**Channel coding**

**Theory:**

Channel coding, also known as forward error control coding (FECC), is a process of detecting and correcting bit errors in digital communication systems. Channel coding is performed both at the transmitter and at the receiver. At the transmit side, channel coding is referred to as encoder, where extra bits (parity bits) are added with the raw data before modulation. At the receive side, channel coding is referred to as the decoder. Channel coding enables the receiver to detect and correct errors, if they occur during transmission due to noise, interference and fading.

The purpose of channel coding theory is to find codes which transmit quickly, contain many valid code words and can correct or at least detect many errors. While not mutually exclusive, performance in these areas is a trade off. So, different codes are optimal for different applications. The needed properties of this code mainly depend on the probability of errors happening during transmission. In a typical CD, the impairment is mainly dust or scratches.

Although not a very good code, a simple repeat code can serve as an understandable example. Suppose we take a block of data bits (representing sound) and send it three times. At the receiver we will examine the three repetitions bit by bit and take a majority vote. The twist on this is that we don't merely send the bits in order. We interleave them. The block of data bits is first divided into 4 smaller blocks. Then we cycle through the block and send one bit from the first, then the second, etc. This is done three times to spread the data out over the surface of the disk. In the context of the simple repeat code, this may not appear effective. However, there are more powerful codes known which are very effective at correcting the "burst" error of a scratch or a dust spot when this interleaving technique is used.