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**FREE E-COLLABORATION TOOLS AS A SUPPORT  
FOR LEADING VIRTUAL TEAMS**



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## **ABSTRACT**

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This Bachelor's thesis is a study of the current freely available e-collaboration tools as solutions to problems of leading a virtual team. The research is conducted as a review of literature on the field of virtual teaming, with a brief overview of the tools available.

There are three restrictions imposed on the research area: the technology is restricted to collaboration tools. This set of tools is further diminished by the start-up-entrepreneurial perspective, which dictates that the tools need to be available at no cost. Thirdly, the research only concentrates on the problems of a virtual team from the leadership perspective.

The research question is "Do freely available e-collaboration tools solve the problems of leading virtual teams?" The answer emerging from the research is "partly". This is because most of the identified problems could only be helped by the technology, not actually solved.

The study consists of an introduction, a concept analysis, discussion of problems, a brief presentation of the e-collaboration tools along with feature descriptions, a description of the solutions, and finally the conclusions.

The main concepts in the research area are virtualness, group, virtual teams, leadership of virtual teams and e-collaboration. The most important conclusion of this study is that although the technology on its own will not solve the problems of leading a virtual team, it is a critical enabler.

Keywords: leadership, virtual team, communication, technology, entrepreneurship

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## 1 INTRODUCTION

Virtual can temptingly be thought to mean "unreal", something that exists only in the minds of teenage internet users as a result of some very clever technical illusion. However, in the sturdy world of work, virtual is very real. Virtual teaming is gaining up on traditional work quickly, and is deemed the twenty-first-century survival skill for organizations. It is a very current topic at the time of writing this thesis, because the technology facilitating the work of virtual teams is developing rapidly.

With the advent of new, readily available technology the start-up world is also being affected. Early-stage start-ups at their most innovative stage tend to also be in the throes of depleting their resources. New enterprises are more and more being constructed by people a great distance away from each other, and need a cost-efficient way to take their first steps in the world of business. The way to do this is to adapt to the virtual team mindset, and develop the team to work from where they stand.

An entrepreneur's life is likely to revolve around entrepreneurship, so working as a virtual team is especially suited to them. Working round the clock is made even easier by removing the traditional obstacle of office hours. As part of a virtual organization, the entrepreneur can work whenever, wherever.

The impact on society by virtual teamwork is likely to be quite remarkable in the future. With the cost-reduction and efficiency achieved, it is likely that many companies yield to the temptation and digitize their inner workings. This, if handled correctly, gives to the layman workforce the freedom and flexibility that used to be reserved to the successful entrepreneur.

Of course there is a chance that virtual teamwork brings with it the shadows of the entrepreneurial world: instead of having the freedom to work whenever and wherever, the employee might then have the freedom to work round the clock, and no less is expected. We can only hope that the powers-that-be understand employee-happiness as a resource that can be tapped into to produce results.

This thesis focuses on the role of the team leader in a virtual team. It touches briefly on problems of e-leading in general, but concentrates on the ones that can be solved with technology. Tools are suggested as solutions for those problems. As an added restriction the tools discussed are required to be freely available, as a practical consideration for the start-up audience.

The scenario that is kept in mind through this study is of a start-up leader coaching and facilitating the work of a virtual team. The e-collaboration tools are understood to be important as the link between individual members, and to be chosen by the leader. The entrepreneurial perspective adds additional pressure of cost-efficiency on top of the traditional pressures faced by a leader.

The research question for this thesis is: Do freely available e-collaboration tools solve the problems of leading virtual teams? The question is designed to restrict the research area firstly to the problems concerning virtual teams, and further to the problems that can potentially be solved by freely available technology.

The method of research for this thesis is a review of literature. The central concepts of the subject are discussed extensively through the studies in the field, encompassing thirty years of research from 1977 to 2007. The literature is used to back up argumentation all through the thesis. To add to the practical value of the thesis, a brief overview of the central current tools is gathered to attempt a solution to the problems found in the literature.

The thesis starts out with a concept analysis, relying heavily on the literature. The concepts of virtual team, e-collaboration and leading a virtual team are discussed in detail. Then, a collection of problems facing the leader of a virtual team are identified from the literature and explained. After identifying the problems, a list of current tools available for virtual teams is presented, with brief feature lists, the information for which is provided by the developers of the tools. The tools are then matched to the problems to provide a proposed solution for each.

## 2 Concept analysis

In this chapter, the concepts of virtual team, e-collaboration and leading a virtual team are discussed and defined from the perspective of this thesis. They are based on the information found in the literature. The sample of studies was chosen mainly on the grounds of references for trustworthiness, and does not represent the full set of studies of the field.

### 2.1 Virtual team

To quite understand the concept of a virtual team, it is important to understand what a team is. In the literature a commonly accepted premise is that a team is essentially a group. Lipnack and Stamps (2000) define a small group as "*individuals interacting interdependently*". They then go on to explain, that it is in fact the task oriented nature of teams that actually distinguish them from mere groups. Hence, teams are conceptually a subset of groups.

