

Picking winners in the IT game

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Imagine an NBA game court with 20 baskets (it's a huge court). Now put 20 teams on the floor. Put money on the team you think will rack up the greatest positive difference between points scored on its own basket and points scored on others' baskets. Do you balk at this gamble on a game that is sure to be chaotic?

Information technology investors, managers, and entrepreneurs play and bet on a similar game daily. But their game is even more chaotic and getting bigger at a breakneck pace. This is because a number of forces have made information the primary means to gain competitive economic advantage. Consequently, there is a huge demand for more and more powerful tools for delivering, processing, and applying information to solve business problems. Supply has followed demand: The total market capitalization of public companies traded in the United States that fall within 18 information-technology-related SIC categories increased almost 44 times from the beginning of 1980 to December 1995, from \$14 billion to \$613 billion.

We have to make our bets. So what's the best winning game plan? How do you pick the sectors and the specific companies that will achieve long-term growth and profit? To start, we believe winners focus on one or more of three fundamental functions: optimizing the movement and warehousing of data, directing and filtering data flows, and transforming data into information. Once one finds one or more of these attributes in an opportunity, he or she needs to look for two more requisites for success: a ripe market and a management team that will capture value and deliver it to its stakeholders.

What's the difference between data and information?

We define information as data that helps solve a problem. Put another way, information is data that answers a question. The difference between data and information is not always clear cut; data turns into information as it is organized to satisfy an objective defined by the worker in the context of his or her entity's pursuit of objectives. The more fully data satisfies the objective, the more value it tends to have as information.

How do we measure the value of information? Figure 1 shows what we call the information value space*. In this space we can plot the value of information as a function of three characteristics that correspond to the three ways information technology plays a key role in competition. The three characteristics are accessibility (corresponding to moving and warehousing data), relevance (corresponding to directing, formatting, or filtering data flows), and utility (corresponding to transforming data into information).

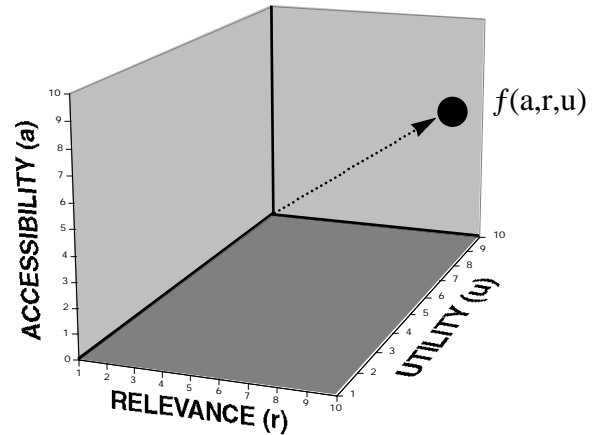
Why information has become key to winning

For a few decades after World War II, the United States clearly dominated the global economy. The country competed in a favorable environment and drew upon an array of

*In a 1948 paper, "A Mathematical Theory of Information," Claude Shannon discussed the quantity of information contained in a data stream, but not the value or use of information, which is our focus.

FIGURE 1

Information Value Space — Attribute Characterization



resources unavailable to most other countries. But significant changes have occurred to increase parity among countries. The resources that formerly gave the United States an edge are now more widely available, and competitors worldwide, as countries or individual players, have been forced to find new competitive advantages in the form of information.

Three fundamental shifts occurred that caused information flows to become paramount in determining the flows of economic value. First, the countries where World War II was fought rebuilt their damaged infrastructures. Second, the ability of companies to compete on a cost basis by employing unskilled labor in mass production became widespread, reducing the value of production economies, or economies of scale, as a competitive tool. Together, these two shifts increased competition, causing profit margins to erode and leading companies to seek new ways to compete. The third fundamental shift was not so much economic as technical: Scientists at Bell Laboratories invented the transistor in the late 1940s, laying the foundation for a huge leap in the size and complexity of the world's communication networks and making it economical for information to take on its new role. This fundamental shift led to more economic and ubiquitous access to data.

