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Technology Support for the Enhancement of Productivity in International Virtual Teams

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Abstract

The enhancement of productivity in international virtual teams can be accomplished through improved technology support, since technology support represents the enabler for traditional teams to operate virtually. As leaders of virtual teams (regardless if the teams are international, national, regional, or local) begin to form and manage virtual workplaces, it is important for them to provide a portfolio of technology support for their teams. Technological tools such as Webcons (i.e., Web conferences), Webcasts (i.e., Web broadcasts), Webinars (i.e., Web seminars), virtual private networks, instant messaging, electronic white boards, and others play a vital role for teams in order to perform effectively in a virtual work world. Although all of these tools are somewhat interdependent, it is helpful to consider them as belonging to one of three broad categories of technology: Infrastructure, Instant Communication, and Collaboration.

This article provides a foundation, based on literature research, for the utilization of technology support to enhance the productivity of international virtual teams, as well as examples through mini-cases to illustrate practical application and integration of these different categories of technology. Though the focus is on international virtual teams, the foundation and examples are also relevant to national, regional, and local virtual teams.

Introduction

The enhancement of productivity in international virtual teams can logically be accomplished through improved technology support, since technology support represents the enabler for traditional teams to operate virtually. This article provides a foundation, based on literature research, for the utilization of technology support to enhance the productivity of international virtual teams, as well as examples through mini-cases to illustrate practical applications of this technology.

As leaders of virtual teams (regardless if the teams are international, national, regional, or local) begin to form and manage virtual workplaces, it is important for them to provide a portfolio of technology support for their teams. Technological tools such as Webcons (i.e., Web conferences), Webcasts (i.e., Web broadcasts), Webinars (i.e., Web seminars), virtual private networks, instant messaging, electronic white boards, and others play a vital role for teams in order to perform effectively in a virtual work world. Although all of these tools are somewhat interdependent, it is helpful to consider them as belonging to one of three broad categories of technology: Infrastructure, Instant Communication, and Collaboration.

Infrastructure

At their core, virtual teams function because of the rapid escalation of the Internet infrastructure and its components: the World Wide Web (WWW or

Web), bandwidth, remote connectivity, virtual private networks (VPNs), intranets, extranets and others. The key to enable the use of these tools is the technology's infrastructure. The traditional hardwired physical infrastructure of many networks is rapidly being replaced by wireless; for example, two of the authors have created a professional office for themselves that is completely wireless (and paperless). The explosion of the Internet and its functionality has driven the demand for bandwidth (Coopers, 1999). The WWW and its underlying structure Transfer Control Protocol/Internet Protocol (TCP/IP) is the communication set of rules that allow individuals to utilize this global network.

Internet

By its nature, the Internet can offer many low-cost or free services to virtual teams. It provides, at minimum, basic communication connectivity to other computers around the world supplying Web browsing, remote log-ins, file transfers, intranets, and extranet capability through Internet Service Providers (ISPs). ISPs may offer customers the ability to build and post a customized Web site. With this tool, it is possible for a virtual team to have its own information posted on a Web site for reference throughout the project. For teams with small project budgets, a Web site offered by the team's ISP would enable team members to post information about the project as it unfolds. There exists a security risk with this option, however, since all Web sites through ISPs are public access; hence, it is possible that others—competitors, hackers, or random visitors—can gain access to the project team's project information by locating this Web site through their browsers.

If, on that site, the ISP also offers the opportunity for customers to have a file-transfer-protocol (FTP) service available, virtual team members may send, store, and retrieve files on that site. This option, as well, represents a potential security risk since FTP capability allows computer users, authorized or unauthorized, access to the Web server. Without safeguards in place by the ISP, this option might enable hackers to transfer files (i.e., viruses) to the Web server.

