Wireless and Mobile Communication

(18CSE458T)

Unit-2

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Cellular Concepts

- Cellular systems are widely used today, and cellular technology need to offer very efficient use of the available frequency spectrum.

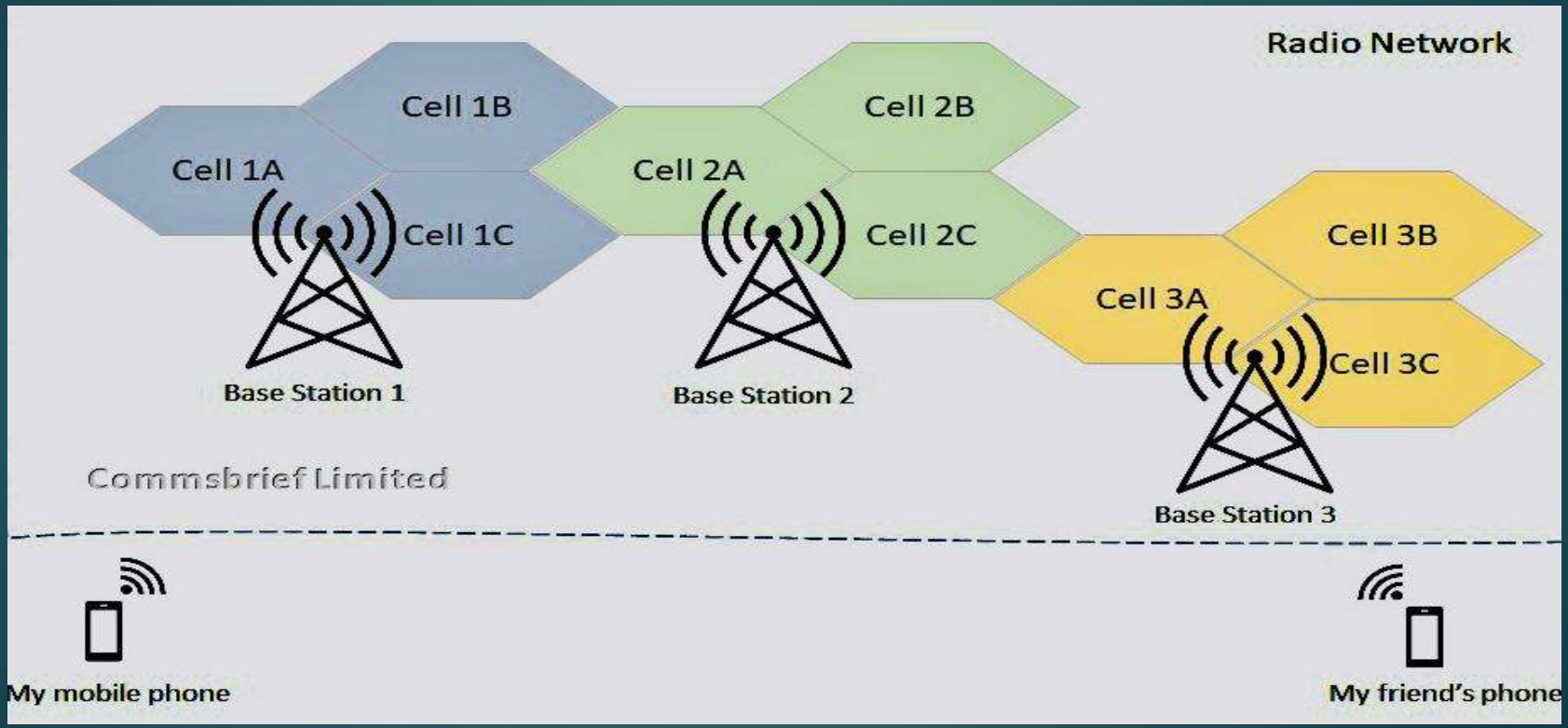
- Mobile networks are also called cellular networks because they consist of a large number of interconnected cells.

Cell Area

- A cell is a geographical area that defines the coverage zone created by the base station of a mobile network.
- The base station, also known as a cell tower.
- Cell towers, also known as radio base stations, are part of a mobile network owned by a mobile network operator.

Cont'd

A mobile network consists of many interconnected cells created by a large network of cell towers that mobile operators throughout villages, towns and cities within a country.



Source: Internet, GeeksforGeeks, Cellular Concepts

Signal Strength

- Signal strength in mobile communication refers to the measurement of the power level of the radio signal received by a mobile device from a cellular network.

- It's important to note that signal strength can vary depending on the cellular network, the technology used (2G, 3G, 4G, 5G), and the specific location you are in.

