# 3G/4G Services Evolution in Pakistan

**(Mitigating Threats to Landline Business through a developed Services Model)**

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**Abstract:** With the introduction of 3G/4G services by the mobile companies, there is an eminent threat to the legacy landline business because of the data services being offered by the mobile companies. Unless and until some sustainable model is not devised, the landline business might suffer immensely with declining revenues. The research thesis will cover the present telecom scenario in the country and will look at the pre and post 3G/4G licensing scenario. After doing this analysis, the landline network will be studied and a model will be developed which will take care of the threat to the landline network.

The above will be achieved through an in depth analysis of, Telecom Network Infrastructure, Technology trends and wireless network evolution, Telecommunication market in Pakistan, Post 3G-SWOT analysis for PTCL, Threats & risks for PTCL in a post 3G world, Challenges for 3G operators in post 3G environment, Case Studies – How markets behave in post 3G environment & Post 3G road map for fixed line operators

## Background

This section looks at different types of telecommunication infrastructures existing and deployed in the country. This will broadly look into the following types of networks:

- Public Switched Telephone Network (PSTN)
- Copper Access Network
- ADSL Network.
- General IPTV Diagram
- FTTx Application Scenario
- Internet Service
- VOIP Service
- Full Optical Access Network Solution
- Full Optical Access Network Solution
- NGN Network Architecture
- PTCL IP Core

## Telecom Network Infrastructure

Following are the different network - infrastructures in place in the country.

- ***Public Switched Telephone Network (PSTN)***

It is the basic and the oldest telephone network deployed in the country. We also call it the legacy network which provided the user with the basic facility to talk to one another over shorter or longer distances. Fig 1.1 explains the network architecture.

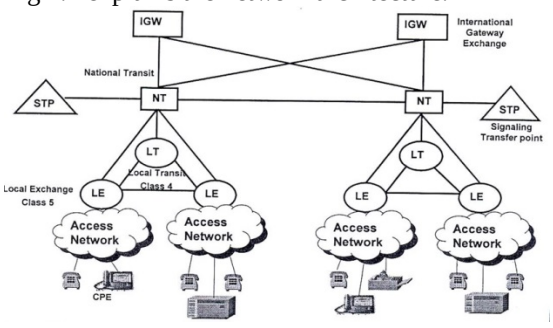


***Fig 1.1: Legacy PSTN Network***
***(Source: Pakistan Telecommunication Company Ltd)*** [1]

- ***Copper Access Network***

The public switched network mainly comprises of the copper cables network. We call it the copper distribution network. Fig 1.2 shows the basic architecture of the copper access network. It is also called the last mile.

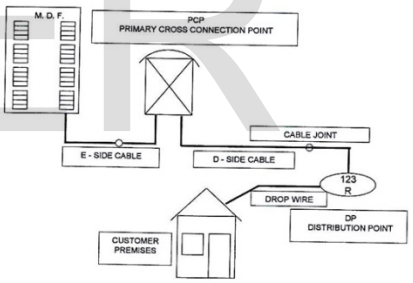


***Fig 1.2: Copper Access Network***
***(Source: Pakistan Telecommunication Company Ltd. Legacy customer to exchange setup)***

Various Access Network Characteristics include the point to point/star architecture, voice & low speed data provisioning and is a passive network. Because of its limited reliability, slower deployment, limited flexibility, limited bandwidth and high cost of maintenance, it is being replaced by optical fiber networks across the country.

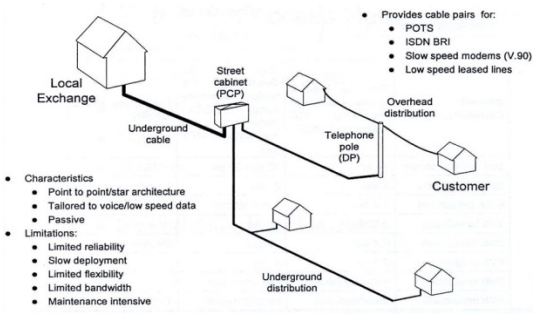


***Fig 1.3: Access network characteristics***
***(Source: Pakistan Telecommunication Company Ltd, PTCL***

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- ***ADSL Network***

In telecom, it is not wise to throw away a network on which millions of dollars of investment has been made. The basic idea is to do away with the network in phases. The older network will fizzle out with the passage of time. Hence keeping this in mind, another network by the name of Asymmetrical Digital Subscriber Line (ADSL) was introduced which used the existing copper pairs and provided higher data rates on the publish switched network which was primarily designed to carry voice traffic but with the introduction of the data traffic, the same was being used at lower speeds for data applications. However with the introduction of ADSL network, higher data rates on the copper network were achieved. Fig 1.4 shows a typical ADSL network design architecture.

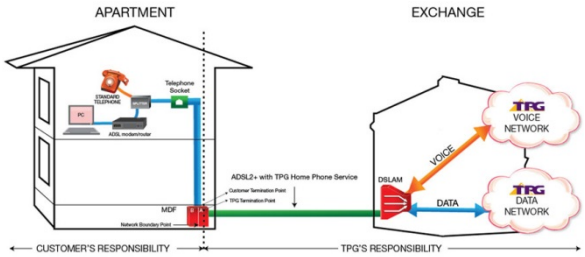



***Fig 1.4: ADSL Network***
***(Source: Pakistan Telecommunication Company Ltd, PTCL)***

However further enhancement in the ADSL networks to further improve the data rates on the existing copper network led to the deployments of ADSL2+ technology (Fig 1.5)

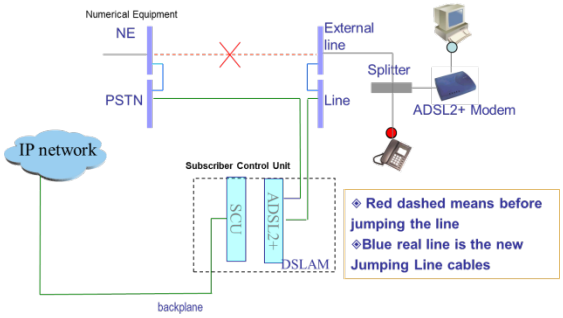
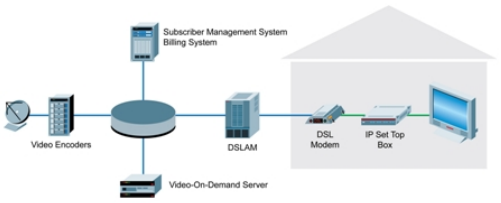



***Fig 1.5: ADSL2+ Network***
***(Source: Pakistan Telecommunication Company Ltd, PTCL)***

- ***General IPTV Diagram***

As the demand for newer services grew, introduction of internet Protocol television (IPTV) came up which provided the users with the service of watching television channels over the IP protocol platform. IP set-top box was installed at the user premises (Fig 1.6) coupled up with a back end network consisting of voice encoder, DSLAM, subscriber management system, video on demand and DSL modem infrastructure.




***DSLAM = Digital Subscriber Line Access Multiplexer***
***Fig 1.6: IPTV Network***
***(Source: Pakistan Telecommunication Company Ltd, PTCL)***

The existing architecture of Pakistan Telecommunication Company Ltd (PTCL) is shown in Fig 1.7. As IP works on the internet platform, hence the same has been provided through the backend routers connected to the internet cloud.

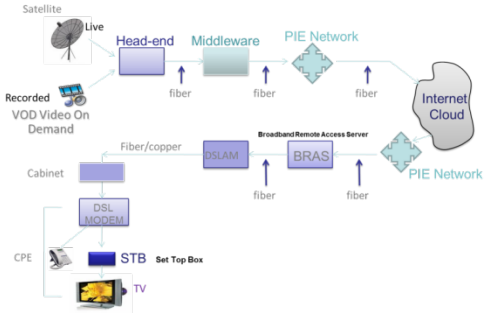



***Fig 1.7: IPTV Network***
***(Source: Pakistan Telecommunication Company Ltd, PTCL)***

- ***FTTx Application Scenario***

However despite using the existing copper network with the introduction of many new devices, the speeds could not be further enhanced as a more powerful medium was required which cannot be other than the fiber optics network. As detailed earlier, different phases of the network design led to the introduction of fiber in the loop. Fig 1.8 explains various scenario's in this regards.

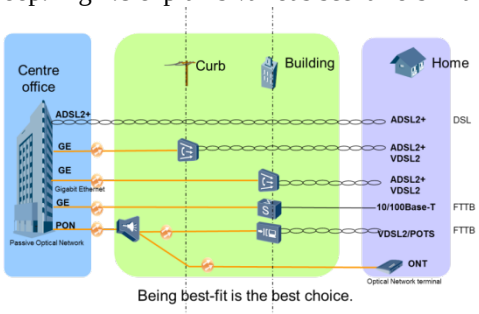



***Fig 1.8: FTTx Network***
***(Source: Pakistan Telecommunication Company Ltd, PTCL)***

Fig 1.9 through Fig 1.13 shows various scenarios (architecture designs) independently.

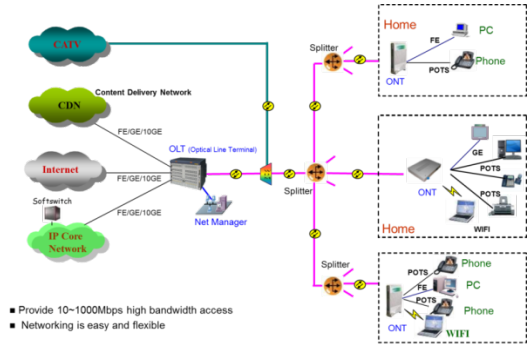



***Fig 1.9: Fiber to the Home (FTTH)***
***(Source: Pakistan Telecommunication Company Ltd, PTCL)***

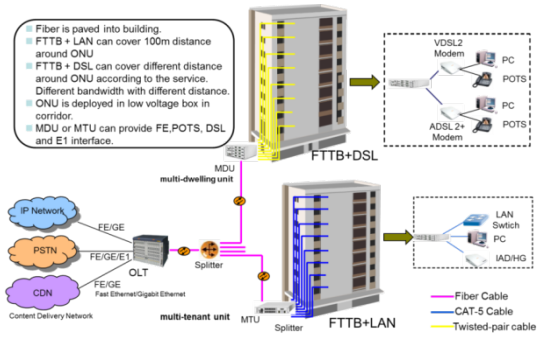



***Fig 1.10: Fiber to the Building (FTTB)***
***(Source: Pakistan Telecommunication Company Ltd, PTCL)***

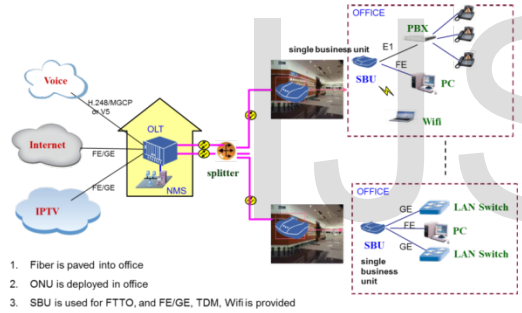



***Fig 1.11: Fiber to the Office (FTTO)***
***(Source: Pakistan Telecommunication Company Ltd, PTCL)***

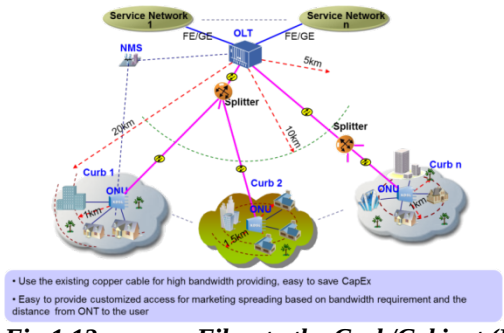



***Fig 1.12: Fiber to the Curb/Cabinet (FTTC)***
***(Source: Pakistan Telecommunication Company Ltd, PTCL)***

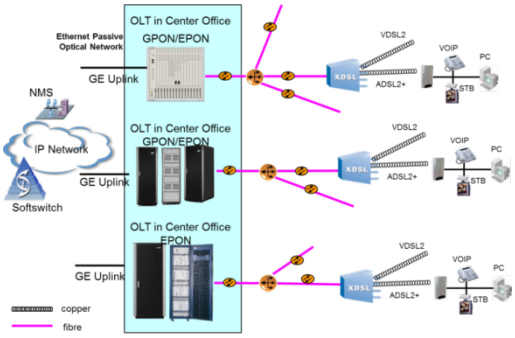



***Fig 1.13: FTTCab/C +xDSL Solution with PON***
***(Source: Pakistan Telecommunication Company Ltd, PTCL)***

- ***Internet Service***

Introduction of Internet services brought about a revolution in the world whereas this mushroom of interconnected devices connected almost the entire planet thus enabling each human being to connect to the other instantaneously (Fig 1.14).

