

A mandate for change is a mandate for smart.

Our political leaders are not the only ones who have been handed a mandate for change. Leaders of businesses and institutions everywhere have a unique opportunity to transform the way the world works.

We find ourselves at this moment because the crisis in our financial markets has jolted us awake. We are seriously focused now on the nature and dangers of highly complex global systems. And this isn't our first such jolt. Indeed, the first decade of the twenty-first century has been a series of wake-up calls with a single theme: the reality of global integration.

The problems of global climate change and energy, global supply chains for food and medicine, new security concerns ranging from identity theft to terrorism – all issues of a hyperconnected world – have surfaced since the start of this decade.

The world continues to get “smaller” and “flatter.” But we see now that being connected isn't enough. Fortunately, something else is happening that holds new potential: the planet is becoming *smarter*.

That is, intelligence is being infused into the way the world literally works – into the systems, processes and infrastructure that enable physical goods to be developed, manufactured, bought and sold. That allow services to be delivered. That facilitate the movement of everything from money and oil to water and electrons. And that help billions of people work and live. How is this possible?

First, the world is becoming instrumented. Imagine, if you can, a billion transistors for *every* human being. We're almost there. Sensors are being embedded everywhere: in cars, appliances, cameras, roads, pipelines...even in medicine and livestock.

Second, our world is becoming interconnected. Soon, there will be two billion people on the Internet – but systems and objects can now “speak” to each other, as well. Think of a trillion connected and intelligent things, and the oceans of data they will produce.

Third, all of those instrumented and interconnected things are becoming intelligent. They are being linked to powerful new back-end systems that can process all that data, and to advanced analytics capable of turning it into real insight, in real time.

With computational power now being put into things we wouldn't recognize as computers, any person, any object, any process or

service and any organization – large or small – can become digitally aware, connected and smart.

With so much technology and networking available at such low cost, what *wouldn't* you enhance? What wouldn't you connect? What information wouldn't you mine for insight? What service wouldn't you provide a customer, a citizen, a student or a patient?

The answer is, you will do all these things – because you can. But there is another reason. We all will because we *must*. Consider:

Congested roadways in the U.S. cost \$78 billion in 4.2 billion lost work hours and 2.9 billion gallons of wasted gas annually – and that's not counting the impact on air quality.

Inefficient supply chains cost \$40 billion annually in lost productivity – more than 3% of total sales.

Our healthcare system really isn't a “system.” It fails to link diagnoses, drug delivery, healthcare providers, insurers and patients – as costs spiral out of control, threatening both individuals and institutions.

One in five people living today lacks safe drinking water.

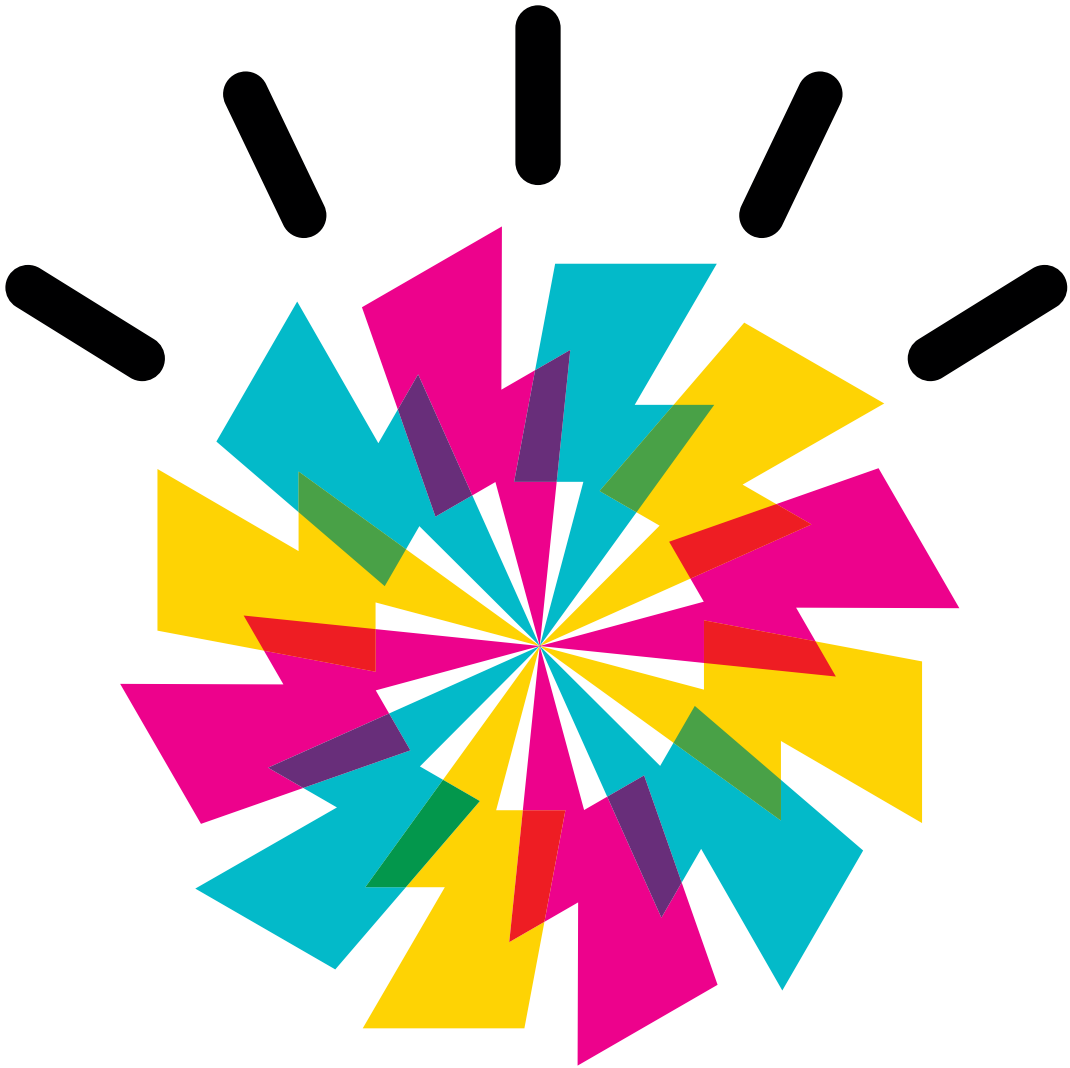
And, of course, we've seen what's developed in our financial markets, a system in which institutions could spread risk, but not track it.

Yet all of these things are solvable on a smarter planet.

Stockholm has used smart traffic systems to cut gridlock by 20%, reduce emissions by 12% and increase public transportation use dramatically. Smart food systems are using RFID technology to trace meat and poultry from the farm through the supply chain to store shelves. Smart healthcare systems can lower the cost of therapy by as much as 90%.

Smart systems are transforming energy grids, supply chains and water management, as well as helping confirm the authenticity of pharmaceuticals and the security of currency exchanges.

There is a tremendous mandate for positive change in the world. We have the resources to do this. In the coming weeks, you'll be hearing more from IBM on the specific ways we can make our planet work better. Let's build a smarter planet. Join us and see what others are thinking at ibm.com/think



Smarter power for a smarter planet.

For most of the last century, our electrical grids were a symbol of progress. The inexpensive, abundant power they brought changed the way the world worked—filling homes, streets, businesses, towns and cities with energy.

But today's electrical grids reflect a time when energy was cheap, their impact on the natural environment wasn't a priority and consumers weren't even part of the equation. Back then, the power system could be centralized, closely managed and supplied by a relatively small number of large power plants. It was designed to distribute power in one direction only—not to manage a dynamic global network of energy supply and demand.

As a result of inefficiencies in this system, the world's creation and distribution of electric power is now incredibly wasteful. With little or no intelligence to balance loads or monitor power flows, enough electricity is lost annually to power India, Germany and Canada for an entire year. If the U.S. grid alone were just 5% more efficient, it would be like permanently eliminating the fuel and greenhouse gas emissions from 53 million cars. Billions of dollars are wasted generating energy that never reaches a single lightbulb.

Fortunately, our energy can be made smart. It can be managed like the complex global system it is.

We can now instrument everything from the meter in the home to the turbines in the plants to the network itself. In fact, the intelligent utility system actually looks a lot more like the Internet than like a traditional grid. It can be linked to thousands of power sources—including climate-friendly ones such as wind and solar. All of this instrumentation then generates new data, which advanced analytics

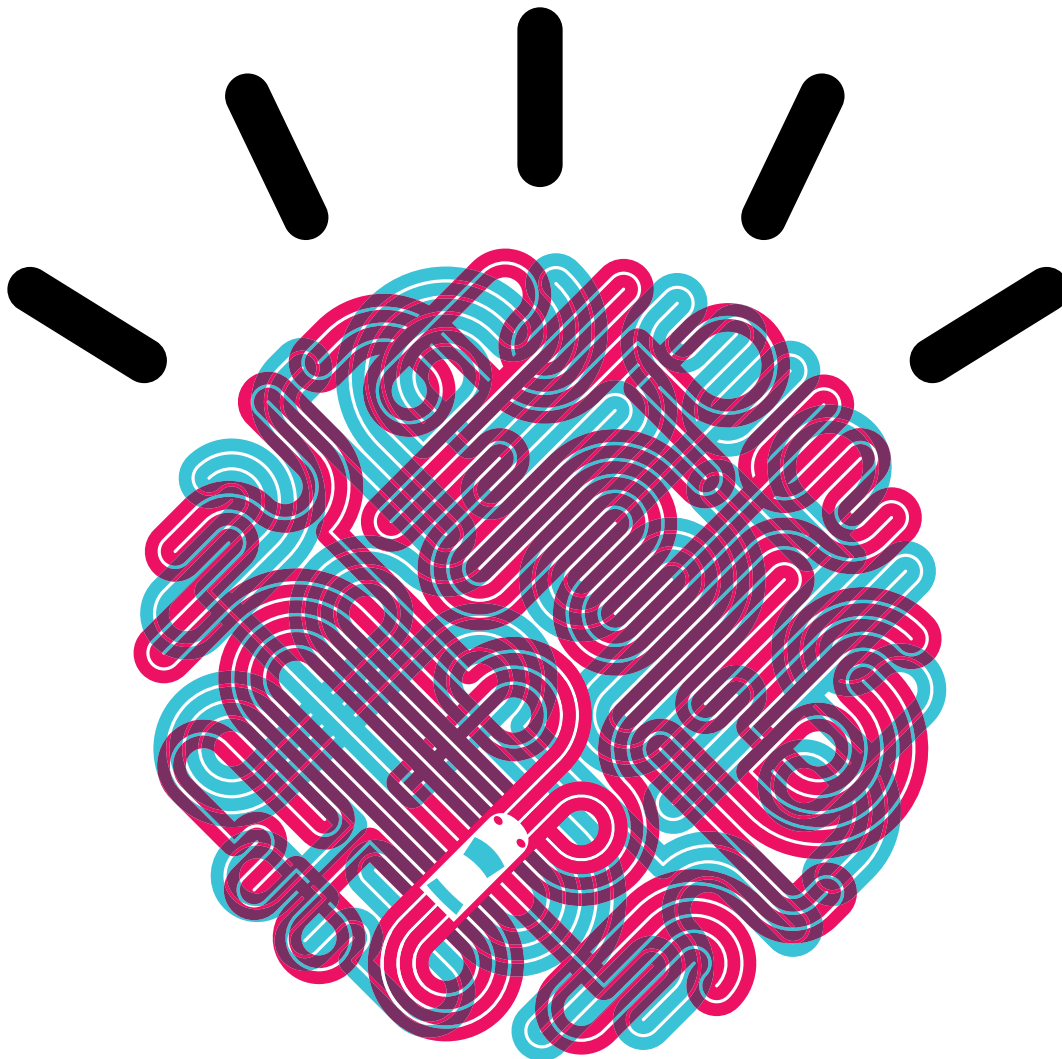
can turn into insight, so that better decisions can be made in real time. Decisions by individuals and businesses on how they can consume more efficiently. Decisions by utility companies on how they can better manage delivery and balance loads. Decisions by governments and societies on how to preserve our environment. The whole system can become more efficient, reliable, adaptive...smart.

Smart grid projects are already helping consumers save 10% on their bills and are reducing peak demand by 15%. Imagine the potential savings when this is scaled to include companies, government agencies and universities. And imagine the economic stimulus that an investment in smarter grids could provide in America's current crisis.

Actually, there's no need for imagination. The investment now being shaped in Washington could yield almost a quarter of a million jobs in digitizing the grid and in related industries such as alternative energy and automotive. It could enable new forms of industrial innovation by creating exportable skills, resources and technology.

IBM scientists and industry experts are working on smart energy solutions around the world. We're working with utility companies globally to accelerate the adoption of smart grids to help make them more reliable and give customers better usage information. We're working on seven of the world's ten largest automated meter management projects. We're even exploring how to turn millions of future electric vehicles into a distributed storage system, so excess power can be harnessed and returned to the system.

Our electrical grids can be a symbol of progress again—if we imbue the entire system with intelligence. And we can. Let's build a smarter planet. Join us and see what others are thinking at ibm.com/think



The roads to a smarter planet.

In 2007, the world crossed an epochal threshold. For the first time in history, the majority of the human population lived in cities. And this urbanization is accelerating. By 2010, there will be 59 metropolitan areas with populations greater than five million – up 50% from 2001.

Many of those city dwellers will be driving cars, and the products they consume will be arriving in trucks. So if you think your day is plagued by gridlock now, what might the future hold?

Quite simply, our transportation infrastructure and management approaches can't handle the world's traffic. In the U.S. alone, 3.7 billion hours are lost every year to people sitting in traffic, and 2.3 billion gallons of fuel – enough to fill 58 supertankers – burn needlessly, at a cost to the economy of \$78 billion per year.

This isn't smart – but it can become so. The systemic nature of urban transportation is also the key to the solution. We need to stop focusing only on pieces of the problem: adding a new bridge, widening a road, putting up signs, establishing commuter lanes, encouraging carpooling or deploying traffic copters.

Instead, we need to look at relationships across the entire system and all the other systems that are touched by it: our supply chains, our environment, our companies...the way people and cities live and work. Traffic isn't just a line of cars: it's a web of connections.

