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RESEARCH REPORT:

ASSESSMENT OF THE DEVELOPMENT TRAJECTORY FOR REAL-TIME COMMUNICATION: RESEARCH REPORPT ON A DELPHI STUDY

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ABSTRACT

This research report presents the results of a Delphi study on Real-time Communication (RTC), a recently emerging genre of communication and collaboration technology. So far, only a few empirically informed attempts have been made to conceptualize the technology and predict future trends in the young and dynamic RTC market. Therefore, a Delphi study with sixteen experts from academia, industry, and technology providers was conducted to discuss the positioning of RTC, market trends, implementation/ design issues, and the implications of RTC use on the organizational and individual level. The results indicate that RTC, interpreted as complementary to existing ICT, is expected make inroad into people's ICT landscape. The trend will go from simple stand-alone application towards add-ons to existing products, such as groupware or business packages. Moreover, in contrast to the often overly-optimistic business media, experts agree that RTC represent complex information systems whose outcome in organizations are difficult to predict. Instead, experts point out that the complex and highly situated character of RTC use needs to be taken into account. While this comprehensive report may identify potential starting points for future research, practitioners could benefit from it by being sensitized for the advantages, limitations and dangers associated with RTC use.

Keywords: Real-Time Communication, Delphi study, ICT

1   INTRODUCTION

Over the past couple of decades we have observed a profound transformation of how organizations do business: most prevalent is the increase in distributed forms of work within and across organizations (cf. Claudio; Ciborra & Suetens, 1996; Malhorta, Majchrzak, Carman, & Lott, 2001; Orlikowski, 2002). The distribution of work has extended degrees of freedom in terms of place and time of work while maintaining a high level of connectedness and access to remote work environments. During the 90's, groupware was heralded as a form of information and communication technology (ICT) that could facilitate collaboration in both co-located and dispersed settings (Iacono & Kling, 2001). However, despite years of research and significant investments into collaboration systems, they are still mostly perceived as helpful but not well established and accepted tools to improve the productivity of distributed work.

Real-time communication technology (RTC) is a recently emerging genre of communication and collaboration systems which resulted from the convergence of the telecommunications and groupware market. RTC products contain at least one of the following features: unified communication, presence status, contextualization into existing information systems, and features of groupware applications.

Currently, the business press and technology evangelists alike are bullish about both the future growth of the RTC market and the organizational impact of the technology. The advent of the "era of unified communication" (Rybczynski & Shetty, 2005) is declared and Gartner, the technology research and advisory company, predicts that by 2011, instant messaging as a form of RTC "will be the de facto tool for voice, video, and text chat with 95 percent of workers in leading global organizations using it as their primary interface for real-time communications by 2013" (Gartner, 2007). Furthermore, the RTC market is expected to grow from $267 million in 2005 to $688 million in 2010 (ibid.). Moreover, RTC is regarded as a remedy for social, organizational, and technological issues which previous technologies – such as groupware – were unable to address (cf. Brodsky, 1999; Lazar, 2007; Oliva, 2003). To make things even better, RTC is expected to increase productivity, improve communication, and save costs (cf. Gilbertson, 2007; Hutton, 2001).

The media are rather effusive about the potential of RTC but lack to deliver a more thorough conceptualization of RTC and its role within the existing ICT landscape and socio-organizational contexts. Rather than following the overly optimistic claims of the business media, we conducted a Delphi to determine and qualify experts' opinions on RTC related issues. The report therefore aims at portraying a more nuanced and empirically grounded picture of RTC. Based on quantitative and qualitative responses of experts, the study focuses on (1) the positioning of RTC, (2) the development trajectory of RTC applications, (3) the implementation and design process, and (4) the implications of RTC-in-use.

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The study covers multiple areas and levels of analysis. Clearly, trade-off decisions have to be made in relation to the scope and depth of research projects and their presentation. Rightly, the reviewers of this paper remarked that the structure and scope of this contribution does not fit into the research article genre. Instead, we consciously decided to present the results of several areas and levels of analysis in the 'research report genre'. By doing so, this Delphi study hopes not only to shed some more light on RTC but also to motivate more detailed work by sketching out relevant research areas. Furthermore, we hope that the research report can make a contribution by sensitizing practitioners for upcoming trends and issues associated with RTC implementation and use.

The Delphi study is structured as follows. In the first section, we conceptualize RTC and discuss three research strands that might help to inform our understanding of RTC, namely the literature on interaction management, groupware and instant messaging. Second, we introduce Delphi study as the research design and delineate the structure of this Delphi study in more detail. Third, the results of the study are presented and subdivided into the following four subsections: positioning, technology, implementation & design, and RTC-in-use. Fourth, some of the findings are revisited and elaborated upon before we conclude with some final remarks.

2   THEORETICAL BACKGROUND

2.1   A tentative conceptual scheme of Real-time Communication Technology

Riemer and Frößler (2007) identify four building blocks of RTC technology, namely unified communication, presence awareness, groupware features, and contextualisation. Resulting of market convergence, RTC has its roots in both the telecommunications market and the market for groupware systems. RTC systems are therefore a combination of well-known features such as Voice-over-IP telephony, instant messaging and various groupware and e-Collaboration features. Based on the idea of unified communication (UC), which describes the computer-supported combination and management of communication channels according to user preferences, RTC overcomes the traditional distinction between either synchronous or asynchronous technologies as both aspects are integrated within one application. However, the provision of status information regarding the availability of the user and his media and communication devices is a decisive new feature that RTC offers. Finally, RTC systems can be embedded in existing organizational processes and software tools, resulting in customized and context specific solutions. Table 1 gives an overview of the characteristics of unified communication and presence & availability on the individual, group and organizational level.

	UC	**Presence & availability**
Individual	Managing multiple integrated communication media & devices Definition of preferred media Unified communication platform Rule-based configuration of message routing and call diversion	Access control (buddy list) Differentiated signaling facility (for media and/or reference groups)
Group	Managing/ configuring (ad hoc set-up etc.) communication and collaboration services and presence-enhanced coll. tools.	Presence awareness, seamless combination of outeraction and interaction Org. embedding (rules & practices) of availability stati (e.g. availability stati linked to documents, processes, groups etc.) Request for (immediate) attention
Organization	Integral part of communication & collaboration infrastructure (e.g. office software and enterprise applications)	Understanding the needs (and limits) for human presence Organizational routines, managerial practices and communication competencies carefully crafted to make good (and careful) use of precious attention

Table 1: Affordances of RTC

Unified Communication

The idea behind Unified Communication (UC) is an extension of unified messaging (UM) services (Riemer & Frößler, 2007). UM aimed at managing and coordinating a user's asynchronous communication through collecting all incoming messages on various channels - such as e-mail, fax, voice mail - on one mailbox. Messages can then be converted for use on different media types: fax or e-mail can be read out to the user by a machine voice, voice messages are transformed in a text based message and send to the user, or channels and devices can be specified for accessing messages of various types.

UC systems extend the idea of UM by integrating different synchronous and asynchronous information and communication channels, such as e-mail, telephone, video conferences, instant messaging, or SMS. Unified communications can be defined as the integration of communication technologies to improve workers' ability to interact (Minifie, 2007; Mohamed, 2007). The user can define preferred channels (text, audio, and video) and devices (landline, mobile or IP phones) with a middleware supporting them in managing channels and devices through a rule-based coordination and filtering system. Depending on criteria such as time, situation, or caller, a user can redirect and filter incoming calls based on pre-defined rules between channels and devices. For example, if an employee decides to work at home, all incoming calls from team members on his office phone will automatically be forwarded to

his private phone number and if that fails, to his mobile phone. Customer calls will be forwarded to a self-service-portal.
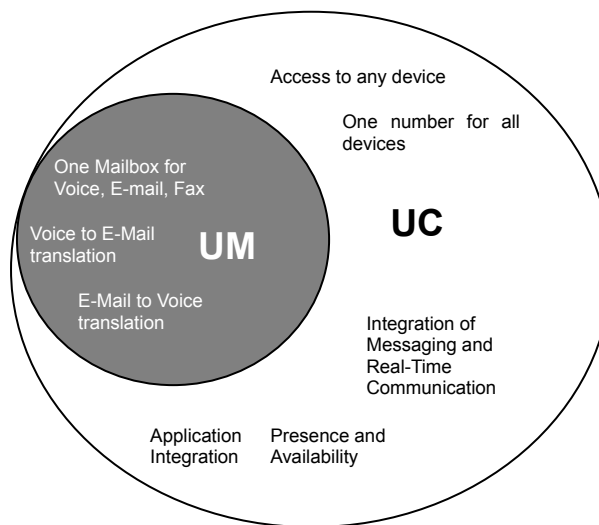

Figure 1: Unified Communication (adopted from Diamontcluster, 2001)

The terms RTC and UC are often used interchangeably both in the business literature (cf. Burton, Parker, Pleasant, & Van Doren, 2007; Mohamed, 2007; Rybczynski & Shetty, 2005) as well as by the systems providers. However, for conceptual clarity, we refer to UC as one out of four components of RTC systems. The other three will now be discussed in more detail.

Presence information

Presence information is the second defining concept of RTC which has already been extensively applied as a component of instant messaging (IM) tools. It signals the availability of people by a status icon in a contact list. The idea behind presence information is to provide additional information on the recipient of a call which can be used in dispersed settings to mitigate delays and obtrusive interruptions. By doing so, it is attempted to reduce the number of unsuccessful communication requests and to improve the accessibility of people. RTC systems enable to derive a person's presence information from the availability of channels and devices in that for each device or for a particular channel (text, audio, video) a presence status is provided. For example, the status for audio communication might be 'available' if one of the user's audio devices is registered as 'active' with the RTC system. Moreover, as to avoid interaction overload, users can further specify their presence information in relation to the context and/or priorities assigned to certain persons.

From the initiator's perspective most instant messaging tools signal availability of a particular person. However, professional RTC systems extend the notion of availability to roles, skills, groups, locations, or objects. Such identities can then be attached to documents

or enterprise applications, allowing people to contact 'on-demand' the contact persons without knowing in advance who they are.

Contextualisation

As briefly mentioned before, RTC provides integrated communication features for organizational processes to enable context-sensitive cooperation. RTC users can initiate communication acts without (1) being concerned about which channel might be appropriate for the recipient or (2) having to search for the appropriate contact details. Buddy lists can be context-specifically organized, i.e. they adapt in relation to the tasks, location, etc. For example, consultants are able to immediately identify in a knowledge database a list of subject experts on a particular topic and select from this contextualized buddy list one of the currently available experts. Furthermore, the user might be able to access location-based services, which offer RTC functionality on mobile devices (e.g. PDAs or mobile phones) to support mobile professionals.

Portfolio of e-Collaboration features

Finally, RTC systems contain a portfolio of e-Collaboration resources and features, which were taken over from groupware applications. Professional RTC applications include web conferencing and application sharing features. While web conferencing enables, supported by presence information on the availability of a group of people, conferencing sessions with more than one recipient at the same time, application sharing features allows users to jointly work on documents on an ad-hoc basis.

RTC is further integrated with team calendars; in particular presence information are combined with calendar information as to enrich signaling by providing background information on the kind and duration of a person's current activities. By doing so, the integration of presence information and team calendars might bring about a more efficient scheduling of meetings.

To sum up, four areas were identified functioning as building blocks for analyzing and addressing current RTC systems. RTC intends to bring about a more efficient management of personal communications by means of improved presence information, management of incoming requests, and collaborative real-time interaction on an ad-hoc basis.

A brief market overview

RTC products currently target the mass market for private customers and the market for business customers (see Table 2). Skype represents the private customer segment, providing basic VoIP, instant messaging features, video/audio conferencing, call forwarding, voice mail and presence awareness information. The business segment is served by players from the telecommunications market such as Siemens, Alcatel, and Nortel and by traditional software providers such as Microsoft, Oracle, or IBM (Elliot, Blood, & Kraus, 2005). Influenced by a company's history, RTC solutions accentuate the four building blocks differently. For instance,

while Siemens' Hipath ® OpenScape™ is based on the company's telephone and unified communication infrastructure, IBM's Workplace Collaboration Services™ (WCS) offers various e-Collaboration features from existing groupware solutions and integrates them with other RTC features provided by Lotus Sametime®.

Market segment	Companies
Private customers	AOL Messenger™
	Gizmo Project
	Google Talk™
	MSN Web Messenger
	Skype™
	Yahoo! Messenger
Business segment	Alcatel OmniTouch Unified Communication
	IBM Workplace Collaboration Services™
	Microsoft Office Communicator 2005
	Nortel Multimedia Communication Server 5100
	Oracle Collaboration Suite
	Siemens Hipath® OpenScape™

Table 2: Overview of some main players in the RTC market

2.2 Conceptualising Interaction Management

Partly enabled or even driven by the proliferation of information and communication technologies and infrastructures, the emerging forms of organizing, work, social life, learning and information sharing are communication and coordination intensive. Some groups of professionals are almost overwhelmed by communication devices, services and – most importantly – communication events. Many of them receive hundreds of emails per day and juggle between 10 and more communication devices, e.g. fixed-line phone, mobile phone, fax, instant message service, pager etc., daily routines have become increasingly fragmented and an increasing share of the working time needs to be spent on retrieving, sending and managing messages.

Furthermore, today's work conditions are marked by increased fluidity of interactions with others. While fluidity offers benefits, such as interacting remotely and flexibly with others, it also creates interruptions and disturbances as asymmetries of interaction become more likely (Masao Kakihara, Sørensen, & Wiberg, 2002). Asymmetries of interaction occur if "the time and topic are convenient for the initiator, but not necessarily the recipient. This asymmetry arises because while initiators benefit from rapid feedback about their pressing

issue, recipients are forced to respond to the initiator's agenda, suffering interruption" (Nardi, Whittaker, & Bradner, 2000: 83). Asymmetries of interaction might even increase over the next couple of years, if communication should become a goal in itself or initiators, acting on any impulse, contact other instantaneously as to free their mind of wandering ideas (de Poot, Mulder, & Kijl, 2005). Conceptualizing an individual's attempts to maintain fluidity, Kakihara et al. (2002) distinguish between a person's desire to be either interactive or interpassive. While the former term stands for communication and collaboration between two or more people (Keller & Keller, 1996, in Kakihara et al., 2002), the latter one denotes a passive relation of a person to others. However, interpassive does not mean that the person is generally passive, rather it characterises a person's desire not to interact as s/he might be immersed in other activities (Masao Kakihara, Soerensen, & Wiberg, 2002). Based on the distinction between interpassive and interactive, Kakihara et al. derive at a 2x2 matrix, describing four potential scenarios of a person's engagement with the world. The first scenario exhibits situations where both parties are interpassive, i.e. they are involved in ongoing activities which are not outwardly orientated, which is why no interaction asymmetries exist. The opposite scenario which also shows no interaction asymmetries covers situations where involved parties signal the desire to interact. However, interaction asymmetries instantaneously occur if an initiator needs to get hold of another person who is momentarily interpassive. Consequently, initiators have to manage these interactions for example by means of obtrusive technologies. The recipient, on the other hand, is confronted with a situation in which s/he has to manage and balance the conflicting demands of, on the one hand, currently ongoing activities and, on the other hand, the temporary interruptions of external parties.

Interaction asymmetries automatically translate into either delays or interruptions. While communication delays impede work on the side of the initiators, since access to needed resources and information is refused by the information provider (recipient), interruptions potentially disrupt the recipient's ongoing work. Rennecker et al. (2005) compare within an ideal situation synchronous and asynchronous forms of communication and the implications on delays and interruptions (see Table 3). While synchronous communication proofs to be more efficient for initiators as control of the interruption rests with the information seeker who can continue the work as delays are reduced, asynchronous modes of interaction favour recipients, who can determine when to respond to a request and, by doing so, adjust communication request to their ongoing work.

Work/ communication impact	Synchronous	Asynchronous
Expected delay in information acquisition	Seconds to minutes	Hours to days
Locus of control of interruption	Information seeker(s)	Information providers
Continuity of task work	Information seeker(s)	Information providers

Table 3: Comparison of work organization in synchronous and asynchronous communication modes (adopted from Rennecker et al. 2005)

2.3 Groupware

RTC shows significant similarities with earlier groupware applications. The literature review concentrated on groupware as to sensitize the researches and identify relevant questions for the research project. In the early 90's, the introduction of groupware was accompanied in the literature by the promise that it would ultimately lead to increased organizational productivity (cf. Bullen & Bennett, 1990). Based on the premise of positive connotations such as cooperation, coordination, and images of convivial workplace relationships (Kling, 1991), it was argued that groupware would enable work to be organized in a more collaborative manner (collaborative claim) (cf. mentioned by Claudio Ciborra, 1996b; Iacono & Kling, 2001; Karsten, 1999; Séamas Kelly, 2004). More specifically, the collaborative claim alleged that groupware allows, first, access to structured information, and, second, more efficient and democratic forms of collaboration as communication within and across organizational groups is increased (cf. Munkvold, 1999; Sproull & Kiesler, 1991). The collaborative claim is part of the technological deterministic tradition as it posits technology as an external phenomenon which determines particular social/ organizational changes (Orlikowski & Iacono, 2000). However, as shown elsewhere, the collaborative claim is rather problematic as it lacks to explain the diverse outcomes of groupware implementation in practice (Karsten, 1999).

