# Multiple Access Multiple accesses in Satellite Communication

**Multiple Access Multiple accesses** is defined as the technique where in more than one pair of earth stations can simultaneously use a satellite transponder. A multiple access scheme is a method used to distinguish among different simultaneous transmissions in a cell. A radio resource can be a different time interval, a frequency interval, or a code with a suitable power level.

If the different transmissions are differentiated for the frequency band, it will be defined as the Frequency **Division Multiple Access (FDMA)**.
Whereas, if transmissions are distinguished based on time, then it is considered as **Time Division Multiple Access (TDMA)**.
If a different code is adopted to separate simultaneous transmissions, it will be **Code Division Multiple Access (CDMA)**.

**Frequency Division Multiple Access (FDMA)**: Frequency Division Multiple Access or FDMA is a channel access method used in multiple- access protocols as a channelization protocol. FDMA gives users an individual allocation of one or several frequency bands, or channels. It is particularly commonplace in satellite communication.

• In FDMA all users share the satellite transponder or frequency channel simultaneously, but each user transmits at single frequency.
• FDMA can be used with both analog and digital signal.
• FDMA requires high-performing filters in the radio hardware.
• FDMA is not vulnerable to the timing problems that TDMA has. Since a predetermined frequency band is available for the entire period of communication, stream data (a continuous flow of data that may not be packetized) can easily be used with FDMA.
• Each user transmits and receives at different frequencies as each user gets a unique frequency slots.
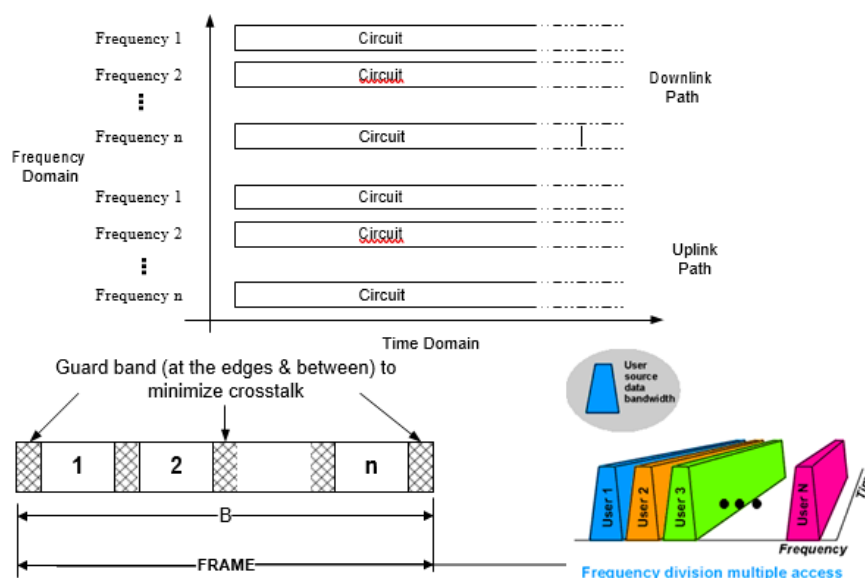


**Time Division Multiple Access (TDMA):** Time division multiple access (TDMA) is a channel access method for shared medium networks. It allows several users to share the same frequency channel by dividing the signal into different time slots. This allows multiple stations to share the same transmission medium (e.g. radio frequency channel) while using only a part of its channel capacity.