Companies in the United States and worldwide are finding that success under this paradigm demands a large, fast flow of relevant information presented in a form that answers critical questions: What are my competitors doing? How are my customers' needs changing? The advent of low-cost semiconductors, combined with other technologies such as distributed network switching and fiber optics, provides a means to meet this

demand. These technologies fostered a proliferation of communication networks. As the supply of transmission capacity has multiplied with decreases in unit costs, the cost of distributing information has cratered. This has helped make information as a competitive tool available to more companies and more workers in each company.

Figure 2 summarizes the change that has taken place in how companies compete to win.

Three ways to win the IT game

As noted above, there are three instances when information technology is especially valuable as a competitive tool: 1) when it warehouses data for easy access and moves it from place to place quickly and efficiently, 2) when it directs or filters data flows according to relevance of the data to the question or problem, and 3) when it turns data into information by putting it in a form that helps solve a problem. These fit into the middle of the data-information loop shown in Figure 3, where data collection, transformation of data into information, and decision-making on the basis of the information constitute a perpetual cycle that is the essence of social and economic activity. In the information technology sector, we are continually working to increase the speed of this loop. As we are inundated with unpredictable and disorganized events (our asynchronous world), we attempt to employ tools to proactively organize, search, and prioritize signals (trying to make our world more synchronous) in order to make decisions.

Information technology companies that concentrate their efforts to add value on one or more of the three areas of accessibility, relevance, and utility have the keys to winning. And just as information value is a function of accessibility, relevance, and utility, so is the potential value of an information technology company a function of the degree to which its products and services increase the accessibility, relevance, and utility of the data flows they work on. We can apply this model to a sample from the universe of information technology companies, as shown in Table 1. Each company is a high-scorer in the information technology game in part because it focuses on maximizing the value of information by working on one or more of these three variables.

I. Optimizing the movement and warehousing of data

When data is generated, the first step in adding value to it is to 1) aggregate it with other data (giving it a context), and 2) move it in order to communicate. Key areas where companies can facilitate and enhance these tasks are in data security, transmission reliability and speed, and ease of network maintenance.

CONCORD COMMUNICATIONS INC.

Concord Communications Inc. is in the network management business, offering a family of products based on Network Health, a software solution for managing complex networks or multiple LAN facilities. Concord's strategy for adding value to

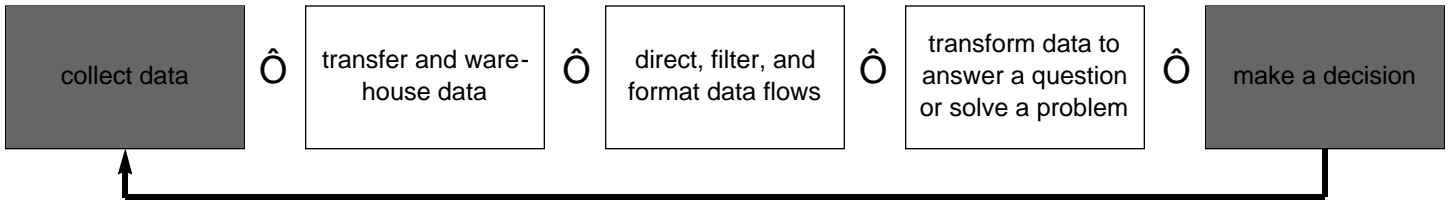
FIGURE 2

Changed Basis for Competition

	POST WWII	TODAY
RESOURCE DEPLOYMENT	<ul style="list-style-type: none"> • Worker and entity specialization • A generally fixed allocation of resources 	<ul style="list-style-type: none"> • Smart, flexible work teams • A flexible allocation of resources • Continual retraining of work force
DIFFERENTIATING RESOURCES	<ul style="list-style-type: none"> • Access to operating assets enables production economies and cost advantage 	<ul style="list-style-type: none"> • Access to strategic workers enables marketing economies and market segmentation advantages
COMMON RESOURCES	<ul style="list-style-type: none"> • Unskilled labor 	<ul style="list-style-type: none"> • Access to operating assets enables production economies and cost advantage • Unskilled labor

FIGURE 3

Where IT Companies Can Score High in the Data-Information Loop — Functional Characterization



data and information can be viewed from two perspectives. First, from the perspective of a worker using a network, Network Health adds value by helping network managers improve transmission reliability, i.e., increasing access to data. Second, from the perspective of network managers who use Network Health, the system filters and formats data and transforms it into information that answers questions such as, "Where is my network likely to bog down in the future?"