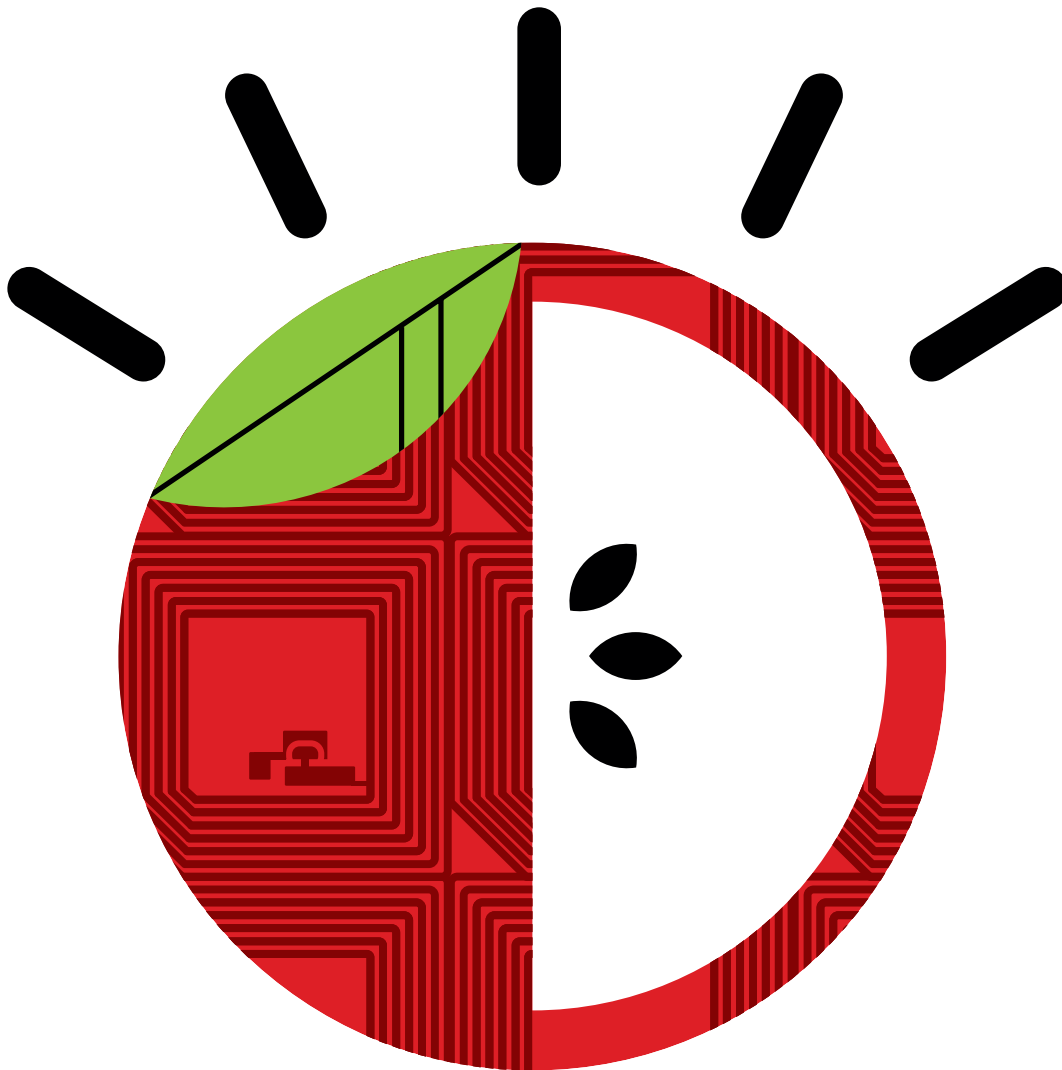
"Smart traffic" isn't yet the norm, but it's not some far-off vision of tomorrow. In many places, IBM is helping to make it happen today.

In Stockholm, a dynamic toll system based on the flow of vehicles into and out of the city has reduced traffic by 20%, decreased wait time by 25% and cut emissions by 12%. In Singapore, controllers receive real-time data through sensors to model and predict traffic scenarios with 90% accuracy. And in Kyoto, city planners simulate large-scale traffic situations involving millions of vehicles to analyze urban impact.

All of this is possible because cities can infuse intelligence into their entire transportation system – streets, bridges, intersections, signs, signals and tolls – which can all be interconnected and made smarter. These new traffic systems can improve drivers' commutes, give better information to city planners, increase the productivity of businesses and raise citizens' quality of life. They can reduce congestion, shrink fuel use and cut CO₂ emissions.

Our rapidly urbanizing planet depends on getting people and things from here to there. In the 20th century, that meant freeways from state to state and nation to nation. In the 21st century, "smart" traffic systems can be the new milestone of progress.

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Setting the table for a smarter planet.

How do we put food on our tables? Once, people simply relied on their local farmers. Today, we depend on a global web of growers, fisheries, packers, shippers, manufacturers, retailers as well as government and industry bodies.

As the world becomes smaller and “flatter,” countries that at one time seemed distant are now primary sources of our food supply. Many of those countries do not have consistent standards for quality, process and accountability. Additionally, this complex system impacts and is impacted by other global systems – from energy to climate to healthcare to trade.

The result is a whole host of inefficiencies arising from issues of scarcity, safety, sustainability and cost. And an opportunity for our food system to get a lot smarter.

We need to make sure our food system is safe. In the U.S. alone, 76 million cases of food-borne illnesses occur each year. Imports account for nearly 60% of the fruits and vegetables we consume, and 75% of the seafood. Yet only 1% of those foods are inspected before they cross our shores.

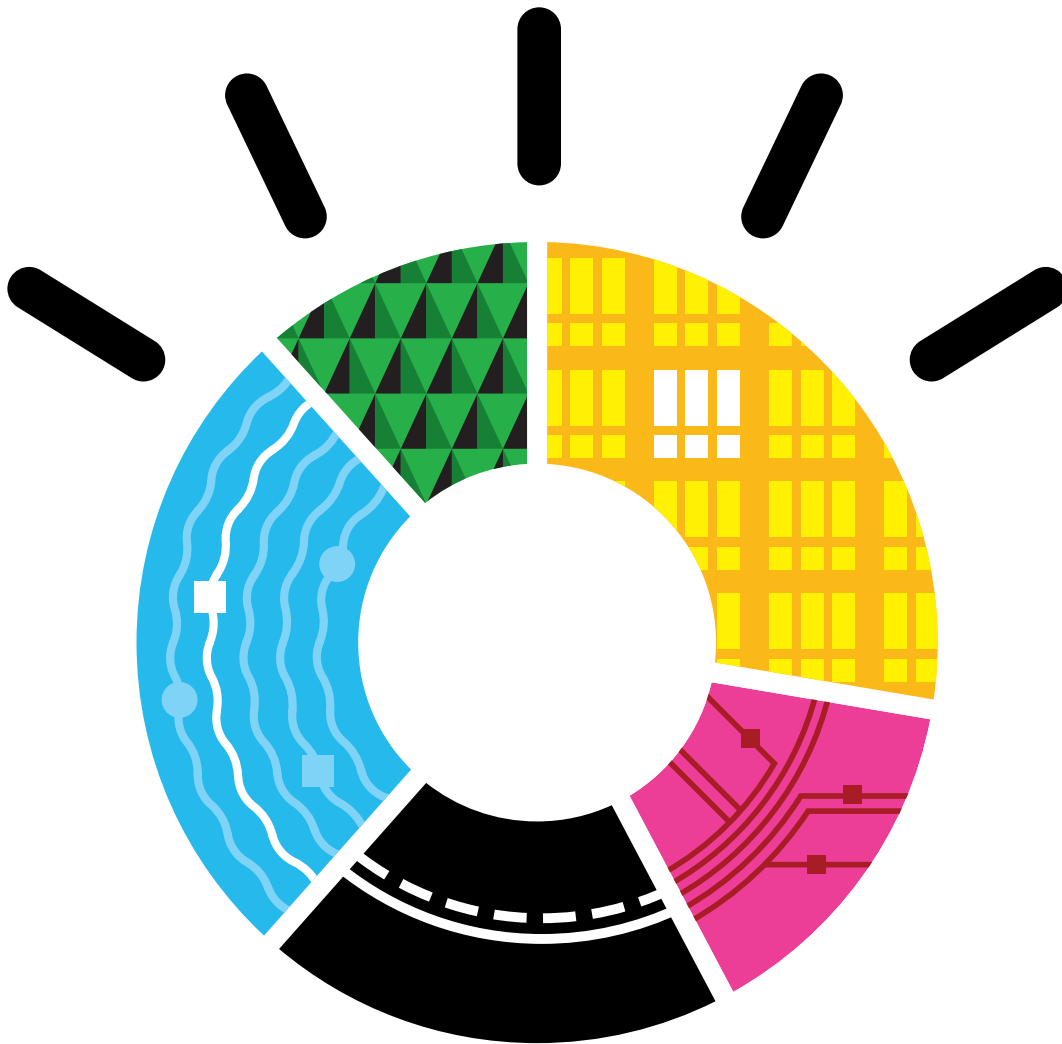
We need it to be affordable. Consumer product firms and retailers lose \$40 billion annually, or 3.5% of their sales, due to supply chain inefficiencies. And the true cost of food production can't always be captured in dollars. Sixty years ago, we could create a calorie of food with less than half a calorie of fossil fuel. Today, a single calorie of modern supermarket food requires 10 calories of fossil fuel to produce.

And we need to make it more sustainable and efficient. Rising fuel costs are making it increasingly difficult to get enough food to the populations that have come to depend on distant producers. At the same time, 30% of the food purchased in developed nations ends up going to waste.

Trying to manage these problems in isolation is no longer an option. Fortunately, a smarter global food system – one that is more connected, instrumented and intelligent – is at hand. For example, IBM is helping Norway's largest food supplier use RFID technology to trace meat and poultry from the farm through the supply chain to the store shelf.

We're also collaborating with some of the world's leading retailers and manufacturers to create software solutions that can more efficiently integrate product demand with supply replacements, and help dramatically cut time, cost, waste and out-of-stock conditions. And in response to the global hunger crisis, IBM scientists are helping to develop stronger strains of rice that could produce crops with much larger, more nutritious yields.

A smarter food system means end-to-end visibility across the entire global supply chain. So scarce resources can be more thoughtfully managed. So people can have more confidence in the quality of their food. So the whole world can put healthy meals on the table. Let's build a smarter planet. Join us and see what others are thinking at ibm.com/think



How we can make our smart systems smarter.

Over the past few weeks, IBM has used this space to explore the possibilities that are emerging from a smarter planet. By "smarter," we mean a world where digital intelligence can be embedded not just in individual things, but also across entire systems, impacting everything from traffic flows to electric power to the way our food is grown, processed and delivered.

But you might be surprised to learn that information technology—which ought to be the smartest aspect of the planet – is itself in need of an intelligence makeover.

It's not a problem with the technology per se. Servers, storage, PCs, software, networking gear and the Internet will all continue to become more powerful, affordable and available. And according to IDC, data volumes and network bandwidth are expected to grow tenfold in the next three years.

The problem is how all this technology is currently configured into systems: The way data centers are designed and operated. The way applications are developed and deployed. The way PCs and servers are managed, upgraded and kept secure. The fact is, the IT systems that underpin so much of how the world works must become much smarter.

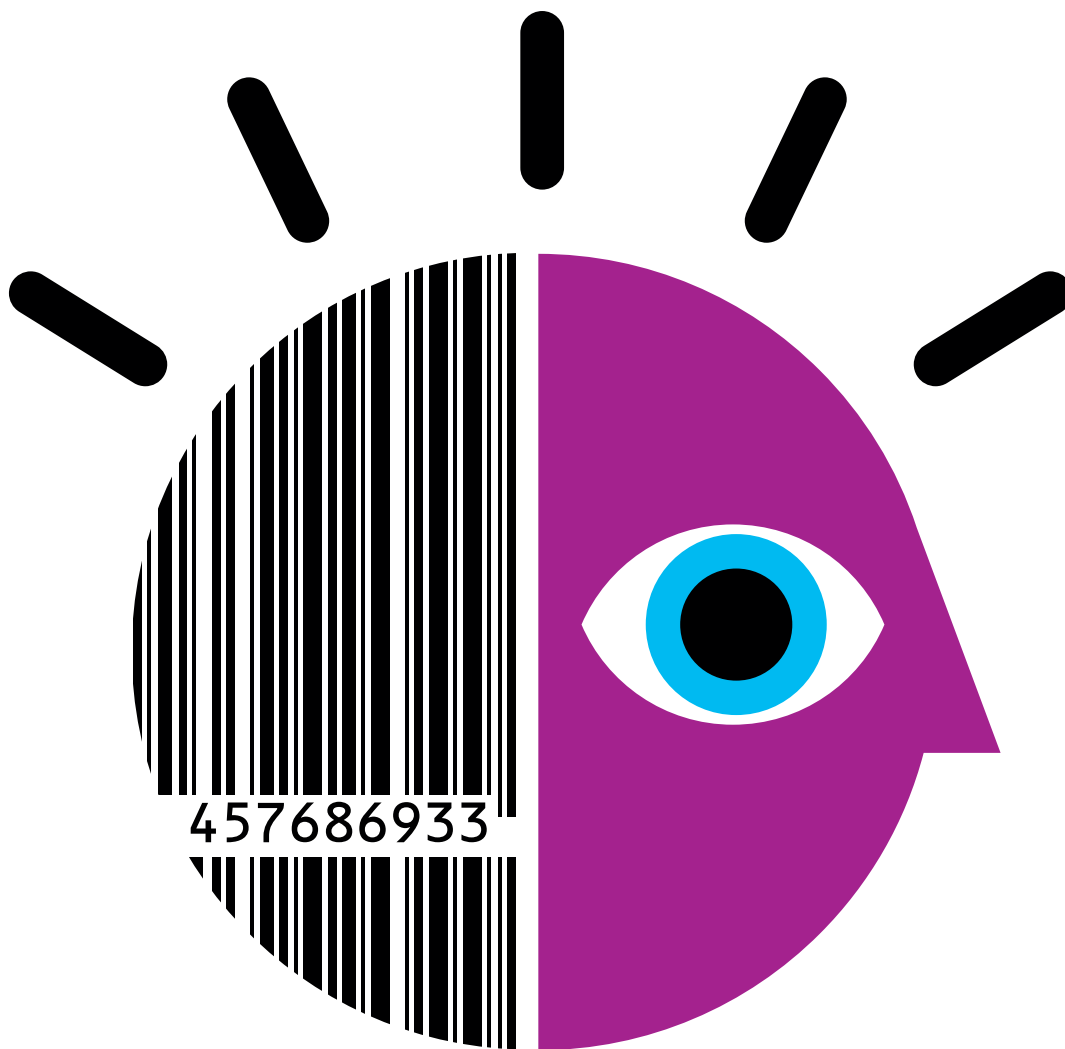
How much smarter? The average commodity server rarely uses more than 6% of its available capacity. In some organizations, as many as 30% of servers aren't utilized at all; they simply waste energy and valuable data center space. IT energy consumption is expected to double in the next five years. In some cases, nearly 70% of companies' IT budgets can be devoted to managing, maintaining, securing and upgrading their systems rather than building new capabilities, services and applications.

