MODELING INCREASINGLY COMPLEX SOCIO-TECHNICAL ENVIRONMENTS

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Abstract: The paper focuses on modeling large open information systems. These are systems composed of many activities, which include relationships between activity participants to create new knowledge and services. The systems are further complicated by the changing nature of both the activities and relationships. The paper proposes increased emphasis on modelling work and social structures and using the models to generate role based interfaces. It illustrates the application to the design of complex outsourcing systems.

1 INTRODUCTION

Greater trends to organizational agility have increased the complexity of information systems, especially where group dynamics are a key element to system operation. The complexity has increased because of the growing nature of interdependencies of knowledge workers (Davenport, 2005), organizational structure, technology and tasks in the global environment, where teams often coordinate their activities and select their work practices. This complex set of relationships, when supported by technology, is now often referred to as a "socio-technical system". Support for such systems requires the provision of an effective infrastructure that enables knowledge workers to easily connect and interact with each other by adapting the infrastructure services to the evolution of their work.

There are few widely accepted methodologies to support the design and evolution of socio-technical systems and the connectivity and interactivity that characterize their open nature. The options available to designers are shown in Figure 1. These are;

- Adopt methods from the deterministic methodologies, in particular object modeling and often attempt to re-engineer what are predominantly open systems.
- Do nothing but give people access to tools and resources that facilitate communication, for example, e-mail, meetings and travel, and
- Adopt a systematic approach to the design of such systems to provide a balance of effective computer support combined with effective meeting.

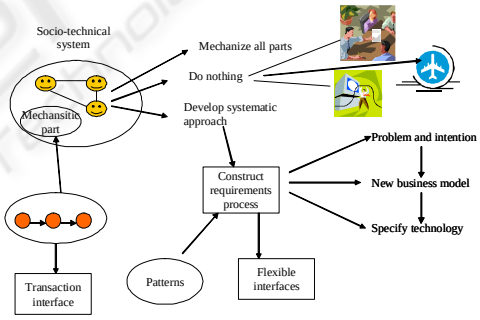

Figure 1: Design Options.

This paper addresses the third of these. It describes a systematic way of describing business activities and matching the work patterns to each activity. The work patterns are then integrated into one work diagram that is used to specify role based interfaces.

Primarily the design goal is to align social, economic and information technology structure while causing least disruption to existing relationships. This design goal is supported by many writers as for example Iqbal (2005), who proposes a set of heuristics as guidelines for analysis or Sutcliffe (2005) who stresses the importance of small group analysis. The ultimate outcome is an infrastructure and the services needed to support the complex business relationships and provide ways for

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users to dynamically change their platforms to match changing relationships in work activities. It is to get away from using personal computers and laptops and over reliance on e-mail and provide a platform that closely matches work practices. The ultimate requirement is to support better connectivity between process participants and ways for them to interact in productive ways while changing their work practices. This connectivity should be related to a context to relieve users of maintaining their own contexts and moving information between different systems, thus having a negative effect on satisfaction, quality and productivity. The paper focuses on modelling such complex relationships to define specific needs. The main aspect is emphasis on integrating business relationships into business activities and support them with customized role based interfaces.

2 MODELING SOCIO-TECHNICAL PROCESSES

Figure 2 illustrates the major dimensions to be addressed in modeling. This paper focuses on the social and work network, here called the collaborative network, and the conversion of the model to technical support systems.

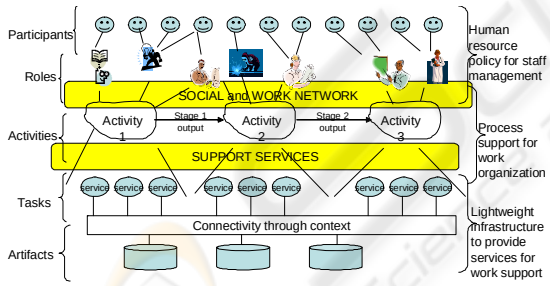

Figure 2: The Major Dimensions of Modeling Complex Relationships.

