4.4.2 Wireless Local Loop Facilities

4.4.2.1 General

There are many types of radio subscriber systems such as a point-to-multipoint TDMA systems and Wireless Local Loop (WLL) systems in the world. These systems can provide telephone lines to subscribers with reasonable cost compared with conventional metallic cable systems.

The radio subscribers systems are usually utilized as the following measures:

(a) Supplementary Access Systems to Cable System

The radio subscriber systems are utilized as a supplementary access system to cable system in areas, where demand cannot be satisfied by cable systems in time/from economical viewpoint. For the purpose, the systems are usually utilized in urban areas such as Ulaanbaatar, Darkhan and Erdenet.

(b) Main Access System in Rural/Remote Area

The radio subscriber system is utilized as a main access system in areas, where the cable construction is difficult from the geographical/economical viewpoints.

4.4.2.2 Digital Wireless Local Loop System

A wireless local Loop (WLL) system uses radio technology to provide reliable, flexible and economical local telephone service in place of traditional copper wire line. A WLL is sometimes called "a Fixed Wireless Access" (FWA).

From the service provider's prospective, the key benefits of WLL are low capital costs, fast network deployment and lower maintenance costs, clearly attractive considerations. Also, the process of building a WLL system does not require precise knowledge of the user's location of the user's location, adding flexibility to planning and deployment of the system.

WLL networks have been proven to have the capability to function as core communications system in times of disaster; for disaster recovery, service providers have the option of rapidly deploying a WLL system during an emergency. WLL system can also be used as redundant backup systems for existing wire line networks. This way, communications downtime caused by natural disasters such as floods, earthquakes, hurricanes, and so on can be kept to a minimum.

The WLL technology is gaining popularity in the developing countries for providing telephone services in sparsely populated rural areas. A WLL is ideal as a start-up telephone system that can be moved around to suit current needs. A WLL eliminates many problems and costs inherent in wire line loop systems.

The possibility of using wireless links to establish the last segment of subscriber access is now regarded as an attractive option for at least five reasons:

1) Radio technologies make it possible to implement networks more cheaply and less time than with wire line system. It may be either the permanent solution in scarcely populated areas or a first step in areas where the population is not yet stabilized giving time to ensure that a wired access system is worthwhile to install it.

2) Wireless access technologies allow for a smooth evolution of the network and hence, investment, following market demand.

3) The cost of installing and maintaining radio access equipment is generally lower than for wire line networks, in sparsely populated areas.

4) Digital technologies support any type of telecommunications service, up to multimedia, depending on data rate required and frequency bandwidth available.

4.4.2.3 CDMA in the Local Loop

Wireless Local Loop (WLL) has traditionally been seen as a way of rapidly providing telephone services in countries that have little or no existing infrastructure. Whilst this is still apparent, by using CDMA technology rather than TDMA access, the benefits of WLL are greater, with CDMA providing to be cost-effective alternative for both field sites and as an integral part of fixed-line systems.

In terms of feature codes and dialling plans, interoperability between WLL and fixed line systems ensures that network growth can appear seamless to both the operator and customers. Mongolia Telecom is now introducing the following WLL systems to cover GER area in Ulaanbaatar city where has a difficulty of extension of wire line.

A local loop network element is shown in Fig.4.4.2.3-1.

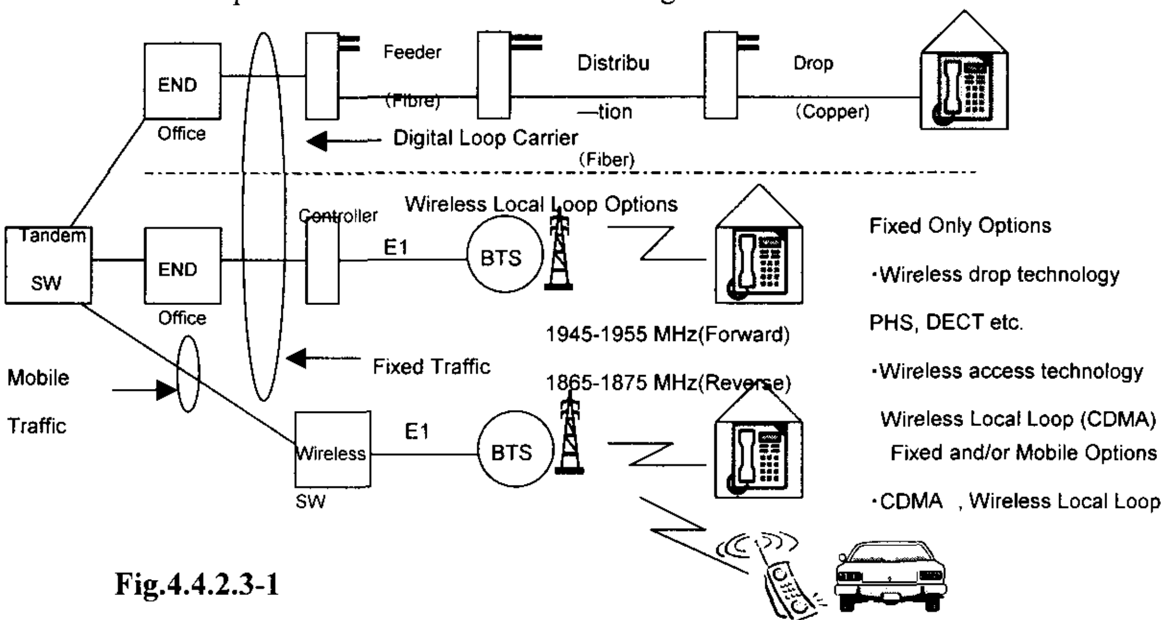


Fig.4.4.2.3-1
Local Loop Network Element

MT CDMA-WLL system major features is shown in Table 4.4.2.3-1

Table 4.4.2.3-1 Major Features of MT CDMA-WLL system

Provider Company	Korea, LG Electronics Inc.
Inauguration year	November 2001
Service area	Ulaanbaatar city GER area
Technology	CDMA-WLL
Manufacturer	LG Electronics Inc.
Radio Frequency	Forward Link : 1945-1955 MHz Backward Link : 1865-1875 MHz
Service Types	Fixed only/Voice/Fax (G3)/PC
System Capacity	10,000 subscribers
Number of Terminal stations	NO
Number of Repeater stations	NO
Number of Base stations	7 BTS
Service Rate	Voice , 9.6 Kbps, 14 Kbps

Site location of CDMA-WLL BTS and service coverage provided by WLL system is shown in Table 4.4.2.3-2.

Table 4.4.2.3-2 BTS Service Coverage and Site Location

BTS Name	Service Coverage	Expected Demand
BTS-1 (Central Post)	Denjiin 1000, 100 ail, half of Dari-Ekh	800
BTS-2 (V buudal)	Chingetsei, Dambadarjaa, 7 buudal, half of Dari+Ekh	1552
BTS-3(Bayankhoshuu)	Bayankhoshuu, Hamin Materialim Kombinat	1231
BTS-4 (Airport)	Tolgoit, Yarmag	1569
BTS-5(TV Center)	Televiz, Microdistrict-3	2239
BTS-6 (Sharhad/Erdenetolgoi)	Microdistrict-16, Sharhad, Amgalan, Uliastai	882
BTS-7(Hailaast)	Hailaast	904
Total		9177

4.4.2.4 Wireless systems in use

The following wireless systems are in use:

- Single channel Radio
- Multi-channel Radio
- Multi-Access Radio-both analogue and digital
- TDMA/FDMA
- VSAT

(1) TDMA-VSAT: In 1998 four aimag centres and four biggest sum centres which had no access to trunk line of microwave link were lined via VSAT DAMA system. While these projects will bring basic phone services, Internet and data communications services to some remote areas for the first time, the systems allow the companies to offer distance learning, telemedicine and other applications in remote regions by using video conference technology. Mongolia is implementing nation-wide VSAT rural telecom network by year 2002 by Telecom II and Telecom III project.

(2) FDMA-VSAT: In 1998 Civil Aviation Authority established FDMA-VSAT networks with regional gateways in the capital city of Ulaanbaatar and few remote sites through out the country for civil air navigation system.

(3) CDMA-WLL: From January 1999 the MobiCom Corp. has started telephone service using CDMA-WLL technology only in Ulaanbaatar capital city.

(4) Single channel Radio and Multi channel Radio (VHF, UHF and HF) : Those radio system is now used widely in rural area, Sums and Bags for emergency communication purpose.

4.4.2.5 Wireless Local Loop Facilities suited for Rural Area

The use of TDMA-based point-to-point (PTP) or point-to-multipoint (PMP) radio systems with wireless local loop tails is a fairly recent phenomenon, having been introduced in rural areas over the past three to four years. The substitution of wireless systems for copper cables in the local loop helps reduce the maintenance costs associated with physical plant in rural areas.

The main features of PMP/TDMA-WLL are as follows:

(1) end-to-end wireless access solution
(2) large service area of up to 540 Km in a chain of repeaters
(3) flexible system capacity expandable to 1400 subscribers per base station
(4) high-quality service using 32 kbits/s ADPCM
(5) robust against natural disasters
(6) low implementation and maintenance cost
(7) solar cells are available for repeater (80 W) and cell stations (40 W)

The major specifications of PMP/TDMA-WLL are summarized in Table 4.4.2.5 -1.

Table 4.4.2.5 -1 Technical specifications for PMP/TDMA-WLL

(1) PMP TDMA System	
Frequency band	1.5/2.4/3.5 GHz
Voice coding	32 Kbit/s ADPCM (ITU-T G.726)
Access method (modulation)	TDM/TDMA (QPSK)
Interface with local exchange	2-wire analogue or V5.2 digital
Transmission capacity	4 Mbit/s, 120 Time slots
Number of subscriber lines per base station	Up to 1400 subscribers (for call rate of 0.07 Erlang/sub.)
Subscriber unit	1/2/16/64 lines
Radio hop distance	Max. 45 Km (max. 12 hops)
Voice band data rate	9.6-14.4 kbit/s
User data rate	Up to 384 kbit/s
(2) PHS-WLL System	
Frequency band	1895-1918 MHz
Voice coding	32 kbit/s ADPCM (ITU-T G726)
Access method (modulation)	TDMA/TDD (π /4 shift QPSK)
Transmission capacity	4 Time slots/RF (4RF/Cell station) 15 Traffic Channels/Cell station
Number of subscriber lines per cell station	Max 128 Lines
Subscriber unit	1 Line
Cell Range	Up to 5 Km with 8 dBi directional antenna Up to 15 Km with adaptive array antenna
Voice band data rate	Up to 14.4 kbit/s

In connection with development of Sum access network, the system comparison of rural telecommunication is shown in Table 4.4.2.5 -2:

Table 4.4.2.5 -2 Comparison of Rural Telecommunication System

Technical Items	Single Channel Radio	Digital Microwave	Radio Multiplex	OFC	Satellite	WLL (TDMA-WLL)
Service area	30-50 Km	20-30 Km (each zone) 25-30 Km (with repeater)	10-50 Km	30-50 Km	Up to 12700 Km	30-50 Km
Kind of Service	TEL, FAX	TEL,FAX, DATA	TEL,FAX, DATA	TEL,FAX, DATA	TEL,FAX, DATA	TEL,FAX, DATA
Quality of Communication	30-40 dB	1E-6	1E-9	1E-9	1E-6	1E-6
Capacity	1 CH	2-4 Mbps 128-512 Sub	2-34 Mbps	2-34 Mbps 30-480 sub	355ch (VSAT)	23-71 (47-143) ch 200-1000 sub
Frequency Band	80,150,400, 800 MHz	1.5,2.0,2.5 GHz	UHF/SHF		6/4 GHz, 14/11 GHz	800/900 MHz, 1.8/1.9 GHz
Interface to exchange	Sub, 2W	Sub 2W or 2 Mbps	2 Mbps or Sub 2 wire		2/4 W	ISDN (Pri) E1/R2 V5.2 2W

4.5 Mobile Communications System

4.5.1 General

MobiCom Corporation was established on March 18, 1966 as the first Mongolian cellular telephone service company. It is a consortium of three companies, KDDI Corporation of Japan, Sumitomo Corporation of Japan and NewCom Company of Mongolia. In March 1996, Ulaanbaatar City, including the Buyant-Uhaa airport district, was covered by the cellular service. MobiCom Corporation's mobile network system is using advanced technology equipment supplied by the Alcatel Company for Global System Mobile Technology. GSM is the latest cellular telephone technology used worldwide and incorporates digital speech encoding. This feature makes it the most secure cellular technology available.

GSM is today the only technology that supports additional service features such as domestic Short Message Service (SMS) and Internet related features such as sending SMS to email, sending of email directly to the personal handset and SMS file broadcasting from the web to the handsets of a group of customers.

Skytel Co. Ltd. Company selected through international competitive bidding for development of cellular telephony system, which commenced from 07 July 1999. Univcom Co., Ltd. Mongolia, SK telecom Co., Ltd. Korea, Taihan Electronic Wire Co., Ltd. Korea in May 1999, established the JVC "Skytel" Co. Ltd. The JVC was founded with 40 % participation from Mongolian side and 60 % from Korean side, SK telecom and Taihan Electric Wire. Skytel has been introduced to public with its Advanced Mobile Phone System (AMPS) network as a second mobile operator in Mongolia. Skytel now introduced a Code Division Multiple Access (CDMA) mobile network in Ulaanbaatar City to provide a broadband mobile service.

The mobile networks interconnect with MT fixed telephone service network as shown in Figure 4.5.1.

4.5.2 Mobile Telephone Communications of MobiCom

(1) Cellular Telephone Service

MobiCom is the first cellular telephone service company in Mongolia. The service started in Ulaanbaatar on 18 March, 1996. The consortium party composed of KDDI

Corporation, Sumitomo Corporation and Mongolia's NewCom Corporation made a successful bid for the license of mobile telecommunications business for 20 year. KDDI has 44.4 % of share, Sumitomo 44.4 % and NewCom 11.2 %. MobiCom service network is established by the latest digital cellular technology GSM900 standard widely used in the World.

In cooperation with Alcatel CIT (France) and its supplies, the GSM900 (Global System of Mobilization) technology became principal operating standard of the Corporation and gives technological advantages and more opportunities to provide best and high quality services for Mongolian market. GSM900 is one of latest cellular communication technology with wide spread around the world. Digital speech encoding feature of the GSM technology makes it the most secure and advanced cellular technology through the world.

The frequency bandwidth is: Up link (mobile stations to base stations) 890 MHz to 915 MHz, Down link (base stations to mobile stations) 935 MHz to 960 MHz. It is possible to assign total 124 radio channels over the 25 MHz frequency spectrums by carrier spacing at 200 KHz with 8 channels TDMA multiplexed. Modulation access system is GMSK (Gaussian Filtered Minimum Shift) at 270.833 Kbps transmission speed. Voice channel is coded by 13 Kbps using RPE-LTP (Regular Pulse Excitation-Long Term Prediction) system in order to increase frequency utilization efficiency.

As a leader of cellular telecommunication of Mongolia, MobiCom is a major player in the area of telecommunications and Internet. Total number of subscribers in Mongolia is about 360,000 including country's basic telecommunications operator and subscribers of the MobiCom were counted more than 173,174 including WLL (Wireless Local Loop) subscribers Today, the MobiCom Corporation is major mobile network operator with 163,117 subscribers in Ulaanbaatar city area, the cities or sum centres of Altanbulag, Arvaikheer, Baganuur, Choir, Darkhan, Erdenet, Kharakhorin, Nalaikh, Sainshand, Sukhbaatar, Zamiin Uud, Zuunkharaa, Zyynmod.

The location of MobiCom GSM900 networks MSC (Mobile Switching Centre), BSC (Base station Controller) and BTS (Base transceiver Station) are shown in Table 4.5.2-1:

Table 4.5.2-1 Location of GSM900 Network Traffic Nodes

No.	City/Sum	Number			Type	Capacity	Subscribers
		MSC	BSC	BTS			
1	Ulaanbaatar	2			Alcatel	200000	141200
			2		Alcatel	200000	
				57	Alcatel 900/1800	191700	
2	Altanbulag			1	Alcatel 900	546	58
3	Arvaikheer			2	Alcatel 900	1090	813
4	Baganuur			2	Alcatel 900	1090	1010
5	Choir			1	Alcatel 900	545	188
6	Darkhan			2	Alcatel 900	3790	6230
7	Erdenet			3	Alcatel 900	4257	6740
8	Kharkhorin			1	Alcatel 900	1460	204
9	Nalaikh			1	Alcatel 900	1460	10
10	Sainshand			1	Alcatel 900	1460	1032
11	Sukhbaatar			1	Alcatel 900	1460	1037
12	Zamiin Uud			3	Alcatel 900	3460	2706
13	Zuunkharaa			1	Alcatel 900	540	861
14	Zyynmod			1	Alcatel 900	540	1028
Total BTS			2	77		21398	163117
Total MSC		2				20000	

MSC: Mobile Switching Centre
BSC: Base Station Controller
BTS: Base transceiver Station

MobiCom GSM mobile switching centre (MSC) is interconnected with MT's PSTN through Digital Distribution Frame in MT Building.

By the end of January 2001 total subscriber of the MobiCom Corporation is as follows:

GSM Post Paid	6,971
GSM Prepaid	99,927
CDMA-WLL	5,983
Total	112,881

The International Roaming service gives opportunity to subscribers to be connected from foreign countries using GSM900 networks with IR roaming services. GSM National Network Configuration of MobiCom is shown in Fig.4.5.2-1.

(2) WLL service

WLL (Wireless Local Loop) service is provided with CDMA (Code Division Multiple Access) mobile network technology. Started three years ago in January 1, 1999, the service provides on opportunity to use telephone service in households and small offices in limited coverage areas, where traditional telephone services are not available. The service also provides international and domestic long-distance call service to all WLL subscribers of the Ulaanbaatar City.

Location of CDMA WLL Network Traffic Nodes is shown in the Table4.5.2-2.

Table 4.5.2-2 Locations of CDMA WLL Network Traffic Nodes

City	Traffic Nodes		Type	Capacity	Subscriber
Ulaanbaatar	MSC		NEAX 61 Σ	12000 Subs	10057
	BSC		NEC	12000 Subs	
	BTS	BTS1	NEC Xing	2500 Subs	
		BTS2	NEC Xing	1300 Subs	
		BTS4	NEC Xing	500 Subs	
		BTS7	NEC Xing	2500 Subs	
		BTS8	NEC Xing	1300 Subs	
		BTS12	NEC Xing	2500 Subs	

MSC- Mobile Switching Centre
BSC-Base Station Controller
BTS- Base Transceiver Station

CDMA WLL MSC is interconnected with MT PSTN through Optical Fiber Distribution Frame in MTC Building.