And consider what's coming: hundreds of billions of smart things—sensors, cameras, cars, shipping containers, intelligent appliances, RFID tags by the hundreds of millions – all becoming interconnected. This will enable new, highly flexible ways of interacting with customers, employees, patients and citizens from any device, anywhere. The resulting volume of data promises insight and intelligence to solve some of our biggest problems – but only if we can process and make sense of it in real time.

If we are going to realize the enormous potential of a smarter planet, we have to reinvent the IT of the 21st century in the same way that we industrialized our factory floors in the 20th –making it more efficient, more dynamic, less complex and less costly.

Fortunately, smarter computing models are at hand. With "service oriented" software, companies can unlock business services from the underlying technology, so their software can be changed and reused flexibly—at a fraction of the cost of developing it from scratch. Virtualization can help companies reinvent their data centers, eliminating up to 70% of their servers and 80% of their floor space. Service management software can orchestrate all of these systems from one place, while letting IT users serve themselves, cutting administrative costs. Together, these new capabilities enable "cloud computing," a new way of looking at IT as a distributed capability, which can be tapped into simply and easily.

Information technology has taken us a long way in the past 50 years. But seizing the opportunities before us will depend on more than intelligent machines. It will depend on spreading intelligence across our technology infrastructures. Let's build a smarter planet. Join us and see what others are thinking at ibm.com/think



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Attention shoppers on a smarter planet.

Nothing, you'd think, would be more dynamic or up-to-the-minute than how we buy and sell. From the early Greek agoras to the modern superstore, markets have always been the most sensitive barometers of economic and societal change.

However, today's retail model is struggling. It's still largely a system built for the realities of an earlier era – a linear, push-based process where products are manufactured in isolation and put into market en masse from factory to truck to store, for customers who do the majority of their shopping in suburban malls. This served very well the needs of manufacturers, retailers and consumers half a century ago. But today, this system is straining to adapt to global supply chains, new ways and venues for selling – both physical and virtual – and a very different kind of consumer.

Global retail today sees lead times as long as 6 to 10 months, forcing vendors to make significant bets on inventory, consumer trends and distribution methods – bloating supply chains with a stockpile of \$1.2 trillion in excess merchandise. At the same time, retailers lose a staggering \$93 billion in missed sales every year, simply because they don't have the right products in stock to meet customer demand. And that demand is more demanding and immediate than ever before: in the U.S., over 92% of adults conduct research online and seek the opinions of others before they ever purchase a product from a store.

To do business with shoppers on a smarter planet, retailers and manufacturers need a smarter system. One that bends retail's global supply chain to these new realities. It needs to be interconnected, so the system can be fed by customer insight at every point in the process – all the way from design to distribution. It needs to be instrumented, so every item of inventory can be

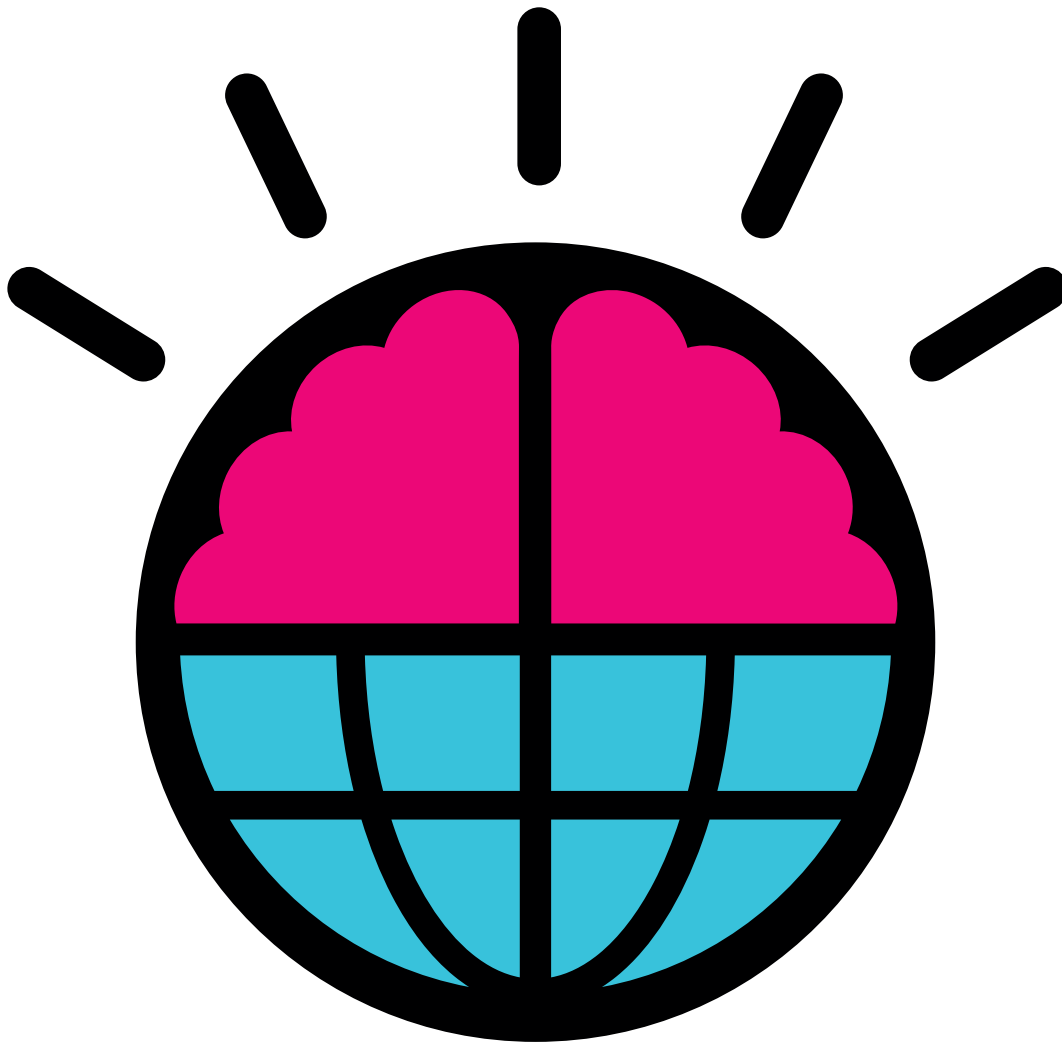
tracked and accounted for. And it needs to be intelligent, so vast amounts of customer data can be analyzed and turned into real value in real time.

You can see examples of this right now: 1-800-FLOWERS.COM, Inc. is tearing down the walls between its 14 brands through a flexible Web platform that lets the company respond to customer needs faster and more efficiently. Outdoor retailer Moosejaw is giving its customers a seamless shopping experience across all channels (retail, Web, mobile, etc.) and is infusing customer feedback and reviews back into a system designed to continuously improve the products and customer experience. The German METRO Group, one of the largest and most international retailing companies in the world, has introduced RFID technology throughout its entire supply chain, to help them get the products its customers want on the shelves when they want them. And top clothing designer Elie Tahari has built an inventory-reporting platform that's helped it better match its products to customer demand.

By building intelligence into our entire retail system, retailers, manufacturers and suppliers can eliminate inefficiency and waste at every step of the chain – crucial in the current economic downturn. Even more important, retailers can better serve the new breed of empowered consumer, whose needs for high value, individual service and low prices will only grow.

Going forward, the watchword of commerce may no longer be caveat emptor – “let the buyer beware.” In a smarter retail system, it is the seller who must be – and can be – vastly more attentive and responsive.

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A new intelligence for a smarter planet.

Every leader makes decisions. And every decision depends on information. That's been true whether someone has led a company, a government, an army or a household.

Over the past 50 years, leaders have experienced a revolution in the quality and quantity of information available to them. The Industrial Age was supplanted by the Information Age largely because the basis of competition shifted to knowledge, expertise and intellectual capital. Indeed, the ultimate value of the information technology industry has never been about chips, computers and software. The industry has always sought to help leaders know with confidence all that has happened, is happening and might happen to every aspect of the enterprise. Can you spot the key patterns? Can you extract critical insights from data? Can you take latency and cost out of making and implementing a decision?

By any measure, these kinds of questions can be answered with more accuracy than ever before in history. But the ante is about to be upped by the volume and variety of information, and the velocity of decision making, on a smarter planet.

How much? Digital information is growing every day at a rate 350 times the volume housed in all the U.S. university research libraries.

What kinds? Information is being authored by billions of people—and flowing from a trillion intelligent devices, sensors and all manner of instrumented objects. Fully 80% of new data growth is unstructured content: e-mail, documents, images, medical records, video, audio and more.

How fast? To keep up with the speed of transactions today, systems may have to take in all types of event information in real time, correlate it, analyze it and take an action more than 60,000 times a second—or 300 times faster than a hummingbird can flap its wings.

So, must we simply resign ourselves to blind spots that keep growing larger? Are we doomed to more needles lost in bigger

haystacks, to more “garbage in,” to opportunities missed because of knowledge latency?

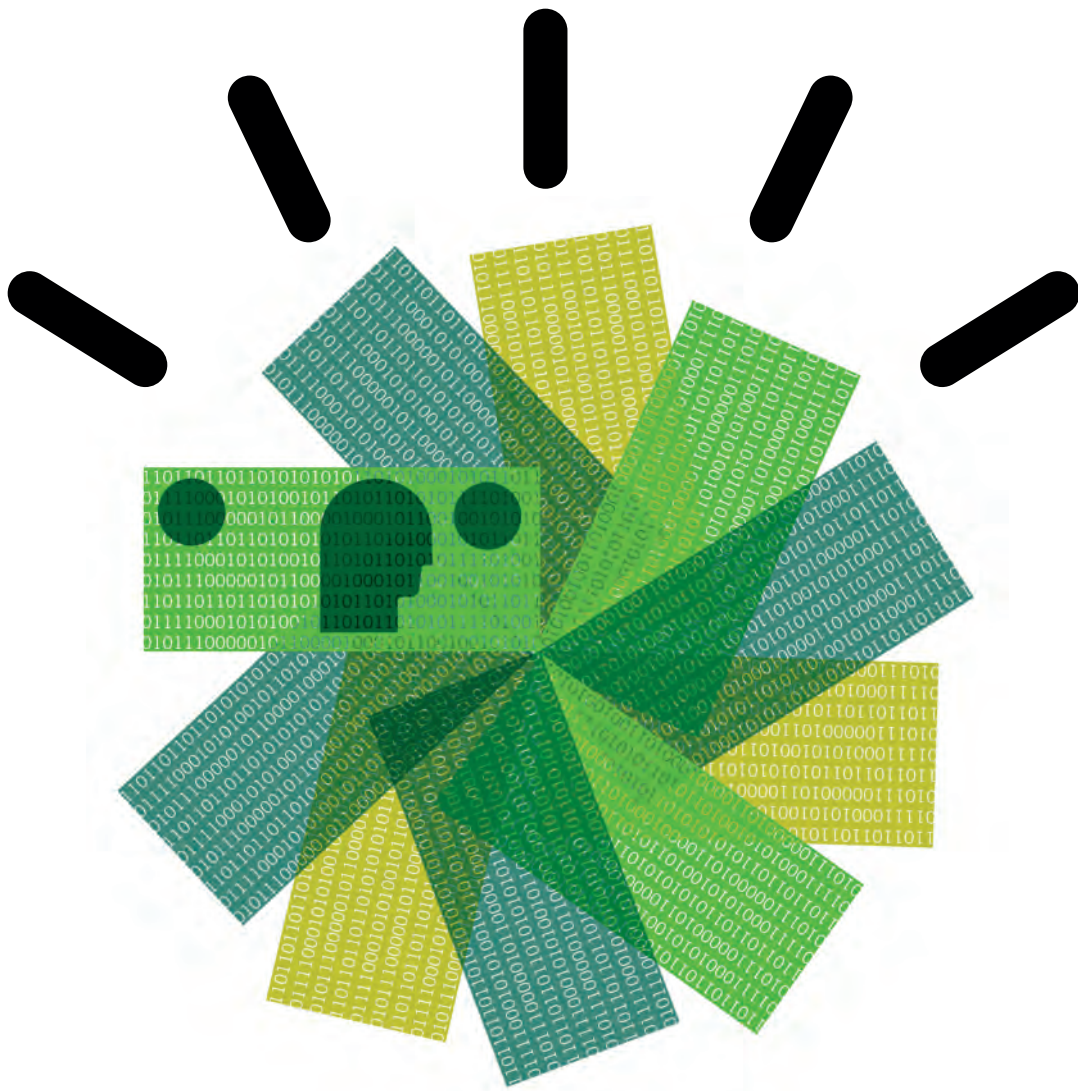
Happily, no. The technology exists to help capture and process all this data, and turn it into not just organized information, or even knowledge, but actual intelligence. We can spot patterns with unprecedented detail. We can capture and analyze changes in markets, trends and consumer preferences faster than ever before. And highly complex systems and large organizations can now be optimized in entirely new ways.

New approaches like “stream computing” use advanced software algorithms to track new stimuli, analyze data-in-motion, correlate it with other relevant information—and plug directly into operational and logistics systems, closing the gap between thinking and doing. Indeed, advanced analytics built on heavy-duty mathematics are starting to move us from “sense and respond” or “real time” decision making to something like prediction.

