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The Market for E-Collaboration Systems - Identification of System Classes Using Cluster Analysis

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THE MARKET FOR E-COLLABORATION SYSTEMS - IDENTIFICATION OF SYSTEM CLASSES USING CLUSTER ANALYSIS

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Abstract

E-Collaboration systems, that is software for supporting communication, coordination and cooperation processes in groups, have become the backbone infrastructure to support E-Work in a globalised world where virtual work in and across organisations has become a prevalent modus operandi. Fuelled by recent technology trends numerous new E-Collaboration systems appeared in the marketplace. Today, the market offers an abundance of systems that often support a wide range of features. In this paper a study is presented that aims to shed light on the market for E-Collaboration systems by structuring the range of available systems into meaningful classes. To this end, a sample of 94 E-Collaboration systems is characterised using a classification approach. Application of a cluster analysis led to the identification of five system classes and a range of sub classes. The resulting system classes are described and trends of integration and convergence, which characterise the market, are discussed. The results, being a reflection of the existing market complexity, should be equally helpful for researchers who deal with E-Collaboration systems as their objects of interest, as well as for business executives, who need a market overview to support buying decisions.

Keywords: E-Collaboration, Groupware, Market Study, Classification, Cluster Analysis.

1 INTRODUCTION

In dynamic markets more and more enterprises react with engaging in collaborative ventures such as strategic alliances or business networks. Many people today work in teams that are distributed across space and time with participants coming from different companies (Bélanger et al., 2003). Increasingly, these virtual teams are used to organize knowledge-intensive work in projects where the best experts are distributed across the globe (Lavin Colky et al., 2002). To this end, E-Collaboration systems, i.e. software for supporting communication, coordination and cooperation between people processes in groups, have become the backbone infrastructure for contemporary E-Work carried out within and across organisations. Fuelled by recent trends such as the maturing of Internet technology, the increase in network bandwidth and the emergence of novel ways of communication (e.g. IP telephony) numerous new E-Collaboration systems have made their market entrance. Hence today, an almost incomprehensible number of systems exist that often support a wide range of collaboration features. Following the recent attention even large IT companies such as IBM, Microsoft, Oracle, Siemens are devoting to the sector, the market for E-Collaboration systems presents itself as fast growing, diversified, and complex.

In this paper a study is presented that aims to shed light on the E-Collaboration market by structuring the range of available systems in meaningful classes. To this end, a cluster analysis approach is used. In the following section the study is motivated and the methodological approach is introduced. Section 3 provides an overview of the criteria that was used to characterise E-Collaboration systems. Section 4 introduces the cluster analysis, while section 5 describes the system classes that emerged from the data analysis. Section 6 discusses the results and gives an overview of ongoing market trends.

2 STUDY OVERVIEW

2.1 Motivation and context

The E-Collaboration system, i.e. the IT artefact used by groups in real-life contexts, represents one of the conceptual elements that are of interest to E-Collaboration researchers (Kock, 2005). In order to fully understand the impact of such systems in groups and organisations, one has to have a good understanding of its typical features, alternative systems, as well as emerging new technologies available to people in context. According to Orlikowski and Iacono (2001) in many studies in the IS field the IT artefact is only poorly understood or articulated. Consequently, the authors call for research to re-focus on the IT artefact as the relevant subject matter. In the same way, Markus (2005) emphasizes the importance of understanding E-Collaboration technology. Researchers must pay "attention to differences in technology's material features…" (Markus, 2005, 9), since the existence of a feature in a particular type of E-Collaboration system can have strong effects on how the system is actually used by groups in order to perform joint tasks (DeSanctis & Poole, 1994; Kock, 2005). Hence, when researching the use and impact of particular E-Collaboration systems it is important to know what features these systems offer: "A small difference in features could mean a noticeable difference in social outcomes for companies choosing between [E-Collaboration] packages" (Markus, 2005, 14). In light of this, the aim of this study is to contribute to a better understanding of the E-Collaboration artefact by providing a classification of systems grounded in real-life complexity of the marketplace.

Existing studies in the field sometimes have no conceptual understanding of the classes of systems they deal with or they are based on rather weak classifications (e.g. Bajwa et al., 2005). Previous attempts to the classification of E-Collaboration systems are mainly conceptual and often based on single collaboration features; this leads to the identification of classes such as: E-Mail systems, Instant Messaging, Calendars, audio teleconferencing, videoconferencing etc. (e.g. Munkvold, 2003; Bajwa et al., 2005). However, most E-Collaboration products today fall in two or more of these categories

rendering the conceptual distinctions worthless. With the diversification of systems and the expansion of the available feature sets a conceptual classification seems no longer suitable. To this end, a market-oriented classification is proposed based on actual similarities and differences between E-Collaboration products in the marketplace. The resulting classification, being a reflection of the existing market complexity, should be equally helpful for researchers who focus on E-Collaboration systems as their objects of interest as well as for business executives, who have an interest in these systems. Market observation is an important task of information managers that aims at gathering information to support systems comparison and buying decisions. Here, our study can contribute to a better understanding by providing an overview of the market for E-Collaboration software packages.