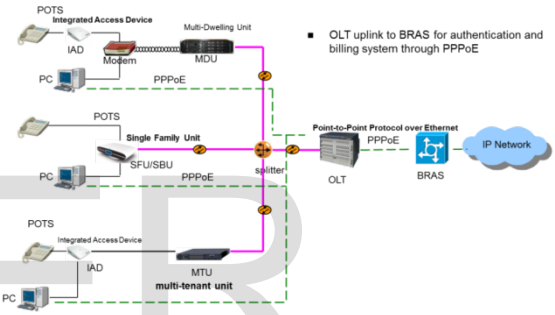



***Fig 1.14: Internet Network***
***(Source: Pakistan Telecommunication Company Ltd, PTCL)***

- ***VOIP Service***

The above outlined developments finally led to voice from being on the SS7 signaling platform to be translated on the Voice over internet Protocol (VOIP). People used the same voice services but the platform shifted to VOIP (Fig 1.15).

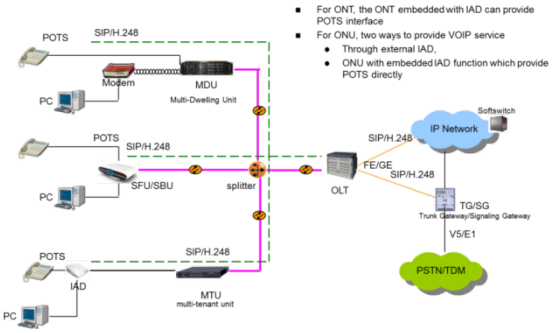



***Fig 1.15: VOIP Network***
***(Source: Pakistan Telecommunication Company Ltd, PTCL)***

- ***Full Optical Access Network Solution***

With the deployment of the full optical network, the bandwidth provisioning at the higher rates has not remained a problem. Voice, video and data can be easily provided on this end to end optical network. (Fig 1.16).

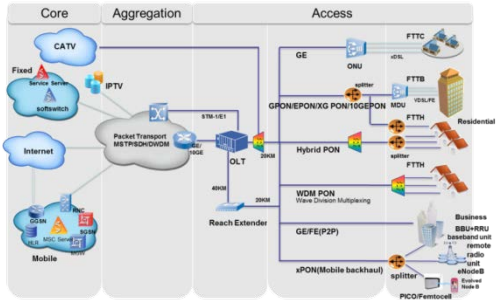



***Fig 1.16: Full Optical Access Solution***
***(Source: Pakistan Telecommunication Company Ltd, PTCL)***

- ***Full Services Access***

With the deployment of the above technologies, especially the fiber in the loop, all the services starting from low speed voice to high speed data/video can be provided to the users through an interconnected network, (Fig 1.17).

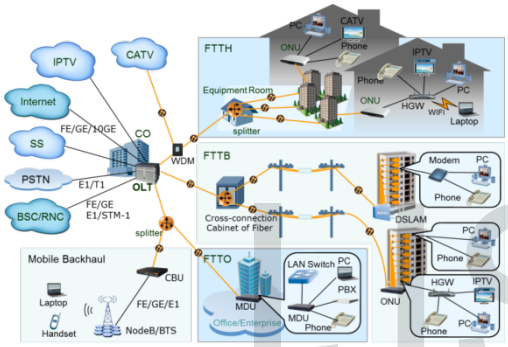



***Fig 1.17: Full Optical Access Solution***
***(Source: Pakistan Telecommunication Company Ltd, PTCL)***

- ***NGN Network Architecture***

It should be understood here that the Next generation Network (NGN) is not some typical standard network but it is basically a "concept" how the future networks are going to look like. In order to avoid operational costs like buildings, staff, power, infrastructure etc., the legacy PSTN networks were transformed into the NGN networks thus integrating all the products, services and management on a single platform. Fig 1.18 & Fig 1.19 depict the NGN network and how it has been transformed from the legacy network to the present state.

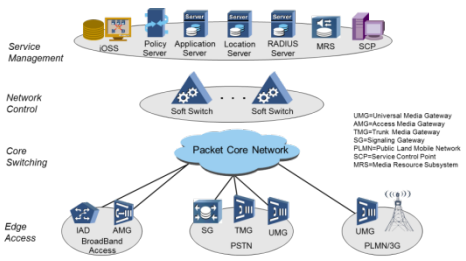



***Fig 1.18: NGN Network Architecture***
***(Source: Pakistan Telecommunication Company Ltd, PTCL)***

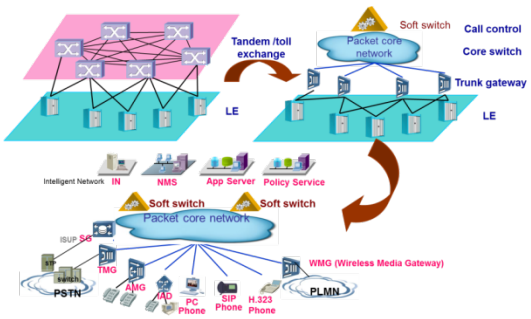



***Fig 1.19: PSTN to NGN Evolution***
***(Source: Pakistan Telecommunication Company Ltd, PTCL)***

- ***PTCL IP Core***

Fig 1.20 & Fig 1.21 present the PTCL metro-Ethernet network core at Islamabad, Lahore and Karachi and the NG transport network respectively.

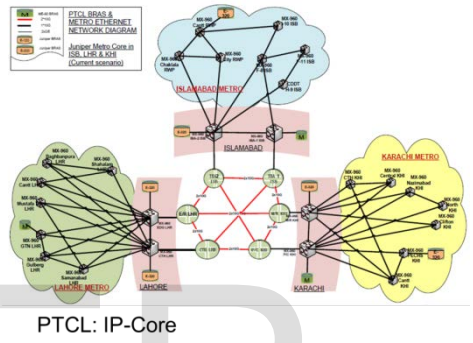



***Fig 1.20: PTCL IP Core Network***
***(Source: Pakistan Telecommunication Company Ltd, PTCL)***

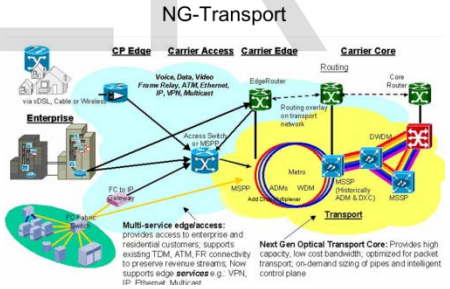



***Fig 1.21: Next Generation (NG) Transport Network***
***(Source: Pakistan Telecommunication Company Ltd, PTCL)***

**Convergence in Telecom**

The man aim of all the technological developments taking place in terms of infrastructure, services and deployments, the main aim was to achieve a converged setup (Fig 1.22) whose maintenance and operations becomes easy and cost effective. Plus all the services should come on a common protocol platform of IP. So now a broadband access solution has been able to achieve all this (Fig 1.23)

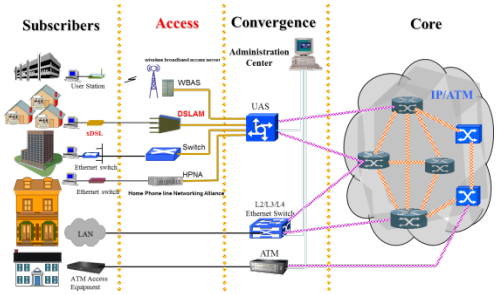



***Fig 1.22: Convergence of Technology***
***(Source: Pakistan Telecommunication Company Ltd, PTCL)***

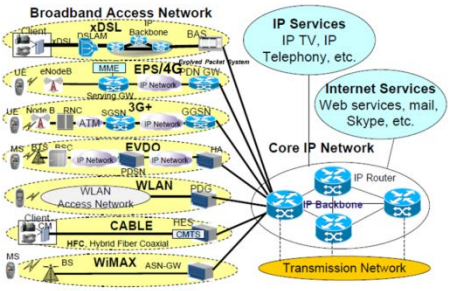



***Fig 1.23: Broadband Access Network***
***(Source: Pakistan Telecommunication Company Ltd, PTCL)***

## Grey Traffic

It should be noted that the deployment of any technology also leads to some technical Challenges & threats which are to be mitigated. Grey traffic is one such threat which involves by-passing the existing IT infrastructure of exchanges and nodes thus involving the use of illegal gateway's for the termination of voice and data traffic.

This is the major cause of revenue losses to the telecom operators. Their mitigation requires deployment of added network infrastructure, fraud detection mechanisms so that the networks can be secured. Fig 1.24 & Fig 1.25 depict the scenario's how the illegal traffic is being transmitted.

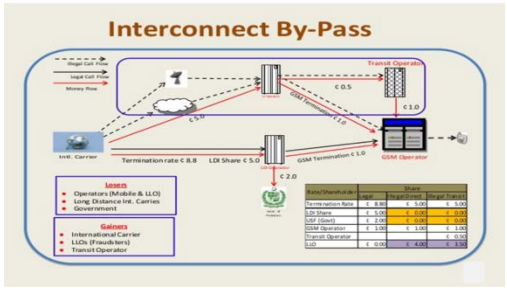



***Fig 1.24: Grey Traffic: Interconnect By-Pass***
***(Source: Generic Network Architecture for grey traffic)***

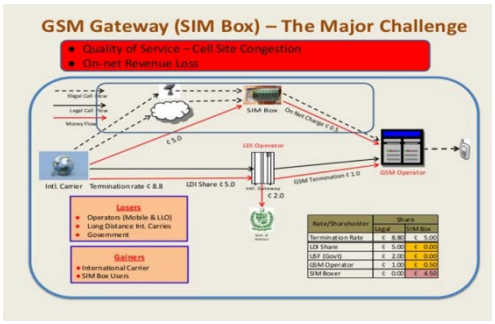



***Fig 1.25: Grey Traffic: GSM Gateway***
***(Source: Generics GSM gateway concept for grey traffic)***

## Wireless Networks Evolution

Here we look at various developments taking place on the wireless side of the networks.