Cell Parameter

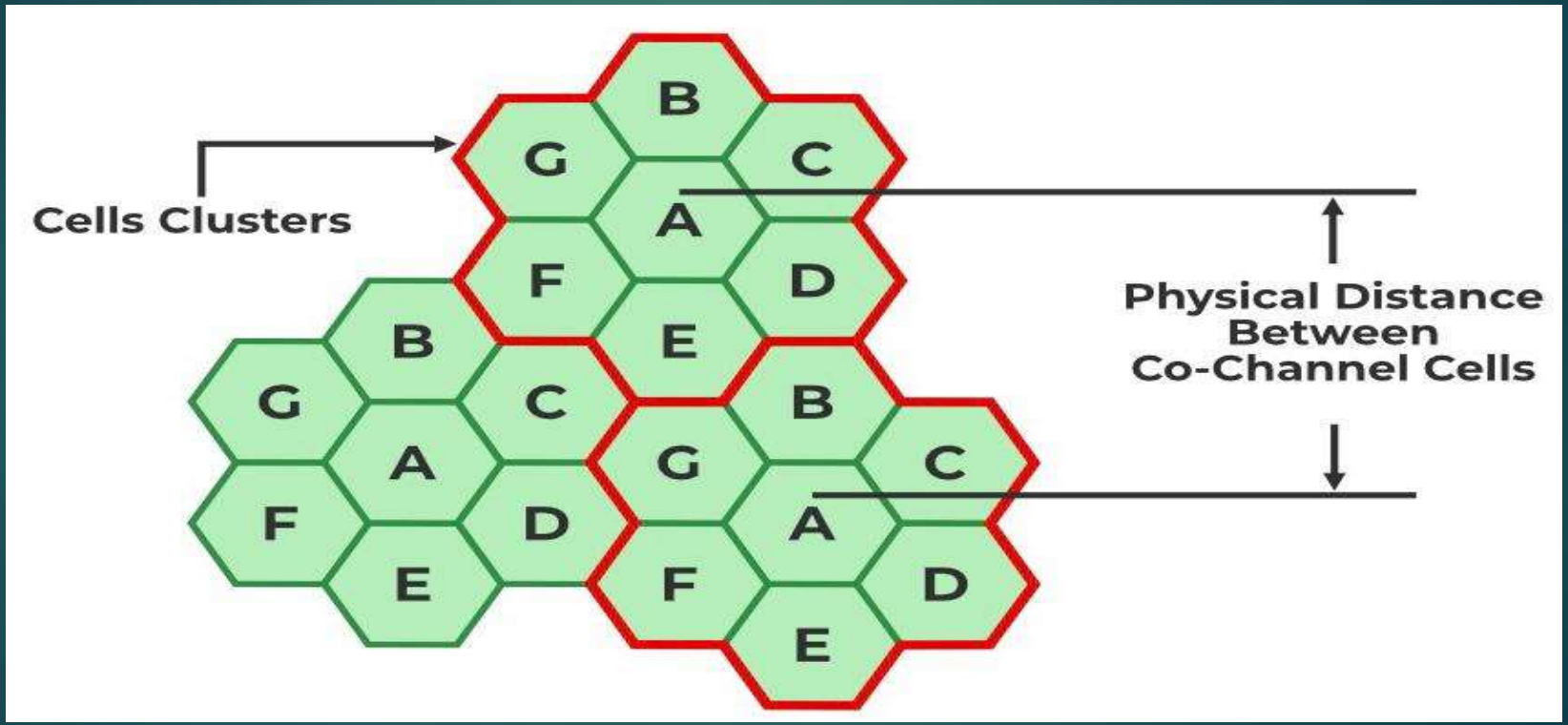
- Cell parameters in mobile communication refer to the various settings and configurations that define the behaviour and characteristics of a cellular network's individual cells.
- Here are some important Cell Parameters:
  - Cell ID
  - Cell Coverage Area
  - Transmit Power
  - Frequency Band
  - Cell Radius
  - Traffic Management

Capacity of a Cell

- The capacity of a cell in mobile communication refers to the maximum number of users or devices that a cell or base station can support.
- The capacity of a cell depends on various factors, including:
  - Spectrum Availability
  - Channel Bandwidth
  - Signal-to-Noise Ratio
  - Interference
  - Cell Size and Density

