CHAPTER TWO

Analyze Before You Act: CMS and Knowledge Transfer

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Content management, which includes document management, Web content management, digital asset management, and records management, is increasingly important in the digital age. CMSWatch, a vendor of content management analysis, publishes the CMS Report, a tool for CMS specialists to sort through the many products for a specific corporate environment. As of April 2006, the report compared 32 vendors of content management software systems and cost $895 for a single-user standard edition. Technical communication practitioners who face the expense and complexity of implementing a content management system need to be aware that before investing in software database systems, it is important to analyze the information environment and the flow of knowledge throughout the organization. Otherwise new document databases can slow existing communication, create extra work, and impede existing methods of knowledge transfer. This is especially true in organizations that create new knowledge, since clear and rapid communication between employees is critical to their success. In some cases, an outside vendor database is not necessary and, in fact, may impede the development of new knowledge.

Content management is complex: the content can include databases of customer records and inquiries, advertising copy, accounting data, technical specifications, chunks of XML and metadata, internal procedures, employee records, vendor correspondence, and more. The amount and types of content in any organization are specific to that organization, and thus no single solution is possible. In this chapter, we warn against relying on the implementation of software systems that do not take into account the complexity and specificity of each organization. Without a solid theoretical understanding of the knowledge flow within an organization, out-of-the-box systems can interrupt the flow of information. Our premise is that the most essential element to any information organization is an unimpeded lateral flow of knowledge between people; content management systems should be built to support that flow.

Technical communicators are uniquely positioned to move into the relatively new field of content management. We occupy the space at the interstices in many organizations, having access to information from many departments, groups, and subject-matter experts. Technical communicators are more likely to have an overall view of the knowledge flow within an organization than subject matter experts who concentrate on a specific portion of a project or process (or on a single project or process). As researchers, we are trained to locate information and make it available to others. The field of content management offers us an opportunity not only to create documents but to structure the systems within which they work. However, to be able to analyze systems that support tacit knowledge exchange, we need to be aware of the flow of knowledge within organizations. The final answer is not always to create a formal content management system.

DEFINITIONS OF KNOWLEDGE AND CONTENT MANAGEMENT

There are different forms of content management and little consensus on its definition. In *Managing Enterprise Content: A Unified Content Strategy* (2003), Ann Rockley focuses on "enterprise" content management "that spans many different areas within an organization, [is] created by multiple authors, and [is] distributed in many different media" (p. ixx). Enterprise content management connects databases from disparate sections of the organization, reducing the effect of silos (departments working in isolation) and creating a single source for all information regarding a specific topic. This approach takes knowledge and breaks it into chunks so that it can be reused in a variety of formats. For large corporations with legal issues, this enterprise content management is an absolute necessity. Addey, Ellis, Suh, & Thiemecke (2002) describe content management differently in *Content Management Systems:* they approach it as a practice specific to Web sites and Web content. They write, "It is probably best to think of content management as a broad concept that covers all aspects of publishing content with digital tools" (p. 12). Wikipedia (2006) notes that there are many different types of CMS such as wikis themselves, digital asset management systems, publication management systems, Web site databases, and more. Overall, the meaning of the term "content management" is still evolving. As the Darwin Web Team (2004) puts it, "The definition of content management remains a running target—one that isn't likely to slow down anytime soon."

Content management is truly something new. It has become necessary due to our increasing use of computers, the consequent explosion of data, and our need to sort and control the data. In *Control through Communication: the Rise of System in American Management,* JoAnne Yates (1989) describes a parallel cultural shift in the 19th century, when we moved from a premodern to an industrial economy. Her basic thesis is that, with the advent of the industrial age, workers and organizations had to "rise above the individual memory and to establish an organizational memory" (p. 6). The tools that she describes are early forms of content management: the typewriter, flat filing, letter presses, press books, and letter boxes. In the 19th century, the technological solutions were evolving, and they are still evolving now. Yates relates the 19th-century communication revolution to the present one when she wrote, it was "an office revolution since unequaled until the advent of the desktop computer" (p. 63). Now, however, the task is more complex, because the amount of data we can store is infinite; part of content management is to discover what is worth storing.

