ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

## School of Computer and Communication Sciences

Goal: The purpose of this PDC project is to complement the theory with a hands-on experience. What you do in this project is not very different from what a communication engineer might do to test the feasibility of a concept.

Assignment: Develop a proof of concept to show that we can exchange files "over the air" between two laptops, by using the display of one laptop as the transmitting device and the camera of the other laptop as the receiving device.

More precisely, on one laptop you should implement a transmitter that reads a text file and transmits it by means of showing on the screen a picture that encodes the text. On the other laptop, you implement a receiver that captures one picture (or more) of the other laptop's screen using the camera, and reproduces the text file.

However, there will be a mask (made of standard white A4 papers) that will be put on top of the screen of the transmitter. The mask will cover 50% of the area of the screen. The mask will be chosen randomly from the following 6 possible patterns:
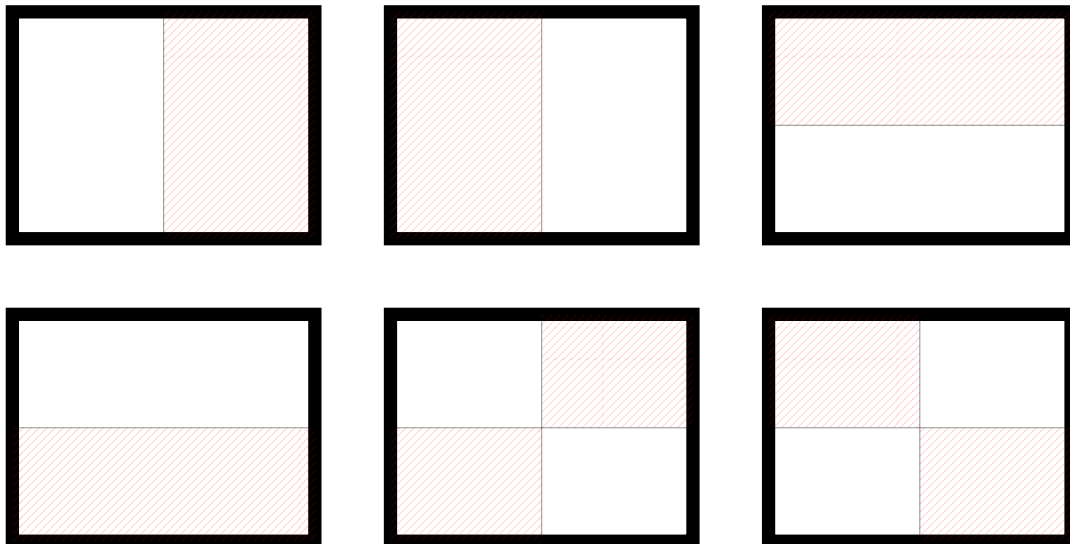
The thick rectangle represents the laptop screen and the shaded area represents the region that will be covered by A4 papers.

Rules and Recommendations:

- You work in teams of *three*.

  Please choose your teammates at latest by **Friday, May 5** and send an email to `elie.najm@epfl.ch` in order to register your team.

- We recommend that you use MATLAB as the programming language, but any other satisfactory solution is also accepted, as long as all the code pertaining to the transmitter and receiver is produced by your team.

- During the last class session (June 2), each group presents their project in a few minutes and gives a demonstration by transmitting a file that we provide.

(i) You will run the transmitter and the receiver on your own laptops (*in airplane mode*) but the mask will be chosen randomly according to the roll of a die.

(ii) You, however, need to send us your codes before **Friday, June 2, 10am**.

(iii) The two laptops will be at a distance of roughly 3m from each other.

(iv) The text file which you will be asked to transmit will contain *roughly 160 characters*.

(v) You will have 5 minutes in total for presentation during which you have to explain your signaling scheme briefly in 2 minutes and then will have 3 minutes for the transmission of the text file (that will be given to you on the spot).

(vi) You will be given *two* chances for transmission. I.e., if the received text is different than the sent one at the first attempt, you can repeat the transmission once more. However, the total duration (of both trials) must not exceed *three* minutes.

- Reliability plays the most important role in the evaluation. Hopefully the communication will be error-free. The data rate and the implementation details play a secondary role.

  (a) If you manage to transmit the file without errors during the first transmission you will get the full mark (15/15 pts).

  (b) In case of error-free transmission in the second attempt you will get 12 pts out of 15.

  (c) Otherwise your mark will be $(1 - \varepsilon) \times 12$ (out of 15 pts) where ε is the fraction of incorrect *bits* in the reproduced text at the receiver.

  (d) On top of that, if you manage to transmit the file without errors during the first transmission, you will have the opportunity to get 5 additional (bonus) points if you manage to transmit a long text file (that will be provided by us) of roughly 3000 characters in less than one minute. Only the group with the highest transmission rate will get the bonus points.

Note: This project is meant to be instructive and enjoyable. It accounts only for 15% of the points that you can accumulate towards your final grade. Do not let it become a major time investment unless you can afford to do so. In particular, we strongly recommend that you do not let the project keep you from fulfilling the other assignments (for PDC and other classes). Remember that the final exam accounts for 50% of the points.