Co-Channel Interference

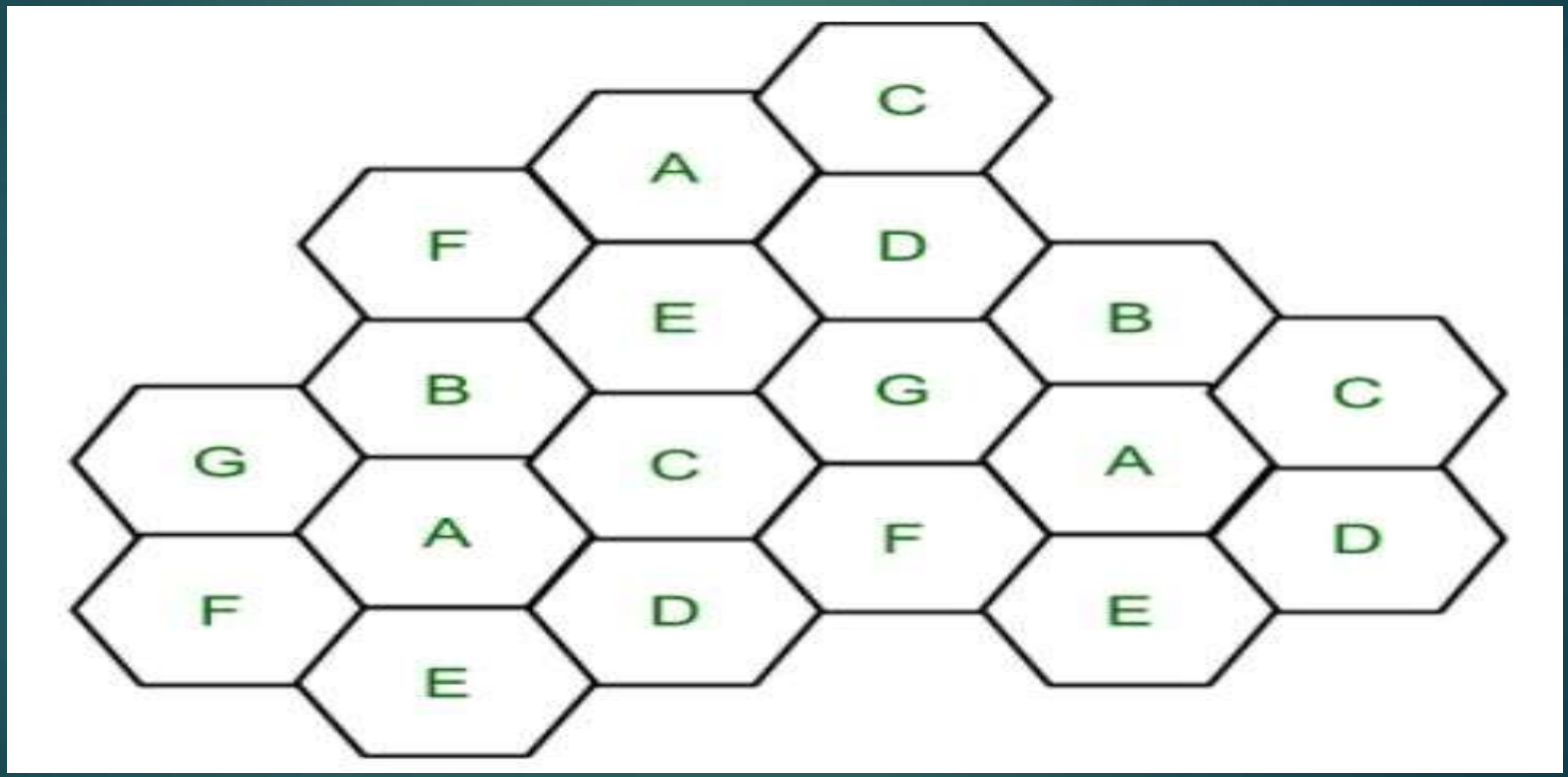
- CCI in mobile communication refers to the interference that occurs when multiple cells in a cellular network use the same frequency or channel to transmit and receive signals.



Source: Internet, Tutorialspoint, Co Chennel Interference

Frequency Reuse

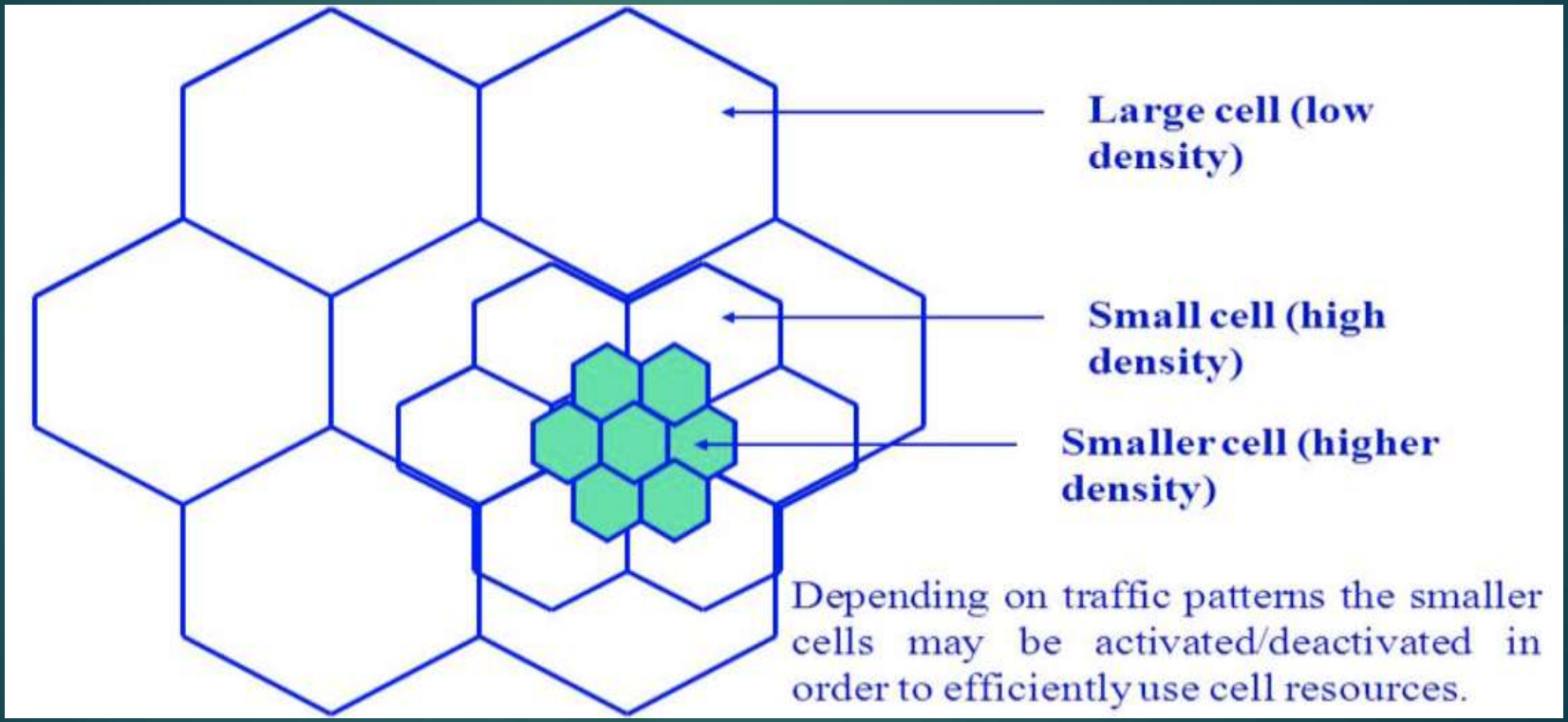
- Frequency in mobile communication enables efficient of the limited available radio frequency spectrum in cellular networks.