2.2 Research process

At the beginning of this study[1] a comprehensive Internet search was carried out to identify systems that qualify as E-Collaboration systems; a total of 236 were identified. Concurrent to this Internet search, a catalogue of classification criteria was compiled to characterize the systems (see section 3). This catalogue is the result of three entwined processes carried by the author and a research assistant[2]: 1) a literature review was carried out in order to identify typical features and characteristics of such systems, 2) further characteristics were identified during the course of the Internet search by examining actual systems and gathering information provided on vendor web sites; in doing so, a number of systems were classified on a preliminary basis in order to test and refine the criteria, 3) a workshop was held to consolidate the criteria and group it in a meaningful way that would best be able to characterize a range of systems. By basing the criteria catalogue both on literature as well as the features and characteristics of existing systems the resulting catalogue is both grounded in established ways of describing systems and does not miss out on new and emerging features at the same time.

Using the criteria, a sample of 94 systems was finally classified in the next step; the sample was made up of all systems for which enough information was available on the Internet to allow for a full classification. The resulting sample turned out to be quite diverse and also makes up for 40% of the identified population so that the author is confident that it provides a good representation of the market. The classification itself was carried out by the author and the assistant independently. From this, a few deviations arose in the classification of systems, which led to a more precise description and application of a few criteria items. Table 1 provides an overview of the research process.

	Steps	Description
1	Internet search for E-Collaboration systems	236 systems were identified that matched with the definition of E-Collaboration systems
2	Development of a classification scheme	Iterative process of literature research, classification of systems, identification and description of new criteria and criteria consolidation
3	Final classification of the selected sample of systems	Classification of 94 systems for which enough information was available to carry out classification with the complete set of criteria
4	Data preparation	Compilation of data matrix as input for statistical data analysis
5	Cluster analysis	Iterative process of clustering using various cluster methods to corroborate the results
6	Interpretation and description	Description of the identified clusters and identification of sub clusters

Table 1: Steps in the research process

[1] The study presented here was based on a predecessor study carried out a year earlier (Riemer, 2007). While the study built on the existing classification criteria and systems identified, the systems as well as the criteria catalogue was challenged in the course of the research process and the resulting criteria catalogue shows a number of improvements to the earlier version.

[2] The author wants to thank Benjamin Rensmann for his invaluable help with the classification part of this study.

3 CLASSIFICATION OF E-COLLABORATION SYSTEMS

The aim of this study is to classify systems according to typical E-Collaboration features and the ways in which systems would typically be used in group contexts. By doing so, the focus was on features that support typical collaborative processes from the group perspective and not on the systems' technical details; aspects such as IT security or systems architecture were not considered.

3.1 Group processes supported by the system

Group processes can be distinguished according to their level of interdependency (e.g. Denise, 1999): Communication describes the process of inter-personal information exchange by means of various types of media. Coordination refers to aligning group activities in regards to joint tasks, projects, and processes; it comprises the planning of tasks, their temporal order, as well as the assignment of resources. Finally, collaboration describes the joint work on shared objects where people share common goals and are jointly responsible for the outcome. E-Collaboration systems can support one, two or all three group processes. If a system provides the respective features to support one of the group processes it was classified accordingly (for the complete systems classification see appendix).

3.2 Types of communication

Communication can take different forms. Three types of media are prevalent in E-Collaboration systems: text, audio and video communication. These can be differentiated further in synchronous and asynchronous communication. Depending on the number of people involved, bilateral communication (e.g. voice call) can be differentiated from multi-person communication (e.g. voice conference). For a full list of all communication types refer to table 2.

3.3 Shared resources and features

E-Collaboration systems go beyond supporting computer-mediated communication (CMC) (Kock, 2005); they typically provide access to a range of shared resources or features that support group processes beyond communication; these resources are core to the classification:

- A *discussion forum* or newsgroup is a resource that allows text-based discussions between group members; it permits posting and commenting on messages; postings are typically presented topic-wise and in chronological order.
- A *black board* simply permits publishing messages without the same interaction as in a forum.
- *Document spaces* permit the structured storage and shared access of documents for group members.
- *Surveys* are used to quickly gather group members' opinions to support decision processes.
- In an *online presentation* a group member presents to the others a document as part of an online session; this can be part of an online meeting or a seminar.
- *Application sharing* allows a user to show applications running on his machine or to hand over the control of an application. It is used to show documents and to facilitate joint work.
- Shared *address books* hold the contact details of the team and of outside people relevant to the joint work. Address books can be jointly maintained and used.
- *Group calendars* support the temporal coordination of group activities; they allow team members to coordinate their joint appointments.
- Shared *task lists* allow group members to coordinate the assignments of shared tasks.
- A *project plan* expands the coordination mechanisms of group calendars in that it allows to determine the activities of a group project, their temporal order and dependencies, and to carry out estimates with regard to duration, and to assign tasks to team members.

