

# **An overview of Computer Supported Cooperative Work for Small and Medium Enterprises**

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**Abstract** : The paper is concerned with the obstacles faced by Computer Supported Collaborative Work (CSCW) environments with respect to their deployment in Small and Medium Enterprises (SMEs). These obstacles are directly connected to the special characteristics of SMEs (such as small size and limited human / financial resources) and can seriously impede the successful introduction of CSCW as well as related teleworking technologies. Based on an overview of related literature, the paper proposes the adoption of Web technologies, both conventional client-based as well as Web Services related ones, for the development of CSCW environments that can be easily deployed in a wide variety of SMEs and related organizations.

**Keywords:** Telework, Small and Medium Enterprises, Computer Supported Cooperative Work

## **1. Introduction**

Telework is widely considered as one sector that can have a significant potential for growth within the Information and Communication Technologies (ICT) domain. ICT penetration in SME's is increasing but is still low compared to bigger organizations; this is especially true for more complex telework applications like Computer Supported Collaborative Work (CSCW) systems. In practice, CSCW can be defined as [1] the act of supporting multiple individuals working together with computer systems. Further adoption of telework by SMEs can be triggered by the use of CSWS if several practical issues are appropriately taken into account.

There are several requirements with respect to a modern CSCW environment. It should incorporate a variety of office-related applications [2] such as multiple authors' documents editing, electronic diaries, email and access to networked databases. CSCW environments must also provide meeting-related facilities via e.g. teleconference despite the fact that complete substitution of face to face meetings is not considered feasible taking into account the current technological conditions. Informal communication e.g. via instant messaging is also required.

Nowadays the underlying technologies that can be used in support of CSCW, such as broadband networks, multimedia communications, peer to peer networking, business support systems etc are mature as well as affordable. What is still missing is the actual CSCW framework that can be used to unify these technologies into a coherent working environment for everyday office use, a fact already identified back in the late 80's and early 90's [3], [4]. Moreover, since the adoption of CSCW is always faced with a need for changing the corporate mentality, there is a series of requirements connected with

cultural and human resource aspects. In the following section a deeper look is attempted at these requirements.

## **2. CSCW requirements**

### ***1.1 Technical Requirements***

One can classify the immediate needs that should be covered by a CSCW system as follows:

1. To distribute jobs
2. To coordinate jobs
3. To deliver job results
4. To distribute other than job material (announcements, orders, rules, information)

These generic requirements lead to a series of technical requirements that should be met by such software. In particular, from a technical viewpoint, CSCW environments should offer [5]:

- **Efficient protocols.** Communication protocols should conserve bandwidth and be able to share data effectively to users throughout the organization.
- **Portable, high-performance implementation.** The software should be able to run on various computer platforms with a very similar look and feel in order to accommodate the IT diversity that is prevalent in corporate organizations as well as in telecommuters' equipment.
- **Effective client interface (GUI) design.** CSCW software should be easily adopted by users regardless of their IT skills. Therefore user interfaces should be simple and user friendly. Efficient on-line help is a big plus.
- **Scalability.** The groupware should be able to accommodate large numbers

- simultaneous users without a noticeable degradation of performance.
- **Distributed management.** Administrators should be able to log on to the system from a variety of locations and solve day to day operational issues.
  - **Interoperability with Legacy Systems.** The groupware should be able to access data stored in existing ICT platforms such as databases, logistics systems etc.

### *1.2 Cultural Requirements*

The acts of distributing and coordinating jobs involve, to a great extent, interactivity between humans. Therefore it is difficult to support them via an environment designed solely according to the technical requirements stated above mainly because, apart from the requirement regarding GUI design, the human factor is taken into account in a very small extent. Looking at the CSCW from a technical viewpoint fails to address the human aspect of the basic function of CSCW which is the support of cooperative work [1].

First of all, one cannot expect that existing business process, based on legacy platforms and in most of the cases involving the exchange of documents in paper form, can be maintained after the introduction of a CSCW system. Therefore a critical step for the introduction of such a system in any company is the mutual convergence between existing procedures and the features of the CSCW system that is being introduced.

It should also be noted that the traditional structure of business process and operation procedures is based upon the notion of “workflow”; specific people are assigned with specific tasks which must be completed under specific constraints e.g. deadlines etc. However, even before the introduction of CSCW systems, task allocation is constantly changing by internal and external factors and the change is negotiated constantly by co-workers. CSCW systems should enable the set-up of informal collaboration networks

which run horizontally through each organization, allowing workers to negotiate, share and perform tasks with colleagues in a self-organizing manner.

