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Water Quality Management Using Cloud Computing – Solution for Corporate Control of Environmental Impact Data

Decision Support and Risk Mitigation in Contaminated Site Cleanup

by
Neno Duplan, President and CEO (info@locustec.com)
Gregory Buckle, Director Data Management Services
Locus Technologies

"There is a water crisis today. But the crisis is not about having too little water to satisfy our needs. It is a crisis of managing water so badly that billions of people - and the environment - suffer."
—World Water Vision Report

The key to properly managing water lies in managing water ***quality***, because the current worldwide water crisis involves not only overall scarcity of usable water but also widespread water pollution caused by the emission of domestic and urban sewage, agricultural waste and, especially, industrial effluents, pollutants and contaminants (e.g., rocket fuel and lead) into the water bodies where all of our drinking, cooking and bathing water originates.

This situation has created— on an almost incomprehensible scale—technical, ecological, social, economic and legal problems for both individual polluting companies and the country as a whole. Various government organizations have put the list of sites impacted by industrial pollution in the *hundreds* of thousands nationwide.

One of industry's most vexing impediments in responding to environmental problems has been difficulties in properly centralizing and managing captured water quality data—the individual facts, statistics and items of information that represent the results of testing and analyses. The critical information that businesses require in order to evaluate their overall water quality footprint and environmental impact is too often largely inaccessible to key decision makers and risk managers because it resides in untold numbers of different formats in the scattered offices of their environmental advisory consultants.

The sheer complexity of managing water quality demands sophisticated technological solutions for monitoring and measuring pollution-producing activities and contaminated sites. Corporate polluters have an acute need for innovative approaches to site investigations, data evaluation, and remediation and containment methods. This means utilizing tools that support scientifically defensible risk assessments, improve the decision-making ability of both C-level executives and risk managers alike, and facilitate successful efforts at removal of pollutants and contaminants where required.

Many companies have begun to realize that they need to take ownership of this information and in the process cut their costs while improving their ability to make decisions and mitigate risks. One way managers are doing this is through the use of information technology (IT) implementations of environmental software applications, computer hardware and the Internet.

A different approach from the heretofore standard (and now outdated) "consultant-centric," spreadsheet-based environmental information management system—with its typical project delays and increased costs—is now essential. The new approach relies on leading-edge Web-based technologies that give environmental professionals Google-like abilities to search complex water data sets and growing piles of seemingly unrelated water quality information.

This answer: Software-as-a-Service (SaaS) and Cloud Computing.

Measuring & Monitoring Industrial Pollution

According to the U.S. Department of the Interior's U.S. Geological Survey, manufacturing industries that produce items such as gasoline and oils, metals, wood and paper products and chemicals account for just about five percent of total water withdrawals, yet contribute to more than half of all domestic water pollution.

Every manufactured product uses some amount of water during parts of the production process for such purposes as fabricating, processing, washing, diluting, cooling, sanitizing within the manufacturing facility, or transporting within the supply chain or to market. Resulting water-borne waste materials include acids, alkalies, toxic metals, oil, grease, dyes, pesticides, polychlorinated biphenyl (PCB) compounds, lubricants, asbestos, phosphates, mercury, nitrates, sulfur, sulfuric acid and many other poisonous materials, including radioactive substances.

Contaminated waste water resulting from manufacturing processes is required by laws like the federal Clean Water Act to be treated to remove impurities and toxins. But waste water is nonetheless often illegally pumped untreated from facilities directly into nearby ponds, streams and rivers, or onto surrounding lands. Other major problems include seepage from leaking underground or aboveground storage tanks, spills and similar accidents. Affected soils can leach toxic chemicals into nearby ground or surface waters, where these materials can poison wells and be taken up by plants and animals, contaminate human drinking water supplies, or volatilize and taint the indoor air in overlying buildings.

Taking a lead from greenhouse gas (GHG) emissions monitoring and measurement, governments and businesses are beginning to deal with water pollution in the same manner. Tools available for doing this include environmental software applications that allow users to input water pollution data, analyze it in sophisticated charts, plot remedial strategies and derive recommendations on how to cut pollution discharges and seepage from operations large and small.

As an example, Locus' flagship software product is **Environmental Information Management (EIM),** which provides online analytical data management for Locus customers around the world. The world's largest and most-used Internet environmental data management system, EIM manages all client mission-critical environmental data, from analytical results for air, water and soil to geologic and field data.

ePortal, the Locus environmental executive dashboard, combines tools and business analytics designed specifically for environmental executives to help them keep on top of key issues. ePortal brings key environmental information to the user's desktop in a Yahoo!-style single sign-on (SSO) interface, providing the ability to drill into the data when a more in-depth view is needed.

