

How It All Began:

" My Journey Through Bhutan "

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Bhutan Telecom Ltd.

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My career in BT

- Started my career on August 17, 1989, with the Department of Telecom:
 - August – December 1989: Transmission (Microwave station), Thimphu.
 - January 1990 – December 1991: Standard A Satellite Earth Station, Thimphu
 - January 1991 – November 1998: Established Telecom Training unit and worked as a course developer, Trainer and HR & Admin.
 - December 1998 – 2008: Data Unit, which became DrukNet (Internet Services)
 - January 2009 – December 2011: Area Manager, Operational Area VI (Phuentsholing).
 - January 2012 – August 2015: Regional Manager, South Western Region, Phuentsholing.
 - September 2015 – August 2016: General Manager, Operations Division.
 - September 2016 to 31st October 2022, General Manager, Corporate Planning & Strategy Division.
 - November 2022- Till date, Team Lead, Strategy Team, CSO

Journey

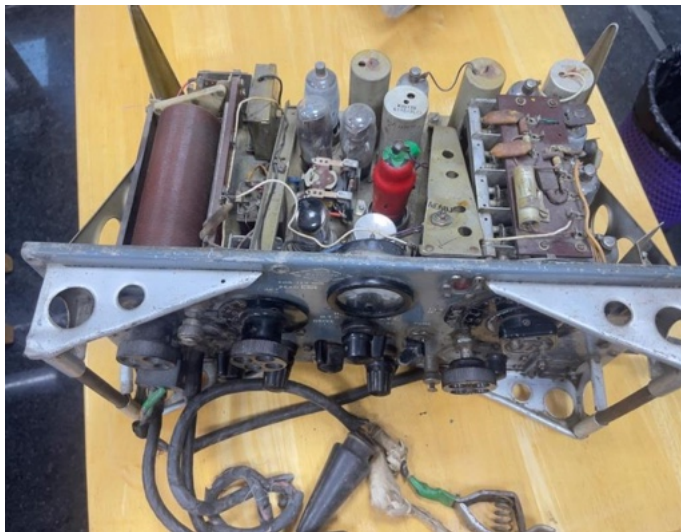


Early Days (Wireless)

Wireless Communications (Amateur Radio)

- "Able Charlie Five Papa November calling"...

The first amateur radio call from Bhutan occurred on the occasion of King Jigme Dorji Wangchuck's travel to the East of the country in November 1955, at Rida, the western province of Wangduephodrang.



Wireless Communications (HF) started in 1965

Communications (Message and RT) was the major mode of communication in Bhutan till Telephone systems were introduced.

Early Days (Telephone)