## Main Trends

Telecom industry has witnessed the development of technology trends especially in case of wireless access. Social networking, digitization, cloud computing, wideband connectivity, application stores, online services, context awareness, big data explosion, ubiquitous communication, green IC and cognitive systems are just some of the trends in the wireless communication leading towards globalization.


***Fig 2.1: Main Trends***

Starting from desktop internet communication since 2000, the development of broadband mobile internet in 2009 to the interaction with real life objects, we have achieved a concept of smart spaces which will lead us towards a ubiquitous virtual world where the line between reality and virtual reality will somehow start fading away.

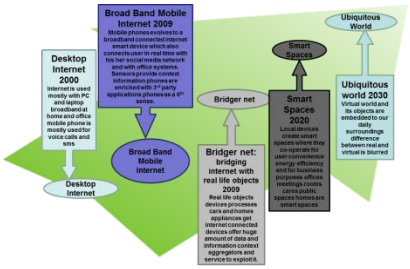



***Fig 2.2: A ubiquitous world***

**Rising New Technologies**

Table 2.1 summarizes the new trends being witnessed as far as the rising technologies are concerned. From social networking to mobile web, the effect has been a total change of life styles across the world. Availability of machines, especially while on the run, is the key trend witnessed on the wireless scene. This has undoubtedly put pressure on the landline networks which are competing with the variety of mobile deployments and applications.

- Social Networking
- Online Services
- Virtualization of Devices
- Cloud Computing
- Green Computing
- Cognitive Networks (software defined radio's)
- E-books and e-book devices
- Bluetooth
- Mobile web
- Portable mobile applications
- Application stores
- Enhanced location awareness
- Cellular broadband
- Touchscreens
- Machine-to-machine (M2M)
- More generic security

***Table 2.1: Rising new technologies***

**Data Traffic Growth Foecast**

In order to do any planning of the networks, it is customary for us to have a look at the data traffic growth trends so that the sizing and the dimensioning of the telecom infrastructure can be made. Fig 2.3 illustrates the conservative and aggressive forecasts based on the historical trends and future exponential growth trends. This is a measure of rightly planning and designing the future networks.

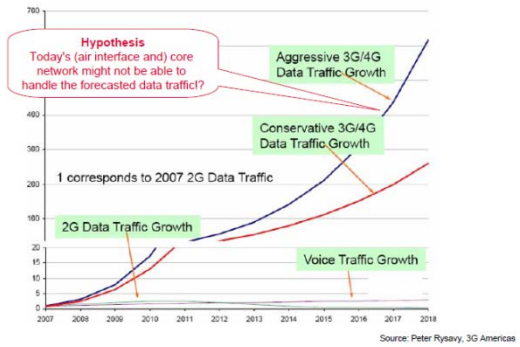



***Fig 2.3: Data Traffic: Forecast***
***(Source: Peter Rysavy, 3G Americas)*** [2]

**Mobile Networks Evolution**

History of the cell phones dates back to 1973 when Dr. Martin Cooper invented the very first handset. The subsequent developments are tabulated in order in Table 2.2.

| |
|---|
| 1973- Dr. Martin Cooper invents the first personal handset while working for Motorola. |
| 1979- First cellular phone communication network started in Japan. |
| 1988- The Cellular Technology Industry Association is created and helps to make the industry into an empire. |
| 1999-First introduction of Mobile Web |
| 2007- Apple Releases the i-Phone |

***Table 2.2: Mobile Evolution Historical Timeline***
***(Source: Internet collected data for timelines: http://www.staygolinks.com/a-timeline-on-the-evolution-of-mobile-communications.htm)***

From there onwards, transformation from 1G to 4G networks has been phenomenal.

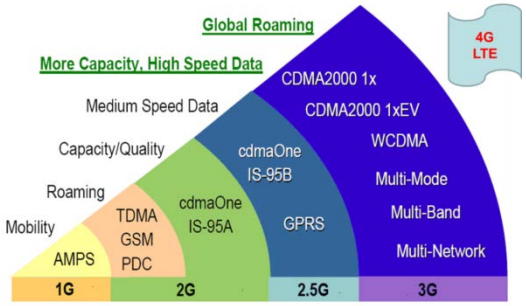



***Fig 2.4: Mobiles: Technology Evolution***
***(Source:Internet: https://www.google.com.pk/search?q=3g+to+4g+evolution&newwindow=1&source=lnms&tbm=isch&sa=X&ved=0CAcQ_AUoAWoVChMI6MfB19nIxwIVqaEUCh00FqBt&biw=1440&bih=763)***

Table 2.3 lists the technological evolution in terms of the respective speeds.

| 2G | 2.5G | | 3G | | 4G | |
|---|---|---|---|---|---|---|
| Name | Name | Download | Name | Download | Name | Download |
| TDMA | GPRS | 115 Kbit/s | WCDMA (UMTS) | 384 Kbp/s | LTE | 100 Mbp/s |
| | EDGE | 236 Kbp/s | HSPA (UMTS) | 14 Mbit/s | WIMAX | 50 Mbp/s |
| | | | | | HSPA+ | 56 Mbit/s |
| CDMA2000 | | | EVDO (CDMA2000) | 3.1 Mbit/s | | |

***Table 2.3: Mobiles: Technology/Speeds***
***(Source: Internet https://www.google.com.pk/search?q=3g+to+4g+evolution&newwindow=1&source=lnms&tbm=isch&sa=X&ved=0CAcQ_AUoAWoVChMI6MfB19nIxwIVqaEUCh00FqBt&biw=1440&bih=763)***

The various generations are explained below:

- ***First Generation "1G"***

- 1st generation of (wireless telecommunication technology) 1983
- Replaced 0G technology (used for radio telephones)
- Used analog radio signals, not the digital signals

- ***Second Generation "2G"***

- Started in1990's
- Used digital circuit switched transmissions.
- 2G, enabled quicker network signaling (lowered number of dropped calls).
- Less bulkier phones & not very large batteries

Fig 2.5 shows the network architecture of GSM architecture (2G/2.5G) with General Packet Radio Service (GPRS).

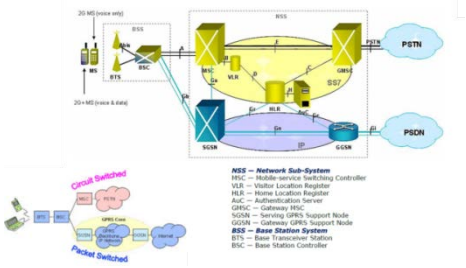



***Fig 2.5: 2G-2.5G: GSM/GPRS Architecture***
***(Source: Pakistan Telecommunication Company Ltd, PTCL)***

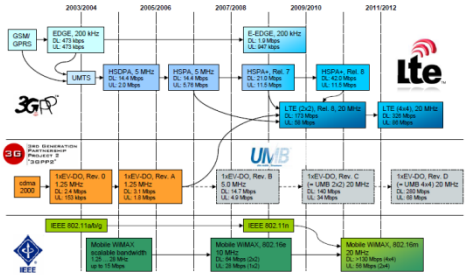



***Fig 2.6: A complete mobile evolution path***
***(Source:***
***Internet: https://www.google.com.pk/search?q=3g+to+4g+evolution&newwindow=1&tbm=isch&tbo=u&source=univ&sa=X&ved=0CBsQsARqFQoTCO7J5_LayMcCFUrtFAodpk4Kqg&biw=1440&bih=763)***

- ***3G Networks***

- Most effective generation.
- 2 MB of data indoors and 384 Kbits for outdoor use.
- Enables emails, internet access & Wi-Fi.

Code Division Multiple Access (CDMA) technology came in great demand in the 3G networks. It had various features and advantages over the previous access schemes. Fig 2.7 - 2.12 describe in detail various features of the CDMA network along with its architectural design.

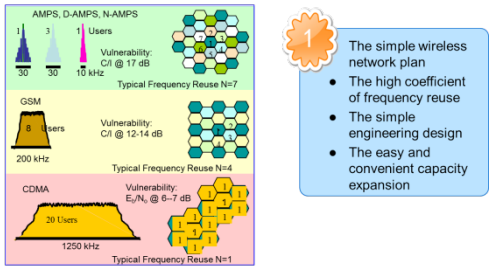



***Fig 2.7: CDMA Features: Simple, Frequency Use & Capacity***
***(Source: Pakistan Telecommunication Company Ltd, PTCL)***

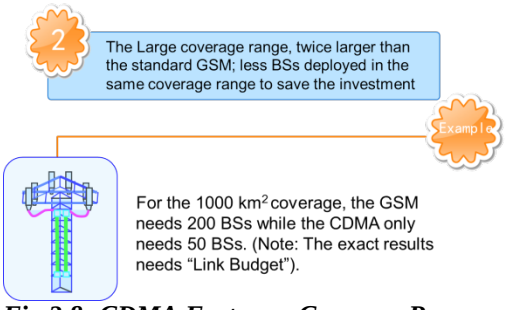



***Fig 2.8: CDMA Features: Coverage Range***
***(Source: Pakistan Telecommunication Company Ltd, PTCL)***

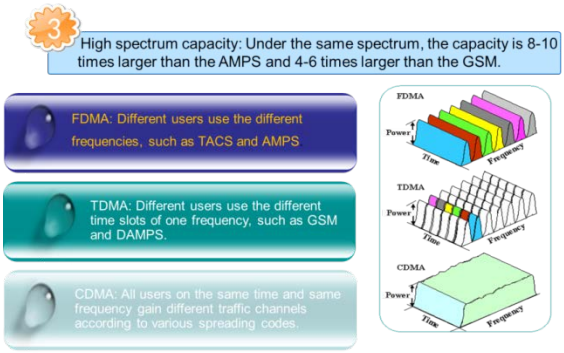



***Fig 2.9: CDMA Features: Spectrum***
***(Source: Pakistan Telecommunication Company Ltd, PTCL)***

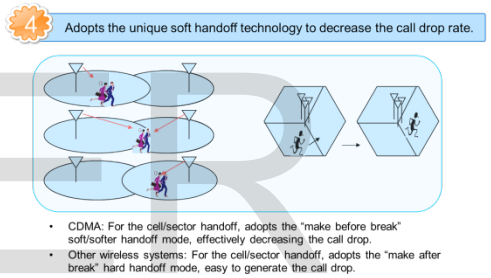
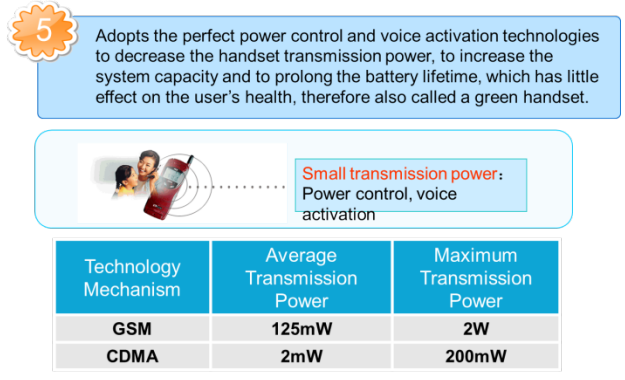



