



What effect will tracking technologies like RFID and GPS have on connected businesses?

LOCATION, LOCATION, LOCATION

Who, what, when, where, why, how: Your eighth-grade teacher drummed these into your head when she tried to teach you how to write a term paper. Describing time, place, form, and event—in prose or elsewhere—is the most efficient way we know to define truth.

Computers are very good at coping with *what*, the crunching and processing of raw data. With a little brain sweat on the programmers' part, they can be better at managing *when* than are we humans. *Why* is the province of AI—and will continue to be.

But *where*—storing an accurate and up-to-date state for the location of your widgets, has remained dependent upon us hapless humans ever since the first inventory clerk mis-keyed the number of gizmos in stock.

That's beginning to change. Tracking technologies such as GPS and RFID technologies are becoming part of the IT infrastructure and part of business solutions. While some of these projects are in experimental or trial stages, there's no doubt that they'll affect our business and personal lives. While raising important privacy and security questions,

tracking technologies (part of what IBM dubbed pervasive computing) are an important—and wonderful—stage in technology enhancing the quality of our lives.

TAG, YOU'RE IT

First, let's review the basics of these emerging technologies. You're probably familiar with devices that use GPS and RFID, but you may not know how they work.

GPS (Global Positioning System) is a satellite-based radio navigation system. Run by the U.S. Department of Defense, GPS triangulates locations using one of 24 satellites and can pinpoint an earth location to within 20 meters horizontally. Because it can accurately identify location, GPS has already been accepted for both consumer and business use: from Hertz's NeverLost mapping system

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Business: the 8th layer



(which gives drivers turn-by-turn directions) to airplane pilot instrumentation. GPS systems can also help tow-truck dispatchers know exactly where in town its vehicles are, so the closest truck can be sent to aid the customer.

RFID (Radio Frequency IDentification) uses tiny microchips to store an ID number and respond to a radio query with its unique code. The chips range from dime-sized to a grain of sand, depending on their power capabilities and their frequency range—from a few inches to a few feet. Right now, you're most likely to be familiar with RFID technology from Mobil's SpeedPass or the auto-pay available on some toll roads. As you pass the embedded chip past a sensor (actually, it's an antenna), it records the ID and it connects it with your database record to make the sale.

need to be individually scanned. That doesn't keep UPS from using bar codes to track shipments—so I can see that my Amazon order is in Kentucky—but a bar-code-equipped package has to wait for someone to look at it.

RFID lets companies know exactly which item is in which truck and when it arrives in which warehouse. It also solves problems that bar codes never could, not the least of which is the ability to identify the contents of a sealed box by passing it through a tunnel antenna. (Are there 24 shirts in this shipment, or only 20?)

For manufacturing plants, the advantages are even more compelling. The company can detect unauthorized equipment use, find specialized tools that aren't where they're supposed to be, locate raw goods in the

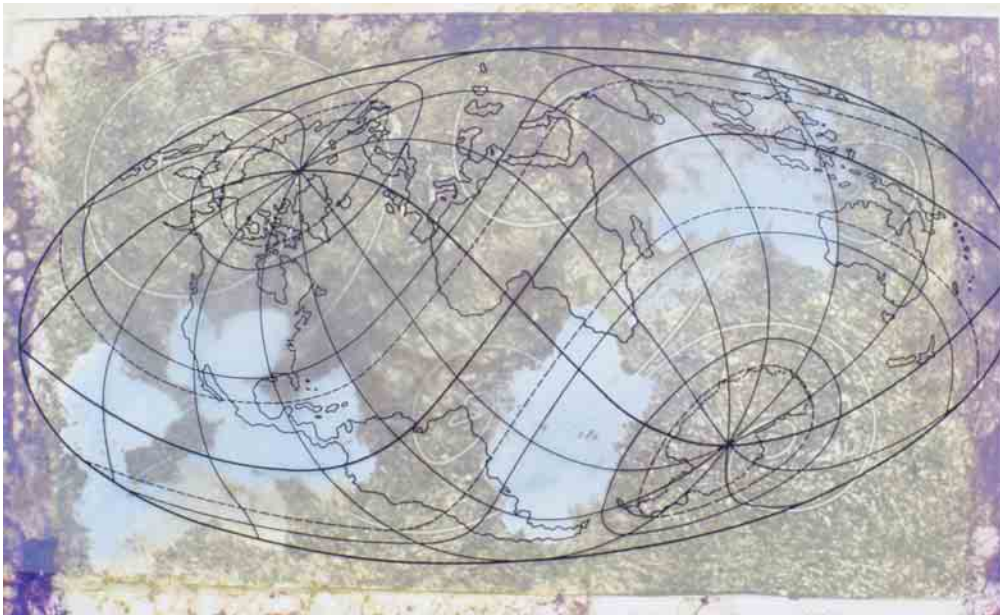
TRACKING TECHNOLOGIES ARE INEVITABLE— PEOPLE ALWAYS CHOOSE CONVENIENCE, EVEN AT A COST OF LIBERTY, ANONYMITY, OR MONEY.

Both these technologies are very powerful, and they're used in many niche business and consumer solutions. RFID chips embedded in cows can help farmers track their dairy production (has Daisy been in the barn?). A chip embedded in a cat helps animal shelters identify lost pets. Penguin migration patterns have been tracked with RFID technology. A GPS system lets a Phoenix-area concrete company control how far its trucks travel in the summer heat (concrete sets up faster when it's hot).