Source: Jochen H. Schiller, Mobile. Communications, 2nd Edition, Addison-Wesley

Cell Splitting

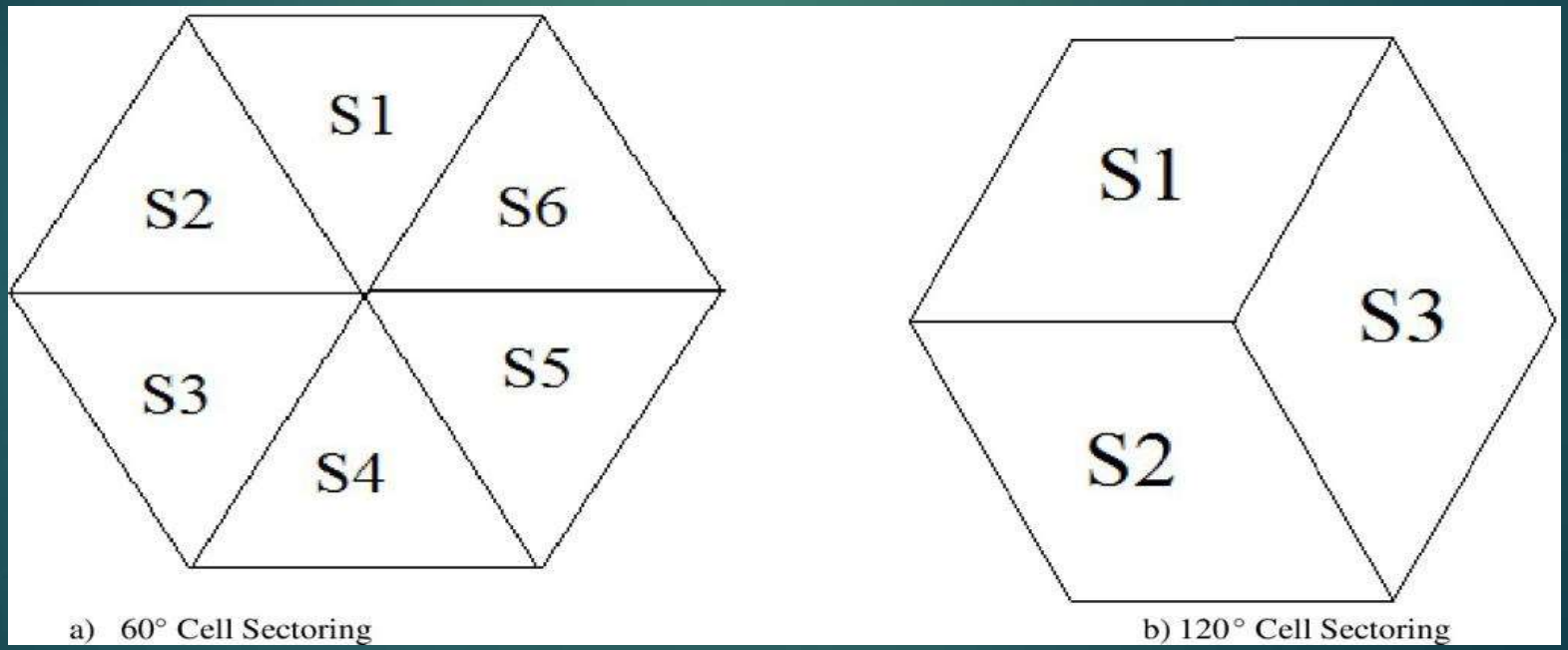
- Cell splitting is a technique used in mobile communication to increase the capacity and coverage of a cellular network by dividing existing cells into smaller cells.