The central part of Figure 2 as proposed by Rizzo (2006) is the activity model that describes the work activities. The main objects here are the activities, the activity roles and the context. Participants can then undertake particular roles. The social structure in this case provides the way to explicitly show the relationships between participants within and between the roles. People are assigned to the roles based on policies followed with the organization or alliance. The way they interact is described by the social or work network. The social part is modeled by what is here called a work diagram, which illustrates the relationships between the roles. The work network in this sense describes the interactions that must take place between people assigned to the various roles to satisfy the work requirements. A social network would also include any informal communication between the role participants. The work carried out within the activities is supported by services. These services are to be provided through lightweight platforms that allow such services to be adapted to the work practices followed by the role participants.

At the work network level construct communication patterns (Dustdar, Hoffman, 2007) and use these as a metaphor in providing services. We can for example say “this is like a brokering activity which needs the following communication support”. This approach parallels that of Oates and Fitzgerald (2007) who are suggesting a multi-metaphor approach to design. We thus have a combination of the multi-method approach where particular designers choose the set of phases, as suggested by Rizzo (2006) and then use heuristics in each phase possibly basing each phase on a particular metaphor or guideline. Rizzo furthermore suggests that activity be used as the unit of analysis.

2.1 Modeling the Relationships

The central modelling approach is shown in Figure 3. It is made up of three components, which are used to specify flexible workspaces or what are sometimes known as lightweight technologies as shown in Figure 3. This becomes the link between the social and technical parts of the socio-technical system. The important aspect here is to introduce models that themselves are dynamic in nature to create a dynamic implementation that follows the connections between participants rather any formal workflow specification.

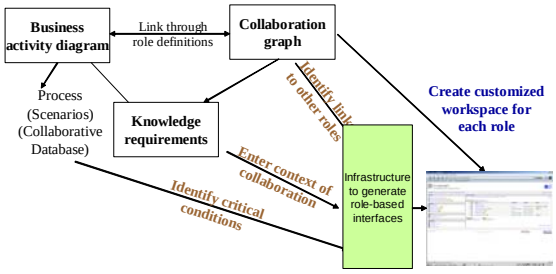

Figure 3: Following with an implementation.

The role of infrastructure is important here as it should be possible to use infrastructure services to

create workspaces for different roles and easily change them as needed.

The central part of the integration is to describe the business activities using a set of well defined terms and then match the descriptions to the work patterns. The parameters for describing activities are:

- The kind of work in the activity (Davenport, 2005). The categories here are transactional work, integrative work such as that found in system development, collaborative work and expert work,
- Management level based on Anthony's framework of strategic, management and operational level, and
- Process focus which may be planning, coordination or task execution.

One design goal may be to create activities which are focused on a clear set of parameters – they are made up of one work kind with one focus performed at one management level. For example the creation of an artefact can be a task execution at an operational level that requires an integrative work kind. Another example, creating a project plan is a task execution at management level and requires collaboration between a number of people. Although ideally we may wish to simplify a design by designing well defined activities this is often not possible. For example the development of a plan may need to be closely linked to actual task execution where organizations must respond to a changing situation.

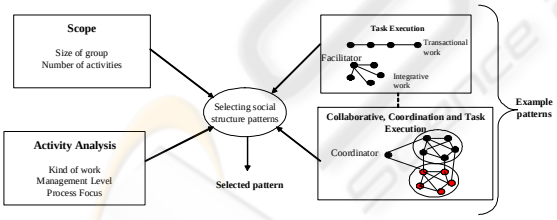

Figure 4: The guidelines framework.

For example, Figure 4 illustrates two such collaborative patterns. Here each black dot is a role. One is where work has one focus – task execution. The pattern depends on the type of work. If it is transactional then usually work passes from role to role. Here people who take the roles simply pass work between themselves, or carry out their individual tasks in accordance with a fixed plan. Where the work is integrative then usually a facilitator is needed to ensure integration. The other pattern is where coordination and task execution are needed in the same activity. Here there can be a number of groups each working on one task, but whose work must be coordinated. Agility requires activities to be continuously monitored and organize changes to the tasks carried out by each task group. There are of course many other patterns to be used in the selection process.