In contrast to technological deterministic approaches, another group of scholars understands groupware as 'radically tailorable tools' which allow end users to modify and alter applications to their particular needs (Malone, Lai, & Fry, 1992). Following this line of reasoning, groupware is perceived as configurable and context specific general-purpose technology which is enacted by individual or collective, intended or unintended activities (cf. Bödker, Pors, & Simonsen, 2004; Orlikowski & Iacono, 2000). The implementation process is open-ended with constant adaptations and innovations of the technology and work practices (cf. Malhorta et al., 2001; Ngwenyama, 1998; Orlikowski, 1996b). However, saying so does not mean to neglect the fact that continuous and conscious lobbying by influential groups is required for the diffusion of new technological infrastructures (Monteiro & Hepsø, 1998).

Users and specialists continuously re-invent the technology and, while doing so, explore new features and learn to exploit the potentials of groupware (Claudio Ciborra, 1996a). Communication about and training on groupware can help novices to appreciate the potentials of the technology and the opportunities it offers (Orlikowski, 1992). By doing so, people's technological frames of preceding technologies - i.e. mental models people have about the world, their organization, technology and which shape the way individuals approach the world - are modified in order to understand groupware and to applying it efficiently and effectively (Orlikowski & Gash, 1994).

Taking such a socio-processual backdrop as starting point, researchers have analyzed the implications of groupware on a broad spectrum of individual and organizational aspects. Referring to Zuboff's (1988) concept of informating, it is argued that through textualizing work, groupware reduces existing communication and knowledge barriers within and across organizations which makes work more transparent and consequently accessible and

widespread available (cf. Claudio; Ciborra & Patriotta, 1996). However, reflecting upon the failure of many knowledge management projects scholars began to question the aforementioned claim. Instead, based on philosophical and psychological concepts of communication, textualizations are understood as "re-presentations of action and reflection, deeply involved in human processes of communication, and which cannot be divorced from their context" (Walsham, 2005: 7). Therefore, it is argued that the interpretation of the explicit representation always depends on and is rooted in a person's tacit knowledge (2001; , 2004; , 2005). Extending this philosophical and psychological perspective to include socio-political aspects, Hayes et al. (2001) analyze how groupware and political/normative context mutually shape each other. They develop the concept of political and safe enclaves which assumes that while safe enclaves enable people to express their own underlying views of activities and facilitate open discussions and reflections, political enclaves are used as a resource by political agents to foster their own agenda. Within the political arena, textualized records are instrumentalized for protecting one's own interests (cf. Séamas; Kelly, 2005; Orlikowski, 1996a, 1996b) but also for furthering the official understanding of how work should be done (cf. Niall; Hayes, 2000). Consequently, the transparency of documents brings about changes in managerial control and power relations (cf. Claudio; Ciborra & Patriotta, 1996; Orlikowski, 1996a). By and large, research discusses hierarchical conflicts (management-employee relationship) (cf. Barrett, Cappleman, Shoib, & Walsham, 2004; Claudio; Ciborra & Patriotta, 1996; Orlikowski, 1992, 1996a) or issues arising among different communities within organizations (cf. Niall; Hayes, 2000). As to overcome potential conflicts, norms and procedures for how management and employees deal with accessible information seem to play an important part for the acceptance of groupware. Norms and procedures need to be specified explicitly and nurtured over time to set expectations about how the information will be used by the management or colleagues (Séamas; Kelly, 2005; Orlikowski, 1992). Within this process, boundary spanners or mediators function as facilitators for developing deeper social bonds and overcoming negative politicizing processes (Niall; Hayes, 2000, 2001; N. Hayes & Walsham, 2001).

Finally, Kelly (2005) follows Orlikowski and Iacono's (2001) call to carefully theorize about IT artifacts with its specific cultural and computational capabilities and its use *in situ*. Drawing upon Wenger's (1998) concept of participation and reification, Kelly analyses how groupware, as a particular materialized form of reification, facilitates "modes of reification and participation by mediating forms of social engagement and providing a means of reifying our experiences" (Séamas; Kelly, 2005: 498). Combining considerations about the materiality of technology with social relations within which technology is embedded may give insightful accounts of the implications of 'RTC-in-use' and ICT in more general.

2.4 Instant Messaging

Since instant messaging (IM) systems share with their presence information and chat functionality some familiarities with RTC technology, a brief overview of the literature on IM is

given below. Three categories are distinguished in order to structure and systematize previous research results, namely the conversational character, the functions of IM and the patterns of use (cf. Isaacs, Walendowski, Whittaker, Schiano, & Kamm, 2002).

The first category 'general conversational' character of IM chat sessions focuses on the temporal duration, media switching, and multi-tasking. Most studies agree that IM sessions are rather short and mainly focus on rapid exchanges and brief interactions (Connell, Mendelsohn, Robins, & Canny, 2001; de Poot et al., 2005; Isaacs et al., 2002; Nardi et al., 2000). Media switching is concerned with the combination of IM with other media. While most studies found elements of media switching in their research, they disagree on the explanations for causations. It is argued that people switch media either as they feel that conversations get too complex to be appropriately addressed through IM (Connell et al., 2001; Nardi et al., 2000), or to call together people to prearranged meetings (Isaacs et al., 2002). Finally, multi-tasking, which is thought to be prevalent in IM, suggests that IM sessions permit users to respond quickly to questions while still working on other tasks (Nardi et al., 2000) or to be engaged in multiple, parallel conversations (Handel & Herbsleb, 2002; Nardi et al., 2000).

The second category focuses on the different functions of IM in private and work settings, some of which are now discussed. First, enabling users to respond rapidly to questions without the overhead of face to face conversations, IM is efficiently used for asking quick questions (Nardi et al., 2000). Second, IM is used for scheduling meetings and arranging impromptu discussions (de Poot et al., 2005; Nardi et al., 2000). With presence information offering hints on people's availability, IM proofs to be supportive in this area (see also Handel & Herbsleb, 2002; Nardi et al., 2000). In addition, while some studies found that IM is used for coordinating impromptu social events and keeping in touch with friends and relatives (Boase, Horrigan, Wellman, & Rainie, 2006; de Poot et al., 2005; Ljungstrand & Segerstad, 2000; Nardi et al., 2000) other research reported only limited evidences for the use of IM in social settings (Handel & Herbsleb, 2002; Isaacs et al., 2002). Moreover, research found that over the course of a day topics of conversations change insofar as during the morning hours negotiating availability is prevalent while during the afternoon topics are less work related and more humorous (Handel & Herbsleb, 2002).

Finally, the third category circumscribes findings on the frequency of message exchanges during conversational events (Isaacs et al., 2002), and the number of chats per day (Handel & Herbsleb, 2002). Studies indicate that work practices have strong implications on the frequency of message exchanges (Isaacs et al., 2002). People with close working relationships often use multi-purpose discussions, sometimes for scheduling work but more often these discussions - consisting of many intense message exchanges over a short period of time - are covering a broad range of complex work related topics. In contrast, for coordinating work (e.g. scheduling interaction in another medium) short, slow paced and single-purpose conversations are used.

3 DEFINITION AND DESCRIPTION OF DELPHI STUDIES

3.1 Historical overview

The first Delphi study was developed during the early 1950's by the Rand Corporation as a research instrument (Dalkey & Helmer, 1963). The study was conducted for the US Air Force and because of security concerns it took over ten years until it got published and renowned beyond the defense community (Linstone & Turoff, 1975). Since then, it has been widely used; between 1975-94 alone 463 papers were identified as being concerned with the Delphi methodology or application (Gupta & Clarke, 1996). The Delphi design is applied in different domains - among others the education sector, tourism and business industries, politics, health sector - and addresses a myriad of issues, e.g. sales forecasting, technology planning, policy formation, or market research (Gupta & Clarke, 1996; Häder & Häder, 1998). Over the last couple of years, Delphi studies have also been applied within the information systems discipline (cf. Köhne & Klein, 2003; Reimers, 2003; Schmidt, Lyytinen, Keil, & Cule, 2001; G. Scott & Walter, 2003; G. M. Scott, 2001), with most of them being used for forecasting, issue identification/ priorization or concept/ framework development (Okoli & Pawlowski, 2004).

To explain the increasing popularity and interest in Delphi studies since the 60's, Häder et al. (2000) list four socio-economic factors that have brought about or at least facilitated this trend:

- Instead of having universal skills and responsibilities, nowadays experts are generally highly specialized domain experts
- Far reaching decisions within industry and academia need to be prepared and supported by a ever greater number of experts
- Many decisions are becoming more complex and complicated with longer planning periods
- Far reaching decisions often entail higher costs.

To sum up, the popularity of Delphi studies can be explained as the consequential outcome of processes involving experts with specialized domain knowledge who have to make far reaching and expensive decisions.

3.2 Typology and definition of Delphi studies

To date, the number of definitions of what a Delphi study is and is about is almost as large as the number of studies that exist and so is the number of different views on the "best" and/ or "useful" procedure (cf. Häder & Häder, 1998; Linstone & Turoff, 2002). However, the classical Delphi design shares the following characteristics across the varying definitions:

- Application of formalized questionnaires
- Panel of experts
- Responses of each single expert are kept anonymous

- Determination of the statistical group response
- Two or more rounds

While some authors suggest the existence of multiple approaches to be a strength of Delphi studies, in that they allow studies to be tailored to the specific circumstances, other scholars oppose such statements as studies often attempt to pursue contradicting objectives which jeopardizes the efficiency and quality of the Delphi instrument (cf. Häder, 2002). As to overcome the divergent opinions and definitions, Häder (2002) proposes not to perceive Delphi study as one monolithic research instrument, rather it should be specifically developed and deployed for different objectives. Particularly, Häder maintains that four different objectives can be identified:

1. Delphi studies for aggregating ideas

This type of studies intends to aggregate ideas as to solve certain problems. Generally, quantitative rounds are rejected in favor of an exclusively qualitative approach, i.e. experts' qualitative opinions of each round are evaluated and feed back to facilitate further verbal responses in the following rounds. The objective of this type is to generate as many varying responses as possible

2. Delphi studies for making as exact predictions as possible about uncertain events

The objective of this type is to bring about a greater clarity concerning an uncertain future event. Studies have often attempted to forecast and even determine future events, e.g. the aforementioned study of the Rand Corporation on national defense. The quality of these studies is then evaluated by comparing the forecasted results with the actual events.

3. Delphi studies for determining and qualifying experts' opinions on diffuse issues

This type of studies intends to determine and qualify the opinions of an explicitly chosen group of experts. The resulting outcome of such studies lends itself, for example, to making inferences concerning required investments or to sensitizing people for potential trends. The quality of these studies can be evaluated in regards to the following two factors: 1. how good are the opinions of all questioned experts reflected in the study? 2. can it be expected that during the course of the Delphi study experts reflect upon previously held assumptions and come to improved judgments. Consequently, rather than attempting to predict the future, this type emphasizes the discussion about potential future developments and, by doing so, actively engages in shaping the future.

4. Delphi studies for building consensus

Finally, the fourth type proposes building of consensus within groups of experts to be the main objective of Delphi studies. The panelists therefore have to be recruited from social groups whose opinions are intended to be harmonized. Furthermore, facts have to be structured and specified in detail before the study commence, as to avoid consensus on abstract issues which would be far from being informative and illuminating. The number of

rounds of such Delphi studies depends upon statistical values, i.e. studies are continued until a predefined value signals that consensus within the group is actually achieved.

Making the decision for one of the four different types of Delphi studies and concentrating on its advantages may contribute to overcoming the dilemma of attempting to pursue contradicting objectives within one study. This particular Delphi study belongs to type three as its objective was to determine and qualify experts' opinions on the current situation and future trends of Real-time communication technology. Due to the fast moving RTC market and the lack of empirical data on RTC use, the Delphi study aims to empirically ground and facilitate the discussion on that subject matter. Many RTC systems are still in a prototype stage and empirical cases have yet to show the full potential of envisaged RTC systems. Forming a group of experts to discuss the envisaged results as part of a Delphi study is therefore a promising and valid approach at the current moment in time to get first empirical results.

Positioning the Delphi study in this way has significant consequences for its design and execution. Due to its overall importance, the role of consensus building will be discussed in more detail. Generally, two contrary opinions are found in the literature, namely (1) that Delphi studies aim at building consensus among the participating experts in the study (cf. Dalkey & Helmer, 1963; Polland & Polland, 2004; G. Scott & Walter, 2003), or (2) that consensus can never be the primary goal of Delphi studies (cf. Köhne & Klein, 2003; Rowe & Wright, 1999; Story, Hurdley, Smith, & Saker, 2001). The former one attempts to, first, bring out the respondents' reasoning and, second, to correct in the following rounds any misconceptions people might hold. By doing so, it is assumed convergence will automatically follow a more thorough way of thinking about the subject matter. In contrast, the latter group argues that consensus may only represent the individual's compliance to conform to the group estimation without re-evaluating formerly held assumptions and arguments (Rowe & Wright, 1999; Woudenberg, 1991). In addition, some authors rightly observe that a lack of consensus is inevitable in situations of uncertainty and Delphi studies should therefore intend to identify reasons for why experts come to diverging assessments (cf. Woudenberg, 1991). In line with those latter statements we argue that the existence of diversity should not be surprising given the fact that in our modern society people be experts in only small areas and be continuously confronted with incomplete and contradicting information.

Finally, to state our own understanding of Delphi studies, we will follow Armstong's (1999) suggestion not to use a too detailed definition and agree with the one given by Linstone et al.:

"Delphi may be characterized as a method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem. To accomplish this "structured communication" there is provided: some feedback of individual contributions of information and knowledge; some assessment of the group judgement or view; some opportunities for individuals to revise views; and some degree of anonymity for the individual responses" (Linstone & Turoff, 1975: 3).

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3.3   The broad structure and panel of the Delphi study

This Delphi study targets a group of experts whom we could assume were familiar with the subject area and most technical terms. Nonetheless, in the introduction of the study the broader context of the subject area was described and a tentative understanding of RTC was given. As RTC has not been clearly defined and differentiated from other ICT, embedding the discussion within a broader discourse was crucial as to create a shared network of meaning. By doing so, it was attempted to ensure that experts had the same reference points while answering the questions. Furthermore, the structure and the objective of the study were explained in the introduction to illustrate its underlying logic. For those panelists who were not familiar with the Delphi design, a section was included which briefly sketched out the research instrument.

The project timetable was tightly scheduled, with two weeks initially planned as response time and one week for evaluating the questionnaires. However, as to attain a high response rate, a one week extension was granted after the first round and even a two week extension after the second one. A two week extension of the final round was unproblematic insofar as no loss of interest had to be taken into account which might have resulted in higher panel mortality.
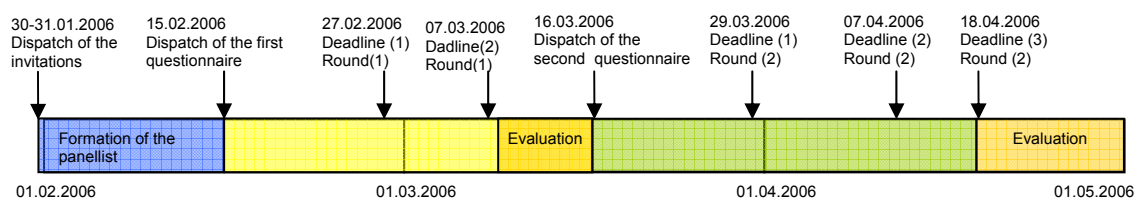

Figure 2: Project timetable

In order to accelerate the process no paper-based questionnaires were sent out. Instead, panelists received e-mails with attached Microsoft Word documents (see appendix 2) which could be returned via fax, e-mail or mail. No panelist made use of the latter option and only one expert during the first round replied via fax.

The selection of experts is a critical stage of Delphi studies as experts' professional and institutional background influences their views and interpretations of the subject matter and consequently the results of the study. In order to structure expert groups studies, have used the following criteria: 1. areas of expertise, 2. institutional background such as university private sector or public sector, 3. different geographical regions, 4. different degrees of expertise (Häder, 2000). A necessary prerequisite for a person to be nominated for the panelist was to be expert in the area of Real-time communication. However, the group of experts was further subdivided into three distinct groups, namely academia, technology providers and users. Consultancies and companies which had already experience with using the technology constituted the latter. All in all, based on established relationships and snowball sampling, 40 experts were selected and asked to participate in the study, with 10

coming from technology providers (25%), 15 from academia (37.5%) and 15 from the user group (37.5%). Out of the 40 experts, 16 experts finally agreed to take part in the Delphi study (40% response rate), with nine coming from academia, four represented the user group and three the technology providers. One expert dropped out after the first round leaving the number of participating experts at 15 (93.75% response rate). Furthermore, the composition of the panel was international, with 16 experts coming from six different nations (Germany, Great Britain, Norway, Switzerland, the Netherlands, and USA).
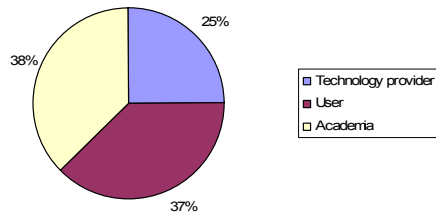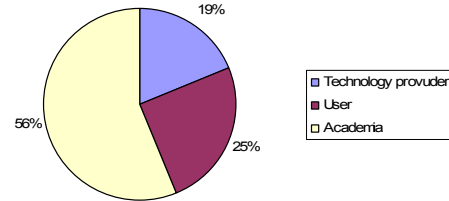
Figure 3: Groups of contacted experts   **Figure 4: Final panel**

All panelists agreed for their names to be listed below, however, one panelist preferred not to disclose his affiliation.

