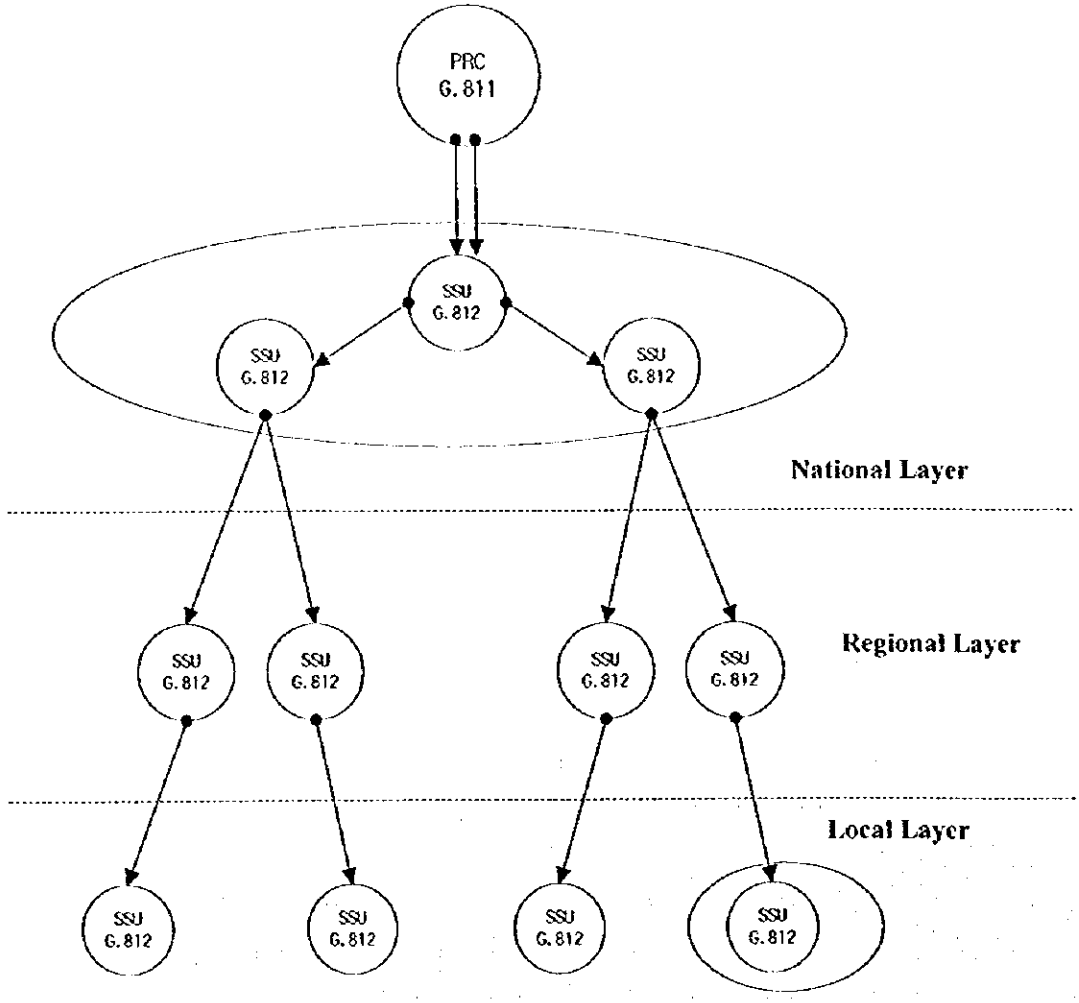


Figure 4.6.1-1 Hierarchical Synchronization

(4) Threshold of Slip Performance

The slip rates represent the synchronization performance. The end-to-end performance for telephone and non-telephone service on a 64kb/s digital connection in an ISDN is recommended in ITU-G.822 as below.

Table 4.6.1-1 Controlled Slip Performance on a 64kb/s

Category	Mean slip rate	Proportion time
(a)	≤ 5 slips in 24 hours	>98.9%
(b)	≤ 5 slips in 24 hours and ≤ 30slips in 1 hour	<1.0%
(c)	> 30 slips in 1 hour	<1.0%

Note. Total time ≥ 1year

Slip is defined as repetition or deletion of a block of bits due to a discrepancy in the read and write rates at a buffer memory. Additionally, if the clock accuracy is degraded, the number of slips is increased.

The correlation of clock accuracy and slip interval/number of slips are shown in Table 4.6.1-2 and also Figure 4.6.1-2.

Table 4.6.1-2 Correlation of Clock Accuracy and Slip Interval/Number of Slips

Clock accuracy	Slip interval	Number of slips per day
10^{-11}	72-day	0.014/day
10^{-10}	7.2-day	0.14/day
10^{-9}	0.72-days	1.4/day
10^{-8}	0.072-day	14/day
7.2×10^{-9}	17280 sec (24×3600÷5)	5/day

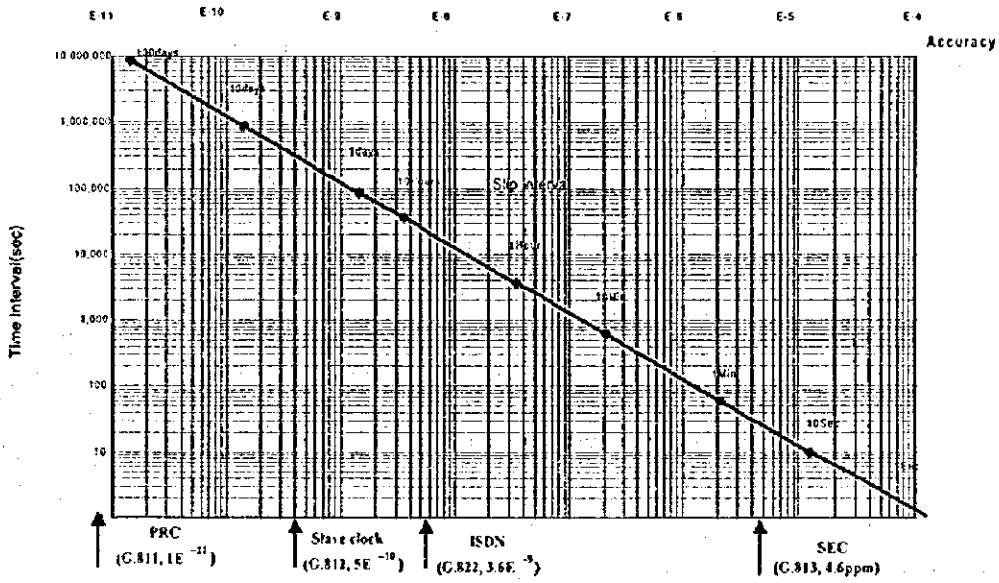


Figure 4.6.1-2 Correlation of Accuracy and Slip Interval

4.6.2 Synchronization of SDH Network

(1) Network Robustness

Synchronization Network of SDH should has robustness, which is recommended in G.803. It is preferable if all node clocks and network element clocks are able to recover timing from at least two synchronization distribution trails. The slave clock must reconfigure to recover timing from an alternative trail when the original trail fails.

The reconfiguration example is given in Figure 4.6.2-1.