RFID technologies are being adopted by big manufacturing, warehousing, and distribution firms who worry about delivering the right items to the right location at the right time. "RFID is the next technology beyond bar codes for tracking items through the supply chain," says Bill Allen, a spokesman for Texas Instruments RFID Systems. Because bar codes are a line-of-sight technology, they

warehouse, and track assemblies as they move from one stage to another.

Because of privacy concerns—we'll get to those in a moment—tracking technologies aren't yet as enthusiastically adopted on human hosts. Today, their use is limited to two categories. First are volunteers who have a vested interest in being tracked, such as mountain climbers (who carry GPS systems to avoid getting lost) or people who want to exchange information at human-networking conferences (with RFID-enabled badges advertising availability). The other use is for people that society deems have fewer-than-usual rights and a legal or moral justification to be watched: Alzheimer's patients, paroled criminals, and newborn babies. For example, one company offers hospitals an RFID system for babies' ID bracelets. An alarm goes off if the child is removed from the facility without



the proper passwords being entered, and the software can be set to require an ID match between mother and child.

You may notice that these applications are mostly standalone. They may use a local database to tie together an ID and customer number, but they aren't well connected to other systems. Obviously, it won't stay that way.

IDENTIFYING OUR FUTURE

Undoubtedly, the real power of tracking technologies will be demonstrated when they become integrated with the rest of the network and the IT infrastructure, including personalization and data mining. Trials for such things are underway today, ranging from high-end clothing store Prada (where "smart labels" identify customers and merchandise, and link individual shoppers to selection information before and after the sale) to Wal-Mart trying out "smart shelves" with networked RFID readers. (Imagine a shelf that can tell the warehouse when it needs to be restocked, and where to find the items to restock it.) KSW-Microtec, a German company, has figured out how to embed washable RFID tags into clothing. Several firms, includ-

ing Nokia, are looking at incorporating RFID with mobile phones; your telephone becomes your credit card.

It only starts there. In the complete soup-to-nuts technology-enabled food chain, you could walk out the door of the supermarket through a scanner that totes up your charges and automatically debits your checking account. No more standing in a check-out line. A smart refrigerator could track your milk purchase and, when the carton is thrown away, automatically put the item on your shopping list (or order it through the Internet). (Somehow I doubt it'll be any better at identifying the blue-green substance in the back of the frig.)

Happily, the technology is being developed with adult supervision, rather than the typical lurching forward with vendors trying to establish proprietary interfaces. The Auto-ID Center is a not-for-profit global research organization headquartered at MIT which, among other things, is developing XML-based standards. Later this year, it intends to release technical specifications to help vendors and developers create RFID-related products and services. Among them are several important elements, such as an object-naming service

and a physical markup language.

Incorporated with personalization technologies, RFID can make purchase recommendations to accessorize the suit you're trying on—or the one you bought the last time you visited the store. (Just like in the movie *Minority Report*.) As TP's Allen says, if you add a temperature or time sensor to the chipset, the multifunctional device can report when a warranty runs out or a machine needs to be serviced. (Presumably, these events would still occur at the same time.)

PRIVACY, PLEASE

Any new technology requires that questions be asked about security and access control, especially when data is shared. It's the integration that puts a shiver up the spine of privacy watchers.

You don't have to be paranoid to worry about the fuzzy gray line between tracking a newborn in the hospital and tracking your spouse's location. If it's okay to put a tracking chip on your toddler at Disneyland (to find the kid when he gets lost), is it equally okay to put one on your teenager? What about on your employees?

I don't think the Big Brother privacy concerns come up seriously until the tracked items reach the door of the supermarket. The RFID chips aren't necessarily turned off once they've left the store—and the technology is new enough that we've no opt-in or opt-out rules for such things. Plus, anytime that data is collected, it's available for someone to mine, subpoena, or hack. You don't have to look too far into the future to imagine misused data. From e-mail's beginnings, would you have predicted spam, e-mail viruses, or even the stupid jokes your sister-in-law sends? What will be the equivalent for RFID or GPS?

Fortunately, nobody is ignoring these questions. But privacy concerns aren't quite as scary as they might initially seem, at least for RFID. The chips can't be read from much further than three feet away and are blocked by things like walls and bodies. No one can point a wand at you from down the street to find out how much money you have in the bank—not without expending a huge amount of energy and building a really big antennae.

Where do I stand? Privacy concerns or no, I think these technologies are as inevitable as credit cards and cellular phones. Whether it's right or wrong to do so, historically, people choose personal convenience even when it means giving up liberty, anonymity, or money.

And, frankly, the benefits are too good to pass up, as both a consumer and a businessperson. If I'm going to live in a secured world, I'd rather use devices to identify myself rather than passwords that are easily forgotten or stolen. I'd like to know that the items I want to buy are on the shelf. I'd be happier knowing that my Amazon order is three miles away from my house rather than "out for delivery." And I'd really like to find my husband when he gets separated from me at the mall.

For businesses, the benefits are even more compelling. The supply chain is under control. You no longer "do inventory" to check on item availability; you just look at the database. Sales aren't lost because the box is on the wrong shelf or the wrong item was sent. IT departments can locate the lost server, farmers know where their livestock is, and the bean-counters know where the beans are. This is an exciting technology which can change the way we interact with the world. And it's just getting started. ~

Esther Schindler is a freelance author based in Scottsdale, Arizona. Although she isn't overly protective of her privacy, somehow she doesn't carry any tracking technology on her person. Yet.



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