Semantics-Driven Middleware Layer for Building Operation Analysis in Large-Scale Environments

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Outline

- Introduction & Motivation – Facility Management Systems
- Problem – BMS Data Analysis
- Methods & Areas of Research
- Results
- Conclusions

Introduction

Facility Management Systems

Facility Management

- According to IFMA (International Facility management association): **„a profession that encompasses multiple disciplines to ensure functionality of the built environment by integrating people, place, process and technology“**
- FM ensures tasks, which are not part of organization‘s „core business“

CAFM(Computer-Aided Facility Management)

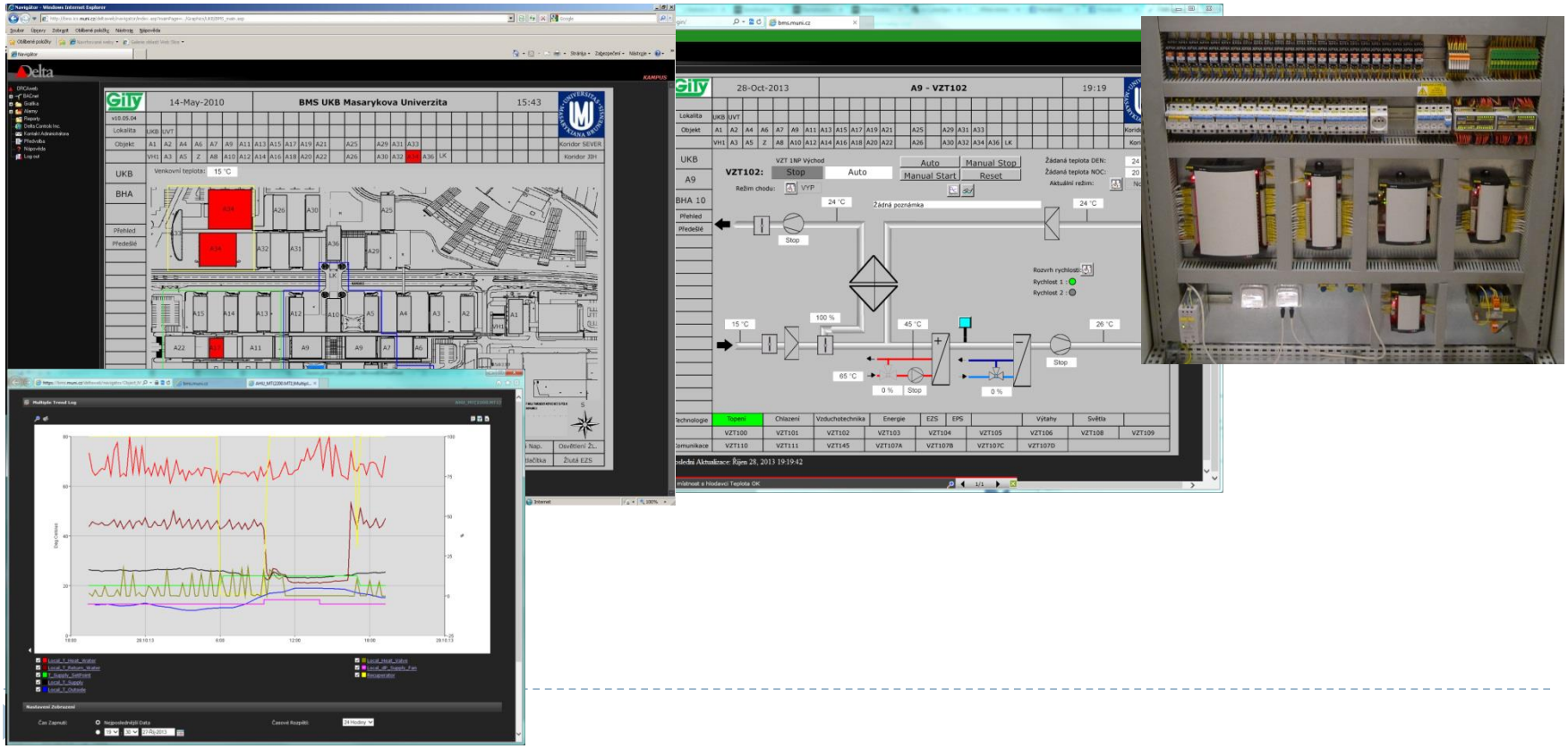
- CAFM software supports:
  - Space management
  - Maintenance
  - Energy management
- Provides advanced analytical tools