- *Resource management* functionality complements the project planning in that it allows managing relevant group resources such as the time balance of group members, conference rooms, or technical facilities. Resources can be assigned to projects, tasks, and activities.
- *Project controlling* functionality allows expense budgeting for group activities. It also provides means for controlling resource consumption, in particular balance sheets to record times and costs.
- *Document distribution lists* support the structured handover of documents between group members. Following a pre-determined process these lists allow for a better coordination than forwarding documents via e-mail.
- *Workflows* permit the collaborative modelling, simulation, execution, and control of complex business processes. They go beyond distribution lists in terms of complexity and level of control.
- *Whiteboards* are virtual boards that permit shared and concurrent sketching and drawing to visualize ideas and thus support brain storming in an online environment.

3.4 Typical use of the system

E-Collaboration systems can further be distinguished by their typical use within a group, whether they are likely to be used continuously in a day-to-day fashion to support ongoing activities or whether the system is used only situational to support a specific group activity. Functions typical for continuous use are e-mail communication or shared document spaces that store team documents. A situation-based use refers to an ad hoc support of activities with a short duration, e.g. joint online meetings.

3.5 Role for the group

Systems that provide functions for the support of basic group processes are regarded as primary systems; they support the group members with all essential functions like E-Mail communication or calendar functionality. Secondary systems provide additional functions to complement primary systems. Primary systems are always used continuously by the group, while secondary systems might either be used continuously to complement a primary system, or situational, e.g. for the duration of an online conference call.

3.6 Awareness features supporting shared perceptions

Compared with traditional workplaces distributed collaboration has several deficits in relation to the perception of shared group activities (Jang et al., 2000). To this end, E-Collaboration systems offer functionality aimed at the production of what is called *awareness* in order to bridge these deficits: „Awareness is an understanding of the activities of others, which provides a context for your own activities" (Dourish & Bellotti, 1992, 117). Four types can be distinguished (Greenberg et al., 1996):

- *Informal awareness* refers to the knowledge of the location and availability of group members. Using a status icon, the system might signal whether a person is currently logged on, where the person is located, or when she or he will be available again (e.g. in Instant Messaging tools).
- *Group structural awareness* indicates the structural properties of the group. Using user profiles or organisation charts the system can provide information with regard to positions of people in the group hierarchy, their roles as well as the rights and responsibilities attached to it.
- *Social awareness* refers to the perception of activities in a shared work environment. It comprises information in regards to the level of user attention, their respective emotional conditions and the level of interest. Social awareness is a typical characteristic of synchronous video communication.
- *Workspace awareness* describes the knowledge of interactions of other participants in relation to shared documents. It indicates whether shared objects have been changed, who is currently working on a document, or what other developments did happen in the shared workspaces.

Having described all classification criteria in detail the following table gives a summary; it is the basis on which the classification of E-Collaboration systems was carried out.

Group process	Communication		Coordination		Collaboration	
Usage of system	Continuous		Situational			
Role for group	Primary		Secondary			
Types of communication	Text messages	Voice messages	Video messages	Instant Messaging	E-Mail	
	Voice call	Video call	Text conference	Voice conference	Video conference	
Shared resources and features	Discussion forum	Black board	Document spaces	Surveys	Online presentation	
	Application sharing	Address book	Group calendar	Task list	Project plan	
	Resource management	Project controlling	Document distribution list	Workflow	Whiteboard	
Awareness	Informal Awareness	Group structural Awareness	Social Awareness	Workspace Awareness		

Table 2: Catalogue of classification criteria

4 CLUSTER ANALYSIS

Based on the criteria catalogue a sample of 94 E-Collaboration systems was classified (see appendix). This classification resulted in a matrix that contains "1" whenever a system possesses a certain feature and "0" otherwise. This data was used to perform a cluster analysis with SPSS 13. In doing so, Ward's method was used as the main algorithm with other procedures to corroborate the results. According to Everitt the Ward algorithm is a versatile method that in most cases promises interpretable results (1993). It tends to the formation of homogeneous clusters and most often signals the correct number of clusters (Everitt, 1993). A cluster analysis is deemed successful, if the researcher, who is familiar with the data, can sensibly interpret the resulting clusters (Everitt, 1993). A good set of clusters shows homogeneous and clearly separable clusters. To identify clusters dendrograms[3] (i.e. graphical plots of the cluster results) were used.