This has the potential to change how the world literally works. Already, insurance companies are seeing the patterns in billions of claims, and can better identify the few that are fraudulent. Police departments are correlating street-level information from myriad observations and devices to identify crime patterns—helping prevent crime, rather than just punishing it. Retailers are optimizing inventory and transport systems by linking what's in stock with weather forecasts—which are better than weather itself as an indicator of consumer behavior.

The list is long—and the change is just starting. Imagine how it will transform all the things leaders of business and society seek—the ways we pursue economic growth, societal progress, environmental sustainability and cures for disease. The way we interact with each other, and with the world.

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Smarter money for a smarter planet.

We know that a lot of money has evaporated in the current financial crisis—but what exactly is it that has been lost? Obviously, it's not hard currency, which represents only 11% of the U.S. money supply. The rest of our "money" flows from a paycheck to a bank to a store and then through the store's supply chain, only to be deposited in another business's account...to start the journey over again.

Money, in other words, has been reduced to zeros and ones. It's intangible, invisible. It's information. Which is central both to the problem we face and to its solution.

Without question, the replacement of physical money with electronic money—and the spectrum of financial innovations that have accompanied it—have helped the world's economy grow and prosper. They have also helped many more people around the world to join the middle class. But our technical and management systems haven't kept pace. They couldn't provide warning signals of risk concentrations, over-leveraging or underpricing. Banks could repackage risk and sell it, but they couldn't value an individual loan in order to unwind the debt when needed.

However, the same digitization that has helped create this challenge is now providing the means to solve it. Intelligence is being infused into the way the world works, including our financial systems. We're all aware of advances like ATMs, credit cards and online banking. But the transformation happening underneath is far more profound. Unprecedented computing power and advanced analytics can turn oceans of ones and zeros into insights, in real time. Which means we could have a safer, more transparent and intelligent financial system for a smarter planet.

We can already see it happening at the level of national governments. The new integrated information system for the Czech Republic Ministry of Finance, for instance, provides insights to help set

monetary policy, and to handle state budget resources and public finance more efficiently.

We see it helping multiple interconnected institutions. The Operational Riskdata eXchange Association, a consortium of 52 leading financial institutions, uses anonymized data to help improve statistical modeling, more accurately quantify risk exposure and address regulatory compliance needs.

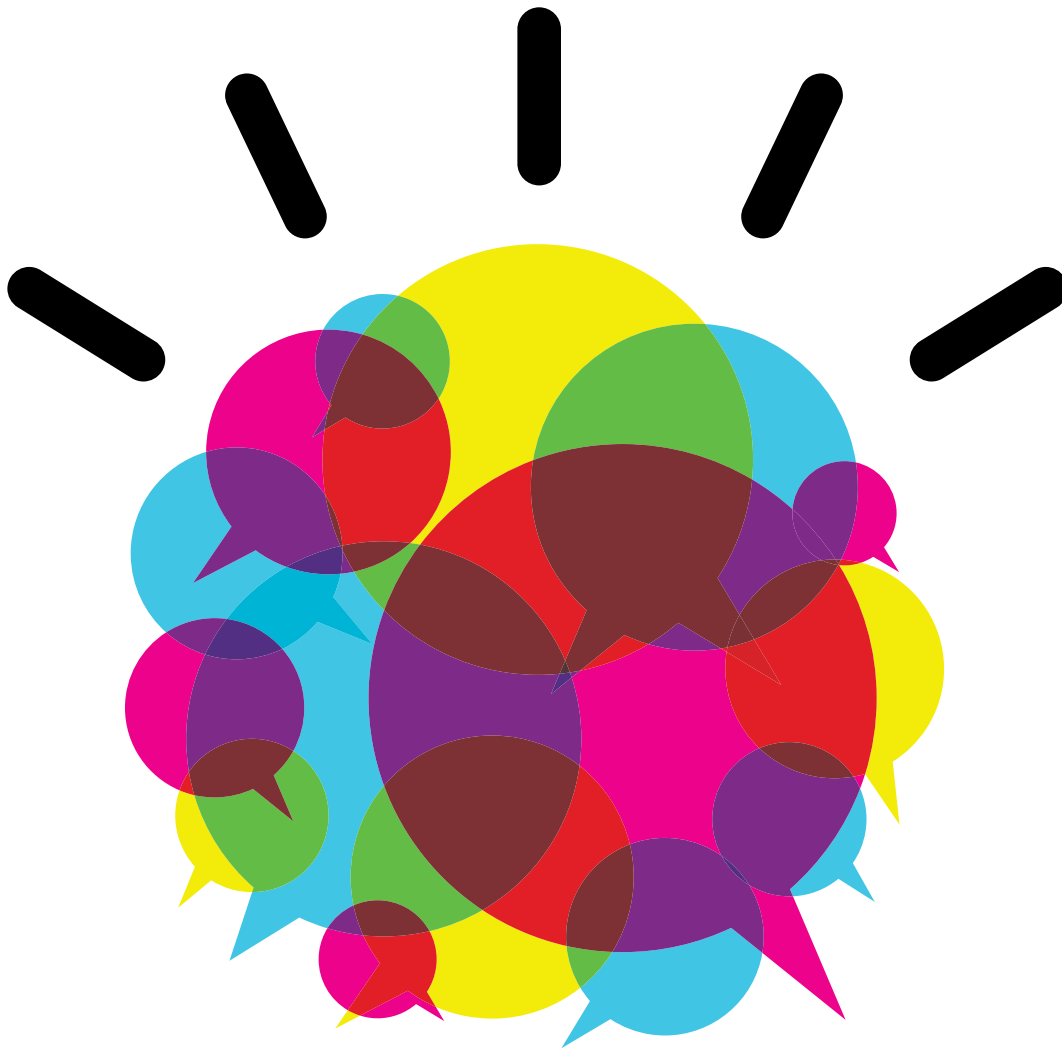
We even see it transforming entire global markets. Consider foreign currency exchange, the world's largest single market. Intraday settlement risk of more than \$2 trillion in volume—more than 50% of foreign exchange transactions—has been eliminated.

And through organizations like Grameen Foundation and Financial Information Network and Operations Ltd. (FINO), poor people around the world can overcome impossible odds. Thanks to technology-enabled microfinance, they can get collateral-free loans and financial services to support income-generating businesses—for a brighter future for their families and communities.

These changes are exciting, but more are needed. There is growing consensus on the need for a centralized risk utility, to help avert future crises—perhaps building on the work of the International Monetary Fund and other institutions to create an early warning system for global finance.

Of course, restoring trust and confidence is much more than a technology challenge. It's also a major policy and behavioral challenge. And no system can ever be devoid of risk. But the benefits of smarter finance are clear—for regulators, bankers, investors, companies and communities, rich and poor around the world, all of whose well-being and prosperity depend on a money system that is stable, secure and accessible to all.

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Look what's talking on a smarter planet.

What's the sound of a planet talking? A century ago, the answer was simple: people conversing in person or over wired networks. Today, it's not just everyone, but also every *thing* talking to every other thing, in constant motion.

An estimated two billion people will be on the Web by 2011—and they'll be doing more than talking. Video on demand, IP television and Internet TV will account for nearly 90% of consumer IP traffic by 2012. When people talk, it will be to many more people—via social networking sites, whose memberships will top 500 million in the next three years.

Consider that 10,000 security cameras in London are connected to the Web, feeding it video 24 hours a day. Or take the 300 connected sensors on a bridge in Minnesota, add the 800 monitoring another in Hong Kong—and multiply by the millions of roads, bridges and buildings in cities around the world. Now add billions of intelligent phones, cameras, cars and appliances, and millions of miles of smart power lines and roadways.

Is it any wonder that in just three years, IP traffic is expected to total more than half a zettabyte? (A zettabyte is a trillion gigabytes—or 1 followed by 21 zeroes.)

A smarter planet will require a smarter communications infrastructure.

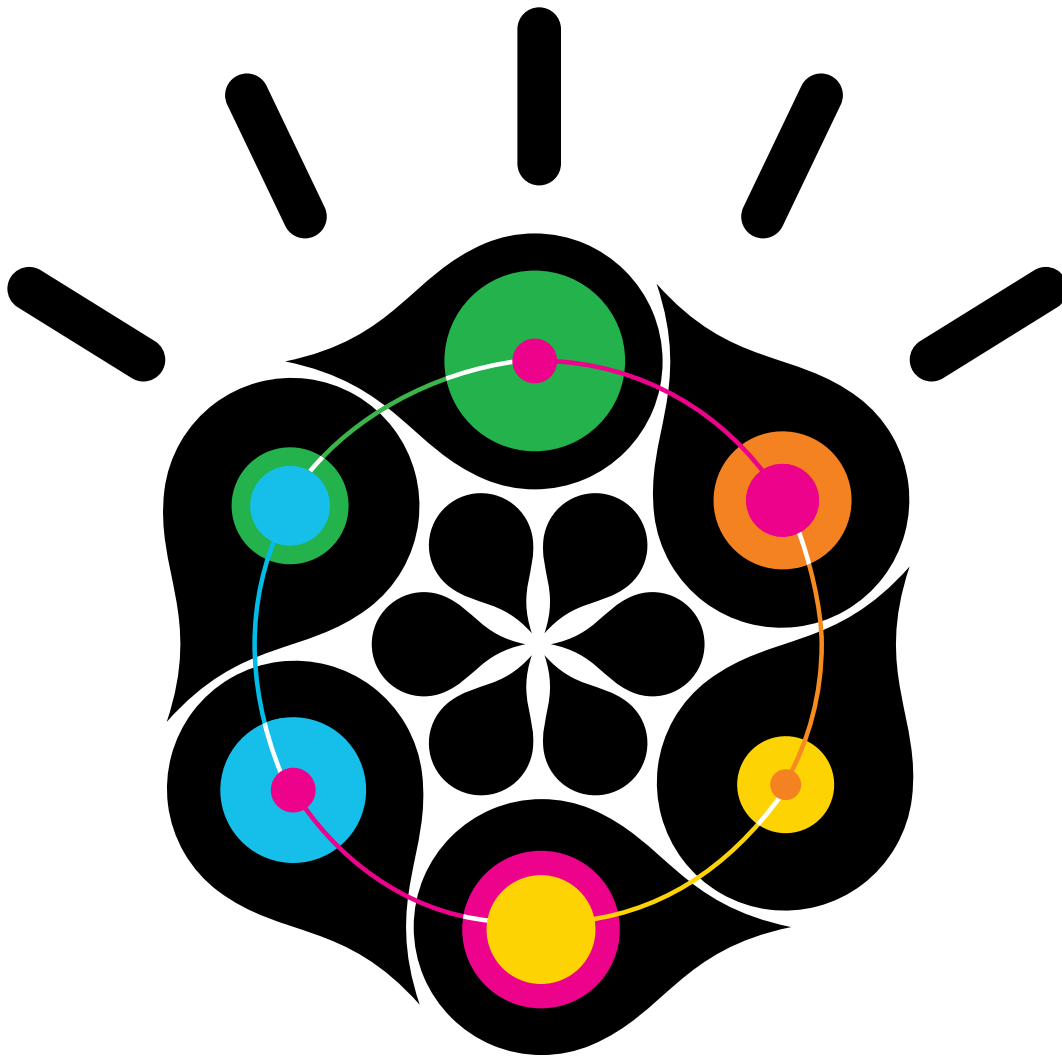
High-speed broadband, as important as it may be, doesn't make a network smart. We need the network to be multidirectional instead of point-to-point. Smart networks must be infused with advanced

analytics and intelligence, so they can identify connected, instrumented things and collect relevant data from them. They'll have to be built on a foundation of standards and software that allow trillions of devices and objects to "talk." And we'll need next-generation digital platforms on which telecom providers can create and deliver all kinds of services.

Fortunately, smarter communications are at hand. India's leading private telco is using IBM's digital platform to deliver new services dynamically to hundreds of millions of people. A U.S. hospital is applying a pervasive wireless infrastructure, bar coding and RFID to manage its assets and administer medications—helping to increase both patient safety and operational efficiency. A network operator in Taiwan is offering customized advertising based on subscriber purchasing patterns—while individual subscribers of one Chinese telecom provider are collaborating directly with the company to create new services. And a university in California worked with IBM on North America's first wireless parking solution to be integrated with payment stations.

A thinking, communicating planet will spur advances in everything from science and medicine, to business and technology...to possibilities not yet imagined...and will help billions of people join the global economy. When things communicate, systems connect. And when systems connect, the world gets smarter.

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Smarter resources to fuel a smarter planet.

Advances in science have made it possible to envision a planet that's powered in very new ways, creating electricity from the sun, the wind, waves, the atom or some combination thereof. But we also know it won't happen overnight—not profitably or on a global scale. For decades to come, we'll need to continue extracting energy stored in matter lying far beneath the Earth's surface—also known as fossil fuels.

In fact, in the near term we'll need to extract more oil and natural gas than ever before. Projections show energy consumption increasing by 50% in the next 25 years. As we move toward a renewable future, we need to shape our hydrocarbon present in ways that are more efficient, affordable and protective of the environment.

Today, we can only extract about one-third of the oil in an existing reserve, leaving billions of barrels in reservoirs. That's unfortunate, since it can cost \$100 million to drill a single new well. Just a 1.5% increase in recovery from existing wells would yield enough oil for half a year's global consumption, lowering the cost of fuel—which would mean lower prices for travel, homes, food and consumer products.

Put simply, we need smarter oil and gas fields. And that means gathering and managing real-time data from across the entire production stream, in vast quantities. One oil field alone can generate the equivalent of 200 DVDs' worth of data per day. Making sense of all this information is critical for better decision making—about exploration, production and management.

