CHAPTER 10

Global Implications of the Cloud

"Open your eyes, Pilot. A new world is here.'' So goes the intro to EVE Onlline, one of a new generation of massively multiplayer online games (also called MMOGs). In these online games, players from all over the globe log in to realistic, real-time virtual worlds via the Internet. They learn different roles and skill sets, and come together in self-selecting teams to carry out daring missions in pursuit of common goals. So, how is this any different from the challenges that await us in the global, real-time economy that surrounds us?

Real-Time Global Collaboration

If you're part of the generation just starting out in business, answers to this question probably seem pretty obvious. If you're part of a generation that's been around for a while, the answers might not seem so obvious—at first. If you're in your twenties, you may have a set of skills and behaviors that will become increasingly valuable in business, and you probably developed them through many hours of online gaming. Popular MMOGs like EVE Online,[1] EverQuest,[2] and World of Warcraft[3] bring together hundreds of thousands of simultaneous online players from countries around the world to interact in complex, lifelike, three-dimensional worlds based on themes from *Star Wars* science fiction to *Lord of the Rings* adventure fantasy.

MMOGs are not to be confused with single-person shooter games where individual players steal cars, blast aliens and tough guys, and get into street fights. Those games develop fast hand-eye

coordination, but not much in the way of business skills. And we aren't talking about virtual social worlds like Second Life either.

Simulation Games Teach Skills

What we're talking about is online games where there are rules and politics and opportunities to collaborate with others and build your reputation and your fortune. To succeed in these games, players have to interact with each other and build relationships and put together plans and go on missions. They join guilds or corporations operated in these games. They develop specific skills related to the roles they play, like pilot, trader, wizard, warrior, hunter, and priest, and they develop reputations and rating levels based on their successes and failures.

The potential for using MMOGs to develop skills that people need to succeed in the global economy is getting serious attention. Recently, a study titled ''Virtual Worlds, Real Leaders'' was conducted by IBM in conjunction with professors from Stanford University and MIT. They focused their study on the MMOG called World of Warcraft, known as WoW by gamers, and here's some of what they found (this study was conducted in 2008):

There are currently about 73 million online gamers worldwide with a compound annual growth rate of 36.5 percent. The average age of online gamers is 35 years; and 56 percent are male and 44 percent are female. Other findings revolve around leadership responsiveness concepts, and specifically, their findings point out the differences in how those concepts are practiced in MMOGs and in the traditional corporate world.

Leadership in the Old World and the New

We've grown accustomed to leadership in the corporate world being restricted to a relatively small group of people who are identified, mentored, and promoted by the company's senior management. In contrast, leadership in the MMOG world is distributed over a wide group of people who work to increase their own skill levels and who are promoted by consensus within the groups in which they operate.

In the corporate world, as the saying goes, it's often not what you know but who you know. In other words, people get a chance for leadership only if they are noticed by senior management. How

many subordinates can a senior manager really notice? (And how much dysfunctional, brown-nosing behavior is motivated by the urgent desire of subordinates to be noticed?) Since senior management is always only a small number of people, the total number of people in a company who can ever be noticed and get a chance to lead is also small, so plenty of qualified people never get a chance.

In MMOGs, the players' skills and aptitudes are constantly measured and made transparently clear to everyone. All players can see the skill levels and success rates of all the other players interacting. Because everyone can see everyone else's qualifications for leadership, the number of people who can become leaders is large. All qualified people get noticed.

Serious Games

Certain types of games can be seen as a form of simulation modeling, and simulation games are a useful way to explore situations that are composed of many actors in situations where they are not linked together in clear cause-and-effect chains of action and reaction. For example, there's no need to use gaming to simulate how a group of billiard balls will move around a table when other billiard balls are shot into their midst. Although there are many actors in this situation, their interactions are well defined in a clear set of cause-and-effect sequences. But gaming is an effective way to simulate how a group of companies working on a project together might behave under different circumstances. The interactions between the actors in this situation are not a clear set of cause-and-effect actions and reactions.