Name	Organization	Round
Dr. Harry Bouwman	University of Technology Delft, Section Information and Communication Technologies	I/II
Dr. Felix Hampe	Universität Koblenz-Landau, Institute for IS Research	I/II
Andreas Jörbeck	Telio	I
Dr. Helmut Krcmar	Technische Universität München, Lehrstuhl für Wirtschaftsinformatik	I/II
Andreas Löber	University of Zurich, Department of	I/II
Dr. Hermann Löh	Universität der Bundeswehr München, Centre for Technology and Innovation Management	I/II
Martin Mocker	Not disclosed	I/II
Dr. Bernhard Schmalzl	Siemens, Director Consulting (Region Südbayern)	I/II
Dr. Petra Schubert	Fachhochschule beider Basel (FHBB), Institute for Business Economics	I/II
Dr. Pascal Sieber	PS AG	I/II
Dr. Carsten Sørensen	London School of Economics, Department of Information systems	I/II
Dr. Charles Steinfield	Michigan State University, Department of Telecommunication, Information Studies and Media	I/II
Dr. Ralf Tyras	Siemens, Director Consulting (Region Nordrhein)	I/II
Dr. Jason Whalley	Strathclyde Business School	I/II
Dr. Arno Wilfert	Arthur D. Little, TIME Practice	I/II
Annette Wolter	Boston Consulting Group	I/II

Table 4: Panel of the Delphi Study

3.4 Design and Evaluation

The questionnaire contained both descriptive and predictive/ future oriented parts with questions being grouped according to individual, organizational and domain specific aspects. Reasoning fields after almost every question allowed experts to share the rationale of their decision or to mention other issues related to the particular question. To facilitate as many responses as possible, it was highlighted that comments could be both keywords and more lengthy descriptions. Furthermore, it was emphasized that all entries would be listed in anonymized form in the second round.

Closed questions were informed by a market analysis of current RTC products and a thorough review of related research strands, such as groupware or instant messaging. However, qualitative questions were used to determine and represent the broad spectrum of experts' opinions on issues that have not been sufficiently discussed in the literature. The open questions of the first round were evaluated, individual answers were consolidated, and

terms were standardized as far as they addressed similar aspects. The resulting list of items was then used to forming quantitative questions that were included in the second round of the Delphi study. Finally, those questions were excluded from the second round if the spectrum of opinions was already fairly comprehensive and/or the consensus among experts was high.

Divergent opinions exist concerning the number of rounds a Delphi study should contain. Whereas some studies argue that 4 to 5 rounds are needed to achieve coherence (Erffmeyer, Erffmeyer, & Lane, 1986) others assume that the most changes occur during round 1 and 2 (Woudenberg, 1991). As stated before, coherence was not the main objective of our study and we argue that finding divergent opinions should be perceived as an insightful finding as well (Häder & Häder, 1998). Beside this theoretical argument for terminating Delphi studies, practical considerations, such as the acceptance of the participants and their motivation, are at least as important (ibid.). Additional rounds run the risk of being perceived as useless by the panelists and result in high panel mortality if no new findings are generated. Given these considerations, the number of rounds was adjusted during the course of our study from initially three to two rounds.

The first questionnaire contained 25 questions with 182 items whereas the second questionnaire contained 18 questions with 184 items. Therefore, although the number of questions was consolidated from round one to round two, the qualitative questions of the first round generated rich findings whereby the number of items slightly increased.

The evaluation of the results was determined by the type of the questions. For quantitative questions graphical representations of the aggregated results were used which represented the median, the upper and lower quartile, and the maximum and minimum values. The median displays the middle value (50% of the responses are below that value) which is less prone to extreme deviations than the statistical average. The left and right margins of the graphic represent the lower quartile and the upper quartile respectively (i.e. 25% of the responses are below or above these values). The values between the lower and the upper quartile represented 50% of all given responses. The "whiskers" shown above and below the upper and lower quartile represent the minimum and maximum values. However, outliers that are more than 1.5 box lengths from the end of the box are excluded. Consequently, the smaller the range from the lower to the upper quartile and the smaller the whiskers the lower is the deviation among all responses. To sum up, the evaluation of quantitative responses not only represented the median and the upper and lower quartile but also extreme values.
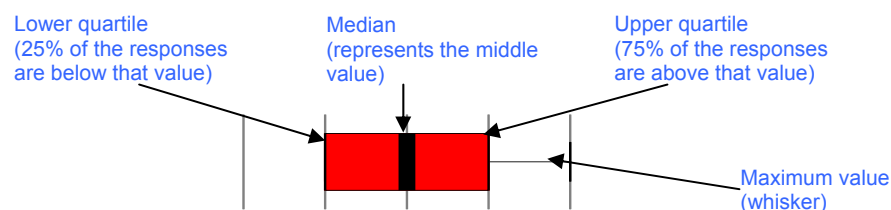
The graphical representation of the quantitative questions formed the feedback for each round. Therefore, each expert received a personalized questionnaire for the second round, containing the aggregated group responses and his/her personal response of round one. By doing so, it was ensured that the cognitive effort involved in answering the questions was reduced to a certain degree.

For those questions which required experts to rank items according to their importance, the average mean of experts' responses was calculated and the items were listed corresponding to their importance, with the most important items having the lowest average mean.

Experts were encouraged to rationalize their responses in the designated reasoning fields. The qualitative comments were quoted without any changes in the second round. Besides rationalizing their own decisions, displaying the aggregated reasoning of all panelists also helped to create a deeper contextual understanding of the questions. In the second round, experts could draw upon this information for reflecting upon their own decision and adjusting their opinion, if required. In the following, for practical reasons all qualitative responses are represented in a more aggregated form.

4   RESULTS

The results of the Delphi study are presented in four different sections. The first section attempts to tentatively position RTC as to find a common basis from which to proceed. Section two intends to take a more detailed look at RTC technology; in particularly, it discusses different forms and features of RTC and their future dissemination. Section three explicates driving forces and obstacles affecting the implementation of RTC and discusses measures for increasing the intra- and inter-organizational acceptance of RTC. The final section attempts to give an understanding of RTC-in-use, in that it explicates the implications RTC might have on the individual and organizational level. As depicted in Figure 5, circumscribing a broad range of areas, the scope of the Delphi study is rather ambitious which is intended as to function as both starting point for future research and also as instrument for practitioners to identify critical areas.
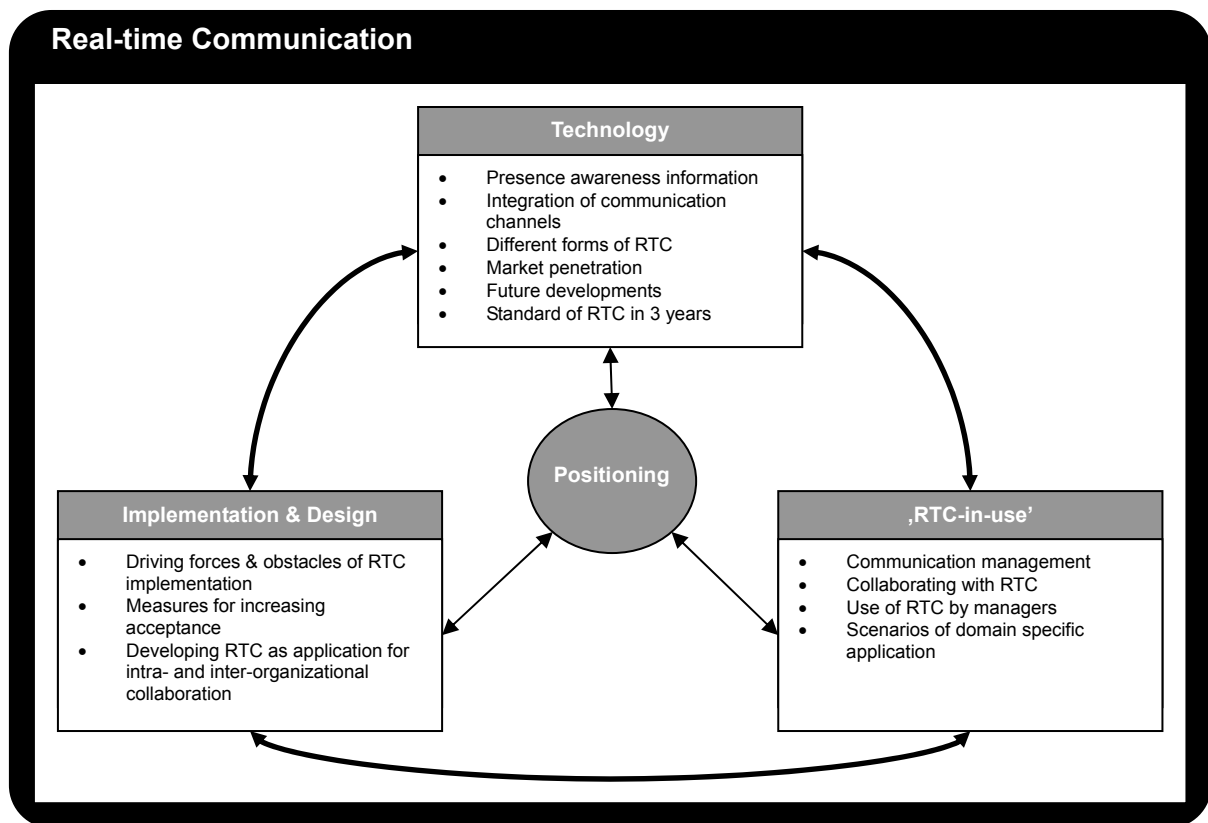
Real-time Communication

Technology
- Presence awareness information
- Integration of communication channels
- Different forms of RTC
- Market penetration
- Future developments
- Standard of RTC in 3 years

Positioning

Implementation & Design
- Driving forces & obstacles of RTC implementation
- Measures for increasing acceptance
- Developing RTC as application for intra- and inter-organizational collaboration

‚RTC-in-use'
- Communication management
- Collaborating with RTC
- Use of RTC by managers
- Scenarios of domain specific application

Figure 5: Structure of the Delphi study

4.1 Positioning of RTC

One of the central elements of the study is to find a common interpretation of RTC. Resulting from the convergence of the telecommunication market and market for groupware technology, RTC could be associated with either of the two strands. In addition, as current developments suggest, RTC may become within a few years an add-on to existing software application packages. The panel strongly agreed that RTC is, as one expert put it, "mainly a descendent of communication technology" which provides, as a "different form of telephony", an extension to the existing communication infrastructure. As Figure 6 shows, experts agreed less upon the other two statements. Some experts stated that RTC will or has already been integrated in groupware and will support collaboration. With additional functionalities such as VoIP, groupware moves from asynchronous to more synchronous forms of collaboration. Others argued that task support in groupware and RTC were significantly different or that RTC was at least not the "latest version" of groupware. Diverging comments were also given concerning RTC as an add-on to existing application packages, with some experts using it in this way while others perceived RTC rather as a stand-alone application.

Disagreeing with the exclusiveness of the questions, more nuanced interpretations were requested since positioning RTC in one area or another lacks to appreciate that RTC may span across several of the aforementioned areas. Such an approach may bring about a better understanding as it is not limited by existing interpretations, rather it appreciates that through

introducing new features, such as presence information, RTC is not a successor of existing ICT products but rather presents itself as a novel information and communication genre. A more careful interpretation is given by one expert who defines RTC "as a complementary functionality to groupware and application packages, integrated in user interface and other areas". However, as the broad majority of experts regards the extension of the existing communication infrastructure to be of paramount importance we extend the definition and conclude with the following tentative definition "RTC is defined as a complementary functionality to groupware, application packages and the communication infrastructure, integrated in user interfaces and other areas which might potentially bring about a qualitative shift of the whole information and communication landscape".
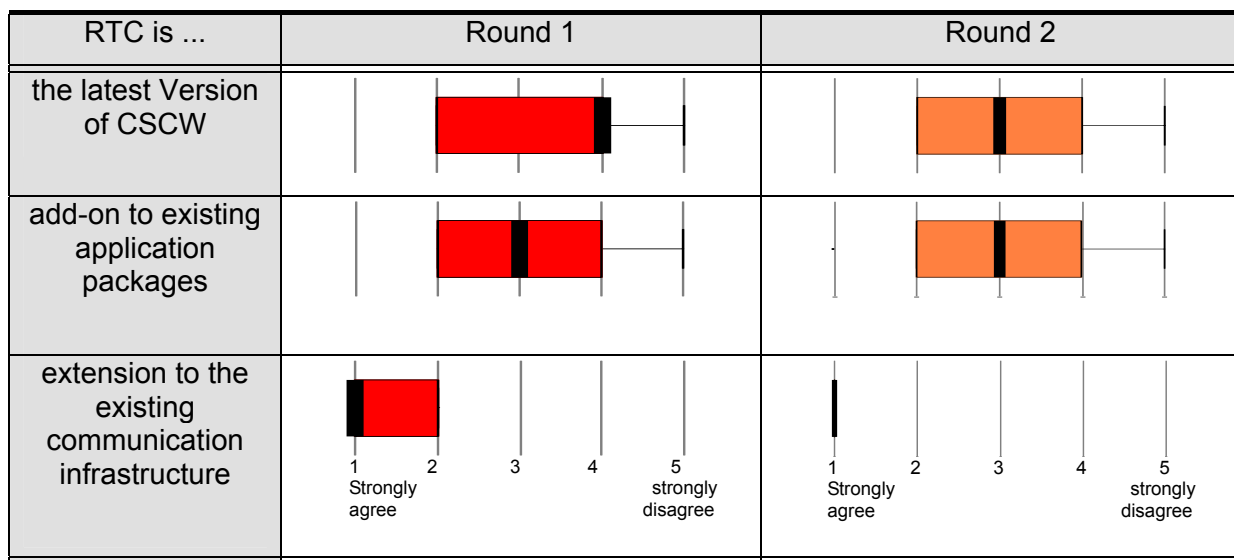
RTC is ...	Round 1	Round 2
the latest Version of CSCW		
add-on to existing application packages		
extension to the existing communication infrastructure		

Figure 6: Positioning of RTC

4.2 RTC Technology

Presence information is a central element of RTC systems with topicality and accuracy of information being crucial for facilitating efficient management of personal communication. Currently, five different types of tracking and updating presence information are imaginable, namely separate availability status for each device, availability based on user action, status setting on one device as deciding factor for all other devices, availability based on physical presence, and availability based on the electronic calendar. While the experts suggest that over the next 12 months separate availability statuses for each device will still be the predominant form of signaling availability, it will lose importance in the long run. Instead, forms which capitalize on the integration of communication channels, such as availability status based on electronic calendars or mobile phone settings determining the status on other devices, will gain prominence. In contrast, automatic signaling based on user actions such as keystrokes is not expected to be of major importance in the future, nor is the availability status which is based on physical presence.

	12 month	3 years	5 years
Separate availability status for different devices	2.75	3.00	3.25
Automatic signaling of availability based on user actions (e.g. keystrokes)	3.19	3.44	3.19
Status setting on mobile phone (e.g. "meeting") determines the status of all other devices	3.47	2.94	2.88
Availability status based on physical presence (e.g. determined by sensors or presence of mobile phone)	5.20	4.56	3.75
Availability status based on electronic calendar (e.g. based on Microsoft Outlook or PDA)	2.87	2.37	2.44

Table 5: Ranking of different forms of presence information

The integration of communication channels is a further crucial element of RTC systems, enabling rule-based management of incoming communication requests, collaborative real-time interaction on an ad-hoc basis, and signaling presence information across different devices. As to develop a unified messaging platform, integrating RTC into personal organizers (e.g. Microsoft Outlook) or mobile devices (e.g. mobile phone, PDA, Blackberry) are two feasible options. The former one is perceived by all experts as very important or at least important. Presence availability information integrated within personal organizers enables to determine people's status and to instantaneously start synchronous interactions. While this might be a valuable functionality for people located at their desk, RTC clients on mobile devices address the needs of today's mobile professionals whose work practices not only exhibit extensive geographical movements but also intense interaction with a wide range of people through both physical and virtual interaction (Masao; Kakihara & Sørensen, 2003). The experts almost concurrently suggest that RTC on mobile devices will be of high importance as "those people in need of RTC will be likely to not sit at one place all the time" and that "it will become even more important when WLAN coverage is [everywhere] available".
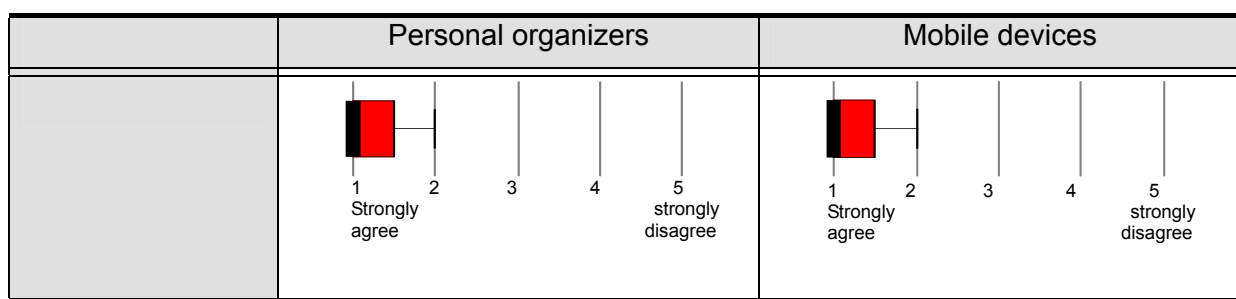
	Personal organizers	Mobile devices

Figure 7: Integration of RTC with personal organizers and mobile devices

However, a more cautious argument was put forward by one expert who indicated that although people might welcome automatic updates of presence information based on the personal calendar, such features almost naturally raise questions about control and surveillance which need to be addressed

