

Workplace E-Collaboration
Theoretical Foundations and Practical Implications

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Arbeitsberichte des Learning Center der Universität
St. Gallen, 1/2003
ISSN 1424-8557

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Table of contents

Part I

1. Introduction.....	5
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Part II

2. General Information about E-Collaboration	6
2.1. Motivation	6
2.2. Definitions.....	7
2.3. Reference Model Workplace E-Collaboration.....	8
2.4. Demarcation to Business Collaboration.....	9
3. Theoretical Foundations of E-Collaboration	10
3.1. E-Collaboration Technological Functions.....	10
3.1.1. E-Collaboration Functionalities.....	11
3.1.2. Further communication infrastructure	15
3.1.3. Taxonomies of E-Collaboration Functionalities.....	16
3.2. E-Collaboration Software Packages	17
3.2.1. Web-Conferencing.....	18
3.2.2. Virtual Teamrooms.....	19
3.2.3. Expert Advice Platforms	19
3.2.4. The Smart Enterprise Suite	19
3.3. E-Collaboration Soft-Facts.....	19
4. Practical Implications.....	22
4.1. Implementing E-Collaboration Functionality	22
4.2. Achieving Key-Success Soft-Factors.....	23
4.2.1. Directives for Virtual Team Leaders	24
4.2.2. Directives for team members.....	27
5. Potential of E-Collaboration	29
5.1. General benefits of implementing workplace e-collaboration.....	29
5.2. User Benefits	30

Part III

6. E-Collaboration Tools Market-Survey.....	31
6.1. Web-Conferencing:.....	31
6.2. Electronic Workspace and Virtual Teamrooms.....	34
6.3. Expert Advice Platforms.....	35
6.4. Smart Enterprise Suites.....	36
7. Literature	37

Figures

Figure 1: Reference Model Workplace E-Collaboration.....	8
Figure 2: Status list example.....	11
Figure 3: Discussion Board example.....	12
Figure 4: Chat example	12
Figure 5: Contact management example.....	12
Figure 6: Agenda builder example.....	13
Figure 7: Polling example.....	14
Figure 8: Task list example.....	14
Figure 9: Whiteboard example	15
Figure 10: E-Collaboration landscape.....	17
Figure 11: The E-Collaboration Pyramid.....	22

Tables

Table 1: E-Collaboration Functionalities and Tool Categories.....	18
Table 2: Soft-facts found in literature (based on [Mayrhofer/Back 2003]).....	21
Table 3: Web-Conferencing Software (in alphabetical order of tool names).....	33
Table 4: Electronic Workspaces and Virtual Teamrooms (in alphabetical order of tool names).....	35
Table 5: Expert Advice Platforms	35
Table 6: Smart Enterprise Suites (in alphabetical order of vendor names).....	36

Executive Summary

Workplace E-Collaboration has grown and is becoming an increasingly important topic, not only since 9/11. Companies are now trying to apply new means of collaboration in order to save traveling expenses and cut down air-traveling for security reasons.

In response to the current situation where tasks are becoming more complex and are requiring heterogeneous expertise, organizations are more and more implementing team based business processes with multi-disciplinary teams. Therefore, horizontal organizational structures and team-based work units have become increasingly more prevalent and experts of different geographical locations have to be put together in “cross-regional project teams”. With advances in technology, there has been an increasing emphasis on far-flung, distributed, “virtual” teams as organizing units of work.

This report provides first answers to the most important questions of “What do I need to implement E-Collaboration” by means of theoretical foundations and practical implications.

We provide a list of technological functions, available for e-collaboration software tools, as well as a taxonomy for these functions and existing software tool categories. Furthermore, we are presenting a list of key success factors regarding culture and organization of “Virtual Teams”.

Finally we are transferring these theoretical foundations into practical implications by providing a technological pyramid indicating the importance of functions to be implemented, directives for team leaders and members, for how to behave in virtual teams, and last but not least, a short market survey of several e-collaboration software tools including company names and contact information.

Part I

1. Introduction

This working report of the Institute for Information Management of the University of St. Gallen has been written, based upon an initial project, where the Institute of Information Management supported GEHE AG, Stuttgart in conducting a study about the potentials and possibilities of applying workplace e-collaboration within the GEHE Group.

With a turnover of 17 billion Euros (in 2001), GEHE Aktiengesellschaft is the European market leader in the field of pharmaceutical distribution. The more than 23.650 employees of the group are employed in a total of 11 European countries (France, Germany, Great Britain, Austria, Belgium, Ireland, Portugal, Norway, Italy, Netherlands and the Czech Republic). The company's success is due to its effective orientation towards the Pharmaceutical Wholesale and Pharmacy Retail Divisions: At the center of the Wholesale Division are comprehensive logistics, service and advisory services for pharmacies concerned with the subjects of medicines and healthcare [Gehe 2003].

The aim of the project was to define a “theoretically perfect world” of e-collaboration and align this with the current situation at GEHE, in order to support collaboration and communication across different locations, as best as possible. In this report, the basics of e-collaboration theory as well as implications for putting e-collaboration into practice, will be provided.

It has to be stated that the results within this report are only partially derived from the GEHE project results, and partially reach beyond these results, as the Institute of Information Management is continuously conducting research in the area of workplace e-collaboration. Therefore, we are presenting theoretical foundations, practical implications as well as a short software market survey representing e-collaboration tools, in the following structure:

Theoretical Foundations of Workplace E-Collaboration

- Current state and need for action
- Definitions and demarcations
- Reference Model Workplace E-Collaboration
- Technological aspects of Workplace E-Collaboration
- Cultural and organizational aspects

Practical implications for implementing E-Collaboration

- Technological aspects
- Directives for team leaders and team members

Software market survey

Part II

2. General Information about E-Collaboration

2.1. Motivation

„Virtual teams are the people-operating systems for the 21st century“ (Lipnack & Stamps)

The current situation on international markets is characterized by diversified, customer specific products with high demands on quality and time, as well as shortened innovation cycles and time to market. We are facing globalization as well as liberalization combined with fast technological changes and intensified competition [Bullinger et al. 1999, p. 97].

“In addition, advances in information and communication technology have enabled a faster pace of change than in the past, and have created jobs that are increasingly more complex and dynamic. In response to these changes, organizational systems, structures, and processes have evolved to become more flexible and adaptive. Horizontal, organizational structures and team-based work units have become increasingly more prevalent and, with advances in technology, there has been an increasing emphasis on far-flung, distributed, “virtual” teams as organizing units of work”. [Bell/Kozlowski, p. 14f]

And this trend is to be continued. According to GARTNER, the following figures are expected:

- “By 2005, 75 percent of global enterprises with a highly distributed, virtual workforce will implement explicit strategies for creating and sustaining a robust social infrastructure within and beyond the traditional boundaries of the workplace to foster both formal and informal interaction (0.7 probability)” [Krammer 2001]
- “Through 2006, workplace agility will be achieved in 30 percent of the Global 2000 enterprises adopting an explicit strategy to support a highly distributed, connected and autonomous workforce (0.7 probability)” [Bell et al. 2002]
- “By 2006, people will spend nearly 70 percent of their time working collaboratively – and not necessarily face to face (0.8 probability)” [Bell et al. 2002]

As a conclusion, it can be said that the need for collaboration in today’s business world is greater than ever. An increasingly fierce competitive environment requires that projects are prioritized in an informed and efficient manner, funding decisions made, nonviable projects closed, progress tracked, and results presented. And the following effects can be mentioned (also see: [Meier 2001, p. 78], [Bell/Kozlowski 2002, p. 14ff]):

- Increased complexity of tasks
- More collaboration in interdisciplinary teams
- Solutions are developed collaboratively

This results in the cooperation of geographically dispersed teams, where the collaboration can only happen efficient and effective, when electronic tools are used. This will ensure the necessary density of communication which is required for successful projects.

