

Lect5: Wireless Communication System Types

Dr. Yazid Khattabi

Communication Systems Course

EE Department

University of Jordan

Wireless communication system types

Terrestrial fixed links

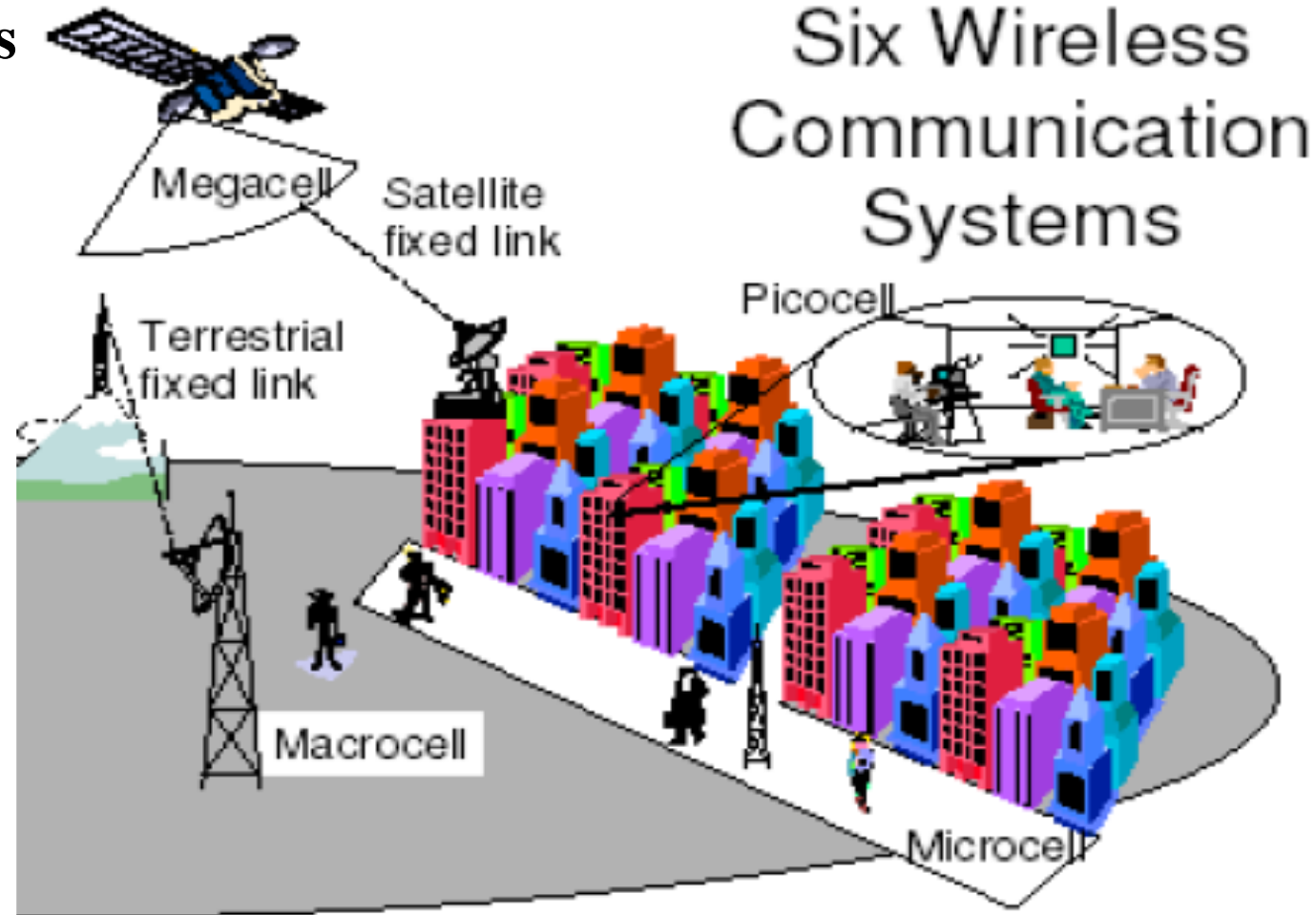
Satellite fixed links:

