CELSIUS Talk: OPT*i*-mising district heating solutions

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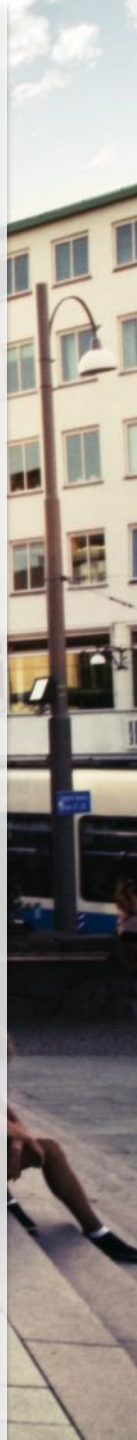

OPTi-misation from top to bottom

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Remember…

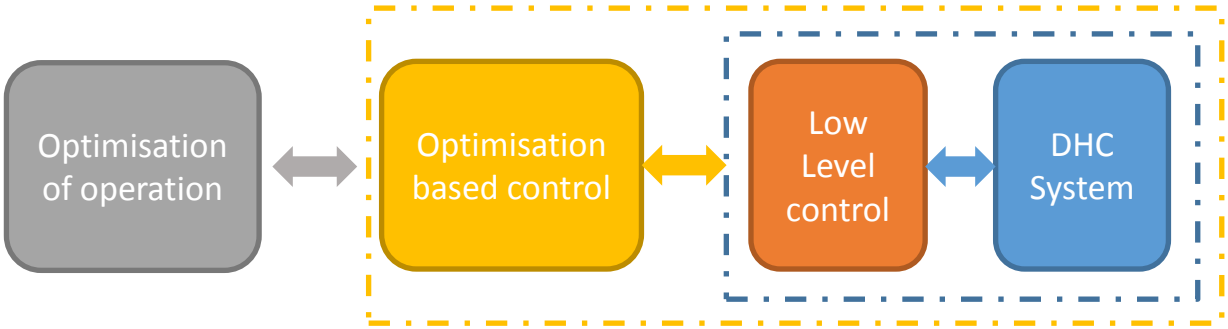
In the context of control and optimisation the following questions are important:

- Is the control strategy really optimal?
- Are the controllers adequate?
- Do we really need to supply the determined amount of heat/cold?

Optimisation

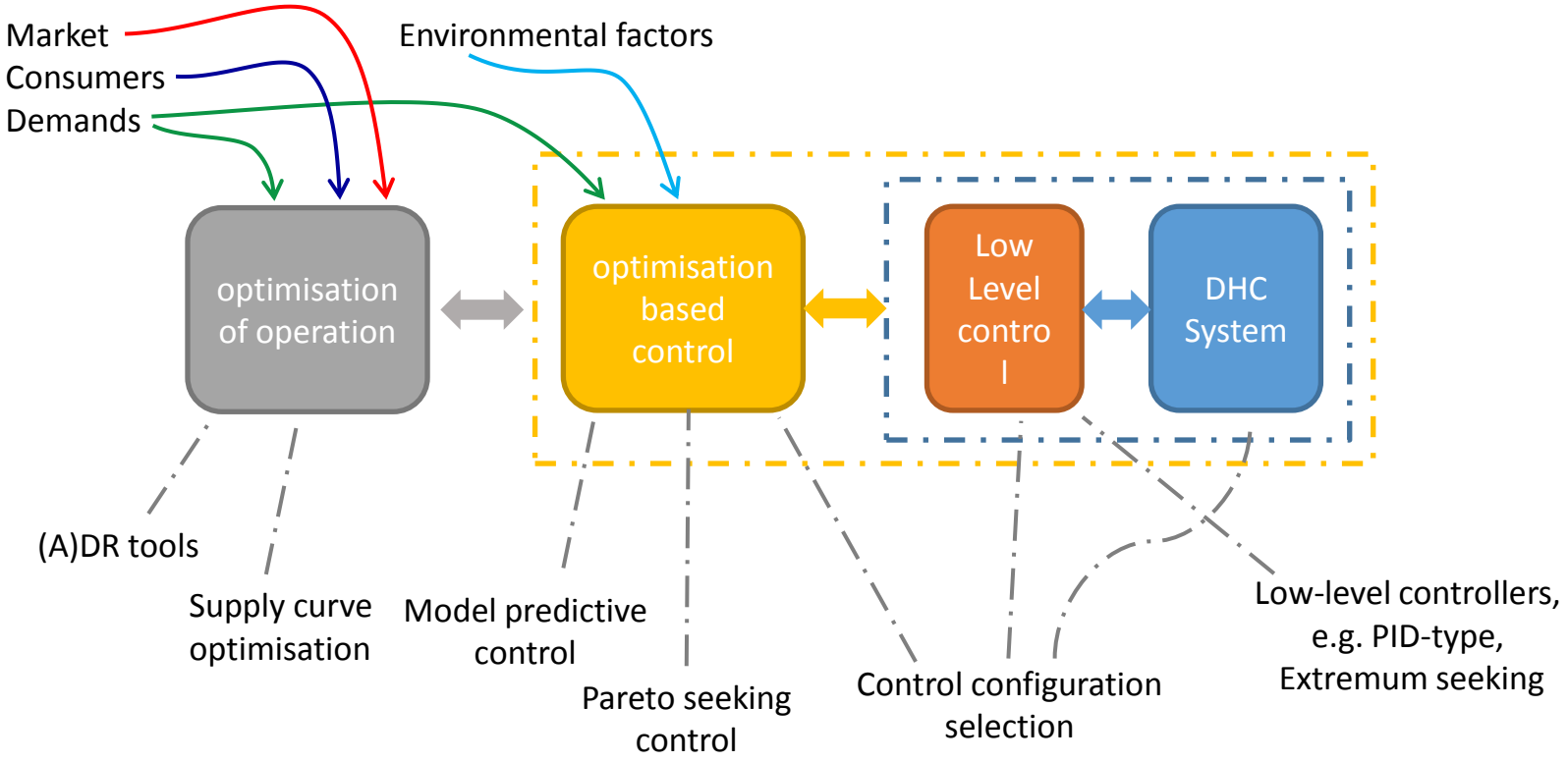
In OPTi, the **hierarchy** of the optimisation and control approach makes use of three layers:

