

# RECORD, Volume 26, No. 3\*

---

Chicago Annual Meeting  
October 15–18, 2000

## Session 16TS Driving Your Information Costs to Zero

**Track:** Computer Science

**Moderator:** GEORGE L. DE GRAAF

**Instructor:** GERALD G. SMEDINGHOFF†

**Recorder:** GEORGE L. DE GRAAF

*Summary: This session discusses three dramatic shifts in everyday economic relationships:*

- *From matter to information*
- *From firms to individuals*
- *From sellers to buyers*

*The instructor discusses application service providers and their impact on the economy and the Internet.*

*Attendees are introduced to application service providers and the potential impact they will have on their business.*

**Mr. George De Graaf:** Gerry Smedinghoff, our presenter, is Director of Market Awareness for UniversalCIO, an application service provider (ASP) specializing in enterprise resource planning (ERP) systems. UniversalCIO is based in Wheaton, Illinois. Gerry is a frequent speaker on economic, health-care, and technology issues. Gerry has appeared on the nationally syndicated PBS television program, *Health Week*. His articles have appeared in publications such as *The Washington Post*, *Las Vegas Review Journal*, *Skydiving*, and *Contingencies*. Prior to joining to UniversalCIO, Gerry was a consulting actuary for Watson Wyatt Worldwide in Washington, D.C. and Nationwide Insurance in Columbus, Ohio.

**Mr. Gerald G. Smedinghoff:** First, let me ask: How many people brought a laptop with them to this meeting? Maybe half. What I'm going to show you today is why ten years from now nobody will carry a laptop computer because everywhere you go, every hotel you stay in, there will be a PC waiting for you, and all you will have to do is type in your user ID and password and you will get access to all your files through an ASP.

We're already in October, so I assume we all survived the Y2K scare. I was not worried about Y2K; let me tell you why because it makes a good opening for this talk. I hold in my hand my ATM card from a local bank. The expiration date is January of 1999. In November of 1998, I got a letter from my bank saying that if

---

\*Copyright © 2000, Society of Actuaries

†Mr. Smedinghoff, not a member of the sponsoring organizations, is Director of Marketing at UniversalCIO in Wheaton, IL.

you bring in your ATM card, we will exchange it for a new one. We'll also give you a \$95 travel voucher on Continental Airlines. When I first got this letter, I thought this was neat. I'd like a free travel voucher. But I also thought, wait a minute. They've always just sent me new cards whenever my old card expired. When your credit card is about to expire, they automatically send you a new one. Why are they going to the extra expense to give me this travel voucher? More importantly from my perspective, why were they making me go to the bank and exchange the card?

I'm one of those people who never wants to see a bank teller again. So I was pondering this for a while, and then it finally dawned on me after a few weeks why they wanted me to bring the card back into the bank. The reason, I guessed, was that these cards were not Y2K compliant and the expiration dates were not valid. And I bet that the cards would still work after January 1999. So I simply waited until February 1999, went to the bank, put my ATM card in, and got \$300 cash. I still have not gone in to exchange my card. This is a withdrawal receipt from last Friday. So it still works 20 months after the expiration date. The important part of this story is, this bank saw that it had a Y2K problem well in advance. And rather than looking at it as a Y2K problem, they looked at it as a marketing opportunity to cement the relationship with their customers.

Our clients are manufacturers and suppliers to the auto industry and they make things—as they say in economics—that you can drop on your foot, as opposed to the realm of insurance that most of you deal with. This talk actually has a more urgent implication to the insurance world because I'm talking about pure information and that's pretty much the only product that you sell.

There have been 5 major economic shifts over the last 20 years. The first major shift is from matter to information. People now realize that the value of the information about a company exceeds the value of its tangible assets. This was first brought to light back in the early 1980s when some accountant at American Airlines noticed that the market value for their SABRE Reservation System exceeded the value of all the planes in the American Airlines fleet.

As we moved into the 1980s, more examples of this started to pop up. In the late 1980s, *TV Guide* was sold to Rupert Murdoch for something like \$1 billion. At that time, \$1 billion was worth more than the market value of either ABC, CBS, or NBC. So the value of the information about what was on television exceeded the value of television itself. Now we've gone to absurd extremes. We've got Amazon.com, which has a market cap that's bigger than Sears and the entire book publishing, distribution, and retailing industry combined. Yet Amazon doesn't even carry any inventory. You could say that Amazon doesn't sell books. They're selling information about books. Or they're selling information about information.

An example you can all relate to is the data on your laptop PC. If your laptop was lost or stolen, what would be your greater concern? Would it be spending \$2,000 or \$3,000 to buy a new laptop, or would it be the value of the lost data that you had on that hard drive?

The second shift is from firms to individuals. We now have situations where people have greater access to information in their personal lives than on the job. I've listed 6 examples of information technology (IT) devices that have been introduced over the last 20 years: e-mail, cell phone, Internet, voice mail, fax, and the pager. I bet most of you are like me in that you have had access to one or more of these devices in your personal life before you had access to them on the job. In my case, I had access to all of them, except the pager, in my personal life before I had access to it in my business life. That can make things very complicated or very awkward, because now you're more productive at home than you are at work, especially in the information business. You almost have to ask yourself, "Why should I bother to go to work because I have greater access to technology tools at home than I do in the office?" You also have to ask yourself, "What's going to happen when my customers have better access to information than my employees do?" How are they going to interact with your company?

The third shift is from sellers to buyers. I'm sure you've all had the same experience that I've had — it might be with a grocery store or with a hardware store. With me it was with a bookstore. You go into the store that you've been going to for several years, you can't find something, and you ask somebody who works there, "Do you know where this is?" And right after the person starts to look for what you ask for, you realize he or she knows less about the store than you do. They're not going to find it. Why is this the case? The reason is, you've been living there for five, seven, or ten years. You've been going to the store all that time. This person they just hired has only been there two or three weeks. You have spent more time in that store than he or she has. You know the layout and the products of the store better than he or she does. In many ways that person is getting in the way—keeping you from getting the products and services that you want. In many cases you're shopping in a store that doesn't have what you want. It's understaffed with untrained employees. You have to go back to the store a second time to get your special order. And you have to pay more to cover the extra overhead.

The fourth shift is a shift from private to public. In the last 20 years, wealth has been created by sharing information, not hoarding it. Systems are now open instead of closed. Two classic examples from the late 1970s are Apple, which thought it owned the entire concept of the personal computer, and Sony, which thought it owned the entire concept of the VCR. They thought, "We are going to own the entire box, the entire concept. If anybody wants to watch a program on videocassette, they have to buy a Sony Betamax." Apple thought the same thing with personal computers. They had a closed system; they wouldn't sell their technology. What market share does Apple have today? What market share does the Sony Betamax have today?

