

Room Systems as a Service Platform for Smart Buildings

Authors: *Risto Kosonen*

Affiliation: *Aalto University, Espoo, Finland*

Session no.: WS 9 28.05.2019

Introduction

- How smart HVAC-technologies can be incorporated in retrofitted buildings
- Evaluate how to integrate different systems including building automation, HVAC and Aalto space mobile application
- Evaluate how ICT-technology and services can be used in buildings through case examples

BUILT ENVIRONMENT FACING CLIMATE CHANGE

Case rooms in Undergraduate center

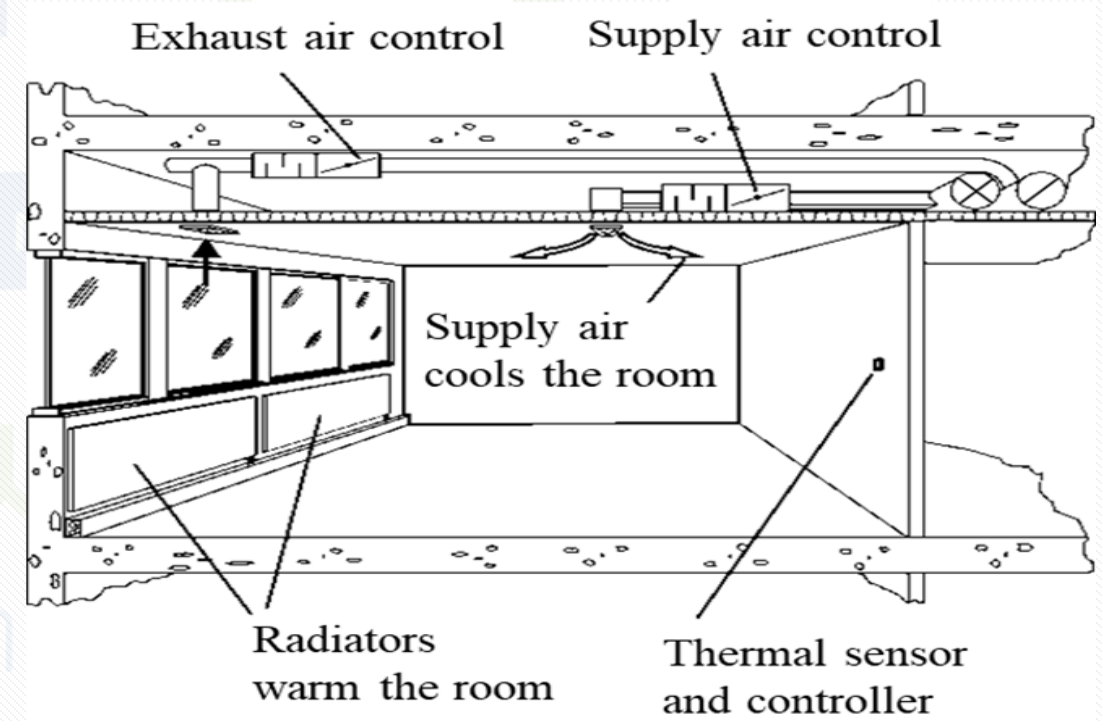
- Smart room systems studied in seven group working rooms of Otakaari 1
- Rooms are used as group working spaces for students