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By integrating synchronous and asynchronous information and communication channels, RTC goes beyond existing groupware applications or classic telephony. Video/ audio conversations or conferences can be started on the fly without having to switching between stand-alone applications. Discussing if RTC could potentially replace classic telephony, experts completely agreed on the important role RTC will play for voice communication in the future. However, rather than completely substituting classic telephony experts propose that RTC will partially substitute telephony or even further diversify the communication landscape. While reliability may currently still speak in favor of classic telephony, lower costs coupled with higher transparency (presence information) may promote RTC in the long run. However, as "classic telephony is dying anyway & VoIP happens anyway behind classic telephony", the future role of the telephone as communication device remains to be seen.
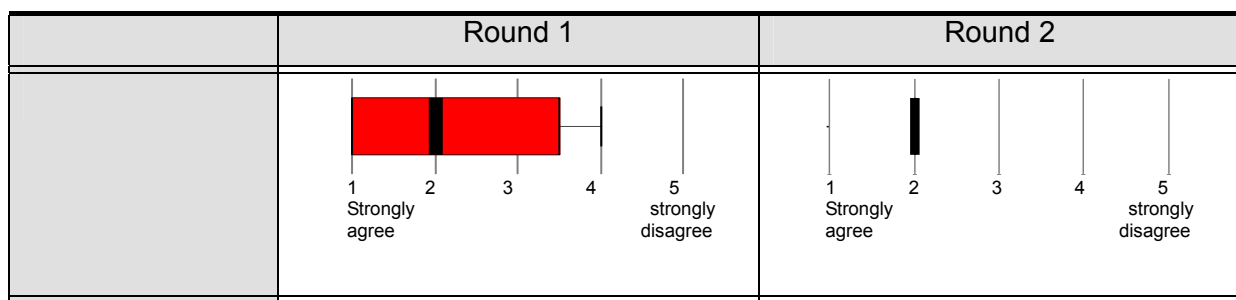
	Round 1	Round 2

Figure 8: RTC as substitute for classical telephony

The panelists were requested to assess the relative dissemination of four different forms of RTC systems, namely compact stand-alone applications, expansions of stand-alone applications, add-ons to existing products, and RTC as central module. Especially on the private customer market, compact, basic stand-alone applications such as Skype are still predominantly represented. Such compact solutions have currently an essential advantage over more complex applications in that they are easier to roll-out and implement. Based on the estimation of the experts, compact stand-alone applications will remain the most prevalent form of RTC over the next 12 month (70%). Although it is suggested that they are losing importance (50% in 3 years and 20% in 5 years), together with the group of extended versions of stand-alone applications they still represent the main form of RTC in five years time (the first two groups have 50% altogether). One expert argued that while in the early phases RTC companies have to establish themselves on the market by either stand-alone applications or central modules, integration will become more important in the future. This assumption is supported by the whole group of experts, which estimates that the relative importance of add-ons to existing products will increase from 10% (12 month) up to 30% in five years. However, the experts are rather skeptical about the potential role of RTC as a central module around which workflow is organized. This skepticism might be informed by the complexity attached to such projects. As one expert aptly remarks "I believe it's very challenging (not only technologically but also socially) to role out RTC as a central module therefore this development will take some time (…)".
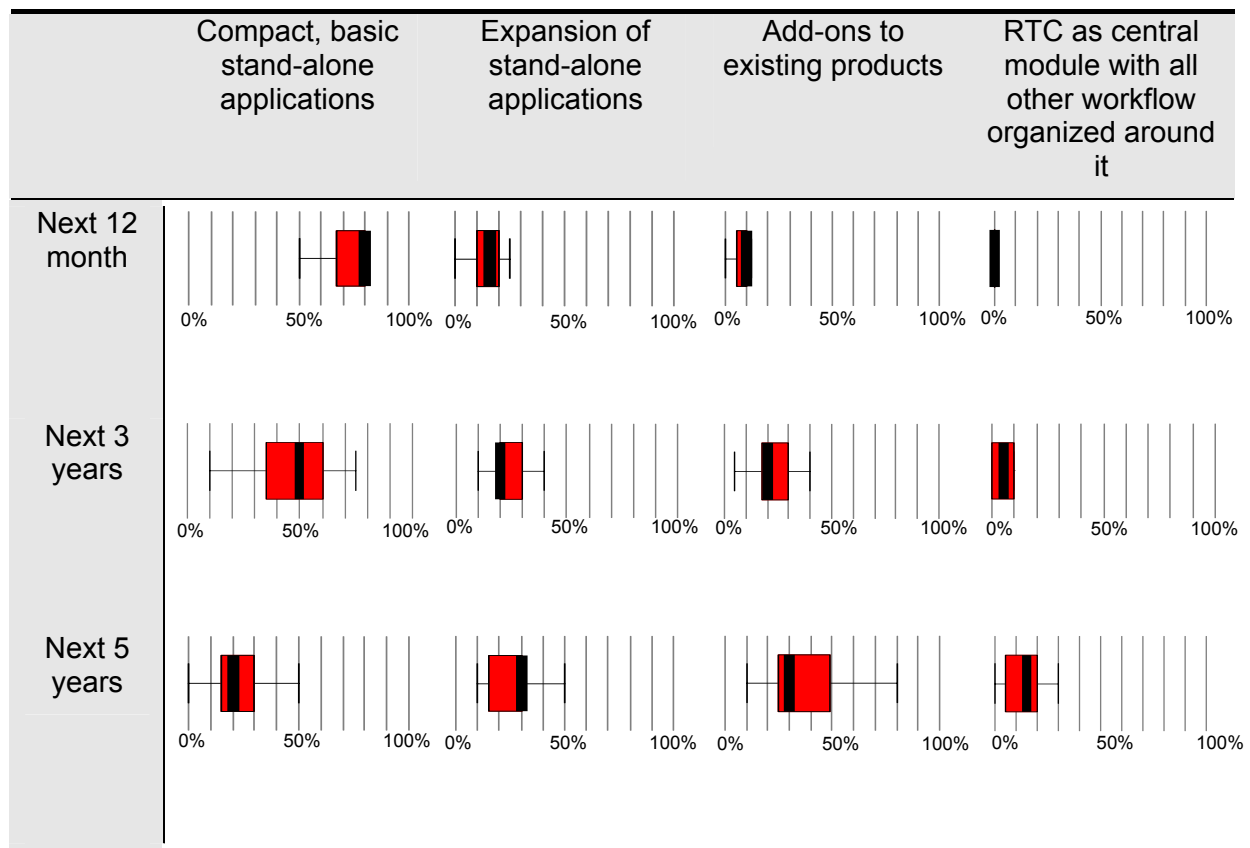
Figure 9: Relative dissemination of four different forms of RTC systems

While the aforementioned question discussed the relative importance of different forms of RTC systems, this question attempts to elucidate the penetration rate of RTC in different product markets, i.e. the share of RTC products in relation to the overall market of groupware products, enterprise resource planning systems and business packages. While the share of groupware products with RTC features is to be expected at 22.5% in 12 month time, experts suggest a steady increase over the next years resulting in a share of 62.5% and even 90% in three and five years. A similarly optimistic trend is forecasted for RTC as integral component of business packages, with market penetration increasing from 30% (12 month) to 85% (five years). However, the prospects for RTC as integral element of ERP systems are perceived by the experts to be rather low. While the panel agrees that RTC won't be integrated into ERP over the next 12 month (only 5%), market penetration will increase over time to 17.5% (3 years) and 37.5% (five years) respectively.
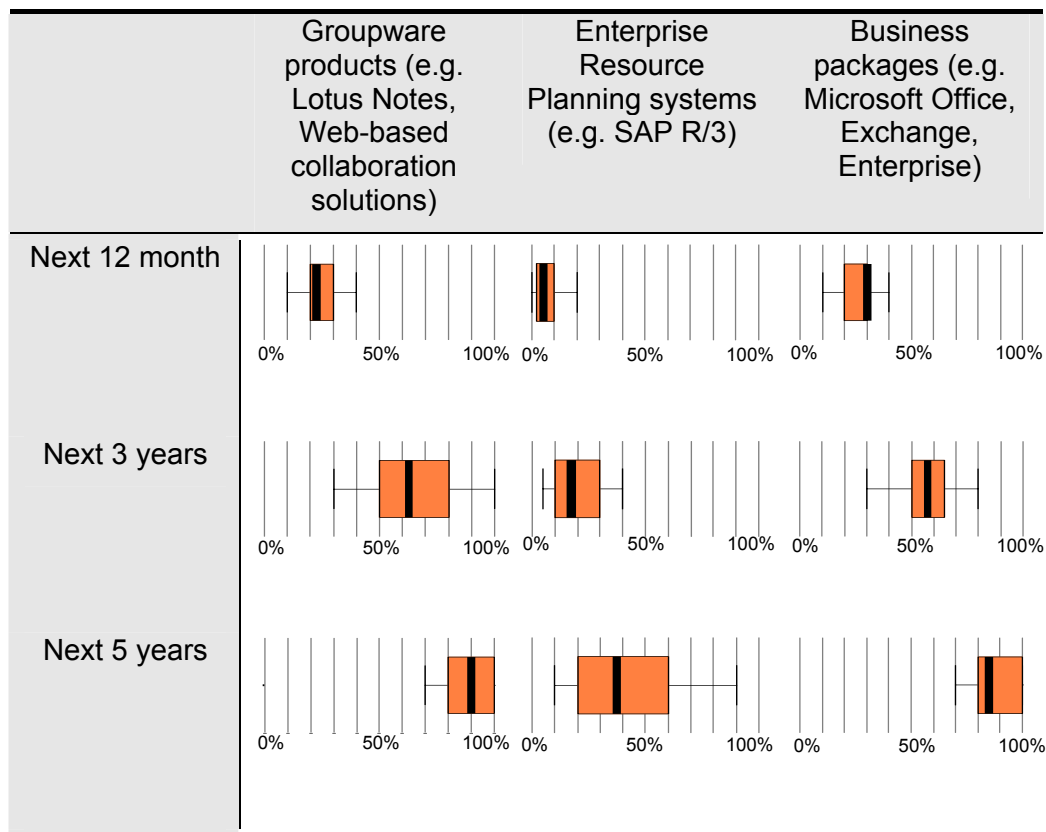
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	Groupware products (e.g. Lotus Notes, Web-based collaboration solutions)	Enterprise Resource Planning systems (e.g. SAP R/3)	Business packages (e.g. Microsoft Office, Exchange, Enterprise)
Next 12 month			
Next 3 years			
Next 5 years			

Table 6: Share of RTC products in relation to the respective product market

From different forms of RTC and their diffusion, the focus is now narrowed down as the panel was asked to determine and qualify those aspects on which the development of RTC will mainly concentrate. During the first round of the study, a broad range of items were collected and experts were asked in the second round to rank the five most important items for each time period. Based on these estimations, the average mean was calculated and the items were ranked accordingly. Table 7 contains for each time period the six most important items.

According to the experts, the development effort will only shift slightly over the next five years. The panel suggests that over the next 12 month, the major emphasis will be on improving the practicability of applications, with the main focus being on usability of existing services, presence information, rule-based communication management and the integration of media and services. Interestingly, communication management and integration of media and services are not listed under the top four aspects in the medium-range planning, potentially because the issues are expected to be resolved till then. On the other hand, security issues and quality of service standards gain importance. In five years, experts suggest that the extension of RTC to other services (e.g. mapping) will be the most important aspects. However, it is noteworthy that presence / location information and usability issues are always ranked under the top four aspects (highlighted in Table 7), which does not only signal the importance of the two issues but also the complexity ascribed to them.

	12 month	3 years	5 years
Security	4.2143	4.1429	4.6429
Usability	2.9286	3.6429	4.2857
Communication management	3.7143	4.7143	5.0000
Quality of service standards	4.2143	4.5714	4.9286
Presence/ location awareness	3.3571	4.3571	4.3571
Integration of media or services	4.1429	4.7143	-
Extension to other services (e.g. mapping)	-	-	4.0714

Table 7: Features and aspects on which the development of RTC will concentrate in the future

As to determine the quasi standard of RTC applications, experts were asked in the first round to name three must features of RTC in three years time and to rank the five most important features in the second round. Combining and matching this question with the previous one therefore not only shows which aspects will potentially be developed over the next years but also which of those features are expected to become a standard feature. The first three listed issues re-emphasize and specify the importance of usability. Integrating devices enables users to experience a unified communication landscape as it allows them to seamlessly switch between devices and channels. "Intuitive contact, status handling and permission management" and "automatic status recognition" are also related to usability aspects. The former aspect corresponds with experts arguing that communication management will be a top issue on which the development of RTC will concentrate. However, as it is not found any longer on experts' long-term agenda (see Table 8), it might strengthen

'Must' features of RTC	Mean
Integration of devices	2.3846
Intuitive contact, status handling and permission management	2.7692
Automatic status recognition	3.8571
Quality of Service equal or better than phone to VoIP	4.0714
Spam protection	4.1429
Integration in existing business applications	4.2857
Location awareness	4.9286

Table 8: 'Must' features of RTC in three years time

the assumption that it will be a 'must' feature in three years time. Automatic status recognition, a form of presence information, is expected to be an integral component of RTC in three years time. Quality of services is ranked fourth, re-emphasizing the importance of reliability if RTC is supposed to partially substitute classic telephony. Spam protection is

ranked fifth; however, as panelists do not perceive it to be an issue that will be extensively developed, existing solutions might already give sufficient support. The integration of RTC in existing business application was already discussed above.

4.3   RTC Implementation and Design

In this section, the panel was requested to discuss a broad range of aspects in the area of implementation and design. The first question referred to the driving forces for the use of RTC. 'Increasing the productivity of distributed teams' is ranked first followed by 'cost advantage of VoIP' which remains a key driver for both small and large organizations. It is argued that cost savings are not only materialized through reduced telephone costs but also lower travel expanses. 'Supporting mobile or telework' is ranked third and the communication crises, which is often mentioned as main argument for the development of RTC is only ranked fifth. Experts believe that following market trends and experimenting with new technology will only play a minor role as driving factors. In addition, company size was mentioned several times as crucial variable influencing the priority given to the different factors mentioned before. For example, one expert argued that while big companies perceive productivity as the main argument, small companies would be rather convinced by the cost advantages of VoIP.

	Mean
Increasing the productivity of distributed teams	2.4667
Cost advantages of VoIP	2.5333
Supporting mobile or telework	2.7333
The communication crisis of managers	3.4000
Following market trends	4.8000
Experimenting with new technologies	5.0000

Table 9: Driving forces for the use of RTC

Experts were then asked to rank what they perceive are the main obstacles for the adoption of RTC within organizations. A lack of conviction that RTC will yield a positive return-on-investment (ROI) is ranked as the most important issue. This answer is quite remarkable as increased productivity and support for teleworkers were named at the same time as two central driving forces for the implementation of RTC. The following comment given by one expert is quoted as one potential explanation for the apparent contradiction: "the main reason [i.e. obstacle] for me is [managers'] insufficient understanding of the potential business benefits and valuing a more, agile organization". That is, managers need to be persuaded of RTC's potential role in facilitating innovative forms of organizing. 'Lower priority compared with other projects' is ranked second, followed by security concerns, uncertainty concerning technological standards, lack of business cases and the complexity of the implementation

project. Emphasizing the complexity of RTC implementation one expert vividly mentioned "Perhaps I am jaded by the repeated demonstration of UK organizations not being able to introduce large and complex IS - RTC are complex and thus require thought and I wonder whether many organizations are capable of introducing them as swiftly as they would like". Finally, budget restrictions are not seen as major hindrance by most of the experts.

	Mean
Not convinced that RTC would yield a positive Return-on-Investment (RoI)	2.5714
Relative low priority compared with other projects	3.5333
Security concerns	4.4667
Uncertainty concerning the development of technological standards	4.6667
No solid business cases for RTC initiatives	4.7333
Complexity of the necessary information and communication systems integration	5.0000
Complexity of the potential implementation project	5.4000

Table 10: Obstacles for the adoption of RTC within organizations

Asked about the factors that do (or might) impede organizations to utilize RTC to its full potential, social issues were by far the most important aspects. First, expert raised concerns that the existing work practices within organizations will constrain the use of RTC. Partly related to this issue, users might emotionally reject RTC as they fear privacy/ control issues, loss of power, or a threat to their positioning within the firm. However, one panelist mentioned that while privacy issues "are always a problem in the beginning, the interpretation of technology as a threat can change over time". Another expert remarked "control will be a problem, especially if management begins to use RTC to discipline staff". The third aspect addresses the concern that RTC might not come up to its full potential if it is not properly integrated within the organizational context. However, the notion of organizational context is here an ambiguous term which was not further specified. Context can either stand for formalized organizational processes or the broader socio-cultural environment of an organization. As one expert suggests "The base technology is there, but is far from effectively integrated in organizational context. Management practices do not yet understand the issues and know how to productively deal with them." Finally, top-management support or security concerns are not interpreted as major issues.