In this chapter we define content management as the method whereby an organization stores and distributes data and information. But to fully understand the distinctions between data~~,~~ and information and their relation to knowledge, we need to look at knowledge management. In *Working Knowledge: How Organizations Manage What They Know,* Thomas Davenport and Laurence Prusak (2000) define data as undigested facts, information as organized data, and knowledge as "a fluid mix of framed experience, values, contextual information, and expert insight" that allows people to act (pp. 2-5). Knowledge management, which preceded content management as a corporate and professional issue, refers to the flow of knowledge within an organization. Since content management focuses on data and information, it is a subset of knowledge management. Data and information should be organized so that they are accessible to appropriate stakeholders; for instance, workers should have access to databases where their resources are stored. This is more difficult than it sounds.

Thus, although our definition of content management is simple—the method whereby an organization stores and distributes data and information—finding the theoretical bases for content management systems is complex. Content management systems should be built to facilitate knowledge transfer and generation. Therefore, in order to do so, designers of content management systems must first understand the knowledge flow within an organization. The volume of data and information is astounding: there are computer programs, backup systems, databases, networks, boxes of papers, filing cabinets, records stored at remote locations, tracking logs, libraries of modules, x-rays, statistical results, receipts, client records, graphics, e-mails, streaming video, and systems documentation, to name a few. Moreover, the content that we use to support knowledge generation is constantly changing. The technical~~-~~communicator-turned-content~~-~~manager visualizes the components and develops ways to connect them. This means making decisions about what is important to connect, what can be left in a silo, how knowledge moves from one person to another, what is important to keep, and what can be discarded. Every content management system will be different.

THEORETICAL BACKGROUND

Increasingly, knowledge is our major product. In *The Myth of the Paperless Office*, Sellen and Harper (2002) wrote, "One of the great changes of the past few decades has been the shift away from manufactured goods toward knowledge-based products and services. Workers are less likely to be using their hands and more likely to be using their minds to monitor, manage, and control the flow of information" (p. 51). Information flow is central to the production of knowledge. Thus, when considering a content management system, technical communication practitioners should start with an analysis of the existing knowledge environment.

One characteristic of knowledge environments is that in order to remain relevant, they are often temporary. Each project requires different inputs and produces different documents. Although existing documents are often used for templates, their lifespan is only as long as that set of knowledge elements is used. Sellen and Harper note that real-time content management systems are often scattered around the office in piles. The piles are meaningful, not just regarding their contents but in their locations and height.

> The information that [knowledge workers] keep is arranged around their offices in a temporary holding pattern of paper documents that serves as a way of keeping available the inputs and ideas they might have use for in their current projects. This clutter also provides important contextual cues to remind them of where they were in their space of ideas (p. 63).

The authors separate documents into three types of files: "hot files" (currently being used), "warm files" (finished or material for the next project), and "cold files" (unused, ready for storage) (Sellen & Harper, 2002, p. 164). Moreover, they note that filing systems are specific to each individual and to each project. When pre-arranged filing systems in content management software are instituted, they are usually incapable of providing the personalization, complexity, and visual clues that knowledge workers use. The authors conclude that digital repositories are most suited to cold (unused) documents (Sellen & Harper, 2002, p. 179).

One major feature underlying contemporary knowledge flow is that there is a great deal of uncertainty in workforce life. Research conducted at the AT&T Labs (Nardi, Whittaker, & Schwarz, 2000) discovered that the transfer of knowledge depends mainly on personal social networks. Due to "downsizing, outsourcing, merging, splitting, acquiring, partnering, and the constant redrawing of internal organizational charts," the structures of many corporations, including their content management systems, are unstable. Moreover, the responsibilities of each employee change frequently, as do their colleagues and reporting relationships. Thus, in our uncertain working environment, people have come to rely on the professional contacts they have made, rather than organizational databases. They interact within and outside their current jobs to get information. In this environment, tools such as "e-mail, voicemail, instant messaging, fax, pagers, and cellular telephones, as well as personal digital assistants" are key because they allow people to carry their knowledge with them (Nardi et. al., 2000).