Megacells:

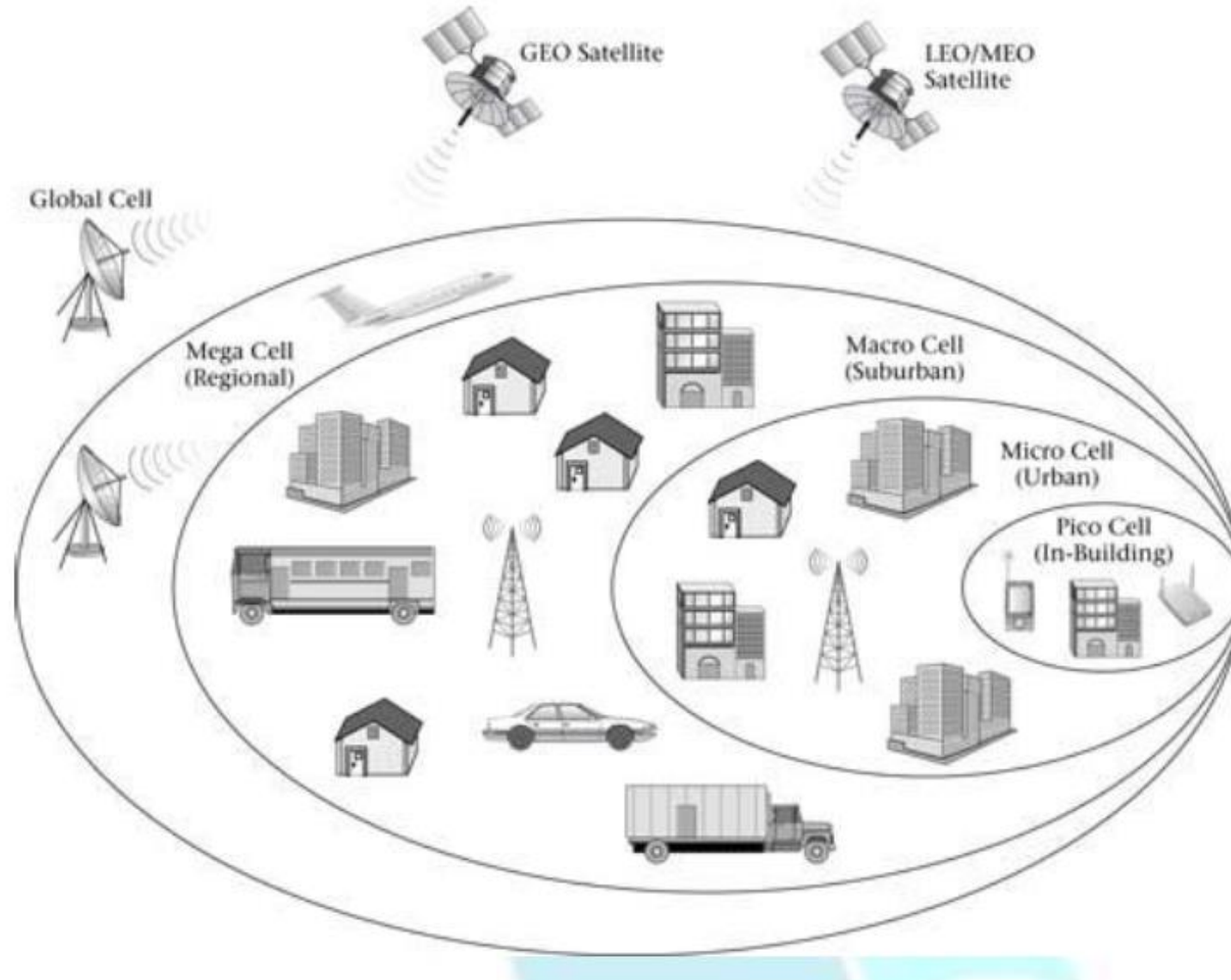
Macrocells:

