Understanding Virtual Organizations

By Les Pang, Ph.D.

This article examines the concepts, technologies, and issues surrounding virtual organizations (VO) from a knowledge management (KM) perspective. It identifies foundational concepts, surveys KM technologies that support VOs and looks at case studies of VOs in the private and public sector. Key to this discussion is a look at technical and managerial issues surrounding VOs and the migration strategies and best practices needed to ensure a successful implementation, as well as the future of VOs.

What Is a Virtual Organization?

More and more organizations are looking at virtual organizations to address critical resource, personnel and logistical issues. There are many definitions of virtual organizations, including:

- A flexible network of independent entities linked by information technology to share skills, knowledge and access to others' expertise in nontraditional ways
- A form of cooperation involving companies, institutions and/or individuals delivering a product or service on the basis of a common business understanding. The units participate in the collaboration and present themselves as a unified organization.
- Virtual organizations do not need to have all of the people, or sometimes any of the people, in one place to deliver their service. The organization exists but you cannot see it. It is a network, not an office. To summarize these definitions, attributes of VOs include:
- A dispersed network of skills and capabilities--The structure of a VO is distributed among multiple locations resulting in the capacity of bringing in a wider pool of skills and capabilities.
- The use of telecommunications and computing technologies--These technologies serve as the enabler that makes a VO exist. One could argue that VOs have always existed--traveling sales staff, outsourced staff and staff working at home. However, what is new is that technology has made it much easier to support distributed work teams. Barriers of distance and time have been overcome by technology.
- Flexible, dynamic, restless--Organizations no longer are constrained by traditional barriers of place and time. VOs support dynamic changes to the organization including employee work environments and processing structures. Restlessness refers to the attitude to willingly change products and services, geographic dispersion, communication patterns. This has the potential of leading toward higher levels of innovation and creativity.

- Integration--When different individuals, groups and organizations get together in a VO, they need to interact collectively to achieve success. This implies greater levels of collaboration, cooperation and trust. Integration leverages the synergy of individuals.
- Situations that are driving many organizations to examine and implement VOs include:

- A need for process innovation--This is often motivated by competitive pressures, stakeholder demands and other factors to achieve increased productivity and quality. There is typically a 30 to 50 percent increase in productivity as result of implementing VOs.
- Sharing of core competencies--VOs help address the voids in an organization resulting from starting up, turnover and retirements.
- Globalization--Many organizations are finally realizing there is a vast pool of untapped skills, knowledge and abilities throughout the world.
- Mobile workers--VO concepts can help the numerous companies employing mobile workers such as auditors, consultants, salespersons and service technicians.
- Cost reduction--Improving efficiency often means reducing overhead, such as physical assets used to support traditional work environments or redistributing costs over several physical locations.
- Changes in employee values and attitudes toward work--Quality of life is a major factor particularly in attracting and retaining quality employees. Employers have realized that a balance of work and personal life, family requirements, personal fulfillment and flexibility are important considerations among employees.
- Costs and problems of traveling--VOs address transportation issues, such as unproductive commute time, traffic hassles, the cost of fuel and environmental impact of commuting vehicles.
- Typical approaches in implementing VOs include:

- Telecommuting--Employees work at a location away from the usual workplace, but not necessarily at home. Computers and telecommunications equipment are used to maintain contact between the telecommuter and the home office.
- Telecenters--These satellite offices typically are located in communities outside of major cities and provide space and equipment for employees commonly not available in the telecommuter's home.
- Mobile working--This refers to the working environment of mobile workers who require tools such as cell phones, e-mail wireless devices, pagers and laptops.
- Hot desking--This arrangement is for offices in which staff members spend a significant amount of time on customer premises. It involves the removal of permanently assigned desks to all or some of the employees. When they arrive, they are assigned a computer workstation where they can access their documents, files, applications and e-mail.

- Hoteling--This is when the client provides a hot desk for the VO's employees.
- Virtual teams--Employees collaborate from remote locations using e-mail, groupware, the Intranet and/or video conferencing.

Technologies

Basic technologies supporting VOs include the Internet and the World Wide Web, telecommunications, electronic mail, groupware such as Lotus Notes, and video conferencing. These technologies have matured somewhat so this article focuses on knowledge management (KM) technologies that support VOs. KM has been defined by the International Center for Applied Studies in Information Technology as "a conscious strategy of getting the right knowledge to the right people at the right time and helping people share and put information into action in ways that strive to improve organizational performance."