Network Health software, along with intelligent hubs, routers, switches, and RMON probes, collects data on network traffic characteristics such as volume, speed, and error rates. This data is managed and analyzed by the Network Health software, which uses trend analysis to proactively tell network managers where, when, and why a network ailment is going to develop.

"The core of the value we provide is answers to questions about the potential for network problems," says Concord Vice President of Engineering Fred Engel. "This is a system with clear economic value, both in the sense of increasing organization efficiency by ensuring cost-effective networks and in the sense of increasing the productivity and effectiveness of network managers."

TUT SYSTEMS INC.

In our framework of adding value to data and information, Tut Systems Inc. is a pure play in improving accessibility by lowering the cost of high-speed data transfer. Tut designs and distributes products using its Fast Copper™ technology, which improves the transmission characteristics of copper wire. For example, one of the technologies under the Fast Copper umbrella employs a patented balun circuit to enhance a transmission's signal-to-noise ratio to a level more than 100 times better than that of other balun technologies employed in transceivers. "Everything we do results in a solution that is the lowest cost solution. That's our essential differentiator," says Chief Executive Officer Sal D'Auria.

Today, Tut sells its technology mainly in the form of the XL line of Ethernet computer networking extenders, which allow organizations to run Ethernet on existing unshielded twisted pair telephone wires for distances up to a quarter mile. (Ethernet on unshielded twisted pair copper wiring using traditional technology is generally limited to about 100 meters.) In many

TABLE 1

Winning Companies and Focus of Game Plan

	CENTERS OF ADDED VALUE		
	I	II	III
Characteristics:	accessibility	relevance	utility
Function:	warehouse move	direct filter format	transform
User application:	gather	learn	decide
Concord Communications	X		
Tut Systems	X		
AccessLine		X	
Data Critical		X	
Farcast		X	X
Verity		X	X

situations, this solution is more cost effective than alternatives, such as laying fiber.

But much of Tut's long-term potential lies in its ability to license its technology and thereby avoid becoming heavily focused on manufacturing. In this context, Tut is deploying its technology in other networking market segments, including telco infrastructure and products that bring 155-megabit ATM connections to the desktop on Ethernet-grade copper LAN wiring. Some estimates put the number of copper line drops at about 100 million for residences and about 30 million to 40 million for businesses. At the same time, estimates put the number of subscribers to computer online services at more than 20 million, establishing a baseline for connections whose users likely are hungry for greater bandwidth. Tut's challenge is to make sure its stakeholders can capture the full value of its technology by partnering with key distribution players who see the importance of making the technology a network standard. "We can't get enough money to compete with firms like AT&T, so we need to establish partnerships with some of the larger players," says Tut's Chairman and Chief Technical Officer Matthew Taylor. "We're completing negotiations with several

such firms."

II. Directing, filtering, and formatting data flows

The second step in adding value to data (data that is being moved) is to match data to appropriate destinations. From the perspective of the person using the data to solve a problem, this is typically thought of as filtering or screening information. But to the extent that data delivery becomes proactive with intelligent agents actually anticipating the user's needs based on a pattern of usage or other criteria — this function can be thought of as directing data flows. The key is to remember that the user, or the worker, is *ultimately responsible* for determining what data is important, not an entity, business plan, or job description.