There is uncertainty about the value of data and information as well: we don't know what data are worth storing. Brown and Duguid (2000), researchers from Xerox PARC, write, "a critical task ahead will be to stop volume from simply overwhelming value" (p. xiii). They remind us that despite the excitement of new software solutions, many technologies "create as many problems as they solve" (p. 3). They continue, "new technology often threatens not to help find a new equilibrium but rather to unsettle equilibria whenever they are found. The rapid innovation endemic to the technology can be destabilizing, even for large organizations with copious resources" (p. 75). At one company that we worked for, the implementation of a content management system required hours of training, cost over a million dollars, and then, because it was unnecessary for the production of work and hard to use, employees simply ignored it. In this case, the only disruption that occurred was the loss of money and time. In other cases, implementing a new system can disrupt production processes.

Computer systems cannot generate knowledge—knowledge is created by people. Computers can assist our knowledge-making activities and store the results. However, knowledge generation is a social endeavor. Working at the IBM Research Center, Erickson and Kellogg (2000) noted that inappropriate software can sever social ties: it can become "technologies that impose walls between people" (p. 80). Dodds, Watts, and Sabel (2003) wrote that problem solving requires "information-rich collaboration between individuals, teams, departments, and even different organizations" (p. 4). Much of this knowledge flows directly between people, in a human network, without the intercession of a computerized system or database. Vendor CMS systems are not responsive to specific situations, changing requirements or intrapersonal interactions. Thus, although they are well suited for storage, they are not well suited for human interaction. In many cases an intermediary, like a librarian, is required to negotiate the pathways to information.

Wenger, McDermott, and Snyder (2002) have suggested that "communities of practice" can create their own documentation and content management systems. A community of practice is a group of people that works together on a joint enterprise and shares knowledge as they do so. Communities of practice themselves are fluid, gaining and losing members as the project develops and changes. The shared knowledge that communities of practice use is a collection of resources that cannot easily be cataloged: "They range from concrete objects, such as a specialized tool or a manual, to less tangible displays of competence, such as an ability to interpret a slight change in the sound of a machine as indicating a specific problem" (Wenger et al., 2002, p. 39). The knowledge that they share is both tacit and explicit. Explicit knowledge is that which can be captured; but tacit knowledge happens of its own accord. Therefore, content managers need to be aware of communities of practice and provide space and time for them to exchange tacit knowledge. The strength of tacit knowledge is that it is powerful and fast, but explicit knowledge can span the boundaries of space and time. In fact, our ability to store explicit knowledge has made complex technology possible.

Human interaction is essential in any organization that relies heavily on knowledge making. In their article written for the Center on Organizational Innovation, Kelly and Stark (2002) discuss the power of “strong personal ties, lateral self-organization, and nonhierarchical relations” (p. 1523). After the September 11 attacks, they held a roundtable discussion with IT and communication executives from the World Trade Center. Many of the organizations had been able to begin operating soon after the attacks, and the participants in the roundtable credited the fast recovery to people, rather than technology. One executive explained,

> It was getting into the systems, [figuring out] the IDs of the systems because so many people had died and the people that knew how to get into those systems . . . were all gone. The way that they got into those systems? They sat around the group, they talked about where they went on vacation, what their kids’ names were, what their wives’ names were, what their dogs’ names were, you know, every imaginable thing about their personal life . . . (p. 1524).

By accessing personal information acquired in social situations, the group was able to guess the passwords of the IT personnel and thus restart the systems. The greatest knowledge generation and transfer occurs between people. Thus, the first step to creating a useful content management system is to read the information environment—how people find what they need, how they communicate, and how they generate knowledge—and incorporate those realities into the CMS design.

THREE CASE STUDIES

In this section, we describe three case studies from the literature that demonstrate some characteristics of knowledge databases. From these case studies we can isolate the signals that colleagues and students can use to read the information environment, thereby discovering and creating knowledge databases on their own. The first case study occurred at the University of Jyväskylä in Finland; the second at the Xerox Palo Alto Research Center (PARC); and the last at the School of Computing, Mathematics, and Statistics at the University of Waikato, New Zealand. In all of these cases the analysis was undertaken by academic and professional researchers. Unfortunately, in the working world we have known, corporations undervalue research, and thus they rely on the advice of commercial vendors such as those listed in CMS Watch. Technical communicators, then, have the opportunity to identify a problem, theorize a solution, and present it to their management. As will be seen below, intelligent solutions can be much simpler than IT solutions.