Smarter exploration means integrating and processing geophysical and other relevant data to develop 3-D models of reservoirs. It means finding previously inaccessible oil and gas reserves embedded

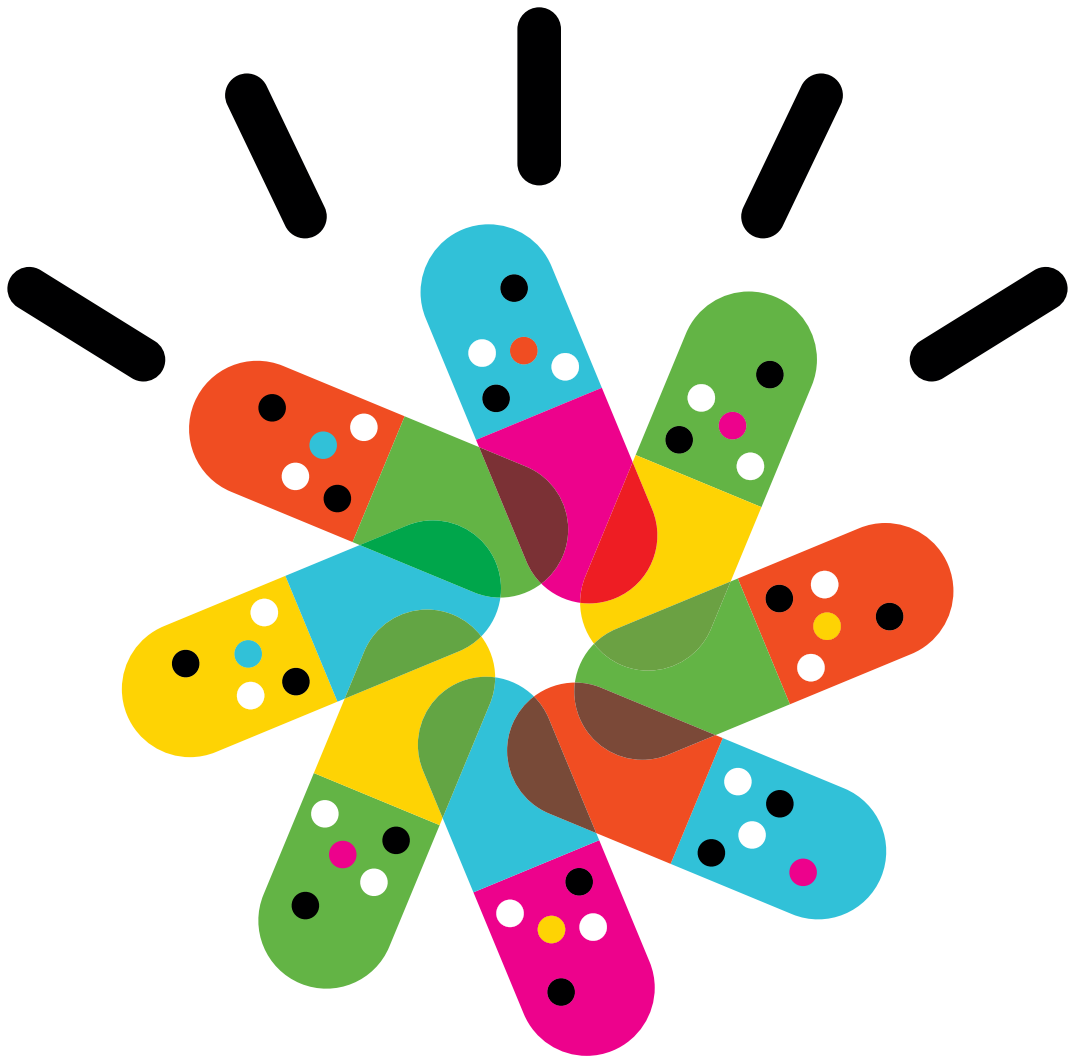
beneath difficult terrain or the deepest ocean waters. Repsol, in partnership with scientists from around the world, is using advanced seismic imaging technology from IBM to reveal oil and gas deposits that traditional imaging techniques can't see.

Smarter production means capturing information about the volume and quality of oil and gas reservoirs before a new well is drilled. It means minimizing the drilling footprint and exploration risk while improving the safety and reliability of operations. One U.S.-based firm is using seismic data and rock physics inversion to create a comprehensive, integrated view of potential resources.

Smarter reservoir management makes use of sensors embedded across pipes, pumps and an entire field, generating data that can be compared against historical trends and applied to help optimize well performance. An intelligent field can even monitor itself while being run by a team of "virtual" experts around the world. Norway's StatoilHydro is linking real-time sensing capabilities in the field with collaborative analytics systems that increase the recovery rates of its oil and gas fields.

And being smarter is not just about management. It's also about anticipating problems before they occur—and, in some cases, adjusting automatically to prevent them, thereby reducing the risks to people and the environment. We have the ability today to infuse the system by which we find, extract and produce our energy resources with intelligence, and to make the most of every single drop.

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Diagnosis for a smarter planet.

The problems with our healthcare system are well known and well documented—and endlessly debated. What's not so apparent is that many of them arise because our healthcare system isn't, in fact, a system.

Rising costs, limited access, high error rates, lack of coverage, poor response to chronic disease and the lengthy development cycle for new medicines—most of these could be improved if we could link diagnosis to drug discovery to healthcare providers to insurers to employers to patients and communities. Today, these components, processes and participants that comprise the vast healthcare system aren't connected. Duplication and handoffs are rampant. Deep wells of lifesaving information are inaccessible.

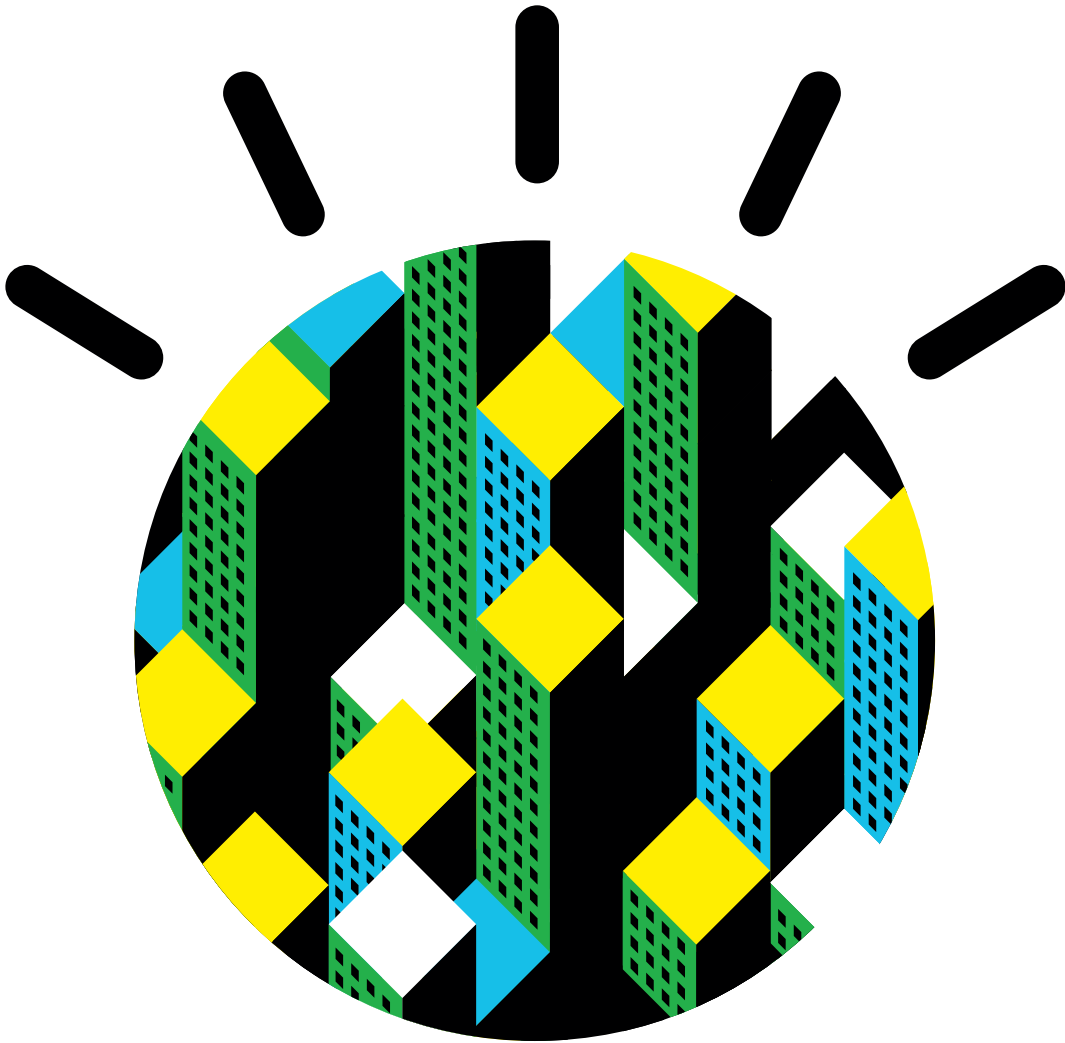
A smarter healthcare system starts with better connections, better data, and faster and more detailed analysis. It means integrating our data and centering it on the patient, so each person “owns” his or her information and has access to a networked team of collaborative care. It means moving away from paper records, in order to reduce medical errors and improve efficiencies. And it means applying advanced analytics to vast amounts of data, to improve outcomes.

Smarter healthcare is *instrumented*, so our health systems can automatically capture accurate, real-time information. IBM's joint initiative with Google Health™ and the Continua Health Alliance enables individuals and families to store and track their health information and stream data from medical devices. Implanet, a French orthopedics manufacturer, is using RFID technology to track surgical implants from manufacture until they're inside patients. And healthcare providers in Denmark are using predictive health systems with advanced telemetry to monitor elderly patients in their homes, sharing data instantly.

Smarter healthcare is *interconnected*, so doctors, patients and insurers can all share information seamlessly and efficiently. Sainte-Justine, a research hospital in Quebec, is automating the gathering, managing and updating of critical research data, which is often spread across different departments. Then they're applying analytics to speed childhood cancer research and improve patient care—while drastically lowering the cost of data acquisition and enhancing data quality. Servicio Extremeño de Salud, a public healthcare service in Spain, has built a regionally integrated system that lets patients go to many health centers within the region, knowing a doctor there can have the patients' complete, up-to-date records for faster and more accurate treatment.

Smarter healthcare is *intelligent*, applying advanced analytics to improve research, diagnosis and treatment. Geisinger Health Systems is integrating clinical, financial, operational, claims, genomic and other information into an integrated environment of medical intelligence that helps doctors deliver more personalized care. This enables them to make smarter decisions and deliver higher-quality care, all because they can easily turn information into actionable knowledge. And IBM is helping some of the world's top universities develop a global network of medical data, giving doctors diagnostic resources that were once unimaginable. These repositories currently hold millions of digital images.

Smarter healthcare systems like these hold promise beyond their particular communities, patients and diseases. The smart ideas from one can be replicated across an increasingly efficient, interconnected and intelligent system. This should result in lower costs, better-quality care and healthier people and communities. In other words, we'll have a true healthcare system, with the focus where it belongs—on the patient. Let's build a smarter planet. Join us and see what others are thinking at ibm.com/think



A planet of smarter cities.

In 1900, only 13% of the world's population lived in cities. By 2050, that number will have risen to 70%. We are adding the equivalent of seven New Yorks to the planet every year.

This unprecedented urbanization is both an emblem of our economic and societal progress—especially for the world's emerging nations—and a huge strain on the planet's infrastructure. It's a challenge felt urgently by mayors, heads of economic development, school administrators, police chiefs and other civic leaders.

The challenges these leaders face—educating the young, keeping citizens safe and healthy, attracting and facilitating commerce, and enabling the smooth flow of planes, trains, cars and pedestrians—are compounded by the global economic downturn.

Thankfully, help is at hand. Around the world, intelligence is being infused into the way our cities work.

Transport officials in Singapore, Brisbane and Stockholm are using smart systems to reduce both congestion and pollution. Public safety officials in major cities like New York are able not only to solve crimes and respond to emergencies, but to help prevent them. City managers in Albuquerque have achieved a 2,000% improvement in efficiency in sharing information across agencies, keeping citizens informed and providing critical municipal services, from residential and commercial development to water to public safety. A large hospital organization in Paris is implementing an integrated patient-care-management solution to facilitate seamless communication across its business applications—enabling them to track every stage of a patient's stay in the hospital.

Italy, Malta and Texas are applying smart meters and instrumentation to make the power grids in their cities more stable, efficient and ready

to integrate renewable energy sources and electric vehicles. Miami-Dade school officials have built a transparent data management system that provides assistance to students, parents and educators to facilitate improved academic achievement. Smart water management in the Paraguay-Paraná River Basin of Brazil is helping to improve water quality for São Paulo's 17 million residents.

These solutions, and many more, are making a real impact today. But they are just the first step toward a true smart city.

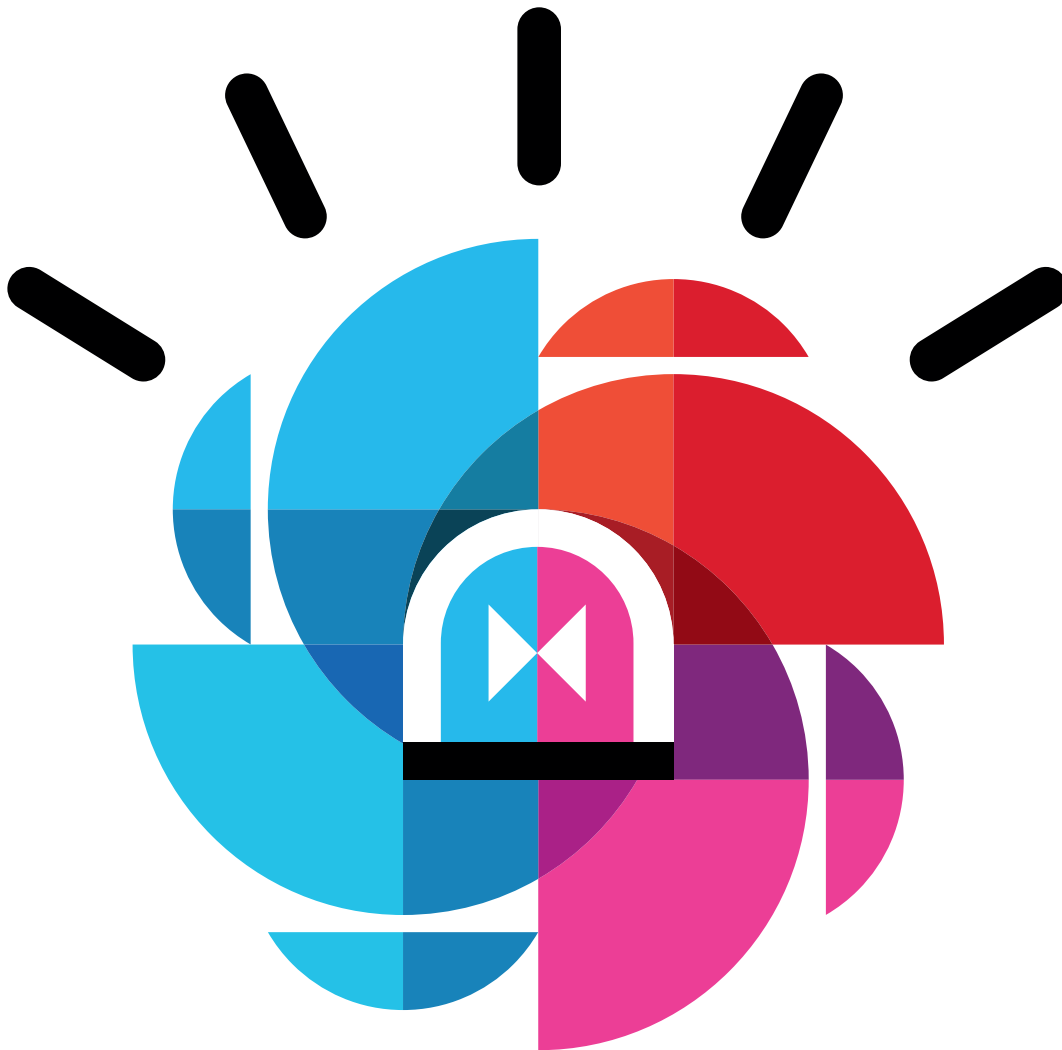
For a glimpse of what that might look like, consider Masdar City, which is being built from scratch near Abu Dhabi, in the United Arab Emirates. Planners there are working with top scientists, engineers and innovators to create interconnected systems and manage them through an integrated city dashboard.