Source: Internet, SlideShare, Cell Splitting and Sectoring

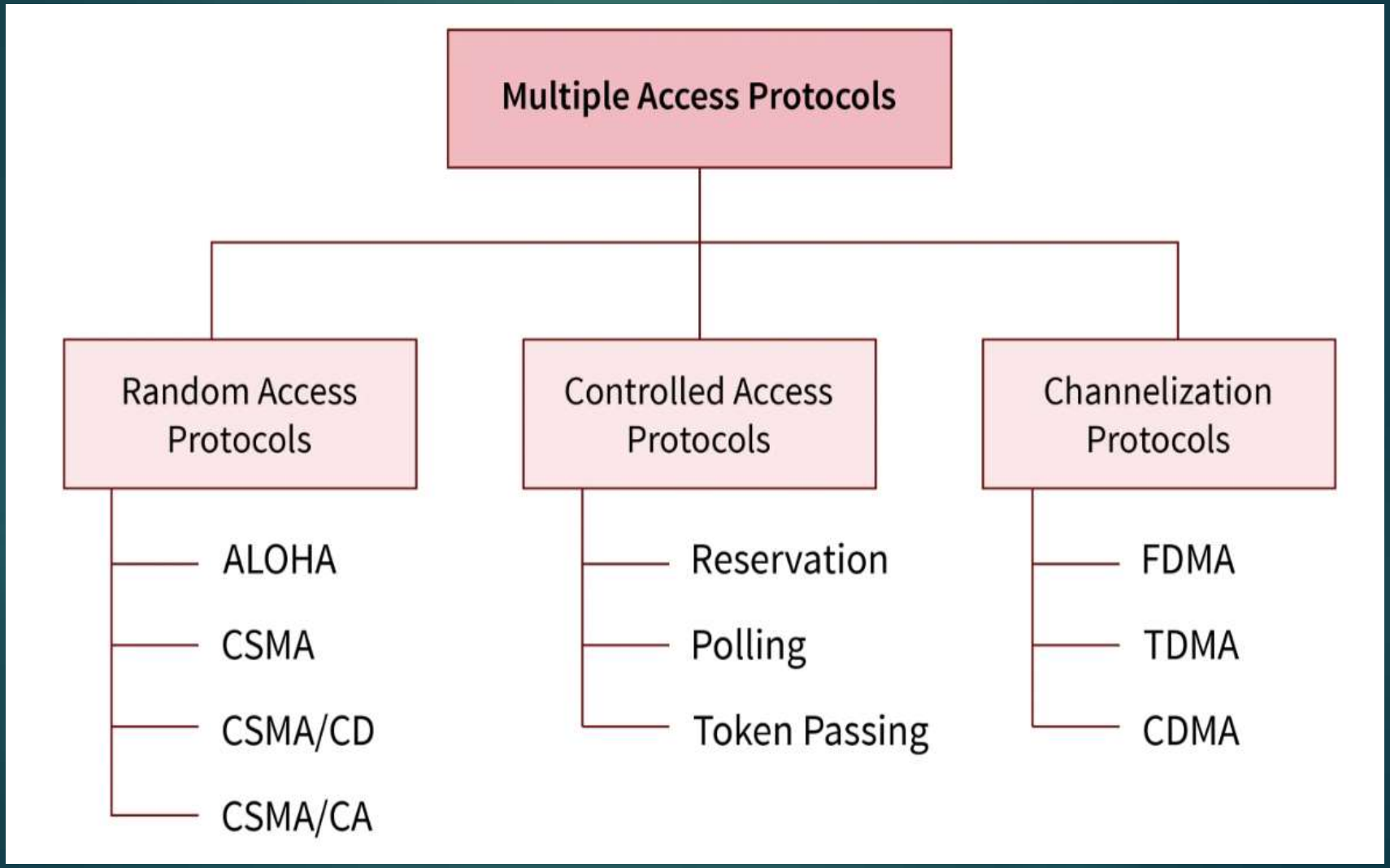
Cell Sectoring

- Cell sectoring is a technique used in mobile communication to enhance the capacity, coverage, and performance of cellular networks.