Microcells:

Picocells:



Wireless communication system types



Wireless communication system types

- ❑ **Terrestrial (microwave) fixed links** (since the late 1940s):
 - To create high data-rate links between points on the Earth, telephone and data networks services .
 - For interconnections between BSs in cellular systems.
 - For covering wide areas in urban and suburban environments for telephone and data services to residential and commercial buildings.
 - Meteorological effects obstructing effects of hills, trees and buildings: significant or not??.
 - Common frequencies: from VHF through to EHF.

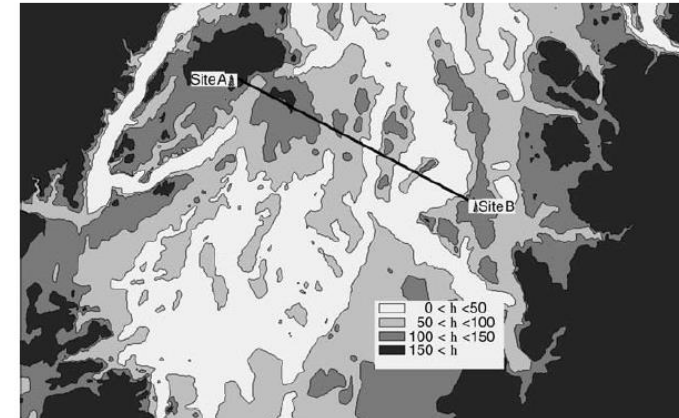
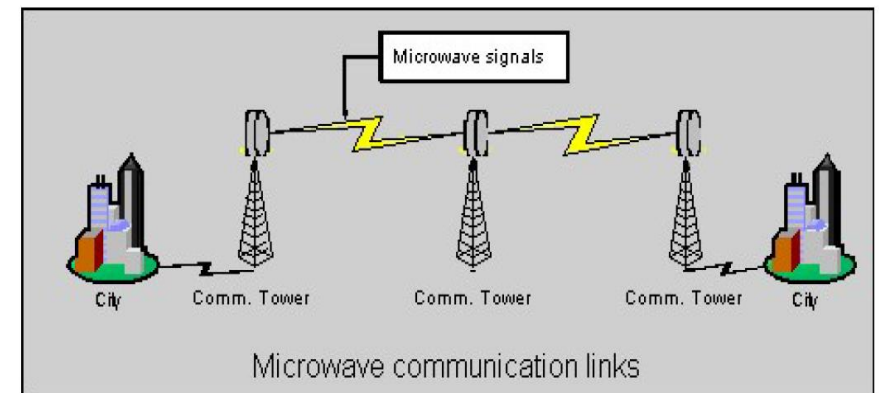


Figure 6.1: A great circle path between two antenna sites; contours are marked with heights in metres above mean sea level. Data is for the Seattle area using the USGS 3 and 1 arcsecond digital terrain models translated into Vertical Mapper format (reproduced by permission of Ericsson)



Wireless communication system types

□ Satellite fixed links (since the 1960s):

- Created between fixed earth stations with large dish antennas and geostationary earth-orbiting satellites.
- For intercontinental communication.
- The propagation effects are large due to the Earth's atmosphere & meteorological effects.
- Usually operated in the SHF and EHF bands.

