A distributed, collaborative development project of a Policy Engine for use in buildings

Global Software Development

Berntsen, R., raber@itu.dk
Hansen, K., kben@itu.dk
Kokholm, T., tkok@itu.dk
Stanciulescu, S., scas@itu.dk
Wainach, N., nicl@itu.dk

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Abstract

background, however, ... what we did (the innovative aspects) contributions (design, evaluation) method results / what it means

Contents

Chapter 1

Introduction

Natural resources are a precious commodity. Constructing resource efficient buildings makes sense, both in a political and economical perspective. Modern buildings today might come equipped with a suite of sensors and actuators, opening up for a degree of customizable control. Our collective need is that buildings can adapt to the users and the sensor-perceived environment, either automatically or manually. This can be achieved by developing policies that controls the actuators. Policies can be based on semi-static data, like time and weekdays. However this can have unforeseen and unwanted consequences. For example, a policy governing lightning activated merely by a static time schedule, might entail problems for people attending a rarely occurring late-night party in the building. If the building? event calendar is accessible to the policy engine, a conditional event-checking statement might ensure continuous lighting. However, in order to achieve a more fine grained control, sensory input is needed. We define the interaction of these policies, as a task residing in Facility Management (FM).

Without policies centralized control of a building is highly complex and error prone task, and the building might not be managed in a resource efficient way. By employing a policy engine, with access to the building? sensors and actuators, both the building owner, the users and the administrators of the building benefits from the automation provided. If policies are correctly defined, building owners save energy and natural resources while providing extra comfort to their tenants. Building users can experience a building autonomously adjusting its internal environment to suit their comfort and needs. FM can achieve fine-grained control of the building, at a reduced workload.

In this paper we will; 1) document the collaborative project between the IT University of Copenhagen, Denmark and Strathmore University, Nairobi Kenya. 2) distill requirements from course provided material and a non-exhaustive literature search on policy engines, and 3) develop a software solution that implements these requirements.

Since this project was defined in the course Global Software Development at ITU, we have been provided a Building Simulator, making it up for a real building. The development focus of this project is therefore geared towards this simulator, and not for design and implementation challenges in doing a policy engine for a real building. The end product is a software based management console, that allow for centralized control of sensors and actuators in a building - by implementing a policy engine that allows for automated actuator responses based on sensor feedback, for example closing the blinds in excess sunlight or turning of the heater when windows are open.

1.1 Context

1.2 Problem

Chapter 2

Related Work

Related work

Chapter 3

Method

3.1 Method

Before any actual work could start, one preliminary goal was to figure out how we could make our group work together as one. Actually this challenge is even more challenging in this project than in a normal work situation: No organization is in order, no predefined roles, no actual project goals and the likes. This chapter will focus on these challenges and how we tried to handle these. We will highlight different methods to create social interaction and understanding. We will focus on how one can rationalize collaboration. Afterwards we will discuss the different tools we used throughout the project life cycle with collaboration in mind. Finally, we will discuss how one can manage a virtual project.

3.1.1 Social Context

When we discuss the *Social Context*, we discuss the direct milieu in which the person is and how different factors can influence this person. Communication is also a part of the social context, which is not necessarily only between two persons but can be between one to many persons, in different time zones, different cultures etc.

3.1.1.0.1 Common ground Our first step to connect to our fellow group mates in Kenya was to introduce ourselves via an e-mail and just shortly highlight some common information about each person from ITU, like stating name,

age etc. This method is known as creating "common ground", as introduced by Olson and Olson **REFERENCE**. The term to create common ground "refers to that knowledge that the participants have in common, and they are aware that they have it in common"**REFERENCE**. Common ground is not only established through simple general knowledge about each participant. It is also created through a persons behaviour and appearance through meetings and conversations. We tried to use this method as a way of getting to know our team members, to create a level of understanding and finally to create a stepping stone from which the project could evolve from.

This initial contact was already quite frustrating because of the fact that it was difficult to get a reply from some of the group members in Kenya, only two members was relatively easy to get in touch with. This leads directly to two different considerations in our group work: "Trust"textbfREFERENCE and "First impressions matters"textbfREFERENCE. Trust in group work is a value of high much the different team members trust in each other. How much does one believe that the other team members will deliver their part of the necessary work? How much does one believe that a mail we be answered? How well does the team work together? The trust is between the two subgroups, Denmark and Kenya, relatively low because of the amount -and lack of- replies and general communication. At the time being we only expect one member from Kenya to be online during our team sessions but at the same time we expect everybody from the ITU-group to be online at every session. This is also translatable from the first impressions that we received from the group from Kenya. It is not in any way rewarding for the group atmosphere not to join group conversations and not replying emails.

The literature for these topics seems to agree that these sort of problems generally arise from two different topics. One being "Collaboration- Technology Readines" and the other "Continuities/Discontinuities".