Virtual Private Networks (VPNs)

More commonly, however, virtual project teams work with or as part of a larger business entity; often, these teams need not rely on creating an independent Web environment, but rather use a portion of an existing corporate network. In large, long term, or computer-intensive projects, project intranets and VPNs are very effective. A virtual private network enables a virtual team to secure its confidential work from the rest of the Internet and operate virtually as though residing on its own local area network (LAN). VPNs exist to provide team members with "tunnels" into secured computer environments. From any location, virtual team members can access

corporate and project information; hence, VPNs are ideal for collaborative documentation projects.

An example of a practical application of a VPN is illustrated through a project that one of the authors worked on at a large, international, food-and-facilities-management company; the technical scope of the project involved installing, migrating, and deploying a new Lotus Notes/Domino server in a remote location. The client company had originally outsourced its Lotus Notes/Domino environment. The service provider that housed the server and all of its applications became a risk: media rumors indicated that the company was in trouble financially and that it might declare bankruptcy or liquidate. Hence, the author's client company decided to create an identical server in-house, migrate its applications to that server and deploy applications to its customer base internally, ultimately canceling the outsourcing contract. This new server was to be located in the company data center in the District of Columbia, United States of America; however the teams of developers, administrators, and users were located in different regions of the country. Given the urgency of this project, since the client company had no idea what contingency plans the outsourced company would have if shut down, the local team in New York State completed some preliminary configuration work in approximately two-days' time, shipped the server to the District of Columbia, then had it "plugged in" by a PC technician with knowledge of PCs but little knowledge of Domino server administration. All other tasks, such as application mirroring, user-base migration, and network "clustering" were handled remotely by the entire virtual team, which ultimately involved members from the States of New York, Pennsylvania, Ohio, and the District of Columbia. The virtual team worked exclusively over a VPN to bring this implementation project to a successful conclusion. Throughout the technical migration of this system, the virtual team utilized VPN technology for all other project components such as migration documents, project-and-task management, electronic communication, and application development.

Intranets

An intranet is a network that uses a Web browser as a universal-applications client and that is accessible only by individuals within a particular organization (Coopers, 1999). In conjunction with VPNs, intranets provide virtual team members with the capability to complete project work from any location, centrally using and storing that work on an organization's infrastructure. Similarly, an extranet extends this type of functionality beyond the organization to include partners, suppliers, and customers.

As an example of an international virtual team using VPN, intranet, and extranet technology, Boeing Corporation developed its Boeing 777 aircraft entirely by paperless processes. This drastically reduced the development time and reduced the amount of scrap and rework by 60% to 90%. As a result, the Boeing 777 has secured a 75% market share over its Airbus A-330 and A-340 competition. As another example, Chrysler Corporation, now owned

by Daimler Chrysler AG, uses a similar approach to design its new cars. The carmaker reduced the time, from concept to production, to two years from six years (Morrison, 1999).

Instant Communication

The crucial nature of communication technologies in electronic business has been established (Luczak, Bleck, & Quadt, 2003). Once the infrastructure is defined for virtual team members, they can use other technology for instant communication. Virtual team members, in order to complete daily tasks and perform day-to-day communication duties, use these tools. This technology includes, but is not limited to, electronic mail (E-mail), newsgroups, Instant Messaging (IM), desktop multimedia conferencing, and net meetings.

Electronic Mail (E-mail)

Though it can be considered an "older" technological system, e-mail is one of the most widely used tools on the Internet. Organizations, individuals, and teams leverage this tool heavily. E-mail works most effectively to communicate simple content and information between two individuals, or as a one-way communication to a group through an e-mailing list. E-mail is not appropriate for sensitive issues, as it cannot communicate tone or body language effectively. E-mail is also not appropriate for multi-user discussion, such as asking for feedback on an issue from multiple team members. While many e-mail products offer "discussion threads" that would trace all of the responses made to that topic, it relies heavily on users ensuring that all communication is shared among the distribution or group list. In Microsoft Outlook, for example, the discussion thread feature requires each user to reply with "Reply-All": if one individual does not, the thread is broken, causing the tool to be ineffective. Therefore, virtual teams need to be careful when using e-mail for day-to-day communications.