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	Mean
Existing work practices not compatible with RTC	1.9286
Potential users reject RTC emotionally (e.g. privacy/ control issues)	2.0714
RTC is not properly integrated within the organizational context	2.6429
RTC is not properly integrated within the existing technical infrastructure	4.214
Lack of top-management support	4.9286
Security concerns	4.9286

Table 11: Factors impeding the adoption and diffusion of RTC

To increase the acceptance of RTC in organizations, management has to play a central role. A controlled, top-down oriented management style, training users how to use RTC efficiently, encouraging users to continuously adapt RTC to their needs and tightly integrating RTC in work process are all areas where experts believe management input is required. However, it is suggested that although top-management supporting RTC would be a facilitator, it is rather unlikely to be on their agenda. Panelists are less convinced by the potential of democratic/ consensus driven management styles to overcome resistance nor seems a laissez-faire policy which leaves it to the users how to adopt and appropriate RTC a promising approach. However one panelist disagrees with the outlook of most experts and argues that "RTC is often a change in personal work practices towards empowerment, lateral organization, etc. Therefore a 'pushy' implementation does not help much, rather management changing their work, e.g. be only reachable through RTC, is a better driver." Although written guidelines might not be a push factor in itself, one expert remarks that the process of engaging with RTC while writing such guidelines is an informative learning process that could foster the use of RTC. In addition to the listed aspects, one expert mentioned that network effects are having an effect on the dissemination of RTC. The more a technology is used the higher the utility of the technology for its users. Therefore, it is argued, RTC should be adopted on a group level. "Small groups of people working at different places can increase their own efficiency and thus convince other groups to also adopt RTC. Smaller rollout groups could help avoid acceptance problems".
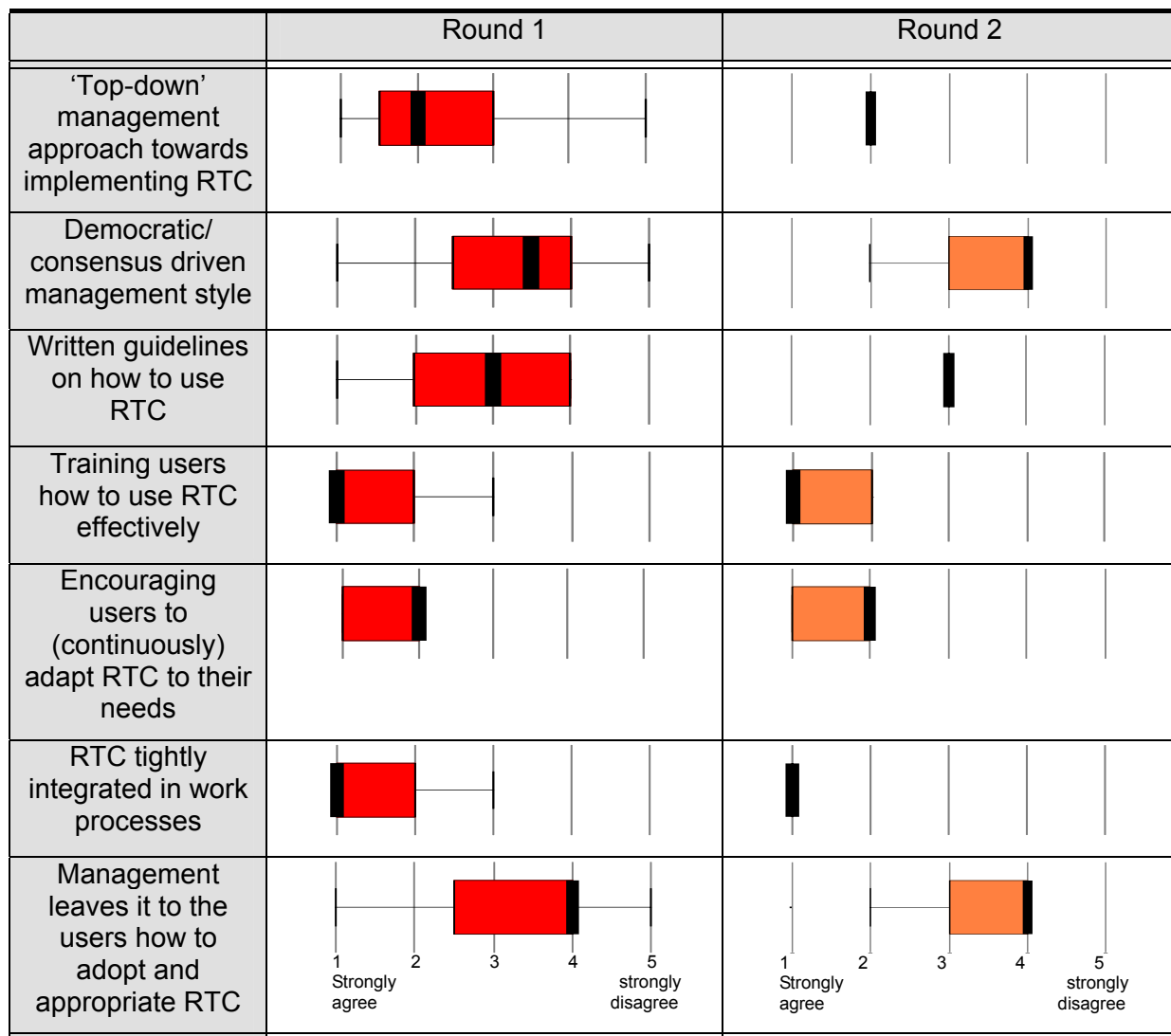
	Round 1	Round 2
'Top-down' management approach towards implementing RTC		
Democratic/consensus driven management style		
Written guidelines on how to use RTC		
Training users how to use RTC effectively		
Encouraging users to (continuously) adapt RTC to their needs		
RTC tightly integrated in work processes		
Management leaves it to the users how to adopt and appropriate RTC	1 Strongly agree 2 3 4 5 strongly disagree	1 Strongly agree 2 3 4 5 strongly disagree

Table 12: Measures for increasing the acceptance of RTC within organizations

Asked to forecast what needs to be done to make RTC more attractive for intra-organizational collaboration usability is ranked first. As to be beneficial for users, the cognitive effort experienced in using RTC needs to be low. Furthermore, early adopters require support as to manage the organizational and cultural changes which accompany the introduction of RTC. Again, management is mentioned as crucial factor for increasing the acceptance of RTC. Domain specific applications, which were already discussed above, are ranked fourth, followed by two technological issues, namely security concerns and interoperability. Finally, it was mentioned that clear business cases which outline the potential use of RTC could increase the acceptance and understanding of RTC.

Collaboration across organizational boundaries poses additional challenges compared to intra-organizational collaboration because of different technological infrastructures, varying organizational processes, cultures, and business objectives. Standards for interoperable platforms and communication media (ranked first) are required to enable inter-organizational collaboration across different technological platforms. Overcoming proprietary standards is a prerequisite for enabling closely integrated standard business processes (ranked 2nd).

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	Mean
Low effort for the user	2.7143
Supporting early adopters in the organizational and cultural change management	3.2857
Management support through leading by example	3.9286
Task specific application	4.2857
Resolve security issues	4.4286
Interoperability	4.4286
Clear business case	4.8571

Table 13: Measures to increase the attractiveness for intra-organizational collaboration

Further technological aspects that need to be addressed are quality of service and security aspects. In inter-organizational settings, protecting confidential information and controlling the visibility of intra-organizational activities to external parties is crucial. Closely related to this aspect is a better privacy control (i.e. which activities shall be visible? for whom shall a person be accessible?). Proven business cases might be required to showcase to partners alternative and novel RTC enabled approaches of organizing.

	Mean
Standards (for interoperable platforms, communication media, information exchange)	1.8571
Integration in standard business processes	3.7857
Quality of Service	4.0714
Security aspects	4.0714
Better privacy control	4.3571
Proven business cases	4.6429
Integration into corporate message	4.7857

Table 14: Measures for making RTC more attractive for inter-organizational collaboration

The final question of the section addressed factors that could potentially prevent RTC from playing a crucial role in the information and communication infrastructure of the future. Again, usability issues was named as the most crucial aspect that RTC providers need to address. Furthermore, in order to be compatible with legacy systems and inter-organizational information systems, standards need to be developed. Unintended consequences (e.g. interaction overload and surging communication volume) brought about by RTC might also be a drawback for RTC. Managers and users have to be persuaded and convinced of the potential benefits of RTC in order to achieve a high level of utilization within the group of

potential users. Convincing business (go to market) models function as an important instrument to impart the potential benefits of RTC. Users and managers often interpret novel technologies with existing technological frames[1]. However, if technologies are sufficiently different, technological frames need to be modified as to reap the full potential of the technology. Orlikowski (1992) proposes two measures for augmenting technological frames, namely, first communicating about the product, and, second, training people in an appropriate way. Discussing business cases could be an alternative medium which might be used as a sense-making instrument within and across organizational boundaries.

	Mean
Usability issues	3.2143
No standards for interoperability	3.2857
Security issues	3.9286
Lack of acceptance by managers and users	4.0000
Increasing interaction overload due to surging communication	4.2857
Critical mass of users	4.6429
Reliability issues	4.7857
No convincing business (go to market) models	4.9286

Table 15: Factors that could prevent RTC from playing an important role in the RTC infrastructure of the future

4.4 Real-time Communication in use

Implications of RTC on the Individual Level

Due to the emerging communication and coordination intensive forms of organizing and the proliferation of information and communication devices and infrastructures, today's professionals need to manage and control their communication behavior and devices carefully. While knowledge workers need instant access to information without any big delay, those professionals whose skills are in high demand have to cope with frequent interruptions. It is suggested that while current technologies such as the mobile phone decrease communication delays for the initiators, they often translate into interruption on the part of the recipient (Rennecker & Godwin, 2005). As to avoid constant availability and interruptions, people may employ tactics, such as not answering the telephone, working away from one's desk, or switching the presence information to "away" or "busy". However, rule-based forwarding of communication requests and self-service portals as offered by RTC might balance the partly conflicting demands of initiators and recipients.

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[1] Technological frame is here understood as people's "assumptions, expectations, and knowledge they use

Asked about RTC's potential to provide initiators with a tool to access time critical information, experts are convinced that RTC might help people to reduce delays by swiftly accessing information providers. On the other hand, experts are slightly more skeptical about RTC's potential to manage interruptions (60% of the experts strongly agree or agree), and to help both initiators and recipients to the same extent to deal with an increased communication volume (66.7% of the experts strongly agree or agree). One expert remarked that although RTC might lead to higher efficiency, it won't change managers' predisposition towards communication. Panelists richly substantiated their critical evaluation with several comments. First, as one expert argued RTC will generate more communication volume as "some topics, you otherwise would not discuss are facilitated by RTC (…) i.e. the more possibilities the more communication. This does not mean that the communication gets 'richer'". Second, it is pointed out that in co-located settings, users might circumvent filtering mechanisms of RTC just by popping up at someone's desk. Third, current technological solutions for managing communication events are not sufficient. Fourth, one panelist points out that interruptions in form of outeraction (Nardi et al., 2000) are needed to negotiate availability. RTC therefore needs to authorize forms of interruptions for negotiating availability. Fifth, it is questioned whether RTC applications will be handled by all users in a way that will ensure the envisaged results. "Organizational issues which are much more important than the technology in the success of the whole information system" therefore need to be taken into account. Finally, as aptly summarized by several panelists, RTC - like any other technology - is a double-edged sword; depending on the organizational aspects mentioned before it can either help users to manage interaction but also result in increased visibility, accessibility and interruptions. Later on, some of the conditions fostering beneficial outcomes of RTC initiatives are discussed in more detail.
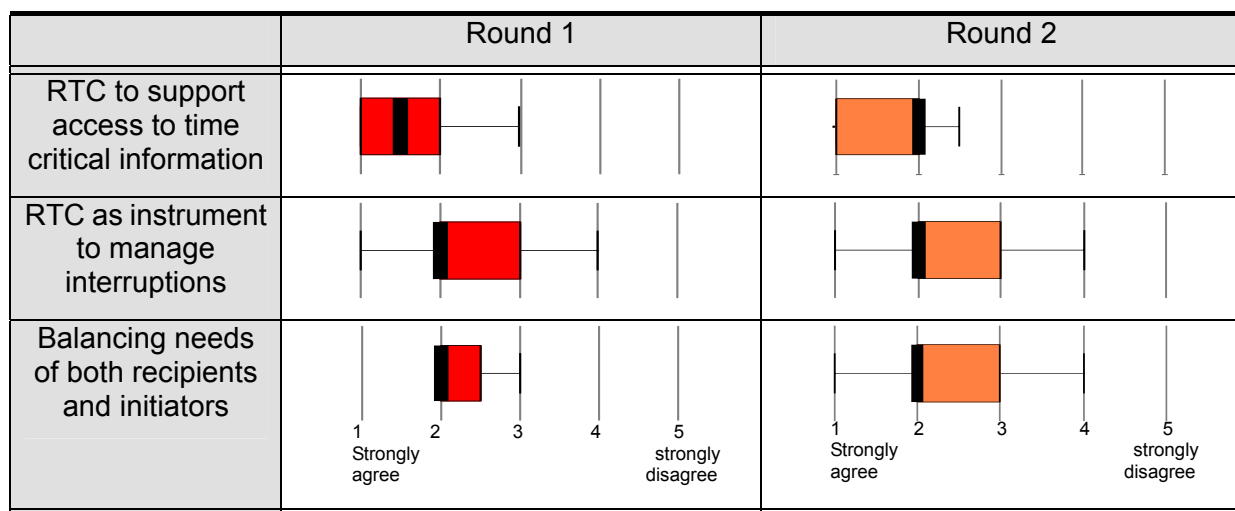
	Round 1	Round 2
RTC to support access to time critical information		
RTC as instrument to manage interruptions		
Balancing needs of both recipients and initiators	1 Strongly agree 2 3 4 5 strongly disagree	1 Strongly agree 2 3 4 5 strongly disagree

Table 16: Potential of RTC to manage delays and interruptions

With the intensification of globalization, enabling the transmission of verbal and non-verbal information and the extension of organizations across time and space (cf. Giddens, 2003), virtual forms of organization have become ubiquitous. However, dispersed forms of

to understand technology in organizations" (Orlikowski & Gash, 1994).

organizing pose new challenges such as a lack of mutual awareness (cf. Gutwin & Greenberg, 2002), exclusion of the core community (cf. Sahay, 1997), or simply the shortcoming to facilitate collaboration (Claudio; Ciborra & Patriotta, 1996; Claudio; Ciborra & Suetens, 1996; Orlikowski, 1992).

Asked to assess the claim that RTC has the potential to support geographically dispersed collaboration, 93.3% of the panelist strongly agreed or agreed. Presence information which signals team members' availability was explicitly mentioned as one factor that might facilitate virtual collaboration. However, with a view to delays, interruptions and communication volume, one expert remarked that while RTC may facilitate dispersed work, it will be achieved at the cost of interruptions. Others argue that whether RTC adds or reduces complexity will depend on the individual and team routines. Finally, one panelist maintained that as not to actually increase the complexity by adding another channel, RTC has to be properly integrated in the existing ICT infrastructure.

	Round 1	Round 2
	1 Strongly agree 2 3 4 5 strongly disagree	1 Strongly agree 2 3 4 5 strongly disagree
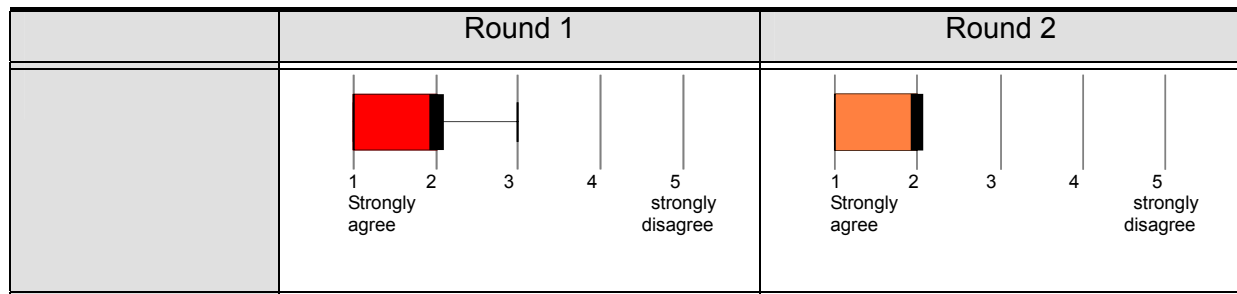
Table 17: Potential of RTC to support geographically dispersed collaboration

The concept of the virtual organization is often portrayed as "all star teams" (Goldman, Nagel, & Preiss, 1995), i.e. a collaboration of experts, who only spent part of their time on the joint project, and whose efficiency crucially relies on the ability and willingness to share or pool their expertise and to coordinate their efforts. As the selection and recruitment of team members is more and more based on people's expertise and capabilities rather than local availability, work among people with diverse social, cultural and professional backgrounds is almost commonplace (cf. Kock, 2000; Konradt & Hertel, 2002; O'Hara-Devereaux & Johansen, 1994).

Experts are cautiously optimistic (60% agreement) that RTC can have positive implications in these settings. It is argued, that e-mails are especially prone to misunderstandings in diverse settings where fast clarification is needed in order to resolve conflicts at an as early stage as possible. RTC is perceived as a potential application that enables fast intervention as to deescalate (potential) conflicts.

As to ensure that RTC lives up to its high expectations, rules and norms were identified by the experts who are needed to ensure proper use. Norms should for example be developed concerning the presence information; that is when is it appropriate to interrupt someone although his/her presence information signals 'do not disturb'. Senior management should take the lead through frequently using rules in well known circumstances and new employees

should be introduced to these rules from the outset. What all these aspects refer to is the need for social protocols that underpin forms of RTC-mediated interaction.

More pessimistic voices were brought to the fore by others who remarked that communication behavior depends on an understanding of cultural backdrops which can not be overcome via formal rules or norms. Face-to-face meetings and phone calls will still be needed as to resolve discontent within groups. In addition, the acceptance of RTC might depend on the professional background with software developers, for instance, being more willing to use RTC for collaborating with colleagues than professional groups which show generally a more averse aptitude to technology.