Information must be shared instead of kept secret. You have to share your business strategy and your data. I still run into people who say, "I've got this idea for a business, but I can't tell you about it; it's secret." Well, if your business plan is going to work, not only do you have to tell your investors, you also have to tell the

public. If you don't tell the public, the customer is not going to know that it exists; they're not going to want to buy it.

It's the same with your data. Our clients are manufacturers, and they're very secretive, as I'm sure you probably are with your data. A manufacturer says, "We can't let anybody know what our production schedule is." Well, if your vendors don't know what your production schedule is, how can they ship you the materials you need on time? And if your customers don't know what your production schedule is, how can they know what's in your inventory? How do they know whether or not you can meet their needs? If somebody shares their information and you don't, guess which company the customer is going to go to.

Things have to be simple instead of complex. We can all identify with this with VCRs. We'd much rather have a VCR which is simple and easy to use instead of a VCR with a lot of features that are too complicated to understand. In the world of ERP, there is SAP, a software company out of Germany. They have what some people regard as the best ERP software in the business. The problem is, it's the most complicated, the most difficult to learn, and the most difficult to run. You may have heard that Hershey Candy, which recently installed this SAP software, was unable to ship candy to their customers for the Halloween season because they couldn't get their software to work.

We're moving toward standards as opposed to things that are unique. For example, when you get into a rental car, one thing you know is that the gas pedal is always going to be on the right and the brake pedal is always going to be on the left; the turn signal is going to be roughly in the same place, as are the wipers. This is the advantage of the Internet. It's a single standard; everybody communicates on the same platform.

The biggest shift is from ownership to assets. Ownership of physical resources is now a liability instead of an asset. The classic example here is Chrysler in the late 1970s when it was on the brink of bankruptcy. Chrysler was making lots of cars they couldn't sell. So they stored them in vacant parking lots. By Chrysler's accounting, these cars were assets. Well, those cars were actually a liability they couldn't sell; they couldn't turn them into cash and Chrysler almost went out of business.

We are moving from a transaction-based economy to a relationship-based economy. Classic examples here are somebody trying to sell you a used car or a car that's a lemon. The idea was, if I could tell you lots of lies or shade the truth enough and sucker you into buying this car, I could take your check and run away from you where you can't find me. You could say the same thing about the whole life insurance policies from years back when the agent would do anything he or she could to get you to put some money down for a whole life insurance policy. Instead of just buying a new car from a dealer today, we now have a relationship with a new car dealer. All cars come with a three-year bumper-to-bumper warranty. So anytime you buy or sell something, you're entering into a long-term relationship.

Since we're entering into long-term relationships, we don't really have to own things anymore. We're finding that we're leasing things instead of buying them. We're leasing cars and computers these days. You don't have to own an asset to use it. A perfect example is airplanes. You don't have to own a plane to be able to fly coast-to-coast. Companies don't have to look so much at capital expenses anymore. They don't have to put down a huge amount of money, like when you buy a car or a home mortgage. They don't have to buy assets; they just have to lease them to use them.

Also, you don't need to own the whole thing. We're moving from a whole concept to just an interchangeable parts concept. Dell is the perfect example with computers. Dell does not make, to my knowledge, any of these components that go into their personal computers. They purchase disk drives from Seagate, they get monitors from Sony, and they get modems from U.S. Robotics. All these have a plug-and-play interaction; if one part doesn't work, they can swap it out and either get a replacement or a part from another manufacturer.

Remember the title of my talk is "Driving Your Information Costs to Zero." Let me define information costs or define where we're going. If you read the business press or the economics literature these days, one name that's popping up more and more is an economist named Ronald Coase. In 1991 Coase was awarded the Nobel Prize in economics for his work on information costs back in the 1930s. Ronald Coase's key insight was that the purpose of a firm or a business is to reduce information costs. I'll explain this a little bit more later, but for now think about information costs as the make-or-buy decision.

An excellent example is a company cafeteria. When you go back 30 or 40 years, companies that had large facilities would own the company cafeteria. The people who worked in the cafeteria worked for the company—say Ford or a big insurance company. Well, we all know from 30 or 40 years ago, the food was lousy and the cafeteria operated at a loss. The reason was Ford is not in the food business; Ford doesn't know anything about food. If you go to a company cafeteria today, you'll notice that the company does not own the cafeteria. That cafeteria is an outside contractor. It's the same thing with a travel agency. Companies used to have their own travel agencies in-house; now most of that is done outside.

This also works on the opposite extreme. Take something we all know how to do like change our oil or bake a loaf of bread. These things are very easy to do, but virtually none of us does them because our time is too valuable to be spent on time-consuming mundane tasks.

The other key economic insight came from J. L. Kelly, who published a very obscure article in the *Bell Systems Technical Journal* back in 1956. His article was essentially a mathematical proof which showed that wealth is created as more data is transmitted with fewer errors over the same unit of time. I like to call this the information principle. This is a corollary to what you could call the production principle—that wealth is created as more goods are manufactured and shipped with

fewer defects over the same unit of time. What Kelly showed is that wealth is directly related to transmission speed. Like your Internet connection: the faster the better. And your wealth is inversely related to your error rate. The error rate in communication would be like noise, static on a phone line, or it could be background noise if there was somebody operating a jackhammer outside.

Prior to 1850, in the agricultural era, the limiting economic factor was inventory or raw materials. People were scrounging the earth looking for enough food and water to survive. That's why nations and tribes went to war—they went to war over raw materials. Once we entered the industrial era, the limiting economic factor became unskilled labor. The barons of the industrial era such as Andrew Carnegie, Cornelius Vanderbilt, and Henry Ford weren't hunting for raw materials; they were hunting for warm bodies to man the machines in their factories.

Once you get into the post-World War II era, the limiting economic factor was skilled labor. Warm bodies were no longer good enough to get the job done. You've probably all seen those pictures from the Great Depression with a line of men waiting outside a factory gate. The foreman would open the gate and hire the next 30 guys who walked in. You'll notice there aren't many companies that hire labor on that principle today. Or if there are, they're not listed on the New York Stock Exchange.