To simulate such a situation, we can define a set of rules that identify the different types of actors involved, the capabilities of each actor, and the different actions each actor can perform. These rules and actors can then be combined in the form of a game where the object of the game is for actors to accomplish certain goals. These are called ''serious games.''[4]

Serious games have been used for decades by military organizations around the world to simulate how opponents might attack—and how to best counter and reverse the attacks. The outcome of repeated simulations using serious games is often the basis for military strategy and policy. Today, serious games are finding applications in business environments, and some companies are starting to

use them to simulate complex business situations and to find effective responses to challenges and opportunities that emerge.

A Supply Chain Game

For example, consider what could happen if a serious game was applied to simulate and optimize the operation of a complex business network like a global supply chain. This is a game that has some pretty stringent rules. Players need to figure out how to deliver products where and when they are needed to meet demand, while at the same time minimizing inventory levels and holding down transportation and manufacturing costs. If you succeed in keeping down inventory levels and costs, but fail to meet product demand, you lose. If you always deliver the products, but fail to keep the other factors under control, then your costs get out of hand and you don't make any money.

How do people and companies learn to excel in this kind of business? In the old days, it was trial and error, making mistakes, and hoping to learn fast enough so that you didn't go out of business before you got better at it. But the learning curve is much steeper now. The rising costs of fuel oil and other commodities are forcing companies around the world to rethink and redesign the supply chains they've built over the last 25 years. Supply chains will need to continually adjust as prices and other factors change. With profit margins so thin, and conditions changing so quickly, it's getting risky to learn by trial and error alone.

Suppose the simulation game provided a map, and on it companies working together in a supply chain could draw in their factories, warehouses, retail stores, and draw in the transportation routes like roads, railways, and harbors that connect those locations. Figure 10.1 is a conceptual diagram of this idea. Then, suppose companies could also define the production volumes of the factories, storage capacity of the warehouses, and movement capacity of the different modes of transportation. Finally, suppose they could associate operating costs with each facility and each mode of transportation.

As the players in this game collaborate to design effective supply chains to respond to changing conditions, the system would constantly keep track of the operating characteristics of the supply chains created, and the players could select the designs that provided the best results. Once that supply chain was in operation, the

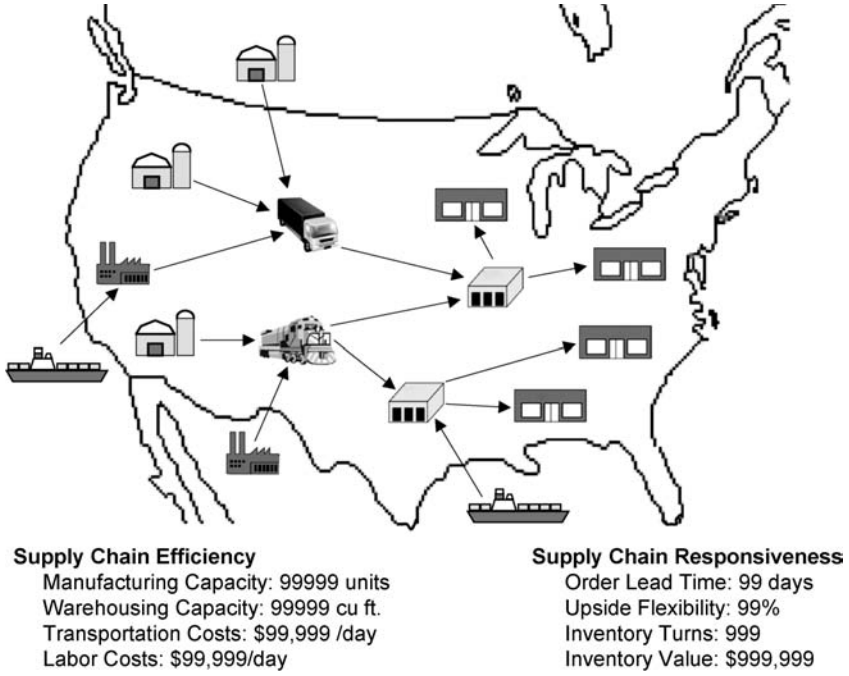

Figure 10.1 A Real-Time Supply Chain Game

system would collect live data feeds from the actual facilities and parties in the supply chain and display the real-time status of ongoing operations. All of this would be hosted in the cloud and it would always be on and available. It would be a massively multi-player online game, and the object would be for its players to monitor and manage their supply chains in order to best respond to changing business conditions.