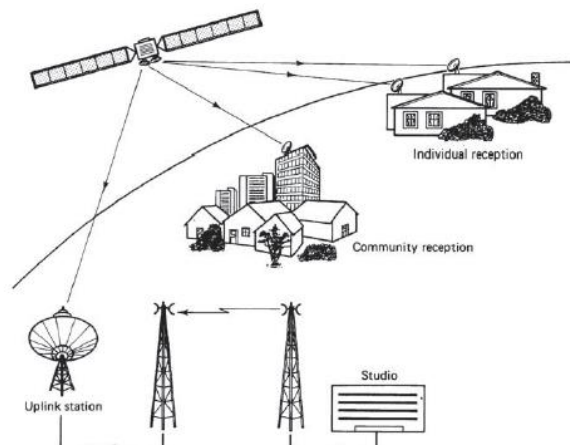
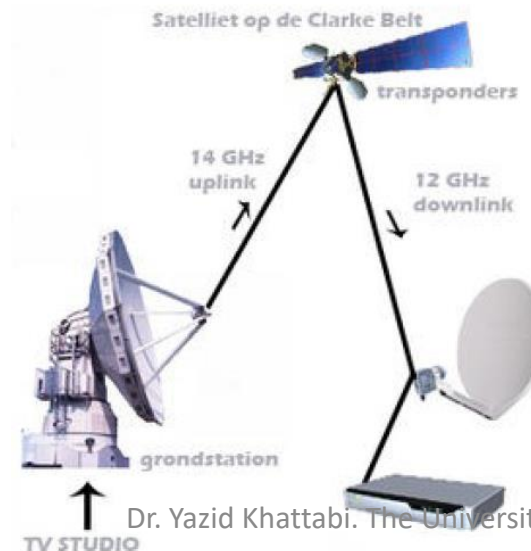
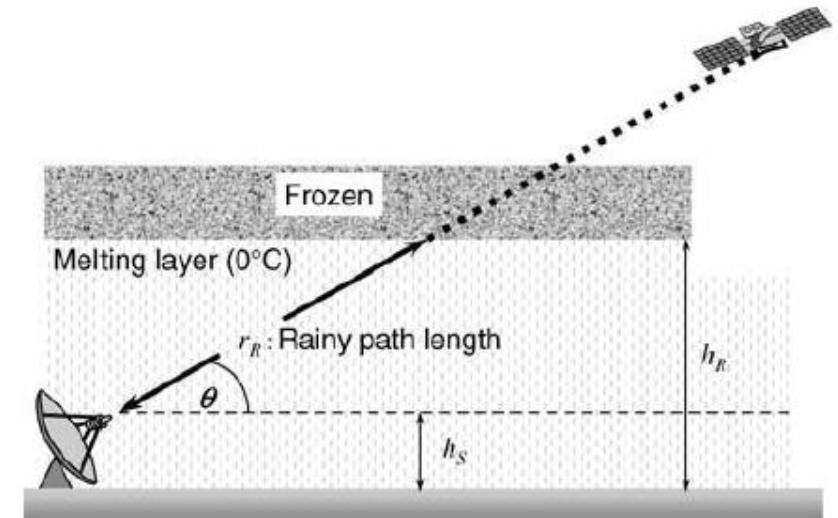


Figure 1.5 Components of a direct broadcasting satellite system. (From Government of Canada, 1983, with permission.)
2018



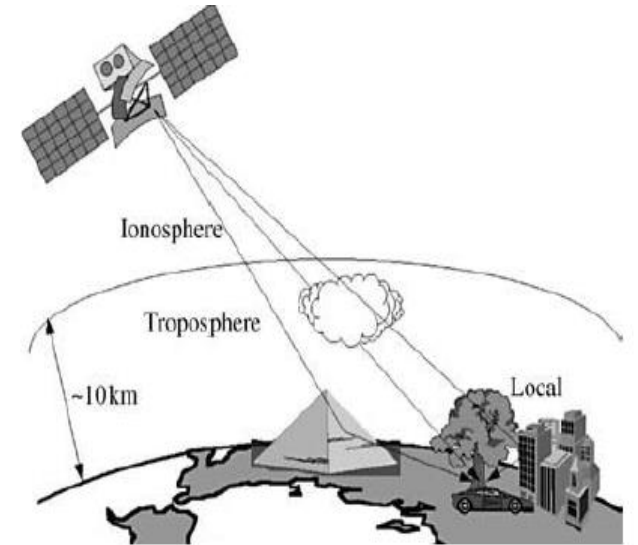
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Wireless communication system types