Newsgroups

Perhaps a better tool for virtual teams is a newsgroup, list-serv, or a collaborative tool. Newsgroups, or list-servs, are "threaded" or thematic discussions that are stored on an Internet server, either on an ISP or an organization's Internet server, that offer users the ability to participate in a multi-way communication with other newsgroup members (Coopers, 1999). Newsgroups may be public or private based on a subscription structure. Newsgroup software is available through common browsers (i.e. Netscape Navigator or Microsoft Internet Explorer), downloadable for free, or available at a low cost from an ISP. A virtual team may choose this technology to communicate in a forum-like structure with little cost against its budget. This technology captures discussions electronically, thereby reducing the broken discussion threads common in e-mail communication tools.

Instant Messaging

Instant messaging (IM) software is a multi-user chat technology that allows clients to conduct PC-to-PC or PC-to-phone voice chats (used in conjunction with a microphone and speakers), communicate with Net-connected Palm or Windows CE devices, and help alert contacts of current communication availability (Willmott & Caplan, 2002). IM evolved out of the more traditional Web-based chat software that was used in a controlled environment (a single, hosted Web site). One of the most widely used IM tools used to-date, for personal (buddy list) communication, is America On-line (AOL) instant messaging.

There is significant controversy over IM within organizations, however. First, the "cost" to this often "free" tool is the advertising of products and the public use of the customer list of these tools. For example, one of the authors has subscribed to at least one of these tools to use while participating on a virtual team and promptly began receiving e-mail messages advertising pornography sites. She experienced a "cost" to using this "free" service. "In the next few years, the number of corporate IM users is expected to increase exponentially, from 18.4 million this year to 229.2 million in 2005, according to Framingham, MA-based consultancy IDC" (Salamone, 2002).

An example of a practical application of IM is illustrated through a project that one of the authors worked on at a medium-sized adhesives manufacturer, based in the United States of America; the project involved developing new workflow applications in Microsoft Exchange and migrating current Lotus Notes/Domino users to that new platform. The company decided to standardize its e-mail platform to Microsoft Exchange versus its current Lotus Notes/Domino platform. In addition to using this tool as an e-mail solution, the company decided to leverage Microsoft Exchange's workflow technology by building workflow applications for use in standard back-office processes. An international virtual team of consultants was hired to assist the manufacturing company with its electronic-workflow project. The project manager and technical staff were in the State of Pennsylvania, the workflow design consultant and Domino users were in the State of New York, and the lead programmer was in Toronto, Canada. During the initial design phase of the project, team members met predominantly face-to-face in New York State with management and a sample user base. During the later design and development stages, team members worked virtually on concurrent tasks, from their respective local offices. At that time, schedules varied—from early morning meetings, to afternoon working sessions, to late-night programming sessions. As a communication mechanism, virtual team members were asked to be available via IM as often as possible, and definitely to be available during afternoons. Hence, through IM, the team members were able to instantly and continuously communicate with each other, for the relatively inexpensive cost of the Internet connection, versus incurring long-distance national and international phone charges.

Additionally, this international virtual team leveraged many communication tools other than IM, such as e-mail and desktop multimedia conferencing. During the process mapping phase, for example, the team used electronic whiteboard technology to collaborate on process and information flow within and between specific application modules (e.g., Electronic Expense Reporting and Product Returns Routing).

Desktop Multimedia Conferencing

Desktop multimedia conferencing software uses existing networking and multimedia technology primarily to deliver video, audio and text to participants who can be globally dispersed; it has also been publicized as a more affordable and efficient alternative to traditional conference room business meetings, because it saves on travel and lodging costs. More recent multimedia conferencing products take advantage of the Internet as a communications medium, allowing attendees to participate in meetings directly from Web browsers. Participants can view Web-based presentations, view participants through desktop-mounted Web cameras, and speak to participants through PC-based microphones. Three-dimensional (3D) capability is also available for multimedia (Vosinakis & Panayiotopoulos, 2005). It is important to note that desktop multimedia conferencing systems should not be perceived as being useful only to larger groups over great distances. For example, one author uses a desktop multimedia conferencing system for daily communication with individual colleagues across the Atlantic Ocean, and two of the authors use this category of software for communication with each other within one physical site, due to its superior features when compared to other categories of communication software.