BIM (Building Infrastructure Modelling)

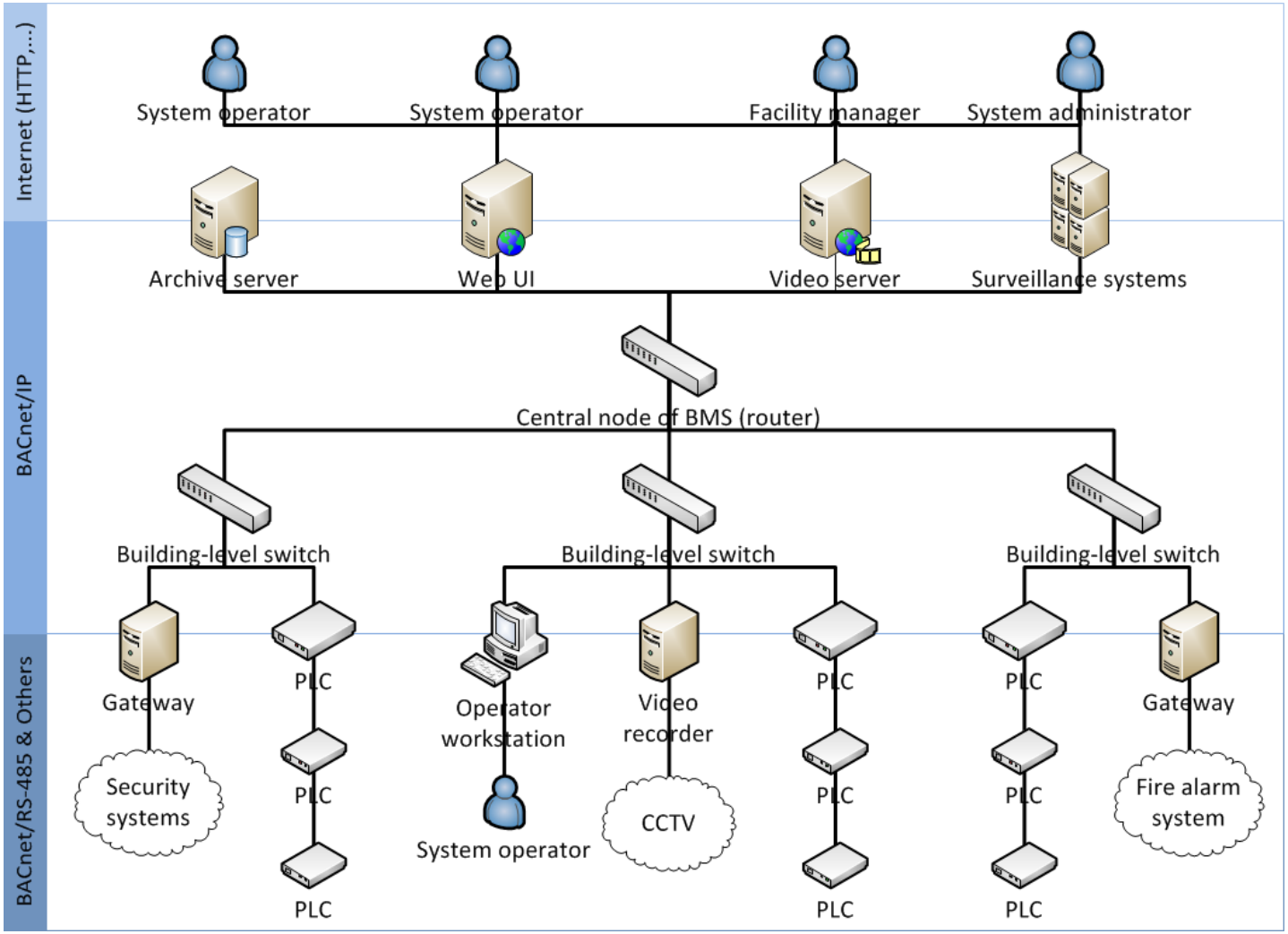
- Database of building constructions and devices

BMS (Building Management System)

- Monitors and controls building automation systems
- MU has large BMS (40 buildings, 1000 devices,...)