- LLC **Low-level control** of pumps, valves and production units. This includes control configuration selection and design of controllers.
- OBC **Optimisation based control** of the DHC system by adjusting set points for the low-level control. This includes the consideration of forecast information.
- O^3 **Optimisation of operation** considering (A)DR strategies and production scheduling.



Control and optimisation approach

The control and optimisation approach considers certain phenomena (top) and makes use of certain methods (bottom):



Identifying grid control strategy with ProMoVis

Answers:

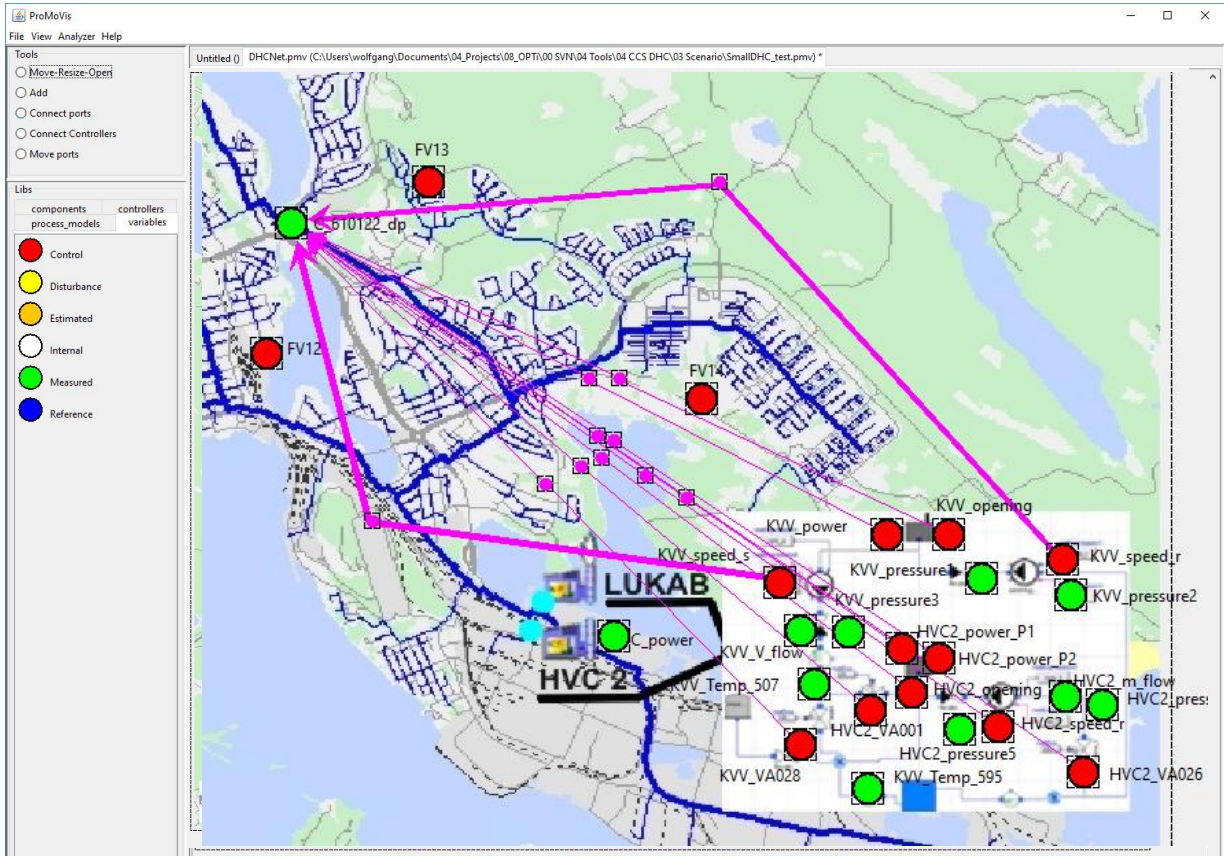
- Is the control strategy optimal?