When you move into the 1970s and 1980s, the limiting economic factor became financial capital. Call this internal data, or information about the company. The key innovator here was Michael Milken, the so-called junk bond king. Milken's key insight was that the value of a company was not the traditional model of adding up the values of all the plants, equipment, and inventory. He said the value of a company is the discounted cash flow of the future revenue streams. There are two aspects here. First, Milken says we're going to value a company based on information, not physical assets. And second, we're going to value a company based on the future instead of looking at what it's done in the past.

As you move into the 1990s, the limiting economic factor became communication. Data is valuable, but if you keep data to yourself, you're essentially squashing it or suffocating it. To make data valuable, you have to share it. You have to share it with your vendors; you have to share it with your employees; you have to share it with your customers; you have to share it with the public.

As we move into the 21st century, the limiting economic factor is bandwidth. Think of this as the speed of your Internet connection. It's how fast you can shove data down a pipeline. And the good news here is that most of the experts predict that by the year 2010, bandwidth will no longer be a factor; we'll be able to buy as much as we want.

Let's relate this to the history of your management information services (MIS) department or your IT department. If you go back into the 1960s, MIS was almost considered to be a division of a company. The reason MIS was a division was because those million dollar monster IBM mainframes represented such a huge

portion of a company's assets. In the 1960s we were obsessed with economies of scale and the idea that bigger was better. Next year we're going to buy an even bigger mainframe. Well, in the 1970s, just the opposite happened. All of a sudden the innovation in computer technology moved away from bigger is better. The 1970s was the era of the minicomputers from DEC and Control Data.

As computers started to get smaller in the 1970s, so did the importance of MIS. The MIS function of a company was now viewed as a department or a team of people with shared skills. As you move into the 1980s, along comes the personal computer. Now we all have PCs on our desks. Well, if everybody has a computer on their desk, what happens to MIS? MIS goes where the computers are. So MIS was broken up and reported to the various different functions: accounting, finance, manufacturing, payroll, or whatever it was. IT people were now looked on as technicians who had a specific knowledge.

As they moved into the 1990s, companies started to outsource their IT. They said, "Look, we have all of these computers sitting on our property, but we can't hire the people to run them." So they started to bring in consultants to run their IT department. As we move into the 21st century, the outsourcing is going to be complete. Companies are going to look at their computer systems and say, "Why do we have these computers? We don't know anything about computers. Why don't you, the ASP, take our computers and put them on your property where your people are, because you know more about computers than we do, and we will just access our software over the Internet." The Internet will function as a utility just like the way you get natural gas, electricity, or phone service.

I mentioned the 1990s was the era of communications. We essentially replaced paper with electronic data interchange (EDI). We're now sending data such as purchase orders—especially in the automotive world—back and forth electronically instead of through paper. We've replaced checks with electronic funds transfer (EFT). We've replaced data entry of actually typing things into a computer with scanners like at the grocery checkout line. We've replaced letters and faxes with e-mail, and we've replaced filing cabinets with network databases.

Back in the 1950s, the great GM automotive engineer, Charles Kettering, came up with what he thought was a brilliant insight. He said, "The car today has become so complex, no single person knows how to build a car." Soon after he made that statement an economist named Leonard Reed said, "That's true. But if you also think about it, nobody even knows how to make a simple lead pencil. Nobody has all the knowledge within his head to be able to make a lead pencil from scratch." And he wrote that up as an essay titled, "I Pencil," which is very famous; it's reprinted in a lot of economic textbooks.

The information required to make a car or a pencil is infinite. The problem is we humans have a limited capacity to process information. We only read at 300 words a minute. So if the information required is infinite and our capacity is limited, how do cars and pencils get made?

There are two aspects here: one is called information sharing, which is the spreading or sharing of information. You can think of this as broadcasting. This is the easy part. The hard part is what's called information hiding. This is where you specialize information specific to each user. You've heard the phrase, "You want to know the time, and somebody tells you how to build a watch." All you want is one specific bit of information. Unfortunately, you get people who throw a huge phone-book-sized manual at you to get something done.

Essentially you want to design a dashboard which gives you the key readings of your company, or your division, or whatever you're working on. Think about the dashboard for a car. There's a lot of information about the car as it's moving down a highway. The dashboard gives you maybe five or six key variables—it gives you instantaneous readings on those variables. You have to do the same thing in business. You can't know everything about your business. But you want to keep instantaneous communication with the five or six key variables that it takes to run it. As they say, build a better mousetrap and the world will beat a path to your door. If you design a better dashboard, the world will also beat a path to your door.

Now let me define information costs. Information costs are the costs of gathering, processing, and transmitting information. Let's say you went home tonight and your refrigerator blew up after 12 years. If you had to buy a new refrigerator, you'd have to go to the electronic appliance store, talk to a salesperson, and learn about the models that are available at what cost. This would probably take a couple of hours of your time. You all know your time is not free, so that would be information costs.

Related to that are what are called transaction costs. Transaction costs are the costs of exchanging money for goods and services and moving and storing inventory. If you're going to buy that refrigerator, you either have to make an extra trip to the bank to get the cash, or you're going to use your credit card and Visa will take a cut of that transaction for the service they provide. It's the same thing with moving the inventory. You either have to move that refrigerator to your house, or you have to pay the appliance store to do it.

What we want to target here is what's called information float. Information float is defined as the time from the occurrence of an event until all of the information about that event is communicated to all parties. Think of this as the float on your checking account where the electric company sends you a bill on the 10th of the month, you get it on the 12th, you write a check on the 15th, they get it on the 18th, and the money is deducted from your account on the 20th. That gap from the 10th to the 20th is an information float gap of ten days. If you also think about financial reporting, generally companies report their financial results roughly a month after the quarter closes. Some of you may have heard that Cisco Systems has now set a standard that they want to be able to do financial close within 24 hours or even overnight. And I think they've actually done it where they can close a quarter and then the next morning the CEO can have the financial report on his or her desk.



Related to that is transaction float. Transaction float is the time from the placement of an order until the product or service is delivered. Domino's Pizza promises a 30-minute transaction float. They'll give you your pizza 30 minutes after you call, and Federal Express will deliver your package 24 hours after you give it to them. If you do any reading in economics, the terms information costs and transaction costs are often interchanged. So from now on I'm just going to use the term information costs to refer to both of them.

The information equation in driving your information cost to zero is this: the unit cost of information is equal to your expense (how much you spend on it), divided by the product of the volume of information that you're able to process and its quality. Your strategy: you want to drive your unit cost to zero by linearly increasing your expense while exponentially increasing your volume and your quality. By that I do not mean just simply spend less money on information. You have to get exponential returns for your investments in IT.