(3) INMARSAT Land Mobile service

The INMARSAT Land Mobile service is high quality satellite communication service (telephone, fax, data transmission, internet e.g.) using the INMARSAT satellite system provided via KDDI Corporation in Mongolia, Subscribers of the INMARSAT Satellite Telecommunication System are able to make any type of calls from anywhere around in Mongolian territory.

(4) Iridium World Satellite Service

Iridium's unique technology consists of sixty-six satellite at an altitude of 780 Km (LEO). Only the Iridium networks of satellites are designed to allow transmission from satellite to satellite until the call or message reaches its destination. With iridium World Satellite Service mobile communications in remote and domestic regions with one of the world's smallest-handheld satellite phones available today. In Mongolia NewCom Telecommunication Corporation received the operating licence of the Iridium World Satellite Service. NewCom Corporation now provides the satellite phone renting service.

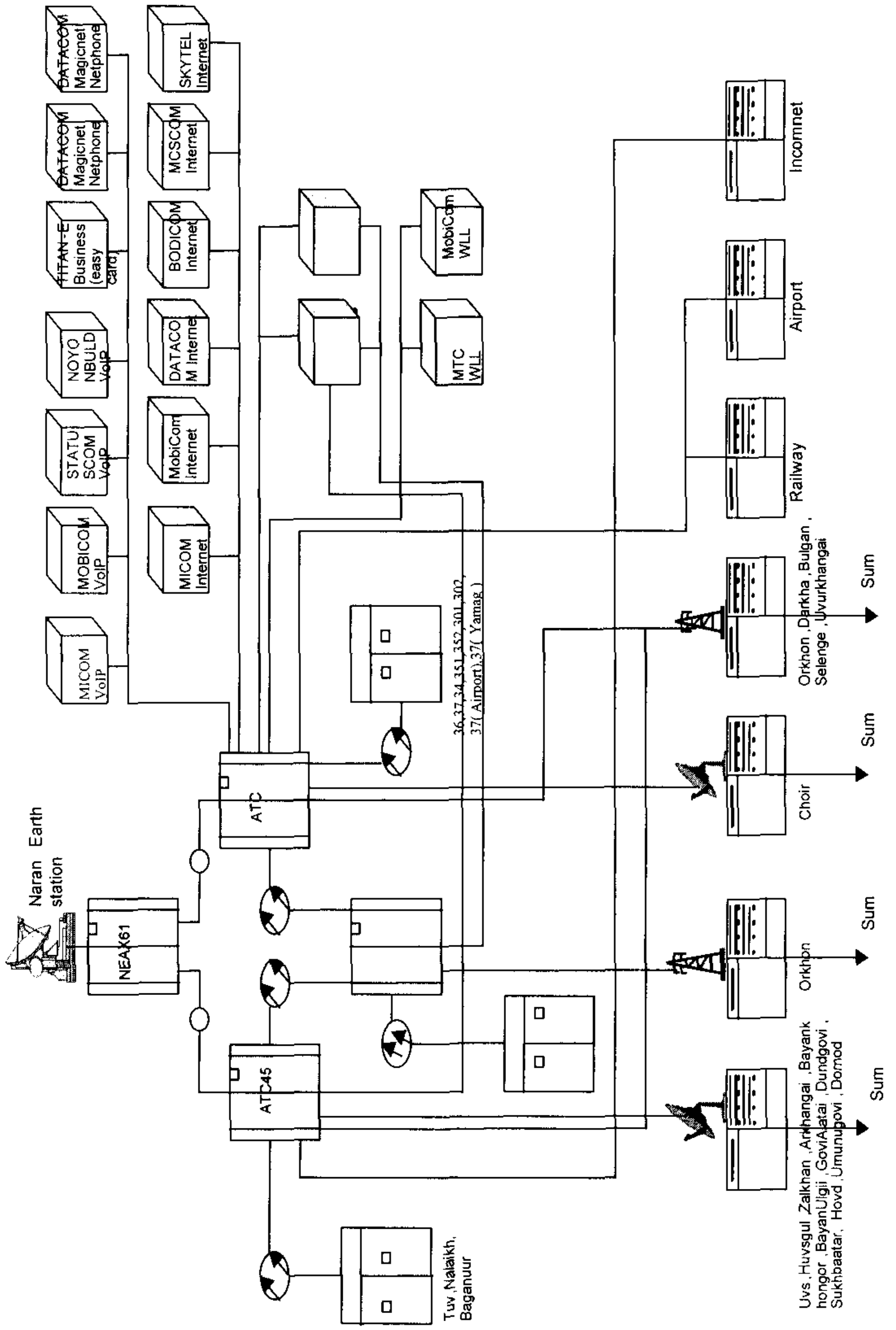


Figure 4.5.1 Mobile Service Network

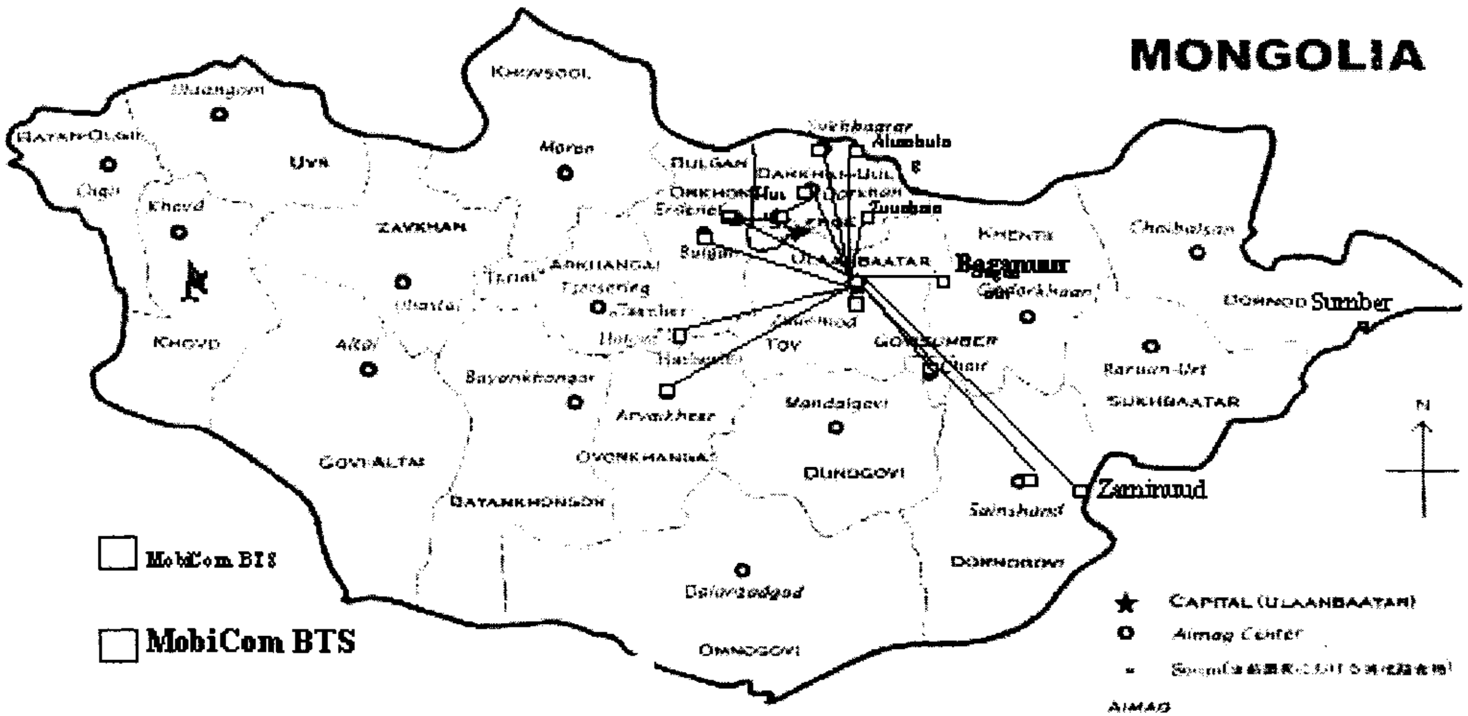


Figure 4.5.2-1 MobiCom GSM National Network

(5) Mobile Internet/WAP

So far, the voice services have been the main services provided by the mobile operators. However, since the move towards the convergence of telecommunication, IT and media industries, the emphasis has shifted to data services, which has resulted in the emergence of new technology such as Wireless Application Protocol (WAP) , General Packet Radio Services (GPRS) and "i-mode". The tremendous success of NTT DoCoMo's i-mode service in Japan, which provides Internet access via mobile phones to 17 million users, revealed the high potential of data services in the Asia Pacific region.

The MobiCom started its public internet services (ISP) under the trade mark MobiNet.mn based on latest information technology innovations and provides internet service using wireless devices as well as leased lines. Starting on February 1, 2001 MobiNet became 5th ISP in the Country.

In the year of 2001 MobiCom introduced new WAP (Wireless Application Protocol, like Japanese i-Mode) based mobile internet service to the Mongolian market. Introducing WAP technology, the customers will be able to use low cost, highly developed mobile internet technology, which will provide opportunity for receiving mobile banking, e-commerce and certain other services without computer.

4.5.3 Mobile Telephone Communications of SKYTEL

Mongolia-Korean joint Venture Skytel was founded in May of 1999 with 40 % participation from Mongolian side and 60 % from Korean side, SK Telecom and Taihan Electric Wire. In July, Skytel has been introduced to public with its AMPS network as a second mobile operator in Mongolia. Today, Skytel has expanded its service throughout Mongolia, so everyone can enjoy reliable and inexpensive service in Ulaanbaatar, Erdenet, Darkhan, Zamiin Uud, Sukhbaatar, Baganuur, Arvaikheee and Bulgan respectively.

The AMPS radio frequency allocation for SKYTEL is as follows:
Up Link (Mobile station to Base station) 824 MHz to 835 MHz
Down Link (Base station to Mobile station) 869 MHz to 880 MHz

In February of 2001, Skytel has successfully launched new technology by CDMA Cellular network in addition to AMPS network. Certainly GSM relatively speaking has more roaming capabilities. Nonetheless CDMA is also catching up. As far as data transmission new mobile services are introduced. Capacity of data transmission is the only for judgement nowadays. Data transmission capacity, cellular technology is no more limited to transfer it only voice calls. Capacity of data transmission is the only merit for judgment nowadays. CDMA Key Parameters is shown in Table 4.5.3-1.

Evolution of data transmission in comparison with CDMA and is drawn in the following Table 4.5.3-2.

The service started in Ulaanbaatar on July 8, 1999, in Erdenet on September 13, 1999, in Darkhan at September 27, 1999, in Zamin-Uud on April 27, 2000, in Sukhbaatar on June 23, 2000. Moreover, wireless payphone service from July 1, 2000. Optical Fibre Cable Network has been extended to 65 Km.

Table 4.5.3-1 CDMA Key Parameters

Item	Details
Frequency Allocation	800 MHz Band, 1800 MHz Band
Carrier Spacing	1.25 MHz
Chip Rate	1.2288 Mbps
Modulation System	QPSK(FW), OQPSK(RV)
Access System	DS-CDMA/FDD
Transmission Rate	Max 14.4 Kbps
Voice Coding System	QCELP, EVRC
Trunk Line Synchronization Method	Synchronization by GPS

Table 4.5.3-2 CDMA and GSM

Cellular technology	Generation	Data Transmission Capacity
AMPS	1G	34 Kbps
GSM	2G	96 Kbps
CDMA(IS-95B)	2.5G	64 Kbps-140 Kbps
CDMA 2000	3G	2 Mbps

Current number of mobile subscriber of Skytel is about 35000 (AMPS: 30000, CDMA: 5000). Skytel is now installing 160 payphone set in Ulaanbaatar. At present time MobiCom has a market share of 77 percent and Skytel has 23 percent. Skytel is planning to expand the service coverage to Baganuur, Tuv, Uvurkhangai and Sainshand in 2002. In near future it is planning to expand to Bayan-Ulgii, Khovd, Bayankhongor, Gobi-Altai, Umnugobi, Dundgovi, Sukhbaatar and Dornod aimag centres. And also, it is planned to put the WAP service into operation until 2004 and planning to transfer to IMT-2000. AMPS Network Configuration of Skytel is shown in Fig.4.5.3-1.

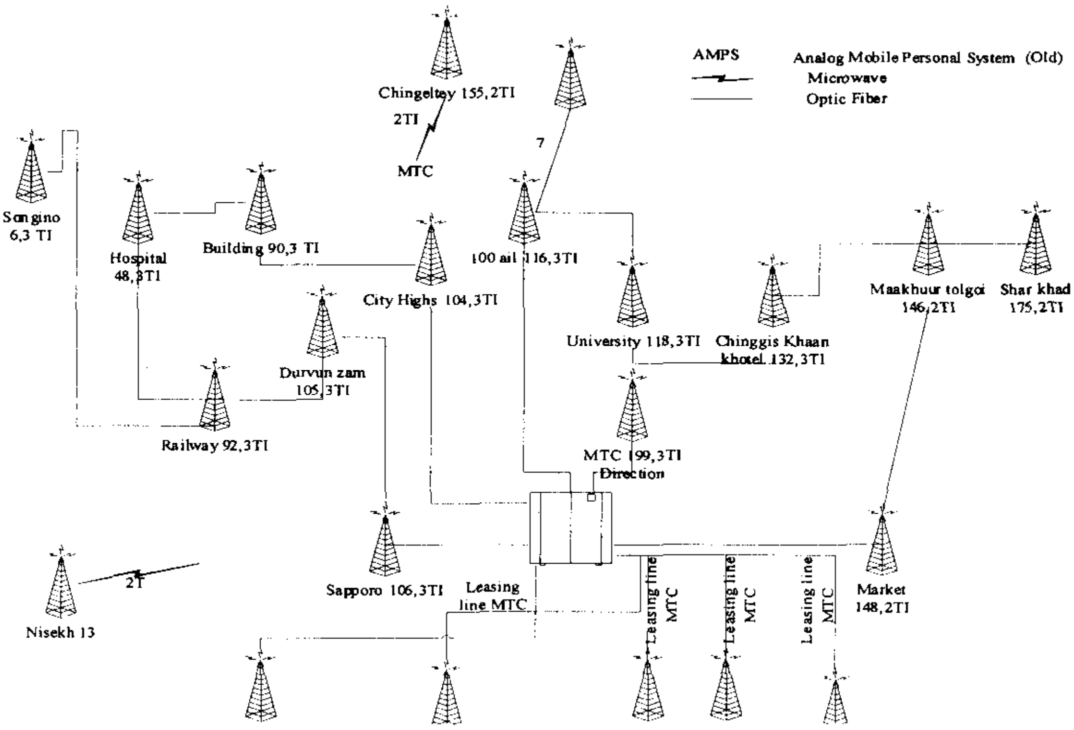


Figure 4.5.3-1 Skytel's AMPS Mobile Transmission Network

4.5.4 Paging Service

MonCom Co., ltd launched paging service in March 1994. Now they have 3000 users. The company provides numeric and alphabetic services via operator. At present, with a capacity of 10,000, MonCom already obtained license in Darhan and Erdenet. In the mid of 1997 "Home Vision "company started the same service in Ulaanbaatar and this year they started to provide voice paging service. The authorities are planning to establish a national paging system via satellite.

4.6 IT Services

4.6.1 Internet Services

Internet services are introduced up to Aimag centres and some Sum centres. MT stated in his annual report 2001 that MT has installed Internet café at all Aimags by 2000. However Internet café or access point of Internet Service Provider (ISP) in Sum area is very limited.

First Internet e-mail service in Mongolia was started in 1994 by Datacom. Full Internet services were appeared in early 1996, and at present eight (8) ISPs who belong to commercial based private company or academic/government function, are operating. They are MT (Micom), Mobicom (Mobinet), Datacom (MagicNet), Bodicom, MCScom, Onet at Erdenet aimag, CSMS (Erdemnet, as education network) and Mongolian Railway Company (RailNet). All Mongolian ISPs except RailNet connect with world networks through gate point of Tier 1 or Tier 2 of United States located in US or Hong Kong via satellite. The newly opened ISP RailNet has a link to Trans Telecom in Russia through his own fibre optic cable.

In 2001, in order to save traffic congestion in the satellite link by inter-local transactions among the Mongolian ISPs, and also to provide users better latency time of the local transactions and to reduce international leased lines, Mongolia Internet Exchange (MIX)

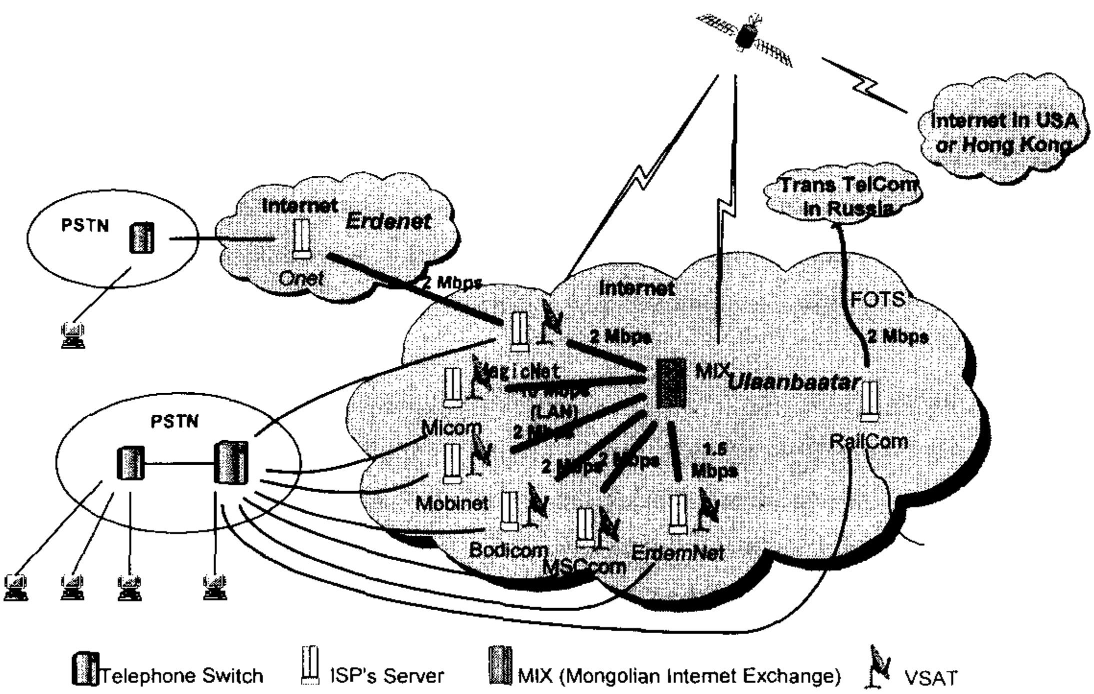


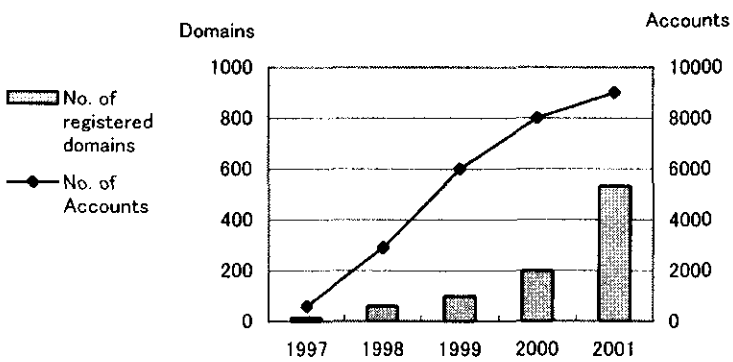
Figure 4.6.1-1 Internet Network in Mongolia at Present

was established by Infocon Co., Ltd. who is non-ISP and the independent company from the ISPs. At present, Erdemnet, Datacom, Mobicom, Bodicom, MSCcom and Micom have joined the MIX. Those MIX and ISPs connection diagram is as shown in Figure 4.6.1-1.