2.2. Definitions

The term “collaborate” stems from the Latin “laborare” which means “to work”. Literally, to collaborate means to “co-work” or work together.

A more precise definition, derived from [Light et al. 2001] would be:

Collaboration is the process of two or more people working together toward a common purpose or goal, where the participants are committed and interdependent and work in a common context, physically co-located and using shared resources.

According to this definition, our working definition for workplace ecollaboration, also influenced by the definitions for *telecollaboration* by [Schooler 1996, p. 210] as well as for *groupware* by [Ellis et al. 1991, p. 38], is as following:

Workplace e-collaboration is the computer mediated process of two or more (dislocated) people working together on a common purpose or goal, where the participants are committed and interdependent and work in a common context, using shared resources, supported by (web-based) electronic tools.

Therefore, we suggest to consider workplace e-collaboration to be an autonomous research and management topic, requiring an holistic approach consisting of several aspects like strategy, processes and technologies accompanied by a management of change.

2.3. Reference Model Workplace E-Collaboration

As we have defined workplace e-collaboration to be the “*computer mediated process* [...]“, a reference model for workplace e-collaboration has to be based upon information and communication technology (ICT) – systems and technologies. But finally, technology is not the determining factor for success of collaboration:

The definition of application scenarios (when and how to use workplace e-collaboration) should be the center of this topic, derived from a specific purpose or vision.

As e-collaboration has to provide an added value and has to fulfill a certain purpose, the application scenarios have to be aligned with existing business processes and have to use certain methodologies additionally to technologies.

Finally, a change management has to take place for implementing and maintaining an organizational and cultural framework.

Based on the *St. Galler Business Engineering Approach* [Österle/Winter 2000, p.12] we can derive the following reference model for workplace e-collaboration (modified from [Mayrhofer/Back 2003]):

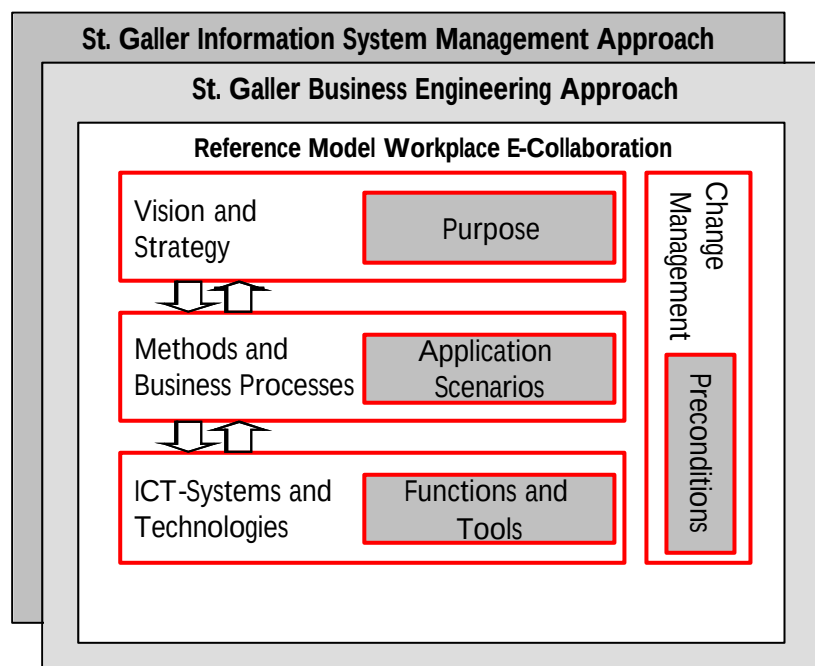


Figure 1: Reference Model Workplace E-Collaboration

On the level of systems and technologies, e-collaboration tools and functionalities have to be provided, being suited to enable and support application scenarios which are developed and defined on the level of business processes, accompanied by suited methodologies for e-collaborating employees. Additionally, a clear strategy for implementing e-collaboration, including a defined purpose and explicit objectives, has to be defined. Finally, the whole

approach has to be accompanied by managing change, developing and maintaining the organizational and cultural framework as well as educating the users.

2.4. Demarcation to Business Collaboration

At the University of St. Gallen, business (e-)collaboration, in opposition to workplace e-collaboration, is seen as a further development step of business networking, which leads to the integration of processes and information systems across organizations or organizational units. Therefore, it is necessary to create common infrastructures and processes. Business collaboration means real-time, internet supported co-ordination of processes and data. It electronically connects all internal and external partners and provides central services. Examples are customer process portals (DELL, DAIMLERCHRYSLER) and supplier platforms (CPGMARKET, COVISINT).

The business collaboration infrastructure comprises the following pillars and can therefore be clearly marked off workplace e-collaboration, although several aspects of workplace e-collaboration are mentioned as well (project space, eCommunity):

- IT-Operation (ISP – Security & Trust – Network Operation – Backup)
- Integration (Standardization, Search/Mining, Directory Services)
- Content and Transaction (Awareness, Content Syndication, Project Space, eCommunity, ASP, Product Catalogue)
- Business Processes (Procurement, Production, Logistics, Marketing, Finance, HR).

For detailed information about Business Networking and (Business) ECollaboration you may have a look at one of the following reports / books / dissertations:

- Österle, H.; Alt, R.; Fleisch, E.: Business Networking - Shaping Collaboration Between Enterprises, 2. überarbeitete Auflage, Springer, Berlin et al., 2001
- Cäsar, M.; Alt, R.; Grau, J.: Collaboration Infrastrukturen im Handel, Universität St. Gallen, 2001
- Reichmayr, C.; Cäsar, M.; Alt, R.; Zurmühlen, R.: Kundenprozessportal der ETA SA, Universität St. Gallen, 2002
- Reichmayr, C.: Collaboration und Web-Services – Architekturen, Portale, Techniken und Beispiele. Dissertation der Universität St. Gallen, 2002.

3. Theoretical Foundations of E-Collaboration

A lot of research has already been done concerning e-collaboration and virtual teams (e.g. [Holton 2001], [Kimball/Eunice 1999], [Lipnack/Stamps 1993], [Poltrick/Engelbeck 1999], etc.) and a lot of software tools are already sold under the label of “e-collaboration” (e.g. see [Bafoutsou/Mentzas 2002], [Meier 2001], [Think of it 2002] and chapter 6 of this report)¹, but none of these provide an holistic view of this topic. Therefore, the following chapter will provide the theoretical foundations of workplace e-collaboration.

Firstly, we reviewed existing literature in order to gain information about preconditions and barriers for e-collaboration.

Secondly, we combined these preconditions with the results of evaluating a (small) number of documented case studies reporting about implementation of e-collaboration and the results gained from our project with GEHE, to identify success factors.

Thirdly, we evaluated several software tools to analyze the basic functionalities and features of such tools.

The basic result of these steps was a list of what we called “technological functions” on the one hand and “soft facts” on the other.

3.1. E-Collaboration Technological Functions

“Technology is not the determining factor for success of virtual teams. Well motivated and focused teams will rise above the limitations of the technology available to them. However, the effectiveness of a team can certainly be enhanced by usage of appropriate technology” [Hayward 2001].

The general needs of virtual, respectively geographically dislocated teams, to fulfill their tasks, are very similar to co-located teams. They have to create outputs, store them anywhere, find supporting material and people to help them. Furthermore, they have to communicate, co-ordinate, co-operate, and finally to collaborate. However, because virtual team members are distributed across space, communication technologies provide the means to link members together and are absolutely critical [Bell/Kozlowski 2002, p. 29]. Therefore, the main functionalities needed by them and provided by a number of e-collaboration technologies (also see: [Bafoutsou/Mentzas 2002], [Meier 2001]) are described below:

¹ A comprehensive list of products related to e-collaboration and e-learning can also be found in „E-Learning“, from November/December 2002, pages 71-93.