Papermill Electronic Diary

The first case study is a report on the creation and use of an electronic "diary" from a Finnish papermill. The authors, researchers from the University of Jyväskylä in Finland, studied papermill and oil-rig work with the intention of using CSCW (computer supported cooperative work) software that they had at their disposal. Their first step was to analyze the working environment. In an ethnographic study using interviews, observation, and participation carried out over a period of 18 months, they collected findings on information systems and information use in papermills. Overall, they found that "the information systems in use are primarily designed for some other user-group than operating personnel" and that there was a "lack of access to organizational memory" (Auramäki et al., 1996, pp. 371, 375). Based on their observations, they developed an electronic diary to be shared among the workers that would facilitate knowledge exchange for the purposes of solving technological problems.

Paper manufacturing is one of Finland's most important industries. Papermills run 24 hours a day, with three shifts, to recoup the original investment in the very expensive equipment. Production lines can be as long as 500 feet, and the rolls of paper are up to 30 feet wide and 20 feet high. It takes time to walk around them, so other workers are often out of sight. The level of noise is high as well, so communication between workers on the same shift is nearly as difficult as between workers on different shifts. Downtime costs up to $20,000 an hour, so the mill workers try to keep the mill running at all times. Rather than stop the machine for small repairs, they adjust what they can and then wait for major breakdowns to do all the maintenance and repairs at once (Robinson, Kovalainen, & Auramäki, 2000, p. 65). This means that the mill workers have to keep track of problems and troubleshoot whatever they can (for example, holes or tears in the paper) during and sometimes across shifts.

At the beginning of the study, the papermill had a paper diary (a logbook) kept in the shift foreman's office. This diary was used for the "morning meetings," when the managers got together to check progress and resolve problems. However, as it was a paper diary and it was located in the manager's office, it was not very accessible to (or used by) the mill workers. The managers who did write in the paper diary didn't use any particular format except date and time, and the entries were used primarily as agendas for the morning meetings. The rest of the data was temperatures and other numbers collected from the machines at various points during each shift. It wasn't searchable except by flipping through the pages.

The authors set up what they thought would be an electronic version of the diary using Lotus Notes. Computer terminals were set up at distributed locations on the shop floor, and all mill workers had access to the terminals. The format was simple: the e-diary had an automatic date and time stamp, job roles, and an area for free-form notes.

To their surprise, the e-diary took off—the starting group of 35 mill workers and two managers quickly grew to 100 workers and 13 managers (Kovalainen, Robinson, & Auramäki, 1998, p. 49). The purpose of the original paper diary expanded into a communal problem-solving and communications tool that recorded the daily functioning of the mill and was searchable. Instead of cryptic notes for the morning meetings, entries became a running commentary on the state of the machines, problems, solutions, and general comments. It became a way for the mill workers to communicate with each other over time and across space to managers; to other workers on the same shift but out of sight or earshot; to workers on following shifts; and to mill workers coming onboard after their days off (mill workers are scheduled nine days on, five days off). The purpose and power of the diary expanded so that it became a tool for knowledge transfer. For example, here is a short cross-shift dialogue (Robinson et al., 2000, p. 67):

> *17.5.97 morning, shift foreman, finishing:* Sensor problem in PL72 . . . Night shift will make the next trim. Then we will see if the fault occurs again.
> *17.5.97 evening, shift foreman, finishing:* Making trim on PL72 went fine.

The e-diary was also used for dialogues between workers during shifts in order to overcome noise and distance between workers. The interactions followed the same general format (Robinson et al., 2000, p. 68):

> *10.11.96 evening, shift foreman, mass sector:* Some yellow rolls have been wrecked.
> *Mass operator, mass section:* The lock on the yellow ink drum has been removed (it will run until it's empty). . . .
> *Roll person:* It is rattling along here too.

In addition to recording "soft" information such as interesting events and experiences, the e-diary entries had more structure, with headings and roles. It was also searchable—workers could pick up all related entries and look for patterns.

What was even more interesting to the authors, however, was the unexpected nature of the communication. First, unlike e-mail systems, the messages were not directed to anyone in particular. The addressee was self-defined—it was whoever answered or took action based on an entry. Another surprise was "hanging entries," which were write-ups about particular problems or machinery peculiarities. What made them hanging was that they were left unresolved, at least within the e-diary. The authors found out later that some were resolved "by other means"—in conversations, by workers simply seeing that something has been done, in morning meetings, and in other ways. However, some of them remained unsolved and were repeated many times. The lack of resolution for these problems itself was significant—they marked areas that might require technical attention. Overall, the e-diary facilitated and recorded conversation that could take place across distance, noise, and time. This conversation enabled greater knowledge transfer than the paper diary in the manager's office, but it was also linked to the ongoing methods of human communication. The only software tool that was necessary for this new process was the relatively common Lotus Notes.

