Modeling the Information Structures of Meetingware

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Resumo

Meetingware é uma tecnologia que ainda não assumiu um papel de relevo nas organizações. Diversas razões contribuem para esta situação, sendo uma delas a falta de um modelo genérico que caracterize em detalhe a funcionalidade associada ao meetingware e ofereça um plano para a sua integração organizacional. Este artigo apresenta um modelo que caracteriza em detalhe os diferentes elementos do meetingware, assim como a funcionalidade correspondente, de modo a que designers e implementadores possam facilmente incorporar estas funcionalidades nos sistemas que utilizam e desenvolvem. O modelo identifica três componentes fundamentais do meetingware: (1) papeis, referenciando a diversidade de pessoas e actividades que se podem observar nas reuniões; (2) recursos, considerando a logística das reuniões, assim como a memória grupal produzida e gerida pelos participantes nas reuniões; e (3) processo, organizando o conjunto de actividades que os participantes numa reunião têm necessariamente que realizar de modo a atingirem os objectivos da reunião.

Abstract

Meetingware is a technology that has not yet taken a significant role in the organization. There are several reasons contributing to this situation, one of them being the lack of a generic model characterizing meetingware functionality and offering a clear path for organizational integration. This paper proposes a model characterizing in detail the different meetingware elements and corresponding functionality, so that designers and developers be able to easily incorporate them in current and future organizational software environments. The model identifies three fundamental components of meetingware: (1) roles, addressing the diversity of people and activities that we can observe in meetings; (2) resources, considering the meeting logistics as well as the group memory produced and managed by the meeting participants; and (3) process, addressing the organization of the set of activities that meeting participants must execute in order to accomplish the meeting goals.

1. Introduction

Broadly defined, meetingware brings together people, hardware, software and roomware, with the purpose of supporting, managing, guiding and stimulating participation in meetings; improving at the same time the meeting processes and outcomes.

Unfortunately, meetingware is an intricate technology: sometimes distributed in time and space, linking many users with distinct abilities, supporting many different hardware and software configurations, supporting different types of groups, tasks and functionality, many times forcing people to plan in advance the system use, and other times specifically requiring experts to configure, manage and use the technology.

If we want to make significant advances in the diffusion and assimilation of this technology throughout the organization, we have to characterize in detail the different meetingware elements and corresponding functionality, so that designers and developers be

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able to follow a clear roadmap to easily incorporate them in current and future organizational software environments.

In this paper we analyze the different elements that make up meetingware, highlighting the relevant properties of each element and identifying the relevant relationships between them. The results from this research are organized in a model with three major elements: roles, process and resources.

Our contributions to the state of the art are the following:

- The proposed model results from looking into many meetingware systems. Although not complete, the model is comprehensive, in particular to what concerns the types of information managed in meetings and the types of information exchanged between meetings and the organization.
- We clarify and organize meetingware functionality, addressing the issue of complexity at the conceptual level. One of the endeavors of modeling is to provide simple, yet detailed descriptions of complex behavior, and we believe that the proposed model simplifies the task of designers and developers integrating meetingware functionality with other organizational systems.
- The proposed model facilitates the evaluation of different meetingware technology offered by the research community and software vendors. A definition of the fundamental components that make up meetingware allows making comparisons and permits organizations that wish to acquire this type of technology to confront the technology with their needs.

The paper is organized as follows. First, we present some related work. The following sections are dedicated to characterize the three components mentioned above. Next, we illustrate how the proposed baseline can be used to compare the functionality of different meetingware. Finally, we present some issues for discussion and conclusions about this work.

2. Related Work

Several authors have identified relevant elements in meetingware. Hoffer and Valacich [1991] identify the elements of organizational memory associated to meetingware. Aiken, et al. [1991] identify a collection of fundamental meetingware components including database, model base, interface, network, facilitator and user. Bui and Jarke [1986] characterize the functionality of the communication manager. Jacob and Pirkul [1992] define a framework specifically focusing on group decision making, with three major systems: language, group problem processing and group knowledge. Silver [1991] proposes a taxonomical view with three major different perspectives that are of interest to designers and users: interface, functionality and holistic attributes. Zigurs and Buckland [1998] offer a definition of task and overview different classifications of tasks in a group context. Rao and Jarvanpaa [1991] present a categorization of meetingware technology in three different features: support to improved communication, support to increased participation and computational support for tasks (information processing). Nunamaker, et al. [1991a] characterized four major mechanisms in meetingware: process support, task support, task structure and process structure. DeSantis and Gallupe [1987] categorized meetingware technology in three levels of complexity: level 1 systems facilitate information exchange among participants; level 2 systems provide decision modeling and group decision techniques; and level 3 systems support machine-induced group communication patterns and can include expert advice.