Games Support Collaborative Decision Making

Then, imagine a real-time flow of data that showed the inventory levels on hand at each location and in transit along with forecasted product demand at each of the retail stores. Now you have a serious game. The simulation gaming software allows people to try different combinations of factories and warehouses and transportation modes for different products. People can see if a given combination will deliver enough products to the retail stores to meet projected demand. And they can see the operating costs associated with each combination.

As demand for products fluctuates, and as operating costs for factories, warehouses, and transportation modes change, businesspeople could constantly test out different ways to meet demand while minimizing cost. If inventory planners and supply chain operators could literally draw supply chain configurations on an electronic map display, and then run those configurations over some time period, they would quickly learn what combinations produce the best results. They would become immersed and completely involved. Now imagine how long it would take before the people playing this game developed high levels of skill in designing and operating high-performance supply chains that responded effectively to changing market conditions. They'd learn and develop accurate intuitions about how best to respond to changing circumstances. They'd be able to constantly adjust their supply chains to maintain the highest service levels at the lowest costs.

Cloud-Based Collaboration Enables a New Way of Working: The Dynamics of Swarming

What makes a flock of birds or a school of fish move as if they are a single entity? What makes them all suddenly rise, turn, and accelerate at the same time? There's something else at work here besides just a leader bird or a captain fish telling all the others what to do. This quick, coordinated behavior from large groups of individuals is called swarming. What can we learn from the dynamics of swarming that's relevant to the way we structure and operate businesses in our real-time economy?

Swarms place more emphasis on decentralized coordination, rather than on centralized control, to get things done. We are used to the hierarchical, top-down model of centralized command and control, but this model is proving too rigid, too slow moving, too cumbersome to deliver the responsiveness we need. How can we use the quick coordination we see in swarms to guide our companies?

One way is to use a business model where senior managers tell their people *what* their objectives are, but then let people figure out *how* they will achieve those objectives. In this model, people need to learn how their individual actions combine to create larger effects within the company to move it toward achieving senior management's objectives, even as situations continue to change in unpredictable ways.

Business process management (BPM) and complex event processing (CEP) systems are key components of any business model that emphasizes this kind of decentralized coordination. These systems provide the real-time monitoring and display of operating results that people need to make business progress. When everyone knows their objectives or performance targets, when they can see moment to moment what is going on and whether operations in their areas are on target or off target, then the swarming dynamic starts to engage.

A notion like swarming behavior violates our classic concepts of command and control, and it sounds pretty chaotic. We might agree that swarming behavior could work when objectives are simple and short term, but for more complex and longer-term objectives, our tendency is to think that we need complex management and control procedures. And it seems like decentralization of control is neither time nor resource efficient because the number of technical and performance issues is so large and their interdependencies are so difficult to unravel.

New Ideas Often Seem Counterintuitive at First

Let's look at this more closely by using a historical analogy. The great economic debate of the twentieth century was the rivalry between countries that believed the best way to operate was with a centrally planned economy versus those that believed the free-market was the best. One group held that a centrally controlled, rationally organized economy that was directed by experts was the best way to deal with all of the complex issues that would arise. The other group said all that was needed was enforcement of a reasonable and prudent set of regulations including respect for contracts, honest and transparent reporting of financial results, and prohibitions against excessive and irresponsible risk taking. Once those regulations were in place, people and companies could effectively organize and control themselves on their own without further intervention.

To illustrate the counterintuitive nature of this debate, imagine that a high-level delegation from the government of a developing nation was trying to figure out which of these two models to adopt. First, they visited the trading floor of a stock exchange in a free-market country. What they saw was a chaotic crowd scene. People were running about writing things on scraps of paper. They were

shouting at each other, waving their arms, making hand signals. And the walls were covered with huge computer screens and electronic displays showing a constantly changing barrage of numbers and words.