BMS (Building Management System)



Motivation

- Facility manager should be able to query the BMS system in similar manner to those examples:
  - Show me which rooms on the second floor of A11 building had running AC units during last 8 weekends.
  - Tomorrow morning, I want to receive report about electricity consumption in 5 minute intervals for those 4 buildings since now.
  - I want to know which devices influence temperature in office of Mr./Mrs. XY.
  - For all buildings at University Campus, compare electricity consumption per square meter.

Problem

Issues of Building Operation Analysis

Issues of BMS

- Inaccessible data
- Missing semantics
- Inflexible built-in analytical features

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- Advanced analytical tools are unavailable for large-scale environments
- Integration of BMS, BIM and CAFM does not exist

Two Types of Users

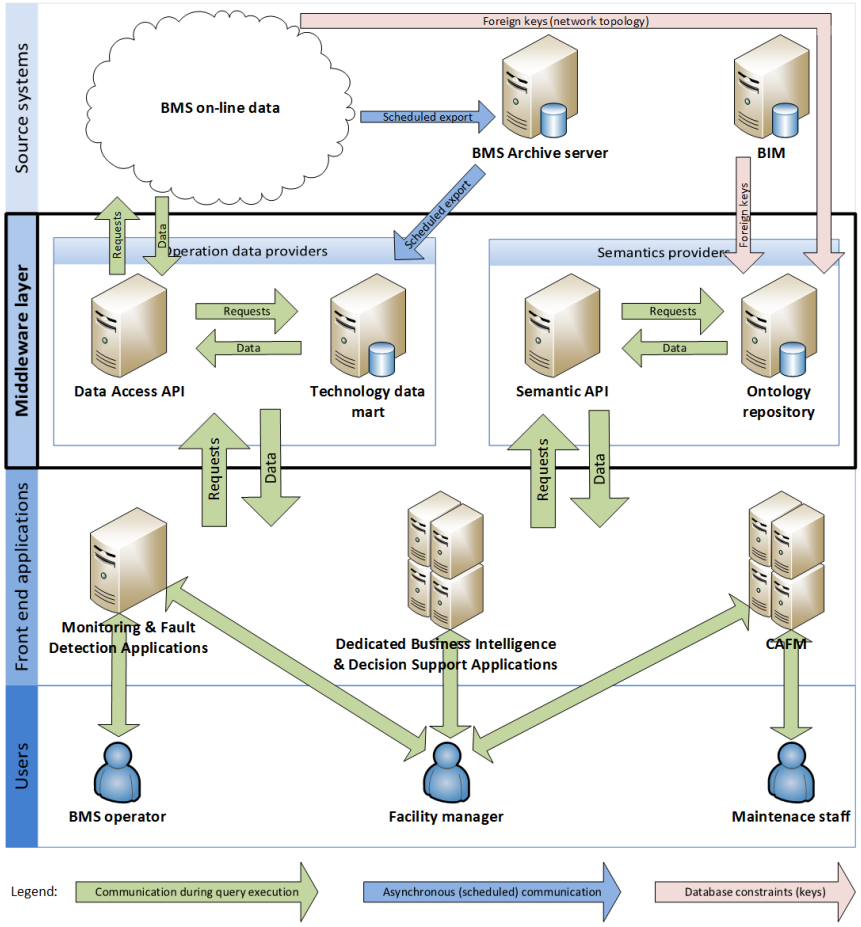
- BMS contain precise and detailed data about building operation
- Those data are not easily accessible
- Two kinds of people:
  - Knows how to analyze data but can‘t get them (Facility managers)
  - Knows how to get the data but can‘t analyze them (BMS operators)

Methods & Areas of Research

Steps Towards Flexible And Efficient Analysis

Methods and Areas of Research

- Middleware
  - Data access
  - Data semantics
- BMS specific operators
- Query library
- Front-end applications