Services available at Ulaanbaatar are 56 kbps dial-up connection by all ISPs, 8 Mbps ADSL connection by Micom, and high-speed 64 kbps, 128 kbps or 256 kbps connection by RailNet.

According to the survey performed by Infocon Co., Ltd. in the beginning of 2001, the number of Internet users and the traffic volume is extremely increased. Total number of subscribers such as government, corporate and individual private accounts reached more than 9,000, and Internet users including who access from Internet café, company or school were estimated more than 30,000.

The survey result says, about 11 % of individual users access Internet from home, about 40 % access from their office or school, and 33 % from Internet café or Internet public service centre.



	1997	1998	1999	2000	2001
No. of registered domains	15	60	98	200	531
No. of Accounts	600	2900	6000	8000	9000
No. of ISPs	1	2	5	6	7

Source: 「Report on E-readiness Assessment of Mongolia」 Infocon Co., Ltd.

Figure 4.6.1-2 Current Internet Domains and Accounts in Mongolia

The average connection time to Internet per one user is 10 hours a month. 60 % of total users are organizations, 38 % are households or individual users. Around 95 % of total users are located in Ulaanbaatar.

Internet service in Mongolia is still in a beginning stage. Dial-up connection's throughput speed in Ulaanbaatar seems to be around 24-48 kbps and 9-14kbps in Aimag or Sum.

Internet users in Aimag/Sum are very limited. For example, a 10-years junior high school only uses Internet at a Sum. That low penetration rate and less access to Internet from Aimag/Sum are mainly due to high charge of long distance communication (in addition to provider's fee, 7 Tg local charge and 20 Tg long distance charge per minute are required), low speed connection, lack of consumable money of the peoples and less opportunity of PC buying or using.

Figure 4.6.1-3 shows the relation between GDP/Capita vs. Internet density in Asian countries. Mongolia is positioned in little bit high-level if it compares with the same income group.

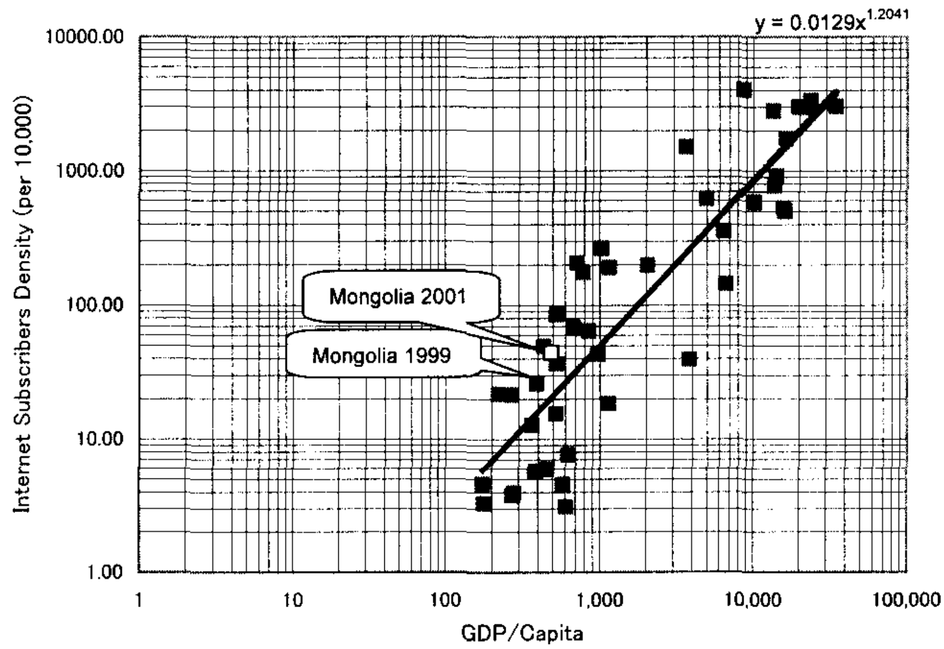


Figure 4.6.1-3 GDP/Capita vs. Internet Subscriber's Density in Asia

However as described in the former, that position is keeping only Ulaanbaatar's subscribers. There are still big gap between Ulaanbaatar and rural areas.

In Ulaanbaatar hundreds of Internet cafés seems to open. Each Internet café furnishes several PCs up to some 40s PCs, and connects to ISP by a 56 kbps dial-up link after gathering the PCs data by a local router.

An aggressive private ICT firm, Datacom Co., Ltd. started Internet Phone service called "Net2Phone Direct" in June 2001 at Ulaanbaatar. This new Internet Phone service does not require a use of computer, and makes 2-5 times less international call fee than ordinal PSTN connection.

4.6.2 Leased Line Services

MT provides following leased line services upon request of customer using terrestrial link and various speeds of VSAT:

- International leased circuit
- High-speed digital leased circuit (HSDLC), for Internet (the speed depends on customer's request.)
- Voice-grade transmission (VGT), for telephone, facsimile, teletype or data transmission
- International TV transmission, for video and audio transmission through INTELSAT and INTERSPUTNIK satellites.

Datacom provides following services throughout Mongolia:

- High-bit-rate digital subscriber line (HDSL) connection, by 2 Mbps
- VSAT connection, by 2 Mbps
- Wireless connection, by 10 Mbps

Both companies do not disclose about their customers, number of lines and connecting points of the customers. However the lines seem to be limited in volume and in area because there are less private companies in Aimag, and no leased line service is deployed to Sum level.

Mongolian Railway Company (MRC) is a PSTN and leased line provider. MRC is leasing 2 Mbps x 3 lines to Mobicom and 2Mbps x 4 lines to Skytel for their districts (Aimags) mobile phone services.

4.6.3 Other Services

Sum MT's telephone office is handling facsimile and telegram messages as the non-voice services. Other than these message services, MT provides TV re-broadcasting or repeating service at all the Sums and re-transmits FM radio signals at some Sums.

4. 7 International Telecommunication Facilities

4.7.1 International Telecommunication Network

The international telecommunications network in Mongolia mostly based on digital systems, are ensuring the highest quality and reliable services. The international transmission network consists of the transmission systems between E10B (a toll switch) and NEAX-61E (an international transit switch (INTS) which is installed at the ITMC and the ISMC) switches, and a digital radio microwave system has been established between ITMC Ulaanbaatar and Naran Earth station. International telephone calls are handled by NEAX61E digital International Transit Switch (INTS).

Naran Earth station has an access to the Intelsat 64 degrees East (INTELSAT 804) and Intelsat 66 degrees East (INTELSAT 704) satellites in the Indian Ocean Region and the Express-6A satellite (80 degrees East) of Intersputnik system. The majority of international traffic to the direct destinations is carried by satellite via INTELSAT and via INTERSPUTNIK to Russia Federation. To Russia 10 circuits have been established via terrestrial microwave system. Satellite-based telecommunications and Mongolian National TV broadcasting services are provided via Intelsat standard A, B and Intersputnik standard C1 antenna. Mongolia is a Signatory of Intelsat and Intersputnik. There is an INTELSAT earth station which uplinks domestic television programme broadcasting to remote television receivers within the whole territory of Mongolia, and receives a variety of regional satellite TV channels for programming in Ulaanbaatar. The Mongolia Telecom international telecommunication network is shown in Figure 4.7.3 -1.

During the period of 2000, the Government of Mongolia established a fibre-optic cable network financed by Japanese Yen Loan along the Mongolian railway from the north border to south border (1410 Km). It is strategically important to have international telecommunications networks of Mongolia put on the fibre-optic cable and interconnected with railway networks in Russia and in People's Republic (PR) of China. Mongolia Railway Company (MRC) has made a contract with Russia Telecom Company and China Telecom Company to connect the MRC fibre-optic cable with the railway communications networks in Russia and in People's Republic of China. It is now planned to establish 9 PCM E1 bearers (270 channels) with China and establish 14 PCM E1 bearers (420 channels) with Russia Federation. It is hoped that such connection with neighbouring networks will increase international traffic, increase network reliability, encourage the introductions of new high-speed data and telecommunications services and subsequently, enable maximum utilisation of the installed capacity of the new optical fibre transmission system.

4.7.2 International Telephone Circuits

An international telephone call service is provided to over 150 countries. The number of international circuits in 2002 is 324 and the number of direct routes is 8 (including Mongolia-USA hard-patch route via Japan). At present, Mongolia is setting up a 2 Mbps IDR circuits routed to Japan, Korea, China and Russia, 1.5 Mbps bearer to Hong Kong, 512 Kbps bearer to Singapore and U.K. (Hard Patch via Tokyo) through the Naran Earth Station. This means that Mongolia is having in total 10.5 Mbps satellite bandwidth via satellite connecting with all over the world.

The International communication network has 7 direct satellite routes, out of which, 5 are directed to Asia, 2 to Mercury of Britain and Russian federation. At this time it is used 9 voice channels and 2 leased line circuits in the route Mongolia-USA. The 9 voice channels linked via Japan's hard patched and 2 leased line circuits via Hong Kong.

Since the IDR modems capacity of all routes at Naran earth station, except of to Korea and Hong Kong was fully occupied and there is no possibility of increasing the capacity, it is requested to expand the channel capacity of International circuit using a digital circuit multiplex techniques. In order to use the satellite bearers effectively digital multiplex equipment like DCME or LRE shall be installed after IDR modems.

The traffic to Europe and America is comparatively increasing. At present, the outgoing traffic to the USA is going through Japan and traffic to European countries through U.K., Japan, Hong Kong and Singapore. Current satellite capacity of direct routes is shown in Table 4.7.2-1 and Table 4.7.2-2.

Table 4.7.2-1 Current Satellite Capacity of Direct Routes

Route	System	Capacity/Occupied	Use of Satellite
E10-ITMC	10 x 2 Mbps	300/300	
ITMC-NRN	34 Mbps	480/324	
NRN-TOK(OYAS)DCME	2 Mbps/IDR	120/85	INTELSAT
NRN-SNGS (LRE)	512 Kbps/IDR	16/16	INTELSAT
NRN-MCW	2 Mbps/IBS	30/30	Intersputnik
NRN-BEI	2 Mbps/IDR	30/30	INTELSAT
NRN-HKG	1.5 Mbps/IDR	24/24	INTELSAT
ULB-SEOUL(TJNS)DCME	2 Mbps/IDR (EF DATA)	150/150	INTELSAT
ULB-SAC	Hard Patch Via JAPAN (KDDI)	9	

Table 4.7.2-2 International Direct Routes /International Telephone Channel

Use of Satellite	Route	No. of Channel (May 2001)	No. of Channel (May 2002)
INTELSAT	BEIJING	29	29
	HONG KONG	22	22
	TOKYO	25	25
	OYAMA	19	49
	SACRAMENTO	9	9
	TEJIN	60	60
	SEOUL	90	90
	SINGAPORE	-	16
INTELSAT	CANADA	14	-
Intersputnik	MOSCOW/SAT	30	24
Total		298	324

4.7.3 Naran Earth Station

"Naran" satellite communication centre is located in Ulaanbaatar and far from about 10 Km west of Mongolia Telecom's building. It is linked by digital microwave (34 Mbps Radio, which is manufactured by NEC Japan, at 7 GHz frequency band) to the International gateway exchange (NEAX-61E) at Mongolia Telecom's building and it is linked by Russian made analogue microwave to the National TV centre for TV broadcasting.

Intelsat Standard-A earth station with 16 meter diameter antenna was installed and put into operation on 25th August, 1993 at Naran satellite communication centre. It transmits and receives digital telephony carriers to/from Intelsat 64 Degrees East. Standard-B earth station with 11 m antenna to the Intelsat 66 Degrees East satellite in the Indian Ocean Region is used for occasional TV transmission service. There is also a satellite route to Moscow operating via Express-6A satellite at 80 Degrees East location of the Intersputnik system and using Russian manufactured Earth Station with 12 meter antenna is used for IDR telephony service and occasional TV service to other countries.

Whole diagram of Naran Earth Station is shown in Figure 4.7.3-1. Whole transmission diagram for TV broadcasting via satellite is shown in Figure 4.7.3-2.

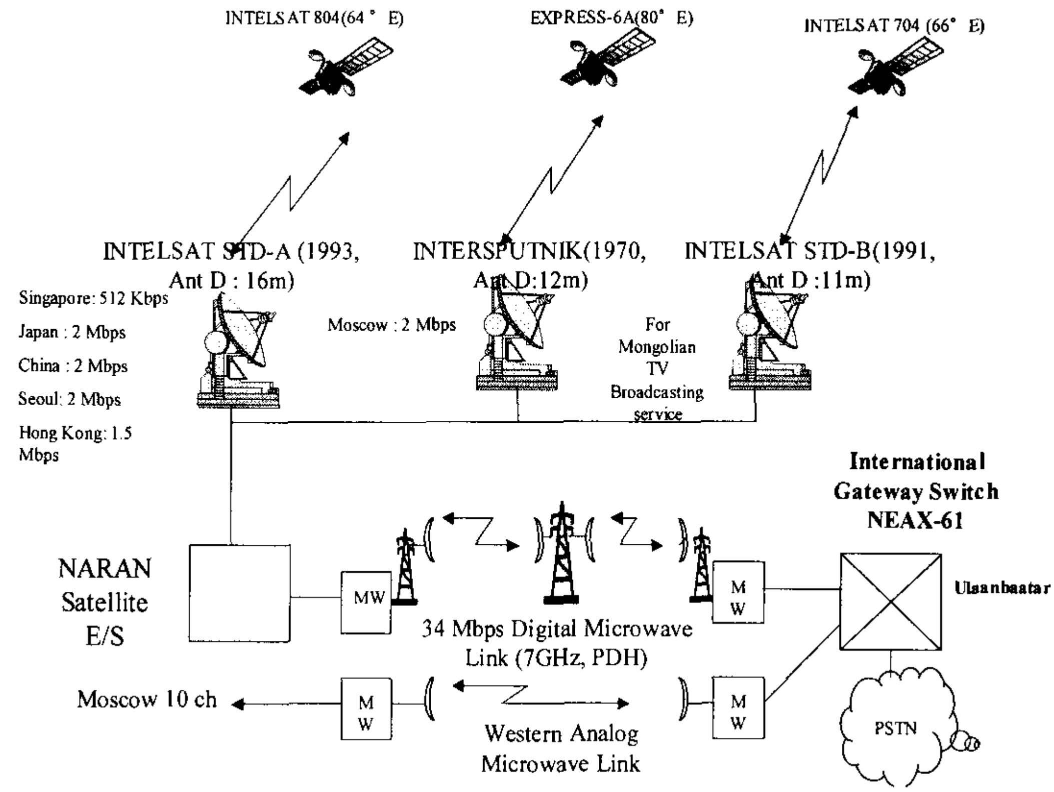
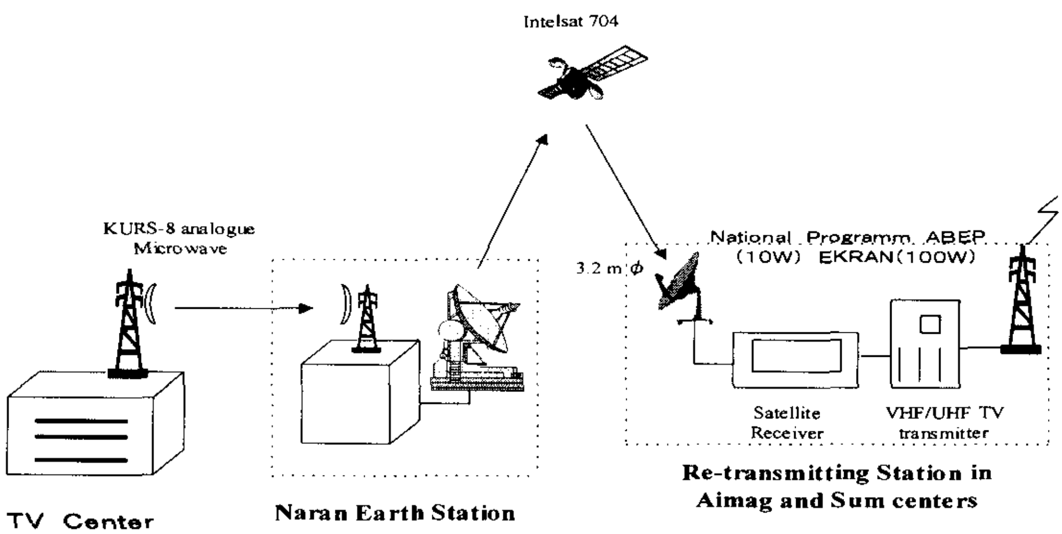


Figure 4.7.3-1 International Transmission Network



Existing situation:

(1) Number of re-transmitting station in Aimag centers is 23 (2) Number of re-transmitting station in Sum centers is 308
(3) Number of Receiving TV channel is 2 (4) Number of Receiving Radio programs is 1

Figure 4.7.3-2 TV Broadcasting

4.7.4 International Telephone Services

Mongolia Telecom (MT) offers international telephone services exclusively to the customers including international direct dialling (IDD), and operator assisted call services. MT achieved the international telephone calls (total chargeable minutes of outgoing calls) growth rate at 17.6 percent during 6 years from 1996 to 2001. In 2001 total chargeable minutes of outgoing calls of international telephone calls were 4992 thousand minutes.