- Shares single carrier frequency with multiple users.
- Slots can be assigned on demand in dynamic TDMA.
- Less stringent power control than CDMA due to reduced intra cell interference
- Higher synchronization overhead than CDMA
- Cell breathing (borrowing resources from adjacent cells) is more complicated than in CDMA.
- Frequency/slot allocation complexity.
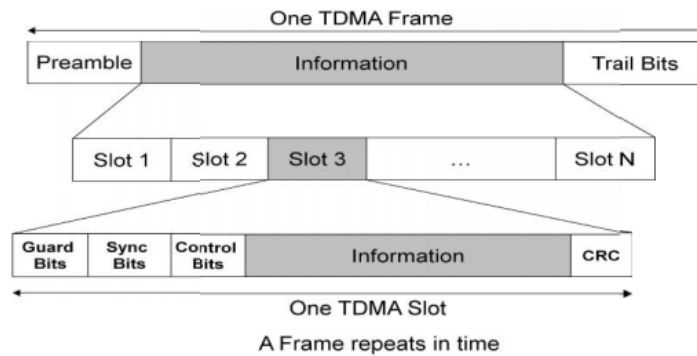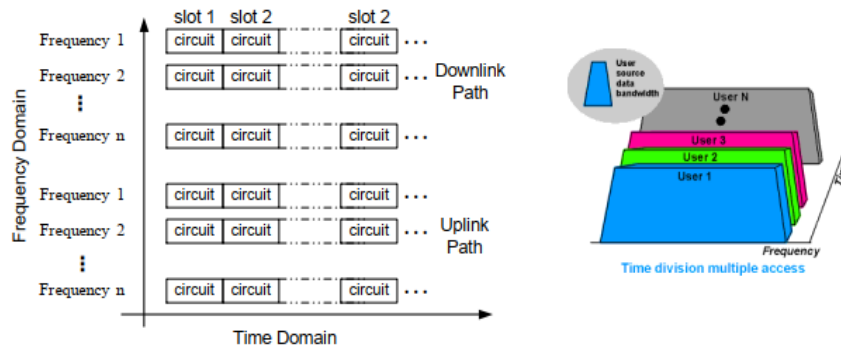




**Code Division Multiple Access (CDMA):** Code division multiple access (CDMA) is a channel access method used by various radio communication technologies. CDMA is an example of multiple access, which is where several transmitters can send information simultaneously over a single communication channel. CDMA uses the codes to identify connections. Their Signals are encoded so that information from an individual transmitter can be detected and recovered only by a properly synchronized receiving station, that knows the code being used.

- One of the early applications for code division multiplexing is in the Global Positioning System (GPS). This predates and is distinct from its use in mobile phones.
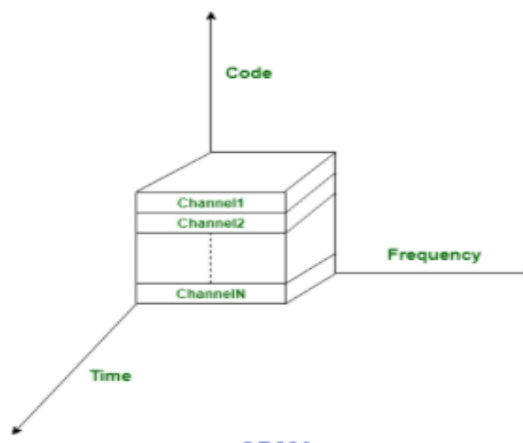
## Comparison between FDMA, TDMA & CDMA:

| S. No. | Parameter | FDMA | TDMA | CDMA |
|---|---|---|---|---|
| 1. | Spectrum utilization for a single station | It does not use full bandwidth. | It uses full bandwidth within alloted time slot | It uses full bandwidth throughout operation |
| 2. | Analog/Digital | Generally analog | Digital | Digital |
| 3. | Interference | Interference may occur | Interference may occur | Interference is eliminated |
| 4. | Synchronization | Difficult in demand assigned | Difficult in demand assigned | Easy |
| 5. | Inter-modulation distortion | Present (back-off needed) | Not present (back-off not needed) | Not present (back-off not needed) |
| 6. | Secrecy (Interception) | Almost insecure | Better than FDMA | Fully secure |
| 7. | Jamming | Exist | Exist | Does not exist |
| 8. | Bit rate | Medium | High | low |
| 9. | Flexibility | Poor | Better | Best |
| 10. | Cost | Low | High | Lowest |