We want to reduce information float to zero. There are six aspects of information float.

One, speed. There is no information today in business that cannot be communicated instantaneously. If someone goes into a Wal-Mart and buys a box of Tide detergent, there's no reason the CEO of Procter & Gamble (P&G) can't learn about that sale instantaneously. Now he or she probably doesn't want to know that you bought a box of Tide at Wal-Mart, but he or she wants to know it in some aggregated form that could help him or her run P&G.

Two, accuracy. Obviously we don't want any errors.

Three, completeness. This is information sharing. Everything should be shared with everyone.

Four, customized. This is where information hiding comes in. Everybody doesn't need to know everything. They only need to know what they need for their job at their specific place or their specific time. Each user wants customized information.

Five, cost. We want to drive this down to zero. Compare the cost of sending a telegram in the 1970s to the cost of sending a fax in the 1980s, down to the cost of sending an e-mail today, which is pennies, maybe even a fraction of a penny.

Six, security. This involves issues such as copyright, identification, and privacy. I'll address these later, but security is something that's assumed. It's like flying on a commercial airline. You assume the airline is safe; otherwise, you wouldn't even get on the plane.

We want to reduce information float to zero. We want to find it, and like a bug, squash it. Where do we find information float? It comes in various forms. First is what I call physical information float. You have to ask yourself, "Do you have

virtual access to your data?" You always want to process digital data and not physical paper. If you ever pick up a piece of paper in your business, you should ask yourself this question before you process it: "Does the information on this paper exist already in some computer database?" If it does not, you should stop and make sure it gets entered in that database before you process it because obviously pieces of paper can get lost or they can be difficult to access.

One of the first companies to do this was the USAA Insurance Company. They scanned all their incoming documents into their database. So if you had an auto policy with them, if you wrote a letter to them, they would not take your letter and put it in a filing cabinet under your name; they would scan it into the computer so that anybody could access it if they knew your name or your policy number, instead of having to go to the third floor to the filing cabinet at the end of the hall and look under the S's. Paper should only be used as a redundancy such as a receipt, a statement, or a contract that somebody might want to read.

The next form of information float is procedural. In many cases your customers can manage the process of the transaction better than the employees. Think of it this way: The cost of an idle customer is more than the cost of an idle employee. I assume everybody is like me, when they buy their gas, that they go to those credit-activated pumps, where they simply swipe a card, pump their gas, and go. Looking back ten years or more when you bought gas, you'd have to pump your gas, then go into the station, wait in line, hand your credit card to the counter attendant, and watch them run your card through the electronic reader. Well, there's no value added to the customer to waiting in line, and there's no value added to having the customer watch somebody behind the counter do the same thing that they could easily do.

I say the cost of an idle customer is more than the cost of an idle employee. Think of it this way. We all attend meetings for a living. We always have the case where somebody's five minutes late or ten minutes late. That really doesn't bother us. Nobody's ever quit their job because somebody was ten minutes late for a meeting. But for most of us, there are companies we will no longer do business with because they made us wait an extra five or ten minutes standing at the counter.

There's contractual information float. Are you managing money-wasting delays instead of wealth-producing activities? In the book, *Reengineering the Corporation*, by Michael Hammer, one of the chapters describes how Ford Motor Company eliminated its incoming purchasing department. Instead of having people process things manually in hand with paper, they gave everybody electronic bar-code readers. So any incoming shipments would simply be scanned in through the bar-code readers. As soon as the incoming shipment was scanned in, the funds were automatically released and their suppliers were paid instantaneously.

If you go back 10, 20, or 30 years, whenever manufacturers like Ford would get an incoming shipment, they would try to delay the payment as long as possible to earn interest on that money. In that situation the supplier is obviously mad

because they're not getting paid, so they're calling on the phone and yelling at Ford. Ford has somebody on its payroll answering those calls, trying to sweet-talk the supplier into continuing to send shipments without getting paid. In that scenario there's an extra person on the payroll of the supplier and there's an extra person on the payroll of Ford. Neither of those people are adding value to the Ford car that you and I are buying. Well, guess what happens? Along come the Japanese, who don't have these inefficiencies built into their supply chain. Guess who's able to build the better quality car at the lower price? Wal-Mart has done the same thing with its suppliers. None of the goods in a Wal-Mart store belong to Wal-Mart. They belong to their suppliers. As soon as that box of Tide gets scanned through the checkout counter, that's when P&G gets paid—and they get paid immediately.

There's hierarchical information float. Can your information be conveyed at a higher level? Your vendors are already on your payroll adding cost to the final product. If your vendor is running a screwed-up business where nobody knows what they're doing, that essentially means that the products you're building or the services that you're providing are pretty much the same. Twenty years ago, a supplier would build a part, then they would have an outgoing inspection department inspect those parts to make sure they were good. Then they would ship them on to Ford. Ford would have an incoming inspection department. They would inspect them to make sure they were good before they sent them down to the assembly line. Here you had an inspector on the supplier's payroll and an inspector on Ford's payroll. They're both doing the same job; one of them is obviously unnecessary.

Wal-Mart has done the same thing with retail forecasting. In the old days Wal-Mart would have people on its payroll trying to guess how many boxes of Tide they would sell in the next six weeks or six months. Well, P&G would have people on its payroll trying to guess how many boxes of Tide Wal-Mart would buy from them over the next six weeks or six months. Wal-Mart finally said, "Hey, wait a minute. We have somebody retail forecasting on our payroll; P&G has somebody doing the exact same job on their payroll. Why don't we get out of the retail forecasting business and let P&G do all that work?" Wal-Mart told P&G, "We're going to give you this much space on our store shelves; it's your job to keep it stocked with Tide detergent."

There's logistical information float. Are you managing information or are you just moving it? Information should wait for people, not the other way around. This is a very important statement: If you ever see anybody waiting for information in your business, or in any process, you know there's a problem. All information should be communicated instantaneously.

Dell assembles computers in Austin, Texas, but they buy their monitors from Sony, which is in New Mexico. When you order a computer from Dell, Dell sends an e-mail to Sony saying, "We are going to complete this computer on October 19th, that's when we're going to ship it." On October 19th, Dell ships the computer from Austin and Sony ships the monitor from New Mexico both via Airborne Express. The computer and the monitor meet up at the Airborne Express distribution center,

and they're both delivered to the customer at the same time. Dell has eliminated the step of shipping the monitor from New Mexico to Texas, because that doesn't add any value to that monitor.