Masdar City's leaders want to be able to fine-tune their metropolis in real time—and thus shape what could be the world's first economically and environmentally sustainable city, with zero carbon emissions, as they go.

The lessons they learn—both technological and in terms of citywide collaborative management—can be spread around the globe.

If someone could have observed the Earth from space two centuries ago, he or she would have seen the light from just two concentrations of a million or more people—London and Beijing. Today, there are 450 such shining cities—and they are the economic, governmental, cultural and technological power plants of a global urban age. Our future depends on keeping them running and growing brightly.

Let's build a smarter planet, city by city. Join us and see what others are thinking at ibm.com/think



Safer citizens of a smarter planet.

Arguably, the first duty of a state is to protect its citizens. The question is how to achieve that in an urbanizing world that is becoming more interconnected, fast-paced and unpredictable every day.

In recent years, forward-thinking city managers, police chiefs, fire chiefs and other officials have made great strides in applying innovative, community-based approaches and new technologies to help reduce urban crime and improve emergency response. But the challenges to public safety continue to grow. Fortunately, new capabilities are now at our disposal to help make urban public safety systems not just more connected and efficient, but smarter.

Progressive leaders around the world are undertaking a transformational shift. Instead of merely responding to crimes and emergencies after the fact, they are analyzing, anticipating and actually working to prevent them. They're doing so with smart systems that capture data from myriad instrumented and interconnected processes, devices and objects, and then apply intelligence to this welter of information to detect patterns and take action in real time.

We see it happening today in New York, where police commanders are using analytics and visualization tools to see crime patterns as they are forming. The city's Real Time Crime Center system can quickly query millions of pieces of information to uncover previously unknown data relationships and points of connection. Integrated crime information analysis, delivered in real time, has helped improve public safety, with a 27% drop in crime since 2001. New York is now ranked as the safest large city in the U.S.

We see it happening in Madrid. Following the terrorist attacks of March 2004, the city developed a new Emergency Response Center so today, when a citizen witnesses an accident and places an emergency call, the system simultaneously alerts the police,

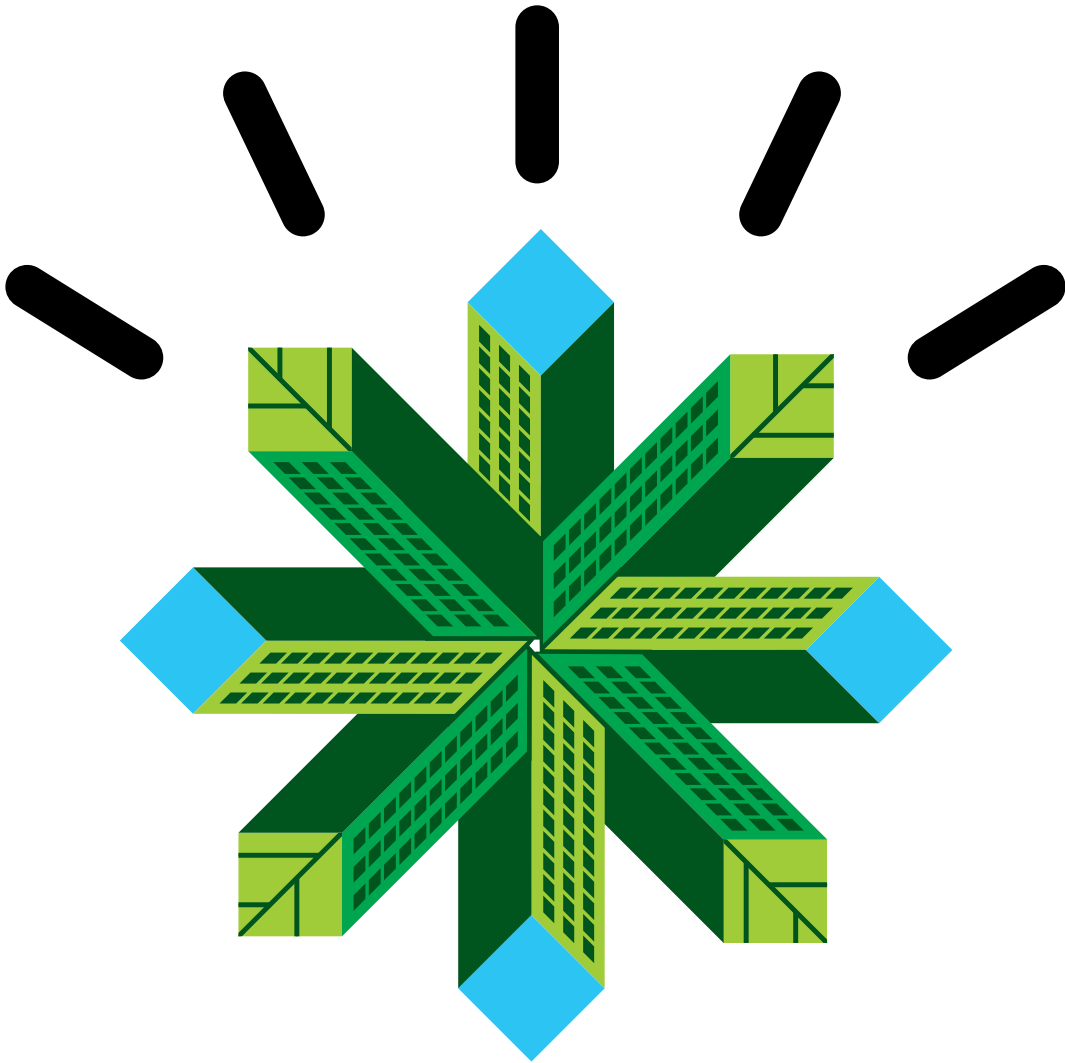
the ambulance service and, if needed, the fire brigade. The smart system can recognize if alerts from several different sources relate to a single or multiple incidents, and assign the right resources based on the requirements coming from the ground.

We see it happening in Poland, where personal and vehicle IDs can be instantly checked in an EU-wide database. The new system has improved police operations, helping to shorten the time for queries, reduce errors and allow police to verify information and uncover potential threats to local and national security, through use at Poland's borders. Overall, the system contributed to a 66% increase in arrest rates for Polish police in 2008.

Finally, we see it happening in Chicago. In the past, video from surveillance cameras was mostly used as evidence after an incident had occurred. Today, 911 dispatchers have access to video from a multitude of cameras citywide, with advanced analytics built into the infrastructure, that are connected to a fiber/wireless network to assist the operator with potential "eyes-on-the-scene" in the vicinity of an incident. The video image they receive helps them dispatch exactly the right services immediately.

IBM is deploying similar systems around the world, and building in methods to protect citizens' privacy by blurring individuals' faces unless an incident is detected—at which point the authorized police personnel can enter a code to see the complete image.

For all cities and regions competing in the global marketplace for work, investment and talent, safety and security are crucial factors in determining overall quality of life. Which is why smarter public safety isn't just a responsibility of the state, it's also a priority for the success of businesses, communities and civil society at large. Let's build a smarter planet. Join us and see what others are thinking at ibm.com/think



Constructing a smarter planet, one building at a time.

Buildings have always been much more than roofs over our heads. Over the last century, as towers of steel reached higher into the sky and homes sprawled farther and farther into the surrounding landscape, our buildings not only housed burgeoning urban populations and growing economies—they also served as symbols of modernity and progress.

Unfortunately, today's offices, factories, stores and homes are also symbols of something else—waste and pollution. In the U.S., buildings consume 70% of all electricity, up to 50% of which is wasted. Lights blaze and air conditioners hum in empty offices at night, and lawn sprinklers turn on even during a rainstorm. Commercial buildings lose as much as 50% of the water that flows into them. By 2025, buildings will be the single largest energy consumers and emitters of greenhouse gasses on our planet.

But on a smarter planet we can think about buildings differently—seeing homes not just as living spaces, but as living systems; seeing offices not just as static structures where work is done, but as manifestations of all the ways the world works.

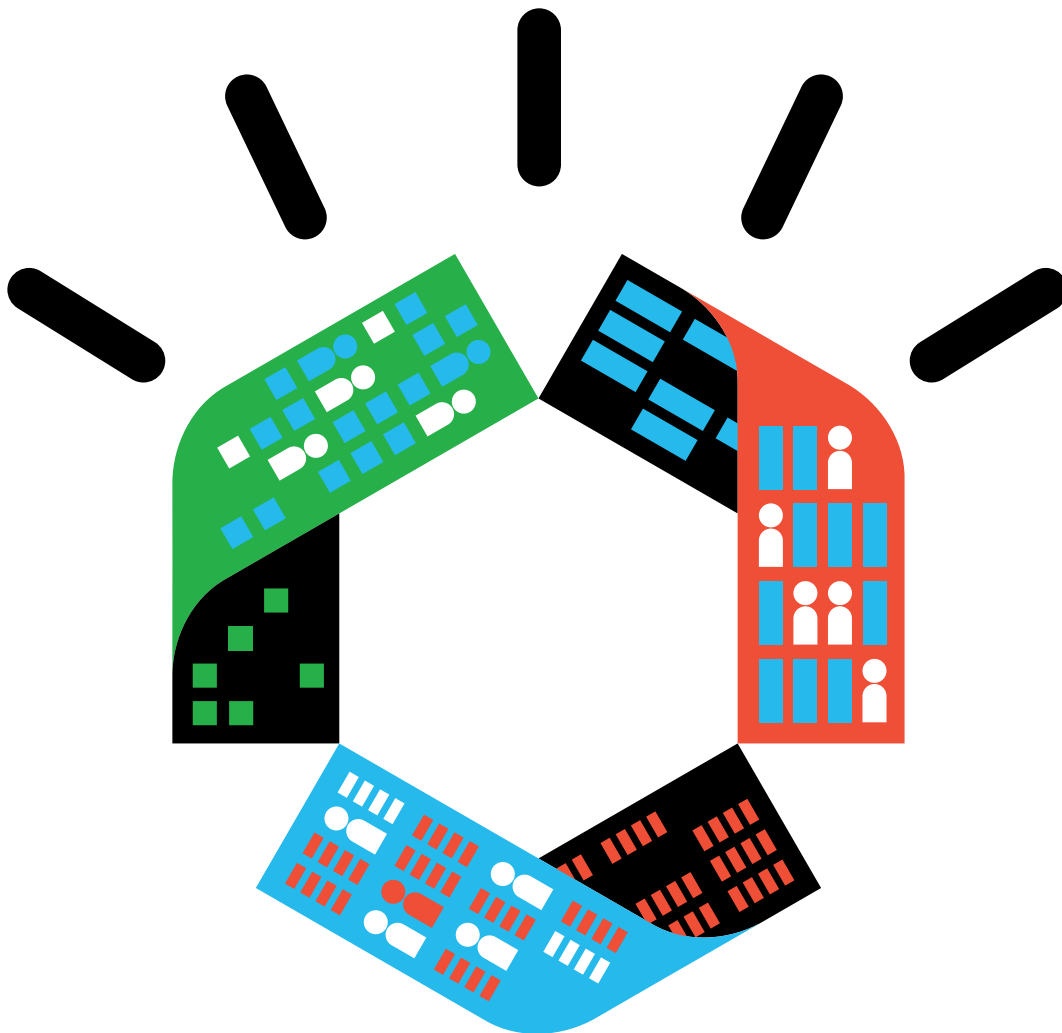
In a smart building, systems are not managed separately—they interoperate. Thousands of sensors can monitor everything from motion and temperature to humidity, precipitation, occupancy and light. The building doesn't just coexist with nature—it harnesses it. Smart buildings can reduce energy consumption and CO₂ emissions by 50% to 70% and save 30% to 50% in water usage.

Although today most attention is focused on smart homes, some of the most dramatic progress is being achieved in commercial

developments around the world. The St. Regis hotel in Shanghai integrated 12 subsystems to create one intelligent building, with a ratio of energy costs to revenue below 5% (compared to 8% for other five-star hotels). GIB-Services in Switzerland is using excess heat from its datacenter to heat a local public swimming pool. A mining company in Canada is using its excess datacenter heat to warm its warehouses during the cold Canadian winters. IBM's own green datacenter in Boulder, Colorado, has replaced energy-greedy air-conditioning with cooling from the air outside, which can be used for up to 75% of the year, contributing up to 50% in annual energy savings.

And for a glimpse of what is possible through a smarter approach, consider the GreenSpaces office park in Delhi, India, on which construction will begin this year. It aims to be the world's greenest and most energy-efficient commercial building, through such innovations as 100% waste and water reclamation, instrumentation and interconnection of all systems, recharging ports for electric cars, and ventilated chairs. It even plans to "grow" its own oxygen and remove harmful compounds from the air through the strategic use of indoor vegetation—which doesn't just help the environment; it also helps people think and be more productive. An earlier prototype was rated the healthiest building in Delhi by the Indian government.

