

Basic Concepts Of Telecommunication

[Part 1]

Prepared By :
Tilak De Silva - Expert

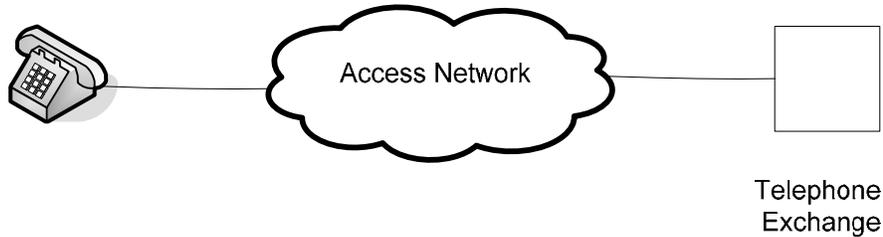
Assisted By :
Chandima Ranasinghe

25.11.2005

Telecom Basics

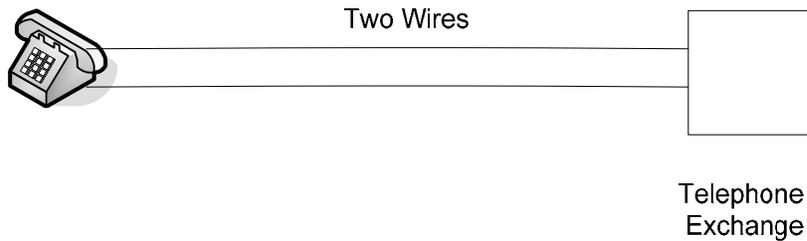
1. What is a telephone Access Network?

The network used to connect the telephone-to-telephone exchange.



2. What is Wired and Wireless?

The connection between telephone and exchange can be two copper wires or radio wave. If copper wires are used it is called wired connection.



It is required two wires to connect the telephone and exchange. It is called a local loop.

This connection also can be provided by a radio wave. It is called a Wireless Local Loop (WLL).

3. What is a fixed telephone?

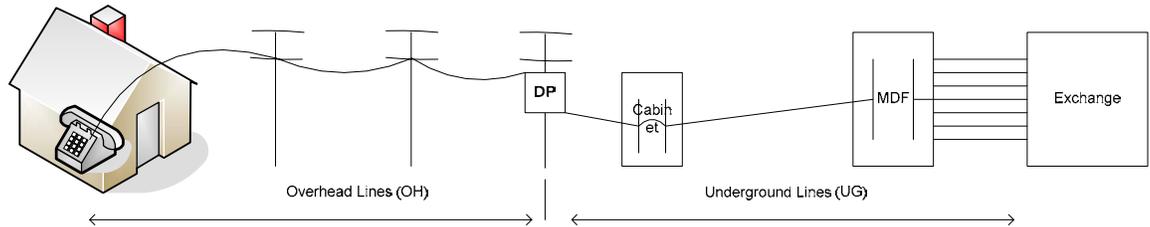
If the telephone is not moved from its position it is called a fixed telephone.

4. Who are the fixed line operators in Sri Lanka?

- Sri Lanka Telecom
- Suntel
- Bell

SLT provides both wired and wireless local loops. Suntel and Bell provides wireless local loops only, therefore they are called WLL operators.

5. Show the path of wired connection



6. What are the devices/Stages involved to a wired connection?

- Telephone exchange
- MDF
- Cabinet
- DP
- Telephone

7. What is the function of telephone exchange?

When a telephone dials a number it is received by the telephone exchange and analyses the number and connect to the relevant telephone via the remote exchange.

For the calls received from the remote exchange the originated telephone exchange checks whether the relevant telephone is free or busy. If the telephone is busy the busy tone is sent to the other exchange. If the telephone is not busy the ring back tone is sent to the other exchange.

Note: These are the basic functions of a telephone exchange. There are many other functions also done by the telephone exchange.