KM technologies supporting VOs include:

- Collaborative technologies
- Extensible markup language (XML)
- Intranets and extranets
- Personal devices
- Wireless technologies
- Virtual reality (VR)
- Portals

Collaborative technologies are divided into two groups--asynchronous and synchronous. Asynchronous collaboration tools include document sharing software, group calendaring and newsgroups. Synchronous tools include virtual meeting rooms (group support systems), shared whiteboards, application sharing and video/audio conferencing.

An interesting combination of both can be found in what is called integrated collaboration. An example is MITRE's Collaborative Virtual Workspace (CVW), which provides a persistent virtual space within which applications, documents and people are directly accessible in rooms, floors and buildings. To a user, a CVW is a building divided into floors and rooms, where each room provides a context for communication and document sharing. CVW allows people to gather in rooms to talk through chat or audio/video conferencing and to share text and URLs with one another. For privacy, users can lock rooms and communicate privately within and between rooms. Rooms are also used for document sharing. Users can place different documents into a room, allowing anyone else in that room to read the document. Examples of documents include whiteboards, URLs, notes and other documents edited through the user's local applications.

Extensible markup language (XML) is meta-markup language for describing structured data in that environment, whereas hypertext markup language

(HTML) is for displaying data and graphics over the web. XML is evolving to be the common structure for data interchange among disparate heterogeneous systems. It will have a tremendous impact in the sharing of data and for supporting increased functionality (e.g., searching for information).

Intranet is a network of networks contained within an enterprise and protected from outside intrusion through firewalls. Intranets permit the sharing of company information and computing resources among managers and employees. Examples of intranet applications include manuals, procedures, internal job offerings, documents, employee information, schedules and calendars, databases and project management.

Extranets permit further accessibility. In an extranet, the intranet is extended to external stakeholders such as customers, suppliers and trading partners. Examples of extranet applications include collaboration, data sharing, project management, news and training.

Personal devices include personal digital assistants, cell phones, e-mail wireless devices and Internet appliances. These devices enable employees to have an office anywhere and an expanded reach to both management and clients. There is a growing trend toward a convergence of functionalities onto one device.

Wireless technologies include Bluetooth, which is a computing and telecommunications specification that describes how mobile phones, computers and personal digital assistants can seamlessly connect with each other using a short-range (10-meter) wireless connection via a radio frequency. The technology requires that a low-cost transceiver chip be included in each device.

Another wireless technology, wireless local area network (LAN), allows a user to connect to a network through a wireless radio connection. IEEE 802.11 specifies the technologies for wireless LANs.

There are various types of *virtual reality*:

- Immersive experience--The user visits a world through a wearable device (e.g., head tracker and helmet, glasses, goggles or a data glove) and interacts with that world as though he/she were actually a part of it. This form of VR is the most popular version and the one with the most exposure.
- Desktop systems--They are at the lower end of the spectrum in terms of cost and are worlds that are not immersive and that run on regular personal computers without additional hardware. These worlds still allow the user to be interactive within the world, but not immersive.
- Mirror world or second person experiences--The user is represented by a figure or avatar inside the computer. The user manipulates this avatar within the world and interacts indirectly with the world. By controlling this electronic

image of his or herself, the user can interact extensively within the world.

- Telepresence technology--The user remotely controls a mechanical manipulator to perform some action or explore some aspect of a world. For example, the user might steer the Mars rover across the terrain, explore under Antarctica or perform surgery remotely. Most of the time the user is wearing some sort of headset to project him or herself into the mechanical manipulator in an immersive manner.
- CAVE (cave automatic virtual environment)--It consists of a multiple screen environment, which surrounds the user. Many CAVE setups have multiple users involved. The user steps into the CAVE and enters a virtual world on all sides. Although probably the most expensive type of VR setup, the CAVE is growing in popularity rapidly because of the ability to project a realistic experience for multiple users at once.

Portals are starting web sites for users to access the knowledge content they need and want. Examples of information resources that can be consolidated and accessed via a portal include search engines, e-mail, web links, databases from disparate sources, forms, documents and task lists.

The Use of Virtual Organizations

The United Kingdom has mandated that 100 percent of its government services be online by 2005. The thrust of this effort is UK Gateway, a web portal that will allow citizens and businesses to conduct all official transactions online. The goal of making all government services digital is an ambitious one by world standards, but there is confidence that the UK will hit its target. In the United Kingdom today, 57 percent of the population of 60 million people have access to the Internet, and 98 percent of the country's three million businesses are connected.

Many organizations and governmental agencies have established virtual organizations. Below are descriptions of a number of them in the private and public sectors.

