Mobile Computing

07/01/2020

MC: we can use any device / compute the mobile (moving) devices.

eg- phone, laptop

computing: commⁿ

In MC, atleast one device must be in movement.

eg- wifi, bluetooth, Infrared, Internet, - applⁿ of MC.
satellite, GPS, GSM, GPRS

applⁿ of MC

horizontal　　vertical

vhf - very high freq
uhf - ultrahigh freq
hf - high freq

Defiⁿ

MC is the ability to use technology while moving.

→ It is a term used to describe technologies that enable people to access n/w services anyplace, anytime and anywhere.

→ MC is to work from a nonfixed location using portable computing or commⁿ devices such as laptops, notebooks, PDAs, smart cell phones etc.

→ This technology enables the mobile workers to create, access, process, store and communicate info without being constrained to a single locⁿ

Mobile Computing

07/01/2020

MC : we can use any device / compute the mobile (moving) devices.

eg - phone, laptop

computing : comm^n

In MC, atleast one device must be in movement.

eg - wifi, bluetooth, Infrared, Internet, - appl^n of MC.
satellite, GPS, GSM, GPRS

appl^n of MC
- horizontal
- vertical

vhf - very high freq
uhf - ultrahigh freq
hf - high freq

Defi^n

MC is the ability to use technology while moving.

→ It is a term used to describe technologies that enable people to access n/w services anyplace, anytime and anywhere.

→ MC is to work from a nonfixed location using portable computing or comm^n devices such as laptops, notebooks, PDAs, smart cell phones etc.

→ This technology enables the mobile workers to create, access, process, store and communicate info without being constrained to a single loc^n

Technologies that enable MC

→ Wireless LAN (WLAN)

→ Satellite

→ Cellular digital packet data (CDPD)

→ Personal comm^n System (PCS)

→ Global System for Mobile comm^n (GSM)

→ Specialized mobile ~~std~~ Radio service (SMR)

→ One and two way paging
hardware

→ plane old telephone system (POTS)

→ Internet

→ Infrared

→ Docking (it can be serial, parallel or LAN)

→ Disk swapping

Appl^n of MC

↳ MC appl^n are divided into 2 categories

Horizontal
(it is broad based appl^n and include s/w)
eg - email, web browzing, word processing, scheduling, messaging, TO DO list, presentation

Vertical → like vodafone, ...
(it is industry specified)
eg - retailing, utilities, warehousing, shipping, law enforcement and public safety.

Mobile Commⁿ

Mobile Commⁿ entails transmission of data to and from handheld devices.

Out of two or more commⁿ devices, atleast one is handheld/mobile.

The locⁿ of the device can vary either locally/globally and commⁿ takes place through a wireless, distributed or diversified n/w.

The commⁿ can be

- guided
- unguided

Guided Transmission

	Optical fibre	Coaxial cable	Twistedpair cable	Power line
range	10^3 Km	40m	2Km 100KHz	below 525 kHz
maxⁿ freq	2×10^4 Hz	500 MHz	100 200MHz	

Adv →

- Multiple sources can transmit simultaneously using multiplexing & coding
- directed path (pt to pt) very little interference b/w the cables

~~using multiplexing and coding~~

★ Disadvantages of transmission through cable :-

→ signal transmitter & receiver are fixed (immobile). Hence, there is no mobility of transmission and reception points.

→ no of transmitters and receivers systems limits the total no of interconnection possible.

Unguided transmission / Wireless

It is carried out through radiated electromagnetic energy.

~~Electrical~~

Signal Propagation

Electrical signal are transmitted by converting them into electromagnetic radiation. This radiation are transmitted via antenna that radiates electromagnetic signals.

There are various freq bands within electromagnetic spectrum and all have diff transmission requirement.