(1) International Direct Dial Service

Subscriber places overseas calls directly without operator assistance. Rates are calculated in six-second units and are considerably reduced after the first minute. MT offers special rate at weekend, holiday discounts ranging from 16 % to 30 %. About 72% of the total traffic was accomplished by the IDD. The international telephone traffic increased in 2000 by 15.7 per cent as compared with 1999 while majority of the international telephone calls was made through IDD. IDD traffic occupied 96.8 per cent in the total international telephone traffic last year.

(2) International Operator-Assisted Calls

MT's operators assist customers to place international telephone calls to about 160 countries of the World.

(3) Home Country Direct

This service is available for callers directly to Japan, Singapore, Republic of Korea and USA. By pushing a button from special telephone, a calling party can access a KDDI, Singapore Telecom, Korea Telecom and AT&T operator and make a collect call to Japan, Singapore, Korea and USA.

(4) International Leased circuits

MT's international leased circuits directly link a customer to the designated overseas locations. MT provides this type of service upon request of the customer.

(5) HSDLC (High Speed Digital Leased Circuits)

High-speed digital leased circuits for Internet offers different spectrum of transmission speeds.

(6) VGT (Voice Grade Transmission)

Voice grade leased circuit are available for voice grade transmissions compatible with telephone standards and convenient for use as a telephone, facsimile, telex and data transmission.

(7) International TV transmission

Mongolian telecom provides with a high quality video and audio transmission through the INTELSAT and INTERSPUTNIK satellite systems.

4.7.5 International Telephone Traffic

In the Table 4.7.5-1 the traffic data of O/G and I/C international telephone services during the period from 1993 to 2001 is shown. When NEAX 61 begun operation in 1993, I/C chargeable minutes reached 1,817,011 minutes, O/G chargeable minutes was 814,912 minutes.

Table 4.7.5-1 I/C and O/G international Telephone Traffic

Year	Number of I/C	Number of O/G	Minutes of I/C	Minutes of O/G	% of I/C (Min)	% of O/G (Min)	Total Minutes (Min)
1993	454252	340903	1817011	814912	69	31	2631923
1994	851510	431766	3153240	1214866	72	28	4368106
1995	1382230	706502	4625826	1885078	71	29	6510904
1996	1709789	873840	6113599	2378991	72	28	8492590
1997	2835388	1115240	7622769	2973628	72	28	10596397
1998	3217788	1393286	8428860	3984774	68	32	12413634
1999	3987400	1505579.	10139822	4154990	71	29	14294812
2000	4839052	1661296	19976422	4522720	82	18	24499142
2001	5346553.	1896572.	21939845	5032789	81	19	26972634

The international telephone traffic has been intensively developed and increasingly extended. The total chargeable minutes has increased about 10 times from 2,631,923 minutes in 1993 to 26,972,634 minutes in 2001. The international telephone traffic increased in 2001 by 19.2 per cent as compared with 1997 while majority of the international telephone calls was made through IDD. IDD traffic occupied 96.8 percent in the total international telephone traffic last year. The total of outgoing call from Mongolia is about 4.2 times higher than the total of incoming call. (81 percent vs. 19 percent)

In the Table 4.7.5-2 the list of high usage traffic destination shows that first 10 countries are included in the existing 8 international direct routing. Particularly, Russia (24%) and China (16%) are heading the international telephone traffic.

When arranging international circuits, it is desirable to maintain direct circuits with countries as much as possible, from the standpoint of national interests. For communication reliability as well and excessive dependence on a particular transit point is not desirable. However, the facility redundancy, economy, intentions of the other countries, and other factors have to be considered as important factors when establishing direct circuits. From the viewpoints of economic aspects for a direct and relayed circuit a direct circuit is more advantageous than a relayed circuit when there is traffic of approximately 60,000 minutes/year.

Table 4.7.5-2 High Usage Traffic Destination List in 2001

No.	Destination	Total Chargeable Minutes	Percentage	No.	Destination	Total Chargeable Minutes	Percentage
1	Russia	**356272**	24.9	17	Switzerland	16610	1.2
2	China	**231280**	16.2	18	Ukraine	14810	1.0
3	Japan	**103520**	7.2	19	Philippines	11420	0.8
4	Germany	**102336**	7.1	20	Japan Direct	10968	0.8
5	U.S.A.	**99197**	6.9	21	India	10277	0.7
6	Korea	**65420**	4.6	22	Hungary	10202	0.7
7	U.K.	52640	3.7	23	Poland	9676	0.7
8	Yugoslavia	30380	2.1	24	Turkey	8685	0.6
9	Hong Kong	26953	1.9	25	Denmark	8524	0.6
10	Singapore	24007	1.7	26	Indonesia	7168	0.5
11	Kazakhstan	23949	1.7	27	Others		
12	Italy	21715	1.5		A) Africa	2687	0.2
13	Canada	19858	1.4		B) America	14802	1.0
14	France	19387	1.4		C) Asia	53683	3.8
15	Australia	19006	1.3		D)Europe	38624	2.7
16	Greece	17422	1.2		Total	1431478	100

The Table 4.7.5 -3 shows that aimags with high usage over the international telephone calls are Ulaanbaatar, Orkhon, Darhan-uul, Bayan-Ulgii, Uvs and Khentii. The tourism season in Mongolia is one reason of high traffic in the international telephone services.

The highest traffic of the international telephone calls in Mongolia is originated from a capital city Ulaanbaatar. The Table.4.7.5-4 shows the international telephone calls percentage in Ulaanbaatar and whole Aimag. It shows one international telephone call is allotted to 1.3 households in Ulaanbaatar, however, in whole Aimag allotted to 40 households. That means that Ulaanbaatar call volume is about 30 times higher than whole Aimag. The international traffic in Ulaanbaatar is high but in Aimag too low.

Table 4.7.5-3 International Telephone Calls originated from Aimag (2001)

AIMAG	Auto(No. of Call)	Manual (No. of Call)	Total (No. of Call)	Auto (Minutes)	Manual (Minutes)	Total (Minutes)	Population	No. of Household	No. of Subscriber Line	Telephone Density
Arhangai	474	0	474	21326	0	21326	97500	25600	1187	1.22
Bayanulgii	13059	24	13083	29752	68	29820	46000	20800	1755	3.82
Bayanhongol	481	15	496	1721	64	1785	85300	20900	1320	1.55
Bulgan	2051	0	2051	7900	0	7900	62600	15900	1741	2.78
Govialtai	808	44	852	2706	209	2915	63600	15400	1737	2.73
Govisumber	268	0	268	1333	0	1333	12300	2900	643	5.23
Darhanuul	19160	354	19514	49652	1339	50991	94800	18500	5871	6.19
Dornogovi	852	224	1076	2283	141	2424	51100	12000	1542	3.02
Dornod	2226	239	2465	6215	666	6881	74200	17300	1687	2.27
Dungovi	10	213	223	52	723	775	51300	12500	1726	3.36
Zavhan	1444	117	1561	4403	387	4790	87200	22000	1587	1.82
Orhon	50177	1012	51189	140471	2818	143289	76000	17300	6323	8.32
Uvurhangai	800	7	807	2750	13	2763	113000	29500	3225	2.85
Umnogovi	408	181	589	1418	414	1832	46900	11600	1883	4.01
Sukhbatar	217	112	329	885	34	919	55900	13975	929	1.66
Selenge	2309	4	2313	6240	151	6391	100900	21800	3225	3.20
Tuv	1612	0	1612	3446	0	3446	98000	23700	1800	1.84
Uvs	3650	99	3749	13650	384	14034	86800	20700	1883	2.17
Khovd	2466	0	2466	9007	0	9007	87800	18500	1456	1.66
Huvsgul	538	116	654	1916	360	2276	119800	26900	2490	2.08
Hentiy	3576	163	3739	9538	471	10009	71400	17500	1609	2.25
Baganuur	6740	11	6751	16345	36	16381				
Nalaikh	766	0	766	5054	0	5054				
Ulaanbaatar	1597251	0	1597251	4342429	0	4342429	786500	174250	74247	9.44
Total	1711343	2935	1714278	4680492	8278	4688770	2368900	559525	119866	5.06

Table 4.7.5-4 International Telephone Calls Percentage in Ulaanbaatar and Whole AIMAG

	Population	Number of Household	Chargeable time per month(MINS)	Total Chargeable time (MINS)	Call duration per call(Mins)	% of Calls	% of Population
ULB	786500	174250	361869	4342429	2.7	93.0	32.6
Aimag	1626500	385275	27262	327141	0.2	7.0	67.4

4.8 Power Facilities

4.8.1 Power Supply System in the Selected Aimag

An example of power supply to a telecom office from the diesel generating station at the Aimag centre of Govi-Altai is as illustrated in Figure 4.8.1-1. There are two sets of diesel generators installed in the yard of the telecom office. One generator is rated at 30kW (37.5kVA, 3 phase, 400V, power factor 0.8, 1500rpm) that was installed in 2001. The generator reportedly has a sufficient capacity to meet actual power demand of approximately 14kW at the telecom office. The other generator is rated at 60kW (not shown in the figure), which is maintained for a back-up power supply.

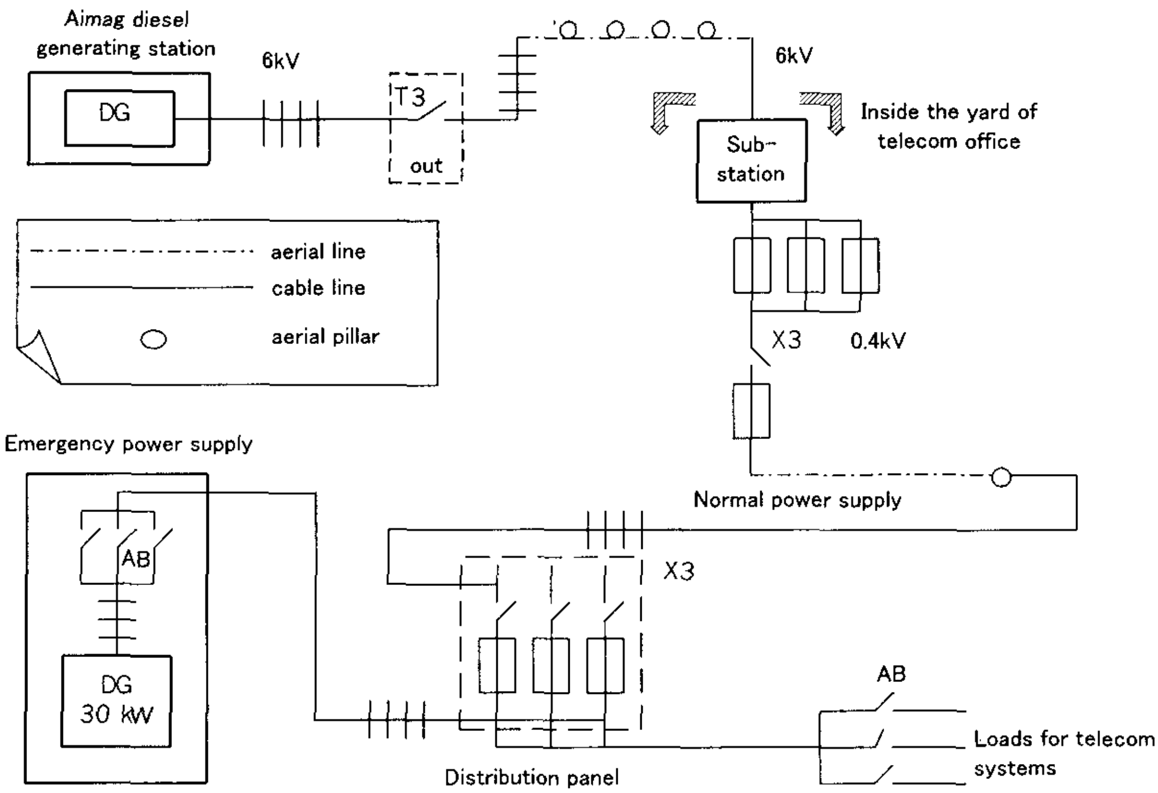


Figure 4.8.1-1 Example of Power Supply System at Telecom Office at Aimag Centre

4.8.2 Power Supply System in the Selected Sum Centres

The field surveys held on May 11-16, 2002 covered three selected Sum centres in Govi-Altai Aimag; Sharga, Haliun, and Biger. Power supply situations at these Sum centres are quite similar as summarized in Table 4.8.2-1. These Sum centres are supplied with electricity by stand-alone diesel generators provided under grant aid of Japan.

Table 4.8.2-1 Power Supply Situations at Selected Sum Centres

Sum Centres	Sharga	Haliun	Biger
Nominal power output of diesel generators	60kW x 2	60kW x 2	60kW x 2
	(Nameplate rating: 100kVA, 400V, 144A, 50Hz, 3phase 4 wire system; 92.7kW, 1500rpm)		
Daily operating hours of diesel generators	5 hours (summer) 7 hours (winter)	3-4 hours (summer) 7 hours (winter)	None (summer) 4.5 hours (winter)
Operating conditions of diesel generators	Good	Good	Good
Operation and maintenance personnel	3 persons (including one accountant)	2 persons	2 persons
Annual diesel fuel procurement (FY 2002 budget)	Tg 10 mil.	Tg 15.4 mil.	Tg 3.8 mil.
Cost of diesel fuel	Tg 530 / litre	Tg 530 / litre	Tg 530 / litre
Monthly electricity charge per household	Approx. Tg 4,700 (fixed)	n.a.	Approx. Tg 5,000 (fixed)
Critical issues in power supply	Heavy financial burden of procurement of diesel fuel and operation and maintenance personnel, resulting in suppressed operating hours of the generators.		
Main power supply to telecom office	Power supply from the diesel generators at the Sum centres; therefore, power is not available during the period outside the operating hours of the generators.		

According to each chief of the Sums, power supply situations at the Sum centres have considerably improved by installation of diesel generators under grant aid of Japan, even though operating hours of the generators must be suppressed to a minimum level, because of a shortage of fuel resulting from financial problems.

None of these selected Sum centres is provided with main or emergency diesel generators or other sources of power supply, except for small-scale solar panels that are used for power supply to emergency short-wave transceivers provided under grant aid of Japan.

Main power supply for microwave repeater stations in Govi-Altai is by the means of diesel generators at the Aimag centre or Sum centres. For instance, the microwave repeater station No.123 is supplied with electricity from the diesel generators at the Aimag centre.

At this repeater station, a power-receiving transformer with a capacity of 40kVA and voltage of 6kV/400V is provided at the terminal point of power supply. Two sets of emergency diesel generators each rated at 16kW are installed inside the repeater station, together with a fuel oil tank of storage capacity of 54kl. Another example is the repeater station No.124 where one emergency diesel generator with a nominal capacity of 16kW (20kVA) is provided.

4.8.3 Power Supply by Utilizing Renewable Energy at the Selected Sum Centres

The only power supply by utilizing renewable energy at the selected Sum centres at Govi-Altai is by means of small-scale solar panels for the short-wave transceivers as described in Section 4.8.2. None of the households at the Sum centres is provided with any type of solar panels or wind generators or diesel generators. According to explanations by chief of each of the Sums, some of the households outside the Sum centre own small-scale solar panels or wind generators or diesel generators, depending on the income of the households. Although Govi-Altai is rich in solar energy, introduction of solar panels is proceeding at a comparatively slow speed.

According to a director of the telecom office at the Aimag centre, telecom offices at 14 out of 18 Sum centres at Govi-Altai are supplied with electricity generated by photovoltaic (PV) systems alone. Capacity of each PV system is said to range from 400W to 1kW; in addition, a battery bank of 132 - 2,000Ah is provided with each PV system for a designed non-sunshine period of 2-3 days. The PV systems are downsized because of non-availability of sufficient investment, according to the explanation made by PTA.

There are seven microwave repeater stations located inside Govi-Altai, and six out of seven stations are supplied with electricity by PV systems as well as power supply from Aimag diesel generators. A typical PV system at the microwave repeater station No.124, for instance, consists of 104 PV modules of each 55W rated power output. A battery bank for the PV system is rated around 3,000Ah, enabling power supply to last for a few hours.

4.8.4 Power Supply Facilities at the Aimag Centres and Sum Centres

Telecom offices located at the Aimag centres and Sum centres that are covered under the Master Plan Study receive power from grids, or Aimag diesel generating (DG) stations, or Sum DG stations.

Power supply from grids is comparatively stable, while power supply from Aimag

DG stations is less stable than that from grids, but efforts have been made to improve reliability and stability of power supply. As compared with these two supply sources, power supply from Sum DG stations is of a low standard; operating hours of most of the DG stations are limited to nighttime, thus making it quite difficult to feed electricity to telecom offices on a 24 hours-a-day basis. Power supply situations at the telecom offices at the individual Aimag centres and Sum centres are described in Annex 10.1, as provided by MTC.

CHAPTER 5

DEVELOPMENT FRAMEWORK AND STRATEGIES

CHAPTER 5

DEVELOPMENT FRAMEWORK AND STRATEGIES

5.1 Background of Master Plan

5.1.1 World Trend on Telecommunications Needs

Recent technological development in telecommunications, transportation, ICT and various production process allows us the worldwide socio-economic activities. In consequence, international economic relationships have been increasingly become complex and tightly connected. In these circumstances, volume of information transactions in economic entities, especially in industrial and services sectors, has significantly increased. To support these transaction requirements, not only enhancement of conventional telecommunications means by increasing voice telephony but also introduction of new type telecommunications means including the Internet, e-mail, data communication, facsimile and utilization of data/information processing equipment are essential. Accordingly, telecommunications network has been indispensable infrastructure for those activities.

5.1.2 Telecommunications Needs in Mongolia

To realise higher economic growth and equitable distribution of social benefits and attracting foreign investment, the Government of Mongolia has been strongly emphasising the need for adequate and efficient infrastructures in the national development policy. In the policy, telecommunications development is placed as a highest priority for the industrial development, higher productivity of agriculture and enhancing efficiency in the service sector. Telecommunications sector is an infrastructure component of the national economy. Demand for telecommunications to serve the purposes of the Government, people and their socio-economic activity is an essential factor for the country's development.