SaaS via Cloud Computing

In the SaaS delivery model, the software vendor provides access to its software and functions remotely as a Web-based service. SaaS allows organizations to access business functionality at a cost typically less than paying for licensed applications, since SaaS pricing is based on a monthly rental fee. Instead of users buying software and paying for periodic upgrades, their use of a SaaS application is subscription based and all upgrades are provided during the term of the subscription. When the subscription period expires, all a client needs to do is to renew.

This on-demand service provides measurable economies of scale and cost advantages because the more customers a SaaS vendor has, the less each customer pays for a subscription. This process continuously drives down costs while improving software quality as a SaaS application benefits from the "wisdom of the crowd," i.e., its many users. When a large network effect is present, as is the case with SaaS-based software, the value of a product or service increases as more people use it. This "network effect," originally coined to describe the rapid spread of telephones, states that the value of a communications network to its users rises exponentially with the number of people connected to it.

SaaS applications are maintained in the service provider's datacenter, and every time users launch their browsers and log on, they get the latest version of the software as well as access to the most current data, which is also stored in the service provider's datacenter. Because the software is hosted remotely, users don't need to invest in additional hardware. SaaS removes the need for organizations to handle installation, set-up and often daily upkeep and maintenance.

SaaS environmental applications are remotely hosted by service providers like Locus Technologies and made available to customers over the Internet—the "Cloud."

"Cloud Computing," a name inspired by the cloud symbol that's often used to represent the Internet in flow charts and diagrams, is a general term for anything that involves delivering hosted services over the Internet. Cloud Computing describes all data processing activity that occurs "outside the firewall" of security measures that protect an organization's networked computer systems. The Cloud provides the computing capacity required to run SaaS and other types of applications. Since SaaS is a subservice of Cloud Computing, all SaaS applications are in the Cloud, which provides the computing power to run those applications. The SaaS application delivery model provides an application like EIM as a utility, and the Cloud compute delivery model provides computing power, also as a utility.

In environmental information management, Cloud Computing puts companies back in charge of their own data while at the same time offering individuals with the appropriate logon privileges unfettered access not only to relevant data, but also to tools needed to analyze these data.

Conclusions

Of all the types of water-related data that companies need, what stands out in terms of sheer volume and complexity are the measurements pertaining to water quality. These include pH balance, temperature, specific conductance, turbidity, dissolved oxygen, hardness, suspended sediment, presence of contaminants and many more. To be relevant, this data must be captured and widely shared. Compared to water ***quantity*** data management, which typically involves one number (amount of water consumed per unit of time), water ***quality*** management is orders of magnitude more complex.

Water quality management is also more complex than—and potentially as important to the future of mankind as—air quality management, which has recently been at the center of environmental discussions due to its linkage to climate change. Mother Earth has a finite supply of fresh water stored in groundwater aquifers, surface waters (lakes, ponds, rivers, reservoirs and streams) and the atmosphere (as clouds and water vapor). In particular, groundwater reserves are being depleted and polluted at unsustainable rates in many regions. Many companies have started tracking water quantity because it is one of necessary parameters for GHG reporting. Few, however, have developed a strategy for water quality management.

Cloud Computing information technology can help manage data and information related to water supply and quality to meet the growing global need for clean water. Unfortunately, industry is not leveraging this new technology as fast and as widely as possible. This is due first to a lack of awareness about what Cloud Computing can do to improve data management and reporting problems and, secondly, to the resistance to change of those groups (mainly consultants) who benefit financially from the status quo.

But water quality issues will continue to pose potential liabilities in the billions of dollars to businesses worldwide. Corporate managers would find themselves able to make quicker, more confident decisions at less cost if they managed the data associated with environment-related risks by using robust Web-based information management systems similar to common enterprise resource planning (ERP) systems used to manage and coordinate all the "back office" resources, information and functions of a business.

Today, the mainstream media, as well as the business and trade press and the public-at-large, seem to be focused almost exclusively on issues related to GHG emissions and climate change. But awareness is beginning to grow that it is just as important to give equal attention to water issues.

In the coming years, as sources of clean water become more scarce worldwide, and more entities compete ever more vigorously for this resource, different businesses will be challenged in different ways.

What is certain is that all businesses will be affected either directly or indirectly by the coming changes. Scarcity usually encourages better management of resources—or forces extinction due to inadequate or inappropriate responses. Consequently, external demands on companies to demonstrate "sustainable water management" practices are starting to be seen, and can only be expected to increase. Cloud Computing-based environmental solutions represent the best way for companies to take ownership of their data, satisfy looming reporting requirements, and tackle their water quality management challenges.

Locus Technologies, Mountain View, Calif., is the industry leader in Cloud Computing environmental solutions serving mid-market and Fortune 1000 corporations in numerous industrial segments, including technology, manufacturing and energy production (e.g., Chevron, ExxonMobil).