The first run of applying Ward to the sample already let to a satisfactory result; five clusters were identified. Since two of the clusters are quite similar and also located next to each other in the dendrogram, the results were triangulated using additional methods. The complete linkage algorithm was used to challenge the Ward result and the single linkage algorithm to search for outliers. Applying complete linkage led to a similar result albeit with quite a few cluster allocations that did not make sense at first sight. It became clear that all wrongly allocated systems were smaller tools with only a limited set of features, all of which belonged to the same cluster of the five clusters identified by the Ward algorithm.[4] After separating these dedicated, specialized tools from the rest of the sample the complete linkage algorithm led to exactly the same remaining four clusters as the Ward method. In the next paragraph the five system classes are introduced and described; this represents the main finding of the study (see also the table in the appendix).

[3] Due to space restrictions all dendrograms had to be omitted from the document. All dendrograms as well as further background data on the study can be found online: http://collaborate.uni-muenster.de/market-study.

[4] The reason for the difference lies in the fact that the Ward algorithm is better able to treat the non-existence of features as a similarity between systems, which led to the identification of the class of smaller tools (dedicated systems, see below).

5 SYSTEM CLASSES

Based on the cluster results five system classes emerged that characterise the market for E-Collaboration systems. Since these classes are still quite large and contain a range of systems further sub classes were identified using the classification criteria as well as other information such as the general market positioning of the systems. In the following, the classes are described using typical characteristics; for details and examples refer to the resulting classification in the appendix.

5.1 Everyday systems

Everyday systems are used continuously by the group as primary systems to support everyday activities. To this end, the systems provide basic features to support all three group processes - communication, coordination and collaboration. Everyday systems focus on asynchronous text-based communication; all systems feature e-mail functionality as primary type of communication. This is a constituent characteristic for this class. Other typical features are shared calendars, address books, task lists, document spaces, and also discussion forums. The main form of awareness supported by these systems is workspace awareness in relation to documents held in shared spaces. 16 systems belong to this class; using the systems' history and typical areas of application five sub classes were identified:

- *Client-server groupware systems* descend from traditional e-mail systems and offer typical functions of PIM clients (albeit for a group context) such as calendars, address books, and task lists (e.g. IBM Lotus Notes, Microsoft Exchange/Outlook). The systems are directed at middle sized to large enterprises because their implementation causes considerable setup costs.
- *Small office groupware* differs from the first sub group in their target group. Being very similar in terms of features these systems are targeted towards smaller enterprises (e.g. VS Office).
- *Web-based team rooms* follow a different philosophy. The core idea is to provide a shared online workspace for discussion and document sharing. Hence, they provide discussion forums and black boards in addition to shared calendars, address books etc. (e.g. phpGroupware) The systems are also suited for smaller enterprises; some providers offer ad hoc workspaces by means of application service providing that can be rented by small teams for the duration of a project (e.g. teamWorks).

5.2 Integrated systems

Integrated systems share many features (e.g. E-Mail, calendars, address books and task lists) with everyday systems, but their constituent characteristic is the support of synchronous communication. All systems offer instant messaging and text conference capabilities. A focal feature is the presence information for creating informal awareness. Moreover, each of the sub classes goes beyond this standard set of features in a certain defining area:

- *Integrated client-server systems* are very similar to the client-server systems described above but for the fact of offering synchronous text communication (e.g. Oracle Collaboration Suite).
- *Real-time collaboration systems* provide a rich set of synchronous real time cooperation via text, voice and video conferencing, as well as application sharing and shared whiteboards. Hence, they share many features with the class of meeting systems (see below).
- *Web-based systems* are much like web-based team rooms described above, but with the support of synchronous text communication and other features such as group surveys (e.g. Yahoo! Groups).
- *Integrated systems with project capabilities* are systems that offer a diverse set of features ranging from text-based communication over everyday features to project management features. They are essentially web-based systems with additional project coordination features.

5.3 Coordination systems

This class is the largest with a total of 24 systems; all systems focus on certain aspects of group coordination. The systems are typically used continuously by the group members albeit as secondary system as complement to everyday systems. Typical features are document spaces, group calendars, task lists, project and resources plans, project controlling, as well as document distribution lists and workflows. Most systems support group structural awareness. Five sub classes were identified:

- *Project coordination systems* focus on the project as the main entity. At the centre are the project and resources planning features. In addition to this, project controlling features are used to capture times and project expenses and to monitor milestones (e.g. Projectplace). Besides, the systems provide shared calendars and document spaces and sometimes simple document distribution lists.
- *Task coordination systems* are used for day-to-day coordination mainly within enterprises, e.g. with the focus on field service coordination. The systems feature shared calendars to coordinate meetings, appointments, or client visits (e.g. TaskTimer). The systems offer a rudimentary project support by means of task lists. However, structured project planning is not supported.
- *Time coordination systems* are more or less online calendars that offer groups the functionality to coordinate team meetings (e.g. Google calendar).
- *Document-oriented coordination systems* are similar to web-based team rooms in terms of shared resources and features, but they do not offer any considerable communication support that would qualify them as everyday systems. The focus of these systems lies in coordinating the joint work on shared documents. Typically, these systems offer shared document spaces and sophisticated versioning functionality, as well as workspace awareness (e.g. BSCW, Microsoft Sharepoint).
- *Process coordination systems* focus on the planning, modelling, execution, and coordination of processes in teams and organisations. The systems are mainly specialized workflow tools (e.g. Lotus Workflow), but systems like Actionworks also offer a broader range of resources to support team coordination besides workflow support.