BUILT ENVIRONMENT FACING CLIMATE CHANGE

HVAC system of the case rooms

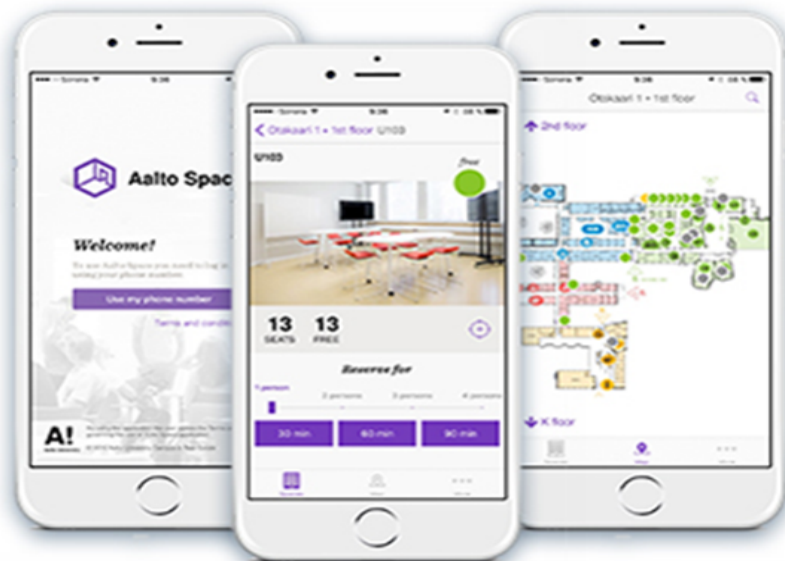
- Ventilation by a VAV ventilation system with T + CO₂ control
- Each room has two supply and exhaust air terminals
- Terminals are equipped with on/off dampers
- Heating by water radiators equipped with manual thermostatic radiator valves



BUILT ENVIRONMENT FACING CLIMATE CHANGE

We let the users to adjust the ventilation and temperature

Aalto Space mobile app for room reservations (iOS + Android)



Space heating:

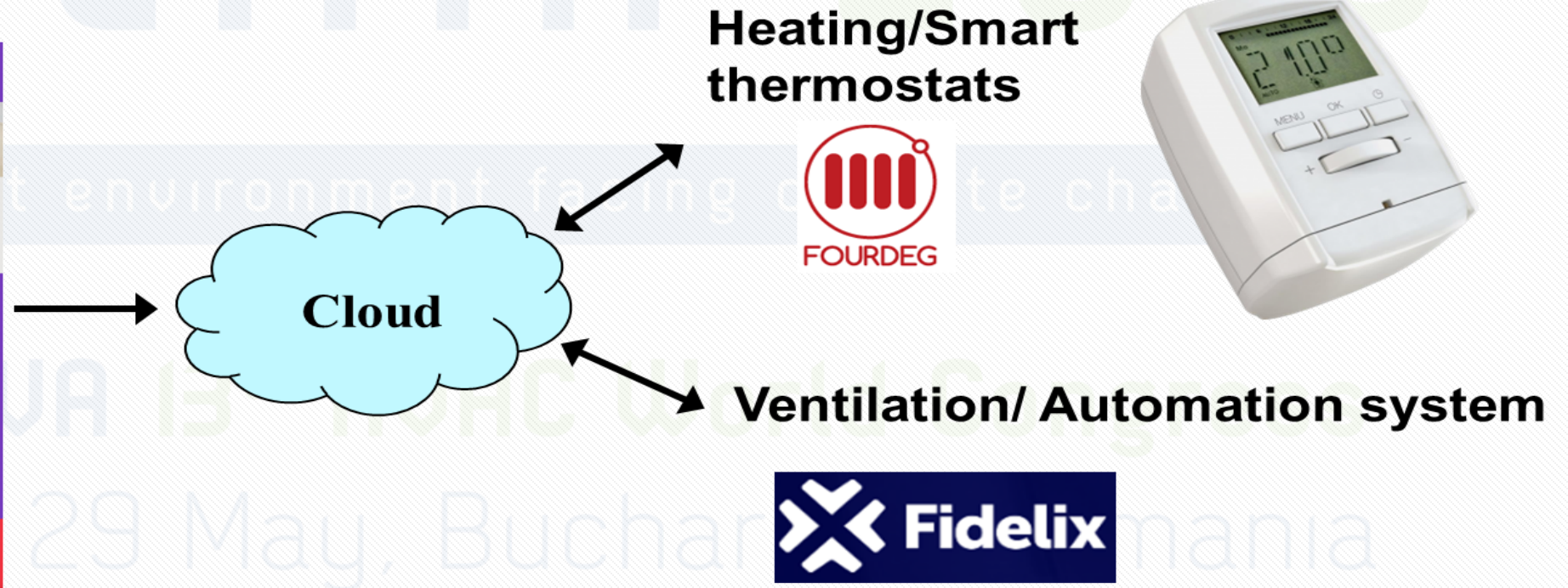
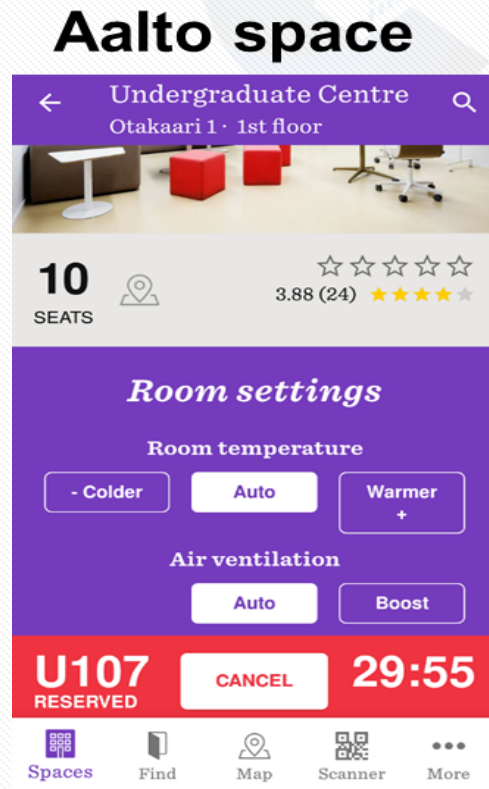
- Users can adjust set point of heating during the reservation
- Electronic IoT thermostats are needed

