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**ECE 535 Satellite Communications**

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Module # 10-3: Comparison Between Multiplexing and Multiple Access

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## **Comparison Between Multiplexing and Multiple Access**

The most used multiple access methods are frequency division multiple access (FDMA) and time-division multiple access. Similar techniques include frequency-division multiplexing (FDM) and time-division multiplexing (TDM). Though both share similar implementations, multiplexing and multiple access use different concepts. Multiplexing is a transmission feature, whereas multiple access is a traffic feature.

Multiple access utilizes circuits through one communication channel through a multiple-access transponder. These circuits may be pre-assigned and allocated on a fixed basis to users. Though not available for general use, the pre-assignment is simple for circuits with heavy traffic. A multiple access system uses a single transponder channel. When a satellite with a multiple access system is employed, it carries several transponders, each covering a different frequency channel.

Signals such as FDM are multiplexed signals. Multiple signals are combined for transmission on a single line or channel, each assigned to a different frequency subchannel within a main channel. FDM separates assigned multiple signals over a single transponder. These signals are modulated by sending the transponder and carried over the separated bands. Signals are combined with a multiplexer and demultiplexed to a receiver to extract the individual receivers. This requires a communication circuit between the transmitter and receiver to mux or demux at either end. Multiplexed signals are often used with single frequencies of lower bandwidth transmitted through a channel with higher bandwidth.

Understanding when to use multiple access versus multiplexing depends on the use case. Multiple access allows multiple users to share the same transponder without interference with one another. Multiple access systems are beneficial when the spectrum is limited over a geographical area. Multiplexed signals are helpful for systems with limited power or system resources. In contrast, multiplexed signals, such as FDM, use pre-assigned frequency to maximize the bandwidth. The frequency assignments allow many users with high data needs to transmit on non-interfering channels. FDM is used in Digital Subscriber Line (DSL) services where the bandwidth is available for data, voice, and video services. Choosing a multiple access or multiplexed schema in satellite communications will ultimately depend on the schema of the communication network.