Kraemer and King [1988] characterize meetingware as socio-technical packages, comprising hardware, software, organizationware and people.

We have not yet seen a proposal to specify an integrated model with these elements. Yet, these types of integrated models have been developed in other fields. For instance, the Dexter Hypertext Reference Model [Halasz and Schwartz 1994] defines a set of components that capture the relevant abstractions for hypertext systems. The Dexter model serves as a basis for terminology, for comparing different hypertext system designs and even for assessing conformance with the reference model. The goals behind the Dexter model motivated our intentions to develop a meetingware model.

The proposed integrated model also results from the analysis of the following meetingware systems and tools: GROUPSYSTEMS [Dennis, et al. 1988], SODA/DECISION EXPLORER [Eden 1989], MEETINGWORKS [Lewis 1987], EXPERT SYSTEM PLANNER [Bostrom, et al. 1990], IDEA CONSOLIDATOR [Aiken and Carlisle 1992], AUTOMATED FACILITATOR AGENT [Aiken and Vanjani 1998], LOGANWEB [Raikundalia and Rees 1995b; Raikundalia and Rees 1995a; Raikundalia and Rees 1996], CIRE [Romano, et al. 1999], D-PLAN [Antunes and Ho 1999; Costa, et al. 1999], JOBBER [Kazman, et al. 1996].

3. Meetingware and Organizational Systems

Considering an information systems view, we may regard organizations consisting of multiple systems that structure and accomplish work using different forms of communication and coordination mechanisms [Malone and Crowston 1994]. These mechanisms include workflows, plans, direct supervision, rules and procedures, training sessions and, inevitably, meetings (Figure 1). All these different mechanisms must interact with each other in order to support organizational goals, but a characterization of such interactions is outside the scope of meetingware since it depends on many organizational factors such as culture, rules, objectives, formal and informal structures, institutionalized practices, market climate, etc (e.g. [Mintzberg 1979]).

Fundamentally, our intention in separating the meetingware and organizational systems is to make a clear separation of what pertains to the meeting from the factors related to the organizational system.

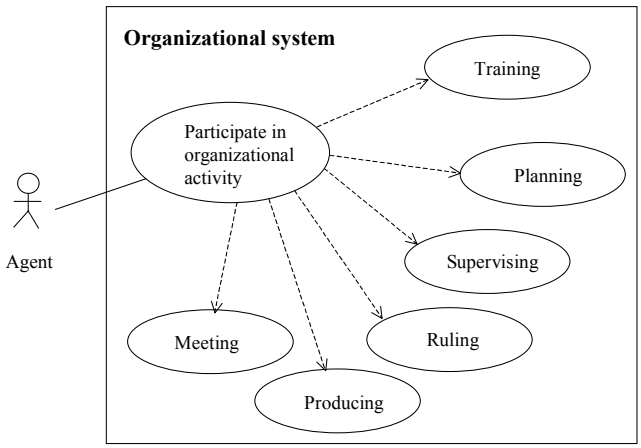

Fig. 1. Meetings as part of the organizational system

4. Meeting roles

Groups are made of individuals who assume interdependent roles according to the organizational expectations, meeting objectives and individual personality [Schwarz 1994]. Considering these different perspectives, it is natural that meeting participants may assume more than one role. Roles may be formally specified by the organization, result from institutionalized practices, negotiated and agreed before the meeting or assumed during meetings.

The following different roles are relevant in meetings: sponsor, facilitator, participant, secretary, observer and organizational agent. Three of these roles are active during the meeting session (facilitator, participants and secretary), while the others are only passively involved in the meeting session. Next, we will describe these roles in more detail.

Participant. The participants intervene in a meeting, producing and sharing various types of information such as ideas and comments. The participants have two attributes relevant within the context of the meeting: qualification and status (others, like personal attitudes are beyond our scope). The number of participants is something that contributes to characterize meetings in different genres, such as task forces, assemblies, commissions or committees, and so should be an attribute to consider when characterizing meetingware.