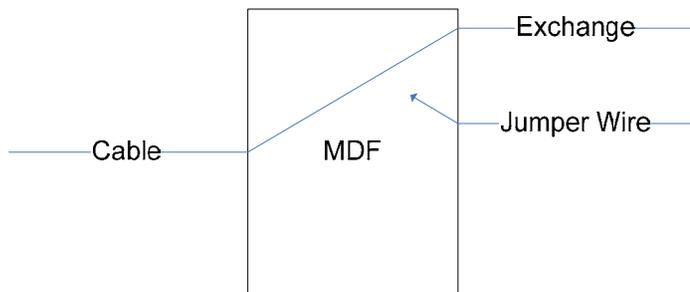
8. What is MDF?

MDF stands for Main Distribution Frame.



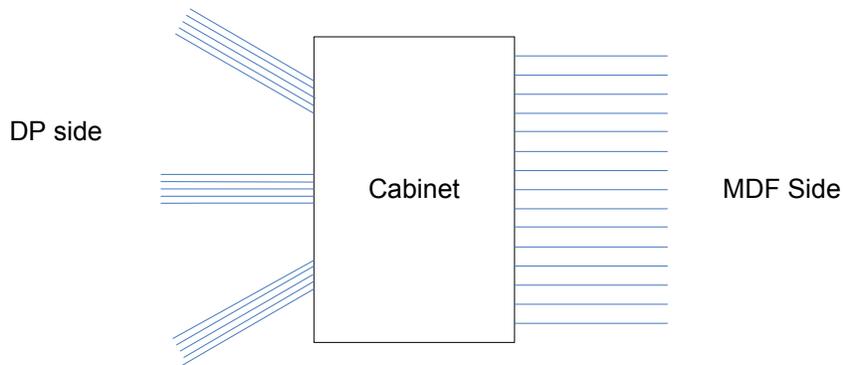
MDF is the interface between telephone exchange and telephone cables. At the time of installation of exchange all telephone channels (line cards) are terminated at the MDF.

The multi pair telephone cables are terminated at the other side.



When a new connection is given the exchange side relevant point and cable side relevant point are connected by using another small cable. This small cable is called a jumper wire. MDF is a passive device. (No need of electrical power to operate.)

9. What is a Cabinet?



50 pair, 100 pair, 200 pair etc. multi pair cables are drawn from MDF to cabinet. From the cabinet 10 pair, 5 pair cables are drawn up to Distribution Points (DPs).

Primary cable - MDF to cabinet cable is called primary cable.

Secondary Cable - Cabinet to DP cable is called Secondary Cable.

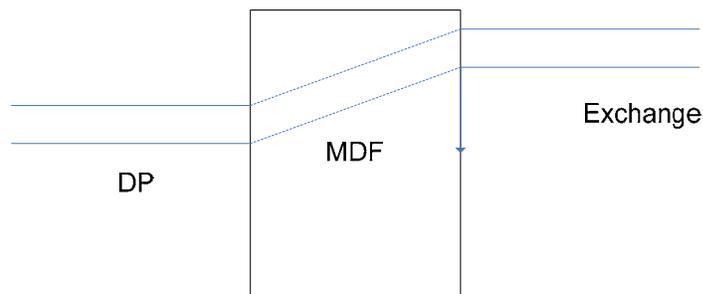
Primary cable to Secondary cable jumpering is done at the cabinet.

10. What is a DP?

A 10 pair or 5 pair cable is laid from Cabinet to Distribution point (DP). That means, there are 10 loops or 5 loops in a DP. When a new connection is provided a pair of cable is drawn from DP to home. That means normally 10 or 5 telephone new connections can be provided from a DP.

11. What are the works to be done to provide a telephone new connection?

- DP to house cabling (Normally Over Head cabling)
- Jumpering at MDF
- The telephone exchange identifies a free line. It is connected to the Allocated loop.

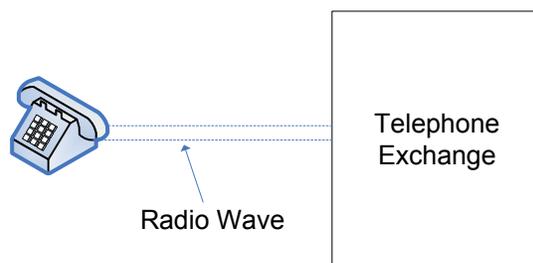


- Allocate a telephone number from the exchange and program it in the exchange.