Background:

- Achievable performance is limited by the chosen control strategy
- Low level control strategies affect on all levels

Enables:

- Optimal selection of control strategies
- Decision making/support



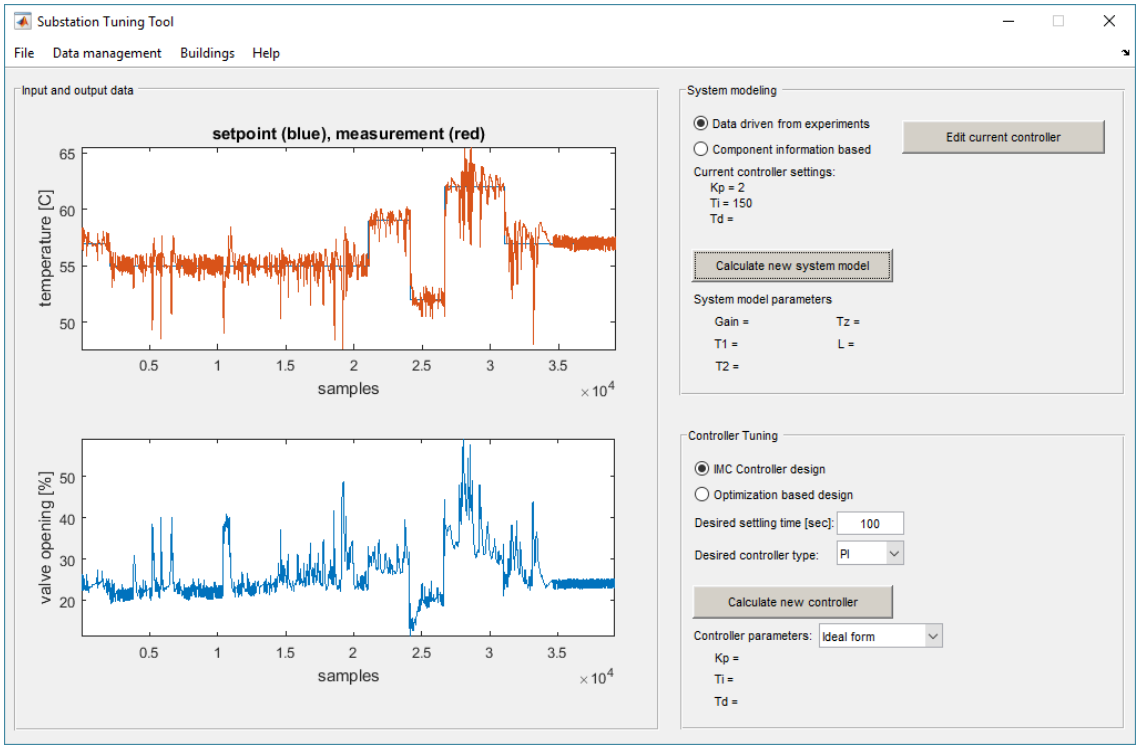
Determining appropriate controller tuning

Answers:

- Is the controller tuned adequately?