5.4 Meeting systems

Meeting systems comprise 13 systems that support online sessions and video conferences; they are used situational and as secondary systems. The systems are based on extensive synchronous communication featuring such as text chat, audio and video communication. Other typical features are application sharing and whiteboards. Surveys can be administered to support ad hoc decisions and online presentations can be held to conduct online seminars. Awareness is also supported to a significant degree in the informal, social, and workspace dimensions. There are three sub classes:

- A small group of systems can be described as *Ad hoc meeting systems*. These are smaller solutions that allow for the quick ad hoc initiation of conferences from the desktop context of the computer, i.e. by means of a small client application (e.g. Microsoft Netmeeting).
- *Standard meeting systems* offer all functions described above and thus support shared meeting sessions (e.g. Click-to-Meet, WebEx MeetingCenter).
- In addition to the standard features *systems with seminar capabilities* offer services for the planning and realization of online seminars and e-learning curricula (e.g. Arel Spotlight, Breeze).

5.5 Specialized tools

This class summarizes the group of 22 systems that only implement a small range of features. Since this group is quite heterogeneous no common characteristics in terms of features can be identified that are shared by all systems. The following sub classes were identified:

- *E-mail systems* provide server functionality that allows enterprises to setup their own e-mail infrastructure (e.g. Sendmail).

- *Forum & discussion systems* support the setup of discussion forums (e.g. Phorum) and text-based collaboration environments. Part of this class are newer techniques discussed under the label 'social software' that provide new ways of text-based collaboration. Popular examples are Blogs or Wikis.
- *Chat systems* provide text and audio conferences (e.g. Teamspeak) that support occasional meetings that do not require the same set of features as provided by grown-up meeting systems.
- *Instant Messaging tools* are small software tools that facilitate the ad hoc initiation of synchronous text communication for two or more people (e.g. Pandion).
- *Instant Collaboration tools* provide all features of Instant messaging tools but with added media richness in that voice and video communication are supported (e.g. Skype or Trillian Pro).
- *Joint work and editing tools* support synchronous work on shared documents. The spectrum reaches from joint text editors (e.g. PabloDraw) to the joint use of office programs (e.g. CoOffice).

Criteria	Everyday systems	Integrated systems	Coordination systems	Meeting systems
Group processes	Communication Coordination Collaboration	Communication Coordination Collaboration	Coordination Collaboration	Communication Collaboration
Type of communication	E-Mail	E-Mail, Instant Messaging, Text conference, (some tools: voice & video)	Generally none (some tools offer simple text messages)	All synchronous (Text, Voice, Video; bilateral and conferences)
Shared resources and features	Group calendar Address book Task list Document spaces (some systems: Discussion forum, Black board)	Group calendar Address book Task list Document spaces (some systems: Discussion forum, Black board)	Group calendar, task lists, Project plan, Resource management, Project controlling, workflow Document spaces	Whiteboard Application sharing Presentations Surveys Protocols Document spaces
Use of system	Continuous	Continuous	Continuous	Situational
Role for group	Primary	Primary	Secondary	Secondary
Awareness	Workspace	Informal, Workspace	Group structural, workspace	Informal, social, workspace

Table 3: Characteristics of the four main system classes

6 DISCUSSION OF RESULTS

The identified classes and sub classes of E-Collaboration systems characterize the status quo of the E-Collaboration systems market. In the following paragraph some differences and similarities between the four main clusters that emerged from the study are discussed. Some ongoing trends that are likely to shape future developments in the marketplace are identified.

6.1 Similarities, differences, and convergence between system classes

A close look at the four main clusters reveals some fundamental differences, but also certain links between sub classes in neighbouring clusters. The two clusters *everyday systems* and *integrated systems* are quite similar except for the support of synchronous communication; both clusters are primary systems and serve a general purpose for work groups. To the contrary, the remaining clusters *coordination systems* and *meeting systems* represent more specialised systems that fulfil secondary group functions albeit in very different ways. Between the first two and the latter two clusters so called *zones of convergence* have been identified, where some of the sub classes are being drawn towards the neighbouring clusters (see figure 1 for a visual representation):

- The *document coordination systems* are very similar to the *web-based team rooms* except that they do not provide any means for everyday group communication such as E-Mail.