Xerox Technicians and Knowledge Transfer

According to Graham (1996), Xerox created its R&D division, the Palo Alto Research Center (PARC), in 1970 to define "the office of the future" (p. 374). Much interesting research has come out of this group. Since part of this effort was to understand work as a social process, the multidisciplinary research center included "a cadre of academically trained anthropologists who spend their time studying how people interact with machines, and with each other" (Buderi, 1998, p. 44). Brown and Duguid (2000) both worked at PARC. In their book *The Social Life of Information,* they discuss the following two examples of analyzing knowledge flow within an organization.

In a now famous case, the anthropologist Julian Orr studied the methods by which Xerox technicians solved problems with machines at customer sites. Since there was an existing document database, and the technicians were generally successful in solving the problems, his fellow researchers questioned the need to study the situation at all (Brown & Duguid, 2000, p. 100). However, Orr's groundbreaking study showed that it was not the document database that enabled the technicians to repair the machines; instead, it was the stories that they told each other over breakfast.

At that time, Xerox technicians were provided with "directive" documents that listed error messages and mapped symptoms to potential solutions. However, the machines were so idiosyncratic that the documentation could not take into account all of the different errors that could occur in different parts of the machine at different times, so the technicians never used the documentation. Brown and Duguid write that "Although the documentation claimed to provide a map, the reps continually confronted the question of how to travel when the ~~un~~marked trails disappeared and they found themselves surrounded by unmarked poison oak" (p. 100). The documentation simply could not take into account the number of variables in the process flow. As Auramäki and colleagues noted above (1996), "the central expertise in immediate process control is knowledge of process interdependencies, and the ability to evaluate probabilities of different cause combinations" (p. 312). The combinations were nearly limitless, and the technicians had to use their combined expertise to discuss possible causes and evaluate and test solutions.

By following the technicians in their daily routine, Orr observed that they discussed the complexities of machine interactions during their breakfast. In fact, they held conversations like this on a daily basis, and it was these conversations, not the documentation, that enabled them to get their work done. Orr discovered that narrative was a powerful tool in complex problem solving (Brown & Duguid, 2000, p. 106). As a consequence, Xerox provided the technicians with two-way radios so that they could consult each other whenever necessary. They also started a knowledge-capture system called "Eureka" that allowed the technicians to enter solutions that were then peer-reviewed. Both of these solutions have been successful.

At the same time, Xerox was trying to lower the number of site visits by technicians, which were expensive. If call-center phone technicians could help customers solve simple problems, they would save money. At first they tried a case-based expert system. Case-based systems provide call-center technicians with a series of prompts—questions to ask—to help define the problem and thus arrive at a solution. However, this process did not work, and the customer would usually ask for a technician to travel to the site anyway. Another researcher from PARC, Jack Whalen, analyzed the performance of different call center technicians and discovered that those who were most successful overheard the calls of other technicians and thus learned more about the common problems than they were able to learn by the scripted case-based system. The solution, in this case, was to restructure the call center so that there were fewer barriers between the call desk technicians (Brown & Duguid, 2000, p. 132). This is another example where a content management system did not answer the real needs of the organization. Graham (1996) stresses "taking account of the subtleties of work practice when incorporating new information technologies into an existing work culture" (p. 373). Technological solutions are often not the best answer to optimize the flow of information.

Lab Technicians in a New Zealand University

Cunningham, Knowles, and Reeves (2001) present a case of analyzing a knowledge flow in a university IT support center. Their original goal was to create a digital library to provide a source of knowledge for the contractors who worked at the support center. Due to their analysis, however, they discovered that a digital library was not necessary. They collected data on six consultants who served 700 faculty, staff, and students at the University of Waikato, New Zealand. Their methods included "interviews of participants; 'shadowing' participants as they worked; observation of semi-social discussions in the School tearoom; and examination of various work artifacts (email, bookmarks, webpages, office bulletin boards, etc.)" (p. 191). Their ethnographic study of how university technical support personnel gather information can be related, on a broader scale, to the way we search for information in general.