Collaboration

Exploitation of modern communication technologies provides a bridge for the project to allow collaboration between geographically distant partners (Hameri, 1997). Since a virtual team may be globally dispersed, cultural awareness becomes very important; a requirement of proper virtual team formation is that team members must be educated about possible cultural differences in expression or perception among the team members, in order to prevent damaging misunderstandings and facilitate the building of trust. Also, language-translator software can be very useful for teams whose members do not all speak the same native language. However, an important caveat is that this category of software is not failsafe. For example, one of the authors is fluent in English and German, and has traveled throughout the United States of America and Germany, as well as a number of English-speaking or German-speaking regions in the United Kingdom, Canada, Austria and Switzerland; this author has not yet discovered a language-translator system that will translate between English and German with complete accuracy, since in both languages the same word can have a subtly

different meaning depending on the region—often a positive connotation in one region versus a negative connotation in another—with the additional confounding factor that languages constantly evolve. Hence, clarification should be sought by team members if there is any perception that the software did not give a completely correct translation. An additional important factor is that the quality of IT infrastructure can vary between countries, and therefore must be considered during the formation of the team. While some teams, both traditional and virtual, are required to find tools independently of their customer or client environments in order to deliver work products, many teams belong to organizations that have infrastructure and communication tools necessary to support effective project execution.

Collaboration tools are developed in order to manage the information that is used in project work products. Too often, individuals, teams, and companies share information haphazardly, rather than collecting, mining, and re-using this information. Collaboration tools reduce the risk of lost information and knowledge by working to collect and organize work products, meaningful project documentation, and valuable knowledge from project participants. An additional benefit of collaboration tools is that they permit experienced outside advisors to be brought in virtually to foster group morale and develop new strategies (Veil & Turner, 2002). For very small or short term projects, it may be appropriate to use electronic file folders (FTP sites) and ISP-based networks for project work. These small teams can store all meeting minutes, design documents, status reports, and analysis data in electronic folders on a Web site or network drive. However, these teams must "force" or "cause" the information to be collected, organized, and maintained. Technology collaboration tools, needed for longer term or more complex projects, offer features that electronically collect, organize, and maintain information intuitively: they vary widely, ranging from free Web-based and individual-based solutions to complex fully-integrated client-server solutions.

For small- to medium-sized projects, virtual team members may consider Web-based, pay-as-you-go project collaboration such as researched by TechRepublic's Rick Freedman. According to Freedman's research, Web-based project tools can solve many collaboration problems by providing a central repository for project information. He has researched the online pay-as-you-go project collaboration tools that are available to consultants and virtual team members in order to facilitate the coordination and management of virtual projects. These tools offer features such as shared calendars, project folders, and discussion forums. One example, OnProject, features a set of tools that enable virtual project management of active projects, tasks, files, and electronic discussions. This product offers drill-down capability in order to view and report more or less detail as well as to gain access to source documents for further investigation. It provides view, add, modify, and update capability to better manage projects and their status. Freedman cautions, however, that while the price for OnProject ($50 per month, for up to 20 users), may be appropriate for many virtual teams, the rather rudimentary discussion feature may discourage and disappoint team members requiring more

advanced capability (Freedman, 2001).