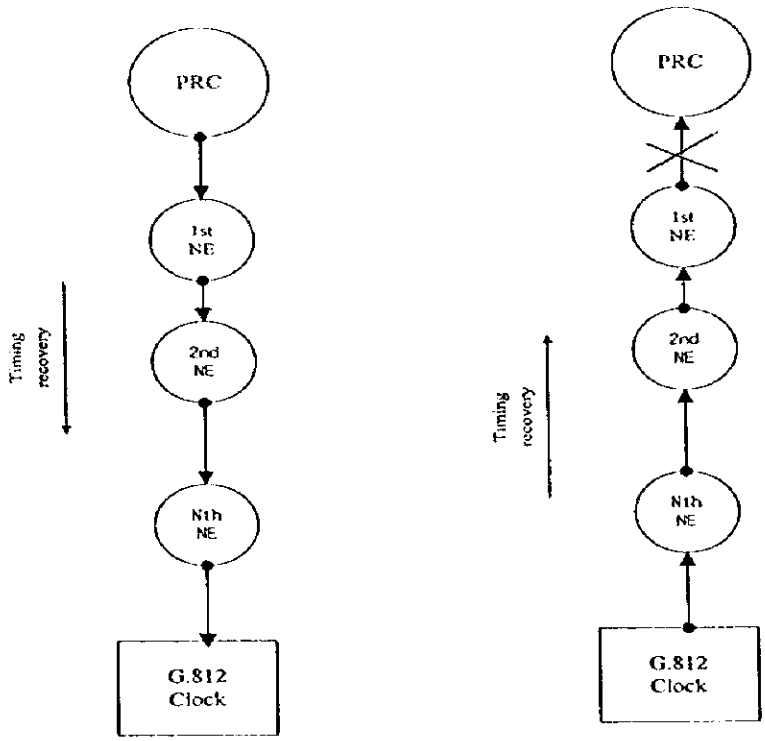
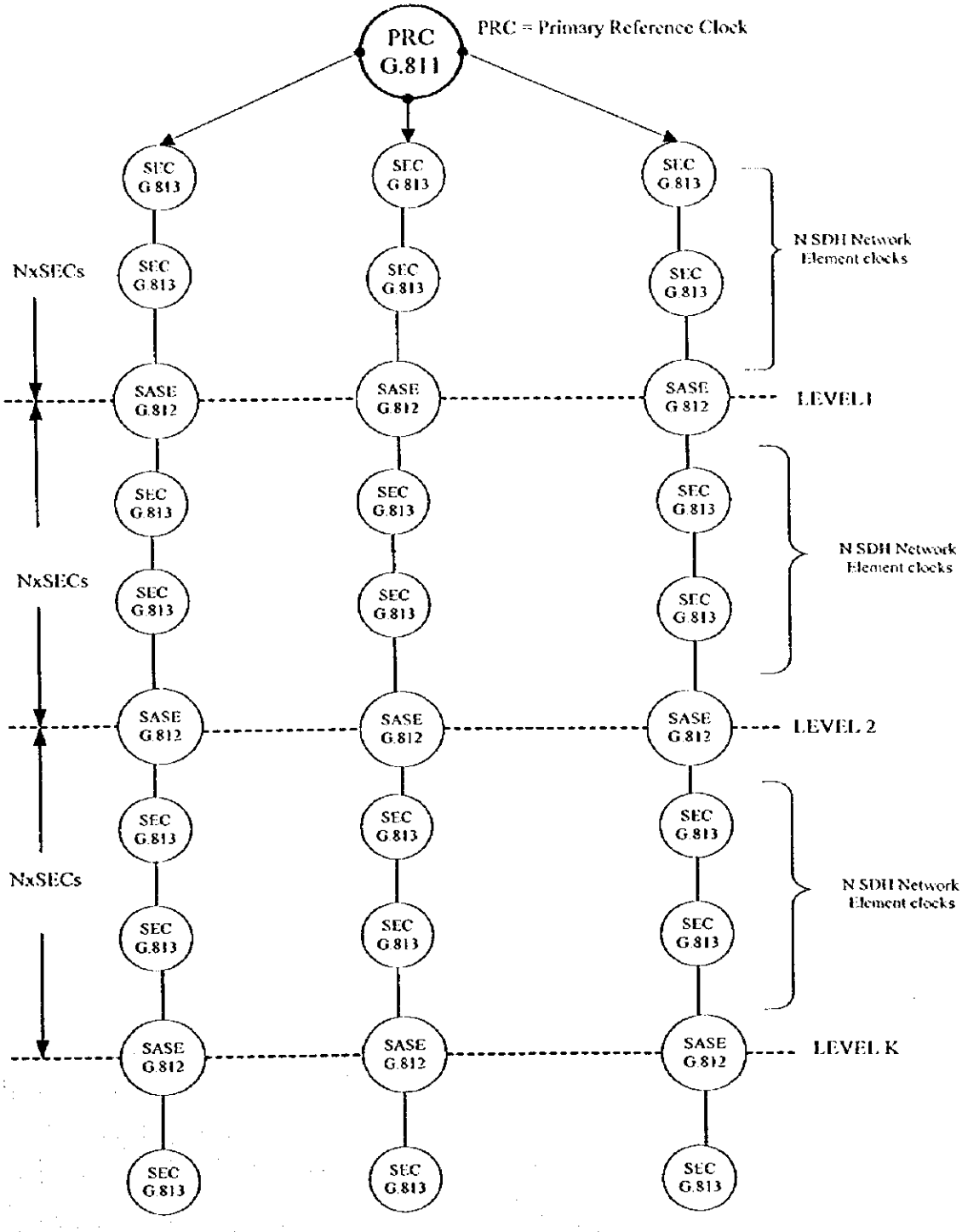


Figure 4.6.2-1 Reconfiguration Example (G.803)

(2) Network Reference Chain

The synchronization network reference chain is shown in Figure 4.6.2-2. The node clocks are interconnected via N network elements with Recommendation G.813. The longest chain should not exceed K slave clocks compliant with Recommendation G.812. The quality of timing will deteriorate as the number of synchronization links increases.

To determine synchronization clock specifications, the values for the worst-case synchronization reference chain are: $K = 10$, $N = 20$ with the total number of SDH network element clocks limited to 60.



The value for the worst case synchronization reference cahin are(Nwork Limitation)
1. K = 10
2. N = 20
3. The total number of SDH Network element is limited to 60.

Figure 4.6.2-2 Network Reference Chain

4.7 Error Performance Objective

This clause introduces the technical standards stipulated in ITU-T recommendation for Error Bit performance digital connections below the primary rate of the digital hierarchy, which are stated for each direction of a n × 64 kbit/s circuit-switched connection. This clause states the Error Bit performance of the followings, which are not adapted in VNPT:

(1) Performance Objectives

The objectives for an international ISDN are shown in Table 4.7-1.

It is intended that international ISDN connections should meet all of the requirements of them.

Table 4.7-1 Error Performance Objectives

Performance classification ratio	Objective (Notes 1, 2)
Severely Errored Second Ratio (%SES)	< 0.002
Errored Second Ratio (%ES)	< 0.08

NOTES
1 The ratios are calculated over the available time. The observation time has not been specified since the period may depend upon the application. A period of the order of any one month is suggested as a reference.
2 Annex A illustrates how the overall performance should be assessed.

(2) Error Performance Events and Parameters

(a) Event

i) Errored Second (ES)

It is a one-second period in which one or more bits are in error.

ii) Severely Errored Second (SES)

It is a one-second period, which has a bit error ratio $\geq 1.10^{-3}$

(b) Parameters

It should be noted that total observation time (S_{total}) is split into two parts, namely, time for which the connection is deemed to be available (S_{avail}) and that time when it is unavailable ($S_{unavail}$). Error performance should only be evaluated whilst the connection is in the available state. See Annexes A and B.

i) Errored Second Ratio (ESR)

The ratio of ES to total seconds in available time during a fixed measurement interval.

ii) Severely Errored Second Ratio (SESR)

The ratio of SES to total seconds in available time during a fixed measurement interval.

(3) Circuit Quality Demarcation of Overall Objectives

Three distinct quality classifications have been identified to represent practical digital transmission circuits on digital hypothetical reference configuration (HRX). These classifications are termed local grade, medium grade and high grade and their usage generally tends to be dependent on their location within a network.

The Figure 4.7-1 shows an example of the circuit quality demarcation adopted in Japan as a reference. The basic concepts of allocation are described below.

(a) The allocation of the permitted degradation is given below.

Local grade	: 15%
Medium grade (two ends)	: 15%
High grade	: 40%

(b) The actual length covered by the medium grade part of the Connection will vary considerably.

(c) The local and medium grade portions are permitted to cover up the first 1,250km of the circuit from T-reference point. For example, in small countries it may go as far as SC, TC or the ISC.

(d) The total allocation of 0.2% severely errored seconds is subdivided into each circuit classification (local, medium, high grade) in the following manner.
0.1% is divided between the three circuit classification in the same proportion.
Remaining 0.1% is a block allowance for worst month.

The national model of Japan is shown as a reference.