What, then, are virtual teams? It is an instance of social organization (Mowshowitz (1997, p.34). Cascio and Surygailo (2003) state that "*virtual teams are often formed to overcome geographical or temporal separations. By definition they are composed of members who rarely, if ever, meet physically*" (Cascio & Shurygailo, 2003, p.362). Virtualness is needed to free teams from the restrictions imposed by the interconnected time zone and location. It is commonly accepted through the literature that overcoming the geographical discontinuity is the main defining factor of virtual teams. For example Sivunen and Valo (2006, p.57) state in their study of technology choice for virtual teams that

"A VIRTUAL TEAM is usually defined as a group of people who work closely together even though they are geographically separated, sometimes residing even in different time zones around the world."

Virtual could also be interpreted as "*being such practically or in effect, although not in actual fact or name*" (Webster's New World Dictionary). That is not the definition of virtual used in this thesis. Sivunen and Valo's (2006) is seen to be the closest interpretation, in the spirit of Lurey and Raisinghani (2001, p.524):

"[Technology] has led to the formation of virtual teams in which workers no longer need to work face-to-face, or even be co-located in the same place, in order to work together."

One of the earliest studies on the distance where virtuality becomes a necessity is described by Lipnack and Stamps (2000, p. 20). It is a study by the MIT professor Tom Allen in 1977, who found that people are not likely to collaborate if they are more than 50ft apart. This means that if the team members are not closer than 50ft to each other, they are likely to be forced to use virtual means of collaboration for the tasks on hand. This is illustrated by figure 1.

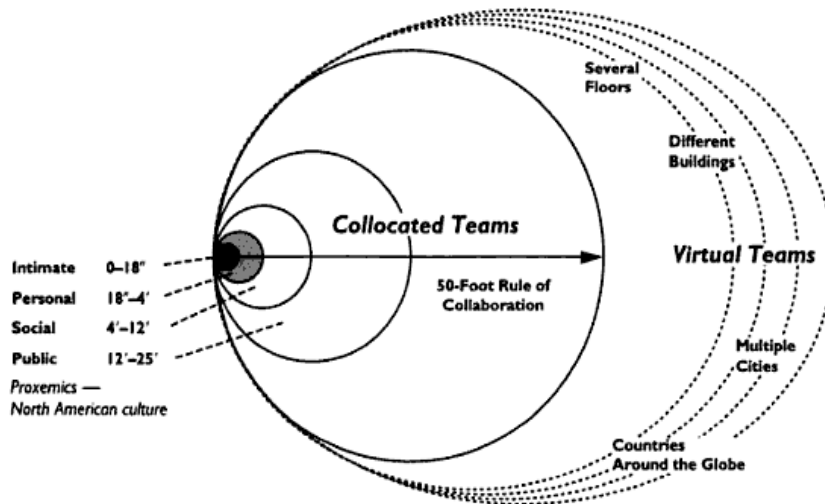


FIGURE 1 Collocated to virtual distance (Lipnack & Stamps, 2000, p. 21)

As well as face-to-face communication, measuring the extent of using electronic means helps in defining the virtuality of a team. Niederman and Beise (1999) created a framework to measure the state of a team based on this. As well as the co-location vs. geographical dispersion angle, they added the concept of mixing face-to-face with virtuality. Their framework (shown in figure 2) stipulates that, compared to traditional teams, the electronic mediation is key in defining a team as virtual. However, according to them, the richest case is where a high level of face-to-face to provide organizational values is used in conjunction with an electronic environment. For the purposes of this study, teams using extensive face-to-face communication are excluded from the concept of the virtual team.



		<b>Face-to-face</b>	
		<b>Low</b>	<b>High</b>
<b>Electronic Mediated</b>	<b>Low</b>	Inactive	Traditional
	<b>High</b>	Highly-Virtual	Fully-Supported

FIGURE 2 Categories of virtual group, team and meeting (Niederman & Beise, 1999, p.16)

However there is more to virtual teams than geographical considerations. Chudoba et al. (2005) say in their study that although "*conflicting definitions of virtuality make it hard to measure such things as how much virtual teaming occurs and how virtual teaming affects performance*", (Chudoba et al., 2005, p.279) it is possible to measure virtuality through the discontinuities of "*geography, time zone, culture, work practices, organization, and technology*" (Chudoba et al., 2005, p.282). The more of these are experienced in a team, the more virtual it is.

There are also other ways of defining virtualness in the literature. According to Zigurs (2003), there is no single cut-off point at which a team "becomes" a virtual team. Instead, what managers must do is assess the context of the team and the degree to which virtuality is present on a variety of dimensions. (Zigurs, 2003, p.340) Zigurs' dimensions are presented in figure 3.