We consider two freq range for wireless transmission

a) vhf - very high freq

b) uhf - ultra high " ⟶ ($\lambda/4$ length)

The freq. f (whenever in MHz), wavelength, λ (in m) of electromagnetic radiation are related by

$$\boxed{f = \frac{c}{\lambda}}$$

if air is medium, $c = 3 \times 10^8$ m/s

✓- remember freq

VHF
R ~ 50 Km ✓
f ~ 50 - 250 MHz

TV VHF
f ~ 174 - 230 MHz ✓

Adv: → freq modulation & multiple freq band transmission is possible
→ transmitting antenna length is 3m to 60cm (due to small $\lambda/2$ length)

Disadv: → Mobility is not practical as transmitting & receiving antenna length is 3m to 60cm and a directed multi dipole or disk antenna is required at receiving end.

UHF
f : 200 - 2000 MHz ✓

GSM
f ~ 890 - 960 MHz

DECT & 3G
f ~ 1880 - 2890 MHz

Digital audio broadcasting

Adv: → multiple freq bands, modulation methods, multiplexing and coding are feasible due to the availability of greater BW
→ mobility is quite practical

Disadv → signal quality degrades due to loss within buildings and reflection from large buildings.
→ A large no. of base stations are required at separation of about 1 to 5 Km each.

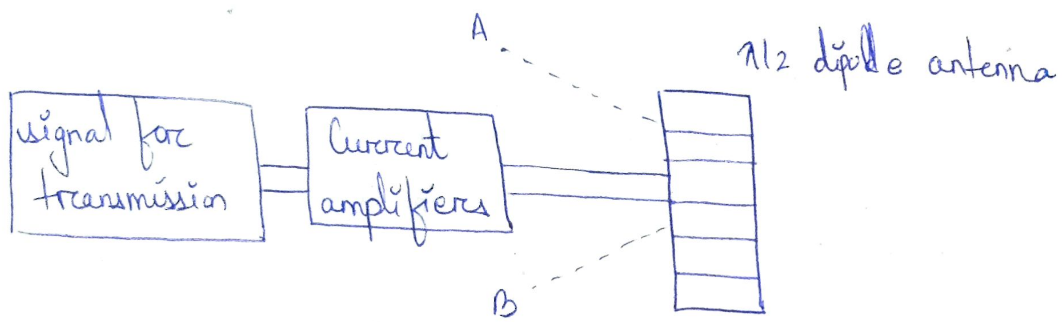
DECT : Digital Enhanced Cordless Telecommⁿ.

Antenna

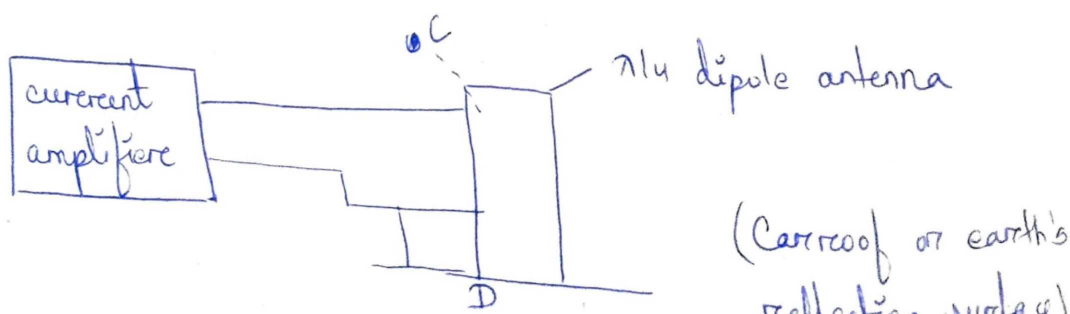
It is a device that transmits and receives electromagnetic signals.
Normally, it functions properly for narrow freq range.
If antenna is not properly tuned to the freq band in which transmitting system connected to it operates, the transmitted and receiving signal may be impaired.