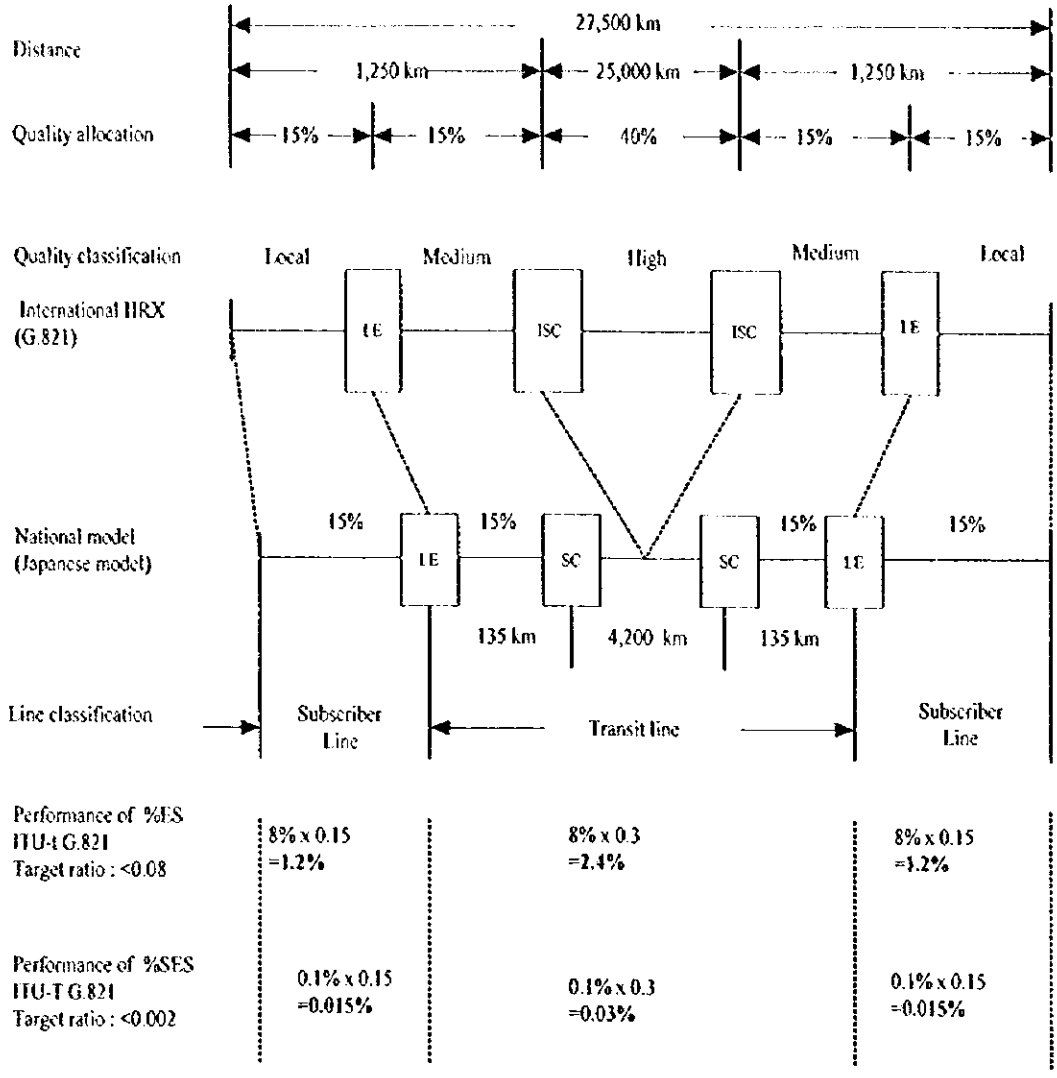


Figure 4.7-1 Circuit Quality Demarcation of Longest HRX.

(4) Error Performance Objective for National Digital Connection

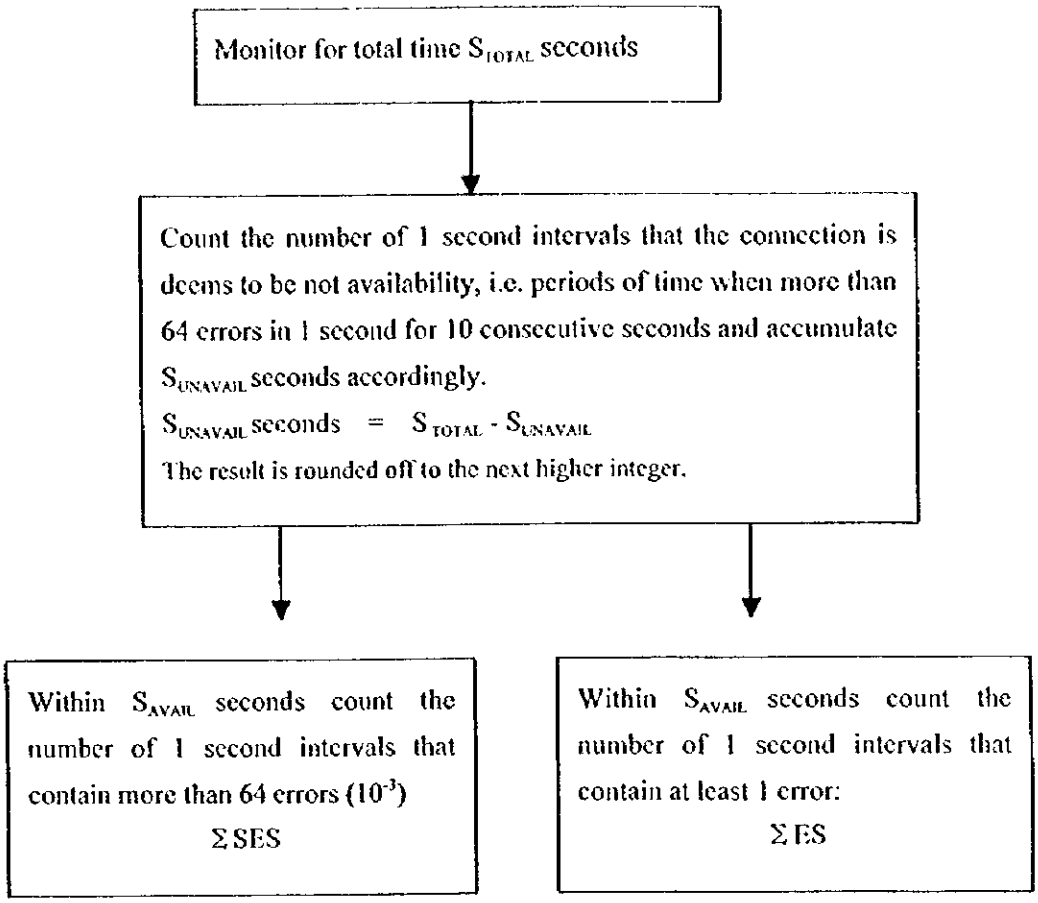
Figure 4.7-1 shows the quality allocation of error performance for national model, which is adopted in Japan, it is recommended that this allocation scheme is used as a standard.

Table 4.7-2 Error Performance Objectives for National Digital Connection

	Subscriber line	Transit line	Overall performance
% SES	0.03 %	0.03 %	0.06 %
% ES	2.4 %	2.4 %	4.8 %

Annex A

Guidelines Concerning the Interpretation of Table 4.7.1



Error Performance Objectives

Performance classification (see Table 4.1.7-1)	Objective
SESR	$\frac{\Sigma SES}{S_{Avail}} < 0.002$
ESR	$\frac{\Sigma ES}{S_{Avail}} < 0.08$

Annex B

Criteria for the Unavailabe period and Available State

A period of unavailable time begins at the onset of ten consecutive SES events. These ten seconds are considered to be part of unavailable time. A new period of available time begins at the onset of ten consecutive non-SES events. These ten seconds are considered to be part of available time. Figure 4.7-2 illustrates this definition.

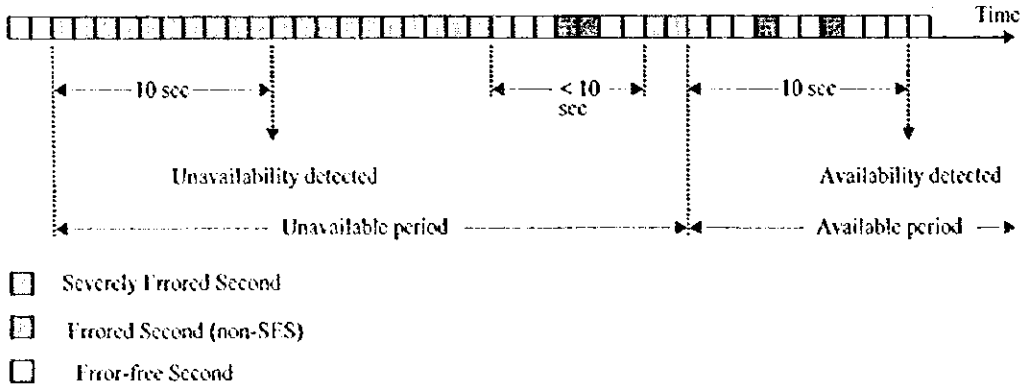


Figure 4.7-2 Example of Unavailability Determination

4.8 SDH Network Availability

This clause introduces the technical standards stipulated in ITU-T recommendation on Network reliability. The protection architecture increases the availability of transmission network, which may include rings, or linear chains of nodes.

(1) One-for-one Link Protection (1+1)

This method of protection is simple to provide, control and understand, consequently this method is widely used. The traffic from the source is transmitted simultaneously over both bearers and the decision to switch between main and standby is taken at the receiving location; in this situation only "loss of signal" is required to initiate changeover. One-for-one protection gives its best performance if the main and standby routes are completely separated, it minimizes the risk of failures.

On the downside, one-for-one protection is a very inefficient use of network

equipment since 50% is always in a standby mode waiting to be used.

(2) One-for-N Link Protection (N+1)

This protection technique is an extension of the above technique. On the assumption that the failure rate of simultaneous failure of two or more routes in a group of N is low enough, it is possible to share the standby route amongst N working routes.

Compared with one-for-one protection this method makes a more cost-effective use of equipment but requires slightly more sophisticated control and cannot offer the same level of availability. Diverse routing of main and standby paths is also much harder to achieve.

(3) Ring Protection

During a ring switch, working channels are switched to the protection channels transmitted in the opposite direction. Ring architectures are considered to be a class of one-for-one protection. However, one-for-one protection does not immediately imply complete physical diversity between main and standby routes, a ring is usually understood to offer two separate directions of communication.

The principal advantage of rings is in their flexibility for providing protection at any node on the ring in response to unforeseen demand.

This paragraph introduces the SDH self-healing ring, which can be categorized into two, two-fiber and four-fiber ring protection. They are described below.

(a) Two-fiber MS Shared Protection Rings

Two-fiber MS switched rings require only two fibers for each span of the ring. Each fiber carries both working channels and protection channels.