Ventilation:

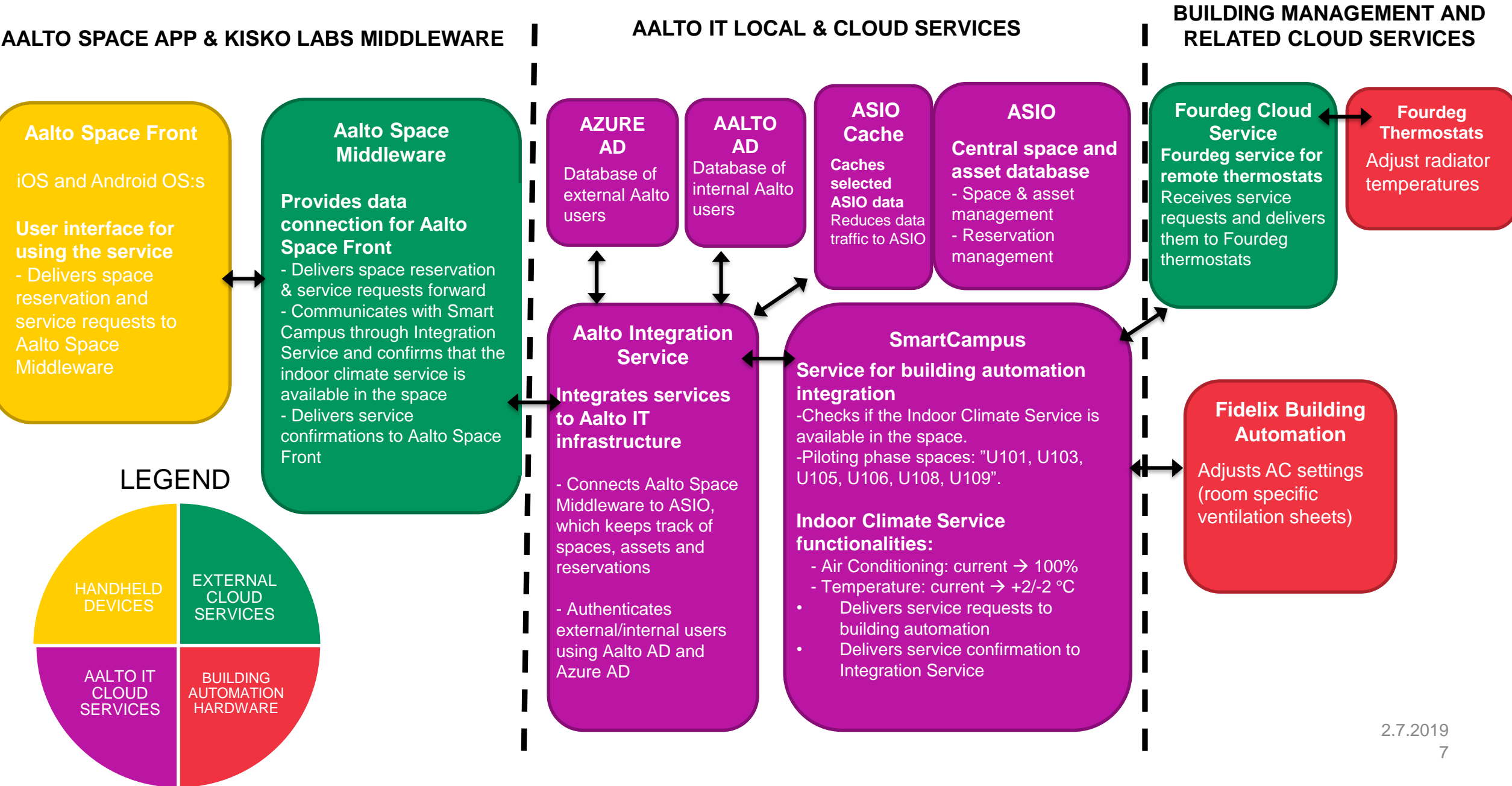
- Users can override the settings of the automation system of Fidelix oy during the reservations