- The *integrated systems with project features* are quite similar to project coordination systems, but are suited for everyday purposes and also provide synchronous communication.
- Finally, the *real-time collaboration systems* lean towards meeting systems in that they provide extensive features for both everyday group support and ad hoc meetings with rich synchronous communication and application sharing functionality.

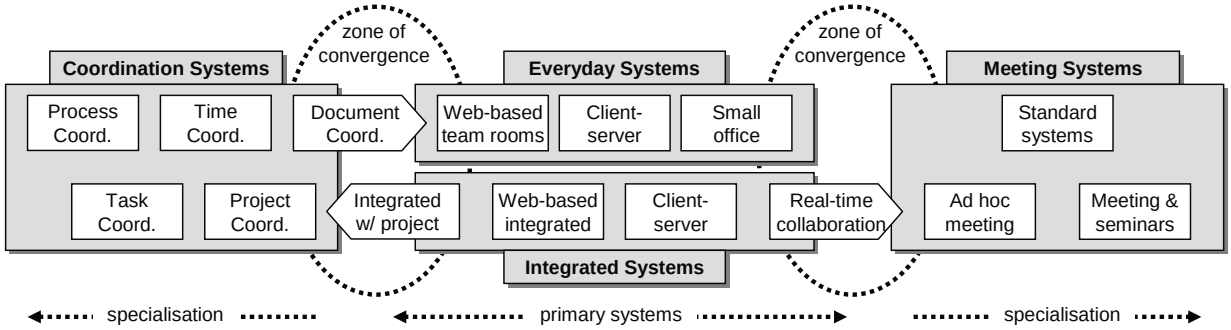

Figure 1: Visualization of the four main clusters and convergence of sub classes

6.2 Trends towards systems integration and real-time communication

The paragraph above discussed the particularities of *integrated systems*. Interestingly, in the earlier version of this study conducted over a year ago, integrated systems did not show up as a separate class; only four system classes were identified (Riemer, 2007). Real-time systems were the only type of integrated products; identified in the earlier study as a small sub class of everyday systems. When comparing the classification of particular systems it becomes obvious that some providers made actual changes by either adding further communication media (in particular real-time features) or by integrating formerly separated systems. Hyperwave for example integrated Instant Messaging and other synchronous communication features to its eKnowledge Suite to create a real-time system.

Drawing from these observations and from recent market developments reported in the media, it becomes clear that there is a tendency towards integrating richer sets of communication media to E-Collaboration systems (e.g. Lazar, 2006). This trend is fuelled by the popularity of both Instant Messaging as well as voice-over-IP telephony. Today, with the *integrated systems* and especially the *real-time collaboration (RTC) systems* showing up as clusters in the study it can be assumed that the trend to integrate these media types will gain momentum. Ultimately real-time systems are likely to integrate a diverse set of media and concepts such as unified messaging, instant messaging, IP telephony, presence management, and video conferencing (Riemer & Frößler, 2006; Lazar, 2006).

7 CONCLUSION AND OUTLOOK

This market study provides practitioners with an overview of available system classes and typical features in the process of systems selection. Researchers who have an interest in the development, use, and adoption of E-Collaboration systems may use the typology as guidance to structure their domain and as support in selecting suitable systems as objects of their research. E-Collaboration researchers need a good understanding of the differences and similarities between systems in order to be able to systematically research E-Collaboration technology effects. As Markus states, “researchers will need to develop ways to characterizes features, to cluster variations into manageable categories and to be explicit about the dynamic nature and temporal boundedness of their subject matter.” (2005, 19) This study aims to contribute to this endeavour by providing characterizations, classifications, and a clustering of systems in classes, as well as a discussion of ongoing market trends.

While the study can serve as a starting point for research studies, it also has certain limitations in that it only provides a high-level classification of systems. In order to identify technology-shaping effects of particular E-Collaboration systems one needs a more specific understanding for differences in features, because "two different implementations of the same packaged technology – for example Lotus Notes – can be quite different..." (Markus, 2005, 18). Consequently, in their studies researchers need to go beyond the classification provided here in theorizing their artefact, e.g. to determine the similarities and differences between the specific instances of systems used in the field.

By concentrating on a marketplace view the study took an external perspective in a double sense: neither was data gathered from developers or providers, e.g. in regards to intentions for developing systems or their subsequent market positioning, nor was the perspective of decision makers explored. This leaves room for further studies that may deepen further the understanding of E-Collaboration systems, as well as the future developments of the market. Future studies might concentrate on the nature of these market developments, e.g. whether developments of divergence (e.g. emerging new system classes) or convergence (e.g. the move towards a dominant design) exist. Moreover, studies might also aim at bringing together system classes and potential usage scenarios in order to draw conclusions in terms of task-technology fit that might be useful to ultimately support decision making.