Then the delegation visited the ministry of economic planning in a country using a centrally planned economy. They saw buildings filled with rows of orderly desks. Well-educated scientists, engineers, and economists collected information. And the ministry made plans and issued orders for what each sector of the economy should produce and when and how much would be needed in order to meet the nation's economic goals. Which model do you think the delegation recommended to their government when they returned home from their travels? And yet by the end of the twentieth century, which model proved to be the more efficient?

Most companies still use traditional hierarchical organization models and employ centralized command and control methods. These companies focus on the traditional industrial concepts of economies of scale and achieving high productivity through rigorous application of standard operating procedures. Most employees of these companies have their work closely regulated by supervisors and bosses. There is little incentive for anyone except senior managers in these companies to take any initiative or to try anything different from the norm. This model works well enough in low-change and predictable markets, but those kinds of markets aren't common anymore.

The notion that a central person or group can do all the thinking for everybody else and tell them what to do and when to do it—no matter how many fancy computer systems they may have—is fundamentally flawed. No amount of centralized reporting systems and computing power can adequately deal with the amount of data that needs to be processed in the short time frames business requires today. The answer lies in breaking up the data to be processed, and the decisions to be made, into many smaller jobs that can all be run simultaneously. This is swarming dynamics. It is similar to the concept used in the design of massively parallel computer networks like the Internet itself.

Decentralized Coordination Replaces Centralized Control

Companies that employ decentralized control structures that incentivize and train their people to think and act for themselves,

and provide them with the real-time performance data they need to make good decisions, will outperform their competitors. Very simply, this is because people working in self-directed teams striving to achieve common performance objectives can find hundreds of ways to make small, continuous adjustments that will increase their profits and decrease their costs every day, every week, every month.

These companies benefit from a continuous stream of efficiencies generated by many small, rapid adjustments as business situations change. They also benefit from profits gained by quickly responding to market opportunities as they appear.

Walk through any company. Talk to people in the operating units. Ask them if they know ways to make their activities more productive and ways to save more money. Ask them if they know ways to better serve customers and if they have ideas for new products or services that customers might want. In most cases people will answer yes to all these questions.

What would happen if senior managers gave people clear performance objectives and then got out of the way? What would happen if people received a constant stream of performance data from BPM and CEP systems that showed them the results of their actions and if they were effective or not? People would see if they were on track to achieve their objectives and they could respond by getting back on track when things went wrong.

How fast would people learn to act on their own initiative and be more productive, save money, increase customer service, and offer new products and services? Would they soon learn to regularly meet or exceed the performance objectives they were given?

Swarming behavior causes an organization to act as a single coordinated entity. An apt analogy for this is the human body. It can be seen as a swarm of cells that continually sense their environment and act on their own without waiting to be told what to do. Our brains are not aware of everything that our bodies are doing nor do they need to be. Individual cells and organs know how to act on their own. And the overall effect of these swarming cells is to produce the coordinated behavior that makes our lives possible.

Unlike the slower and more predictable industrial economy of the twentieth century, we live in an unpredictable global economy and the best efficiencies come from swarming dynamics that make hundreds of small adjustments to respond quickly as situations change. Organizations operating like this are structured as networks

of many self-directed operating units that respond quickly without waiting to be told what to do.

Cloud-based BPM and CEP systems provide the people in these operating units with the real-time information they need. People know what their performance objectives are, and they have the training and authority need to act effectively. This is a powerful way to operate in high-change environments.

It is a mistake to use BPM and CEP systems to merely strengthen traditional centralized command and control procedures. That usually produces the opposite of the desired effect, just as centrally planned economies actually produced less efficiency and productivity, not more. The real power of these systems lies in driving the organizational swarming of self-directed operating units. They can enable people to monitor operations and learn to make their own decisions—just as individual companies act in a free market and just as cells act in our bodies.