BUILT ENVIRONMENT FACING CLIMATE CHANGE

Principle of the Aalto Space control



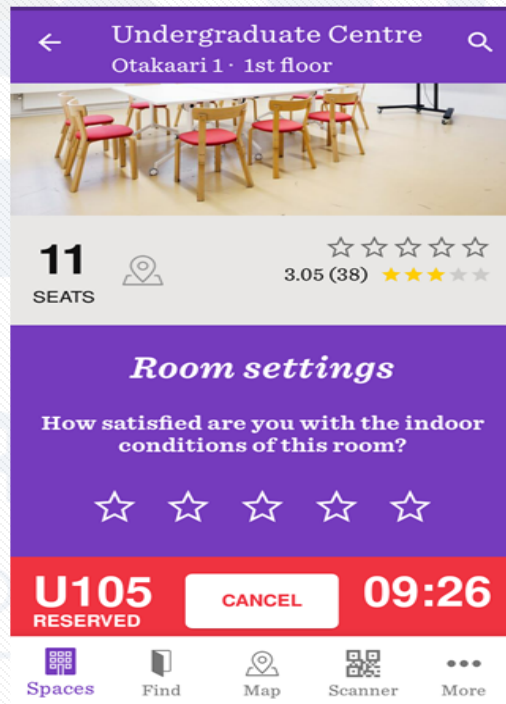
Integration of Aalto Space, real estate IT services and Building Management systems together