□ Megacells:

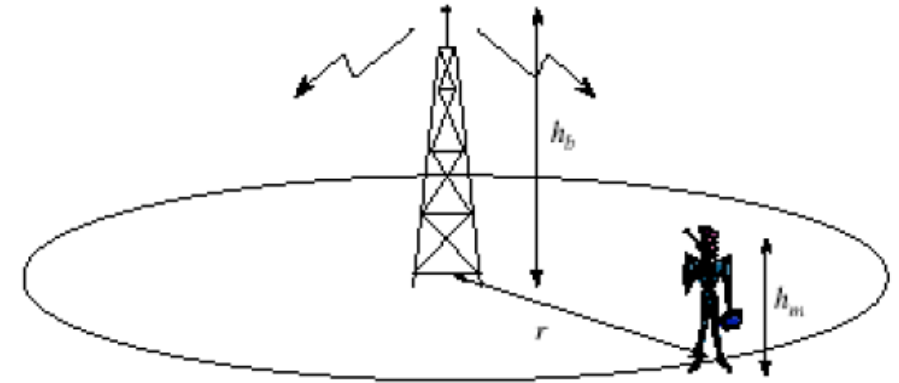
- Provided by satellite systems (or stratospheric balloons) to mobile users.
- Allows coverage of very wide areas with reasonably low user densities.
- e.g: a satellite in a LEO would cover a region of ~ 1000 km in diameter.
- The propagation effects are dominated by objects close to the user.
- Atmospheric effects play a role at higher frequencies.
- Most systems operate at L and S bands: voice and low-rate data services.
- Some high as Ka band: Internet access at high data rates over limited areas.



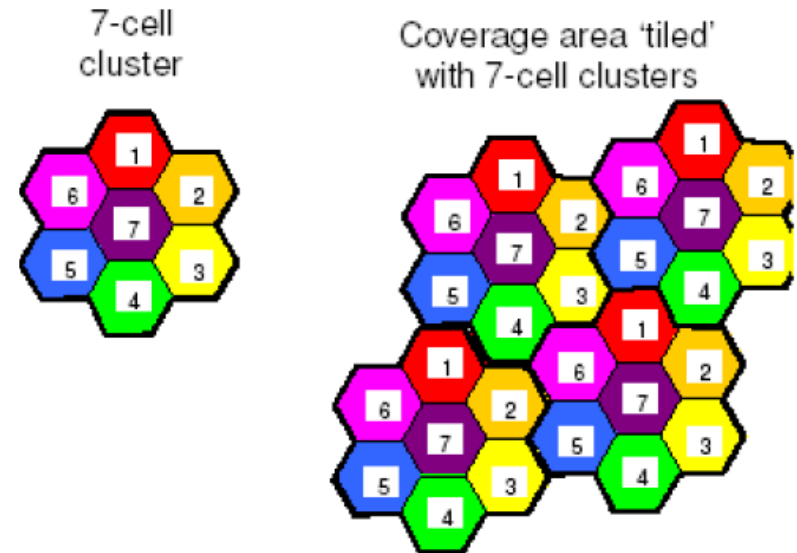
Wireless communication system types

□ Macrocells (cellular systems):

- To provide mobile and broadcast services (voice and data).
- Particularly outdoors, to rural, suburban and urban environments with medium traffic densities.
- BS antenna heights $>$ the surrounding buildings, providing a cell radius from around 1 km ~ 10s of kilometres.
- Mostly operated at VHF and UHF.
- May be used to provide fixed broadband access to buildings at high data rates, typically at UHF and low SHF frequencies.