***Fig 2.10: CDMA Features: Handoff Capabilities***
***(Source: Pakistan Telecommunication Company Ltd, PTCL)***




| Technology Mechanism | Average Transmission Power | Maximum Transmission Power |
|---|---|---|
| GSM | 125mW | 2W |
| CDMA | 2mW | 200mW |

***Fig 2.11: CDMA Features: Power Control***
***(Source: Pakistan Telecommunication Company Ltd, PTCL)***

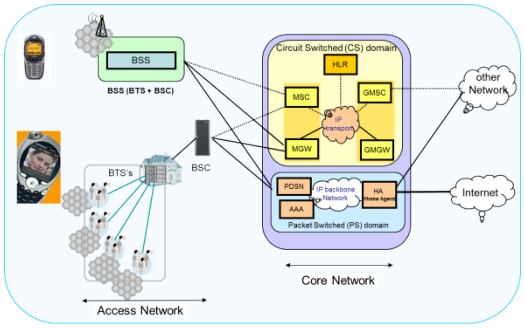



***Fig 2.12: CDMA Network Architecture***
***(Source: Pakistan Telecommunication Company Ltd, PTCL)***

While the developments in the CDMA towards the mobile sector were taking place, the technology evolution for only data access via the CDMA devices was also taking root and following its technological evolution trends. Evolution Data only (EVDO) was its starting point. These were called CDMA200 systems. History of CDMA2000 evolution is explained in Fig 2.14.

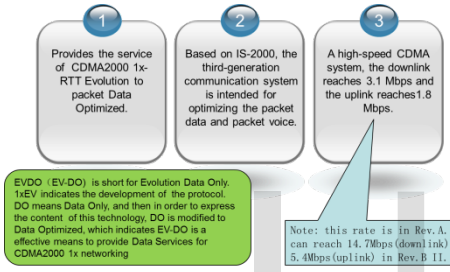



***Fig 2.13: Evolution Data Only (EVDO)***
***(Source: Pakistan Telecommunication Company Ltd, PTCL)***

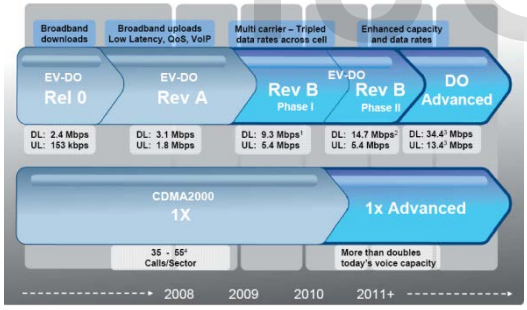



***Fig 2.14: History of CDMA2000 Evolution***
***(Source: Internet: https://lazure2.wordpress.com/mobile-internet-standards/)***

- ***4G (LTE)***

- LTE stands for Long Term Evolution
- Next Generation mobile broadband technology
- Data transfer rates 100 Mbps
- UMTS 3G technology
- All-IP traffic

| | |
|---|---|
| • High network throughput<br>• Low latency<br>• Plug & Play architecture<br>• Low Operating Costs<br>• All-IP network<br>• Simplified upgrade path from 3G networks | • Faster data downloads/uploads<br>• Improved response for applications<br>• Improved end-user experience |
| *for* Network Operators | *for* End Users |

***Table 2.4: LTE Advantages***

Major LTE Radio Technologies Use:

- Orthogonal Frequency Division Multiplexing (OFDM) for downlink
- Single Carrier Frequency Division Multiple Access (SC-FDMA) for uplink
- Multi-input Multi-output(MIMO) for enhanced throughput
- Reduced power consumption
- Higher RF power amplifier efficiency (less battery power used by handsets)

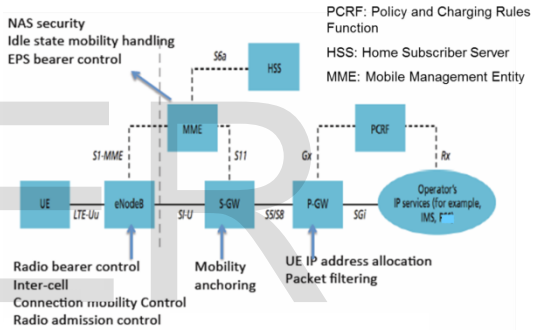



***Fig 2.15: LTE Architecture/Network***
***(Source: Pakistan Telecommunication Company Ltd, PTCL)***

- ***Download Comparisons***

In the end, the download comparisons are shown in Fig 2.16 – 2.17 to give an idea of the usage speeds along with the respective technologies in case of mobile communication.

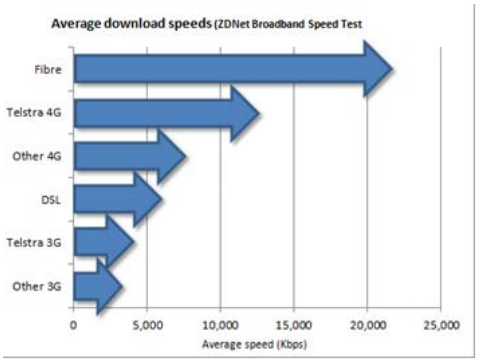



***Fig 2.16: Average Download Speeds***
***(Source: Broadband Streetstats)***

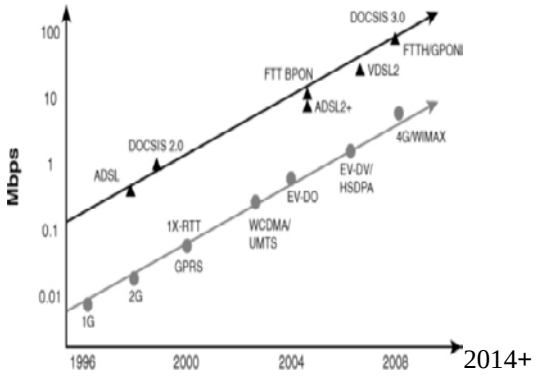



***Fig 2.17: Technologies-Speeds***
***(Source: Broadband Streetstats)***

**Telecom Market in Pakistan**

Here we focus on the overall telecom market scene in the country by covering every aspect.

**Background**

At present, there is no literature or statistics available in the country which can throw light on the emerging scenarios. The only available source of data is Pakistan telecommunication Authority (PTA) which to some extent collects the data from different operators. Individual companies do keep the data/information but it is generally fragmented, lacking the business vision and the insight.

Over the years, the combined Tele-density in Pakistan of Mobiles, and Fixed/Wireless Local Loop (LL) access has increased manifolds. Fig 3.1 shows the overall picture.

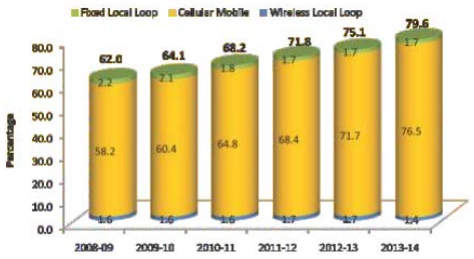



***Fig 3.1: Tele-density***
***(Source: Pakistan Telecommunication Authority)*** [3]

The Telecom Revenues show the growth of 7.0% .The increasing revenues from the telecom sector indicate the strength and size of the current Telecom market. Telecom operators are now exploring new avenues to earn from, reducing dependence on the voice channels alone. The Telecom revenue and Local Loop (LL) statistics also shows a promising picture.

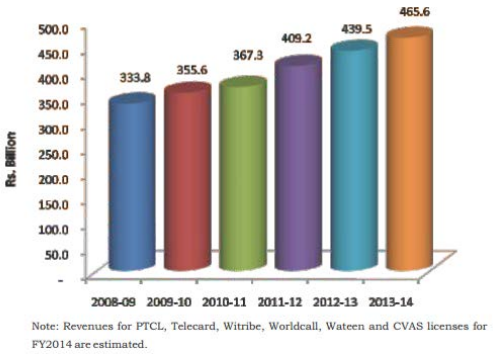



***Fig 3.2: Telecom Revenues***
***(Source: Pakistan Telecommunication Authority: Annual Report 2013-14)***

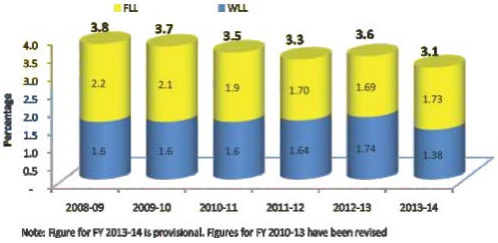



***Fig 3.3: LL Tele-density***
***(Source: Pakistan Telecommunication Authority: Annual Report 2013-14)***

As far as the broadband services are concerned, many developing countries have initiated Information & Communication Technology (ICT) programs. In Pakistan Broadband subscriber base has shown a promising increase in terms of numbers.

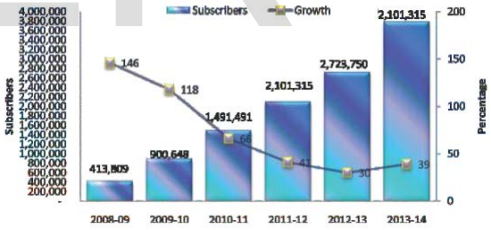



***Fig 3.4: Broadband Subscribers***
***(Source: Pakistan Telecommunication Authority: Annual Report 2013-14)***

PTCL (Pakistan telecommunication Company Limited), being the largest telecom network services provider in the country, is the Significant Market Power/Player (SMP).

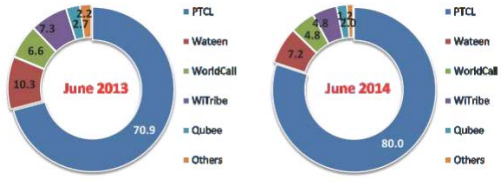



***Fig 3.5: Broadband Operators (Market Share)***
***(Source: Pakistan Telecommunication Authority: Annual Report 2013-14)***

Broadband in Pakistan

| Broadband Subscribers by Technology | | | | | | | |
|---|---|---|---|---|---|---|---|
| Technology | DSL | HFC | WiMax | FTTH | EvDO | Others | Total |
| 2005-06 | 26,611 | | | | | | **26,611** |
| 2006-07 | 44,669 | | | 484 | | | **45,153** |
| 2007-08 | 102,910 | 42,760 | 19,612 | 2,800 | | | **168,082** |
| 2008-09 | 262,661 | 36,201 | 88,477 | 3,967 | 22,503 | | **413,809** |
| 2009-10 | 476,722 | 49,110 | 257,616 | 5,002 | 111,194 | 1,004 | **900,648** |
| 2010-11 | 695,245 | 34,274 | 428,523 | 6,346 | 325,140 | 1,963 | **1,491,491** |
| 2011-12 | 880,071 | 35,520 | 589,887 | 8,444 | 584,459 | 2,934 | **2,101,315** |
| 2012-13 | 1,064,003 | 33,184 | 575,939 | 11,152 | 1,033,513 | 3,868 | **2,721,659** |
| Jul-13 | 1,089,765 | 33,102 | 570,916 | 11,416 | 1,078,313 | 3,936 | **2,787,448** |
| Aug-13 | 1,100,072 | 33,289 | 568,293 | 11,702 | 1,171,819 | 3,980 | **2,889,155** |
| Sep-13 | 1,149,285 | 33,220 | 570,172 | 12,021 | 1,209,927 | 4,138 | **2,978,763** |
| Oct-13 | 1,150,246 | 33,543 | 565,610 | 12,290 | 1,260,802 | 4,238 | **3,026,729** |
| Dec-13 | 1,184,736 | 33,553 | 566,452 | 12,912 | 1,379,251 | 4,595 | **3,181,499** |
| Jan-14 | 1,208,323 | 33,681 | 566,879 | 13,416 | 1,517,255 | 4,656 | **3,344,210** |
| Source: PTA | | | | | | | |

***Table 3.1: Broadband Subscribers by Technology***

***(Source: Pakistan Telecommunication Authority: Annual Report 2013-14)***

DSL, CDMA-2000 & EVDO penetration statistics in Pakistan are represented below.