Facilitator. The facilitator is a neutral role, accepted by the meeting participants, that carries a vast set of facilitative functions [Bostrom, et al. 1993; Clawson, et al. 1993]: (1) Promoting a sense of belonging and responsibility; (2) Demonstrating self-awareness/expression; (3) Selecting and preparing the technology; (4) Hearing, clarifying and integrating information; (5) Developing and asking the right questions; (6) Maintaining the group targeted in the results; (7) Creating comfort with technology; (8) Creating an open and positive atmosphere; (9) Building harmony and relationships; (10) Presenting information to the group; (11) Demonstrating flexibility; (12) Planning and developing meetings; (13) Managing conflicts and negative emotions; (14) Understanding technology and its capacities; (15) Encouraging and supporting multiple perspectives; and (16) Directing and managing the meeting.

The manner in which this role delivers its facilitative support to the meeting can be classified in the following categories: user driven (UD), when the facilitative functions are available to all meeting participants and thus there is no person specifically assigned to this role; facilitator-driven (FD), when there is one person designated to assume this role; and chauffeur-driven (CD), when the person designated to assume the facilitation role only manages the technology but not the process [Dickson, et al. 1993].

The role of the facilitator is fundamental to the meeting process, and may contribute in a decisive way to its success [Nunamaker, et al. 1997; Clawson, et al. 1993; Jay 1976]. Thus, it must be explicitly addressed by meetingware.

Secretary. The role of the secretary is to take notes and produce a meeting report [The 3M Meeting Management Team 1994]. One fundamental aspect to consider in this role is the type of technology available to take notes and produce reports, since this functionality may be centralized (C) or carried out by a group of people (distributed, D). This functionality may also be user-intensive (UI) or automated (A) by the technology [Aiken, et al. 1991; Aiken and Vanjani 1998].

Sponsor. The sponsor has a fundamental, although sometimes neglected, passive role in a meeting. The sponsor is the "owner" of the meeting and, ultimately: (1) Is the repository of the meeting objectives; (2) Defines and clarifies the meeting objectives; (3) Approves the meeting agenda, set up by or in collaboration with the facilitator; (4) Reviews the meeting outcomes; (5) Provides an interface between the organization and the meeting.

Some literature also mentions the role of the meeting leader [The 3M Meeting Management Team 1994]. The leading role is a combination (in one person) of the sponsor and facilitator roles and thus will not be considered by us.

Observer. The observer is a passive role dedicated to become aware or infer about actions, interactions and patterns of behavior in meetings [The 3M Meeting Management Team 1994].

Organizational agent. The organizational agent is a role that, although being passive, produces information necessary to the meeting and is affected by the meeting outcomes. The type of information managed by the organizational agent is relevant to define the interface between the organizational and meeting systems.

5. Meeting resources

Under this category we consider two fundamental components of meetingware (Figure 2): logistics and group memory.

Logistics

The meeting logistics includes a description of generic meeting facilities, such as physical rooms, tables, chairs, computers, networks and roomware [Streitz, et al. 1997] (e.g. liveboard [Wagner, et al. 1993]). The different room arrangements can be categorized in: office stations, meeting rooms, laboratories and conference rooms.

One intrinsic characteristic of meetings, which is related to logistics, is the definition of time and place of the meeting. This classification affords defining the following meeting settings: STSP (same time/same place), STDP (same time/different place) and DTDP (different time/different place) [Beise, et al. 1992]. One more category has been added to this typology, designated ATAP (any time/any place) to classify situations that cannot clearly be confined in one of the other categories.

Another characteristic of meetings related to logistics is the communication mode. In the absence of technology, it will be Face-to-Face (FtF). However, meetingware supports other communication modes [Fjermestad and Hiltz 1999]:

- Group Support System (GSS) – This situation uses software tools that structure communication and assist group decision (such as voting tools);
- Computer Mediated Communication (CMC) – This type of technology primarily provides support to group discussions through messages exchange (such as chat systems), although other types of support may be provided as well;
- Decision Support System (DSS) – A Decision Support System is focused on a person. It comprises single-user software and a single computer shared in a FtF setting. This technology may also be designated chauffeured technology [Clawson, et al. 1993].

The combination of different roomware technologies has been considered influential to assert group productivity. Thus, it is necessary to characterize roomware in detail. Roomware may be classified in [Streitz, et al. 1997]: individual workstations in a network (WS); a

liveboard configuration, with one single computer (LB); and a combined situation, with individual workstations plus a liveboard connected in a network (WS+LB).