3.1.1. E-Collaboration Functionalities

Audio/Video conferencing

Audio or video is transmitted via the web (e.g. VoIP = Voice over IP) to enhance human presence in meetings. Additionally, headsets or web-cams are required. Depending on bandwidth, voice and video is transmitted without any interferences.

Awareness utilities

E-Mail Notifications

Are sent to inform about changed project information, entries in the calendar and to-do lists, new activities in the group, or revisions and changes in documents.

Online paging/messaging

Instant alerts “pop up” on the user’s screens, serving as informal messages, or notifying about scheduled meetings, etc.

“Buddy list” / status of members

Shows the current status of team members (active, away, do not disturb, offline) and allows ad-hoc contact (e.g. via chat).



Figure 2: Status list example

Bookmark archive

Internet addresses (links) are collected and stored in a shared place. All entries are assigned to certain categories and can be retrieved accordingly.

Bulletin & Discussion Boards

A message board, where a conversation can be carried on over time. The user can leave a message for someone, and they can answer it, and the initiator can respond back to them later.

In some cases, the subject is set and the discussion is carried on, either with all participants online, or over time, where anyone can share his or her opinion at any time, as long as the subject is still open.

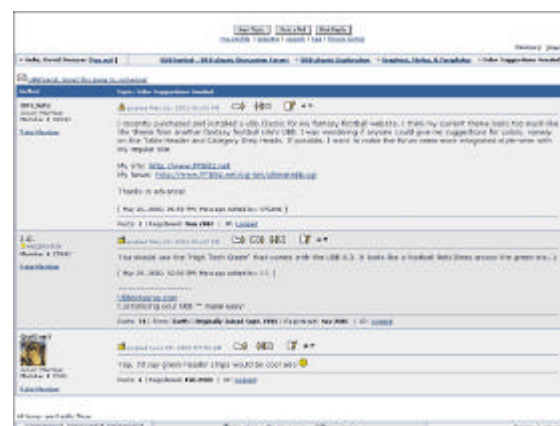


Figure 3: Discussion Board example

Chat / Instant messaging

Real time text talk, where messages appear on both users screens. Usually, a split screen is used, where the local typing appears in one part and the remote in the other. There is no particular subject set and it does not scale to more than a very few users.



Figure 4: Chat example

Contact Management

An address book is provided, where contact information about meeting participants or project partners can be found. Typically, several groups and subgroups can be managed as well. Members and groups can be listed and retrieved according to several categories.



Figure 5: Contact management example

Document Management

Includes sharing of documents. Documents are stored in a central server and users can work on the documents, either using their local applications, or the tool's functionality. Occasionally, there is possibility for version control, check-in and out, search, electronic signing, and access control.

E-Mail

The most common means of electronic communication. It allows wide contact over the Internet and its primary use is for text messages, normally relatively brief. Messages are

typically sent by individuals to individuals or groups of recipients and often accompanied by file attachments.

E-Mail integration (Mailing lists)

A directory, where e-mail addresses are collected and structured. E-mails can directly be sent to an entire group of recipients.

File and document sharing

Documents and files are available to a group of people to view. In the simplest form, files come as e-mail attachments and users can work with them using their local applications. Alternatively, files are uploaded to a site/server.

Meeting minutes/records

Minutes are disseminated among participants, action items are posted, or the team's thoughts are gathered so as to constitute the starting point for subsequent meetings. Recordings and reports of online meetings can be distributed as well.

Meeting scheduling tools / agenda builder

Creating meeting agendas and lists of issues (for online meetings) or using calendars for organizing meetings.

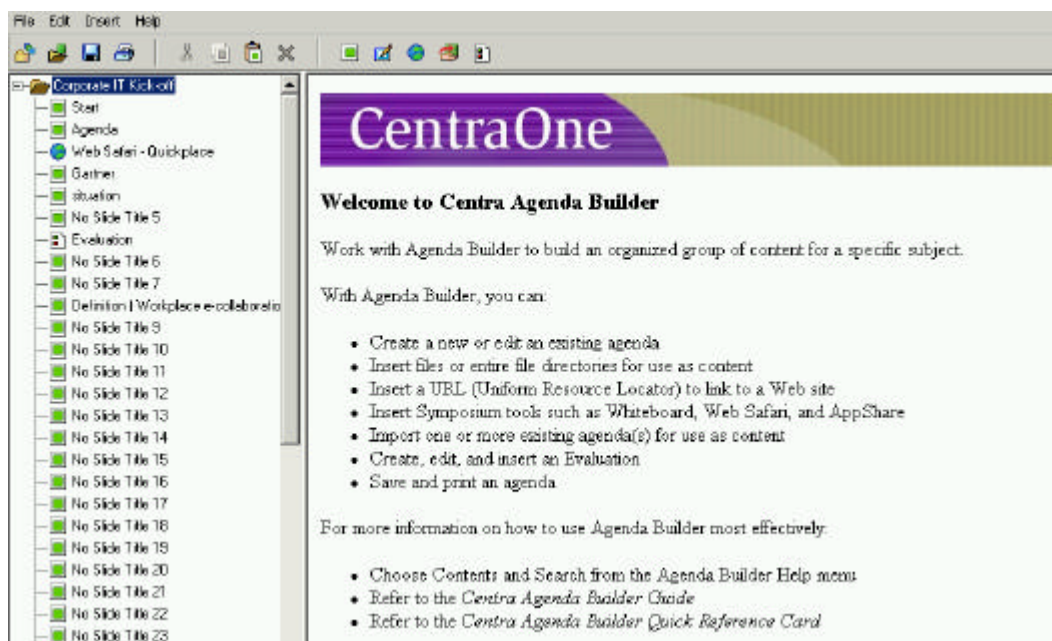


Figure 6: Agenda builder example

Presentation capability

Users can conduct online presentations, i.e. show and annotate PowerPoint slides.

Screen sharing/ document (application sharing)

Both people have the same view of the screen and possibly the remote user can take control of the other user's system. Web tours are a special case of application sharing, provided by most web-conferencing software providers as an additional functionality: Participants of a meeting/seminar are guided through the WWW. This is achieved by displaying the selected web-sites of the presenter on the participants computer.

Surveys/polling

Decisions are made online, and surveys on different topics are conducted. The type of questions can vary from Yes/No, multiple choice to text questions.

Figure 7: Polling example

Synchronous work on files (multi-authoring-systems)

Files/documents can be edited simultaneously by a number of users, either on each other's screen, or on a whiteboard.

Task lists

Lists of actions to be performed, pending activities, unresolved problems and scheduled meetings are kept, and the user is notified for new items in the list (also see awareness utilities above).

Figure 8: Task list example

Team calendar

Calendars for organizing meetings, tracking absence and presence of members. Showing team events and personal events. Regional and international holidays.

Whiteboard

Allows two or more people to view and draw on a shared drawing surface, used for discussing or describing objects, which are difficult to verbalize.



Figure 9: Whiteboard example

Workflow management support

Workflow functionality is used to control, assist and expedite the coordination of activities that must be performed in a specific order to fulfill certain group goals. It is used to synchronize steps, execute automatic tasks, keep track of information, show status and inform and remind users.

Yellow Pages

Can be seen as an extended contact management facility which enables users to find persons according to their expertise or interests.