ACCESSLINE TECHNOLOGIES

AccessLine Technologies is a telecommunications software development and systems integration company whose products imbue the telecom network with intelligence for directing a variety of information and data flows. The core application is single-number portability. You provide a single phone number to people for all communications. The AccessLine System™ retains a schedule of where you can be reached — through your office phone system, your cellular phone, your home phone, your fax machine, your pager, etc. — and your calls follow you. The system intelligently handles all forms of telecom network communications, including voice, fax, and data.

"With AccessLine, our customers become clearly differentiated from their competitors because communicating becomes easier for subscribers and their callers," explains AccessLine CEO Daniel Kranzler. "The system facilitates more communication, in essence increasing the bandwidth of communication and increasing the bandwidth of revenue."

The 120-employee company has systems delivered in 30 markets across North America and Europe. Studies of potential demand suggest there could be a large market for AccessLine: about 30% of surveyed small business and mobile professionals in North America, England, and Japan expressed very high interest in the service. The challenge will be for the company to persist through the present market adoptive cycle. Kranzler draws an analogy to an earlier innovation: "The timing situation is like that of voice mail. Upon introduction, voice mail was immediately practical and useful, but acceptance was slow in the first five years."

DATA CRITICAL

Like AccessLine, Data Critical provides increased data accessibility as its value proposition. Also like AccessLine, the core of the company's value is in the realm of relevance: directing, filtering, and formatting data flows. In particular, Data Critical's system takes large graphical data files (such as electrocardiograms, mug shots, and sketches of suspects), transforms them into a code suitable for transmission over the paging network, and reassembles them into images on a desktop, portable, or palmtop computer. More generally, Data Critical's

base technology uses any radio medium to send large data files to the customer. Among its first applications is with Hewlett-Packard for the transmission of medical data (EKGs, for example) to physicians.

"We focus on moving high-value data and delivering it to users in a usable format," explains Data Critical CEO Jeff Brown. "To date most of our customers are in vertical markets where access to a particular type [relevance] of information [in a format complementary to the environment] has very high value. For example, in the case of EKG transmissions, you're dealing with the value of saving a life."

A key, ongoing challenge for the company is staying on top of how people's jobs are changing to capitalize on opportunities to deliver information value to new markets. Brown cites the example of utility field workers, who traditionally spent time early in the morning and at the end of the day at a central office to pick up vehicles, inventory, and assignments. To the extent field workers can receive their assignments electronically and manage inventory in the field, utilities are able to increase worker productivity by having field workers keep their vehicles at home and go directly to work at job sites. This represents an opportunity for Data Critical to facilitate data transfer and presentation.

III. Transforming data into information

The third step in adding value to data is to organize and present it in such a way as to transform it into information — data that answers a question or solves a problem. This is probably the most difficult link in the data-information chain, because it requires software to possess a relatively good capability to understand the data and the question or problem it is dealing with — in other words, to be able to assess data characteristics such as relevance and to organize data into responses or solutions. While some game-oriented software does this to varying degrees, there are few commercial products with practical, real-world applications. However, a few companies are clearly on track to move into this realm.

FARCAST

Farcast is a news and information delivery service that uses software agents, called droids, to deliver user-selected precise information. The user imbues the droid with aspects of his or her personality and interests by instructing the droid — using simple Boolean logical statements — to seek out information and report back at *user-defined time periods*. The user can tell the droid what level of detail it should provide.

Information is gleaned by the droids from a number of sources including the Associated Press, United Press International, Businesswire, PR Newswire, and Newsbytes. The sources together provide Farcast about 10,000 articles per day. Farcast's goal is to provide its service to a large number of users and to give its customers a competitive edge. As a result, Farcast has chosen to charge a flat fee of \$9.95 per month, regardless of usage.

Farcast employs economical e-mail as the distribution medium. Using Farcast requires no client software other than

a standard e-mail program and direct or indirect access to the Internet. More than 90 million people use e-mail today, and the number is expected to increase at least three-fold during the next five years.

Chief Executive Officer Jim Opfer notes, "Customers continually tell us that their primary use of Farcast is for corporate business intelligence — for tracking their industry and their competition — thus giving them a competitive advantage."