Finally, one should also consider the level of support provided by the technology. This characteristic was defined by DeSantis and Gallupe [1987] in three levels summarized in the section 2 of this paper (1 – facilitating information exchange; 2 – decision modeling and group decision techniques; 3 – machine induced activities). To this classification, Fjermestad and Hiltz [1998] added a level 0, which considers some types of technology that offer very low group support. For instance, chat systems that show a few lines of text exchanged between users are classified in level 0.

Group memory

Group memory concerns the shared information resources that a group uses to accomplish work. The major attributes of group memory items are [Orlikowski and Yates 1998]: purpose; contents; media used; who is involved in producing the item; when was the item produced and where should the item be produced or used.

Regarding meetings, we shall take into account the agendas¸ meeting reports and support documents [Costa, et al. 2001]. The agenda is considered a critical element to manage meetings successfully since meetings tend to crystallize their actions around it [Niederman and Volkema 1996]. The agenda may have two different types of information: the list of topics or goals that the group must deal with; and the series of steps that the group should execute in order to accomplish their goals. Agendas including a list of steps are very rare and, in fact, meetings are frequently based on no agenda at all [Romano and Nunamaker 2001].

The reports are the visible outcome of meetings. The most common form is the meeting minutes, but other types of documents may be produced as well, such as action plans [Costa, et al. 2002]. The meeting reports are characterized by the structure and format of the aggregation of items in a report. These items present a certain content that results from the participants' interactions and is linked to the meeting agenda.

In what concerns technology use, one should consider four different report formats:

- Automatically generated transcripts of information exchanged in meetings (e.g. persistent conversation);
- Automatically generated summaries, such as voting results;
- Meeting data formatted to support visualization by the participants, secretary, sponsor and organizational agents [Nunamaker, et al. 1991b; Raikundalia and Rees 1995b; Raikundalia and Rees 1995a];
- A collection of group memory components typically generated during meetings, such as dictionaries or formal definition lists. These components support complex group memory management. For instance, a browsing tool allows the users to move through the meeting memory, enlarging in a specific area to obtain details, or zooming out to have a high level vision of meeting data [Nunamaker, et al. 1991b].

In what concerns documents used to support the meeting, they can be essentially of three types:

- Base Documents – The documents that will be affected by decisions taken in meetings, for example a management report submitted for approval;
- Support documents – The documents used to directly support the decisions taken in meetings. For example, in an investment decision, a viability study would be a possible support document;

- Context documents – The documents necessary to characterize or explain the meeting process. For instance, some meetings, such as parliamentary meetings, follow a regiment, and that regiment is necessary to explain the meeting process.

6. Meeting Process

The meeting process structures the set of activities that the participants must execute in order to achieve some common goal.

The nature of activities changes as the participants move forward towards the goal. To reflect this, we typify activities accordingly to that progression and consider the following levels of detail:

- The meeting as a whole;
- The partition of the meeting process in several activities;
- The decomposition of the meeting process in several activities and sub-activities;
- The fragmentation of the meeting in an intricate collection of elementary activities, such as individual interventions or comments.

The first level characterizes the meeting process while maintaining the perspective of the whole. One example is given by the genre approach [Orlikowski and Yates 1994]. The genre approach regards a meeting as a pattern of recurrent communicative actions including logistics, agenda, the meeting itself and the meeting report. This approach allows typifying and characterizing meetings like briefings, progress report meetings, staff meetings and management meetings in terms of purposes and communication patterns [Costa and Antunes 2001; Antunes, et al. 2001].

The second and third levels focus on the decision structure. The partitioning approach follows a logical view over decision making that is recurrent in literature [Gonçalves and Antunes 2000; Ho and Antunes 1999]. According to this view, the goal is divided in several partial goals that can be accomplished in a systematic way. Planning is a good example of such a systematic approach, where the group has to identify what actions should be taken, by whom, when, what resources are needed and how can success be measured.