3.1.2. Further communication infrastructure

Video conferencing facility

Video conferencing facilities enable people to virtually meet via using a camera and screen. The main disadvantages concerning this functionality are:

- No integrated solutions available (application sharing, chat, etc.)
- Users have to leave their workplace as the necessary hardware equipment is typically installed in a dedicated room. This circumstance prevents spontaneous ad-hoc meetings and users typically can not access everything (documents, files, etc.) from their workplace.
- Expensive hardware equipment required by each participant of the virtual meeting

Telephone (conferencing)

The first mode of synchronous collaboration for dispersed teams. It enables people to communicate in their natural speech. Basically it is used for 1:1 communication. Telephone conferences require additional (pay-per-use) services.

Face-to-face

Face to face is still the most powerful way of informing, communicating, meeting and exchanging (implicit) knowledge. Nevertheless, this way of collaborating is restricted by time and space.

3.1.3. Taxonomies of E-Collaboration Functionalities

For the purpose of putting collaborative systems (respectively groupware or CSCW) into categories, several taxonomies are already existing (e.g. according to time and space see [DeSanctis & Gallupe 1987, p.597ff], according to supporting functions see [Teufel et al. 1995, p.27] related to knowledge networks see [Raimann et al. 2000, p.18ff])

On the other side – as the research field of workplace e-collaboration is relatively young – there are only few taxonomies, putting collaborative services and functionalities into a categorized system. One of those has been developed by [Bafoutsou/Mentzas 2002], which uses a two axis diagram(X-axis: The degree of collaboration functionality; Y-axis: The degree of document management from file sharing to synchronous work on files). Nevertheless, this taxonomy seems to be most suited for our purposes and accordingly, we have derived our own taxonomy based on these findings:

Therefore, the landscape of e-collaboration functionalities is depicted below. It shows a portfolio of functionalities according to their ability to support team activities and to manage content. On the X-axis the degree of team collaboration support is divided into the supporting activities of coordination, communication and cooperation. As it is not always easy to assign functionalities to certain categories they have been assigned to those, where they are used most frequently, or should have their focus on. E.g. e-mail could also be used for co-coordinating (meetings), but the main focus is on communicating.

On the Y-axis the ability to manage content is split into the categories of “no content management support”, “structured storage of data”, and “storage, retrieval, versioning, etc.”, which equals full content management support. Regarding the content management support direction, the following annotations have to be made:

“No content management support” means, that functionalities assigned to this category do not have to provide possibilities to manage content. Therefore, this category mainly contains functionalities with focus on synchronous communication or online co-operation.

“Structured storage of data” means, that functionalities provide some simple possibilities to store and organize content, like e-mails in folders etc.

Finally, the category “storage, retrieval, versioning, etc.” is used for functionalities with extended content management functionality, like check-in/-out, versioning, access control, retrieval, etc.

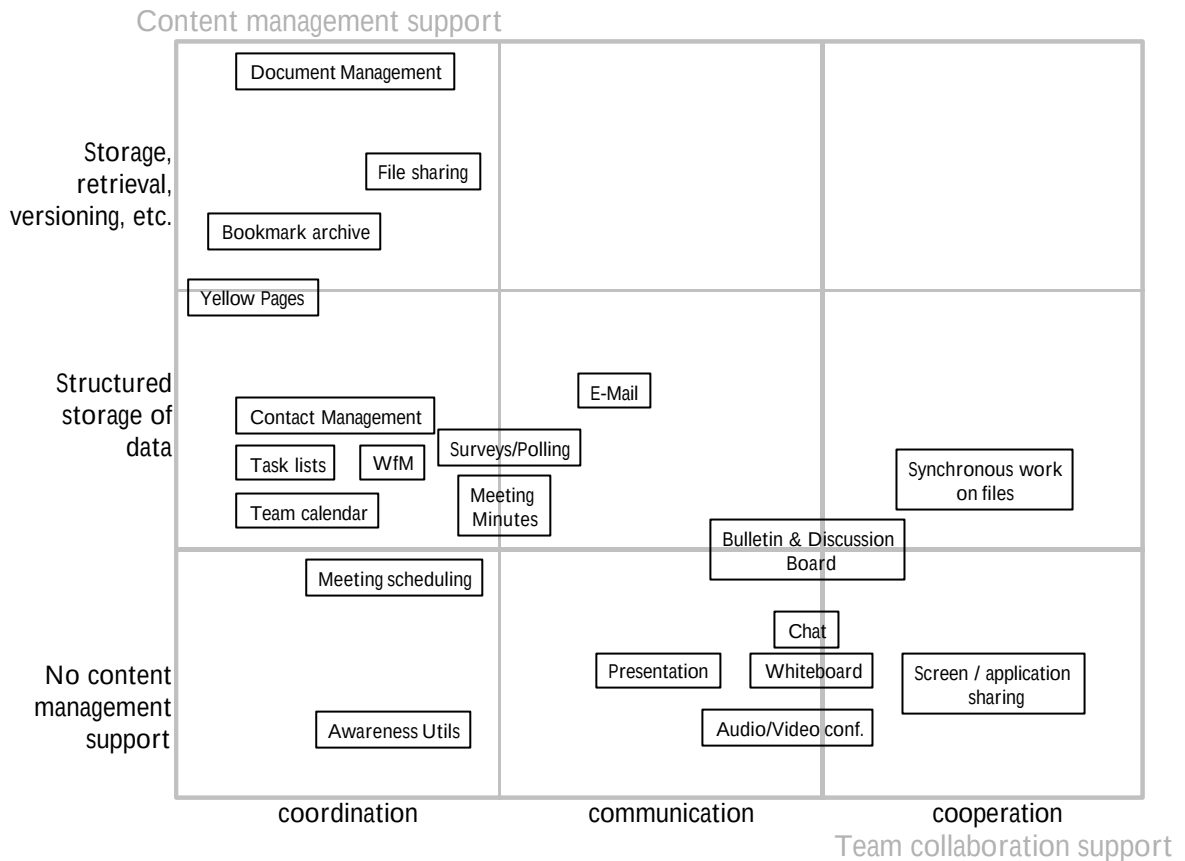


Figure 10: E-Collaboration landscape

3.2. E-Collaboration Software Packages

The taxonomy above presents single functionalities which we have identified analyzing several different software tools. But each of the tools, we have been looking at, is typically focusing on a specific set of functionalities.

Therefore, we are able to build categories of software tools, where each category has a special focus for supporting workplace e-collaboration. These categories are web-conferencing, virtual teamrooms, expert advice platforms, as well as the so called 'Smart Enterprise Suite' and will be described below. A number of software tools, providers as well as their contact information can be found in chapter 6.

The matrix below shows the categories and supported functionalities and indicates which functionalities are typically supported by most tools of a category (X), or are optionally supported by some (O).

Functionality	Web-Conferencing	Virtual team room	Expert advice platform	Smart Enterprise Suite
Audio- / Videoconferencing	X			O
Awareness utilities	X	O	O	X
Bookmark archive		O		O
Bulletin and discussion boards		X	O	X
Chat / Instant messaging	X	O	O	X
Contact Management	O	X	O	X
Document Management		O		X
E-mail integration (Mailing-lists)	O	X	O	X
File and document sharing		X		X
Meeting minutes / records	X			O
Meetings scheduling tools	X	O		O
Presentation capability	X			O
Screen Sharing / Document (application) sharing	X		O	O
Surveys / Polling	X	X		O
Synchronous work on files (Multi-authoring)		O		O
Task lists		X		X
Team calendar		X		X
Whiteboard	X			O
Workflow Management Support		O		O
Yellow Pages		O	X	X

Table 1: E-Collaboration Functionalities and Tool Categories

3.2.1. Web-Conferencing

Web-Conferencing software tools are focusing on synchronous communication and collaboration by providing an integrated set of functionalities to support meetings of geographically distributed people. Most of the tools within this category provide audio and video conferencing as the most important means for communication in combination with the possibility to show and annotate presentation slides. Additional functionalities provide further means for communication (text chat, surveys, etc.) or cooperation (shared drawing on a whiteboard, screen and application sharing).