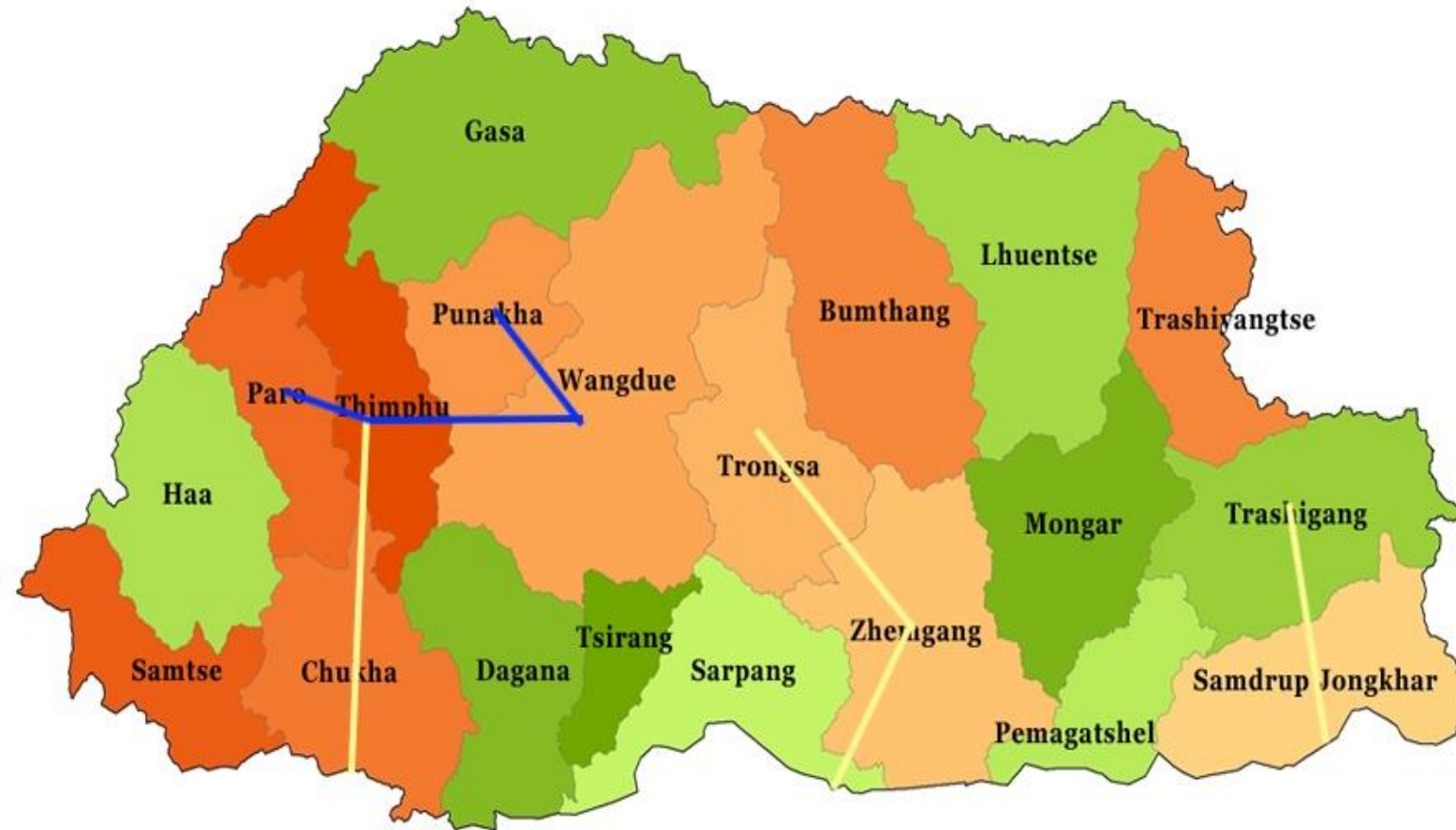
Telecommunications services in Bhutan started in 1963.

The technology was an open wire carrier transmission system with step-by-step Exchange. (Strowger system)

The exchange was inaugurated on 1st May 1965 at Phuentsholing.

In 1970, the Ministry of Communications was established with two departments: the Department of Telecommunications and the Department of Civil Wireless (HF radiocommunications), (Bhutan Telecom).

Open Wire Topology



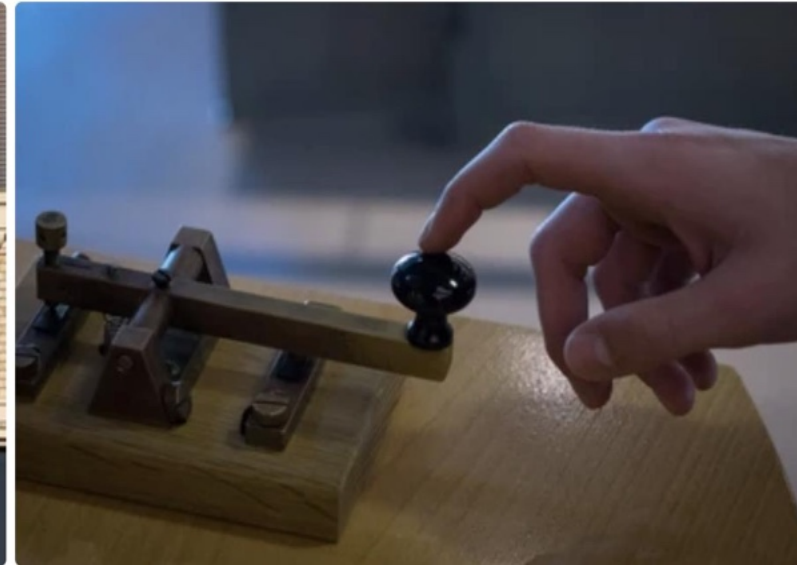
- 3 separate networks were built, Western Bhutan (Thimphu to Phuentsholing,
- Central Bhutan (Trongsa to Gelephu.
- Eastern network (Trashigang to Samdrupjongkhar).