The aforementioned requirement for horizontal cooperation is tightly connected with the support of a shared information space. The common information space should show the context, strategies and perspective that have been applied in producing this information. This is crucial since co-workers have a tendency to criticize information if they can assess neither its source nor its validity. Moreover, information is not neutral but it is always connected to the goals of each individual; and people may have different goals even if they are collaborators. Of course, access to information should be managed in an intelligent manner. Only information relevant to the role of each worker should be accessible otherwise collaboration can easily turn into chaos.

There is also a mentality factor that can have an impact in the introduction of CSCW system in an organization, namely stress. It has been observed [6] that teleworkers are sometimes more stressed during telework than during conventional working. This has been attributed to timing stress due to the asynchronous nature of teleworking and to stress due to the fact that workers have to decide along with other people that they cannot see. A properly designed system should take into account the requirement for reducing stress factors.

### **3. The SME case**

SME's model themselves according to bigger organizations that they consider market successful [7]. Traditionally, SME's:

- Have less human, financial and technological resources
- Can be more innovative

- Are more flexible and responsive to environmental change

Of course when it comes to the introduction of a new ICT technology such as CSCW to SMEs, one size does not fit all [8] since SME is a very broad term covering multiple sizes and types of organisations. But in any case, SME's have certain common limitations concerning the adoption of CSCW systems such as reduced resources (financial, human), lack of IT support and constant pressure from competition.

Thus the requirement of increased usability of CSCW environments becomes even more pressing in the SME domain since SMEs have a much lower potential to train their staff as well as to absorb the possible pressure imposed on personnel due to the introduction of CSCW systems. The lack of IT support means that an organization must be provided with a turn-key CSCW implementation that can be efficiently supported by the vendor or a responsible 3<sup>rd</sup> party without significant SME involvement. There have been several cases reported, of computers or other technologies not being used due to poor implementation and support [9]. Additionally, SMEs cannot be binded with a legacy technology which may incur additional costs for extension and support over the years therefore CSCW systems should be open systems.

Based on the above, Web based technologies constitute ideal tools for building CSCW systems since they combines the ubiquity of the web with the limited resources of SMEs. According to [10] there are three main reasons for adopting WWW technologies in the development of CSCW systems:

1. Browser based interfaces are present in every computing platform and are very familiar to all users, even novice ones. Therefore a Web-based CSCW can be easily adopted by its potential users since it significantly eases the learning curve

- compared to proprietary applications.
2. Web technologies provide independence from operating systems and computer architectures; moreover relevant CSCW applications are accessible from any networked location via a simple URL.
  3. WWW technologies (JavaScript, HTTP, HTML, Cgi-scripts, Java servlets), serve quite well the need for multi-user, distributed shared applications like CSCW systems.

Recently, the emergence of the Web services paradigm [11] opens up new possibilities regarding process distribution as well as collaboration in CSCW systems.

#### **4. The Web Services Paradigm**

Web services consist of a set of standards that allow the invocation of IT services via the Web in a transparent manner, independent of operating system or computing platform. Services exist in the context of Web servers that can activate them in response to relevant requests from remote clients. In order for a Web service to be invoked, its interface is exposed in a standardized form via a description in the Web Services Description Language (WSDL) [13]. This description is contained in an XML document and it is sufficient for a client application to remotely invoke the service provided that the client application is aware of the service's functionality. Invocations and responses are coded in an XML-based protocol called Simple Object Access Protocol (SOAP) [14] which is transported over HTTP. Finally client applications may discover Web Services by querying dedicated databases called UDDI registries named after the Universal Discovery Description and Integration (UDDI) protocol [15] used for the communication between the inquiring application and the registry.

A Web services based framework for CSCW environments is proposed in [12]. The framework identifies several categories of services that can be combined into a CSCW system. Communication services provide the necessary infrastructure for the support of information exchange such as email, messaging, voice communication and conferencing. Applications services comprise a set of office-related applications that become Web-services compliant. Collaboration / coordination services are responsible for the orchestration and synchronization of tasks between individuals as well as teams. Finally security services provide horizontal mechanisms that ensure the integrity and privacy of the exchanged information.

## **5. Conclusions**

The introduction of CSCW environments, despite their obvious advantages, is faced with several obstacles especially when it comes to the SME domain. Therefore CSCW must abide to specific requirements that are not only technological but are also strongly connected to the cultural change imposed by the introduction of such systems in any organization. The small size of SMEs and the subsequent lack of human and financial resources calls for a CSCW environment that is open, easy to deploy, user friendly, independent of operating systems and computing platforms. Web-based technologies comply with all these requirements and constitute the ideal set of tools for the development of effective CSCW environments for SMEs.

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