

Introduction to Digital Communication

Difference between analogue and Digital

Analogue: Take infinite symbols

Digital: Take finite set of symbols

Channel coding

To improve error detection and correction

Let's say we send a 1 and zero to the receiver and during the transmission, the signal was changed to 0 and another was changed to 1, and the receiver will receive a 0 and we will not know the signal we get is correct or not since from the transmitter, it only transmits one symbol.

But if we add a 0 to both of the symbols like:

01

00

And during the transmission, if the errors again like:

11

10

We can detect the error immediately since they are either 01 or 00

The "0" we add is redundant bits.

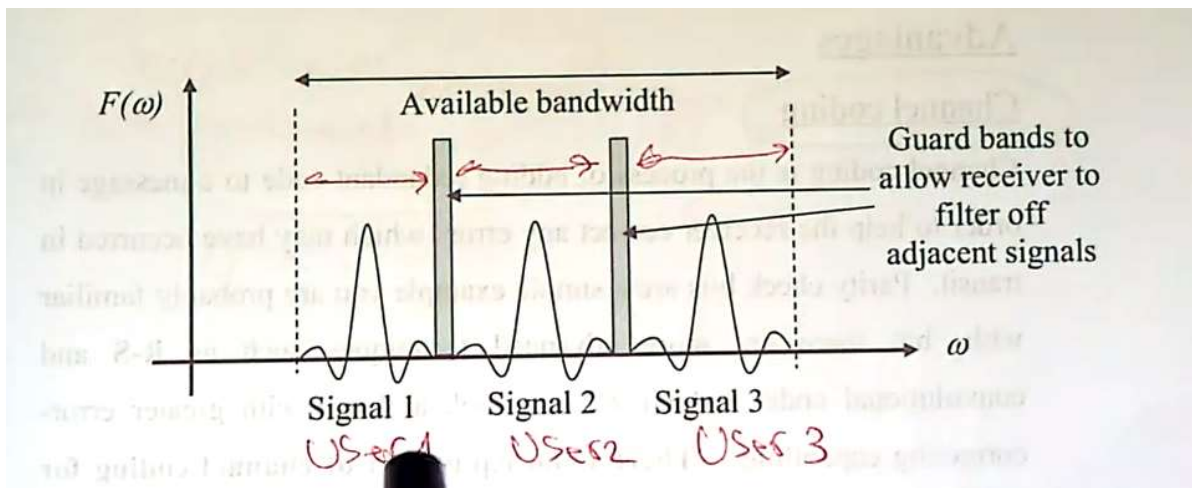
Source coding

To improve the data rates

Multiplexing

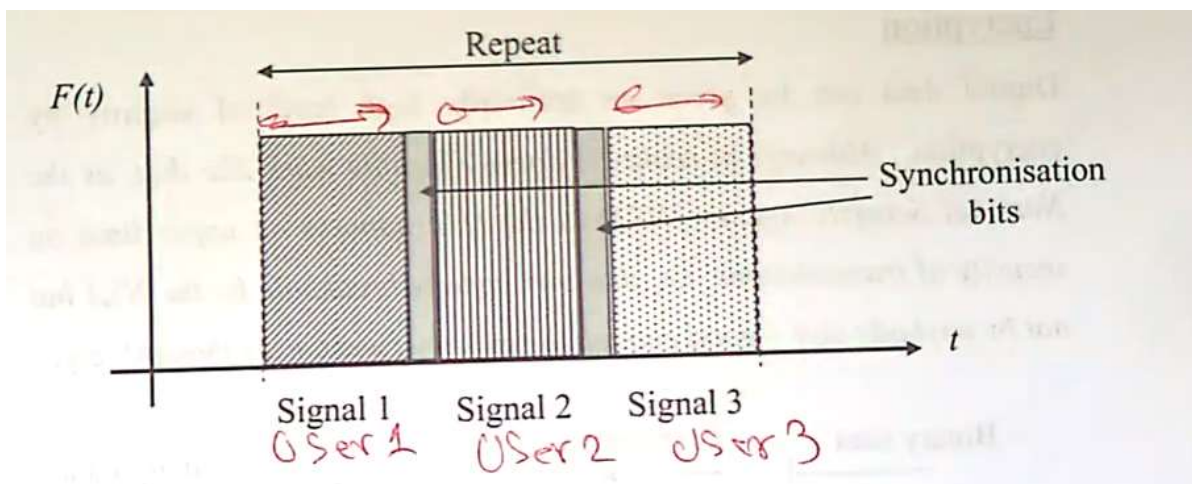
To share a resource

- Frequency division multiple access



We share the bandwidth with many users. Each user is allocated part of the bandwidth all the time.