It's the same principle with airline e-tickets. When I fly out of O'Hare from Gate B17, there's no point in United Airlines sending me a ticket so I can take that ticket to B17. They already know in advance when the flight's leaving and they know it's leaving out of Gate B17. What's the point of sending information to me just so I can hand-carry it to Gate B17?

Intellectual information float. Does the answer already exist, but in a different form? In many cases a close enough computer beats an exact human being. This is the principle behind database marketing and underwriting. If you fly, you've already learned the hard way that Visa and MasterCard have figured out that anybody who has enough money to fly is probably a good credit risk. They're looking for people who make a lot of money and who pay their bills. So they figure if you're able to fly, you probably meet those criteria. They're not going to go through the list of frequent flyers and try to weed out the people who don't pay their bills, so they just send everybody a preapproved credit card application.

Same principle with indexed stock portfolios. Large companies used to have their own investment staff to invest their pension funds. This investment staff in many cases wouldn't even beat the averages like the Standard & Poor's (S&P) 500. So companies decided, "Why do we have all these people on our payroll who can't meet the averages on the S&P 500? Why don't we just buy an indexed portfolio and get rid of our investment department?"

Incremental information float. Going back to my ATM card example, in many cases you already know the answer; the customer has already told you what they want. When I go to get some more cash, I'm going to put this card in the ATM. The first question is if I speak English or Spanish. Well, they asked me that question last week and I told them I spoke English. The odds are very low that the next time I go to get cash I'm going to decide I want to speak Spanish. I have already told them I speak English. I've told them a thousand times, yet they can't seem to remember this.

Whenever you have an interaction with your customer, whenever they give you an incremental bit of information, you should store that information and use it. If you've ordered books through Amazon.com, all you do is you type in your e-mail address and password and they remember you; they remember your address, your credit card number, and several other preferences you have.

Terminal information float. You should always ask yourself, "Is the information in a terminal state such that it will not change?" A good example here is a supplier that sends a shipment to Ford. Once they've loaded that truck, what's on that truck is not going to change. So you only should count that shipment once. You shouldn't count it on the end going in and then count it again on the end going out. The same thing with when you take your grocery cart through the checkout line—

what's in that cart is not going to change. The data is in a terminal state. After that, no human being should be processing the information. The information processing after that point should be automatic as it is with the bar-code scanners at the checkout line.

We still have problems in the medical area where you have an electronic device that gives a reading like a blood pressure, and the nurse will manually write down the reading and then put it on a chart. Well, anytime you manually process information, you're introducing the opportunity for an error. We want to eliminate those sorts of interactions.

Intermedial information float. Are you competing with the speed of light? Compare tracking your package via Fed-Ex today versus that same process ten years ago. Ten years ago you had to call up Fed-Ex, wait to get somebody on the phone, and read them your package number. They would take what you read, type it into their computer, and tell you where the package was. Now you just go on the Internet, type in your package number, and you get the information instantaneously. There's no reason that you should have to interact with a human being who could possibly introduce an error into the process.

If any of you saw the PBS documentary, *The Machine That Changed The World*, they showed how the London Stock Exchange tried an experiment with electronic trading. They were just like the Chicago Board of Trade is today, where people are buying and selling via the open outcry system—i.e., traders yelling at each other back-and-forth. So they tried electronic trading alongside the trading pits to see how it went. They did this on a Monday in October in 1986; by Friday, the entire floor of the exchange was empty because everybody instantaneously realized that it's much easier to transact trades electronically than it is to pay human beings to yell at each other for bid-and-ask prices.

Monitorial information float. Are you juggling too much information simultaneously? Computers have unlimited bandwidth whereas humans do not. The biggest example here would be program trading, where you're trying to hedge risk on currencies, and you have a market in Frankfurt, one in London, one in the U.S., and one in Japan. And whenever you see a difference, you're supposed to buy one and sell the other. Well, it's very tough for a human being to look around at six or eight different computer screens and try to spot an arbitrage opportunity; that's a job for a computer.

They've also done this with credit card fraud now. Companies are trying to look for suspicious credit card transactions. They don't do it with human beings. They do it with neural network software. Twenty years ago, you would see a charge that you didn't make and you would be calling the credit card company. Now with the neural network software, the credit card company can spot these suspicious transactions and they will call you before you even get the bill and ask, "Hey, did you charge this?"

Ten years ago, the most common charge made on a stolen credit card was a \$60 charge for women's shoes. Apparently people stealing credit cards would buy a lot of women's shoes, either to wear or return in exchange for cash. Today the most common charge on a stolen credit card is office supplies, such as computers, fax machines, or copiers.

Relational information float. Sometimes we forget who the customer is. This is the area where there's the most potential for wealth creation. What we need to do is reverse-engineer the accumulated knowledge and trust of every relationship. If you think about your utility bills, such as electric, phone, or gas, most utilities give you a 12- or 15-digit account number, which they ask you to write on your check. I've never met anybody who knows their account numbers or even cares what they are. What we have to do is reverse-engineer that transaction. Remember, you're the customer. You should go to the electric company and say, "Look, I don't care what your number is, here's my number. This is the number to my bank account. If you want to get paid, you have to go talk to them."

The next great innovation in grocery shopping is going to be what I call "Wal-Marting your grocer." Surveys now show that grocery shopping is the most hated activity among consumers; people would just rather spend their time doing other things. What will eventually happen is people will do to their grocery store what Wal-Mart has done to P&G. Remember, Wal-Mart says, "OK, P&G, you have this ten by six feet of shelf space, it's your job to keep it stocked." What we should do is go to our grocer and say, "Hey, look. Here's my refrigerator; it's this big. It's your job to keep it full." Or, "Here's my pantry, it's this big and here's what I want in it."

I gave several examples of information float, and you'll notice that many of these companies took a huge leap or maybe an incremental leap by using IT. There are generally four scenarios or four levels of IT competitiveness.

The lowest level is what is called an operational necessity, which is simply a requirement to survive. In 1990, the big three automakers told their suppliers, "We are no longer going to process paper five years from now. If you want to do business with us, all of our communications have to be electronic." So if you were an auto supplier, you either developed the capability to do EDI, or you went out of the auto supply business.

The next level up from that is called competitive necessity, which is a requirement to compete. If you remember back in 1983 or 1984, when Sears introduced its Discover credit card, they were still big on the Sears Financial Network. They came up with this great idea. Sears said, "We want to promote our Discover credit card, so we won't accept MasterCard, Visa, or American Express, but instead we'll give people an application for our Discover card." They were hoping they would squash MasterCard and Visa. However, what happened was, customers who went to Sears didn't have time to fill out an application for Discover, so they just took their business elsewhere, to other stores in the mall. Sears learned very quickly, within a

few years, that if they wanted to compete they had to accept MasterCard and Visa, and that's pretty much standard today.