5.1.3 Telecommunications Policy in Mongolia

The telecommunications sector policy of Mongolia is keeping the basic policy with the MTSPS 2001, based on the Network Master Plan to 2010. The objective of the general strategy for developing the telecommunications sector in Mongolia for 2010, according to the MTSPS 2001, is to introduce more fruitful investment along with the latest high-tech system and technology into Mongolia. This objective shall be implemented in the manner of opting for the latest modern technologies in harmony with ensuring customers demands, issuing licences to services providers as well as registering them:

(a) To keep on the reformation and expansion of digitalisation of the telecommunications network in combination with technologies of optical fibre, microwave, space and mobile communications;

(b) To introduce the optical fibre technology into the backbone network, connect centres of all Aimags and towns with the high-speed broad bandwidth information transmission network, develop the integrated information network for the country;

(c) To digitalise the radio and television broadcasting and receiving stations broaden the receipt coverage of radio and television broadcasting from a satellite, increase channel numbers, improve the quality of broadcasting. These measures shall be implemented step by step;

(d) To speed-up the penetration of optical fibre cables into the urban area telephone network lines, and the copper cables, the optical fibre cables and the wireless technologies into the subscriber lines and increase the coverage extent;

(e) To introduce the space mobile communications system into the rural communications; and

(f) To improve the telecommunications services supplies, by 2010, a telephone density in the urban areas shall achieve 15 telephones per 100 inhabitants in Ulaanbaatar, 10 - 12 in Aimag centres, international and domestic calls from all Sum centres shall be performed automatically and ensured no less than 50 percent of the population with technical opportunities to be connected into the Internet.

5.1.4 Rural Area Development Policy and Telecommunications

The Government of Mongolia defines the Action Program for the rural area development to take up the important position to formulate its key objectives in order to ensure higher economic growth, pursue an export-oriented economy policy, and to improve the living standard of people by streamlining the distribution of wealth and income, and develop an effective system of social welfare. The regional and rural development policy in the Action Program aims at formulating the following programmes:

(a) Improving the water supply and public services in Aimag centres;

(b) Develop information technology and internet as a tool for intensifying economic relations;
(c) Encouraging investment and industrial growth in the rural areas;
(d) Regulating by law economic and legal relations of herder households and farmers for improvement of their livelihood and business;
(e) Supplying the herders and general rural population with cheap but good quality goods;
(f) Improvement of the system of maintaining herds under state protection;
(g) Setting up a mechanism of protecting livestock from natural disasters;
(h) Promoting cooperation between herders, farmers, business entities and research institutions;
(i) Improving the system of protecting livestock, health, renew, from animal diseases;
(j) Improving water supply in not less than 70% of the pastureland in the desert and steppe regions;
(k) Prepare the electricity supply in rural area;
(l) Improving air space usage on the territory of Mongolia;
(m) Expanding international road communication link and reinforcing bridges;
(n) Improving the quality of basic and introduce new types of postal services;
(o) Expanding the range of mobile communication; and
(p) Increasing the number of radio and TV channels beamed to rural areas.

The Action Program is seeking the optimal harmony in (a) sustainable social development, (b) sustainable economic development, (c) development of potential natural resources and environmental protection.

(a) To improve social and public services in the rural area, such as educational services, health and medical care services, etc., securing basic human needs;
(b) To fill the gaps of information services between the urban and rural areas;
(c) To enhance and secure agriculture and livestock farming industry development, and
(d) To encourage local industries development focusing on small-medium scale industries and others (mining, tourism and services industries, etc.)

5.1.5 Rural Telecommunications Development Funds

Funding is one of the heaviest burdens to develop the telecommunications services in rural area. Investment cost of telecommunications facilities is higher in the rural area than the urban area. Maintenance and operation costs in the rural are higher than the urban, too, while revenues per line are lower in general. Under the circumstance, approaching the rural development challenges has been made through the creation of special rural telecommunications funds, normally obtained from the telecommunications sector. Attention should be paid to such approach related to the ralisation of the funds for the rural telecommunications services. The funds are usually obtained from a special tax collected from the revenues of existing and new telecommunications operators. Other resources may include a portion of license fees, proceeds of sales of state-owned telecommunications operators and national budget. Normally, these funds provide resources for a specific capital investment programme and/or the coverage of clearly defined purpose(s).

Within the framework of the policy for implementing the universal services obligations, every citizen of Mongolia shall create the technical opportunity to utilize the telecommunications services. To do so, private international as well as other all sorts of financial resources shall be applied. In areas with high demands and supplies, there shall be supported private sectors to carry out telecommunications services under common commercial conditions. Running services in the remote and dispersedly populated regions of the Mongolian territory are cost expensive, thus, there shall be created a mechanism of attracting providers there.

5.2 Development Framework, Key Targets and Strategies

The objective of this Master Plan is to set up a framework, in quantitative and in recognising the actual situation, for the establishment of the future information network at the rural areas in Mongolia which will support the socio-economic development of the rural areas. To reduce a gap of the telephone services and the new IT services between the urban and rural areas, the Government of Mongolia intends to perform the following development framework and strategies.

5.2.1 Basic Policy for Framework

The basic policy for setting-up the framework of the Master Plan Study for the development of the rural telecommunications system is as follows:

(a) To digitalise and expand the existing telecommunications network in Sum centres to realise automatic dialling and to replace the aged equipment, including the transmission system between Aimag centres and Sum centres; and

(b) To introduce and expand the IP-network (including Internet) to contribute the information welfare (telephony, e-Education, e-Medicine) to the rural dwellers and to contribute socio-economic development of the rural areas.

5.2.2 Planning Period and Target Years of the Master Plan

This Master Plan Study covers long-term development for the telecommunications network up to 2020 in the whole Mongolia. The planning period up to 2020 is divided into several milestones as target years i.e., a short-term plan up to 2008, a medium-term plan up to 2013 and a long-term plan up to 2020.

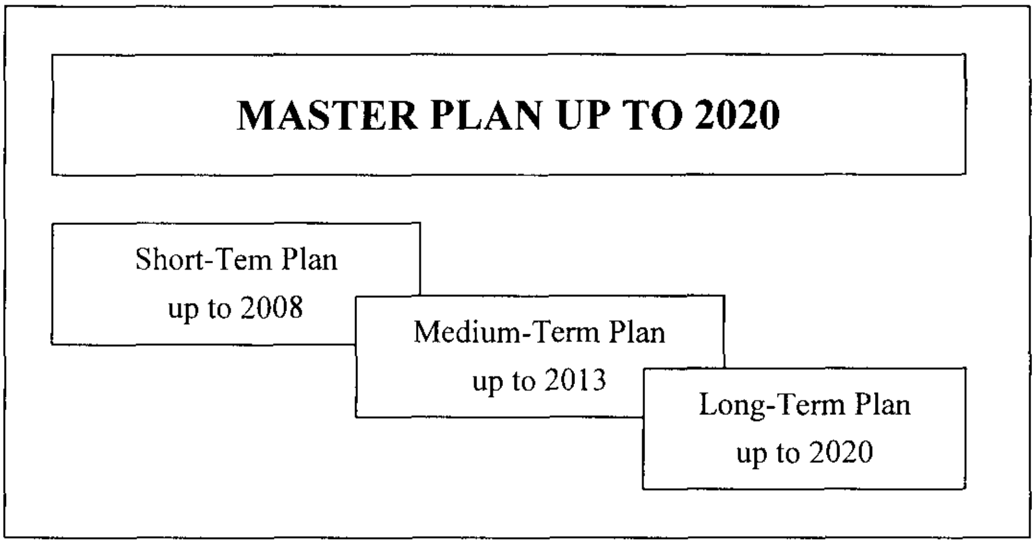


Figure 5.2-1 Planning Period and Target Years in the Master Plan

5.2.3 Strategies

For the setting-up this Master Plan Study, the special attention shall be paid in the following items:

(a) To respect the basic policy of MTSPS;
(b) Maximum use of the existing equipment;
(c) Realistic and cost-effective works in Phase-I (up to 2008) period for the section of the priority project(s) among these works; and
(d) To review the works planned in Phases-II (up to 2013) and III (up to 2020) period in appropriate timing whether the plans are in line with the technical trend and innovation and conform with the demand of the area at the time.

5.2.4 Socio-Economic Growth Frame

(1) Population Forecast of Mongolia

For forecasting the population growth of Mongolia, the past records of the population of Mongolia and its annual growth tendency are reviewed in Chapter 2. As the result of the examination of the MOFE's study and two other studies for the population forecast, the MOFE's study is adopted as the base data with appropriate adjustments made under this Master Plan Study. The base data coincide with the latest long-range forecasts of UNDP and World Bank in general. Details of the forecasted population of Mongolia are shown in Table 5.3-1.

(2) GDP and GRDP Forecast of Mongolia

For forecasting the growth of GDP, GRDP, GDP per Capita and GRDP per Capita in Mongolia, their respective past records and annual growth tendency are reviewed in Chapter 2. For the long-range forecast of GDP and GRDP, the annual growth rates of 1.1%, 3.9% and 5 for 2001-2003 as used by MOFE and IMF are studied. In this Master Plan Study, the annual growth rates of 5% for 2004-2008, 5.2% for 2009-2013 and 5.5% for 2014-2020 that are selected as medium growth rates are adopted, having reviewed three alternative source data of growth rates (low growth: 2.2% for 2002-2008, 3.7% for 2009-2013, 5.2% for 2014-2020, medium growth: as stated and high growth: 5% for 2003-2008, 6% for 2009-2013, 7.5% for 2014-2020) are applied under this Master Plan Study. GDP per Capita and GRDP per Capita are computed based on the above medium growth of GDP and GRDP and the population forecast. Details of the forecasted GDP per Capita and GRDP per Capita are shown in Table 5.3-1, while the forecasts of GDP and GRDP are indicated in Chapter 2.

5.2.5 Fulfilment of Fixed Telephone Demand

The strategy for the fulfilment plan of the fixed telephone demand in the rural areas is as follows:

(a) Aimag Centre
The fixed telephone demand in Aimag centre is almost fulfilled now, and will be fulfilled completely during all the stages of the Phases-I, II and II.

(b) Sum Centre

The fixed telephone demand is not fulfilled completely due to the capacity limitation of the switching equipment and the outside plant facilities now. During the Phase-I, 100 % of the fixed telephone demand in Sum centre will be fulfilled in the major Sums of the major Aimag and the major Sums in the other Aimags where much initial cost is not required. Accordingly the target fulfilment will be 50% in the earlier stage and 80% at the latter stage of the Phase-I, depending on the available funds.

(c) Bag

Now the communication by radio broadcasting or the HF transceiver is available only. The automatic dial connection from the HF transceiver in Bag will be obtained through operator at Aimag or Sum centres during the Phase-I. The HF transceiver in Bag will be replaced with WLL (Wireless Local Loop) and/or satellite system during the Phases-II and III.

5.2.6 Fulfilment of Mobile Telephone Demand

In accordance with the present government policy, the development of the telecommunications in the rural areas will be done by the fixed telephone service (including WLL), and the services by the mobile telephone services is not included in such policy. The fulfilment of the mobile telephone demand will be done by the second operators in the following manner:

(a) Aimag Centre

The mobile telephone demand in some Aimag centres is fulfilled by the second operators now. The second operators will gradually expand the coverages area into all Aimag centres during all the stage of the Phases-I, II and III.

(b) Sum Centre

The mobile telephone demand in some large Sum centres is fulfilled by the second operators now. The second operators will gradually expand the coverage areas into high demand Sum centres during the Phases-I and II, and into all Sums in the Phase-III.

(c) Bag

The mobile telephone service is not available in Bag now and will not be available even if at the Phases-III.

5.2.7 Network Style and Expansion (PSTN and VoIP)

Now the existing PSTN facilities in Aimag centres are of analogue and digital facilities. Some of them are recently installed and constructed. Those facilities will be respected and utilised at most. As the recent high-speed technical innovation, the VoIP system has been introduced and replaced with the existing PSTN facilities in many countries. The strategy for the network style and expansion shall be done in the following manner:

(a) Aimag Centre

The PSTN and VoIP networks will be coexisted in the Phase-I. The demand fulfilment will be performed by the expansion of the PSTN network at the initial stage of the Phase-II, and be by the introduction of the IP network at the latter stage of the Phase-I, depending the technical innovation and development of IP. The expansion of the PSTN will be suspended at the end of the Phase-I. The expansion by the IP network will be realised and the existing PSTN will be retired in the Phases-II and III.

(b) Sum Centre

Now the PSTN is available and the long distance and international calls are connected by operator. The automatic dial connection and the DLC (Digital Loop Concentration) and PBX will be realised at the major Sums in the Phase-I. The IP network at the major Sums will be realised through the gateway connection of the trunk line, and the automatic dialling at all Sums by the IP network will be realised in the Phases-II an III.

(c) Bag

Now the HF transceiver service is available and isolated from the PSTN. The automatic dial connection from the HF transceiver in Bag through operator at Aimag or Sum centre will be available in the Phase-I. The automatic dialling at all Bags will be realised by the IP network in the Phases-II and III.

5.2.8 Internet Services

(a) Aimag Centre

The Internet is available in some Aimags now. The Internet and/or Internet cafe at all Aimag will be introduced in the Phase-I. The high speed Internet will be introduced at some Aimags in the Phase-II The high speed Internet will be introduced at all Aimags in the Phases-II and III.

(b) Sum Centre

The Internet is not available in Sums now. The Internet and/or Internet cafe will be introduced in some Sums in the Phase-I. The high speed Internet will be introduced at some Sums in the Phases-II and III.

(c) Bag

The Internet is not available in Bag now. The Internet will be available by the dial-up in the Phases-II and III.

5.2.9 IT-spot

(a) Aimag Centre

Telephone booth only is available now. The IT spot (PCs and printer for IT and Internet service such as the present Internet cafe are installed in MT office, including telephone and facsimile) will be established at all Aimags in the Phase-I. The IT spot function, using the high speed Internet, etc., will be upgraded in the Phases-II and III.

(b) Sum Centre

The telephone booth only is available now. The IT spot will be established at all Sums in the Phases-I and III. The IT spot function, using the high speed Internet, etc., will be upgraded in the Phase- III.

(c) Bag

Telephone booth is available only at special Bag now. The IT spot will be established at all Bags through the Phases-I, II and III.

5.2.10 E-business

(a) Present Situations

The stand-alone Personal Computer (PC) is available at school, hospital, municipal offices in Aimag centre now. The stand-alone PC is available at school, hospital, municipal offices in some Sum centres now. The stand-alone PC is not available in Bag now.

(b) Phase-I

The establishment of the institutional system and execution of pilot the projects, such as the introduction of e-Education or e-Medicine at selected schools or hospitals in Aimag centres and Sum centres, is expected in the initial stage of the Phase-I. The above is not available in Bag. The full-scale of the institutional system and execution of the e-Education or e-Medicine at selected schools or hospitals in Aimag centres and Sum centres is expected in the latter stage of the Phase-I. The above is not available in Bag.

(c) Phases-II and III

The services for e-Education and e-Medicine shall be upgraded in All Aimag and Sums in the Phases-II and III.

5.3 Service Provision and Supply Volume

The service provision and supply volume up to the year 2020 are established in the following policies and major objectives:

(a) To digitalise the telecommunications network in Sum centres, including the transmission system between Aimag centres and Sum centres;
(b) To realise the Distant Direct Dialling in Sum centres;
(c) To realise 100% fulfilment of the demand forecast in major Sums centres;
(d) To introduce the IP-network and Internet service in Sum centres; and
(e) To attain an acceptable quality of services for the fixed telephone service and data communications for both national and international communications.

5.3.1 Forecasted Demand in Whole Aimags

(1) Fixed and Mobile Telephone Service

The telephone density in the whole Aimags in 2020 is 9.92 lines per 100 inhabitants for the fixed telephone service, 15.55 lines per 100 inhabitants for the mobile telephone service, and 25.47 lines per 100 inhabitants for the total of the fixed and mobile telephone services as shown in Table 5.3-1. Further details are referred to Chapter 7.

(2) Internet Service

The Internet density in the whole Aimags in 2020 is 2.77 subscribers per 100 inhabitants as shown in Table 5.3-1. Further details are referred to Chapter 7.

5.3.2 Service Provision

The telecommunications operators in Mongolia are providing various telecommunications services mainly consisting of the fixed telephone services, mobile telephone services, Internet and other services. At present MT provides the basic services covering the fixed telephone, telex and telegram services as monopoly, including leased circuit service. Now all the telecommunications services, including the international service, Internet and other new services, is opened to the private operators, and MT provides the basic services based on the 2001 MTSPS. The fixed telephone services and IT services to be expected to popularise from the short-term and long-term views are proposed considering a service development strategy of Mongolia and a world-wide trend on the telecommunications service development.

5.3.3 Supply Volume

The supply volume up to 2020 is established based on this Master Plan Study. Establishment of the supply volume described in this Section is mainly that for the fixed telephone service and Internet service.

(1) Fixed Telephone Services

According to the 2001 MTSPS, the Government of Mongolia intends to achieve that the telephone density in the urban area shall be 15 DEL per 100 inhabitants in Ulannbaatar and, 10 - 12 in Aimag centres, international and domestic calls from all Sum centres shall be performed automatically and ensured no less than 50 percent of the population with the technical opportunities to be connected into the Internet.

As of the end of 2001, approximately 130,000 DEL are provided in the whole country as a result of development up to the present. It means 5.38 DEL per 100 inhabitants in the whole country. Under this Master Plan Study, the demand fulfilment plan at Sum centres will be about 82% at the end of 2008, about 96% at the end of 2013, and 100% at the end of 2020, depending on the fund available, as shown Table 5.3-1. Further details are shown in Chapter 7.

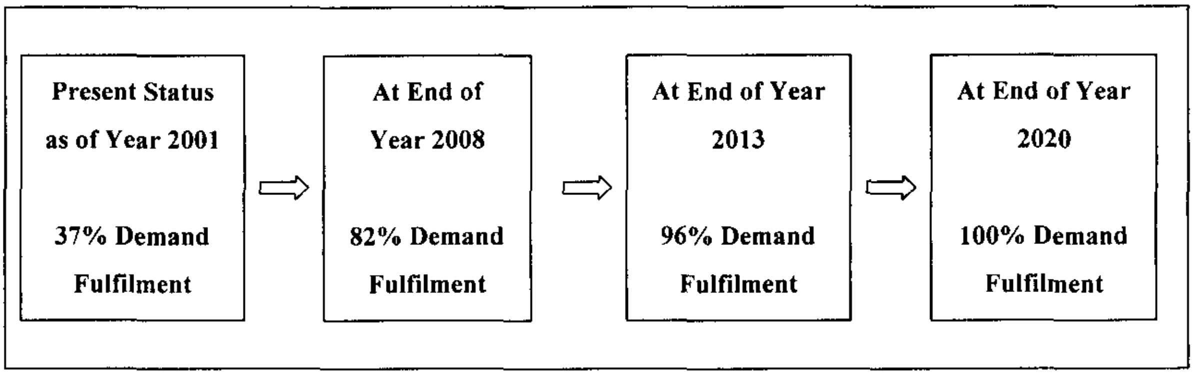


Figure 5.3-1 Demand Fulfilment Plan in this Master Plan

In consequence, all the planning components consisting of the supply plan, network plan, facilities plan, manpower plan, etc. are prepared, based on the above condition.

