13 Directions for Collaborative Scientific Dialog

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Knowledge—information—accumulates in stages. A group of scientists, for example, might start with an initiative and some ideas that they share. Over time, they would develop that into new information or new knowledge, which I will label a competency. At that point, if what they have accumulated is of value, we would like them to formally codify it into methods, approaches, and techniques—and begin to teach. So at this stage we call it "competency leadership" because these are the people teaching other scientists or other knowledge workers about what they have discovered and codified. Finally, this would mature into a broad base of networked communities sharing a body of knowledge with each other based upon the course of that accumulation over time.

Today all of the technology companies—including IBM—have some rudimentary capabilities to support the accumulation of knowledge. These might include enhancing infrastructure, such as with an e-mail system. Many people trade information that way—sometimes attaching detailed bodies of thought. There comes a point in that behavior, though, where you have to start thinking about what is and is not confidential, what has a cost, and other considerations. Security issues, for example, apply to basic infrastructure as well as to more complex technologies.

Infrastructure enhancements therefore enable the accumulation of knowledge in that first phase. You can find documents, scan them,

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index them, and perhaps put them through engines that will glean certain aspects and put those in sophisticated indexes—allowing you to get at them without reading the whole thing. You then can move to work management—essentially, moving packets of information around an organization, or among scientists, in connection with the work that they do. It implies that we have to first understand the work that they do as well as the sequence and alternate sequences in which they do the work. Otherwise, we are not able to move the information with them. We require them to go get it at every point. This is not a new technology.

Knowledge management, however—the capability to search, capture, retrieve, share information, evaluate, and transfer—is fairly new. You encounter this capability on the Internet today, where you can use text-based search engines to find things. The newer search engines, however, are not thinking "text" any more. Instead, they are keeping track of your personal search history and, from that, are making deductive representations in the software about your interests—persisting out there on the network while you are sleeping or not at work, and accumulating more information for you based upon your historical search profile. So that technology does exist, and it is going to come into play more and more in the near future.

Finally, we have the issue of very high-powered computing, and the kinds of simulations and things it enables us to do. We still do not have very good interfaces, so it may take an army of programmers and scientists to construct the complex simulation and we still have consoles, terminals, text, and numbers to interface with the computer. That is not good enough. What we will see coming into play within our lifetimes is a more "virtual reality" sort of thing, where you will have a software representation of yourself resident in the computer. You could be connected physically in some sense to the computer, which is then moving your software representation through a virtual reality. The exciting thing about that is the capability it will give us to interact software representation to software representation—not just a one- or two-dimensional interface via terminal to the computer, but a three- and four-dimensional interface to the computer. It will then be able to respond more quickly, and it will take much less time to construct the simulations.

Establishing a Knowledge Management System

When working with groups to establish a knowledge management system, we first define what that group's work products are. We then

establish a dependency diagram among them. For example, if we are working with a group of people who are responsible for building something or constructing an experiment, we would ask them about the sequence in which they do things and then chunk those things into work products. At every point, then, they have an internal checkpoint or an internal delivery to the project in the form of a work product, and we establish a relational dependency diagram among them.

We then describe each of the work products: What is the work product? What is its purpose? What is the impact of not having it? If you are not having it, what is the reason? What notation is used during it? We then provide an example of its output, the development approach to creating it, validation and verification that its is correct, and referenced advice and guidance to people who are new to executing the work product. We also describe other scientists or knowledge workers who have used it, and provide some estimate of the amount of time that it takes to execute the work product.

Each work product has these kinds of characteristics. What is different about characterizing them this way is that it is content-oriented rather than project-oriented. The problem of project management meeting knowledge worker or scientist can be solved to some extent by representing the content part in work products.

Next, we group all of the project's work products into domains. The domains of a given project would differ. If a project has a procedural sequence to be described, we assign a process domain—and those work products are in the process domain. An organization domain indicates that after the project, the roles of people must change. There is an application domain, which is where software and similar systems typically are described. If there is a technology being used, we assign a technology domain that describes the work products related to technology creation and its attributes. Finally, there is a management domain, which describes the project management-oriented types of work products.

Knowledge Management Solutions

We find in IBM that knowledge management solutions typically are built using Lotus frameworks, because we purchased Lotus. My group, in consulting, is not handcuffed to them. We are using Microsoft- and Lotus-based knowledge management solutions, and some of the things we are learning relate to interaction in knowledge spaces. For exam-

ple, we now are able to have e-meetings within my internal group, wherein we connect to a site on the Internet—either a Microsoft- or a Lotus-based site. We can see each other because we have little cameras that connect. We can also look at a "workspace" in which somebody can post a Microsoft Word or PowerPoint "exhibit." There is also a chat capability and—if you add a conference call to that—real-time interaction.

These collaborative spaces allow us to connect project personnel and clients—particularly during the period between the start-up of the initiative and the onset of large-scale computing. It is a fascinating facet of knowledge management from a behavioral standpoint, because it is where all the behaviors you like and do not like occur. It also represents what technology will bring to bear on knowledge management in the next few years.