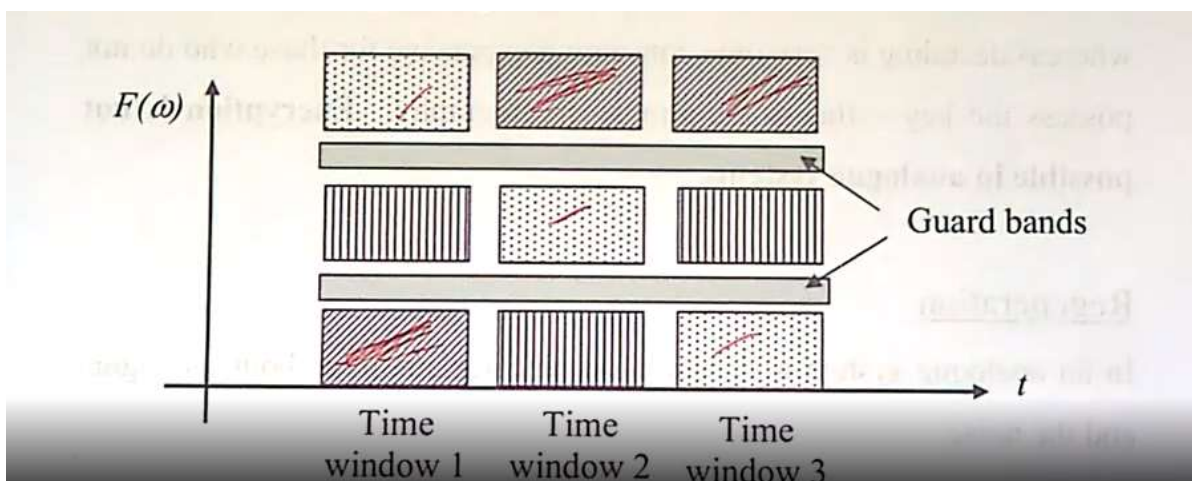
- Time division multiple access



Each user is allocated all the bandwidth part of the time.

Limit: At the receiver we need the synchronization, we need to know when each user will start the transmission

- Code division multiple access

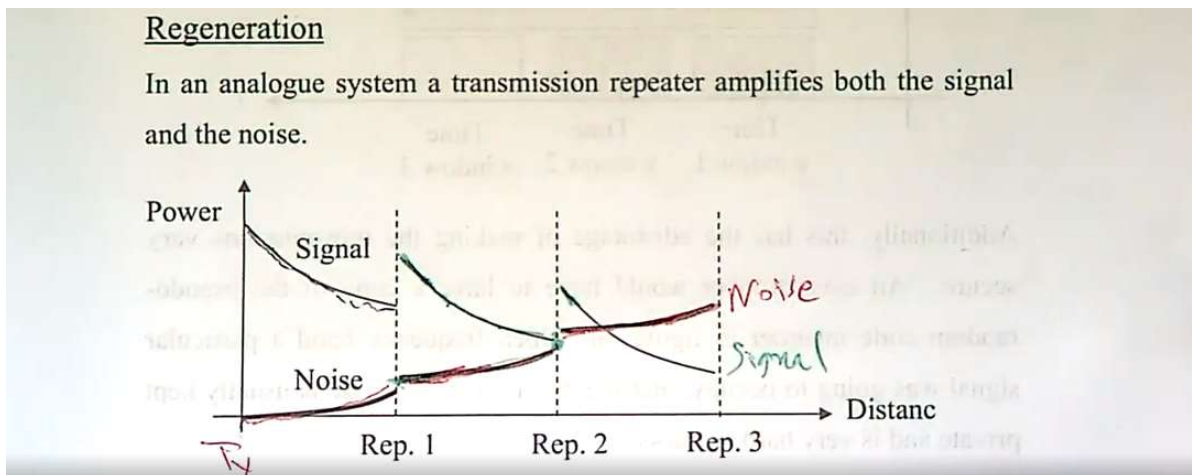


It will combine the advantages of TDMA and FDMA

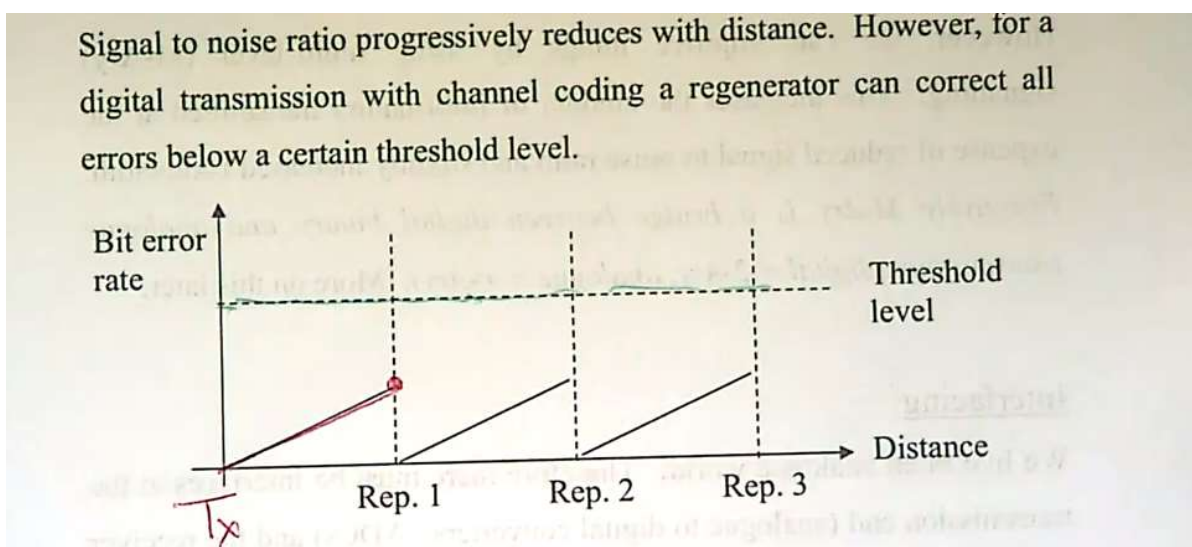
It will choose which part of the available bandwidth the signal will be transmitted in. Many signals are transmitted over the same bandwidth, but because the codes are different, the signals don't interfere

Regeneration

In an analogue system a transmission repeater amplifies both the signals and noises



This is very inefficient!!



In the first stage, we introduce some errors so we don't amplify the signal instead we use the channel coding to analyse the signal (like what errors have been introduced) and start the whole process agains