2.2 An Example

Outsourcing is an example one such system. Contemporary outsourcing situations can be quite complex in nature. Outsourcing presents one such system, which is an outsourcing arrangement that includes a number of organizations. Often such outsourcing arrangements are quire complex as for example shown in Figure 5, which is a simplified form of an ongoing practical case study. Here the process service provider maintains a service (which may include a number of applications) and subcontracts the provision of application programs for a third party, the software vendor. At the same time there is the network provider , who supports the network, operating systems required by the three alliance members. Different roles, which are shown on the business activity diagram, are associated with each of these organizations and they must collaborate to resolve any issues. In this case the initial analysis indicates a business requirement to maintain a quality of service to the client through response to queries and general maintenance of a level of client satisfaction.

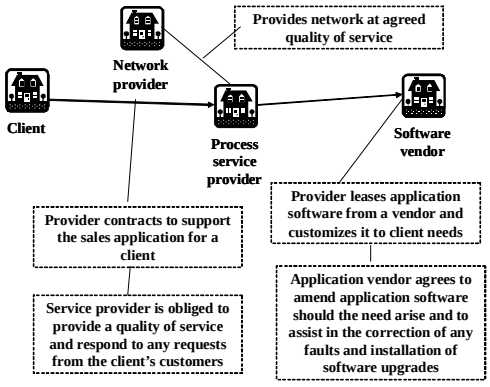

Figure 5: An outsourcing business arrangement.

2.3 Top level – Identify the Major Activities

The important concepts in this case are the high level business activities and the roles and

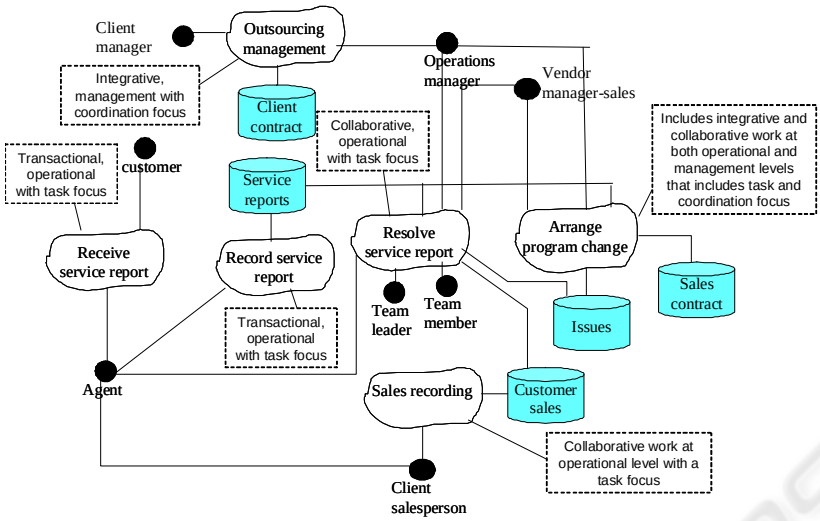

Figure 6: A Business Activity Model.

relationships between them as well as the artifacts they use. We call this the business activity diagram. Figure 6 is an example of such a high level in the context of resolving trouble reports in an outsourcing arrangement. The diagram also shows a description for each activity. For example:

"Receive service report" and "Sales recording" are both operational with a task focus usually of a transactional nature,

"Resolving a service report" can be classified as at the operational management level, often of a collaborative nature.

"Arrange program change", which may result from a service report and has a mix of different work kinds and hence should probably be decomposed into two activities, one to decide what change is needed and the other to coordinate the change implementation.

2.4 Collaborative Graph

The work network is now constructed using the kind of approach illustrated earlier in Figure 4. We look at the activity description and match a social pattern to the activity. A different pattern is constructed for each of the teams, which are primarily collaborative at the operational management level and focus on task execution. There are then the overlapping activities of coordinating any software changes with the software vendor and coordinating a response to a customer. In addition a transient team may be constructed to resolve an urgent issue. The collaborative graph is shown in Figure 7, which also identifies the activity that was used to generate parts of the work network.