Early Days (Telegraph & TELEX)

Telegraph services were available at:

- Thimphu Phuentsholing,
- Thimphu - Wangduephodrang,
- Thimphu - Calcutta, India.

Telex switching equipment is located at the Thimphu exchange. The telex service is available at Phuentsholing and Thimphu.



Into modern Telecommunications.

In 1984, Bhutan established its first link with the outside world. Microwave link from Thimphu to Hasimara, India.

In 1990, the Standard A earth station in Thimphu was commissioned.

The first Digital Switch in Thimphu was commissioned.

DRCS Transmissions connecting the western Parts of Bhutan.

The National Telecommunications Development Plan (NTDP), a 4 Phase Digital Transmission system (34 Mbps) and SPC Switching, was built with Grant assistance from the Government of (1993-1997).

Rural connectivity to 50 remote Basic Health Units and schools using single-channel VHF technology



My Early Internet Experience, 1994

- 2400 bits per second dial-up services to ITU TIES system in Geneva
- Gopher was the browser (there was no WWW)
- PINE was the mail system (CLI)

Preparation for Internet Connectivity

- Story of .bt ccTLD. bt
- Transferred to BTNIC (BT) in 2006
- APNIC insists on application submission by email when there is no Internet..

DrukNet

- The Internet was introduced in Bhutan on 2nd June 1999.
- 256kbps satellite link to the UK.
- Dial-up Services (33.6 Kbps) and 56Kbps.
- 3 PoPs (Tashigang, Phuentsholing and Thimphu)

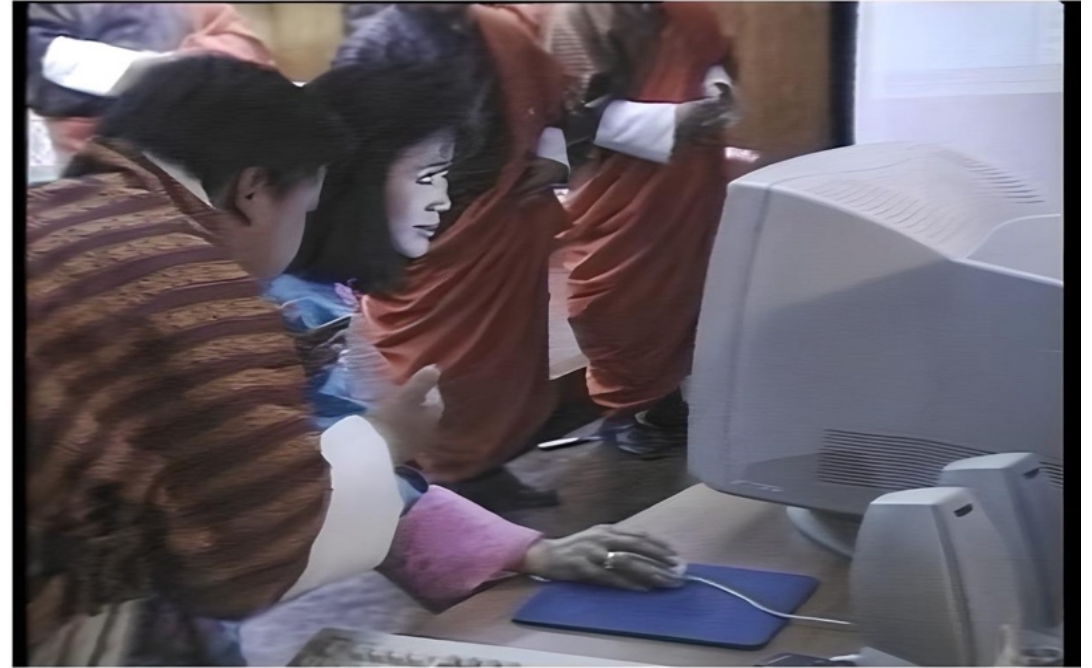
proxy.druknet.net.bt

Competition in the Internet market(2004)

Drukcom Pvt.

Samden Tech Pvt. Ltd

- 24 ISPs in the country today.