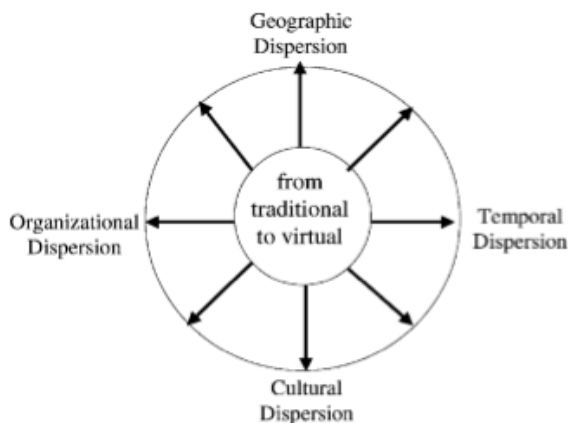


FIGURE 3 Zigurs' dimensions of virtual teams (Zigurs, 2003, p.340)

Zigurs' model is very similar to the one used by Chudoba et al. (2005) to assess virtualness. As it can be safely assumed that the time zone is tied to the geographic location, and work practices to the cultural and organizational disper-

tion of technology in Zigurs' dimensions. The concepts used in these two models are widely accepted in the literature in defining the virtuality of a team.

It might be argued that "going virtual" is a hindrance to the team, because of the lack of face-to-face communication. However, studies like the one conducted by Akkirman and Harris (2005, p.404) show that "*the virtual workplace does not have a categorically negative impact on organizational communication.*" In fact, in many of the studies on virtual teams it is found that the lack of face-to-face time is sometimes a very good thing, reducing friction caused by personal issues between the team members. Also, when the highly synchronous face-to-face interaction is compared to the less synchronous technology-mediated interaction, it seems that the team members tend to make more informed decisions when interacting through technology. This seems to be because of the additional thinking time allowed by the slower synchronicity. Akkirman and Harris (2005, p. 397) in their empirical study of an organization even found that virtual office workers were more satisfied with organization communication than traditional office workers. They state in their conclusions (p. 403) that "*if results-by-management reduces the influence of office politics, then being physically removed from the social context of work might increase satisfaction because it allows the worker to focus on what will provide rewards.*"

Virtual teaming is deemed to be effective by the studies in general, and in fact quite essential by some. Lipnack and Stamps (2000, p.28) even go as far as to say virtual teaming is a twenty-first-century survival skill. What do these apparently effective teams do? According to Zigurs (2003), the work of teams comes down to two basic processes:

1. Conveyance, which is the exchange of information and an attempt to understand its meaning
2. Convergence, which is the development of shared understanding on the meaning of the information exchanged.

Teams work on specific tasks, conveying information back and forth, and then developing it only to be conveyed again. This virtuous loop is assisted, or in the case of virtual teams, enabled, by technological media. The development and selection of the right media is important, because, as the studies point out, traditional means of face-to-face communication are limited at best.

## 2.2 E-collaboration

"The attribute 'virtual' designates distributed work that is predominantly based on electronic information and communication tools" (Hertel et al., 2005, p.71). Therefore it is important to carefully consider the tools used in virtual teamwork.

The term for the media used by virtual teams for information conveyance and convergence has not been agreed upon in the literature. Sivunen (2007, p.30) has in her dissertation identified the terms groupware, teamware, meetingware, electronic meeting systems or EMS, group decision support systems (GDSS), group support systems (GSS) and computer-mediated communication

systems (CMCS). In addition, "*computer-mediated collaboration (CMC)*" (Hertel et al., 2005, p.70) "*computer-supported cooperative work (CSCW)*" (Leinonen et al., 2005, p.301) are used in the literature.

For the purposes of this thesis, the term for the media used by virtual teams is e-collaboration tools. The basis for using this term is that collaboration, or "working together" (from Latin *collaborare*), is at the heart of all teamwork. It seems to describe the interdependent interaction towards a common goal with an almost onomatopoeical quality. Collaboration requires two things from the activity it describes: labour, which implies output of some sort, and having more than one actor. As described by Lipnack and Stamps (2000), a team is built from interdependent interacting individuals (more than one actor) to work on tasks toward common goals (output).

The electronic media utilized by the team makes the teamwork e-collaboration. The "e" is in this thesis understood to stand for electronic, with an implication of geographical distance overcome by the technology.

The tools in this thesis are discussed from the conveyance-convergence viewpoint set out by Zigurs (2003) on page 346: conveyance should be done with media of low synchronicity, while convergence requires media of high synchronicity. Low synchronicity is taken to mean communication that is not striving to establish real-time information exchange, but is instead utilizing the possible benefits of time being allowed for the processing of the information. High synchronicity is understood to mean an activity where real-time communication is attempted, to facilitate the process of converging the information in its logical order.

The division of tools based on synchronicity is important when considering virtual teams, because of the dimension of time zone discontinuity. When considering a tool to use in a team, it is important to know if it can be used if the team members never actually work at the same time. An example of such a case would be a global team, with members distributed across many time zones. The chosen tools and successful task handling will at best ensure a continuity of work 24 hours a day.