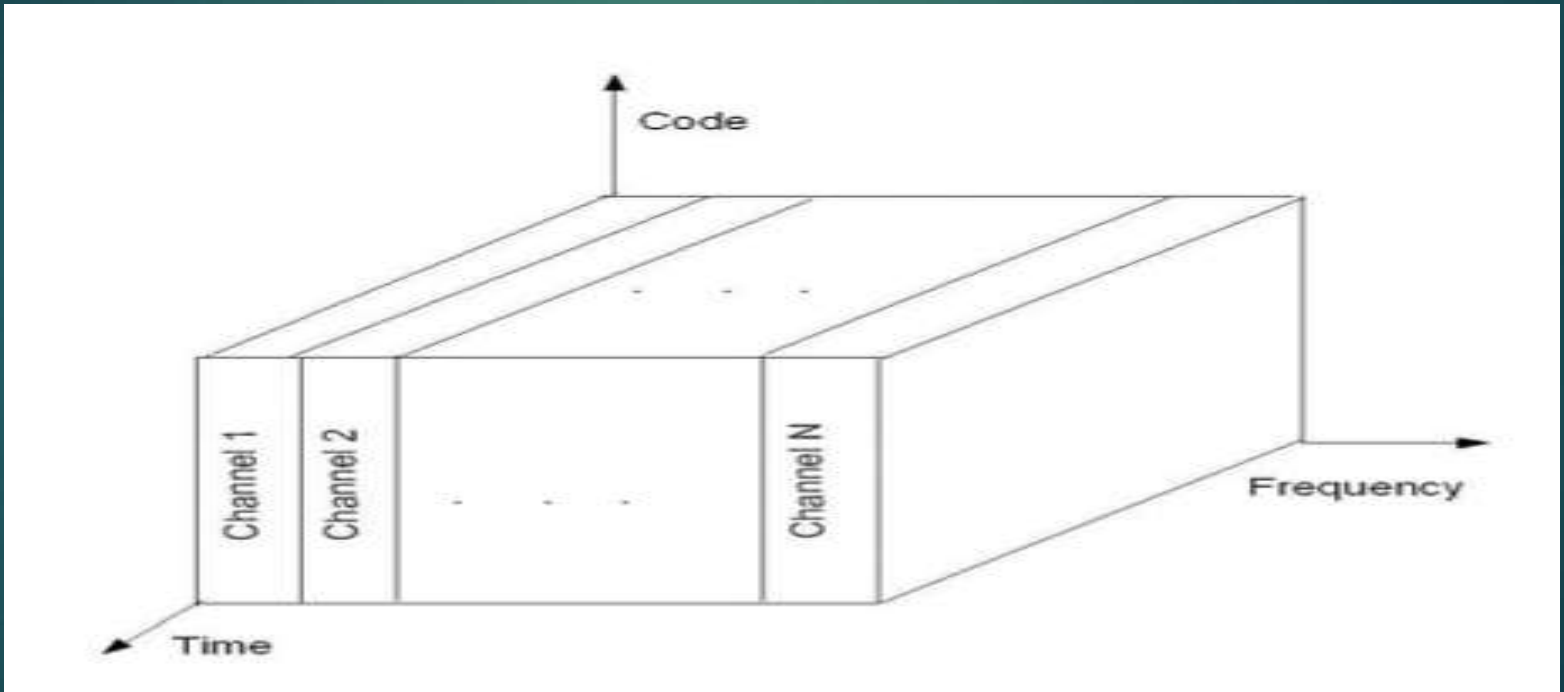
Source: Jochen H. Schiller, Mobile. Communications, 2nd Edition, Addison-Wesley

Multiple Radio Access Protocols



Frequency Division Multiple Access

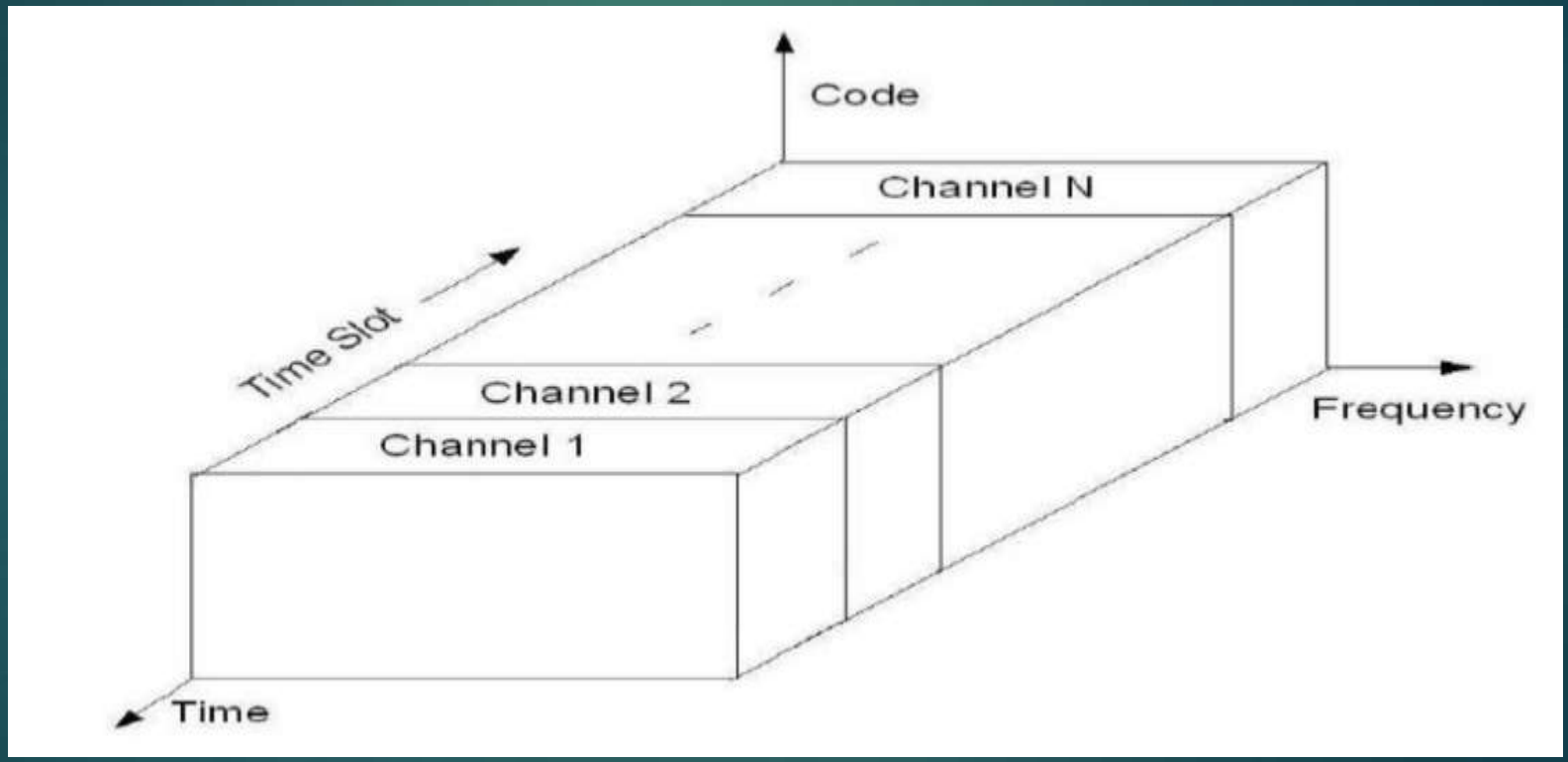
- This was the multiple-access technique for cellular systems in which each individual user is assigned a pair of frequencies while making or receiving a call.