How we deployed Internet



ip numbering customer

202.144.128.0/25 backbone p
128.128/25 public net
129.0/27 core eth
129.32/27 ars etc
129.64/26 NDC
129.128/25 Dialups

Thimphu 202.146.128.0 - 202.146.129.0
P/ling 202.146.120.0/24
Jakarta 202.146.131.0/24
T/ling 202.146.132.0/24

↑ infrastructure
↑ customers
202.146.158.0/24
202.146.159.152/24 loops

128 } info
129 }
130 }
135 } cust
136 } in
137 }
139 } cust

128 } int
129 }
130 }
131 }
132 } info

↑ cust
158
159 loop etc

P/ling
ARL.p/ling eth 0 202.146.130.1/27 (159.20)
ser eth 202.146.128.2/30
dial pool 202.146.130.128/25

T/ling
ARL.t/ling eth 0 202.146.132.1/27 (159.21)
202.146.128.6/30
202.146.132.128/25

202.146.129.128
.200 NS.DRUKNET.NET.BT
.210 RELAY.DRUKNET.NET.BT
.220 WWW.DRUKNET.NET.BT
.254 eth0-1.br1.druknet.net.bt.

202.146.129.0
.1 eth0-0.br1.druknet.net.bt.
.2 eth0-0.cel.thimphu.druknet.net.bt.
.3 eth0-0.cir2
.4 eth0-0.gsi
.5 eth0-0.guz
.6 eth0-0.ari
.30 eth0-0.swi



Satellite to Fibre

OPGW (Phuentsholing-Thimphu and Paro built by Bhutan Telecom in mid-2000).

OPGW and ADSS are the transmission backbone Operators/ISPs.

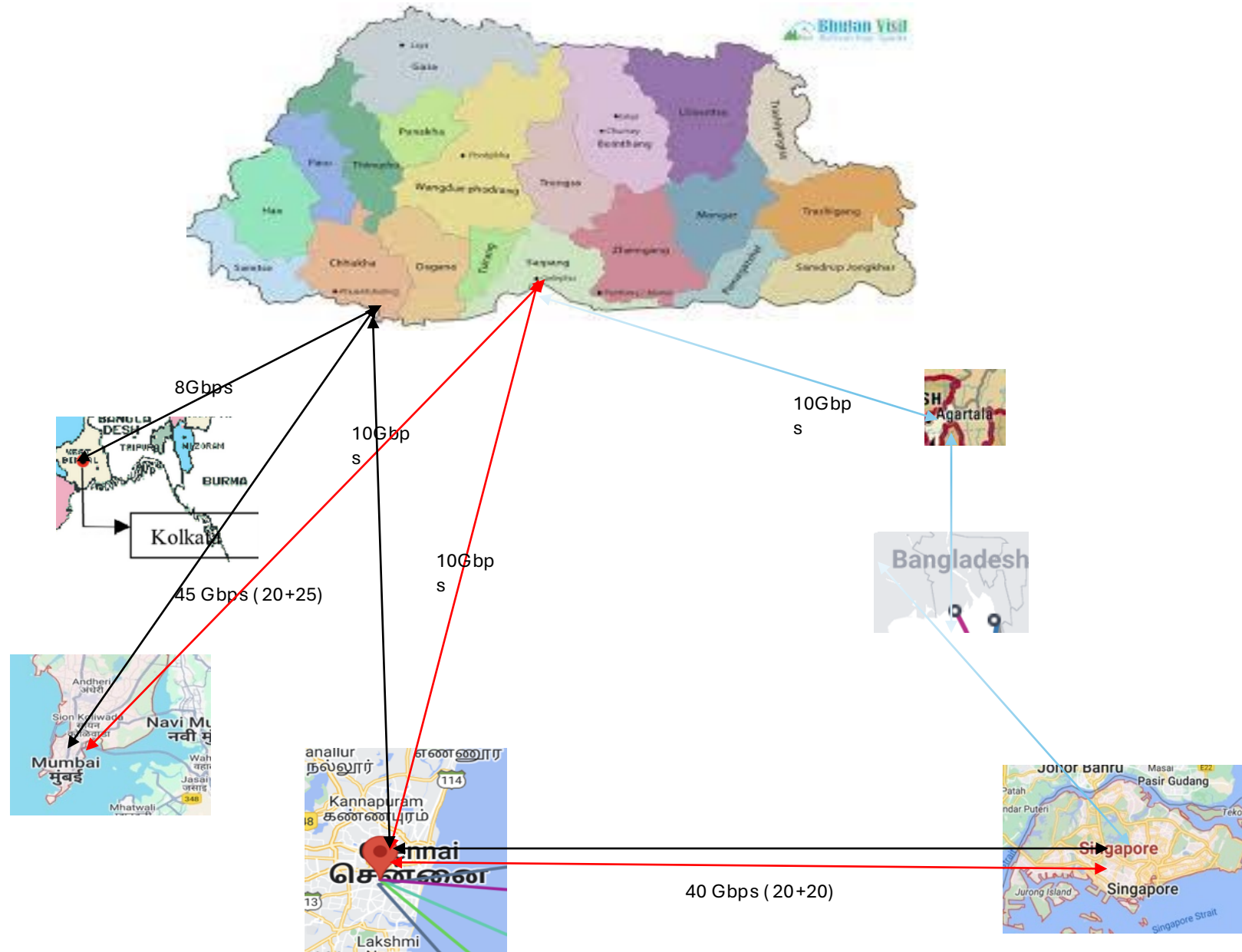
A DS3 Circuit (45 Mbps) IPLC to LINX London.