DSL in Pakistan

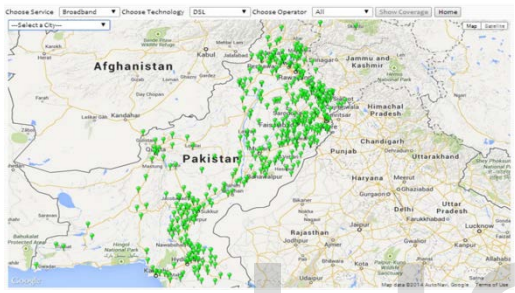



***Fig 3.6: DSL (Pakistan)***

***(Source: Pakistan Telecommunication Authority: Annual Report 2013-14)***

CDMA-2000, EV-DO in Pakistan

| Country/Territory | Operator | Technology | Type of System | Status | Infrastructure Vendor(s) |
|---|---|---|---|---|---|
| Pakistan | National Telecommunications Corporation (NTC) | 1X | WLL, 450, 1900 MHz | Commercial | |
| Pakistan | Pakistan Telecommunication Company Limited (PTCL) | EV-DO Rev. B | Mobile, 1900 MHz | Commercial | Huawei, ZTE |
| Pakistan | Pakistan Telecommunication Company Limited (PTCL) | 1xEV-DO Rev. A | WLL, 1900 MHz | Commercial | |
| Pakistan | Pakistan Telecommunication Company Limited (PTCL) | 1X | WLL, 450, 1900 MHz | Commercial | Huawei, Motorola, ZTE |
| Pakistan | Special Communications Organization (SCO) | 1X | WLL, 800 MHz | Commercial | |
| Pakistan | TeleCard Limited | IS-95A | WLL, 1900 MHz | Commercial | ZTE |
| Pakistan | TeleCard Limited | 1X | WLL, 450, 1900 MHz | Commercial | Alcatel-Lucent, ZTE |
| Pakistan | Worldcall | 1xEV-DO Rev. A | WLL, 450, 1900 MHz | Commercial | Huawei |
| Pakistan | Worldcall | 1xEV-DO Rel. 0 | WLL, 450, 1900 MHz | Commercial | Huawei |
| Pakistan | Worldcall | 1X | WLL, 450, 1900 MHz | Commercial | Huawei, Samsung |

***Table 3.3: CDMA-2000, EVDO***

***(Source: Pakistan Telecommunication Authority: Annual Report 2013-14)***

EVDO in Pakistan

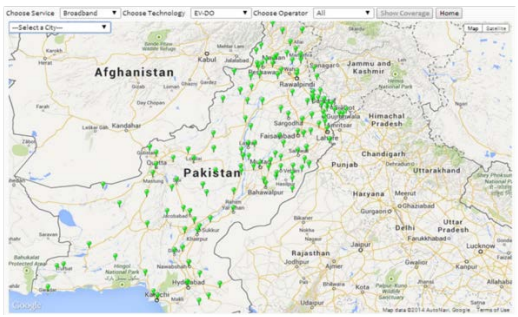



***Fig 3.7: EVDO (Pakistan)***

***(Source: Pakistan Telecommunication Authority: Annual Report 2013-14)***

Following are some of the other vital statistics in the following areas;

- Pakistan Mobile Subscribers Growth (Present/Projected)
- Pakistan Internet Subscribers Growth (Present/Projected)
- Pakistan Fixed Line Subscribers (Present/Projected)
- PTCL Products, Services & Tariffs

**Pakistan mobile subscribers – 2009-2020**

| Year | Lower growth scenario | | Higher growth scenario | |
|---|---|---|---|---|
| | Subscribers (million) | Penetration | Subscribers (million) | Penetration |
| 2009 | 97.6 | 57% | 97.6 | 57% |
| 2010 | 102.8 | 60% | 102.8 | 60% |
| 2011 | 112.9 | 64% | 112.9 | 64% |
| 2012 | 121.9 | 69% | 121.9 | 69% |
| 2015 | 140.0 | 75% | 180.0 | 96% |
| 2020 | 175.0 | 87% | 260.0 | 129% |

(Source: www.budde.com.au)

***Table 3.4: Pakistan Mobile Subscribers Growth (Present/Projected)***

***(Source: www.budde.com.au)*** [4]

**Pakistan Internet subscribers – 2011-2020**

| Year | Lower growth scenario | | Higher growth scenario | |
|---|---|---|---|---|
| | Subscribers (million) | Penetration | Subscribers (million) | Penetration |
| 2011 | 2.8 | 1.6% | 2.8 | 1.6% |
| 2012 (e) | 3.5 | 1.9% | 3.5 | 1.9% |
| 2015 | 5.0 | 2.7% | 13.0 | 7.0% |
| 2020 | 10.0 | 5.0% | 30.0 | 15.0% |

(Source: www.budde.com.au)

***Table 3.5: Pakistan Internet Subscribers Growth (Present/Projected)***

**Pakistan fixed-line subscribers – 2009-2020**

| Year | Lower growth scenario | | Higher growth scenario | |
|---|---|---|---|---|
| | Subscribers (million) | Penetration | Subscribers (million) | Penetration |
| 2009 | 6.2 | 3.8% | 6.2 | 3.8% |
| 2010 | 5.8 | 3.6% | 5.8 | 3.6% |
| 2011 | 6.0 | 3.6% | 6.0 | 3.6% |
| 2012 | 5.8 | 3.2% | 5.8 | 3.2% |
| 2015 | 6.0 | 3.3% | 7.0 | 3.9% |
| 2020 | 6.2 | 3.1% | 10.0 | 5.0% |

(Source: www.budde.com.au)

***Table 3.6: Pakistan Fixed Line Subscribers (Present/Projected)***

(Sept, 2013: Fixed Line Subscribers = 3,041,648. Dec, 2013: Wireless Local Loop Subscribers = 2,599,314. Total = 5.64 Million)


***Fig 3.8: PTCL Products & Services***

***(Source: www.ptcl.com.pk)***

| Product Name | Average Tariff | Device Price |
|---|---|---|
| Land line | Package charges: Rs. 499 per month<br>Unlimited On-Net Calls (local and long distance)<br>No Line Rent<br>Mandatory for NTCs | No Device |
| V Fone | On Net Rs. 1.20/Min<br>Off Net 1.80/Min<br>SMS 0.35<br>Internet 2.50/15 Min<br>Line Rent Rs. 120/Month | Rs. 3600/= |
| EVO 3.1 USB | Rs. 750/Month | Rs. 2250/= |
| EVO Wingle | Rs. 1250/Month | Rs. 3250/= |
| EVO Tab | Rs. 750/Month | Rs. 14500/= |
| EVO Wingle 9.3 | Rs. 2500/Month | Rs. 4000/= |
| Nitro 9.3 | Rs. 3000/Month<br>(with Bundle Offer 4 Month advance) | Free |
| DSL | Rs. 750/Month (2 MB) Upto 10-GB Download | Free |
| IP TV | Rs. 649/Month | Rs. 4999/= |

***Fig 3.9: PTCL Products/Services/Tariff***
***(Source: Pakistan www.ptcl.com.pk)***

**Research Problem, Methodology & Objectives**
**Problem Statement**

With the introduction of 3G/4G services by the mobile companies, there is an eminent threat to the legacy landline business because of the data services being offered by the mobile companies. Unless and until some sustainable model is not devised, the landline business might suffer immensely with declining revenues

**Aims and Objectives**

The objectives of this research are:

- To study the introduction of 3G/4G Services in Pakistan
- To investigate Threats and Opportunities faced by Mobile Operators
- To study the mitigation steps taken by international landline operators to counter the mobile threat.
- To devise a sustainable model which will counter mobile data threat.

**Research Methodology**

To achieve objectives mentioned earlier,

- Study of the present Telecom Market Pre-Post 3G/4G scenario.
- Study of service models of International telecom operators.
- Devising a service model to counter the threat of mobile data/services to the landline operators.

**SWOT ANALYSIS**

A comprehensive SWOT Analysis is done to access the market situation and to come up with a viable sustainable model.

**Post 3G-SWOT Analysis**

Analysis of the internal and external environment is an important part of the strategic planning process which is performed by strategic planning tool called as SWOT (Strength, Weaknesses, Opportunities and Threats) analysis.

Environmental factors internal to the firm usually can be classified as strengths (S) or weaknesses (W), and those external to the firm can be classified as opportunities (O) or threats (T).

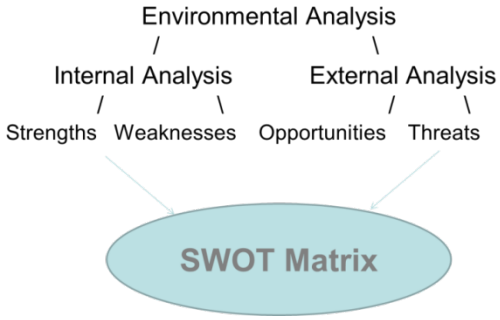



***Fig 5.1: The SWOT Analysis Framework***

***Strengths***

Attributes of the organization those are helpful in achieving the objectives.

***PTCL Strengths***

- Largest Telecommunication Company of Pakistan with an extensive network.
- Strong international brand name
- Captured great market share in telecom industry
- Generating remarkable revenues
- Competent and Skillful Human Resources
- PTCL is offering multiple value added services
- All the telecommunication companies operating in Pakistan directly or indirectly dependent upon PTCL network.
- An international gateway
- Low- rates & affordable packages

***Weaknesses***

Attributes of the organization those are harmful in achieving the objectives.

***PTCL Weaknesses***

- Quality of Service
- Customer Care
- Churn management
- Functional units are not well organized
- Access Network Issues (Ageing Network)
- Low Margins due to competition

***Opportunities***

External conditions that may be helpful in achieving the objectives.

- Huge market potential to Increase market share.