3 SPECIFYING TECHNICAL SUPPORT SYSTEMS

The technical component has a two part role – infrastructure support and individual, support. This corresponds to the bricks and bits suggested in (Fruchter, 2001) where the bricks build the global support and the bits are what is provided to user. The kind of infrastructure needed is primarily of a lightweight nature. Some earlier work (Hawryszkiewycz, 2007) described the kinds of lightweight workspaces for different kinds of activities, ranging from lightweight exchange to process support. Each of these provides a range of services needed by a particular activity type.

The goal is to allow each role to have a customized interface with access to a common context. The role responsibilities are identified from the business activity diagram from the activities in which the role participates. These activities are included in the role interface as that shown in Figure 8 for the network manager (with sensitive data suppressed). The interface also includes access to all roles connected to the role in the work network to encourage informal interaction. The goal is to allow each role to have a role specific interface with access to a common context. The role responsibilities are identified from the social network analysis by identifying the activities of the role and presenting them in the role interface.

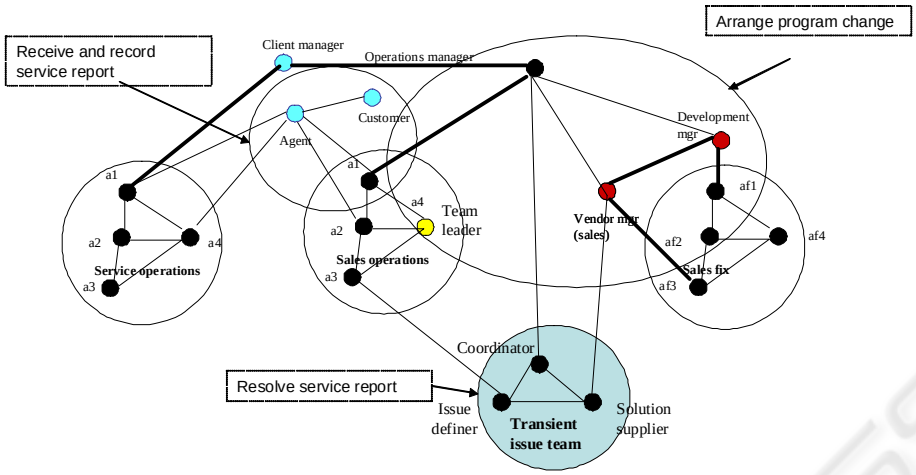

Figure 7: The Collaboration Graph.

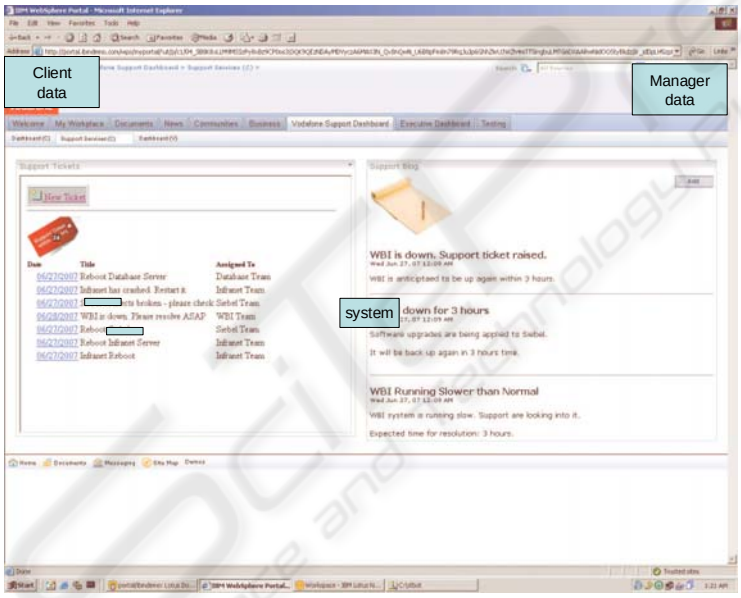

Figure 8: An interface for the network manager.

4 SUMMARY

This paper described the components that now make up many of the emerging systems, which are needed to support dynamic networked enterprises within global environments. These are characterized by closely linked activities and communication patterns between the activity participants. The paper identified the need to focus more on these communication patterns in system design and suggested ways of fin\ding the best patterns by matching them to activity descriptions. It described a way of describing such activities and illustrated an application to an outsourcing system.

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