The decomposition approach regards meeting processes as decomposable in multiple levels of detail, with goals and sub-goals. For instance, Kaner [1996] proposed a generic pattern consisting of divergent, groan, convergent and closure phases. Each phase was then subdivided in several sub-phases (e.g., the divergent phase was subdivided in surveying the territory, searching for alternatives and raising difficult issues). Another example is this nine-step model proposed by Schwarz [1994]: define the problem; establish criteria for evaluating solutions; identify root causes; generate alternative solutions; evaluate alternative solutions; select the best solution; develop an action plan; implement the action plan; and evaluate outcomes and the process. Briggs and Vreede [2001] follow a similar approach, identifying several basic patterns like diverge, converge, organize, elaborate, abstract and evaluate.

Finally, the meeting process can also be characterized in a very fragmented way, according to the flows of individual interventions produced by the participants and facilitator. These interventions can be categorized in process and content interventions [Miranda and Bostrom 1999]. Defining the agenda, inviting the participants, opening and closing the meeting sessions, or tracking the agenda, are a few examples of process interventions. An example of the characterization of the meeting process as a collection of content interventions is given by the IBIS argumentative structure [Conklin and Begeman 1988].

The other attributes to consider in process or content interventions are:

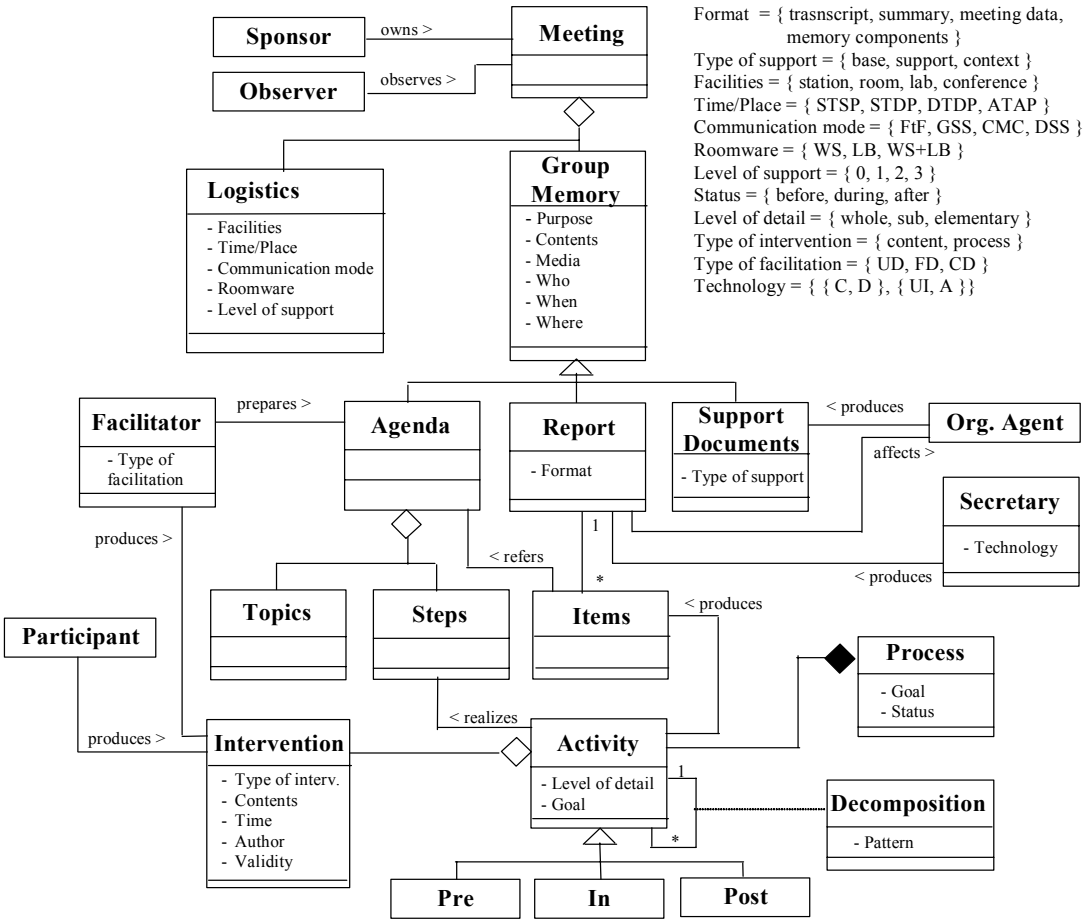

Fig. 2. Meetingware relevant elements

- Contents – Corresponds to what is really transmitted to the group; Time – An attribute of great importance to characterize an intervention is the moment when it is produced. Based on this attribute, we can identify a set of characteristics of group communication. On the one hand there is the technical aspect of synchronous and asynchronous communication. On the other hand, associated to the time stamp, there exists the possibility of parallel interventions. This possibility contributes to improve some group activities, like idea generation [Gallupe, et al. 1991].
- Author – The person that produces an intervention may be identified or not. This factor can have an important role in the process results. Several researchers have reported the effects of anonymity in the interaction process (e.g. [Connolly, et al. 1990]).
- Validity –The validity corresponds to the time during which the intervention can be accessible. The validity has repercussions on the organizational memory.