Additionally, for administrative matters, users with contact information (optional) can be managed.

3.2.2. Virtual Teamrooms

Virtual teamrooms can also be seen as 'light' web based groupware and focus on the coordination activities within a team, by providing team calendars, address books, task lists, discussion boards as well as some possibilities for exchanging documents.

3.2.3. Expert Advice Platforms

Expert advice platforms are usually a specific kind of yellow pages. They provide a list of persons according to their expertise, including contact information and possibilities to directly get into contact. Contact can be established via web-conferencing tools, via e-mail or phone. Most of these platforms are company independent and used by a large number of web-users, although first implementations within companies (e.g. for service and hotline) can already been found. It can also be thought of using these platforms within companies for retrieving the best suited contact persons and getting into contact with them.

Some tools provide a user rating of experts, indicating the quality of advice, as well as average response times. In some cases, payment of this online consulting can be directly processed via the platform.

3.2.4. The Smart Enterprise Suite

Especially GARTNER is predicting, that "The Smart Enterprise Suite Is Coming" [Gilbert et al. 2002]. It covers enterprise needs for content management, knowledge management and collaboration, and supports the extended virtual workplace – inside and between companies. Most of the tools within this category have their origin in the area of knowledge management and are now integrating collaboration functionalities. They are often the result of integrating a number of existing components of one provider. Another study of GARTNER [Oppenheimer 2002] is predicting, that real time collaboration is expected to have the highest growth rate within the collaboration and knowledge management software market for the period of 2001-2006.

3.3. E-Collaboration Soft-Facts

"Regardless of technological advances in virtual communications, change in the way we work together is a process not an event. As such, it will take time and will require each of us to adapt to new environments, new technologies and new ways of working" [Holton 2001, p. 46].

As already mentioned above, technology is just the enabler or can enhance collaboration, but the main success factor is motivated and focused teams. But how to make and maintain teams motivated and focused? The answer already lies in our definition of workplace e-collaboration ("common purpose, interdependent, committed, ...).

Regarding soft-facts, [Light et al. 2001] suggest four pillars of successful collaboration:

- the participants have a common purpose, where the relationship is grounded in the principles of trust
- participants are committed to specific goals and objectives supporting that common purpose
- participants are interdependent because they rely on each other roles, talents, resources, expertise, knowledge, and other contributions
- participants are individually and collectively accountable for the results of the collaboration

In research, trust is often mentioned to be the most critical success factor for effective collaboration (e.g. [Holton 2001], [Handy 1995], etc.). [Sprenger 2002] even assumes that trust will be the most critical success factor in the next decade.

[Handy 1995, p. 44ff] lists seven principles of trust: Trust is not blind, but tough. It needs boundaries, bonding and touch and demands learning. And finally it requires leaders.

He further believes, that the more virtual a team is, the more meetings are necessary, although they are different: They are more about processes than tasks and it is more important to get to know each other and not to get things done. Virtual meetings in contrary, are more task oriented [Handy 1995, p. 46].

[Holton 2001, p. 37] therefore argues, that the ideal situation would seem to be that in which an established and well performing team adds virtuality to its operational dynamic.

[Moser 2002] focuses her article on cooperation with the aim of knowledge exchange. She argues, that employees will be likely to cooperate, if they can benefit in the long run, if cooperation contributes to their daily work and is interesting to them. Therefore, she lists a number of conditions for successful cooperation:

- Culture of reciprocity, means that employees expect others to also share their knowledge in order to achieve a balance in the long run
- Employees and the organization have to trust in a long term perspective, because benefits of collaboration are likely to be achieved in the long term
- Knowledge has to be interchanged within and between different levels of hierarchy and therefore, a high degree of autonomy of employees as well as participation in decisions are required

Additionally [Die Akademie, p. 9ff] evaluates some success and failure factors in their survey about teams and teamwork:

- Trust, information flow, cooperation, and coordination of activities are found to be most important
- Communication barriers, missing purpose, and team culture as well as unexpressed conflicts and missing trust are the top 5 reasons for teams to fail

All these failure and success factors and preconditions of collaboration can analogously be applied for e-collaboration, but additionally some details have to be taken into consideration due to the lack of informal personal contact and lower frequency of interaction.

Therefore, [Mongoose 2002] proposes a total of 12 principles of e-collaboration. These are based on sociological principles, but focused on web communities. To some extent, they can be applied to what we define as workplace e-collaboration. These 12 principles are:

Purpose, identity, reputation, governance, communication, groups, environment, boundaries, trust, exchange, expression, and history.

Bringing all theoretical recommendations and findings from several case studies together, we are deriving the following five key success factors for workplace e-collaboration (based on [Mayrhofer/Back 2003]):

Key success factor	Description
Purpose and commitment	The purpose of the team, its vision, objectives, and strategies are clear and communicated. The participants are committed to achieving these specific goals and objectives supporting that common purpose
Trust	Relationships between participants must be grounded in the principles of trust.
Identity and group affiliation	Members can identify each other. They know their roles, responsibilities, expertise, and interests. They know what's going on within the team.
Team style	Member behavior is regulated according to group/team values, habits, rules, and standards.
Communication	Members must be able to interact with each other. Virtual as well as physical.

Table 2: Soft-facts found in literature (based on [Mayrhofer/Back 2003])

4. Practical Implications

4.1. Implementing E-Collaboration Functionality

Additionally to the taxonomy for workplace e-collaboration functionalities, we have developed a so called “E-collaboration Pyramid”. In this representation, functionalities supporting workplace e-collaboration are arranged according to their priority for implementing e-collaboration. [Bell/Kozlowski 2002, p. 19] argue, that the required technology strongly depends on the tasks to be fulfilled. They propose, that different types of virtual teams exist and, the more complex tasks are, the more synchronous collaboration tools are required.

Nevertheless, as there may be multiple virtual teams with different task complexities within the company, we have decided to use four categories of e-collaboration functionalities, starting with “basic functions”, which are strongly required for e-collaboration – but not only for the purpose of e-collaboration. This category contains the real basic functionalities like intranet, e-mail, file-sharing, etc. which should be available at every company.