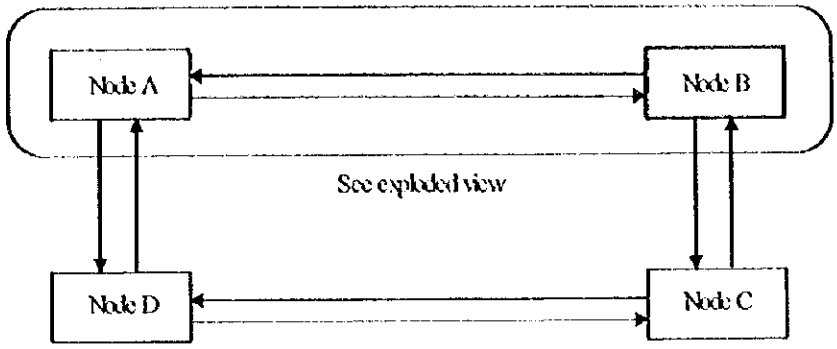
On each fiber, half the channels are defined as working channels and half are defined as protection channels. The working channels in one fiber are protected by the protection channels traveling in the opposite direction around the ring. (See Figure 4.8-1.) This permits the bi-directional transport of working traffic.

Two-fiber MS shared protection rings support ring switching only. When a ring switch is invoked, the time slots that carry the working channels are switched to the time slots that carry the protection channels in the opposite direction.

(b) Four-fiber MS Shared Protection Rings

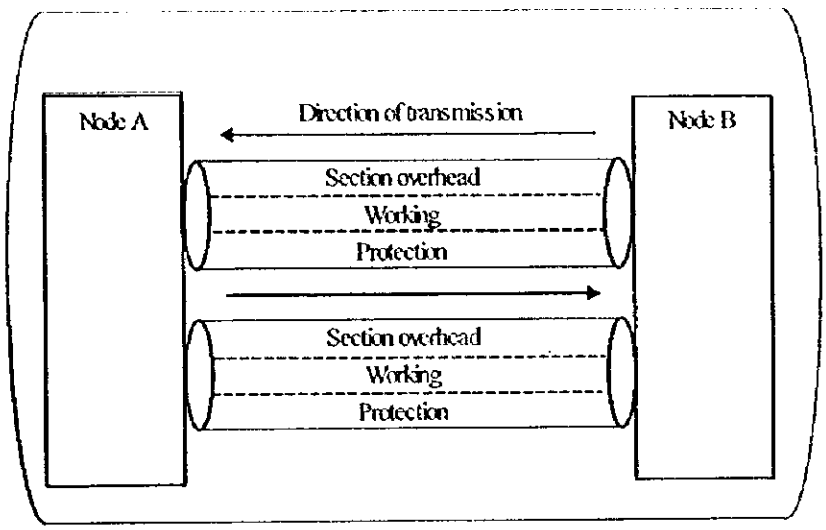
Four-fiber MS shared protection rings require four fibers for each span of the ring. As illustrated in Figure 4.8-2, working and protection channels are carried over different fibers: two multiplex sections transmitting in opposite directions carry the working channels and the protection channels. The multiplex section overhead is dedicated to either working or protection channels since working and protection channels are not transported over the same fibers.

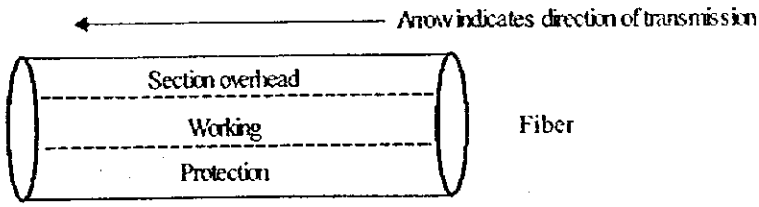
Four-fiber MS shared protection rings support ring switching as a protection switch, as well as span switching, though not concurrently. Multiple span switches can coexist on the ring since only the protection channels along one span are used for each span switch. Certain multiple failures (those that affect only the working channels of a span such as electronic failures and cable cuts severing only the working channels) can be fully protected using span switching.



NOTE – Each fibre carries both working and protection traffic, as shown in the exploded view.

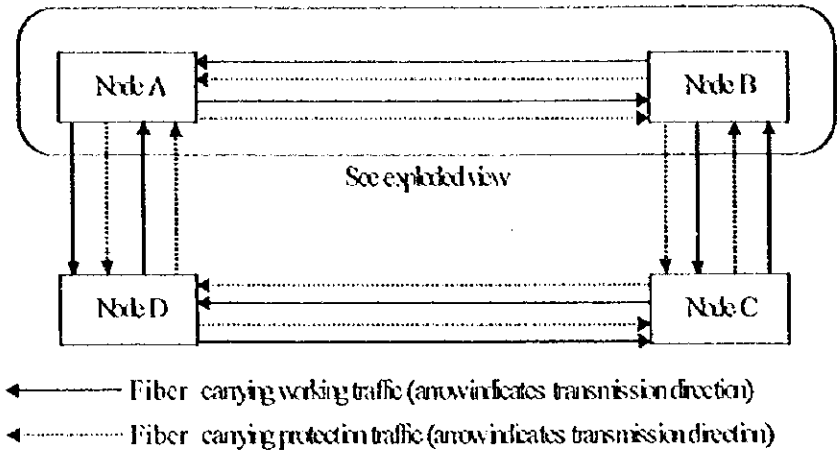
a) View of entire ring



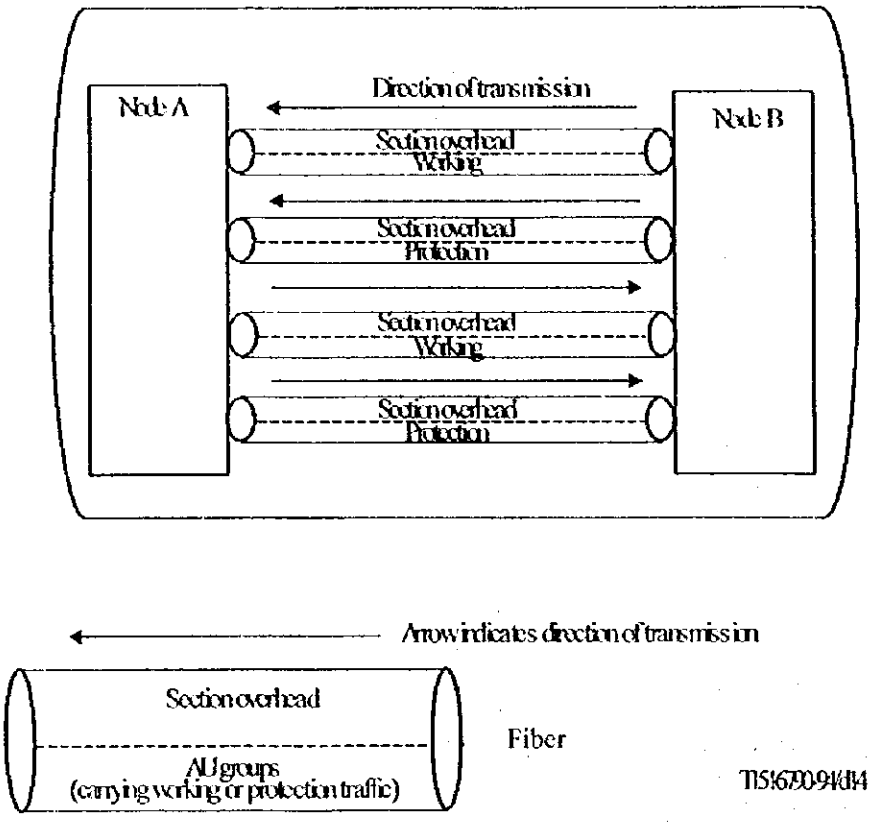


b) Exploded view of the shaded portion of the ring

Figure 4.8-1 Two-fiber MS Shared Protection Ring



a) View of entire ring



b) Exploded view of the shaded portion of the ring

Figure 4.8-2 Four-fiber MS Shared Protection Ring

(4) Objectives of Network Protection (quotation from ITU-T G.841).

(a) Switch Time

On rings with no extra traffic, no previous bridge requests, and less than 1200 km of fiber, the switch completion time shall be less than 50 milliseconds.

(b) Extent of Protection

For a single point failure, the ring will restore all traffic that would be passing through the failed location had no failure occurred.

(c) Maximum Nodes of Ring.

Each node on the ring shall be assigned an ID that is a number from 0 to 15, allowing a maximum of 16 on the ring (see Figure 4.8-3), The ID is independent of the order that the nodes appear on the ring.