Taking a different approach, the set of process activities can also be classified according to what is designated as the meeting lifecycle. A detailed analysis of meetings allows verifying that the meeting lifecycle consists of three stages: (1) the pre-meeting stage, considering activities that have to be executed before the meeting; (2) the in-meeting stage, considering activities accomplished during the meeting; and (3) the post-meeting stage, considering activities that may be required afterwards. In the pre-meeting stage we include the meeting proposal, approval, planning (including definition of topics, goals and selection of participants) and invitation [Antunes and Ho 2001]. In the in-meeting stage we find content interventions and process interventions.

In the post-meeting stage we should consider meeting assessment, report production and distribution, and progress review.

Note that the proposed baseline is generic and avoids adopting any particular policies to specifying meeting phases, activities or tasks. Ultimately, the meeting process may just consist of several interventions.

7. Examples

In Figures 3-5 we provide some examples of common uses for the model.

The first example considers that decisions are structured according to the rational approach defined by Simon [1997]. In this approach there exists a goal and a wish to maximize some utility function, and there is some systematic way to accomplish the task (bounded by considerations of time and cost). Simon [1997] proposed the following three phases for the decision-making process: listing all alternative strategies (intelligence); determination of all consequences that follow upon each strategy (design); and comparative evaluation (choice). As shown in Figure 3, we have decomposed the process activities in the intelligence, design and choice phases, and defined the agenda accordingly. The report is limited to transcribe the adopted decision.

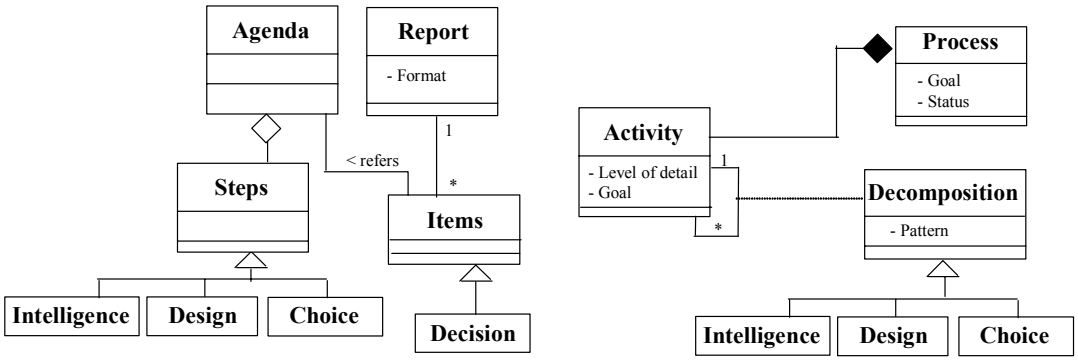

Fig. 3. Rational meeting according to Simon [1997]

In Figure 4 we show a more complex approach to decision-making supported by a tool implemented by Antunes and Ho [2001]. The tool uses the Kaner's [1996] approach to structure the decision process, decomposing it in divergent, groan, convergent and closure phases. Note also that the mentioned tool also supports several pre-meeting activities.