The e-collaboration tools discussed in this thesis are based entirely on internet technology. Other tools also exist, such as phones and older technologies, but because of practical limitations all other technologies are excluded. The significance of the internet is summarized well by Beranek et al. (2005, p.201): "*Clearly the rise of network technologies has made the use of virtual teams feasible. The practicality of virtual teams would be significantly stunted without the strides made in the underlying hardware technologies such as wide area networks (WANs), voice-over internet protocol (VOIP), virtual private networks (VPNs) and of course, the internet itself.*"

The e-collaboration tools in this thesis that are presented as possible solutions to the problems facing virtual teams are chosen for their free availability. The freeness of these tools is defined by their availability without a transactional demand. "Free" in this case does not necessarily mean that the tool must be licensed under any open source licence. In fact, the licence of any tool is not

taken into account at all. If the tool can be used by any individual or a group of individuals without a need for transaction, it is considered "free".

The reason for choosing only free tools is the startup-entrepreneurial perspective chosen for this thesis. The team for whom the solution is proposed is assumed to be working with very little resources and only the essential devices and tools to carry on the tasks required in running a start-up business.

### 2.3 Leading a virtual team

For the purposes of this thesis, only general problems of virtual teams are included. Any problems relating to specific types of teams are omitted. This is in line with the practical considerations of facilitating the work of a generic start-up business.

The term used to describe the leader of a virtual team in this thesis is "e-leader". It is used in the literature, e.g. by Cascio and Shurygailo (2003, p.362), and seems a fitting description to differentiate from a traditional leader. In this thesis, the leader of a virtual team will also sometimes be referred to as the "team leader" or simply "leader".

The role of an e-leader requires a versatile skill set. The responsibilities are numerous and range from building the team, setting goals and tasks, motivating the team to do the tasks, helping with the work, keeping tabs on the progress, ensuring deadlines are met and generally keeping the team happy and active. According to Sivunen and Valo (2006), it is the leader who often has to choose the media through which the team members communicate. The team leader is responsible for managing the team efficiently, and the technology choices have effects on the cohesion and effectiveness of the team. (Sivunen & Valo, 2006, p.57)

Zigurs (2003) laid out that *"leadership in virtual teams is expressed through technology; therefore leaders and team members have to make sense of technology in order to make the most capable use of it"* (p.347), adding another source of pressure. The e-leader must be able to effectively handle the technology, and not show weakness. They must be able to train the team members if necessary. There is little tolerance for ineffective leadership in projects carried out by virtual teams (Cascio & Shurygailo, 2003).

Hertel et al. (2005) identified four phases of implementing virtual teams. The first phase is "Preparations", and consists of decisions that are essential to creating the team, for example the mission statement and personnel selection. The second phase is "Launch", where the tasks required to begin successful teamwork are carried out. These are, for example, conducting a kick-off workshop. The "Launch" phase is likely to take more time than in traditional teamwork, because of the degree of high virtuality (p.72). The third phase, "Performance management" includes issues of leadership and the maintenance of motivation and communication within virtual teams. The fourth phase, "Team de-

velopment" entails evaluation activities of team processes together with team training and assimilation of new members.

The four phases of Hertel et al. (2005) weigh squarely on the team leaders shoulders, except in part for the first one. Performance management and team development are the phases this thesis has most importance for. In this thesis, the e-leader is seen as a coach of an expert team, rather than an instructor for specific tasks. They are to give subtle factual, practical and emotional support, coercing the team members to success (Sivunen, 2007).

Kayworth and Leidner (2002) discovered that the highly effective virtual team leaders act in a mentoring role, showing a high degree of understanding toward the team members. Still, when the occasion calls, they are able to assert their authority without causing bad blood in the team. A good virtual team leader also excels in regular, detailed and prompt communication.

Trust is important in an environment of little non-verbal communication. In a virtual team, trust is established by repeatedly setting expectations and then delivering results that meet or exceed those expectations (Cascio & Shurygailo, 2003). As the facilitator of successful results, the responsibility lies heavy on the leader of a virtual team. This calls for even more care to be taken when choosing the tools to create the e-collaboration environment. Despite all the pressure, Zigurs (2003, p.349) expresses that there is hope yet: "*leadership can and should be expressed in virtual teams. The new technological environments that are emerging provide an unprecedented opportunity for a new way of thinking about leadership.*"

## 3 Problems

The e-leaders role ranges from building and motivating the team to making technical decisions on the tools used for e-collaboration. This chapter focuses on defining the main problems likely to be faced by the e-leader. First, problems related to setting goals are discussed. Then, issues with information and feedback, and finally cultural issues. For the appropriate issues, a direction of possible solution is proposed. After looking at these problems, the issues in choosing the correct e-collaboration tools are briefly discussed.

### 3.1 Goals

According to Sivunen (2007), the main problems with goals in teams are that the goals are not discussed, they are not concrete enough, they are too generic, or there is not enough information on strategy. Goal setting is important, so that the team members are empowered to make decisions on their own work.

The problem with goals not being discussed seems quite trivial at first, but when there are many team members and the work is hectic, it is quite understandable that setting individual goals can be forgotten. This needs to be addressed so that it is easy for the team leader to find out if the goals have been set and discussed. Sivunen (2007, p.106) states that it is especially important to make sure the goals are discussed at the beginning of a new team's work.