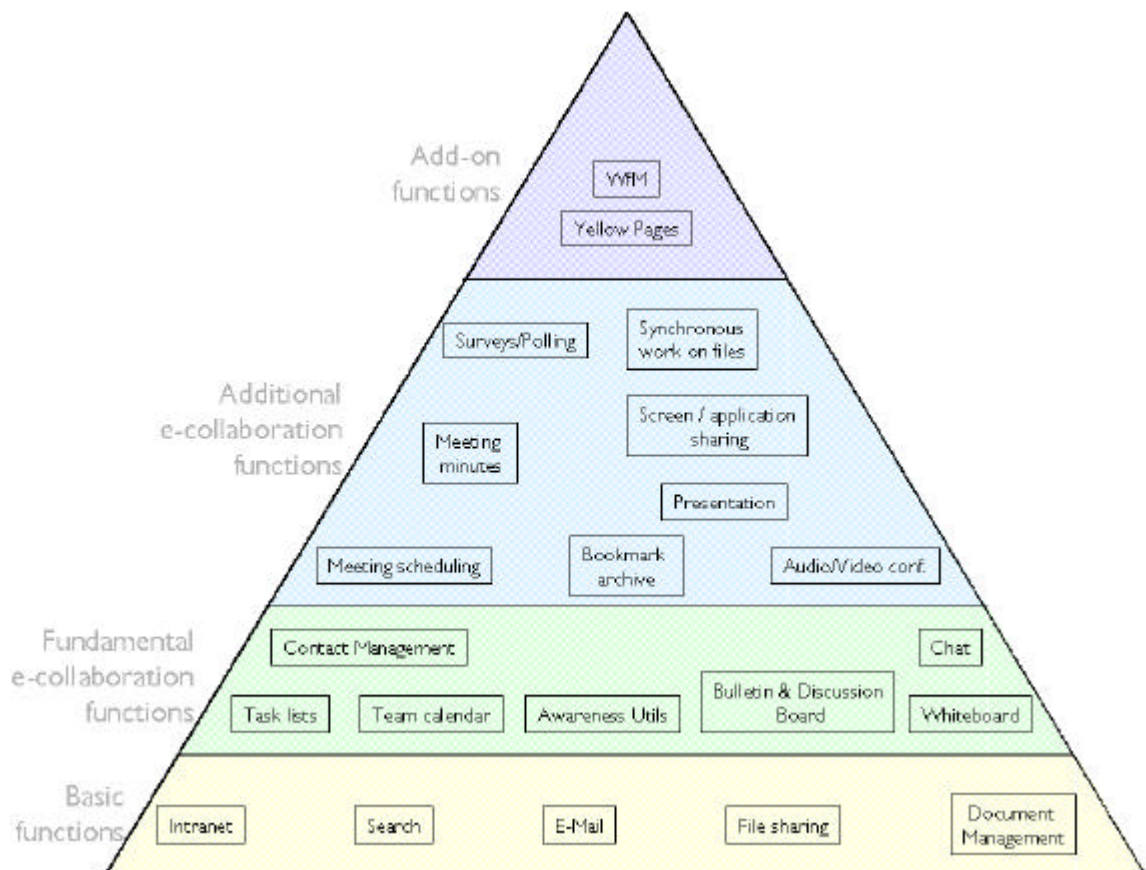


Figure 11: The E-Collaboration Pyramid

The fundamental e-collaboration functions are directly put on these basics and contain the basic coordination facilities like task lists or calendars as well as some additional communication functionalities like chat, whiteboard, etc. These functionalities are suited to support at least teams, dealing with tasks of low complexity.

Additional e-collaboration functionalities are regarding especially enhanced communication facilities like audio-video conferencing and screen-/application sharing.

Finally, workflow management and yellow pages are seen as a kind of add-on functions, due to the fact, that they have their origins in other “disciplines” (Knowledge Management or Workflow Management) and are not of critical importance for virtual teams.

Although we intended to provide a “general” representation of importance of technologies, first research results within our project with GEHE showed, that this pyramid can only be a starting point and has to be adjusted to company specific requirements and the current state of available technologies. We found, that functionalities, users are used to, are evaluated to be more useful than functionalities, which have not been implemented, yet. In our case, e-mail, file and document sharing as well as some coordination functionalities like team calendars and team address books have been evaluated to be most important, whereas chat and whiteboard have been the least required functionalities.

4.2. Achieving Key-Success Soft-Factors

Based upon the theoretical findings above, as well as findings from best-practices, the following chapters provide proposals for team leaders and members, for how to behave in virtual teams in order make them most successful.

The first results from our research project with GEHE showed, that all of our five key success soft-factors have been rated to be important:

E.g. regarding communication, the possibility to meet face-to-face and the availability of communication guidelines have been found to be of critical importance. Regarding purpose and commitment, a clear strategy and vision as well as leadership by example have been most required. Trust within the team and freedom in accomplishing tasks (trust) as well as to know team members and have time and resources for relationship building (identity and team affiliation) have been rated important as well. For creating and maintaining team style, it was found to be most important to have norms, standards and templates.

4.2.1. Directives for Virtual Team Leaders

“By 2006, successful leadership of high-performing virtual teams will be a primary factor for determining succession and advancement within globally distributed enterprises (0.8 probability)” [Bell 2002]

[Bell 2001] argues, that ecollaboration is all about people and their behavior and that technology is an important ingredient, but the success would finally depend on skilled leadership, explicit attention to processes and protocols, and a distinct set of skills for both the team leader and team members.

Especially the main functions of team leaders – to monitor team member performance and to implement solutions to work problems – is severely restricted by the lack of face-to-face contact within the team [Bell/Kozlowski 2002, p.15].

Therefore, we collected a list of behavior proposals for leaders of virtual teams, from literature as well as from our first project results, in order to support achieving the defined success factors of e-collaboration:

PURPOSE & COMMITMENT:

- Leaders should provide a clear, engaging direction along with specific individual goals, which enable members to monitor and evaluate their own performance [Bell/Kozlowski 2002, p. 26]. They should establish a vision and purpose to give the enterprise and its employees a clear idea of the way to go

TRUST

- [Sprenger 2002] assumes that it will only be possible to lead employees who are not physically located at the leader's location by trusting these employees
- Leaders need to trust virtual teams and not impose repeat check-up processes (hand-off management). Similarly, members of virtual teams need to trust their enterprise leaders and each other. This involves trust-building behaviors, like consistency and integrity in communication, open flow of information, and ensuring their own behavior matches the declared intent [Mahoney 2001]
- It is important to judge the output, not the process, to value what people do, not when and where they are working [Krammer 2001]
- Provide time and resources for relationship building as well as face-to-face meetings
- Lead by example

IDENTITY & TEAM AFFILIATION

- “Start with team-building exercises, using face-to-face where possible to establish a basis for relationships” [Zigurs 2003, p. 348]
- Make the whole visible to everyone in order to make it easier for the team to maintain an image of itself as a whole [Kimball/Eunice 1999, p. 59]. E.g.:
 - Distribute a team photograph and put it somewhere, where it is likely to be kept in view
 - Distribute a map that shows the name of each team member or create a graphic showing the member sitting in a place around a table
- Provide a “line of sight”, to keep distributed team members more than informed, about what is going on. Provide more information than meeting minutes. According to [Kimball/Eunice 1999, p. 59] it can be achieved by:
 - “Journalism style” of meeting minutes including photos
 - Encourage people to acknowledge who is missing in the room and connect distributed team members into the process
 - Create a “virtual water cooler”, an electronic space for swapping of stories and feelings as well as task oriented messages
- Clearly specify each team member’s role in the team
- Especially for cross-cultural teams it is most critical to develop an own culture within the team
- Provide the ability to browse and search for members based on various criteria (e.g. expertise, interests, hobbies, etc.)
- Profiling popular or currently “hot” users, so other members know what they are doing
- Publish event schedules and current activity levels

TEAM STYLE

- Create tracks and footprints in physical space to make it easier for team members and others in the organization to experience the team as “real” and important [Kimball/Eunice 1999, p. 60]:
 - Create a sign or a team inbox
 - Especially at the beginning, circulate team “output” with some kind of team-specific headings and formatting

- Amplify energy to help the team to create and maintain motivation [Kimball/Eunice 1999, p. 59f]:
 - o “Spotlight” members or part of teams where something interesting happened
 - o Develop a team routine to distribute hot news
 - o Create ways to celebrate accomplishments
- Anticipate unintended consequences and debrief how the team dealt with those events [Zigurs 2003, p. 348]

COMMUNICATION

- Continuously provide feedback to your team members in order to not “lose” them
- Catalyze rich conversations, to avoid only logistical details, routine reports and administrative matters [Kimball/Eunice 1999, p. 59]:
 - o Hold periodic team conferences
 - o Rotate responsibilities among members to facilitate discussion on non-routine topics
 - o Invite “experts” to engage with the team
- Develop and publish clearly stated rules for communication. E.g. “establish standards for communicating contextual cues with each message to reduce the potential for misinterpretations” [Zigurs 2003, p. 348]

Some companies (e.g. DEUTSCHE TELEKOM BUSINESS ACADEMY) even implemented a new role of a “virtual coach”, who has the following responsibilities [Pusacker 2002, p.26]:

- Supporting establishment of virtual working environments
- Supporting establishment of virtual international collaboration
- Consulting of virtual teams
- Broker of contacts and guidelines
- Generation of know how
- Evaluation of feedback and initiation of improvements

4.2.2. Directives for team members

“By 2006, people will spend nearly 70 percent of their time working collaboratively – and not necessarily face to face (0.8 probability)” [Bell et al. 2002]

PURPOSE

- “Force” your leader to communicate a clear vision and purpose of the team. According to [Die Akademie 2002, p. 10], missing purpose and objectives are one of the main failure factors of teams
- Be sure to understand the vision, purpose and objectives of the team as well as your role and responsibilities – be sure to know how to contribute to the purpose

TRUST

- Trust your team leader and each other in the team. Trust will only develop if you are ready to trust others [Handy 1995, p. 44; Holton 2001; Sprenger 2002]
- Exploit all opportunities to meet your colleagues face-to-face in order to get to know each other better. Trust often builds upon personal relationships (e.g.: [Krammer 2001; Handy 1995, p.46], etc.)