Private Sector Case Studies

Aventis (France)--One of the world leaders in pharmaceuticals and agriculture, Aventis was launched in December 1999 through the merger of Hoechst AG of Germany and Rhône-Poulenc SA of France. Its engineering department in the United States was made up of many technical islands that reported to different organizations and different businesses. There was no consistency in work quality, no practical standards and little cooperation between any of the groups. In response, a virtual organization organized into five technical service groups (TSGs) and one technology group (TG) was formed. The TSGs were developed around process technologies and customer needs, not geography. The engineers in a TSG can be and are located anywhere in North America. The TG is based in New Jersey primarily because of the economies of a central lab facility. This new organization is highly mobile, focused on customer needs and

aligned with business goals. It shares technology, information and best practices.

Dell Computers (US)--Companies are rapidly moving away from self-contained, vertically integrated organizations to virtual entities that rely on business partners to fulfill major parts of their supply chains. This means a company will outsource any part of its operations to companies that can more efficiently, reliably and cost-effectively implement the work. For example, most of the components in a Dell computer are made by other companies while Dell focuses on its strengths--marketing, customer support and integration of these components into the final computer products.

When buying a computer from Dell, the virtual organization includes the Dell customer service rep, assembly line and assembly crew, supply people for various components, the UPS truck and driver who delivers the computer, and people from MasterCard who pay for it. All of the inventory in the system, regardless of location and ownership of the company, can be viewed as a single system. Benefits may include overall lower inventory levels in the whole system and better customer service. For example, Dell tries to keep as little actual inventory on hand as possible.

British Telecom (Great Britain)--British Telecommunications PLC is one of the world's leading providers of telecommunications services and one of the largest private sector companies in Europe. In April 2000, the company announced a reorganization of its activities into new, self-contained businesses that enable greater management focus. Process streamlining was initiated, concentrating on the way in which orders progressed through the organization. The preparation work was conducted in virtual teams where professionals from British Telecom and its consultants worked closely. Using the Internet and the extranet, British Telecom was successful in connecting the ordering system seamlessly to all the existing legacy systems in the organization.

Processing time was drastically reduced within the expected time frame. The company can deal with much greater volumes--three to four more than before--with the same number of people. A BT spokesman indicated: "With better information more quickly available, it is easier for us to convert leads into orders. Optimizing our electronic interface has vastly improved our collaboration with telemarketing companies."

Crowley Communications (US)--This public relations firm provides products and services such as press releases, brochures, photos and graphics. The firm has only one full-time employee, Jolene Crowley, who is in charge of contracting teams of people to work on projects as needed. These teams are spread around California and the rest of the United States and are made up of specialists linked by computers and telecommunications equipment. This virtual company partners with a marketing firm for larger scale projects.

Reuters Holdings (Great Britain)--This financial information services company created virtual teams with representatives from 12 companies around the world to work on user interfaces for the company. Facilitated by the signing of nondisclosure agreements, there has been savings in recruitment costs, staff benefits and overhead as a result of this virtual organization approach.

Public Sector Case Studies

US Department of Defense--All military services have constructed virtual battlefields as an integrated part of their military strategy. Besides training and mission rehearsal, these battle labs test weapons that have yet to be created. Often these battlefields are distributed and interactive. For example, war game participants are located at remote sites and use high-bandwidth telecommunication technology and high performance computing to simulate an armed conflict. Participants can provide online interactivity with real-time responses.

US Army--The Army Knowledge Online serves as a portal for army personnel to personalize content, access web e-mail and newsgroups, locate other army personnel, read army news, run web-based army applications and search all army web sites.

US Department of Agriculture (USDA)--USDA's Animal and Plant Health Inspection Service merged all 250 IRM employees throughout the agency's 11 units into a single organization. Instead of moving employees to a centralized location, they were left physically and budgetarily where they were before the initiative began. Employees are funded by one unit and receive direction from another.

At the USDA's National Plant Data Center, 90 percent of interaction is done via teleconferencing, e-mail and video conferencing. "Some of the team members have never met each other in person," a USDA representative said.

At its Agricultural Marketing Service, USDA avoided the costs of setting up a reading room by creating a virtual reading room online. This also significantly reduced Freedom of Information Act requests.

US Department of Energy--The department and its contractors uses advanced computer and communication technologies to manage a highly complex radioactive waste management project at Yucca Mountain, Nevada. The Yucca Mountain project has begun to implement "virtual teamwork" to provide more efficient and effective collaboration among employees.