In the 20th century, people marveled at what could be built by filling our buildings with steel. In the 21st, let's see what new heights—and reduced footprints—we can achieve by filling them with intelligence. Let's build a smarter planet. Join us and see what others are thinking at ibm.com/think



Making our organizations as smart as our people.

You probably work a lot smarter today than you did twenty years ago, or ten years ago—or even last year. The Internet and wireless revolutions continue to transform the way individuals create, use and share information; the way we build and maintain relationships; the way we make decisions.

So why does it feel like we are working so much harder?

Unfortunately, the best work in many companies often happens despite our processes and structures, rather than because of them. Individuals and teams today are ready to collaborate, multitask and cocreate—and yet, every week, businesses waste 5.3 hours per employee because of inefficient processes. A full two-thirds of employees believe there are colleagues who can help them do their jobs better, but they don't know how to find them—and 42% of people say they are forced to make decisions with the wrong information at least once a week. It's no wonder that 91% of CEOs surveyed say they need to restructure the way their organizations work.

To work smarter, we'll need smarter organizations—enhancing and benefiting from their people's expertise, enterprise and creativity, rather than inhibiting them. Transforming the collaborative infrastructure and processes of our places of work will enable people to take advantage of the full scope of an instrumented, interconnected and intelligent planet. And the good news is that many organizations around the world are showing the way.

Some are re-architecting their operations around the ability to capture real-time data. For instance, planners for Danone, the world's leading maker of fresh dairy products, can adjust their production process continually—and implement changes in hours that used to take days. Insurance firm Celina uses collaboration tools to connect its independent agents and underwriters, helping them to reduce policy turnaround time from weeks to days. And Hannover Medical School

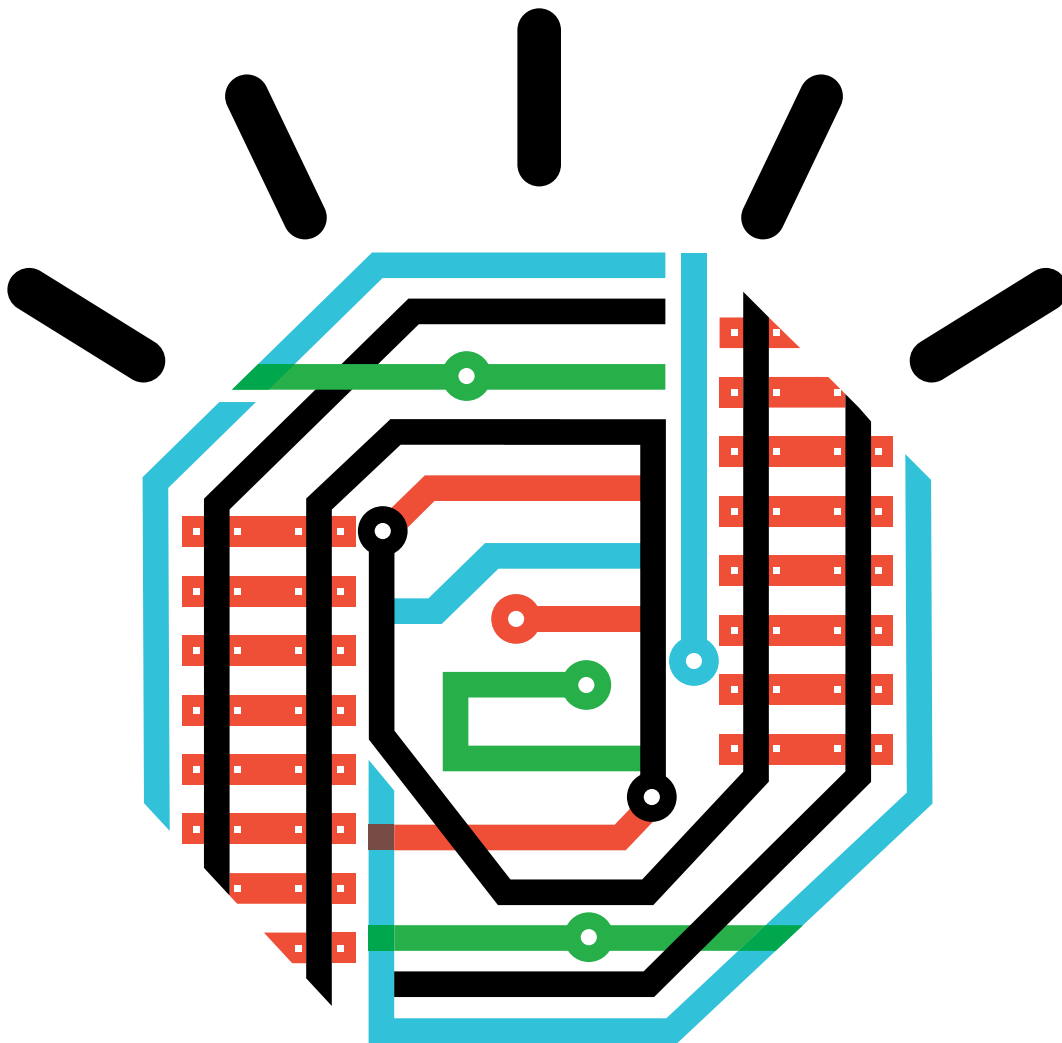
in Germany uses mobile and wireless technology to gather and record trauma patients' data in real time throughout their hospital stay, enabling its system to communicate, "Patient X is waiting for doctor Y in room Z."

Some are working and collaborating in new ways across ecosystems, supply chains and their own internal silos. Using in-car wireless telemetry, auto-leasing services provider UBench International helps cars alert drivers to scheduled maintenance checks and directs them to a community of service providers. Moosejaw Mountaineering's social networking approach has increased its online customer conversion rate by 50%. The Salvation Army's Web-based collaboration infrastructure across 118 countries connects volunteers, supplies and relief coordination activities.

And some organizations are changing where and how decisions are made, and are including input from employees, partners and customers. Motorcycle maker Harley-Davidson has tapped the on-the-road insights of the worldwide Harley Owners Group to shape its processes and product development. And IBM reached out to clients, partners, employees and their families—more than 150,000 people from 70 organizations—in 2006's InnovationJam. They generated 46,000 ideas, and so far we've invested \$70 million in ten of them—generating revenues close to \$300 million over the past two years.

Organizations around the world are transforming themselves, not only to manage their processes more efficiently, but also to help their people work smarter, instead of just harder. Indeed, in a world of smarter work, we may finally be able to make our organizations as agile, as collaborative and as creative as the people within them.

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Next stop: a smarter planet.

For the better part of the past two hundred years, the world's railway systems stood as a symbol, and literal engine, of modernity. They were integral to the Industrial Revolution, the expansion of the American West and the opening of the global economy to peoples everywhere. They connected communities, fostered the growth of cities, and allowed goods to be moved within and among them.

While our romance with trains may be behind us, our dependence on them is anything but. Every year, the planet's rail lines carry 10 billion tons of freight and 21 billion people. And given current population trends and patterns of mass urbanization, this demand is only going to grow. Between 2006 and 2007, the global rail market increased by 9%. U.S. demand alone for freight rail is projected to double in the next 25 years.

And that demand is a good thing. Rail is two to five times more energy efficient than road or air transportation. One ton of rail freight can be moved 423 miles using one gallon of fuel. And a single freight train on a track can replace 280 trucks on a road, reducing fuel use, congestion and emissions. In fact, passenger travel by rail produces three to ten times less CO₂ than cars or airplanes.

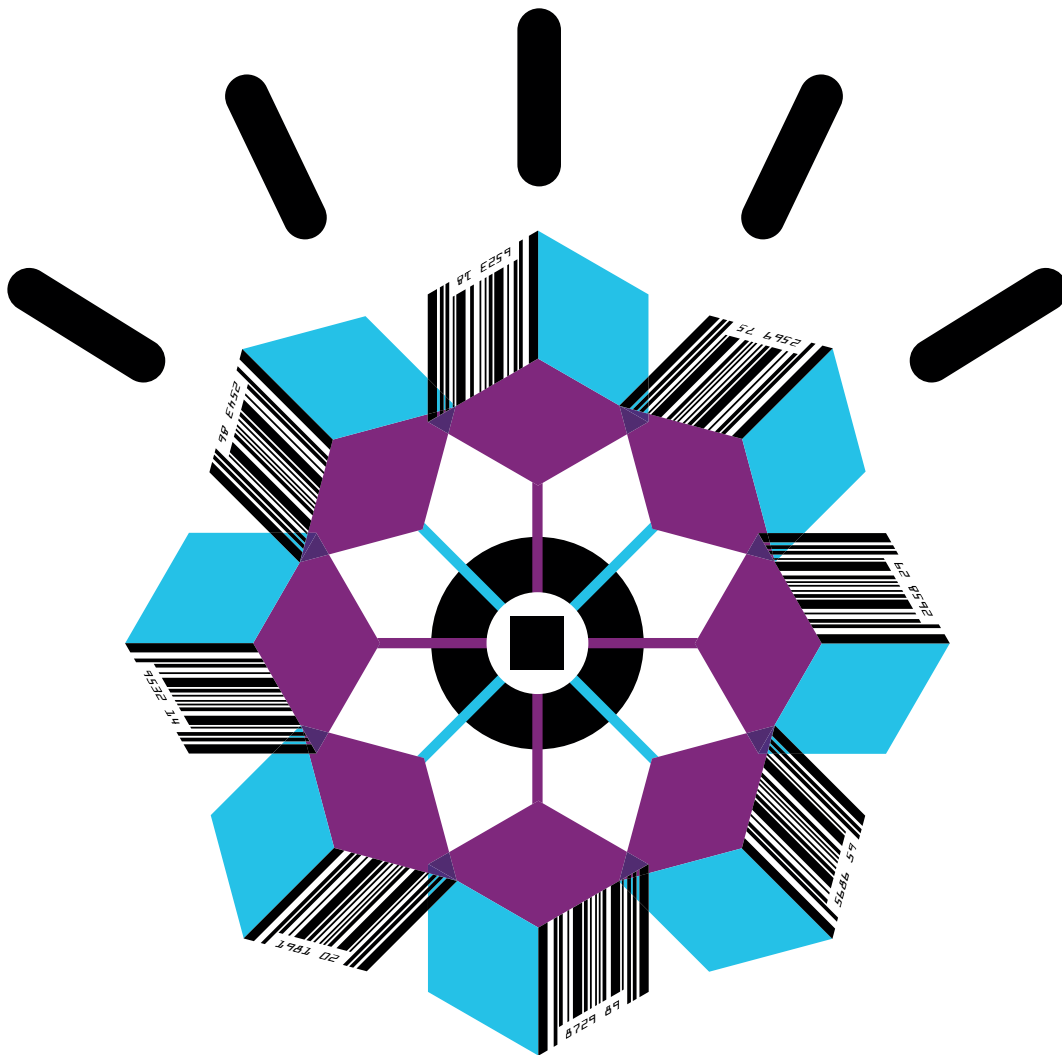
The problem is, global demand for rail is outpacing capacity, straining the planet's existing systems, creating bottlenecks and limiting the ability of fragile economies to grow. Trains can be delayed in congested hubs or are forced to stand aside on one-track lines. Passenger reservation and ticketing systems need to be modernized. Growing urban populations are driving an unprecedented need for rail, and governments are placing increasing demands on railroads to ensure safety. Quite simply, today's aging infrastructure and technology won't support the transportation needs of a smarter planet.

Imagine a smart rail system instead – one infused with enough intelligence to increase capacity and utilization and reduce congestion. A system in which schedules are dynamically adjusted to cope with weather-related outages. In which delays are reduced by self-diagnosing subsystems. In which smart sensors detect potential problems before they cause delays or derailments. In which train cars monitor themselves and supply chains, and passenger travel patterns are analyzed to minimize environmental impact.

Fortunately, we don't have to wait to begin seeing some of these impacts, because smarter rail systems are already being implemented around the world. The Union Pacific Corporation is testing a wireless monitoring system that will capture and analyze critical data on trains, from air pressure to brake monitoring to wheel-bearing temperature to axle health. Commuters on Singapore's public transport system use smart cards to pay for train and bus fares, and the data collected helps routes and schedules to be shaped by their behavior. Netherlands Railways uses advanced analytics software to weigh 56,000 variables, including the railroad's infrastructure and passenger demand, to assemble and schedule more than 5,000 passenger trains per day, improving operating efficiency by 6% with an estimated annual savings of 20 million euros. And the State of California anticipates that high-speed trains can help eliminate more than 12 billion pounds of greenhouse gases and save 12.7 million barrels of oil each year.

Over the last two centuries, we measured the increasing sophistication of trains in miles of track and miles per hour. In this century, we can measure it by smarts per mile.

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Smarter ways to make smarter products.

Fully 66% of products developed in the past year included some kind of embedded information technology. We're living in a world of smarter products, and that brings myriad benefits – not to mention a lot of interactive fun—to all of us.

But what does it mean for the creators of those products? What are the implications for *them* of infusing computing into things we would never think of as computers: phones, cars, appliances, clothes, household goods, medical devices and more? And what changes must they make for a world in which products are ever more personalized, interconnected and adaptive?

One reality is clear: software is becoming a strategic business asset for every company, no matter what they produce. The makers of smarter products have to become just as proficient in complex systems integration and software development as they've been in conventional product design and manufacturing. They'll have to manage their software as a core business process, applying the same levels of discipline and expertise they already bring to customer relationships, finance, human resources and product lifecycle management.

This shift is profound, and urgent. For instance, how does a company manage and integrate software across a complex, ever expanding supply chain when more and more components are sourced from different locations, arrive with software already embedded and are assembled in various combinations? Aerospace industry leaders are responding by transforming the way they manage a constantly changing set of design and manufacturing requirements. They are implementing new systems that let them share more reliable data with global suppliers and deliver smarter products at lower costs.