Even if the goals have been discussed, Sivunen (2007) found that they remain quite ineffective if they are not concrete and clear enough. This is because they are hard to remember and work towards, especially if the team members feel the goals don't relate to their work. This problem needs to be addressed so that it is made sure that the team members have understood their goals.

Sivunen's third problem of goal setting is that the goals are too abstract and not team specific. This might happen if the team leader works higher up in the organization, and cannot fully understand the context of the team. As an example of this, if the team leader gets paid for global results and the team

members for local results, then it might be difficult for the team leader to understand why the members tend to focus on the local tasks.

The problem involving strategic goals arises from the rapidly changing organizations. When the organization changes, it is important that the employees can keep track of where they are, and what they are working towards. It is the responsibility of the team leader to make sure the team members understand their strategic significance.

### 3.2 Information and feedback

Not only do the goals need to be set, also feedback metrics and information flow need to be established. It is quite self-evident that without feedback, there is no way of knowing if a) the goals have been understood and b) if they are being reached. The key points on feedback and information management rising from the literature are the newcomers' problems (e.g. Sivunen 2007, Ahuja & Galvin 2003), keeping track of task-completion (Sivunen, 2007), giving feedback to the team members (Sivunen, 2007), maintaining documentation and establishing "standard procedures" (Cascio & Shurygailo, 2003).

The newcomers' problems in the studies are mainly where to get the information needed, and who to contact with a specific problem. Sivunen (2007) found in her study that the threshold for asking for help can be quite high. This issue is likely to be solved with procedure, similarly to discussing goals early on when joining the team. On the issue of contacting the right people, Ahuja and Galvin (2003, p.176) suggest a coordination role for the team in their research: *"Our research suggests that virtual groups ... would seem to benefit by having an internal coordination and external liaison role. The amount of information exchange activity in this group indicates the importance of having a person focused on managing the flow of information through the group. For example, many newcomers don't know who the correct contact is for obtaining a particular type of information so they contact the coordinator for help."*

In the case of a small start-up team, it is likely that the coordinator is the team leader. The obvious solution for this issue seems to be the explicit definition of that role when discussing the leader's role within the team.

The information on task-completion is essential for the team leader to keep track of progress. A likely e-collaboration solution involves a shared tool with which to mark the progress on a given task. Another way would be to set up a reporting schedule for each task.

As well as receiving feedback, the team leader needs to give information to the team members on their progress. After all, the team leader is compiling the results towards a common goal, and has the best understanding of overall progress. Without this feedback, the team members have no way of knowing if they are performing up to par or not, and how they should improve their work. This issue needs to be solved with procedure, setting up feedback meetings or otherwise notifying the team members of their progress and performance.

The last issues concerning information are maintaining the documentation and setting standard procedures. These are special, because their solutions facilitate solving the aforementioned issues. For example, the documentation on goals, specific and generic, needs to be up to date and comprehensive. Also, without standard procedures it is not possible for the team members to know how to use the e-collaboration tools uniformly, and what are the appropriate ways to communicate in a given situation. Bell and Kozlowski (2002) found that it is important to "*develop appropriate habitual routines early on in the team's lifecycle*". The solution for maintaining the documentation and establishing standard procedures involves agreeing to use and keep up-to-date a tool to share the information.

### 3.3 Culture

According to Barczak et al. (2006, p.28), the four key challenges facing global team leaders are: team members who speak different native languages, who come from different cultural backgrounds, who live and work in multiple countries, and who come from different companies. The fact that these are all more or less cultural issues emphasizes the importance of culture. Cascio and Shurygailo (2003) agree that culture is the most important challenge, while also shedding light on its meaning in this context: "*culture refers to shared norms about expected behavior*" (Cascio & Shurygailo, 2003, p.374). They go on to state that "*E-leaders must be sensitive to cultural norms, especially where virtual teams span multiple regions of the world*" (Cascio & Shurygailo, 2003, p.375).

While concentrating on problems that are likely to be solved with e-collaboration tools, culture seems such an important issue that it cannot be lightly omitted. The attributes of virtual teamwork, distributed spatial distance and lack of face-to-face communication are seen by Bell and Kozlowski as impeding the two primary leadership functions, performance management and team development (Bell & Kozlowski, 2002, p.25). As culture is ever present in fulfilling these leadership functions, it must be considered by the e-leader when carrying out decisions. This is especially important when facing the challenge identified by Cascio and Shurygailo: "*promoting close cooperation among teams and team members in order to integrate deliverables*" (Cascio & Shurygailo, 2003, p.375). Because culture affects the primary leadership functions, it is important for ensuring the proper convergence of the information that a healthy environment exist within the team culturally.

When the e-leader has considered all the aforementioned issues, they still have left the problem of choosing the right tools and procedures. Ferris (2007) found that the tools should be chosen to fit the task at hand and the existing working environment of the team (Ferris, 2007, p.263). He also found that the tools need to be chosen for communication and coordination.

The tools used for communicating with the team, according to Ferris (2007), must be evaluated for being synchronous or asynchronous, where the



information is held (server or individual's storage) and whether there is appropriate version control. The tools for coordination need to provide clarity of purpose, expectations and process. As well choosing tools to solve specific problems, the leader needs to choose and provide tools for the team to use in their routine work. The identified problems are summarized in table 1.