	Round 1	Round 2
	1 Strongly agree 2 3 4 5 strongly disagree	1 Strongly agree 2 3 4 5 strongly disagree
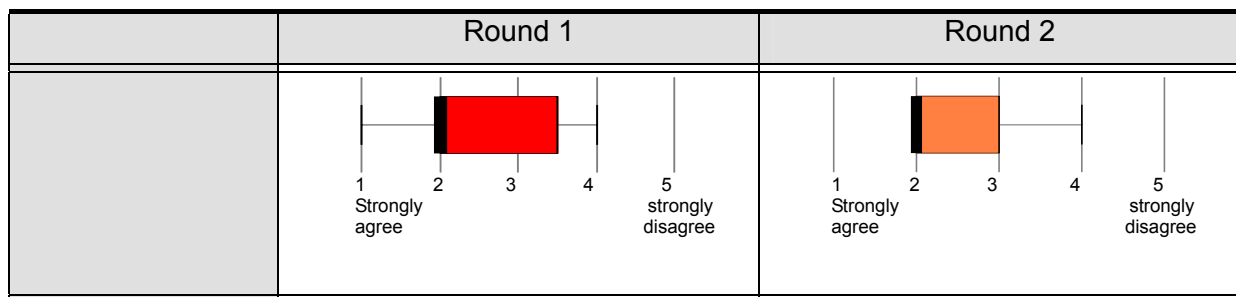
Table 18: Potential of RTC to support work among people with different social, cultural or professional backgrounds

Intended to discuss the consequences of RTC on individual's work practices, the next question addressed aspects such as coordination, networking, inclusion and distraction and the support of geographically dispersed forms of collaboration.

Experts unanimously believed RTC to be an effective instrument for managers to coordinate subordinates. RTC might also bring about a change in management practices form a top-down oriented approach to lateral coordination. However, RTC may not substitute face-to-face meetings which will further be needed to efficiently coordinate work.

92.9% of the experts were convinced that RTC will be an efficient and productive way for employees to maintain work related contacts. Presence information is again mentioned to be crucial in dispersed settings for maintaining and facilitating mutual awareness. Although 50% of the panel argue that RTC might nurture a feeling of inclusion in dispersed forms of collaboration (21,4% strongly agree and 28,6% agree with the claim), the given comments show a much more nuanced interpretation of the issue. Generally, experts questioned the capability of technology to achieve this objective. Rather, depending on the organizational context, RTC can result in a situation of inclusion and trust but also surveillance, control and mistrust. Consequently, community building efforts were suggested to achieve the intended goals.

Concerns were raised at several occasions that rather than helping professionals to manage their communication events, RTC may unintentionally increase the communication volume and cause even more interruptions. And indeed, experts tended to agree with the claim that RTC might cause even more distractions. References were made to instant messaging which, as it was argued, causes distraction and disturbances through splitting

phases of undisturbed work into ever smaller pieces. However, as one expert remarked, this might only initially be the case and could fade off after the fascination of RTC is gone. In addition, presence information was again mentioned as helpful instrument against distraction.

	Round 1	Round 2
Efficient way for managers to coordinate subordinates		- Not included in round 2 -
… be an efficient and productive way for employees to stay in touch with their peers (work-related contacts)?		
… give dispersed members of the organization (e.g. mobile or teleworkers) a stronger feeling of 'inclusion'?		
… distract people from their work?	1 Strongly agree 2 3 4 5 strongly disagree	1 Strongly agree 2 3 4 5 strongly disagree

Table 19: RTC influencing specific aspects of people's work practices

Finally, the focus is narrowed down to specifically concentrate on the group of managers. Characterized by communication and coordination intensive work practices, managers were selected as reference group for those professionals who could benefit from the introduction of RTC.

Over the next ten years, the panel expects managers to increasingly use RTC. While it is forecasted that in 2 years time, 20% of the managers will use the technology, the share will increase to 42.5% (five years) till it reaches 80% in ten years time. The top-management and 'some dinosaurs' are identified as groups which might resist using RTC. However, most experts believe that in 10 years time, RTC will be like email a standard component of everybody's communication infrastructure.

	Round 1	Round 2
2 years		
5 years		
10 years		
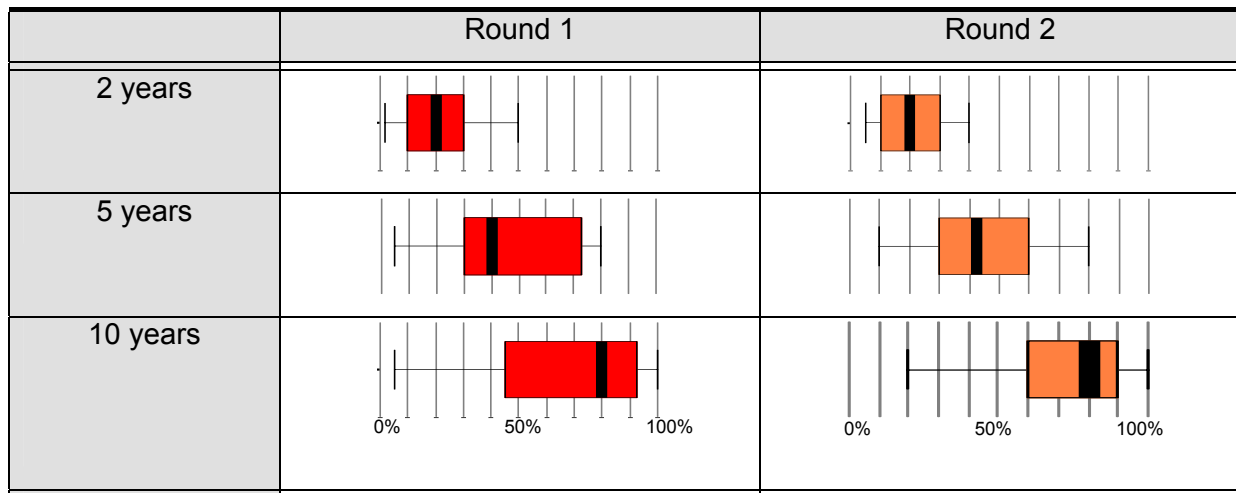
Table 20: Diffusion of RTC within the manager cohort

Asked to rank the features of RTC applications that will be of major importance for managers in three years time, 'presence information' of the information holder (first rank), and the managers themselves (ranked second) are the two front-runners. One expert explicitly emphasized that presence information is by far the most important aspect on the list by stating that "the key benefit for managers it to know when they can talk to one another (scheduling is also important but can be done with other media) furthermore they are able to decrease their own availability (…)".

	Mean
Availability information of communication partners	2.3077
Signaling of own availability and preferred communication channel(s)	3.0714
Voice-, web-, videoconferencing on the fly	3.0769
VoIP services	4.2857
Service portals that allow people to schedule appointments or access documents	4.3571
Busy signals cover all channels	4.5714
Rule-based, automatic forwarding of calls	4.6429

Table 21: Most important features for managers in three years time

Not only does the aforementioned point underline how important mutual awareness is for managers as to maintain fluid work but it also suggest the need to deal with and manage continuous interruptions and delays. Service portals that allow managers to schedule appointments or access documents, busy signals which cover all channels, and rule-based

automatic forwarding of calls are also listed which all address similar objectives. While it can be argued that the latter two aspects mainly help recipients to cope with their communication volume, service portals offer initiators support to close their tasks.

While the aforementioned question was specifically designed to concentrate on RTC features, the items of this question derived from a qualitative round and discuss more broadly important features and aspects of RTC. Usability is once again ranked as the most important factor. The next items can be broadly subsumed under the label accessibility, namely connectivity, availability, conferencing on the fly, unified communication and mobility. In order to be available and instantaneously communicate if required, managers need constant access (always on). In addition, RTC applications need to take account of managers' geographical mobility. Integration with the existing information and communication infrastructure is vital as not to just add another communication channel and further increase the already existing complexity.

	Mean
Usability	2.4286
Connectivity (always on)	3.5000
Availability (location information, context on mobile devices; individual access rights to show information; automatic status management)	3.8571
Unified communication (everything on one device; choose preferred communication channel or device)	4.2143
Receive information of business partners to the right time in the right manner	4.9286
Reliability	4.5714
Mobility	3.6429
Conferencing on the fly (semi-autonomous; automatic scheduling of conferences)	4.9286
Spam protection	5.1429

Table 22: Features and aspects of RTC that will be of major importance for managers in three years time

Organizational Level

After discussing the implications of RTC on the individual level, this section focuses on the organizational level; in particularly on the effects of RTC on the intra-and inter-organizational environment. Although scholars and practitioners have aimed at facilitating collaboration and

knowledge exchange between colleagues, empirical findings of the groupware literature show that it is far from being a straightforward and easily achievable goal (Karsten, 1999).

The experiences gained with groupware are well reflected in experts' opinions. While optimistic about the potential of RTC to strengthen the knowledge exchange within organizations (71.4% agreement), experts specified in their responses that technology alone will not be enough for facilitating knowledge exchange. RTC should rather be understood as an 'enabler' and issues such as social protocols, organizational culture or appropriate strategies are at least equally important.

Potential of RTC to	Round 1	Round 2
… strengthen the knowledge exchange within the organization?		
… bring about a positive change in the culture and climate of organizations		
… … improve the effectiveness of knowledge management		
… lead to a culture of surveillance and control?		
… lead to more spontaneous forms of collaborating?		
… improves the mutual understanding between team members?	1 Strongly agree 2 3 4 5 strongly disagree	1 Strongly agree 2 3 4 5 strongly disagree

Table 23: Implications of RTC on various organizational issues

Being aware of the important role of socio-cultural factors for the enactment of RTC, panelists were less convinced that RTC could at the same time affect the organizational culture (median of experts is rather undecided). Rather, it was understood that the organizational culture is part of the social dimension and technology has no bearing on conflict management or individual's attitudes. Novel forms of knowledge management (e.g. experts providing background information if and when needed) strongly depend on a culture of openness, cohesion and benevolence. Again, as social and organizational issues are said to

play the pre-dominant role, it is less surprising that panelists were skeptical about RTC as facilitator for new forms of knowledge management (median of experts is undecided). In addition, it was noted that with an increase of the communication volume brought about by RTC, documentation and knowledge management might even become worse. People may instead apply evasive tactics, such as the 'do not disturb' status, as to circumvent interruptions.

Panelists do not support the claim that RTC leads to a culture of surveillance and control. Although management might feel tempted to use RTC in this way the organizational context and rules might prevent RTC from being used as surveillance instrument.

Starting conferences on the fly or contacting others instantaneously on an as needed basis are only two features of RTC, potentially leading to more spontaneous forms of collaboration. Experts are confident that RTC will have such implications within organizations, with 85.7% of the panelists supporting this claim.

However, this does not consequentially result in a better understanding between colleagues. Rather, how RTC will be enacted in organizations will be strongly influenced by other factors, such as team size or prior working experiences.

Domain Specific Applications of RTC

The organizational context was mentioned time and again as influential factor for the enactment of RTC. In this section, the Delphi study attempts to, first, identify promising fields for the application of RTC, and, second, specify the need for specialized RTC services. The scenarios were selected based on different characteristics along the geographical, contextual, and temporal dimension. The term context is used here to describe whether people share mutual knowledge and common interpretations. The time dimension describes either time critical situations in which individuals need instantaneously access to information or people, or settings with less pressing time demands. Finally, geographic mobility captures different forms of mobility such as wandering (within one location), visiting, or traveling (cf. Kristoffersen & Ljungberg, 1999).

Although for all of the selected scenarios experts assumed a positive trend over the next couple of years, they suggested that in some sectors RTC will show a steeper incline than in others. In the health care sector, especially hospitals, the availability of time critical information can have life-determining importance (for a more detailed description of the health care sector scenario, see Riemer, Arendt, & Wulf, 2005). This applies for example to information in the patients' records and to background information regarding laboratory files. Given that an increasing number of hospitals use electronic patient records today, an integration of these hospital information systems with real time communication functions may prove beneficial. In such a system the presence information of authors of laboratory files and patient records may indicate their availability for urgent inquiries by the doctor on duty. Through such RTC features, the doctor may be able, in cases of emergency, to get immediately in contact with specialists and laboratory assistants in order to access background information about the patient or to

consult with his colleagues. The hospital context is therefore characterized by time-critical information with specialists and nurses who frequently move around within the building. However, for different reasons the panelists are skeptical that RTC will play an influential role in the hospital setting. Experts named the following decisive factors: the healthcare sector [in Germany] is a slow adopter; the bad record of the UK health sector with implementing large IT projects; budget restrictions; and problems with existing IS which need to be sorted out first (e.g. digital records).

With internet-based services such as e-banking, e-CRM or outsourcing, the financial sector strongly depends on ICT in mediating key business practices (cf. Madan, Sørensen, & Scott, 2003). With financial analysts requiring instantaneous access to information providers, RTC might present itself as a supportive application. And indeed, experts strongly agreed that although RTC won't be used over the next 12 month, it is expected that specific applications will be developed and applied within the financial sector over the next 5 years. They argued that even today the financial service sector is much more used to similar services and analysts should be thankful for solutions that enable swift feedback.

Mobile workers, characterized by high geographical mobility, (potentially) time critical tasks, and interaction with a large amount of people from different backgrounds is one of the groups experts believe will capitalize on the introduction of RTC. The large majority of the panelist strongly agrees (86.7%) that in five years time, specialized solutions will be available for this market segment which will support distributed companies and their mobile knowledge workers.

Less agreement was achieved in relation to the construction sector. Some experts described scenarios where "workers, architects and suppliers of building materials in large construction projects use RTC in order to clarify information and manage inter-organizational project work" or where RTC is seen as "being very useful for architects/ civil engineers etc". Others described the sector as a quite conservative industry. In the end, experts do not agree that any specialized solution will be available for the construction sector in the short and medium term and they are only cautiously optimistic that RTC will be represented in the construction sector in the long run.

Unlike mobile professional, experts suggest that no specialized services will be available for software developers in the foreseeable future. Although the median shifts from disagree (12 month) to agree (5 years), with 35.7% a still large percentage of the panel remains undecided concerning the application of RTC within this setting.

A similar pattern can be reported for specialized application in a mobile private setting. While no applications will be available in the near future, experts expect a spill over from professional work applications which will then be adapted to the private setting.

The characteristics of research and development projects with budget restrictions, tightly knit groups and low degree of mutual interdependency make specialized solutions

unlikely to be developed for this setting. However, all experts agree that in the long run RTC will be used in one form or another.

Supply chains could benefit from specifically designed RTC applications in order to facilitate just-in-time decision making and higher transparency of logistic processes. However, the question was controversial, as experts suggested that over the next 3 years, specialized solutions are unlikely to be launched but will finally be applied in the long run.

5   DISCUSSION

In the previous section, we presented the results of the Delphi study which cover a broad spectrum of different areas. While this contribution can not provide a detailed discussion of the findings, we selected some themes and will briefly discuss them based on the theoretical background which was introduced earlier.

While RTC intentionally set out to better manage surging communication volumes, experts were skeptical that it will help recipients and initiators to the same extents; in particularly as RTC might cause additional communicative volume and coordination effort. Similar to instant messaging, it was argued, RTC might distract and disturb users through splitting phases of undisturbed work into ever smaller pieces. This intuitive statement can be further substantiated by focusing on the materiality of RTC and comparing it with the consequences groupware had on social interaction. While oral communication is ephemeral, groupware is different and distinctively shapes the quality of interaction through, first, making reifications persistent, reproducible, aggregatable, and accessible regardless of one's physical location, and, second, requires people to actively engage in inscribing representations of their experiences. However, not only do these processes of creating representations involve additional efforts but they also place limits on how much of a person's experiences can be usefully represented. In contrast, by way of integrating synchronous and asynchronous forms of communication, RTC emphasizes verbal communication and might reduce the effort involved in creating written verbal communication and mitigates the limitations which are connected with inscribing experiences.

Two main issues, inferred from the arguments given above, are worth to be elaborated in more detail. First, RTC enables and strongly values synchronous communication which might help to overcome some of the limitations of groupware technology and reduce the burden involved in creating written reifications. In an ideal situation, RTC would enable people to shift from asynchronous to synchronous communication as soon as they experience difficulties in representing their ideas and experiences properly. Rather than creating almost anonymous repositories of knowledge, a large part of documents remain embedded in processes of discourse, interpretation and joint sense making. The human remains in the loop. Consequently, RTC might be a powerful means for initiators as to get access to time critical information, with presence information facilitating virtual forms of collaboration. However, as the form of dispersed collaboration enabled by RTC emphasis synchronous verbal

communication, it could potentially result in increased communicative volume and coordination effort.