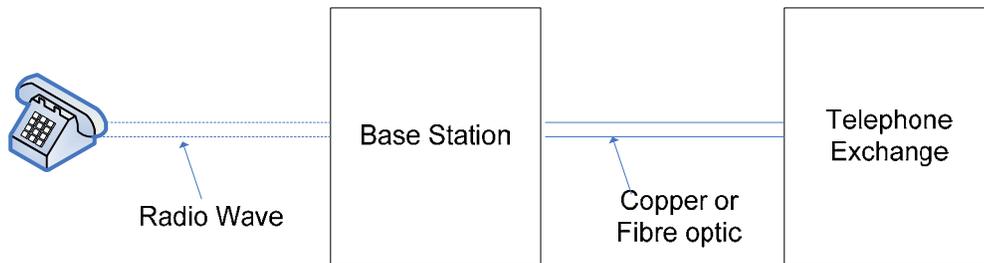
In order to provide a new connection all above functions have to be completed.

12. What is a Wireless Access Loop?

The telephone
And exchange is connected by using a radio wave.



In practical scenario, an intermediate unit is used. It is called a Base station.



Telephone is connected to Base Station by using a radio wave. The Base Station is connected to telephone exchange by using copper or fibre optic.

13. What are the components in Base Station?

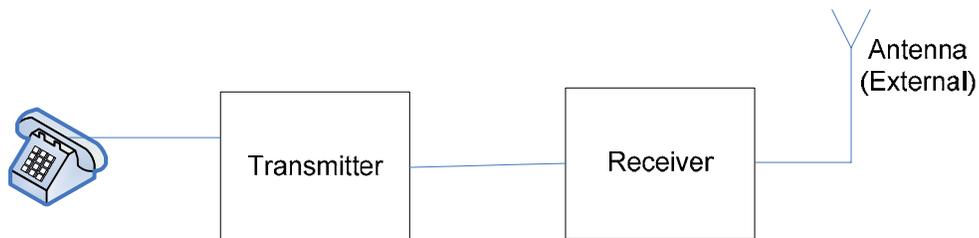
- Transmitter
- Receiver
- Antenna

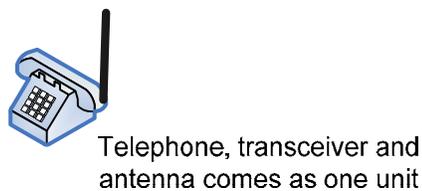
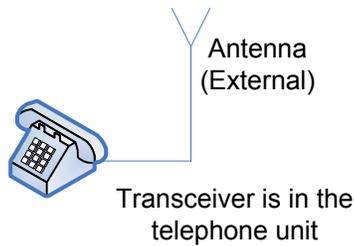
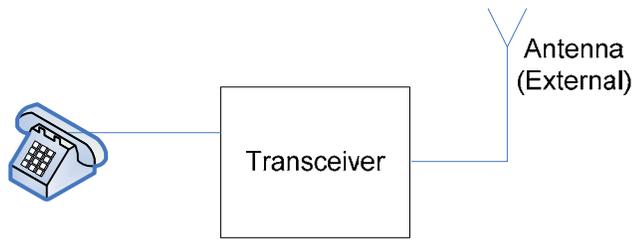
Normally Transmitter and Receiver come as one unit and it is called Base Transceiver Station (BTS).

14. What are the components of Customer Premises?

- Transmitter
- Receiver
- Antenna
- Telephone

The whole set is called Customer premises Equipment (CPE).





The transmitter and Receiver need electrical power to operate. If they are in the telephone unit it should be provided the electrical power. (e.g.: Normal CDMA telephone)

15. What is a Radio Wave?

Any signal energy travels through the air (atmospheric) as a wave.

16. What are the characteristics of a wave?

It has a frequency (f), wave length (λ), and Speed (V).

The letter λ is a Greek Letter and it is called Lambda.

The relationship of those three are,

$$V=f \lambda$$

17. How a signal travels through copper cable and fibre optic cable?

Signal travels as a Wave.

18. Is there any difference between Radio Wave and Copper and Fibre Waves?

No, all belong to electromagnetic waves.