TODO:

- Common ground - in progress
- Coupling of work
- Trust
- Ethnocentrism
- Collaboration readiness
- Technology readiness
- First impression matters

- Communication

3.1.2 Collaborative Work

Collaborative work across cultures is a challenge. In our case we had to work together 9 people with 4 being from Kenya, a culture and country that we before entering this project, didn't know much about. As mentioned earlier the social context and the process of creating 'common ground' with the collaborators is of high importance to create a fundamental shared understanding of the task and build up the motivation and very much needed trust for the collaboration to succeed. Cooperative work is defined by Schmidt REFERENCE as "People engage in cooperative work when they are mutually dependent in their work and therefore are required to cooperate in order to get the work done," (Schmidt)

The bigger the group the more 'articulation work', articulation work is the extra activities required for collaboration. The task at hand defines what is work and what is articulation work. Articulation work is about who does what, when and where. There are mechanisms of interaction that supports the process when articulation work cannot be handled through every day social interaction. These mechanisms are for instance: Organizational structures (formal/informal), plans, schedules and conceptualschemes. What all these mechanisms have in common is that they all strive to reduce the effort in labor, resources, time, etc. required to handle articulation work. Our strategy for the articulation work was to define processes and choose the groupware technologies that supported our cause best possible. To rationalise the interaction of the coordination task we segregated the tasks into smaller more comprehensible tasks. Group members were assigned to these tasks that would work closer together on solving that particular task. Further more we created a project plan with deadlines and milestones to keep track of everything. Moreover we agreed on having a status meeting every week, where we would discuss progress, issues, ideas etc. Arranging a meeting where all is able to attend is not always easy because of

- Cooperative work
- Articulation work
- Awareness
- Coordination of actions
- Management of coupling
- Coordination of mechanisms

3.1.3 Groupware Technologies

- Adoption process
- Adaptation
- Critical mass

3.1.4 Virtual Project Management

- Continuities
- Discontinuities
- Virtual meetings
- Virtual team dynamics

->START NOTES

CSCW: Every real world system is an open system No formal descriptions can capture collaborative work Impossible to anticipate every contingency which might occur Collaboration is open ended There will always be exception handling Plans are resources for work

-> Discontinuities 'gaps or lack of coherence in aspects of work, such as work setting, task, and relations with other managers' (Watson-Manheim et al., 2002:193)

'a discontinuity, edge, or other dividing characteristic present in the work context of team' (Espinosa et al.2003:158)

General properties of discontinuities Not stable, but changeable Can be seen as highly interlinked – continuum Can emerge and change over time as people adapt in the teams Discontinuities may only affects parts of the work Discontinuities often appear in bundles (for instance geography+time +organizational) Examples of discontinuities: Temporal (working across time zones, geographic work location, work group membership(e.g. who you work with), organizational affiliation and cultural backgrounds, expertise related (novice vs experts), historical (different version of a product), different professions (e.g. developers and researchers) or different technologies.

-> Continuities

Stable factors in the collaboration that the participants are aware of and consciously act on, or they may be implicit and unrecognized. (Watson-Manheim et al., 2002:200)

Continuities can appear to routine or invisible in order to overcome discontinuities
Can be described as strategies or factors to overcome discontinuities

-> END NOTES

Chapter 4

Design

high level design argument for it, discuss the alternatives overall system architecture components, relationships limitations of your design

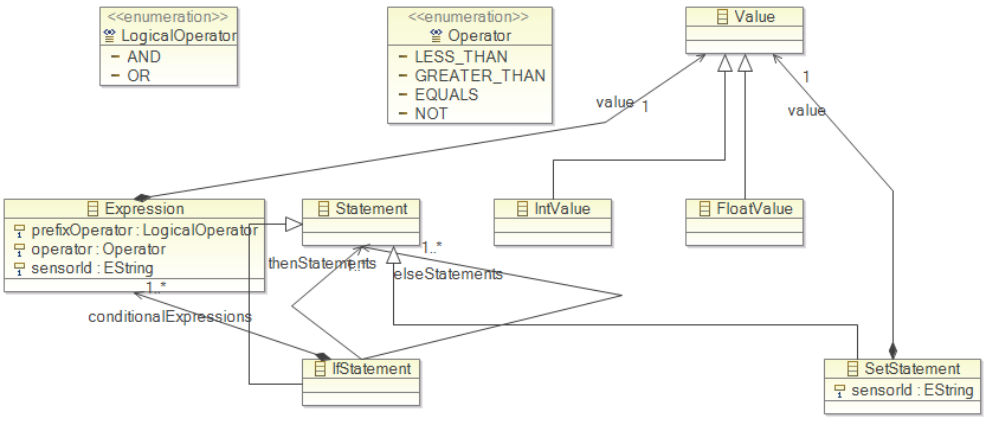

Figure 4.1: Model

Chapter 5

Implementation

5.1 System

5.1.1 Interface Component

5.1.2 Abstraction Component

5.1.3 Storage Component

5.1.4 Request Flow

5.2 Collaboration Structure

5.2.1 Communication Protocol

Chapter 6

Evaluation

eval..

Chapter 7

Discussion

discussion...

Chapter 8

Conclusion

conclusion...

Bibliography

Appendix A

Appendix

A.1 A.1. Requirements

A.2 A.2. Tests