The second POP in Hong Kong with a 155Mbps IPLC circuit.

TIER III Designed Data Center.



256Kbps to 105 Gbps IP Backbone ++



Impact of Internet (G2C) Services



Family

Services related to the family



Education & Learning

Learning is a lifelong process of transforming information and experience into knowledge, skills, and behaviours.



Health & Wellness

Health refers to physical, mental, and social well-being; wellness aims to enhance well-being.



Money & Property

Money and property law are mutually constitutive.



Construction & Housing

Bhutan pursues a unique and sustainable approach to development based on the philosophy of Gross National Happiness (GNH).



Justice, Law & Grievances

The Judiciary of Bhutan established the Grievance Cell to understand and address the aspirations and needs of justice service consumers



Pension services

You can avail Pension and Provident related services from here.



Transport & Infrastructure

To be a dynamic organization for building quality and sustainable infrastructure, efficient transportation services, and built environment



Life Events

Frequently used service



Online Payment

Pay online for any services available in G2C



Security & Defense

Security refers to all the measures that are taken to protect a place, or to ensure that only people with permission enter it or leave it.



Agriculture & Livestock

The impact of agricultural practices on the environment.



Business & Tax Services

The taxes that businesses must pay as a normal part of business operations.



Thromde Utility Service

Thromde Want to build a house, get occupancy certificate, water connection, etc. Check Thromde services.



Tourism, Passport & Visa

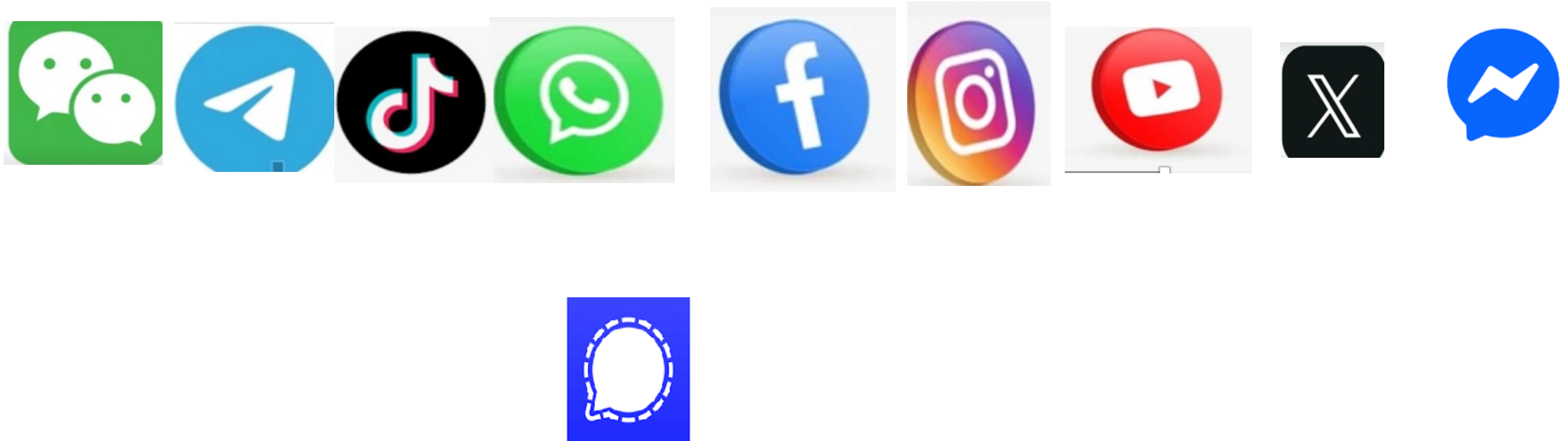
The Bhutan visa application form is available online on the eVisa website

Impact of Internet (Telemedicine)

First Telemedicine services started at Bumthang in 2000.