TABLE 1 Summary of problems

---

**Problem**

---

Goals not discussed  
Goals not concrete enough  
Goals too generic  
Not enough information on strategy  
How to give newcomers information  
How to keep track of task-completion  
How to inform the team members of their progress  
Maintaining documentation  
Establishing standard procedures  
Routine virtual work

## 4 E-Collaboration tools

In this chapter, a set of e-collaboration tools is presented. The sample of tools does not necessarily represent the full set of possible tools in the sense that a tool would be chosen from every possible category, but instead an example choice of popular tools.

The e-collaboration tools presented in this thesis have been chosen to give the reader an understanding of the tools available. The list of tools is shown in table 2. It is impractical to list all the internet-based free tools, therefore only a limited list is presented. For each of the tools a short feature list is compiled from the descriptions on the tools' respective websites.<sup>1</sup>

TABLE 2 List of e-collaboration tools, sorted by synchronicity

<b>High synchronicity</b>	<b>Medium synchronicity</b>	<b>Low synchronicity</b>
Skype	PiratePad	Google Calendar
TeamViewer	Google Docs	Google Sites
		Google Video
		Zimbra
		Dropbox
		Yammer
		Scrumy
		MediaWiki

Google Apps and Zimbra are collaboration suites, consisting of many basic tools for e-collaboration. Dropbox is a service to handle files and sharing. Skype and TeamViewer are e-meeting tools. Yammer and Scrumy are tools for project management and team communication. MediaWiki is a website building platform commonly used for maintaining a knowledge base. PiratePad is a real-time collaboration tool for creating documents.

Google Apps is a service consisting of Gmail, Google Calendar, Google Docs, Google Sites and Google Video. In order to gain access, a Google Apps

<sup>1</sup> List of features collected 8.2.2011

account is set up for the organization. Every user added gets an account to access the aforementioned tools.

Gmail is a simple e-mail service, which lets the user send and receive e-mails of text and html-markup. It also lets the user archive the e-mails, and set up rules to sort them. Also lets the user create mailing lists.

Google Calendar is a calendar tool which lets the user schedule appointments, invite other users to the appointments, create and view multiple calendars and share calendars within the team. It also lets the user publish calendars to be viewed by everyone on the internet.

Google Docs is a tool to create web-based documents, spreadsheets, drawings and presentations, which lets the users edit the same file at the same time. It also includes version control and integration with Gmail.

Google Sites is a website building tool, with which the user can build, for example, project workspaces, team sites and intranets. It consists of templates which are customized to fit the need.

Google Video is a service which hosts and streams videos. It aims to make communications like internal training and announcements more engaging, without adding a need to share videos over e-mail.

Zimbra is an email and collaboration suite. It is required to be installed server, and is administrated by the user. It includes tools for e-mail, contact management, group calendars, file sharing and document management.

Dropbox is a service that allows the user to sync files from any computer to an online space and vice versa. It also lets multiple users share files. Dropbox can synchronize the chosen files to the online space automatically, so it can be used for automatic backup. Dropbox also has a web interface to the files.

Skype is a Voice over IP (VoIP) service, that lets users call each other over the internet for free. Skype also provides video calling, instant messaging and conference calling. Screen sharing is also possible. While the calls from Skype to Skype are free all over the world, calls from Skype to phones incur a cost. Before calls to phones can be made, "Skype Credit" must be paid to the service.

TeamViewer is a tool specifically for screen sharing. It lets the user hold meetings where they share information on their screen to multiple participants, and chat with instant messaging. The sharing user needs to download a desktop application, however the viewers can join the meeting using their internet browser.

Yammer is an "Enterprise social network". To gain access, an e-mail address for the enterprise is needed. After registering, a microblogging environment is available, based on a stream of updates by team members. The updates can be tagged, and can turn into conversations through a commenting feature. Yammer collects all the users registered with specific enterprise e-mail accounts into a company directory. It allows each user to create a profile and give information on the organization hierarchy. Users can also send each other direct messages, and share files.

Scrumy is a project management tool, which lets the users track the progress of tasks. It has a graphical drag & drop interface. It is like a collection of

sticky notes on a wall, which are moved as they progress through columns labelled "to do", "in progress", "verify" and "done". Tasks can be assigned to team members, and their status column changed by anyone in the team.

MediaWiki is a Wiki platform, which is required to be installed on a server. It is used to create a website that allows the creation and editing of inter-linked web pages via a web browser using a simplified markup language or a WYSIWYG text editor. Anyone in the team can update the information on the Wiki.

PiratePad is a service where anyone can create a new collaborative document, known as a "pad". Each pad has its own URL, and anyone who knows this URL can edit the pad and participate in the associated chats. Password-protected pads are also possible. Each participant is identified by a colour and a name. The software auto-saves the document at regular, short intervals, but participants can permanently save specific versions (checkpoints) at any time. A "time slider" feature allows anyone to explore the history of the pad. The document can be downloaded in plain text, HTML, Microsoft Word, or PDF format.

