Physical Experiments

Prepare the CPM Lab

1. Start the NUCs and switch with the white remote control by turning on the wall plug number 1.
2. Start the router with the white remote control by turning on the wall plug number 2.
3. Start the Computation Hardware.
4. Log in as `cpm-stud`.
5. Build your desired version of the CPM Lab.
6. Start the LCC.

Experiment

Simulated

Make sure that your HLC works in simulation. Simulate your desired vehicles, choose your desired script and follow this guide to start the experiment. All real vehicles need to be turned off for this, as they share the DDS interface with simulated vehicles.

Real

If you want to record a video of your experiment

1. Toggle the *Record* switch in the *Lab Camera* section of the *Setup* tab of the LCC.
2. After you stop the experiment, you find the video in `/tmp/cpm_lab_recordings/`

Continue to

1. Turn the vehicles on and position them in the driving area.
2. Turn on *lab mode* in the *Setup* tab of the LCC to activate the IPS.
3. Wait until all vehicles are shown at their correct poses in the LCC.
4. Choose your desired script and follow this guide to start the experiment.

> ⚠ Always ensure that the vehicles' batteries are loaded. If the battery percentage drops below 40%, charge the vehicle after your experiment.

> ⓘ **Troubleshooting**
>
> - If the Main PC does not start, make sure the power bar to which the PC is connected is switched on.
> - If you do not see a login screen this most likely because the login screen is shown either on the big screen on the wall or the screen on your left. You can either unplug the second screen or turn the corresponding screen on (worst case, turn on both).
> - If you encounter any problems during the experiment, refer to the diagnosis-tab. It can give a first idea where to look for errors.

Find errors at RTI DDS transmission

Use the RTI Tool (you find it on the main PC in applications):

1. Select "admin console"
2. Go to domain and View Preferences
3. Change the DDS Domain (on the bottom of the admin console) if necessary (the main PCs ID is 21, if you are not on the main PC you find it in /etc/profile)
4. Subscribe to the topic you want to listen to (keep the "advanced settings" unchanged) now you can choose the selected field if it is not already displayed from the dropdown menu.

Using NUCs for distributed calculation

The idea of the NUCs is to simulate a potent computer on a real vehicle for each vehicle. If you do not use the "NUC"-mode, all calculation will be done centralized on the main PC.

Turn on NUCs

Switch on the wallplug of the server rack by using the white remote control usually close to the main PC. The NUCs start automatically and each NUC will signal the LCC individually that it is online. You can find the online NUCs in the window on the bottom next to the button "reset view" at "HLC online". When you open the menu each NUC that is online is displayed. For each vehicle there is one corresponding NUC. The IDs have to match (e.g. vehicle 6 to NUC 6).

Nice to know

When you start the NUCs there is a program that is called "autostart". This program requests a password or, if you connect to the main PC, is connected via a ssh connection. The program will ask the main PC if there is a new software version for the NUCs and after a potential update it forces the NUCs to give a feedback every second to the main PC in the way of " I am online (ID)", where it identifies its ID via its own IP. if this alive-signal is not sent for a specified period of time, the LCC will mark this NUC as offline.

Nice to know

The NUC is supposed to simulate a potent server on a real life vehicle. This server would be usually connected via LAN. In the lab the vehicle and the NUC are seperate and therefore connected via WLAN. They use the DDS strucutre to exchange data.

Use the NUCs

1. You can use the NUCs if you choose the "deploy remote" option. The script will be sent to the NUCs for calculation instead of being calculated on the main PC centrally.
2. Start your program choosing "Deploy" . The script will be loaded to the NUC and started.
3. Switch to the timer-tab in the LCC. When all NUC are ready ("WAITING") select "Start".
4. To finish your simulation hit either "Stop" in the timer-tab or "Kill" in the setup-tab.

Fun Fact

You cannot use the "Central Routing" example for the distributed calcuation, as its purpose is to be calculated centralized (that why it is called CENTRAL routing;)).

If you upload it on the NUC, each NUC would calculate the trajectory and collisions for only local IDs and would have no knowledge about the neighbours. So collisions would be quite possible.

Nice to know

The Matlab version on the NUCs can be selected from the installed ones using the startup script. See Specifying the matlab version for HLCs on the NUCs.