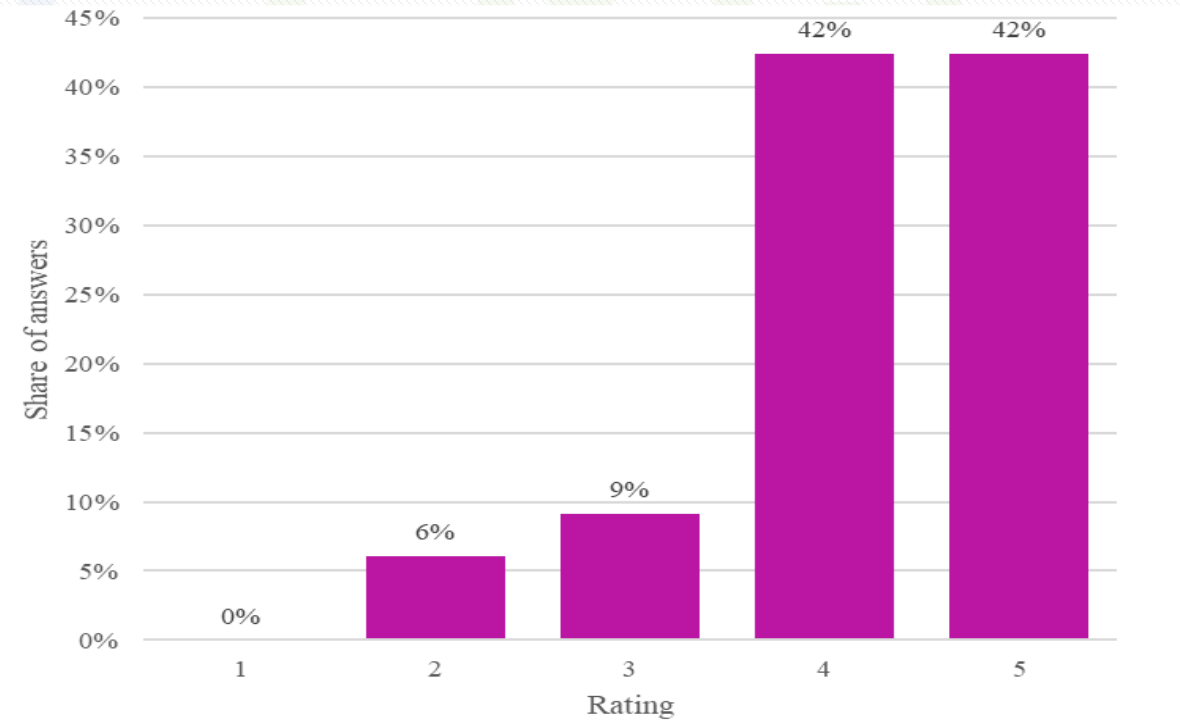
BUILT ENVIRONMENT FACING CLIMATE CHANGE

User satisfaction?

“How satisfied are you with the indoor conditions of this room?”



User feedback



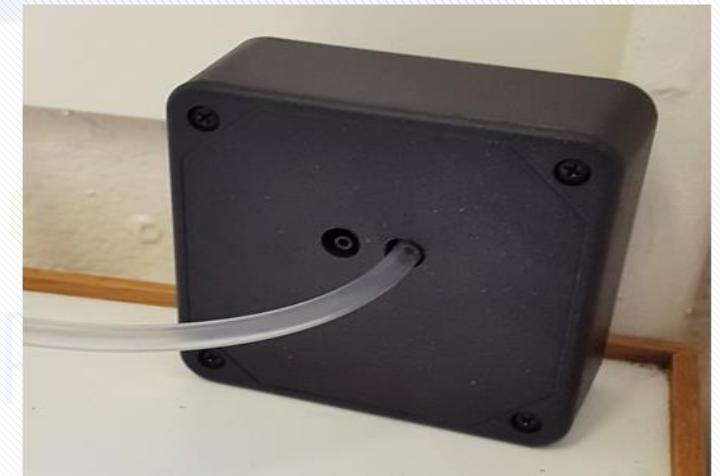
Monitoring of the pressure difference over the envelope

- Wireless data collection by Integral IoT service
- Data is transferred to the cloud by Sigfox radio network
- Pressure sensors: Sensirion, sensor model SDP816-125PA
- (accuracy 3 % of reading)
- Time step of the measurement 30 min