US Social Security Administration--The administration links 36 sites of various sizes across the country in a virtual call center operated by 3,800 full- and part-time employees, along with 4,000 more trained and equipped to back them up. Incoming calls across the United States are routed to whatever site has

employees available to answer them. For example, someone from Baltimore may call the Social Security office in that city. If the representatives at the Baltimore center are busy, calls are rerouted to the Birmingham, Alabama, center assuming representatives there are free. This assists in leveling the workload and improving customer service by reducing busy signals. Last year, the call center's busy rate was a mere 7 percent, and the average time a caller waited to talk with someone was two minutes. In 1995, a study found that the average wait time of eight minutes among private sector firms was considered top-notch in customer service.

Technical and Managerial Issues

Several key technical issues surround VOs:

- The capability of the communications network--For example, the potential limitations on bandwidth for transmission. This has the impact of slowing down the necessary information flow and interactivity between the entities in a VO. Related to this problem is the reliability of the network and its servers. If the network is down frequently, it can have profound effects on the productivity of a VO.
- Hardware and software compatibility issues--For example, in a telecommuting scenario, home computers range in the type of hardware characteristics, such as processing power and memory. These inconsistencies often result in common applications being slow, difficult to use or even inoperative across the different computers.
- Computer security--Due to the multiple clients in a web-based architecture, there are many points of possible intrusion into the centralized applications and data sources of an organization.
- The dynamic nature of technology--This makes managing hardware and software upgrades a difficult task for any information technology manager in a VO.

Communication Issues

The communication issues are not necessarily technical in nature, but related to human factors. Members in a virtual team may find it frustrating that messages are misunderstood or not received by other members thereby resulting in inefficiencies. Areas causing these difficulties include e-mail slang and informalities, technical jargon, confusion over teleconferencing protocols and outdated distribution lists.

There is the problem regarding ambiguity about whom to include in the communications. To be conservative, a virtual team member may send messages to everyone on the team, which contributes to mailbox overload. On the other end of the spectrum, team members may inadvertently leave out important constituents in the communication loop, thereby leading to situations where critical information was not received in a timely manner.

The lack of face-to-face interaction and the absence of body language or vocal inflections tend to reduce the quality of the message delivered. Moreover, a receiver can misinterpret the tone of the message because of the way the message was constructed (e.g., use of capital letters, e-mail slang and icons, setting the level of importance as urgent).

Finally, there is a problem with store-and-forward asynchronous communication systems in that it often takes time to communicate. There is the delay in waiting for a response after a message is delivered. This may be an issue when critical information must be passed on in a timely manner.

Managerial Issues

Managers new to a VO need to realize a new managerial style is required because of the special issues one must face in a distributed work environment:

- *Potential abuse and wasted time*--The lack of face-to-face interaction may result in the employee focusing on nonwork activities.
- *Security*--Organization resources may be open to intruders and hackers.
- *Managing and controlling at a distance*--Traditional managers do not feel secure particularly in a crisis when their employees are working remotely.
- *Ensuring employee self-motivation and self-discipline*--Keeping the employee focused on the job can be challenging when there is limited managerial oversight.
- *Defining goals and limits of responsibility*--This must be done in a virtual team to prevent duplicating an effort or missing a key job requirement.
- *Loss of personal contact*--Employees may miss the camaraderie of a traditional office environment.

There are organizational and market conditions that would prevent employees from taking part in a VO. There may be a lack of strategic fit for the company. For example, the company wants to focus on face-to-face customer interaction as opposed to using communication technologies. Also, there may be cultural resistance particularly in an organization where trust and sharing are difficult to achieve. Furthermore, a VO cannot be successful where knowledge cannot be readily shared, perhaps because of security restrictions. Finally, the lack of computing and communications technologies can hold back the implementation of a VO.

Migration Strategies

A suggested generic outline in transitioning to this new paradigm is presented below:

- Designate a capable individual.
- Establish a task force.
- Identify a vision for the VO.

- Identify business requirements.
- Conduct feasibility studies.
- Develop a migration plan.
- Provide training and user awareness.
- Set a face-to-face kickoff meeting.
- The US General Services Administration (GSA) has provided a detailed list of steps for the implementation of a telecommuting effort:

1. Designate a capable person to serve as the agency telecommuting coordinator and contact. Also, to the extent possible, establish an individual or task force to provide technical information regarding legal, human resources and technology/telecommunications issues as they relate to your organization.
2. Contact the federal task force that is coordinating governmentwide application of telecommuting programs and register the organization's coordinator. The coordinator will be provided with generic materials, guidance and other information to use in developing an implementation plan and associated policies specific to the organization.
3. Initiate informal discussion with local union representatives, if applicable.
4. If necessary, determine employee interest.
5. Explore the feasibility of the alternate workplace(s) with interested employees and identify equipment needs and costs. Visit the telecenters if applicable.
6. Make an official announcement and commitment to the program and refer inquiries to your coordinator.
7. Train all involved and be sure to explain the program's operation to nonparticipants within affected units.
8. Implement the program.