(2) Mobile Telephone Services

The total number of mobile telephone subscribers amounts to 228,000 as end of 2001. It is 64% of the total subscribers of the fixed and mobile telephone subscribers. The coverage areas of the services are in Ulaanbaatar and other major Aimags. Most of subscribers is registered in Ulaanabaatar and using the service mainly for their business and private communications. Since the operation of the service in 1996, the number of mobile subscribers has been quite rapidly increasing. Especially, for past a few years, the growth of the subscriber number is more than 100% per year. However, it seems that the increase of the number will be slightly slowing down at present.

According to the demand forecast of the mobile telephone service described in Chapter 7, the number of the subscribers will reach to approximately 592,151 in 2020. It will be about 60% of the total subscribers of the fixed and mobile telephone services. The Government of Mongolia is encouraging investment and parallel operation by private sector in healthy competition among operators including MT. Considering the above condition, the service coverage areas are to be expanded to all Aimag centres and major Sum centres by 2020 by parallel operation among operators playing the role of fulfilment of the demand.

Table 5.3-1 Key Development Targets up to 2020

Indexes	Sub-Indexes	Area	Present Status (2001 and/or 2002)	Development Targets			
				Short-Term Target		Medium-Term Target	Long-Term Target
				(2003-2005)	(2006-2008)		
Socio-Economy	Population	Whole country	2,412,818	2,561,461	2,673,259	2,879,374	3,181,944
		Whole Aimags	1,616,618	1,667,961	1,699,059	1,797,674	1,976,644
	GDP per Capita (US$ Constant in 1995)	Whole country	590.9	669.5	742.6	888.3	1,169.3
	GRDP per Capita (US$ Constant in 1995)	Whole Aimags	442.7	503.8	572.5	697.2	922.4
Demand Forecast (DELs)	Fixed Telephone Service (PSTN)	Whole country	167,587	196,637	218,424	270,212	370,489
		Whole Aimags	92,138	105,747	115,954	143,128	196,140
		Sum centre	28,795	32,801	35,806	44,318	60,780
	Mobile Telephone Service	Whole country	208,083	271,983	319,908	420,025	592,151
		Whole Aimags	110,367	142,189	166,056	218,035	307,364
		Sum centre	35,525	45,372	56,064	65,985	97,687
	Total of Fixed and Mobile Telephone Services	Whole country	375,670	468,620	538,332	690,237	962,640
		Whole Aimags	202,505	247,936	282,010	361,163	503,504
		Sum centre	64,320	78,173	91,870	110,303	158,467
DELs/100 Inhabitants	Fixed Telephone Service (PSTN)	Whole country	6.95	7.68	8.17	9.38	11.64
		Whole Aimags	5.70	6.34	6.82	7.96	9.92
	Mobile Telephone Service	Whole country	8.62	10.62	11.97	14.59	18.61
		Whole Aimags	6.83	8.52	9.77	12.13	15.55
	Total of Fixed and Mobile Telephone Services	Whole country	15.57	18.30	20.14	23.97	30.25
		Whole Aimags	12.53	14.86	16.60	20.09	25.47
Supply Volume (DELs)	Fixed Telephone Service (PSTN)	Sum centre	10,521	20,646	29,302	42,391	60,780
Switching Capacity (Line Units)	Fixed Telephone Service (PSTN)	Sum centre	19,724	37,178	47,812	58,898	62,100
Demand Forcast of IT and Data	Internet Services	Whole country	9,000	81,078	135,137	172,590	210,042
		Whole Aimags	450	23,184	40,234	57,350	74,466
		Sum centre	-	5,081	8,891	15,559	22,227
IT/Data circuits per 100 Inhabitants	Internet Density	Whole country	0.37	3.17	5.06	5.99	6.60
		Whole Aimags	0.03	1.39	2.37	3.19	3.77

(3) Internet Services

Recognition of the crucial role played by the telecommunications for the promotion of socio-economic development and business development in the rural areas is very significant not only in the developed countries but also in the developing countries. With a progress of the innovation toward the information society, the Internet services are essential for administrative, business and social activities. In addition, the operation itself of the Internet services will be much attractive as a business in the new era. In accordance with the 2001 MTSPS, the Government of Mongolia encourage investment and parallel operation by the private sector in healthy competition with the Government sector for the operation of Internet services to be expected to popularise.

(4) Leased Circuits

In Mongolia, the leased circuits mainly consist of data, voice, packet, telex circuits. In the business activities, the leased circuit services become important means of business communication in all industrial and service sectors. In addition, the leased circuit service is also indispensable not only for ordinary commercial sectors but also for telecommunications business sector, especially for the Internet and new service operators. Based on a result of leased circuit demand estimate and considering the above circumstances, necessary leased circuit capacity is included in the transmission network plan and facilities plan. From a view of area expansion, the leased circuit services are to be expanded to nation-wide service.

5.4 Network Expansion and Improvement

The PSTN facilities are available in Sum centres and the long distance and international calls are connected by operator. The most important development objective in the rural areas in the 2001 MTSPS is to digitalise the telecommunications network in Sum centres, including the transmission system between Aimag centres and Sum centres. As the recent high-speed technical innovation, the VoIP system has been introduced and will take over the existing PSTN facilities in the near future. The strategy for the network style and expansion in the rural areas will be done in the following manner:

(a) The automatic dial connection will be realised through small switching system or DLC at the major Sums in the Phase-I;

(b) The IP network will be extended to major Sums through digital trunk line, and automatic dialling will be realised at all Sums on the IP network in the Phases-II and III;

(c) In this Master Plan Study, it is proposed that the above objectives will be achieved by the year 2020, if the necessary fund available; and

(d) Based on the above, the proposed telecommunications network of this Master Plan is designed in consideration of the following:

(i) The network is economical in not only the installation but also the operation;

(ii) The network is made up applying latest technologies at present;

(iii) The network is capable to fulfil every new application of the fixed telephone service; and

(iv) The network is capable to approach to the Internet world, covering the country of Mongolia and all other world.

The development targets for the respective network components are shown in Table 5.4-1. For more details, Chapter 9 is to be referred.

Table 5.4-1 Network Component Development Targets up to 2020

System	Present Status as of 2001	Development Targets		
		Short-Term by 2008	Medium-Term by 2013	Long-Term by 2020
Switching System	PSTN (Manual, Analogue & Digital)	PSTN (Digital and VoIP)	VoIP	VoIP
Transmission System	Open Wire, Microwave, FOTS & VSAT (Analogue, Digital, SDH & PDH)	Open Wire, Microwave, FOTS & VSAT (Analogue, Digital, SDH & PDH)	Open Wire, Microwave, FOTS & VSAT (Analogue, Digital, SDH & PDH)	Open Wire, Microwave, FOTS & VSAT (Analogue, Digital, SDH & PDH)
Subscriber Access System	Metallic Cable	Metallic Cable and WLL System	Metallic Cable and WLL System	Metallic Cable and WLL System
IT Service	Narrow Band	Narrow and Wide Band	Narrow and Wide Band	Wide Band

5.5 Service Quality Improvement

The service quality is able to be indicated by major three factors i.e. call completion rate, faults rate and fault clear rate. They are still low level compared with those in other countries. Low call completion rate will result loss of revenue from call charge and high fault rate will bring an increase of operation and maintenance cost. Low clear rate will affect to various customers' activities. The present service quality of the whole MT as of the end of 2001 is as follows:

(a) Call Completion Rate: 55%
Mainly caused number busy and customer error.

(b) Fault Rate: 44.5/year/100 DEL
The figure does not include the faults in subscriber facilities and mainly occurs at the subscriber cables.

(c) Fault Clear Rate within 24 hours: 50%
The figure include the faults in subscriber facilities.

The above service quality will be able to be improved by taking appropriate actions with an introduction of adequate quality control system. Improvement targets of the service quality are shown in Table 5.5-1. Fore more details, Chapter 12 is to be referred.

Table 5.5-1 Service Quality Improvement Targets up to 2020

Indexes	Sub-Indexes	Area	Present Status (2001 and 2002)	Improvement Targets			
				Short-Term Target		Medium-Term Target	Long-Term Target
				Phase-I		Phase-II	Phase-III
				(2003-2005)	(2006-2008)	(2009-2013)	(2014-2020)
Service Quality for Fixed Telephone (PSTN)	Call Completion Rate	Whole Country	55% (2002)	58%	60%	64%	70%
	No. of Faults (/Year/100 DEL)	Whole Country	42% (2001)	40%	34%	28%	22%
		Aimag Centre	44% (2001)	40%	35%	30%	23%
	Fault Clear Rate Within 24 Hours	Whole Country	50% (2002)	60%	70%	80%	95%
Operational Efficency (PSTN)	Number of Staff	Whole Country	4,508 (2001)	3,950	3,540	2,850	3,340
		Sum Centre	987 (2001)	711	637	513	601
	DEL/Staff	Whole Country	26.48 (2001)	49.01	65.90	94.96	110.87
		Sum Centre	10.66 (2001)	29.04	45.99	82.64	101.10

5.6 Operational Efficiency Improvement

The operational efficiency is able to be indicated by the number of DEL per staff (Productivity). The productivity as the end of 2001 was 26.48. It means low efficiency compared with153.1 of Thailand and 174.45 of Malaysia in 1999. This low efficiency will result small size services, many O/M points, many operators for manual connection and vast/speared/long-distance operation and maintenance areas.

The present low efficiency will be able to be improved mainly by digitalisation of network facilities especially in the rural areas, introducing computerised operation and maintenance system and restructuring operation and management. Improvement targets of the operational efficiency and the required number of staff are shown in Table 5.6-1. For more details, Chapter 12 is to be referred.

Table 5.6-1 Productivity Improvement Target up to 2020

Item	Improvement Targets			
	2001	2008	2013	2020
No. of DEL	119,360	218,424	270,212	370,489
No. of Total Staff	4,508	3,540	2,850	3,340
Productivity (No. of DEL/Staff)	26.48	65.90	94.96	110.87

CHAPTER 6

FUNDAMENTAL TECHNICAL PLAN

CHAPTER 6

FUNDAMENTAL TECHNICAL PLAN

The fundamental technical plan for forming telecommunications networks in Mongolia is based principally on the ITU recommendations. The technical plan is subject to consent to Communications Regulatory Commission (CRC), though the network providers or service providers are free to determine their own standard. The technical plan submitted to CRC is studied, before approval issuance, from technical point of view in consideration of the existing network, trends of the world, and ITU Recommendations. Should the interests of existing provider and the new applicant be not consent, the application shall be placed under coordination of CRC.

With the adoption of the Telecommunications Law in 1995, the telecommunications network operators and service providers have come in the deregulated telecommunications market. The new comers' network has been established compatible with the Mongolia Telecommunications Company (MT) network substantially.

The fundamental technical plan to be applied to the network development under the Master Plan should be in conformity with the ITU recommendations, be in the framework of the existing rules and be compatible with the existing MT network.

6.1 Network Configuration

6.1.1 Existing Network

(1) Major Networks

The present telecommunications network in Mongolia is sorted roughly into three (3) classes. The national network has been formulated placing the Mongolia Telecom (MT) network in the centre, because the MT network was only the network existed before the telecommunications market was opened to public.

a) Nationwide basic telecommunications network of MT,
b) Fixed and mobile networks provided by private operators as:
   - Railway Telecom network,

- WLL netwok by MobiCom,
- Mobile network by MobiCom and Skytel,

c) Internet data network of Micom, Datacom, Bodicomputer, etc.

Figure 6.1.1-1 shows the structure of national telecommunications network of the Mongolia Telecom (MT) and relation with Railway Telecom network, mobile phone networks, and Internet networks. The figure is focused on the MT network, for substantial information other than that of MT is not open to public.

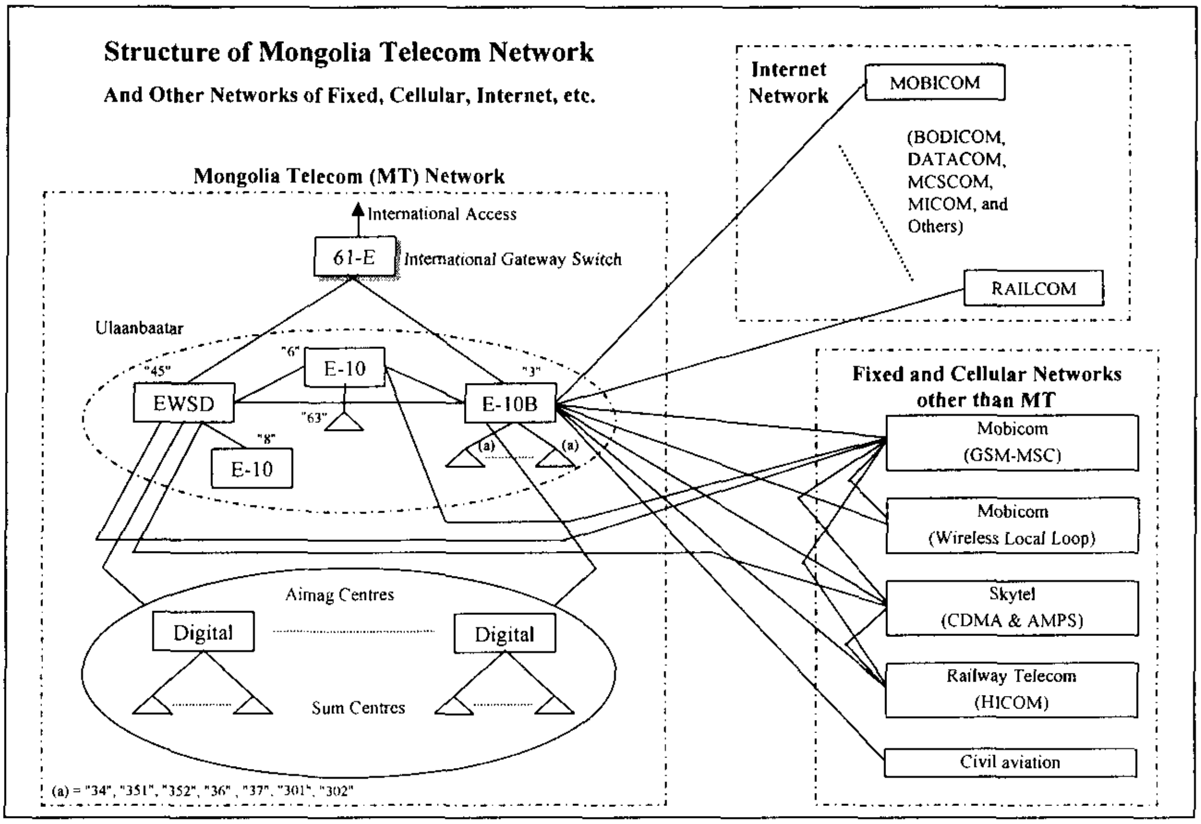


Figure 6.1.1-1 Networks of Mongolia Telecom (MT) and Others

(2) Network Forming Technologies

The telecommunications network of Mongolia is formed with various technologies ranging from optical fibre connection of the latest digital technology to open wire connection of the outmoded technology.

It is made up with digital telephone switching system, very small aperture antenna (VSAT) satellite communication system, optical fibre transmission system, digital/analogue microwave transmission system, open wire transmission system of copper, steel and aluminium, copper cable access network, asynchronous subscriber digital line (ADSL). IP technology is also applied to the Mongolian network.

The switching systems are being replaced with digital ones in the national capital Ulaanbaatar, Aimag centres, and in some Sum centres. All the switching systems in Ulaanbaatar is planned to be digitised before the end of 2002. The switching systems of Aimag centres have been digitised under the Telecom-2 and Telecom-3. The operator's consoles in Ulaanbaatar and Aimag centres are made up with desktop computer, though they coexist with common battery manual boards in some telecom centres.

Transmission network is made up with optical fibre transmission system, digital microwave transmission system, analogue microwave transmission system, very small aperture terminal (VSAT) system, and open wire transmission system. The open wire transmission uses cupper wire, steel wire, and aluminium wire depending on the case.

The access network is made up with ordinary copper cable lines. A private network service operator started ADSL service in Ulaanbaatar in 2002 and others are supposed to follow. Wireless Local Loop (WLL) technology is in service already in Ulaanbaatar.

The IP technology is operational for the Internet service of world wide web browsing, e-mail, in addition to voice communication through IP network.

6.1.2 Switching Network Hierarchy

(1) MT Network

The Mongolia Telecom is an entity which possesses the telecommunications network which covers whole the country. The Mongolian telecommunications network is a network wherein the local exchanges are connected to the transit exchange in a star-shape. Figure 6.1.2-1 shows the MT network hierarchy.

The national switching network is consisted of such levels as:

I) International gateway Switching Centre (ISC),
II) National Transit Centre (NTC),
III) Provincial Switching Centres (PSC), and
IV) Sum Centres.