Cellular Reuse Concept



Wireless communication system types

□ Microcells:

- Designed for high traffic densities in urban and suburban areas to users both outdoors and within buildings.
- Base station antennas are lower than nearby building rooftops, so coverage area is defined by street layout.
- Cell length up to around 500 m.
- Mostly operated at VHF and UHF, but services as high as 60 GHz have been studied (mm-wave communications).

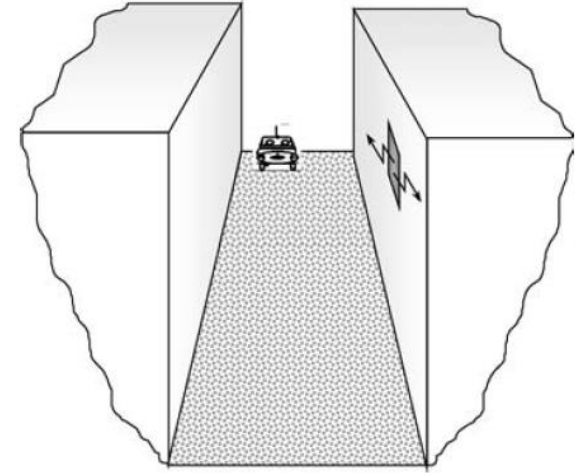


Figure 12.1: A microcell in a built-up area

Wireless communication system types

□ Picocells:

- Very high traffic density or high data rate applications in indoor environments.
- In railway stations, office buildings and airports, etc
- Users both mobile and fixed;
- fixed users: exemplified by WLAN between computers.
- Coverage is defined by the shape and characteristics of rooms, and QoS is dictated by the presence of furniture and people.

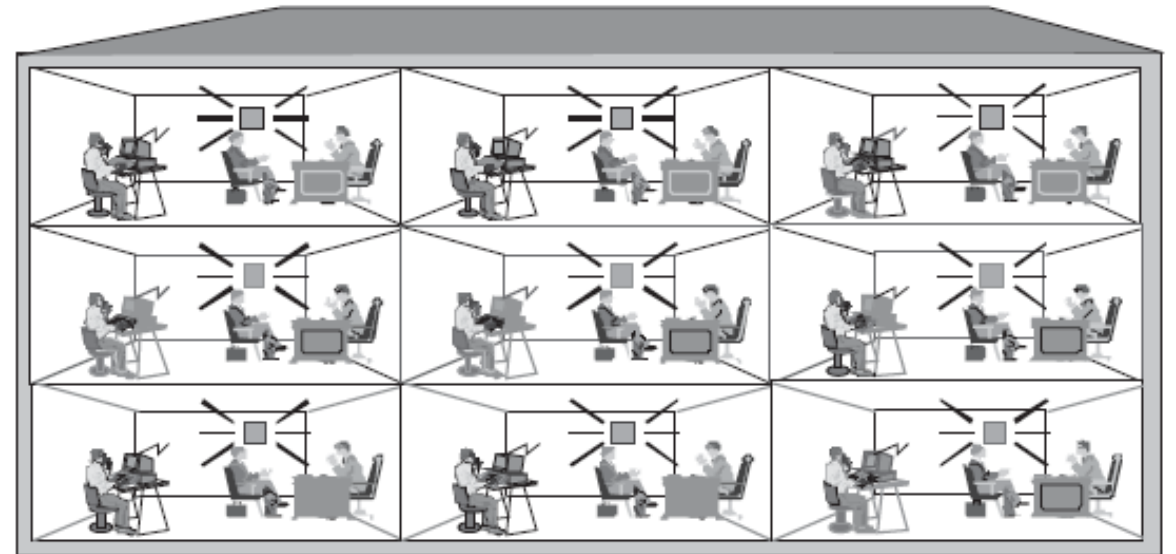


Figure 13.1: Picocells

Thank you