## 5 Solutions

In this chapter an answer is attempted to the research question, in light of the set of tools proposed and the problems discovered in earlier chapters. The choice of technology is first explained to be based in the literature review conducted for this thesis. Then, the tools are briefly discussed as solutions, and finally a solution fit is attempted for each identified problem.

Do the freely available e-collaboration tools meet the requirements of leading a virtual team? Solutions need to be found for the following problems: goals not discussed, goals not concrete enough, goals too generic, not enough strategic information, how to give newcomers information, how to keep track of task-completion, how to inform the team members of their progress, issues with maintaining documentation and establishing standard procedures.

According to Sivunen and Valo (2006, p.58), the traditional way to theorize the use and choice of communication technology has been to explain it either on a rational, or a social basis. Rational criteria is used to find the technology which will best suit the task in hand, and the social takes in to account the values and attitudes of other people in choosing the best tool for the given situation (p.59). Therefore this is not just a simple task of gathering a set of tools.

The rationale behind taking into account the social perspective arises from the four factors that need to be considered in the choice of technology according to Sivunen and Valo: accessibility, social distance, idea sharing, and informing. Accessibility and social distance are factors that affect the choice of technology on social grounds, whereas idea sharing and informing are task-related factors (p.61). Sivunen and Valo go on to state that "*accessibility was one of the most important factors behind the virtual team leaders' technology choice, and the leaders chose different technologies according to people's ease of access through that medium*" (p.66). This division of criteria must be kept in mind, when relating to the solutions set out here.

From the list of tools presented, the ones that create a virtual workplace for every day routines are Google Apps, Zimbra, PiratePad, Dropbox, Skype and TeamViewer.

Google Apps takes care of document creation and handling, provides an e-mail service and a palette of calendar management and website creation. As an alternative to the cloud-based Apps, Zimbra is a collaboration suite that provides roughly the same functionality, but also gives more freedom and responsibility to the administrator. PiratePad is a lighter supplement to the document creation available in these suites, letting the user quick access to collaborating in real time on a simple text document.

Dropbox acts as a central repository to files needed by the team members, not unlike a filing cabinet. It has the potential to free the team from being dependent on the devices at their disposal for safekeeping of documents, which makes it easier to swap devices on the fly if needed.

Skype and TeamViewer enable the team to hold meetings online, emulating traditional meetings. With Skype, the team can, for example, hold a video conference, take individual calls, and share their screen to give presentations. Skype also provides instant messaging for less synchronized communication. TeamViewer specializes in screen sharing.

## 5.1 Goals

The problems with goal setting proposed by Sivunen (2007) can be only loosely solved by using technology, as they are in essence a qualitative problem. For example for making sure that the goal is agreed, a Wiki can be used. If it is agreed that all the goals that are set are to be written in the Wiki, then a quick review of the Wiki will tell both the member and leader of the team if the goals are insufficient. This is not feasible, however, if the team has not agreed on the depth the goals always need to be set out.

The Wiki is also a loosely fitting solution to the next two problems with goals. If the goals are not concrete enough, or are too generic, then it can be hoped that a review of them in the Wiki presents these deficiencies. However this is a problem not very well solved by the technology.

The lack of strategic information can be solved slightly better by the Wiki than the two previous problems. If the strategy is kept up to date in the Wiki, it is relatively easy for the members to check on the relevant facts when interest arises.

## 5.2 Information and feedback

When providing newcomers with information upon joining the team, it is important to provide clear, explicit how-tos in writing, as well as the customary coaching interaction. A Wiki will go far in providing these how-tos, if the team is committed to documenting the procedures that have been agreed upon. Ahuja and Galvin (2003) propose that a simple database of group information

be made available, and give Frequently Asked Questions as an example of good practice. Yammer can also be a useful tool for the newcomer, with its company directory, profiles of team members and meta-tagged knowledge base.

Task-completion can be tracked with Scrumy. The state of the defined tasks is shown graphically. Also Yammer is helpful in determining a tasks progress, by showing all the status updates associated with the task via tagging.

Scrumy also shows a quick overview of their progress to the team members themselves. Yammer provides an overview too, with the aforementioned microblogging, on the team's progress as a whole. However this is not likely to be enough feedback, so the team leader must not forget to actively keep in contact with individual team members on their progress, utilizing the aforementioned tools for routine work.

The maintenance of team-wide documentation can be managed by either using one of the collaboration suites, or by centralizing the documentation in the Wiki. Using a wiki for authorship of documents does enable a deeper level of collaborative authorship than other methods (Ferris, 2007, p.264), however it also requires a deep commitment by the team to keep the information up to date.

The standard procedures called for by Bell and Kozlowski (2002), or indeed the lack of them, clearly cannot be solved by the technology. Therefore, as with the goals, the technology can only help in making them more explicit, for example in the Wiki.

