CSCW Experience for Distributed System Engineering

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INTRODUCTION

Cooperation with computers, or Computer Supported Cooperative Work (CSCW), started in the 1990s with the growth of computers connected to faster networks.

Cooperation and Coordination

CSCW is a multidisciplinary domain that includes skills and projects from human sciences (sociology, human group theories, and psychology), cognitive sciences (distributed artificial intelligence), and computer science (human/computer interfaces; distributed systems; networking; and, recently, multimedia).

The main goal of the CSCW domain is to support group work through the use of networked computers (Ellis et al., 1991; Kraemer et al., 1988). CSCW can be considered a specialization of the Human-Computer Interaction (HCI) domain in the sense that it studies interactions of groups of people through distributed groups of computers.

Two main classes can be defined within the CSCW systems. Asynchronous Cooperations do not require the co-presence of all the group members at the same time. People are interacting through asynchronous media like e-mail messages on top of extended and improved message systems. At the opposite, Synchronous Cooperations create stronger group awareness, because systems supporting them require the co-presence of all the group members at the same time. Exchanges among group members are interactive, and nowadays, most of them are made with live media (audio- and videoconferences).

Groupware (Karsenty, 1994) is the software and technological part of CSCW. The use of multimedia technologies leads to the design of new advanced groupware tools and platforms (Williams et al., 1994), such as shared spaces (VNC, 2004), electronic boards (Ellis et al., 1991), distributed pointers (Williams et al., 1994), and so forth. The major challenge is the building of integrated systems that can support the current interactions among group members in a distributed way.

Coordination deals with enabling and controlling cooperation among a group of human or software distributed agents performing a common work. The main categories of coordination services that can be distinguished are dynamic architecture and components management; shared workspace access and management; multi-site synchronization; and concurrency, roles, and group activity management.

Related Projects

Many researches and developments for distance learning are made within the framework of the more general CSCW domain.

Some projects, such as Multipoint Multimedia Conference System (MMCS) (Liu et al., 1996) and Ground Wide Tele-Tutoring System (GWTTs) (GWTTS project, 1996), present the use of video communications with videoconference systems, communication boards, and shared spaces, built on top of multipoint communication services. The Distance Education and tutoring in heterogeneous teleMatics envirOnmentS (DEMOS) project (Demos project, 1997) uses common public shared spaces to share and to control remotely any Microsoft Windows application. The MultiTeam project (MultiTeam project, 1996) is a Norwegian project to link distrib-

uted classrooms over an ATM network through a giant electronic whiteboard the size of an ordinary blackboard. Microsoft NetMeeting (Netmeeting, 2001), together with Intel Proshare (now Polycom company) (Picture Tel, 2004), are very popular and common synchronous CSCW toolkits based on the H.320 and H.323 standards and both composed of a shared electronic board, a videoconference, and an application sharing space. These tools are used most of the time on top of the classical Internet that limits their efficiency due to its not guaranteed quality of service and its irregular rate. Most of their exchanges are based on short events made with TCP/IP protocol in peer-to-peer relationships. The ClassPoint (ClassPoint, 2004) environment has been created by the First Virtual Communications society (formerly White Pine society). It is composed of three tools: a videoconference based on See You See Me for direct video contacts among the distributed group members, the dialogs, and views of the students being under the control of the teacher. An electronic whiteboard reproduces the interactions made by classroom blackboards. A Web browser has been customized by a synchronous browsing function led by the teacher and viewed by the whole-distributed class. This synchronous browsing can be relaxed by the teacher to allow freer student navigation.

BACKGROUND

A Structuring Model for Synchronous Cooperative Systems

Different requirements are identified for the design of networked synchronous CSCW systems. Such systems may be designed to improve the efficiency of the group working process by high-quality multimedia material. The networked system must support both small- and large-scale deployments, allowing reduced or universal access (Demos project, 1997). Defining the requirements of a networked synchronous CSCW system needs multidisciplinary expertise and collaboration. For this purpose, we distinguish three distinct viewpoints: functional, architectural, and technological.

Moreover, several objectives may be targeted by the networked solution retained for the synchronous CSCW system, including adaptability, upgradability, multi-user collaboration, and interaction support. In practice, the design and development of a networked solution first involve general skills such as software architecture, knowledge organization, and other work resources management; and the second development of domain-specific multimedia cooperation tools. We identify three generic interaction levels that are likely to be significant for the different viewpoints: the cooperation level, the coordination level, and the communication level. Their content is summarized in Table1.

For software architecture design, level-based layering allows different technologies to be used for implementing, integrating, and distributing the software components. This separation increases the upgradability of the systems. Layering allows the implemented system to likely guarantee the end-user quality of service while taking advantage of the different access facilities. For adaptability, multi-user collaboration, and interaction support, level-based decomposition allows functional separation between individual behaviors and group interaction rules definition.

Table 1. The three levels and three viewpoints of the structuring model

Interaction Levels/ Viewpoints	Cooperation	Coordination	Communication
Functional view	User-to-user interaction paradigms	User-level group coordination functions (sharing, and awareness)	User-to-user information exchange conventions
Architectural view	Cooperation tools	software-level group coordination services (for tools and components)	Group communication protocols (multipeer protocols)
Technological view	Individual tool implementation technology (interfacing, and processing)	Components integration technology	Component distribution technology (request transport protocols)