The next level up from that is what is called the competitive opportunity, or a chance to take a lead. This is what Shell did by automating their gas pumps back in the late 1980s. There was no one pressuring Shell to do this. But Shell saw an opportunity, and within five or six years all the oil companies converted to automated gas pumps. You have to go way out into a rural area now to find a gas station that doesn't have a credit-card-activated pump.

The final level is what's called the breakaway opportunity. This is where you have a chance to completely change the industry. This is what Microsoft did with their Encarta Encyclopedia. Everybody in this room is old enough to remember that 20 years ago, an encyclopedia was from Encyclopedia Britannica; it cost \$1,500 and it weighed 100 pounds. And it was actually a piece of living-room furniture. You would display proudly that you had the Encyclopedia Britannica. Along comes Microsoft. They said, "No, an encyclopedia is a little disk that weighs maybe half an ounce, and it costs \$49.95."

What Microsoft saw was, who buys and uses encyclopedias? It's mostly kids—let's say 10 or 12 years old. Does a 10-year-old kid care if the entry for ancient Greece is 8,000 words or 800 words? Encyclopedia Britannica is obviously the best encyclopedia; nobody questioned that. Microsoft said, "Why don't we buy a cheap encyclopedia (I think it was Funk & Wagnalls), we'll dress it up with some fancy graphics, and kids would much rather have that than this Encyclopedia Britannica." As parents, we'd obviously much rather spend \$49.95 than \$1,500. Microsoft almost drove Britannica out of business within about six or seven years.

The real irony of this story is that within five years, Microsoft will probably have to sell Encarta. And the reason is this: Microsoft changed the definition of an encyclopedia from a physical book to a piece of information. Now think about the cost of accessing that information. Today, or a few years ago, it was \$49.95. Now the Encyclopedia Britannica is on the Internet free for everybody. What's the cost of accessing the Encyclopedia Britannica? It's a mouse click. If the cost is the same, a mouse click, which encyclopedia do you want to access? Do you want to access the best, Encyclopedia Britannica? Or do you want this cheap knockoff from Microsoft?

Microsoft does applications and operating systems. They do not do, or they don't succeed at, what is called content—content is things such as movies, music, or books. Microsoft has always failed whenever they try to enter the content business.

What I want you to do is think about the Internet. The relationship of the Internet to your data is just like the relationship of electricity to energy, or the relationship of your credit card to your wealth. It just gives you access. What is going to happen is companies are going to completely outsource their MIS function. A company's MIS department is going to merge with an Internet Service Provider

(ISP) and form an ASP. The ASP will provide what we call A<sup>5</sup> data access. A<sup>5</sup> access is Anything, Anytime, Anywhere with Anyone in Any amount.

Anything is what is referred to as functionality. In the PC business it's called plug-and-play. If you think about this electrical outlet back here, I can plug my computer into it; I can plug a toaster into it or a hair dryer. Anything will work in that electrical outlet.

You want it available anytime. You want it available just in time (JIT). Like a light switch, you turn it on; when you're done with it, you turn it off. It's available JIT: on/off, 24 hours, 7 days a week.

You want to be able to access it anywhere, or a universal connection. If you take your PC to any hotel room, there will be a plug that will be able to power it. Or, as they say with Visa, "Visa is everywhere you want to be."

You want to be able to share your information with anyone. Anybody can access the Internet with a computer. It's not like the old days when my IBM PC was incompatible with your Apple, or my DEC VAX was incompatible with your IBM mainframe.

Finally, there's any amount. You must have scalability. You must be able to grow by a factor of 10 or 100 almost instantaneously. Back to the 1970s, a small business might purchase what was then called a microcomputer. The business would grow, then they would have to move up to a minicomputer from DEC or Control Data. When they moved up to the next level of computer, they had to throw out their hardware and software. So they're running on a DEC VAX. When they moved up to an IBM mainframe, again they must throw out the hardware and software and start all over again from scratch. That is no longer the case. When Amazon.com wants to grow today, they don't have to throw out their old computers; all they have to do is add server capacity or bandwidth capacity.

I said wealth, energy, and data. Think of A<sup>5</sup> access and let me give you a little history. Go back 1,000 years. Who were the wealthiest people? They were the landowners. They were the dukes and the barons or whatever titles the king would give them. You were wealthy if you owned land. The problem with land is you can't store it. You can't pick it up and move it; it's fixed. So people decided that wealth or money was gold. Gold is nice, but the problem with gold is it's very heavy to carry around and it's tough to make change with. So then they came up with coins or cash. Cash is nice, but it can get lost. At some point in the development process of economic man, we invented banks. The key concept of a bank is that people said, "My wealth is too valuable, too important, and too complex for me to handle. I'm going to give all of my wealth to you, the bank, and let you manage it for me."

Generally, how do we think about things we consider to be valuable, important, and complex? If it's too valuable, too important, and too complex, I want to keep it to myself. I don't want anything to happen to it. But when things become so



valuable, so important, and so complex we want access to it—anything, anytime, anywhere, with anyone and any amount. Then we delegate it to someone else.

We've done the same thing to energy in this century with electricity. How do you generate energy? You don't generate it on your own. The electric company generates it and sends it to you. Even as late as the 1930s—my father grew up in Chicago—every fall the coal company dumped a load of coal in our front yard. He would have to physically shovel this coal into our furnace. That's how we stayed warm during the winter. Nobody has to physically handle energy any more, just as they don't have to physically carry cash anymore. It's going to be the same thing with your data. If you look at the progression of data, where does your data have to be? Your data can be A<sup>5</sup> accessible over the Internet.

Let's focus on the money analogy. Think about your financial service providers such as a bank or a brokerage firm. What are the services you get? You get checking and credit cards. You can trade, buy, and sell stocks. You can diversify your portfolio through a mutual fund. They'll keep records for you, and maybe do some research.

But what are the principles that control your money? First of all, you can't even touch your money. If I said to you, "Show me your life savings; show me your wealth, where it is?" you wouldn't be able to do that. You can't touch your wealth. You also, in many cases, don't even control your wealth. If you have your money invested in a mutual fund, you're not buying and selling individual stocks in that mutual fund; the fund manager is doing that. You can't fix problems with your wealth. If you get a statement from your brokerage firm that's wrong, what do you do? You make a copy of your old statement and you send it back to them and you say, "Here's the problem. It's up to you to fix it." You don't hire the personnel. They work for the bank, or for Schwab; they don't work for you. You don't store your wealth in your mattress as they did back in the 1930s. And in most cases, you don't know where your wealth is, and you probably don't even care.