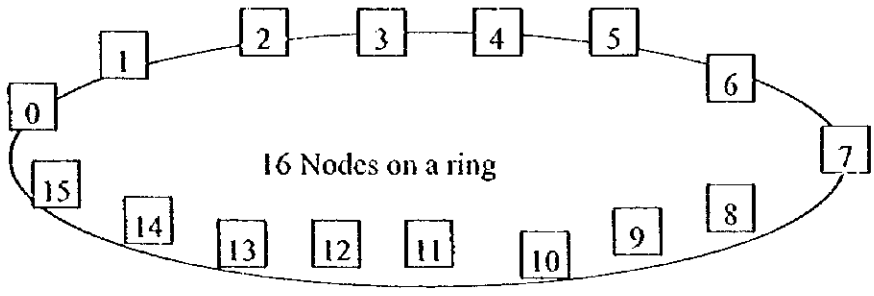


Figure 4.8-3 16-Nodes Ring Topology.

(5) Network Availability

ITU-T G.827 specifies the availability parameter and objectives for Path element of International constant bit-rate digital paths at or above the primary rate.

(a) Length

$500 \times (i-1) \leq L \leq 500 \times I \quad (i=1, 2, \ldots..,20)$

$L \geq 10\,000$km

(b) End-to-end protected unavailability path between A & B.

Figure 4.8-4 shows redundant configuration using two parallel paths and a protection switch at one end (for each direction of transmission), the availability of the protected path between points A and B is:

$$UR_{(AB)} = UR_1 \times UR_2 + UR_S$$

$UR_{(AB)}$ = Unavailability of a path

$UR1, UR_2$ = Unavailability ratios of the parallel paths.

UR_S = Unavailability of the protection switch for one direction

Availability (%) = (1- Unavailability) × 100

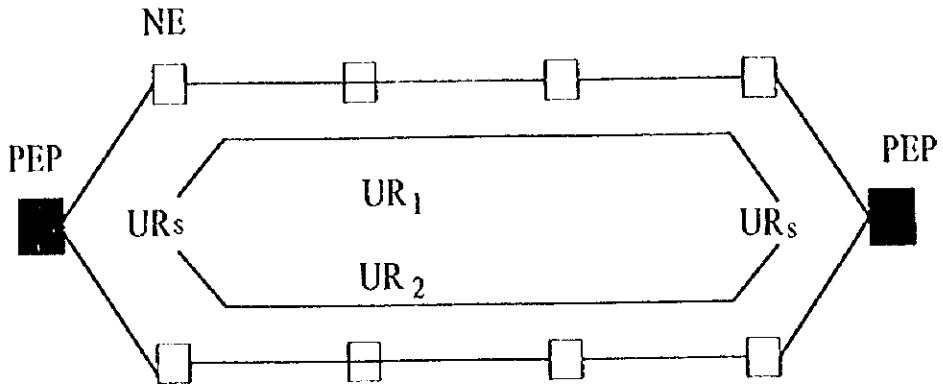


Figure 4.8-4 Path with Redundant Topology

A measure of the availability and unavailability is the ratio:

Availability = (operable time)/(operable time + down time)

Unavailability = 1-availability = (down time)/(operable time + down time)

In Japan, unavailability is used as a measure of trunk section as specified below.

Ordinary failure (small scale) : 6×10^{-3}

Extraordinary failure (large scale) : 1×10^{-3}

(c) The target of Availability at the Primary Rate

i) Hypothetical reference circuit (2,500km)

The objective for the availability of a 2500km Hypothetical reference circuit in one direction should be greater than **99.6%** for a one year duration (G.602). To achieve this objective, appropriate protection scheme may be required.

ii) Design objective

The design objective for the availability of translating equipment for a 2,500km should be greater than **99.9%** measured for a period of one year for one direction of transmission. (Reference from G.602)

The example of availability calculation is shown below.

Example (Excerpt from G.602)

Example of Reliability and Availability calculations for a line section in one direction based on the following assumptions;

(1) Line repeater MTBF = 2×10^5 ours (one way)
(2) 100 line repeaters in section;
(3) Each failure lasts 4 hours;
(4) 12 tubes cable with 1:5 protection switching;
(5) Reliability (MTBF)
   - 100 repeater will have failure in (2×10^5)/100 = 2000hours
(6) Availability
   - This is approximately 4.5 failures per year $\times$ 4hours = 18 hours outage per year(0.2%)
   - Without protection switching, Availability = 99.8%
   - Non-availability X = 2×10^{-3}

4.9 Transmission Loss (LR)

This clause introduces the technical standards stipulated in ITU-T for loudness loss.
Over the years, various methods have been used to measure and express the loudness loss of telephone connections. The reference equivalent method (RE) was a subjective method, which had been widely used in ITU-T, then reference equivalent was replaced by the corrected reference equivalent (CRE).
The currently recommended values of loudness loss in terms of loudness ratings are given in Recommendations G.111 and G.121, which are not adapted in VNPT.

(1) Loudness Ratings (LRs)
The loudness rating is defined by the amount of loss inserted in a reference system to secure equality of perceived loudness to that obtained over the speech path being measured.
Practical telephone connections are composed of several parts connected together. To deal with these parts in different combinations, loudness ratings must be defined in a suitable manner so that "OLR", "SLR", "RLR" and "CLR" ratings can be used.
(a) Overall Loudness Rating (OLR)

The loudness loss between the speaking subscriber's mouth and the listening subscriber's ear via a connection.

(b) Send Loudness Rating (SLR)
The loudness loss between the speaking subscriber's mouth and an electric interface in the network.

(c) Receive Loudness Rating (RLR)
The loudness loss between an electric interface in the network and the listening subscriber's ear.

(d) Circuit Loudness Rating (CLR)
The loudness loss between two electrical in a connection or circuit.
Transmission loss between local telephone systems, i.e. between SLR and RLR in Figure 4.9-1. The circuits concerned in real telephone connections will consist of trunk junctions, trunk circuits, switching centers, etc.
The connection configuration is shown in Figure 4.9-1 and 4.9-2.

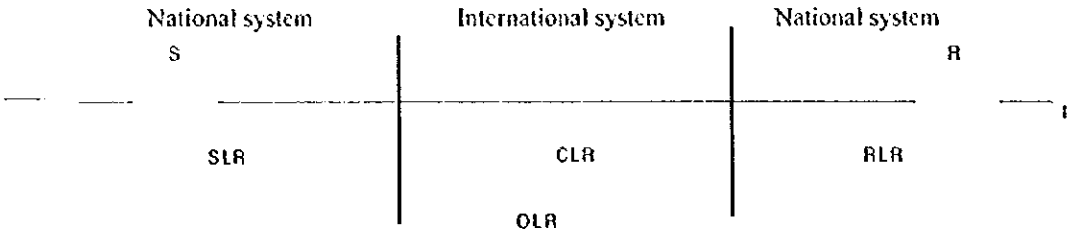


Figure 4.9-1 Designation of LRs in an International Connection

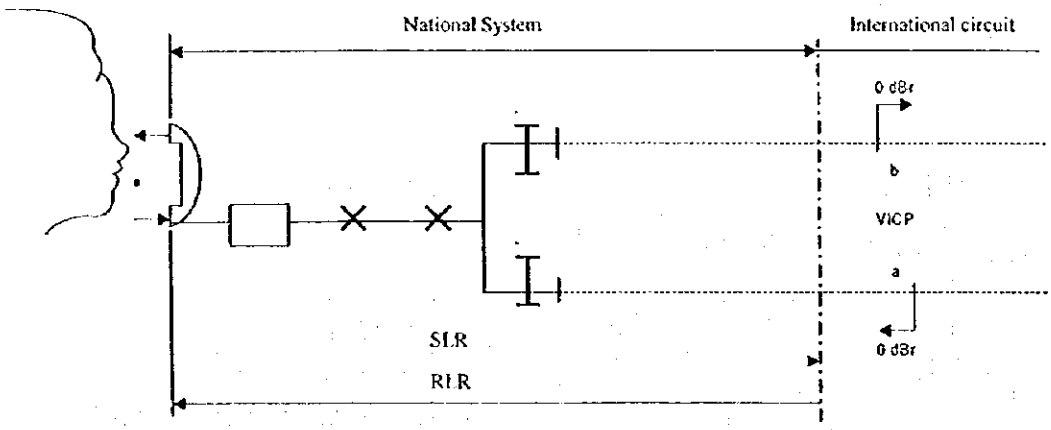


Figure 4.9-2 Reference Points for SLR and RLR for a National System

(2) LR Values Recommended by ITU-T (G.111)

The technical requirements for the national telephone connection depend on the values of the recommend L.R. The LR value for International connection (G.111) and National System (G.121) is shown in Table 4.9-1.

Table 4.9-1 LR Value as Cited in G.111 and G.121

	SLR	CLR	RLR	OLR
Traffic weighted mean values Long term Short term	 7 – 9 7 - 15	 0 – 0.5* 0 – 0.5	 1 – 3 1 - 6	 8 – 12 8 – 21
Maximum value for an average-sized country	16.5		13	
Minimum value	+2			

Note: For a digital circuit CLR=0dB, for an analogue/digital circuit CLR=0.5dB

(3) The Value of R and T Pads Recommended by ITU-T

The transmission loss contributes to the maintenance of stability and the control of echo on an international connection, which is governed by the national transmission plan adopted.

The values given are those appropriate for digital connections between subscribers with existing analogue 2-wire subscriber lines on digital local exchanges. It is recognized that different values may be appropriate for connections in the evolving mixed analogue/digital network.