Pressure
difference



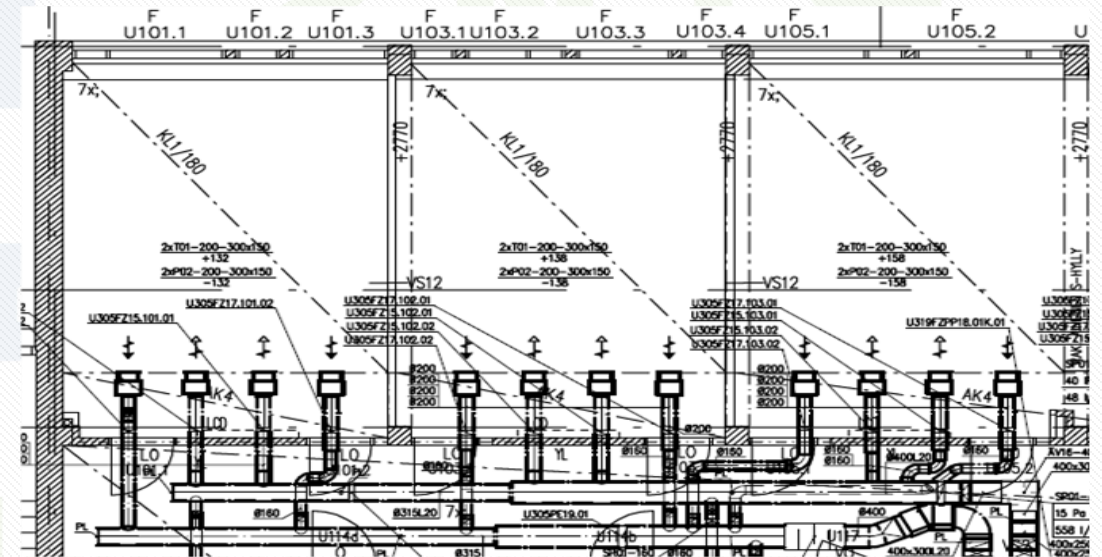
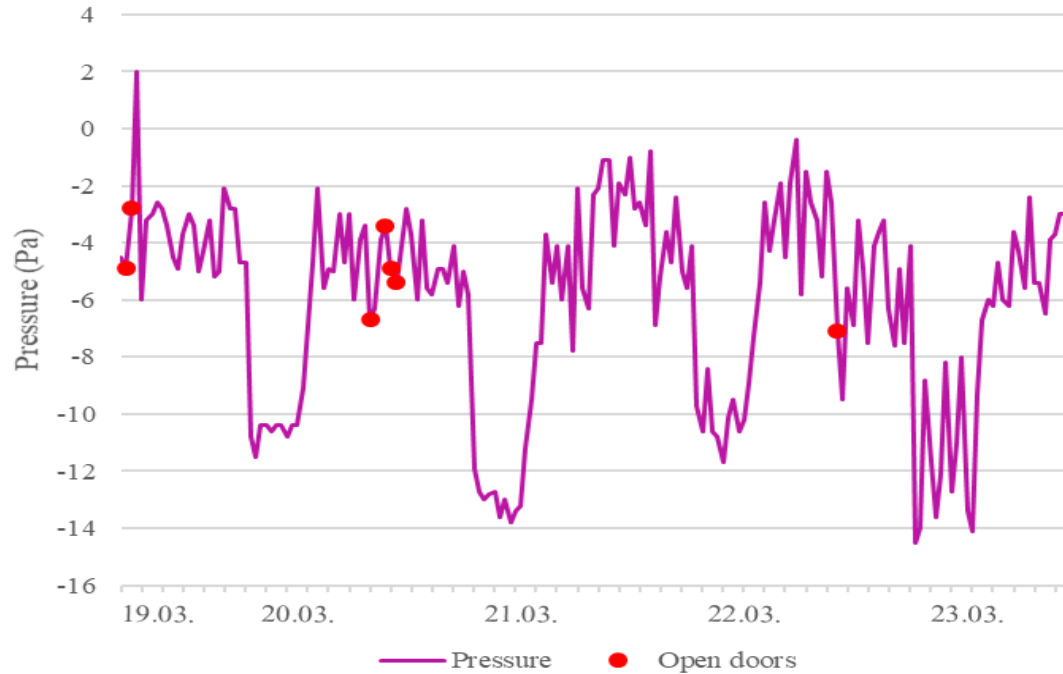
Cloud