Types of antenna is based on freq range they operate, can be

i) dipole antenna (two end remain 180° out of phase) (eg- TV antenna)
ii) parabolic Disc



(λ/2 dipole antenna)



(λ/4 dipole antenna)

* $\frac{\lambda}{2}$ / $\frac{\lambda}{4}$ antenna are called dipole antenna as at any given instant, both ends A and B are 180° out of phase

14/1/20

Q A 200 MHz – 2000 MHz uhf signal is to be transmitted wirelessly. Calculate length of dipole antenna required for transmission.

{ans : 7.5 cm to 75 cm}

$$\lambda_1 = \frac{c}{f} = \frac{3 \times 10^8 \text{ m/s}}{200 \times 10^6 \text{ s}}$$

$$= 1.5 \text{ m}$$

$$\therefore \text{length of dipole} = \frac{\lambda}{2} = \frac{1.5}{2} \text{ m} = 0.75 \text{ m}.$$

$$\lambda_2 = \frac{c}{f} = \frac{3 \times 10^8 \text{ m/s}}{2000 \times 10^6 \text{ s}}$$

$$= 0.15 \text{ m}$$

$$\therefore \text{length of dipole} = \frac{0.15}{2} = 0.075 \text{ m}$$

Assign.

Q A dipole antenna is to be mounted on a conducting surface. Calculate length of the required antenna for transmitting a GSM signal. of freq 900 MHz.

$\lambda/4$ antenna

$$\lambda = \frac{c}{f} = \frac{3 \times 10^8}{9 \times 10^8} = \frac{1}{3} \text{m} \quad \therefore \text{length} = \frac{\lambda}{4} = \frac{1}{12} \text{m} = 8.33 \text{ cm}$$

$\lambda/4$ antenna

This antenna is mounted on a long conducting surface.

eg- roof of car, moist ground surface

At any time, the end C and surface, D are 180° out of phase.

The original and reflected waves thus superimpose and create the same electrical effects as in $\lambda/2$ antenna.

In general, length of antenna $\propto$ wavelength, λ

$$\rightarrow \quad " \quad " \quad " \quad \propto \frac{1}{\text{freq of transmitted signal}}$$

→ The radiation pattern of given antenna defines a path of a which each point will have identical signal strength at any given instant

→ A circular pattern means radiated energy and thus the signal strength is equally distributed in all directions in a plane.

Signal Propagation

Wireless propagation of signal faces many complications as the antenna height & size at mobile terminals are very small. So, in order to minimize the significance influence of obstacles, propagation routes have to be designed specially and calculated taking into account of various types of propagation loss.

Also the propagation properties vary with place and time for a mobile terminal.

So, generally ~~statiscal~~ statistical propagation model are used whereby no specific data paths are considered rather channel parameters are modelled as ~~stocas~~ stochastic variables (probability based random variables). random variable is used

~~i) Line of sig~~

The parameters which affect signal propagation are :-

i) Line of sight

It is transmission of signal without refraction & diffraction or scattering in b/w the transmitter and receiver.

→ Signal strength in free space decreases as the sqr of the dist from the transmitter as at larger distances, the radiated power is distributed over a larger, spherical surface area.

mid. sem.
Q A transmitter sends a signal which has strength of 9 μW/cm² at a dist of 500 m. Assuming free space propaⁿ in line of sight, calculate signal strength at 1500 m.

ii) Attenuation

→ Signal strength also decr. due to attenuation when obstacles in the path of signal is greater in size than the wavelength of signal.