Source: Jochen H. Schiller, Mobile. Communications, 2nd Edition, Addison-Wesley

Time Division Multiple Access

- In TDMA, the entire bandwidth is available to the user but only for a finite period of time.



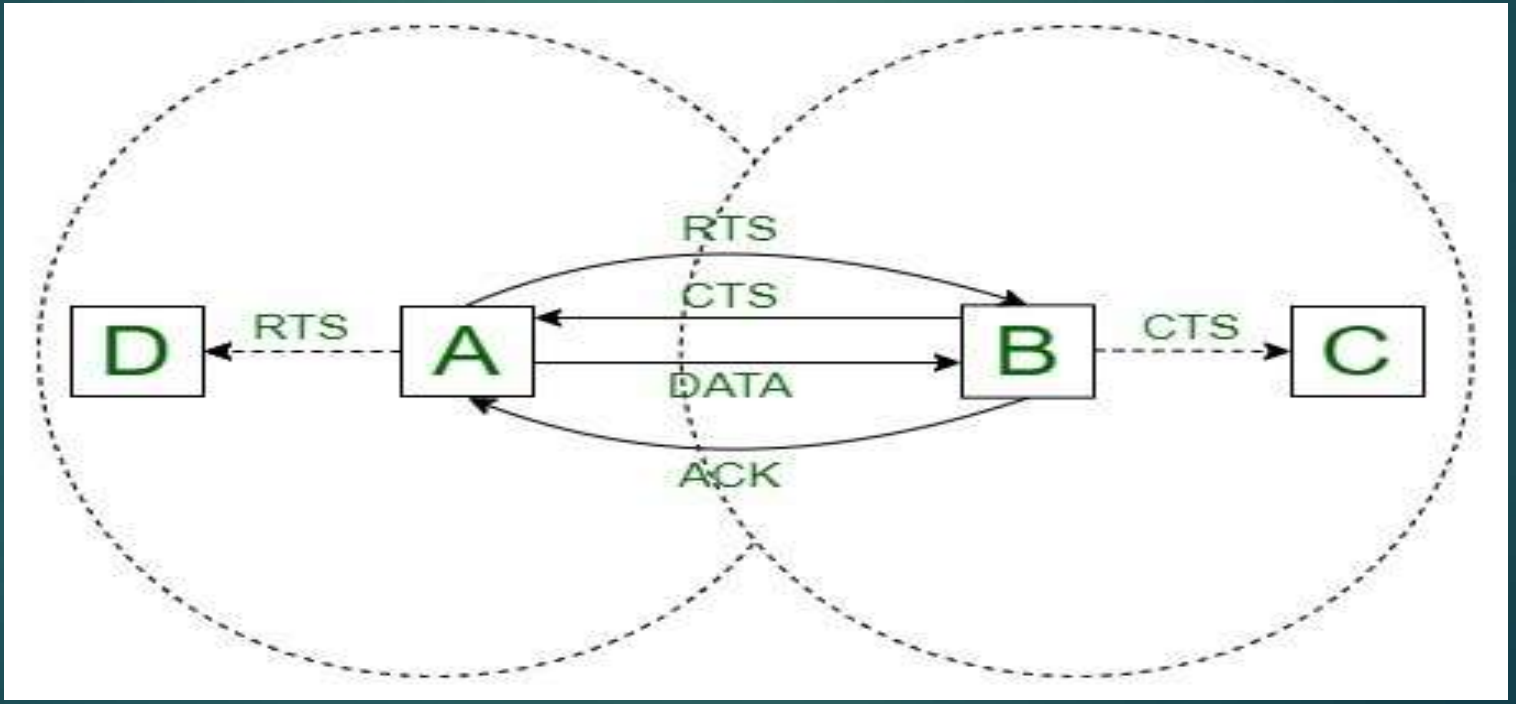
Source: Jochen H. Schiller, Mobile. Communications, 2nd Edition, Addison-Wesley

Fixed ALOHA & Slotted ALOHA

- Fixed ALOHA is a simple and straightforward random access protocol. In Fixed ALOHA, each station or device can transmit data packets at any time.
- Slotted ALOHA dividing time into discrete slots. Each slot represents a fixed time ,which a station can transmit a packet.

Multiple Access with Collision Avoidance

- MACA is a protocol used in wireless communication to manage access to a shared communication medium, such as a wireless channel, in a way that minimizes between transmitting devices.