Real-Time Visibility Could Make Us a Whole Lot Smarter

The dynamics of swarming scale up from individual companies to entire industry value chains and trading networks. Consider what could happen if we were to apply cloud-based systems to provide real-time visibility into global ecosystems and allow people anywhere in the world to access and act on that visibility.

If we could see our world as it changes, would that set up a powerful feedback loop enabling us to learn to respond effectively to those changes? Perhaps the best way to learn to live in balance with our planet and the interdependent ecosystems that support our life is to make those ecosystems visible. Seeing is believing. If all of us (not just select groups of experts) can see what's happening as it happens, then maybe we can all figure out what we need to do to.

Traditional approaches to managing our environment call for selected groups of experts to collect reams of data and publish their findings and recommendations in lengthy reports that are then used (in greater or lesser degrees) to formulate rules and regulations to control the behavior of the rest of us. A new approach is to build networks of environmental sensors and combine the data streams coming from those sensors into real-time displays that show everyone what's happening, so all of us can participate in deciding

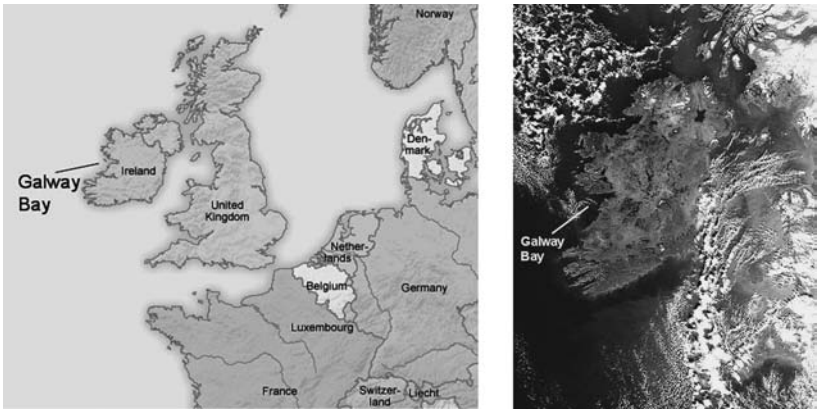

Figure 10.2 Galway Bay on the West Coast of Ireland

what needs to be done. We wonder which approach will prove to be more effective.

The Irish government is experimenting with this new approach in a project intended to better understand and manage the ecosystem and natural resources of Galway Bay on the west coast of Ireland (see Figure 10.2).

The Ireland Marine Institute has partnered with IBM to deploy a network of sensors for monitoring conditions in the bay. This is the first phase in the creation of the SmartBay Environmental Monitoring System and it is now sending real-time data back to the Marine Institute, where it is used to create real-time dashboards and maps for use by different constituencies—fishermen, tourists, ship captains, government agencies, and the like—to enable them to respond appropriately as conditions change. This project is a glimpse of how humans can learn how to live in balance with our world.

Technology Used and What the Sensor Network Measures

The Ireland Marine Institute worked with IBM to design and deploy a network of sensors tied to buoys that were deployed in Galway Bay in the summer of 2009. The sensor buoys were built by the Dublin-based company TechWorks Marine. Figure 10.3 is a picture from the Marine Institute website that shows what the sensor buoys look like.

Each SmartBay buoy supports an array of advanced ocean sensors that collect and transmit real-time information on ocean conditions that benefit scientists, commercial fishermen, fish farmers,

Figure 10.3 Galway Bay Sensor Buoys

Photos courtesy of Ireland Marine Institute—photo on left by Phil Trickett.

environmental monitoring agencies, and the general public. The buoys transmit their data to the Marine Institute via a wireless WiMAX network, where it is displayed through a web portal showing the real-time conditions in the bay. The different constituencies of people using this portal can easily access the data of most interest to them.

The sensors on the buoys are loaded with IBM software, and new versions can be remotely downloaded as needed via WiMAX. At present, the sensors are measuring environmental conditions in the bay like air and sea temperature, wind velocity, rainfall, currents and tides, wave action, and chemical makeup of the seawater. Figure 10.4 shows a screenshot of the SmartBay portal. The Galway Bay project is a prototype example of what a cloud-based environmental sensor network could look like.