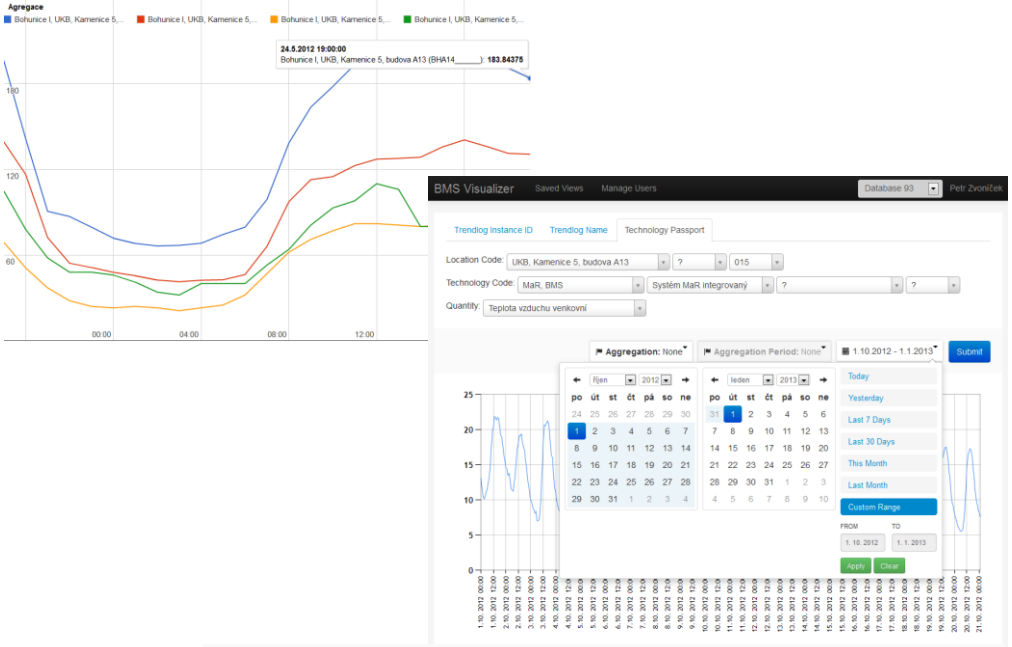


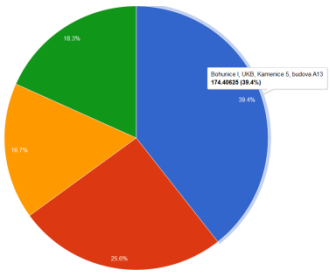
Results

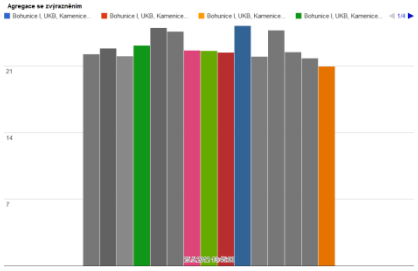
Existing Applications & Tools, Work in Progress

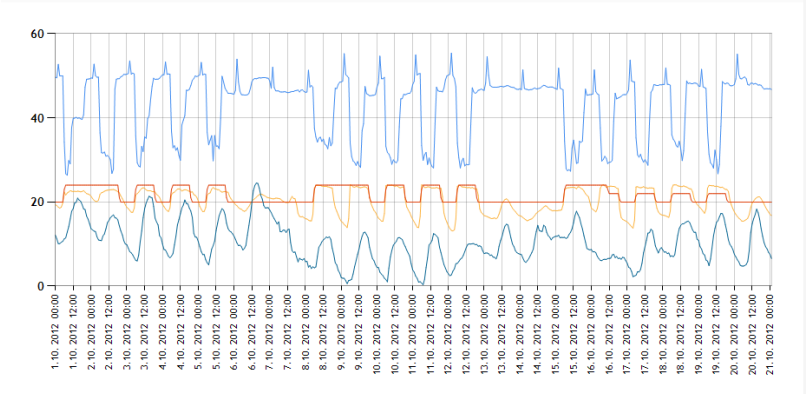
Results

- Exposing data
  - Technology data mart
  - BMS API
- Integrating BMS&BIM
  - Ontology repository
- Analysis & UI
  - CEP engine
  - Archive data browser
  - Machine learning methods









Conclusions

Benefits of Proposed Solution

Conclusion

- The main goal:
  - Middleware for FM data processing
- Developers will focus on:
  - Analytical methods
  - Convenient user interfaces
- Facility managers will be provided with:
  - Direct querying of the BMS
  - Flexible reports
  - Advanced analytical tools
  - Incorporation of BMS data into CAFM

Thank You for your attention.

Questions?