On longer-term projects or company-sponsored projects, virtual teams may choose solutions for collaborative, datamining, documentation control, and knowledge management. As an example, CNA Insurance Company utilized collaboration technology to solve its communication dilemma prior to a large convention. The company's senior vice president of organizational development used collaboration (portal) software in order to supply 350 participants with project status reports, budgeting tools, document logs, responsibility matrices, project summaries, and goals, electronically. This solution also provided CNA and colleagues with a general discussion space to review key documents, make modifications, and respond to revisions others had made. This technology resulted in participants who were fully briefed in advance of the convention, enabling management to launch into the more pivotal issues, confident that everyone in attendance had prior knowledge of the concerns at hand (Robb, 2002).

To date, IBM/Lotus has excelled in the collaborative software arena with its Lotus Notes/Domino and Sametime solutions. Al Zollar, general manager of IBM's Lotus Software division, explains that IBM's company-wide deployment of Lotus applications has resulted in Big Blue savings of $4 million a month in travel expenses, by conducting more than 4,000 e-meetings per month using Lotus' Sametime application, as part of $400 million in annual savings for the company since deploying Lotus' Dynamic Workplaces solution. The Dynamic Workplaces initiative, the cornerstone of Lotus' contextual collaboration strategy, includes Lotus technology for e-meetings, e-learning and instant messaging as well as employee directory lookup, knowledge and expertise management and customizable portals. Additionally, more than 60% of Big Blue's some 300,000 employees use Sametime for instant messaging, in an effort to equip the company's employees for the journey to a dynamic workplace (Callaghan, 2002).

Another technology leader involves the virtual team experts Jessica Lipnack (CEO of NetAge) and Jeffrey Stamps (Chief Scientist of Open Text Affinity Partner) who have provided technology tools for their clients with their product Livelink. Livelink VirtualTeams integrates the proven Virtual Teams Methodology(TM) with Livelink's collaboration technologies, enabling team members to focus on critical success factors (Newswire, 2002).

As a final note regarding collaboration, as the future of virtual teams unfolds, Microsoft is paving its way by providing virtual teams with collaborative solutions through its .Net ("dot Net") architecture.

An example of the practical integration of a number of technologies discussed above is illustrated by the following company project, in Washington Mills, a company well known to one of the authors. Washington Mills is a medium-sized, international manufacturing company headquartered in North Grafton, State of Massachusetts, United States of America, with plants located in Niagara Falls, New York State, Tonawanda, New York State, Hennepin, State of Illinois, Sun Prairie, State of Wisconsin, Niagara Falls, Canada, Manchester, England, and Orkanger, Norway. A project to implement an

Enterprise Resource Planning (ERP) system has been initiated and is expected to be completed in two to three years. The current international virtual team is primarily made up of individuals located at a single site but also includes contract developers from Canada and Florida. In order to coordinate virtual-team members, an e-mailing list has been created, through which the various team members can keep each other apprised of concerns and progress. The project itself is managed with a Web-based tool named Request Tracker. Request Tracker is a "ticketing" system currently used by the company's Information Systems (IS) staff to manage user support requests.

The virtual team's contract developers will use the company's Virtual Private Network to upload and test their work. Desktop multimedia conferencing software such as PalTalk—which supports simultaneous, real-time, bi-directional video, audio and text—is currently being evaluated as a means of facilitating development, support, and training. Such software will reduce travel costs and will have benefits extending beyond the project itself.

As the project implementation begins to affect a larger portion of the company's work force, a single e-mailing list will become a cumbersome means for project communication. Instead, a second e-mailing list will be created for users, keeping the current e-mailing list as a "developers" list. Request Tracker will be expanded to enable wider user access, and a Web forum will be implemented so that users can initiate and monitor discussions on various components of the ERP project (e.g., Accounting, Manufacturing, Customer Service, etc.).

Post-implementation, the Web forum and Request Tracker are expected to become the primary tools for day-to-day user support.