IDENTITY & TEAM AFFILIATION

- Be sure about your roles and responsibilities within your team as well as those of other team members
- Keep your team members informed about what you are currently doing or have been achieving so far

TEAM STYLE

- Try to keep an eye on team processes and socializing – not only focus on tasks and topics
- Support your team leader in developing your “own” team culture and team language
- Do not keep conflicts unexpressed, but do not hide behind technology, when you are intending to express your displeasure

COMMUNICATION

- Keep in the loop with team mates [Krammer 2001]
- Due to a lack of spontaneous interaction in virtual teams [Krammer 2001], try to
 - o create alliances
 - o keep in touch
 - o get adopted
- Sharpen your communication styles [Krammer 2001; Zigurs 2003, p. 348]
- Exploit all opportunities to meet face-to-face (e.g. [Krammer 2001; Zigurs 2003, p. 348], etc.)

5. Potential of E-Collaboration

The following chapter presents the potential of implementing workplace e-collaboration in general as well as for individuals.

5.1. General benefits of implementing workplace e-collaboration

As already stated in one of the first chapters of this report dealing with the need for action concerning this topic, workplace e-collaboration helps to overcome the current challenges of:

- Increased complexity of tasks
- More collaboration in interdisciplinary teams required
- Solutions have to be developed collaboratively

Successful implementation of virtual teams respectively workplace e-collaboration can help solving these challenges, and in general leads to the following advantages:

- [Apgar 1998, p. 122] argues, that virtual work can help to acquire and retain the best human resources in the marketplace
- Teams can be put together according to the required expertise
- Virtual teams are not restricted to time, space and culture
- Information flows freely between business units
- E-collaboration leads to fast access of know how
- Improvement of the required communication density within distributed team members
- Faster and improved decisions due to more relevant information available
- Improved information and communication throughout the company
- Saving of travel costs

5.2. User Benefits

The benefits for each user participating in workplace e-collaboration has to be put into first place. For a well-working community, [Melzner 2002] assumes, that functional benefits as well as emotional benefits have to be provided.

Functional benefits

E-collaboration is simplifying day-to-day work. In our sense, this will analyze how good different functionalities can support collaboration of geographically dispersed teams along their business processes. The degree of supporting several areas can be rated only, not the importance of the areas itself, due to the fact that this strongly depends on specific company needs.

Emotional benefits:

Why is it “fun” for employees to participate in workplace e-collaboration, respectively in virtual teams. [Melzner 2002] suggests that the following functions can provide emotional benefits:

- Recognition
- Publications
- Incentives
- Keep in touch with friends/colleagues
- Be part of a group (group dynamic)
- Personalization of information
- Screen savers, personal homepage, photo gallery, joke of the day, ...

Part III

6. E-Collaboration Tools Market-Survey

This final chapter provides an (incomplete) list of tools supporting E-Collaboration according to the categories defined in chapter 3.2 (“web conferencing”, “virtual teamrooms”, “expert advice platforms” and “smart enterprise suites”):

6.1. Web-Conferencing:

Tool Name	Company Name	URL
Centra One, Centra Symposium	TERTIA Edusoft AG Schweiz Herrn Urs Widmer Hohlstraße 608 8048 Zürich Tel. 0041 / 1 439 29 29 Fax: 0041 / 1 439 29 25 E-Mail: info@tertia-edusoft.ch	www.centra.com www.tertia.de www.tertia-edusoft.ch
Conference Center	Genesys Conferencing (formerly: Astound) Darome Teleconferencing GmbH Berlin Zimmerstrasse 55 10117 Berlin +49 (0)30-20 17 04-0 +49 (0)30-20 17 04-33	www.genesys.com
Click to Meet (CuSeeMeConference Server)	First Virtual Communications Stephan Ausburg Phone: +49 (0) 89.75.96.84.51 Fax: +49 (0) 89.75.96.84.52 Email: sausburg@fvc.com	www.fvc.com
Dyce Instant Messenger (no audio/video)	go4teams GmbH Julius-Reiber-Strasse 15A DE-64293 Darmstadt 0700-GO4TEAMS +49/6151/869-5421 info@go4teams.com	www.go4teams.com
eConferencing Suite	Hyperwave Niederlassung München tel. +49-89-94304-0 fax +49-89-94304-199 email info@de.hyperwave.com	www.hyperwave.de
ERoom (Digital Workplace Platform, Real Time Server) → Documentum	Documentum GmbH Inselkammerstr. 2 D - 82008 Unterhaching Tel: +49 (0) 89 6 66 81-0 Fax: +49 (0) 89 6 66 81-1 11	www.documentum.de

Invoke Collaboration → Raindance (pay-per-use pricing)	Raindance Communications Inc.	www.raindance.com www.evoke.com
EW Meeting	Webkonferenzen.info Fahr und Partner Robert-Bosch-Straße 35 64625 Bensheim Telefon 06251-582 6064 Telefax 06251-582 6069	www.webkonferenzen.info www.fahr.com
Facilitate.com	Facilitate.com 4323 23rd Street San Francisco, CA 94114 (800) 423-8890	www.facilitate.com
Foroso Meeting Center Foroso Training Center	Foroso Communications Parchetwiesen 33 D-82362 Weilheim Tel: 0700-FOROSO-00 (*) info@foroso.de	www.foroso.com
Grouputer	Grouputer Solutions Pty. Ltd enquiries@grouputer.com	www.grouputer.com
IBT Live Collaboration	Time4You GmbH communication & learning Maximilianstr. 4 76133 Karlsruhe fon +49(7 21) 83016-0 fax +49(7 21) 83016-16	www.time4you.de
Interwise Millenium	Interwise Inc. Switzerland Avenue des Eaux-Vives, 6 1207 Geneva SWITZERLAND Phone: +41 (22) 849.00.00	www.interwise.com
Learn Linc	Mentergy Europe info@mentergy.eu.com D: Media Freilingen GmbH Am Grauen Stein 6 DE-56244 Freilingen +49 2666-1081 info@media-center.com	www.mentergy.eu.com
Live e-Learning	Netucate GmbH In der Au 25-29 D- 61440 Oberursel Tel.: 06171/632-300 - Fax: 06171/632-399 E-Mail: info@netucate.com	www.netucate.com
Lotus Sametime	IBM Schweiz Bändliweg 21 8010 Zürich Tel. 058 333 44 55 Fax. 058 333 40 40	www.sametime.com www.lotus.com
MeetingPlace	Latitude Communications 50 Regent Street London, W1R 6LP 020-7470-7125 ukinfo@latitude.com	www.meetingplace.com www.latitude.com