The economics are very compelling to the customer: It's estimated that the average cost per minute for a knowledge worker is about \$1. Using this assumption, a customer who saves 10 minutes of Web browsing in one day by using Farcast has covered the cost of an entire month of Farcast service. In reality, the savings are many times that amount.

VERITY

Verity provides software tools and applications that help people intelligently search, filter, and disseminate textual information found in a variety of forums and formats, including enterprise networks, online services, the Internet, and CD-ROMs. As such, the company focuses on two of the three key centers for adding value to data and information: relevance and utility. The company's strategy is to establish its software as the de facto standard for gathering and assembling data into information that answers questions.

In addition to responding to queries, Verity's Topic system lets users deploy software agents to continuously monitor information streams for data that responds to an interest the user has expressed.

Like Farcast, Verity does not yet provide the service of providing concise, specific answers to questions. However, Verity is developing information clustering and document summarization capabilities that will move farther in the direction of transforming data into information, using software intelligence systems to digest large amounts of data retrieved and present it in a more usable manner.

From contender to champion

With a focus on one or more of the three areas for adding value to information — access, relevance, and utility — an information technology company is probably a strong contender in the information technology league. But this alone isn't enough to make a company a champion. To be a champion, a company needs several other characteristics. These generally fall into two categories: meeting a real market need and having a management team that can capture maximum value and deliver it to stakeholders.

No points for setting up long shots: Meet a clear need

There are lots of great ideas for adding value to data, as detailed above, but watch out for the long shots. Take the example of personal digital assistants: PDAs add value to data by providing a convenient mini-warehouse for data collected by the user and by providing a mobile-format platform for software to filter, present, and transform data into information. Clearly, many of us could use such a device — we often need

to record, transmit, or access information when using a desktop or notebook computer isn't convenient. But with some exceptions, the PDAs offered didn't quite match their targeted markets' utility. Potential consumers found that key technologies, such as handwriting recognition, fell short of their expectations. The devices also lacked accessibility: a convenient and inexpensive means to connect with the telecom-datacom infrastructure. They were expensive relative to the value they provided and difficult to read.

Undoubtedly, PDAs in some form will hit their mark (products such as Hewlett-Packard's Palmvue show promise in vertical markets). But often investors and entrepreneurs in the information technology sector cannot afford to spend time setting up such long shots while competitors rack up two-pointers.

What are some rules to use in avoiding long shots? Here are a few:

n Don't invest in research and development that has an inappropriate time frame or incubating environment. Entrepreneurs sometimes have the resources to invest in long-term research and development independent of any existing business or product line. Venture capitalists, on the other hand, often require a relatively quick return (within four to seven years) on a research investment tied to extending a company's existing products or services.

n Avoid investing in technology that isn't robust. Technology that works only part of the time typically doesn't satisfy customers, who desire 100% satisfaction. Your competitors will be scoring points while you wait for the engineers to perfect the technology.

n Be sensitive to the market timing of a product or service whose success in meeting a market's need depends on the future influence of an outside factor, such as the availability of a new telecommunications infrastructure or a change in government regulation. Products that require extensive selling provide an opportunity for competitors to be scoring with more easily bought competitive products.

Tut, Data Critical, and AccessLine are just a few examples of companies that have it right in all three areas. For example, Tut had essentially fully developed its technology before rolling out its business. "We did a lot of that work on our own nickel before outside investors came in," Matthew Taylor notes. This let the outside investors' dollars focus on marketing and deployment. Similarly, AccessLine CEO Dan Kranzler emphasizes that "It's important to differentiate between concepts and reality. A key to our success is that AccessLine works now and is achieving results for our customers." In another example, Data Critical CEO Jeff Brown stresses that the company focuses on using existing infrastructure (the paging network) to solve specific vertical market needs. "We're using systems that are out there today, existing technology," Brown says.

Make the points count: Capture value for stakeholders

Hopefully, your company is a team with strong assets in technology and products. But remember, a team with great shooters may not be worth betting on if it has no defense or a fragmented offense. Winning will be a function of game strat-