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Appendix: Final classification in order of resulting clusters

				Process			Use		Role	Type of Communication										Shared resources and features																Awareness			
				Communication	Coordination	Collaboration	continuous	situational	primary	secondary	Text messages	Voice messages	Video messages	Instant Messaging	eMail	Voice call	Video call	Text conference	Voice conference	Video conference	Discussion forum	Black board	Document spaces	Surveys	Online presentation	Application sharing	Address book	Group calender	Task list	Project plan	Ressource management	Project controlling	Document distribution list	Workflow	Whiteboard	Informal Awareness	Group Structural Aw.	Social Awareness	Workspace Awareness
Everyday systems	Client-Server Groupware	15	David V8 Corporate Edition	1	1	1	1		1			1			1							1				1	1	1										
		21	Exchange/Outlook	1	1	1	1		1						1							1				1	1	1										
		42	Lotus Domino/Notes	1	1	1	1		1						1							1				1	1	1										1
		50	Netmail Advanced	1	1	1	1		1						1							1				1	1	1		1								
		54	Openexchange Server (SuSE)	1	1	1	1		1						1					1	1	1				1	1	1										1
		75	Softalk OfficeTalk	1	1	1	1		1						1											1	1	1	1	1								1
	Small Office	31	HotOffice	1	1	1	1		1						1			1			1	1				1	1	1										1
		55	OpenGroupware.org	1	1	1	1		1						1						1	1				1	1	1		1					1			
		86	VS Office	1	1	1	1		1						1						1	1				1	1	1										1
		93	x-manage	1	1	1	1		1			1			1							1				1	1	1										
	Web-based teamrooms	40	iOffice	1	1	1	1		1						1					1	1	1				1	1	1		1	1				1			1
		53	open EIS	1	1	1	1		1						1			1		1	1	1				1	1	1										1
		61	phpGroupWare	1	1	1	1		1		1				1			1		1	1	1	1			1	1	1										
		69	Share360	1	1	1	1		1		1				1					1	1	1				1	1	1										1
		81	teamWorks	1	1	1	1		1						1					1	1	1				1	1	1				1				1		
		89	Web Crossing	1	1	1	1		1		1				1			1		1	1					1	1											1
Integrated collaboration suites	C/S. Grpw.	11	Collaboration Suite (Oracle)	1	1	1	1		1			1		1	1			1				1			1	1	1	1				1		1	1	1		1
		23	FirstClass 8.0	1	1	1	1		1			1		1	1			1		1		1				1	1	1							1			
		52	Novell GroupWise	1	1	1	1		1					1	1			1				1				1	1	1							1			1
	Real-time Collaboration	28	Groove Virtual Office	1	1	1	1		1		1	1		1		1		1	1	1		1				1	1	1						1	1	1		1
		29	HiPath OpenScape	1	1	1	1		1			1	1	1	1	1	1	1	1	1			1			1	1	1						1	1		1	1
		33	Hyperwave eKnowledge Suite	1	1	1	1		1					1	1	1	1	1	1	1	1		1			1	1	1							1	1		1
		41	IsoSpace	1	1	1	1		1		1			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1				1	1	1	1	1
		45	Lucane	1	1	1	1		1					1	1	1		1	1		1		1			1	1	1						1	1		1	1
	Web-based	72	Silk	1	1	1	1		1		1			1	1			1		1	1	1	1		1	1	1								1	1		1
		90	WebBoard Collaboration Server	1		1	1		1		1			1	1			1		1	1	1	1											1	1			1
		94	Yahoo! Groups	1	1	1	1		1		1			1	1			1				1	1				1	1							1	1		1
	Integr. project	6	BrightSuite	1	1	1	1		1		1			1	1			1		1	1	1	1	1	1		1	1	1	1	1				1	1		1
		18	eGroupware.org	1	1	1	1		1					1	1			1				1	1	1	1	1	1				1			1			1
		19	EMC Documentum eRoom	1	1	1	1		1		1			1	1			1		1		1	1			1	1	1				1	1	1				
Coordination systems	Project coordination	13	CollaborativeWorkspaces Suite		1	1	1			1	1									1		1	1			1	1	1	1			1						1
		25	fx-project		1	1	1			1												1	1			1	1	1	1	1	1				1			
		38	Infowit Creative Manager		1		1			1										1							1	1	1	1	1				1			
		56	OPMCreator		1			1		1	1									1		1					1	1	1		1				1			1
		62	Projectplace		1	1	1			1	1									1		1				1	1	1	1		1	1			1			
		63	Prolog Scheduler		1	1	1			1										1		1						1	1	1	1		1		1			
		80	Teamwork		1	1	1			1												1				1	1	1	1	1								1
	Task coord.	35	ibs-Office		1		1			1												1				1	1			1	1			1				
		76	Task-Base / Time2do		1		1			1												1					1	1			1			1				