Same thing with your data. What is your data composed of? Right now it's your MIS department. You have hardware, software, a network, data storage, training, and support. The same principles that apply to your money apply to your data. You won't be able to touch it because you don't really want to. There's no point in touching a disk drive. You won't be able to control your data. You probably can't now because you're having trouble finding the IT staff to manage your network. You won't be able to fix it. You won't hire the personnel. They'll work for the ASP, not your company. You won't store the data on your site; it will be stored off-site, accessible everywhere on the Internet. You won't know where your data is, and again, you won't care as long as you have A<sup>5</sup> access to it.

I said I would get to security issues. This is where a lot of people get nervous. What do you do when the electric power goes out? Well, in most cases, you just wait until the power comes back on. If the power goes out, you're out of business. There's nothing you can do. What do you do if your wallet is stolen? If your wallet

is stolen, you call up your bank and the credit card companies and say, "My wallet's gone; stop all transactions." Essentially what you do is you delegate the problem to somebody else. You say, "I'm in a big fix, get me out of it." What do you do if your house burns down? Well, if your house burns down, you're insured for the value of the house, plus you don't have to worry because your wealth is not stored there. Your wealth is stored in mutual funds or stocks or whatever.

How about when your system crashes? This is most people's greatest fear in the business world. What are you going to do? Generally you have three options: fear, panic, or waste.

With fear, things might be running fine now, but you're terribly afraid that you won't be able to hire and retain sufficient expertise to keep your network up and running. You just do not know what you're going to do when disaster strikes.

The second level is panic. You're not going to learn that your IT staff can't do the job until a crisis occurs. This scenario actually took place with my last employer. In the Washington, D.C. office, a hacker attacked our e-mail system and virtually shut it down for a week. Try going a week with everybody in your office not using e-mail and see how productive you are. After a week our network administrator was able to restore the e-mail system. How many of you can guess the first thing we did after he got the network up and running? Obviously, we fired him. The reason we fired him is because, at that time, he was the most important person in the company. But he wasn't the CEO, and he wasn't the most highly paid. We figured out that we weren't in the IT business; we were actuaries and consultants. Shortly thereafter we started outsourcing our IT.

The final scenario is waste. You can have the world's highest paid and most expert IT staff, but they're likely to be very overpaid and underutilized. If they're really that good, your system is going to be running smoothly most of the time and they're going to spend their time playing computer games.

So let's say you're still skeptical. You still don't like the idea of giving up control of your data. You like the way it is now. We have our IT Department, we're in control, we're going to take it from here. Well, you still have a lot of risks you have to deal with.

Platform risk. What operating system, hardware and software, are you running? Are they obsolete? Are you still running one of those Wang office automation systems back from the 1970s? They still work; but they're virtually useless today because they don't interact with anything. A lot of our customers in the manufacturing world were running DEC VAXs from the late 1980s or early 1990s. The problems they have now are twofold. One is, a lot of them are not Y2K compliant. Second, now that DEC is out of business, they can't get parts for those computers. There's a network where you can buy and sell parts for DEC VAXs, but they're slowly dwindling away to nothing—like eight-track tape players.

Quality risk. Is your error rate acceptable? If you're still doing data entry or you're still one generation behind in some level of technology, you probably have higher error rates. Are your customers willing to tolerate that?

Talent risk. Are you able to hire the IT expertise that you need? Do you have expertise on staff for local area networks, wide area networks, wireless application protocols, or ISPs?

Retention risk. What is the career path to your IT staff? Our customers aren't in the IT business. The best their IT staff can do is graduate to the head of MIS and their career is pretty much over. What's going to happen in that scenario is the best and the brightest people are going to leave the company and go elsewhere where they can make a lot more money. Your company is going to be staffed with career dead-enders who don't have much ambition and aren't going to keep up with the latest technology.

Moral risk. Is your data safe from theft and sabotage? A lot of people are worried about sending their credit card number over the Internet or letting their data pass through the Internet. If somebody wants access to your data, they're not going to bother to try to intercept it over the Internet and then decode or de-encrypt it. If I wanted access to your data, I'd go to somebody in your IT department and say, "Here, I'll give you \$5,000; give me a back-up copy of your disk drives." I'm sure I can get it much easier and much cheaper than trying to intercept it over the Internet.

Communication risk. Can your customers even talk to you? This was the situation with GM, the big three. They said unless you do EDI, we're not going to do business with you.

Regulation risk. Can you keep up with the law or the standards? There was a huge consolidation in the banking and insurance industries in the 1990s. With insurance it was related to the accounting standards and reporting requirements of the New York 126 law, and with banks the consolidation was simply the fear of Y2K. The smaller banks looked at the Y2K liability risk they had in the mid-1990s and said, "We can't take this risk; we're just going to sell out now." Well, my bank sold out. The bank that bought it had incompatible software so the expiration dates weren't valid for my ATM card.

Time risk. Are your customers willing to wait for you? The example here would be Shell and gas pumps. If Shell automates their gas pumps and you don't, customers aren't going to want to wait and stand in line an extra five minutes. I read an article by one guy who said he no longer goes to Shell because they ask the question, "Do you want a receipt?" forcing him to wait an extra five seconds. So he goes to a station that gives him his receipt automatically.

Cost risk. The big question for Kmart now is, can they develop the same IT capabilities as Wal-Mart within a year or two? If they can't, they're on their way

out of business. In fact, they've recently announced they are closing 50 or 60 stores.

So how long do you have to react? What's the survival timetable? Go back to the 1960s when seat belts were introduced and when the Surgeon General published its report on smoking. Twenty-five years later there was virtually no change in behavior. In 1983, seat belt use was only 14%. It took more than a generation to adopt a change.

Move into the 1970s when ATMs and voice mail were introduced; that change process shrunk down to a matter of years. I'm sure many of you can remember when answering machines were first introduced. People thought it was an insult to get an answering machine. People would say, "I want to talk to a real person. I don't want to talk to a machine." Today, none of us can live without voice mail.

That time shrunk down to months when e-mail became popular. It was a matter of months from the time you needed it until the time you got it. That shrunk down to weeks. For example, if your customers tell you they now are going to pay you by EFT, if you want to get paid, you have to adopt EFT. So you'll have to do this in a matter of weeks.

