Process-Aware Information Systems for Virtual Teamwork

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INTRODUCTION

The question of the "right" organizational form and the appropriate information systems support remains of paramount importance and still constitutes a challenge for virtually all organizations, regardless of industrial background. Organizations distribute their required work activities among groups of people (teams), with teams constituting the main building block for implementing the work (tasks). In most cases, team members are organized as "virtual (project) teams." These teams are under heavy pressure to reduce time to market of their products and services and lower their coordination costs. Some characteristics of distributed virtual teams are that team (member) configurations change quite frequently and that team members report to different managers, maybe even in different organizations. From an information systems' point of view, distributed virtual teams often are self-configuring networks of mobile and "fixed" people, devices, as well as applications. A newly emerging requirement is to facilitate not just mobility of content (i.e., to support a multitude of devices and connectivity modes) to team members, but also to provide contextual information on work activities to all distributed virtual team members (Dustdar, 2002a, 2002b, 2002c). By context, we mean traceable and continuous views of associations (relationships) between artifacts (e.g., documents, database records), resources (e.g., people, roles, skills), and business processes. Context is composed of information on the "who, when, how, and why." The remainder of this chapter is organized as follows: The next section provides an overview of related work on classification systems of collaborative systems and provides an overview on evaluation aspects of current collaborative systems for virtual teamwork. Section 3 discusses some issues and problems related to the integration of artifacts, resources, and processes. Section 4 presents one proposed solution. Finally, Section 5 discusses some future trends and concludes the chapter.

FUNCTIONAL CLASSIFICATION OF COLLABORATIVE SYSTEMS

There has been a lot of work on classification models for collaborative systems. However, there is no one-and-agreed-upon taxonomy of analyzing and understanding collaborative systems. Academia and industry suggest various classification schemes. In industry, for example, people frequently use the term *e-mail* and *groupware* interchangeably. More generally, there is the tendency to classify categories of collaborative systems by naming a product (e.g., many use the terms *Lotus Notes* and *groupware* interchangeably). Academic research has suggested many different classification models. For a recent survey of collaborative application taxonomies, see Bafoutsou and Mentzas (2002). DeSanctis and Gallupe (1987), Ellis, Gibbs and Rein (1991), and Johansen (1988) suggest a two dimensional matrix based on time and place, where they differentiate between systems' usage at same place/same time (e.g., electronic meeting rooms), same place/different time (e.g., newsgroups), different place/different time (e.g., workflow, e-mail), different place/same time (e.g., audio/video conferencing, shared editors). This classification model helps one to easily analyze many tools on the market today; however, it fails to provide detailed insights on collaborative work activities themselves, as well as their relationship to business processes. Ellis (2000) provides a functionally oriented taxonomy of collaborative systems that helps one to understand the integration issues of workflow and groupware systems. The classification system of Ellis (2000) provides a framework in which to understand the characteristics of collaborative systems and their technical implementations.

The first category (Keepers) provides those functionalities related to storage and access to shared data (persistency). The metaphor used for systems based on this category is a "shared workspace." A shared workspace is basically a central repository where all team members put (upload) shared artifacts (in most cases,

documents) and share those among the team members. Technical characteristics of "keepers" include database features, access control, versioning, and backup/recovery control. Examples of popular systems include *BSCW* (Bentley et al., 1997), IBM/Lotus *TeamRoom* (IBM, 2002), and the peer-to-peer workspace system *Groove* (Groove, 2002). The second category (Communicators) groups all functionality related to explicit communications among team members. This boils down to messaging systems (e-mail). Its fundamental nature is a point-to-point interaction model where team members are identified only by their name (e.g., e-mail address) and not by other means (e.g., skills, roles, or other constructs, as in some advanced workflow systems). The third category (Coordinators) is related to the ordering and synchronization of individual activities that make up a whole process. Examples of Coordinator systems include workflow management systems. Finally, the fourth category (Team-Agents), refers to semi-intelligent software components that perform domain-specific functions and thereby help the group dynamics. An example of this category is a meeting scheduler agent. Most systems in this category are not off-the-shelf standard software. Both evaluation models presented above provide guidance to virtual teams on how to evaluate products based on the frameworks. Current systems for virtual teamwork have their strength in one or two categories of Ellis' framework. Most systems on the market today provide features for Keepers and Communicators support or are solely Coordinator systems (e.g., Workflow Management Systems) or Team-Agents. To the best of our knowledge, there is no system that integrates at least three of the above categories into one system. In the following section, we evaluate current collaborative systems categories for their usage in virtual teams and summarize their shortcomings with respect to the requirement for virtual teamwork.

Evaluation of Collaborative Systems for Virtual Teamwork

Cooperative tasks in virtual teams are increasing, and, as a consequence, the use of collaborative systems is becoming more pervasive. In recent years, it has increasingly become difficult to categorize systems according to the frameworks discussed previously, due to the increasing fuzziness of systems boundaries and to recent requirements for virtual teamwork. Traditional systems in the area of interest to virtual teamwork are groupware, project management (PM) and workflow management systems (WfMS). These system categories are based on different metaphors. Groupware systems mainly can be categorized along two lines (metaphors)—the *communications* or the *workspace* metaphor.

Communications-oriented groupware supports unstructured work activities using communications as the underlying interaction pattern. One very popular instance of communications-oriented groupware is e-mail. When e-mail is used as the main medium for virtual teams (as in most cases), data and associated information (e.g., attachments) remain on central mail servers and/or personal inboxes without any *context* information in which those e-mail communications were used (i.e., involved business processes, performed activities, created artifacts). Enterprise groupware systems generally focus on enterprise-wide messaging and discussion databases and do not support organizational components and structures, such as people and their associated roles, groups, tasks, and skills. This leads to "organizationally unaware" systems that treat all messages alike (semantically) and without any awareness of underlying business processes that are essential for efficient collaboration in project teams.

Workspace-oriented groupware, on the other hand, allows team members to upload or download artifacts using files and folders to organize their work. Groupware, as previously indicated, usually does not implement an underlying organizational model (i.e., providing information on the structure of a team, such as team members and their roles, skills, tasks, and responsibilities). The lack of explicit organizational structuring is a disadvantage and an advantage at the same time. It is disadvantageous because traditional groupware has no "hooks" for integrating business process information, which is important in order to integrate artifacts, resources, and processes. This will be discussed in more depth in the next section. The advantage of the lack of explicit organizational structure information is that these systems may be used in all organizational settings without much prior configuration efforts, and they lead to increased personal flexibility, as the proliferation of e-mail systems in teamwork demonstrates.

The second category, which we will briefly investigate in this section, is *project management systems*. As we have stated, virtual teamwork is, in most cases, organized as project work. Projects have well defined goals and are defined by their *begin* and *end* dates, as well as by the required resources and their tasks (work breakdown structure). It is interesting to note, however, that PM systems traditionally support the work of the project manager as the main (and sometimes the only) user of the PM system. They do not support dynamic interaction (instantiation) of processes. More recently, project management systems combine with information sharing tools (shared workspaces) to provide a persistent storage for artifacts. The enactment of the task by team members, as defined by the project manager, is not supported by PM systems. In other words, we can conclude that PM systems are not geared towards virtual teamwork, but focused more on the planning aspect. They provide "static" snapshots (usu-