Although some of the consultants' task-based work was well defined, much of it was unique problem solving. Most universities have technical support departments that are responsible for simple tasks such as configuring individual e-mail accounts, connecting printers, and providing basic answers to users. These departments are also responsible for more undefined tasks such as locating conflicts within and between programs, databases, and networks; setting up new facilities; and providing the administration with information about current and future needs in hardware and software. As the authors note, "For some of the tasks there is a level of repetition. . . . Some of the tasks, however, fall into the category of 'one-offs'," in which the research and resolution will not be used again (p. 191). At the beginning of this study, they were considering using Greenstone, software created by the New Zealand Digital Library Research Group (http://www.nzdl.org), which provides multiple entry points for searching document collections (p. 190).

However, after studying the activities of the technical support consultants, the researchers concluded that the standard search functions provided in database software such as Greenstone were not useful for the types of searches that the IT consultants used. The following are some of the reasons that they felt a digital library would not be helpful:

- Formally published documents usually aren't useful
- Many documents are ephemeral
- Documents may not be trustworthy
- A primary information source is other people
- Information might not look like a document (pp. 192-196)

Moreover, existing digital library systems make the assumption that people find information by creating a search string. However, many people find information by browsing remembered locations and using personalized information resources. Some of the IT consultants, for example, saved files on their desktops. Others used color as well as location to keep track of information. One consultant used colored stickies at his workstation and another used colored nodes in a mind map file (p. 195). If documents are necessary, they are often produced by the consultants themselves.

Search faculties in digital databases are too far removed from immediate tacit human knowledge flows to be useful in a just-in-time situation. They are less likely to be used than less formal documentation that is written on scrap paper, pinned to the walls, or transferred between people. In *The Myth of the Paperless Office,* the authors note that people leave papers "around their offices in a temporary holding pattern" (Sellen & Harper, 2002, p. 63). That holding pattern leaves visual and tactile clues as to where useful information can be found. Digital libraries require remembering a verbal search string, or a search route, that was successful in the past. Since the documents themselves are in "cold storage," several steps removed from human activity, it requires time to find, access, and assess them before they can be brought into the live working environment. Although digital libraries may be useful in long-term, research-oriented professions, they are inconsequential for the immediate task of keeping up with changing technology.

Cunningham, Knowles, and Reeves (2001) conclude that, too often, "system developers concentrate on creating an information system, rather than on ensuring that the system created is useful and usable, or even investigating whether a system should be created at all!" (p. 198). Software developers are generally not trained in usability or human-computer interaction. The gap, then, must be filled by others, including technical communicators.

CONCLUSION

In an information economy, where knowledge is our product, it is necessary to carefully analyze the existing knowledge flow in an environment before implementing a content management system. Established knowledge (as well as data and information) can be contained in content management systems, but current working knowledge is far too fluid to be captured and placed in a database. If a business or corporation is required by law to have consistency in disseminating data and information, then a full content management system is necessary. However, if a business or corporation relies on the development of new knowledge or the rapid exchange of existing knowledge, it must rely on the seemingly disorganized and uncontainable flow of human interaction and communication. This may mean making changes to workplace environments rather than building new IT systems.

All of the case studies shown here emphasize that the most effective knowledge exchange can happen with relatively simple technology. Researchers at University of Jyväskylä discovered that a simple application of Lotus Notes, distributed through a complex paper-making factory, allowed people to locate and solve mechanical problems. At Xerox PARC, researchers discovered that scripted documentation was useless for solving complex problems, whereas verbally exchanging tacit knowledge was successful. At the University of Waikato, researchers discovered that a database of documentation was unnecessary because lab technicians assembled their own dynamic "libraries" as they solved problems. A formal content management system was not necessary in any of these situations.

Technical communicators, especially those trained in academic settings, are well placed to take on the challenge of proposing and implementing content management systems. As generalists, rather than specialists, we are often at the interstices of organizations, so that we can see the flow of knowledge (or lack thereof) between departments and silos. Inherently interdisciplinary and experienced in continually understanding new concepts, we are especially attuned to seeing entire organizations rather than parts. For us, as well as for the organizations that we serve, we should know that the best CMS solution is not always an IT solution, but an intelligent solution.

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