MeetingRoom 7 (pay-per-use)	MeetingRoom7 175 E 5th St Suite 310 St Paul, MN 55101 United States	www.meetingroom7.com
Meeting Zone	Open Text Switzerland Hechtackerstrasse 41 9014 St. Gallen Phone: +41 (0) 71 272 15 00 Fax: +41 (0) 71 272 15 15 E-mail: info.ch@opentext.com	www.opentext.com
Microsoft Netmeeting	Microsoft AG Richtistrasse 3 CH-8304 Wallisellen Telefon: 0848 22 44 88 Telefax: 043 456 44 44	www.microsoft.com
Netviewer (ad hoc desktop sharing, Audio via phone, 1 to many optionally).	Netviewer GmbH Beiertheimer Allee 18 D-76137 Karlsruhe Tel.: +49-721-354499-0 Fax.: +49-721-354499-30 info@netviewer.de	www.netviewer.de
PlaceWare Conference Center	(acquired by Microsoft in Q1/03) PlaceWare International Holding Sarl I/O KPMG Fides Peat, Rue de Seyon 1 CH-2001 Neuchatel Switzerland	www.placeware.com
Web-4M	JDH Technologies Suite J3 11834 Canon Boulevard Newport News, Virginia 23606 USA Phone: +01 757-873-4747 FAX: +01 757-873-8484 info@jdhtech.com	www.jdhtech.com
WebEx	WebEx EMEA Zekeringstraat 48-1 1014 BT Amsterdam The Netherlands Tel: +31 (0)20 4108 700 Fax: +31 (0)20 4108 732 EMEAinfo@webex.com	www.webex.com
WebLearner-WebCast	Lerneffekt GmbH Harburger Schlossstrasse 30 DE-21079 Hamburg +49 40 300-923-0 info@lerneffekt.de	www.lerneffekt.de
WeMeeting, e-Auditorium	NetDIVE, Inc. 41 Sutter Street, #1142, San Francisco CA USA 94104	www.eauditorium.com www.netdive.com

Table 3: Web-Conferencing Software (in alphabetical order of tool names)

6.2. Electronic Workspace and Virtual Teamrooms

Tool Name	Company Name	URL
BSCW	OrbiTeam Software GmbH Endenicher Allee 35 D-53121 Bonn Telefon +49-228-410140-0 Fax +49-228-410140-1 info@orbiteam.de	http://www.bscw.de
Caucus 4.4	CaucusCare 2630 Lillian Road Ann Arbor, MI 48104 USA info@caucuscare.com	www.caucuscare.com
CenterWorks	bone labs GmbH Rotherstr. 22 10245 Berlin Germany	http://www.centerworks.de
Cybozu Office 3 Share360	Cybozu Inc. Tokyo, JP	www.cybozu.com
Divine Fuse	Divine xtendx ag -authorized Swiss divine distributor- Adlikerstrasse 246 8105 Regensdorf Phone +41 (0)43 305 8600 Fax +41 (0)43 305 8602	www.divine.com
DocuTouch	Netupdate, Inc. 2495 140th Ave NE, D-101 Bellevue, Washington 98005 425-246-2117	www.docutouch.com
Documentum	Documentum GmbH Inselkammerstr. 2 D - 82008 Unterhaching Tel: +49 (0) 89 6 66 81-0 Fax: +49 (0) 89 6 66 81-1 11	www.documentum.com
Eroom → Documentum		http://www.eroom.com
Freeoffice	CAS Software AG Wilhelm-Schickard-Str. 12 76131 Karlsruhe Telefon: +49 721 9638-0 Fax: +49 721 9638-299	http://www.freeoffice.de http://www.cas.de
GroupWise	Novell Leutschenbachstrasse 41 CH-8050 Zurich, Switzerland (41) 43 299 7606 (41) 43 299 7501	http://www.novell.com/offices/emea/
HyperOffice 3.0	Application Corporation	www.application.com

Intranets	Intranets.com 40 Holborn Viaduct London EC1N 2PB, United Kingdom Tel: +44 (0) 20 7832 3460 Fax: +44 (0) 20 7832 3582	www.intranets.com
InfoWorkSpace (= Ezenia!)	Ezenia! 154 Middlesex Turnpike Burlington, MA 01803 +44 1628 415711	www.ezenia.com www.infoworkspace.com
Intraspect 5	Intraspect 40 Holborn Viaduct UK-London EC1N 2PB, Tel: +44 (0) 20 7832 3460 Fax: +44 (0) 20 7832 3582	www.intraspect.com
Lotus Quickplace	IBM Schweiz Bändliweg 21 8010 Zürich Tel. 058 333 44 55 Fax. 058 333 40 40	www.lotus.com
Team Now	<i>Service wurde eingestellt!</i>	www.teamnow.com
teamOn	TeamOn Systems, Inc. 1180 NW Maple Street, Suite 201 Issaquah, WA 98027 Tel: 425-369-5700	www.teamon.com
Teamspace	5 POINT AG Heidelberger Str. 55-61 64285 Darmstadt Tel.:(06151) 130 97 -0 Fax:(06151) 130 97 -10 info@5point.de	http://www.5point.de/ www.teamspace.org
Teamware Pl@za Teamware Office	Teamware Cont. Europe Het Kwadrant 1 3606 AZ Maarssen The Netherlands Tel. +31 346 598 335 Fax +31 346 598 235	www.teamware.net
Yahoo! Groups	Yahoo! Inc. 701 First Avenue Sunnyvale, California 94089	http://groups.yahoo.com

Table 4: Electronic Workspaces and Virtual Teamrooms (in alphabetical order of tool names)

6.3. Expert Advice Platforms

Tool Name	Company Name	URL
Knowledge Markets	Information Markets Corp bizdev@infomarkets.com (USA) 1-800-391-3363	www.infomarkets.com
WeTellYou	WeTellYou.com Streulistrasse 33 8032 Zürich Switzerland info@wetellyou.com	www.wetellyou.com

Table 5: Expert Advice Platforms

6.4. Smart Enterprise Suites

Tool Name	Company Name	URL
Aspen Enterprise Productivity Suite	Click2learn, Ltd. The Innovation Centre 225 Marsh Wall Docklands London E14 9FW UK Phone: +44 (0)20 7517 4200	www.click2learn.com
Divine	Divine Neumann-Reichardt-Str. 27-33 22041 Hamburg Phone: +49 (0) 40 65733-0 Fax: +49 (0) 40 65733-888	www.divine.com
Hummingbird Enterprise	Hummingbird SA World Trade Centre Leutschenbachstrasse 95 8050 Zürich, Switzerland Tel: 00 41 (0)1 308 36 76 Fax: 00 41 (0)1 308 35 20	www.hummingbird.com
Hyperwave	Hyperwave Niederlassung München tel. +49-89-94304-0 fax +49-89-94304-199 email info@de.hyperwave.com	www.hyperwave.de
WebSphere Infrastructure and DominoDoc with Lotus K-Station, Quickplace, Sametime, etc.	IBM Schweiz Bändliweg 21 8010 Zürich Tel. 058 333 44 55 Fax. 058 333 40 40	www.sametime.com www.lotus.com
Integrating several applications within Sharepoint-Portal Server. Additional acquisition of Placeware (web conferencing)	Microsoft AG Richtistrasse 3 CH-8304 Wallisellen Telefon: 0848 22 44 88 Telefax: 043 456 44 44	www.microsoft.com
LiveLink with MeetingZone	Open Text Switzerland Hechtackerstrasse 41 9014 St. Gallen Phone: +41 (0) 71 272 15 00 Fax: +41 (0) 71 272 15 15 E-mail: info.ch@opentext.com	www.opentext.com

Table 6: Smart Enterprise Suites (in alphabetical order of vendor names)

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