- Development of new, innovative and customized products (Increase in company product lines)
- Adopt latest technologies.
- Making technology accessible to all (e.g. broadband).
- Aggressive marketing strategy to promote its products & services
- Developing customer centric approach
- PTCL holds more than 60% of the broadband market, and offering attractive packages for its broadband service EVO – that has significantly increased its subscriber base.
- In terms of broadband users by technology, the EvDO segment remained the major contributor. It added 256,543 new subscribers, which is about 80% of the total broadband subscriptions sold by the industry in the last three months.
- Joint ventures with other telecommunication companies for cost effectiveness

***Threats***

External conditions that may be harmful in achieving the objectives.

***PTCL Threats***

- Highly competitive market
- Cellular companies entrance in 3G/4G industry
- Threats & Risks for PTCL in a Post 3G/4G Scenario
    - The mobilization of the Internet experience
    - Fixed-mobile substitution
    - Competition drives customer focus
    - Regulatory challenges
    - New devices enable the mobilization of the Internet experience
    - Most "cool" devices are 3G, 4G, WiFi enabled –
- Broadband pricing pressure
    - Intense competition in the mobile sector has led to a price war which has affected fixed broadband as well
    - PTCL DSL pricing: 10GB/month: PKR499
    - Zong GPRS/EDGE pricing:
        - 2GB/month: PKR200
        - 4GB/month: PKR400
        - Unlimited: PKR999/month or PKR10/day
- Regulatory challenges
    - Existing
        - Significant Market Power/Player (SMP) designation
        - More than 25% market share in fixed and wireless local loop, domestic and international long distance, call transit, domestic leased lines, IP bandwidth, retail and wholesale broadband access
        - Roaming in case of EVDO
        - Tariff caps
    - Potential
        - PTCL LTE plans

**Challengs for 3G Operators in Post 3G Enviornment**

There are many challenges for the 3G operators in the post 3G environment. These challenges can be summarizes as:

- Network Issues
- Network infrastructure investment
- Quality of service, data throughput
- New handsets
- Price war, low ARPU
- Broadband pricing at different stages of market development
- Service pricing in emerging market
- Churn

These are explained individually, one by one.

***Network Issues***

- Operating at 2.1GHz, UMTS coverage range is only about 65% of GSM900 for voice and 40% for 384/128kb/s data
- Additional sites may be required
- Lower frequency bands are desirable for UMTS coverage

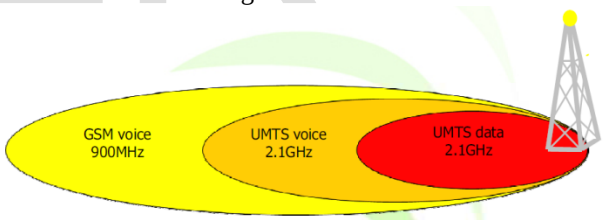



***Fig 5.2: Frequency Bands***

***Network infrastructure investment***

- 2.5G (GPRS/EDGE) core network is 3G ready
- New radio access network (RAN) required
    - Node B (base stations)
    - RNC (Radio Network Controller)
    - Antennas for 2.1GHz band, cabling etc
- Investment required for a nationwide 3G network in Pakistan is hundreds of millions of US$, potentially > US$1 billion
-

***Quality of service, data throughput***

- Experience from real life 3G networks: The average capacity of a 14Mb/s HSDPA cell may only be 1.8Mb/s
-

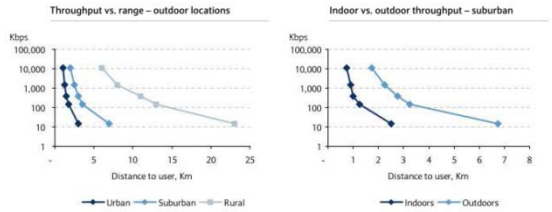



***Fig 5.3: Throughput vs Range (Indoor/Outdoor)***
***(Source: www.budde.com.au)***

***New handsets***

- Network features will only materialize if customers' handsets support them
  - Handset subsidies?
- FBR introduced a new tax on handsets in April 2013
  - PKR1,000 on smartphones
  - PKR500 on other handsets (non-satellite)
  - Expected to raise PKR5 billion in government revenue annually
  - Smartphones sell for PKR100,000…3,000

***Price war, low ARPU***

- Pakistan has some of the world's lowest prices for mobile services
  - PKR2 (US$0.02) per minute within Pakistan or to USA
  - GPRS/EDGE: PKR100 (US$1) per GB of data
    - Unlimited data for PKR999/month or PKR10/day
    - Cheaper than unlimited DSL
- More ARPU from increasing usage, new services?
  - In most markets where mobile penetration is still growing, *increasing 3G usage and falling prices have compensated each other*, so that ARPU has not risen significantly (10…20%)
  -

**Overall ARPU across all mobile operators in Pakistan – 2002; 2004 - 2009**

| Year | ARPU (PKR/month) | ARPU (US$/month) |
|---|---|---|
| 2002 | 1,135 | 19.2 |
| 2004 | 507 | 8.5 |
| 2005 | 356 | 5.9 |
| 2006 | 268 | 4.5 |
| 2007 | 255 | 4.3 |
| 2008 | 248 | 3.0 |
| 2009 (e) | 250 | 3.0 |

(Source: BuddeComm based on PTA data)
Note: PTA stopped reporting this indicator in 2008

**Mobile monthly ARPU by operator – 2009**

| Operator | ARPU (US$/month) |
|---|---|
| PMCL (Mobilink) | 2.7 |
| Telenor | 2.5 |
| PTCL (Ufone) | 3.0 |
| Warid Telecom | 3.5 |
| Zong (formerly CMPak) | 1.7 |

(Source: BuddeComm estimates based on company data)

***Table 5.1: Challenges for 3G operators: Price War, Low ARPU***

***Broadband pricing at different stages of market development***

- Case study South Africa
  - 3G end-user pricing at launch (2004):
    - 1GB of data cost R (*Rand)* 599 (US$99) per month including a dongle (24 months contracts)
  - 15% of per-capita GDP
  - Average income was R1350 (US$220) per month
  - "Early adopter" ARPU of 3G users was around US$90/month (2G users: US$24)
  - Mobile penetration was 45%
  - International bandwidth was limited (0.02kb/s per population) and very expensive
  -

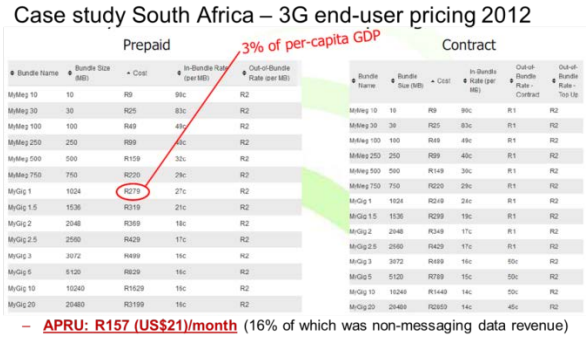



***Table 5.2: Broadband pricing at different stages of market development***
***(Source: www.budde.com.au)***

***Service pricing in emerging market***

- 3G broadband pricing in India
  - Services launched in 2010/2011
  - 1GB of data costs around INR250 (US$4) per month which is equivalent to 3% of per-capita GDP
    - *ARPU is only US$1.60 per month*
- Pakistan
  - PKR100/GB EDGE data is equivalent to 1% of per-capita GDP
  - *Prices could and should be higher*

***Churn***

- Mobile number portability (MNP) increases churn
- Churn rates in some markets are as high as 80%, can increase with 3G
  - Service availability, quality
  - Attractive offers
- What can be done?
  - Loyalty programs
  - Churn management systems
  - Targeted offers

**3G Licensing**

For the 3G licensing, there was a six years of delay in Pakistan. Following are the timelines/statistics which caused these delays and the final bidding of the frequency spectrum.

- First announced in 2007
- 2010: PTA says spectrum will be sold to existing operators who can then use it to offer 3G or 4G services 2011

  - Government announces target of US$1 billion in 3G license fees
  - PTCL claims no new spectrum concessions can be sold before March 2013 (seven years after its privatization)
  - Government says 3G licenses are not new concessions but extensions of existing ones, challenges 2013 time limit
- 2012: 3G Policy calls for spectrum auction among existing and new players
  - New players not to launch services before March 2013
  - 3 licenses with a base price of US$210 million each
    - 3 blocks of 10MHz of paired spectrum in 2.1/1.9GHz band
    - 8-15 years tenure
  - More 3G and 4G spectrum to be made available March 2013
  - Expressions of interest from:
    - Mobilink, Ufone, Zong, Qubee
    - Vodafone, NTT DoCoMo, QTel, AT&T, Roshan
- 2013:
  - New government announced technology-neutral licenses (3G/4G), increases its revenue target to US$1.2 billion
  - Withholding tax on mobile services increases from 10 to 15%
    - on top of existing 19.5% federal excise duty
  - Date set for April 2014
  - Reserve price to be set after receiving report from consultant
- 2014:
  - PTA invites bids for 3G license.
  - Turkcell expresses interest, visits PTA
- PTA Information Memorandum (Feb. 2014) www.pta.gov.pk/media/im_250214.pdf
  - 2100 MHz: 2x30 MHz for 3G (3 blocks, base price US$295m)
  - 1800 MHz: 2x20 MHz for 4G (2 blocks, base price US$210m)
  - 850 MHz: 2x7.38 MHz (new entrants only, base pr. US$291m)
- 15 years license term
- *Coverage and QoS obligations*

Table 5.3 shows the results of the final auction which took place for the sale of the frequency spectrum.

| 3G Auction | | | | | |
|---|---|---|---|---|---|
| Band | Available Spectrum | Zong | Mobilink | Ufone | Telenor |
| 2100 MHz | 30 MHz | 10 MHz | 10 MHz | 5 MHz | 5 MHz |
| | | $306.9 m | $300.9 m | $147.5 m | $147.5 m |
| 4G Auction | | | | | |
| 1800 MHz | 20 MHz | 10 MHz | | | |
| | | $210 m | | | |

***Table 5.3: 3G/4G Auction Results***

**Case Studies & Analysis**

Now we look at the case studies in the countries which have a similar telecom scenarios and environments in order to come up with a sustainable model after analyzing what other operators have done to save their landline businesses.

**How Markets Behave in Post 3G Enviornment**

In order to compare the telecom infrastructures between different countries, there is a need to do the benchmarking. One such factor is to look at is the Gross Domestic Product (GDP) of each country. Gross domestic product (GDP) dollar estimates are derived from purchasing power parity (PPP) calculations (Per Capita Income). It is calculated in terms of the value of all final goods and services produced within a country in a given year, divided by the average (or mid-year) population for the same year.

| | IMF (2012) | World Bank (2012) | CIA (2013) |
|---|---|---|---|
| • Pakistan | 254.66 | 240.91 | 258.33 |
| • India | 320.25 | 323.00 | 333.33 |
| • Bangladesh | 163.58 | 154.25 | 175.00 |
| • Indonesia | 410.25 | 413.00 | 433.33 |
| • Sri Lanka | 503.80 | 512.16 | 541.66 |

* Amount in US$ Per Month

***Table 6.1: IMF, World Bank & CIA: purchasing power parity (PPP) calculations (Per Capita Income) per year.***

***(Source: IMF, World bank, CIA)***

Or our analysis, we have picked up Pakistan, India, Bangladesh, Indonesia and Sri Lanka because of their similar telecom infrastructure plus almost similar power parity (PPP) Per Capita Income (Table 6.1) per month. It can be easily converted to per month basis for clarity (Table 6.2).

| | IMF (2012) | World Bank (2012) | CIA (2013) |
|---|---|---|---|
| • Pakistan | 3,056 | 2,891 | 3,100 |
| • India | 3,843 | 3,876 | 4,000 |
| • Bangladesh | 1,963 | 1,851 | 2,100 |
| • Indonesia | 4,923 | 4,956 | 5,200 |
| • Sri Lanka | 6,046 | 6,146 | 6,500 |

* Amount in US$ Per Year

***Table 6.2:*** ***IMF, World Bank & CIA: purchasing power parity (PPP) calculations (Per Capita Income) per month.***

Let's first have a look at the Average Revenue per User (ARPU) in all these countries as a percentage of the per capita income in case of mobile networks (Table 6.3). However the data usage on mobiles has not reached such level of usage because of many varied factors. It will not be out of place to also calculate mobiles ARPU per Month as percentage of per capita income for mobile data services (Table 6.4).