BUILT ENVIRONMENT FACING CLIMATE CHANGE

Pressure difference over the building envelope

Room U101

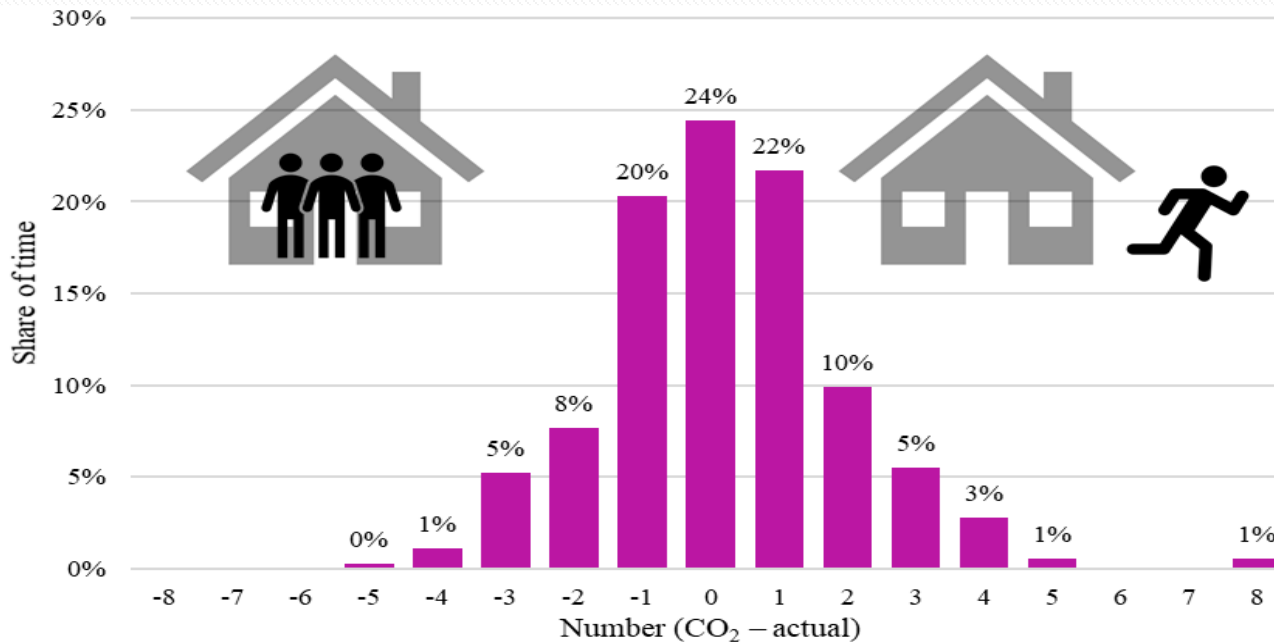


Even though, the rooms are connected by the same ducts, the neighboring rooms do not have a major effect on the pressures in the rooms.