At the same time, product development cycles are being challenged by the integration of mechanical, electronic and software technologies

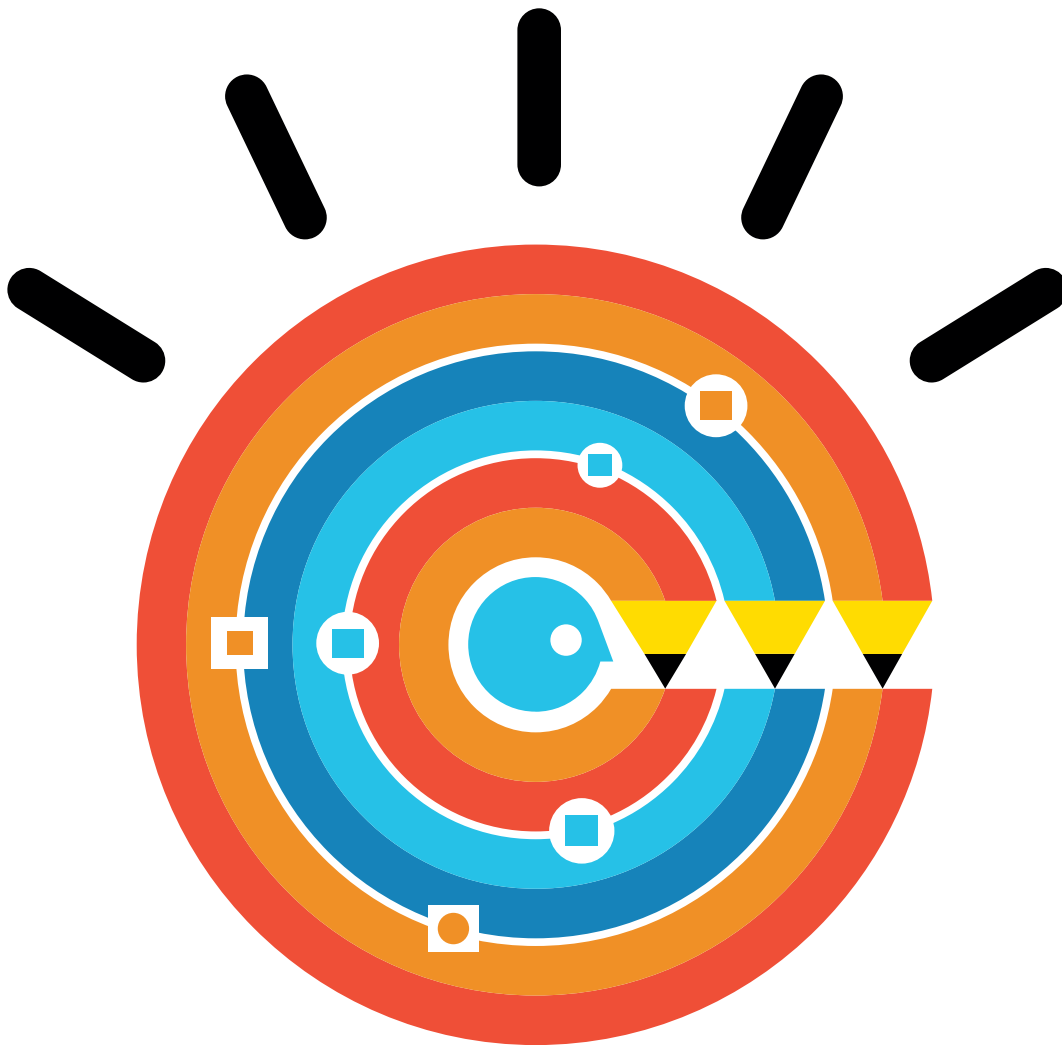
into the design process. This requires new levels of interoperability – but for those who make the shift, the results are real. BMW, for example, reshaped its engineering processes, modeling them on the development processes of leading software providers. They create digital design concepts that allow projects to be shared, modified and improved virtually as they flow across the company's far-flung divisions. This has dramatically reduced testing and manufacturing costs. Overall, best-in-class manufacturers that have built software systems or virtual prototyping into their business practices are meeting 90% of their product deadlines and 87% of their budget targets.

Finally, no product today is, in fact, a "finished product." Even after it is made, shipped and purchased, its makers need to build its capacity for continual and dynamic updating, to respond to upgrades, audits and the increasingly interactive nature of how products are used today.

For example, one global manufacturer of medical devices needed a more efficient, reliable way to track and validate their product requirements—every upgrade, every response to a problem and every bug fix required documented analysis. Their solution was to migrate 95% of their requirements from a manual process (involving volumes of complicated documentation) to a seamless automated process that not only reduces production complexity but also helps to make sure that the devices satisfy requirements.

These products, and myriad others, are making our lives more efficient, reliable, healthy and delightful—and they're being created beyond the confines of the assembly line. With smarter ways to make all the things we want and need, we now have the opportunity to do for product creation in the 21st century what mass production did in the 20th.

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A new school of thought for a smarter planet.

Our education systems are one of the great, enduring achievements of the 19th century. They were designed to prepare children for success in a burgeoning industrial economy, and they did their job well. But a 21st century services-and-knowledge-based economy has altered the landscape, and it requires different skills and ways of learning. If we hope to help our children achieve their potential – and realize the potential of a smarter planet – then school itself will have to get a lot smarter.

As a start, we can better integrate the collection of cottage industries that make up today's education "system." There are more than 15,000 local school districts in the United States delivering K-12 programs, and they face a conundrum. Local involvement is crucial, but local districts suffer from the inefficiency of separate operating systems, measurements and management processes, wasting precious resources. Developed countries, on average, spend nearly 4% of their GDP on education, and costs are rising – up 42% between 1995 and 2004, according to an OECD study. And the situation is similar no matter where you look. In China, there are nearly 500,000 primary and middle schools, each managing its own infrastructure.

A smarter education system would start by reducing waste and upgrading aging infrastructure – crucially important during an economic crisis, when funds are needed for improved instruction. But most importantly, smarter education will reshape learning not around administrative processes, but around the two key components of any education system: the student and the teacher.

Consider a town in Illinois, where educators are mining student data electronically – from academic records to information on student mobility and attendance. Or a Florida county with one of the largest school systems in the U.S., whose Teacher Workbench provides teachers with instructional resources linked to timely student data. This information will help teachers to identify what

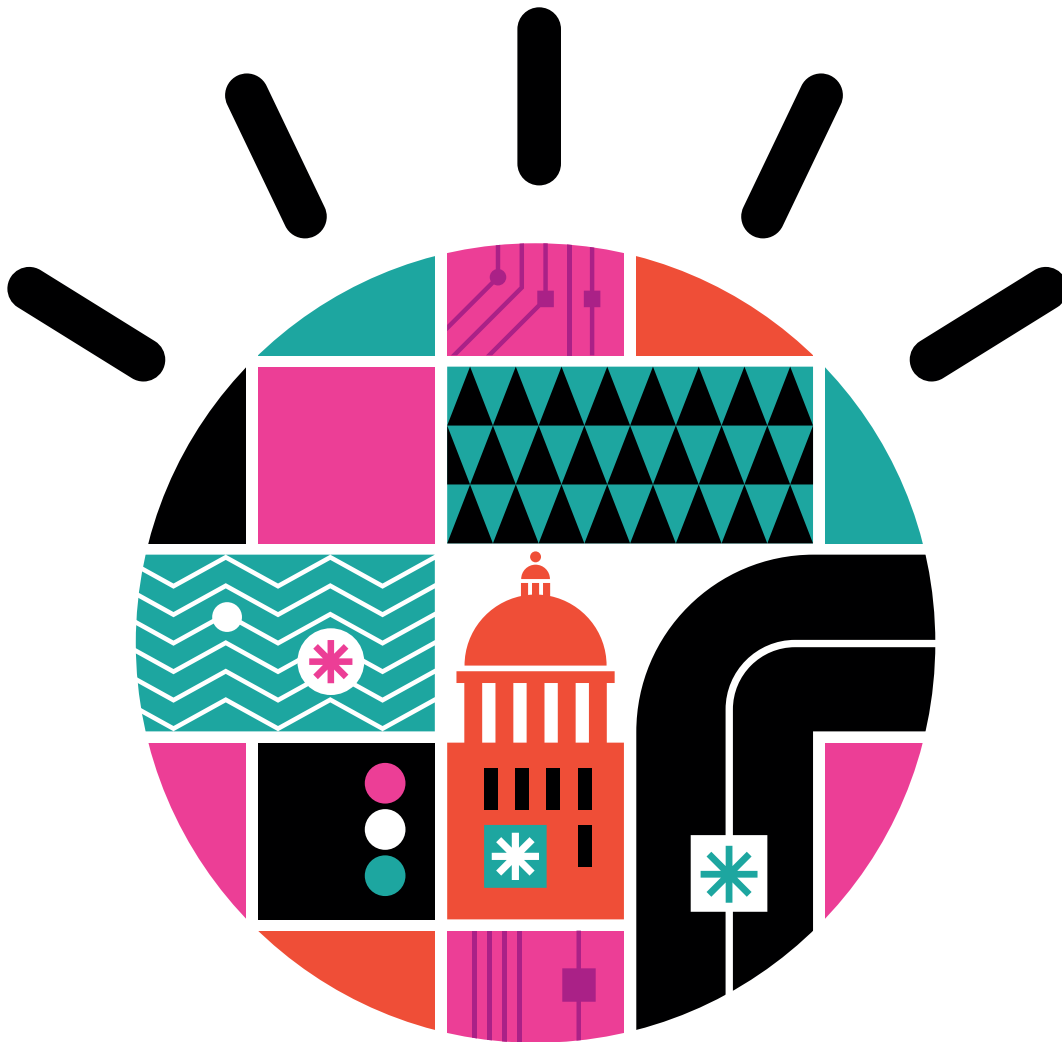
each student needs and thus individualize instruction to improve student achievement, while protecting confidentiality. Smarter systems also ensure that schools don't bear the education burden alone. They enable the inclusion of supporting organizations and communities – from colleges to health and social service agencies to families – transforming schools into a student-centered educational ecosystem.

In China, the Ministry of Education is expanding access and improving knowledge sharing through its open source "Blue Sky" e-learning platform, which has been used by more than 780,200 Chinese students and teachers since July 2006. The state of Brandenburg in Germany is harnessing Web-based tools that help teachers and other education experts across a widely dispersed region to connect systematically for the first time. In Broward County, Florida, parents can access a "virtual counselor" to track their children's attendance, assignments and progress.

In Ohio, student data is feeding performance dashboards for teachers, helping them to share courseware and lesson plans. On the horizon is the opportunity to create education "clouds" – like the one North Carolina State University uses to provide computing power and IT tools to students and faculty for research, student learning and administration.

Despite intense fiscal pressures around the world, economic stimulus programs offer the opportunity to foster real innovation in the way education is delivered. Many regions, states and provinces are exploring new models, including shared service delivery for routine functions. And the savings that result can be invested in improved teacher compensation and new hiring in key areas such as math and science. Because in the end, the chief beneficiaries of smarter education must be those who teach and those who learn.

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Smarter government for a smarter planet.

As local and national governments work to infuse intelligence into their transport, energy, water, telecommunications and other systems in order to stimulate economies and benefit citizens, it begs the question: can the operations of government itself become smarter?

Smarter government will do more than simply regulate the outputs of our economic and societal systems. It will be a smoothly functioning system itself, interconnecting dynamically with citizens, communities and businesses in real time to spark growth, innovation and progress. The challenges are many – from departmental silos to process delays to lack of transparency and accountability. But governments around the world are showing real progress.

Smarter government means collaborating across departments and with communities – to become more transparent and accountable, to manage resources more effectively, and to give citizens access to information about decisions that affect their lives. In the UK, Southwest One, an innovative joint venture, is providing shared services by integrating many functions of the Somerset County Council, the Taunton Deane Borough Council, and the Avon and Somerset Police. And in Albuquerque, a business intelligence solution has improved efficiency by 2,000% in the city's ability to generate reports and keep citizens informed.

Smarter government means helping to promote economic growth by streamlining cumbersome processes and simplifying reporting requirements, which are especially burdensome to small firms. For example, the Maryland Department of Labor, Licensing and Regulation has enabled online renewal of professional licenses and public verification of valid license holders. And the Belgian Crossroads Bank for Social Security has automated 42 services

for employers, eliminating 50 social security declaration forms. As a result, 23 million declarations were made electronically in 2008 – a major productivity benefit for Belgian businesses, saving them an estimated €1.7 billion a year.

At the most fundamental level, smarter government means making operations and services truly citizen-centric. Leading governments are integrating their service delivery, establishing offices that support multiple services and placing the most needed transactions on the Web. For example, Australia's Centrelink helps the government to provide appropriate service offerings based on citizens' life events, such as marriage, the birth of children and the need for elder care. Kyoto, Japan, created a Web site that allows all people, regardless of their abilities or native language, to access city information.

And then there are those times when being citizen-centric with speed and accuracy may be a matter of life and death. During the recent wildfires in California, government agencies turned to Twitter to provide real-time updates on the status of the fires – directing people without power, but with mobile devices, to Google Maps for evacuation information.

This month, IBM will convene the first of a series of "smarter cities" summits in Berlin. Leaders and forward thinkers from around the world will share ideas about smart healthcare, smart traffic, smart water management, smart energy and more. And among the most promising innovations they map out will be those they have applied to government itself.

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Let's build a smarter planet.

As we move toward a globally integrated economy and society, we find ourselves at a moment of enormous challenge—and of even greater opportunity.

The world isn't just getting smaller and flatter, it is actually becoming *smarter*. Today, almost anything—any physical object, process or system—can be instrumented, interconnected and infused with intelligence.

The question is, what will we do with that? Beginning last fall, IBM launched an ongoing conversation about some of the most critical issues and most promising opportunities facing our planet. We have explored what it means to make the systems by which our world works, work better—our energy, our medicine, our food, our water, our supply chains, our roads, our cities...everything. The list is long, and the dialogue has just begun.

We believe that smarter systems can and will make a meaningful difference to the prosperity of the global economy, the sustainability of our planet and the health of global society. We also believe that IBM is uniquely positioned to help—thanks to our depth of resources, expertise and experience. We can help provide enterprises, institutions and governments of all sizes around the world with the tools and thinking necessary to build a planet of smarter systems.

The future now beckoning to us is one of enormous promise—a future we can build now if we open our minds and let ourselves think about what our world could be.

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