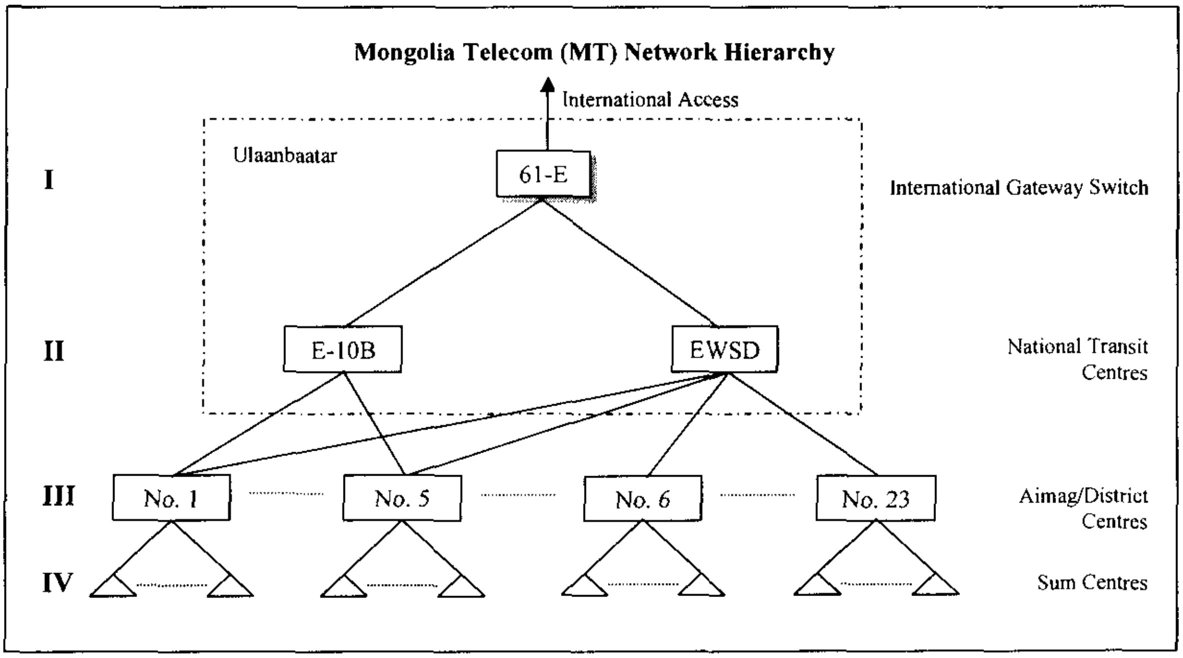


Figure 6.1.2-1 Hierarchy of Network of Mongolia Telecom

(2) Railway Company's Network

The Mongolian Railway Company network is deployed along its railway running from Sukhbaatar in the north to Zamin Uud in the south passing the national capital Ulaanbaatar. An optical fibre link is provided along the railway to connect 14 PBX exchanges. Six (6) MT exchanges allocated near the route are accommodated to the link.

6.1.3 Network Configuration for Master Plan

(1) Network Design Basic Concept

In the Master Plan Study, the network will be designed in conformity with the configuration now applied to the MT network basically. The ITU recommendations will be referred where the specifications are not given. The network to be proposed in this Master Plan Study is focused to that which links the Aimag centre with Sum centres and that in Sum centre. The telecommunications demand in Aimag centre will also be taken into consideration.

The national telecommunications network is supposed to be developed under coordination of CRC. More new network providers may participate into the telecommunications market and the existing network providers may extend their networks with new concepts in the future. The influence of such networks should be taken into consideration. In this context, the telecommunications network of the Master Plan will be designed as an expansion of the existent MT network of Aimag centres, Sum centres, or between them, which would coexist with the private operators' networks.

Since the existent network of conventional technology is shifting to an IP-based network all over the world, attention will be paid in designing the network under the Master Plan. It is a fact, however, that the existing facilities composing the MT network include those purchased very recently. Accordingly, the network will be designed so that those facilities be used as much and long as possible.

(2) Network Capacity Expansion

The network capacity will be expanded through expansion of existing facilities. The network capacity in Aimag will be increased to meet the demand fulfilment plan of each target year, that is, 2008, 2013, and 2020. The existing switching system, however, may be replaced with a new concept switch or a switch node device of new technology to meet the requirements of IP-based network, provided that the life of existing equipment is over and IP network is available at the relevant Aimag centre.

The switching equipment in Sum centre, which is mostly PBX, will be replaced with a new traffic node which can offer same services as that offered in Aimag centre with a capacity to meet the traffic forecast to the target year. The ordinary switching system substantially composing the existing PSTN will have additional capacity to meet the traffic increase, if required. PBX will not be in the case, but replaced.

The existing equipment in Sum centre will be re-used being transferred to another Sum centre with old type PBX, if the removed one's life is not over and re-usable. The traffic node in Sum centre will be a simple traffic concentration device. A switching equipment may be provided, if the forecast traffic is big enough to have a switching system in the Sum centre. A small IP compatible switch may be introduced, if appropriate, in place of the conventional switching system.

The transmission network between Sum centres and Aimag centre requires substantial replacement. The existing transmission network between Aimag centre and Sum centre which is composed of open-wire transmission system should be replaced with digital system in order to expand the capacity and to support the switching node function. Proper transmission system will be realised using a) a light route radio transmission system, e.g., 2 Mbps digital microwave transmission system, b) optical fibre transmission system, c) satellite communication system.

The access network connecting the user's terminal with the traffic concentration node in the Sum centre will be expanded with new metallic cables or radio links. The existing access network will be examined and replaced with new network, if it is not durable in digital transmission.

(3) Steps of Network Evolution

The existing switching systems in Aimag centres are digital and the switching equipment in Sum centres is mostly analogue. The existing transmission links connecting Aimag centre and Sum centres are almost analogue.

The telecommunications network is shifting into a digital world wherein the transmission of voice and data is realised through digital transmission links and digital traffic nodes. The Internet protocol (IP) is already in use in Mongolia for international voice communication, in addition to international data communication. The trend will come over to the rural area gradually.

The transmission link between Aimag centre and Sum centre, and the network in Sum centre under the Master Plan will be designed so that the network will be compatible with other networks in Mongolia always on the course of growth. The target network will be expanded applying the existing technology for the time being, or up to 2008, then it will be expanded gradually with IP technology up to 2013, expecting the IP technology being matured applicable to the rural area.

It is supposed in the Study that the target network will grow enough with the IP technology in the period of Phase 3 up to 2020. The network will afford communication of voice, text, still image, and movie.

(4) Phases to IP-based Network

It is planned under the Master Plan that the target network be shifted to IP-based network by the year 2020 through three (3) phases. Selected Aimag-Sum transmission links and Sum centre networks should be digitised by 2008, and others be digitised and shifted to IP-based network by phases by 2020. Figure 6.1.3-1 shows the concept of the steps and transition to IP-based network.

(a) Phase-1

By the year 2008, the switching system and transmission system in all Aimag centres will be digitised to offer the distant direct dialling (DDD) service to all the telephone users connected to the Aimag centre exchange. The international direct dialling (IDD) will be allowed to those who need it in the Aimag centre. Digital leased circuits will be available in the Aimag centres through the digitalisation. Subscriber digital line (xDSL) will be extended to all Aimag centres. The Aimag exchange will be developed to meet demand increase during this Phase.

The transmission link of selected sections between Aimag centre and Sum centres will be digitised during the Phase-1. The existing open wire transmission link will be replaced with optical fibre transmission system, digital microwave transmission system, or VSAT.

The existing PBX will be removed in selected Sum centres and a small switch node will be introduced to takeover the existing PBX function and, at the same time, to fulfil the demand increase. The small switch node is defined here as a device which concentrates and distributes the traffic of access network being placed remote from Aimag centre. it shall be a device by which the services allowed in the host switch be equally allowed. The selection regarding the traffic node equipment is subject to the demand, traffic, and cost at each site.

The access network of selected Sum centres will be expanded to meet the demand, through metallic cable or radio link of wireless local loop (WLL). Interconnection of transceivers allocated in Bags and PSTN will be realised through operator assistance at Sum centre.

(b) Phase-2

By the year 2013, the exchange capacity of Aimag centre will be expanded to meet demand increase of this Phase. The capacity expansion will be realised substantially with IP-based switch introduction in selected Aimag centres. A gateway switch interfacing with IP network will be introduced for IP traffic in selected Aimag centres.

The transmission system will be provided through optical fibre, digital microwave, or VSAT system.

The analogue switching system in all Sum centres will be digital. The transmission system linking those Sum centres and the Aimag centre exchange will be digital. Through the digitisation, DDD service, IDD service, digital leased circuit service will be available in all the Sum centres.

Routers for IP protocol traffic will be introduced and a base terminal station (BTS) for mobile phone system will be introduced in selected Sums.

The access network will be provided with metallic cables and/or wireless local loop (WLL). The xDSL service will be available in Sum centres gradually.

(c) Phase-3

By the year 2020, the telecommunications infrastructure will be completely digital in the whole country. Thus, the telecommunications network will be expanded to cover all the Bug centres and the information accessibility will be guaranteed in all aspects of telephony voice communication, text/data communication, steal and moving image communication, etc.

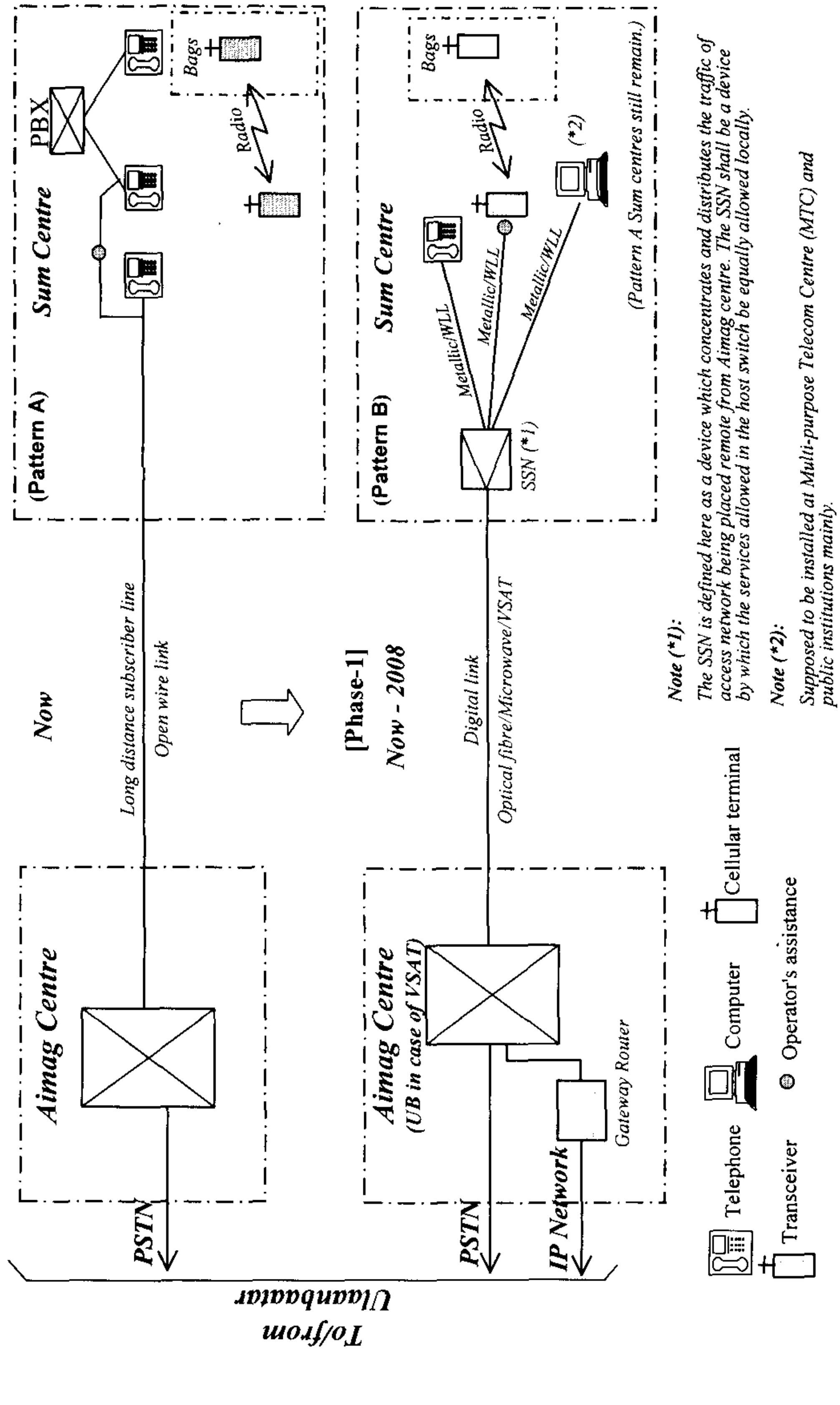


Figure 6.1.3-1 Network Evolution by Phase (1/2)

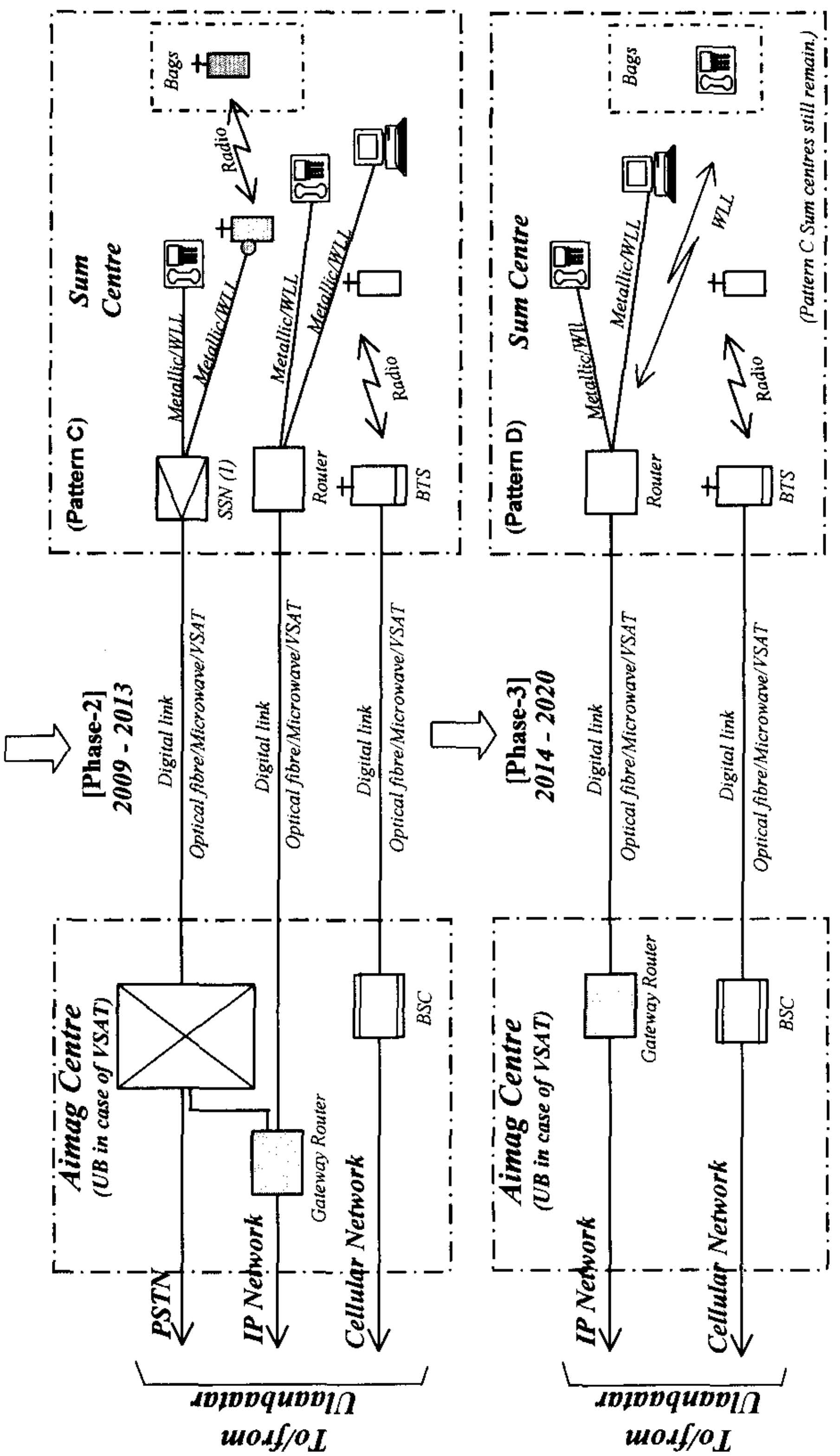


Figure 6.1.3-1 Network Evolution by Phase (2/2)

6.2 Numbering Plan

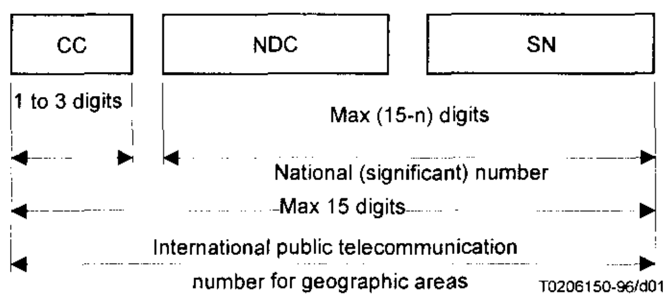
6.2.1 General

The existing numbering plan of telecommunications network in Mongolia was put into effect under the Order No. 159 of 11th May, 2000, of Minister of Infrastructure. It defines and includes a) Numbering formulation, b) Numbering structure, c) Dialling procedure between circuits, and d) Numbering Allocation.

6.2.2 Number Formulation and Structure

The number formulation defines the numbering of a) Emergency and special calls, b) Fixed telephone service, c) Cellular telephone service, and d) Wireless local loop network.

Telephone number of Mongolia consists of Country code (CC), National Destination Code (NDC) and Subscriber number (SN). The CC is set at "976" in accordance with ITU-T Recommendations E-series. Figure 6.2.2-1 shows the existing number structure of Mongolia. The maximum number of digits of the telephone number (CC + NDC + SN) of Mongolia is 13.



CC Country Code for geographic areas
NDC National Destination Code (optional)
SN Subscriber Number
n Number of digits in the country code

NOTE – National and international prefixes are not part of the international public telecommunication number for geographic areas.

Figure 6.2.2-1 Existing Number Structure

6.2.3 Prefix and National Significant Number

(1) Prefix Codes

The prefix codes are:

Trunk or inter-network call: "0";
International call: "00";

Where:

MT: "001" (PSTN);
Skytel: "002" (IP-Network);
Mobicom: "003" (IP-Network);
Micom: "004" (IP-Network);
Incomnet: "005" (IP-Network);
Railwaycom: "006" (PSTN).

(2) National Significant Number

The national significant number, or the part consisted of NDC and SN, in Mongolian network is 8 to 10 digit in length. The former (8 digits) is for the fixed telephone lines in Ulaanbaatar and mobile/WLL network. The latter (9 to 10 digits) is for the land line network in Aimag centres and Sum centres. Figure 6.2.3-1 shows the national significant number structure. See annex for the detail.