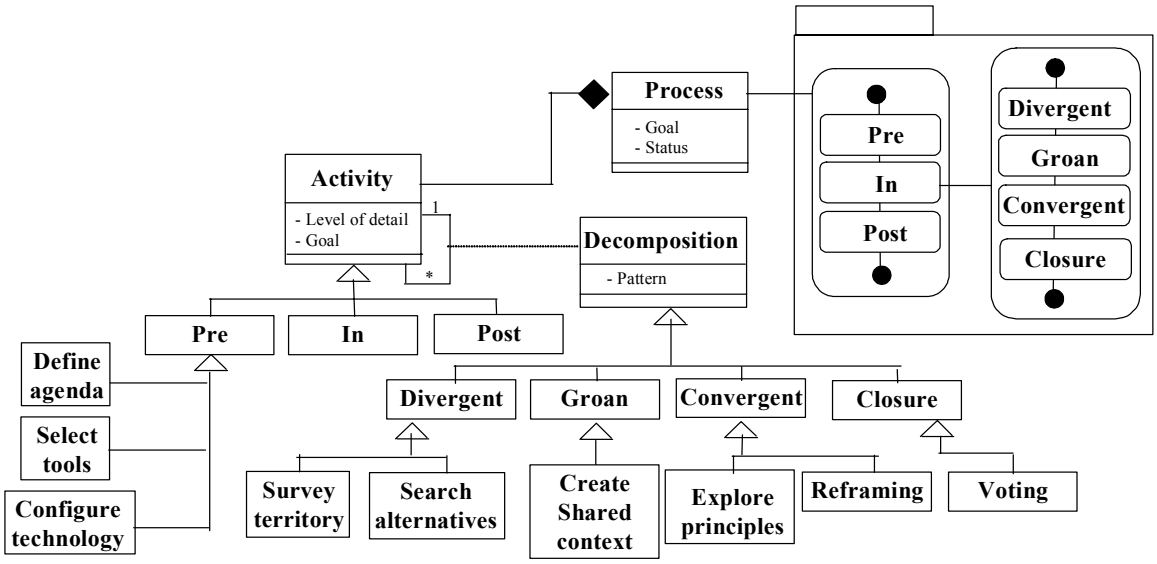

Fig. 4. Rational meeting according to Antunes and Ho [2001]

In Figure 5 we show an example of a meetingware that bases its implementation of the meeting process on the IBIS [Conklin and Begeman 1988] model. IBIS (Issue-Based Information System) was developed to provide a simple yet formal structure for the discussion and exploration of wicked problems. Wicked problems do not yield to the rational approach to problem solving. With a wicked problem, the understanding of the problem is evolving along with the work on a solution. The IBIS model structures the discussion of the problem in accordance with three major data elements: issues, positions and arguments. These elements are linked together, so that one issue may generate other issues and several positions (against or in favor) supported by arguments.

Therefore the model categorizes the participants' interventions according to these elements. The produced report consists in the generated web of issues, positions, arguments and links, since no definite decision is obtained with this process.

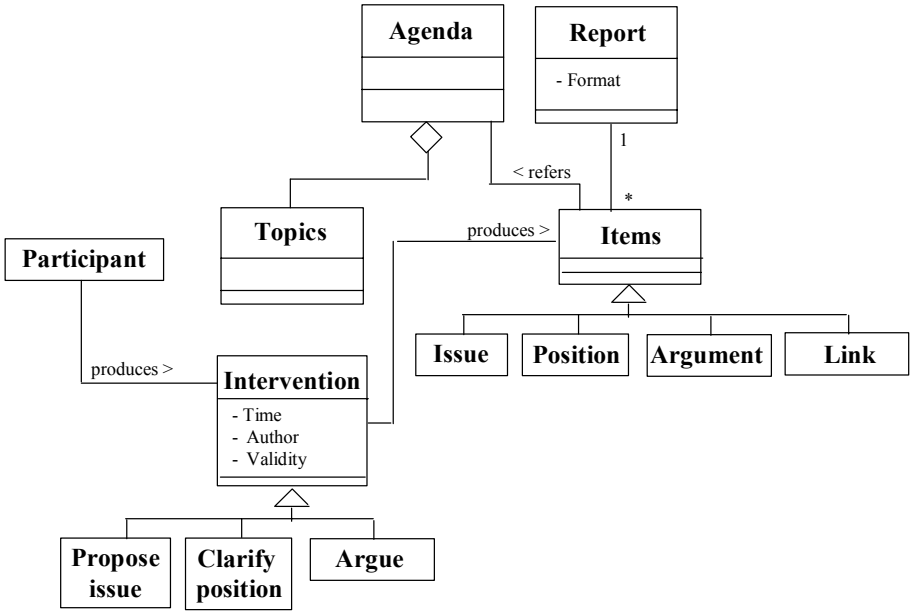

Fig. 5. IBIS [Conklin and Begeman 1988] meeting

8. Discussion

The proposed model identifies three major meetingware components: roles, meeting process and resources. The first component allows specifying the types of roles involved in meetings. The level of detail considered is the necessary one to clarify who interacts with the meetingware and what functionality the meetingware is expected to deliver to users. The model highlights two commonly neglected roles: sponsor and organizational agent. In particular, the organizational agent is a key role, being affected by important meeting resources and acting as an organizational liaison. The lack of organizational integration of meetingware may be attributed to this lack of support to the organizational agent.