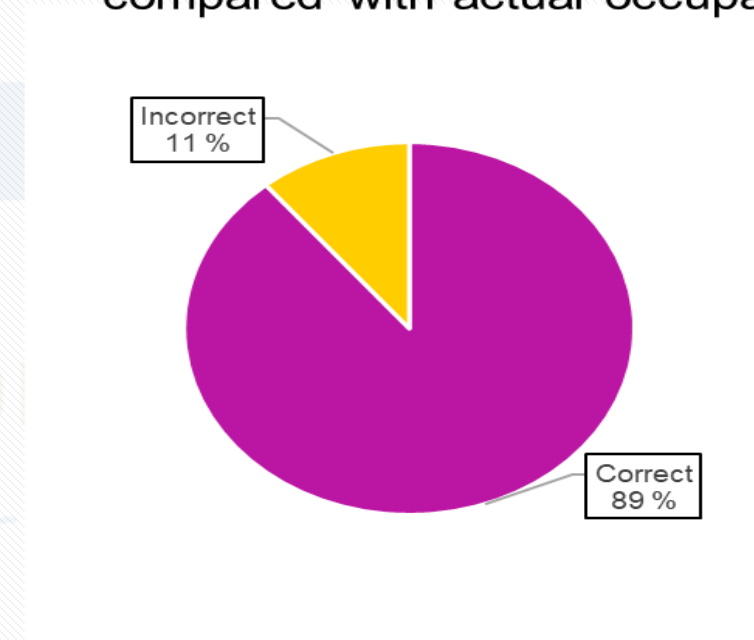
BUILT ENVIRONMENT FACING CLIMATE CHANGE

Room occupancy – CO₂ concentration

Difference between CO₂ concentration-based calculation and actual occupancy



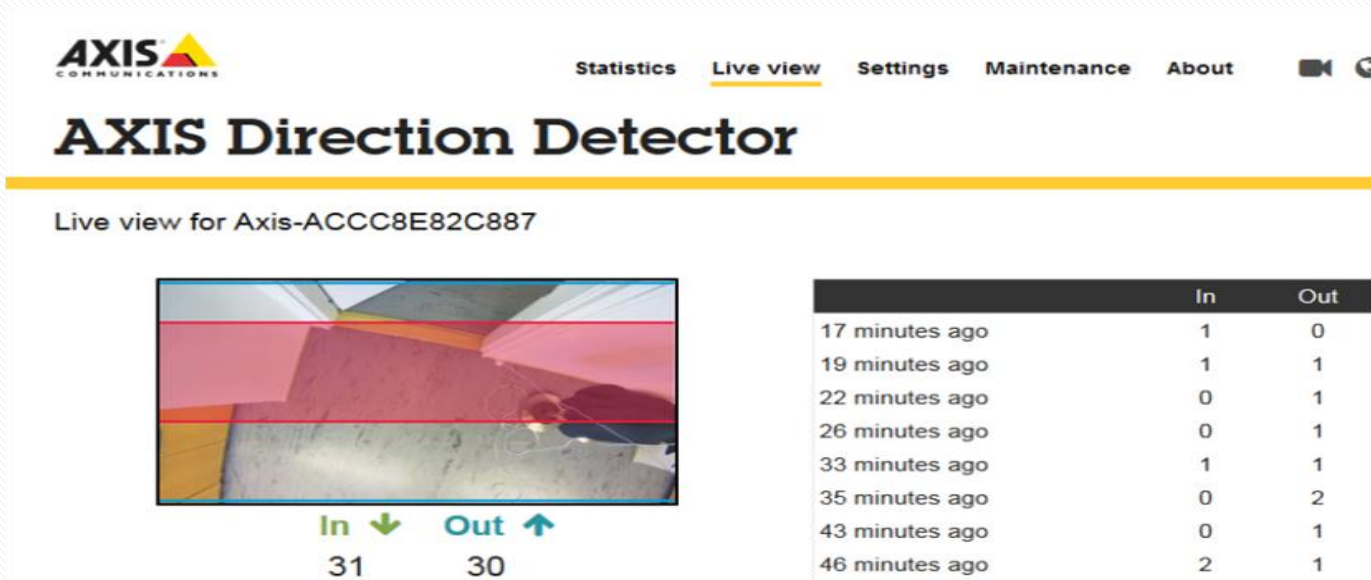
CO₂ concentration-based room occupancy compared with actual occupancy



BUILT ENVIRONMENT FACING CLIMATE CHANGE

Room occupancy – AXIS M3045-WV

- Fixed mini dome surveillance camera with AXIS direction detection application
- 95% accuracy in detecting movement



Conclusions

The main benefits of the novel system compared the standard ones are:

- 1) the monitoring of the ventilation system performance is improved and possible risk of damages in building envelope could be reduced,**
- 2) the controllability of indoor climate is enhanced in energy efficient manner, and**
- 3) finally users' perception on the indoor climate is improved.**



Thank you!