I mentioned the scenario from the London Stock Exchange. From Monday to Friday everybody who did business on the London Stock Exchange had to change the structure of their company. We're getting down to a matter of hours. That's generally the response time of your electric company. Your power is never out for more than an hour or two.

Think about your own operational necessities. Consider a migrant farm worker who comes north from Mexico to pick grapes. That person doesn't have indoor plumbing; he or she can't read or write, doesn't have access to electricity, may have never used a telephone, and doesn't have a bank account, a driver's license, or a credit card, yet he or she is able to survive. However, unless he or she obtains access to these things, he or she has a very limited ability to advance in our economy. Notice that if I had not had access to any one of those, I would not be speaking here today.

Moving into the 21st century, your operational necessities are going to increase. Everybody is going to have to have access to a PC, e-mail, EFT, EDI, scanners, and bar-coding. All of our data will be accessed through the Internet. So here's a brief survival checklist.

Do your competitors, customers, suppliers, or employees have lower information costs than you do?

Are they trying to get around you? Is there an Amazon.com alternative open to them?

Where are you on the reliability and security scale, i.e., fear, panic, and waste? Is that where you want to be?

Which of the nine IT risks threaten you the most, and how are you addressing them?

Is your business founded on industrial-age economic models such as vertical integration, economies of scale, or diversification? No one is building their business based on those models. You're building your business or creating wealth on an information model.

How are you leveraging the economics of external information and exponentially increasing bandwidth?

When will employees, customers, and suppliers have A<sup>5</sup> access to your data?

In less than 30 years Wal-Mart went from nothing to the world's largest retailer. How did they do it? They didn't have any proprietary technologies. They were in discount retail, so they sold goods at a very low margin. They weren't in the middle of Times Square or in the big cities, where the wealthiest customers were. Their markets were rural and generally lower class. The switching costs were zero. By switching costs I mean, if you didn't like Wal-Mart you could just go across the street to Kmart or to another store at virtually no cost. Their workforce is not the brain trust of the world. They generally have high-school-educated people working on an hourly basis, and the turnover in discount retail is very high. Wal-Mart was able to go from nothing to the world's largest retailer in less than 30 years not by doing any of these things or taking any advantage in these areas, but simply through the better processing of information.

Three final points to summarize:

The purpose of a business is to reduce information costs. That's all your job essentially is, especially in the insurance world where you're dealing with pure information.

More information transmitted with fewer errors translates into wealth.

And finally, like a utility, information must be A<sup>5</sup> universally acceptable. You need access to anything, anytime, anywhere, with anyone in any amount.

**Mr. James J. Altman:** You've spoken a lot about how information is moved, but you haven't talked much about how it's analyzed. The business many of us are in is working on the analytics and using techniques on the data to draw more information out of it. Where do you see that going? What kind of analytic techniques are used with it, because in our business unlike maybe manufacturing a lot of that is required.

**Mr. Smedinghoff:** I gave the examples of neural networks with credit card fraud, and program trading. I also mentioned the concept of the dashboard. There's an infinite amount of information you can process. I know in my actuarial career, we

almost thought we got paid by the pound or by the kilobyte of information. But you're not in the business of processing information per se. You're in the business of designing a better dashboard—think of it that way. I use that analogy a lot in manufacturing and it applies in any area. The further you go up, the less you have access to the technical side of things. What you need to know about technology is (a) what's possible and (b) what's feasible. In designing the dashboard, you're able to rearrange the way you can look at a company. You want to design the most efficient way to look at a company, a line of business, or an industry.

**Ms. Grace C. Caress:** How many ASPs are out there and is this really more of a data-warehousing concept where people can access information, or is it where people can put applications on the Internet and employees or customers can have access to the software and data?

**Mr. Smedinghoff:** There are a lot of ASPs out there. Two that you might see ads for in the press are Corio and USinternetworking. For those two companies and many others, the popular model is just what you said—data warehousing. It's essentially just moving your computers from one place to another. We think that model is ultimately not going to work, or that's not the way it's going to evolve because nobody is really interested in a new technology. They're interested in added value.

We think what's going to happen—and this is the model that we're working on—is that we are essentially going to become your IT department. It's not simply a matter of, "Hey, we have some technology, would you like to buy it?" We're working with automotive suppliers. We're saying, "We know the automotive supply business; we know the software that you work with. We can do things for you that the people selling just the technology can't do for you." So we want to add a lot of intelligence to the software and to the data and not just give you a bunch of hardware. It's going to move toward that model because the data-warehousing model is simply an additional technology that people are selling off the street. Ultimately, you have to add some intelligence to it.

**From the Floor:** Do you see any difference globally in receptivity to this technology or the willingness to use these tools and techniques? Is it more likely to be the U.S. and developed industrial countries or do you see this being adopted globally rather quickly?

**Mr. Smedinghoff:** The key drivers we've seen—if you follow the political news—are H1B visas: the visas where we're trying to bring over high-tech workers from overseas. We can't get enough of them there. A lot of companies are saying that they don't have to physically bring the person here. They can work at a terminal in Europe somewhere or in Asia somewhere and that's just fine. So you can see already the splitting up of the physical relationship.

Obviously a lot of us are telecommuting; we don't have to show up for work. Well, they can be overseas just as well. As that pressure mounts—unless the government decides, "Hey, let everybody in"—that's just going to be another

added pressure point. Companies are just going to break and say, "Look, we can't handle this; what can we do? What are our options?" And one of those options will be transcontinental outsourcing. I know Hewlett Packard and America Online customer support is done in India or in countries in that area. So that's the first step. The next step is going to be companies saying, "We don't care where our data is, just put it where we can access it."

**Mr. Curtis Lee Robbins:** You mentioned building more intelligence into the software. Where does artificial intelligence enter into the information?

**Mr. Smedinghoff:** I used to be a big fan of artificial intelligence. I read a lot of newsletters and books on that topic. Unfortunately, it has been a great bust from what people thought it was going to be in the 1970s and 1980s. The advancements that I've seen that have actually worked are the neural network software that handles credit card fraud, which I discussed. A lot of people are using neural network software to try to predict where markets are going to go. They take a lot of data history, they create a model that can match that history, and then they let their model work on past data to see how well their model is able to predict how the markets will react in the future based on what they know about the past. It's called training a model with neural networks. You run more data to it and you refine the model based on what you learned from the new data. That's where most of the advances I've seen are.