Solving the identified problems is not just a question of technology. The e-leader needs to have a well-organized plan in order to successfully move to a virtual office (Akkirman & Harris, 2005, p.404). Merely providing the technology is not enough. Akkirman and Harris (2005) found in their study of an organization that successfully transformed into a virtual workplace, "*where workers were empowered, hierarchy was eliminated, and coaching was emphasized*" (p.404), that:

*"The first stage was establishing information technology and network infrastructure and providing ongoing training. Then, the organization changed its organizational structure to form a process-based organization that allowed employees to take an entire process from start to finish in one rapid flow." (Akkirman & Harris, 2005, p.404)"*

However that was not enough. The authors then go on to describe how the organization adopted management by results, not concentrating on processes and time-based measurement but instead measuring results. Then the organization removed the need for paper records, opting for a digital format for all the information needed for the work. Only then could the organization successfully move the bulk of their workforce out of the traditional office, and into the virtual workspace.

Granted, Akkirman and Harris (2005) studied an organization at a very different stage than a start-up, it is still important for the e-leader to recognize that the e-collaboration environment must address all the needs of the team members. It might be well advised to approach the problem from assessing the tools traditionally needed, and then providing those in the digital form, as per how the organization did in Akkirman and Harris' study.

The virtual team needs to accomplish all the functions of a traditional team, but instead of traditional methods use e-collaboration substitutes. An example of a different approach needed in the e-collaboration environment is the need for a more self-managing atmosphere (Bell & Kozlowski, 2002, p.26). In a traditional co-located organization, the performance-regulating behaviour of the leader can happen rapidly with a glance round the office, whereas in the e-collaboration environment this information is not so readily available. This loads a lot of responsibility on the individual team members, and clear engaging direction along with specific individual goals should be clearly communicated by the team leader (Bell & Kozlowski, 2002, p.26).

Also time should be allocated to training the team, once the tools have been chosen. Beranek and Martz (2005, p.200) found that "*teams receiving training showed more cohesiveness, perceptions of the process and satisfaction. These factors have been shown to increase team members' ability to exchange information and to positively affect the group's performance*". The training described by the authors consisted of teamwork training, discussion on drawbacks to electronic communication, and netiquette rules (p.205). The authors give hope to e-leaders in their conclusions, having found that while not impossible to manage, virtual teams just require more management and training than face-to-face teams (p.210).

The proposed solutions are summarized in table 3, along with a proposal for how well the solution fits the problem. A strong fit solves the problem, a weak fit only facilitates the solution.

TABLE 3 Summary of solutions

<b>Problem</b>	<b>Proposed solution</b>	<b>Proposed fit</b>
Goals not discussed	Wiki	Weak
Goals not concrete enough	Wiki	Weak
Goals too generic	Wiki	Weak
Not enough information on strategy	Wiki	Weak
How to give newcomers information	Wiki	Weak
How to keep track of task-completion	Scrumy, Yammer	Strong
How to inform the team members of their progress	Scrumy, Yammer, e-mail	Strong
Maintaining documentation	Wiki	Strong
Establishing standard procedures	Wiki	Weak
Routine virtual work	Google Apps, Zimbra, PiratePad, Dropbox, Skype, TeamViewer	Strong

It is important to emphasize, that according to Lurey and Raisinghani (2001), virtual team members need everything to be reinforced in a much more structured, formal process. Organizational leaders who try to improve the performance of their virtual teams by simply providing them with more advanced



technologies may be misdirecting their resources. Therefore when picking and choosing technologies from a list of solutions such as the one accomplished here, it is imperative to keep in mind the context in which they will be implemented.

## 6 Conclusion

The thesis started out with a concept analysis, exploring the concepts of virtual team, e-collaboration and leading a virtual team. Then, a collection of problems facing the leader of a virtual team were identified from the literature and explained. After identifying the problems, a list of current tools available for virtual teams was presented, along with brief feature lists. The tools were then matched to the problems to provide a proposed solution for each.

The problems discussed were: goals not being discussed, goals not concrete enough, goals too generic, not enough strategic information given to the team, how to give newcomers information, how to keep track of task-completion, how to inform the team members of their progress, issues with maintaining documentation and establishing standard procedures.

The tools were sorted for their synchronicity, and matched to the problems as proposed solutions. For each pairing, an evaluation of its value was made, based on whether the tool actually solved the problem or not. Only 40% solved the problem, and the remaining 60% merely helped with the solution.

The research question for this thesis was "Do freely available e-collaboration tools solve the problems of leading virtual teams?" The answer presenting itself from the examined set of tools seems to be "partly". This is because the larger part of the problems could only be helped by the technology, not actually solved.

The problems turned out to be so qualitative in nature, so connected to the decision making and personal abilities of the leader, that technology can merely act as a medium to bring the decisions to the team members. However, as the carrier of that information, the magnitude of its importance surprised the author during the conduction of this research. While not the direct solution, the technology choice seems to be critical to the success of a virtual team.

This research is limited by its narrow study of the e-collaboration tools. Because of the restricted length and scope of this thesis, there was no comprehensive empirical study conducted on the tools. Hence, further study should include empirical research on how these tools actually perform on the field.

Another limitation is the fact that free tools were used: if the perspective were shifted from strict cost-efficiency, the results might be very different.

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