***ARPU's (Mobile) Per Month***

| | ARPU | % of Per Capita |
|---|---|---|
| • Pakistan | 2.50 | 0.98 |
| • India | 3.00 | 0.93 |
| • Bangladesh | 2.50 | 1.52 |
| • Indonesia | 3.05 | 0.74 |
| • Sri Lanka | 2.41 | 0.47 |

* Amount in US$

***Table 6.3:*** ***Mobiles ARPU: Per Month as percentage of per capita income.***
***(Source: IMF, World bank, CIA)***

***ARPU***

| | Voice | Data |
|---|---|---|
| • Pakistan | 2.20 | 0.30 |
| • India | 2.64 | 0.36 |
| • Bangladesh | 2.20 | 0.30 |
| • Indonesia | 2.68 | 0.366 |
| • Sri Lanka | 2.12 | 0.28 |

* Note: ***Data : Voice*** (10-12 Revenue is from Data; Ufone)

***Table 6.4:*** ***Mobiles ARPU: Per Month as percentage of per capita income (Mobile Data services).***

Let's now look at each countries telecom analysis in terms of the following parameters:

(a) Fixed and Mobile Operators presence
(b) Key Developments on the Telecom scene

### *1. Bangladesh*

***Operators***

| Fixed Network | Mobile Network |
|---|---|
| • Bangladesh Telecommunications Company Limited (BTCL) - formerly Bangladesh Telegraph and Telephone Board (BTTB) | • Grameenphone |
| • Peoples Telecom (Formerly Bangladesh Rural Telecommunications Authority) | • Banglalink |
| • Sheba Telecom | • Robi |
| • WorldTel | • Airtel Bangladesh |
| • Dhaka Phone | • Teletalk |
| | • Citycell |

***Table 6.5:*** ***Bangladesh: Fixed & Mobile Networks operators***

*Key Developments*

- **Bangladesh's mobile market passed 100 million subscribers in early 2013**
- **The five-year period prior to this had seen mobile subscriber numbers grew almost 20 times**
- **Of the mobile operators, Grameen Phone has 42% of the total mobile subscriber base (mid-2013)**
- **The first 3G licence was awarded to the state-owned operator, Teletalk, which launched a pilot 3G offering in late 2012.**
- **The 3G licensing for private operators was seriously delayed but finally took place in September 2013, with four operators winning licences.**
- **Coming into 2013, the number of mobile internet services had grown rapidly to dominate the online market (narrowband offerings; 2.5G-based services).**
- **The fixed-line market experienced a major setback in the first half of 2010 when the regulator shut down five operators in major move against illegal VoIP services.**
- **This market segment (fixed-line market) had effectively recovered from the setback by 2013 but it remained a depressed market with little growth**

***Table 6.6:*** ***Bangladesh: Key Developments***

### *2. India*

***Operators***

| Fixed Network | Mobile Network |
|---|---|
| • BSNL | • Bharti Airtel |
| • MTNL | • Vodafone India |
| • Bharti | • Reliance Communications |
| • Tata | • Idea Cellular |
| • Reliance | • BSNL |
| | • TATA DOCOMO |
| | • Aircel |
| | • Uninor |
| | • MTS India |
| | • Videocon |
| | • MTNL |
| | • Loop Mobile India |
| | • RIL INFOTEL |

***Table 6.7:*** ***India: Fixed & Mobile Networks operators***

*Key Developments*

- *Year 2012 saw a significant 'correction' in India's mobile market, as operators removed inactive subscribers from their databases.*
- *By end-2012 the country had 865 million mobile subscribers, for a penetration of 69%; This was down from 895 million (penetration 72%) at end-2011.*
- *By April 2013 there were 867 million subscribers as the market finally returned to positive growth.*
- *GSM had further strengthened its position as the dominant mobile technology over CDMA.*
- *The number of fixed broadband internet subscribers was steadily increasing, reaching 15 million for a penetration of just over 1% by population by the start of 2013.*
- *DSL continues to hold the major portion of the local fixed broadband market: 85% by end-2012.*
- *The market had witnessed a large scale roll-out of 3G networks by operators across the country following the long-delayed licensing; However, 3G had not immediately delivered the expected boost to the market in terms of large scale adoption of mobile data services; Nevertheless, mobile broadband was expanding rapidly and had quickly been established as a key form of broadband access.*
- *Following the Supreme Court decision cancelling operator licenses in February 2012, the re-auction of the vacant spectrum took place in late 2012 and early 2013; The process was generally seen as a failure for the government as the auctions failed to attract the level of bids and bidders; The license cancellations and subsequent re-auctioning of spectrum had been a major upheaval for India's telecom market place.*

***Table 6.8: India: Key Developments***
***(Source: www.buddee.com.au)***

### *3. Indonesia*

***Operators***

| ***Fixed Network*** | ***Mobile Network*** |
|---|---|
| • Aora | • Telkomsel |
| • Astro N | • XL Axiata |
| • Indosat | • Indosat |
| • Indovision | • Hutchison |
| • Kabelvision Indonesia | • Axis |
| • max3 | • Telkom |
| • Telkom | • Bakrie Telecom |
| • Telkomvision | • Mobile-8 |
| | • Smart Telecom |
| | • Ceria Mobile |

***Table 6.9: Indonesia: Fixed & Mobile Networks operators***

*Key Developments*

- Indonesia's mobile market passed 285 million subscribers by March 2013 with penetration running at just over 117%.
- After years of strong growth, the annual increase in mobile subscribers had moderated somewhat by 2013 to somewhere around 10%.
- The 3G market had got off to a slow start, but by 2012 there were sign of a surge in growth, with sales of smartphones jumping sharply.
- Internet subscription rates were on the increase, boosted by strong uptake of mobile broadband.
- Construction of the US$1.5 billion Palapa Ring optical fiber cable project is continuing.

***Table 6.10: India: Key Developments***
***(Source: www.buddee.com.au)***

A massive development has taken place in Indonesia which needs to be looked at more closely. The Broadband subscribers, Cellular and Fixed Line Subscribers, Indonesia Digital Network initiative are summarized below.

| | Unit | Years ended December 31, | | |
|---|---|---|---|---|
| | | 2013 | 2012 | Changes (%) |
| Broadband Subscribers | | | | |
| Fixed broadband (Speedy) | (000) subscribers | 3,013 | 2,341 | 28.7 |
| Mobile broadband (Flash) | (000) subscribers | 17,271 | 11,039 | 56.5 |
| Blackberry | (000) subscribers | 7,556 | 5,764 | 31.1 |
| **Total Broadband Subscribers** | **(000) subscribers** | **27,840** | **19,144** | **45.4** |
| Cellular Subscribers | | | | |
| Postpaid (kartuHalo) | (000) subscribers | 2,489 | 2,149 | 15.8 |
| Prepaid (simPATI, Kartu As) | (000) subscribers | 129,023 | 122,997 | 4.9 |
| **Total Cellular Subscribers** | **(000) subscribers** | **131,513** | **125,146** | **5.1** |
| Fixed Line Subscribers | | | | |
| Fixed wireline | (000) subscribers | 9,351 | 8,946 | 4.5 |
| Fixed wireless | (000) subscribers | 6,766 | 17,870 | (62.1) |
| **Total Fixed Line Subscribers** | **(000) subscribers** | **16,117** | **26,816** | **(39.9)** |

***Table 6.11: Indonesia: Users Statistics for various services***
***(Source: Indonesia Digital Network)***

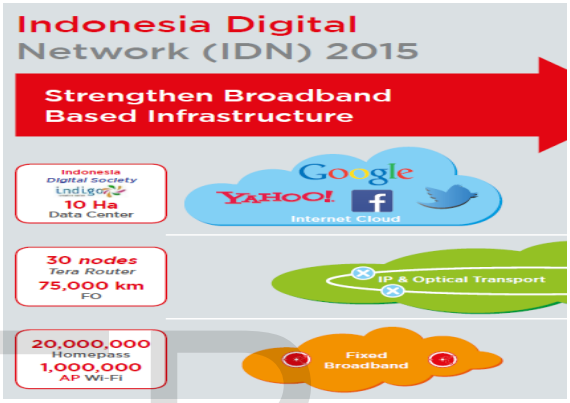



***Fig 6.1: Indonesia Digital Network (IDN)***
***(Source: Indonesia Digital Network)***

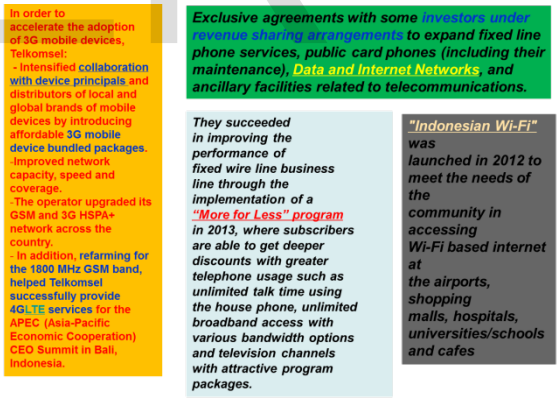



***Fig 6.2: Indonesia: Initiatives***

### *4. Sri Lanka*

***Operators***

| ***Fixed Network*** | ***Mobile Network*** |
|---|---|
| •Sri Lanka Telecom (SLT) | •Dialog Axiata PLC |
| •Lanka Bell Limited | •Mobitel (Pvt) Ltd |
| •Suntel | •Etisalat Lanka (Pvt) Ltd |
| | •Bharti Airtel Lanka (Pvt) Ltd |
| | •Hutchison Telecommunications Lanka (Pvt) Ltd |

***Table 6.12: Sri Lank: Fixed & Mobile Networks operators***

| Key Developments |
|---|
| - *Successful implementation of its ultra high speed Broadband Network under its nation-wide network modernization project "i-Sri Lanka" which has already driven an increase of 40,000 new broadband connections to the network.*<br>- *It will provide ultra high speed broadband 20Mbps service to more than 90% of customers.*<br>- *Broadband and PeoTV (triple play) services.*<br>- *The i-Sri Lanka project was kicked-off in 2011 to enhance and upgrade SLT's existing fixed network, by expanding the fibre network to bring it closer to customers through Fibre-to-the-Node (FTTN) deployment of Multi-Service Access Nodes (MSANs).*<br>- *Next Generation Network (NGN) modernization project.*<br>- **Despite a global trend of declining fixed line subscribers, SLT has consistently driven a steady increase in fixed customers over the last 3 years.**<br>- **The Company's impressive product range and the demand for high speed uninterrupted Broadband and entertainment through PEO TV has seen fixed PSTN line (SLT Megaline) customers steadily increase.**<br>- **The demand for high speed uninterrupted broadband has fuelled the company's strategy to deliver double-play and triple-play services, which has contributed to ongoing growth in our fixed customer base and revenues.** |

***Table 6.13: Sri Lanka: Key Developments***
***(Source: www.buddee.com.au)***

As is the case with Indonesia, Sri Lanka has also shown very promising initiatives/development in terms of mobile subscribers and Sri Lankan telecom product Portfolios.