Positioning	
RTC is defined as a complementary functionality to groupware, application packages and communication infrastructure, integrated in user interfaces and other areas which might potentially bring about a qualitative shift of the whole information and communication landscape	
Technology	

Individual	• Development effort on
	   o improving usability, presence availability
	   o Voice-, web-, videoconferencing on the fly
	   o Rule-based automatic forwarding of calls
	   o Busy signals cover all channels
	• Trend from separate availability statuses to integrated management across several devices
	• Future important features for managers: location information, context on mobile devices, individual access rights to show information, automatic status management

Group	• Partly substitution of classic telephony • Development effort on security & spam protection • Service portals to allow people to schedule appointments and access documents

Organizational	• While (extended) stand-alone applications are predominant, add-ons to existing products will gain ground
	• Trend towards
	   o integrating RTC in groupware applications and business packages
	   o integrating personal organizers and mobile devices into RTC environment
	• Effort over the next five years on
	   o developing presence & availability (e.g. intuitive contact, status handling, and permission management)
	   o improving quality of services and guarantee constant access

Implementation and Design	
Individual	• Motive for RTC: Supporting mobile workers and managers • Hindrance: emotional rejection of RTC, usability • Measures: Training users, reduce cognitive effort for users
Group	• Motive for RTC: Increasing productivity of virtual teams • Hindrance: lack of business cases, existing work practices, top-management support, information overload caused by RTC, critical mass of users • Measures: Top-down management, integration in work processes, continuous adaptation, support of early adopters, leading by example, clear business cases
Organizational	• Motive for RTC: Cost advantages of VoIP • Hindrance: low RoI, priority, security, complexity, no standards, insufficient integration • Measures: standards for (inter-organizational) interoperability, integration of RTC in inter-organizational standard business processes, Quality of services, integration into corporate message, security & privacy control
RTC-in-use	
Individual	• May reduce delays and interruption but could also result in even higher communication volume • Presence availability as instrument against distraction • Key benefit for managers, who will increasingly use RTC, is to know when they can talk to one another and to manage their own availability
Group	• RTC with its presence availability information as facilitator of virtual collaboration • Risk of increased communication volume and distraction • Organizational norms and rules required to balance interruptions and communication volume • Weak indications for support of work in culturally diverse teams • RTC may bring about feelings of inclusion and trust but also surveillance, control, and mistrust • Trend within the group of managers to increasingly use RTC • Implications of RTC on socio-organizational issues (e.g. knowledge management, org. culture, control, etc.) are not determined by RTC which only functions as enabler. It rather depends on organizational norms and routines.

Table 24: Overview of the main findings

Second, it is well reflected by experts' remarks in this Delphi study that the effects of RTC within an organizational setting are not purely determined by the technology, rather the implications of RTC can only be understood by taking the socio-organizational context within which the technology is embedded into account. For instance, communicative practices change over time triggered by material or perceptual changes in particular contexts. Changes in media use can either result in migration – unreflected action that reproduces communicate practices established in one medium or community within another medium or community – or variation – departure from established forms of social interaction by introducing some changes in the genres enacted within the new context (Yates, Orlikowski, & Okamura, 1999).

Consequently, social protocols that buttress RTC mediated forms of social interaction need to be developed and nurtured through managerial and collegial effort both for organizational and inter-organizational arrangements. Management needs to take an active stance as to develop institutional arrangements, governance structures and implement an organization-wide information infrastructure. In addition, the strategic importance of RTC for intra and inter-organizational interaction need to be stressed by the management as to create and provide a platform for identification but also a sense of tolerance and appreciation of diversity in inter-organizational settings (Poulymenakou & Klein, 2006). Business models are necessary to spell out and negotiate among management and users how RTC intends to achieve its objectives. Drawing upon success stories of RTC-mediated intra and inter-organizational collaboration might strengthen the persuasiveness of the business case. Business models should specify:

- "An architecture for the product, service and information flows, including a description of the various business actors and their roles; and
- a description of the potential benefits for the various business actors; and
- a description of the sources of revenues." (Timmers, 1998)

In doing so, business models do not only explicate how RTC intends to achieve its value proposition but also opens the platform for discussions about the involved players and potential shifts of their roles, responsibilities, and work load. However, concentrating solely on the economic and strategic dimension can only be a first step towards managing RTC in general and the expectations of the stakeholders in particular. Rather, claims are made for a better understanding of the social dimension (cf. Riemer, 2006).

Attention has to be paid to the danger of bypassing important social protocols in attempts to move to new ICT mediated forms of participation (Séamas; Kelly, 2005). A proper understanding of how RTC affects aspects such as trust, feelings of integration, benevolence, and help-giving in interpersonal relationships is needed to appreciate potential disruptions of social protocols which could be caused by RTC mediated forms of interaction. For example, explicating the demarcation between front and back regions (cf. Claudio; Ciborra & Patriotta, 1996), such as deciding on the scope of visibility of presence information, need to be addressed as to facilitate and enable the diffusion of the technology. Consequently, the implementation of RTC is a precarious process which requires the balancing of existing work

practices and new forms of participation enabled by RTC. Training users on RTC can help them to appreciate the potentials of the technology as technological frames[2], used for understanding preceding technologies, are modified (Orlikowski, 1992; Orlikowski & Gash, 1994). By doing so, users might experience new features and learn to exploit the potentials of RTC. Mediators (Bansler & Havn, 2004) play a significant role in facilitating continuous adaptation between particular technologies and the organizational context. However, mediators do not hold a neutral position, rather they are actively involved in an ongoing sense-making process to determine the affordances of the technology and its potential use and limitations. By doing so, mediators take up a pivotal role in tightly integrating RTC in existing work processes.

For the adoption and diffusion of RTC, aspects such as usability, standards, security and interoperability need to be addressed. The focus needs to be shifted form "understanding how a single user adopts and exploits a specific application and/or technology to understanding how users adopt, configure, use, reshape, and transfer varying and dynamic sets of services, over time on multiple devices across multiple organizational contexts" (Lyytinen & Yoo, 2002: 384). Ensuring interoperability of inter-organizational information systems is crucial for the diffusion of RTC on a broader scale. While stand-alone applications are (1) an attempt of technology providers to establish themselves on the market and (2) a strategy of circumventing the complexity attached with attaining interoperability, integration will become a more important aspect in the future (see also Figure 9). Inter-organizational information infrastructures can either be constructed from the scratch or existing infrastructures are linked with a two-stage approach (Riemer & Klein, 2006). The two stage approach proposes that, first, a common set of standards, protocols, interfaces, etc. need to be negotiated before existing infrastructures are coupled based on the agreed upon standards. Table 25 summarizes some issues that need to be addressed for facilitating the adoption and diffusion on the intra-organizational and inter-organizational level.

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[2] Technological frames concern the assumptions, expectations, and knowledge people use to understand technology in organizations. This includes not only the nature and role of the technology itself, but the specific conditions, applications, and consequences of that technology in particular contexts.

	Intra-organizational setting	Inter-organizational setting
Management	Leading by example Supporting early adopters Clear business (-> org. culture & productivity) cases (reflexive monitoring) Top-down implementation of RTC Targeted and selective implementation	Proven business cases Integration into corporate message Group or community coverage
Implementation & Design	'Fit' between existing work practices and RTC Training Continuous adaptation of RTC Communication competencies & management Tight integration of RTC in work processes and organizational context	Integration in standard business processes Better privacy control Facility to manage different projects Facility to manage varying groups over time: how to delete someone from the buddy list
Technology	Usability Interoperability Security Quality of Services Integration with other devices Configuration Complementarity (RTC is just an additional dimension)	Standards for interoperable platforms and communication media Quality of Services

Table 25: Issues to be addressed for the adoption and diffusion of RTC

6   CONCLUSION

Real-time communication technology presents itself as a new and emerging technology in the e-Collaboration arena. However, no empirical research has been done so far to conceptualize RTC and experts' interpretation of its implications on the individual, organizational and domain specific level of analysis. This Delphi study intended to close the gap, and by doing so, bring about an empirically informed understanding of RTC. Specifically, the Delphi study tentatively positions RTC as a complementary functionality to groupware, application packages and communication infrastructure, integrated in user interfaces and other areas.

A positive trend is expected for the diffusion of RTC over the next couple of years, with almost 80% of managers using RTC in ten years time. Integration of devices, presence information, usability, Quality of Services, and security issues are recurrently surfacing topics

which are of high importance. A trend from compact stand-alone applications or expansion of stand-alone applications to RTC as add-on to existing products is expected to occur in the long term. While a lack of maturity of the RTC market might currently still pose an obstacle for any significant investment in and adoption of RTC, a positive trend of domain specific applications is expected for sectors such as finance and mobile workers, which will subsequently spill over into other areas.

Through integrating asynchronous and synchronous communication and presence information, RTC might facilitate the management of delays/interruptions, support dispersed collaboration, help managers to coordinate subordinates, facilitate inclusion, and help to develop and maintain social capital. However, this might come at the cost of increased communication volume caused by the shift from asynchronous to synchronous forms of social interaction. Consequently, rules and norms are needed to manage the implementation and use of RTC. Management is required to develop institutional arrangements, governance structures and, by doing so, negotiate expectations concerning the potentials and use of RTC. Within this context, business models play a crucial role for (1) explicating the value proposition, benefits and limitations of RTC within an organizational context, and (2) highlighting the involved players and the implications of RTC on their roles, information exchange, responsibilities, and work load. However, the focus needs to be extended beyond the strategic and economic to the social dimension. Such a perspective appreciates RTC implementation as an ongoing process and emphasizes the pivotal role of social protocols, work practices and the enactment of RTC *in situ*. The latter point emphasizes that the outcome of RTC is not purely determined by the technology, rather the enactment of RTC is understood as a recursive relationship between RTC, which enables and constraints forms of engaging with the world, and the socio-organizational context within which RTC is embedded.

The Delphi study concentrated on different levels of analysis, namely individual, organizational and domain specific aspects. For researchers, the study identified potential starting points for future research within the organizational, managerial and technological realm. At the same time, the study contributed to sensitize practitioners for the potential benefits and limitations of RTC and highlighted relevant areas for managing the implementation and use of RTC. Emphasizing the context specific implications of RTC is not to be understood to downplay and devalue management's sphere of influence, on the contrary, it advocates managers' central role by asking to take the complexity and highly situated character of managerial and organizational work into account. The focus should therefore be on the strategies (i.e. negotiations, reconciliations and exchanges between people) applied by managers in order to shape work practices and governmental structures to facilitate the adoption, diffusion, and application of RTC.

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APPENDIX 1: BENEFITS AND SHORTCOMING OF DELPHI STUDIES

Benefits	Shortcomings
Individual Dimension	Managerial/ processual issues
Express their opinions privately Experts can revise their opinions as hitherto unconsidered factors are considered without publicly admitting that they have done so Fosters independent thinking and reflection about an issue and supports the gradual formation of an opinion Bring out respondent's reasoning, the factors he considered relevant to the problem, his own estimate of these factors, information that would enable him to arrive at a better appraisal, help him to make more confident answers	No formalized process for differentiating experts from layman and for selecting experts Sloppy execution with crudely designed questionnaires Many iterations can lead to boredom as most significant changes occur during the first and second round
Organizational Dimension	Methodological Issues
Can be used as a learning and research instrument Get feedback from a large group of people who might be geographically separated	Difficult to estimate reliability and validity No guideline which methodological apparatus is for which situation The benefit of anonymity is controversial as it can also result in individual compromises and a lack of feeling responsible rather than reflection and reduce the interaction in groups
Methodological Dimension	
Planning, forecasting, and decision making tool Appropriate method when there is no historical data Attempt to avoid disadvantages of conventional methods (social, personal, political conflicts) while taking advantages of the positive aspects (knowledge from varying sources, synthesis of opinions) Captures a wide range of interrelated variables and multidimensional features	

APPENDIX 2: QUESTIONNAIRE

Assessment of the Development Trajectory for Real-Time Communication: A Delphi Study

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Abstract

This Delphi study reflects the current situation and future development of Real-Time Communication (RTC) technology. The introduction describes the features of RTC, the foreseen modes of using RTC and the context of its application.

Further, a short overview of the Delphi method is given and the different styles of research questions are introduced.

The Delphi study itself consists of two parts with two sections each (all in all 25 questions). The estimated time for answering the questionnaire is 20-30 minutes.

Introduction

Over the past years we have observed a profound transformation of the organisation and practices of work: most prevalent is the increase of distributed forms of work within and across organisations. In parallel, the availability, bandwidth, media-richness and diversity of communication technologies and services has increased even faster than the development of computers. Partly enabled or even driven by the proliferation of information and communication technologies and infrastructures, the emerging forms of organising, of work, social life, learning and information sharing are communication and coordination intensive.

These trends have lead to a situation, where individuals (and organisations) are almost overwhelmed by communication devices, services and – most importantly – communication events. Many professionals receive hundreds of emails per day and juggle between 10 and more communication devices, e.g. fixed-line phone, mobile phone, fax, instant message service, pager etc., daily routines have become increasingly fragmented and an increasing share of the working time needs to be spent on retrieving, sending and managing messages.

The distribution of work has extended degrees of freedom in terms of place and time of work – telework has significantly increased over the past years – while maintaining a high level of connectedness and access to remote work environments. However, as companies increasingly rely on distributed project teams, the productivity of distributed teams has been critically scrutinized. Despite years of research and significant investments into collaboration systems (e.g. groupware, computer-supported collaborative work systems), they are still mostly perceived as helpful but not well established and accepted tool to increase the productivity of distributed work.

In response to these needs, a new genre of communication services, called real-time communication (RTC), has been developed and introduced. RTC focuses and integrates synchronous forms of communication, in particular instant messaging and telephony. While the currently existing solutions, such as Skype[TM] or OpenScape[TM] (for a list of RTC solutions see the appendix) differ in their functional scope, the core elements are similar:

- Integration of synchronous communication services, such as instant messaging (IM), telephony (VoIP) as well as access to or forwarding to fixed line and mobile services including voice box), video telephony and the respective conferencing service (IM, voice, video) and file sharing on a PC or PDA.

- Signalling of the status of availability (icon represents status). Advanced solutions permit the assignment of priorities to individuals or groups as well as to define – differentiated by communication partner - preferred communication channels/ media for incoming communication requests.

- Provision of "Buddy list" as a tool to manage and control communication partners (reciprocal opt-in).

Together, these functions allow a seamless combination of instant messaging ("can we talk"), a VoIP call or a conference chat or call. During conference calls, communication partners can maintain a private chat conversation.

The scope of available functions depends on the market segment:

- Low-cost solutions, which provide downloads and VoIP typically for free (e.g. Skype^{TM}),

- Mid-range solutions with extended functionality, e.g. Window sharing and Microsoft Outlook ® integration (e.g. Web.de Com.Win 3.0),

- Professional solutions with advanced integration into the existing telecommunication and information systems infrastructure (e.g. Siemens Hipath® OpenScape™, Alcatel OmniTouch^{TM}).

The following application scenarios illustrate varying ways of how RTC might be used:

Consultancy

Within a consultancy setting, RTC allows individual consultants to channel communication requests to different devices based on criteria such as priority, availability status, location, time-of-day or day-of-week. E.g. a consultant, who works at home, decides to be only available for her team members as she wants to work undisturbed on a time critical task. For her team members, her availability information signals her availability and their calls on her office phone will automatically be forwarded to her private phone number and if that fails, to her mobile phone. However, availability information will signal to all others that the consultant does not want to be disturbed and calls to her office phone or mobile will be forwarded to a self-service portal. The self-service portal allows, depending on the caller's privileges, to access the consultant's schedule, make appointments and to read and retrieve documents stored on an exchange folder. The consultant can check her e-mails, voice-mails, the calendar, and appointments over the voice-portal while travelling home or to a client.[3]

Management of technical breakdowns

In order to facilitate fast response to technical breakdowns, e.g. in data centres, focused and quick communication is a decisive factor. An RTC system, integrated within the recovery process and which helps by adding available experts to the communication process can offer significant support in time critical situations. Task forces can be either formed by the responsible manager or automatically by the RTC system based on a data base of past cases. Consequently, context-sensitive buddy lists may be created by the RTC system to present to the task force members only those contacts they need to talk to during the recovery process. Another feature of such an RTC system could be to automatically seal off the involved persons from external people for the duration of the incident in order to reduce interruptions and thus to improve the concentration on the actual service recovery.

Managing 'under pressure'

Although managers nowadays have a myriad of communication and information channels at their disposal, availability is a big issue for them and for those people trying to contact them. In addition, as tasks generally have a high priority and urgency, delays are not an acceptable option. RTC systems offer managers an integrated and configurable infrastructure, which enables communication independent of the actual location. Managers can choose spontaneously among different communication and information channels (telephony, instant messaging, video-conferencing). Communication media are easily combined depending on the contextual needs (e.g. initiating a conversation via instant messaging to request availability and then shifting to VoIP). RTC also allows a differentiated management of the availability status (automatically/ manually) and, by doing so, accentuates synchronous forms of communication. Thus managers regain some control over their flow of communication, as they can decide who can contact them, when and which device they prefer.

Structure of the Delphi study

As the examples above indicate, the implications of RTC are twofold. Individuals may use RTC as a tool for reorganising their communication and work patterns. However, individuals do not adopt or use RTC in isolation, rather individual forms of usage will emerge in the context of organizational changes and within a network of communication partners. This study aims at exploring both general organizational

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[3] The example is based on Siemens OpenScape

implications and those specific to particular contexts. The Delphi study is therefore focusing on three levels of analysis, namely individuals, organizational aspects, and domain specific applications.

The questions in this study will be divided into two parts, a descriptive part and a predictive/ future oriented part.

I. Descriptive part: status quo
- a) What is the current situation and interpretation of RTC?
- b) What issues do arise during the implementation of RTC?

II. Predictive part: future trends
- a) What are the implications of RTC on the organizational context?
- b) What are potential future trends of RTC development?

Both parts encompass the three levels of analysis identified above. Table 1 gives an overview of the structure of the Delphi study and the issues that will be discussed.

Focus Levels of analysis	Descriptive	Predictive
Individual	• Challenges of today's working environment and potential demands for RTC	• Individuals' future media profile • New forms of availability information • Implications for people's work practices • Importance of applications
Organizational aspect	• Evaluation of current RTC products for organisations • Managing RTC	• Opportunities and threats for RTC • Spotting technological trends • Implications of RTC on organizing
Scenarios of domain specific applications	————	• Potential domains of application • Market segments • Customizability

Table 26: Overview of the structure

Frank Frößler♣ & Stefan Klein☼

DELPHI Method and Research Design

Delphi studies are used for a broad range of different reasons (e.g. aggregating ideas, predicting uncertain future events, determining and qualifying experts' opinions, consensus building), which have strong implications for the design of the studies.