Best Practices

Based on a review of successful implementations of the VO concept, the following is a list of best practices:

- Foster cooperation, trust and empowerment.
- Ensure each partner contributes an identifiable strength or asset.
- Ensure skills and competencies are complementary, not overlapping.
- Ensure partners are adaptable.
- Ensure contractual agreements are clear and specific on roles and deliverables.
- If possible, do not replace face-to-face interaction entirely.
- Provide training which is critical to team success.
- Recognize that it takes time to develop the team.
- Ensure that technology is compatible and reliable.
- Provide technical assistance that is competent and available.

Technical and Managerial Trends

Technological Changes

There have been a number of recent developments and efforts likely to help in

supporting VOs in the future.

Advances in telecommunications particularly in support of broader bandwidths are evident today. The Internet2 project is headed by a consortium of more than 180 universities working in partnership with industry and government aimed at accelerating the creation of tomorrow's Internet. Its primary goals include: creating a leading-edge network capability for the national research community, enabling revolutionary Internet applications and ensuring the rapid transfer of new network services and applications to the broader Internet community.

Significant improvements in wireless technologies are on the horizon. For example, third-generation (3G) wireless networks will offer high-speed, packet-switched mobile voice/data networks. The 3G standards, which are being defined by working groups within the International Telecommunications Union (ITU), will be deployed to support significantly higher bandwidth over wireless communications. This increased mobile bandwidth will open up a whole new generation of applications to wireless subscribers such as collaborative and multimedia services.

Gartner Group predicts that the era of contextual computing is coming--there will be a proliferation of devices in the home, office, car and on the person, and these devices will have different interfaces optimized for the environment where the person resides. As an example, a driver could use commute time to catch up on e-mail and personalized news through an in-car system with built-in speech synthesis and intelligent agents. Within the context of VO, this era will be characterized by anytime, anywhere access to constituents on the virtual team.

Organizational Trends

• Organizational trends are summarized below:

• *More telecommuting*--With energy costs rising and environmental concerns growing, governments have been heavily promoting the concept of telecommuting and other forms of VO.
• *Outsourcing*--Many organizations are turning to outsourcing to fulfill their business requirements, particularly when these requirements are outside their core mission. Application service providers are one type of outsourcing where specific applications, data and support are located off-premises and accessible typically via the Internet. VOs can be the foundation for outsourcing activities such as these.
• *24-hour-a-day storefronts*--Growth of the Internet has been fueled by consumer desire to have convenient access to products and services. VOs must support this requirement.
• *Partnerships and strategic alliances*--The number of partnerships and interorganizational alliances among different firms has grown steadily and is expected to increase as part of need to gain competitive edge and new

customers. These collaborative efforts can be facilitated via the VO structure.

- *Growth in virtual intermediaries*--Examples include education brokers, market organizers and personalized service providers.

People Trends

Employee expectations are expected to change. The following trends are anticipated in the upcoming years:

- No set schedule or workplace
- Greater focus on own initiative and responsibility, requiring more self-discipline and self-motivation
- More flexible guidelines and rules
- Higher mobility of individuals
- Potentially less job security for those not willing to participate in the VO approach

Preparing for the Future

The question arises on how to best prepare for the transition to a VO. Here are possible answers:

1. Establish a vision. Know the proposed end state to identify the direction in which the organization should focus.
2. Consider new ways of working and managing people. Because of the unique nature of VOs, managers need to look at different ways to, say, evaluate employee performance.
3. Understand the new technologies. To maximize value, it is important to know the benefits and shortcomings of the various technologies used to support VOs.
4. Look for the right collaborators. Look not only for the right members for an internal virtual team but also the right external partners which will support the overall requirements of your organization using VO strategies.

Technologies to help enable VOs are already here. The acceptance of VOs depends on willingness of society, organizations and people to understand this concept and transition to this effective approach to management. However, as seen in this article, the concept is fraught with numerous issues and challenges. Note that understanding the technology is not enough. One must examine the people and relationship issues as well--work practices, management oversight, organizational culture and strategic alliances.

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Disclaimer

The views expressed in this presentation are those of the author and do not reflect the official policy or position of the National Defense University, the Department of Defense or the US government.

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