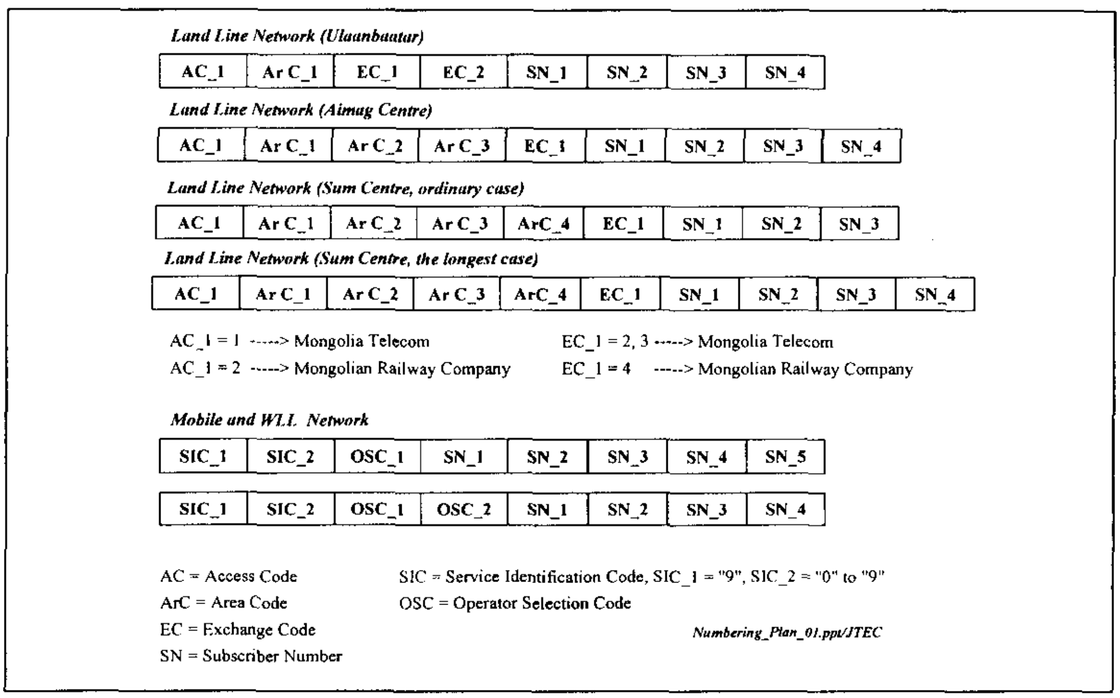


Figure 6.2.3-1 National Significant Number

The NDC consists of:

a) Network identification code (AC, SIC, OSC);

b) Area code;

c) Exchange code; and

d) Subscriber number.

Note: Network Identification Code are AC (Access Code of PSTN), SIC (Service Identification Code of mobile/WLL network), and OSC (Operator Selection Code of mobile/WLL network).

The Network identification code is assigned as follows:

"1": Mongolia Telecom network;

"2": Mongolian Railway network;

"9": Mobile/WLL network and others.

Accordingly, a trunk and inter-network call dial consists of:

(Prefix) + (Network identification code) + (Area code) + (Exchange code) + (Subscriber number).

Prefix code dialling is not required in the case of calling mobile phones and in the case of a call within a local call area.

A trunk call to a subscriber 45-XXXX in MT network in Ulaanbaatar is accessed by dialling (0+1+1+45+XXXX). A subscriber of MRC network in Ulaanbaatar is accessed by dialling (0+2+1+94+XXXX). A trunk call to a subscriber 2-2XX of MT network in Zuunkharaa of Selenge Aimag is accessed by dialling (0+1+3647+2+2XX). While a subscriber 4-3XXX of MRC network in Zuunkharaa of Selenge Aimag is accessed by dialling (0+2+3647+4+3XXX).

For local calls, attention has been paid to shorten the digits to be dialled, that is, AC and ACr are not required for the local call connection. For that purpose, the MT's SN starts with an EC "3", "4", "5" and "6" in Ulaanbaatar and "2" or "3" in Aimags and Sums, while that of MRC starts with an EC "9" in Ulaanbaatar and "4" or "5" in Aimag and Sums. Figure 6.2.3-2 shows a case of dialling between networks in Ulaanbaatar.

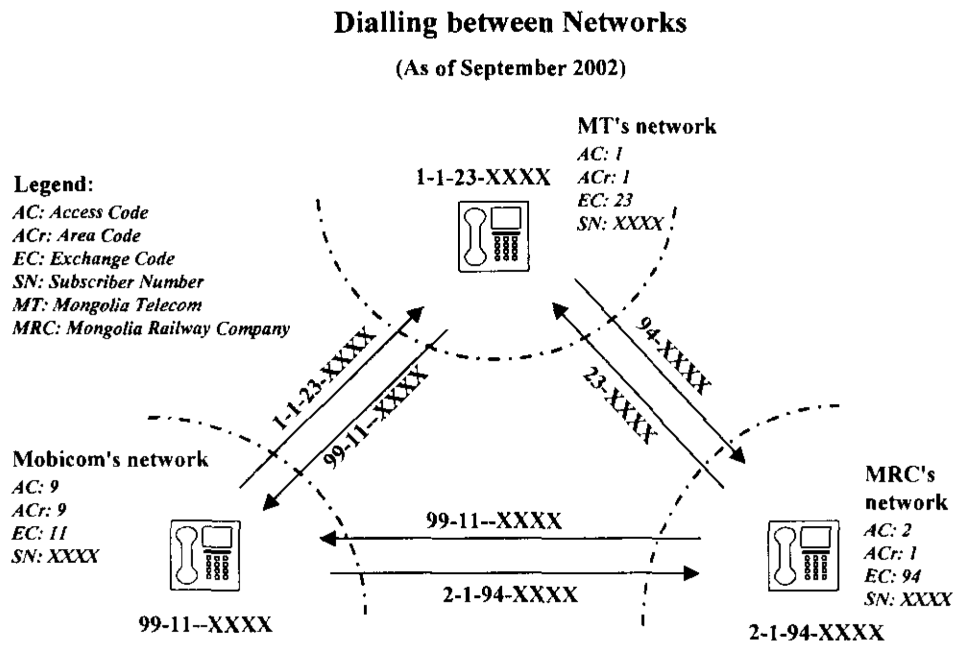


Figure 6.2.3-2 Dialling between Networks

(3) Unification in Trunk Dialling

The way of dialling differs depending on the cases, that is, access from MT telephone to mobile phone does not requires AC, while the access from mobile phone to MT telephone needs it. It is preferred to introduce a unified numbering whereas the users are allowed to dial in a same way regardless where he (she) is. This will be realised to dial in all cases starting with AC not including "0".

6.2.4 Numbering Capacity

The numbering capacity of telecommunications networks in Mongolia may not be sufficient in some areas in the near future, as participation of new telecommunication service provider is encouraged by the Government.

The shortage in numbering may be found in:

a) Access Code (AC) for the international call operator;
b) Operator Selection Code (OSC) for mobile network operator; and
c) Subscriber number (SN) range of some Sum centres.

(1) AC for International Call

The Access Code (AC) for international call is a code placed before Country Code (CC). It is a three (3) digits code starting with "00" in Mongolia. There are six (6) international call access codes assigned and used as:

a) "001" for MT of PSTN;
b) "002" for Skytel of IP-based network;
c) "003" for Mobicom of IP-based network;
d) "004" for Micom of IP-based network;
e) "005" for Incomnet of IP-based network;
f) "006" for Railwaycom of PSTN.

Shortage in numbering capacity of AC for international call operator may have come up in the future, for only three (3) ACs are available as of October 2002 and the regulations keep the door open to new comers.

It is preferred to separate the international call service networks into two (2) categories, that is, a) PSTN and b) IP-based network. Each of them should be given a code to differentiate the network.

(2) OSC for Mobile/WLL Network

Network Identification Code (NIC) is followed by area code, exchange code and subscriber number. The NIC is practically the Access Code (AC), Service Identification Code (SIC) and Operator Selection Code (OSC) in the Mongolian National Numbering Plan.

The NIC now effective is three, that is, "1" for Mongolia Telecom network, "2" for Mongolian Railway network, and "9" for the group of mobile/WLL telephone networks. NIC "1" and NIC "2" will not have problem in the future, for each of them is allocated to one (1) network operator, respectively. While NIC "9" may have problems in the near future as the numbering range is tight being shared by several operators. There are only two (2) ranges of numbering available for new comers, that is, ""93" and "97".

The group of NIC "9" is shared by:

a) "90" of MT network;
b) "91" and "96" of Skytel network;

c) "92" of Government network;

d) "94" of MRC network;

d) "95" and "99" of Mobicom network.

The possible shortage in the numbering capacity in the future will be solved by a combination of:

a) Separation of networks other than mobile/WLL from the group "9X"; and

b) Insertion of one (1) digit between the first digit and the second digit.

It is preferred to take action in line with "Item a)" above as soon as possible. It will contribute to establish a numbering system oriented to the users and yield four (4) new numbering ranges. See Annex for the detail. The separation could be followed by an insertion of one (1) digit, if more shortage is foreseen.

Exchanges codes in Ulaanbaatar shall be modified to complete the above separation of the non-mobile/WLL networks from NIC "9". It is recommended to insert "5" before existing "92", "94", and "98", which are all non-mobile/WLL networks, "2" before MT exchange codes. See Annex for the detail.

(3) Subscriber Number (SN) Range of Sum Centre

The effective numbering plan gives a range of 2,000 to the Sum centre exchange of MT network and 1,000 to that of MRC. However, some MRC Sum centre exchanges are assigned actually one (1) exchange code and four (4) digits of subscriber number, that is, a numbering range of 10,000 lines. As a result, the total length of NSN is 10 in digit in the longest case.

The numbering range of the Sum centre will not be sufficient in some cases, according to the demand forecast of the Master Plan Study. The demand forecast indicates 2,000 or more telephone demand in some Sum centres in 2020.

It is recommended, in order to resolve such possible shortage of numbering capacity, that the capacity of 2,000 of MT exchange and 1,000 of MRC exchange be expanded to 10,000 respectively in directory number. It will be realised by inserting one (1) digit between EC and SN, that is, inserting "2" in the case of MT network and "5" in the case of MRC network. This way yields another seven (7) range for new comers. See Annex for detail. This matches well with actual numbering range now in use.

6.2.5 Numbering Plan for Inter-connection between PSTN and IP Network

The numbering plan for IP-based network is under study; it will be shaped learning from ITU recommendations and introductive trends in advanced countries in the future.

It is now widely possible to originate calls from IP address-based networks to other networks, but it is uncommon to terminate calls from other networks to IP address-based networks (except in very particular cases of IP PABX). Rather, calls are generally terminated on the PSTN, so the called party can only use a terminal device connected to those networks. In order to access a subscriber on an IP address-based network from the PSTN, some sort of global numbering/addressing scheme across both PSTN and IP address-based networks needs to be developed and implemented.

ITU-T Study Group 2 (SG2) is currently studying a number of possible options whereby users in IP address-based networks can be accessed from/to PSTN users. One option is the assignment of E.164 numbering resources to IP devices. Another approach is to support service inter-working between different subscriber addressing systems in the PSTN and IP networks; for example, using the Internet Engineering Task Force (IETF)'s ENUM protocol.

> ***ENUM** is a standard adopted by the Internet Engineering Task Force (IETF) that uses the domain name system (DNS) to map telephone numbers to Web addresses or uniform resource locators (URL). The goal of the ENUM standard is to provide a single number to replace the multiple numbers and addresses for an individual's home phone, business phone, fax, cell phone, and e-mail.*

ENUM defines a Domain Name System (DNS)-based architecture and protocol for mapping an E.164 telephone number to what are known as Uniform Resource Identifiers (URIs). URIs are strings of characters that identify resources such as documents, images, files, databases, and email addresses. For example, http://www.itu.int/infocom/enum/ is the URI for the ITU website providing an overview of ENUM activities.

There are still today unresolved technical issues related to ENUM. They essentially deal with the consistent behaviour that have to be ensured between the telephony and Internet segments of a call established between a Telephony subscriber and an IP one.

Addendum 1 to Document 42-E of World Telecommunication Development Conference (WTDC-02) held on March 2002, contributed by Japan reported that In Japan a study group was formed to discuss technical problems regarding IP networks during the move from PSTN networks to IP networks, and to especially focus on implementing IP telephony service into the telecommunication infrastructure.

The Addendum suggests that in studying the numbering plan, patterns of interconnection between PSTN telephones and IP-based network telephones may be categorised as follows. Figure 6.2.5-1 shows the patterns.

a) IP-telephone to PSTN ordinary telephone;
b) Between PSTN ordinary telephones through IP-based network;
c) PSTN ordinary telephone to IP-telephone;
d) IP-telephone to IP-telephone.

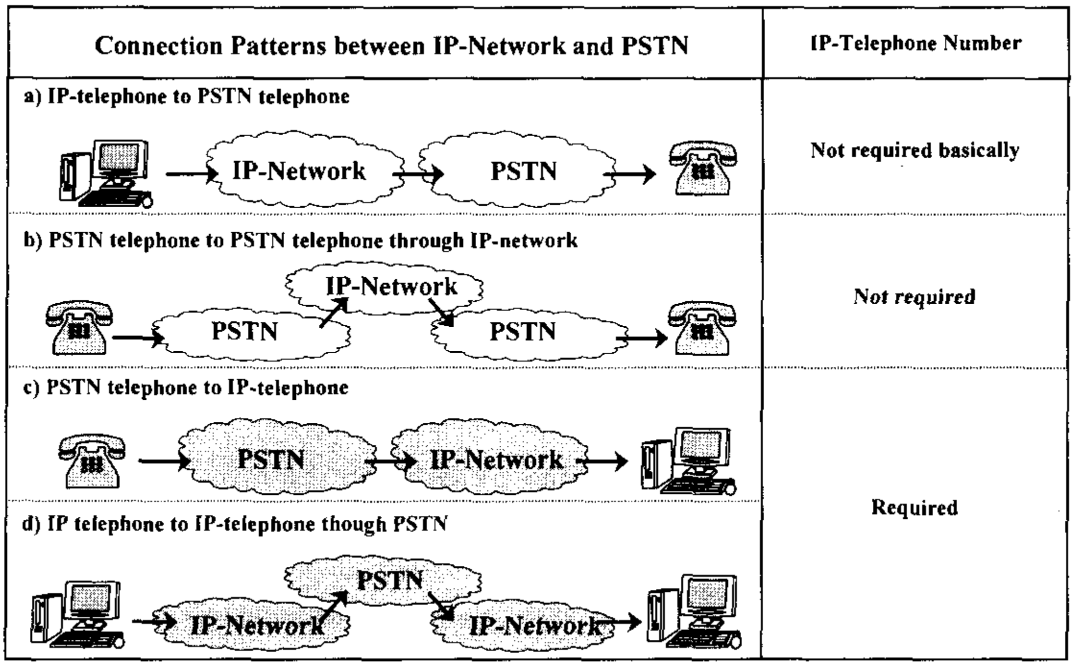


Figure 6.2.5-1 Interconnection between PSTN and IP-based Network Telephones

In shaping the IP-telephone number, the addendum suggests that the following two (2) ways will be discussed, that is, a) the IP-telephone number be given in conformity with ITU-T Recommendation E.164, whereas even international incoming calls are routed, where the PSTN on E.164 and IP-network coexist; b) the IP-telephone number could be a combination of alphabetic letters and numerals, whereas the calling party and called party are closed in the IP-network, regardless whether the IP-network and PSTN are interconnected or not.

For the case a), a numbering plan starting with "050" is applied in Japan. For the case b), it is left as items to be studied in the future. It recommends, in addition, that the number which looks same as that under E.164 should not be allocated to IP telephone.

6.3. Signalling Plan

6.3.1 General

ITU-T Recommendations indicate the Signalling System No. 7 protocols which provide the signalling 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). Leading telephone switching system manufacturers fabricate their products in compliance with the specifications defined by such Recommendations and supply them to users for international and national applications.

ITU-T Recommendations deal with fundamentally the international networks. However, most signalling procedures, information elements and message types specified for international use are also required in typical national applications. Coding space has been reserved in order to allow national administrations and recognised private operating agencies to introduce network specific signalling messages and elements of information within the internationally standardised protocol structure.

The signalling messages specified by ITU-T cover most services essential to a general telephone network. Accordingly, Mongolia Telecom (MT) has established its signalling link network making use of the messages already specified by ITU-T. The main signalling systems used in Mongolia is ITU-T Common Channel Signalling System No. 7 and R2 Signalling System.

6.3.2 Signalling System in Use

(1) Signalling System of Aimag Level Exchanges

MT has applied specifications of CCS No. 7 protocol to the sections between most digital exchanges introduced under past projects. The relevant signalling system will be applied to the links between digital exchanges in the future too. The CCS No. 7 is now applied to the following sections of digital transmission system.

Ulaanbaatar ATC-3	to	Orkhon, Darkhan, Bulgan, Selenge, Uvurkhangai;
Ulaanbaatar ATC-45	to	Orkhon, Darkhan, Bulgan, Selenge, Uvurkhangai;
Ulaanbaatar ATC-68	to	Orkhon.

ITU-T R2 signalling system is applied to the sections of analogue microwave transmission system and very small aperture satellite (VSAT) system. They are:

Ulaanbaatar ATC-3	to	(Analogue microwave transmission system) Bayankhongor, Govi-Altai, Khovd, Bayan Ulgiy, Dundgovi, Umnugovi, Khentiy, Sukhbaatar, Dornod, Dornogovi, Choir, Baganuur. (VSAT system) Arkhangai, Khuvsgul, Uvs, Zavkhan, Tosontsengel, Zamin-Uud.
Ulaanbaatar ATC-45	to	(VSAT system) Arkhangai, Khuvsgul, Uvs, Zavkhan, Bayankhongor, Bayan-Ulgiy, Govi-Altai, Dundgovi, Sukhbaatar, Khovd, Khentiy, Umnugovi, and Dornod.

(2) Signalling System between Aimag Centre and Sum Centre

The links between Aimag centre and Sum centres are subscriber line. One side of the transmission link is terminated with subscriber line interface circuits (SLIC) of the switching equipment of the Aimag centre and the other side is terminated with a ordinary telephone apparatus. In a few cases it is accommodated to PBX as trunk line. Accordingly, the transmission section is controlled by loop signal with dial pulse or multi-frequency pulse.

(3) Signalling System of International Gateway Switch

The international gateway switch NEAX-61 installed in Ulaanbaatar is now connected with foreign countries exchanges with ITU-T No. 5 signalling system. The domestic side of the switching unit is functioning with ITU-T No. 7 signalling system. The international side is under upgrading construction to add the function of the ITU-T No. 7 signalling system. The project is supposed to complete in 2002.