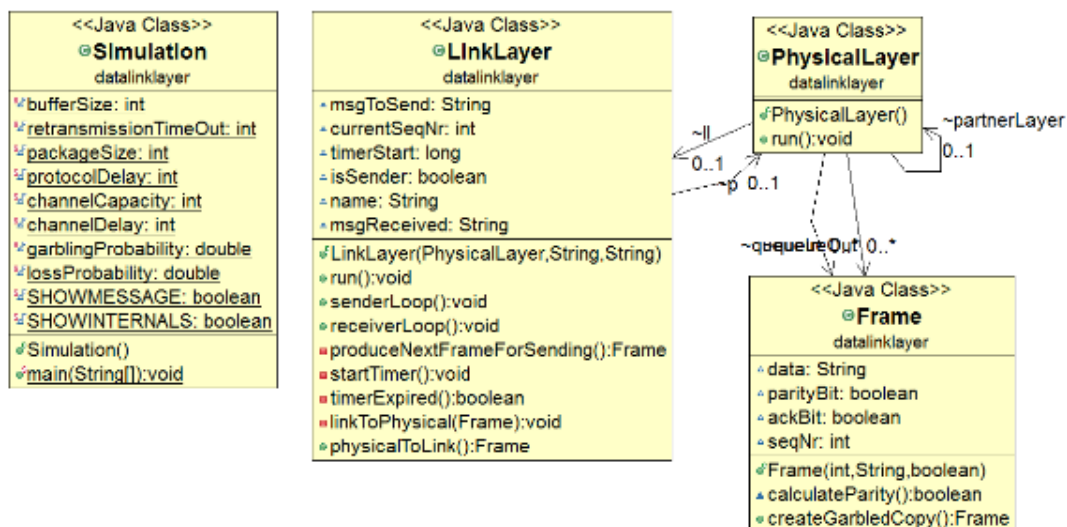# 6. Link Layer Protocol Programming

In this lab we will play with a simulated link layer protocol. We modify some parameters and do some coding to improve the protocol. The simulation files can be downloaded at

https://ole.unibz.it/mod/resource/view.php?id=10847

The simulation consists of four classes as shown below:

The class Simulation.java simulates the communication between two Link Layers, which each use their own Physical Layer to actually exchange messages.

One of the Link layers acts as sender, the other as receiver of a String sent in packages of 1 Byte. Each package is individually acknowledged, and only after acknowledgment the next package is transmitted.

Messages can get garbled and lost. To deal with garbled packages, the Link Layers uses a parity bit to check for errors. If a parity is wrong, no acknowledgement is sent. The sender will then receive a timeout while waiting for the acknowledgment and retransmit the package.

Your tasks are

1. Understand the code.
2. Explain why much less than errorProb frames are retransmitted.
3. Explain how lost acknowledgments are handled in the protocol.
4. Find the optimal value for the retransmission timer.
5. Improve the protocol by transmitting more than one package (aka sliding window).

Bonus 1: Improve the protocol by introducing negative acknowledgements, that is, if the receiver notices that a message got garbled, he notifies the sender instead of just waiting until the sender retransmit after a timeout. How big is the speedup due to NACKs?

Bonus 2: Improve the error detection of the protocol, e.g. by adding another parity bit. What is the impact of your improvement?