		77	TaskTimer 2004		1		1			1																1	1	1		1	1				1			
		82	TMBusiness		1		1			1																1	1	1		1					1			
	Time coord.	26	Google Calendar		1		1			1																	1											1
		48	Meeting Maker		1					1	1																1			1								1
		87	Wcal		1		1			1	1																1	1										
		88	Web Calendar		1		1			1	1															1	1	1										
	Document coord.	7	BSCW		1	1	1			1	1									1		1	1				1	1				1						1
		70	SharePoint		1	1	1			1										1		1				1	1	1							1			1
		78	teamspace		1	1	1			1	1							1		1	1	1	1			1	1	1	1									1
		85	VE-Forum		1	1	1			1	1									1	1	1	1			1	1	1										
	Process coordination	1	ActionWorks		1		1			1	1									1		1					1	1	1			1	1			1			1
		20	e-Work		1		1			1																		1					1			1		1
		34	Hyperwave Workflow		1		1			1																					1	1			1			
		36	iGrafx Process Central		1		1			1											1							1					1						1
		44	Lotus Workflow		1		1			1											1											1	1			1			
Meeting systems	Ad-hoc meeting	24	FlashMeeting	1		1		1		1						1	1	1	1	1				1											1			1	1
		27	GoToMeeting (Citrix)	1		1		1		1					1		1		1	1					1										1				
		51	NetMeeting	1		1		1		1					1		1	1	1	1					1										1	1		1	1
		92	WeMeeting	1		1		1		1	1				1		1		1	1				1	1										1	1		1	1
	Standard meeting systems	9	Click to Meet	1		1		1		1					1		1	1	1	1			1		1	1									1	1		1	1
		12	Collaborative Virtual Workspace	1		1		1		1	1				1		1	1	1	1			1			1									1	1	1	1	1
		17	eAuditorium	1		1		1		1					1		1	1	1	1				1	1	1									1	1			1
		30	HotConference	1		1		1		1					1		1	1	1	1					1	1									1	1		1	1
		32	Hyperwave eConferencing Suite	1		1		1		1					1		1	1	1	1				1		1									1	1		1	1
		43	Lotus Sametime	1		1		1		1					1		1		1	1			1	1	1	1									1	1		1	1
		66	Raindance Meeting Edition	1		1		1		1					1		1	1	1	1			1	1	1	1									1	1		1	1
		91	WebEx MeetingCenter	1		1		1		1						1	1		1	1				1	1	1									1	1		1	1
	Meeting systems w/ web seminars	2	Arel Spotlight Meeting	1		1		1		1					1		1	1	1	1			1	1	1	1									1	1		1	1
		5	Breeze Meeting	1		1		1		1					1		1	1	1	1			1	1	1	1									1	1		1	1
		8	Centra Live	1		1		1		1					1		1	1	1	1			1	1	1	1									1	1		1	1
		46	marratech	1		1		1		1					1		1	1	1	1				1	1										1	1		1	1
		49	MeetingLinc	1		1		1		1					1		1	1	1	1				1	1	1									1	1		1	1
		83	TourMaster	1		1		1		1					1		1	1	1	1				1	1										1	1		1	1
Dedicated, specialized tools	E-Mail	37	IMail Server 2006	1				1		1						1					1																		
		68	Sendmail	1				1		1						1																							
	Forum & discussion	59	Phorum	1				1		1	1										1																		
		60	phpBB	1				1		1	1										1			1															
		3	bBlog	1				1		1	1										1																		
		4	Blogger.com	1				1		1	1										1																		
		47	MediaWiki			1	1			1	1										1		1																
	Chat	73	SiteSticky	1				1		1						1		1																	1	1			
		79	Teamspeak	1				1		1						1		1	1																	1			
	Instant Messaging	10	Coccinella	1		1	1			1	1				1			1																	1	1			
		16	DyCE Instant Messenger	1		1	1			1					1			1								1									1	1			1
		58	Pandion	1			1			1					1			1																		1			
		65	Quick Conference	1			1			1	1				1			1									1									1			
		71	Shinkuro	1		1	1			1	1				1			1				1				1									1				1
	Instant Comm.	22	Eyeball Chat	1				1		1	1		1	1		1	1	1																		1		1	
		64	Qnext	1		1	1		1		1			1		1	1	1	1	1		1														1			
		74	Skype	1			1			1	1	1		1		1	1	1	1	1																1	1		
		84	Trillian Pro	1			1			1	1	1	1	1		1	1	1	1	1																1			
	Joint work & editing	14	CoOffice			1		1		1																1													1
		39	InstaColl			1		1		1																1													1
		57	PabloDraw			1		1		1								1								1													1
		67	Remote Desktop			1		1		1																1													