How a Smart Species Can Get Smarter

So far, we humans are the most successful species on this planet, and our success is a testament to how smart we are. Over the past couple of centuries, we've learned how to employ industrial technology to efficiently extract and process our planet's resources so that we can improve our standard of living. Now we need to get even smarter and learn how to use information technology to continue that improvement, while at the same time, finding ways to live within limits that our planet's ecosystems can sustain over the long haul. That's going to be tricky.

We're an argumentative species and we don't like others telling us what to do. It's hard to comprehend the changes brought

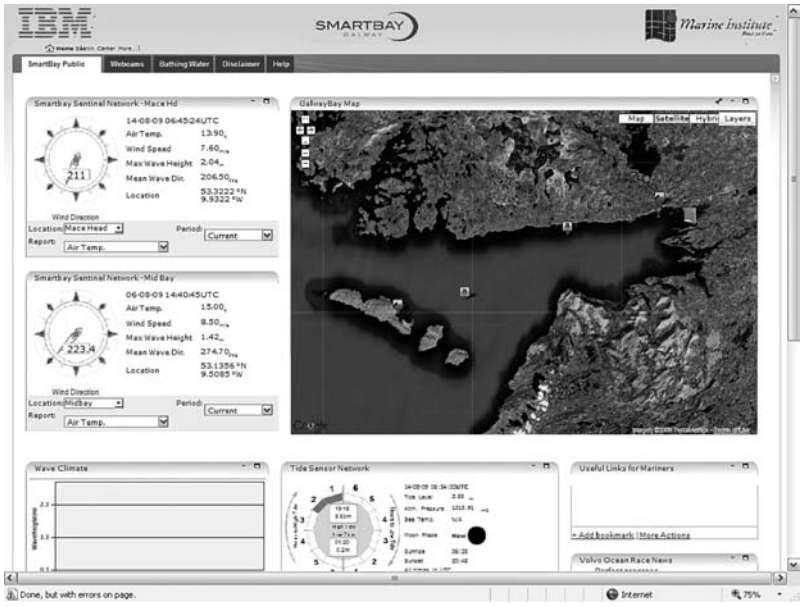

Figure 10.4 Galway SmartBay Portal

Screenshot courtesy of Ireland Marine Institute and IBM.

about by our growing population and our growing use of natural resources. Many of us still remember a time when this planet seemed infinite in resources, and it's hard to confront the notion that there actually are limits. We all have to be involved in figuring out how to live in balance with Mother Earth because, if we leave the job to select groups of experts and regulators, the rest of us won't believe what they tell us, and we won't accept the regulations they propose.

So clearly, seeing is believing. Real-time visibility and transparency is the best way to promote efficient markets in finance and commerce. It's the best way to promote good government, and it's the best way to deal with the tough choices and lifestyle changes we need to make in this century.

New Realities and New Opportunities

In his book *The Empathic Civilization,* Jeremy Rifkin presents a vision of how the global spread of real-time (or near-real-time) technology like the Internet, social media, mobile computing, and the cloud is promoting a growing sense of the relationships

and interconnections between people and our planet's biosphere. He points out that, along with the growth of this new sense of connectedness, we are also confronted with the growing effects of widespread pollution and environmental destruction caused by the industrial technology that supported our standard of living over the past 100 years.

He makes a compelling case that we are in a race, on one hand, between approaching environmental catastrophe and, on the other hand, learning to harness information and communications technology to support new ways of living in balance with our planet's ecosystem. Rifkin suggests that we need to see the rapid growth of the Internet and related technology in the larger context created by this race because it will otherwise be hard to understand why the Internet and cloud technology could be spreading so rapidly, and what their real benefits might be. He puts it like this:

> We talk breathlessly about access and inclusion in a global communications network, but speak little of exactly why we want to communicate with one another on such a planetary scale. What's sorely missing is an overarching reason for why billions of human beings should be increasingly connected. Toward what end? The only feeble explanations thus far offered are to share information, be entertained, advance commercial exchange, and speed the globalization of the economy. All the above, while relevant, nonetheless seem insufficient to justify why nearly seven billion human beings should be connected and mutually embedded in a globalized society. Seven billion individual connections, absent any overall unifying purpose, seem a colossal waste of human energy.[5]

His line of reasoning about the overarching purpose of all this technology leads to some obvious and profound questions. For instance, what if the universal, real-time visibility made possible by this technology caused countries to see continuing environmental deterioration and its attendant dangers of ecological collapse as one of the largest and most imminent threats they face? What if countries started spending to protect themselves against this new threat the same way they spend on protecting themselves against traditional military threats?

What if governments began redirecting portions of their military budgets to address this new threat? Would the environmental sensor business and related lines of environmental monitoring and remediation be a good industry for companies to enter? The global infrastructure for this business is cloud computing, and that infrastructure is being rolled out at an accelerating pace as you read these words.

The growing, worldwide, cloud computing infrastructure is supporting the creation of many new companies that are developing software and devices for application systems to address unique industry needs in ways never before possible. These companies no longer need to spend money on building data centers to host their software-as-a-service offerings and support their internal operations. They can instead devote their resources to optimizing and enhancing their customer-facing applications. In addition, they can use web search engines like Google, Yahoo, Bing, and Ask (these are the new global yellow pages) to develop more efficient ways to attract customers. Increasingly, customers find these new companies by conducting keyword searches or by hearing about them through social media. Companies can find new customers and close business deals without the labor-intensive sales processes of the past. This is why the cloud is so important; it is changing the business ecosystem, and it has the potential to also change the world's ecosystem.

Rifkin offers this opinion of how the global network of information and communication technology can be harnessed to address our energy needs:

> ''It was the first Industrial Revolution that brought together print and literacy with coal steam and rail. The second combined the telegraph and telephone with the internal combustion engine and oil. What we now have now is the possibility of a distributed energy revolution. We can all create our own energy, store it, and then distribute it to each other. Twenty-five years from now, millions of buildings will become power plants that will load renewable energy. We will load solar power from the sun, wind from turbines, and even ocean waves on each coast. We can also make the power grid of the world smart and intelligent; we call it inter-grid. Not far from now, millions and millions of people will load power to buildings, store it in

> the form of hydrogen and distribute energy peer-to-peer; just like digital media and the internet.''[6]

The power generation model that supports our civilization will change with the spread of smart power grids that are based on the universal flow of real-time information. The cloud will enable creation of tens of thousands of new businesses to deliver whole new categories of products and services to bring smart power grids to every part of the world.

Power generation will return once again to individual home and office buildings, but it will be a far cry from the wood burning, coal fired, or fuel oil–based technology that once powered individual buildings. It will be sustainable and it will tap the energy of sun, wind, and waves. It will work over regional networks composed of central power stations and thousands or millions of individual, interconnected power consumers and generators. When extra power is needed by individuals, they will draw it from the network; and when they are generating more power than they need, they will send their excess power back to the network to be allocated to where it is needed.

And this brings us back to our original analogy for cloud computing in Chapter 1. We said that traditional in-house IT infrastructure is going to be outsourced to cloud vendors who enjoy economies of scale and thus offer computing services at lower and lower price points. This is clearly happening.

Yet there's another trend happening that we discussed in Chapters 7 and 8: the trend of embedding new, innovative IT systems and IT professionals ever more deeply into the very business units that at the same time are outsourcing the operation and ownership of their traditional information and communications technology.

Racing toward Global Awareness: The One

Cisco's Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2009–2014, states that, ''Global mobile traffic will double every year through 2014, increasing 39 times between 2009 and 2014. Mobile data traffic will grow at a compound annual growth rate (CAGR) of 108 percent between 2009 and 2014, reaching 3.6 exabytes per month by 2014.''[7] (An exabyte is one billion gigabytes.)