Table 4.9-2 shows the value of R and T pads in each country.

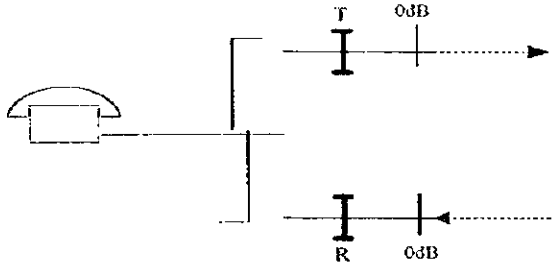


Figure 4.9-3 R and T Pads

Table 4.9-2 Values of R and T Pads for Various Countries

	Connection type					
	Own exchange		Local via digital junctions (digital trunks)		Trunk via digital trunk exchange	
	R dB	*T* dB	*R* dB	*T* dB	*R* dB	*T* dB
Germany (F.R.) (For subscribers on short lines: *R* 10 dB, *T* 3 dB)	7	0	7	0	7	0
Australia	6	0	6	0	6	0
Austria	7	0	7	0	7	0
Belgium	7	0	7	0	7	0
Canada	0	0	3	0	6	0
Denmark	6	0	6	0	6	0
Spain	7	0	7	0	7	0
United States	0	0	3	0	6	0
Finland	7	0	7	0	7	0
France	7	0	(Not used)	(Not used)	7	0
India	6	0	6	0	6	0
Italy	7	0	7	0	7	0
Japan	4	0	8	0	8	0
Netherlands (National) Netherlands (International)	4.5	1.5	4.5	1.5	4.5 10.5	1.5
Norway	5	2	5	2	5	2
United Kingdom	6	1	6	1	6	1
Sweden (National) Sweden (International)	5	0	5	0	5 7	0 0
USSR	7	0	7	0	7	0
USSR	7	0	7	0	7	0
Yugoslavia	7	0	7	0	7	0
New Zealand	7	0.5	7	0.5	7	0.5

(4) Transmission Loss Allocation Plan

When Telephone exchanges and Transmission lines are digitized, the nominal transmission loss of the digital circuits is 0dB, however adequate value of R/T pads should be inserted for the maintenance of stability and the control of echo based on above recommendation. For example, in case of NTT (Japan), 8 dB is given to R pad in subscriber circuit in switching equipment and also 7 dB is given to subscriber cable, which is shown in Figure 4.9-4.

In Vietnam, 7 dB is already allocated to subscriber cable' loss and additionally Telephone exchanges and Transmission lines are almost digitized, so that this Transmission Loss allocation plan may be adopted in Vietnam as a standard.

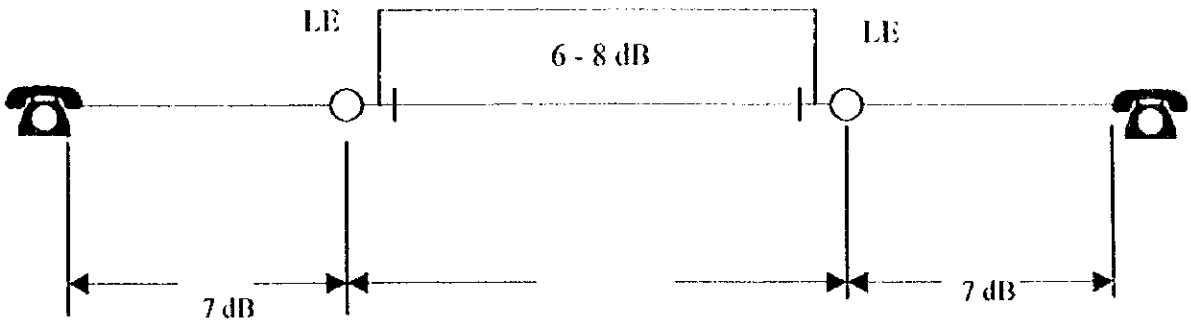


Figure 4.9-4 Transmission Loss Allocation

4.10 Quality Standard (Grade of Service)

In the development plan of Posts and Telecommunications Sector in 1996 – 2000, DGPT is entrusted with the responsibility in carrying out the plan for managing standard and quality to make up national standard system suited with the international standards (ITU). Staff members of DGPT agree to promulgate standard and quality systems in 3 fields: equipment, networks and service quality in the whole country.

4.10.1 Standard for Connection Loss

In Recommendations E.500 series that specify the traffic measurement method, the CCITT has defined the mean of the 30 highest working days during 12-month period of the mean busy-hour traffic of a circuit group as normal load, and the mean of the 5 highest for days during 12-month as high load. The loss probability for international system is defined as follows (Recommendation E.520)

- Loss probability per link at normal load: 0.01 or less
- Loss probability per link at high load: 0.07 or less

(1) Grade of Service in Vietnam

Grade of service is specified in Vietnam.

(a) Internal Traffic (Internal loss probability of local exchange)

After receiving dial tone, the probability of not being able to establish a connection from an arbitrary subscriber's line to a particular free subscriber's line on the exchange shall not exceed 0.01 under normal load conditions nor 0.03 under high load conditions.

(b) Outgoing Traffic (Internal loss probability of originating exchange)

After receiving dial tone, the probability of not being able to establish a connection from an arbitrary subscriber's line to a particular outgoing trunk circuit (Internal Blocking) shall not exceed 0.002 under normal load condition nor 0.02 under high load conditions.

(c) Incoming Traffic (Internal loss probability of terminating exchange)
After connecting to a signaling receiver, the probability of not being able to establish a connection from an arbitrary incoming trunk circuit to a particular subscriber's line shall not exceed 0.002 under normal load conditions nor 0.02 under high load conditions.

(d) Transit Traffic (Internal loss probability of transit exchange)
Under normal load conditions, the probability of not being able to establish a connection from a particular incoming inlet to a particular free outlet shall not exceed 0.001. Under high load conditions, this probability shall not exceed 0.01.

(e) Trunk Traffic (Connection loss)
Connection loss is usually indicated by probability of loss. Erlang B Formula is used for calculation of trunk circuits with 1 % grade of service (probability of loss). Trunk line loading is 70% (0.7 Erl. per trunk line) in standard loading, and 80% (0.8 Erl. per trunk line) in over loading.

(2) Allocation of Loss Probability in Vietnam
Connection loss must be allocated to each circuit section and switch that form the longest connection system. The overall objective of switching stage loss is allocated to originating, transit and terminating exchanges as shown in Figure 4.10.1-1 and Figure 4.10.1-2 for toll and local call. The total objective loss is shown in Table 4.10.1-1.

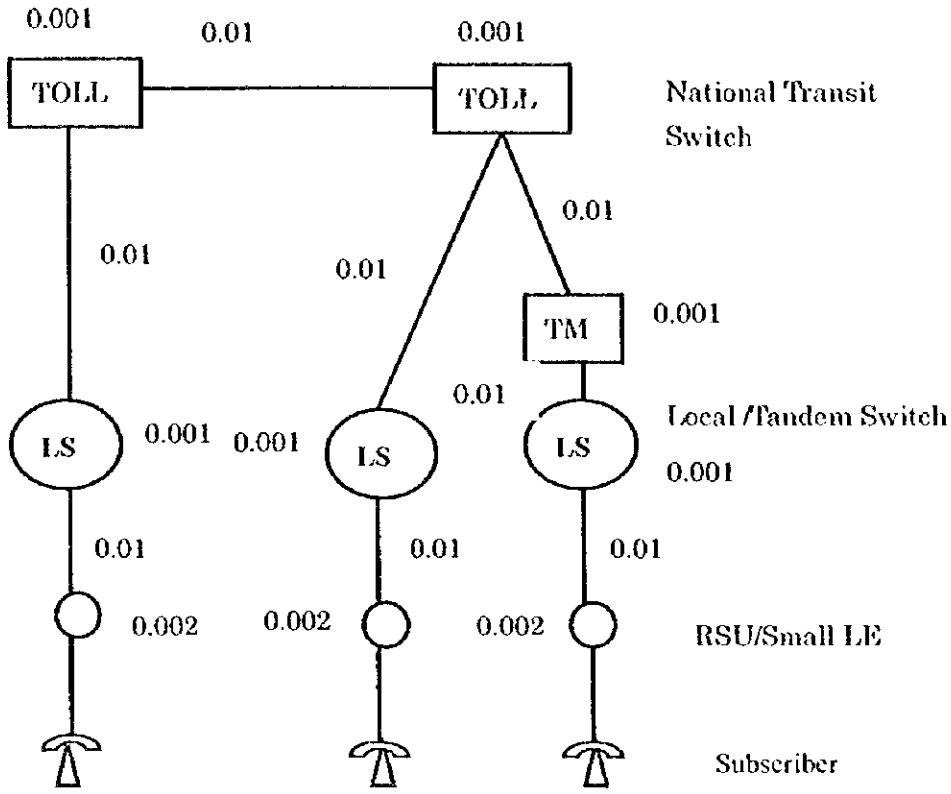


Figure 4.10.1-1 Allocation of Loss Probability (Toll Call)

