

## **IMPLICIT OR EXPLICIT COORDINATION OF VIRTUAL TEAMS IN BUILDING DESIGN**

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**Abstract.** This paper describes the conclusions of a reflection driven by a virtual team, composed of three research teams (one in computing at LORIA, one in telecommunications at France Telecom R&D, and a last one in building construction and design at CRAI) in the context of a common project. The topic of this project is the coordination of a virtual team in the context of a virtual enterprise, with experiments in the field of building construction. More precisely, our goal is to define a model of cooperative work allowing the partners of a building construction to coordinate their efforts in an efficient way.

### **1. Introduction**

Our objective is the coordination of Virtual Teams. We are particularly interested in coordination in the context of SMEs, which communicate through Internet for co-conception and/or cooperative engineering applications purposes (Bignon, Halin and Malcurat, 2000).

Quickly at the beginning of the project, everybody agreed on the central role of object sharing, and especially document sharing, for team coordination. Complementary, two main approaches was brought to the fore: on the one hand, explicit (and directive) coordination which supposes explicit process modeling and enforcement and on the other hand implicit (and permissive) coordination which supposes auto-coordination, based on some kind of group awareness.

## 2. Explicit Coordination vs. Implicit Coordination

### 2.1. EXPLICIT COORDINATION

Partisans of explicit coordination explains that process modeling:

- already exists,
- has proved efficiency in work coordination,
- is an efficient way for enterprise to capitalize their know-how and to resist to market evolution,
- allows enterprises to interoperate by interconnecting their processes,
- is supported by workflow systems that allow for graphical process modeling, process enactment and process tracking.

Reciprocally, they pointed out that auto-coordination cannot allow:

- a good knowledge of the work in progress and an effective process tracking,
- effective capitalization of the know-how.

### 2.2. IMPLICIT COORDINATION

Partisans of implicit, or auto-, coordination had also some good arguments. Implicit coordination approach:

- -does not allow an important investment in modeling, even if critical events, on which awareness is based, have to be described,
- is dynamic and flexible (as process are not really modeled, they can be changed easily),
- better fits the current way people work,
- does not request an enterprise to make visible its know-how to cooperate with another,
- is a good anti-stress for the SME responsible managers connected to Internet, especially if awareness is based on group communication.

Reciprocally, they argued that process modeling approach:

- requests a priori an important modeling effort,
- is not currently efficient to manage the subtlety of interactions as they occur in creative applications, hence risks to lead to rigid processes which either will be rejected, or break the synergy existing, on building sites
- is not currently efficient to support interoperability of processes,
- can be felt as “Big Brother” and increases the stress of people,
- imposes SME to make “public” their processes what they cannot accept due to the competitive context of the market: two enterprises cooperating in a project can be in competition in another at the same time or in the future.

## 2.3 EVOLUTION OF POSITIONS

Finally, partisans of explicit coordination accepted some criticism of partisans of implicit coordination and recognized some qualities to this approach. And reciprocally, both parties agree on the idea that no approach alone can fulfill the requirements of good coordination: a good coordination is a subtle mixture of explicit and implicit coordination.

## 3. Requirements and Design for Asynchronous Coordination

### 3.1 EXPLICIT COORDINATION

#### *3.1.1 Requirements and design criteria*

The process must be seen as a combination of **process fragments**. Each fragment corresponding to a point of view and/or a role and to provide means to combine such fragments in a coherent global process.

This fragments represent **adaptive and cooperative processes** to manage different variants of the same initial process and to allow activities of the processes to exchange information during execution.

The fragments come from **abstract workflows**. This is important in the context of virtual enterprises where some partners accept to make visible only some aspects of their processes. This argues also for the ability to generalize a concrete process into an abstract one.

#### *3.1.2 State of the art*

A lot workflow products exist on the market. They are widely used in a lot of applications, especially production and administrative application. However, we have to notice that current systems do not apply efficiently for creative application in general and co-design and co-engineering applications in particular.

This is due to the needs we just introduce above, the study of which is still in the domain of research: need of adaptability (Reichert and Dadam, 1998), need of abstraction (van der Aalst, 1999), need of interactivity (Godart, Perrin, and Skaf, 1999).

### 3.2 IMPLICIT COORDINATION

#### *3.2.1 Requirements and design criteria*

Events and information to be notified must be structured. This is not only a problem of confidentiality as it can appear, this is mainly a problem of

selectivity and quality of information: the right information must be transmitted to right person at the right time.

Participants must be structured in communication and information groups. This is directly related to the above issue. It is necessary to partition the set of participants in groups, based on their roles, their space of intervention.

Divergence between participants must be measured and controlled. It is necessary to control the disorder, which may be introduced by the permissiveness of the approach, and to maintain this disorder under an agreed limit.

### *3.2.2 State of the art.*

Implicit coordination is mainly based on awareness. Currently, a lot of tools provide awareness (typically tele-presence and a limited form of group management as in ICQ), but it is specific to the embedding tools.

Some experimental toolkits exist but they are still in the domain of research (Prinz, 1999) and new research topics start, as example concerning divergence measurement (Chi, 1997; Bouazza, Skaf-Molli, and Molli, 1999)

## 3.3 RELATIONSHIP BETWEEN EXPLICIT AND IMPLICIT COORDINATION.

We think that a good coordination is a subtle mixture of explicit and implicit coordination. This implies to deepen how to take advantage of integrating these two dimensions. i.e. how to use one approach to fill the deficiencies of and to enhance the other.

### *3.3.1 Requirements and design criteria.*

Notification to fill in the gap between process fragments. Implicit coordination can be seen as the minimum mechanism to integrate process fragments. Especially, multi-membership communication groups can apply efficiently in this objective, one participant having the ability to participate to several groups corresponding to several processes.

Communication groups can be defined to explain process monitoring decisions to performers, and to inform administrator on the degree of acceptance of current processes.

The processes must be used as the basis to structure information and communication groups. Communication groups can be organized based on activities, process fragments, roles as defined in workflow.

Implicit coordination must rest on process awareness. The process knowledge will be used for improving the information quality. In particular, the information concerning the state of an executed process, will be some help, on the ground, and limit any divergence.

### 3.3.2 State of the art

In some way, most of GroupWare tools yet integrate these dimensions, but in a very limited and specific way. As example process awareness in workflow systems thanks to “to\_do\_list”.

At the level of research, we think that the study of the relationship between explicit and implicit coordination needs some specific and enthusiastic new research. The Orbit demonstration is good illustration of the interest of the approach (Mansfield and Kaplan, 1997)

## 4. Conclusion

The problem of coordination of virtual teams and virtual enterprises is still an open research problem and for several years, even if some useful tools yet exist. The fact that tools yet exist is an opportunity that must be used to make experiments.

Synchronous tools are important in the objective of team coordination. There is a close relationship between synchronous coordination and asynchronous coordination, and especially between synchronous coordination and implicit asynchronous coordination. Implicit coordination relies on the idea of a good awareness will induce discussions and that will lead to auto-coordination.

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