Background

- Controller tuning is often a low priority activity.
- Quantification of performance loss in economic terms is very difficult.



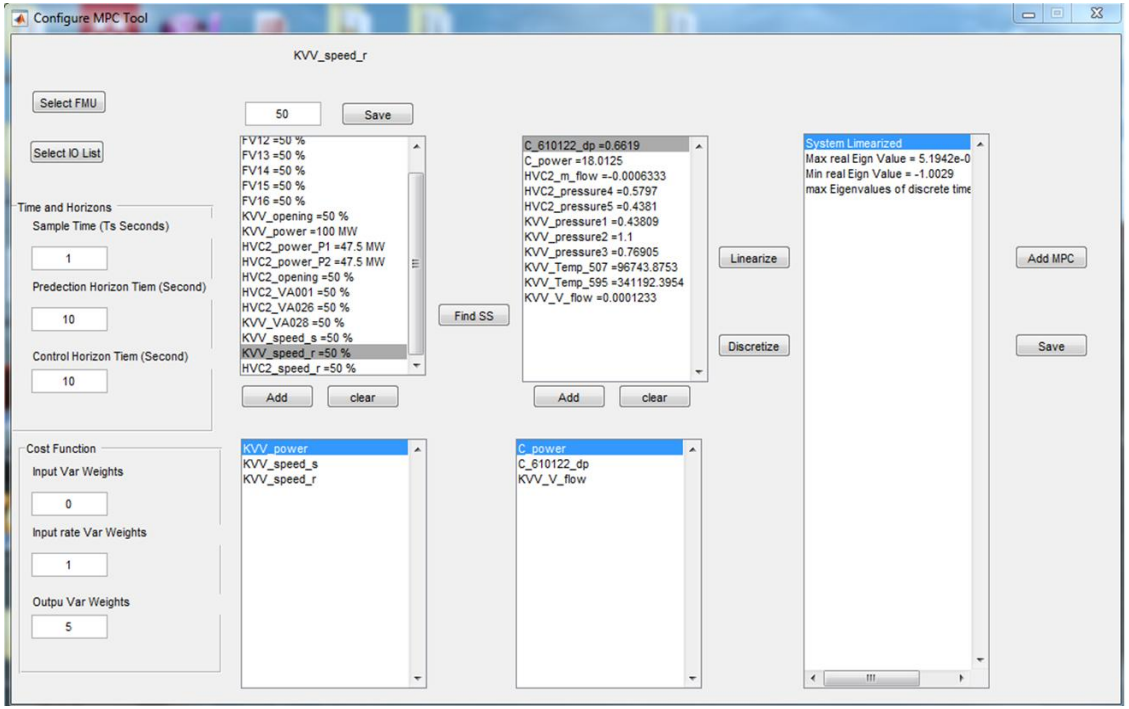
Enables

- Tuning of controllers based on experimental data
- Component based modeling reduces the exerimental burden

Optimisation based control – Predictive control

Answers:

- Do we really need to supply the determined amount of heat/cold?



Background:

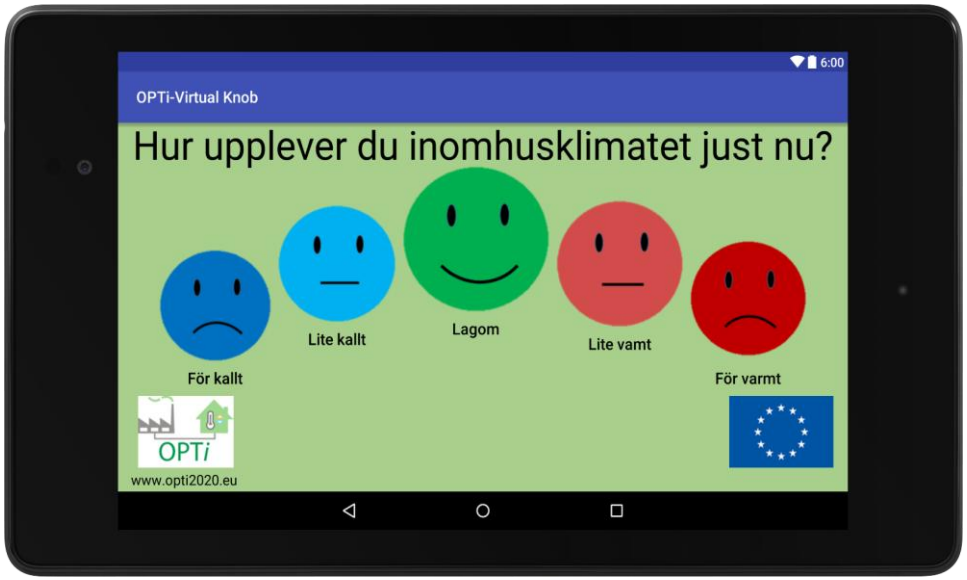
- Peak load demands and weather conditions can be foreseen.
- MPC controllers are not easily deployed.