This Delphi study is designed as a written expert discussion to determine experts' opinions about the current situation and future development of RTC. It is thus suitable for systematically deducing a sound and reassessed statement reflecting the group's opinions. However, it is not required that the experts come to a consensus nor is it attempted to predict the future. Rather, this type of Delphi study aims at fostering the communication about how the future might look.

It is not necessary that the group of experts be put in personal contact with each other, rather, questionnaires are administered over several rounds and serve as the platform for the discussion. Experts' responses will be aggregated by a moderator and will be returned to all participants in anonymized form for the next round of questions. The intervals between the rounds will be approximately four weeks. We are planning a total of three rounds.

For round 2 and 3, the aggregated findings of the previous rounds will be made available. The experts then have the opportunity to reflect on their own judgements and assumptions based on the opinions expressed by the group and to revise or elaborate on them. Every expert can therefore contribute to the discussion and, at the same time, learn the opinions of other leading experts within the subject area.

The panel consists of about 30 experts from industry (consultancies, RTC providers, potential customers) and academia. After the completion of the Delphi study, a summary of all rounds and of the results will be made available to the panellists, who may decide whether they wish to be named in the final report.

Types of questions

The questionnaire consists of three different types of questions:

1. You will be asked to rank how much you agree/ disagree with a statement or assumption. The positioning of your (x) signals how much you agree or disagree.

Strongly agree	Agree	**Undecided**	Disagree	Strongly disagree

2. You are asked to weight aspects or assumptions that are given. Each time 100 percentage points should be distributed. Sometimes, you are asked to rank aspects of a question for different time periods. In these cases, 100% points should be distributed for each time period.

	Issue 1	Issue 2	Issue 3	Issue 4	SUM
Next 12 month	20	24	12	44	**=100%**
In 3 years	35	29	20	16	**=100%**

3. You are asked to **rank different aspects** starting with most important= 1. A empty field is given, which allows you to state aspects not included in the list. However, if you are not inserting a new entry, the empty field should be ranked as least important.

4. If you wish, you may use the **"Reasoning fields"** to share the rationale for your decision, give more detailed information, mention aspects not listed in the questionnaire, etc. The length of your comments can be either keywords or more lengthy descriptions. In both cases, entries are summarized and listed (in anonymized form) in later questionnaires.

Questionnaire
0. Evaluation of your degree of experience

Before you start with the Delphi study, please indicate, based on the information given in the introduction, how familiar you are with "Real-time communication".

- ☐ I am not familiar with RTC
- ☐ I have been heard about RTC, but never used myself
- ☐ I am familiar with RTC
- ☐ I am competent in this subject area
- ☐ I am an expert on RTC

I. Descriptive part: Evaluating the status quo of RTC technology

1. To position RTC within the different areas, please evaluate the three statements with regard to their appropriateness.					
	Strongly agree	Agree	**Undecided**	Disagree	Strongly disagree
"*Real-time communication technology is the latest version of groupware/ Computer-Supported Collaborative Work (CSCW), e.g. Lotus Notes, Lotus Domino.*"	☐	☐	☐	☐	☐
"*Real-time communication technology is an add-on to existing application packages (e.g. ERP systems (SAP) or Microsoft Office, Exchange, and Enterprise).*"	☐	☐	☐	☐	☐
"*Real-time communication technology is an extension to the existing communication infrastructure.*"	☐	☐	☐	☐	☐
Reasoning:					

Level of analysis: The individual

2. Time critical tasks and tight deadlines are present in most working environments.					
	Strongly agree	Agree	**Undecided**	Disagree	Strongly disagree
a. In your opinion, can RTC help individuals (initiators of requests) to obtain time critical information from other parties, needed in order to continue with their work?	☐	☐	☐	☐	☐
b. In your opinion, can RTC help those who are interrupted by collaboration requests (recipients) to manage interruptions in their daily work more efficiently?	☐	☐	☐	☐	☐
c. In your opinion, is RTC equally suitable for helping both roles, initiators and recipients of communication, to deal with an increased communicative volume.	☐	☐	☐	☐	☐
Reasoning:					

3. Tasks or projects are more and more conducted with others, who are geographically dispersed. This often leads to increased complexity and coordination efforts.					
	Strongly agree	Agree	**Undecided**	Disagree	Strongly disagree
In your opinion, can RTC help to mitigate the complexity caused by dispersed collaboration?	☐	☐	☐	☐	☐
Reasoning:					

4. Teams often consist of participants with diverse professional, social, and cultural backgrounds which typically increases the complexity of collaboration					
	Strongly agree	Agree	**Undecided**	Disagree	Strongly disagree
In your opinion, can RTC facilitate collaboration in a diverse environment?	☐	☐	☐	☐	☐
Reasoning:					

Level of analysis: Organizational aspects

5. What in your opinion are the driving forces for the use of real-time communication technology in organisations? *(Please rank the following aspects from most important=1 to least important=7)*

Cost advantages of VoIP	
The communication crisis of managers	
Supporting mobile or telework	
Experimenting with new technologies	
Following market trends	
Increasing the productivity of distributed teams	
Other:	

Reasoning:

6. In your opinion, which are the major obstacles for the adoption of RTC in companies? (*Please rank the following aspects from most important=1 to least important=9*)

No solid business cases for RTC initiatives	
Complexity of the potential implementation project	
Complexity of the necessary information and communication systems integration	
Security concerns	
Relative low priority compared with other projects	
Budget restrictions	
Uncertainty concerning the development of technological standards	
Not convinced that RTC would yield a positive Return-on-Investment (RoI)	
Other:	

Reasoning:

7. In your opinion, <u>after adopting RTC</u>, to what extent do (or might) the following factors impede organisations to utilise RTC to its full potential? *(Please,rank the following factors with the most important= 1 and the least important= 7)*

Lack of top-management support	
Existing work practices not compatible with RTC	
Potential users reject RTC emotionally (e.g. privacy/ control issues)	
RTC is not properly integrated within the organizational context	
RTC is not properly integrated within the existing technical infrastructure	
Security concerns	
Other:	

Reasoning:

8. In your opinion, can the following measures increase the acceptance of RTC in organisations.

	Strongly agree	Agree	**Undecided**	Disagree	Strongly disagree
'Top-down' management approach towards implementing RTC	☐	☐	☐	☐	☐
Democratic/ consensus driven management style	☐	☐	☐	☐	☐
Written guidelines on how to use RTC	☐	☐	☐	☐	☐
Training users how to use RTC effectively	☐	☐	☐	☐	☐
Encouraging users to (continuously) adapt RTC to their needs	☐	☐	☐	☐	☐
RTC tightly integrated in work processes	☐	☐	☐	☐	☐
Management leaves it to the users how to adopt and appropriate RTC	☐	☐	☐	☐	☐
Others:	☐	☐	☐	☐	☐

Reasoning:

Frank Frößler♣ & Stefan Klein☼

I. Predictive part

Level of analysis: The individual

9.	In your opinion, what is the share of managers who will work in a RTC supported environment?

In 2 years	%
In 5 years	%
In 10 years	%
Reasoning:	

10. How important are in your opinion the following features <u>for managers</u> in their daily work if they are integrated in RTC applications? *Rank the importance of the features (most important= 1 till least important= 8).*

	Very important	Important	**Undecided**	Unimportant	Very unimportant
Availability information of communication partners[4]	☐	☐	☐	☐	☐
Voice-, web-, videoconferencing on the fly	☐	☐	☐	☐	☐
Rule-based, automatic forwarding of calls	☐	☐	☐	☐	☐
Signalling of own availability and preferred communication channel(s)	☐	☐	☐	☐	☐
Busy signals cover all channels [5]	☐	☐	☐	☐	☐
Service portals that allow people to schedule appointments or access documents	☐	☐	☐	☐	☐
VoIP services	☐	☐	☐	☐	☐
Others:	☐	☐	☐	☐	☐
Reasoning:					

11. The accuracy and topicality of availability information[6] is perceived as crucial for the success of RTC solutions. Please evaluate the dissemination of the following forms of updating availability information in the future. *(Rank the different forms from most common=1 to least common= 6)*

	Next 12 month	In 3 years	In 5 years
Separate availability status for different devices			
Automatic signalling of availability based on user actions (e.g. keystrokes)			
Status setting on mobile phone (e.g. "meeting") determines the status of all other devices			
Availability status based on physical presence (e.g. determined by sensors or presence of mobile phone)			
Availability status based on electronic calendar (e.g. based on Microsoft Outlook or PDA)			
Others:			

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[4] For example, a buddy lists which shows whether a listed person is online

[5] If a person is on the phone, a busy signal will appear for example on his mobile and VoIP application

[6] Signalling of the availability status (icon represents status). Advanced solutions allow to assign priorities to individuals or groups as well as to define – differentiated by communication partner - preferred communication channels/ media for incoming communication requests.

	Very important	Important	**Undecided**	Unimportant	Very unimportant
12. **How important do you think will be the integration of RTC into applications which function as personal organizers (e.g. Microsoft Outlook)?**	☐	☐	☐	☐	☐
Reasoning:					

	Very important	Important	**Undecided**	Unimportant	Very unimportant
13. **How important do you think will be the availability of RTC clients on mobile devices (e.g. Mobile Phone, PDA, Blackberry etc.)?**	☐	☐	☐	☐	☐
Reasoning:					

14. Name and rank three features of RTC that will be most important for <u>managers</u> in three years time (most important first).
1.
2.
3.
Reasoning:

15. Assuming RTC has been made available throughout the organisation, do you think that RTC will …					
	Strongly agree	Agree	**Undecided**	Disagre	Strongly disagree
a) … help managers to better coordinate their teams?	☐	☐	☐	☐	☐
Reasoning:					
b) … be an efficient and productive way for employees to stay in touch with their peers (work-related contacts)?	☐	☐	☐	☐	☐
Reasoning:					
c) … distract people from their work?	☐	☐	☐	☐	☐
Reasoning:					
d) … give dispersed members of the organisation (e.g. mobile or teleworkers) a stronger feeling of 'inclusion'?	☐	☐	☐	☐	☐
Reasoning:					

Level of analysis: Organizational aspects

16. Please estimate the share of the following products, in relation to the respective product market, that will include RTC as integral component (e.g. percentage of groupware products that include RTC).

	Next 12 month	In 3 years	In 5 years
Groupware products (e.g. Lotus Notes, Web-based collaboration solutions)	%	%	%
Enterprise Resource Planning systems (e.g. SAP R/3)	%	%	%
Business packages (e.g. Microsoft Office, Exchange, Enterprise)	%	%	%

	Strongly agree	Agree	**Undecided**	Disagre	Strongly disagree
17. In your opinion, do you think that RTC solutions will be used to substitute classic telephony?	☐	☐	☐	☐	☐
Reasoning:					

18. The functionalities of different RTC solutions vary in scope. How do you rate the relative dissemination of the four different solutions within organisations for each time period? (100 percentage points should be distributed across the four solutions <u>for each time period</u>, e.g. 12 month)

	Compact, basic stand-alone applications (VoIP + Instant Messaging)	Expansion of stand-alone applications (VoIP + Instant Messaging + integration with address books, web pages, e-mail inbox, databases)	Add-ons to existing products (e.g. desktop solutions like Microsoft or ERP systems)	RTC as central module with all other workflow organized around it	
Next 12 month					**100%**
In 3 years					**100%**
In 5 years					**100%**
Reasoning:					

19. Please name three aspects on which the development of RTC will mainly concentrate on in the future. *Name and rank three factors according to their relevance (most important first) for the three different time periods.*

	1.	2.	3.
Next 12 month			
In 3 years			
In 5 years			

20. In your opinion, <u>in three years time</u>, which new features will be a 'must' for RTC?

Answer:

Reasoning:

21. What needs to be done to make RTC more attractive for inter-organizational collaboration?

Answer:

Reasoning:

22. What needs to be done to make RTC more attractive for intra-organizational collaboration?

Answer:

Reasoning:

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23. Which factors could prevent RTC from playing a crucial role in the information and communication infrastructure of the future? *Name and rank three factors according to their relevance (most important first).*

1.

2.

3.

Reasoning:

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24. Assuming RTC has been made available throughout the organisation, do you think that RTC will...

	Strongly agree	Agree	**Undecided**	Disagree	Strongly disagree
a) … strengthen the knowledge exchange within the organisation?	☐	☐	☐	☐	☐
Reasoning:					
b) … bring about a positive change in the culture and climate of these organisations (e.g. openness, cohesion, handling of conflicts, mutual helpfulness)?	☐	☐	☐	☐	☐
Reasoning:					
c) … improve the effectiveness of knowledge management, i.e. experts will provide background information and explanations about electronic documents if and when needed?	☐	☐	☐	☐	☐
Reasoning:					
d) … lead to a culture of surveillance and control?	☐	☐	☐	☐	☐
Reasoning:					
e) … lead to more spontaneous forms of collaborating?	☐	☐	☐	☐	☐
Reasoning:					
f) … improves the mutual understanding between team members?	☐	☐	☐	☐	☐
Reasoning:					

Level of analysis: Scenarios of domain specific applications

25. In your opinion, what is the likelihood that specialized RTC solutions will be available for the following fields of application?

a) Support of mobile workers with RTC in order to deliver just in time information and on demand access to colleagues.					
	Very likely	Likely	**Undecided**	Unlikely	Very unlikely
Next 12 month	☐	☐	☐	☐	☐
In 3 years	☐	☐	☐	☐	☐
In 5 years	☐	☐	☐	☐	☐
Reasoning:					

b) Support in the healthcare sector as RTC enables on-demand transfer and real-time updates of patients' files and provides availability information of medical staff, in particular experts.					
	Very likely	Likely	**Undecided**	Unlikely	Very unlikely
Next 12 month	☐	☐	☐	☐	☐
In 3 years	☐	☐	☐	☐	☐
In 5 years	☐	☐	☐	☐	☐
Reasoning:					

c) Construction workers, architects and suppliers of building materials in large construction projects use RTC in order to clarify information and manage inter-organizational project work.					
	Very likely	Likely	**Undecided**	Unlikely	Very unlikely
Next 12 month	☐	☐	☐	☐	☐
In 3 years	☐	☐	☐	☐	☐
In 5 years	☐	☐	☐	☐	☐
Reasoning:					

d) Software developers at dispersed locations use RTC. Developers' availability information are attached to scripts and documents so that they can be contacted if colleagues need support with respect to these documents or scripts.					
	Very likely	Likely	**Undecided**	Unlikely	Very unlikely
Next 12 month	☐	☐	☐	☐	☐
In 3 years	☐	☐	☐	☐	☐
In 5 years	☐	☐	☐	☐	☐
Reasoning:					

e) Use of RTC in a mobile private setting; with dissemination of availability information, local information about buddies, push and pull information delivery, and other mobile services.					
	Very likely	Likely	**Undecided**	Unlikely	Very unlikely
Next 12 month	☐	☐	☐	☐	☐
In 3 years	☐	☐	☐	☐	☐
In 5 years	☐	☐	☐	☐	☐
Reasoning:					

f) RTC will be used in research and development projects to support collaboration among dispersed research teams.					
	Very likely	Likely	**Undecided**	Unlikely	Very unlikely
Next 12 month	☐	☐	☐	☐	☐
In 3 years	☐	☐	☐	☐	☐
In 5 years	☐	☐	☐	☐	☐
Reasoning:					

g) RTC as integral component of supply chains in order to facilitate just-in-time decision making, and higher transparency of logistic processes.					
	Very likely	Likely	**Undecided**	Unlikely	Very unlikely
Next 12 month	☐	☐	☐	☐	☐
In 3 years	☐	☐	☐	☐	☐
In 5 years	☐	☐	☐	☐	☐
Reasoning:					

Other:					
	Very likely	Likely	**Undecided**	Unlikely	Very unlikely
Next 12 month	☐	☐	☐	☐	☐
In 3 years	☐	☐	☐	☐	☐
In 5 years	☐	☐	☐	☐	☐
Reasoning:					

Please fill in the following information, as we will send you a personalized questionnaire for the next rounds.	
Name	

_____

Anonymity

☐ I **do agree** that I will be listed as a panellist in the final report of the project.
☐ I **do not want** to be listed as a panellist in the final report of the project

Thank you for your participation!

APPENDIX 3: LIST OF ACRONYMS

CSCW	Computer-supported cooperative work
ICT	Information and communication technology
IM	Instant Messaging
RTC	Real-time communication
VoIP	Voice over Internet Protocol
ERP	Enterprise Resource Planning (e.g. SAP)
PDA	Personal Digital Assistant

APPENDIX 4: LIST OF SELECTED RTC SOLUTIONS

Low-cost segment		
Skype		www.skype.com
Gizmo		www.gizmo-project.com
Google Talk		http://www.google.com/talk/
Yahoo! Messenger		http://messenger.yahoo.com/
MSN Messenger		http://webmessenger.msn.com/
Middle segment		
Skype		www.skype.com
Web.de Com.Win 3.0		http://www.web.de/
Professional segment		
Openscape		http://enterprise.usa.siemens.com/products/solutions/openscape.html
Alcatel OmniTouch		http://www.alcatel.com/enterprise/en/products/unified_communications/index.html
Nortel Multimedia Communication Server 5100		http://products.nortel.com/go/product_content.jsp?segId=0&parId=0&prod_id=52080&locale=en-US
IBM Workplace Collaboration Services		http://www-142.ibm.com/software/workplace/products/product5.nsf/wdocs/workplacehome
Microsoft Communicator 2005		http://www.microsoft.com/office/livecomm/communicator/prodinfo/overview.mspx

APPENDIX 5: EXAMPLE - INTERFACE OF GIZMO