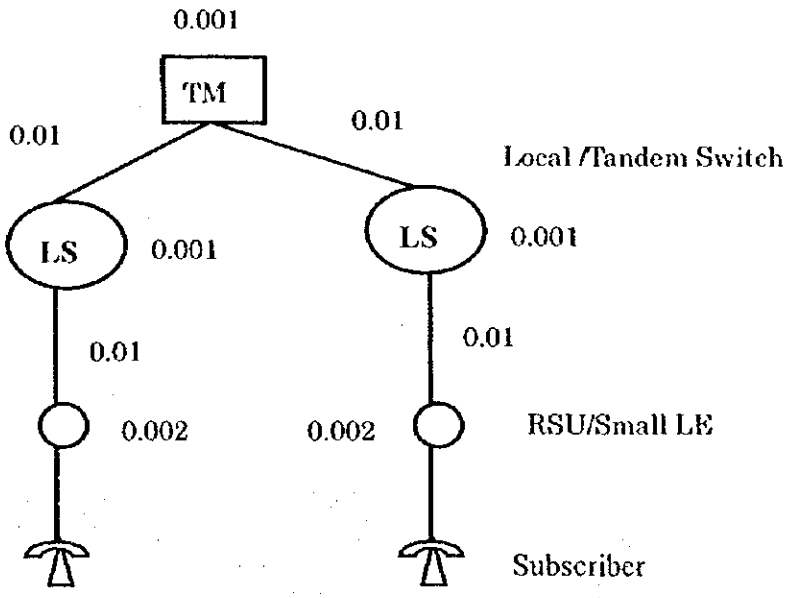


Figure 4.10.1-2 Allocation of Loss Probability (Local Call)

Table 4.10.1-1 Overall Objectives of Connection Loss

Connection	Objective
Toll	0.069 or less
Local	0.047 or less

4.10.2 Standard for Connection Delay

ITU-T recommends grade of service in it's E.540 Series Recommendations. The switching quality (grade of service) for international exchange is recommended in E.543. DGPT specifies the delay probability standard for following items based on ITU-T as exchange performance.

(a) Dial tone delay
(b) Incoming response delay
(c) Exchange call set-up delay
(d) Call release delay

4.11 Inter-Network Connetion

4.11.1 Inter-Network Connection of Existing Network in Vietnam

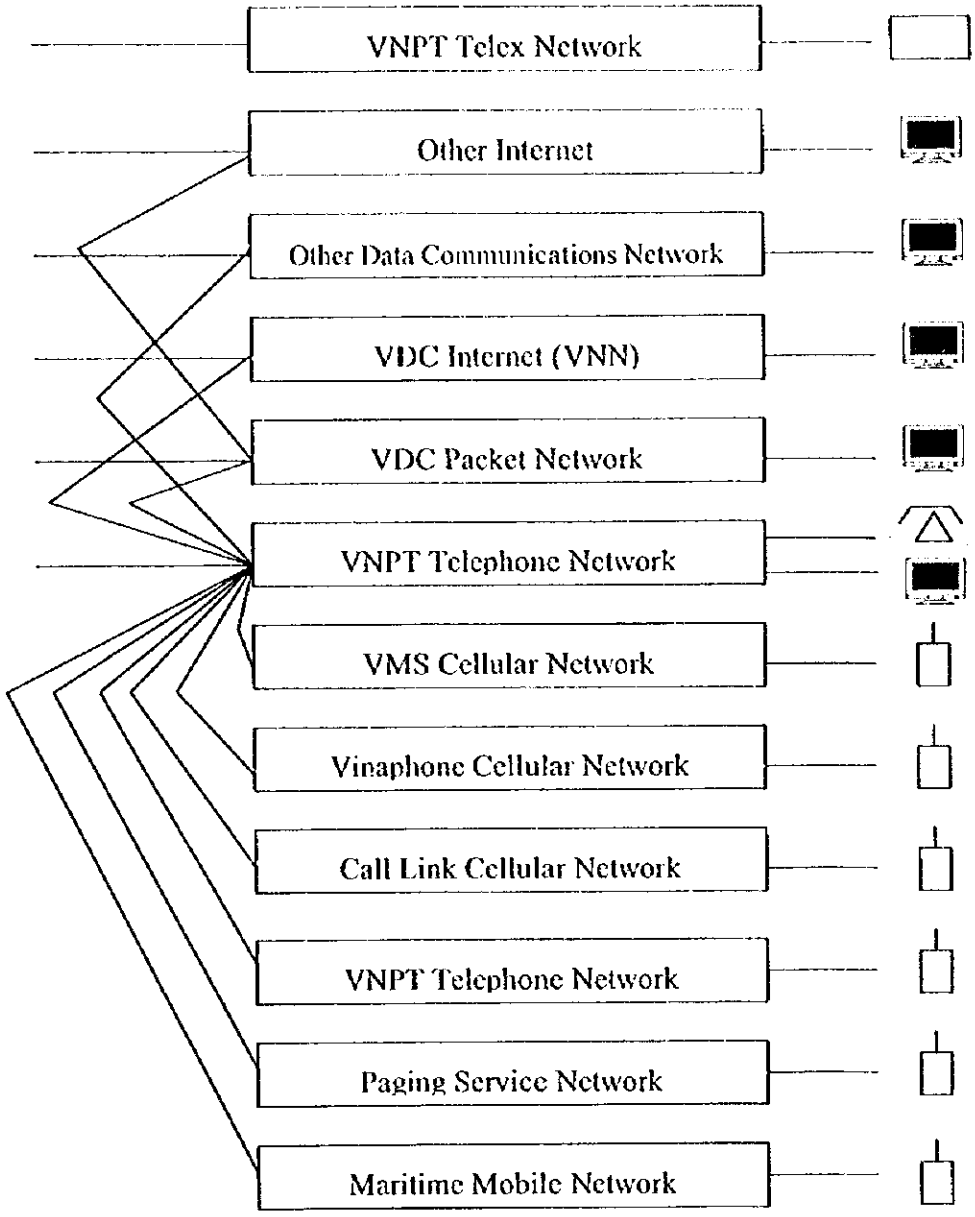
(1) Outline of the Existing Inter-networks

In Vietnam there are several telecommunications networks besides VNPT Public Service Telephone Network (PSTN); i.e. cellular telephone networks and paging networks. Some of them are inter-connected with VNPT telephone network through transit/trunk circuits /MSU(Main Switch Unit) and others are connected by normal subscriber lines such as an access network of DLC (Digital Loop Carrier), Radio Subscriber System, Paging system, etc.

TELEX networks are not inter-connected with VNPT telephone network.

(2) Current Status of Inter-network Connection

Figure 4.11.1-1 shows the existing major networks and inter-connection between them.



Source: JICA Study Team.

Figure 4.11.1-1 Existing Major Networks and Inter-connection between Them

VPC data communication (Packet) network is inter-connected with VNPT telephone network.

The cellular telephone networks, VMS network,Vinaphone Network and Call Link network are interconnected with VNPT's PSTN network through trunk circuits of AXE-103 of 3 Regions Ha Noi, Da Nang and Ho Chi Minh.

Paging service nerworks, and pay telephone networks are also inter-connected with

VNPT telephone network at the stage of telephone subscriber networks.

4.11.2 Inter-Networks Connection with Other Operators

Since other telecommunications operators will commence the telecommunication services in 1999 in Vietnam, VNPT/DGPT will be going to re-arranging the existing numbering plan, methods of inter-network connections (interconnections), access charge systems and other necessary tasks with possiblities to invite some more telecommunications network providers in future.

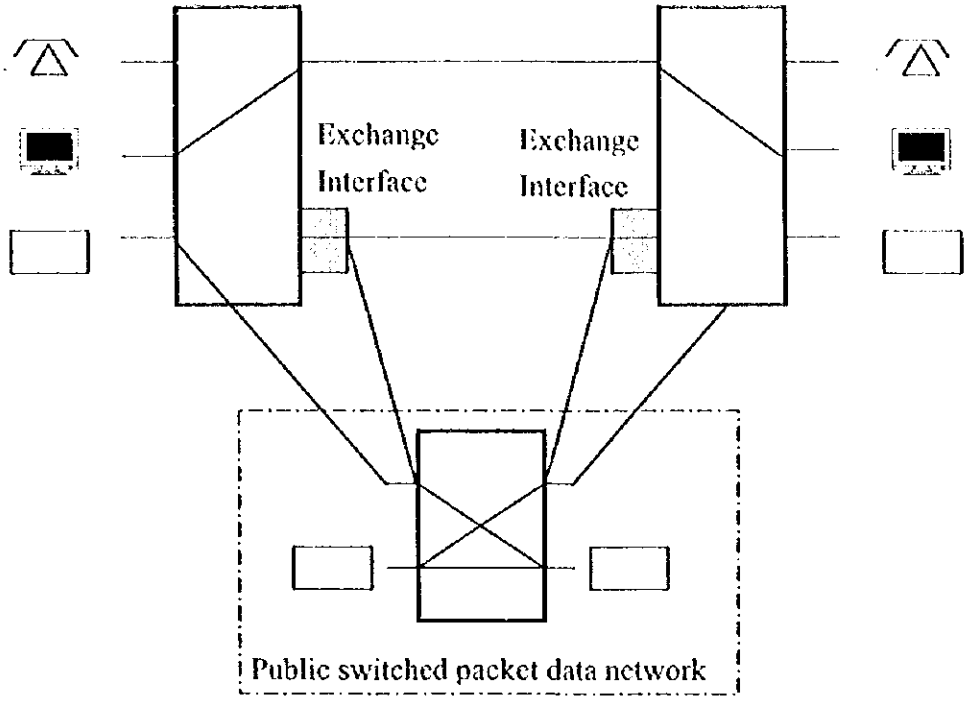
It will give a proper Destination Network Code (DNC) to each of coming new carrier operators. Then following to the new numbering system which Network the DNCs, all the networks including existing VNPT and cellular networks,will have the options to establish the direct inter-network connection each other.

