

(1) Multiple Access Technique in wireless communication

- FDMA - Frequency Division multiple access.
- TDMA - Time Division Multiple Access.
- CDMA - Code Division, multiple Access.
- OFDMA - Orthogonal frequency Division multiple Access.
- SC-FDMA - Single carrier FDMA
- SDMA - Space Division multiple Access.
- NOMA - Non-orthogonal multiple access.

Comparison :-

TDMA vs FDMA vs CDMA

Feature	TDMA	FDMA	CDMA
Basic principle	Divides time into slots	Divides bandwidth into frequencies	uses unique code for each user.
Bandwidth usage.	Shared in time	Divided into fixed frequency bands	Entire bandwidth shared.
Synchronization	strict timing required	less synchronization required	Required complex synchronization
interference	Time slot interference possible	Adjacent channel interference	Resisted to interference
Complexity	medium	Low	high.

Spectral efficiency	Moderate	Loco	High
Handoff	Faster than FDMA	Complex	Soft handoff (batched)
Used in	GSM	Analog System (GPRS)	3G (WCDMA, CDMA2000)

(2) EDGE as an Add-on to GSM/GPRS (BSS Enhancement)

EDGE (Enhanced Data Rates for GSM evolution) is a technology developed to increase the data capacity of GSM/GPRS network without changing the existing core network. It is often described as an "add-on" for the following reasons.

Modulation Enhancement:

EDGE uses 8PSK modulation in addition to the GMSK used in GSM enabling higher data rates.

No core Network changes;

It operates over the existing GSM core networks (MSC, BSC, GSN, GRISN). The upgrades are limited to the base stations (BSS).

Software / Hardware Upgrades:

only the BTS and BSC require software and minor hardware enhancement. This avoids the need for costly infrastructure replacement.

Backward compatibility:-

EDGE supports fallback to GPRS/GSM for non-compatible devices or areas, ensuring seamless connectivity.

Improved throughput:

Enables data rates up to 384 kbps, making it suitable for 3G services like mobile internet, MMS, and streaming.

Conclusion:-

EDGE serves as a bridge between 2G and 3G, leveraging existing investments while providing enhanced capabilities, and is considered a cost-effective upgrade path for operators.