→ Few eg are

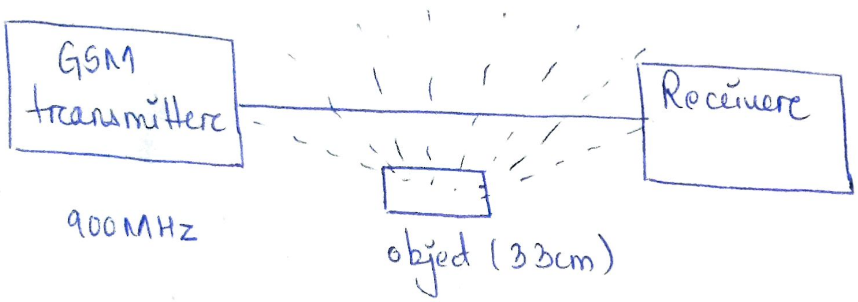
a) If a FM radio sends out a 90 MHz ($\lambda = 3.33$m) band signal then signal will be attenuated by size 10 m and above.

b) If a transmitter sends a GSM signal of 900 MHz, ($\lambda = 33.33$ cm), it will face attenuation of object 1 m and above.

iii) <u>Scattering of signal</u>

A signal scatters when it encounters an obstacle of size <u>equal to or less than the wavelength</u>.

eg A GSM signal, 33 cm (900 MHz) in wavelength is scattered by an obj of $\boxed{30\text{ cm}}$ or less.

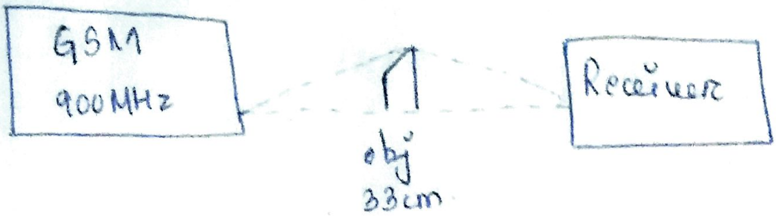


iv) <u>Diffraction of signal</u>

A signal bends as a result of diffraction from the edge of an obstacle of size <u>equal or less than</u> the wavelength.

eg GSM signal, 33 cm in wavelength will be diffracted from obj of $\boxed{33\text{ cm}}$ or less.

* In scattering, small part of signal reaches receiver anyway.
In diffraction, signal may or may not reach the " depending on geometry of object/obstacle and the separation b/w the obj receiver and transmitter.



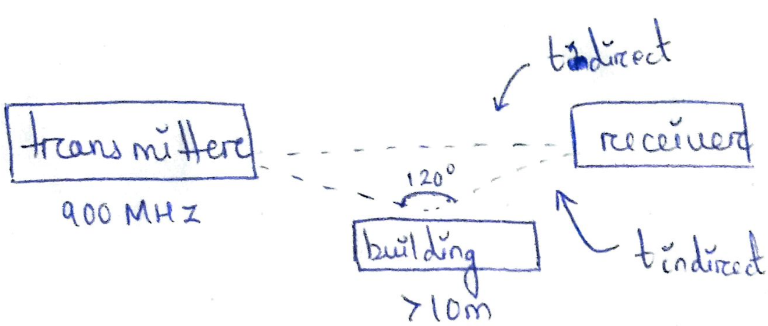
v) Reflection of signal

A signal may be reflected from the surface of obstacle of size greater than wavelength of signal.

eg A GSM signal 900 MHz will be reflected when obstacle size is 10m or above.

→ Reflected signal offers a delay in reaching its destination

$$\text{delay} = t_{indirect} - t_{direct}$$
$$= \frac{\text{additional path travelled (in m)}}{3 \times 10^8 \text{ m/s}}$$



Assign.

Q A receiver receives 2 signals, one directly in line of sight and other after a reflection of 120° from a transmitter at a dist of 1000m.

Calculate the delay in reflected signal wrt direct signal.

$$t_{direct} = \frac{1000}{3 \times 10^8} s = \frac{1}{3 \times 10^5} s = 3.33 s$$

$$t_{indirect} = \frac{1000}{\sin\left(\frac{120^\circ}{2}\right) \times 3 \times 10^8}$$

$$= 3.85\ \mu s$$

$$\text{delay} = t_{indirect} - t_{direct}$$

$$= (3.85 - 3.33)\ \mu s$$

$$= 0.52\ \mu s.$$