Furthermore, by 2014, about 66 percent of the world's mobile data traffic will be video, and mobile video will grow at a CAGR of 131 percent between 2009 and 2014. Mobile video has the highest growth rate of any application category measured within the forecast. The Middle East and Africa are projected to have the highest growth rate of any region at 133 percent CAGR, followed by Asia Pacific at 119 percent and North America at 117 percent.

The study shows that audio communications will be dwarfed by data and video communications and 66 percent of the world's mobile traffic will be video by 2014. That's a huge change in a very short time. Global mobile traffic will exceed two exabytes per month by 2013 and, regardless of our present economic troubles, it will reach one exabyte per month in half the time previously taken by fixed data traffic.

Mobile devices increase people's individual contact time with the network. Mobile voice service is already considered a necessity by many, and mobile data, video, and TV services are now also becoming an essential part of people's lives. In addition, mobile machine-to-machine (M2M) connections continue to increase. The coming years will see constantly increasing adoption of mobile video despite economic conditions.

What could all this mean? It's as if our planet is employing us to build out a nervous system that covers the planet and allows for all of us to plug into it and see what is happening, as it happens.

Similar to Human Development

This growth of global communications and computing networks is somewhat analogous to our own progress. We humans emerged as the creatures we are today when our cerebral cortex blossomed within our developing brain. In that expansion of the cerebral cortex, we awoke and became aware of ourselves. Our planet (Mother Earth) has spawned this whole unruly lot of us, and now perhaps she is using us to grow a network over the top of us that encompasses all geographical points on her surface. And in the expansion of this global network—this planetary cerebral cortex—there might emerge a new awareness.

Kevin Kelly is a noted commentator, journalist, and thought leader on the impact of digital technology on society and individuals. He was a founding editor of *Wired* magazine and has

contributed work to publications including *The Economist, Time, Harper's Magazine, Science*, and the *New York Times*. His book *Out of Control: The New Biology of Machines, Social Systems, and the Economic World*[8] delivers insights into the workings of complex organizations and organisms. He builds on the themes of cybernetics and general systems theory and shows findings from several fields of contemporary science and philosophy that illustrate how intelligence is not organized as a centralized function, but instead is organized as a network or a swarm like a hive of bees.

He made an insightful presentation in 2007 titled ''Predicting the Next 5,000 Days of the Web'' at the annual conference of a not-for-profit foundation called TED (Technology, Entertainment, Design). In it, he talks of the phenomenal growth rate the web is experiencing and speculates on where it's taking us. He ends his presentation with the thought that all this growth is leading to the creation of what we call the cloud, or what he calls the ''One,'' and he describes it like this (note that OS stands for operating system):

> There is only one machine.
> The web is its OS.
> All screens look into the One.
> No bits will live outside the web.
> To share is to gain.
> Let the One read it.
> The One is us.[9]

Notes

1. EVE Online is a game based on a *Star Wars*-type theme, www.eveonline.com/.
2. EverQuest is based on a dungeons and dragons theme, http://everquest.station.sony.com/.
3. World of Warcraft is based on a *Lord of the Rings*-type of theme, www.worldofwarcraft.com/index.xml.
4. Serious games are used extensively in the military and health care for training of soldiers and health care delivery professionals. Many universities are also using serious games for educational purposes. And now serious games are also being used as a collaboration platform. The Wikipedia listing for serious games is a good place to start a larger investigation of serious games and their evolving uses; http://en.wikipedia.org/wiki/Serious_game.
5. Jeremy Rifkin, *The Empathic Civilization: The Race to Global Consciousness in a World in Crisis* (New York: Tarcher/Penguin, 2010), p. 594.
6. Ibid, p. 517.

7. Cisco Systems Inc., ''Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2009–2014,'' paper (February 9, 2010), www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-520862.html.
8. Kevin Kelly, *Out of Control: The New Biology of Machines, Social Systems, and the Economic World* (New York: Basic Books, 1995) [orig. pub. 1992].
9. Kevin Kelly, ''The Next 5,000 Days of the Web,'' presentation at TED conference (filmed December 2007), www.ted.com/index.php/talks/kevin_kelly_on_the_next_5_000_days_of_the_web.html.