The second component is dedicated to characterize meeting resources. On the one hand, this component characterizes the major data elements that get in and out of the meeting (agenda, report and support documents). On the other hand, this component identifies how information is managed by the meetingware (e.g. facilities, meeting configurations and time/space). So, we complement the functional description offered by the previous component with a model of data managed by meetingware at a high level of abstraction. Certainly, the important aspect to emphasize here is the support to resources that are important not only to meetings but extends to the whole organization: the agenda and report. Considering that some degree of formalization is achieved by the model, we expect that meetingware can be more tightly coupled to other organizational tools, such as, for instance, workflow systems.

The third component addresses the meeting process. This component affords decomposing the meeting process in several activities and sub-activities, while describing users' interventions in the system.

It should be noted that the model only describes items that are independent from any specific technology, meeting process, decision process, group interaction process, group facilitation process, etc. The model purposefully avoids items and relationships that would restrict the decisions that necessarily have to be made by the designers about the type of control that the meeting participants can exert on the system. In this respect, the model addresses not only the different levels of detail of the information items produced during

meetings (ranging from participants' interventions to complete meeting reports) but also the different structures that the system may impose on the meeting process (ranging from none at all, to a precise list of activities followed by the participants). According to our experience, this approach covers most of the alternatives that designers have to consider when crafting this technology.

The application of the model to evaluate meetingware is flexible enough to accommodate different meeting arrangements, software configurations and information resources, as well as different views over process definitions.

The model has also the potential to define an evaluation grid for meetingware, allowing comparisons between quite different tools and systems, and facilitating the convergence between meetingware functionality and organizational needs.

In the line of the Dexter Hypertext model [Halasz and Schwartz 1994], we can envisage another significant application for the model: the definition of a meetingware standard interchange format. The existence of such a standard would permit the exchange of information between meetingware tools and application. This would allow users to take advantage of different meetingware capabilities and their availability in the organization or across organizations.

Furthermore, a common interchange format could even allow a better integration between meetingware and the remaining components of organizational systems. The existence of a meetingware model clearly facilitates the construction of that format, rendering the model elements into a XML-like syntax. This definition will be addressed in future work.

Recommendations to Designers and Developers

In general, the proposed model may bring benefits to researchers by establishing a common language and affording the comparison of research results across experiments. However, considering its descriptive nature, we believe that it may mostly be beneficial to designers and application developers. The following recommendations were drawn from our experience using the model to design and develop meetingware.

First of all, the problem that meetingware is trying to address is inherently complex, because of the particular combination of people, organization and technology. The technology and the way people use it are both complex as well: supporting multiple configurations, different tasks and functionality, and linking many users with distinct roles. The model offers designers the opportunity to evaluate with stakeholders the organizational needs and map them in the relevant meetingware elements, thus avoiding many mismatches that often occur. Thus, the model should be used early in the design process in order to evaluate several meetingware systems offered in the market and identify a set of preliminary design requirements if design is to proceed. The model can be used to typify the most frequent meetings in the organization, define the agendas and reports used by these meetings and analyze any formalisms or bounds used by the meeting participants in their decisions processes.

This detailed description of meetingware elements and roles is also fundamental to meetingware developers. In particular, it identifies where, how and when the meetingware system can be integrated with other organizational tools and systems. For instance, the meeting logistics may be integrated with calendaring tools now common in organizations; the agenda topics and steps, participants interventions and report items may be integrated with

group communication support tools; the meeting support documents may be integrated with hypertext tools; or the agenda and report may be integrated in the organizational document repository.

9. Conclusions

This paper proposes a model for meetingware consisting of three components: roles, meeting process and resources. Each one of these components consists mainly of a collection of class definitions. The model is flexible enough to accommodate different meeting arrangements, software configurations and information resources, as well as different views over process definitions.

The major contribution of the model is the clarification of meetingware functionality, offering a comprehensive description with the potential to be reused in the future, either to evaluate the convergence between meetingware functionality and organizational needs, to support the development of future systems and tools, or to facilitate the integration of meetingware with other organizational systems.

Acknowledgments

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