Enables:

- Design of MPC controllers is largely facilitated
- Provides the opportunity to find new supply temperature curves

Virtual Knob Concept – Understanding the user

- Enables the use of live feedback from the consumers about their comfort.
- A simple, intuitive interface to express their experience of the comfort
- Ranging from ‘too cold’ to ‘too hot’.



Virtual Knob

Answers:

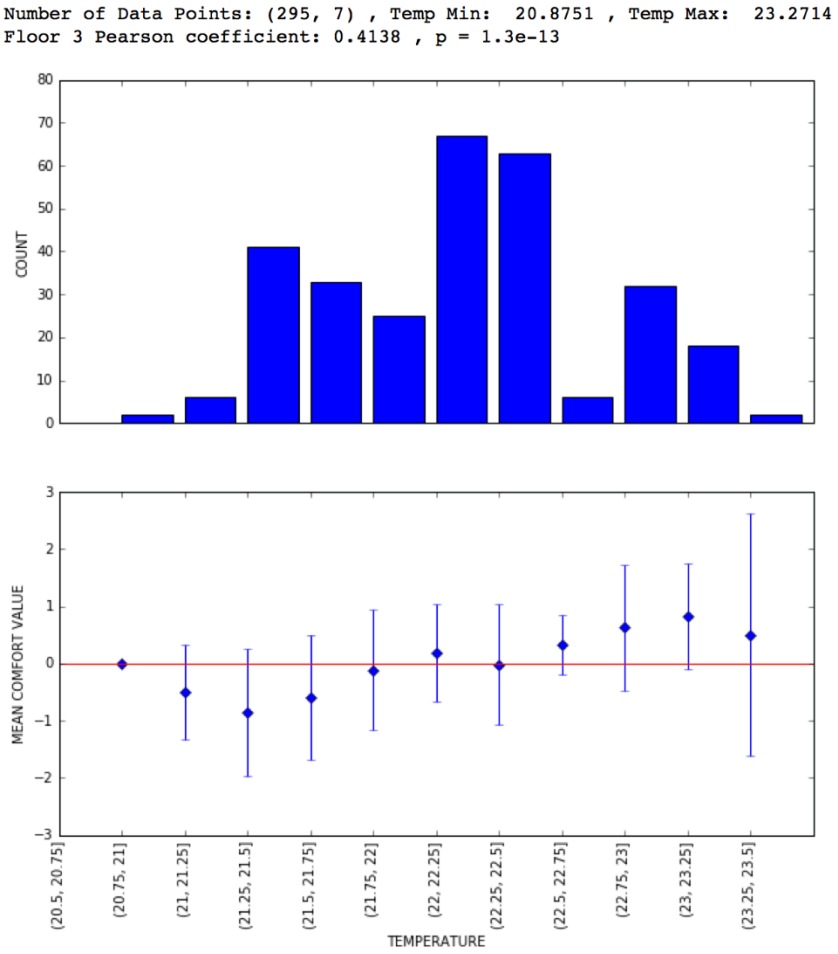
- How much heat/cold is needed?

Enables:

- Active use of the comfort zone in optimization.
- Aids in widening the comfort zone

Typical problem:

- Access to users data, its usage and sharing



Summary

- A number of methods and tools for the design of control and optimisation scheme in DHC are developed
- The resulting schemes integrate with OPTi-Sim through the use of the FMI standard.
- Developed tools:
  - Control configuration selection which provides control strategies
  - Tuning and assessment of low level controllers
  - Design support for predictive controllers
- Testing of the tools is ongoing but initial evaluation test show promising results.