The High-Performance Team

A project can be viewed as a temporary organization, with the project manager being the chief executive of the temporary organization (Turner & Müller, 2003); hence, it is especially important that the project manager be knowledgeable about the technology that will produce high performance for his or her virtual team. While technology is the leading enabler for virtual teams, one cannot forget the basic requirements of all high performance teams. WWW.techrepublic.com is a well-renowned Web "community" constructed and maintained by the Gartner Group. In one of its publications, Gartner emphasizes, "A well-expressed purpose is mandatory in all teams, particularly virtual teams. A defined team purpose bonds dispersed and disparate people—each contributing skill, focus, accountability, and learning. It becomes the logical connector in a work environment that lacks physical cues (e.g., body language, casual meetings, white boards, office locations, and rank). Without physical cues and boundaries to serve as symbols, purpose brings focus and clarity to people's roles and serves as a compass for team direction and effort. In other words, a well-crafted purpose helps team members understand their roles, their collective impact, and how they will make a difference" (Gartner, 2001).

Technology, along with traditional communications methods, must be utilized in the virtual-team environment. Lipnack & Stamps challenge that "team members, as guided by their leadership, need to select the communication medium appropriate to the need:

- Face-to-face helps build trust.
- Real-time media keep people in sync.
- Asynchronous media create the ability to link over time, the persisting online meeting place" (Lipnack & Stamps, 2000).

Most of the tools discussed throughout this paper meet these requirements. Instant messaging software and desktop multimedia conferencing provide real-time connectivity. Collaborative tools such as IBM/Lotus Domino infrastructure or Web-based forums and newsgroups provide asynchronous solutions to communication.

However, like traditional meetings, virtual meetings need to be scheduled and documented; action items need to be assigned. Routine live-group interactions, either face-to-face or through multimedia conferencing, is necessary. The authors agree with the experts that, wherever possible, kickoff meetings should be face-to-face unless geographic barriers prevent it. "IT people [specifically] know so much about the technology, it's difficult for them to put the technology aside and think about human issues. For IT people to get focused off the hardware and into the 'peopleware' is the real challenge in design, implementation and participation [of virtual teaming]. The solution is to try to bring them face-to-face to begin with, because it gives you a chance to build trust. Without trust, nothing is going to happen" (Lipnack, 2001).

Despite the myriad of technology solutions available to virtual teams, many experts believe that "co-located teams still work best, [yet] most feel that virtual teams can be successful if they are formed, trained and managed correctly. Team members must be able to communicate well and work independently. They also should possess a good work ethic, initiative and creativity" (Joinson, 2002).

Given the rapid expansion of the Internet and the supporting technology tools that enable individuals to work "separately, together," projects executed in a virtual environment are inevitable. Globalization and the easy availability of groupware (e-mail, teleconferencing, threaded discussions, etc.), now make virtual teaming both desirable and inevitable. "Virtual teaming is a concept that makes sense for today, when the Internet plays an increasingly vital role in just about every aspect of business. But a warning is warranted. Successful virtual teaming takes more than bonding and consensus. It also demands a rigorous mindset. Apply discipline and virtual teaming delivers speed, innovation, competitive advantage and a synergism that can be achieved with maximum efficiency and at a minimum cost" (Nucifora, 2002).

Furthermore, "[for] a virtual team that is working anywhere at any time, digital technology dramatically expands its communication bandwidth—professionally, organizationally, educationally, psychologically, personally, intellectually, emotionally, and socially" (Lipnack & Stamps, 2000).

Conclusions

Through the 1990s and early 2000s, telecommunication companies, government organizations and other technologists have focused on infrastructure—developing the hardware, software, and standardized protocols to deliver quicker telecommunication access, and to provide it to numerous additional locations around the globe. This has resulted in a present infrastructure that—though not ideal—is realistically sufficient. Through the second half of the 2000s and beyond, increased focus on instant communication and collaboration should be done, since these are the areas where the greatest performance gains can be realized.

There has also been a paradigm shift from traditional teams to virtual teams, due to organizations expanding regionally and globally; this shift has a more pronounced effect on international virtual teams, due to the greater difficulty, because of greater distance, in arranging traditional meetings. As this paradigm shift continues, evolving technology support must be provided, for virtual teams to continue to enhance their productivity.

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