**1. Secrecy Outage Probability**

Outage probability in general is the probability that a given information rate is not supported, because of variable channel capacity. Outage probability is defined as the probability that information rate is less than the required threshold information rate. It is the probability that an outage will occur within a specified time period.

1.1. Slow-fading channel

For example, the capacity of a slow fading channel is:

Where h is the fading coefficient and SNR is the signal-to-noise ratio without fading. As C is a random variable based on the random h, no constant rate can be defined through the Shannon-Hartley theorem. There may be a chance that information rate may go below the required threshold level. For slow fading channel, outage probability is defined as:

Where r is the required threshold information rate.

1.2. Why use the capacity as a means of security?

As wireless communications increase in usage, the same can be said about the sensitive information that are exchanged through the wireless channels. Users desire the secrecy of their sensitive information thus it is imperative that the transmission must be secure. One solution can be found in the field of Cryptography. However, these methods requires a shared-key (public key) between each of the communication points. This does not scale well with the massive increase of devices, since each device counts as an active user. Each new user requires a key, which can increase the complexity and result in security gaps.

The other approach to this problem is the physical layer security, which exploits the channel’s innate characteristics in order to protect the transmitted data. During AWGN the threshold is a certain number, which allows for zero information leakage to a passive eavesdropper. Otherwise, in a setting where both the receiver and the eavesdropper experience any form of fading, on top of the AWGN, there can be outages due to the random nature of the fading. Therefore, a certain question arises. Can we estimate the probability in which the channel’s fading causes the secrecy to go out? The answer to this question is whether we can make the estimation based on the probability density function of the fading which denotes the channel model.