Source: Jochen H. Schiller, Mobile. Communications, 2nd Edition, Addison-Wesley

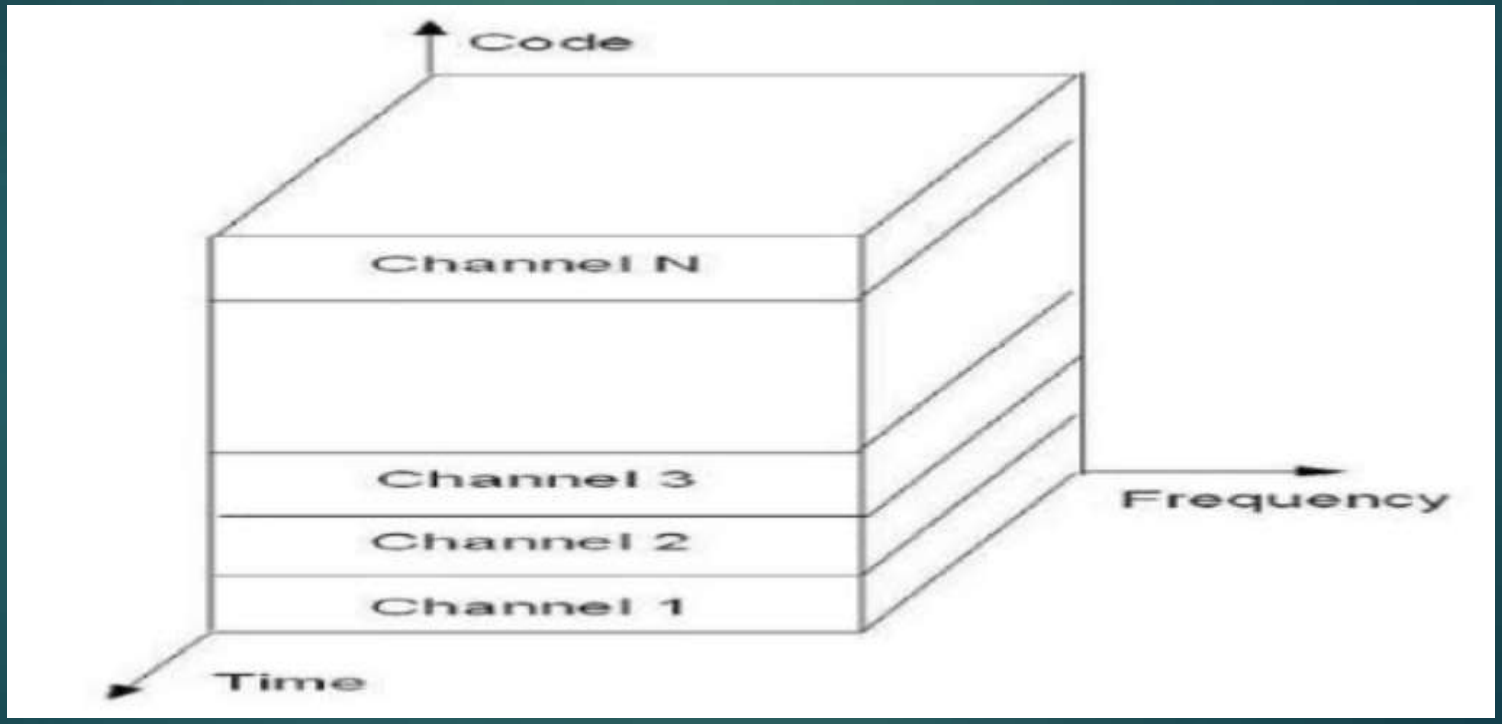
Space Division Multiple Access

- SDMA is a multiple access technique used in wireless communication systems to enhance capacity and efficiency.

- SDMA has been applied in various wireless communication standards and technologies, such as 4G LTE-Advanced, 5G NR (New Radio), and Wi-Fi 6 (802.11ax), to increase system capacity and improve network performance in high-density and interference-prone environments.

Code Division Multiple Access

- In CDMA, the same bandwidth is occupied by all the users, however they are all assigned separate codes, which differentiates them from each other.



Source: Jochen H. Schiller, Mobile. Communications, 2nd Edition, Addison-Wesley

Spread ALOHA Multiple Access

- S-ALOHA is a multiple access technique used in wireless communication systems to allow multiple users to access a shared communication medium efficiently.

OFDM & Variants of OFDM

- Frequency Division Multiplexing is a modulation and multiple access technique used in wireless communication systems.
- Here are some variants of OFDM:
  - OFDMA
  - SC-FDMA
  - OFDM-CDMA
  - W-OFDM

Comparison of Multiple Access Techniques

FDMA	TDMA	CDMA
In this, sharing of bandwidth among different stations takes place.	In this, only the sharing of time of satellite transponder takes place.	In this, there is sharing of both i.e. bandwidth and time among different stations takes place.
There is no need of any codeword.	There is no need of any codeword.	Codeword is necessary.
Synchronization is not required.	Synchronization is required.	Synchronization is not required.
The rate of data is low.	The rate of data is medium.	The rate of data is high.
Mode of data transfer is continuous signal.	Mode of data transfer is signal in bursts.	Mode of data transfer is digital signal.
It is little flexible.	It is moderate flexible.	It is highly flexible.

Thank You