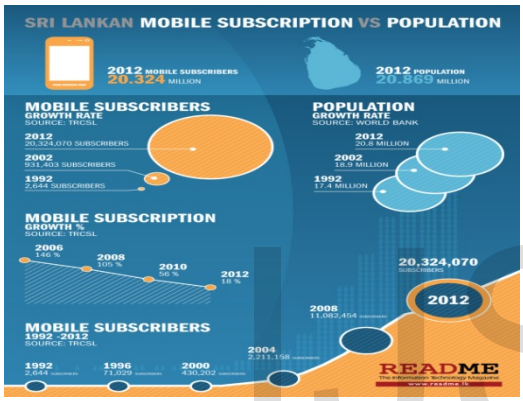



***Fig 6.3: Sri Lanka: Mobile Subscriber's vs population***
***(Source: Readme)***

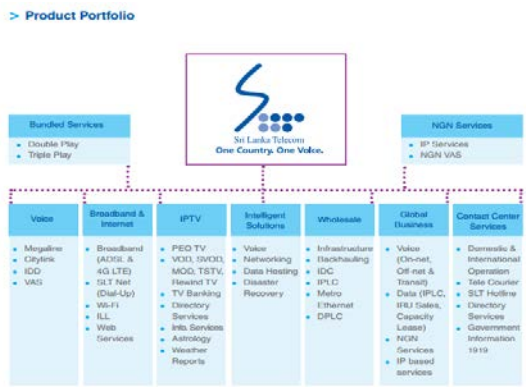



***Fig 6.4: Sri Lanka: Siri Lanka Telecom Product portfolios***
***(Source: Sri lanka Telecom)***

The in-depth analysis of the telecom scene and different developments taking place in the countries around us while also keeping the western trends in mind, we are in a better position to place and develop a model to implement our own strategy which will be both modular and sustainable for the future growth.

**Conclusion, Model & Recommendations**

In the end, conclusions are drawn, a sustainable model is developed and future recommendations are made.

**Post 3G Road Map for Fixed Line Operators**

Based on the data analysis, following are the outcomes as far as the fixed line operators are concerned.

**1. Opportunities & Strategies**

Opportunities and the strategies for the fixed line operators to stay in the business are outlined below:

- **Focusing on high bandwidth users/applications**

– Current mobile networks will begin to struggle with average data consumption per user of around
• 9GB/month (3.5G, 42Mb/s, 10MHz spectrum, 50% penetration)
• 22GB/month (LTE added, 10MHz spectrum, 50% penetration)
– Only fixed-line broadband can support the premium customer segment
• High-usage urban residential and SME sector
• Business/enterprise sector
• Government, public sector

- **Maximizing the copper asset: From ADSL to VDSL2+**

– The copper access network of a national carrier is a valuable asset that is not easily replicated or replaced
– Technology evolution has enabled quantum leaps in bandwidth
  • ADSL: up to 8Mb/s
  • ADSL2, ADSL2+: up to 24Mb/s
  • VDSL, VDSL2, 2+: up to 200Mb/s (up to 300m from the DSLAM, can be extended with FttN)
– Telcos who fail to follow this path risk losing their fixed-line business to competitors

- **Case Studies**

Table 7.1 outlines various case study comparisons as to how some operators suffered or initiate certain steps to deal with the fixed line challenge.

| **Not maximizing the copper asset: Telkom Kenya** |
|---|
| – Majority stake was acquired by France Telecom/Orange in 2007<br>– Concentrated on the mobile sector, incl. mobile broadband<br>– As of 2014, DSL service is still only available at |

| |
|---|
| 256kb/s…2Mb/s<br>– Fixed-lines in service fell 80% from 265k to 58k<br>– 11k ADSL users (population 44 million)<br>– Three competitors rolled out metropolitan and long-distance fiber optic networks since 2005 and have 60k FTTH subscribers<br>– Telkom reacted in 2011 by installing FTTH in two suburbs of Nairobi |
| **Maximizing the copper asset: From ADSL to VDSL2+: Pakistan** |
| – PTCL launched VDSL in 2011 in Karachi, Lahore, Islamabad in combination with FTTC, FTTB<br>– Unlimited downloads<br>• 10Mb/s: PKR 9,999/month<br>• 20Mb/s: PKR15,000/month<br>• 50Mb/s: PKR20,000/month<br>– Nayatel installed FTTH in Islamabad in 2007 |
| **Telekom Malaysia (TM) HSBB project** |
| – National High Speed Broadband (HSBB) infrastructure using a mix of fiber and VDSL, 20,000 WiFi hotspots<br>– Initiated 2008, launched 2010<br>– Urban and suburban areas<br>– Total cost estimated at MYR (*Malaysian* Ringgit)11.3 billion (US$3.3 billion) over ten years<br>• Government contributed MYR5.8 billion<br>• Strict procurement policy, 'out of the box' strategy saved MYR 1 billion<br>– 1.5 million households (of 6.2 million) passed by Sept. 2013<br>– Triple play, 20Mb/s<br>– Content development platform, encouraging local developers<br>– Wholesale deals with other major telcos under Open Access model (condition of government funding)<br>– Faster growing than NBNs (National Broadband Networks) in Singapore, Australia, New Zealand |

***Table 7.1: Case Studies***

- **Backhaul Services**

• New fixed-line products for 3G operators
– Need for increased backhaul capacity
• Tens of thousands of 3G and 4G base stations will require backhaul capacity upgrades
• Fiber offers better latency than microwave links (µs vs. ms)
• Rapid response ability required

- **Multimedia services and applications**

– Presence services
– Enhanced Voicemail (e.g. message forwarding, web-based interface)
– Unified Messaging (voice, SMS, MMS, IM)
– Audio/Video/Web Conferencing
– Content Sharing (e.g. video streaming, web content)
– Location-based services (location finder, navigation, traffic)
– Electronic ticketing (events, travel, boarding pass)
– Multi-network, multi-device access
– Inter-network, inter-device handover

- **Drivers for network operators to adopt IMS**

– New revenue streams from multimedia services
• Subscriber growth is slowing
• Mobile voice market is saturated, ARPU is falling
– Reduce costs
• Next-Generation Network (NGN) approach
• Easier, faster implementation of new services
• Standardized third-party interfaces, multi-vendor approach

- **LTE as an extension of the fixed broadband network**

– Australia: National Broadband Network (NBN)
• $36…73 billion (!) nationwide FTTH deployment
• 93% of homes, schools, workplaces
– Australia urbanization: 89%
• Political project born
• First 100Mb/s promised, then 1Gb/s
• Opposition (now in government) wants to substitute more FTTH with FTTN and with wireless, especially in rural and regional areas

- **Worldwide Trend for IPTV Services**

• Worldwide revenue growth for IPTV services in the next five years will outpace gains of the overall global pay-TV space
• Between 2011 and 2017, IPTV revenues are anticipated in 2017 to reach $21.3

billion, more than double 2011 revenues totalling $9.7 billion
- Global IPTV revenues forecast to double by 2017 with U.S. leading the way

- **Fiber Optic Access Strategies in Low ARPU Environment**

Fiber to the home can be achieved first by first going up to the fiber to the node, then the curb/cabinet and finally to the building. This will simply divide the project into smaller chunks, thus fewer investments before finally reaching all the way to the customer premises (Fig 7.1).

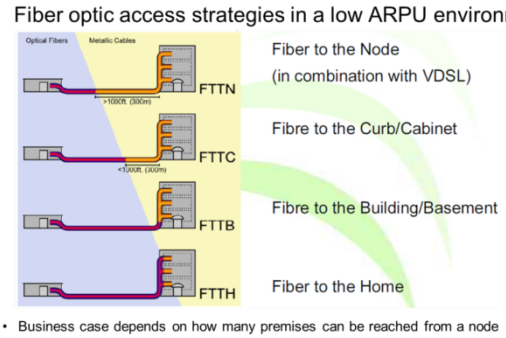



***Fig 7.1: Type of Fiber optic Access (Low ARPU's)***

***(Source: PTCL)***

- **Worldwide WiFi Hotspots**

The growth of the hotspots around the world (Fig 7.2) has simply changed the dynamics of the business. The best strategy for the landline operators is to either start on its own or enter into agreements with the hotspot operators by providing them with the backend bandwidth.

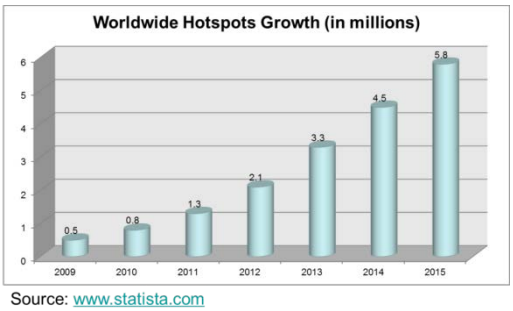



***Fig 7.2: Hotspots Growth around the World***

- **Tariffs**

- By introducing low cost tariffs, competitor base pricing, flexible and affordable promotion packages like Vodafone has done in India & Grameen phone in Bangladesh.
- To compete on volume as initial price of 3G data is going to be high due to huge licensing and infrastructure costs.
- Creating competitive & innovative service bundling.

- **Developing Customer Centric Approach**

- Creating Value for your services
- Value your customer and meet their expectations
- Formulate strategies to retain customers
- Transform organizational culture into superior service culture
- Become a solution provider and get the competitive edge

**Model & Recommendations**

All the above Strategies for Fixed Line companies to turn challenges into new opportunities can be summarized as:

- Focusing on high bandwidth users/applications
- Capturing the high value business/enterprise segment
- New fixed-line products for 3G operators
- Mobile data offloading – WiFi, Femtocells
- Fixed-wireless business (CDMA2000-EVDO)
- 4G opportunities for landline operators
- LTE as the extension of the fixed broadband network
- Integrating the landline and mobile business
- Multimedia services – IMS for mobile and fixed operators
- Moving towards an All-IP network – The NGN concept


***Fig 7.3: Developed Model: Sustainable Action plan***

This research has focused on the way the 3G technology shall affect PTCL growth and its potential to do so in future. In our attempt to understand the impact of 3G invasion, we focus on how economic growth and prosperity have been affected in other parts/countries of the world and how PTCL can move forward and transform this threat into a big opportunity by taking various steps to save its landline business.

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