19. What is an Electromagnetic wave?

The energy travels as electric energy and magnetic energy.

20. What is Frequency?

It is one of the characteristics of a wave measured in Hertz (Hz).

Normally frequency is measured in kHz, MHz, GHz, THz.

- k – kilo - 10^3
- M – Mega - 10^6
- G – Giga - 10^9
- T - Tera - 10^{12}

Eg: kHz – Kilo Hertz

21. What is Wave Length?

It is another characteristic of a wave and measured in meters. Normally measures in millimeter (mm), micrometer (μm), nanometer (nm).

μ is a Greek letter and it is called mew.

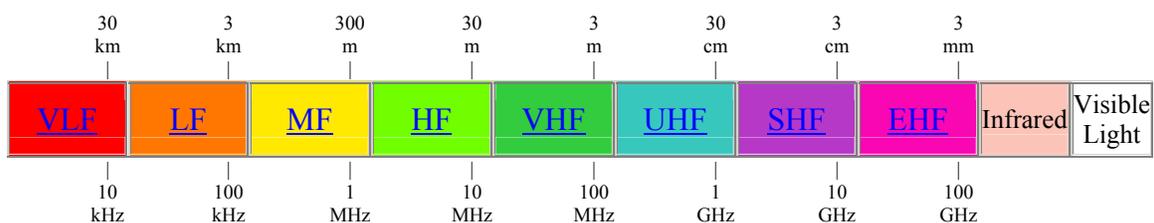
- m – milli - $1/1000 - 10^{-3}$
- μ - micro - 10^{-6}
- n – nano - 10^{-9}

Normally the electromagnetic waves in fibre are measured as a wavelength, not as frequencies.

Eg: 1300nm, 1550nm

22. What is frequency spectrum?

The usable electromagnetic frequency range (Band) is called frequency spectrum.



23. What is a transmission media?

An electromagnetic wave can be sent through

Copper

Radio

Fibre optic

They are called transmission media.

24. What are the usable frequency bands of different transmission medias?

Copper - from Hz to Mhz

Radio - from kHz to GHz

Fibre optic - T Hz range

25. What is guided media?

Copper and fibre optic are called guided media since the wave goes through the media. Those waves will not interfere with each other.

26. What is unguided media?

Radio waves go through air (free space). There is no physical connection between the transmitter and receiver. Therefore free space is called unguided media.

If two signals are transmitted with same frequency these two can be mixed up and both will not be able to use. (Just like the two airplanes fly at same height of same route)

Therefore the usage (allocation) of frequencies should be controlled by a particular body. In any country it is controlled by a government body. In Sri Lanka Telecommunication Regulatory Commission (TRC) controls it.

The usable frequency band also called “frequency spectrum”.

27. What are the standard frequency bands?

Different frequency ranges are given different names.

Designation		Frequency	Wavelength
ELF	Extremely low frequency	3Hz to 30Hz	100'000km to 10'000 km
SLF	Super low frequency	30Hz to 300Hz	10'000km to 1'000km
ULF	Ultra low frequency	300Hz to 3000Hz	1'000km to 100km
VLF	very low frequency	3kHz to 30kHz	100km to 10km
LF	low frequency	30kHz to 300kHz	10km to 1km
MF	medium frequency	300kHz to 3000kHz	1km to 100m
HF	high frequency	3MHz to 30MHz	100m to 10m
VHF	very high frequency	30MHz to 300MHz	10m to 1m
UHF	ultrahigh frequency	300MHz to 3000MHz	1m to 10cm
SHF	Super high frequency	3GHz to 30GHz	10cm to 1cm
EHF	extremely high frequency	30GHz to 300GHz	1cm to 1mm

Different frequency bands are suitable for different usages (applications).
Different band also gives different letters.

e.g.:

1-2 GHz 30-15 cmL Band
2-4 GHz 15-7.5 cmS Band
4-8 GHz 7.5-3.75 cmC Band
8-12 GHz 3.75-2.50 cm..... X Band
12-18 GHz 2.5-1.67 cmKu Band
18-27 GHz 1.67-1.11 cmK Band
27-40 GHz 1.11 cm-7.5 mm ..Ka Band