A digitised X-ray could be sent to Thimphu General Hospital to be reviewed by a Radiologist for advice.

Impact of Internet (Social Media)



Early computer

-
- Typewriter
 -
 - WordPerfect, FoxPro
 - Windows 3.1 ++



Mobile

On 11th November 200, Bhutan Telecom introduced GSM Mobile.

Tashi Infocom second mobile operator in 2008.

LTE coverage throughout the country led to an explosion in Internet usage.

5G is an investment, where globally Operators are facing RoI.

3GPP is the standard for GSM.

Licenses are a major cost.

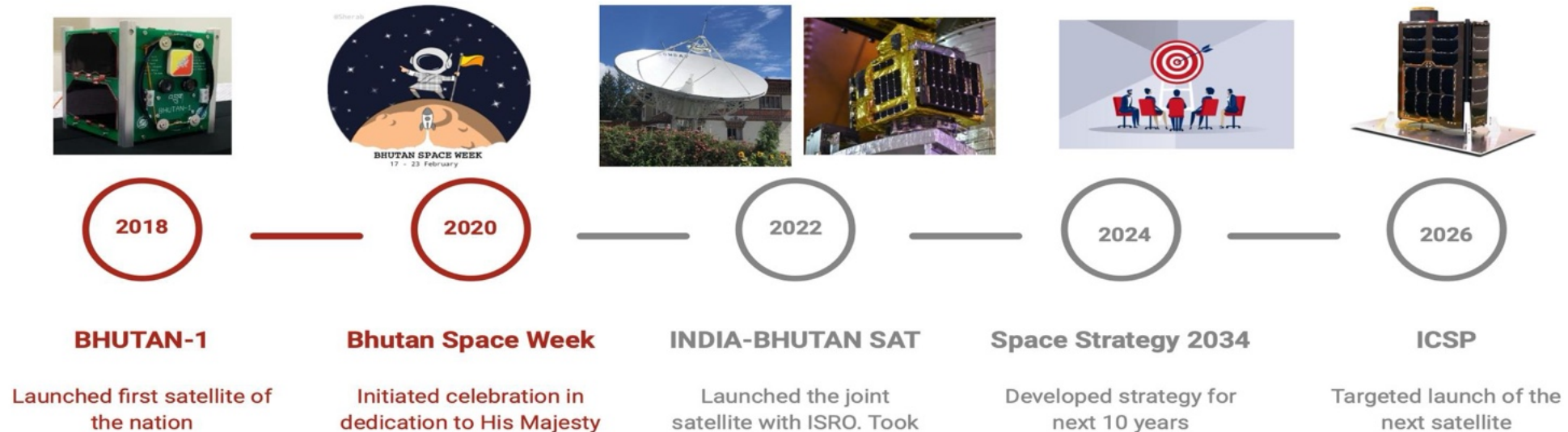
Handset OEMs

Mobile Subscribers	875,946
LTE	660,473
5G	80,852
3G	32,031
2G	3,196
Broadband	5,601
Lease Line	40,527
PSTN	9,829
Source	bicma

Satellite Journey

- Satellite communications (VSAT) in mid-1990
- VSAT provided communications to the very remote parts of Bhutan.

What have we achieved so far?



btNOG

btNOG 1 – 4 hosted by
Bhutan Telecom

btNOG 5-12 (btNOG coord
team who are volunteers)

Support from RGoB and Govt
Tech Agency)



btIX(Bhutan Internet Exchange)

- Inaugurated on 8th January 2019 with 7 members. Now there are 13 members



One member, one vote(founding members)
Membership Fees sustain the infrastructure development and operational costs.



Bhutan Progressing

IoT (Internet of Things). nbIOT, LORA WAN

JNW Super FabLab,

NFTs (non-f u n g i b l e t o k e n s) , K i n g d

art series sold using NFT

Binance Pay (crypto payment) for tourists.

Digital ngultrum is being piloted.

Drone manufacturers.

Third IP gateway from (Samdrupjongkhar in future.

Security is still a big threat to AI applications

Thank you