VNPT networks will be interconnected with the existing and new networks through the switching systems or a gateway switch. In future, the VNPT gateway switch should be national gateway of 3 Regional Centers.
The number of gateway switches or the connection points will be increased in proportion to the growth of inter-network traffic in future.
The signalling system between the gateway switches should be CCS No.7.

For the public switched packet data network (PSPDN), the inter-network connection can be realised by X.series protocol.

According to VNPT Development plans, it is planned to introduce an ISDN by the year 2000. The ISDN will have a packet handling function and will be inter-connected with the existing VDC packet switching system.

Figure 4.11.2-1 shows a probable inter-network connection between VNPT ISDN and public switched packer data nerworks. The VNPT ISDN will be inter-connected with other data communication networks by X.series(for example X75) protocol, if required.



Source: JICA Study Team.

Figure 4.11.2-1 Probable Inter-Network Connection between VNPT ISDN and PSPDN

4.11.3 Interface

(1) Interface with the access network

As for an interface with the access network, V5 Interface has been standardized as a common platform of the subscriber line interface which connects the switching system (Main Switch Unit: MSU) and the access network (DLC/PON: Passive Optical Network/WLL) in accordance with ITU-T Recommendations G964 and G965.

An example of interface relationships between the switching systems and the access network is illustrated in Figure 4.11.3-1

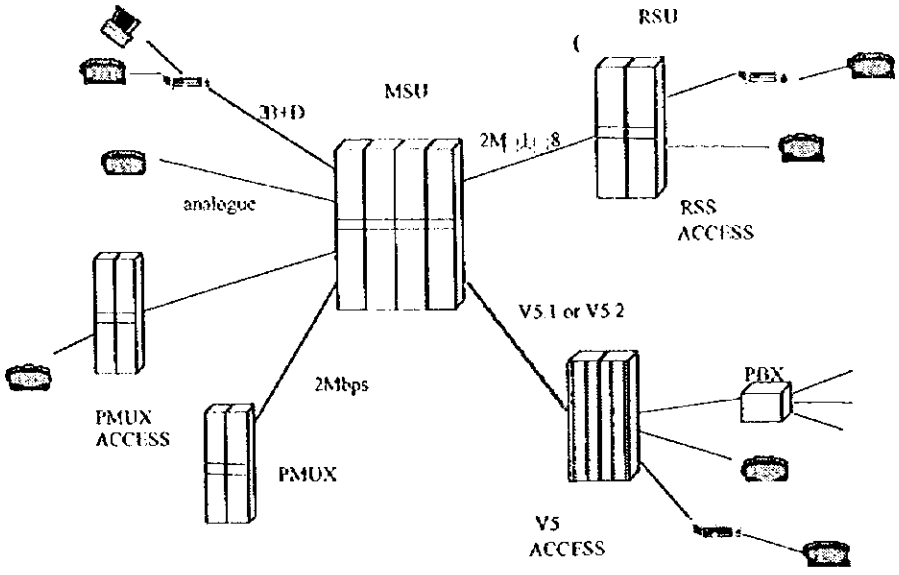


Figure 4.11.3-1 An Example of Access Network Configuration

(2) V5.2 Interface

V5.2 Interface is standardized by ITU-t in March 1995 in accordance with European Specification (ETSI Standard) as an international standard interface which connects Local Exchange (L. E.) and the access network in the Multi-vender Environment.

V5.2 interface is shown in Figure 4.11.3-2.

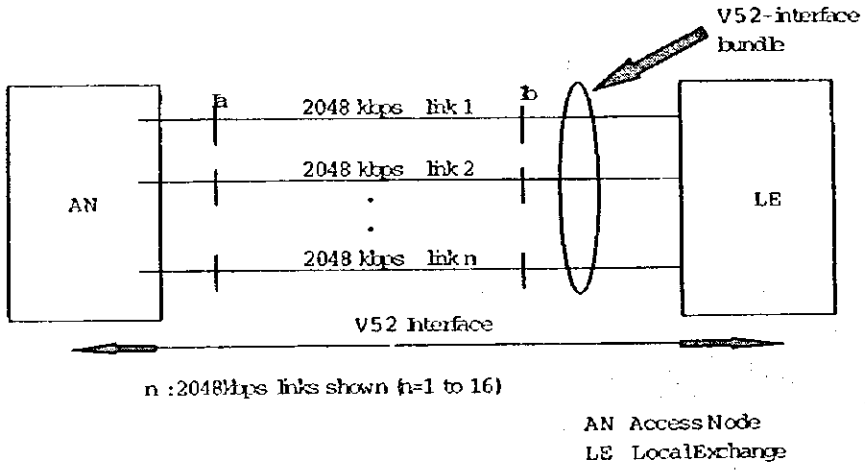


Figure 4.11.3-2 V5.2 Interface

(3) V5.1 Interface

V5.1 Interface is also standardized by ITU-T together with V5.2 Interface in June 1996 in accordance with ETSI Specification (European Standard).

A comparison between V5.1 Interface and V5.2 Interface is shown in Table 4.11.3-1.

Table 4.11.3-1 Comparison between V5.1 Interface and V5.2 Interface

	V5.1 Interface	V5.2 Interface
Interface Link	2,048kbps x 1	2,048kbps x N N:1 ~ 16
Channel Concentration	Not available	Available(BCC Protocol) BCC: Bearer Channel Connection
Subscriber Access Interface	-Analogue Telephone Interface -ISDN Basic Interface -Leased Line Access	-Analogue Telephone Interface -ISDN Basic Interface -Leased Line Access -ISDN Primary Group Access
Others	-	Link control etc is regulated for For Multi-media Link

4.11.4 Interconnection Interface

An interconnection interface is necessary to interconnect between the existing VNPT networks and new common carrier networks such as VIETEL Networks and SAIGON Postel ones. For this purpose the following system must be standardized:

(1) Numbering Plan

There are two (2) cases to realized the associated interconnection between different networks in relation to the numbering plans;

(a) Present number plan can be applied without changing an identification code of the new common carrier network.

(b) A new identification code must be provided for a new common carrier network, depending on the network type and operation license of the new common carrier.

(2) Tariff System

In the tariff system for the mutual connection between different operator networks, there are two (2) kinds of tariff system;

(a) Sum-Up Charging System: Defining business services clearly with a boundary of POI (Point of Interface), communications fees will be individually set up for each operator who handles the communication traffic.

(b) END-TO-END Charging System: one out of an calling side operator, inter-provincial operators and a called side operator will set up a total amount of the communication fees and will collect the fees from customers.

(3) Types of Interconnections and Responsibility of Business Operators

(a) A type of the interconnection can be classified into two (2) types of interconnections in a major breakdown, as shown in the followings:

i) Transit Circuit Interconnection

ii) Subscriber Line Interconnection

(b) Advantage and Disadvantage of both types

i) Transit Circuit Interconnection

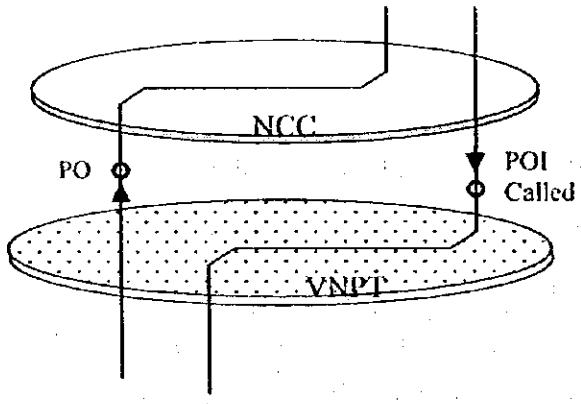
- Same communication quality as the existing network
- Overall economical effect is available
- Many interconnection interfaces

ii) Subscriber Line Interconnection

- Communication quality will be inferior than the existing network
- Economical effect will not be expected as a whole
- Interconnection interfaces are simple and renovation cost is rather low.

(4) Interconnection Method

The mutual interconnection of different common carriers are normally made through the Point of Interface (POI), as illustrated in Figure 4.11.4-1.



igure 4.11.4-1 An Example of Point of Interface (POI)